

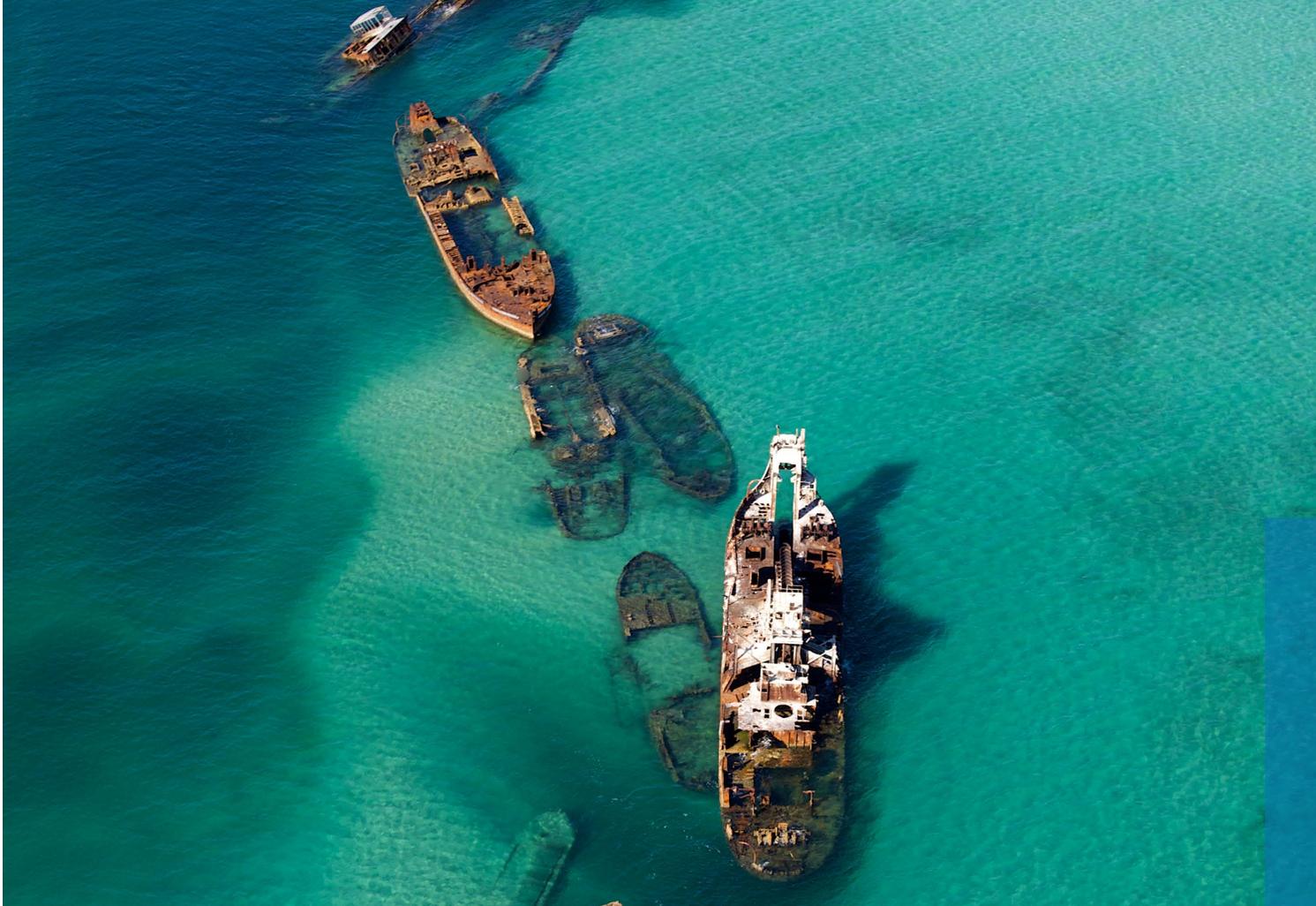


International Institute of Fisheries Economics and Trade Conference 2014

Proceedings

7 - 11 July 2014

QUT Gardens
Point Brisbane, Australia



Conference Sponsors

Platinum Sponsor



Gold Sponsor



Silver Sponsor



Award Sponsors



AquaFish Aquaculture Economics Prizes: US National Oceanic and Atmospheric Administration (NOAA) Fisheries and AquaFish Innovation Laboratory

EAFE Best African Student Paper Prize: European Association of Fisheries Economists (EAFE)

JIFRS-Yamamoto Prize: Japan International Fisheries Research Society (JIFRS)

Participation Support Sponsor



Keynote Speakers

Dale Squires *Southwest Fisheries Science Centre*

**Title: *Mitigating
Ecosystem-Level
Impacts of Fisheries
Bycatch on Marine
Megafauna:
Conservation Policy,
Economic Instruments
and Technical Change***



Professor Dale Squires is Senior Scientist with U.S. NOAA Fisheries, Adjunct Professor of Economics at the University of California San Diego, on the Scientific Advisory Committees of the International Seafood Sustainability Foundation and the International Pole-and-Line Foundation, CLIOTOPS, and former Chair of the Highly Migratory Species Plan Development and Management Teams of the Pacific Fishery Management Council.

He has worked with national governments, World Bank, Inter-American Development Bank, FAO, OECD, IUCN, Regional Fishery Management Organizations, and U.S. Fishery Management Councils and taught at universities in Europe, Asia, Australia, and USA.

He is the author of over 85 peer-reviewed journal articles and co-author or co-editor of 8 books and monographs.

His interests lie in technological change, marine biodiversity conservation, and rights-based management with international fisheries for large pelagic species.

Tony Smith *CSIRO*

**Title: *Economic
performance
and ecosystem
based fisheries
management***



Dr Tony Smith AM leads the Ecosystem Based Management (EBM)

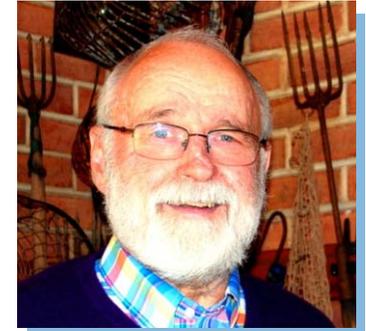
Research Stream in the CSIRO Wealth from Oceans Flagship. He has contributed widely to the assessment and modelling of fisheries and marine resources in Australia as well as globally, including development of methods for scientific evaluation of fishery harvest strategies. He was recently appointed an affiliate Professor at the School of Aquatic and Fishery Sciences at the University of Washington.

In 2003, he received the Centenary of Federation Medal for his contributions to Australian and international fisheries science. In 2011, he was appointed a Member (AM) of the Order of Australia for service to marine science through research and development of ecosystem based fisheries management, particularly the implementation of harvest strategies and policy governing sustainable practices. In 2012 he was awarded the Kungsefenan Swedish Seafood Award in the Sustainable Fisheries category. He has also been a member of the Marine Stewardship Council's (MSC) Technical Advisory Board since 2009.

In recent years, Dr Smith has contributed to the development of the Code of Conduct for Responsible Fisheries guidelines on the precautionary approach to capture fisheries, and on indicators for sustainable development of marine capture fisheries. He has made a major contribution to the development of the Commonwealth Harvest Strategy Policy in Australia, and to developing generic scoring guidelines for sustainable fisheries for the Marine Stewardship Council. He has also led development of several tools in support of ecosystem based management, including methods for ecological risk assessment of fisheries.

Lee G. Anderson *University of Delaware*

**Title: *The Application
of Basic Economic
Principles to Real
World Fisheries
Management***



Professor Anderson earned a PhD in Economics from the University of Washington in 1970. He is currently the Harrington Professor Emeritus of Marine Studies and Economics at the University of Delaware. He is past President of the International Institute of Fisheries Economics and Trade and of the North American Association of Fisheries Economists. In 1993 he was awarded the Rosenstiel Award for his contributions to Fisheries Economics and Management especially the application of Individual Transferable Quotas. In 2006, he received the International Institute of Fisheries Economics and Trade's Distinguished Service Award.

Among the factors in his selection for this honor are Dr. Anderson's authorship of the classic text, *The Economics of Fisheries Management*, first published in 1977, revised in 1986 and republished in 2004, which has served as an important learning tool for fisheries economists nationally and internationally. Additional books have included *The Bioeconomics of Fishery Management* (with Dr. Juan Carlos Seijo), and a two-volume edited collection of previous published articles on fisheries economics.

In addition to these texts and chapters in over 35 books, reports and proceedings, Dr. Anderson has published over 60 scientific papers in highly respected journals including *Marine Resource Economics*, the *Journal of Environmental Economics and Management*, the *American Journal of Agricultural Economics*, and *Land Economics*, among others. His scholarly contributions have strongly influenced the fundamental development of the application of economics to fisheries problems.

In addition to his scholarly contributions, Dr. Anderson has exerted a strong influence in the policy arena, particularly in the implementation of Individual Transferable Quota (ITQ) systems at state, federal, and international levels. He is currently in his sixth term as a member of the Mid-Atlantic Fishery Management Council and he has advised the US National Marine Fisheries Service, the Atlantic States, Great Lakes, and other US Marine Fisheries Commissions, the US Department of State, the US General Accounting Office, the National Academy of Sciences, the World Bank, the UN Food and Agriculture Organizations, the European Union, and the Governments of New Zealand, Australia, Oman, Morocco and Chile.

Keynote Speaker

Rögnvaldur Hannesson NorskHelsenett

Title: *Crisis in World's Fisheries?*

Professor Hannesson completed his MA as well as PhD at the University of Lund (1974). During his studies, he also spent a year at the University of British

Columbia working with Professor Anthony Scott and interacting with other notable fisheries economists such as Harry Campbell, and Colin W. Clark. Ron retired last year from his position as professor of fisheries economics at the Norwegian School of Economics, Bergen, at the mandatory age of 70. He has also been a visiting scholar at universities in Canada, the U.S., Australia, Iceland and Germany.

Professor Hannesson's scientific production includes 85 refereed journal articles, 29 book chapters, as well as numerous conference proceedings. He is also the author of 87 books including: *The Privatization of the Oceans*, *Investing for Sustainability*, *Bioeconomic Analysis of Fisheries and Fisheries Mismanagement: The Case of the Atlantic Cod* and, most recently, *Ecofundamentalism: A Critique of Extreme Environmentalism*.

Professor Hannesson was president of the International Institute of Fisheries Economics and Trade (IIFET) from 1986–90. He was a member of the Advisory Board of the Fisheries Centre, University of British Columbia, Vancouver (1992–1998) and sat on FAO's Advisory Committee on Fisheries Research from 1997–2004. In 2000, Professor Hannesson was honoured with IIFET's Distinguished Service Award, in recognition of his service to this institute, in particular, as well as to the field, in general.



IIFET Distinguished Service Award

Sean Pascoe CSIRO

Title: *Balancing economic, social and environmental objectives in EBFM*

Dr Sean Pascoe is a marine resource economist with over 25 years of experience in the economic analysis of fisheries.

He is currently Senior Principle Research Scientist in the CSIRO Division of Marine and Atmospheric Research, and Team Leader of the Marine Resource Economics Team. He is also currently an Adjunct Professor at the Queensland University of Technology, where he supervises a number of PhD, Masters and Honours students working in the area of fisheries, aquaculture and marine biodiversity conservation economics. Prior to join CSIRO in 2006, Dr Pascoe was Professor of Natural Resource Economics and Director of the Centre for the Economics and Management of Aquatic Resources (CEMARE), University of Portsmouth, UK.

Dr Pascoe's research work has included assessment of maximum economic yield in fisheries, spatial management (including modelling fisher location choice), bioeconomic modelling and productivity and efficiency analysis. He has also worked extensively in the area of multicriteria decision analysis and elicitation of social, economic and environmental objectives of management. More recently he has worked in the area of the economics of marine biodiversity conservation, including the assessment of offsets, and economic valuation of the impacts of coral bleaching on benefits to divers and the impact of marine parks on recreational fishing benefits.

He has produced over 95 journal articles along with numerous reports and conference papers. In 2009, he was the recipient of a CSIRO medal for research excellence, and in 2012 was awarded the Newton Turner Award for exceptional senior scientists.



Conference Committee

Organising Committee

Co-chair: Sean Pascoe, The Commonwealth Scientific and Industrial Research Organisation

Co-chair: Louisa Coglan, Queensland University of Technology

Ann Shriver, International Institute of Fisheries Economics and Trade

Lauren Kerr, Queensland University of Technology Conferences

Diane McDonald, Queensland University of Technology

Lee-Anne Vipathkun, Queensland University of Technology

Clevo Wilson, Queensland University of Technology

Jim Innes, The Commonwealth Scientific and Industrial Research Organisation

Anna Norman, The Commonwealth Scientific and Industrial Research Organisation

Steering Committee

Chair: Stephanie McWhinnie, The University of Adelaide

George Kailis, Austral Fisheries Pty Ltd

Ian Cartwright, Australian Fisheries Management Authority

Scientific Committee

Chair: Sarah Jennings, University of Tasmania

Monday 7th July 2014

- 4.00pm - **Registration Opens**
7.00pm The Cube, Level 4, P Block, QUT Gardens Point
- 5.00pm- **Welcome Reception**
7.00pm The Cube, Level 4, P Block, QUT Gardens Point

Tuesday 8th July 2014

- 8.00am **Registration Opens**
Z Block, Level 4 Atrium, QUT Gardens Point

- 9:00am - **Opening Ceremony**
9:30am ROOM: Z411

- 9.30am - **PLENARY 1**
10.30am **Keynote speaker: Dale Squires, Southwest Fisheries Science Center**
Mitigating Ecosystem-Level Impacts of Fisheries Bycatch on Marine Megafauna: Conservation Policy, Economic Instruments and Technical Change
ROOM: Z411

- 10.30am - **Morning Tea**
11.00am Z Block, Level 4 Atrium, QUT Gardens Point

CONCURRENT SESSION 1							
TOPIC:	SESSION 1.1 Modelling and Management	SESSION 1.2 Environment: Valuation	SESSION 1.3 Development and Policy	SESSION 1.4 Management : Catch Shares, Quotas & Market Power	SESSION 1.5 Management: Efficiency Analysis	SESSION 1.6 Gender & Development	SESSION 1.7 Markets: Sustainability & Certification
CHAIR:	Satoshi Yamazaki	Amar Doshi	Piyashi DebRoy	Natacha Carvalho	Sean Pascoe	Elizabeth Adebayo	Steven Rust
ROOM:	Z411	Z401	Z406	Z303	Z304	Z302	Z309
	1.1A - Rebecca Toseland, Transition to Rights-Based Management in Fisheries: Evidence from Alaska (31)	1.2A - Tesfom Melake Araya, Data Mining Multiple Stakeholders' Responses to Declining Schizothorax Fishery in the Lakes of Kashmir, India (5)	1.3A - Nada Bougouss, North Africa: role of small scale fisheries in the economic development (388)	1.4A - Ragnar Arnason, ITQ Prices: What do they Reveal? (454)	1.5A - Chhandita Das, Alternative Approaches to Estimate Fisheries Trip Costs (281)	1.6A - Vina Ram-Bidesi, An Economic Perspective on Integrating Gender Issues in Fisheries Management and Development in the Pacific Islands (266)	1.7A - Frazen Tolentino, Improving Sustainability in Tuna fisheries through Market-based incentive mechanisms (105)
	1.1B - Mihoko Tegawa , A Study on the Efficiency Mechanism of Pooling System and Social Capital in Fishery (302)	1.2B - Erlend Dancke Sandorf, Exploring Discontinuous Preferences in Choice Experiments: The Case of Cold Water Coral in Norway (86)	1.3B - Duy Nguyen Ngoc, Government support and its profitability effects – An empirical study on offshore fisheries in Vietnam (162)	1.4B - John Tisdell, Bidding and performance in multiple unit combinatorial auctions for fisheries quotas: Role of information feedbacks (99)	1.5B - Stephanie McWhinnie, The Role of Fixed Costs and Non-discretionary Variables in Fisheries: A Theoretical and Empirical Investigation (191)	1.6B - Meryl Williams, Does Women's Empowerment have Economic Benefits? (371)	1.7B - Michaela Aschan, Documenting sustainability for value-added fish products (245)
	1.1C - Maria Rebecca Campos, Bioeconomic Modelling of Fishery Conservation Policies in the Philippines (10)	1.2C - Hiroki Wakamatsu, Impacts of Actual Harm and Harmful Rumors from Radioactive Spill from the Fukushima Disaster on the Japanese Seafood Market (171)	1.3C - Iyabode Taiwo, Socio Economic and Environmental Impact of Ogun River on Food Security in Ogun State, Nigeria (170)	1.4C - Andrea Haas, Assessing the Degree of Corporate Concentration in British Columbia's Fisheries (178)	1.5C - Peggy Schrobback, Economic capacity and capacity utilisation of Queensland's Sydney rock oyster industry (148)	1.6C - Alagie Sillah, Towards Ecosystem Based Management of Fisheries (53)	1.7C - Kim Walshe, A Jurisdictional approach to marine stewardship council certification (294)
	1.1D - Diwakar Poudel, Optimal Harvest in a Multispecies Age Structured Fishery Model at Different Level of Density Dependency (81)	1.2D - Melissa Errend, Applying Principles from Economics to Improve the Transfer of Ecological Production Estimates in Fisheries Ecosystem Services Research (354)	1.3D - Hussein Al-Masroori, Towards Developing Index for the Assessment of Sustainable Development: A Case Study of the Sultanate of Oman (267)	1.4D - Barbara Hutniczak, Optimal Quota Allocation in Multispecies Environment (34)	1.5D - Md Akhtaruzzaman Khan, Capacity and Factors Affecting Capacity Utilization of Marine Fisheries: A Case of Gill-net Fleet in the Bay of Bengal (63)	1.6D - Runia Mowla, Beneficial roles of women in fisheries and aquaculture practices in coastal areas in Bangladesh with some socio cultural confront (115)	1.7D - Martin Purves, An Analysis of the Economic Benefits of MSC Certification for the South African Hake Fishery (392)

- 12.30pm - **Lunch**
1.30pm Z Block, Level 4 Atrium, QUT Gardens Point



1.30pm –
3.30pm

SPECIAL SESSION A

SPECIAL SESSION A.1 Making Integrated Ecological-Economic Models Useful

CHAIR: Dan Holland
ROOM: Z411
Presenters:
J. Rasmus Nielsen, Ralf
Doering, Douglas Lipton,
Olivier Thebaud, Sean
Pascoe

SPECIAL SESSION A.2 Socio-economic assessment of the new Common Fisheries Policy of the EU

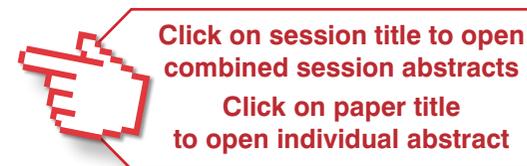
Ralf Doering
Z401
Presenters:
Ralf Doering, Pascal le
Floc'h, Peder Andersen,
Clara Ulrich

SPECIAL SESSION A.3 Cost-Recovery Principles for Fisheries and Biosecurity

Paul Mwebaze
Z406
Presenters:
Harley Smith, Mark
Edwards, Paul Mwebaze,
Ragnar Arnason

SPECIAL SESSION A.4 Extending the Business Case for Traceability from the Global North to the Global South

Megan Bailey
Z309
Presenters:
Mark Soboil, Eric Enno
Tamm, Momo Kochen,
Simon Bush, Alex Miller



3.30pm –
4.00pm

Afternoon Tea

Z Block, Level 4 Atrium, QUT Gardens Point

4.00pm –
5.30pm

CONCURRENT SESSION 2

TOPIC:

SESSION 2.1 Management

CHAIR:
ROOM:

Jennifer Meredith
Z411
2.1A - Julia Hoffmann, Common Pool Politics and inefficient Fishery Management (365)
2.1B - Andrew Scheld, Costly Avoidance in a Multispecies Catch Share Fishery (436)
2.1C - Natacha Carvalho, Small-scale fisheries in the midst of the EU Fleet: findings from the 2013 AER on the EU fishing fleet (84)
2.1D - Michele Barnes-Mauthe, The Total Economic Value of Small-Scale Fisheries with a Characterization of Post-Landing Trends: an Application in Madagascar with Global Relevance (2)

SESSION 2.2 A.2 Socio-economic Assessment of the New Common Fisheries Policy of the EU cont.

Clara Ulrich
Z401
Presenters:
Manuel Bellanger, Leyre
Goti, Katell Hamon

SESSION 2.4 Management: ITQs

Barbara Hutniczak
Z303
2.4A - Juan Agar, The Effect of IFQs on the Total Factor Productivity of the US Gulf of Mexico Red Snapper Fishery (312)
2.4B - Marysia Szymkowiak, Estimating the Costs of Quota Share Trading Restrictions in the Alaskan Halibut ITQ Program Using Linear Programming (321)
2.4C - Zulhamsyah Imran, Factors Affecting on the Depletion of Anchovy Fisheries in Krueng Raya Bay, Aceh-Indonesia (109)
2.4D - James Sanchirico, Dynamic Efficiency Costs of Non-Efficiency Objectives in Tradable Permit Programs (406)

SESSION 2.5 Management: Regulation & Analysis

George Kailis
Z304
2.5A - Jorge Holzer, Harvest Reporting, Uncertainty and the Value of Timely Information (214)
2.5B - Rachel Cooper, An Analysis of the Structural Changes in the Offshore Demersal Hake (*Merluccius capensis* and *M. paradoxus*) Trawl Fishery in South Africa (107)
2.5C - Muhamad Suhendar, Cost Benefit Analysis of Vessel Monitoring System (VMS) in Indonesia for Managing The Transition to Sustainable and Responsible Fisheries (342)
2.5D - Serkan Kucuksenel, The Promise of Transferable Fishing Concessions (234)

SESSION 2.6 Fisheries Modelling & Management

Samantha Paredes
Z302
2.6A - Tess Stafford, The Multi-species Aspect of Labor Supply Decisions in Spatially Explicit Bio-economic Fishery Models (293)
2.6B - Aneesh Hariharan, A game theoretic bargaining framework for cooperative management of the Pacific sardine (270)
2.6C - Lisa Pfeiffer, The Effects of Catch Share Management on Rent Generation through Targeting and Production Choices (418)

SESSION 2.7 Markets: Sustainability & Certification

Martin Purves
Z309
2.7A - Simon Bush, Vertically Differentiating Environmental Standards: The Case of the Marine Stewardship Council (452)
2.7B - Petter Olsen, Value-Adding for Captured Fish Products by Documenting Sustainability (467)
2.7C - Gunnar Knapp, Estimating United States Salmon Consumption (441)
2.7D - Haja Razafimandimby, Using a Choice Experiment to Account for Preference Heterogeneity in Fresh Spiny Lobster Attributes: The Case of French Consumers (400)

5.30pm –
7.00pm

Poster Session Special Event

The Cube, Level 4, P Block, QUT Gardens Point

9:00am - 9:45am **PLENARY 2 - IIFET Fellow Presentations**
Keynote speaker: Lee Anderson, University of Delaware
The Application of Basic Economic Principles to Real World Fisheries Management
 ROOM: Z411

9.45am - 10.30am **PLENARY 3 - IIFET Fellow Presentations**
Keynote speaker: Ragnavalder Hannesson, Norskhusenett
Crisis in World's Fisheries?
 ROOM: Z411

10.30am - 11.00am **Presentation Ceremony Best Paper Awards**
 ROOM: Z411

11.00am - 11.30am **Morning Tea**
 Z Block, Level 4 Atrium, QUT Gardens Point



11.30am - 1.00pm **CONCURRENT SESSION 3**

	SESSION 3.1	SESSION 3.2	SESSION 3.3	SESSION 3.4	SESSION 3.5	SESSION 3.6	SESSION 3.7
TOPIC:	Markets: Preferences & Prices	Climate: Variability & Vulnerability	Management: Community & Co-management	Management: Time, Risk and Safety	Fisheries Modelling: Micro Foundations and Applications	Small Scale and Artisanal Fisheries	Markets: Related Markets Policy
CHAIR:	Ruth Pincinato	Jay Abolofia	Kate Barclay	Julia Hoffmann	Tess Stafford	Joseph Luomba	Katell Hamon
ROOM:	Z411	Z401	Z406	Z309	Z304	Z302	Z306
	<p>3.1A - Sevaly Sen, Will third party certification provide management and economic benefits to Australian domestic fisheries? (265)</p> <p>3.1B - Taiwo Mafimisebi, Fresh Fish Attributes and Consumers' Preference Ranking in Rural and Urban Households in Ondo State, Nigeria (9)</p> <p>3.1C - Fabian Zimmermann, Is size-dependent pricing prevalent in fisheries? The case of Norwegian demersal and pelagic fisheries (16)</p> <p>3.1D - James Bukenya, Price Interactions between Farm-Raised and Wild-Harvested African Catfish in Uganda (129)</p>	<p>3.2A - Alan Haynie, Not Just a March to the North: How Climate Variation Affects the Bering Sea Pollock Trawl and Pacific Cod Longline Fisheries (415)</p> <p>3.2B - Frank Millerd, Governance and Management of Arctic Fisheries (420)</p> <p>3.2C - Kanae Tokunaga, Remapping Tuna Sovereignty in the Pacific: Forging a Nexus between Access and Climate Change Mitigation (430)</p> <p>3.2D - Kimanh Nguyen, Climate Change, Rural Household Food Consumption and Vulnerability in Vietnam (138)</p>	<p>3.3A - Nga Thi Thanh Ho, Fisheries Co-management in Tam Giang Lagoon, Vietnam: A Right-based Management System (14)</p> <p>3.3B - A K M Firoz Khan, Co-management of Inland Capture Fisheries Provide Enhance Production and Equity of Benefit Distribution to the Poor Fisher: an Experience from Bangladesh (253)</p> <p>3.3C - Uthpala Rathnayake, Opportunities for Sustainable Management of Landing Facilities in the Anchorages Nilwella (254)</p> <p>3.3D - Dileepa Samika Thanuksha de Croos, How Artisanal Stake-seine Fishery Survived for Last 300 Years in the Dynamic and Competitive Environment? (376)</p>	<p>3.4A - Louisa Coglean, Fisheries Management and Fisher Discount Rates (382)</p> <p>3.4B - Lisa Pfeiffer, A Safer Catch? The Effects of Catch Share Management on Safety and Risk Taking in the Pacific Northwest Fisheries (419)</p> <p>3.4C - Gakushi Ishimura, Fishing together or alone? Evaluation of the efficiency in the post-tsunami group operations of the off-shore longline fisheries operations in Kesenuma, Japan (252)</p>	<p>3.5A - Dale Squires, The Microeconomic Foundations of Renewable Resource Models (220)</p> <p>3.5B - Lone Kronbak, On International Fisheries Agreement, Entry Deterrence and Ecological Uncertainty (169)</p> <p>3.5C - Marko Lindroos, Two-period Coalition Stage-Model of Fisheries with Enforcement (233)</p> <p>3.5D - Emmi Nieminen, International fisheries agreements under slow and fast environmental changes (236)</p>	<p>3.6A - Ayanboye Oluyemi, Gender Inequalities Issues in Fish Farming in Southwestern, Nigeria (132)</p> <p>3.6B - Margaret Masette, Long-term impacts of globalisation on small scale fisher communities: Two decades of liberalized economy in Uganda (235)</p> <p>3.6C - Upendo Hamidu, Assessment of the Marine Artisanal Fisheries in Tanzania Mainland (208)</p> <p>3.6D - Hayford Agbekpohnu, Willingness to Participate in an Insurance Scheme by Artisanal Fishers in Ghana (242)</p>	<p>3.7A - Ola Flaaten, Stubborn Fuel Tax Concessions – The Case of Fisheries in Norway (231)</p> <p>3.7B - Michele Barnes-Mauthe, Information Sharing Networks and Rates of Incidental Catch (286)</p> <p>3.7C - Yajie Liu, Exploring the Influence of Climate, Competition and Aquaculture on the Dynamics of Fraser River Sockeye Salmon and the Economics of their Fisheries (422)</p> <p>3.7D - Thong Tien Nguyen, The World Demand for Catfish Pangasius: A Demand System Approach (227)</p>

1.00pm - 2.00pm **Lunch**
 Z Block, Level 4 Atrium, QUT Gardens Point

2.00pm -
3.30pm

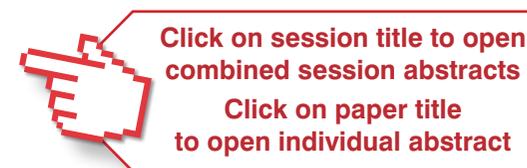
CONCURRENT SESSION 4

	SESSION 4.1	SESSION 4.2	SESSION 4.3	SESSION 4.4	SESSION 4.5	SESSION 4.6	SESSION 4.7
TOPIC:	Markets: Demand	Climate: Adaptation	Management: Rents & Returns	Value Chain Analysis	Aquaculture: Efficiency	Poor Data & Valuation	Markets: Related Markets Analysis
CHAIR:	Michele Barnes-Mauthe	Urs Steiner Brandt	James Stewart	Øystein Hermansen	Peggy Schrobback	Trevor Hutton	Simon Bush
ROOM:	Z411	Z401	Z406	Z309	Z304	Z302	Z306
	4.1A - Ruth Beatriz Mezzalira Pincinato, A derived demand analysis for sardines in the Southeastern Brazil (94)	4.2A - Mabel Ipinmoroti, Socio-economic Implication of Climate Change on Small Scale Fisheries of Southwestern Nigeria (73)	4.3A - Kathryn Bisack, Understanding Noncompliance of Protected Species Regulations in the Northeast Gillnet Fishery: Before and After 'Consequence Closures'(218)	4.4A - Øystein Hermansen, Effects of Floor Prices in First-Hand Sales (363)	4.5A - Edward Ebo Onumah, Production Risk and Technical Efficiency of Fish Farms in Ghana (13)	4.6A - Elizabeth Adebayo, Economics of Fish Harvesting in Nigeria: A Case Study of Yola North Local Government Area of Adamawa State (135)	4.7A - Bernardo Patti, Small pelagic fish market in the south of Sicily: socioeconomic linkages between catch volume and local consumption (215)
	4.1B - Taro Oishi, "Fast Fish" Campaign in Japan and Consumers' Consciousness of Marine Environmental Preservation (205)	4.2B - Kimanh Nguyen, Climate Change Awareness, Coping Mechanisms and Adaptation in Poor Rural Coastal Communities, Vietnam (139)	4.3B - Tesfom Melake Araya, SWOT analysis and recommended policies and strategies of Eritrean fisheries (196)	4.4B - Manoel Pedroza, Transformations of the Retail Fish Market in Brazil and its Impacts on Small-Scale Fish Farming (154)	4.5B - Carel Ligeon, The Use of Hierarchy Process, Cost Benefit Analysis and Goal Programming to Evaluate Profitability and Sustainability of Aquaculture: The Case of Tilapia Farming in Jamaica (340)	4.6B - Piyashi DebRoy, Estimation of Inland Fish Production in North-East India: Current Status and Future Challenges (59)	4.7B - Mohottala Gedara Kularatne, Water Poverty: Water Poverty Index (WPI) for Culture-Based Fish Farming Communities in Village Irrigation System of Sri Lanka (338)
	4.1C - Hirotugu Uchida, Long-Term Health Effects, Risk Perceptions, and Consumption Patterns for Aquacultured Seafood (352)	4.2C - Chris Kennedy, Predicting Recreational Fishery Landings Under Alternative Climate Scenarios: The US Summer Flounder Fishery (328)	4.3C - Jennifer Meredith, Evaluating the Performance of Fisheries Management Systems: Lessons from the Fisheries Performance Indicators (425)	4.4C - Ria Fitriana, A Value Chain Analysis of Fish Products: Case study from Pantar Island, Eastern Indonesia (175)	4.5C - Hasneen Jahan, Productivity Growth in the Shrimp Farming Industry of Bangladesh: A Luenberger Productivity Indicator Approach (47)	4.6C - Ken Smith, Value of the Queensland Freshwater Fishery (79)	4.7C - Benjamin Fissel, Evaluating Changes in Total Factor Productivity in the Amendment 80 Catcher/Processor Fishery (448)
	4.1D - Hirotugu Uchida, Estimation of Demand System of Bivalves in Rhode Island (396)	4.2D - Achini De Silva, Crowd Sourcing to Mitigate the Climate Change effects on Small Scale Fisheries in Sri Lanka (332)		4.4D - Duy Nguyen Ngoc, Cooperation for Sustainable Business Development – The Case of Value Chain of Skipjack Tuna in Vietnam (268)	4.5D - Adewale Isaac Fatuase, Evaluation of Feed Type Choices and Performance of Fish Farming in Akure South Local Government Area of Ondo State, Nigeria (32)	4.6D - Daniel Lew, Weighting and Imputation for Missing Data in a Cost and Earnings Survey of Alaska Charter Fishing Businesses (98)	

3.30pm -
4.00pm

Afternoon tea

Z Block, Level 4 Atrium, QUT Gardens Point



4.00pm -
5.30pm

CONCURRENT SESSION 5

TOPIC:

SESSION 5.1

Globalisation & Trade

SESSION 5.2

Climate: Vulnerability

SESSION 5.3

Management and Development

SESSION 5.4

Value Chain Analysis

SESSION 5.5

Models: Shocks & Sustainability

SESSION 5.6

Management & Development: Small-scale Fisheries

SESSION 5.7

Social Performance & Management

CHAIR:
ROOM:

Olivier Thebaud
Z411

Kimanh Nguyen
Z401

James Bukenya
Z406

Ingrid Van Putten
Z309

Simone V. de Souza
Z304

Tesfom Melake Araya
Z302

Kate Brooks
Z306

5.1A - Prathvi Rani, Export Performance of Indian Shrimp to European Union under proposed Free Trade Agreement: An Ex-ante Assessment (101)

5.2A - Thanh Viet Nguyen, Livelihood Vulnerability Assessment of Climate Change at Community Level Using Household Survey: A Case Study of Coastal Communities in Rang Dong Town, Nghia Hung District, Nam Dinh Province, Vietnam (124)

5.3A - Yoshihiro Kuronuma, Key Conditions for the Sustainability of Community-Based Fisheries Management on Unrestricted Fisheries: A Study of Self-Imposed Management in the Alfonsino Fishing Grounds off Katsuura, Japan (378)

5.4A - Jayasekhar Somasekharan, Restructuring the Value Chain Governance: The Impact of Food safety regime on fishery sector of Kerala, India (299)

5.5A - Yun-Ling Jocelyn Wang, Managing for Sustainable Yield and Risk: Optimal Escapement Goal Policies in Bristol Bay (443)

5.6A - James Wilen, Should Fisheries Remain Open Access as Employment Buffers for the Poor? (429)

5.7A - Michele Barnes-Mauthe, Cultural Bequest Values for Ecosystem Service Flows Among Indigenous Fishers: a Discrete Choice Experiment Validated with Mixed Methods (153)

5.1B - Andrew Wamukota, Income distribution and inequality among fishers and fish traders in two small-scale Kenyan coral reef fisheries (22)

5.2B - Urs Steiner Brandt, The Effect of Extreme Events on the Local Fisher Communities Risk Perception on Climate Change and Willingness for Implementing Adaptation Measures (375)

5.3B - Joseph Luomba, Role of Beach Management Units in Implementing Fisheries Policy. A Case Study of Two BMUs in Lake Victoria, Tanzania (122)

5.4B - Achini De Silva, Ecological foot print of the postharvest losses in Tuna industry: A case of Sri Lanka (280)

5.5B - Cloe Garnache, Fish, Floods, and Farmers: The Joint Production of Ecosystem Services on a Working Landscape (287)

5.6B - Taiwo Mafimisebi, Awareness and Utilization of Indigenous Knowledge Systems in Artisanal and Coastal Fishing in Southwest, Nigeria (8)

5.7B - Eric Thunberg, From Fishing Capacity to Diversity; Changing Fishery Management Priorities in the US New England Groundfish Fishery (397)

5.1C - Sun Chen, The Influence of Economic Globalization to the Consumption Demand of Fish and Fishery Products of Chinese Residents (28)

5.2C - Cassandra Young, Vulnerability assessments in fisheries social-ecological systems: some experiences in their development and implementation for adaptation planning (197)

5.3C - Douglas Lipton, Fishery Buybacks, Efficiency and Participation (177)

5.4C - James A. Young, Knowledge is Power? The role of market information in value creation by developing country aquaculture producers (311)

5.5C - Steven Rust, Can Stochasticity Cause Overcapacity in a Pure Open Access Fishery? (289)

5.6C - Natacha Carvalho, Defining Small-Scale Fisheries: Closing the Gap between a Simple Definition Based on Vessel Characteristics and Local Operational Range (83)

5.7C - Alex Miller, The Economic Status and Performance of the U.S. Gulf of Mexico Inshore Shrimp Fishery in 2008 and 2012: Before and after the Deepwater Horizon Oil Disaster (426)

5.1D - Manoel Pedroza, Effects of Non-Tariff Barriers on Brazilian Fisheries Exports to Europe (92)

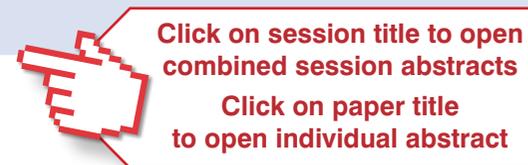
5.2D - Hoki Massaquoi, The Effects of Climate Change, it's Adaptation, Vulnerability and Economic Impacts on Fisheries in the World; with Reference to Sierra Leone (451)

5.3D - John Ledyard, A Simple Buy-back Auction for Fisheries Management (213)

5.4D - Ayanboye Oluyemi, Value Chain Analysis of the Artisanal Fisheries of the Ogun Waterside Area, Nigeria (95)

5.5D - Lorena Fricke, The Economic Consequences of Regime Shifts in Marine Ecosystems (314)

5.6D - Joshua Cinner, A Sea Change on the African Coast: Early Social and Ecological Outcomes of a Governance Transformation in Kenyan Fisheries (469)



PLENARY 4

9:00am -
10:00am

Keynote speaker: Tony Smith, CSIRO

Economic performance and ecosystem based fisheries management

ROOM: Z411

10:00am -
10:30am

Distinguished Service Award: Sean Pascoe, CSIRO

Balancing economic, social and environmental objectives in EBFM

ROOM: Z411

10:30am -
11:00am

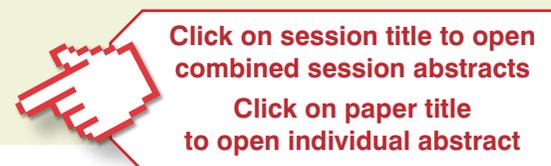
Morning Tea

Z Block, Level 4 Atrium, QUT Gardens Point

11:00am -
12:30pm

CONCURRENT SESSION 6

TOPIC:	SESSION 6.1 Management: Institutions, ITQs and Governance	SESSION 6.2 Management: Policy	SESSION 6.3 Aquaculture: Industry Structure	SESSION 6.4 Management: Regulation & Allocation	SESSION 6.5 Models: Ecological Effects	SESSION 6.6 Indigenous Fisheries Management	SESSION 6.7 Poor Data & Uncertainty
CHAIR:	James Innes	Kanae Tokunaga	Mohottala Gedara Kularatne	A. Justin Kirkpatrick	Lisa Pfeiffer	Michelle Voyer	Maria Rebecca Campos
ROOM:	Z303	Z411	Z406	Z304	Z302	Z309	Z306
	6.1A - Timothy Emery, An experimental analysis of assignment problems and economic rent dissipation in quota managed fisheries (173)	6.2A - Dale Squires, Mitigation of Ecosystem-Level Impacts of Fisheries Bycatch on Marine Megafauna: Conservation Policy, Economic Instruments, and Technical Change (221)	6.3A - A.B.M. Mahfuzul Haque, An Empirical Analysis of Community Based Fish Culture (CBFC) Systems in Bangladesh: Impacts on Expenditures and Inequality (118)	6.4A - Courtney Sakai, Eliminating Harmful Fisheries Subsidies: Using Trade and Economic Policies to Rebuild Fisheries, Improve Livelihoods, and Promote Sustainable Fishing Worldwide (423)	6.5A - Øystein Hermansen, Bioeconomics and Seasonal Variations in Catchability (361)	6.6A - Roku Mihinui, Te Arawa: Kaitiakitanga - Traditional Customary Practices for Freshwater and Fisheries Management: The Challenges and Successes for Te Arawa to Manage Freshwater Environments and Fisheries in Aotearoa/ New Zealand (339)	6.7A - Rolf Groeneveld, Source of Uncertainty in Indonesian Tuna Fisheries Management and the Effect of Uncertainty on Economic Value (116)
	6.1B - George Kailis, Tall Tales? Legal History, Economics and Rights to Fish (207)	6.2B - Cassandra Young, Payments for Ecosystem Services - A fisheries and aquaculture perspective (198)	6.3B - Kimanh Nguyen, Aquaculture Participation on Poverty Alleviation: The Case of Ben Tre Province, Vietnam (258)	6.4B - Hirotsugu Uchida, Are Two Rents Better Than None? The Case for Monopoly Harvester Co-Ops (353)	6.5B - James Sanchirico, Fishing History Determines Economic Value of Ecological Information in Multispecies Fisheries (408)	6.6B - Hekia Bodwitch, Fisheries Sustainability Challenges Embedded in Individual Transferable Quota Systems: Knowledge, Technology and Indigenous Fisheries Development in New Zealand (442)	6.7B - Julian Morison, Having a Crack at MEY when Time, Money and Data are Short (344)
	6.1C - Ragnar Arnason, Economically Sensible Caps on ITQ-Holdings (453)	6.2C - Zuzy Anna, Indonesian Fisheries Resource Accounting (157)	6.3C - Thomas Murray, Developing Cooperative Production models for Molluscan Shellfish Culture in the U.S (163)	6.4C - Niels Vestergaard, Recent Developments in Fisheries Economics Research (216)	6.5C - Rachel Cooper, An Agent Based Model of South African Demersal Hake Trawling Examining the Dynamics of the Industry Between Target Resource and Markets (403)	6.6C - Lê Chí Công, The Roles of Family Conflict and Identity in the Theory of Planned Behaviour (3)	6.7C - Rolf Groeneveld, The Information Value of Full-Retention Policies (370)
	6.1D - James Stewart, Quota Market Efficiency: The New Zealand Annual Catch Entitlement (ACE) Market (480)	6.2D - Benjamin Fissel, Identifying Technology Shocks in Fisheries Production (446)	6.3D - Miroslav Batka, Fisheries and Aquaculture to 2050 (440)	6.4D - Rolf Groeneveld, A limited entry fishery and Real Options theory (160)	6.5D - Rudi Voss, Assessing social – ecological trade-offs to advance ecosystem-based fisheries management (256)		6.7D - Sean Pascoe, Proxy Measures for Economic Target Reference Points in Data Poor Multispecies Fisheries (381)



12:30pm -
1:30pm

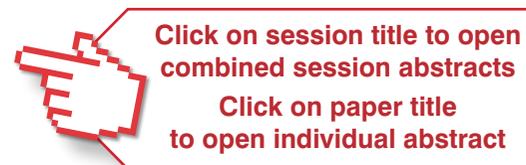
Lunch

Z Block, Level 4 Atrium, QUT Gardens Point

1.30pm –
3.30pm

SPECIAL SESSION B

	SPECIAL SESSION B.1	SPECIAL SESSION B.2	SPECIAL SESSION B.3	SPECIAL SESSION B.4
	Understanding responses to catch share systems in marine fisheries	Collaborating for Ocean Health: A discussion by the Blue Ribbon Panel – special advisory body to the Global Partnership for Oceans	Integrating the Social in Marine Environment Governance	Market Access Issues Related Multiple Certification Schemes for Fish and Fishery Products in International Trade
CHAIR:	Olivier Thebaud	James Anderson	Kate Barclay	Karunasagar Iddya
ROOM:	Z303	Z411	Z406	Z304
	Presenters Olivier Thebaud, Dan Holland, Katell Hamon, Andrew Scheld, James Innes, Sherry Larkin, Olivier Guyader	Presenters James L. Anderson, Ragnar Arnason, Ove Hoegh-Guldberg	Presenters Kate Barclay, Kate Brooks, Ingrid Van Putten, Michelle Voyer, Simon Foale	Presenters Audun Lem, Nada Bougouss, Nguyen Dung, Thomas Darmawan



3.30pm -
4.00pm

Afternoon Tea
Z Block, Level 4 Atrium, QUT Gardens Point

4.00pm -
5.30pm

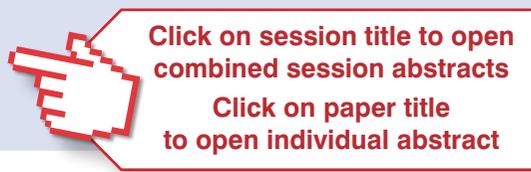
CONCURRENT SESSION 7

	SESSION 7.1	SESSION 7.2	SESSION 7.3	SESSION 7.4	SESSION 7.5	SESSION 7.6	SESSION 7.7
TOPIC:	B.1 Understanding Responses to Catch Share Systems in Marine Fisheries (cont)	Management, Regulation and Marine Reserves	Aquaculture: Disease Management	B.4 Market Access Issues Related Multiple Certification Schemes for Fish and Fishery Products in International Trade (cont)	Models: Alternative Approaches	Recreational: Valuation & Management	Environment: Invasive Species
CHAIR:	Dan Holland	Jannike Falk-Petersen	Cassandra de Young	Audun Lem	Guyader Olivier	Melissa Errend	Paul Mwebaze
ROOM:	Z411	Z308	Z406	Z309	Z302	Z305	Z306
	Presenters Dale Squires, Ralf Doering, Ingrid Van Putten, Caleb Gardner	7.2A - Renato Molina, Potential Benefits of a Transboundary Marine Protected Area Under no Cooperation Between Countries (200) 7.2B - James Rising, Global Benefits of Marine Protected Areas (179) 7.2C - James Hilger, Regulatory Impacts on Exit from the California Drift Gillnet Swordfish Fishery: A Treatment-Control Duration Model (475) 7.2D - Sean Sloan, Evergreen Licences, Resource Shares and Share Trading – Taking Them Out Of The 'Too Hard Basket' (460)	7.3A - Kanae Tokunaga, Economics of Commercial Aquaponics: Hydroponic Vegetable Production as a Potential Aquaculture Water Treatment System (437) 7.3B - Jay Abolofia, Putting a Price on Lice: Quantifying the Biological and Economic Impacts of Sea Lice on Farmed Salmonids (260) 7.3C - Kanar Hamza, Sustainable (biological) control of sea lice in Norwegian Atlantic salmon farms: a system dynamics approach (276)	Presenters Renata Barroso, Karunasagar Iddya, J Panisuan,	7.5A - Alan Haynie, FishSET: a Spatial Economics Toolbox to Better Incorporate Fisher Behavior into Fisheries Management (417) 7.5B - Porter Hoagland, An Empirical Analysis of Portfolio Management as a Tool for Implementing Ecosystem-Based Fishery Management (421) 7.5C - Francois Bastardie, Supporting bio-economic evaluation of spatial planning constraining fishing activities: be quantitative, spatially-explicit, vessel-oriented, stochastic, and dynamically coupled to fish populations (186) 7.5D - Soile Oinonen, Fisheries and Optimal Eutrophication Management: A Bayesian Approach (360)	7.6A - James Kahn, Community-Based Sport Fishing as a Sustainable Development Path in Remote Regions in Developing Countries (199) 7.6B - Doron Schultz, Estimate of recreational fishermen preferences and willingness to pay for a license under several regulatory regimes using a discrete choice model (111) 7.6C - Ye Chen, The Value of Recreational Fishing in Shanghai (71) 7.6D - Robert Curtotti, Frameworks for Measuring the Economic Value of Australia's Recreational and Commercial Fisheries (335)	7.7A - Juniors Marire, Disjuncture in Environmental Policymaking: A case of Trout in the Alien Invasive Species Regulatory Reforms in South Africa (240) 7.7B - Durayalage Suseema Ariyaratna, Evaluation of importance of Orinoco Sailfin Catfish (<i>Pterygoplichthys multiradiatus</i>) as a food source (244) 7.7C - Yajie Liu, Emerging Jellyfish and its Significance in Local Fisheries - a Periphylla Story in the Trondheimsfjord (319)

6.00pm -
11.00pm

Conference Dinner
South Bank Surf Club, South Bank

CONCURRENT SESSION 8					
9.00am - 10.30am	SESSION 8.1	SESSION 8.2	SESSION 8.3	SESSION 8.4	SESSION 8.5
TOPIC:	Poor Data & Markets	Marine Reserves	Management: Spatial & Bycatch	Management: Multiple Uses	Ecosystem Modelling
CHAIR:	Roger Edwards	Hirotsugu Uchida	Timothy Emery	Lone Kronbak	Soile Oinonen
ROOM:	Z411	Z303	Z304	Z309	Z302
	<p>8.1A - Andrew Wamukota, Testing for the influence of global trade on local fish prices and food security in an African coral reef fishery (21)</p> <p>8.1B - Mariko Fujimoto, Reciprocal business practices among fishermen, middlemen, and merchants in the dagaa processing industry in a coastal community on Zanzibar Island, Tanzania (315)</p> <p>8.1C - Hiroyuki Inai, Patron-Client Relationship (PCR) in Fresh Fish Trade (FFT) at Lake Chad, Cameroon (433)</p>	<p>8.2A - Mehdi Doroudi, South Australia's Marine Park Catch/Effort Reduction Program – Implications for Fisheries Management (461)</p> <p>8.2B - Jannike Falk-Petersen, A Deliberative Approach to Valuation of Cold Water Corals - Investigating Opportunity Costs and the Precautionary Principle (239)</p> <p>8.2C - Katrina Davis, Considering the Costs of Enforcement: Improving Marine Spatial Planning (465)</p>	<p>8.3A - Alan Haynie, Assessing the Impact of Chinook Bycatch Reduction Incentives in the Bering Sea Pollock Fishery (424)</p> <p>8.3B - Renato Molina, Implications of Different Spatial Management Strategies when Establishing Territorial User Fishing Rights and Marine Protected Areas for Interconnected Marine Systems (201)</p> <p>8.3C - Tracey Osborne, Valuing Fishing Grounds and the Cost of Displaced Fishing (348)</p>	<p>8.4A - A. Justin Kirkpatrick, The Economic Impact of Offshore Wind Development on Northwest Atlantic (US) Fisheries (187)</p> <p>8.4B - Samantha Paredes, Exploring incentive based management options for regulating mine and dredge spoil dumping in the marine environment (292)</p> <p>8.4C - Porter Hoagland, Coastal and Marine Spatial Planning in the Context of Ecosystem-Based Fisheries Management: Assessing Tradeoffs between Wind Farms and Marine Fisheries in New England (434)</p> <p>8.4D - Mohottala Gedara Kularatne, Irrigation Development on Lagoon Fisheries and Fishing Communities: A case study of Malala Lagoon in Sri Lanka (435)</p>	<p>8.5A - Peder Andersen, Ecosystem Economics: The Baltic Cod Fishery Case (334)</p> <p>8.5B - Trevor Hutton, Interpreting Output From an Ecosystem-Based Model with Various Degrees of Complexity in the Specification of the Fleet Dynamics (337)</p> <p>8.5C - Giles Austen, Anticipating the Unintended Consequences of Environmental Management in a Marine Socio-Ecological System using Qualitative Loop Analysis (351)</p> <p>8.5D - Esther Fondo, Modelling the Potential Fisheries Impacts on the Trophic Structure of Moreton Bay, Australia (355)</p>



10.30am - **Morning Tea**
11.00am Z Block, Level 4 Atrium, QUT Gardens Point

CONCURRENT SESSION 9					
11.00am - 12.30pm	SESSION 9.1	SESSION 9.2	SESSION 9.3	SESSION 9.4	SESSION 9.5
TOPIC:	Markets & Consumer Prices	Environment: ICZM	Management: Efficiency Analysis	Management: Tuna & DWFN	Fisheries Enhancement & Alternative Livelihoods
CHAIR:	Hiroyuki Inai	Katrina Davis	Edward Ebo Onumah	Robert Curtotti	Miroslav Batka
ROOM:	Z411	Z303	Z304	Z309	Z302
	<p>9.1A - Thong Tien Nguyen, Asymmetric Transmission between Farm Price and Export Price: The Case of Vietnam Pangasius Industry (230)</p> <p>9.1B - Sherry Larkin, Household Consumption Patterns in the U.S. Southeast from Panel Scanner Data: Market Comparison and Demographic Preference Analysis (341)</p> <p>9.1C - Nobuyuki Yagi, A Weekend Effect in Expenditure Levels for Fisheries Products in Japan's Consumer Market (438)</p> <p>9.1D - Elizabeth Adebayo, Comparative Economics of Fresh and Smoked Fish Marketing in some Local Government Areas in Adamawa State (395)</p>	<p>9.2A - Olivier Thebaud, Of sets of offsets: cumulative impacts and strategies for compensatory restoration (313)</p> <p>9.2B - Sean Pascoe, Licensed to Kill: Can we use Quota Markets to Conserve Seabirds? (380)</p> <p>9.2C - Eduardo Galicia, Economic Value of Wildlife-Tourism to maximize benefits for Conservation of Coastal Fisheries in a Natural Protected Area (330)</p>	<p>9.3A - Justin Otoo, Technical Efficiency of Artisanal Fisheries in the Southern Sector of Ghana (25)</p> <p>9.3B - Carmen Pedroza, Production constraints and the impact of globalization on inland fishing products in Mexico (74)</p> <p>9.3C - Thanh Viet Nguyen, Efficiency analysis of offshore fishing fleet in the South-eastern Sea (Vietnam) using DEA (123)</p> <p>9.3D - Paul Mwebaze, Estimating Technical Efficiency for Abalone Fisheries in Victoria, Australia (295)</p>	<p>9.4A - Agnes Yeeting, Moving Towards Market Based Approaches for Tuna Management in the Western and Central Pacific- The Case of the PNA (249)</p> <p>9.4B - Satoshi Yamazaki, How Do Fishing Access Agreements Affect Harvesting Decisions of Small Island Nations?: The Case of the Western and Central Pacific Tuna Fishery (347)</p> <p>9.4C - Chris Anderson, Fishery Performance Indicators for Regional Fishery Management Organizations: Global Tuna Fisheries (444)</p> <p>9.4D - Haruko Yamashita, Comparative Study on the Fishery Labor Supply in East Asian Countries/ Region (449)</p>	<p>9.5A - Ria Fitriana, Seaweed value chain: a case study in Pantar Island, Eastern Indonesia (174)</p> <p>9.5B - Amar Doshi, Scenarios for feasible algaculture using a techno-economic model (285)</p> <p>9.5C - Nerissa Salayo, Economics of Community-Based Stock Enhancement of Abalones in Sagay Marine Reserve, Negros Occidental, Philippines (103)</p>

12:30pm - **Closing Ceremony**
1:30pm ROOM: Z411

Session number: 1.1

Paper number: 31

Transition to Rights-Based Management in Fisheries: Evidence from Alaska

Rebecca Toseland, University of California, Santa Barbara, Santa Barbara, CA, United States

Catch share programs are emerging as a rights-based management tool capable of improving biological and economic performance in marine fisheries relative to traditional command and control regulation approaches. This paper examines the determinants of the transition from command and control regulation to rights-based management in marine fisheries. I develop a conceptual framework describing a regulator's decision to adopt a rights-based management regime. I empirically test the hypotheses advanced in the conceptual framework with a duration analysis of rights-based management program adoption in a group of federally managed Alaska fisheries. Consistent with the conceptual framework, I find that rent dissipation along input cost and product value dimensions increases the likelihood of program adoption, and high transaction costs decrease the likelihood of program adoption. Finally, I find mixed evidence that resource depletion increases the likelihood of program adoption.

Session number: 1.1

Paper number: 302

A Study on the Efficiency Mechanism of Pooling System and Social Capital in Fishery

Mihoko Tegawa (presenting), Hirotsugu Uchida¹

1. University of Rhode Island, Kingston, Rhode Island, United States

Self-management has been recognized as important in successfully governing the common pool resources. This is no exception in fishery. Fishery cooperatives, where fishermen collectively manage the fishery, are garnering much attention from both regulators and academics. In this study, we aim to empirically disentangle the efficiency mechanism of pooling system. The pooling system is a management rule that self-governing fishery can implement. Under the system a group of harvesters share catch and/or profits among members. Employment of the pooling system is a collective action that a group of harvesters takes. The pooling system can induce fishers different incentives ranging from free-riding on other's fishing effort to strengthening effort coordination such as rotation of fishing grounds and joint marketing. This research hypothesizes two factors potentially affecting these different incentives: social capital and cooperative fishing practice. Social capital refers to attributes such as trust, reciprocity and cooperation in a human relationship that is important in economic welfare. Cooperative fishing practice is often employed under the pooling system because the system can make self interests align with group interests. We collected the data from fishery cooperatives in Japan, which have a long history of self-management as well as ample cases of the pooling system. In addition to surveys with fishery cooperatives staffs and fishermen, economic experiments are used to quantify social capital.

Session number: 1.1

Paper number: 10

Bioeconomic Modelling of Fishery Conservation Policies in the Philippines

Maria Rebecca Campos, University of the Philippines Open University, Los Banos, Laguna, Philippines

The Philippines is surrounded with many fishing grounds. In spite of this, most fishermen in the area live in poverty, and their plight is getting worse, not better. Current fisheries policies for the area have failed to improve the situation but no research has been done to find out why. This report uses a bioeconomic model to simulate the effects of changes in the enforcement levels of current policies. Investments of the government on different levels of enforcement were assessed using benefit cost analysis. The report assesses the effects of enforcing current fisheries policies more stringently. The situation would be transformed into one in which large and perhaps increasing numbers of people would continue to fish, expending larger amounts of effort to comply with various gear restrictions but, in all likelihood, harvesting no fewer fish. Because the bay is already overfished, catch per unit effort and marginal productivity would decrease. Any additional fishing effort in the bay will result in a decrease in the average catch of all fishermen. Enforcement of current policies will not address the underlying problems of open access and the overfishing it leads to. One policy to deal with the problems of open access and overfishing is to set a limit on the total number of fish that can be caught and divide this quota among Lamon Bay's fishermen.

Session number: 1.1

Paper number: 81

Optimal Harvest in a Multispecies Age Structured Fishery Model at Different Level of Density Dependency

Diwakar Poudel, Norwegian School of Economics, Bergen, Hordaland, Norway

This study suggests an optimal harvest policy for Barents Sea species, namely Northeast Arctic Cod (*Gadus morhua*) and Capelin (*Mallotus villosus*) in the multispecies ecosystem. We have solved a multispecies age structured bioeconomic model for predator-prey interaction. Barents Sea stock data from ICES (International Council for the Exploration of the Seas) are employed for the application of the model. Basically, this paper is an application of theoretical model by Steinshamn (2011), which highlights that stock density dependency plays greater role in the optimal management of fishery. We study several scenarios of stock density for predator-prey ecosystem to investigate the optimal harvest policy in multispecies environment. Of the several general biological and economic constraints, we also include the sustainability constraint in the model that contributes towards the ecosystem based management of fishery. Our preliminary findings are that smooth but lower harvest is optimal for capelin fishery compared to the single species model. While pulse fishing yields higher value in cod (predator) compared to the current fishing policy because of the lower cost of harvesting due to density dependency.

Session number: 1.1

Paper number: 31

Transition to Rights-Based Management in Fisheries: Evidence from Alaska

Rebecca Toseland, University of California, Santa Barbara, Santa Barbara, CA, United States

Catch share programs are emerging as a rights-based management tool capable of improving biological and economic performance in marine fisheries relative to traditional command and control regulation approaches. This paper examines the determinants of the transition from command and control regulation to rights-based management in marine fisheries. I develop a conceptual framework describing a regulator's decision to adopt a rights-based management regime. I empirically test the hypotheses advanced in the conceptual framework with a duration analysis of rights-based management program adoption in a group of federally managed Alaska fisheries. Consistent with the conceptual framework, I find that rent dissipation along input cost and product value dimensions increases the likelihood of program adoption, and high transaction costs decrease the likelihood of program adoption. Finally, I find mixed evidence that resource depletion increases the likelihood of program adoption.

Session number: 1.1

Paper number: 302

A Study on the Efficiency Mechanism of Pooling System and Social Capital in Fishery

Mihoko Tegawa (presenting), Hirotsugu Uchida¹

1. University of Rhode Island, Kingston, Rhode Island, United States

Self-management has been recognized as important in successfully governing the common pool resources. This is no exception in fishery. Fishery cooperatives, where fishermen collectively manage the fishery, are garnering much attention from both regulators and academics. In this study, we aim to empirically disentangle the efficiency mechanism of pooling system. The pooling system is a management rule that self-governing fishery can implement. Under the system a group of harvesters share catch and/or profits among members. Employment of the pooling system is a collective action that a group of harvesters takes. The pooling system can induce fishers different incentives ranging from free-riding on other's fishing effort to strengthening effort coordination such as rotation of fishing grounds and joint marketing. This research hypothesizes two factors potentially affecting these different incentives: social capital and cooperative fishing practice. Social capital refers to attributes such as trust, reciprocity and cooperation in a human relationship that is important in economic welfare. Cooperative fishing practice is often employed under the pooling system because the system can make self interests align with group interests. We collected the data from fishery cooperatives in Japan, which have a long history of self-management as well as ample cases of the pooling system. In addition to surveys with fishery cooperatives staffs and fishermen, economic experiments are used to quantify social capital.

Session number: 1.1

Paper number: 10

Bioeconomic Modelling of Fishery Conservation Policies in the Philippines

Maria Rebecca Campos, University of the Philippines Open University, Los Banos, Laguna, Philippines

The Philippines is surrounded with many fishing grounds. In spite of this, most fishermen in the area live in poverty, and their plight is getting worse, not better. Current fisheries policies for the area have failed to improve the situation but no research has been done to find out why. This report uses a bioeconomic model to simulate the effects of changes in the enforcement levels of current policies. Investments of the government on different levels of enforcement were assessed using benefit cost analysis. The report assesses the effects of enforcing current fisheries policies more stringently. The situation would be transformed into one in which large and perhaps increasing numbers of people would continue to fish, expending larger amounts of effort to comply with various gear restrictions but, in all likelihood, harvesting no fewer fish. Because the bay is already overfished, catch per unit effort and marginal productivity would decrease. Any additional fishing effort in the bay will result in a decrease in the average catch of all fishermen. Enforcement of current policies will not address the underlying problems of open access and the overfishing it leads to. One policy to deal with the problems of open access and overfishing is to set a limit on the total number of fish that can be caught and divide this quota among Lamon Bay's fishermen.

Session number: 1.1

Paper number: 81

Optimal Harvest in a Multispecies Age Structured Fishery Model at Different Level of Density Dependency

Diwakar Poudel, Norwegian School of Economics, Bergen, Hordaland, Norway

This study suggests an optimal harvest policy for Barents Sea species, namely Northeast Arctic Cod (*Gadus morhua*) and Capelin (*Mallotus villosus*) in the multispecies ecosystem. We have solved a multispecies age structured bioeconomic model for predator-prey interaction. Barents Sea stock data from ICES (International Council for the Exploration of the Seas) are employed for the application of the model. Basically, this paper is an application of theoretical model by Steinshamn (2011), which highlights that stock density dependency plays greater role in the optimal management of fishery. We study several scenarios of stock density for predator-prey ecosystem to investigate the optimal harvest policy in multispecies environment. Of the several general biological and economic constraints, we also include the sustainability constraint in the model that contributes towards the ecosystem based management of fishery. Our preliminary findings are that smooth but lower harvest is optimal for capelin fishery compared to the single species model. While pulse fishing yields higher value in cod (predator) compared to the current fishing policy because of the lower cost of harvesting due to density dependency.

Session number: 1.2

Paper number: 5

Data Mining Multiple Stakeholders' Responses to Declining *Schizothorax* Fishery in the Lakes of Kashmir, India

Neha W. Qureshi¹, Krishnan M.¹, C Sundaramoorthy², Ramasubramanian V³, **Tesfom Melake Araya¹ (presenting)**

1. Central Institute of Fisheries Education, Mumbai, Maharashtra, India

2. Central Institute of Research on Cotton Technology, Mumbai, Maharashtra, India

3. Central Institute of Fisheries Education, Mumbai, India, Mumbai, Maharashtra, India

This study documented the historical perspective of lake fisheries in Kashmir, India, estimated the trends in fish production using the Kane's cross impact analysis and the stakeholders' willingness to pay for the restoration of *Schizothorax* fishery in the lakes of Kashmir. The cross impacts of introduction of carps in the lakes of Kashmir on *Schizothorax* fishery and total fish production are evaluated by Kane's cross impact analysis. Considering the obvious shortcomings of logistic regression, Classification and Regression Trees (CART) has been used for data mining multiple stakeholders' responses to make a case for sustainable development of the *Schizothorax* fishery in the lakes of Kashmir. On the whole, time spent on the lakes to earn their livelihoods emerged as the root node as the single most important variable that determined WTP of stakeholders followed by income, type of stakeholder and age in the tree model. The CART analysis not only yielded the variables that determined the WTP but the pruned tree gave the hierarchy of the variables that determined WTP. The results of the study strongly made a case for a concerted multi-institutional action plan for the restoration of *Schizothorax* fishery in the lakes of Kashmir.

Session number: 1.2

Paper number: 86

Exploring Discontinuous Preferences in Choice Experiments: The Case of Cold Water Coral in Norway

Erlend Dancke Sandorf, UiT The Arctic University of Norway, Tromsø, Norway

This paper estimates the willingness-to-pay (WTP) for cold water coral (CWC) protection in Norway using a choice experiment (CE). CWC is believed to be an important habitat for fish species and the loss of CWC may indirectly and adversely affect fisheries. It has been estimated that as much as 50% of CWC in Norway may already have been destroyed by bottom trawling. Furthermore, the scientific evidence regarding the ecosystem function of CWC is inconclusive. Consequently estimating the value of CWC can give important policy signals. The results show that people have a positive WTP for CWC protection and that people clearly prefer to protect CWC areas that are important habitat for fish species. In addition the paper explores the existence of respondents with apparent discontinuous preferences in a CE setting. One would expect this to be an issue for CWC, because valuing a good that is unknown is likely to increase the cognitive burden of the choice task and consequently increase the probability of using simplifying heuristics. This violation of the underlying continuity axiom is one of the critiques raised against CE and might potentially lead to different and biased WTP estimates. We use a follow-up question on a Likert-type scale to identify individuals with apparent discontinuous preferences. This approach allows for some sensitivity analysis when identifying respondents with discontinuous preferences. Controlling for individuals with discontinuous preferences leads to different, but not

significantly different, WTP estimates, which suggests that discontinuous preferences are not a major concern in this study.

Session number: 1.2

Paper number: 171

Impacts of Actual Harm and Harmful Rumors from Radioactive Spill from the Fukushima Disaster on the Japanese Seafood Market

Hiroki Wakamatsu¹ (presenting), Tsutomu Miyata¹

1. Fisheries Research Agency, Kanazawa-ku, Yokohama., Not in the US, Japan

We investigated whether the spill of radioactive materials from the Fukushima nuclear plant into the Pacific Ocean has had a negative impact on demand for cod and pollock in wholesale markets in Japan between January 2004 and July 2013. A Bai and Perron structural break test detected several break points in the market, including the Fukushima disaster, and successfully eliminated the impact of the other disturbing shocks by introducing dummy variables for the breaks identified in our analysis. A vector autoregressive model with break dummies found that the radioactive spill had a significantly negative impact on demand for cod. Our results suggest that the amount of radiation detected in cod products negatively affected Japanese demand for cod and positively affected demand for pollock. We also found that consumers' current concerns about radioactive spills affect demand for pollock positively.

Session number: 1.2

Paper number: 354

Applying Principles from Economics to Improve the Transfer of Ecological Production Estimates in Fisheries Ecosystem Services Research

Melissa Errend¹ (presenting), Ted DeWitt²

1. Oregon State University, Newport, OR, United States

2. US EPA, Newport, OR, United States

Ecosystem services (ES) provide a pathway to connect ecosystem processes to human well-being. Ecosystem-based fisheries management can utilize the ecosystem service framework to assess trade-offs of actions such as restoration and gear restrictions, or environmental changes such as ocean acidification and warming, and sea level rise. However, due to a lack of existing data, time, or funding, estimates of ecological production may need to be transferred from different geographic, temporal, or spatial scales to a data-poor site. While production estimate transfer represents a useful tool for research, policy, and resource management, inconsistency and a lack of transparency in how transfers are performed may increase uncertainty in the accuracy of the final estimate. Associated uncertainties then can propagate as error through to the economic value of the ES. While methodologies exist to transfer the economic value of ES (e.g., benefit transfer), there is no analogous formalized process to transfer ecological data underlying ES production. Drawing from the benefit transfer literature, we present a framework to improve the transparency and accuracy of transferred ecological and biophysical data that underpin estimates of ES production for coastal ecosystems with examples from studies and models of habitat-fishery linkages.

Session number: 1.2

Paper number: 5

Data Mining Multiple Stakeholders' Responses to Declining *Schizothorax* Fishery in the Lakes of Kashmir, India

Neha W. Qureshi¹, Krishnan M.¹, C Sundaramoorthy², Ramasubramanian V³, **Tesfom Melake Araya¹ (presenting)**

1. Central Institute of Fisheries Education, Mumbai, Maharashtra, India

2. Central Institute of Research on Cotton Technology, Mumbai, Maharashtra, India

3. Central Institute of Fisheries Education, Mumbai, India, Mumbai, Maharashtra, India

This study documented the historical perspective of lake fisheries in Kashmir, India, estimated the trends in fish production using the Kane's cross impact analysis and the stakeholders' willingness to pay for the restoration of *Schizothorax* fishery in the lakes of Kashmir. The cross impacts of introduction of carps in the lakes of Kashmir on *Schizothorax* fishery and total fish production are evaluated by Kane's cross impact analysis. Considering the obvious shortcomings of logistic regression, Classification and Regression Trees (CART) has been used for data mining multiple stakeholders' responses to make a case for sustainable development of the *Schizothorax* fishery in the lakes of Kashmir. On the whole, time spent on the lakes to earn their livelihoods emerged as the root node as the single most important variable that determined WTP of stakeholders followed by income, type of stakeholder and age in the tree model. The CART analysis not only yielded the variables that determined the WTP but the pruned tree gave the hierarchy of the variables that determined WTP. The results of the study strongly made a case for a concerted multi-institutional action plan for the restoration of *Schizothorax* fishery in the lakes of Kashmir.

Session number: 1.2

Paper number: 86

Exploring Discontinuous Preferences in Choice Experiments: The Case of Cold Water Coral in Norway

Erlend Dancke Sandorf, UiT The Arctic University of Norway, Tromsø, Norway

This paper estimates the willingness-to-pay (WTP) for cold water coral (CWC) protection in Norway using a choice experiment (CE). CWC is believed to be an important habitat for fish species and the loss of CWC may indirectly and adversely affect fisheries. It has been estimated that as much as 50% of CWC in Norway may already have been destroyed by bottom trawling. Furthermore, the scientific evidence regarding the ecosystem function of CWC is inconclusive. Consequently estimating the value of CWC can give important policy signals. The results show that people have a positive WTP for CWC protection and that people clearly prefer to protect CWC areas that are important habitat for fish species. In addition the paper explores the existence of respondents with apparent discontinuous preferences in a CE setting. One would expect this to be an issue for CWC, because valuing a good that is unknown is likely to increase the cognitive burden of the choice task and consequently increase the probability of using simplifying heuristics. This violation of the underlying continuity axiom is one of the critiques raised against CE and might potentially lead to different and biased WTP estimates. We use a follow-up question on a Likert-type scale to identify individuals with apparent discontinuous preferences. This approach allows for some sensitivity analysis when identifying respondents with discontinuous preferences. Controlling for individuals with discontinuous preferences leads to different, but not significantly different, WTP estimates, which suggests that discontinuous preferences are not a major concern in this study.

Session number: 1.2

Paper number: 171

Impacts of Actual Harm and Harmful Rumors from Radioactive Spill from the Fukushima Disaster on the Japanese Seafood Market

Hiroki Wakamatsu¹ (presenting), Tsutomu Miyata¹

1. Fisheries Research Agency, Kanazawa-ku, Yokohama., Not in the US, Japan

We investigated whether the spill of radioactive materials from the Fukushima nuclear plant into the Pacific Ocean has had a negative impact on demand for cod and pollock in wholesale markets in Japan between January 2004 and July 2013. A Bai and Perron structural break test detected several break points in the market, including the Fukushima disaster, and successfully eliminated the impact of the other disturbing shocks by introducing dummy variables for the breaks identified in our analysis. A vector autoregressive model with break dummies found that the radioactive spill had a significantly negative impact on demand for cod. Our results suggest that the amount of radiation detected in cod products negatively affected Japanese demand for cod and positively affected demand for pollock. We also found that consumers' current concerns about radioactive spills affect demand for pollock positively.

Session number: 1.2

Paper number: 354

Applying Principles from Economics to Improve the Transfer of Ecological Production Estimates in Fisheries Ecosystem Services Research

Melissa Errend¹ (presenting), Ted DeWitt²

1. Oregon State University, Newport, OR, United States

2. US EPA, Newport, OR, United States

Ecosystem services (ES) provide a pathway to connect ecosystem processes to human well-being. Ecosystem-based fisheries management can utilize the ecosystem service framework to assess trade-offs of actions such as restoration and gear restrictions, or environmental changes such as ocean acidification and warming, and sea level rise. However, due to a lack of existing data, time, or funding, estimates of ecological production may need to be transferred from different geographic, temporal, or spatial scales to a data-poor site. While production estimate transfer represents a useful tool for research, policy, and resource management, inconsistency and a lack of transparency in how transfers are performed may increase uncertainty in the accuracy of the final estimate. Associated uncertainties then can propagate as error through to the economic value of the ES. While methodologies exist to transfer the economic value of ES (e.g., benefit transfer), there is no analogous formalized process to transfer ecological data underlying ES production. Drawing from the benefit transfer literature, we present a framework to improve the transparency and accuracy of transferred ecological and biophysical data that underpin estimates of ES production for coastal ecosystems with examples from studies and models of habitat-fishery linkages.

Session number: 1.3

Paper number: 388

North Africa: role of small scale fisheries in the economic development

Nada Bougouss, INFOSAMAK, Casablanca, Morocco, Morocco

The fish supply chain, in countries of North Africa, is characterized by a large number of small-scale fishers. These small-scale fisheries account for 80 to 90 % of the total production. Countries of the region are setting development plans to improve infrastructure of handling, storage, processing, marketing and distribution of fishery products from small-scale fisheries. The enhancement of know-how and expertise transmitted to a wider segment of the sector, especially artisanal and small-scale units, would undoubtedly bring about significant changes to the sector by way improved skill levels and competitiveness, which will in turn help the sector to consolidate and grow further. Furthermore, bringing small-scale stakeholders together with funding institutions would help them to improve their access to financial assistance and boost investment in the sector.

In this perspective, the Centre for Marketing Information and Advisory Services for Fishery Products in the Arab Region (INFOSAMAK) is interested in making a presentation on “North Africa: role of small scale fisheries in the economic development”. The proposed presentation will provide information on the importance of small-scale fisheries for food security, provision of employment and generation of revenues in countries of North Africa. It also discusses the contribution of enhanced and improved small-scale fisheries to local and national economies. Furthermore, the presentation argues the importance of the sector in increasing hard currency earnings and balancing fish trade deficit shall economic and policy requirements be efficient. And therefore contribute to economic development of the North Africa region.

Session number: 1.3

Paper number: 162

Government support and its profitability effects – An empirical study on offshore fisheries in Vietnam

Duy Nguyen Ngoc¹ (presenting), Ola Flaaten², Long Le Kim³

1. University of Tromsø and Nha Trang University, Nha Trang, Khanh Hoa, Viet Nam

2. University of Tromsø, Tromsø, Troms, Norway

3. Nha Trang University, Nha Trang, Khanh Hoa, Viet Nam

Vietnam’s fishery policy is to shift fishing pressure from the overexploited onshore fisheries to the less exploited offshore fisheries. In 1997 Vietnam introduced an investment program for offshore vessels, in 2008 introduced fuel cost compensation subsidies, and in 2010 proposed another subsidy program. This paper firstly investigates and quantifies Vietnamese governmental subsidies to offshore fishing vessels, and then examines the effect of these subsidies on the profitability of vessels. First we discuss vessel behaviour and possible effects of the government subsidies within the context of the Gordon-Schaefer bio-economic model theoretically and then apply this knowledge to evaluate the profitability of an open-access fishery in Vietnam. The Khanh Hoa offshore fishery is surveyed with respect to the earnings, costs, technical and operational characteristics and efficiency of 57 gillnet vessels and 39 longline vessels in 2011 and 2012. Main economic performance indicators, including gross revenue, income, gross value added, gross cash flow, profit, net profit (rent) are used to

evaluate the profitability of vessels. The effect of the government subsidies is done by comparison analyses of vessel economic performance with and without the subsidies. Potential policy implications of the results are discussed.

Session number: 1.3

Paper number: 170

Socio Economic and Environmental Impact of Ogun River on Food Security in Ogun State, Nigeria

Iyabode Taiwo¹ (presenting), Samuel Obasa², Adebayo Shittu, Mabel Ipinmoroti³

1. Institute of Food Security, Environmental Resources & Agricu, Abeokuta, Other, Nigeria

2. Department of Aquaculture and Fisheries, Abeokuta, Ogun, Nigeria

3. Osun State University, Ibadan, Oyo, Nigeria

Small-scale fisheries can generate significant profit, enhance resilience to shocks and crises, and make meaningful contributions to poverty alleviation and food security. There is very limited information on how well these potentials are being tapped in developing countries. This study examines the socioeconomic, livelihood and food security impacts of Ogun River on households in neighbouring communities. It is based on primary data obtained in a cross-section survey of 50 households drawn by multistage random sampling from fishing and farming communities around Opeji axis of the river. The data were collected using a combination of Focus Group Discussions and Household Interviews; and analysed by descriptive and inferential statistics (Chi-square, t and F tests). An average household in the sample was made up of six (4.7 ± 0.4) members, headed by a male (74.5%), aged 46.3 ± 1.9 years. The mean household income was N192, 000.00 \pm 23,874.00/year while the mean per capita household income was N43 667.80/person/year. With this, 78.9% of the households fell below US\$1.25 (N197.5)/head/day severe poverty threshold. Only 23.1% of the households were food secured. Majority were food insecure with (26.9%) or without (42.3%) hunger. Incidence of poverty and food insecurity were however significantly ($p < 0.05$) lower among household of fishers (62.1% and 54.8% respectively). Chi-square tests revealed that gender, marital status and household size were the key determinants of food insecurity in the study area, hence the need to keep household size small. Income sources could be diversified to include off-farm employment ($p < 0.01$) and fishing ($p < 0.05$) to reduce food insecurity.

Session number: 1.3

Paper number: 267

Towards Developing Index for the Assessment of Sustainable Development: A Case Study of the Sultanate of Oman

Hussein Al-Masroori¹ (presenting), Shekar Bose¹

1. Sultan Qaboos University, Al-Khod, Muscat, Oman

The Sultanate of Oman has devoted particular attention to promote sustainable development of the fisheries sector to ensure its long-term contributions to community welfare. Considering this strategically important initiative this study aimed at assessing the extent of sustainability by developing a sustainability index based on appropriate criteria encompassing the key components of the ecologically sustainable development principles and indicators at the first stage. In the second stage sustainability index for each component was quantified based on the average score of each criterion. Finally, the Multi-Criteria Decision Analysis

(MCDA) was carried out to investigate the effects of two distinct management regimes (1997 and 1998) at the level of indicators and criteria.

The results indicate a significant linkages and relationships between indicators and hence criteria. These cross-criterion and cross-indicator interactions are directly or indirectly impacting the status of sustainability. Relatively low variation was found in the rankings within the 'ecological well-being' criteria as compared to the 'human well-being' criteria. This signals inconsistency in the policy preferences over time. Comparing the two management regimes, it is noted that the variation for both 'ecological' and 'human well-being' criteria during the 1997 management regime is lower than that of the 1998 management regime. This, perhaps, reflects the primary stakeholders' reaction to the control of fishing effort introduced in 1998. Based on the findings some important policy implications are also discussed to promote sustainability in the fisheries sector.

Session number: 1.3

Paper number: 388

North Africa: role of small scale fisheries in the economic development

Nada Bougouss, INFOSAMAK, Casablanca, Morocco, Morocco

The fish supply chain, in countries of North Africa, is characterized by a large number of small-scale fishers. These small-scale fisheries account for 80 to 90 % of the total production. Countries of the region are setting development plans to improve infrastructure of handling, storage, processing, marketing and distribution of fishery products from small-scale fisheries. The enhancement of know-how and expertise transmitted to a wider segment of the sector, especially artisanal and small-scale units, would undoubtedly bring about significant changes to the sector by way improved skill levels and competitiveness, which will in turn help the sector to consolidate and grow further. Furthermore, bringing small-scale stakeholders together with funding institutions would help them to improve their access to financial assistance and boost investment in the sector.

In this perspective, the Centre for Marketing Information and Advisory Services for Fishery Products in the Arab Region (INFOSAMAK) is interested in making a presentation on “North Africa: role of small scale fisheries in the economic development”. The proposed presentation will provide information on the importance of small-scale fisheries for food security, provision of employment and generation of revenues in countries of North Africa. It also discusses the contribution of enhanced and improved small-scale fisheries to local and national economies. Furthermore, the presentation argues the importance of the sector in increasing hard currency earnings and balancing fish trade deficit shall economic and policy requirements be efficient. And therefore contribute to economic development of the North Africa region.

Session number: 1.3

Paper number: 162

Government support and its profitability effects – An empirical study on offshore fisheries in Vietnam

Duy Nguyen Ngoc¹ (**presenting**), Ola Flaaten², Long Le Kim³

1. University of Tromsø and Nha Trang University, Nha Trang, Khanh Hoa, Viet Nam

2. University of Tromsø, Tromsø, Troms, Norway

3. Nha Trang University, Nha Trang, Khanh Hoa, Viet Nam

Vietnam's fishery policy is to shift fishing pressure from the overexploited onshore fisheries to the less exploited offshore fisheries. In 1997 Vietnam introduced an investment program for offshore vessels, in 2008 introduced fuel cost compensation subsidies, and in 2010 proposed another subsidy program. This paper firstly investigates and quantifies Vietnamese governmental subsidies to offshore fishing vessels, and then examines the effect of these subsidies on the profitability of vessels. First we discuss vessel behaviour and possible effects of the government subsidies within the context of the Gordon-Schaefer bio-economic model theoretically and then apply this knowledge to evaluate the profitability of an open-access fishery in Vietnam. The Khanh Hoa offshore fishery is surveyed with respect to the earnings, costs, technical and operational characteristics and efficiency of 57 gillnet vessels and 39 longline vessels in 2011 and 2012. Main economic performance indicators, including gross revenue, income, gross value added, gross cash flow, profit, net profit (rent) are used to evaluate the profitability of vessels. The effect of the government subsidies is done by comparison analyses of vessel economic performance with and without the subsidies. Potential policy implications of the results are discussed.

Session number: 1.3

Paper number: 170

Socio Economic and Environmental Impact of Ogun River on Food Security in Ogun State, Nigeria

Iyabode Taiwo¹ (presenting), Samuel Obasa², Adebayo Shittu, Mabel Ipinmoroti³

1. Institute of Food Security, Environmental Resources & Agricu, Abeokuta, Other, Nigeria

2. Department of Aquaculture and Fisheries, Abeokuta, Ogun, Nigeria

3. Osun State University, Ibadan, Oyo, Nigeria

Small-scale fisheries can generate significant profit, enhance resilience to shocks and crises, and make meaningful contributions to poverty alleviation and food security. There is very limited information on how well these potentials are being tapped in developing countries. This study examines the socioeconomic, livelihood and food security impacts of Ogun River on households in neighbouring communities. It is based on primary data obtained in a cross-section survey of 50 households drawn by multistage random sampling from fishing and farming communities around Opeji axis of the river. The data were collected using a combination of Focus Group Discussions and Household Interviews; and analysed by descriptive and inferential statistics (Chi-square, t and F tests). An average household in the sample was made up of six (4.7 ± 0.4) members, headed by a male (74.5%), aged 46.3 ± 1.9 years. The mean household income was N192, 000.00 \pm 23,874.00/year while the mean per capita household income was N43 667.80/person/year. With this, 78.9% of the households fell below US\$1.25 (N197.5)/head/day severe poverty threshold. Only 23.1% of the households were food secured. Majority were food insecure with (26.9%) or without (42.3%) hunger. Incidence of poverty and food insecurity were however significantly ($p < 0.05$) lower among household of fishers (62.1% and 54.8% respectively). Chi-square tests revealed that gender, marital status and household size were the key determinants of food insecurity in the study area, hence the need to keep household size small. Income sources could be diversified to include off-farm employment ($p < 0.01$) and fishing ($p < 0.05$) to reduce food insecurity.

Session number: 1.3

Paper number: 267

Towards Developing Index for the Assessment of Sustainable Development: A Case Study of the Sultanate of Oman

Hussein Al-Masroori¹ (presenting), Shekar Bose¹

1. Sultan Qaboos University, Al-Khod, Muscat, Oman

The Sultanate of Oman has devoted particular attention to promote sustainable development of the fisheries sector to ensure its long-term contributions to community welfare.

Considering this strategically important initiative this study aimed at assessing the extent of sustainability by developing a sustainability index based on appropriate criteria encompassing the key components of the ecologically sustainable development principles and indicators at the first stage. In the second stage sustainability index for each component was quantified based on the average score of each criterion. Finally, the Multi-Criteria Decision Analysis (MCDA) was carried out to investigate the effects of two distinct management regimes (1997 and 1998) at the level of indicators and criteria.

The results indicate a significant linkages and relationships between indicators and hence criteria. These cross-criterion and cross-indicator interactions are directly or indirectly impacting the status of sustainability. Relatively low variation was found in the rankings within the 'ecological well-being' criteria as compared to the 'human well-being' criteria. This signals inconsistency in the policy preferences over time. Comparing the two management regimes, it is noted that the variation for both 'ecological' and 'human well-being' criteria during the 1997 management regime is lower than that of the 1998 management regime. This, perhaps, reflects the primary stakeholders' reaction to the control of fishing effort introduced in 1998. Based on the findings some important policy implications are also discussed to promote sustainability in the fisheries sector.

Session number: 1.4

Paper number: 454

ITQ Prices: What do they Reveal?

Ragnar Arnason, University of Iceland, Reykjavik, Reykjavik, Iceland

ITQ systems generate ITQ prices. For any given ITQ-managed species there are typically two prices. One is for the annual (or seasonal) quota, the other is for the longer lasting ITQ-share. In well-functioning ITQ markets, these prices reveal important information about the fishery. In the single species framework, prices of annual quotas measure the current profitability of fishing and prices for ITQ-shares reflect the expected future profitability of fishing under the ITQ system. Trading arbitrage leads to a determinate functional relationship between the prices of annual quantity quotas and that of TAC-shares. In the multi-species framework, if the ability to select the species composition of the harvest is less than perfect, the information content of the ITQ-prices is much less straight-forward. For instance the price of annual quotas for a given species may, under not uncommon circumstances, far exceed its landings price or, alternatively, be approximately zero.

This paper explores these issues. It derives explicit expressions ITQ prices under various circumstances including the multi-species context with imperfect selectivity, discarding possibilities and ITQ-noncompliance. To illustrate the issues, empirical data on ITQ prices in Iceland are presented.

Keywords: ITQ prices, ITQs, TAC-shares, informational content of ITQ prices

Session number: 1.4

Paper number: 99

**Bidding and performance in multiple unit combinatorial auctions for fisheries quotas:
Role of information feedbacks**

John Tisdell¹ (presenting), Sayed Iftekhar

1. University of Tasmania, Hobart, Tasmania, Australia

Fishers often face adverse selection and moral hazard problems as they require combinations of quotas to fish. They may fish in multiple species fisheries or require by-catch as well as harvestable species quotas. Acquiring one without the other is worthless. Combinatorial auctions allow trading of packages of different types of quotas (for example for different regions, industry or species) in the same auction market. Bidders can submit bids on combinations of quotas which would allow them enjoy synergy benefits. This article investigates the impact of varying levels of information feedback on performance in a multiple unit forward combinatorial auction using laboratory experiments. We questioned whether (a) providing additional information and (b) learning through time helps in more efficient bidding. We designed and tested three information treatments. Under the basic information treatment bidders were provided with market prices and own-bid status information. The second treatment involved providing additional information on winning bids. The final treatment extended the provision of information on all bids and their respective status. The results of human bidders were compared with robot bidders with a fixed learning strategy.

We observed that much of the benefits of information are derived from structural effects, like

repeated rounds and package valuations. Providing additional market information did not improve auction performances. Robots with synergistic valuations earned similar profits as humans. In contrast, allowing traders to revise their offers improved auction performances. These results will be useful in designing fisheries quota markets.

Session number: 1.4

Paper number: 178

Assessing the Degree of Corporate Concentration in British Columbia's Fisheries

Andrea Haas¹ (presenting), U. Rashid Sumaila¹

1. University of British Columbia, Fisheries Centre, Fisheries Economics Research Unit, Vancouver, BC, Canada

The absence of owner-operator licensing policy in British Columbia (BC) has had some unintended effects on the ownership structure of fisheries access rights, raising concerns over the amount of corporate control of licenses being exerted in BC's fisheries. This specific study aims to investigate the degree of corporate control in BC's salmon and herring fisheries by using Canada's Department of Fisheries and Oceans (DFO) license lists, and cross-referencing these with corporate registry databases offered by the government. Many fishing operations are incorporated to protect against liability and for insurance purposes, and so a suite of characteristics which describe a "corporation" will be co-derived with member of the fishing industry. Next, the amount of corporate control of these fisheries will be reviewed over a 20-year period and analyzed for changes that may be consistent with definitions of economic concentration. The introduction of quotas attached to licenses has the potential to exacerbate the concentration of fisheries access rights, and herring has been under quota management for some time now. The results of this research will have far-reaching implications for the licensing policy and management of BC's fisheries going forward into the future, as DFO considers a movement towards the implementation of quota management in its Pacific salmon fishery.

Session number: 1.4

Paper number: 34

Optimal Quota Allocation in Multispecies Environment

Barbara Hutniczak, University of Southern Denmark, Esbjerg, Southern Denmark, Denmark

A fishing vessel can be considered a firm that, in many cases, represents multiproduct joint production. Therefore, multispecies interactions entail that individual fishing quotas, while appealing from an economic standpoint, may create considerable negative externalities if not set in optimal proportions. Take, for example, discarding excess production at sea that causes unnecessary fish mortality and hinders stock recovery. The paper aims to develop a methodological framework for setting the optimal policy for quota allocation in multispecies interaction system that is influenced by uncertain environmental conditions.

The model is based on individual vessel targeting ability, which in turn is dependent upon vessel characteristics and associated flexibility regarding harvest technique throughout the year. These characteristics are modelled by a restricted profit function in which fixed parameters are related to capital endowment and limits established by a regulatory body due to biological overfishing. The model reveals possible spillover effects, the direction of

increasing pressure using spare capacity in situation when harvest of one of the target species is subject to a binding quota.

An empirical application is provided for the Polish Baltic Sea fleet where the most valuable target species is cod, whose recruitment is highly influenced by environmental conditions. Multispecies interactions are incorporated as separate submodels for cod, herring, and sprat, species that are linked through predation. Regarding annual quota, the regulatory body is restricted by minimum stock size reflecting a precautionary approach. The final quota proportions are derived by simulating stock changes under stochastic conditions over time.

Session number: 1.4

Paper number: 454

ITQ Prices: What do they Reveal?

Ragnar Arnason, University of Iceland, Reykjavik, Reykjavik, Iceland

ITQ systems generate ITQ prices. For any given ITQ-managed species there are typically two prices. One is for the annual (or seasonal) quota, the other is for the longer lasting ITQ-share. In well-functioning ITQ markets, these prices reveal important information about the fishery. In the single species framework, prices of annual quotas measure the current profitability of fishing and prices for ITQ-shares reflect the expected future profitability of fishing under the ITQ system. Trading arbitrage leads to a determinate functional relationship between the prices of annual quantity quotas and that of TAC-shares. In the multi-species framework, if the ability to select the species composition of the harvest is less than perfect, the information content of the ITQ-prices is much less straight-forward. For instance the price of annual quotas for a given species may, under not uncommon circumstances, far exceed its landings price or, alternatively, be approximately zero.

This paper explores these issues. It derives explicit expressions ITQ prices under various circumstances including the multi-species context with imperfect selectivity, discarding possibilities and ITQ-noncompliance. To illustrate the issues, empirical data on ITQ prices in Iceland are presented.

Keywords: ITQ prices, ITQs, TAC-shares, informational content of ITQ prices

Session number: 1.4

Paper number: 99

**Bidding and performance in multiple unit combinatorial auctions for fisheries quotas:
Role of information feedbacks**

John Tisdell¹ (presenting), Sayed Iftekhhar

1. University of Tasmania, Hobart, Tasmania, Australia

Fishers often face adverse selection and moral hazard problems as they require combinations of quotas to fish. They may fish in multiple species fisheries or require by-catch as well as harvestable species quotas. Acquiring one without the other is worthless. Combinatorial auctions allow trading of packages of different types of quotas (for example for different regions, industry or species) in the same auction market. Bidders can submit bids on combinations of quotas which would allow them to enjoy synergy benefits. This article investigates the impact of varying levels of information feedback on performance in a multiple unit forward combinatorial auction using laboratory experiments. We questioned whether (a) providing additional information and (b) learning through time helps in more efficient bidding. We designed and tested three information treatments. Under the basic information treatment bidders were provided with market prices and own-bid status information. The second treatment involved providing additional information on winning bids. The final treatment extended the provision of information on all bids and their respective status. The results of human bidders were compared with robot bidders with a fixed learning strategy.

We observed that much of the benefits of information are derived from structural effects, like repeated rounds and package valuations. Providing additional market information did not improve auction performances. Robots with synergistic valuations earned similar profits as humans. In contrast, allowing traders to revise their offers improved auction performances. These results will be useful in designing fisheries quota markets.

Session number: 1.4

Paper number: 178

Assessing the Degree of Corporate Concentration in British Columbia's Fisheries

Andrea Haas¹ (presenting), U. Rashid Sumaila¹

1. University of British Columbia, Fisheries Centre, Fisheries Economics Research Unit, Vancouver, BC, Canada

The absence of owner-operator licensing policy in British Columbia (BC) has had some unintended effects on the ownership structure of fisheries access rights, raising concerns over the amount of corporate control of licenses being exerted in BC's fisheries. This specific study aims to investigate the degree of corporate control in BC's salmon and herring fisheries by using Canada's Department of Fisheries and Oceans (DFO) license lists, and cross-referencing these with corporate registry databases offered by the government. Many fishing operations are incorporated to protect against liability and for insurance purposes, and so a suite of characteristics which describe a "corporation" will be co-derived with member of the fishing industry. Next, the amount of corporate control of these fisheries will be reviewed over a 20-year period and analyzed for changes that may be consistent with definitions of economic concentration. The introduction of quotas attached to licenses has the potential to exacerbate the concentration of fisheries access rights, and herring has been under quota management for some time now. The results of this research will have far-reaching implications for the licensing policy and management of BC's fisheries going forward into the future, as DFO considers a movement towards the implementation of quota management in it's Pacific salmon fishery.

Paper number: 34

Optimal Quota Allocation in Multispecies Environment

Barbara Hutniczak, University of Southern Denmark, Esbjerg, Southern Denmark, Denmark

A fishing vessel can be considered a firm that, in many cases, represents multiproduct joint production. Therefore, multispecies interactions entail that individual fishing quotas, while appealing from an economic standpoint, may create considerable negative externalities if not set in optimal proportions. Take, for example, discarding excess production at sea that causes unnecessary fish mortality and hinders stock recovery. The paper aims to develop a methodological framework for setting the optimal policy for quota allocation in multispecies interaction system that is influenced by uncertain environmental conditions.

The model is based on individual vessel targeting ability, which in turn is dependent upon vessel characteristics and associated flexibility regarding harvest technique throughout the year. These characteristics are modelled by a restricted profit function in which fixed parameters are related to capital endowment and limits established by a regulatory body due to biological overfishing. The model reveals possible spillover effects, the direction of increasing pressure using spare capacity in situation when harvest of one of the target species is subject to a binding quota.

An empirical application is provided for the Polish Baltic Sea fleet where the most valuable target species is cod, whose recruitment is highly influenced by environmental conditions. Multispecies interactions are incorporated as separate submodels for cod, herring, and sprat, species that are linked through predation. Regarding annual quota, the regulatory body is restricted by minimum stock size reflecting a precautionary approach. The final quota proportions are derived by simulating stock changes under stochastic conditions over time.

Session number: 1.5

Paper number: 281

Alternative Approaches to Estimate Fisheries Trip Costs

Chhandita Das, Integrated Statistics, Woods Hole, MA, United States

Economic data on the costs of operating commercial fishing businesses are essential for a range of analysis relevant to fisheries management and regulations. For example, cost information is needed to correctly assess regulatory impacts, economic profitability profiles, fleet efficiency and productivity measures. The costs incurred by a vessel can be categorized into two broad groups, annual costs and trip costs. This research focuses on trip costs estimation only. Typically, analysts use some average cost criterion or ordinary least square methods to estimate trip costs. However, these methods are incomplete because they fail to take into account of all the variability in the data. The additional challenge with trip costs data is that there are multiple observations per vessel as a vessel typically takes multiple trips per year. Hence, observations within the same vessel are expected to be correlated. Moreover, each vessel has unequal number of trips, yielding an unbalanced panel. This unequal group size may also be a potential source of heteroscedasticity. This research explores several modeling approaches to account for this correlation. Improved methods will yield better cost estimates, which in turn may lead to more effective management regulations. The models considered here are, an ordinary least square model with heteroscedasticity corrected variances, a random effect model, a stochastic frontier model and a doubly heteroscedastic stochastic frontier model. The estimations are conducted using trip cost data collected by the Northeast Observer Program. The performances of the proposed models are compared based on model fit statistics and prediction properties.

Session number: 1.5

Paper number: 191

The Role of Fixed Costs and Non-discretionary Variables in Fisheries: A Theoretical and Empirical Investigation

Stephanie McWhinnie¹ (presenting), Kofi Otumawu-Apreku¹

1. University of Adelaide, Australia

We investigate the effects of incorporating a fixed input on equilibrium profits and biomass. We first set up a theoretical model with an input that is fixed in the short-run (vessel size) but that can be used with a variable input at suboptimal capacity. We use this model to get predictions for the impact on profits of exogenous changes in biomass, output price and vessel size. These give us interesting theoretical insights into why it is important to incorporate fixed inputs into profit analysis. We subsequently conduct an empirical investigation

to gain an understanding of the effects of these non-discretionary factors on profit efficiency. In particular, we apply a truncated regression with bootstrap methodology to data on individual firm profit efficiency from the South Australian Rock Lobster Fishery. We find empirical support for our predictions that increased biomass and smaller vessel length are associated with higher profits. An additional empirical result is that individual quota management is positively associated with profit efficiency.

Session number: 1.5

Paper number: 148

Economic capacity and capacity utilisation of Queensland's Sydney rock oyster industry

Peggy Schroback¹ (presenting), Sean Pascoe²

1. Queensland University of Technology, Brisbane, Queensland, Australia

2. CSIRO, Australia

The Sydney rock oyster (SRO) industry is located on Australia's east coast and is one of the country's oldest farming industries. This industry has been affected by a range of challenges over the past decades, which includes reoccurring disease outbreaks, the management of food security, biodiversity and environmental degradation risks, severe weather events and increased market competition from Australia's Pacific oyster industry.

SRO production appears to be particularly challenged in the Queensland's Moreton Bay, the northern most cultivation area of the industry. Today, it is unclear whether this situation is due to oyster farmer's business choices, personal traits or whether environmental conditions in the Moreton Bay limit the economic capacity of the oyster industry in this region.

In this study we assess the economic capacity and capacity utilisation of the Queensland SRO industry using cross-sectional time-series data. We use the conventional production input factors, labour and capital, for a multi-output orientated data envelopment analysis (DEA). In a second-stage analysis we estimate the inference of oyster lease owner's personal traits and environmental conditions at production sites on the derived capacity scores over time.

The results provide information about the potential industry output that can be produced in Moreton Bay if production capacity is fully utilised under given resource conditions and the extent of capacity underutilisation. This knowledge will form the basis for a discussion about the optimal allocation of territorial access rights for Queensland's SRO industry.

Session number: 1.5

Paper number: 63

Capacity and Factors Affecting Capacity Utilization of Marine Fisheries: A Case of Gill-net Fleet in the Bay of Bengal

Md Akhtaruzzaman Khan¹ (presenting), Atle Guttormsen, Ferdous Alam

1. Bangladesh Agricultural University, Mymensingh, Mymensingh, Bangladesh

Excess capacity and overexploitation are the main problems for the sustainability of marine fisheries around the world. This study estimates the capacity utilization, excess capacity and factors affecting capacity utilization of the multispecies gill-net boats operating in the Bay of Bengal using cross-sectional primary data collected from the two main marine fishing areas in Bangladesh. Data envelopment analysis (DEA) method is used by applying general algebraic modeling system (GAMS). Moderate to low degrees of observed capacity utilization and high levels of technical inefficiency are observed in the monsoon and nonmonsoon seasons, respectively; however, unbiased capacity utilization is close to full in both seasons. High degree of excess capacity exists in both seasons; therefore more than one-third of boats can be decommissioned. Boat capacity, number of trips per month and trip duration is the main factors affecting capacity utilization in the gill-net fishing. Licensing

restrictions seem to be an effective instrument for auto-elimination of boats from the fishery; however, this will have large distributional effects that need to be taken into account.

Session number: 1.5

Paper number: 281

Alternative Approaches to Estimate Fisheries Trip Costs

Chhandita Das, Integrated Statistics, Woods Hole, MA, United States

Economic data on the costs of operating commercial fishing businesses are essential for a range of analysis relevant to fisheries management and regulations. For example, cost information is needed to correctly assess regulatory impacts, economic profitability profiles, fleet efficiency and productivity measures. The costs incurred by a vessel can be categorized into two broad groups, annual costs and trip costs. This research focuses on trip costs estimation only. Typically, analysts use some average cost criterion or ordinary least square methods to estimate trip costs. However, these methods are incomplete because they fail to take into account of all the variability in the data. The additional challenge with trip costs data is that there are multiple observations per vessel as a vessel typically takes multiple trips per year. Hence, observations within the same vessel are expected to be correlated. Moreover, each vessel has unequal number of trips, yielding an unbalanced panel. This unequal group size may also be a potential source of heteroscedasticity. This research explores several modeling approaches to account for this correlation. Improved methods will yield better cost estimates, which in turn may lead to more effective management regulations. The models considered here are, an ordinary least square model with heteroscedasticity corrected variances, a random effect model, a stochastic frontier model and a doubly heteroscedastic stochastic frontier model. The estimations are conducted using trip cost data collected by the Northeast Observer Program. The performances of the proposed models are compared based on model fit statistics and prediction properties.

Session number: 1.5

Paper number: 191

The Role of Fixed Costs and Non-discretionary Variables in Fisheries: A Theoretical and Empirical Investigation

Stephanie McWhinnie¹ (presenting), Kofi Otumawu-Apreku¹

1. University of Adelaide, Australia

We investigate the effects of incorporating a fixed input on equilibrium profits and biomass. We first set up a theoretical model with an input that is fixed in the short-run (vessel size) but that can be used with a variable input at suboptimal capacity. We use this model to get predictions for the impact on profits of exogenous changes in biomass, output price and vessel size. These give us interesting theoretical insights into why it is important to incorporate fixed inputs into profit analysis. We subsequently conduct an empirical investigation

to gain an understanding of the effects of these non-discretionary factors on profit efficiency. In particular, we apply a truncated regression with bootstrap methodology to data on individual firm profit efficiency from the South Australian Rock Lobster Fishery. We find empirical support for our predictions that increased biomass and smaller vessel length are associated with higher profits. An additional empirical result is that individual quota management is positively associated with profit efficiency.

Session number: 1.5

Paper number: 148

Economic capacity and capacity utilisation of Queensland's Sydney rock oyster industry

Peggy Schrobback¹ (presenting), Sean Pascoe²

1. Queensland University of Technology, Brisbane, Queensland, Australia

2. CSIRO, Australia

The Sydney rock oyster (SRO) industry is located on Australia's east coast and is one of the country's oldest farming industries. This industry has been affected by a range of challenges over the past decades, which includes reoccurring disease outbreaks, the management of food security, biodiversity and environmental degradation risks, severe weather events and increased market competition from Australia's Pacific oyster industry.

SRO production appears to be particularly challenged in the Queensland's Moreton Bay, the northern most cultivation area of the industry. Today, it is unclear whether this situation is due to oyster farmer's business choices, personal traits or whether environmental conditions in the Moreton Bay limit the economic capacity of the oyster industry in this region.

In this study we assess the economic capacity and capacity utilisation of the Queensland SRO industry using cross-sectional time-series data. We use the conventional production input factors, labour and capital, for a multi-output orientated data envelopment analysis (DEA). In a second-stage analysis we estimate the inference of oyster lease owner's personal traits and environmental conditions at production sites on the derived capacity scores over time.

The results provide information about the potential industry output that can be produced in Moreton Bay if production capacity is fully utilised under given resource conditions and the extent of capacity underutilisation. This knowledge will form the basis for a discussion about the optimal allocation of territorial access rights for Queensland's SRO industry.

Session number: 1.5

Paper number: 63

Capacity and Factors Affecting Capacity Utilization of Marine Fisheries: A Case of Gill-net Fleet in the Bay of Bengal

Md Akhtaruzzaman Khan¹ (presenting), Atle Guttormsen, Ferdous Alam

1. Bangladesh Agricultural University, Mymensingh, Mymensingh, Bangladesh

Excess capacity and overexploitation are the main problems for the sustainability of marine fisheries around the world. This study estimates the capacity utilization, excess capacity and factors affecting capacity utilization of the multispecies gill-net boats operating in the Bay of Bengal using cross-sectional primary data collected from the two main marine fishing areas in Bangladesh. Data envelopment analysis (DEA) method is used by applying general algebraic modeling system (GAMS). Moderate to low degrees of observed capacity utilization and high levels of technical inefficiency are observed in the monsoon and nonmonsoon seasons, respectively; however, unbiased capacity utilization is close to full in both seasons. High degree of excess capacity exists in both seasons; therefore more than one-third of boats can be decommissioned. Boat capacity, number of trips per month and trip duration is the main factors affecting capacity utilization in the gill-net fishing. Licensing restrictions seem to be an effective instrument for auto-elimination of boats from the fishery; however, this will have large distributional effects that need to be taken into account.

Session number: 1.6

Paper number: 266

An Economic Perspective on Integrating Gender Issues in Fisheries Management and Development in the Pacific Islands

Vina Ram-Bidesi, School of Marine Studies, University of the South Pacific, Suva, Central Division, Fiji

The need to articulate new ways to manage and utilize marine and fisheries resources has become apparent. The paper outlines the critical importance of managing marine resources for small islands countries of the Pacific and focuses on the role that women can play towards achieving sustainable fisheries.

The paper looks at two important issues in the context of Pacific Islands. First, it elaborates on the concept of marine stewardship in marine policy making and how it can contribute towards effective management of fisheries resources by reducing transaction costs. Secondly, the paper focuses on ways to increase effective fish utilization by the need to strengthen shore-based activities that can in turn improve fisheries values. Using a cost and benefit perspective, the paper attempts to show the critical role women can strategically play in these two areas towards improving fisheries management and development. Opportunities and challenges in integrating gender issues into mainstream fisheries planning and management are discussed.

Session number: 1.6

Paper number: 371

Does Women's Empowerment have Economic Benefits?

Meryl Williams, Genderaquafish, Aspley, Queensland, Australia

Gender inequalities pervade aquaculture and fisheries. Participation is marked by strong gendered divisions of labour, and sector policy is gender-blind even though sociological and ethnographic studies show that policy impacts are highly gendered. In projects concerned with economic development, the main approach taken to address inequalities is to "empower women," but, in so doing, the projects often ignore some fundamental empowerment concepts.

This presentation will build on a recent review of studies of women's empowerment in aquaculture and fisheries (Choo and Williams, in press). The review revealed the long term nature of empowerment, which often needs to be supported by deep institutional change. The review also found that narrow development approaches based on finding income-generating opportunities for the women tended to give them only welfare-level work and could even overburden them. Women achieved little economic benefit. To succeed in reaching higher stages of empowerment, women must be able to access the resources they need and hold secure rights to space and resources. Finally, women's empowerment can increase or decline as circumstances change. This is particularly pertinent because ongoing changes in fish supply chains tend to work against women, but may also work for them.

These conclusions can guide development planning but they would be more powerful if they could be advanced further with systematic economic research, which, to date, has been almost entirely lacking. We know little about the economic dimension of women's

empowerment. This presentation will explore what economics research might bring to women's empowerment and gender studies, including discussing the views of leading fishery economists.

Session number: 1.6

Paper number: 53

Towards Ecosystem Based Management of Fisheries

Alagie Sillah, Department of Fisheries / Focal Point for The Association of Gambian Fishing Companies (TAGFC), Banjul, Banjul City Council (BCC), Gambia

Women are crucial to the fisheries and the aquaculture sector. Worldwide, fishery and aquaculture production activities provide revenues to an estimated 155 million people, of whom a substantial proportion is female. In developing countries most fishing activities fall into the small-scale fisheries sector employing roughly 40 million people, and directly affecting the livelihood, poverty prevention and alleviation, and food security of approximately 400 million others. The believe that men do the actual fishing, with women more involved in post-harvest and marketing activities, remains prevalent across most cultural, social, political and environmental strata. Global average figures which supports this perception, mask the real importance of women at country level. In the world's two major fish producing countries, China and India, women represent respectively 21% and 24% of all fishers and fish farmers.

Aquaculture is promoted as a development strategy as it enables poor women to operate low technology and low input systems that are extension of their domestic tasks, allowing them to integrate activities with household and child care chores. Gambian women make up about 20% of fish farmers and many successful entrepreneurs. In West Africa, 30% of those engaged in the production and breeding of ornamental fish are women. Compared to other sectors, women and gender issues have been missing from key global nominative fisheries and aquaculture policies. There have been, however, some promising turning points that highlight the way gender policy aids resilience in fishing communities.

Session number: 1.6

Paper number: 115

Beneficial roles of women in fisheries and aquaculture practices in coastal areas in Bangladesh with some socio cultural confront:

Runia Mowla¹ (presenting), Nurun Naher¹

1. FAO Representation in Bangladesh, Dhaka, Dhaka, Bangladesh

In Bangladesh, women constitute about 50% of the population but comprise only one-fourth of the labor force. Considering women's critical roles in fisheries sector many projects in Bangladesh address both men and women as target groups putting more emphasis on women groups. One such project is 'Emergency cyclone Recovery and restoration Project (ECRRP)' in the south and south-east coastal areas which has a wide ranging intervention to support Government of Bangladesh in facilitating recovery from the damage to livelihoods and infrastructure caused by previously occurred natural disasters. This paper analyzes the women's roles that they are already playing in the sector, how they benefit from this involvement and even how their participation is affected by socio cultural norms such as seclusion, segregation and the veiling of women in public etc. Tools used in the study

include: Focus Group Discussions; Home visits; key informants' interviews and KAP survey. The project team has brought in some good progressive initiatives to achieve gender equality objectives; such as give selection of 19% women headed household in fish farming, select 25- 25 men and women farmer for Farmer Field School (FFS) etc. As a conclusion, the paper proposes some measures for the improvement of women's contribution and status in this sector for example: integrating gender sensitive objective and indicators in sectoral level policies and program design and formulation.

Key words: beneficial roles, socio cultural confronts, Farmer field School

Session number: 1.6

Paper number: 266

An Economic Perspective on Integrating Gender Issues in Fisheries Management and Development in the Pacific Islands

Vina Ram-Bidesi, School of Marine Studies, University of the South Pacific, Suva, Central Division, Fiji

The need to articulate new ways to manage and utilize marine and fisheries resources has become apparent. The paper outlines the critical importance of managing marine resources for small islands countries of the Pacific and focuses on the role that women can play towards achieving sustainable fisheries.

The paper looks at two important issues in the context of Pacific Islands. First, it elaborates on the concept of marine stewardship in marine policy making and how it can contribute towards effective management of fisheries resources by reducing transaction costs. Secondly, the paper focuses on ways to increase effective fish utilization by the need to strengthen shore-based activities that can in turn improve fisheries values. Using a cost and benefit perspective, the paper attempts to show the critical role women can strategically play in these two areas towards improving fisheries management and development. Opportunities and challenges in integrating gender issues into mainstream fisheries planning and management are discussed.

Session number: 1.6

Paper number: 371

Does Women's Empowerment have Economic Benefits?

Meryl Williams, Genderaquafish, Aspley, Queensland, Australia

Gender inequalities pervade aquaculture and fisheries. Participation is marked by strong gendered divisions of labour, and sector policy is gender-blind even though sociological and ethnographic studies show that policy impacts are highly gendered. In projects concerned with economic development, the main approach taken to address inequalities is to “empower women,” but, in so doing, the projects often ignore some fundamental empowerment concepts.

This presentation will build on a recent review of studies of women's empowerment in aquaculture and fisheries (Choo and Williams, in press). The review revealed the long term nature of empowerment, which often needs to be supported by deep institutional change. The review also found that narrow development approaches based on finding income-generating opportunities for the women tended to give them only welfare-level work and could even overburden them. Women achieved little economic benefit. To succeed in reaching higher stages of empowerment, women must be able to access the resources they need and hold secure rights to space and resources. Finally, women's empowerment can increase or decline as circumstances change. This is particularly pertinent because ongoing changes in fish supply chains tend to work against women, but may also work for them.

These conclusions can guide development planning but they would be more powerful if they could be advanced further with systematic economic research, which, to date, has been almost entirely lacking. We know little about the economic dimension of women's empowerment. This presentation will explore what economics research might bring to women's empowerment and gender studies, including discussing the views of leading fishery economists.

Session number: 1.6

Paper number: 53

Towards Ecosystem Based Management of Fisheries

Alagie Sillah, Department of Fisheries / Focal Point for The Association of Gambian Fishing Companies (TAGFC), Banjul, Banjul City Council (BCC), Gambia

Women are crucial to the fisheries and the aquaculture sector. Worldwide, fishery and aquaculture production activities provide revenues to an estimated 155 million people, of whom a substantial proportion is female. In developing countries most fishing activities fall into the small-scale fisheries sector employing roughly 40 million people, and directly affecting the livelihood, poverty prevention and alleviation, and food security of approximately 400 million others. The believe that men do the actual fishing, with women more involved in post-harvest and marketing activities, remains prevalent across most cultural, social, political and environmental strata. Global average figures which supports this perception, mask the real importance of women at country level. In the world's two major fish producing countries, China and India, women represent respectively 21% and 24% of all fishers and fish farmers.

Aquaculture is promoted as a development strategy as it enables poor women to operate low technology and low input systems that are extension of their domestic tasks, allowing them to integrate activities with household and child care chores. Gambian women make up about 20% of fish farmers and many successful entrepreneurs. In West Africa, 30% of those engaged in the production and breeding of ornamental fish are women. Compared to other sectors, women and gender issues have been missing from key global nominative fisheries and aquaculture policies. There have been, however, some promising turning points that highlight the way gender policy aids resilience in fishing communities.

Session number: 1.6

Paper number: 115

Beneficial roles of women in fisheries and aquaculture practices in coastal areas in Bangladesh with some socio cultural confront:

Runia Mowla¹ (presenting), Nurun Naher¹

1. FAO Representation in Bangladesh, Dhaka, Dhaka, Bangladesh

In Bangladesh, women constitute about 50% of the population but comprise only one-fourth of the labor force. Considering women's critical roles in fisheries sector many projects in Bangladesh address both men and women as target groups putting more emphasis on women groups. One such project is 'Emergency cyclone Recovery and restoration Project (ECRRP)' in the south and south-east coastal areas which has a wide ranging intervention to support Government of Bangladesh in facilitating recovery from the damage to livelihoods and infrastructure caused by previously occurred natural disasters. This paper analyzes the women's roles that they are already playing in the sector, how they benefit from this involvement and even how their participation is affected by socio cultural norms such as seclusion, segregation and the veiling of women in public etc. Tools used in the study include: Focus Group Discussions; Home visits; key informants' interviews and KAP survey. The project team has brought in some good progressive initiatives to achieve gender equality objectives; such as give selection of 19% women headed household in fish farming, select 25- 25 men and women farmer for Farmer Field School (FFS) etc. As a conclusion, the paper proposes some measures for the improvement of women's contribution and status in this sector for example: integrating gender sensitive objective and indicators in sectoral level policies and program design and formulation.

Key words: beneficial roles, socio cultural confronts, Farmer field School

Session number: 1.7

Paper number: 105

Improving Sustainability in Tuna fisheries through Market-based incentive mechanisms

Frazen Tolentino¹ (presenting), Paul Berentsen², Simon Bush², Alfons Oude Lansink³

1. Wageningen University and Research Centre, Tanauan City, Batangas CALABARZON, Philippines

2. Wageningen University, Wageningen, Gelderland, Netherlands

3. Wageningen University and Research Centre, Wageningen, Gelderland, Netherlands

This study evaluates existing market-based incentive mechanisms, such as Marine Stewardship Council (MSC) certification, Fishery Improvement Projects (FIPs), and International Seafood Sustainability Foundation (ISSF) associate membership, as innovative instruments for tuna fishers to improve sustainability of their fishing methods. There is little knowledge on ways these types of incentive mechanisms influence conditions for fishers' improvement strategies. This study aims to reduce this research gap by identifying the requirements set by these incentive mechanisms, the required capabilities of fishers, and institutional support for fishers to fulfil these requirements. The focus was on Filipino tuna fishers under these incentive mechanisms and information gathering was done in and outside the Philippines due to international operations of Filipino tuna fishers. Qualitative methods using multiple case studies were used to draw generalisations from cases. The data were obtained from in-depth interviews with tuna fishery stakeholders such as NGO representatives, government officials, fishers and traders, and from attendance of workshops. Insights from empirical data were validated through reviews of scientific and other literatures, internal organisational reports, and validating interviews with tuna fishery experts. Initial insight suggests that introducing incentive mechanisms interacts with existing social and political contexts at the local level fishery, which ultimately determine short- and long-term improvement strategies of fishers. This research improves the understanding of how incentive mechanisms can contribute to fishery sustainability via value chain. (223 words)

Keywords: market-based incentive mechanisms, improvement strategy, tuna fishery, sustainability

Session number: 1.7

Paper number: 245

Documenting sustainability for value-added fish products

Michaela Aschan¹ (presenting), Claire Armstrong², Melania Borit¹, Kaare Nielsen¹, Raul Primicerio¹, Petter Olsen³

1. University of Tromsøe, Tromsøe, Troms, Norway

2. University of Tromsø, Tromsø, Troms, Norway

3. Nofima, Tromsøe, Troms, Norway

There are three main aspects of sustainability; the environmental, the social and the economic. When it comes to fisheries, stock sustainability is particularly important and the stock and ecosystem health has significant effects both on the environment and on the sector economy. In order to add value to a product, sustainability needs to be documented and communicated to the buyer and the end-consumer. Recent studies in British supermarkets have shown that a price premium exists, and commonly it is between 10 and 20%.

Sustainability initiatives in marine resource management have tended to emphasize biological sustainability only, typically through green certification schemes. However, there is clearly also potential for adding value through documenting the social and economic sustainability dimensions. This potential creates an incentive for the operators (organized groups of fishermen) to develop transparent management plans where all aspects of sustainability are taken into account. This presentation summarizes various sustainability indicators for the fisheries sector; it explains what the indicators mean, and how they are interrelated, and exemplifies how they may be used in management plans to achieve value added fish products.

Session number: 1.7

Paper number: 294

A Jurisdictional approach to marine stewardship council certification

Kim Walshe¹ (presenting), Guy Leyland², Daniel Gaughan¹, Heather Brayford¹

1. Department of Fisheries, Western Australia, Perth, Western Australia, Australia

2. WA Fishing Industry Council, Fremantle, WA, Australia

Western Australian (WA) fisheries have a long association with environmental certification – the WA rock lobster fishery (in 2000) was the first fishery certified under the Marine Stewardship Council (MSC) standards.

In 2012 the Western Australia Minister of Fisheries announced that the State Government had committed \$14.6 million across a four-year period for a program to seek third - party sustainability certification for Western Australia's commercial fisheries. The project would be implemented as a priority undertaking and in partnership with the Western Australia Fishing Industry Council (WAFIC). Subsequently the Minister announced that a sole certification standard would be used – the MSC standard.

All the State's commercial fisheries are to be pre-assessed, but only those units of certification (UoCs) which most if not all fishers support certification will go to Full Assessment.

Several challenges have occurred during the implementation of the programme including integrating a manageable pre-assessment schedule for 45+ fisheries with 106 potential Units of Certification (species/method/area management units), and providing supporting documentation for each of these assessments. Structuring the assessments into grouping based on a bioregional framework was found to be an efficient approach to multispecies/fishing method pre-assessment.

The impact of the programme is likely to create significant change not only to the fisheries but also to the management agency and governance/management approach.

The programme may create some novel approaches to extending environmental certification, including the use of bio-regional frameworks and the assessment and potential certification of joint recreational and commercial fisheries.

Session number: 1.7

Paper number: 392

An Analysis of the Economic Benefits of MSC Certification for the South African Hake Fishery

Martin Purves¹ (presenting), Philippe Lallemand², Cobus Venter³, Mike Bergh², Ernst Thompson², Margaret Hansen²

1. Marine Stewardship Council, Cape Town, Western Cape, South Africa

2. OLRAC-SPS, Tokai, Western Cape, South Africa

3. Bureau for Economic Research, Stellenbosch, Western Cape, South Africa

Ecolabelling has become an essential component of the global sustainable seafood trade. The MSC is currently the world leader in certification and ecolabelling programs for wild capture fisheries. While the environmental benefits of certification have been widely recognised, its economic benefits are often anecdotal or unknown. The South African hake trawl fishery was first certified in 2004 and re-certified in 2010 for a further 5-years. Two studies were conducted to investigate the potential economic benefits of MSC certification to the Hake fishery. Firstly, FishStat and Comtrade data were collected to analyse the global production and trade in whitefish, focussing on hake. Additional information was collected from industry sources, NGOs and from MSC-specific data on export volumes and values. A succession of four scenarios were proposed to simulate possible economic outcomes resulting from shifting to a non-certified fishery. The method then compared the current economic worth of the fishery to the progressive loss of value following these scenarios; the difference representing the net worth of MSC-certification to the fishery. The analysis showed that the fishery's NPV of combining these scenarios over a 5-year period corresponds to a 35% reduction vis-à-vis the status quo. Furthermore a second study based on multipliers derived from industry input-output analysis and on a comprehensive Social Accounting Matrix showed that MSC certification contributes an estimated 6,800 to 13,600 full-time equivalent (FTE) jobs in the hake industry. Together these studies showed that retaining MSC-certification is critical in order to maintain high levels of employment and current market position.

Session number: 1.7

Paper number: 105

Improving Sustainability in Tuna fisheries through Market-based incentive mechanisms

Frazen Tolentino¹ (presenting), Paul Berentsen², Simon Bush², Alfons Oude Lansink³

1. Wageningen University and Research Centre, Tanauan City, Batangas CALABARZON, Philippines

2. Wageningen University, Wageningen, Gelderland, Netherlands

3. Wageningen University and Research Centre, Wageningen, Gelderland, Netherlands

This study evaluates existing market-based incentive mechanisms, such as Marine Stewardship Council (MSC) certification, Fishery Improvement Projects (FIPs), and International Seafood Sustainability Foundation (ISSF) associate membership, as innovative instruments for tuna fishers to improve sustainability of their fishing methods. There is little knowledge on ways these types of incentive mechanisms influence conditions for fishers' improvement strategies. This study aims to reduce this research gap by identifying the requirements set by these incentive mechanisms, the required capabilities of fishers, and institutional support for fishers to fulfil these requirements. The focus was on Filipino tuna fishers under these incentive mechanisms and information gathering was done in and outside the Philippines due to international operations of Filipino tuna fishers. Qualitative methods using multiple case studies were used to draw generalisations from cases. The data were obtained from in-depth interviews with tuna fishery stakeholders such as NGO representatives, government officials, fishers and traders, and from attendance of workshops. Insights from empirical data were validated through reviews of scientific and other literatures, internal organisational reports, and validating interviews with tuna fishery experts. Initial insight suggests that introducing incentive mechanisms interacts with existing social and political contexts at the local level fishery, which ultimately determine short- and long-term improvement strategies of fishers. This research improves the understanding of how incentive mechanisms can contribute to fishery sustainability via value chain. (223 words)

Keywords: market-based incentive mechanisms, improvement strategy, tuna fishery, sustainability

Session number: 1.7

Paper number: 245

Documenting sustainability for value-added fish products

Michaela Aschan¹ (presenting), Claire Armstrong², Melania Borit¹, Kaare Nielsen¹, Raul Primicerio¹, Petter Olsen³

1. University of Tromsøe, Tromsøe, Troms, Norway

2. University of Tromsø, Tromsø, Troms, Norway

3. Nofima, Tromsøe, Troms, Norway

There are three main aspects of sustainability; the environmental, the social and the economic. When it comes to fisheries, stock sustainability is particularly important and the stock and ecosystem health has significant effects both on the environment and on the sector economy. In order to add value to a product, sustainability needs to be documented and communicated to the buyer and the end-consumer. Recent studies in British supermarkets have shown that a price premium exists, and commonly it is between 10 and 20%.

Sustainability initiatives in marine resource management have tended to emphasize biological sustainability only, typically through green certification schemes. However, there is clearly also potential for adding value through documenting the social and economic sustainability dimensions. This potential creates an incentive for the operators (organized groups of fishermen) to develop transparent management plans where all aspects of sustainability are taken into account. This presentation summarizes various sustainability indicators for the fisheries sector; it explains what the indicators mean, and how they are interrelated, and exemplifies how they may be used in management plans to achieve value added fish products.

Session number: 1.7

Paper number: 294

A Jurisdictional approach to marine stewardship council certification

Kim Walshe¹ (presenting), Guy Leyland², Daniel Gaughan¹, Heather Brayford¹

1. Department of Fisheries, Western Australia, Perth, Western Australia, Australia

2. WA Fishing Industry Council, Fremantle, WA, Australia

Western Australian (WA) fisheries have a long association with environmental certification – the WA rock lobster fishery (in 2000) was the first fishery certified under the Marine Stewardship Council (MSC) standards.

In 2012 the Western Australia Minister of Fisheries announced that the State Government had committed \$14.6 million across a four-year period for a program to seek third - party sustainability certification for Western Australia's commercial fisheries. The project would be implemented as a priority undertaking and in partnership with the Western Australia Fishing Industry Council (WAFIC). Subsequently the Minister announced that a sole certification standard would be used – the MSC standard.

All the State's commercial fisheries are to be pre-assessed, but only those units of certification (UoCs) which most if not all fishers support certification will go to Full Assessment.

Several challenges have occurred during the implementation of the programme including integrating a manageable pre-assessment schedule for 45+ fisheries with 106 potential Units of Certification (species/method/area management units), and providing supporting documentation for each of these assessments. Structuring the assessments into grouping based on a bioregional framework was found to be an efficient approach to multispecies/fishing method pre-assessment.

The impact of the programme is likely to create significant change not only to the fisheries but also to the management agency and governance/management approach.

The programme may create some novel approaches to extending environmental certification, including the use of bio-regional frameworks and the assessment and potential certification of joint recreational and commercial fisheries.

Session number: 1.7

Paper number: 392

An Analysis of the Economic Benefits of MSC Certification for the South African Hake Fishery

Martin Purves¹ (presenting), Philippe Lallemand², Cobus Venter³, Mike Bergh², Ernst Thompson², Margaret Hansen²

1. Marine Stewardship Council, Cape Town, Western Cape, South Africa

2. OLRAC-SPS, Tokai, Western Cape, South Africa

3. Bureau for Economic Research, Stellenbosch, Western Cape, South Africa

Ecolabelling has become an essential component of the global sustainable seafood trade. The MSC is currently the world leader in certification and ecolabelling programs for wild capture fisheries. While the environmental benefits of certification have been widely recognised, its economic benefits are often anecdotal or unknown. The South African hake trawl fishery was first certified in 2004 and re-certified in 2010 for a further 5-years. Two studies were conducted to investigate the potential economic benefits of MSC certification to the Hake fishery. Firstly, FishStat and Comtrade data were collected to analyse the global production and trade in whitefish, focussing on hake. Additional information was collected from industry sources, NGOs and from MSC-specific data on export volumes and values. A succession of four scenarios were proposed to simulate possible economic outcomes resulting from shifting to a non-certified fishery. The method then compared the current economic worth of the fishery to the progressive loss of value following these scenarios; the difference representing the net worth of MSC-certification to the fishery. The analysis showed that the fishery's NPV of combining these scenarios over a 5-year period corresponds to a 35% reduction vis-à-vis the status quo. Furthermore a second study based on multipliers derived from industry input-output analysis and on a comprehensive Social Accounting Matrix showed that MSC certification contributes an estimated 6,800 to 13,600 full-time equivalent (FTE) jobs in the hake industry. Together these studies showed that retaining MSC-certification is critical in order to maintain high levels of employment and current market position.

Session number: 2.1

Paper number: 365

Common Pool Politics and inefficient Fishery Management

Julia Hoffmann¹ (presenting), Martin F. Quaas²

1. Christian-Albrechts-University Kiel, Department of Economics, Kiel, Schleswig-Holstein, Germany

2. University of Kiel, Kiel, Schleswig-Holstein, Germany

The main instrument used in fishery management is the total allowable catch (TAC). Fishery management often fails because TACs are set too high and do not sufficiently restrict fisheries. The question we address in this paper is why do decision makers choose inefficiently high TACs? Our approach is to model the annual negotiation as a dynamic non-cooperative game in discrete time. We assume two types of decision makers. The 'patient' type prefers fishing in the future. The 'impatient' type prefers fishing today. Decisions on TACs are made by majority voting. We show that despite forward-looking profit maximization the impatient decision makers have an incentive to choose a higher TAC than would be optimal for them because of an anticipation effect. The impatient majority has to consider that in the next period the patient majority might rule which chooses lower TACs. To compensate for the lower catch the impatient decision makers choose higher TACs in the current period. Under cooperation, binding agreements on lower TACs could be implemented which can lead to a more successful fishery management.

Session number: 2.1

Paper number: 436

Costly Avoidance in a Multispecies Catch Share Fishery

Andrew Scheld (presenting), Chris Anderson

1. Christian-Albrechts-University Kiel, Department of Economics, Kiel, Schleswig-Holstein, Germany

2. University of Kiel, Kiel, Schleswig-Holstein, Germany

Joint harvest technology in multispecies fisheries is often characterized by imperfectly selective gear, allowing only limited control of catch composition. In such fisheries, catch share management can be problematic if relative shares significantly diverge from harvest compositions. A mismatch in allocation with catch incentivizes avoidance behavior through manipulations in harvest strategy, timing, and/or location. If joint production technology does not satisfy free output disposal, avoidance behavior may become costly as increased landings of healthy stocks are forgone to reduce harvest of the jointly caught constraining stock. In this paper, a simple theoretical model of individual input-constrained revenue maximization is explored using a joint production transformation function which relaxes the assumption of free output disposal to investigate optimal avoidance behavior. Costly avoidance is found to be optimal when marginal revenues are negative, indicating quota price or shadow costs exceed ex-vessel value. An empirical Bayesian hierarchical model of joint production, estimating the marginal rate of product transformation between a constraining stock and the aggregate mix, is then presented. Results indicate that the low allocation species was avoided at the cost of reduced joint landings. Additionally, significant heterogeneity in joint production, captured through the model's hierarchical structure, suggests a well-functioning quota market could have produced large efficiency gains.

Session number: 2.1

Paper number: 84

Small-scale fisheries in the midst of the EU Fleet: findings from the 2013 AER on the EU fishing fleet

Natacha Carvalho¹ (presenting), Fabrizio Natale², Angel Calvo Santos³

1. EU Joint Research Centre, Ispra, Varese, Italy

2. Joint Research Centre, Ispra, Varese, Italy

3. DG MARE, Brussels, Brussels, Belgium

In 2011, the EU small-scale fleet accounted for over half of the number of active vessels, deployed more than 60% of the number of days at sea but consumed only 10% of the fuel consumption. While this fleet represented 6% of the EU landings in weight, it generated 15% of the landed value of the EU fleet in 2011, indicating that the segment fetches a higher average price for their catch than the larger fleets. The small-scale fleet contributed 19% of the GVA, 16% of the gross profit and 20% of net profits produced by the EU fleet in 2011. In relative terms, and compared to the other main fleet components, the small-scale fleet generated the highest GVA, gross profit and net profit as a % of income, 62%, 20% and 8%, respectively. This paper presents some of the main findings of the 2013 Annual Economic Report on the EU fishing fleet, with emphasis given to the EU small-scale fleet. In addition, EU coastal communities dependent on small-scale fisheries are identified and mapped using several spatial techniques, bringing together DCF data and information held in the EU Fleet Register and Eurostat. These fisheries dependent communities are defined according to their relevance in terms of fisheries employment and GVA in respect of general employment conditions in the surrounding areas of the port. On the sea side, analysis of spatial patterns of fishing activity from logbook data is used to calculate dependency ratios in respect to stocks subject to quota and TAC regulations for one case study. The calculation of such dependency ratios provides a direct link between economics and fisheries regulatory measures based on geography and is intended to meet the need of assessing the impact of policy also at the local level along with the regionalisation of the new CFP. Finally, the paper will present the specific treatment given by the new CFP and EMFF to promote the suitable fishing of artisanal fleets and the strengthening of fisheries coastal communities.

Session number: 2.1

Paper number: 2

The Total Economic Value of Small-Scale Fisheries with a Characterization of Post-Landing Trends: an Application in Madagascar with Global Relevance

Michele Barnes-Mauthe¹ (presenting), Kirsten L.L. Oleson¹, Bienvenue Zafindrasilivonona

1. University of Hawaii at Manoa, Honolulu, HI, United States

Small-scale fisheries make key contributions to food security, sustainable livelihoods and poverty reduction, yet to date the economic value of small-scale fisheries has been poorly quantified. In this study, we take a novel approach by characterizing post-landing trends of small-scale fisheries resources and estimating their total economic value, including both commercial and subsistence values, in a remote rural region in Madagascar. We construct annual landings and characterize gear and habitat use, post-landing trends, fishing revenue, total market value, costs and net income, profitability, employment and dependence on small-scale fisheries. Our results show that the small-scale fisheries sector employs 87% of the

adult population, generates an average of 82% of all household income, and provides the sole protein source in 99% of all household meals with protein. In 2010 an estimated 5524 metric tons (t) of fish and invertebrates were extracted annually by small-scale fishers in the region, primarily from coral reef ecosystems, of which 83% was sold commercially, generating fishing revenues of nearly \$6.0 million (PPP, 2010). When accounting for subsistence catch, total annual landings had an estimated value of \$6.9 million (PPP, 2010). Our results demonstrate the importance of small-scale fisheries for food security, livelihoods and wealth generation for coastal communities, and highlight the need for long-term management strategies that aim to enhance their ecological and economic sustainability. Our findings should catalyze national and regional policy makers to re-examine existing fisheries policies that neglect this sector, and spur researchers to better quantify small-scale fisheries globally.

Session number: 2.1

Paper number: 365

Common Pool Politics and inefficient Fishery Management

Julia Hoffmann¹ (presenting), Martin F. Quaas²

1. Christian-Albrechts-University Kiel, Department of Economics, Kiel, Schleswig-Holstein, Germany

2. University of Kiel, Kiel, Schleswig-Holstein, Germany

The main instrument used in fishery management is the total allowable catch (TAC). Fishery management often fails because TACs are set too high and do not sufficiently restrict fisheries. The question we address in this paper is why do decision makers choose inefficiently high TACs? Our approach is to model the annual negotiation as a dynamic non-cooperative game in discrete time. We assume two types of decision makers. The 'patient' type prefers fishing in the future. The 'impatient' type prefers fishing today. Decisions on TACs are made by majority voting. We show that despite forward-looking profit maximization the impatient decision makers have an incentive to choose a higher TAC than would be optimal for them because of an anticipation effect. The impatient majority has to consider that in the next period the patient majority might rule which chooses lower TACs. To compensate for the lower catch the impatient decision makers choose higher TACs in the current period. Under cooperation, binding agreements on lower TACs could be implemented which can lead to a more successful fishery management.

Session number: 2.1

Paper number: 436

Costly Avoidance in a Multispecies Catch Share Fishery

Andrew Scheld (presenting), Chris Anderson

1. Christian-Albrechts-University Kiel, Department of Economics, Kiel, Schleswig-Holstein, Germany

2. University of Kiel, Kiel, Schleswig-Holstein, Germany

Joint harvest technology in multispecies fisheries is often characterized by imperfectly selective gear, allowing only limited control of catch composition. In such fisheries, catch share management can be problematic if relative shares significantly diverge from harvest compositions. A mismatch in allocation with catch incentivizes avoidance behavior through manipulations in harvest strategy, timing, and/or location. If joint production technology does not satisfy free output disposal, avoidance behavior may become costly as increased landings of healthy stocks are forgone to reduce harvest of the jointly caught constraining stock. In this paper, a simple theoretical model of individual input-constrained revenue maximization is explored using a joint production transformation function which relaxes the assumption of free output disposal to investigate optimal avoidance behavior. Costly avoidance is found to be optimal when marginal revenues are negative, indicating quota price or shadow costs exceed ex-vessel value. An empirical Bayesian hierarchical model of joint production, estimating the marginal rate of product transformation between a constraining stock and the aggregate mix, is then presented. Results indicate that the low allocation species was avoided at the cost of reduced joint landings. Additionally, significant heterogeneity in joint production, captured through the model's hierarchical structure, suggests a well-functioning quota market could have produced large efficiency gains.

Session number: 2.1

Paper number: 84

Small-scale fisheries in the midst of the EU Fleet: findings from the 2013 AER on the EU fishing fleet

Natacha Carvalho¹ (presenting), Fabrizio Natale², Angel Calvo Santos³

1. EU Joint Research Centre, Ispra, Varese, Italy

2. Joint Research Centre, Ispra, Varese, Italy

3. DG MARE, Brussels, Brussels, Belgium

In 2011, the EU small-scale fleet accounted for over half of the number of active vessels, deployed more than 60% of the number of days at sea but consumed only 10% of the fuel consumption. While this fleet represented 6% of the EU landings in weight, it generated 15% of the landed value of the EU fleet in 2011, indicating that the segment fetches a higher average price for their catch than the larger fleets. The small-scale fleet contributed 19% of the GVA, 16% of the gross profit and 20% of net profits produced by the EU fleet in 2011. In relative terms, and compared to the other main fleet components, the small-scale fleet generated the highest GVA, gross profit and net profit as a % of income, 62%, 20% and 8%, respectively. This paper presents some of the main findings of the 2013 Annual Economic Report on the EU fishing fleet, with emphasis given to the EU small-scale fleet. In addition, EU coastal communities dependent on small-scale fisheries are identified and mapped using several spatial techniques, bringing together DCF data and information held in the EU Fleet Register and Eurostat. These fisheries dependent communities are defined according to their relevance in terms of fisheries employment and GVA in respect of general employment conditions in the surrounding areas of the port. On the sea side, analysis of spatial patterns of fishing activity from logbook data is used to calculate dependency ratios in respect to stocks subject to quota and TAC regulations for one case study. The calculation of such dependency ratios provides a direct link between economics and fisheries regulatory measures based on geography and is intended to meet the need of assessing the impact of policy also at the local level along with the regionalisation of the new CFP. Finally, the paper will present the specific treatment given by the new CFP and EMFF to promote the suitable fishing of artisanal fleets and the strengthening of fisheries coastal communities.

Session number: 2.1

Paper number: 2

The Total Economic Value of Small-Scale Fisheries with a Characterization of Post-Landing Trends: an Application in Madagascar with Global Relevance

Michele Barnes-Mauthe¹ (presenting), Kirsten L.L. Oleson¹, Bienvenue Zafindrasilivonona¹. University of Hawaii at Manoa, Honolulu, HI, United States

Small-scale fisheries make key contributions to food security, sustainable livelihoods and poverty reduction, yet to date the economic value of small-scale fisheries has been poorly quantified. In this study, we take a novel approach by characterizing post-landing trends of small-scale fisheries resources and estimating their total economic value, including both commercial and subsistence values, in a remote rural region in Madagascar. We construct annual landings and characterize gear and habitat use, post-landing trends, fishing revenue, total market value, costs and net income, profitability, employment and dependence on small-scale fisheries. Our results show that the small-scale fisheries sector employs 87% of the adult population, generates an average of 82% of all household income, and provides the sole protein source in 99% of all household meals with protein. In 2010 an estimated 5524 metric tons (t) of fish and invertebrates were extracted annually by small-scale fishers in the region, primarily from coral reef ecosystems, of which 83% was sold commercially, generating fishing revenues of nearly \$6.0 million (PPP, 2010). When accounting for subsistence catch, total annual landings had an estimated value of \$6.9 million (PPP, 2010). Our results demonstrate the importance of small-scale fisheries for food security, livelihoods and wealth generation for coastal communities, and highlight the need for long-term management strategies that aim to enhance their ecological and economic sustainability. Our findings should catalyze national and regional policy makers to re-examine existing fisheries policies that neglect this sector, and spur researchers to better quantify small-scale fisheries globally.

Session number: 2.4

Paper number: 312

The Effect of IFQs on the Total Factor Productivity of the US Gulf of Mexico Red Snapper Fishery

Daniel Solis¹, **Juan Agar**² (presenting), Julio del Corral³

1. Florida A&M University, Tallahassee, FL, United States

2. NOAA - Southeast Fisheries Science Center, Miami, FL, United States

3. Universidad de Castilla-La Mancha, 13003 Ciudad Real, Castilla-La Mancha, Spain

The introduction of individual fishing quotas (IFQs) in the Gulf of Mexico red snapper fishery significantly impacted the way the commercial fleet operated. As result of the added flexibility afforded by the IFQ program, vessels began taking fewer but longer trips. They also began diversifying the composition of their catch. The purpose of this paper is to assess the impact of the IFQ program on the total factor productivity (TFP) of the Gulf of Mexico red snapper fleet. We also decompose the productivity changes into factors for technological progress and technical and scale efficiency. To do so, we expand on traditional frameworks by introducing the use stochastic distance frontiers, which can deal with the randomness and multi-species nature of the fishing industry. In addition, we control for stock abundance and regulatory and environmental conditions. An unbalanced panel data including more than 900 distinct vessels during the six years preceding and following the implementation of IFQ program are used in the analysis. Our preliminary results suggest that the IFQ program improved the TFP of the fishery. We also found that technical efficiency and technological progress increased while scale efficiency decreased.

Session number: 2.4

Paper number: 321

Estimating the Costs of Quota Share Trading Restrictions in the Alaskan Halibut ITQ Program Using Linear Programming

Marysia Szymkowiak, University of Delaware, Gustavus, Alaska, United States

Rights-based fisheries management programs allocate to fishermen a specified portion of the annual TAC, providing fishermen with the incentive to optimize the value of this share, which has been shown to lead to more economically efficient behavior. Less efficient operators will tend to leave the fishery, decreasing overcapacity, but this exodus can have negative socioeconomic impacts, especially on isolated coastal communities. Managers often seek to minimize these adverse impacts by implementing community protection measures, which, in turn, restrict the ability of shareholders to optimize the value of their shares, thus reducing the economic efficiency gains possible with unrestricted privileges. Although such measures are common throughout rights-based management programs, there is relatively little literature on their costs and benefits. This study addresses this critical gap by assessing the costs of restrictions in the Alaskan Halibut ITQ program, including individual and vessel use caps and the categorization, and prohibition on inter-category trading, of quota shares. Linear programming (LP) is applied to estimate the costs, in lost potential economic rent, of these regulatory restrictions, from 2007 to 2011. Quota share trade restrictions and use caps are simulated as constraints in the LP models, with the maximized objective function representing the rent generation possible under loosened regulations. The results of this study indicate that rents in the halibut ITQ fishery could increase by as much as 28% if biological restrictions on inter-area trades were loosened, or 8% if social restrictions on inter-class

trades were loosened, with use caps constraining these potential gains.

Session number: 2.4

Paper number: 109

Factors Affecting on the Depletion of Anchovy Fisheries in Krueng Raya Bay, Aceh-Indonesia

Zulhamsyah Imran¹ (presenting), Masahiro Yamao¹

1. Hiroshima University, Higashi-Hiroshima, Hiroshima, Japan

Anchovy fisheries become collapse in the next decade. This research design to identify key factors on anchovy depletion and examine maximum sustainable yield (MSY) with focusing on tsunami affected area in Aceh. It work was conducted at Krueng Raya Bay during September - October 2012. Survey, focus group discussion and interview were implemented to explore the status of anchovy, mangrove and coral reef ecosystem. Anchovy catch was 52% of the total production of lift net boat in the end of west monsoons season 2012. Anchovy fisheries depletion was led by overfishing, destruction of mangrove and coral reef ecosystem. This tragedy was propelled by anthropogenic factors and the Asian tsunami compounded the deterioration of this common tragedy. Simple regression model resulted the difference model of MSY either before or after tsunami which were shown by $y = 0.8696 - 0.00008x$ and $y=0.1138 - 0.00002x$ respectively. Model 1 recommended reducing a number of lift net boat reach to 43 units for optimum of yield. Otherwise, Model 2 suggested that only 23 units can be operated for optimal effort each month. Anchovy stock decreased before tsunami and depleted after tsunami. Destruction of mangrove and coral reef ecosystem have contributed for sustainable development of anchovy fisheries.

Session number: 2.4

Paper number: 406

Dynamic Efficiency Costs of Non-Efficiency Objectives in Tradable Permit Programs

Kailin Kroetz¹, **James Sanchirico¹ (presenting)**, Daniel Lew²

1. UC Davis, Davis, California, United States

2. NOAA Fisheries, Alaska Fisheries Science Center, Davis, CA, United States

Economic efficiency is not the sole objective in many tradable permit programs. Other objectives include community, cultural, and other non-economic goals. In response to the presence of these non-economic goals, restrictions on trading quota are often implemented. If these restrictions on trade are binding, then they decrease economic efficiency. We develop one of the first applications of dynamic discrete choice models (DCCM) to fishery economics to investigate the impacts of restrictions on the evolution of a fishery managed with a tradable permit program. Using confidential data from the Alaskan halibut and sablefish ITQ program, we model the transition dynamics from the initial allocation of permits and identify the key mechanisms that impact the transition period. We use the DCCM to develop counterfactual scenarios to quantify the magnitude of the economic efficiency loss. For example, we model a counterfactual representing the situation where there are no restrictions on the length of vessel that can fish the quota. In this case, we find in the first five years of the halibut fishery program the average yearly resource rent in the scenario without restrictions is over 100% higher than in the restricted fishery. In a similar analysis of the sablefish fishery we find that

the average yearly resource rent is over 80% higher in the counterfactual scenario.

Session number: 2.4

Paper number: 312

The Effect of IFQs on the Total Factor Productivity of the US Gulf of Mexico Red Snapper Fishery

Daniel Solis¹, **Juan Agar² (presenting)**, Julio del Corral³

1. Florida A&M University, Tallahassee, FL, United States

2. NOAA - Southeast Fisheries Science Center, Miami, FL, United States

3. Universidad de Castilla-La Mancha, 13003 Ciudad Real, Castilla-La Mancha, Spain

The introduction of individual fishing quotas (IFQs) in the Gulf of Mexico red snapper fishery significantly impacted the way the commercial fleet operated. As result of the added flexibility afforded by the IFQ program, vessels began taking fewer but longer trips. They also began diversifying the composition of their catch. The purpose of this paper is to assess the impact of the IFQ program on the total factor productivity (TFP) of the Gulf of Mexico red snapper fleet. We also decompose the productivity changes into factors for technological progress and technical and scale efficiency. To do so, we expand on traditional frameworks by introducing the use stochastic distance frontiers, which can deal with the randomness and multi-species nature of the fishing industry. In addition, we control for stock abundance and regulatory and environmental conditions. An unbalanced panel data including more than 900 distinct vessels during the six years preceding and following the implementation of IFQ program are used in the analysis. Our preliminary results suggest that the IFQ program improved the TFP of the fishery. We also found that technical efficiency and technological progress increased while scale efficiency decreased.

Session number: 2.4

Paper number: 321

Estimating the Costs of Quota Share Trading Restrictions in the Alaskan Halibut ITQ Program Using Linear Programming

Marysia Szymkowiak, University of Delaware, Gustavus, Alaska, United States

Rights-based fisheries management programs allocate to fishermen a specified portion of the annual TAC, providing fishermen with the incentive to optimize the value of this share, which has been shown to lead to more economically efficient behavior. Less efficient operators will tend to leave the fishery, decreasing overcapacity, but this exodus can have negative socioeconomic impacts, especially on isolated coastal communities. Managers often seek to minimize these adverse impacts by implementing community protection measures, which, in turn, restrict the ability of shareholders to optimize the value of their shares, thus reducing the economic efficiency gains possible with unrestricted privileges. Although such measures are common throughout rights-based management programs, there is relatively little literature on their costs and benefits. This study addresses this critical gap by assessing the costs of restrictions in the Alaskan Halibut ITQ program, including individual and vessel use caps and the categorization, and prohibition on inter-category trading, of quota shares. Linear programming (LP) is applied to estimate the costs, in lost potential economic rent, of these regulatory restrictions, from 2007 to 2011. Quota share trade restrictions and use caps are simulated as constraints in the LP models, with the maximized objective function representing the rent generation possible under loosened regulations. The results of this study indicate that rents in the halibut ITQ fishery could increase by as much as 28% if biological restrictions on inter-area trades were loosened, or 8% if social restrictions on inter-class trades were loosened, with use caps constraining these potential gains.

Session number: 2.4

Paper number: 109

Factors Affecting on the Depletion of Anchovy Fisheries in Krueng Raya Bay, Aceh-Indonesia

Zulhamsyah Imran¹ (presenting), Masahiro Yamao¹

1. Hiroshima University, Higashi-Hiroshima, Hiroshima, Japan

Anchovy fisheries become collapse in the next decade. This research design to identify key factors on anchovy depletion and examine maximum sustainable yield (MSY) with focusing on tsunami affected area in Aceh. It work was conducted at Krueng Raya Bay during September - October 2012. Survey, focus group discussion and interview were implemented to explore the status of anchovy, mangrove and coral reef ecosystem. Anchovy catch was 52% of the total production of lift net boat in the end of west monsoons season 2012. Anchovy fisheries depletion was led by overfishing, destruction of mangrove and coral reef ecosystem. This tragedy was propelled by anthropogenic factors and the Asian tsunami compounded the deterioration of this common tragedy. Simple regression model resulted the difference model of MSY either before or after tsunami which were shown by $y = 0.8696 - 0.00008x$ and $y=0.1138 - 0.00002x$ respectively. Model 1 recommended reducing a number of lift net boat reach to 43 units for optimum of yield. Otherwise, Model 2 suggested that only 23 units can be operated for optimal effort each month. Anchovy stock decreased before tsunami and depleted after tsunami. Destruction of mangrove and coral reef ecosystem have contributed for sustainable development of anchovy fisheries.

Session number: 2.4

Paper number: 406

Dynamic Efficiency Costs of Non-Efficiency Objectives in Tradable Permit Programs

Kailin Kroetz¹, **James Sanchirico¹ (presenting)**, Daniel Lew²

1. UC Davis, Davis, California, United States

2. NOAA Fisheries, Alaska Fisheries Science Center, Davis, CA, United States

Economic efficiency is not the sole objective in many tradable permit programs. Other objectives include community, cultural, and other non-economic goals. In response to the presence of these non-economic goals, restrictions on trading quota are often implemented. If these restrictions on trade are binding, then they decrease economic efficiency. We develop one of the first applications of dynamic discrete choice models (DCCM) to fishery economics to investigate the impacts of restrictions on the evolution of a fishery managed with a tradable permit program. Using confidential data from the Alaskan halibut and sablefish ITQ program, we model the transition dynamics from the initial allocation of permits and identify the key mechanisms that impact the transition period. We use the DCCM to develop counterfactual scenarios to quantify the magnitude of the economic efficiency loss. For example, we model a counterfactual representing the situation where there are no restrictions on the length of vessel that can fish the quota. In this case, we find in the first five years of the halibut fishery program the average yearly resource rent in the scenario without restrictions is over 100% higher than in the restricted fishery. In a similar analysis of the sablefish fishery we find that the average yearly resource rent is over 80% higher in the counterfactual scenario.

Session number: 2.5

Paper number: 214

Harvest Reporting, Uncertainty and the Value of Timely Information

Jorge Holzer College Park, MD, United States

This study focuses on the pervasive issue faced by fisheries managers of observation error in key control variables such as effort and harvest. The uncertainty generated by reporting lags, misreporting and other forms of non-compliance often leads regulators to adopt a precautionary approach and set stringent restrictions in order to attain management goals like adherence to total allowable catch limits. In this paper we model the interaction between the manager and the industry as a Stackelberg game. We derive the corresponding subgame perfect equilibrium to show that firms' investment in timely information –information that shifts the distribution of the observation error in the sense of stochastic dominance– is beneficial for the industry, as it allows the regulator to relax effort restrictions. We use data from the Maryland Blue Crab Design Team Pilot Project to assess the industry's return of investing in early disclosure of catch information. In this pilot project, a subset of commercial fishermen voluntarily adopted electronic, real-time reporting instead of the current alternative of paper reporting that causes a two months lag in providing catch data.

Session number: 2.5

Paper number: 107

An Analysis of the Structural Changes in the Offshore Demersal Hake (*Merluccius capensis* and *M. paradoxus*) Trawl Fishery in South Africa

Rachel Cooper¹ (presenting), Astrid Jarre¹, Anthony Leiman¹

1. University of Cape Town, Cape Town, Western Cape, South Africa

The hake (*Merluccius capensis* and *M. paradoxus*) directed offshore demersal trawl is the most economically important fishing sub-sector in South Africa, generating 30 000 jobs and comprising more than 50% of fisheries value. The industry changed to long term rights (LTRA), allocated in 2006 for a 15 year period. This study investigates the structure of the industry half-way between allocations. Data obtained through government and industry consultation are used to generate a structural representation of this subsector, its fleet, vertical integration level, consolidation extent including horizontal clustering e.g. catch-share agreements, product value-adding and heterogeneity in business models. Vertical integration is an important characteristic of the industry. Nine business clusters were identified, of which three represent 75.7% of rights and 70% of vessels. The findings indicate consolidation is likely at a higher level than rightsholder numbers imply, due to horizontal clustering. This is consistent with an economically mature industry of scale. Retirement and industry led effort-restriction in relation to MSC certification, catch-cost efficiency and a shift to frozen product, led to a decline in vessel numbers, especially wetfish vessels. Industry's response to a broadening of rights access has been to maintain efficiency and profitability through economies of scope and scale by forming clusters, retiring old vessels and engaging in MSC certification to broaden or retain market access. The trend of consolidation since the 2006 LTRA and the record of consolidations and absorptions of smaller businesses suggest that consolidation is probable to continue at a slow but steady pace.

Session number: 2.5

Paper number: 342

Cost Benefit Analysis of Vessel Monitoring System (VMS) in Indonesia for Managing The Transition to Sustainable and Responsible Fisheries

Muhamad Suhendar, Ministry of Marine Affairs and Fisheries Republic of Indonesia, Jakarta, Dki Jakarta, Indonesia

One method to support a fisheries MCS system that recommended by the Food and Agriculture Organization (FAO) is using a Vessel Monitoring System (VMS). The VMS is a tools to analyze movement of fishing vessel. The costs and benefits of VMS investment can be estimated.

The analysis of the Indonesian VMS system revealed weaknesses and constraints. The most important weakness has to do with inefficient use of data caused by underdeveloped software solutions. System revealed substantial opportunities to improve the usefulness and effectiveness of the system by reducing time delay and developing a better system interface. The costs and benefits of the necessary investment were estimated. The costs are estimated at \$1 million. The overall yearly loss of revenue due to illegal fishing in Indonesia was however estimated at around \$9 million. Based on data on the extent of illegal fishing under different VMS systems suggests that an improved VMS might reduce illegal fishing by up to 50% over a 10 year period. Given these assumptions the benefits of the improvements to the VMS far exceed the cost, in fact the ratio of benefits to costs is about 17, the benefits are 17 times larger than the cost. The breakeven point is after only about 15 months, and the internal rate of return is 80%. The results of sensitivity analysis reveal that the result of positive net benefits is robust against very large changes in model assumptions.

Session number: 2.5

Paper number: 234

The Promise of Transferable Fishing Concessions

Serkan Kucuksenel, Middle East Technical University, Ankara, Ankara, Turkey

Two of the primary issues of the next Common Fisheries Policy (CFP) reform are maximum sustainable yield (MSY) and transferable fishing concessions (TFCs). The European Commission set the goal of achieving MSY for all European fisheries by 2015. Besides, the European Commission agreed on implementing TFCs under some major principles including reserving a part of total quotas for small-scale fishermen in order to prevent the disappearance of small-scale fishing communities in coastal regions. The interrelation between these two objectives should be well understood. In this study, the impact of fishing on total biomass is analyzed under an age-structured model. Following that, the potential effects of TFCs on the achievement process of the goal of MSY harvesting conditions are explained. This paper shows that the implementation of TFCs, under the major principles defined by the European Commission, has an impact on both the total biomass growth and the time to reach the goal of MSY. The paper concludes that the level of reserved quotas for small scale fishermen does matter since reserving more quotas for small-scale fishermen reduces the time needed to achieve MSY.

Session number: 2.5

Paper number: 214

Harvest Reporting, Uncertainty and the Value of Timely Information

Jorge Holzer College Park, MD, United States

This study focuses on the pervasive issue faced by fisheries managers of observation error in key control variables such as effort and harvest. The uncertainty generated by reporting lags, misreporting and other forms of non-compliance often leads regulators to adopt a precautionary approach and set stringent restrictions in order to attain management goals like adherence to total allowable catch limits. In this paper we model the interaction between the manager and the industry as a Stackelberg game. We derive the corresponding subgame perfect equilibrium to show that firms' investment in timely information –information that shifts the distribution of the observation error in the sense of stochastic dominance– is beneficial for the industry, as it allows the regulator to relax effort restrictions. We use data from the Maryland Blue Crab Design Team Pilot Project to assess the industry's return of investing in early disclosure of catch information. In this pilot project, a subset of commercial fishermen voluntarily adopted electronic, real-time reporting instead of the current alternative of paper reporting that causes a two months lag in providing catch data.

Session number: 2.5

Paper number: 107

An Analysis of the Structural Changes in the Offshore Demersal Hake (*Merluccius capensis* and *M. paradoxus*) Trawl Fishery in South Africa

Rachel Cooper¹ (presenting), Astrid Jarre¹, Anthony Leiman¹

1. University of Cape Town, Cape Town, Western Cape, South Africa

The hake (*Merluccius capensis* and *M. paradoxus*) directed offshore demersal trawl is the most economically important fishing sub-sector in South Africa, generating 30 000 jobs and comprising more than 50% of fisheries value. The industry changed to long term rights (LTRA), allocated in 2006 for a 15 year period. This study investigates the structure of the industry half-way between allocations. Data obtained through government and industry consultation are used to generate a structural representation of this subsector, its fleet, vertical integration level, consolidation extent including horizontal clustering e.g. catch-share agreements, product value-adding and heterogeneity in business models. Vertical integration is an important characteristic of the industry. Nine business clusters were identified, of which three represent 75.7% of rights and 70% of vessels. The findings indicate consolidation is likely at a higher level than rightsholder numbers imply, due to horizontal clustering. This is consistent with an economically mature industry of scale. Retirement and industry led effort-restriction in relation to MSC certification, catch-cost efficiency and a shift to frozen product, led to a decline in vessel numbers, especially wetfish vessels. Industry's response to a broadening of rights access has been to maintain efficiency and profitability through economies of scope and scale by forming clusters, retiring old vessels and engaging in MSC certification to broaden or retain market access. The trend of consolidation since the 2006 LTRA and the record of consolidations and absorptions of smaller businesses suggest that consolidation is probable to continue at a slow but steady pace.

Session number: 2.5

Paper number: 342

Cost Benefit Analysis of Vessel Monitoring System (VMS) in Indonesia for Managing The Transition to Sustainable and Responsible Fisheries

Muhamad Suhendar, Ministry of Marine Affairs and Fisheries Republic of Indonesia, Jakarta, Dki Jakarta, Indonesia

One method to support a fisheries MCS system that recommended by the Food and Agriculture Organization (FAO) is using a Vessel Monitoring System (VMS). The VMS is a tools to analyze movement of fishing vessel. The costs and benefits of VMS investment can be estimated.

The analysis of the Indonesian VMS system revealed weaknesses and constraints. The most important weakness has to do with inefficient use of data caused by underdeveloped software solutions. System revealed substantial opportunities to improve the usefulness and effectiveness of the system by reducing time delay and developing a better system interface. The costs and benefits of the necessary investment were estimated. The costs are estimated at \$1 million. The overall yearly loss of revenue due to illegal fishing in Indonesia was however estimated at around \$9 million. Based on data on the extent of illegal fishing under different VMS systems suggests that an improved VMS might reduce illegal fishing by up to 50% over a 10 year period. Given these assumptions the benefits of the improvements to the VMS far exceed the cost, in fact the ratio of benefits to costs is about 17, the benefits are 17 times larger than the cost. The breakeven point is after only about 15 months, and the internal rate of return is 80%. The results of sensitivity analysis reveal that the result of positive net benefits is robust against very large changes in model assumptions.

Session number: 2.5

Paper number: 234

The Promise of Transferable Fishing Concessions

Serkan Kucuksenel, Middle East Technical University, Ankara, Ankara, Turkey

Two of the primary issues of the next Common Fisheries Policy (CFP) reform are maximum sustainable yield (MSY) and transferable fishing concessions (TFCs). The European Commission set the goal of achieving MSY for all European fisheries by 2015. Besides, the European Commission agreed on implementing TFCs under some major principles including reserving a part of total quotas for small-scale fishermen in order to prevent the disappearance of small-scale fishing communities in coastal regions. The interrelation between these two objectives should be well understood. In this study, the impact of fishing on total biomass is analyzed under an age-structured model. Following that, the potential effects of TFCs on the achievement process of the goal of MSY harvesting conditions are explained. This paper shows that the implementation of TFCs, under the major principles defined by the European Commission, has an impact on both the total biomass growth and the time to reach the goal of MSY. The paper concludes that the level of reserved quotas for small scale fishermen does matter since reserving more quotas for small-scale fishermen reduces the time needed to achieve MSY.

Session number: 2.6

Paper number: 293

The Multi-species Aspect of Labor Supply Decisions in Spatially Explicit Bio-economic Fishery Models

Tess Stafford, University of New South Wales, UNSW, NSW, Australia

This paper analyzes the bias associated with ignoring the multi-species aspect of labor supply decisions in spatially explicit bioeconomic fishery models. Recent advancements have been made to simultaneously model the biology of a marine species and the strategic behavior of harvesters over both time and space in order to more accurately predict the effect of regulatory policies on harvester effort and resource population. These models assume a nested choice structure in which the harvester first faces a dichotomous decision between fishing for the target species or not on a given day and then chooses a location to fish conditional on participation. This structure implicitly groups all non-target species options together in the first nest forcing participation-specific coefficients to be the same for all outside options, including fishing for an alternative species and staying home, two very different choices. Using a complete 15-year panel of all fishing trips made by fishermen possessing a Florida spiny lobster license, including non-lobster trips, I show that the simplifying assumption of a dichotomous choice structure in the first nest is not innocuous and that the participation probabilities can change substantially with the addition of another species as an outside alternative.

Session number: 2.6

Paper number: 270

A game theoretic bargaining framework for cooperative management of the Pacific sardine

Aneesh Hariharan¹ (presenting), Vincent Gallucci¹, Sandy McFarlane²

1. University of Washington, Seattle, Seattle, WA, United States

2. Fisheries and Oceans, Nanimo, BC, Canada

The Pacific sardine (*Sardinops sagax*) has been one of the most abundant fish in the California Current Ecosystem (CCE) since the late 1990's. In recent years under a warm regimen, large Pacific sardine reached Canadian waters in mid-June and returned to the spawning ground in Southern California during October. The biomass of the Pacific sardine is a highly fluctuating entity that has been hard to quantify. Thus, the TAC (or the Total Allowable Catch) for the Pacific sardine varies considerably across years. As a result, industries suffer potential fisheries closures. Since the resource has been shared by these nations, there is the potential for conflict scenarios to arise.

In this talk, we present a game theoretic approach that can be applied for management of this transboundary stock. In particular, we focus on a bargaining framework, that is endogenously determined, which in turn feeds into our model for cooperative management. Results from successful cooperative management of the Iberio-Atlantic sardine will be presented. Simulations and implications for cooperative management in a bargaining framework will be highlighted for the Pacific sardine. Our model is tailored to ensure a profit maximization goal for the sardine industry under current management scenarios.

Session number: 2.6

Paper number: 418

The Effects of Catch Share Management on Rent Generation through Targeting and Production Choices

Lisa Pfeiffer¹ (presenting), Alan Haynie²

1. NOAA Northwest Fisheries Science Center, Seattle, WA, United States

2. NOAA/NMFS/AFSC, Seattle, WA, United States

Catch share management has been designed and used as a means for improving efficiency in fisheries by reducing the dissipation of fishery resource rents. Important impacts often include a reduction in the number of vessels fishing and the elimination of the incentive to overcapitalise along other dimensions, such as crew, gear, and effort. In addition, catch shares may create new rents by creating the incentive for harvesters to increase the value of fish caught. We investigate changes in the fishing and processing strategies of Bering Sea and Aleutian Islands (BSAI) Pacific Cod (*Gadus macrocephalus*) longline catcher/processor harvesters due to the formation of a fishing cooperative in 2010. We focus on the creation of value in the fishery through three mechanisms: the propensity of harvesters to target sizes of fish that increase product value, changes in recovery rates, and the development of markets for byproducts. We find that recovery rates and the value of byproducts increased after the formation of the cooperative, reversing a period of decreasing recovery rates and byproduct production that corresponded with an escalating race-for-fish prior to rationalization. An entirely new byproduct, roe for bait, began to be marketed under the cooperative. Finally, we note that the potential for broad-scale changes in product form and profitability appear relatively limited compared to fisheries with high-value product potential, such as roe in the Alaska pollock fishery and fresh (vs. frozen) fish in the Alaska and British Columbia halibut fisheries.

Session number: 2.6

Paper number: 293

The Multi-species Aspect of Labor Supply Decisions in Spatially Explicit Bio-economic Fishery Models

Tess Stafford, University of New South Wales, UNSW, NSW, Australia

This paper analyzes the bias associated with ignoring the multi-species aspect of labor supply decisions in spatially explicit bioeconomic fishery models. Recent advancements have been made to simultaneously model the biology of a marine species and the strategic behavior of harvesters over both time and space in order to more accurately predict the effect of regulatory policies on harvester effort and resource population. These models assume a nested choice structure in which the harvester first faces a dichotomous decision between fishing for the target species or not on a given day and then chooses a location to fish conditional on participation. This structure implicitly groups all non-target species options together in the first nest forcing participation-specific coefficients to be the same for all outside options, including fishing for an alternative species and staying home, two very different choices. Using a complete 15-year panel of all fishing trips made by fishermen possessing a Florida spiny lobster license, including non-lobster trips, I show that the simplifying assumption of a dichotomous choice structure in the first nest is not innocuous and that the participation probabilities can change substantially with the addition of another species as an outside alternative.

Session number: 2.6

Paper number: 270

A game theoretic bargaining framework for cooperative management of the Pacific sardine

Aneesh Hariharan¹ (presenting), Vincent Gallucci¹, Sandy McFarlane²

1. University of Washington, Seattle, Seattle, WA, United States

2. Fisheries and Oceans, Nanimo, BC, Canada

The Pacific sardine (*Sardinops sagax*) has been one of the most abundant fish in the California Current Ecosystem (CCE) since the late 1990's. In recent years under a warm regimen, large Pacific sardine reached Canadian waters in mid-June and returned to the spawning ground in Southern California during October. The biomass of the Pacific sardine is a highly fluctuating entity that has been hard to quantify. Thus, the TAC (or the Total Allowable Catch) for the Pacific sardine varies considerably across years. As a result, industries suffer potential fisheries closures. Since the resource has been shared by these nations, there is the potential for conflict scenarios to arise.

In this talk, we present a game theoretic approach that can be applied for management of this transboundary stock. In particular, we focus on a bargaining framework, that is endogenously determined, which in turn feeds into our model for cooperative management. Results from successful cooperative management of the Iberio-Atlantic sardine will be presented. Simulations and implications for cooperative management in a bargaining framework will be highlighted for the Pacific sardine. Our model is tailored to ensure a profit maximization goal for the sardine industry under current management scenarios.

Session number: 2.6

Paper number: 418

The Effects of Catch Share Management on Rent Generation through Targeting and Production Choices

Lisa Pfeiffer¹ (presenting), Alan Haynie²

1. NOAA Northwest Fisheries Science Center, Seattle, WA, United States

2. NOAA/NMFS/AFSC, Seattle, WA, United States

Catch share management has been designed and used as a means for improving efficiency in fisheries by reducing the dissipation of fishery resource rents. Important impacts often include a reduction in the number of vessels fishing and the elimination of the incentive to overcapitalize along other dimensions, such as crew, gear, and effort. In addition, catch shares may create new rents by creating the incentive for harvesters to increase the value of fish caught. We investigate changes in the fishing and processing strategies of Bering Sea and Aleutian Islands (BSAI) Pacific Cod (*Gadus macrocephalus*) longline catcher/processor harvesters due to the formation of a fishing cooperative in 2010. We focus on the creation of value in the fishery through three mechanisms: the propensity of harvesters to target sizes of fish that increase product value, changes in recovery rates, and the development of markets for byproducts. We find that recovery rates and the value of byproducts increased after the formation of the cooperative, reversing a period of decreasing recovery rates and byproduct production that corresponded with an escalating race-for-fish prior to rationalization. An entirely new byproduct, roe for bait, began to be marketed under the cooperative. Finally, we note that the potential for broad-scale changes in product form and profitability appear relatively limited compared to fisheries with high-value product potential, such as roe in the Alaska pollock fishery and fresh (vs. frozen) fish in the Alaska and British Columbia halibut fisheries.

Session number: 2.7

Paper number: 452

Vertically Differentiating Environmental Standards: The Case of the Marine Stewardship Council

Simon Bush¹ (presenting), Peter Oosterveer

1. Wageningen University, Wageningen, Gelderland, Netherlands

This paper explores the externally-led vertical differentiation of third-party certification standards using the case of the Marine Stewardship Council (MSC). We analyse this process in two dimensions. First, ‘MSC-plus’ fisheries employ strategies to capture further market value from fishing practices that go beyond their initial conditions for certification and seeking additional recognition for these activities from international NGOs. Second, ‘MSC-minus’ fisheries, not yet able to meet the requirements of MSC standards, are being enrolled in NGO and private sector sponsored Fisheries Improvement Projects (FIPs), providing an alternative route to global markets. In both cases the credibility and authority of the MSC is challenged by new coalitions of market actors opening up new options for capturing market value and/or improving the conditions of international market access. Using a global value chain (GVC) framework, the results offer new insights on how such standards not only influence trade and markets, but are also starting to change their internal structure and governance in response to threats to their credibility by actors and modes of coordination in global value chains.

Session number: 2.7

Paper number: 467

Value-Adding for Captured Fish Products by Documenting Sustainability

Petter Olsen, Nofima, Tromsøe, Troms, Norway

The documentation of sustainability constitutes a significant opportunity for product value-adding in the captured fish sector, and a means of differentiating sustainably caught and landed fish from inferior alternatives. In the industry-owned R&D project WhiteFish the main objective is to create a tool for catch and processing SMEs in the captured fish supply chain that will enable them to document degree of sustainability on single batch / trip level. A number of biologic, environmental, social and economic indicators have been defined, and after initial configuration only a few daily recordings are needed to enable the generation of a “Sustainability Certificate”, highlighting degree of sustainability for the batch / trip in question in all these areas, including a rough estimate of carbon footprint. WhiteFishMaLL is the consumer-oriented follow-up to WhiteFish where, after conducting detailed interviews and getting feedback from focus groups, consumers indicated what sustainability-related information they are most interested in, and how they prefer to get access to it. Based on this, batch-specific QR-codes with link to extended product information (including sustainability information) were developed and deployed in cod and haddock supply chains, enabling environmentally conscious consumers in UK fish&chip shops to scan the code and get access to previously unavailable product information. This presentation will use the outcomes and experiences from these two projects to illustrate that value-adding for captured fish products by documenting sustainability is a very real and present possibility.

Session number: 2.7

Paper number: 441

Estimating United States Salmon Consumption

Gunnar Knapp, University of Alaska Anchorage, Anchorage, AK, United States

A starting point in understanding the United States salmon market—and what opportunities it offers for both farmed and wild producers—is getting basic information on United States salmon consumption. How much salmon do Americans consume, of what species, from what origins and what product forms? How has consumption been changing over time? Getting this kind of information is surprisingly difficult—mainly because of the challenges associated with estimating U.S. consumption of wild salmon. The United States is the world's largest producer of wild salmon, but much of this salmon is exported, in many different product forms, and it is difficult to estimate how much is consumed in the United States and in what product forms it is consumed. This paper describes a methodology for estimating United States salmon consumption from trade data, harvest data, Alaska production data and several other sources, and presents estimates of consumption for the years 1990-2012. Key findings include (a) total fresh and frozen salmon consumption grew very rapidly from less than 60,000 mt in 1990 to more than 250,000 in the early 1990s, but subsequently leveled off; (b) imported farmed salmon accounted for almost all of this growth; (c) in 2012 imported farmed salmon accounted for about 68% of U.S. consumption of fresh and frozen salmon, domestic farmed salmon accounted for about 5%, and wild salmon accounted for about 27%; and (d) wild salmon consumption varies significantly from year to year, reflecting variation in domestic wild salmon harvests.

Session number: 2.7

Paper number: 400

Using a Choice Experiment to Account for Preference Heterogeneity in Fresh Spiny Lobster Attributes: The Case of French Consumers

Haja Razafimandimby (presenting) and Abdelhak NASSIRI, UMR AMURE, France

This paper aims to assist policy makers in formulating national labeling scheme recognizing the environmental quality for seafood products in France. A choice experiment is employed to estimate consumer preferences for fresh spiny lobster. In addition to the conditional logit model, a random parameter logit model, a random parameter logit model with interactions and a latent class model are estimated to account for heterogeneity in the consumers' preferences. The factors influencing these preferences are analyzed on the basis of a survey carried out on more than 300 consumers in three different cities (Paris, Toulouse and Brest). The results highlighted the existence of three categories of consumers. They also confirmed a willingness to pay for attributes of freshness, quality and certain environment related attributes. The originality of the paper is to have included among product's characteristics the carbon footprint attribute. It thus helps to clarify the debate on relevant sustainability criteria to include in the common reference for labeling of sea fishing products in France.

Session number: 2.7

Paper number: 452

Vertically Differentiating Environmental Standards: The Case of the Marine Stewardship Council

Simon Bush¹ (presenting), Peter Oosterveer

1. Wageningen University, Wageningen, Gelderland, Netherlands

This paper explores the externally-led vertical differentiation of third-party certification standards using the case of the Marine Stewardship Council (MSC). We analyse this process in two dimensions. First, 'MSC-plus' fisheries employ strategies to capture further market value from fishing practices that go beyond their initial conditions for certification and seeking additional recognition for these activities from international NGOs. Second, 'MSC-minus' fisheries, not yet able to meet the requirements of MSC standards, are being enrolled in NGO and private sector sponsored Fisheries Improvement Projects (FIPs), providing an alternative route to global markets. In both cases the credibility and authority of the MSC is challenged by new coalitions of market actors opening up new options for capturing market value and/or improving the conditions of international market access. Using a global value chain (GVC) framework, the results offer new insights on how such standards not only influence trade and markets, but are also starting to change their internal structure and governance in response to threats to their credibility by actors and modes of coordination in global value chains.

Session number: 2.7

Paper number: 467

Value-Adding for Captured Fish Products by Documenting Sustainability

Petter Olsen, Nofima, Tromsøe, Troms, Norway

The documentation of sustainability constitutes a significant opportunity for product value-adding in the captured fish sector, and a means of differentiating sustainably caught and landed fish from inferior alternatives. In the industry-owned R&D project WhiteFish the main objective is to create a tool for catch and processing SMEs in the captured fish supply chain that will enable them to document degree of sustainability on single batch / trip level. A number of biologic, environmental, social and economic indicators have been defined, and after initial configuration only a few daily recordings are needed to enable the generation of a “Sustainability Certificate”, highlighting degree of sustainability for the batch / trip in question in all these areas, including a rough estimate of carbon footprint. WhiteFishMaLL is the consumer-oriented follow-up to WhiteFish where, after conducting detailed interviews and getting feedback from focus groups, consumers indicated what sustainability-related information they are most interested in, and how they prefer to get access to it. Based on this, batch-specific QR-codes with link to extended product information (including sustainability information) were developed and deployed in cod and haddock supply chains, enabling environmentally conscious consumers in UK fish&chip shops to scan the code and get access to previously unavailable product information. This presentation will use the outcomes and experiences from these two projects to illustrate that value-adding for captured fish products by documenting sustainability is a very real and present possibility.

Session number: 2.7

Paper number: 441

Estimating United States Salmon Consumption

Gunnar Knapp, University of Alaska Anchorage, Anchorage, AK, United States

A starting point in understanding the United States salmon market—and what opportunities it offers for both farmed and wild producers—is getting basic information on United States salmon consumption. How much salmon do Americans consume, of what species, from what origins and what product forms? How has consumption been changing over time? Getting this kind of information is surprisingly difficult—mainly because of the challenges associated with estimating U.S. consumption of wild salmon. The United States is the world’s largest producer of wild salmon, but much of this salmon is exported, in many different product forms, and it is difficult to estimate how much is consumed in the United States and in what product forms it is consumed. This paper describes a methodology for estimating United States salmon consumption from trade data, harvest data, Alaska production data and several other sources, and presents estimates of consumption for the years 1990-2012. Key findings include (a) total fresh and frozen salmon consumption grew very rapidly from less than 60,000 mt in 1990 to more than 250,000 in the early 1990s, but subsequently leveled off; (b) imported farmed salmon accounted for almost all of this growth; (c) in 2012 imported farmed salmon accounted for about 68% of U.S. consumption of fresh and frozen salmon, domestic farmed salmon accounted for about 5%, and wild salmon accounted for about 27%; and (d) wild salmon consumption varies significantly from year to year, reflecting variation in domestic wild salmon harvests.

Session number: 2.7

Paper number: 400

Using a Choice Experiment to Account for Preference Heterogeneity in Fresh Spiny Lobster Attributes: The Case of French Consumers

Haja Razafimandimby (presenting) and Abdelhak NASSIRI, UMR AMURE, France

This paper aims to assist policy makers in formulating national labeling scheme recognizing the environmental quality for seafood products in France. A choice experiment is employed to estimate consumer preferences for fresh spiny lobster. In addition to the conditional logit model, a random parameter logit model, a random parameter logit model with interactions and a latent class model are estimated to account for heterogeneity in the consumers' preferences. The factors influencing these preferences are analyzed on the basis of a survey carried out on more than 300 consumers in three different cities (Paris, Toulouse and Brest). The results highlighted the existence of three categories of consumers. They also confirmed a willingness to pay for attributes of freshness, quality and certain environment related attributes. The originality of the paper is to have included among product's characteristics the carbon footprint attribute. It thus helps to clarify the debate on relevant sustainability criteria to include in the common reference for labeling of sea fishing products in France.

Session number: 3.1

Paper number: 265

Will third party certification provide management and economic benefits to Australian domestic fisheries?

Sevaly Sen, Sydney Fish Market, Sydney, NSW, Australia

Some export fisheries in Australia have opted for third party certification to gain or maintain access to export markets. For domestic fisheries, the economic and management benefits of third party certification have yet to be fully demonstrated. However, as a response to community perceptions, competition with other users of the coastal zone and potential closure, many of the fisheries which supply domestic markets need to demonstrate they are, or are transitioning, to being sustainable and responsibly managed.

To address these issues, Sydney Fish Market is leading a research project to assess the feasibility of using an existing third party certification scheme, develop a national fisheries management standard or develop best practice fisheries management guidelines focused on the characteristics of many Australian fisheries: small and medium sized enterprises, multi-gear and multi-species. The benefits of the various approaches need to be demonstrated to all players in the supply chain, but also additional costs to industry have to be justified given that the catching sector pays for fisheries management under either full or partial cost recovery regimes.

This paper discusses the results of the research project and explores the broader issues of the need for third party certification within a robust regulatory environment, including the assessment of environmental performance of fisheries and promotion of ecologically sustainable fisheries management under the 1999 Environment and Biodiversity Protection and Conservation Act.

Session number: 3.1

Paper number: 9

Fresh Fish Attributes and Consumers' Preference Ranking in Rural and Urban Households in Ondo State, Nigeria

Taiwo Mafimisebi¹ (presenting), Abiodun Osuntunde¹, Ojuotimi Mafimisebi²

1. The Federal University of Technology, Akure, Akure, Ondo, Nigeria

2. Rufus Giwa Polytechnic, Owo, Owo, Ondo, Nigeria

The study investigated fresh fish characteristics that determine consumers' preference for fresh fish in rural and urban households. Primary data were collected from a total of 192 fresh fish consumers using multi-stage sampling procedure. The data were analyzed using descriptive statistics, regression analysis and Relative Attribute Model (RAM). The results showed that an average sampled respondent was literate with mean household size of 5. The average age of respondents was 35years, while the average monthly income of household was ₦34,240 (urban) and ₦26,880 (rural). Empirical result revealed that urban households consumed more catfish than other fish species owing to possession of certain attributes, availability and price. Also, rural households consumed more fresh fish than urban households because of cheaper price occasioned by proximity to riverine areas where fishing is the predominant occupation. Regression results revealed that sweetness, extent of boniness and cheapness were more significant than other attributes in influencing preference ranking.

Also, the preference for fresh fish was found to be more significant in determining consumers' monthly expenditure on fresh fish. The relative importance of the individual fresh fish attributes revealed that boniness and sweetness took leading positions in consumer preference ranking in both rural and urban households. It is concluded that consumers of fresh fish look out for certain characteristics which differ in their ability to influence consumers' motivation to make purchase decisions. It is recommended that fresh fish sellers watch out for these attributes for rapid turnover and profitable fish marketing business.

Session number: 3.1

Paper number: 16

Is size-dependent pricing prevalent in fisheries? The case of Norwegian demersal and pelagic fisheries

Fabian Zimmermann, University of Bergen, Bergen , Hordaland, Norway

It is commonly acknowledged that body weight of fish is a key factor in determining market value of landed catch, thus influencing optimal harvest strategies. However, in management strategy evaluations and bioeconomic modelling, body size is often an overlooked economic parameter, and there are no systematic studies on the prevalence of size-dependent pricing. In our study we assessed the presence and magnitude of size-dependent pricing in ex-vessel prices of fish in Norwegian fisheries. The data encompass landings of four pelagic and four demersal stocks in Norway in 2000–2010. Linear mixed models and generalized additive models were used to determine the dependence of unit price on weight class as well as on total yield and time (year). The results show a significant positive relationship between weight class and price for seven out of the eight examined fish stocks. The relative effect of body weight on price was the strongest for cod, Greenland halibut, Norwegian spring-spawning herring and mackerel, lesser for North Sea herring and saithe, and negligible for horse mackerel. These findings demonstrate that size-dependent pricing is common in Norwegian fisheries and might be also widespread internationally. To incorporate such price structures and thus the real valuation of biological attributes like fish size in management strategies could therefore contribute to improved economic performance and sustainability of fisheries.

Session number: 3.1

Paper number: 129

Price Interactions between Farm-Raised and Wild-Harvested African Catfish in Uganda

James Bukenya¹ (presenting), Maurice Ssebisubi²

1. Alabama A&M University, Normal, Alabama, United States

2. Aquaculture Management Consultants Limited, Kampala, Kampala, Uganda

This study explores the interdependencies of farm-raised and wild-harvested African catfish supply chains in Uganda. The country's fisheries sector is comprised of both capture and farm-raised fisheries with the former contributing most of the total production. Capture fishery is basically artisanal while aquaculture is primarily practiced by farmers as one of the many farming activities. The issue of integration between farm-raised and wild-harvested African catfish supply chains is important, since different developments are taking place in these chains. First, during the last decade African catfish has become an important traded species with exports to regional markets rising even faster than production, yet limited

research has been undertaken to study the interactions between the two supply chains. Second, the analysis provides a contribution to the unsettled issue relating to the competition between farmed and wild species. This is important as the overfishing of wild stocks coupled with the expansion of a wide variety of aquaculture products in the market, could lead to farmed fish competing more directly with wild fish in the study region. The analysis draws on monthly price data from 2006:01 to 2013:08, and applies threshold autoregressive approaches to test for the existence of a long-run relationship and price asymmetry. The results show that, prices in both market channels are linked in the long-run, implying that farm-raised catfish forms part of the same market as wild-harvested catfish in the country. The findings have strong implications for aquaculture producers and artisanal fishers as they can serve as a basis for more efficient farm management and marketing decisions.

Session number: 3.1

Paper number: 265

Will third party certification provide management and economic benefits to Australian domestic fisheries?

Sevaly Sen, Sydney Fish Market, Sydney, NSW, Australia

Some export fisheries in Australia have opted for third party certification to gain or maintain access to export markets. For domestic fisheries, the economic and management benefits of third party certification have yet to be fully demonstrated. However, as a response to community perceptions, competition with other users of the coastal zone and potential closure, many of the fisheries which supply domestic markets need to demonstrate they are, or are transitioning, to being sustainable and responsibly managed.

To address these issues, Sydney Fish Market is leading a research project to assess the feasibility of using an existing third party certification scheme, develop a national fisheries management standard or develop best practice fisheries management guidelines focused on the characteristics of many Australian fisheries: small and medium sized enterprises, multi-gear and multi-species. The benefits of the various approaches need to be demonstrated to all players in the supply chain, but also additional costs to industry have to be justified given that the catching sector pays for fisheries management under either full or partial cost recovery regimes.

This paper discusses the results of the research project and explores the broader issues of the need for third party certification within a robust regulatory environment, including the assessment of environmental performance of fisheries and promotion of ecologically sustainable fisheries management under the 1999 Environment and Biodiversity Protection and Conservation Act.

Session number: 3.1

Paper number: 9

Fresh Fish Attributes and Consumers' Preference Ranking in Rural and Urban Households in Ondo State, Nigeria

Taiwo Mafimisebi¹ (presenting), Abiodun Osuntunde¹, Ojuotimi Mafimisebi²

1. The Federal University of Technology, Akure, Akure, Ondo, Nigeria

2. Rufus Giwa Polytechnic, Owo, Owo, Ondo, Nigeria

The study investigated fresh fish characteristics that determine consumers' preference for fresh fish in rural and urban households. Primary data were collected from a total of 192 fresh fish consumers using multi-stage sampling procedure. The data were analyzed using descriptive statistics, regression analysis and Relative Attribute Model (RAM). The results showed that an average sampled respondent was literate with mean household size of 5. The average age of respondents was 35 years, while the average monthly income of household was ₦34,240 (urban) and ₦26,880 (rural). Empirical result revealed that urban households consumed more catfish than other fish species owing to possession of certain attributes, availability and price. Also, rural households consumed more fresh fish than urban households because of cheaper price occasioned by proximity to riverine areas where fishing is the predominant occupation. Regression results revealed that sweetness, extent of boniness and cheapness were more significant than other attributes in influencing preference ranking. Also, the preference for fresh fish was found to be more significant in determining consumers' monthly expenditure on fresh fish. The relative importance of the individual fresh fish attributes revealed that boniness and sweetness took leading positions in consumer preference ranking in both rural and urban households. It is concluded that consumers of fresh fish look out for certain characteristics which differ in their ability to influence consumers' motivation to make purchase decisions. It is recommended that fresh fish sellers watch out for these attributes for rapid turnover and profitable fish marketing business.

Session number: 3.1

Paper number: 16

Is size-dependent pricing prevalent in fisheries? The case of Norwegian demersal and pelagic fisheries

Fabian Zimmermann, University of Bergen, Bergen , Hordaland, Norway

It is commonly acknowledged that body weight of fish is a key factor in determining market value of landed catch, thus influencing optimal harvest strategies. However, in management strategy evaluations and bioeconomic modelling, body size is often an overlooked economic parameter, and there are no systematic studies on the prevalence of size-dependent pricing. In our study we assessed the presence and magnitude of size-dependent pricing in ex-vessel prices of fish in Norwegian fisheries. The data encompass landings of four pelagic and four demersal stocks in Norway in 2000–2010. Linear mixed models and generalized additive models were used to determine the dependence of unit price on weight class as well as on total yield and time (year). The results show a significant positive relationship between weight class and price for seven out of the eight examined fish stocks. The relative effect of body weight on price was the strongest for cod, Greenland halibut, Norwegian spring-spawning herring and mackerel, lesser for North Sea herring and saithe, and negligible for horse mackerel. These findings demonstrate that size-dependent pricing is common in Norwegian fisheries and might be also widespread internationally. To incorporate such price structures and thus the real valuation of biological attributes like fish size in management strategies could therefore contribute to improved economic performance and sustainability of fisheries.

Session number: 3.1

Paper number: 129

Price Interactions between Farm-Raised and Wild-Harvested African Catfish in Uganda

James Bukenya¹ (presenting), Maurice Ssebisubi²

1. Alabama A&M University, Normal, Alabama, United States

2. Aquaculture Management Consultants Limited, Kampala, Kampala, Uganda

This study explores the interdependencies of farm-raised and wild-harvested African catfish supply chains in Uganda. The country's fisheries sector is comprised of both capture and farm-raised fisheries with the former contributing most of the total production. Capture fishery is basically artisanal while aquaculture is primarily practiced by farmers as one of the many farming activities. The issue of integration between farm-raised and wild-harvested African catfish supply chains is important, since different developments are taking place in these chains. First, during the last decade African catfish has become an important traded species with exports to regional markets rising even faster than production, yet limited research has been undertaken to study the interactions between the two supply chains. Second, the analysis provides a contribution to the unsettled issue relating to the competition between farmed and wild species. This is important as the overfishing of wild stocks coupled with the expansion of a wide variety of aquaculture products in the market, could lead to farmed fish competing more directly with wild fish in the study region. The analysis draws on monthly price data from 2006:01 to 2013:08, and applies threshold autoregressive approaches to test for the existence of a long-run relationship and price asymmetry. The results show that, prices in both market channels are linked in the long-run, implying that farm-raised catfish forms part of the same market as wild-harvested catfish in the country. The findings have strong implications for aquaculture producers and artisanal fishers as they can serve as a basis for more efficient farm management and marketing decisions.

Session number: 3.2

Paper number: 415

Not Just a March to the North: How Climate Variation Affects the Bering Sea Pollock Trawl and Pacific Cod Longline Fisheries

Alan Haynie¹ (presenting), Lisa Pfeiffer²

1. NOAA/NMFS/AFSC, Seattle, WA, United States

2. NOAA Northwest Fisheries Science Center, Seattle, WA, United States

How will changing climate impact commercial fisheries? The observed impacts of climate variation on the spatial distribution of Bering Sea fisheries are surprisingly different than the impacts on fish populations. In this paper, we integrate work that independently examined the impact of climate change on the Bering Sea pollock and Pacific cod catcher-processor fisheries. We examine how both fisheries have adjusted to variation in economic conditions, changes in abundance, and environmental conditions. For pollock, the mean location of winter fishing has varied little between warm and cold years, but there has been a northward shift in summer pollock biomass and fishing. However, contrary to the idea that this shift would be correlated directly with warming temperatures, this shift is contemporaneously correlated with the colder than average climate conditions in the latter part of the last decade. For Pacific cod, the mean location of fishing has not shifted significantly as a result of climate variation, but fishing trips have changed. Climate affects relative spatial catch-per-unit-effort (CPUE) in both fisheries by causing a cold pool (water less than 2°C that persists into the summer) that both species avoid. In the Pacific cod fishery, vessels make long-distance moves more often in warmer, low-CPUE years, leading to significantly higher fuel costs. We develop a general framework of the avenues through which climate affects fisheries; understanding the relationship among fishing location, climate variables, and economic factors is essential in predicting the effects of future warming on fisheries.

Session number: 3.2

Paper number: 420

Governance and Management of Arctic Fisheries

Frank Millerd, Wilfrid Laurier University, Kitchener, Ontario, Canada

Warming of the Arctic has taken place with a loss of sea ice and changes in the Arctic ecosystem. Valuable commercial species may move northward and large-scale commercial fishing may be proposed. This paper will consider the potential for commercial fisheries in the Arctic, much of which is international waters, and discuss the institutional arrangements needed - their authority, objectives, responsibilities, and structures.

Current international institutions and agreements, including the Arctic Council, in which Arctic nations “promote cooperation, coordination, and interaction among the Arctic States” and other multilateral and regional agreements, will be assessed for their adaptability, effectiveness, and efficiency. Can current arrangements be adapted for Arctic fisheries or are new agreements needed? An agreement between all potential participants and all those affected is imperative before any large-scale commercial fishing occurs. The Arctic could set an example with fisheries management and governance that avoids rent dissipation, adapts to a changing natural environment, protects the rights of indigenous peoples, and anticipates rather than reacts to changes.

Any institutional arrangement in the Arctic needs to address a number of challenges, including the limited knowledge of the ecosystem, the speed and consequences of climate change, other potential uses of the Arctic (including shipping and fossil fuel extraction), territorial claims and disputes, and the wishes and actions of non-Arctic nations.

The impacts due to a warmer climate and potential marine commercial fisheries on the fisheries carried on by indigenous populations and fisheries in the lakes and rivers of the Arctic will also be discussed.

Session number: 3.2

Paper number: 430

Remapping Tuna Sovereignty in the Pacific: Forging a Nexus between Access and Climate Change Mitigation

Kanae Tokunaga¹ (presenting), Alison Rieser¹

1. University of Hawaii at Manoa, Honolulu, Hawaii, United States

The Parties to the Nauru Agreement of 1982 (PNA) are seven Pacific island states that established a joint fishery management system to protect Pacific tuna stocks from over exploitation by the distant-water fishing nations (DWFNs). The PNA have been successful at managing fishing effort and retaining economic rent from the fish in the region via various policies such as the Vessel Day Scheme. Through conditions on access, they require DWFN fleets to modify their fishing practices in their EEZs and those enclaves of high seas that lie between their EEZs.

However, climate change poses new challenges to their resource governance strategies. Studies suggest that climate change will alter tuna migratory patterns and habitat. This is a serious threat to the economy and development of the PNA. For some archipelagic, atoll states, the threat includes loss of sovereign rights in their exclusive economic zones due to sea level rise.

This study proposes a fishery management policy for the PNA and other states with tuna sovereignty that incorporates climate change mitigation goals. The policy would require DWFNs to reduce their GHG emissions in order to gain access rights to the PNA-managed tuna fishery. We investigate the economic feasibility of the policy by comparing the current price of the access rights to the tuna fishery and the cost and benefit of GHG emission reduction by the DWFNs. By drawing from international legal principles, we also show the plausibility of such policy.

Session number: 3.2

Paper number: 138

Climate Change, Rural Household Food Consumption and Vulnerability in Vietnam

Trang Le¹, **Kimanh Nguyen (presenting)**, CHUONG BUI, CURTIS JOLLY

1. NhaTrang University, NHA TRANG, KHANH HOA, Viet Nam

Ben Tre Province in the Mekong Delta, Vietnam, has suffered immensely from recent climate change triggered weather events. Along with salt water intrusion, unusual typhoons also inflicted serious damages to the economy of the province. Economic damages caused by salt water intrusion from 1995 to 2008 amounted to US \$32,423,080,632. In this study, we

attempt to measure the effects of climate change on household consumption and levels of vulnerability. Three hundred households were surveyed. The vulnerability index was estimated using the VEP approach. The distribution of vulnerability index showed that on average there is a 43 percent probability that a coastal household will fall below the minimum consumption threshold level of US \$1.25 per capita per day. Forty-six percent of households are vulnerable to climatic risk, while 54 percent of households are considered not vulnerable. The factors affecting food consumption in rural households in Ben Tre Province in the Mekong Delta are the households other sources of income, education level of head of households, livelihood diversity index, the number of contacts the household made to access credit, gender of the head of the household and the number of young people working outside the household. Level of education of the head of household marginally increases consumption risks. The average number of floods that affect the household in the past 10 years reduces consumption vulnerability while the average number of the floods that inundated the community in the past ten years increases consumption vulnerability.

Session number: 3.2

Paper number: 415

Not Just a March to the North: How Climate Variation Affects the Bering Sea Pollock Trawl and Pacific Cod Longline Fisheries

Alan Haynie¹ (presenting), Lisa Pfeiffer²

1. NOAA/NMFS/AFSC, Seattle, WA, United States

2. NOAA Northwest Fisheries Science Center, Seattle, WA, United States

How will changing climate impact commercial fisheries? The observed impacts of climate variation on the spatial distribution of Bering Sea fisheries are surprisingly different than the impacts on fish populations. In this paper, we integrate work that independently examined the impact of climate change on the Bering Sea pollock and Pacific cod catcher-processor fisheries. We examine how both fisheries have adjusted to variation in economic conditions, changes in abundance, and environmental conditions. For pollock, the mean location of winter fishing has varied little between warm and cold years, but there has been a northward shift in summer pollock biomass and fishing. However, contrary to the idea that this shift would be correlated directly with warming temperatures, this shift is contemporaneously correlated with the colder than average climate conditions in the latter part of the last decade. For Pacific cod, the mean location of fishing has not shifted significantly as a result of climate variation, but fishing trips have changed. Climate affects relative spatial catch-per-unit-effort (CPUE) in both fisheries by causing a cold pool (water less than 2°C that persists into the summer) that both species avoid. In the Pacific cod fishery, vessels make long-distance moves more often in warmer, low-CPUE years, leading to significantly higher fuel costs. We develop a general framework of the avenues through which climate affects fisheries; understanding the relationship among fishing location, climate variables, and economic factors is essential in predicting the effects of future warming on fisheries.

Session number: 3.2

Paper number: 420

Governance and Management of Arctic Fisheries

Frank Millerd, Wilfrid Laurier University, Kitchener, Ontario, Canada

Warming of the Arctic has taken place with a loss of sea ice and changes in the Arctic ecosystem. Valuable commercial species may move northward and large-scale commercial fishing may be proposed. This paper will consider the potential for commercial fisheries in the Arctic, much of which is international waters, and discuss the institutional arrangements needed - their authority, objectives, responsibilities, and structures.

Current international institutions and agreements, including the Arctic Council, in which Arctic nations “promote cooperation, coordination, and interaction among the Arctic States” and other multilateral and regional agreements, will be assessed for their adaptability, effectiveness, and efficiency. Can current arrangements be adapted for Arctic fisheries or are new agreements needed? An agreement between all potential participants and all those affected is imperative before any large-scale commercial fishing occurs. The Arctic could set an example with fisheries management and governance that avoids rent dissipation, adapts to a changing natural environment, protects the rights of indigenous peoples, and anticipates rather than reacts to changes.

Any institutional arrangement in the Arctic needs to address a number of challenges, including the limited knowledge of the ecosystem, the speed and consequences of climate change, other potential uses of the Arctic (including shipping and fossil fuel extraction), territorial claims and disputes, and the wishes and actions of non-Arctic nations.

The impacts due to a warmer climate and potential marine commercial fisheries on the fisheries carried on by indigenous populations and fisheries in the lakes and rivers of the Arctic will also be discussed.

Session number: 3.2

Paper number: 430

Remapping Tuna Sovereignty in the Pacific: Forging a Nexus between Access and Climate Change Mitigation

Kanae Tokunaga¹ (presenting), Alison Rieser¹

1. University of Hawaii at Manoa, Honolulu, Hawaii, United States

The Parties to the Nauru Agreement of 1982 (PNA) are seven Pacific island states that established a joint fishery management system to protect Pacific tuna stocks from over exploitation by the distant-water fishing nations (DWFNs). The PNA have been successful at managing fishing effort and retaining economic rent from the fish in the region via various policies such as the Vessel Day Scheme. Through conditions on access, they require DWFN fleets to modify their fishing practices in their EEZs and those enclaves of high seas that lie between their EEZs.

However, climate change poses new challenges to their resource governance strategies. Studies suggest that climate change will alter tuna migratory patterns and habitat. This is a serious threat to the economy and development of the PNA. For some archipelagic, atoll states, the threat includes loss of sovereign rights in their exclusive economic zones due to sea level rise.

This study proposes a fishery management policy for the PNA and other states with tuna sovereignty that incorporates climate change mitigation goals. The policy would require DWFNs to reduce their GHG emissions in order to gain access rights to the PNA-managed tuna fishery. We investigate the economic feasibility of the policy by comparing the current price of the access rights to the tuna fishery and the cost and benefit of GHG emission reduction by the DWFNs. By drawing from international legal principles, we also show the plausibility of such policy.

Session number: 3.2

Paper number: 138

Climate Change, Rural Household Food Consumption and Vulnerability in Vietnam

Trang Le¹, **Kimanh Nguyen (presenting)**, CHUONG BUI, CURTIS JOLLY

1. NhaTrang University, NHA TRANG, KHANH HOA, Viet Nam

Ben Tre Province in the Mekong Delta, Vietnam, has suffered immensely from recent climate change triggered weather events. Along with salt water intrusion, unusual typhoons also inflicted serious damages to the economy of the province. Economic damages caused by salt water intrusion from 1995 to 2008 amounted to US \$32,423,080,632. In this study, we attempt to measure the effects of climate change on household consumption and levels of vulnerability. Three hundred households were surveyed. The vulnerability index was estimated using the VEP approach. The distribution of vulnerability index showed that on average there is a 43 percent probability that a coastal household will fall below the minimum consumption threshold level of US \$1.25 per capita per day. Forty-six percent of households are vulnerable to climatic risk, while 54 percent of households are considered not vulnerable. The factors affecting food consumption in rural households in Ben Tre Province in the Mekong Delta are the households other sources of income, education level of head of households, livelihood diversity index, the number of contacts the household made to access credit, gender of the head of the household and the number of young people working outside the household. Level of education of the head of household marginally increases consumption risks. The average number of floods that affect the household in the past 10 years reduces consumption vulnerability while the average number of the floods that inundated the community in the past ten years increases consumption vulnerability.

Session number: 3.3

Paper number: 14

Fisheries Co-management in Tam Giang Lagoon, Vietnam: A Right-based Management System

Nga Thi Thanh Ho¹ (presenting), Helen Ross²

1. University of Queensland, Gatton, QLD, Australia

2. The University of Queensland, Gatton, Queensland, Australia

Tam Giang lagoon, Vietnam is a coastal system confronting social-ecological challenges. The complexity and diversity of lagoon uses and property rights have made government fail to sustainable management of the lagoon. In that context, co-management regimes have been established across different combinations of wild fisheries, aquaculture and marine sanctuary. This paper examines the evolution and development of fisheries co-management in Tam Giang lagoon with an emphasis on design of co-management system and allocation of Territorial Use Rights for Fisheries (TURF) to fishers' organizations. The findings show that co-management in Tam Giang was designed as a right-based management system in which lagoon resources become communal property and are co-managed by fishing community. Co-management system consists of small scale management units (fishers associations) that are possible for fishers to cope with. The co-management system operates as a network of 64 community fishers' organizations that are allocated management authority over their areas (TURF). TURFs have been considered as an incentive for fishers to participate in management of the lagoon. However, the allocation of TURF to Fishery Associations (FAs) has not been carried out consistently in all over lagoon area and among FAs. This has resulted in an unfair situation in which some FAs can exercise more power than others, and some FAs have to bear more responsibilities than others though they use the same resources. In addition, the small scale unit management system potentially reveals ineffectiveness if the linkage between management units is not strengthened.

Session number: 3.3

Paper number: 253

Co-management of Inland Capture Fisheries Provide Enhance Production and Equity of Benefit Distribution to the Poor Fisher: an Experience from Bangladesh

A K M Firoz Khan¹ (presenting), Sk. Md Mohsin²

1. WorldFish, Dhaka, Dhaka, Bangladesh

2. LGED, Dhaka, Dhaka, Bangladesh

Inland open water fisheries in Bangladesh cover an area of 4.3 million ha, contributing about 29% of total fish production in 2011-12. Depletion of fish stocks is common due to habitat degradation caused by siltation, increased pressure on fisheries resources, destructive fishing and an acute shortage of dry season wetland habitat. Co-management is a possible solution to these issues, which can enhance productivity and income for the communities involved. Several Community Based Fisheries Management (CBFM) projects have promoted co-management in Bangladesh. This paper is a modest attempt to measure the impacts of co-management on fish productivity and distributional patterns of income for more than a decade, CBFM is found to have made positive contributions to the productivity, income and socio-economic wellbeing of the households involved in the management.

The paper also describes the local institution (CBO) building and networking processes,

fisheries management measures, distributional patterns of benefits and creation of social capital for stakeholders involved in co-management. Trends in species diversity, and women's involvement and empowerment are also explored. The paper concludes that CBFM has a vital role to play in improving floodplain bio-diversity by restoring fish habitat, and improving wetland ecosystems, as well as improving the access of poor people to fisheries resources.

Key words: Co-Management of Fisheries, Productivity, Distribution and equity, Women involvement, Bangladesh

Session number: 3.3

Paper number: 254

Opportunities for Sustainable Management of Landing Facilities in the Anchorages Nilwella

Uthpala Rathnayake, National Institute of Fisheries and Nautical Engineering, Colombo, Western Province, Sri Lanka

Infrastructure facilities of landing sites, which are the core of the fishing industry in Sri Lanka, were severely damaged by the tsunami in December 2004.

Currently these facilities are being rebuilt in association with various non-governmental organisations. At present there are large numbers of small anchorages which require development of facilities and these involve relatively high investment costs and would then need to be maintained properly. One of the problems, at present, is that these landing centres are not maintained by any agency. In view of the high cost factor in the construction, maintenance and management of these fishery landing centres, it will become necessary to consider seriously how these could be managed in a sustainable way with added value for fishermen and their families. For this purpose, two anchorages were selected and related primary and secondary data together with both qualitative and quantitative analysis was used to evaluate the present situation and to identify opportunities and needs for the future. This research paper shows that all the facilities required in a fishery landing complex have to be operated through a proper sustainable system of management. It should become the responsibility of all the stakeholders in the fishing industry to develop the industry in a sustainable way. This is a challenge and a formidable task. For this purpose rebuilt facilities should be developed as a function of a community based management system through the local fisheries association under the direction of the government

Session number: 3.3

Paper number: 376

How Artisanal Stake-seine Fishery Survived for Last 300 Years in the Dynamic and Competitive Environment?

Dileepa Samika Thanuksha de Croos, dileepaserious@gmail.com, MakanduraGonawila, Sri Lanka

Despite to the high fishing pressure; use of illegal fishing methods; deforestation, manufacturing, tourism & even the dynamic market environment, an artisanal stake-net fishery, which operates for shrimps, has been able to survive since 1721 in Negombo lagoon in the western Sri Lanka. The key strength of the stake-net fishery is its community-based

management systems which closely related with the ecosystem. But sustainable-utilisation is practically difficult in developing countries because assessing resources, setting limits on their utilisation & monitoring and enforcing complex regulations is not easy where government agencies do not have sufficient capacity for collecting data. Therefore, the present status of stake-net fishery management system in present competitive environment was evaluated. The Rapid Appraisal method was used, in gathering information on the community-based management system, by contacting active fishermen; community leaders; fish collectors; & auctioneers from 2011-2013.

The equitability of sharing resources by a rotational lots drawing system for distributing access rights to fishing sites among members was identified as the key feature in limiting the fishing pressure resulting low conflicts and sustainable resource usage. Access right is tightly restricted to “culturally-homogeneous” eligible members. Loyalty of fishermen to uphold the Stake-net fishery management system remains strong. Loss of fishing sites due to siltation dramatically increased over the last 4-5 years. However, there is no guarantee that the cumulative past experience of a society will necessarily fit them to solve new problems & threats. Anyhow, successful community-based stake-net fishery management provides a useful blueprint upon which the management of other fisheries might be based.

Session number: 3.3

Paper number: 14

Fisheries Co-management in Tam Giang Lagoon, Vietnam: A Right-based Management System

Nga Thi Thanh Ho¹ (presenting), Helen Ross²

1. University of Queensland, Gatton, QLD, Australia

2. The University of Queensland, Gatton, Queensland, Australia

Tam Giang lagoon, Vietnam is a coastal system confronting social-ecological challenges. The complexity and diversity of lagoon uses and property rights have made government fail to sustainable management of the lagoon. In that context, co-management regimes have been established across different combinations of wild fisheries, aquaculture and marine sanctuary. This paper examines the evolution and development of fisheries co-management in Tam Giang lagoon with an emphasis on design of co-management system and allocation of Territorial Use Rights for Fisheries (TURF) to fishers' organizations. The findings show that co-management in Tam Giang was designed as a right-based management system in which lagoon resources become communal property and are co-managed by fishing community. Co-management system consists of small scale management units (fishers associations) that are possible for fishers to cope with. The co-management system operates as a network of 64 community fishers' organizations that are allocated management authority over their areas (TURF). TURFs have been considered as an incentive for fishers to participate in management of the lagoon. However, the allocation of TURF to Fishery Associations (FAs) has not been carried out consistently in all over lagoon area and among FAs. This has resulted in an unfair situation in which some FAs can exercise more power than others, and some FAs have to bear more responsibilities than others though they use the same resources. In addition, the small scale unit management system potentially reveals ineffectiveness if the linkage between management units is not strengthened.

Session number: 3.3

Paper number: 253

Co-management of Inland Capture Fisheries Provide Enhance Production and Equity of Benefit Distribution to the Poor Fisher: an Experience from Bangladesh

A K M Firoz Khan¹ (presenting), Sk. Md Mohsin²

1. WorldFish, Dhaka, Dhaka, Bangladesh

2. LGED, Dhaka, Dhaka, Bangladesh

Inland open water fisheries in Bangladesh cover an area of 4.3 million ha, contributing about 29% of total fish production in 2011-12. Depletion of fish stocks is common due to habitat degradation caused by siltation, increased pressure on fisheries resources, destructive fishing and an acute shortage of dry season wetland habitat. Co-management is a possible solution to these issues, which can enhance productivity and income for the communities involved. Several Community Based Fisheries Management (CBFM) projects have promoted co-management in Bangladesh. This paper is a modest attempt to measure the impacts of co-management on fish productivity and distributional patterns of income for more than a decade, CBFM is found to have made positive contributions to the productivity, income and socio-economic wellbeing of the households involved in the management.

The paper also describes the local institution (CBO) building and networking processes, fisheries management measures, distributional patterns of benefits and creation of social capital for stakeholders involved in co-management. Trends in species diversity, and women's involvement and empowerment are also explored. The paper concludes that CBFM has a vital role to play in improving floodplain bio-diversity by restoring fish habitat, and improving wetland ecosystems, as well as improving the access of poor people to fisheries resources.

Key words: Co-Management of Fisheries, Productivity, Distribution and equity, Women involvement, Bangladesh

Session number: 3.3

Paper number: 254

Opportunities for Sustainable Management of Landing Facilities in the Anchorages Nilwella

Uthpala Rathnayake, National Institute of Fisheries and Nautical Engineering, Colombo, Western Province, Sri Lanka

Infrastructure facilities of landing sites, which are the core of the fishing industry in Sri Lanka, were severely damaged by the tsunami in December 2004.

Currently these facilities are being rebuilt in association with various non-governmental organisations. At present there are large numbers of small anchorages which require development of facilities and these involve relatively high investment costs and would then need to be maintained properly. One of the problems, at present, is that these landing centres are not maintained by any agency. In view of the high cost factor in the construction, maintenance and management of these fishery landing centres, it will become necessary to consider seriously how these could be managed in a sustainable way with added value for fishermen and their families. For this purpose, two anchorages were selected and related primary and secondary data together with both qualitative and quantitative analysis was used to evaluate the present situation and to identify opportunities and needs for the future. This research paper shows that all the facilities required in a fishery landing complex have to be operated through a proper sustainable system of management. It should become the responsibility of all the stakeholders in the fishing industry to develop the industry in a sustainable way. This is a challenge and a formidable task. For this purpose rebuilt facilities should be developed as a function of a community based management system through the local fisheries association under the direction of the government

Session number: 3.3

Paper number: 376

How Artisanal Stake-seine Fishery Survived for Last 300 Years in the Dynamic and Competitive Environment?

Dileepa Samika Thanuksha de Croos, dileepaserious@gmail.com, MakanduraGonawila, Sri Lanka

Despite to the high fishing pressure; use of illegal fishing methods; deforestation, manufacturing, tourism & even the dynamic market environment, an artisanal stake-net fishery, which operates for shrimps, has been able to survive since 1721 in Negombo lagoon in the western Sri Lanka. The key strength of the stake-net fishery is its community-based management systems which closely related with the ecosystem. But sustainable-utilisation is practically difficult in developing countries because assessing resources, setting limits on their utilisation & monitoring and enforcing complex regulations is not easy where government agencies do not have sufficient capacity for collecting data. Therefore, the present status of stake-net fishery management system in present competitive environment was evaluated. The Rapid Appraisal method was used, in gathering information on the community-based management system, by contacting active fishermen; community leaders; fish collectors; & auctioneers from 2011-2013.

The equitability of sharing resources by a rotational lots drawing system for distributing access rights to fishing sites among members was identified as the key feature in limiting the fishing pressure resulting low conflicts and sustainable resource usage. Access right is tightly restricted to “culturally-homogeneous” eligible members. Loyalty of fishermen to uphold the Stake-net fishery management system remains strong. Loss of fishing sites due to siltation dramatically increased over the last 4-5 years. However, there is no guarantee that the cumulative past experience of a society will necessarily fit them to solve new problems & threats. Anyhow, successful community-based stake-net fishery management provides a useful blueprint upon which the management of other fisheries might be based.

Session number: 3.4

Paper number: 382

Fisheries Management and Fisher Discount Rates

Louisa Coglan¹ (presenting), Sean Pascoe²

1. QUT, Australia

2. CSIRO, Australia

Fishers are faced with multiple risks, including unpredictability of future catch rates, prices and costs. While the latter are largely beyond the control of fisheries managers, effective fisheries management should reduce uncertainty about future catches while also enhancing profitability. Different management instruments are likely to have different impacts on the risk perception of fishers, and this should manifest itself in their discount rate. Assuming licence and quota values reflect the expected net present value of the flow of future profits, then a proxy for the implicit discount rate of vessels in a fishery can be derived by the ratio of the average level of profits to the average licence/quota value. In this paper, we derive the implicit discount rate for a wide variety of Australian fisheries under differing management systems, and test the assumption that rights based management instruments lower perceptions of risk in fisheries. Using unbalanced panel data for 19 fisheries from 1993 to 2012, we find empirical evidence that the implicit discount rate decreases with increased quality of the use right, consistent with expectations.

Session number: 3.4

Paper number: 419

A Safer Catch? The Effects of Catch Share Management on Safety and Risk Taking in the Pacific Northwest Fisheries

Lisa Pfeiffer¹ (presenting), Trevor Gratz

1. NOAA Northwest Fisheries Science Center, Seattle, WA, United States

Fishing is the most dangerous job in the United States. When fisheries management creates the incentive to “race for fish”, a fishing season can be reduced to only a few days and involve around-the-clock fishing in life-threatening weather conditions. Overloaded vessels, ignoring maintenance problems on vessels, and fishing in dangerous conditions may be commonplace. However, catch share management can reduce the incentive to race for fish, and one of the many results of catch share management has been a significant decrease in the speed and intensity of fishing and a lengthening of the fishing season. This is expected to increase safety in fisheries, as fishermen no longer need to work around the clock, they can return to port for repairs if something goes wrong with their vessel, and they do not need to fish in stormy or dangerous conditions. We evaluate the effect of the transition from limited entry to catch share management on risk-taking behavior in two important Pacific Northwest fisheries, the fixed gear sablefish fishery and the groundfish trawl fishery. The probability of fishing in poor weather conditions (spatially averaged maximum daily wind proxies weather conditions), conditional on expected profits, describes a captain’s propensity for risk taking. We find average maximum wind speed had a negative effect on the probability of going fishing in all management regimes. However, the effect of weather was greater under catch shares implying that captains are more risk averse when the race to fish incentives are eliminated.

Session number: 3.4

Paper number: 252

Fishing together or alone? Evaluation of the efficiency in the post-tsunami group operations of the off-shore longline fisheries operations in Kesenuma, Japan

Gakushi Ishimura¹ (presenting), Keita Abe², Kento Ito³, Bolorchimeg Byamba⁴

1. Hokkaido University, sapporo, hokkaido, Japan

2. Department of Economics, the University of Washington, Seattle, wa, United States

3. Graduate School of Environmental Science, Hokkaido University, sapporo, Not in Regions Listed, Japan

4. Center for Sustainability Science, Hokkaido University, sapporo, Not in Regions Listed, Japan

Fishing communities in the northern Tohoku, Japan were severely affected by March 11 2011 tsunami by the Great Tohoku Earthquake. The off-shore longline fishery in Kesenuma, which mainly target swordfish and blue shark, was one of the few survived fishing vessel groups and has significant economic effects of this community due to the integrated operations of the local processing industries. From April 2012, their operations have shifted to group operations (“Group Sougyou”) from individual operations (“Kojin Sougyou”) to optimize the production by sharing information and the cost sharing under one of the national fishery recovery initiatives. This study evaluates the efficiency of their group operations by analyzing the integrated data set of log-book (i.e., catch location, fuel consumption, operational costs) and detailed daily market data of their landings (i.e., price, size) in group operations. This study concludes by addressing challenges and strategies of the off-shore longline fisheries in their recovery. Our analysis suggests that 1) current group operations are quasi-optimum for the production by failing sharing information, 2) the risk sharing structure between vessel owners and crews should be reconsider to motivate crews to improve their operations. This study ends with implications for future strategies for the recovery of the off-shore longline fishery in Kesenuma.

Session number: 3.4

Paper number: 382

Fisheries Management and Fisher Discount Rates

Louisa Coglan¹ (presenting), Sean Pascoe²

1. QUT, Australia

2. CSIRO, Australia

Fishers are faced with multiple risks, including unpredictability of future catch rates, prices and costs. While the latter are largely beyond the control of fisheries managers, effective fisheries management should reduce uncertainty about future catches while also enhancing profitability. Different management instruments are likely to have different impacts on the risk perception of fishers, and this should manifest itself in their discount rate. Assuming licence and quota values reflect the expected net present value of the flow of future profits, then a proxy for the implicit discount rate of vessels in a fishery can be derived by the ratio of the average level of profits to the average licence/quota value. In this paper, we derive the implicit discount rate for a wide variety of Australian fisheries under differing management systems, and test the assumption that rights based management instruments lower perceptions of risk in fisheries. Using unbalanced panel data for 19 fisheries from 1993 to 2012, we find empirical evidence that the implicit discount rate decreases with increased quality of the use right, consistent with expectations.

Session number: 3.4

Paper number: 419

A Safer Catch? The Effects of Catch Share Management on Safety and Risk Taking in the Pacific Northwest Fisheries

Lisa Pfeiffer¹ (presenting), Trevor Gratz

1. NOAA Northwest Fisheries Science Center, Seattle, WA, United States

Fishing is the most dangerous job in the United States. When fisheries management creates the incentive to “race for fish”, a fishing season can be reduced to only a few days and involve around-the-clock fishing in life-threatening weather conditions. Overloaded vessels, ignoring maintenance problems on vessels, and fishing in dangerous conditions may be commonplace. However, catch share management can reduce the incentive to race for fish, and one of the many results of catch share management has been a significant decrease in the speed and intensity of fishing and a lengthening of the fishing season. This is expected to increase safety in fisheries, as fishermen no longer need to work around the clock, they can return to port for repairs if something goes wrong with their vessel, and they do not need to fish in stormy or dangerous conditions. We evaluate the effect of the transition from limited entry to catch share management on risk-taking behavior in two important Pacific Northwest fisheries, the fixed gear sablefish fishery and the groundfish trawl fishery. The probability of fishing in poor weather conditions (spatially averaged maximum daily wind proxies weather conditions), conditional on expected profits, describes a captain’s propensity for risk taking. We find average maximum wind speed had a negative effect on the probability of going fishing in all management regimes. However, the effect of weather was greater under catch shares implying that captains are more risk averse when the race to fish incentives are eliminated.

Session number: 3.4

Paper number: 252

Fishing together or alone? Evaluation of the efficiency in the post-tsunami group operations of the off-shore longline fisheries operations in Kesenuma, Japan

Gakushi Ishimura¹ (presenting), Keita Abe², Kento Ito³, Bolorchimeg Byamba⁴

1. Hokkaido University, sapporo, hokkaido, Japan

2. Department of Economics, the University of Washington, Seattle, wa, United States

3. Graduate School of Environmental Science, Hokkaido University, sapporo, Not in Regions Listed, Japan

4. Center for Sustainability Science, Hokkaido University, sapporo, Not in Regions Listed, Japan

Fishing communities in the northern Tohoku, Japan were severely affected by March 11 2011 tsunami by the Great Tohoku Earthquake. The off-shore longline fishery in Kesenuma, which mainly target swordfish and blue shark, was one of the few survived fishing vessel groups and has significant economic effects of this community due to the integrated operations of the local processing industries. From April 2012, their operations have shifted to group operations (“Group Sougyou”) from individual operations (“Kojin Sougyou”) to optimize the production by sharing information and the cost sharing under one of the national fishery recovery initiatives. This study evaluates the efficiency of their group operations by analyzing the integrated data set of log-book (i.e., catch location, fuel consumption, operational costs) and detailed daily market data of their landings (i.e., price, size) in group operations. This study concludes by addressing challenges and strategies of the off-shore longline fisheries in their recovery. Our analysis suggests that 1) current group operations are quasi-optimum for the production by failing sharing information, 2) the risk sharing structure between vessel owners and crews should be reconsider to motivate crews to improve their operations. This study ends with implications for future strategies for the recovery of the off-shore longline fishery in Kesenuma.

Session number: 3.5

Paper number: 220

The Microeconomic Foundations of Renewable Resource Models

Dale Squires (presenting), Niels Vestergaard¹

1. University of Southern Denmark, Esbjerg, Esbjerg, Denmark

Stronger microeconomic foundations to dynamic renewable resource models lead to rethinking the commons problem. Specifications of technology consistent with microeconomics allow reinterpreting the market failure under open access for common resources, the dynamic economic optimum, and global commons issues in general. The market failure is broader and deeper than previously understood, both open access and optimum resource stocks vary considerably from conventional wisdom and can be difficult to distinguish between, both optimum and open access steady-state equilibriums may be absent, and different microeconomic specifications can lead to strikingly different results. Better understanding this commons problem and how to analyze it consistent with microeconomic principles in turn opens up its reinterpretation and policies by which to address it. Even fully structured property rights are insufficient to solve the commons problem. An empirical example illustrates the effects of alternative microeconomic specifications upon optimum renewable resource management.

Session number: 3.5

Paper number: 169

On International Fisheries Agreement, Entry Deterrence and Ecological Uncertainty

Hans Ellefsen, **Lone Kronbak**¹ (presenting), Lars Ravn-Jonsen²

1. University of Southern Denmark, Odense M, Denmark, Denmark

2. University of Southern Denmark, Esbjerg, Denmark, Denmark

From the game theoretical perspective, a prerequisite for an international fishery agreement (IFA) to be stable is that parties expect their benefits from joining the agreement to exceed benefits from free riding on the agreement, and parties only comply with the agreement as long as this is true. The agreement, therefore, implicitly builds on an expectation of the ecological condition of the natural resource. Typically, the game theoretical models assume that all parties have the same (often perfect) information of the resource and the exploitation is an equilibrium use of the stock. As known from experts from natural science the fish ecology still has many open questions, e.g. predicting population dynamics, immigration patterns, food availability, diseases, etc. In some cases parties disagree about the state, abundance and migration of a stock, which can significantly disturb the possibilities for reaching an agreement for exploitation of the stock. The paper develops a model, applied to the North East Atlantic mackerel fishery, analyzing IFA under different ecological scenarios combining it with the economic theory of entry deterrence. The model is empirically used to determine whether the original parties to the agreement have an advantage in that the results from fishing the stock down to a smaller size to prevent another party from entering into the fishery. The paper presents a novel method for illustrating the obstacles in why an agreement for the North East Atlantic mackerel has been so hard to achieve.

Session number: 3.5

Paper number: 233

Two-period Coalition Stage-Model of Fisheries with Enforcement

Lone Kronbak¹, Marko Lindroos² (presenting)

1. University of Southern Denmark, Odense M, Denmark, Denmark

2. University of Helsinki, Helsinki, University of Helsinki, Finland

In the coalition game theoretical literature applied to fisheries, the dynamics of coalition formation have lacked attention. Some authors have used the concept of far-sighted coalition formation in sequential games but not included the stage structure in the authority level. The idea of the current paper is to contribute to the literature by introducing coalition formation dynamics in a simple two-period manner to the stage-model of enforcement in fisheries. Thus, we study a two-period, stage-game model of fisheries with enforcement, where coalition formation is endogenous among fishing parties. In the first period, stage one consists of determining enforcement and in the second stage players need to make the decision on how much to harvest now and how much to save for the future. In a coalition setting this means whether fishermen wish to join the coalition now or in the future, and most importantly which coalition structures are stable.

The results show that the dynamic setting allows an increased number of coalitions to be stable. In particular it is shown that in a simple dynamic model of coalition formation with a limited number of symmetric players even the grand coalition may be stable. This is in contrast with previous more pessimistic results (like Pintassilgo and Lindroos, 2008) who showed that with three symmetric countries the equilibrium would be the singleton coalition structure.

Session number: 3.5

Paper number: 236

International fisheries agreements under slow and fast environmental changes

Emmi Nieminen¹ (presenting), Florian Diekert²

1. University of Helsinki, University of Helsinki, Helsinki, Finland

2. University of Oslo, Oslo, n/a, Norway

Environmental changes can be slow and occur over long time scales, or they can be relatively rapid. Examples of these two kinds of changes could be the straddling of North-Atlantic mackerel into Icelandic waters related to global warming on the one hand or trophic regime shifts induced by sudden inflows of salty water into the Baltic Sea on the other hand. Here we study analytically how the speed of environmental change affects the strategic interaction of two competing countries. What are the prospects of obtaining a cooperative solution with the help of (self-enforcing) contracts, when the stock distribution shifts from one country's territorial waters to another country's waters?

Climate change effects on the spatial distribution of fish stocks have received increased interest in the literature on non-cooperative management. Most studies rely on numerical methods to solve a “split-stream model”. We return to its predecessor, the “fish-war model” to solve analytically for the compensation that the player losing the stock has to receive. As the conservation incentives of this player decrease as the stock changes owner, he has to obtain a higher share. Therefore, an international agreement in terms of quota-shares may

meet a binding constraint. In fact, an in-kind agreement under fast environmental change will never be self-enforcing. In contrast, agreements that allow for monetary compensation will always be self-enforcing, echoing earlier calls for financial side-payments.

Session number: 3.5

Paper number: 220

The Microeconomic Foundations of Renewable Resource Models

Dale Squires (presenting), Niels Vestergaard¹

1. University of Southern Denmark, Esbjerg, Esbjerg, Denmark

Stronger microeconomic foundations to dynamic renewable resource models lead to rethinking the commons problem. Specifications of technology consistent with microeconomics allow reinterpreting the market failure under open access for common resources, the dynamic economic optimum, and global commons issues in general. The market failure is broader and deeper than previously understood, both open access and optimum resource stocks vary considerably from conventional wisdom and can be difficult to distinguish between, both optimum and open access steady-state equilibriums may be absent, and different microeconomic specifications can lead to strikingly different results. Better understanding this commons problem and how to analyze it consistent with microeconomic principles in turn opens up its reinterpretation and policies by which to address it. Even fully structured property rights are insufficient to solve the commons problem. An empirical example illustrates the effects of alternative microeconomic specifications upon optimum renewable resource management.

Session number: 3.5

Paper number: 169

On International Fisheries Agreement, Entry Deterrence and Ecological Uncertainty

Hans Ellefsen, **Lone Kronbak**¹ (presenting), Lars Ravn-Jonsen²

1. University of Southern Denmark, Odense M, Denmark, Denmark

2. University of Southern Denmark, Esbjerg, Denmark, Denmark

From the game theoretical perspective, a prerequisite for an international fishery agreement (IFA) to be stable is that parties expect their benefits from joining the agreement to exceed benefits from free riding on the agreement, and parties only comply with the agreement as long as this is true. The agreement, therefore, implicitly builds on an expectation of the ecological condition of the natural resource. Typically, the game theoretical models assume that all parties have the same (often perfect) information of the resource and the exploitation is an equilibrium use of the stock. As known from experts from natural science the fish ecology still has many open questions, e.g. predicting population dynamics, immigration patterns, food availability, diseases, etc. In some cases parties disagree about the state, abundance and migration of a stock, which can significantly disturb the possibilities for reaching an agreement for exploitation of the stock. The paper develops a model, applied to the North East Atlantic mackerel fishery, analyzing IFA under different ecological scenarios combining it with the economic theory of entry deterrence. The model is empirically used to determine whether the original parties to the agreement have an advantage in that the results from fishing the stock down to a smaller size to prevent another party from entering into the fishery. The paper presents a novel method for illustrating the obstacles in why an agreement for the North East Atlantic mackerel has been so hard to achieve.

Session number: 3.5

Paper number: 233

Two-period Coalition Stage-Model of Fisheries with Enforcement

Lone Kronbak¹, Marko Lindroos² (presenting)

1. University of Southern Denmark, Odense M, Denmark, Denmark

2. University of Helsinki, Helsinki, University of Helsinki, Finland

In the coalition game theoretical literature applied to fisheries, the dynamics of coalition formation have lacked attention. Some authors have used the concept of far-sighted coalition formation in sequential games but not included the stage structure in the authority level. The idea of the current paper is to contribute to the literature by introducing coalition formation dynamics in a simple two-period manner to the stage-model of enforcement in fisheries. Thus, we study a two-period, stage-game model of fisheries with enforcement, where coalition formation is endogenous among fishing parties. In the first period, stage one consists of determining enforcement and in the second stage players need to make the decision on how much to harvest now and how much to save for the future. In a coalition setting this means whether fishermen wish to join the coalition now or in the future, and most importantly which coalition structures are stable.

The results show that the dynamic setting allows an increased number of coalitions to be stable. In particular it is shown that in a simple dynamic model of coalition formation with a limited number of symmetric players even the grand coalition may be stable. This is in contrast with previous more pessimistic results (like Pintassilgo and Lindroos, 2008) who showed that with three symmetric countries the equilibrium would be the singleton coalition structure.

Session number: 3.5

Paper number: 236

International fisheries agreements under slow and fast environmental changes

Emmi Nieminen¹ (presenting), Florian Diekert²

1. University of Helsinki, University of Helsinki, Helsinki, Finland

2. University of Oslo, Oslo, n/a, Norway

Environmental changes can be slow and occur over long time scales, or they can be relatively rapid. Examples of these two kinds of changes could be the straddling of North-Atlantic mackerel into Icelandic waters related to global warming on the one hand or trophic regime shifts induced by sudden inflows of salty water into the Baltic Sea on the other hand. Here we study analytically how the speed of environmental change affects the strategic interaction of two competing countries. What are the prospects of obtaining a cooperative solution with the help of (self-enforcing) contracts, when the stock distribution shifts from one country's territorial waters to another country's waters?

Climate change effects on the spatial distribution of fish stocks have received increased interest in the literature on non-cooperative management. Most studies rely on numerical methods to solve a “split-stream model”. We return to its predecessor, the “fish-war model” to solve analytically for the compensation that the player losing the stock has to receive. As the conservation incentives of this player decrease as the stock changes owner, he has to obtain a higher share. Therefore, an international agreement in terms of quota-shares may meet a binding constraint. In fact, an in-kind agreement under fast environmental change will never be self-enforcing. In contrast, agreements that allow for monetary compensation will always be self-enforcing, echoing earlier calls for financial side-payments.

Session number: 3.6

Paper number: 132

Gender Inequalities Issues in Fish Farming in Southwestern, Nigeria

Ayanboye Oluyemi, Oyo State College of Agriculture, Igboora, Nigeria, Oyo state, Nigeria, Nigeria

One of the most important issues discussed in Nigeria today is that of women participation in agricultural development. This is because of the important role played by them in national development and most needs of any developing nation of the world today. This study focused and examined gender inequalities issues in fish farming in southwestern, Nigeria. The work examined, if women participate fully in fish farming as men do, if men and women have equal right to access economic resources and control of fish farming benefits and the influence of selected socio-economic characteristics of women and men. A multi-stage sampling technique was used in the capital cities of the six states in Southwestern, Nigeria by random selection of 80 fish farmers (40 male farmers and 40 female farmers) due to few numbers of female fish farmers. The study was carried out with the use of well structured interview schedule to obtain the necessary data. Both descriptive and inferential analytical tools were employed. Probit analysis was employed to investigate the determinants of women and men participation in fish farming in the study area. The findings of this study provided information on the level of access to resources by gender and how it can impact fish production. It also provided useful information to policy makers on how to address the complex issues related to gender inequalities and food security. Key words: Gender, gender inequality, fish farming and Nigeria

Session number: 3.6

Paper number: 235

Long-term impacts of globalisation on small scale fisher communities: Two decades of liberalized economy in Uganda

Margaret Masette¹ (presenting), Bwambale Mbilinyi²

1. NARO, Kampala, N/A, Uganda

2. NAFIRRI, Jinja, Eastern province, Uganda

Uganda liberalized her economy in late 1980s. Prior to 1985, the fisheries resources catered for domestic market and contributed insignificantly to the GDP. However, after the economic liberalization, the impacts on the overall economy and particularly among small scale fisher communities have been tremendous. Using secondary data from 1990- 2013 and structured survey tools, we examined and compared impacts among key fisheries actors; fishers, processors (artisanal and industrial), traders and local consumers within L. Victoria basin. Our findings indicated that as much as the fisheries sub sector contributed 12% to the agricultural GDP and 2.5 % to the national GDP in 2013, the negative outstripped positive impacts. Initially, most actors had increased incomes which declined with time. The women processors were the most affected as their tasks shifted from lucrative to unbeneficial ventures. Fishers had extended fishing trips from 8h to 16h whilst total catch per trip declined from 500kg to 20kg of Nile perch. Fish processing plants declined from 20 to 11 while production capacities reduced to 25%. Incomes from fish exports declined by 40% and 50% of factory employees transitioned. The per capita fish consumption declined from 13kg to 5.7kg which has probably contributed to 33% of malnourished children. Positive impacts included improvement of handling infrastructure for fish destined to EU markets, promotion

of aquaculture that culminated into increased number of farmers from 5000 to 20,000 and regional trade in small pelagic fishes increased by 70%. Generally, globalization has impacted negatively on small-scale fisher communities in Uganda.

Session number: 3.6

Paper number: 208

Assessment of the Marine Artisanal Fisheries in Tanzania Mainland

Upendo Hamidu, Ministry of Livestock and Fisheries Development, Dar es Salaam, Dar es Salaam, Tanzania

The main objective of this study was to describe the marine artisanal fishery in Tanzania mainland by manipulating data from frame and catch assessment surveys from 1984 -2011. Results showed that catches have been fairly stable while fishing effort has been increasing leading to decline in CPUE. This could be attributed to population growth, poor fishing technology, use of non-motorized small vessels, and competition. Ring nets dominated the fishery in terms of catch landed per gear. Beach seines, and spears, which are illegal, have been increasing overtime. A linear regression analysis showed that fishers, vessels, gears, and catch value were significant variables in explaining variations in landed catch over the time period ($r^2 = 0.7833$). Dar es Salaam recorded the highest catch ($p = 2.6E-06$) because of better markets and facilities while the lowest was observed in Mtwara ($p = 0.01126$). Coast region recorded more vessels and gears. Catch was significantly different ($p = 2.2E-06$) across districts within five regions. Ilala district recorded the highest. Average income was significantly high in Dar es Salaam ($p = 0.008469$) because of urbanization and concentration of economic activities. Two clusters of regions that were similar according to species landed were observed. Coast, Tanga, Lindi and Dar es Salaam were similar in species composition whereas Mtwara was different with fewer species. Data collection, entry and analysis need to be done in a consistent manner. Proper data collection, management, and analysis could lead to fisheries sector being more representative towards the GDP of the country.(Ctrl/Cmd+V)

Session number: 3.6

Paper number: 242

Willingness to Participate in an Insurance Scheme by Artisanal Fishers in Ghana

Hayford Agbekpornu¹ (presenting), Doris Yeboah¹, Samuel Quaatey¹, Rosina Williams¹, Richard Yeboah¹, Fuseina Issah¹

1. Ministry of Fisheries and Aquaculture Development, Fisheries Commission, Accra, Greater Accra, Ghana

This study examines the willingness of canoe owners and crew members to participate in an insurance scheme in Ghana. A total of 386 canoe owners and 164 crew from four (4) coastal regions and the inland lake areas were sampled. Data was collected through semi-structured questionnaires on socio-economic characteristics, canoe characteristics, attitude at sea, assets, income, type of insurance, willingness to participate in insurance schemes, emergency coping mechanism and disasters encountered. A logit model was used to identify factors most likely to affect willingness to pay on group life insurance for crew.

The study reveals that most canoe owners and crew members who go to sea adopt some safety measures such as informing their families, listening to weather forecast and carrying mobile phones. Very few go to fishing in groups, use life jacket and compasses for

navigation. Also, some respondents are involved in National Health Insurance Scheme (NHIS).

Results suggest that most of the respondents are willing to participate as well as pay for group life, personal life, family insurance, fishing gears and pension schemes. The factors that most strongly affect WTP for group insurance of crew are family size, number of dependents, experience of fishing, whether canoe owners have ever been involved in insurance, listening to weather forecast before going fishing and ownership of a car. In conclusion, the study shows that majority of respondents are willing to participate in the various insurance schemes including group and life.

Key words- Artisanal fishers, insurance scheme, willingness to participate (WTP), Logit model.

Session number: 3.6

Paper number: 132

Gender Inequalities Issues in Fish Farming in Southwestern, Nigeria

Ayanboye Oluyemi, Oyo State College of Agriculture, Igboora, Nigeria, Oyo state, Nigeria, Nigeria

One of the most important issues discussed in Nigeria today is that of women participation in agricultural development. This is because of the important role played by them in national development and most needs of any developing nation of the world today. This study focused and examined gender inequalities issues in fish farming in southwestern, Nigeria. The work examined, if women participate fully in fish farming as men do, if men and women have equal right to access economic resources and control of fish farming benefits and the influence of selected socio-economic characteristics of women and men. A multi- stage sampling technique was used in the capital cities of the six states in Southwestern, Nigeria by random selection of 80 fish farmers (40 male farmers and 40 female farmers) due to few numbers of female fish farmers. The study was carried out with the use of well structured interview schedule to obtain the necessary data. Both descriptive and inferential analytical tools were employed. Probit analysis was employed to investigate the determinants of women and men participation in fish farming in the study area. The findings of this study provided information on the level of access to resources by gender and how it can impact fish production. It also provided useful information to policy makers on how to address the complex issues related to gender inequalities and food security. Key words: Gender, gender inequality, fish farming and Nigeria

Session number: 3.6

Paper number: 235

Long-term impacts of globalisation on small scale fisher communities: Two decades of liberalized economy in Uganda

Margaret Masette¹ (presenting), Bwambale Mbilinyi²

1. NARO, Kampala, N/A, Uganda

2. NAFIRRI, Jinja, Eastern province, Uganda

Uganda liberalized her economy in late 1980s. Prior to 1985, the fisheries resources catered for domestic market and contributed insignificantly to the GDP. However, after the economic liberalization, the impacts on the overall economy and particularly among small scale fisher communities have been tremendous. Using secondary data from 1990- 2013 and structured survey tools, we examined and compared impacts among key fisheries actors; fishers, processors (artisanal and industrial), traders and local consumers within L. Victoria basin. Our findings indicated that as much as the fisheries sub sector contributed 12% to the agricultural GDP and 2.5 % to the national GDP in 2013, the negative outstripped positive impacts. Initially, most actors had increased incomes which declined with time. The women processors were the most affected as their tasks shifted from lucrative to unbeneficial ventures. Fishers had extended fishing trips from 8h to 16h whilst total catch per trip declined from 500kg to 20kg of Nile perch. Fish processing plants declined from 20 to 11 while production capacities reduced to 25%. Incomes from fish exports declined by 40% and 50% of factory employees transitioned. The per capita fish consumption declined from 13kg to 5.7kg which has probably contributed to 33% of malnourished children. Positive impacts included improvement of handling infrastructure for fish destined to EU markets, promotion of aquaculture that culminated into increased number of farmers from 5000 to 20,000 and regional trade in small pelagic fishes increased by 70%. Generally, globalization has impacted negatively on small-scale fisher communities in Uganda.

Session number: 3.6

Paper number: 208

Assessment of the Marine Artisanal Fisheries in Tanzania Mainland

Upendo Hamidu, Ministry of Livestock and Fisheries Development, Dar es Salaam, Dar es Salaam, Tanzania

The main objective of this study was to describe the marine artisanal fishery in Tanzania mainland by manipulating data from frame and catch assessment surveys from 1984 -2011. Results showed that catches have been fairly stable while fishing effort has been increasing leading to decline in CPUE. This could be attributed to population growth, poor fishing technology, use of non-motorized small vessels, and competition. Ring nets dominated the fishery in terms of catch landed per gear. Beach seines, and spears, which are illegal, have been increasing overtime. A linear regression analysis showed that fishers, vessels, gears, and catch value were significant variables in explaining variations in landed catch over the time period ($r^2 = 0.7833$). Dar es Salaam recorded the highest catch ($p = 2.6E-06$) because of better markets and facilities while the lowest was observed in Mtwara ($p = 0.01126$). Coast region recorded more vessels and gears. Catch was significantly different ($p = 2.2E-06$) across districts within five regions. Ilala district recorded the highest. Average income was significantly high in Dar es Salaam ($p = 0.008469$) because of urbanization and concentration of economic activities. Two clusters of regions that were similar according to species landed were observed. Coast, Tanga, Lindi and Dar es Salaam were similar in species composition whereas Mtwara was different with fewer species. Data collection, entry and analysis need to be done in a consistent manner. Proper data collection, management, and analysis could lead to fisheries sector being more representative towards the GDP of the country. (Ctrl/Cmd+V)

Session number: 3.6

Paper number: 242

Willingness to Participate in an Insurance Scheme by Artisanal Fishers in Ghana

Hayford Agbekpornu¹ (presenting), Doris Yeboah¹, Samuel Quaatey¹, Rosina Williams¹, Richard Yeboah¹, Fuseina Issah¹

1. Ministry of Fisheries and Aquaculture Development, Fisheries Commission, Accra, Greater Accra, Ghana

This study examines the willingness of canoe owners and crew members to participate in an insurance scheme in Ghana. A total of 386 canoe owners and 164 crew from four (4) coastal regions and the inland lake areas were sampled. Data was collected through semi-structured questionnaires on socio-economic characteristics, canoe characteristics, attitude at sea, assets, income, type of insurance, willingness to participate in insurance schemes, emergency coping mechanism and disasters encountered. A logit model was used to identify factors most likely to affect willingness to pay on group life insurance for crew.

The study reveals that most canoe owners and crew members who go to sea adopt some safety measures such as informing their families, listening to weather forecast and carrying mobile phones. Very few go to fishing in groups, use life jacket and compasses for navigation. Also, some respondents are involved in National Health Insurance Scheme (NHIS).

Results suggest that most of the respondents are willing to participate as well as pay for group life, personal life, family insurance, fishing gears and pension schemes. The factors that most strongly affect WTP for group insurance of crew are family size, number of dependents, experience of fishing, whether canoe owners have ever been involved in insurance, listening to weather forecast before going fishing and ownership of a car. In conclusion, the study shows that majority of respondents are willing to participate in the various insurance schemes including group and life.

Key words- Artisanal fishers, insurance scheme, willingness to participate (WTP), Logit model.

Session number: 3.7

Paper number: 231

Stubborn Fuel Tax Concessions – The Case of Fisheries in Norway

Ola Flaaten¹ (presenting), John R. Isaksen², Øystein Hermansen²

1. University of Tromsø, Tromsø, Troms, Norway

2. NOFIMA, Tromsø, T, Norway

On the background of the abolishment of traditional subsidies this paper discusses the persistency of the major remaining subsidy scheme in Norwegian fisheries: exemption from fuel taxes. The reimbursement scheme stems from the late 1980s, and has been persistent since, under different governments. This paper gives the background for this support against theoretical predictions on subsidies' effects on fishing behaviour and profitability. For 2011 the estimated exempted fuel taxes to the fishing fleet is 999.0 million NOK, amounting to 6.3 per cent of the landed value, against 772.7 million NOK (6.4 per cent of landed value) in 2007. Also, the Norwegian scheme is discussed against similar arrangements in other countries. The national fishing fleet is heterogeneous with respect to oil consumption in transport and fishing operations. Hence, the effect of the fuel subsidies is different along different fleet components. The implications of abolishing this subsidy for the fishing fleet in general, for different vessel groups, as well as for policy implications are discussed.

Session number: 3.7

Paper number: 286

Information Sharing Networks and Rates of Incidental Catch

Michele Barnes-Mauthe¹ (presenting), John Lynham², Kolter Kalberg³, PingSun Leung¹

1. University of Hawaii at Manoa, Honolulu, HI, United States

2. University of Hawaii , Honolulu, HI, United States

3. Joint Institute for Marine and Atmospheric Research, Honolulu, HI, United States

Pelagic fishers operate in a dynamic environment and are faced with a high level of uncertainty on a daily basis. To cope with this complexity, fisher's often rely on sharing information with others in order to improve their decision making. Yet previous research has not explicitly investigated the effect of resource user's social networks on environmental outcomes in a marine setting. Linking observer data from 2008-2012 to a complete social network dataset from Hawaii's longline fishery, we empirically estimate the relationship between fisher's information sharing networks and rates of incidental catch. The network exhibits strong homophily, with fishers organizing themselves into three information sharing network groups largely corresponding to their ethnic affiliation. Controlling for spatiotemporal factors, we find significant differences in shark bycatch among the three network groups. Additionally, we find that bycatch rates for individuals whose majority of ties fall outside their ethnic group are more closely aligned with their network group, rather than their ethnic group. Significant differences in shark bycatch among network groups hold when examining only reciprocal ties, which breaks the network up into several distinct components, and controlling for ethnicity. Our results indicate that some fishers may be dynamically reacting in time and space to information received from trusted sources within their network group on strategies to mitigate bycatch, while others are not. This research provides the first empirical evidence that network homophily is correlated with environmental outcomes, and that network structure is significantly related to rates of

incidental catch.

Session number: 3.7

Paper number: 422

Exploring the Influence of Climate, Competition and Aquaculture on the Dynamics of Fraser River Sockeye Salmon and the Economics of their Fisheries

Yajie Liu¹ (presenting), Brendan Connors²

1. SINTEF Fisheries and Aquaculture, Trondheim, Sør-Trøndelag, Norway

2. ESSA Technologies Ltd, Vancouver, BC, Canada

Climate, competition, and disease are well-recognized drivers of population dynamics and can be intertwined by animal migrations with consequences for the ecosystems and economies that depend on them. Sockeye salmon from the Fraser River of British Columbia are one of the most ecologically, economically, and socially important salmon complexes in Western North America. Recent research suggests that competition with other salmon for food, changes in oceanographic conditions, and exposure to farmed salmon may in combination contribute to declines in Fraser sockeye productivity. This paper evaluates the potential ecological and economic consequences arising from these drivers. We use empirically based simulation modeling of sockeye salmon populations to explore how potential future changes in these drivers may affect sockeye spawning populations and associated fishing efforts and catches of different fisheries. We then incorporate economic components and estimate the profit losses across a range of plausible future climate, competition and aquaculture scenarios. These preliminary analyses reveal mixed results. But, the long term profit loss and decline in productivity are predominately driven by pink salmon competition, which can be magnified by exposure to open net-pen aquaculture and compensated by climate change. Importantly these analyses do not consider single potential drivers of sockeye dynamics in isolation but instead highlight how interactions among these hypothesized drivers may influence the coastal economies and ecosystems that depend upon Fraser sockeye. These analyses provide an important framework for informing policy and management as improved information emerges on the key driver of Fraser River sockeye salmon dynamics.

Session number: 3.7

Paper number: 227

The World Demand for Catfish *Pangasius*: A Demand System Approach

Thong Tien Nguyen¹ (presenting), Giap Van Nguyen², Max Nielsen³

1. Nha Trang University, former fellow of UNU-FTP, Nha Trang, Khanh Hoa, Viet Nam

2. Institute of policy and strategy for agriculture and rural development, Ho Chi Minh, Ho Chi Minh, Viet Nam

3. University of Copenhagen, Frederiksberg C, Frederiksberg C, Denmark

In this paper we present a world demand system for *Pangasius* catfish products. We use solely exporting data from Vietnam for estimating a non-linear Almost Ideal Demand System because Vietnam accounts for more than 90% catfish export value of the world and the products exported are mostly in filleted form. The demand system includes eight equations representing for most important markets that are EU, USA, ASEAN, Chinese & Hong Kong, Russian, Ukrainian, Arabian, and ROW (rest of the world) markets. The monthly data are

updating from 2003 to December 2013. Direct elasticity including own- and cross- price elasticity and income elasticity are calculated to show how consumers from different markets of the world prefer for the *Pangasius* catfish. While there are many demand studies for other whitefish species and salmon, which are strongly competed by catfish in international markets, there is a lack of demand study for *Pangasius* catfish. Therefore, this study will supplement seafood demand literature and be meaningful for seafood producers.

Keywords: Catfish, Pangasius, Vietnam, demand system, elasticity, AIDS.

Session number: 3.7

Paper number: 231

Stubborn Fuel Tax Concessions – The Case of Fisheries in Norway

Ola Flaaten¹ (presenting), John R. Isaksen², Øystein Hermansen²

1. University of Tromsø, Tromsø, Troms, Norway

2. NOFIMA, Tromsø, T, Norway

On the background of the abolishment of traditional subsidies this paper discusses the persistency of the major remaining subsidy scheme in Norwegian fisheries: exemption from fuel taxes. The reimbursement scheme stems from the late 1980s, and has been persistent since, under different governments. This paper gives the background for this support against theoretical predictions on subsidies' effects on fishing behaviour and profitability. For 2011 the estimated exempted fuel taxes to the fishing fleet is 999.0 million NOK, amounting to 6.3 per cent of the landed value, against 772.7 million NOK (6.4 per cent of landed value) in 2007. Also, the Norwegian scheme is discussed against similar arrangements in other countries. The national fishing fleet is heterogeneous with respect to oil consumption in transport and fishing operations. Hence, the effect of the fuel subsidies is different along different fleet components. The implications of abolishing this subsidy for the fishing fleet in general, for different vessel groups, as well as for policy implications are discussed.

Session number: 3.7

Paper number: 286

Information Sharing Networks and Rates of Incidental Catch

Michele Barnes-Mauthe¹ (presenting), John Lynham², Kolter Kalberg³, PingSun Leung¹

1. University of Hawaii at Manoa, Honolulu, HI, United States

2. University of Hawaii , Honolulu, HI, United States

3. Joint Institute for Marine and Atmospheric Research, Honolulu, HI, United States

Pelagic fishers operate in a dynamic environment and are faced with a high level of uncertainty on a daily basis. To cope with this complexity, fisher's often rely on sharing information with others in order to improve their decision making. Yet previous research has not explicitly investigated the effect of resource user's social networks on environmental outcomes in a marine setting. Linking observer data from 2008-2012 to a complete social network dataset from Hawaii's longline fishery, we empirically estimate the relationship between fisher's information sharing networks and rates of incidental catch. The network exhibits strong homophily, with fishers organizing themselves into three information sharing network groups largely corresponding to their ethnic affiliation. Controlling for spatiotemporal factors, we find significant differences in shark bycatch among the three network groups. Additionally, we find that bycatch rates for individuals whose majority of ties fall outside their ethnic group are more closely aligned with their network group, rather than their ethnic group. Significant differences in shark bycatch among network groups hold when examining only reciprocal ties, which breaks the network up into several distinct components, and controlling for ethnicity. Our results indicate that some fishers may be dynamically reacting in time and space to information received from trusted sources within their network group on strategies to mitigate bycatch, while others are not. This research provides the first empirical evidence that network homophily is correlated with environmental outcomes, and that network structure is significantly related to rates of incidental catch.

Session number: 3.7

Paper number: 422

Exploring the Influence of Climate, Competition and Aquaculture on the Dynamics of Fraser River Sockeye Salmon and the Economics of their Fisheries

Yajie Liu¹ (presenting), Brendan Connors²

1. SINTEF Fisheries and Aquaculture, Trondheim, Sør-Trøndelag, Norway

2. ESSA Technologies Ltd, Vancouver, BC, Canada

Climate, competition, and disease are well-recognized drivers of population dynamics and can be intertwined by animal migrations with consequences for the ecosystems and economies that depend on them. Sockeye salmon from the Fraser River of British Columbia are one of the most ecologically, economically, and socially important salmon complexes in Western North America. Recent research suggests that competition with other salmon for food, changes in oceanographic conditions, and exposure to farmed salmon may in combination contribute to declines in Fraser sockeye productivity. This paper evaluates the potential ecological and economic consequences arising from these drivers. We use empirically based simulation modeling of sockeye salmon populations to explore how potential future changes in these drivers may affect sockeye spawning populations and associated fishing efforts and catches of different fisheries. We then incorporate economic components and estimate the profit losses across a range of plausible future climate, competition and aquaculture scenarios. These preliminary analyses reveal mixed results. But, the long term profit loss and decline in productivity are predominately driven by pink salmon competition, which can be magnified by exposure to open net-pen aquaculture and compensated by climate change. Importantly these analyses do not consider single potential drivers of sockeye dynamics in isolation but instead highlight how interactions among these hypothesized drivers may influence the coastal economies and ecosystems that depend upon Fraser sockeye. These analyses provide an important framework for informing policy and management as improved information emerges on the key driver of Fraser River sockeye salmon dynamics.

Session number: 3.7

Paper number: 227

The World Demand for Catfish *Pangasius*: A Demand System Approach

Thong Tien Nguyen¹ (presenting), Giap Van Nguyen², Max Nielsen³

1. Nha Trang University, former fellow of UNU-FTP, Nha Trang, Khanh Hoa, Viet Nam

2. Institute of policy and strategy for agriculture and rural development, Ho Chi Minh, Ho Chi Minh, Viet Nam

3. University of Copenhagen, Frederiksberg C, Frederiksberg C, Denmark

In this paper we present a world demand system for *Pangasius* catfish products. We use solely exporting data from Vietnam for estimating a non-linear Almost Ideal Demand System because Vietnam accounts for more than 90% catfish export value of the world and the products exported are mostly in filleted form. The demand system includes eight equations representing for most important markets that are EU, USA, ASEAN, Chinese & Hong Kong, Russian, Ukrainian, Arabian, and ROW (rest of the world) markets. The monthly data are updating from 2003 to December 2013. Direct elasticity including own- and cross- price elasticity and income elasticity are calculated to show how consumers from different markets of the world prefer for the *Pangasius* catfish. While there are many demand studies for other whitefish species and salmon, which are strongly competed by catfish in international markets, there is a lack of demand study for *Pangasius* catfish. Therefore, this study will supplement seafood demand literature and be meaningful for seafood producers.

Keywords: Catfish, *Pangasius*, Vietnam, demand system, elasticity, AIDS.

Session number: 4.1

Paper number: 94

A derived demand analysis for sardines in the Southeastern Brazil

Ruth Beatriz Mezzalira Pincinato¹ (presenting), Frank Asche

1. University of Portsmouth, Portsmouth, Hampshire, United Kingdom

Demand studies are important since it may provide insight on price sensitivity, on the degree of substitution between products and other effects. However, although is expected for the next decades the increase of seafood production coming mainly from developing countries, current studies in these regions are relatively scarce, including in Brazil. There is a gap of knowledge in this area that this paper attempts to contribute. Therefore, the objective of this paper is to analyse the sardines' derived demand in the Southeastern Brazil region, focusing specially on the possible influence of imported sardines' prices (frozen) in the canned sardines' domestic market structure. Sardines are among the 10th most consumed species in Brazil (canned or fresh), and the Brazilian sardine is also the main domestic fishery production, but currently is considered overexploited. Moreover, imports have an important role in the market, since it supplies with almost half of sardines used in the industry for canned sardine, especially when the domestic production fails in to do it. Derived demand models were used in the attempt to quantify the degree of substitution between imports and domestic production related to the canneries. The preliminary results suggest significant substitution effects in the canned sardines' domestic market structure. Considering that increased demand creates opportunities for domestic producers as well as imports, market information is essential to ensure effective fishery management, and to encourage suppliers to take ecosystem considerations into account in their harvesting activities.

Session number: 4.1

Paper number: 205

“Fast Fish” Campaign in Japan and Consumers’ Consciousness of Marine Environmental Preservation

Taro Oishi¹ (presenting), Ienori Tatefuku, Masashi Mochizuki²

1. Fukuoka Institute of Technology, Fukuoka city, Fukuoka prefecture, Japan

2. Fisheries Technology Department; Kyoto Prefectural Agriculture, Forestry and Fisheries Technology Center, Kyoto, Kyoto, Japan

The “fast fish” campaign is a policy promoted by the Ministry of Agriculture, Forestry and Fisheries in Japan. The term “fast fish” refers to fish products that are boneless and easy to prepare. Our study examined the campaign’s influence on consumer consciousness of marine environmental preservation in Japan, which is a major seafood-consuming country. To obtain the data for analysis, an Internet questionnaire survey was conducted with 420 consumers throughout Japan last November 2013. The sample was randomly selected, stratified by gender and age, and based on statistics of the Statistics Bureau of the Ministry of Internal Affairs and Communications (2010). Structural equation modeling (SEM) analysis was then applied to the data. The results are as follows. For the determinants of consumer consciousness of marine environmental preservation, the practice of eating many fish has a positive impact, whereas a bother to cook fish has a negative impact. Hence, the “fast fish” campaign may be deemed successful in raising consumer consciousness of marine environment preservation by increasing opportunities to eat seafood products and promoting interest on marine products. Meanwhile, it has no effect on improving such a consciousness

via the pathway toward removing the trouble of cooking fish.

Session number: 4.1

Paper number: 352

Long-Term Health Effects, Risk Perceptions, and Consumption Patterns for Aquacultured Seafood

Hirotsugu Uchida¹ (presenting), Cathy Roheim², Roberty Johnston³

1. University of Rhode Island, Kingston, Rhode Island, United States

2. University of Idaho, Moscow, Idaho, United States

3. Clark University, Worcester, MA, United States

For US aquaculture industry, primary factors influencing their competitiveness are consumers' perceptions of long-term health risks related to domestic farmed seafood consumption. The public is often particularly sensitive to food risk scares, and can often dominate other considerations in food choice and lead to large impacts on consumption and the viability of aquaculture industry. While recent labeling requirements have aided consumers in determining the seafood production process and the country of origin, it remains difficult for consumers to address health risk in purchasing decisions as there is widespread confusion with respect to riskiness of various species, whether farmed or wild. Using the data collected through experimental auctions and surveys from actual seafood consumers in Rhode Island, this paper examines how consumers perceive, process and respond to information regarding mixed, or offsetting, long-term health effects in aquaculture products, and how this influence purchase behavior relative to competing food products. We also investigate how the source and type of risk information matter. Our preliminary results show that (a) information that emphasizes health benefit (e.g., omega-3 fatty acid) had mostly no significant impacts on the demand for wild and farmed salmon products, while (b) information emphasizing the health risk (e.g., mercury contamination) had a significant impact on the demand for swordfish product. Thus we find, consistent with previous studies albeit on different settings, that negative information is more influential on consumers' behavior than positive information. Further analyses will be performed on incorporating heterogeneous preferences and individual characteristics from the survey.

Session number: 4.1

Paper number: 396

Estimation of Demand System of Bivalves in Rhode Island

Pratheesh Sudhakaran¹, **Hirotsugu Uchida² (presenting)**

1. University of Rhode Island, KINGSTON, RI, United States

2. University of Rhode Island, Kingston, Rhode Island, United States

Shellfish especially bivalves constitute 14% of total fish production contributing 5,046 metric tones in 2011 (NMFS 2012). Despite of the large market share, market demand of the bivalves are less studied. We used secondary data from SAFIS (Standard Atlantic Fisheries Information System) which collect fish production from open fishery water bodies. Detailed daily data of quantity harvested and price of the shellfish harvested was used to estimate demand for shellfish in Rhode Island. The shellfish considered in this analysis are quahogs, scallops, and whelk, but quahogs have strong market for three different size categories namely, neck quahogs, cherrystone, and chowders. We used dynamic Almost Ideal Demand System (AIDS) model to estimate demand system of shellfish. Preliminary result suggests

that neck quahog and scallop are inelastic in nature where as other shellfish are elastic in nature with respect to a price change. Income elasticity estimation revealed that all the shellfish species are necessary goods. The detailed estimation results and the econometrics tests conducted will be presented in the conference. The outcome of the study will help the Department of Environment and Management (DEM), Rhode Island to frame a management plan for shellfish which is under progress.

Session number: 4.1

Paper number: 94

A derived demand analysis for sardines in the Southeastern Brazil

Ruth Beatriz Mezzalira Pincinato¹ (presenting), Frank Asche

1. University of Portsmouth, Portsmouth, Hampshire, United Kingdom

Demand studies are important since it may provide insight on price sensitivity, on the degree of substitution between products and other effects. However, although is expected for the next decades the increase of seafood production coming mainly from developing countries, current studies in these regions are relatively scarce, including in Brazil. There is a gap of knowledge in this area that this paper attempts to contribute. Therefore, the objective of this paper is to analyse the sardines' derived demand in the Southeastern Brazil region, focusing specially on the possible influence of imported sardines' prices (frozen) in the canned sardines' domestic market structure. Sardines are among the 10th most consumed species in Brazil (canned or fresh), and the Brazilian sardine is also the main domestic fishery production, but currently is considered overexploited. Moreover, imports have an important role in the market, since it supplies with almost half of sardines used in the industry for canned sardine, especially when the domestic production fails in to do it. Derived demand models were used in the attempt to quantify the degree of substitution between imports and domestic production related to the canneries. The preliminary results suggest significant substitution effects in the canned sardines' domestic market structure. Considering that increased demand creates opportunities for domestic producers as well as imports, market information is essential to ensure effective fishery management, and to encourage suppliers to take ecosystem considerations into account in their harvesting activities.

Session number: 4.1

Paper number: 205

“Fast Fish” Campaign in Japan and Consumers’ Consciousness of Marine Environmental Preservation

Taro Oishi¹ (presenting), Ienori Tatefuku, Masashi Mochizuki²

1. Fukuoka Institute of Technology, Fukuoka city, Fukuoka prefecture, Japan

2. Fisheries Technology Department; Kyoto Prefectural Agriculture, Forestry and Fisheries Technology Center, Kyoto, Kyoto, Japan

The “fast fish” campaign is a policy promoted by the Ministry of Agriculture, Forestry and Fisheries in Japan. The term “fast fish” refers to fish products that are boneless and easy to prepare. Our study examined the campaign’s influence on consumer consciousness of marine environmental preservation in Japan, which is a major seafood-consuming country. To obtain the data for analysis, an Internet questionnaire survey was conducted with 420 consumers throughout Japan last November 2013. The sample was randomly selected, stratified by gender and age, and based on statistics of the Statistics Bureau of the Ministry of Internal Affairs and Communications (2010). Structural equation modeling (SEM) analysis was then applied to the data. The results are as follows. For the determinants of consumer consciousness of marine environmental preservation, the practice of eating many fish has a positive impact, whereas a bother to cook fish has a negative impact. Hence, the “fast fish” campaign may be deemed successful in raising consumer consciousness of marine environment preservation by increasing opportunities to eat seafood products and promoting interest on marine products. Meanwhile, it has no effect on improving such a consciousness via the pathway toward removing the trouble of cooking fish.

Session number: 4.1

Paper number: 352

Long-Term Health Effects, Risk Perceptions, and Consumption Patterns for Aquacultured Seafood

Hirotsugu Uchida¹ (presenting), Cathy Roheim², Robert Johnston³

1. University of Rhode Island, Kingston, Rhode Island, United States

2. University of Idaho, Moscow, Idaho, United States

3. Clark University, Worcester, MA, United States

For US aquaculture industry, primary factors influencing their competitiveness are consumers' perceptions of long-term health risks related to domestic farmed seafood consumption. The public is often particularly sensitive to food risk scares, and can often dominate other considerations in food choice and lead to large impacts on consumption and the viability of aquaculture industry. While recent labeling requirements have aided consumers in determining the seafood production process and the country of origin, it remains difficult for consumers to address health risk in purchasing decisions as there is widespread confusion with respect to riskiness of various species, whether farmed or wild. Using the data collected through experimental auctions and surveys from actual seafood consumers in Rhode Island, this paper examines how consumers perceive, process and respond to information regarding mixed, or offsetting, long-term health effects in aquaculture products, and how this influence purchase behavior relative to competing food products. We also investigate how the source and type of risk information matter. Our preliminary results show that (a) information that emphasizes health benefit (e.g., omega-3 fatty acid) had mostly no significant impacts on the demand for wild and farmed salmon products, while (b) information emphasizing the health risk (e.g., mercury contamination) had a significant impact on the demand for swordfish product. Thus we find, consistent with previous studies albeit on different settings, that negative information is more influential on consumers' behavior than positive information. Further analyses will be performed on incorporating heterogeneous preferences and individual characteristics from the survey.

Session number: 4.1

Paper number: 396

Estimation of Demand System of Bivalves in Rhode Island

Pratheesh Sudhakaran¹, **Hirotsugu Uchida**² (presenting)

1. University of Rhode Island, KINGSTON, RI, United States

2. University of Rhode Island, Kingston, Rhode Island, United States

Shellfish especially bivalves constitute 14% of total fish production contributing 5,046 metric tones in 2011 (NMFS 2012). Despite of the large market share, market demand of the bivalves are less studied. We used secondary data from SAFIS (Standard Atlantic Fisheries Information System) which collect fish production from open fishery water bodies. Detailed daily data of quantity harvested and price of the shellfish harvested was used to estimate demand for shellfish in Rhode Island. The shellfish considered in this analysis are quahogs, scallops, and whelk, but quahogs have strong market for three different size categories namely, neck quahogs, cherrystone, and chowders. We used dynamic Almost Ideal Demand System (AIDS) model to estimate demand system of shellfish. Preliminary result suggests that neck quahog and scallop are inelastic in nature where as other shellfish are elastic in nature with respect to a price change. Income elasticity estimation revealed that all the shellfish species are necessary goods. The detailed estimation results and the econometrics tests conducted will be presented in the conference. The outcome of the study will help the Department of Environment and Management (DEM), Rhode Island to frame a management plan for shellfish which is under progress.

Session number: 4.2

Paper number: 73

Socio-economic Implication of Climate Change on Small Scale Fisheries of Southwestern Nigeria.

Mabel Ipinmoroti¹ (presenting), Iyabode Taiwo²

1. Osun State University, Ibadan, Oyo State, Nigeria

2. Institute of Food Security, Environmental Resources & Agricu, Abeokuta, Other, Nigeria

Small-scale (subsistent and artisanal fisheries) in developing countries constitute a significant part of the fisheries sector. Climate variability affects the lives and livelihoods of tropical majority of small scale fisherfolks who make up 90% of the world's fishers and fish traders. Small-scale actors are usually the most vulnerable through loss of productive and non-productive assets and infrastructure: landing sites, boats, gears, housing, hospital, schools, sewage systems. This study sought to discover the economic and social impact of climate change on the fisheries sector of Southwestern Nigeria.

Structured questionnaire were administered to 300 fishers selected randomly from inland waters of South-western Nigeria. Data were analysed using descriptive statistics of means and percentages. Respondents had experiences ranging between 5 and 40 years on the various water bodies, 72% have dependants, 64% have no alternative sources of income, average family size was 8. The fisheries have witnessed unusual fluctuation in water level evident in alternate flooding and dryness, disappearance of some species, reduction in individual fish sizes, and 29.55% increase in frequency of gear loss per annum. Subsequently there is 59.38% decrease in catches, 97.55% increase in maintenance cost and 40.35% increase in the cost of inputs and 109.24% increase in fish price. Further analysis reveals 82% increase in total expenditure (TC) and 15% decrease in total revenue (TR) of small scale fishers under this study.

The climate variability predisposes the small scale fisher to decrease fish yield and income. His livelihood is threatened by reduction in disposable income and food insecurity.

Session number: 4.2

Paper number: 139

Climate Change Awareness, Coping Mechanisms and Adaptation in Poor Rural Coastal Communities, Vietnam

Kimanh Nguyen (presenting), Trang Le¹, Chuong Bui, Curtis Jolly

1. Nhatrang University, Nha Trang, Khanh Hoa, Viet Nam

Vietnam has been ranked among the highest vulnerable areas to climate change in Asian countries. Eight of the ten most vulnerable provinces including Ben Tre Province are located in the Mekong River Delta. We conducted a study to evaluate community knowledge, awareness, perception of severity, coping mechanism and adaptation to climate change in Ben Tre Province. Community members were aware of changing climatic conditions and pointed out indicators of some of these changes. About 90% of respondents indicated that they suffered losses from salt water intrusion. Fishing decline encouraged some fisher folks to contemplate career changes. Households adopted various coping mechanism to deal with climate change events. Age, education and previous affliction with climate change events influence knowledge, awareness, perception of severity and preparedness of climate change

events. Local governments proposed adaptation strategies such as building of dikes to prevent salt water intrusion, improvement in irrigation systems, planting of mangrove trees and building salt water extraction plants. Of the two adaptation strategies evaluated to mitigate the community and financial losses from climate change, the sea dike system protected more land but the irrigating system was more cost effective in mitigating losses from climate change.

Session number: 4.2

Paper number: 328

Predicting Recreational Fishery Landings Under Alternative Climate Scenarios: The US Summer Flounder Fishery.

Chris Kennedy¹ (presenting), Scott Steinback², Min-Yang Lee³

1. George Mason University, Fairfax, VA, United States

2. NOAA Fisheries, Woods Hole, MA, United States

3. Northeast Fisheries Science Center, Woods Hole, MA, United States

This research develops a spatially-explicit model of recreational angler participation in an effort to predict outcomes for the US summer flounder (fluke) fishery under alternative climate scenarios, and inform adaptive management approaches. The mid-Atlantic coastal waters of the US have experienced significant warming in recent years, resulting in noticeable pole-ward shifts of important fish species, including fluke. While commercial fleets have been able to adapt, and aggregate recreational harvest limits (RHLs) have been achieved, state-level RHLs – based on historical harvest shares – are persistently exceeded by northern jurisdictions, leading to significant inter-jurisdictional differences in bag and size limits, and repeated addendums to the fishery management plan to prevent drastic cuts for offending jurisdictions.

Using data from a choice experiment and the NMFS MRIP system, a random utility model of recreational angler behavior is estimated, and willingness to pay estimates for both kept and released fish are generated. The model is coupled with an age- and spatially-structured population model (developed in conjunction with this research) to estimate historical selectivity across jurisdictions. Stock profiles under alternative climate scenarios are used to simulate angler welfare, trip-level participation, and harvest outcomes at the jurisdictional level, and under alternative bag and size limits.

This research provides a predictive tool for managers to respond proactively to changing distributions, and offers insight into the costs and benefits of reallocation and/or novel allocation approaches (e.g., the Headboat Collaborative pilot program in the Gulf of Mexico). Further, this approach should be useful for evaluating other fishery resources experiencing shifting distributions.

Session number: 4.2

Paper number: 332

Crowd Sourcing to Mitigate the Climate Change effects on Small Scale Fisheries in Sri Lanka

Achini De Silva, Sabaragamuwa University, Belihuloya, Sabaragamuwa, Sri Lanka

Small scale fisheries play an important role in coastal communities as well as macro economy of the country. Value chains of small scale fisheries and the actors were highly vulnerable to climate change effects due to its inherited nature of poor resource status, scale of operation, and imperfect knowledge on markets. Key focus of the study was the role of imagining adaptations for small scale fisheries that would contribute to minimizing the negative impacts of climate change on employment, income, food security, health and safety. The first part of the study focused eye on collaborative design. Randomly selected stakeholders were involved in designing process. The design considerations include weather forecasting, weather warnings, craft and gear design, postharvest handling, designing landing sites and markets, distribution systems, training programmes for crew members, and financial management to imagine adaptations scenarios. Crowd sourcing approach forwarded to measure the feasibility and social acceptability of the design and visualization strategies. Crowd source model allows access to particular knowledge which empowered uses to make changes best fit to their locations as well as inform general public about the climate change including both negative and positive aspects.

Key words: small scale fishery, crowd sourcing, climate change

Session number: 4.2

Paper number: 73

Socio-economic Implication of Climate Change on Small Scale Fisheries of Southwestern Nigeria.

Mabel Ipinmoroti¹ (presenting), Iyabode Taiwo²

1. Osun State University, Ibadan, Oyo State, Nigeria

2. Institute of Food Security, Environmental Resources & Agricu, Abeokuta, Other, Nigeria

Small-scale (subsistent and artisanal fisheries) in developing countries constitute a significant part of the fisheries sector. Climate variability affects the lives and livelihoods of tropical majority of small scale fisherfolks who make up 90% of the world's fishers and fish traders. Small-scale actors are usually the most vulnerable through loss of productive and non-productive assets and infrastructure: landing sites, boats, gears, housing, hospital, schools, sewage systems. This study sought to discover the economic and social impact of climate change on the fisheries sector of Southwestern Nigeria.

Structured questionnaire were administered to 300 fishers selected randomly from inland waters of South-western Nigeria. Data were analysed using descriptive statistics of means and percentages. Respondents had experiences ranging between 5 and 40 years on the various water bodies, 72% have dependants, 64% have no alternative sources of income, average family size was 8. The fisheries have witnessed unusual fluctuation in water level evident in alternate flooding and dryness, disappearance of some species, reduction in individual fish sizes, and 29.55% increase in frequency of gear loss per annum. Subsequently there is 59.38% decrease in catches, 97.55% increase in maintenance cost and 40.35% increase in the cost of inputs and 109.24% increase in fish price. Further analysis reveals 82% increase in total expenditure (TC) and 15% decrease in total revenue (TR) of small scale fishers under this study.

The climate variability predisposes the small scale fisher to decrease fish yield and income. His livelihood is threatened by reduction in disposable income and food insecurity.

Session number: 4.2

Paper number: 139

Climate Change Awareness, Coping Mechanisms and Adaptation in Poor Rural Coastal Communities, Vietnam

Kimanh Nguyen (presenting), Trang Le¹, Chuong Bui, Curtis Jolly

1. Nhatrang University, Nha Trang, Khanh Hoa, Viet Nam

Vietnam has been ranked among the highest vulnerable areas to climate change in Asian countries. Eight of the ten most vulnerable provinces including Ben Tre Province are located in the Mekong River Delta. We conducted a study to evaluate community knowledge, awareness, perception of severity, coping mechanism and adaptation to climate change in Ben Tre Province. Community members were aware of changing climatic conditions and pointed out indicators of some of these changes. About 90% of respondents indicated that they suffered losses from salt water intrusion. Fishing decline encouraged some fisher folks to contemplate career changes. Households adopted various coping mechanism to deal with climate change events. Age, education and previous affliction with climate change events influence knowledge, awareness, perception of severity and preparedness of climate change events. Local governments proposed adaptation strategies such as building of dikes to prevent salt water intrusion, improvement in irrigation systems, planting of mangrove trees and building salt water extraction plants. Of the two adaptation strategies evaluated to mitigate the community and financial losses from climate change, the sea dike system protected more land but the irrigating system was more cost effective in mitigating losses from climate change.

Session number: 4.2

Paper number: 328

Predicting Recreational Fishery Landings Under Alternative Climate Scenarios: The US Summer Flounder Fishery.

Chris Kennedy¹ (presenting), Scott Steinback², Min-Yang Lee³

1. George Mason University, Fairfax, VA, United States

2. NOAA Fisheries, Woods Hole, MA, United States

3. Northeast Fisheries Science Center, Woods Hole, MA, United States

This research develops a spatially-explicit model of recreational angler participation in an effort to predict outcomes for the US summer flounder (fluke) fishery under alternative climate scenarios, and inform adaptive management approaches. The mid-Atlantic coastal waters of the US have experienced significant warming in recent years, resulting in noticeable pole-ward shifts of important fish species, including fluke. While commercial fleets have been able to adapt, and aggregate recreational harvest limits (RHLs) have been achieved, state-level RHLs – based on historical harvest shares – are persistently exceeded by northern jurisdictions, leading to significant inter-jurisdictional differences in bag and size limits, and repeated addendums to the fishery management plan to prevent drastic cuts for offending jurisdictions.

Using data from a choice experiment and the NMFS MRIP system, a random utility model of recreational angler behavior is estimated, and willingness to pay estimates for both kept and released fish are generated. The model is coupled with an age- and spatially-structured population model (developed in conjunction with this research) to estimate historical selectivity across jurisdictions. Stock profiles under alternative climate scenarios are used to simulate angler welfare, trip-level participation, and harvest outcomes at the jurisdictional level, and under alternative bag and size limits.

This research provides a predictive tool for managers to respond proactively to changing distributions, and offers insight into the costs and benefits of reallocation and/or novel allocation approaches (e.g., the Headboat Collaborative pilot program in the Gulf of Mexico). Further, this approach should be useful for evaluating other fishery resources experiencing shifting distributions.

Session number: 4.2

Paper number: 332

Crowd Sourcing to Mitigate the Climate Change effects on Small Scale Fisheries in Sri Lanka

Achini De Silva, Sabaragamuwa University, Belihuloya, Sabaragamuwa, Sri Lanka

Small scale fisheries play an important role in coastal communities as well as macro economy of the country. Value chains of small scale fisheries and the actors were highly vulnerable to climate change effects due to its inherited nature of poor resource status, scale of operation, and imperfect knowledge on markets. Key focus of the study was the role of imagining adaptations for small scale fisheries that would contribute to minimizing the negative impacts of climate change on employment, income, food security, health and safety. The first part of the study focused eye on collaborative design. Randomly selected stakeholders were involved in designing process. The design considerations include weather forecasting, weather warnings, craft and gear design, postharvest handling, designing landing sites and markets, distribution systems, training programmes for crew members, and financial management to imagine adaptations scenarios. Crowd sourcing approach forwarded to measure the feasibility and social acceptability of the design and visualization strategies. Crowd source model allows access to particular knowledge which empowered uses to make changes best fit to their locations as well as inform general public about the climate change including both negative and positive aspects.

Key words: small scale fishery, crowd sourcing, climate change

Session number: 4.3

Paper number: 218

Understanding Noncompliance of Protected Species Regulations in the Northeast Gillnet Fishery: Before and After ‘Consequence Closures’

Kathryn Bisack¹ (presenting), Chhandita Das²

1. NOAA/NMFS/NEFSC, Woods Hole, MA, United States

2. Integrated Statistics, Woods Hole, MA, United States

In the northeast sink gillnet fishery, fishermen are required to attach pingers to their nets to reduce the incidental catch of harbor porpoise. However, because non-compliance has been a problem, area closures (called ‘consequence closures’) are to be implemented when incidental bycatch rates exceed previously-agreed threshold values. Our study investigated potential factors that might influence pinger compliance decisions by fishermen in two different time periods: (a) before the 2007 agreement was reached on using consequences closures and (b) afterward. Using a probit modeling framework in which both economic and normative factors were considered, we found that in the pre-2007 period fishermen who had previously violated pingers regulations and who were not exclusive gillnet fishermen were less likely to comply with the pinger regulations. We subsequently tested whether this finding applies from 2007 onward. Preliminary results show this to be the case, although more complete analyses are still underway. Compliance behavior may not have changed because: (1) the penalty of a consequence closure is applied in aggregate to the sink gillnet fishing fleet, not to any one individual; and (2) the potential impacts of a consequence closure at some future time (e.g., two years away) may be too opaque to affect compliance decisions made by fishermen today.

Session number: 4.3

Paper number: 196

SWOT analysis and recommended policies and strategies of Eritrean fisheries

Tesfom Melake Araya¹ (presenting), Krishnan M.¹, Venugopalan Rangarajan²

1. Central Institute of Fisheries Education, Mumbai, Maharashtra, India

2. Indian Institute of Horticultural Research, Bangalore, Karnataka, India

Eritrea is resource rich but low capitalized country. The Red Sea of Eritrea has one of the most underexploited fisheries sectors in the world. This present study attempts to capture the strengths, weaknesses, opportunities and threats (SWOT) of the Eritrean fisheries sector. SWOT analysis has been used for deriving the reasons for the poor exploitation of the fisheries resources of Eritrea. The factors identified are used to formulate and recommend suitable policies and strategies for development and proper exploitation of the Eritrean fisheries sector. The study also used the compound growth rate and performance analysis of the fish production as pre-investigative tools to develop the SWOT. Eritrean marine fisheries were found to be performing below the optimum registering an overall negative growth rate of 1.92 % and high instability of 99. Looking at the overall performance for the period 1950-2009 the situation was found to be ‘less desirable’. Therefore, there is an urgent need to improve all parameters that enable efficient and higher levels of fish production in a sustainable manner. The various factors identified resulted in the growth and instability in fish production of the Eritrean fisheries sector. The SWOT analysis is important because it delivers the information of a given sector in all its ramifications which enables a policy maker to make a quick, yet studied judgment of the sector within a limited time frame.

Keywords: SWOT analysis, fisheries policies, development strategies, performance, instability, marine fish production,

Session number: 4.3

Paper number: 425

Evaluating the Performance of Fisheries Management Systems: Lessons from the Fisheries Performance Indicators

Jennifer Meredith¹ (presenting), James Anderson², Jingjie Chu², Chris Anderson

1. University of Washington, Seattle, WA, United States

2. The World Bank, Washington, DC, United States

The Fishery Performance Indicators (FPIs) are an evidence-based instrument for measuring rent generation from fishery resources and a set of indicators that can be used to evaluate and compare the world's fisheries management systems. The FPIs seek to quantify the current level of success that fisheries management systems are having in generating quantifiable and understandable wealth for communities and ecosystems. These indicators are designed not only as a tool for identifying fisheries that are underperforming, but also as a framework for pinpointing what policies and interventions are likely to have the greatest impact. Currently, the FPIs have been conducted in more than 70 diverse fisheries around the globe. Analysis across the existing dataset demonstrates the important role played by property rights. Fisheries that implement harvest rights-based management or limited entry programs experience much higher economic and ecological outcomes without a corresponding fall in community well-being. Preliminary data analysis also suggests that while tenure is important, other factors such as data collection, involvement of stakeholders, adoption of technology, and improvement of infrastructure are also critical to the performance of the harvest and post-harvest sectors. Additionally, this analysis suggests that the post-harvest sector plays a critical role in the performance of the fishery and possibly due to existing durable investments, processors can even promote sustainable harvest in fisheries where formal governance is weak.

Session number: 4.3

Paper number: 218

Understanding Noncompliance of Protected Species Regulations in the Northeast Gillnet Fishery: Before and After ‘Consequence Closures’

Kathryn Bisack¹ (presenting), Chhandita Das²

1. NOAA/NMFS/NEFSC, Woods Hole, MA, United States

2. Integrated Statistics, Woods Hole, MA, United States

In the northeast sink gillnet fishery, fishermen are required to attach pingers to their nets to reduce the incidental catch of harbor porpoise. However, because non-compliance has been a problem, area closures (called ‘consequence closures’) are to be implemented when incidental bycatch rates exceed previously-agreed threshold values. Our study investigated potential factors that might influence pinger compliance decisions by fishermen in two different time periods: (a) before the 2007 agreement was reached on using consequences closures and (b) afterward. Using a probit modeling framework in which both economic and normative factors were considered, we found that in the pre-2007 period fishermen who had previously violated pingers regulations and who were not exclusive gillnet fishermen were less likely to comply with the pinger regulations. We subsequently tested whether this finding applies from 2007 onward. Preliminary results show this to be the case, although more complete analyses are still underway. Compliance behavior may not have changed because: (1) the penalty of a consequence closure is applied in aggregate to the sink gillnet fishing fleet, not to any one individual; and (2) the potential impacts of a consequence closure at some future time (e.g., two years away) may be too opaque to affect compliance decisions made by fishermen today.

Session number: 4.3

Paper number: 196

SWOT analysis and recommended policies and strategies of Eritrean fisheries

Tesfom Melake Araya¹ (presenting), Krishnan M.¹, Venugopalan Rangarajan²

1. Central Institute of Fisheries Education, Mumbai, Maharashtra, India

2. Indian Institute of Horticultural Research, Bangalore, Karnataka, India

Eritrea is resource rich but low capitalized country. The Red Sea of Eritrea has one of the most underexploited fisheries sectors in the world. This present study attempts to capture the strengths, weaknesses, opportunities and threats (SWOT) of the Eritrean fisheries sector. SWOT analysis has been used for deriving the reasons for the poor exploitation of the fisheries resources of Eritrea. The factors identified are used to formulate and recommend suitable policies and strategies for development and proper exploitation of the Eritrean fisheries sector. The study also used the compound growth rate and performance analysis of the fish production as pre-investigative tools to develop the SWOT. Eritrean marine fisheries were found to be performing below the optimum registering an overall negative growth rate of 1.92 % and high instability of 99. Looking at the overall performance for the period 1950-2009 the situation was found to be 'less desirable'. Therefore, there is an urgent need to improve all parameters that enable efficient and higher levels of fish production in a sustainable manner. The various factors identified resulted in the growth and instability in fish production of the Eritrean fisheries sector. The SWOT analysis is important because it delivers the information of a given sector in all its ramifications which enables a policy maker to make a quick, yet studied judgment of the sector within a limited time frame.

Keywords: SWOT analysis, fisheries policies, development strategies, performance, instability, marine fish production,

Session number: 4.3

Paper number: 425

Evaluating the Performance of Fisheries Management Systems: Lessons from the Fisheries Performance Indicators

Jennifer Meredith¹ (presenting), James Anderson², Jingjie Chu², Chris Anderson

1. University of Washington, Seattle, WA, United States

2. The World Bank, Washington, DC, United States

The Fishery Performance Indicators (FPIs) are an evidence-based instrument for measuring rent generation from fishery resources and a set of indicators that can be used to evaluate and compare the world's fisheries management systems. The FPIs seek to quantify the current level of success that fisheries management systems are having in generating quantifiable and understandable wealth for communities and ecosystems. These indicators are designed not only as a tool for identifying fisheries that are underperforming, but also as a framework for pinpointing what policies and interventions are likely to have the greatest impact. Currently, the FPIs have been conducted in more than 70 diverse fisheries around the globe. Analysis across the existing dataset demonstrates the important role played by property rights. Fisheries that implement harvest rights-based management or limited entry programs experience much higher economic and ecological outcomes without a corresponding fall in community well-being. Preliminary data analysis also suggests that while tenure is important, other factors such as data collection, involvement of stakeholders, adoption of technology, and improvement of infrastructure are also critical to the performance of the harvest and post-harvest sectors. Additionally, this analysis suggests that the post-harvest sector plays a critical role in the performance of the fishery and possibly due to existing durable investments, processors can even promote sustainable harvest in fisheries where formal governance is weak.

Session number: 4.4

Paper number: 363

Effects of Floor Prices in First-Hand Sales

Øystein Hermansen¹ (presenting), Sverre Tyholdt Braaten², Eivind Hestvik Brækkan³

1. NOFIMA, Tromsø, T, Norway

2. School of Business and Economics, University of Tromsøe, Tromsøe, Troms, Norway

3. School of Business and Economics, University of Tromsøe, Tromsøe, Troms, Oman

Bargaining power has in many fisheries shifted considerably from fish processors to fishermen with modern communications, higher fleet mobility and increased scarcity of the resources. In Norway, fishermen were to a large degree exploited by processors up until the early 20th century. A strong collaborative effort from the fishermen's union culminated with the introduction of the "Act on Raw Fish" in 1933. Here, first hand sales of fish were to take place through fishermen-owned sales organizations and subject to a floor price, to a very large degree defined by the same organizations.

Needless to say, this represented a major shift in bargaining power, and these major parts of the act are still in force today. This even though the processing firms show poor profitability and the fleet has far better economic results.

A considerable, but varying, part of the total first hand sales are made at the floor price, indicating that it is effective. Aside from distributional aspects, the floor price can have unintended detrimental effects. With supply of fish being highly seasonal in Norwegian fisheries, a floor price could exacerbate the seasonality through not exposing fishermen to the true costs of high supply. It can also increase incentives for not reporting the correct quantities landed.

The aim of this study is to employ econometric models to estimate the effect of the floor price regime and to obtain estimates of prices without such a regime in force.

Session number: 4.4

Paper number: 154

Transformations of the Retail Fish Market in Brazil and its Impacts on Small-Scale Fish Farming

Manoel Pedroza¹ (presenting), Renata Barroso², Roberto M. V. Flores¹

1. Embrapa Fisheries and Aquaculture (Brazilian Agricultural Research Corporation), Palmas, Tocantins, Brazil

2. Embrapa, Palmas, TO, Brazil

Emergence of fish farming in Brazil has generated significant effects on household agriculture, in terms of food security and income generation. However, small-scale fish farmers in the state of Tocantins have been affected by a transformation process concerning the emergence of supermarkets in the fish market. The lower prices and regular supply offered by supermarkets have created a significant competition with traditional market channels used by smallholders (e.g. farmers market, fishmongers and direct sell). The goal of this study is to analyze these transformations and its impacts over Tocantins' small scale fish farmers.

The methodological design applied is an exploratory qualitative research, based on the approach of Global Value Chain. The data were collected by face-to-face interviews.

In Tocantins, the increased role of supermarkets has affected the fish market structure, previously based on traditional market channels. There is an excluding process of small-scale fish farmers, mainly due to their difficulties to access supermarket. The main limitations are related to difficulty in consolidate their production and then provide the required volume on a regular basis and competitive prices.

It is evident that the sustainability of small scale fish farms must be based on adding value of the products and in the access to new markets. The increase of production scale, improving logistics efficiency and organizing farmers are some determinant elements to increase added value. However, adding value requires a high level of organizational management. An increased production scale, quality and logistics efficiency, are key factors to ensure access to these opportunities.

Session number: 4.4

Paper number: 175

A Value Chain Analysis of Fish Products: Case study from Pantar Island, Eastern Indonesia

Ria Fitriana¹ (presenting), Natasha Stacey²

1. Charles Darwin University, Jakarta, DKI Jakarta, Indonesia

2. Charles , Darwin, NT, Australia

Pantar Island's coastal communities like many other coastal communities in eastern Indonesia have a high dependency on marine resources for income, food security and other benefits. Fish products (comprising several species of demersal and pelagic species) are particularly valuable (in addition to other products harvested and traded for export markets) as they are a source of cash income and food for other coastal and mountain dwelling people in Pantar and neighboring islands. Understanding how the fish trade operates and identifying the interventions that can enhance the position and participation of local communities along the value chain is one approach to improving their livelihoods.

This paper examines the fish products traded in Pantar Island, eastern Indonesia through a value chain analysis (VCA). The VCA explores the core processes (e.g. input, production, collection, intermediary trade, wholesale and retail marketing, and consumption) involved and actors (including gendered analysis) who provide services and goods at each point of the value chain. The analysis also identifies the relationships and power differential among actors and how price is determined. The research is based on data collected through focus group discussions with fishers in four villages in Pantar and interviews with local and intermediary traders. The intent was to identify effective pathways to enhance the participation of local producers in the fish product value chain. This paper discusses key issues, potential risks faced by coastal communities, and potential strategies for upgrading of the value chain as one of way to enhance the livelihoods of coastal communities. The results also show how household engagement in the fish trade contributes significantly to household food security.

Session number: 4.4

Paper number: 268

Cooperation for Sustainable Business Development – The Case of Value Chain of Skipjack Tuna in Vietnam

Duy Nguyen Ngoc¹ (presenting), Kimanh Nguyen

1. University of Tromsø and Nha Trang University, Nha Trang, Khanh Hoa, Viet Nam

The production and distribution of fish products in Vietnam have been faced with strict consumer requirements such as seafood quality, hygiene, safety standards, traceability, environmentally friendly manufacturing and fisheries resource conservation. These are compulsory requirements for sustainable business development in international markets. The research applies the Structure – Conduct – Performance (SCP) model for analyzing value chain of fishing products to develop sustainable business for these items. This paper uses the case of the skipjack tuna in the Khanh Hoa fishery in Vietnam, which the most important actors in the value chain are fishermen, large traders and export seafood processing firms. The results show that the value chain develops on the lack of close cooperation and sustainability. The distributions of benefits and risk among the actors are unbalanced. The fishermen provide the biggest value-added, but they receive the lowest benefits, conversely, the big traders and the seafood processing companies contribute smaller ratios of value-added than that of the fishers while these two actors get the greatest benefit. The fishers are the actors facing the most disadvantages because of price fluctuation and high production risks, while the big traders face with the least risks. The actors in the value chain face difficulties in accessing information of international markets and disadvantages due to high bargaining power from the importers. The research recommends establishing a modeling of vertical and horizontal cooperation to link closely the actors within the value chain for the sustainable business development of this item.

Session number: 4.4

Paper number: 363

Effects of Floor Prices in First-Hand Sales

Øystein Hermansen¹ (presenting), Sverre Tyholdt Braaten², Eivind Hestvik Brækkan³

1. NOFIMA, Tromsø, T, Norway

2. School of Business and Economics, University of Tromsø, Tromsø, Troms, Norway

3. School of Business and Economics, University of Tromsø, Tromsø, Troms, Oman

Bargaining power has in many fisheries shifted considerably from fish processors to fishermen with modern communications, higher fleet mobility and increased scarcity of the resources. In Norway, fishermen were to a large degree exploited by processors up until the early 20th century. A strong collaborative effort from the fishermen's union culminated with the introduction of the "Act on Raw Fish" in 1933. Here, first hand sales of fish were to take place through fishermen-owned sales organizations and subject to a floor price, to a very large degree defined by the same organizations.

Needless to say, this represented a major shift in bargaining power, and these major parts of the act are still in force today. This even though the processing firms show poor profitability and the fleet has far better economic results.

A considerable, but varying, part of the total first hand sales are made at the floor price, indicating that it is effective. Aside from distributional aspects, the floor price can have unintended detrimental effects. With supply of fish being highly seasonal in Norwegian fisheries, a floor price could exacerbate the seasonality through not exposing fishermen to the true costs of high supply. It can also increase incentives for not reporting the correct quantities landed.

The aim of this study is to employ econometric models to estimate the effect of the floor price regime and to obtain estimates of prices without such a regime in force.

Session number: 4.4

Paper number: 154

Transformations of the Retail Fish Market in Brazil and its Impacts on Small-Scale Fish Farming

Manoel Pedroza¹ (presenting), Renata Barroso², Roberto M. V. Flores¹

1. Embrapa Fisheries and Aquaculture (Brazilian Agricultural Research Corporation),
Palmas, Tocantins, Brazil

2. Embrapa, Palmas, TO, Brazil

Emergence of fish farming in Brazil has generated significant effects on household agriculture, in terms of food security and income generation. However, small-scale fish farmers in the state of Tocantins have been affected by a transformation process concerning the emergence of supermarkets in the fish market. The lower prices and regular supply offered by supermarkets have created a significant competition with traditional market channels used by smallholders (e.g. farmers market, fishmongers and direct sell). The goal of this study is to analyze these transformations and its impacts over Tocantins' small scale fish farmers.

The methodological design applied is an exploratory qualitative research, based on the approach of Global Value Chain. The data were collected by face-to-face interviews.

In Tocantins, the increased role of supermarkets has affected the fish market structure, previously based on traditional market channels. There is an excluding process of small-scale fish farmers, mainly due to their difficulties to access supermarket. The main limitations are related to difficulty in consolidate their production and then provide the required volume on a regular basis and competitive prices.

It is evident that the sustainability of small scale fish farms must be based on adding value of the products and in the access to new markets. The increase of production scale, improving logistics efficiency and organizing farmers are some determinant elements to increase added value. However, adding value requires a high level of organizational management. An increased production scale, quality and logistics efficiency, are key factors to ensure access to these opportunities.

Session number: 4.4

Paper number: 175

A Value Chain Analysis of Fish Products: Case study from Pantar Island, Eastern Indonesia

Ria Fitriana¹ (presenting), Natasha Stacey²

1. Charles Darwin University, Jakarta, DKI Jakarta, Indonesia

2. Charles , Darwin, NT, Australia

Pantar Island's coastal communities like many other coastal communities in eastern Indonesia have a high dependency on marine resources for income, food security and other benefits. Fish products (comprising several species of demersal and pelagic species) are particularly valuable (in addition to other products harvested and traded for export markets) as they are a source of cash income and food for other coastal and mountain dwelling people in Pantar and neighboring islands. Understanding how the fish trade operates and identifying the interventions that can enhance the position and participation of local communities along the value chain is one approach to improving their livelihoods.

This paper examines the fish products traded in Pantar Island, eastern Indonesia through a value chain analysis (VCA). The VCA explores the core processes (e.g. input, production, collection, intermediary trade, wholesale and retail marketing, and consumption) involved and actors (including gendered analysis) who provide services and goods at each point of the value chain. The analysis also identifies the relationships and power differential among actors and how price is determined. The research is based on data collected through focus group discussions with fishers in four villages in Pantar and interviews with local and intermediary traders. The intent was to identify effective pathways to enhance the participation of local producers in the fish product value chain. This paper discusses key issues, potential risks faced by coastal communities, and potential strategies for upgrading of the value chain as one of way to enhance the livelihoods of coastal communities. The results also show how household engagement in the fish trade contributes significantly to household food security.

Session number: 4.4

Paper number: 268

Cooperation for Sustainable Business Development – The Case of Value Chain of Skipjack Tuna in Vietnam

Duy Nguyen Ngoc¹ (presenting), Kimanh Nguyen

1. University of Tromsø and Nha Trang University, Nha Trang, Khanh Hoa, Viet Nam

The production and distribution of fish products in Vietnam have been faced with strict consumer requirements such as seafood quality, hygiene, safety standards, traceability, environmentally friendly manufacturing and fisheries resource conservation. These are compulsory requirements for sustainable business development in international markets. The research applies the Structure – Conduct – Performance (SCP) model for analyzing value chain of fishing products to develop sustainable business for these items. This paper uses the case of the skipjack tuna in the Khanh Hoa fishery in Vietnam, which the most important actors in the value chain are fishermen, large traders and export seafood processing firms. The results show that the value chain develops on the lack of close cooperation and sustainability. The distributions of benefits and risk among the actors are unbalanced. The fishermen provide the biggest value-added, but they receive the lowest benefits, conversely, the big traders and the seafood processing companies contribute smaller ratios of value-added than that of the fishers while these two actors get the greatest benefit. The fishers are the actors facing the most disadvantages because of price fluctuation and high production risks, while the big traders face with the least risks. The actors in the value chain face difficulties in accessing information of international markets and disadvantages due to high bargaining power from the importers. The research recommends establishing a modeling of vertical and horizontal cooperation to link closely the actors within the value chain for the sustainable business development of this item.

Session number: 4.5

Paper number: 13

Production Risk and Technical Efficiency of Fish Farms in Ghana

Edward Ebo Onumah¹ (presenting), Justina Adwoa Onumah²

1. University of Ghana, Accra, Greater Accra, Ghana

2. CSIR-Science and Technology Policy Research Institute, Accra, Greater Accra, Ghana

This study adopts the stochastic frontier model with flexible risk properties to analyze production risk, technical efficiency and its determinants of fish farms in four regions of Ghana including Greater Accra, Eastern, Western and Ashanti Regions. The study employs a two year panel data of 480 farms making a total of 960 observations through a random selection. The findings demonstrate that the translog model is best fit for the mean output function, whilst the input variables: hired labour, family labour, fingerlings, feed and other cost are identified to positively influence fish farm output at an increasing returns to scale. The study also finds that feed and other cost are risk increasing inputs, whilst hired labour, family labour and fingerlings are identified to be risk decreasing inputs. The estimated average technical efficiency score of 0.76 shows that the efficiency score is compromised when the production technology is modeled without the flexible risk property. Additionally, the study finds that age, experience, land, gender, pond type and fish farming education significantly influence technical efficiency of farmers. Specifically, it is observed that technical efficiency improved over time. The study concludes that on the average, 24% of potential output is lost due to technical inefficiency and production risk and given the present state of technology and input level, the possibility of enhancing production can be achieved by reducing technical inefficiency by 24% through adoption of practices of the best fish farm.

Key words: Stochastic frontier model, flexible risk property, productivity, panel data

Session number: 4.5

Paper number: 340

The Use of Hierarchy Process, Cost Benefit Analysis and Goal Programming to Evaluate Profitability and Sustainability of Aquaculture: The Case of Tilapia Farming in Jamaica.

Curtis Jolly¹, Carel Ligeon² (presenting), Nathanael Hishamunda³, Vincent Wright⁴

1. Auburn University, Auburn, Alabama, United States

2. Auburn University, Montgomery, Montgomery, Alabama, United States

3. FAO, Rome, Rome, Italy

4. Northern Caribbean University, Savalamar, Mandeville, Jamaica

Jamaica has attained the highest aquaculture growth rate in Central America and the Caribbean from 1995 to 2010. Aquaculture production supplies almost half of total fish consumed in the country. However, fish production development has encountered severe problems that have almost retarded its progress. The Jamaican farmers cite a number of biophysical, socio-economic and market forces that constrain the future growth of the industry. They are eager to understand the effects of these factors on the industry growth. In this study, we use the Analytical Hierarchal Process (AHP), Cost Benefit Analysis (CBA) and Goal Programming (GP) to evaluate how elimination of these constraints may enhance the financial profitability and sustainability of fish farming in Jamaica. AHP results show, in descending order, farmers' stated preferences to enhance aquaculture economic contribution

are improvements: In environmental sustainability; Government influence; Marketing and sales; Technological innovation; Social working environment; Industry and trade; and Production. The CBA results show that internal rate of return from a 10.0 acre tilapia production farm within existing conditions is 30.36 percent, but if half of the changes are implemented to satisfy farmers' ordered preference scale, the IRR can increase to 41.18 percent; however, if changes are neglected the IRR drops to 20.57 percent. The GP results show that production and sales are underachieved. To attain production and marketing targets costs increase and environmental conditions deteriorate. When farmers' preferences are not considered in changes to attain production and sales targets, investment capital requirements increase, environmental and working conditions worsen.

Session number: 4.5

Paper number: 47

Productivity Growth in the Shrimp Farming Industry of Bangladesh: A Luenberger Productivity Indicator Approach

Hasneen Jahan¹ (presenting), Tihomir Ancev²

1. Bangladesh Agricultural University, Mymensingh, Mymensingh, Bangladesh

2. The University of Sydney, Sydney, NSW, Australia

Shrimp aquaculture is one of the fastest growing economic activities in the coastal areas of Bangladesh and earns substantial foreign exchange for the country. However, the environmental degradation is a major concern for the sustainable development of this industry. This paper studies the tradeoffs between the economic and environmental performance of shrimp farming in terms of productivity measurement. A directional distance function approach is employed to estimate the Luenberger total factor productivity indicators under the assumptions of weak and strong disposability of undesirable outputs. Based on average farm level data from shrimp farming, this study estimates the productivity change between the year 2000 and 2010 and compares how the different directional vectors and output sets influence the productivity. The Luenberger indicators are further decomposed into efficiency change and technical change components to explain the source of productivity change. The results show that overall the productivity of shrimp farms has decreased in most districts, except Cox's Bazar and Chittagong districts. For most of the farms, the negative productivity growth was driven by the negative technological change. The productivity growth is an indication of sustainable development. Therefore, true productivity growth including economic and environmental performance needs to be considered in developing effective policy measures to attain sustainable development of the shrimp farming industry.

Session number: 4.5

Paper number: 32

Evaluation of Feed Type Choices and Performance of Fish Farming in Akure South Local Government Area of Ondo State, Nigeria

Adewale Isaac Fatuase¹ (presenting), Igbekere Ajibefun², Moses Bobola³

1. Department of Agricultural Technology, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria, Owo, Ondo State, Nigeria

2. Rufus Giwa Polytechnic, Owo, Owo, Ondo, Nigeria

3. Federal University of Technology, Akure, Akure, Ondo, Nigeria

The long desired self-sufficiency in national and grass-root fish production is momentous to food security in Nigeria. The nature and patterns of feed utilization among fish farming households will provide a strategy to raise demand for local feeds thereby raising national feed production vis-à-vis reducing Nigeria's import dependency on feeds. The study investigated the feed choices and performance of fish farmers in Akure South Local Government Area of Ondo State, Nigeria. A random sampling of 120 fish farmers was taken and subjected to profitability and multinomial logit model analyses. The findings revealed that majority of the respondents (57.50%) cultured juvenile seed while 55.83% used only earthen pond. The gross margin and net farm income were ₦686,808.36 and ₦546,790.15 respectively. The result of the expense structure ratio (ESR) showed that 50% of the total cost of fish production was made up of fixed cost items. Benefit cost ratio (2.30) and rate of return (1.30) indicated that fish farming was a profitable venture in the study area. Results of multinomial logit model revealed that the major factors that significantly influenced fish farmer's preferences for either a combination of imported and local feeds or the imported feed only to the local feed were educational status, fish price, experience, cost of feed, household income, numbers of pond and household size. The study concluded that massive awareness on the benefit of locally made feed as a viable alternative to the popular imported feed should be encouraged.

Session number: 4.5

Paper number: 13

Production Risk and Technical Efficiency of Fish Farms in Ghana

Edward Ebo Onumah¹ (presenting), Justina Adwoa Onumah²

1. University of Ghana, Accra, Greater Accra, Ghana

2. CSIR-Science and Technology Policy Research Institute, Accra, Greater Accra, Ghana

This study adopts the stochastic frontier model with flexible risk properties to analyze production risk, technical efficiency and its determinants of fish farms in four regions of Ghana including Greater Accra, Eastern, Western and Ashanti Regions. The study employs a two year panel data of 480 farms making a total of 960 observations through a random selection. The findings demonstrate that the translog model is best fit for the mean output function, whilst the input variables: hired labour, family labour, fingerlings, feed and other cost are identified to positively influence fish farm output at an increasing returns to scale. The study also finds that feed and other cost are risk increasing inputs, whilst hired labour, family labour and fingerlings are identified to be risk decreasing inputs. The estimated average technical efficiency score of 0.76 shows that the efficiency score is compromised when the production technology is modeled without the flexible risk property. Additionally, the study finds that age, experience, land, gender, pond type and fish farming education significantly influence technical efficiency of farmers. Specifically, it is observed that technical efficiency improved over time. The study concludes that on the average, 24% of potential output is lost due to technical inefficiency and production risk and given the present state of technology and input level, the possibility of enhancing production can be achieved by reducing technical inefficiency by 24% through adoption of practices of the best fish farm.

Key words: Stochastic frontier model, flexible risk property, productivity, panel data

Session number: 4.5

Paper number: 340

The Use of Hierarchy Process, Cost Benefit Analysis and Goal Programming to Evaluate Profitability and Sustainability of Aquaculture: The Case of Tilapia Farming in Jamaica.

Curtis Jolly¹, **Carel Ligeon² (presenting)**, Nathanael Hishamunda³, Vincent Wright⁴

1. Auburn University, Auburn, Alabama, United States

2. Auburn University, Montgomery, Montgomery, Alabama, United States

3. FAO, Rome, Rome, Italy

4. Northern Caribbean University, Savalamar, Mandeville, Jamaica

Jamaica has attained the highest aquaculture growth rate in Central America and the Caribbean from 1995 to 2010. Aquaculture production supplies almost half of total fish consumed in the country. However, fish production development has encountered severe problems that have almost retarded its progress. The Jamaican farmers cite a number of biophysical, socio-economic and market forces that constrain the future growth of the industry. They are eager to understand the effects of these factors on the industry growth. In this study, we use the Analytical Hierarchal Process (AHP), Cost Benefit Analysis (CBA) and Goal Programming (GP) to evaluate how elimination of these constraints may enhance the financial profitability and sustainability of fish farming in Jamaica. AHP results show, in descending order, farmers' stated preferences to enhance aquaculture economic contribution are improvements: In environmental sustainability; Government influence; Marketing and sales; Technological innovation; Social working environment; Industry and trade; and Production. The CBA results show that internal rate of return from a 10.0 acre tilapia production farm within existing conditions is 30.36 percent, but if half of the changes are implemented to satisfy farmers' ordered preference scale, the IRR can increase to 41.18 percent; however, if changes are neglected the IRR drops to 20.57 percent. The GP results show that production and sales are underachieved. To attain production and marketing targets costs increase and environmental conditions deteriorate. When farmers' preferences are not considered in changes to attain production and sales targets, investment capital requirements increase, environmental and working conditions worsen.

Session number: 4.5

Paper number: 47

Productivity Growth in the Shrimp Farming Industry of Bangladesh: A Luenberger Productivity Indicator Approach

Hasneen Jahan¹ (presenting), Tihomir Ancev²

1. Bangladesh Agricultural University, Mymensingh, Mymensingh, Bangladesh

2. The University of Sydney, Sydney, NSW, Australia

Shrimp aquaculture is one of the fastest growing economic activities in the coastal areas of Bangladesh and earns substantial foreign exchange for the country. However, the environmental degradation is a major concern for the sustainable development of this industry. This paper studies the tradeoffs between the economic and environmental performance of shrimp farming in terms of productivity measurement. A directional distance function approach is employed to estimate the Luenberger total factor productivity indicators under the assumptions of weak and strong disposability of undesirable outputs. Based on average farm level data from shrimp farming, this study estimates the productivity change between the year 2000 and 2010 and compares how the different directional vectors and output sets influence the productivity. The Luenberger indicators are further decomposed into efficiency change and technical change components to explain the source of productivity change. The results show that overall the productivity of shrimp farms has decreased in most districts, except Cox's Bazar and Chittagong districts. For most of the farms, the negative productivity growth was driven by the negative technological change. The productivity growth is an indication of sustainable development. Therefore, true productivity growth including economic and environmental performance needs to be considered in developing effective policy measures to attain sustainable development of the shrimp farming industry.

Session number: 4.5

Paper number: 32

Evaluation of Feed Type Choices and Performance of Fish Farming in Akure South Local Government Area of Ondo State, Nigeria

Adewale Isaac Fatuase¹ (presenting), Igbekele Ajibefun², Moses Bobola³

1. Department of Agricultural Technology, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria, Owo, Ondo State, Nigeria

2. Rufus Giwa Polytechnic, Owo, Owo, Ondo, Nigeria

3. Federal University of Technology, Akure, Akure, Ondo, Nigeria

The long desired self-sufficiency in national and grass-root fish production is momentous to food security in Nigeria. The nature and patterns of feed utilization among fish farming households will provide a strategy to raise demand for local feeds thereby raising national feed production vis-à-vis reducing Nigeria's import dependency on feeds. The study investigated the feed choices and performance of fish farmers in Akure South Local Government Area of Ondo State, Nigeria. A random sampling of 120 fish farmers was taken and subjected to profitability and multinomial logit model analyses. The findings revealed that majority of the respondents (57.50%) cultured juvenile seed while 55.83% used only earthen pond. The gross margin and net farm income were ₦686,808.36 and ₦546,790.15 respectively. The result of the expense structure ratio (ESR) showed that 50% of the total cost of fish production was made up of fixed cost items. Benefit cost ratio (2.30) and rate of return (1.30) indicated that fish farming was a profitable venture in the study area. Results of multinomial logit model revealed that the major factors that significantly influenced fish farmer's preferences for either a combination of imported and local feeds or the imported feed only to the local feed were educational status, fish price, experience, cost of feed, household income, numbers of pond and household size. The study concluded that massive awareness on the benefit of locally made feed as a viable alternative to the popular imported feed should be encouraged.

Session number: 4.6

Paper number: 135

Economics of Fish Harvesting in Nigeria: A Case Study of Yola North Local Government Area of Adamawa State

Elizabeth Adebayo¹ (Presenting), Sarah Anyanwu², Nelson Ikenwachukwu³, Lucky Onyia³

1. Modibbo Adama University of Technology, Yola, Nigeria, Yola, Adamawa, Nigeria

2. University Of Abuja, Nigeria, Abuja, Fct, Nigeria

3. Modibbo Adama University of Technology, Yola, Yola, Adamawa, Nigeria

Fish production is a source of livelihood for millions of Nigerians both as primary and secondary income provider. The study examined the economics of fish harvesting in Yola, Nigeria with the objectives of examining the socioeconomic status of the fishers, determining the gross margin of fish harvesting, examining the variable influencing fish harvesting and identifying the constraints to fish harvesting in the study area. Primary data were collected from 40 randomly selected fishers. The data were subjected to descriptive statistics, gross margin and multiple regression analyses. Majority (67.5%) of the fishers are below the age of 30 with 45% having at least 3 years experience in the job. The result shows that the venture is profitable with the average Gross Margin of N27, 434.38 (\$171.46) per month. The result of the regression model revealed that labour input, age of the fishers and the cost of fishing gear are the major determinants of the fish harvesting in the study area. The major constraints to fish harvesting include; high cost of fishing gear, lack of capital and uncertainties associated with the venture. It is recommended that inputs such as fishing gears, trap feeds should be made available and at subsidized prices.

Session number: 4.6

Paper number: 59

Estimation of Inland Fish Production in North-East India: Current Status and Future Challenges

Piyashi DebRoy¹ (presenting), Krishnan M.¹, Ramasubramanian V², Keith Criddle³, Tesfom Melake Araya¹

1. Central Institute of Fisheries Education, Mumbai, Maharashtra, India

2. Central Institute Of Fisheries Education, Mumbai, India, Mumbai, MAHARASHTRA, India

3. University of Alaska Fairbanks, Juneau, Alaska, United States

The study attempts to assess the growth and instability of fish production in the eight North-East (N-E) states of India comprising Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, which contributes only 5.9 % to total fish production in the country. Fish production statistics of North Eastern Development Finance Corporation Limited during years 1999-2000 to 2010-2011 were used to estimate trends, Compound Growth Rate (CGR), Coppock's Instability Index (CII), based on values obtained using Exponential Smoothing and ARIMA methods for each of the eight states and also for all states taken together. The total fish production in N-E states of India increased from 219,000 tonnes to 313,000 tonnes during the study period, and is forecasted with Brown model to be 406,000 tonnes in 2015-2016. Data exploration revealed flaws in the data collection and compilation. Polynomial trend models gave the best fit to data in most of the states. CGR and CII showed Tripura with high growth and high instability; Mizoram with low growth and low instability; and other states with high instability and low growth, which

beliefs expectations vis-à-vis the potentiality of the available resources. The challenges are strengthening of the required database, accessibility, publication of monthly and species-wise fisheries statistics, adoption and/or reorienting of data collection methodology developed by the Central Inland Fisheries Research Institute, Barrackpore, India in the N-E states, reducing instability and enhancing sustainable growth in the fish production.

Session number: 4.6

Paper number: 79

Value of the Queensland Freshwater Fishery

Ken Smith¹ (presenting), George Antony

1. Department of Agriculture Fisheries and Forestry, Brisbane, Queensland, Australia

A Regulatory Impact Statement (RIS) for management options in Queensland freshwater fisheries required the valuation of the major use, recreational fishing.

A RIS involves analysis of the broader impacts of new regulatory options, including an appropriate cost benefit analysis that demonstrates that the preferred option is the one that generates the greatest public benefit. As per the Queensland Government's guidelines for preparing RISs, the costs and benefits of all options were assessed against the baseline position of the current level of regulation or status quo position.

The analysis faced the usual problem of valuing recreational benefits in that most of these are of the non-market type. Some non-market values could be obtained from recent studies. These were complemented with a novel valuation of health impacts via the combination of disparate sources of information. Even conservatively assessed, health benefits boost the value of recreational fishing very significantly.

Session number: 4.6

Paper number: 98

Weighting and Imputation for Missing Data in a Cost and Earnings Survey of Alaska Charter Fishing Businesses

Daniel Lew¹ (presenting), Amber Himes-Cornell², Jean Lee³

1. NOAA Fisheries, Alaska Fisheries Science Center, Davis, CA, United States

2. NOAA Fisheries - Alaska Fisheries Science Center, Seattle, WA, United States

3. Pacific States Marine Fisheries Commission, Seattle, WA, United States

Surveys of fishery participants are often voluntary, and as a result, commonly have missing data associated with them. There are two types of missing data generally of concern—unit non-response and item non-response. Unit non-response occurs when a potential respondent does not complete and return a survey, resulting in a missing respondent from those who had been contacted to participate in the survey. Item non-response occurs in returned surveys when an individual question is unanswered. Both types of missing data may lead to issues with extrapolating results to the population. Numerous approaches have been developed to address both types of missing data, and two of the principal ones, weighting and data imputation, are discussed in this paper. We discuss adjusting data for estimating population estimates from surveys and illustrate the effects of weighting and different data imputation approaches on estimates of costs and earnings in the Alaska charter boat sector using data from a 2012 survey. Both weighted and unweighted estimates are calculated for data with and

without imputed data. Simple imputation methods, in addition to several hot deck imputation methods, are utilized, and a jackknife resampling approach is used to generate standard errors. The results suggest ignoring missing data will lead to markedly different results than those estimated when controlling for the missing data.

Session number: 4.6

Paper number: 135

Economics of Fish Harvesting in Nigeria: A Case Study of Yola North Local Government Area of Adamawa State

Elizabeth Adebayo¹ (Presenting), Sarah Anyanwu², Nelson Ikenwachukwu³, Lucky Onyia³

1. Modibbo Adama University of Technology, Yola, Nigeria, Yola, Adamawa, Nigeria

2. University Of Abuja, Nigeria, Abuja, Fct, Nigeria

3. Modibbo Adama University of Technology, Yola, Yola, Adamawa, Nigeria

Fish production is a source of livelihood for millions of Nigerians both as primary and secondary income provider. The study examined the economics of fish harvesting in Yola, Nigeria with the objectives of examining the socioeconomic status of the fishers, determining the gross margin of fish harvesting, examining the variable influencing fish harvesting and identifying the constraints to fish harvesting in the study area. Primary data were collected from 40 randomly selected fishers. The data were subjected to descriptive statistics, gross margin and multiple regression analyses. Majority (67.5%) of the fishers are below the age of 30 with 45% having at least 3 years experience in the job. The result shows that the venture is profitable with the average Gross Margin of N27, 434.38 (\$171.46) per month. The result of the regression model revealed that labour input, age of the fishers and the cost of fishing gear are the major determinants of the fish harvesting in the study area. The major constraints to fish harvesting include; high cost of fishing gear, lack of capital and uncertainties associated with the venture. It is recommended that inputs such as fishing gears, trap feeds should be made available and at subsidized prices.

Session number: 4.6

Paper number: 59

Estimation of Inland Fish Production in North-East India: Current Status and Future Challenges

Piyashi DebRoy¹ (presenting), Krishnan M.¹, Ramasubramanian V², Keith Criddle³, Tesfom Melake Araya¹

1. Central Institute of Fisheries Education, Mumbai, Maharashtra, India

2. Central Institute Of Fisheries Education, Mumbai, India, Mumbai, MAHARASHTRA, India

3. University of Alaska Fairbanks, Juneau, Alaska, United States

The study attempts to assess the growth and instability of fish production in the eight North-East (N-E) states of India comprising Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, which contributes only 5.9 % to total fish production in the country. Fish production statistics of North Eastern Development Finance Corporation Limited during years 1999-2000 to 2010-2011 were used to estimate trends, Compound Growth Rate (CGR), Coppock's Instability Index (CII), based on values obtained using Exponential Smoothing and ARIMA methods for each of the eight states and also for all states taken together. The total fish production in N-E states of India increased from 219,000 tonnes to 313,000 tonnes during the study period, and is forecasted with Brown model to be 406,000 tonnes in 2015-2016. Data exploration revealed flaws in the data collection and compilation. Polynomial trend models gave the best fit to data in most of the states. CGR and CII showed Tripura with high growth and high instability; Mizoram with low growth and low instability; and other states with high instability and low growth, which belies expectations vis-à-vis the potentiality of the available resources. The challenges are strengthening of the required database, accessibility, publication of monthly and species-wise fisheries statistics, adoption and/or reorienting of data collection methodology developed by the Central Inland Fisheries Research Institute, Barrackpore, India in the N-E states, reducing instability and enhancing sustainable growth in the fish production.

Session number: 4.6

Paper number: 79

Value of the Queensland Freshwater Fishery

Ken Smith¹ (presenting), George Antony

1. Department of Agriculture Fisheries and Forestry, Brisbane, Queensland, Australia

A Regulatory Impact Statement (RIS) for management options in Queensland freshwater fisheries required the valuation of the major use, recreational fishing.

A RIS involves analysis of the broader impacts of new regulatory options, including an appropriate cost benefit analysis that demonstrates that the preferred option is the one that generates the greatest public benefit. As per the Queensland Government's guidelines for preparing RISs, the costs and benefits of all options were assessed against the baseline position of the current level of regulation or status quo position.

The analysis faced the usual problem of valuing recreational benefits in that most of these are of the non-market type. Some non-market values could be obtained from recent studies. These were complemented with a novel valuation of health impacts via the combination of disparate sources of information. Even conservatively assessed, health benefits boost the value of recreational fishing very significantly.

Session number: 4.6

Paper number: 98

Weighting and Imputation for Missing Data in a Cost and Earnings Survey of Alaska Charter Fishing Businesses

Daniel Lew¹ (presenting), Amber Himes-Cornell², Jean Lee³

1. NOAA Fisheries, Alaska Fisheries Science Center, Davis, CA, United States

2. NOAA Fisheries - Alaska Fisheries Science Center, Seattle, WA, United States

3. Pacific States Marine Fisheries Commission, Seattle, WA, United States

Surveys of fishery participants are often voluntary, and as a result, commonly have missing data associated with them. There are two types of missing data generally of concern—unit non-response and item non-response. Unit non-response occurs when a potential respondent does not complete and return a survey, resulting in a missing respondent from those who had been contacted to participate in the survey. Item non-response occurs in returned surveys when an individual question is unanswered. Both types of missing data may lead to issues with extrapolating results to the population. Numerous approaches have been developed to address both types of missing data, and two of the principal ones, weighting and data imputation, are discussed in this paper. We discuss adjusting data for estimating population estimates from surveys and illustrate the effects of weighting and different data imputation approaches on estimates of costs and earnings in the Alaska charter boat sector using data from a 2012 survey. Both weighted and unweighted estimates are calculated for data with and without imputed data. Simple imputation methods, in addition to several hot deck imputation methods, are utilized, and a jackknife resampling approach is used to generate standard errors. The results suggest ignoring missing data will lead to markedly different results than those estimated when controlling for the missing data.

Session number: 4.7

Paper number: 215

Small pelagic fish market in the south of Sicily: socioeconomic linkages between catch volume and local consumption

Bernardo Patti¹ (presenting), Carmen Pedroza², Ignazio Piazza¹, Salvatore Mazzola¹

1. CNR-IAMC, Campobello di Mazara, Trapani, Italy

2. UNAM, Jiquilpan, Michoacan, Mexico

Along the southern Sicilian coast (Central Mediterranean Sea), Sciacca harbor is the most important landing port for small pelagic fish species (mainly anchovies and sardines). This landing side accounts for about 2/3 of total catch in GFCM-FAO Geographical Sub-Area 16 (South of Sicily), where two operational units (OU) are presently active: purse seiners and pelagic pair trawlers. The GSA16 fleet is composed from about 50 units (17 purse seiners and 30 pelagic pair trawlers counted in December 2006). In both OUs, anchovy represents the main target species due to the higher market price.

This study analyzes the links between anchovy landings by pelagic pair trawlers and their market price from daily catch/price data collected in Sciacca harbor throughout the period 1999-2013.

Both time series show a seasonal signal (more evident in landings series) most probably linked to the ecology of the species (which spawns in coastal areas from March to September); and significant trends, increasing for landings and decreasing for prices. The relationship between landings and prices suggests the presence of elasticity for prices, most marked during the Summer and the Autumn. In spite that small pelagic fishes are quite appreciated for direct fresh consumption, landings are always totally absorbed by local transformation (canning) companies' high demand. Local consumption of fresh fish is low, because small pelagic fish are considered "poor" when compared to the wide fish variety in Sciacca market.

Session number: 4.7

Paper number: 338

Water Poverty: Water Poverty Index (WPI) for Culture-Based Fish Farming Communities in Village Irrigation System of Sri Lanka

Mohottala Gedara Kularatne¹ (presenting), Upali Sarath Amarasinghe¹, Sena De Silva

1. University of Kelaniya, Kelaniya, Western, Sri Lanka

Irrigation provides production, income, consumption, employment, food security and other social improvements. The primary focus of Water Poverty Index (WPI) is on poor people who suffer the most from inadequate access to water. The main objective of this paper is to analyse to what extent physical, social, economic and environmental factors associate with water scarcity, access to water and ability to use water for productive culture-based fisheries (CBF) activities among the agricultural farming communities in village irrigation systems (VISs) in Sri Lanka. The paper undertakes an estimating WPI of 23 successfully harvested and 13 non-harvested fish farming communities in five administrative districts of Sri Lanka.

Capacity of water resources used are comparatively high (15.3) in the national level but it is much lower in harvested and non-harvested fish farming communities (8.8 and 7.9

respectively) in VISs. WPI for communities who have fully harvested their fish catch in VISs is 61.3. WPI value of the fully harvested communities is higher than the national average (56.2) in Sri Lanka. It is a noticeable factor that national figure of WPI and the WPI for non-harvested communities have almost similar values. The analysis shows that fully harvested communities have significant impact of use of reservoir water on their economics activities. In conclusion, capacity of water use is a main constraint to the development of CBF activities in VISs. Therefore, it is recommended that capacity of water use must be enhanced through the improvement of the social capital of agricultural farming communities.

Keywords: Culture-based fishery, Water Poverty Index, Village Irrigation Systems

Session number: 4.7

Paper number: 448

**Evaluating Changes in Total Factor Productivity in the Amendment 80
Catcher/Processor Fishery**

Benjamin Fissel, NOAA, Seattle, WA, United States

Amendment 80 of the Bering & Sea Aleutian Island Groundfish Fisheries Management Plan instituted groundfish retention standards (GRS) with the goal of reducing discards, which had been historically high for a particular fleet. The GRS continue to be a subject of regulatory attention as recent discard levels are markedly below the GRS targets. Coincident with the implementation of the GRS an economic cost-data collection program was established which will enable us to estimate the impact of these regulatory changes on the Amendment 80 fleet. Using the aggregate-quantity-price index framework of O'Donnell (2012a, 2012b) this paper explores the relationships among technologies, regulations and behavior as well as develops empirical estimates of the effects of groundfish retention standards on net revenues, productivity, and efficiency in the Amendment 80 fishery.

Session number: 4.7

Paper number: 215

Small pelagic fish market in the south of Sicily: socioeconomic linkages between catch volume and local consumption

Bernardo Patti¹ (presenting), Carmen Pedroza², Ignazio Piazza¹, Salvatore Mazzola¹

1. CNR-IAMC, Campobello di Mazara, Trapani, Italy

2. UNAM, Jiquilpan, Michoacan, Mexico

Along the southern Sicilian coast (Central Mediterranean Sea), Sciacca harbor is the most important landing port for small pelagic fish species (mainly anchovies and sardines). This landing side accounts for about 2/3 of total catch in GFCM-FAO Geographical Sub-Area 16 (South of Sicily), where two operational units (OU) are presently active: purse seiners and pelagic pair trawlers. The GSA16 fleet is composed from about 50 units (17 purse seiners and 30 pelagic pair trawlers counted in December 2006). In both OUs, anchovy represents the main target species due to the higher market price.

This study analyzes the links between anchovy landings by pelagic pair trawlers and their market price from daily catch/price data collected in Sciacca harbor throughout the period 1999-2013.

Both time series show a seasonal signal (more evident in landings series) most probably linked to the ecology of the species (which spawns in coastal areas from March to September); and significant trends, increasing for landings and decreasing for prices. The relationship between landings and prices suggests the presence of elasticity for prices, most marked during the Summer and the Autumn. In spite that small pelagic fishes are quite appreciated for direct fresh consumption, landings are always totally absorbed by local transformation (canning) companies' high demand. Local consumption of fresh fish is low, because small pelagic fish are considered "poor" when compared to the wide fish variety in Sciacca market.

Session number: 4.7

Paper number: 338

Water Poverty: Water Poverty Index (WPI) for Culture-Based Fish Farming Communities in Village Irrigation System of Sri Lanka

Mohottala Gedara Kularatne¹ (presenting), Upali Sarath Amarasinghe¹, Sena De Silva
1. University of Kelaniya, Kelaniya, Western, Sri Lanka

Irrigation provides production, income, consumption, employment, food security and other social improvements. The primary focus of Water Poverty Index (WPI) is on poor people who suffer the most from inadequate access to water. The main objective of this paper is to analyse to what extent physical, social, economic and environmental factors associate with water scarcity, access to water and ability to use water for productive culture-based fisheries (CBF) activities among the agricultural farming communities in village irrigation systems (VISs) in Sri Lanka. The paper undertakes an estimating WPI of 23 successfully harvested and 13 non-harvested fish farming communities in five administrative districts of Sri Lanka.

Capacity of water resources used are comparatively high (15.3) in the national level but it is much lower in harvested and non-harvested fish farming communities (8.8 and 7.9 respectively) in VISs. WPI for communities who have fully harvested their fish catch in VISs is 61.3. WPI value of the fully harvested communities is higher than the national average (56.2) in Sri Lanka. It is a noticeable factor that national figure of WPI and the WPI for non-harvested communities have almost similar values. The analysis shows that fully harvested communities have significant impact of use of reservoir water on their economics activities. In conclusion, capacity of water use is a main constraint to the development of CBF activities in VISs. Therefore, it is recommended that capacity of water use must be enhanced through the improvement of the social capital of agricultural farming communities.

Keywords: Culture-based fishery, Water Poverty Index, Village Irrigation Systems

Session number: 4.7

Paper number: 448

**Evaluating Changes in Total Factor Productivity in the Amendment 80
Catcher/Processor Fishery**

Benjamin Fissel, NOAA, Seattle, WA, United States

Amendment 80 of the Bering & Sea Aleutian Island Groundfish Fisheries Management Plan instituted groundfish retention standards (GRS) with the goal of reducing discards, which had been historically high for a particular fleet. The GRS continue to be a subject of regulatory attention as recent discard levels are markedly below the GRS targets. Coincident with the implementation of the GRS an economic cost-data collection program was established which will enable us to estimate the impact of these regulatory changes on the Amendment 80 fleet. Using the aggregate-quantity-price index framework of O'Donnell (2012a, 2012b) this paper explores the relationships among technologies, regulations and behavior as well as develops empirical estimates of the effects of groundfish retention standards on net revenues, productivity, and efficiency in the Amendment 80 fishery.

Session number: 5.1

Paper number: 101

Export Performance of Indian Shrimp to European Union under proposed Free Trade Agreement: An Ex-ante Assessment

Prathvi Rani¹ (presenting), Nalini Ranjan Kumar¹

1. Central Institute of Fisheries Education, Andheri west, Maharashtra, India

Shrimp is one of the largest traded commodities in the world and account for about 50 percent of total export of marine products (3.5 billion US \$) from India in value term during 2012-13. The European Union (EU) is the second largest buyer of Indian marine products with a share of 22% in value term during 2012-13. An attempt has been made to analyse the performance of Indian shrimp exports to the EU and the likely impact of the proposed Free Trade Agreement (FTA) between India and EU. The study is based on data collected from UN COMTRADE statistical database of UN and The World Integrated Trade Solutions (WITS) of World Bank pertaining to 2000-2012. To analyse the performance of Indian shrimp exports, share and trade intensity index were calculated. SMART model (an application of partial equilibrium model) was used to assess the likely impact of FTA. The study revealed that Indian shrimp exports to EU has reached the all- time high of 0.4 billion USD in 2011. The trade intensity index of 4.12 showed India's trade of Shrimp and prawn were four times more intense with EU compared to other trading destinations. SMART model simulations revealed that in case EU imposes a tariff of 5.92 percent, Indian shrimp exports will gain 65.40 million USD with 30.80 million USD trade creation effect and 34.60 million USD of diversification effect. In case of zero tariff, Indian shrimp exports will gain 0.12 billion USD with trade creation and diversification effect of 0.05 and 0.063 billion USD respectively. Under post-FTA situation, India will gain more share of EU import of Shrimp at the same time Ecuador and Argentina will lose the most. Though EU will lose huge amount of tariff revenue from India under FTA, the loss (1.3 million USD at 5.92% tariff and 2.2 million USD at no tariff), will be compensated by equally huge gain of consumer surplus in European Union.

Session number: 5.1

Paper number: 22

Income distribution and inequality among fishers and fish traders in two small-scale Kenyan coral reef fisheries

Andrew Wamukota¹ (presenting), Tom Brewer², Beatrice Crona³

1. Linnaeus University, Mombasa, Coast, Kenya

2. Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Townsville, Australia

3. Stockholm Resilience Center, Stockholm University, Stockholm, Stockholm, Sweden

Since the mid-1960s fish production has become increasingly market-driven with actors downstream in the commodity chain increasingly determining the price of fish. Previously, it has been shown that fishers' incomes tend to be low in both developed and developing countries and that linking fisheries to global markets causes income inequalities. Research has also shown that although many factors affect the sustainability of any individual fishery, income inequality and the struggle for food security are significant contributors, particularly in developing countries. Despite awareness of the link between poverty and resource exploitation, the distribution of benefits derived from fish trade remains poorly understood.

This study, carried out in five small-scale coral reef fishing communities along the Kenyan coast, sought to explore this link and in so doing found that both fishers and traders engaged in a more globally integrated fishery received higher incomes. There was no evidence that greater global market integration causes higher income inequalities within a fishery, an indication that linking local fisheries to global markets has potential positive income effects. We recommend disaggregated analyses in future studies of fishery income distribution in order to properly inform interventions within the context of specific fishery resource and respective market characteristics.

Session number: 5.1

Paper number: 28

The Influence of Economic Globalization to the Consumption Demand of Fish and Fishery Products of Chinese Residents

Sun Chen, Shanghai, China

With the economic globalization, the consumption demand of Chinese residents has changed gradually. The paper analyzes consumption tendency of Chinese residents from two aspects, those are per capita consumption level and consumption characteristics. On the one side, per capita ownership of fish and fishery products of China is above the world average level, whereas per capita consumption of that is not high. In 2011, per capita household consumption of urban and rural residents is 14.62 kg and 5.36 kg respectively. Meanwhile, there evidence obvious gap between urban residents and rural residents and among different regions. On the other side, under the condition of economic globalization, with the growing of per capita income, the increment of population size, the improvement of urbanization, the enlargement of aging population and the change of consumption custom and preference, the per capita consumption level of Chinese will undoubtedly rise year by year. In the end of the paper, with the help of Gray Model (1.1), the forecast of resident consumption demand of fish and fishery products of China from 2013 to 2022 is given.

Session number: 5.1

Paper number: 92

Effects of Non-Tariff Barriers on Brazilian Fisheries Exports to Europe

Manoel Pedroza¹ (presenting), Roberto M. V. Flores¹, Renata Barroso²

1. Embrapa Fisheries and Aquaculture (Brazilian Agricultural Research Corporation), Palmas, Tocantins, Brazil

2. Embrapa, Palmas, TO, Brazil

Non-tariff barriers (NTBs) affect particularly developing countries because of their market dependence on developed countries. Given the recent development of the Brazilian aquaculture, the analysis of the NTBs is critical face to its internationalization process. This article aims to analyze the impacts of NTBs implemented by EU to the Brazilian seafood exportations.

The inventory-based approach was chosen with regard to their best capacity in estimating NTBs effects. Annual series of export values, between 1990 and 2010, were analyzed in order to identify the NTBs effects. The five more important groups of seafood exported were analyzed. The unit root test chose was the augmented Dickey–Fuller test (ADF).

The analysis shows that the five series are no stationary, even at a significance level of 10%. Only the series of crustaceans is no stationary at a significance level of 5%. For crustaceans it is still necessary to differentiate one more time to find the correct order of series integration. Results show that only the fresh fish item has presented significant impact of NTB at a significance level of 10%. For the other four products the p -value shows that null hypothesis that the effects are different from zero cannot be rejected.

Session number: 5.1

Paper number: 101

Export Performance of Indian Shrimp to European Union under proposed Free Trade Agreement: An Ex-ante Assessment

Prathvi Rani¹ (presenting), Nalini Ranjan Kumar¹

1. Central Institute of Fisheries Education, Andheri west, Maharashtra, India

Shrimp is one of the largest traded commodities in the world and account for about 50 percent of total export of marine products (3.5 billion US \$) from India in value term during 2012-13. The European Union (EU) is the second largest buyer of Indian marine products with a share of 22% in value term during 2012-13. An attempt has been made to analyse the performance of Indian shrimp exports to the EU and the likely impact of the proposed Free Trade Agreement (FTA) between India and EU. The study is based on data collected from UN COMTRADE statistical database of UN and The World Integrated Trade Solutions (WITS) of World Bank pertaining to 2000-2012. To analyse the performance of Indian shrimp exports, share and trade intensity index were calculated. SMART model (an application of partial equilibrium model) was used to assess the likely impact of FTA. The study revealed that Indian shrimp exports to EU has reached the all- time high of 0.4 billion USD in 2011. The trade intensity index of 4.12 showed India's trade of Shrimp and prawn were four times more intense with EU compared to other trading destinations. SMART model simulations revealed that in case EU imposes a tariff of 5.92 percent, Indian shrimp exports will gain 65.40 million USD with 30.80 million USD trade creation effect and 34.60 million USD of diversification effect. In case of zero tariff, Indian shrimp exports will gain 0.12 billion USD with trade creation and diversification effect of 0.05 and 0.063 billion USD respectively. Under post-FTA situation, India will gain more share of EU import of Shrimp at the same time Ecuador and Argentina will lose the most. Though EU will lose huge amount of tariff revenue from India under FTA, the loss (1.3 million USD at 5.92% tariff and 2.2 million USD at no tariff), will be compensated by equally huge gain of consumer surplus in European Union.

Session number: 5.1

Paper number: 22

Income distribution and inequality among fishers and fish traders in two small-scale Kenyan coral reef fisheries

Andrew Wamukota¹ (presenting), Tom Brewer², Beatrice Crona³

1. Linnaeus University, Mombasa, Coast, Kenya

2. Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Townsville, Australia

3. Stockholm Resilience Center, Stockholm University, Stockholm, Stockholm, Sweden

Since the mid-1960s fish production has become increasingly market-driven with actors downstream in the commodity chain increasingly determining the price of fish. Previously, it has been shown that fishers' incomes tend to be low in both developed and developing countries and that linking fisheries to global markets causes income inequalities. Research has also shown that although many factors affect the sustainability of any individual fishery, income inequality and the struggle for food security are significant contributors, particularly in developing countries. Despite awareness of the link between poverty and resource exploitation, the distribution of benefits derived from fish trade remains poorly understood. This study, carried out in five small-scale coral reef fishing communities along the Kenyan coast, sought to explore this link and in so doing found that both fishers and traders engaged in a more globally integrated fishery received higher incomes. There was no evidence that greater global market integration causes higher income inequalities within a fishery, an indication that linking local fisheries to global markets has potential positive income effects. We recommend disaggregated analyses in future studies of fishery income distribution in order to properly inform interventions within the context of specific fishery resource and respective market characteristics.

Session number: 5.1

Paper number: 28

The Influence of Economic Globalization to the Consumption Demand of Fish and Fishery Products of Chinese Residents

Sun Chen, Shanghai, China

With the economic globalization, the consumption demand of Chinese residents has changed gradually. The paper analyzes consumption tendency of Chinese residents from two aspects, those are per capital consumption level and consumption characteristics. On the one side, per capita ownership of fish and fishery products of China is above the world average level, whereas per capita consumption of that is not high. In 2011, per capita household consumption of urban and rural residents is 14.62 kg and 5.36 kg respectively. Meanwhile, there evidence obvious gap between urban residents and rural residents and among different regions. On the other side, under the condition of economic globalization, with the growing of per capita income, the increment of population size, the improvement of urbanization, the enlargement of aging population and the change of consumption custom and preference, the per capita consumption level of Chinese will undoubtedly rise year by year. In the end of the paper, with the help of Gray Model (1.1), the forecast of resident consumption demand of fish and fishery products of China from 2013 to 2022 is given.

Session number: 5.1

Paper number: 92

Effects of Non-Tariff Barriers on Brazilian Fisheries Exports to Europe

Manoel Pedroza¹ (presenting), Roberto M. V. Flores¹, Renata Barroso²

1. Embrapa Fisheries and Aquaculture (Brazilian Agricultural Research Corporation),
Palmas, Tocantins, Brazil

2. Embrapa, Palmas, TO, Brazil

Non-tariff barriers (NTBs) affect particularly developing countries because of their market dependence on developed countries. Given the recent development of the Brazilian aquaculture, the analysis of the NTBs is critical face to its internationalization process. This article aims to analyze the impacts of NTBs implemented by EU to the Brazilian seafood exportations.

The inventory-based approach was chosen with regard to their best capacity in estimating NTBs effects. Annual series of export values, between 1990 and 2010, were analyzed in order to identify the NTBs effects. The five more important groups of seafood exported were analyzed. The unit root test chose was the augmented Dickey–Fuller test (ADF).

The analysis shows that the five series are no stationary, even at a significance level of 10%. Only the series of crustaceans is no stationary at a significance level of 5%. For crustaceans it is still necessary to differentiate one more time to find the correct order of series integration. Results show that only the fresh fish item has presented significant impact of NTB at a significance level of 10%. For the other four products the p -value shows that null hypothesis that the effects are different from zero cannot be rejected.

Session number: 5.2

Paper number: 124

Livelihood Vulnerability Assessment of Climate Change at Community Level Using Household Survey: A Case Study of Coastal Communities in Rang Dong Town, Nghia Hung District, Nam Dinh Province, Vietnam

Thanh Viet Nguyen, VNU University of Economics and Business, Hanoi, Hanoi, Viet Nam

Vietnam ranked at 6th on the list of the global rankings of Climate Risk Index (CRI) for the period 1991 to 2010. The damage caused by extreme weather events such as storms, floods for coastal communities in Vietnam significantly increases each year. Objective of this study is to investigate climate change adaptation strategies for the livelihoods of coastal communities in Rang Dong town, Nghia Hung district, Nam Dinh province, Vietnam. Sustainable Livelihood Framework of DIFID is used to analyse livelihoods of coastal residents. Livelihood assets including financial, physical, human and natural capital are considered as adaptation strategies for coastal communities. Interviews were conducted with 79 households in Rang Dong town focusing on drawbacks of livelihood assets. The results indicate that livelihood assets do not have much adaptability to climate change. Financial, physical and human capital still showed much weakness and awareness of residents about climate change was not real profound. Natural capital has been being reduced by the impact of climate change. An assessment on household's adaptation revealed that respondents have not made any measures to reduce the impacts of climate change causing for the health, water and actions of livelihoods. On that basis, the research provides some recommendations, which are made for policy makers to improve the ability to cope of coastal residents to the effects of climate change.

Session number: 5.2

Paper number: 375

The Effect of Extreme Events on the Local Fisher Communities Risk Perception on Climate Change and Willingness for Implementing Adaptation Measures.

Urs Steiner Brandt (presenting), Dewan Ali Ahsan

1. Embrapa Fisheries and Aquaculture (Brazilian Agricultural Research Corporation), Palmas, Tocantins, Brazil
2. Embrapa, Palmas, TO, Brazil

This study seeks to investigate the questions of how do local fish communities in developing cope with extreme events caused by climate change and whether extreme event trigger political reaction (on adaptation issues national and internationally). The aim of the study is to provide insight into how perceived climate change risk is translated into adaptation action and how is the prospect for fish communities facing potential more risks from climate change events in the future.

We conducting survey studies to elucidate the local perceived risk of climate change and take the case of Bangladesh shrimp fishers and compare these experienced severe storm / flooding's and those not. And specifically focus on the severe cyclone Aila that hit Bangladesh in 2009. Do those experienced such event higher perceived risk of climate change and if so, will they take adaptation actions?

Our preliminary studies suggest that those affected have a clearer perception of the cases of

climate change, but have little means to adapt to changes. A full scale study will we done in spring 2014. On the positive side, extreme events are likely to trigger international response like the Bangladesh Climate Change Resilience Fund set-up in 2010.

Session number: 5.2

Paper number: 197

Vulnerability assessments in fisheries social-ecological systems: some experiences in their development and implementation for adaptation planning

Cassandra Young¹ (presenting), Cecile Brugere²

1. UN FAO, Rome, Rome, Italy

2. SEI, Heslington, York, United Kingdom

Vulnerability assessments play an important role in the climate change adaptation process in that they link physical changes (either current or projected) with the ability of aquatic and human systems to cope or benefit from such change. In general, a vulnerability assessment helps to target adaptation actions by better understanding who are the vulnerable people/species and how their vulnerability can be reduced, where the vulnerable ecosystems are and whether resource management can improve their capacity to adapt, where the economic consequences of vulnerability of fishery systems will be felt most and how we can plan to minimize those consequences and where climate change will create new opportunities and bring benefits and, importantly, for whom. This talk will provide a brief introduction to vulnerability schools of thought and some examples of how vulnerability assessments have been applied within fisheries and aquaculture systems.

Session number: 5.2

Paper number: 451

The Effects of Climate Change, it's Adaptation, Vulnerability and Economic Impacts on Fisheries in the World; with Reference to Sierra Leone.

Hoki Massaquoi,

Globally, our earth is warming; the earth's average temperature has risen by 1.4⁰F over the past century, and is projected to rise another 2 to 11.5⁰ F over the next hundred years. Small changes in the average temperature of the planet can translate to large and potentially dangerous shifts in climate and weather. Climate change is now recognized has the greatest environmental and fundamental human development challenge facing the world in the 21st century; especially in aquaculture and freshwater fisheries include: stress due to increased temperature and oxygen demand and decreased pH; water quality and volume; extreme weather events; increased frequency of disease and toxic events; sea-level rise and conflicts of interest with coastal defence needs and the use of new areas due to decreased ice cover.

The economic impacts of climate change at global level, include the Gross revenues from marine capture fisheries worldwide are estimated at between US\$ 80 and 85 billion annually (FAO, 2009); Total impact throughout the global economy is between US\$ 220 and 235 billion in 2003 (Dyck & Sumaila, 2010).

Thus, this changes will likely affect our present society and environment ; with reference to my country Sierra Leone. The Adaptation options thus centre on altering catch size and effort. The scope for autonomous adaptation is increasingly fishery in Sierra Leone: Closed

Seasons, Regulatory Mechanism, Monitoring, Control and Surveillance, Quotas, Education and Research.

Session number: 5.2

Paper number: 124

Livelihood Vulnerability Assessment of Climate Change at Community Level Using Household Survey: A Case Study of Coastal Communities in Rang Dong Town, Nghia Hung District, Nam Dinh Province, Vietnam

Thanh Viet Nguyen, VNU University of Economics and Business, Hanoi, Hanoi, Viet Nam

Vietnam ranked at 6th on the list of the global rankings of Climate Risk Index (CRI) for the period 1991 to 2010. The damage caused by extreme weather events such as storms, floods for coastal communities in Vietnam significantly increases each year. Objective of this study is to investigate climate change adaptation strategies for the livelihoods of coastal communities in Rang Dong town, Nghia Hung district, Nam Dinh province, Vietnam. Sustainable Livelihood Framework of DIFID is used to analyse livelihoods of coastal residents. Livelihood assets including financial, physical, human and natural capital are considered as adaptation strategies for coastal communities. Interviews were conducted with 79 households in Rang Dong town focusing on drawbacks of livelihood assets. The results indicate that livelihood assets do not have much adaptability to climate change. Financial, physical and human capital still showed much weakness and awareness of residents about climate change was not real profound. Natural capital has been being reduced by the impact of climate change. An assessment on household's adaptation revealed that respondents have not made any measures to reduce the impacts of climate change causing for the health, water and actions of livelihoods. On that basis, the research provides some recommendations, which are made for policy makers to improve the ability to cope of coastal residents to the effects of climate change.

Session number: 5.2

Paper number: 375

The Effect of Extreme Events on the Local Fisher Communities Risk Perception on Climate Change and Willingness for Implementing Adaptation Measures.

Urs Steiner Brandt (presenting), Dewan Ali Ahsan

1. Embrapa Fisheries and Aquaculture (Brazilian Agricultural Research Corporation), Palmas, Tocantins, Brazil
2. Embrapa, Palmas, TO, Brazil

This study seeks to investigate the questions of how do local fish communities in developing cope with extreme events caused by climate change and whether extreme event trigger political reaction (on adaptation issues national and internationally). The aim of the study is to provide insight into how perceived climate change risk is translated into adaptation action and how is the prospect for fish communities facing potential more risks from climate change events in the future.

We conducting survey studies to elucidate the local perceived risk of climate change and take the case of Bangladesh shrimp fishers and compare these experienced severe storm / flooding's and those not. And specifically focus on the severe cyclone Aila that hit Bangladesh in 2009. Do those experienced such event higher perceived risk of climate change and if so, will they take adaptation actions?

Our preliminary studies suggest that those affected have a clearer perception of the cases of climate change, but have little means to adapt to changes. A full scale study will we done in spring 2014. On the positive side, extreme events are likely to trigger international response like the Bangladesh Climate Change Resilience Fund set-up in 2010.

Session number: 5.2

Paper number: 197

Vulnerability assessments in fisheries social-ecological systems: some experiences in their development and implementation for adaptation planning

Cassandra Young¹ (presenting), Cecile Brugere²

1. UN FAO, Rome, Rome, Italy

2. SEI, Heslington, York, United Kingdom

Vulnerability assessments play an important role in the climate change adaptation process in that they link physical changes (either current or projected) with the ability of aquatic and human systems to cope or benefit from such change. In general, a vulnerability assessment helps to target adaptation actions by better understanding who are the vulnerable people/species and how their vulnerability can be reduced, where the vulnerable ecosystems are and whether resource management can improve their capacity to adapt, where the economic consequences of vulnerability of fishery systems will be felt most and how we can plan to minimize those consequences and where climate change will create new opportunities and bring benefits and, importantly, for whom. This talk will provide a brief introduction to vulnerability schools of thought and some examples of how vulnerability assessments have been applied within fisheries and aquaculture systems.

Session number: 5.2

Paper number: 451

The Effects of Climate Change, it's Adaptation, Vulnerability and Economic Impacts on Fisheries in the World; with Reference to Sierra Leone.

Hoki Massaquoi,

Globally, our earth is warming; the earth's average temperature has risen by 1.4⁰F over the past century, and is projected to rise another 2 to 11.5⁰ F over the next hundred years. Small changes in the average temperature of the planet can translate to large and potentially dangerous shifts in climate and weather. Climate change is now recognized as the greatest environmental and fundamental human development challenge facing the world in the 21st century; especially in aquaculture and freshwater fisheries include: stress due to increased temperature and oxygen demand and decreased pH; water quality and volume; extreme weather events; increased frequency of disease and toxic events; sea-level rise and conflicts of interest with coastal defence needs and the use of new areas due to decreased ice cover.

The economic impacts of climate change at global level, include the Gross revenues from marine capture fisheries worldwide are estimated at between US\$ 80 and 85 billion annually (FAO, 2009); Total impact throughout the global economy is between US\$ 220 and 235 billion in 2003 (Dyck & Sumaila, 2010).

Thus, these changes will likely affect our present society and environment ; with reference to my country Sierra Leone. The Adaptation options thus centre on altering catch size and effort. The scope for autonomous adaptation is increasingly fishery in Sierra Leone: Closed Seasons, Regulatory Mechanism, Monitoring, Control and Surveillance, Quotas, Education and Research.

Session number: 5.3

Paper number: 378

Key Conditions for the Sustainability of Community-Based Fisheries Management on Unrestricted Fisheries: A Study of Self-Imposed Management in the Alfonsino Fishing Grounds off Katsuura, Japan

Yoshihiro Kuronuma, Otsuma Women's University, Tama-shi, Tokyo, Japan

This paper attempts to elucidate and analyze key conditions for the sustainability of community-based fisheries management (CBFM) on unrestricted fisheries in Japan. It re-examines over fifty years worth of empirical evidence about the natural outcome for socio-economic rationality of the self-imposed management of common property with reference to the Alfonsino (*Beryx splendens*) fishing grounds off Katsuura by the Chiba Prefecture Small-Type Coastal Fishing Vessel Fishery Cooperative (STCC). This observation shows that exclusive use of fishing grounds and other factors, such as a communal solidarity and social milieu to protect the fishing grounds among fishermen, has continuously existed as the necessary conditions to establish sustainable CBFM in unrestricted fisheries of the Alfonsino fishing grounds off Katsuura for over fifty years, and that adjustments of the fishery operations and other matters have also been necessary, based on the establishment of an organization of fishing-ground users. However, one should not overlook the fact that the Alfonsino resource management as a migratory species would be required under different types of fisheries operations in different fishing grounds other than the STCC operation in the fishing grounds off Katsuura. In order to deal with this issue, a co-management system was introduced through the cooperation of the Japanese government, the Chiba prefectural government, and the STCC in recent years. This system includes a resource-management plan together with a fisheries risk-management plan under the fraternal insurance of the fishery. This so-called co-management system, as one type of Japanese adaptive fisheries management systems, would play an important role for sustainable key conditions for CBFM on unrestricted fisheries of self-imposed management in the Alfonsino fishing grounds off Katsuura, Japan.

Session number: 5.3

Paper number: 122

Role of Beach Management Units in Implementing Fisheries Policy. A Case Study of Two BMUs in Lake Victoria, Tanzania

Joseph Luomba, Mwanza, Tanzania

Management of the Lake Victoria fisheries has transformed from centralized to a co-management approach where the government and other stakeholders including Beach Management Units (BMUs) share management responsibilities. In Tanzania, the BMUs were formed in 1990's under the Lake Victoria Environmental Management Project (LVEMP I) and then reformed during the Implementation of a Fisheries Management Plan (IFMP) project carried out from 2005-2010. The change to co-management was as a result of the failure of top down approach in managing the fisheries resources and thus it was assumed that with co-management fisheries management as well as poverty levels will be improved. However, the declining fish stocks and claims of poverty within fisheries communities raises concerns about the impacts of BMUs in implementing fisheries policy.

This paper uses data generated from a case study of two BMUs in Magu and Ilemela districts of Lake Victoria to address these concerns. Findings reveal that BMUs have formulated regulatory measures to manage the fishery but have been ineffective in implementing some of the measures. On the other hand, BMUs have no poverty eradication schemes, lack skills and expertise to tackle the challenges posed by poverty. The inability of the BMUs to tackle these challenges threatens the sustainability of the fisheries given that most riparian communities entirely depend on the resources for their livelihood.

Key words: Lake Victoria, Co-management, BMU, fisheries policy, Tanzania

Session number: 5.3

Paper number: 177

Fishery Buybacks, Efficiency and Participation

Douglas Lipton¹ (presenting), Jorge Holzer, Geret DePiper

1. NOAA Fisheries, Silver Spring, MD, United States

License and vessel buybacks continue to be utilized by fishery managers to achieve reductions in actual and latent fishing effort worldwide. While there is debate about their effectiveness in achieving sustainability, the design of alternative implementing mechanisms has received less attention. When participation is assumed endogenous, the specific features of the mechanism are crucial in shaping incentives, bids and participation. Under costly participation, there is a contrast in how fixed price and reverse auction mechanisms trade off cost effectiveness for participation.

We present the rationale for a novel mechanism that buys items offered at the baseline price until either the budget is exhausted or all the items are acquired. With the latter, items are acquired at a premium price until either the budget is exhausted or all the items offered at the high price are bought back. In either case, when the offers exceed the total budget, the winners are determined using a lottery. The mechanism seeks to encourage participation while capping the amount paid per item.

The fixed price, reverse auction and two-price scheme with lottery are compared in terms of average cost per item acquired and ex-ante efficiency. We derive the equilibrium strategies for the three mechanisms and use simulations of a model calibrated with data from a buyback of licenses in the Maryland blue crab fishery. If the complexity of the mechanism discourages participation, it is shown that the two-price scheme performs best for most of the distributions of values assumed.

Session number: 5.3

Paper number: 213

A Simple Buy-back Auction for Fisheries Management

John Ledyard¹ (presenting), Ted Groves

1. Caltech, Pasadena, CA, United States

In an open fishery, the competition for the limited fish stock can lead fishermen to a "race for fish" with sub-optimally high capital investments. Buyback programs to reduce excess capacity in national fisheries have been often used, but seldom successful. Where they have successfully reduced excess capacity, the programs have come at a high cost, almost always

in the form of governmental subsidies to buy out the excess capacity. These subsidies may even exceed the full gain in social surplus from the fishery that is, after all, the main purpose of the programs. While, in principle, the presence of excess capacity implies there are Pareto-improving allocations of fishing rights, which involve the removal of the highest cost or least efficient vessel capacity from the industry, the difficulty is in identifying the least efficient vessels and providing the incentives for their owners to be voluntarily bought out by the owners of vessels remaining in the fishery.

Our paper explores, from a mechanism-design approach, the possibilities for and limits of buyback programs - specifically auctions - that are entirely self-financed. Our main results delimit conditions on the fishery that allow an efficient, self-financed (i.e. requiring no outside subsidies) auction design that will also satisfy voluntary participation (i.e. all a priori identified vessel owners will choose to participate in the auction.)

Session number: 5.3

Paper number: 378

Key Conditions for the Sustainability of Community-Based Fisheries Management on Unrestricted Fisheries: A Study of Self-Imposed Management in the Alfonsino Fishing Grounds off Katsuura, Japan

Yoshihiro Kuronuma, Otsuma Women's University, Tama-shi, Tokyo, Japan

This paper attempts to elucidate and analyze key conditions for the sustainability of community-based fisheries management (CBFM) on unrestricted fisheries in Japan. It re-examines over fifty years worth of empirical evidence about the natural outcome for socio-economic rationality of the self-imposed management of common property with reference to the Alfonsino (*Beryx splendens*) fishing grounds off Katsuura by the Chiba Prefecture Small-Type Coastal Fishing Vessel Fishery Cooperative (STCC). This observation shows that exclusive use of fishing grounds and other factors, such as a communal solidarity and social milieu to protect the fishing grounds among fishermen, has continuously existed as the necessary conditions to establish sustainable CBFM in unrestricted fisheries of the Alfonsino fishing grounds off Katsuura for over fifty years, and that adjustments of the fishery operations and other matters have also been necessary, based on the establishment of an organization of fishing-ground users. However, one should not overlook the fact that the Alfonsino resource management as a migratory species would be required under different types of fisheries operations in different fishing grounds other than the STCC operation in the fishing grounds off Katsuura. In order to deal with this issue, a co-management system was introduced through the cooperation of the Japanese government, the Chiba prefectural government, and the STCC in recent years. This system includes a resource-management plan together with a fisheries risk-management plan under the fraternal insurance of the fishery. This so-called co-management system, as one type of Japanese adaptive fisheries management systems, would play an important role for sustainable key conditions for CBFM on unrestricted fisheries of self-imposed management in the Alfonsino fishing grounds off Katsuura, Japan.

Session number: 5.3

Paper number: 122

Role of Beach Management Units in Implementing Fisheries Policy. A Case Study of Two BMUs in Lake Victoria, Tanzania

Joseph Luomba, Mwanza, Tanzania

Management of the Lake Victoria fisheries has transformed from centralized to a co-management approach where the government and other stakeholders including Beach Management Units (BMUs) share management responsibilities. In Tanzania, the BMUs were formed in 1990's under the Lake Victoria Environmental Management Project (LVEMP I) and then reformed during the Implementation of a Fisheries Management Plan (IFMP) project carried out from 2005-2010. The change to co-management was as a result of the failure of top down approach in managing the fisheries resources and thus it was assumed that with co-management fisheries management as well as poverty levels will be improved. However, the declining fish stocks and claims of poverty within fisheries communities raises concerns about the impacts of BMUs in implementing fisheries policy.

This paper uses data generated from a case study of two BMUs in Magu and Ilemela districts of Lake Victoria to address these concerns. Findings reveal that BMUs have formulated regulatory measures to manage the fishery but have been ineffective in implementing some of the measures. On the other hand, BMUs have no poverty eradication schemes, lack skills and expertise to tackle the challenges posed by poverty. The inability of the BMUs to tackle these challenges threatens the sustainability of the fisheries given that most riparian communities entirely depend on the resources for their livelihood.

Key words: Lake Victoria, Co-management, BMU, fisheries policy, Tanzania

Session number: 5.3

Paper number: 177

Fishery Buybacks, Efficiency and Participation

Douglas Lipton¹ (presenting), Jorge Holzer, Geret DePiper

1. NOAA Fisheries, Silver Spring, MD, United States

License and vessel buybacks continue to be utilized by fishery managers to achieve reductions in actual and latent fishing effort worldwide. While there is debate about their effectiveness in achieving sustainability, the design of alternative implementing mechanisms has received less attention. When participation is assumed endogenous, the specific features of the mechanism are crucial in shaping incentives, bids and participation. Under costly participation, there is a contrast in how fixed price and reverse auction mechanisms trade off cost effectiveness for participation.

We present the rationale for a novel mechanism that buys items offered at the baseline price until either the budget is exhausted or all the items are acquired. With the latter, items are acquired at a premium price until either the budget is exhausted or all the items offered at the high price are bought back. In either case, when the offers exceed the total budget, the winners are determined using a lottery. The mechanism seeks to encourage participation while capping the amount paid per item.

The fixed price, reverse auction and two-price scheme with lottery are compared in terms of average cost per item acquired and ex-ante efficiency. We derive the equilibrium strategies for the three mechanisms and use simulations of a model calibrated with data from a buyback of licenses in the Maryland blue crab fishery. If the complexity of the mechanism discourages participation, it is shown that the two-price scheme performs best for most of the distributions of values assumed.

Session number: 5.3

Paper number: 213

A Simple Buy-back Auction for Fisheries Management

John Ledyard¹ (presenting), Ted Groves

1. Caltech, pasadena, ca, United States

In an open fishery, the competition for the limited fish stock can lead fishermen to a "race for fish" with sub-optimally high capital investments. Buyback programs to reduce excess capacity in national fisheries have been often used, but seldom successful. Where they have successfully reduced excess capacity, the programs have come at a high cost, almost always in the form of governmental subsidies to buy out the excess capacity. These subsidies may even exceed the full gain in social surplus from the fishery that is, after all, the main purpose of the programs. While, in principle, the presence of excess capacity implies there are Pareto-improving allocations of fishing rights, which involve the removal of the highest cost or least efficient vessel capacity from the industry, the difficulty is in identifying the least efficient vessels and providing the incentives for their owners to be voluntarily bought out by the owners of vessels remaining in the fishery.

Our paper explores, from a mechanism-design approach, the possibilities for and limits of buyback programs - specifically auctions - that are entirely self-financed. Our main results delimit conditions on the fishery that allow an efficient, self-financed (i.e. requiring no outside subsidies) auction design that will also satisfy voluntary participation (i.e. all a priori identified vessel owners will choose to participate in the auction.)

Session number: 5.4

Paper number: 299

Restructuring the Value Chain Governance: The Impact of Food safety regime on fishery sector of Kerala, India.

Jayasekhar Somasekharan, Central Plantation Crops Research Institute, Kasaragod, Kerala, India

In this study we have considered the theoretical aspects of Global Value Chain and empirically validated the concepts by taking up a case study of Kerala in India. We have initiated this study with the hypothesis that, the evolving stringent food safety standards imposed by the export markets of developed countries are trade restrictive to the Indian seafood export and such a rise in standard will, not only affect the export firms alone, but also the entire supply chain will have to adjust accordingly. While examining the evolution of value chain dynamics we have found different types of co ordinations have governed the seafood export chain of Kerala over a period of time (late 1950s onwards). The evolution of Kerala's seafood industry from mid 1950s to late 1960s provides a good example of how captive form of coordination can evolve towards inter-firm governance structure. From early 1970s onwards, the value chain coordination shifted from earlier captive form to a modular type. In the recent food safety regulations regime, the pre-processing node of the value chain is getting integrated to the processing sector causing a major restructuring of the value chain. At the upstream end of the chain we may observe different type of coordination. Varying from arm's length transaction through relational coordination to even vertical integration. Indian fishery sector should upgrade the national system for testing, certification and laboratory accreditation so as to be at par with the prevailing international trade regulatory safety parameters.

Session number: 5.4

Paper number: 280

Ecological foot print of the postharvest losses in Tuna industry: A case of Sri Lanka

Achini De Silva¹ (presenting), Torbjorn Trondsen², Niroshan Jayasooriya, Lalith Amaralal³

1. Sabaragamuwa University, Belihuloya, Sabaragamuwa, Sri Lanka

2. University of Tromso, Tromso, Tromso, Norway

3. National Aquatic Resources Agency (NARA), Colombo, West, Sri Lanka

This paper will present some preliminary result from a study of post-harvest losses in the Sri Lanka tuna value chain. Fish losses refer to the decrease in edible fish mass throughout the part of value chain that specifically leads to edible food for human consumption. Sri Lanka is a unique player in international tuna market but is suffering from postharvest losses in term of quality degradation throughout the value chain. Focusing these losses is of high importance to improve the incomes and the nutritional security of the domestic consumers and combating hunger. This study will estimate the actual losses and, the reason the losses, the environmental impacts and solutions to minimize the losses. The principal focus is to analyse the resource utilization in the value chain from boat to folk (fishing, transport, handling, processing, distribution and consumption) and the environmental performances. Life Cycle Assessment is used as a key tool for the assessment. Global warming potential is considered environmental impact categories and assessed in qualitative way.

Possible solution of the food losses is discussed from the point of view of the fishing vessel

to the retailer in terms of wasted natural resources and unnecessary carbon and water foot print, impact on biodiversity in production of tuna products

Key words: Postharvest, losses, tuna, ecological foot print

Session number: 5.4

Paper number: 311

Knowledge is Power? The role of market information in value creation by developing country aquaculture producers.

Ingrid Kelling¹, James A. Young² (presenting)

1. Consultant, Paris, Paris, France

2. University of Stirling, Stirling, Stirlingshire, United Kingdom

International seafood trade takes place through value chains that link production in developing countries to developed country markets. As a result of the emergence of the global value chain analytical framework from the political economy of development (and underdevelopment) approach, value chain analysis has traditionally maintained a production orientation to study the workings and impacts of value chains. This paper challenges this prevailing focus by looking 'backwards' from final demand to production, enabling an examination of the ways in which seafood value chains are shaped by value chain agents' abilities to generate, disseminate and respond to market information. The paper reveals what consumers perceive as valuable, examines the governance and coordination conditions under which information is disseminated as not all value chain relationships are equally conducive to knowledge transfer, and enlarges existing examinations of upgrading by analysing the role of market information. The paper shows that although increased knowledge is necessary, it is not a sufficient condition for increased value creation. Instead, the successful integration of developing country producers into global markets is partly dependent on governance and industry development in the exporting country, and strong relationships between production and market agents. Weaknesses in these structures and relationships undermine supplier power by reducing access to market information, lessening incentives for sharing information, and restricting value-creating capabilities.

Session number: 5.4

Paper number: 95

Value Chain Analysis of the Artisanal Fisheries of the Ogun Waterside Area, Nigeria

Ayanboye Oluyemi, Oyo State College of Agriculture, Igboora, Nigeria, Oyo state, Nigeria, Nigeria

The artisanal fisheries sector makes a significant contribution to income, employment creation and food security in Nigeria. To help improve the economics performance of the artisanal fisheries in the artisanal fisheries of Ogun waterside, this report presents the outputs of a value-chain study for the sector. The study was taken up with the objective of identification of local and regional market potential for each main species of fish commonly found in the catch of artisanal fisherfolk. The study methodology included both desk research and primary research in the various markets of the study area. Various tools and technique of research including structured questionnaire, personal interviews and group discussion were used to collect quantitative and qualitative information about financial performance, employment creation, and the critical factors impacting on the performance of each sub-

sector of the value-chain during the primary study. A sample of 176 respondents from different sections of the fishery trade was covered in the study. The results have shed some light on the different value chains present in the trade. It also gives a detail description of the various players involved, their roles and responsibilities, the cost of operation and the barriers to entry, mobility and exit at various points of the value chain. The major problems constraints in the fisheries development are namely; poor transportation network, high cost of fishing inputs, inadequate funding and poor storage facilities. Appropriate measures have been recommended. Key words: Value chains, Artisanal fisheries, and Nigeria.

Session number: 5.4

Paper number: 299

Restructuring the Value Chain Governance: The Impact of Food safety regime on fishery sector of Kerala, India.

Jayasekhar Somasekharan, Central Plantation Crops Research Institute, Kasaragod, Kerala, India

In this study we have considered the theoretical aspects of Global Value Chain and empirically validated the concepts by taking up a case study of Kerala in India. We have initiated this study with the hypothesis that, the evolving stringent food safety standards imposed by the export markets of developed countries are trade restrictive to the Indian seafood export and such a rise in standard will, not only affect the export firms alone, but also the entire supply chain will have to adjust accordingly. While examining the evolution of value chain dynamics we have found different types of coordinations have governed the seafood export chain of Kerala over a period of time (late 1950s onwards). The evolution of Kerala's seafood industry from mid 1950s to late 1960s provides a good example of how captive form of coordination can evolve towards inter-firm governance structure. From early 1970s onwards, the value chain coordination shifted from earlier captive form to a modular type. In the recent food safety regulations regime, the pre-processing node of the value chain is getting integrated to the processing sector causing a major restructuring of the value chain. At the upstream end of the chain we may observe different type of coordination. Varying from arm's length transaction through relational coordination to even vertical integration. Indian fishery sector should upgrade the national system for testing, certification and laboratory accreditation so as to be at par with the prevailing international trade regulatory safety parameters.

Session number: 5.4

Paper number: 280

Ecological foot print of the postharvest losses in Tuna industry: A case of Sri Lanka

Achini De Silva¹ (presenting), Torbjorn Trondsen², Niroshan Jayasooriya, Lalith Amaralal³

1. Sabaragamuwa University, Belihuloya, Sabaragamuwa, Sri Lanka

2. University of Tromso, Tromso, Tromso, Norway

3. National Aquatic Resources Agency (NARA), Colombo, West, Sri Lanka

This paper will present some preliminary result from a study of post-harvest losses in the Sri Lanka tuna value chain. Fish losses refer to the decrease in edible fish mass throughout the part of value chain that specifically leads to edible food for human consumption. Sri Lanka is a unique player in international tuna market but is suffering from postharvest losses in term of quality degradation throughout the value chain. Focusing these losses is of high importance to improve the incomes and the nutritional security of the domestic consumers and combating hunger. This study will estimate the actual losses and, the reason the losses, the environmental impacts and solutions to minimize the losses. The principal focus is to analyse the resource utilization in the value chain from boat to folk (fishing, transport, handling, processing, distribution and consumption) and the environmental performances. Life Cycle Assessment is used as a key tool for the assessment. Global warming potential is considered environmental impact categories and assessed in qualitative way.

Possible solution of the food losses is discussed from the point of view of the fishing vessel to the retailer in terms of wasted natural resources and unnecessary carbon and water foot print, impact on biodiversity in production of tuna products

Key words: Postharvest, losses, tuna, ecological foot print

Session number: 5.4

Paper number: 311

Knowledge is Power? The role of market information in value creation by developing country aquaculture producers.

Ingrid Kelling¹, **James A. Young**² (presenting)

1. Consultant, Paris, Paris, France

2. University of Stirling, Stirling, Stirlingshire, United Kingdom

International seafood trade takes place through value chains that link production in developing countries to developed country markets. As a result of the emergence of the global value chain analytical framework from the political economy of development (and underdevelopment) approach, value chain analysis has traditionally maintained a production orientation to study the workings and impacts of value chains. This paper challenges this prevailing focus by looking 'backwards' from final demand to production, enabling an examination of the ways in which seafood value chains are shaped by value chain agents' abilities to generate, disseminate and respond to market information. The paper reveals what consumers perceive as valuable, examines the governance and coordination conditions under which information is disseminated as not all value chain relationships are equally conducive to knowledge transfer, and enlarges existing examinations of upgrading by analysing the role of market information. The paper shows that although increased knowledge is necessary, it is not a sufficient condition for increased value creation. Instead, the successful integration of developing country producers into global markets is partly dependent on governance and industry development in the exporting country, and strong relationships between production and market agents. Weaknesses in these structures and relationships undermine supplier power by reducing access to market information, lessening incentives for sharing information, and restricting value-creating capabilities.

Session number: 5.4

Paper number: 95

Value Chain Analysis of the Artisanal Fisheries of the Ogun Waterside Area, Nigeria

Ayanboye Oluyemi, Oyo State College of Agriculture, Igboora, Nigeria, Oyo state, Nigeria, Nigeria

The artisanal fisheries sector makes a significant contribution to income, employment creation and food security in Nigeria. To help improve the economics performance of the artisanal fisheries in the artisanal fisheries of Ogun waterside, this report presents the outputs of a value-chain study for the sector. The study was taken up with the objective of identification of local and regional market potential for each main species of fish commonly found in the catch of artisanal fisherfolk. The study methodology included both desk research and primary research in the various markets of the study area. Various tools and technique of research including structured questionnaire, personal interviews and group discussion were used to collect quantitative and qualitative information about financial performance, employment creation, and the critical factors impacting on the performance of each sub-sector of the value-chain during the primary study. A sample of 176 respondents from different sections of the fishery trade was covered in the study. The results have shed some light on the different value chains present in the trade. It also gives a detail description of the various players involved, their roles and responsibilities, the cost of operation and the barriers to entry, mobility and exit at various points of the value chain. The major problems constraints in the fisheries development are namely; poor transportation network, high cost of fishing inputs, inadequate funding and poor storage facilities. Appropriate measures have been recommended. Key words: Value chains, Artisanal fisheries, and Nigeria.

Session number: 5.5

Paper number: 443

Managing for Sustainable Yield and Risk: Optimal Escapement Goal Policies in Bristol Bay

Chris Anderson, **Yun-Ling Jocelyn Wang**¹ (presenting)

1. University of Washington, Seattle, WA, United States

The salmon fisheries in Bristol Bay, Alaska are evaluating a policy of increasing escapement goals in order to increase average yields, but doing so will likely entail having more years where the fishery does not open, and some years where there are too many fish to process. We develop an integrated bioeconomic simulation model to predict the distribution of profits that will result from alternative escapement policies. The model uses historical reconstructions of daily fish abundance throughout the five districts of the fishery to predict the spatial distribution of harvester effort, and thus daily landings. Based on daily landings and pre-season staffing decisions, the processors choose product forms, determining market production and the price received. Ex-vessel price is determined as a function of total processor revenue. The model characterizes the mean, variance and changes in the allocative distribution of profits resulting from increasing the escapement goals. Initial results suggest that escapement goals that target MSY significantly increase the variance in harvester incomes.

Session number: 5.5

Paper number: 287

Fish, Floods, and Farmers: The Joint Production of Ecosystem Services on a Working Landscape

Cloe Garnache East Lansing, MI, United States

This paper examines the tradeoffs between the production of crops and habitat for juvenile salmon, through flood events, on the Yolo Bypass floodplain. I investigate how changes in the fishery management institution affect the economic returns to fish habitat.

To understand how habitat provision affects the economic surplus of the farmers and fishers, I develop a bioeconomic model of Yolo Bypass agriculture, salmon population, and California ocean fishery.

The results reveal large total producer surplus gains from improving habitat management and the natural resource management institution. In contrast with previous studies on open access resources, I find that the gains from habitat management exceed those that arise from improving the management institution. These findings have important policy implications because many fisheries are already regulated.

Session number: 5.5

Paper number: 289

Can Stochasticity Cause Overcapacity in a Pure Open Access Fishery?

Steven Rust¹ (presenting), Satoshi Yamazaki², Sarah Jennings³

1. The University of Tasmania, Hobart, Tasmania, Australia
2. University of Tasmania, Hobart, Tasmania, Australia
3. University of Tasmania School of Economics and Finance, Hobart, Tasmania, Australia

Overcapacity remains a major issue in world fisheries. The specific conditions that give rise to overcapacity in the pure open access fishery remain unclear, however the non-malleability of capital is widely regarded as a necessary condition for the accumulation of excess harvesting capacity. In the process of fisheries collapse known as Ludwig's ratchet, it has been observed that persistent levels of overcapacity are related to episodes of strong investment which are stimulated by the temporal fluctuation in biomass. We examine the role of such stochasticity, as described by two independent environmental processes, using an adaptation of the traditional Gordon-Schaefer model that includes a Marshallian investment process for fishers who form myopic expectations of the future. The results for a pure open access fishery, in which capital is perfectly non-malleable, confirm the role played by unexpected positive shocks in the biomass due to favourable recruitment events in generating equilibrium overcapacity in the fishery. Simulations that use a parameterised version of our model further demonstrate a connection between the magnitude of positive shocks in the biomass and the extent of overcapacity. On the other hand, the variability of the steady-state overcapacity is shown to be strongly related to the underlying variation in recruitment. We conclude that the existence of perfectly non-malleable capital, in itself, is not sufficient to generate overcapacity in the pure open access fishery and that stochasticity plays a key role.

Session number: 5.5

Paper number: 314

The Economic Consequences of Regime Shifts in Marine Ecosystems

Lorena Fricke¹ (presenting), Martin F. Quaas²

1. Kiel University, Kiel, Schleswig Holstein, Germany
2. University of Kiel, Kiel, Schleswig-Holstein, Germany

Evidence for regime shifts in the late 1980s has been documented for marine ecosystems all across the Northern hemisphere. The synchronicity of these events suggests a common driver, such as climate change. However, trophic cascades caused by overfishing are regularly observed in marine ecosystems that experience a regime shift. We investigate the economic consequences of such regime shifts in marine ecosystems. Using a simple ecological-economic model of three ecologically interdependent fisheries, we analyze the distributional implications on the stakeholders under open access for the case with and without a regime shift. In the model, instabilities occur due to an exogenous shock on the predator population dynamics. Furthermore, we assume an underlying harvesting technology under which catch per unit of effort does not linearly decrease with stock size, but rather use a generalized Gordon-Schaefer harvesting technology where the stock-output elasticity may differ from unity. By explicitly modelling input and output markets, we are able to closely investigate producer and consumer surplus generated in the fishery. In our empirical application, we test the model implications for Baltic sea sprat, herring and cod fisheries.

Session number: 5.5

Paper number: 443

Managing for Sustainable Yield and Risk: Optimal Escapement Goal Policies in Bristol Bay

Chris Anderson, **Yun-Ling Jocelyn Wang**¹ (presenting)

1. University of Washington, Seattle, WA, United States

The salmon fisheries in Bristol Bay, Alaska are evaluating a policy of increasing escapement goals in order to increase average yields, but doing so will likely entail having more years where the fishery does not open, and some years where there are too many fish to process. We develop an integrated bioeconomic simulation model to predict the distribution of profits that will result from alternative escapement policies. The model uses historical reconstructions of daily fish abundance throughout the five districts of the fishery to predict the spatial distribution of harvester effort, and thus daily landings. Based on daily landings and pre-season staffing decisions, the processors choose product forms, determining market production and the price received. Ex-vessel price is determined as a function of total processor revenue. The model characterizes the mean, variance and changes in the allocative distribution of profits resulting from increasing the escapement goals. Initial results suggest that escapement goals that target MSY significantly increase the variance in harvester incomes.

Session number: 5.5

Paper number: 287

Fish, Floods, and Farmers: The Joint Production of Ecosystem Services on a Working Landscape

Cloe Garnache East Lansing, MI, United States

This paper examines the tradeoffs between the production of crops and habitat for juvenile salmon, through flood events, on the Yolo Bypass floodplain. I investigate how changes in the fishery management institution affect the economic returns to fish habitat.

To understand how habitat provision affects the economic surplus of the farmers and fishers, I develop a bioeconomic model of Yolo Bypass agriculture, salmon population, and California ocean fishery.

The results reveal large total producer surplus gains from improving habitat management and the natural resource management institution. In contrast with previous studies on open access resources, I find that the gains from habitat management exceed those that arise from improving the management institution. These findings have important policy implications because many fisheries are already regulated.

Session number: 5.5

Paper number: 289

Can Stochasticity Cause Overcapacity in a Pure Open Access Fishery?

Steven Rust¹ (presenting), Satoshi Yamazaki², Sarah Jennings³

1. The University of Tasmania, Hobart, Tasmania, Australia

2. University of Tasmania, Hobart, Tasmania, Australia

3. University of Tasmania School of Economics and Finance, Hobart, Tasmania, Australia

Overcapacity remains a major issue in world fisheries. The specific conditions that give rise to overcapacity in the pure open access fishery remain unclear, however the non-malleability of capital is widely regarded as a necessary condition for the accumulation of excess harvesting capacity. In the process of fisheries collapse known as Ludwig's ratchet, it has been observed that persistent levels of overcapacity are related to episodes of strong investment which are stimulated by the temporal fluctuation in biomass. We examine the role of such stochasticity, as described by two independent environmental processes, using an adaptation of the traditional Gordon-Schaefer model that includes a Marshallian investment process for fishers who form myopic expectations of the future. The results for a pure open access fishery, in which capital is perfectly non-malleable, confirm the role played by unexpected positive shocks in the biomass due to favourable recruitment events in generating equilibrium overcapacity in the fishery. Simulations that use a parameterised version of our model further demonstrate a connection between the magnitude of positive shocks in the biomass and the extent of overcapacity. On the other hand, the variability of the steady-state overcapacity is shown to be strongly related to the underlying variation in recruitment. We conclude that the existence of perfectly non-malleable capital, in itself, is not sufficient to generate overcapacity in the pure open access fishery and that stochasticity plays a key role.

Session number: 5.5

Paper number: 314

The Economic Consequences of Regime Shifts in Marine Ecosystems

Lorena Fricke¹ (presenting), Martin F. Quaas²

1. Kiel University, Kiel, Schleswig Holstein, Germany

2. University of Kiel, Kiel, Schleswig-Holstein, Germany

Evidence for regime shifts in the late 1980s has been documented for marine ecosystems all across the Northern hemisphere. The synchronicity of these events suggests a common driver, such as climate change. However, trophic cascades caused by overfishing are regularly observed in marine ecosystems that experience a regime shift. We investigate the economic consequences of such regime shifts in marine ecosystems. Using a simple ecological-economic model of three ecologically interdependent fisheries, we analyze the distributional implications on the stakeholders under open access for the case with and without a regime shift. In the model, instabilities occur due to an exogenous shock on the predator population dynamics. Furthermore, we assume an underlying harvesting technology under which catch per unit of effort does not linearly decrease with stock size, but rather use a generalized Gordon-Schaefer harvesting technology where the stock-output elasticity may differ from unity. By explicitly modelling input and output markets, we are able to closely investigate producer and consumer surplus generated in the fishery. In our empirical application, we test the model implications for Baltic sea sprat, herring and cod fisheries.

Session number: 5.6

Paper number: 429

Should Fisheries Remain Open Access as Employment Buffers for the Poor?

Frances Homans¹, James Wilen² (presenting)

1. Dept. of Applied Economics, St. Paul, Minnesota, United States

2. University of California, Davis, Davis, CA, United States

A number of fisheries observers contend that maintaining open access to resource use provides the poor a valuable employment buffer function. The argument is that if labor can shift into fishing when agriculture suffers unforeseen drops in productivity, then open access can provide a form of insurance that would be eliminated under rationalization. We investigate these contentions using a model from Scott (1957) in which a fixed amount of labor is employed in an economy with two sectors. Under open access, labor is allocated such that the value of marginal product in agriculture is equal to the value of average product in the fishery. Rationalization of the fishery is modelled by solving a dynamic optimization problem in which the present value of rents from both sectors is maximized by the choice of labor allocation between the sectors. We then introduce stochastic shocks to agricultural productivity and investigate how a fishery provides a short run employment buffer by smoothing out dips in income from negative shocks to agriculture. We solve for the open access equilibrium and compare it with the optimal stochastic feedback solution for the jointly optimized system. We generate transition and steady state distributions of key outcomes such as biomass, wages, and rents and labor use in both sectors. We assess the extent to which the employment buffer and income smoothing functions are diminished when a fishery under open access is rationalized. We conclude by discussing policy implications for fisheries reform in developing countries.

Session number: 5.6

Paper number: 8

Awareness and Utilization of Indigenous Knowledge Systems in Artisanal and Coastal Fishing in Southwest, Nigeria

Taiwo Mafimisebi¹ (presenting), Abidemi Famofo¹, Ojuotimi Mafimisebi²

1. The Federal University of Technology, Akure, Akure, Ondo, Nigeria

2. Rufus Giwa Polytechnic, Owo, Owo, Ondo, Nigeria

Use of indigenous knowledge systems (IKS) is critically important in production systems and environmental management in Nigeria. Despite the importance of fisheries to Nigeria's economy and the indispensable role of IKS in it, IKS used in fishing households have not been adequately researched. This study identified and examined the utilization of IKS in fishing in Southwest, Nigeria. Data obtained from 171 fisher-folks, eight key informants and eight FGDs were analyzed using descriptive and inferential statistics and the logistic regression model. The study revealed that 34 indigenous knowledge (IK) items were being used. A categorization of IK items based on IKS use index (IKSUI) revealed that about 21.0%, 32.0% and 47.0% of IK items were poorly-used, moderately-used and highly-used, respectively. Also, about 15.0%, 33.0% and 52.0% of fisher-folks were categorized as low-users, moderate-users and high-users of IK, respectively. About 86.9% believed that IK is better and more effective than Western Knowledge (WK), 71.4% believed that IK reduces production cost and 70.2% affirmed that it increases output. Age of household head, fishing experience and number of elderly people in household, were significantly positively related

to IKS use while household's fishing income, household head's education and number of fishing boats/canoes showed negative relationships with IK use. About 92.0% of fisher-folks posited that IKS is their only means of increasing and sustaining fishing and fishing income. It is concluded that IKS is very important in fisheries in the study area and that a documentation of fishing IKS be carried out in Nigerian fishing communities.

Session number: 5.6

Paper number: 83

Defining Small-Scale Fisheries: Closing the Gap between a Simple Definition Based on Vessel Characteristics and Local Operational Range

Natacha Carvalho¹ (presenting), Fabrizio Natale², Anton Paulrud³

1. EU Joint Research Centre, Ispra, Varese, Italy

2. Joint Research Centre, Ispra, Varese, Italy

3. Swedish Agency for Marine and Water management, Göteborg, Göteborg, Sweden

The definition for small scale fisheries is a recurrent one and a key issue for policy and research. Policy needs a straightforward definition, yet, due to the inherent nature of small scale fisheries, a universal definition does not seem attainable nor appropriate. A more precise and representative definition than the one widely used at present would need to place more emphasis on the relationship with coastal communities, the limited operational range and the characteristics of the enterprise rather than simply using arbitrary vessel characteristics, such as vessel length. In this study we use data mining and spatial analysis techniques to base the definition of SFF on operational range rather than the crude reference to vessel length. This methodology brings together data from several sources, including vessel logbook data, the EU fleet register, socio-economic data collected under the EU data collection framework (DCF). The process involves two main steps: (1) labelling vessel classes based on clusters of operational range attributes and (2) identifying classification rules to match the labelled classes on the basis of vessels characteristics available from the EU fleet register. Preliminary results, using the Swedish fishing fleet as a case study, show that there is a correspondence between vessel characteristics and operational range classes but this correspondence is relying on vessel tonnage and engine power characteristics rather than vessel length. The analysis produced highly reliable results with more than 90% matches. Errors detected were linked to the labelling and clustering phase rather than the classification phase.

Session number: 5.6

Paper number: 429

Should Fisheries Remain Open Access as Employment Buffers for the Poor?

Frances Homans¹, **James Wilen**² (presenting)

1. Dept. of Applied Economics, St. Paul, Minnesota, United States

2. University of California, Davis, Davis, CA, United States

A number of fisheries observers contend that maintaining open access to resource use provides the poor a valuable employment buffer function. The argument is that if labor can shift into fishing when agriculture suffers unforeseen drops in productivity, then open access can provide a form of insurance that would be eliminated under rationalization. We investigate these contentions using a model from Scott (1957) in which a fixed amount of labor is employed in an economy with two sectors. Under open access, labor is allocated such that the value of marginal product in agriculture is equal to the value of average product in the fishery. Rationalization of the fishery is modelled by solving a dynamic optimization problem in which the present value of rents from both sectors is maximized by the choice of labor allocation between the sectors. We then introduce stochastic shocks to agricultural productivity and investigate how a fishery provides a short run employment buffer by smoothing out dips in income from negative shocks to agriculture. We solve for the open access equilibrium and compare it with the optimal stochastic feedback solution for the jointly optimized system. We generate transition and steady state distributions of key outcomes such as biomass, wages, and rents and labor use in both sectors. We assess the extent to which the employment buffer and income smoothing functions are diminished when a fishery under open access is rationalized. We conclude by discussing policy implications for fisheries reform in developing countries.

Session number: 5.6

Paper number: 8

Awareness and Utilization of Indigenous Knowledge Systems in Artisanal and Coastal Fishing in Southwest, Nigeria

Taiwo Mafimisebi¹ (presenting), Abidemi Famofo¹, Ojuotimi Mafimisebi²

1. The Federal University of Technology, Akure, Akure, Ondo, Nigeria

2. Rufus Giwa Polytechnic, Owo, Owo, Ondo, Nigeria

Use of indigenous knowledge systems (IKS) is critically important in production systems and environmental management in Nigeria. Despite the importance of fisheries to Nigeria's economy and the indispensable role of IKS in it, IKS used in fishing households have not been adequately researched. This study identified and examined the utilization of IKS in fishing in Southwest, Nigeria. Data obtained from 171 fisher-folks, eight key informants and eight FGDs were analyzed using descriptive and inferential statistics and the logistic regression model. The study revealed that 34 indigenous knowledge (IK) items were being used. A categorization of IK items based on IKS use index (IKSUI) revealed that about 21.0%, 32.0% and 47.0% of IK items were poorly-used, moderately-used and highly-used, respectively. Also, about 15.0%, 33.0% and 52.0% of fisher-folks were categorized as low-users, moderate-users and high-users of IK, respectively. About 86.9% believed that IK is better and more effective than Western Knowledge (WK), 71.4% believed that IK reduces production cost and 70.2% affirmed that it increases output. Age of household head, fishing experience and number of elderly people in household, were significantly positively related to IKS use while household's fishing income, household head's education and number of fishing boats/canoes showed negative relationships with IK use. About 92.0% of fisher-folks posited that IKS is their only means of increasing and sustaining fishing and fishing income. It is concluded that IKS is very important in fisheries in the study area and that a documentation of fishing IKS be carried out in Nigerian fishing communities.

Session number: 5.6

Paper number: 83

Defining Small-Scale Fisheries: Closing the Gap between a Simple Definition Based on Vessel Characteristics and Local Operational Range

Natacha Carvalho¹ (presenting), Fabrizio Natale², Anton Paulrud³

1. EU Joint Research Centre, Ispra, Varese, Italy

2. Joint Research Centre, Ispra, Varese, Italy

3. Swedish Agency for Marine and Water management, Göteborg, Göteborg, Sweden

The definition for small scale fisheries is a recurrent one and a key issue for policy and research. Policy needs a straightforward definition, yet, due to the inherent nature of small scale fisheries, a universal definition does not seem attainable nor appropriate. A more precise and representative definition than the one widely used at present would need to place more emphasis on the relationship with coastal communities, the limited operational range and the characteristics of the enterprise rather than simply using arbitrary vessel characteristics, such as vessel length. In this study we use data mining and spatial analysis techniques to base the definition of SFF on operational range rather than the crude reference to vessel length. This methodology brings together data from several sources, including vessel logbook data, the EU fleet register, socio-economic data collected under the EU data collection framework (DCF). The process involves two main steps: (1) labelling vessel classes based on clusters of operational range attributes and (2) identifying classification rules to match the labelled classes on the basis of vessels characteristics available from the EU fleet register. Preliminary results, using the Swedish fishing fleet as a case study, show that there is a correspondence between vessel characteristics and operational range classes but this correspondence is relying on vessel tonnage and engine power characteristics rather than vessel length. The analysis produced highly reliable results with more than 90% matches. Errors detected were linked to the labelling and clustering phase rather than the classification phase.

Session number: 5.7

Paper number: 153

Cultural Bequest Values for Ecosystem Service Flows Among Indigenous Fishers: a Discrete Choice Experiment Validated with Mixed Methods

Kirsten L.L. Oleson¹, **Michele Barnes-Mauthe¹ (presenting)**, Luke Brander², Tom Oliver³, Ingrid van Beek⁴, Bienvenue Zafindrasilivonona, Pieter van Beukering⁵

1. University of Hawaii at Manoa, Honolulu, HI, United States

2. VU University, Amsterdam, Amsterdam, NA, Netherlands

3. University of Hawaii, Honolulu, HI, United States

4. Wageningen University and Research Centre, 6708 PB Wageningen, NA, Netherlands

5. VU University, Amsterdam, 1081 HV Amsterdam, NA, Netherlands

Perhaps the most undervalued, yet critically important ecosystem services are related to socio-cultural values tied to the non-material benefits that arise from human-ecosystem relationships, such as bequest. Bequest values linked to natural ecosystems can be particularly significant for indigenous communities, whose livelihoods and cultures are often closely tied to ecological structures and functions. In this study we apply a discrete choice experiment (DCE) to determine indigenous fishers' preferences and willingness-to-pay for bequest gains from local management actions in a locally managed marine area in Madagascar. We validate and discuss our results by employing a unique rating and ranking game and other mixed methods. We find that bequest is highly valued and considerably important, with respondents indicating willingness to pay a substantial portion of their income to protect ecosystems for future generations. Through all of our inquiries bequest emerged as having the highest priority, even when respondents were forced to make difficult trade-offs among other provisioning and regulating ecosystem services which directly and indirectly support their livelihoods. This study is among the first to quantify bequest values, and among a relative few to apply a DCE to model trade-offs and value ecosystem service flows in a developing country context, thereby making an important contribution to the field of environmental valuation. Our results also directly inform marine and coastal management in Madagascar and elsewhere by providing crucial information on the often overlooked socio-cultural value of bequest in comparison to other ecosystem service benefits.

Session number: 5.7

Paper number: 397

From Fishing Capacity to Diversity; Changing Fishery Management Priorities in the US New England Groundfish Fishery

Eric Thunberg, NOAA Fisheries, Woods Hole, MA, United States

After 16 years under a limited access program with effort controls, the New England groundfish fishery transitioned to a catch share management system in 2010. For much of its earlier management history issues related to fishing capacity were paramount as effort controls were increasingly restrictive to meet biological objectives. As the size of the active fleet declined from over 1,000 vessels from 1994-2001 to less than 400 vessels in 2011 the management concern shifted to fleet diversity. Fleet diversity has been cast in terms of the existence of vessels based characteristics such as size, gear, and region rather than their share in landings or economic value. This lends itself to indices used to measure biodiversity such as richness, and the numbers equivalent of the Simpsons Index and Shannon Index. The paper describes the management context surrounding the transition from concerns over capacity to

fleet diversity and provides estimates of fleet diversity from 1994 to 2011. The results indicate the fleet diversity as measured by the Shannon Index has declined by approximately 35% from 1994 to 2011 yet there were 42 vessel types or “species” that were present in all 18 years. These vessel types accounted for about 85% of active groundfish vessels and over 90% of total groundfish landings in all years. Thus, even though the size of the fleet and overall diversity has declined the “core” groundfish fleet remains.

Session number: 5.7

Paper number: 426

The Economic Status and Performance of the U.S. Gulf of Mexico Inshore Shrimp Fishery in 2008 and 2012: Before and after the Deepwater Horizon Oil Disaster

Alex Miller¹ (presenting), Jack Isaacs²

1. Gulf States Marine Fisheries Commission , Ocean Springs, MS, United States

2. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA, United States

The commercial penaeid shrimp fishery in the U.S. Gulf of Mexico is the most important fishery in the southeast region of the United States from an economic perspective. In Federal waters, the fishery is managed under the Gulf of Mexico Shrimp Fishery Management Plan, and there has been a moratorium on permits to harvest shrimp in federal waters since 2006. In inshore and near-shore waters, the fishery is managed by the States of Florida, Alabama, Mississippi, Louisiana, and Texas. In 2009 and 2013, the Gulf States Marine Fisheries Commission surveyed inshore state licensed vessels to collect 2008 and 2012 economic and financial data. A multi-page, self-administered mail survey collected information concerning the shrimp harvesting business, vessel information, fishing effort, total revenue, trip costs, and other associated costs. Data was used to calculate the balance sheet, cash flow statement, and income statement at the vessel level. Economic heterogeneity within the fleet and among States was also explored. The results from data year 2012 were compared to the results from data year 2008, or before the 2010 *Deepwater Horizon* Oil Disaster in the Gulf. The fishery is facing a range of difficulties that together are threatening the short-term and long-term economic viability of the industry. Nonetheless, the inshore Gulf shrimp fishery is a major industry in the southeast region of the United States, accounting for much employment and other significant contributions.

Session number: 5.7

Paper number: 469

A Sea Change on the African Coast: Early Social and Ecological Outcomes of a Governance Transformation in Kenyan Fisheries

Joshua Cinner¹ (presenting), Tim McClanahan²

1. ARC Centre of Excellence for Coral Reef Studies, Townsville, QLD, Australia

2. Wildlife Conservation Society, New York, Bronx, United States

We examined social and ecological outcomes over a period of transformational change in the governance of Kenyan fisheries. We randomly selected 8 sites of 33 pilot co-management sites and surveyed perceptions of resource users 3 and 6 years after the policy was implemented. In total, we conducted 344 resource user surveys (randomly selected from lists of fishers operating out of the landing site) and 16 organizational leader interviews. To compare resource users’ perceptions over time, we used a cumulative link mixed model with community as a random effect to account for the non-independence of samples within

communities. We found that devolving decision-making power to local communities initially promoted a perception of winners and losers among resource users, but after just six years, there were virtually no resource users who felt that the new governance arrangement was detrimental to their livelihood. This newly acquired authority to capture the benefits from local management resulted in an unexpected proliferation of community-based marine reserves - a substantial change to the anti-reserve discourse that halted the government's most recent attempt to establish a national marine reserve. We also examined reef fish biomass and coral cover over time in several locations. Several community-based reserves showed increases in fish biomass and coral cover, while others did not and likely suffered from poor compliance and weak management. The current lack of negative perceptions towards co-management provides a critical window of opportunity to strengthen local governance institutions by investing in leadership capacity, transparency, and enforcement.

Session number: 5.7

Paper number: 153

Cultural Bequest Values for Ecosystem Service Flows Among Indigenous Fishers: a Discrete Choice Experiment Validated with Mixed Methods

Kirsten L.L. Oleson¹, **Michele Barnes-Mauthe¹ (presenting)**, Luke Brander², Tom Oliver³, Ingrid van Beek⁴, Bienvenue Zafindrasilivonona, Pieter van Beukering⁵

1. University of Hawaii at Manoa, Honolulu, HI, United States

2. VU University, Amsterdam, Amsterdam, NA, Netherlands

3. University of Hawaii, Honolulu, HI, United States

4. Wageningen University and Research Centre, 6708 PB Wageningen, NA, Netherlands

5. VU University, Amsterdam, 1081 HV Amsterdam, NA, Netherlands

Perhaps the most undervalued, yet critically important ecosystem services are related to socio-cultural values tied to the non-material benefits that arise from human-ecosystem relationships, such as bequest. Bequest values linked to natural ecosystems can be particularly significant for indigenous communities, whose livelihoods and cultures are often closely tied to ecological structures and functions. In this study we apply a discrete choice experiment (DCE) to determine indigenous fishers' preferences and willingness-to-pay for bequest gains from local management actions in a locally managed marine area in Madagascar. We validate and discuss our results by employing a unique rating and ranking game and other mixed methods. We find that bequest is highly valued and considerably important, with respondents indicating willingness to pay a substantial portion of their income to protect ecosystems for future generations. Through all of our inquiries bequest emerged as having the highest priority, even when respondents were forced to make difficult trade-offs among other provisioning and regulating ecosystem services which directly and indirectly support their livelihoods. This study is among the first to quantify bequest values, and among a relative few to apply a DCE to model trade-offs and value ecosystem service flows in a developing country context, thereby making an important contribution to the field of environmental valuation. Our results also directly inform marine and coastal management in Madagascar and elsewhere by providing crucial information on the often overlooked socio-cultural value of bequest in comparison to other ecosystem service benefits.

Session number: 5.7

Paper number: 397

From Fishing Capacity to Diversity; Changing Fishery Management Priorities in the US New England Groundfish Fishery

Eric Thunberg, NOAA Fisheries, Woods Hole, MA, United States

After 16 years under a limited access program with effort controls, the New England groundfish fishery transitioned to a catch share management system in 2010. For much of its earlier management history issues related to fishing capacity were paramount as effort controls were increasingly restrictive to meet biological objectives. As the size of the active fleet declined from over 1,000 vessels from 1994-2001 to less than 400 vessels in 2011 the management concern shifted to fleet diversity. Fleet diversity has been cast in terms of the existence of vessels based characteristics such as size, gear, and region rather than their share in landings or economic value. This lends itself to indices used to measure biodiversity such as richness, and the numbers equivalent of the Simpsons Index and Shannon Index. The paper describes the management context surrounding the transition from concerns over capacity to fleet diversity and provides estimates of fleet diversity from 1994 to 2011. The results indicate the fleet diversity as measured by the Shannon Index has declined by approximately 35% from 1994 to 2011 yet there were 42 vessel types or “species” that were present in all 18 years. These vessel types accounted for about 85% of active groundfish vessels and over 90% of total groundfish landings in all years. Thus, even though the size of the fleet and overall diversity has declined the “core” groundfish fleet remains.

Session number: 5.7

Paper number: 426

The Economic Status and Performance of the U.S. Gulf of Mexico Inshore Shrimp Fishery in 2008 and 2012: Before and after the Deepwater Horizon Oil Disaster

Alex Miller¹ (presenting), Jack Isaacs²

1. Gulf States Marine Fisheries Commission , Ocean Springs, MS, United States

2. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA, United States

The commercial penaeid shrimp fishery in the U.S. Gulf of Mexico is the most important fishery in the southeast region of the United States from an economic perspective. In Federal waters, the fishery is managed under the Gulf of Mexico Shrimp Fishery Management Plan, and there has been a moratorium on permits to harvest shrimp in federal waters since 2006. In inshore and near-shore waters, the fishery is managed by the States of Florida, Alabama, Mississippi, Louisiana, and Texas. In 2009 and 2013, the Gulf States Marine Fisheries Commission surveyed inshore state licensed vessels to collect 2008 and 2012 economic and financial data. A multi-page, self-administered mail survey collected information concerning the shrimp harvesting business, vessel information, fishing effort, total revenue, trip costs, and other associated costs. Data was used to calculate the balance sheet, cash flow statement, and income statement at the vessel level. Economic heterogeneity within the fleet and among States was also explored. The results from data year 2012 were compared to the results from data year 2008, or before the 2010 *Deepwater Horizon* Oil Disaster in the Gulf. The fishery is facing a range of difficulties that together are threatening the short-term and long-term economic viability of the industry. Nonetheless, the inshore Gulf shrimp fishery is a major industry in the southeast region of the United States, accounting for much employment and other significant contributions.

Session number: 5.7

Paper number: 469

A Sea Change on the African Coast: Early Social and Ecological Outcomes of a Governance Transformation in Kenyan Fisheries

Joshua Cinner¹ (presenting), Tim McClanahan²

1. ARC Centre of Excellence for Coral Reef Studies, Townsville, QLD, Australia

2. Wildlife Conservation Society, New York, Bronx, United States

We examined social and ecological outcomes over a period of transformational change in the governance of Kenyan fisheries. We randomly selected 8 sites of 33 pilot co-management sites and surveyed perceptions of resource users 3 and 6 years after the policy was implemented. In total, we conducted 344 resource user surveys (randomly selected from lists of fishers operating out of the landing site) and 16 organizational leader interviews. To compare resource users' perceptions over time, we used a cumulative link mixed model with community as a random effect to account for the non-independence of samples within communities. We found that devolving decision-making power to local communities initially promoted a perception of winners and losers among resource users, but after just six years, there were virtually no resource users who felt that the new governance arrangement was detrimental to their livelihood. This newly acquired authority to capture the benefits from local management resulted in an unexpected proliferation of community-based marine reserves - a substantial change to the anti-reserve discourse that halted the government's most recent attempt to establish a national marine reserve. We also examined reef fish biomass and coral cover over time in several locations. Several community-based reserves showed increases in fish biomass and coral cover, while others did not and likely suffered from poor compliance and weak management. The current lack of negative perceptions towards co-management provides a critical window of opportunity to strengthen local governance institutions by investing in leadership capacity, transparency, and enforcement.

Session number: 6.1

Paper number: 173

An experimental analysis of assignment problems and economic rent dissipation in quota managed fisheries

Timothy Emery (presenting), John Tisdell¹, Klaas Hartmann, Bridget Green, Caleb Gardner, Rafael Leon

1. University of Tasmania, Hobart, Tasmania, Australia

If the spatial and temporal distribution of resources is not homogenous it creates an assignment problem. While the adoption of individual (or transferable) quota management in many commercial fisheries has resolved issues of over-appropriation, assignment problems may remain due to the spatial and temporal complexity of fisheries resources, which creates heterogeneity in the economic value of catches. This leads to competition between fishers for the most valuable portions of the stock and dissipation of economic rent. In order to solve an assignment problem, either the quota units must be fully delineated in time or space, or fishers need to coordinate their effort. When fishers' sociocultural background, wealth, business structure and/or expertise are heterogeneous, reaching an agreement on a preferred strategy for solving an assignment problem can be particularly challenging, because some may see themselves as disproportionately more affected by its adoption. To investigate whether an assignment problem could be effectively managed by two types of fishers (lease quota fishers and quota owners), a series of economic experiments were conducted. Participants were more likely to cooperate and make socially optimal decisions to prevent rent dissipation when they could communicate amongst themselves and were in an experimental group containing solely quota owners. Experimental groups containing both types of fishers were less likely to cooperate because lease quota fishers may have seen themselves as disproportionately affected by the adoption of a socially-optimal strategy for preventing rent dissipation due to: (i) inequality in wealth; (ii) insecurity of tenure; and (iii) asymmetric information exchange.

Session number: 6.1

Paper number: 207

Tall Tales? Legal History, Economics and Rights to Fish.

George Kailis, University of Notre Dame Australia, Fremantle, WA, Australia

The most problematic factor in the implementation of catch share/quota schemes is generally equity, including the treatment of prior rights. Depending on the framing of the relevant question, a catch share scheme can be characterized as the recognition of existing equities in fishing activities or as the appropriation of public rights and their capture by private operators. The presentation explores the history of English common law fishing rights, including the treatment of that history in fisheries economics. In English common law, fishing rights were neither "owned" by the public nor the state but the state had the power to create valuable exclusive rights. From a common law perspective, allocation of catch shares is not fairly described as an appropriation of rights "owned" by the public instead the nature and design of any such scheme is fundamentally a public policy choice, albeit governed by common law legal assumptions and rules relating to process. English legal history underpins the legal system for the many countries that trace their legal system in whole or part to English common law.

Session number: 6.1

Paper number: 453

Economically Sensible Caps on ITQ-Holdings

Ragnar Arnason, University of Iceland, Reykjavik, Reykjavik, Iceland

Many ITQ fisheries are subject to an upper limit or cap on ITQ-holdings by individual companies. The economic rationale for these caps seems to be to reduce the opportunities for monopolistic behaviour by the companies. A possible social cost of the caps is that limiting company size in fisheries, especially small fisheries, may prevent economics of scale from being exploited.

This paper investigates this issue. It observes that the primary way to exercise monopoly power in an ITQ fishery is to withhold quota from being fished. It then shows that even when market power exists, in the sense that withholding quota from fishing would influence prices, it is often not profitable for companies to use this power. It further shows that the critical ITQ-holdings, i.e. the holdings at which it becomes profitable to withhold quotas, are in general complicated functions of the conditions in the fishery and the associated markets. With the help of the derived relationships it is shown that the critical quota holdings in the above sense are typically quite large. Finally, the question of the net social gains of reducing possible monopolistic behaviour at the cost of less returns to scale are briefly considered.

Keywords: ITQs, ITQ caps, concentration of ITQs, Monopolistic behaviour in ITQ fisheries

Session number: 6.1

Paper number: 480

Quota Market Efficiency: The New Zealand Annual Catch Entitlement (ACE) Market

James Stewart (presenting), Jonathan Leaver

1. University of Tasmania, Hobart, Tasmania, Australia

Balancing actual catch with Annual Catch Entitlement (ACE) is crucial to the efficient operation of the New Zealand Quota Management System (QMS). ACE market efficiency is dependent on the existence of ACE prices that reflect all available information, and that are freely accessible by all market participants.

This study identifies the information channels used to determine ACE availability, and establishes how accessing information differs between large and small fishers. The study considers the ACE market for the overall fishery, as well as one important target (and bycatch) fishery (the snapper management area 1 (SNA1) fishery). The views of fishers, fish processors, and quota brokers on the operation of the ACE market have been captured by means of an ACE market survey and through extensive consultation with industry participants. Some indications of market inefficiency are identified and discussed.

The findings provide for an assessment of whether standard conditions for efficient markets exist in the New Zealand ACE market.

Session number: 6.1

Paper number: 173

An experimental analysis of assignment problems and economic rent dissipation in quota managed fisheries

Timothy Emery (presenting), John Tisdell¹, Klaas Hartmann, Bridget Green, Caleb Gardner, Rafael Leon

1. University of Tasmania, Hobart, Tasmania, Australia

If the spatial and temporal distribution of resources is not homogenous it creates an assignment problem. While the adoption of individual (or transferable) quota management in many commercial fisheries has resolved issues of over-appropriation, assignment problems may remain due to the spatial and temporal complexity of fisheries resources, which creates heterogeneity in the economic value of catches. This leads to competition between fishers for the most valuable portions of the stock and dissipation of economic rent. In order to solve an assignment problem, either the quota units must be fully delineated in time or space, or fishers need to coordinate their effort. When fishers' sociocultural background, wealth, business structure and/or expertise are heterogeneous, reaching an agreement on a preferred strategy for solving an assignment problem can be particularly challenging, because some may see themselves as disproportionately more affected by its adoption. To investigate whether an assignment problem could be effectively managed by two types of fishers (lease quota fishers and quota owners), a series of economic experiments were conducted. Participants were more likely to cooperate and make socially optimal decisions to prevent rent dissipation when they could communicate amongst themselves and were in an experimental group containing solely quota owners. Experimental groups containing both types of fishers were less likely to cooperate because lease quota fishers may have seen themselves as disproportionately affected by the adoption of a socially-optimal strategy for preventing rent dissipation due to: (i) inequality in wealth; (ii) insecurity of tenure; and (iii) asymmetric information exchange.

Session number: 6.1

Paper number: 207

Tall Tales? Legal History, Economics and Rights to Fish.

George Kailis, University of Notre Dame Australia, Fremantle, WA, Australia

The most problematic factor in the implementation of catch share/quota schemes is generally equity, including the treatment of prior rights. Depending on the framing of the relevant question, a catch share scheme can be characterized as the recognition of existing equities in fishing activities or as the appropriation of public rights and their capture by private operators. The presentation explores the history of English common law fishing rights, including the treatment of that history in fisheries economics. In English common law, fishing rights were neither “owned” by the public nor the state but the state had the power to create valuable exclusive rights. From a common law perspective, allocation of catch shares is not fairly described as an appropriation of rights “owned” by the public instead the nature and design of any such scheme is fundamentally a public policy choice, albeit governed by common law legal assumptions and rules relating to process. English legal history underpins the legal system for the many countries that trace their legal system in whole or part to English common law.

Session number: 6.1

Paper number: 453

Economically Sensible Caps on ITQ-Holdings

Ragnar Arnason, University of Iceland, Reykjavik, Reykjavik, Iceland

Many ITQ fisheries are subject to an upper limit or cap on ITQ-holdings by individual companies. The economic rationale for these caps seems to be to reduce the opportunities for monopolistic behaviour by the companies. A possible social cost of the caps is that limiting company size in fisheries, especially small fisheries, may prevent economics of scale from being exploited.

This paper investigates this issue. It observes that the primary way to exercise monopoly power in an ITQ fishery is to withhold quota from being fished. It then shows that even when market power exists, in the sense that withholding quota from fishing would influence prices, it is often not profitable for companies to use this power. It further shows that the critical ITQ-holdings, i.e. the holdings at which it becomes profitable to withhold quotas, are in general complicated functions of the conditions in the fishery and the associated markets. With the help of the derived relationships it is shown that the critical quota holdings in the above sense are typically quite large. Finally, the question of the net social gains of reducing possible monopolistic behaviour at the cost of less returns to scale are briefly considered.

Keywords: ITQs, ITQ caps, concentration of ITQs, Monopolistic behaviour in ITQ fisheries

Session number: 6.1

Paper number: 480

Quota Market Efficiency: The New Zealand Annual Catch Entitlement (ACE) Market

James Stewart (presenting), Jonathan Leaver

1. University of Tasmania, Hobart, Tasmania, Australia

Balancing actual catch with Annual Catch Entitlement (ACE) is crucial to the efficient operation of the New Zealand Quota Management System (QMS). ACE market efficiency is dependent on the existence of ACE prices that reflect all available information, and that are freely accessible by all market participants.

This study identifies the information channels used to determine ACE availability, and establishes how accessing information differs between large and small fishers. The study considers the ACE market for the overall fishery, as well as one important target (and bycatch) fishery (the snapper management area 1 (SNA1) fishery). The views of fishers, fish processors, and quota brokers on the operation of the ACE market have been captured by means of an ACE market survey and through extensive consultation with industry participants. Some indications of market inefficiency are identified and discussed.

The findings provide for an assessment of whether standard conditions for efficient markets exist in the New Zealand ACE market.

Session number: 6.2

Paper number: 221

Mitigation of Ecosystem-Level Impacts of Fisheries Bycatch on Marine Megafauna: Conservation Policy, Economic Instruments, and Technical Change

Dale Squires (presenting), Joe Bull¹

1. Conservation Science, Imperial College, Ascot, England, United Kingdom

Bycatch reduction policies, traditionally focused on command-and-control at-sea measures, can be reframed to a broader-based biodiversity conservation and ecosystem management strategy. More cost- and ecologically-effective bycatch mitigation measures may directly and more effectively increase impacted populations elsewhere in their geographic range or life cycle. At-sea bycatch reduction faces diminishing returns in benefits and rising marginal costs to the point where additional gains in bycatch reduction are outweighed by the marginal costs and net economic benefits decline. There can be an opportunity cost to at-sea bycatch reduction within a broad-based and holistic bycatch perspective. A broader-based ecosystem approach to biodiversity conservation thus allows incorporating a broader range of policy instruments, applied at life stages and geographical ranges other than those of the strict harvesting process to achieve better cost- and ecological effectiveness. Incentive-based bycatch reduction practices may more directly and cost-effectively reduce bycatch. One of the most important forces reducing bycatch is induced (directed) biased bycatch-saving technical change that is differentially directed by different policy instruments and technology policies. Policy instruments not only directly reduce bycatch but also create incentives to induce and direct bycatch-saving technical change. Biodiversity mitigation that is both compensatory (offsets) and non-compensatory is part of a holistic approach that may or may not be intended to directly offset current fishing or substitute for current at-sea measures, and may instead be a complementary measure. Biodiversity mitigation can be evaluated according to six criteria. Other conservation policy instruments from the terrestrial realm can also be applied as part of a holistic conservation strategy. The focus is upon large megafauna in large pelagic ecosystems.

Session number: 6.2

Paper number: 198

Payments for Ecosystem Services - A fisheries and aquaculture perspective

Cassandra Young¹ (presenting), Daniela Ottaviani²

1. UN FAO, Rome, Rome, Italy

2. UN FAO, Rome, Please Choose, Italy

Payments for ecosystem services (PES) are positive incentives offered to producers or resource owners in exchange for the provision of a given ecosystem service, such as biodiversity, water regulation, food, recreation and tourism. Interest in applying this economic instrument within the aquatic ecosystems has increased alongside a growing interest in the valuation of aquatic ecosystem services. PES may prove a useful tool for the fisheries and aquaculture management toolbox but what would a PES look like in fisheries and aquaculture and what are some criteria for PES potential? This paper provides an overview of the PES concept and what it might look like in the fisheries and aquaculture context and some thoughts of its usefulness as an economic instrument for fisheries.

Session number: 6.2

Paper number: 157

Indonesian Fisheries Resource Accounting

Zuzy Anna¹ (presenting), Akhmad Fauzi²

1. Padjadjaran University, Bandung, West Java, Indonesia

2. Faculty of Economic and Management Bogor Agricultural University, Indonesia

Optimal and sustainable fisheries industry can only be achieved with proper planning, through the implementation of appropriate management instruments as well. Fisheries resources accounting is one of the planning instruments, which should be used as a main reference of Fisheries Management Plan. In general, fisheries accounting provide insights for policy makers on how the flow of the stocks of fish, and its relation to changes in the dynamic of natural and economic activity of fishing. The preparation of Indonesian Fisheries resource accounting is an effort to implement the recommendation of Agenda 21 UNCED, as formulated in the System of Integrated Environmental and Economic Accounting (SEEA). Besides, this is also a mandate of Indonesian Law No. 32/2009 regarding the Management and Environmental protection. The paper discusses the fisheries account, both physical and monetary, for Pelagic and Demersal fish. The methods use is the standard bio-economic modeling, using fox algorithm for parameter estimation, and resource accounting method of the System of National Accounts of FAO (2004), adapted to the existing condition data. The results of the analysis, include measurement of standing stocks (physical assets account), fishable biomass, depletion, as well as monetary account. Paper also provides suggestion for management, as well as policy recommendation.

Key Words: Fisheries resource Accounting, Physical assets account, monetary account, Fisheries Management Plan, Bio-economic modeling, Policy recommendation.

Session number: 6.2

Paper number: 446

Identifying Technology Shocks in Fisheries Production

Benjamin Fissel, NOAA, Seattle, WA, United States

This research develops a method for estimating discreet changes (shocks) to total factor productivity (TFP) using catch-per-unit-effort (CPUE) and biological stock assessment data. An estimator for identifying jumps in realized volatility is adapted to the identification and estimation productivity shocks. The estimator is tested through simulation and in an application where technology shocks are known. Testing shows that most of the technology shocks can be identified using this method. This estimator provides a means for identifying technology shocks when the time of adoption is unknown.

Session number: 6.2

Paper number: 221

Mitigation of Ecosystem-Level Impacts of Fisheries Bycatch on Marine Megafauna: Conservation Policy, Economic Instruments, and Technical Change

Dale Squires (presenting), Joe Bull¹

1. Conservation Science, Imperial College, Ascot, England, United Kingdom

Bycatch reduction policies, traditionally focused on command-and-control at-sea measures, can be reframed to a broader-based biodiversity conservation and ecosystem management strategy. More cost- and ecologically-effective bycatch mitigation measures may directly and more effectively increase impacted populations elsewhere in their geographic range or life cycle. At-sea bycatch reduction faces diminishing returns in benefits and rising marginal costs to the point where additional gains in bycatch reduction are outweighed by the marginal costs and net economic benefits decline. There can be an opportunity cost to at-sea bycatch reduction within a broad-based and holistic bycatch perspective. A broader-based ecosystem approach to biodiversity conservation thus allows incorporating a broader range of policy instruments, applied at life stages and geographical ranges other than those of the strict harvesting process to achieve better cost- and ecological effectiveness. Incentive-based bycatch reduction practices may more directly and cost-effectively reduce bycatch. One of the most important forces reducing bycatch is induced (directed) biased bycatch-saving technical change that is differentially directed by different policy instruments and technology policies. Policy instruments not only directly reduce bycatch but also create incentives to induce and direct bycatch-saving technical change. Biodiversity mitigation that is both compensatory (offsets) and non-compensatory is part of a holistic approach that may or may not be intended to directly offset current fishing or substitute for current at-sea measures, and may instead be a complementary measure. Biodiversity mitigation can be evaluated according to six criteria. Other conservation policy instruments from the terrestrial realm can also be applied as part of a holistic conservation strategy. The focus is upon large megafauna in large pelagic ecosystems.

Session number: 6.2

Paper number: 198

Payments for Ecosystem Services - A fisheries and aquaculture perspective

Cassandra Young¹ (presenting), Daniela Ottaviani²

1. UN FAO, Rome, Rome, Italy

2. UN FAO, Rome, Please Choose, Italy

Payments for ecosystem services (PES) are positive incentives offered to producers or resource owners in exchange for the provision of a given ecosystem service, such as biodiversity, water regulation, food, recreation and tourism. Interest in applying this economic instrument within the aquatic ecosystems has increased alongside a growing interest in the valuation of aquatic ecosystem services. PES may prove a useful tool for the fisheries and aquaculture management toolbox but what would a PES look like in fisheries and aquaculture and what are some criteria for PES potential? This paper provides an overview of the PES concept and what it might look like in the fisheries and aquaculture context and some thoughts of its usefulness as an economic instrument for fisheries.

Session number: 6.2

Paper number: 157

Indonesian Fisheries Resource Accounting

Zuzy Anna¹ (presenting), Akhmad Fauzi²

1. Padjadjaran University, Bandung, West Java, Indonesia

2. Faculty of Economic and Management Bogor Agricultural University, Indonesia

Optimal and sustainable fisheries industry can only be achieved with proper planning, through the implementation of appropriate management instruments as well. Fisheries resources accounting is one of the planning instruments, which should be used as a main reference of Fisheries Management Plan. In general, fisheries accounting provide insights for policy makers on how the flow of the stocks of fish, and its relation to changes in the dynamic of natural and economic activity of fishing. The preparation of Indonesian Fisheries resource accounting is an effort to implement the recommendation of Agenda 21 UNCED, as formulated in the System of Integrated Environmental and Economic Accounting (SEEA). Besides, this is also a mandate of Indonesian Law No. 32/2009 regarding the Management and Environmental protection. The paper discusses the fisheries account, both physical and monetary, for Pelagic and Demersal fish. The methods use is the standard bio-economic modeling, using fox algorithm for parameter estimation, and resource accounting method of the System of National Accounts of FAO (2004), adapted to the existing condition data. The results of the analysis, include measurement of standing stocks (physical assets account), fishable biomass, depletion, as well as monetary account. Paper also provides suggestion for management, as well as policy recommendation.

Key Words: Fisheries resource Accounting, Physical assets account, monetary account, Fisheries Management Plan, Bio-economic modeling, Policy recommendation.

Session number: 6.2

Paper number: 446

Identifying Technology Shocks in Fisheries Production

Benjamin Fissel, NOAA, Seattle, WA, United States

This research develops a method for estimating discrete changes (shocks) to total factor productivity (TFP) using catch-per-unit-effort (CPUE) and biological stock assessment data. An estimator for identifying jumps in realized volatility is adapted to the identification and estimation productivity shocks. The estimator is tested through simulation and in an application where technology shocks are known. Testing shows that most of the technology shocks can be identified using this method. This estimator provides a means for identifying technology shocks when the time of adoption is unknown.

Session number: 6.3

Paper number: 118

An Empirical Analysis of Community Based Fish Culture (CBFC) Systems in Bangladesh: Impacts on Expenditures and Inequality

A.B.M. Mahfuzul Haque¹ (presenting), Md Akhtaruzzaman Khan², Madan Mohan Dey

1. WorldFish, Bangladesh and South Asia Office, Dhaka, Dhaka, Bangladesh

2. Bangladesh Agricultural University, Mymensingh, Mymensingh, Bangladesh

Seasonal floodplains contribute significantly to the total fish production in Bangladesh but may contribute even more if proper management systems are in place. Over one third of Bangladesh comprises floodplains (2.8 million ha) and most households in these areas, of which 2.7 million are poor and extremely poor, depend directly on these floodplains for their food and livelihoods. Large areas of these floodplains are suitable for fish culture during monsoon season. Food availability and livelihood security can be ensured by culturing fish in these floodplain areas with proper management systems. WorldFish implemented an action research project to assess the contribution of collectively managed floodplain aquaculture on sustainable use of floodplain resources and equitable distribution of benefits among the fishing communities. Using three years of panel data from project and control sites, this study examines the impact of Community Based Fish Culture (CBFC) on expenditure and inequality. Non-parametric propensity score matching method (PSM) methods are used for impact assessment. Gini-coefficient and Gini decomposition methods were used to estimate the effect of expenditures on inequality. The results show that community based fish culture systems have positive and significant impact on fishers' expenditures. Results also reveal that CBFC system has an equalization effect on food, clothing and health expenditures. Furthermore, this management system helps to distribute total expenditure equally among the fisher communities.

Session number: 6.3

Paper number: 258

Aquaculture Participation on Poverty Alleviation: The Case of Ben Tre Province, Vietnam

Kimanh Nguyen (presenting), CURTIS JOLLY, Chuong Bui¹, Trang Le²

1. Auburn University, Auburn, Alabama, United States

2. NhaTrang University, NHA TRANG, KHANH HOA, Viet Nam

Aquaculture production growth rate has surpassed that of all other production industries in the agricultural sector in the past decade. Aquaculture has always been viewed as an activity capable of producing food, employment, jobs and income and dragging rural residents out of poverty. However, research results on the effects of aquaculture on poverty alleviation have been mixed. We use Tobit, simulation models and cross sectional 2012 survey data of 285 households, in Ben Tre Province, Vietnam, to evaluate the effects of aquaculture involvement on poverty, measured using per capita consumption of less than \$1.25, \$1.50 and \$2.00 per day. The results show for per capita consumption of less than \$1.25 per day that households' level of education, credit demand, the number of household members below age of 15 or above 64 increase per capita consumption above the poverty line. The number of family members working outside the household, participation in farming, and livelihood diversification increase poverty levels. With per capita consumption < \$1.50 the same variables were significant as before, but aquaculture involvement positively influenced

poverty alleviation. Agriculture as primary occupation and aquaculture involvement increased standard of living. At less than \$2.00 per capita consumption per day, education, number of members below 15 and above 64, involvement in fishing and aquaculture positively influenced standard of living, and poverty alleviation. The study shows that aquaculture can increase per capita income per day, if the individual already consumes more than \$1.25 per day or not absolutely poor.

Session number: 6.3

Paper number: 163

Developing Cooperative Production models for Molluscan Shellfish Culture in the U.S

Thomas Murray, Virginia Institute of Marine Science, Gloucester Point, Virginia, United States

New business models are being developed by vertically integrated shellfish culture businesses (“integrators”) and contract grower cooperatives (“co-ops”). Similar in many respects to successful vertical integration models in the U.S. poultry industry, clam and oyster farms and growers are developing contract models to support the shellfish grow-out operations in return for expanded marketing capability and access to value added markets. By contracting co-ops the integrator benefits in many ways for example:

- Financial risk is spread between the integrator and the co-ops should the crop fail.
- Better yields are likely obtained when a principal investor (the co-op) is in charge of planting, maintaining, and harvesting the crop than if an hourly wage earner were in charge.
- If many small growers enter the market with no marketing plan, prices may plummet or, at times, growers may not be able to sell product at all.

Advantages to co-op growers include:

- Less risk for production and less risk for loss of income.
- By combining volume with a larger integrator with marketing expertise, the co-ops have a ready market at a more stable price.
- Less operating capital necessary.
- Opportunity to obtain additional income from the shellfish farm.

This presentation will discuss the current structure of cooperative shellfish grow-out including explanations of the economic benefits and tradeoffs for both the shellfish integrator and grower. It will conclude with an example on structuring such contracts to benefit each party and maximize the return to the participants.

Session number: 6.3

Paper number: 440

Fisheries and Aquaculture to 2050

Miroslav Batka, International Food Policy Research Institute (IFPRI), Washington, DC, United States

The proposed paper discussed scenarios of possible future developments in the global fisheries and aquaculture markets. The paper is based on the IFPRI’s global IMPACT Model (International Model for Policy Analysis in Agriculture), a leading model of global agricultural markets. Recently, fish commodities have been added to the model and

aquaculture feed markets have been linked to existing livestock and soybean commodity flows. As a result, the IMPACT model currently represents the most detailed and comprehensive model of the linkages between the aquaculture and agricultural sectors.

Projections, both medium- and long-term are presented, for the 2030 and 2050 time horizon. Along with a thoroughly vetted baseline, with input from both the World Bank and the Food and Agriculture Organisation of the United Nations, the authors present a number of scenarios centered on the future trends in consumption preferences and issues surrounding feed availability, scarcity and efficiency.

Moreover, the paper discusses issues of energy efficiency and energy intensity of the aquaculture sector, in contrast with the energy demands of other meat and food producing sectors. The paper discusses the opportunities and challenges that the aquaculture sector represents in terms of the future of sustainable food production and sustainable production intensification.

Finally, the paper discusses the implications of future development of the aquaculture sector for the nutrition and health of the world's most food insecure regions.

Session number: 6.3

Paper number: 118

An Empirical Analysis of Community Based Fish Culture (CBFC) Systems in Bangladesh: Impacts on Expenditures and Inequality

A.B.M. Mahfuzul Haque¹ (presenting), Md Akhtaruzzaman Khan², Madan Mohan Dey

1. WorldFish, Bangladesh and South Asia Office, Dhaka, Dhaka, Bangladesh

2. Bangladesh Agricultural University, Mymensingh, Mymensingh, Bangladesh

Seasonal floodplains contribute significantly to the total fish production in Bangladesh but may contribute even more if proper management systems are in place. Over one third of Bangladesh comprises floodplains (2.8 million ha) and most households in these areas, of which 2.7 million are poor and extremely poor, depend directly on these floodplains for their food and livelihoods. Large areas of these floodplains are suitable for fish culture during monsoon season. Food availability and livelihood security can be ensured by culturing fish in these floodplain areas with proper management systems. WorldFish implemented an action research project to assess the contribution of collectively managed floodplain aquaculture on sustainable use of floodplain resources and equitable distribution of benefits among the fishing communities. Using three years of panel data from project and control sites, this study examines the impact of Community Based Fish Culture (CBFC) on expenditure and inequality. Non-parametric propensity score matching method (PSM) methods are used for impact assessment. Gini-coefficient and Gini decomposition methods were used to estimate the effect of expenditures on inequality. The results show that community based fish culture systems have positive and significant impact on fishers' expenditures. Results also reveal that CBFC system has an equalization effect on food, clothing and health expenditures. Furthermore, this management system helps to distribute total expenditure equally among the fisher communities.

Session number: 6.3

Paper number: 258

Aquaculture Participation on Poverty Alleviation: The Case of Ben Tre Province, Vietnam

Kimanh Nguyen (presenting), CURTIS JOLLY, Chuong Bui¹, Trang Le²

1. Auburn University, Auburn, Alabama, United States

2. NhaTrang University, NHA TRANG, KHANH HOA, Viet Nam

Aquaculture production growth rate has surpassed that of all other production industries in the agricultural sector in the past decade. Aquaculture has always been viewed as an activity capable of producing food, employment, jobs and income and dragging rural residents out of poverty. However, research results on the effects of aquaculture on poverty alleviation have been mixed. We use Tobit, simulation models and cross sectional 2012 survey data of 285 households, in Ben Tre Province, Vietnam, to evaluate the effects of aquaculture involvement on poverty, measured using per capita consumption of less than \$1.25, \$1.50 and \$2.00 per day. The results show for per capita consumption of less than \$1.25 per day that households' level of education, credit demand, the number of household members below age of 15 or above 64 increase per capita consumption above the poverty line. The number of family members working outside the household, participation in farming, and livelihood diversification increase poverty levels. With per capita consumption < \$1.50 the same variables were significant as before, but aquaculture involvement positively influenced poverty alleviation. Agriculture as primary occupation and aquaculture involvement increased standard of living. At less than \$2.00 per capita consumption per day, education, number of members below 15 and above 64, involvement in fishing and aquaculture positively influenced standard of living, and poverty alleviation. The study shows that aquaculture can increase per capita income per day, if the individual already consumes more than \$1.25 per day or not absolutely poor.

Session number: 6.3

Paper number: 163

Developing Cooperative Production models for Molluscan Shellfish Culture in the U.S

Thomas Murray, Virginia Institute of Marine Science, Gloucester Point, Virginia, United States

New business models are being developed by vertically integrated shellfish culture businesses (“integrators”) and contract grower cooperatives (“co-ops”). Similar in many respects to successful vertical integration models in the U.S. poultry industry, clam and oyster farms and growers are developing contract models to support the shellfish grow-out operations in return for expanded marketing capability and access to value added markets.

By contracting co-ops the integrator benefits in many ways for example:

- Financial risk is spread between the integrator and the co-ops should the crop fail.
- Better yields are likely obtained when a principal investor (the co-op) is in charge of planting, maintaining, and harvesting the crop than if an hourly wage earner were in charge.
- If many small growers enter the market with no marketing plan, prices may plummet or, at times, growers may not be able to sell product at all.

Advantages to co-op growers include:

- Less risk for production and less risk for loss of income.
- By combining volume with a larger integrator with marketing expertise, the co-ops have a ready market at a more stable price.
- Less operating capital necessary.
- Opportunity to obtain additional income from the shellfish farm.

This presentation will discuss the current structure of cooperative shellfish grow-out including explanations of the economic benefits and tradeoffs for both the shellfish integrator and grower. It will conclude with an example on structuring such contracts to benefit each party and maximize the return to the participants.

Session number: 6.3

Paper number: 440

Fisheries and Aquaculture to 2050

Miroslav Batka, International Food Policy Research Institute (IFPRI), Washington, DC, United States

The proposed paper discussed scenarios of possible future developments in the global fisheries and aquaculture markets. The paper is based on the IFPRI's global IMPACT Model (International Model for Policy Analysis in Agriculture), a leading model of global agricultural markets. Recently, fish commodities have been added to the model and aquaculture feed markets have been linked to existing livestock and soybean commodity flows. As a result, the IMPACT model currently represents the most detailed and comprehensive model of the linkages between the aquaculture and agricultural sectors.

Projections, both medium- and long-term are presented, for the 2030 and 2050 time horizon. Along with a thoroughly vetted baseline, with input from both the World Bank and the Food and Agriculture Organisation of the United Nations, the authors present a number of scenarios centered on the future trends in consumption preferences and issues surrounding feed availability, scarcity and efficiency.

Moreover, the paper discusses issues of energy efficiency and energy intensity of the aquaculture sector, in contrast with the energy demands of other meat and food producing sectors. The paper discusses the opportunities and challenges that the aquaculture sector represents in terms of the future of sustainable food production and sustainable production intensification.

Finally, the paper discusses the implications of future development of the aquaculture sector for the nutrition and health of the world's most food insecure regions.

Session number: 6.4

Paper number: 423

Eliminating Harmful Fisheries Subsidies: Using Trade and Economic Policies to Rebuild Fisheries, Improve Livelihoods, and Promote Sustainable Fishing Worldwide.

Courtney Sakai, Oceana, Washington, DC, United States

Eliminating capacity-enhancing fisheries subsidies is the largest single action that can be taken to address global overfishing. Capacity-enhancing subsidies create strong economic incentives to overfish, depleting fisheries resources worldwide, particularly to the detriment of small-scale fishers and communities. Globally these subsidies amount to approximately \$35bn per year. Scientists, economists, and governments broadly acknowledge subsidy reform as a key part of achieving sustainable fisheries. However, despite international commitments and attention, harmful fisheries subsidies are still pervasive. The solution comes not through traditional fisheries management but through trade and economic policies. We provide a review and assessment of past and existing initiatives for subsidy reform at international, regional, and national levels, such as those undertaken at the World Trade Organization (WTO), in the Trans-Pacific Partnership (TPP) trade agreement, and by the European Union. Some of these initiatives remain incomplete or face new challenges as the result of political issues and ongoing geopolitical changes. Our study identifies and evaluates potential venues to address fisheries subsidies and determines the best opportunities and combination of political and technical initiatives, to achieve global subsidies reform now.

Session number: 6.4

Paper number: 353

Are Two Rents Better Than None? The Case for Monopoly Harvester Co-Ops

Hirotsugu Uchida¹ (presenting), Dale Manning²

1. University of Rhode Island, Kingston, Rhode Island, United States

2. Colorado State University, Fort Collins, CO, United States

Despite the efforts of natural resource economists to implement rights-based fishery management systems, many of the world's fisheries remain over-exploited and lack an institution to change course. Given the status quo of overharvesting and depleted fish stocks, it seems natural for a harvester co-op to jointly curtail fishing mortality, which inevitably leads to reduced landings in the short run. Because of this, the legality of harvester co-op has been the topic of debate. Many authors have pointed out the potential conservation benefits of the creation of "conservation cartels," however currently such co-ops are often considered as violation of antitrust law. In this paper, we use an optimal control model of a fishery with stock-dependent costs to compare the monopolist (cartel) outcome to a rent dissipated fishery. The monopolist creates rent by restricting harvest to increase price (monopoly rent) but also manages for an increased fish stock to decrease harvest costs (resource rent). Monopoly rent decreases welfare while the resource rent increases it. We develop a dynamic model of a fishery with the potential for market power and show that in fisheries with relatively elastic demand and/or costs that decrease quickly with an improved fish stock, a monopoly co-op can be socially preferred to continued rent dissipation. This result has important policy implications in fisheries where first-best solutions are not politically feasible the creation of a monopoly co-op can represent a social improvement.

Session number: 6.4

Paper number: 216

Recent Developments in Fisheries Economics Research

Niels Vestergaard¹ (presenting), Lone Kronbak², Dale Squires

1. University of Southern Denmark, Esbjerg, Esbjerg, Denmark

2. University of Southern Denmark, Odense M, Denmark, Denmark

Fisheries economics stand on the cusp of potentially sizeable changes in orientation and policy focus, leading in turn to comparable changes in modeling and general analysis. Notably, fisheries are increasingly framed as part of the overall marine environment rather than considered as solely or largely a commercial fishing issue. Other changes further challenge this traditional conceptual foundation, including technological change, multiple externalities, asymmetric information, marine planning and strategic interactions among players that are especially pronounced in international settings. This paper contends there is a potential for re-development of fishery economic models related to fishery and marine economics in several directions also related to the economic foundation.

Session number: 6.4

Paper number: 160

A limited entry fishery and Real Options theory

Diana van Dijk¹, **Rolf Groeneveld**² (presenting), Ekko C. van Ierland³

1. EAWAG, Dübendorf, Zurich, Switzerland

2. Wageningen University, Wageningen, The Netherlands, Netherlands

3. Wageningen University, Wageningen, Gelderland, Netherlands

Natural resources, including fisheries, provide a significant source of income in the state of Alaska. Salmon fisheries in Alaska are managed through a limited entry system, which places an overall limit on the number of commercial vessels in the fishery. Permits are tradable, but somewhat counter intuitively, a high proportion of the permits sit latent in any given year while permit values are often high. We argue that the option value of permits may explain this phenomenon. In the face of uncertainty about future resource rents, fishermen are faced with the challenge of determining at which ex-vessel price they should invest and disinvest in the fishery. We characterize the uncertainty as coming through the ex-vessel price and develop an optimal switching model that determines at what threshold prices fishermen switch between three states of operation: active, lay-up and exit. The model is applied to permit holders in the Bristol Bay sockeye salmon drift gillnet fishery. Results show that optimal threshold prices depend on the cost profile of the fisherman. It may also be appealing for fishermen to hold on to a permit because they expect the ex-vessel price and the market value of the entry permit to recover to their historically high levels.

Session number: 6.4

Paper number: 423

Eliminating Harmful Fisheries Subsidies: Using Trade and Economic Policies to Rebuild Fisheries, Improve Livelihoods, and Promote Sustainable Fishing Worldwide.

Courtney Sakai, Oceana, Washington, DC, United States

Eliminating capacity-enhancing fisheries subsidies is the largest single action that can be taken to address global overfishing. Capacity-enhancing subsidies create strong economic incentives to overfish, depleting fisheries resources worldwide, particularly to the detriment of small-scale fishers and communities. Globally these subsidies amount to approximately \$35bn per year. Scientists, economists, and governments broadly acknowledge subsidy reform as a key part of achieving sustainable fisheries. However, despite international commitments and attention, harmful fisheries subsidies are still pervasive. The solution comes not through traditional fisheries management but through trade and economic policies. We provide a review and assessment of past and existing initiatives for subsidy reform at international, regional, and national levels, such as those undertaken at the World Trade Organization (WTO), in the Trans-Pacific Partnership (TPP) trade agreement, and by the European Union. Some of these initiatives remain incomplete or face new challenges as the result of political issues and ongoing geopolitical changes. Our study identifies and evaluates potential venues to address fisheries subsidies and determines the best opportunities and combination of political and technical initiatives, to achieve global subsidies reform now.

Session number: 6.4

Paper number: 353

Are Two Rents Better Than None? The Case for Monopoly Harvester Co-Ops

Hirotsugu Uchida¹ (presenting), Dale Manning²

1. University of Rhode Island, Kingston, Rhode Island, United States

2. Colorado State University, Fort Collins, CO, United States

Despite the efforts of natural resource economists to implement rights-based fishery management systems, many of the world's fisheries remain over-exploited and lack an institution to change course. Given the status quo of overharvesting and depleted fish stocks, it seems natural for a harvester co-op to jointly curtail fishing mortality, which inevitably leads to reduced landings in the short run. Because of this, the legality of harvester co-op has been the topic of debate. Many authors have pointed out the potential conservation benefits of the creation of "conservation cartels," however currently such co-ops are often considered as violation of antitrust law. In this paper, we use an optimal control model of a fishery with stock-dependent costs to compare the monopolist (cartel) outcome to a rent dissipated fishery. The monopolist creates rent by restricting harvest to increase price (monopoly rent) but also manages for an increased fish stock to decrease harvest costs (resource rent). Monopoly rent decreases welfare while the resource rent increases it. We develop a dynamic model of a fishery with the potential for market power and show that in fisheries with relatively elastic demand and/or costs that decrease quickly with an improved fish stock, a monopoly co-op can be socially preferred to continued rent dissipation. This result has important policy implications in fisheries where first-best solutions are not politically feasible the creation of a monopoly co-op can represent a social improvement.

Session number: 6.4

Paper number: 216

Recent Developments in Fisheries Economics Research

Niels Vestergaard¹ (presenting), Lone Kronbak², Dale Squires

1. University of Southern Denmark, Esbjerg, Esbjerg, Denmark

2. University of Southern Denmark, Odense M, Denmark, Denmark

Fisheries economics stand on the cusp of potentially sizeable changes in orientation and policy focus, leading in turn to comparable changes in modeling and general analysis. Notably, fisheries are increasingly framed as part of the overall marine environment rather than considered as solely or largely a commercial fishing issue. Other changes further challenge this traditional conceptual foundation, including technological change, multiple externalities, asymmetric information, marine planning and strategic interactions among players that are especially pronounced in international settings. This paper contends there is a potential for re-development of fishery economic models related to fishery and marine economics in several directions also related to the economic foundation.

Session number: 6.4

Paper number: 160

A limited entry fishery and Real Options theory

Diana van Dijk¹, **Rolf Groeneveld² (presenting)**, Ekko C. van Ierland³

1. EAWAG, Dübendorf, Zurich, Switzerland

2. Wageningen University, Wageningen, The Netherlands, Netherlands

3. Wageningen University, Wageningen, Gelderland, Netherlands

Natural resources, including fisheries, provide a significant source of income in the state of Alaska. Salmon fisheries in Alaska are managed through a limited entry system, which places an overall limit on the number of commercial vessels in the fishery. Permits are tradable, but somewhat counter intuitively, a high proportion of the permits sit latent in any given year while permit values are often high. We argue that the option value of permits may explain this phenomenon. In the face of uncertainty about future resource rents, fishermen are faced with the challenge of determining at which ex-vessel price they should invest and disinvest in the fishery. We characterize the uncertainty as coming through the ex-vessel price and develop an optimal switching model that determines at what threshold prices fishermen switch between three states of operation: active, lay-up and exit. The model is applied to permit holders in the Bristol Bay sockeye salmon drift gillnet fishery. Results show that optimal threshold prices depend on the cost profile of the fisherman. It may also be appealing for fishermen to hold on to a permit because they expect the ex-vessel price and the market value of the entry permit to recover to their historically high levels.

Session number: 6.5

Paper number: 361

Bioeconomics and Seasonal Variations in Catchability

Øystein Hermansen¹ (presenting), Arne Eide²

1. NOFIMA, Tromsø, T, Norway

2. Norwegian College of Fisheries Science, Tromsø, Troms, Norway

Bioeconomic theory and models have provided considerable management-relevant insight on the dynamics and utilization of renewable resources. Early models focused on explaining the economic and behavioral drivers that led to overutilization and depleted fish stocks (Gordon 1954, Scott 1955). Refinements of the models showed the considerable rents that could be acquired if fishing effort is reduced and the stock allowed growing to optimal levels.

The model time perspective is usually limited to one year and is thus not explicitly taking into account the often strong seasonal variations in parameters such as growth, quality characteristics and costs of harvesting. Optimal resource utilization is likely to depend on these variations. Hence, the timing of harvest is important for rent maximization, named the “time of capture problem” by Wilson (1982).

Intraannual variations in growth rates, prices and quality have been studied in some papers, but none have analyzed the effects of catchability. This paper therefore discusses how optimal stock dynamics are influenced by seasonal variations in catchability. The analysis is carried out using a Gordon-Schaefer type bioeconomic model of a fishery – first from a general optimal control perspective, then the results are numerically employed on a model fishery. We investigate the results for open access and ITQ management regimes. In addition we discuss the optimum adjustment path in moving towards equilibrium.

Session number: 6.5

Paper number: 408

Fishing History Determines Economic Value of Ecological Information in Multispecies Fisheries

Timothy Essington¹, James Sanchirico² (presenting), Marissa Baskett²

1. University of Washington, Seattle, Washington, United States

2. UC Davis, Davis, California, United States

Calls to account for ecological interactions and tradeoffs in fishery management have grown over time. For example, some groups are asking to reduce global forage fish catch by 10-20% to ensure food supplies for other species. These efforts follow advances in ecology and the development of large food web models, such as Ecosim and Atlantis. To help inform ecosystem-based management, we examine the implications of ecological interactions for management, and what are the costs of assuming one type of interaction when in fact another interaction is present? We develop a flexible delay-differential bioeconomic model based on cod and herring fisheries for multiple types of species interactions. We incrementally add complexity to species interactions, from no interactions, cod predation on herring, linear herring predation on cod eggs, and non-linear predation on cod eggs that produces depensation. The latter case has been hypothesized to result in a regime switch whereby cod might not be able to rebuild even in the absence of fishing. We use pseudospectral collocation to solve for the optimal dynamic solution under numerous fishing histories and ecological

interactions. We find small deviations in optimal management and net present value across the cases, which imply that assuming the fish stocks are independent (aka single species management) is not necessarily an inferior strategy. The exception to this result is when the fish stocks were severely overfished. In this case, single species management could suppress cod recovery and result in economic losses on the order of 20% over time.

Session number: 6.5

Paper number: 403

An Agent Based Model of South African Demersal Hake Trawling Examining the Dynamics of the Industry Between Target Resource and Markets

Rachel Cooper¹ (presenting), Astrid Jarre¹, Anthony Leiman¹

1. University of Cape Town, Cape Town, Western Cape, South Africa

The offshore demersal hake trawling industry is the largest sub-sector, accounting for 85% of the catch, of South Africa's most valuable fishery, the hake (*Merluccius capensis* and *M. paradoxus*) directed fishery. The companies involved in extraction and processing of hake in the offshore demersal hake trawling sector are completely heterogeneous, with different structures, vessel fleets, product types that they produce, sizes and proportions of quota and presumably markets. We therefore hypothesize that changes in market forces in terms of volume, price, product type demanded (e.g. fresh vs. frozen) will have dissimilar effects on different types of companies. Modelling provides one way of exploring scenarios of such changes. We aim to gain a preliminary understanding of the dynamics of the industry of this sub-sector, i.e. the post-harvest industry between target resource and market of offshore demersal hake trawl, with regard to its structure and the relative importance of internal and external drivers, such as consumer preferences and demand for fresh or frozen fish. We produced an agent based model prototype of the post-harvest industry that is capable of taking into account the heterogeneity of companies, their fleets and behaviours, since it models individual companies, vessels and importing countries, their attributes and their interactivity, and used it to examine a range of scenarios. We emphasize the importance of a prototyping approach in developing this type of model, particularly where the ultimate aim is to use it in conjunction with ecological models in an ecosystem approach to fisheries framework.

Session number: 6.5

Paper number: 256

Assessing social – ecological trade-offs to advance ecosystem-based fisheries management

Rudi Voss¹ (presenting), Martin F. Quaas¹, Jörn Schmidt², Olli Tahvonen³, Martin Lindegren⁴, Christian Moellmann⁵

1. University of Kiel, Kiel, Schleswig-Holstein, Germany

2. Christian-Albrechts-Universität zu Kiel, Department of Economics, Sustainable Fisheries, Kiel, Schleswig-Holstein, Germany

3. Department of Forest Sciences, University of Helsinki, Helsinki, Helsinki, Finland

4. Scripps Institution of Oceanography, University of California, La Jolla, California, United States

5. Institute for Hydrobiology and Fisheries Science, Center for Earth System Research and Sustainability (CEN), KlimaCampus, University of Hamburg, Hamburg, Hamburg, Germany

Modern resource management faces trade-offs in the provision of various ecosystem goods and services to humanity. For fisheries management to develop into an ecosystem-based approach, the goal is not only to maximize economic profits, but to consider equally important conservation and social equity goals. Here, we introduce such a triple-bottom line approach to the management of multi-species fisheries using the Baltic Sea as a case study. We apply a coupled ecological-economic optimization model to address the actual fisheries management challenge of trading-off the recovery of collapsed cod stocks versus the health of ecologically important forage fish populations. We show that cod recovery strategies based on profit maximization may cause the risk of stock collapse for forage species with low market value, such as Baltic sprat. Economically efficient conservation efforts to protect sprat would be borne exclusively by the forage fishery, challenging resource use equity between fishing sectors. Optimizing equity instead of sprat biomass would reduce potential profits of the overall Baltic fishery, but may offer an acceptable balance between overall profits, species conservation and social equity. Our case study shows a practical example of how an ecosystem-based fisheries management will be able to offer society options to solve common conflicts between different resource uses. Approaches like ours, adding equity considerations to the traditional trade-off between economy and ecology, will greatly enhance credibility and hence compliance to management decisions, a further footstep towards healthy fish stocks and sustainable fisheries in the world ocean.

Session number: 6.5

Paper number: 361

Bioeconomics and Seasonal Variations in Catchability

Øystein Hermansen¹ (presenting), Arne Eide²

1. NOFIMA, Tromsø, T, Norway

2. Norwegian College of Fisheries Science, Tromsø, Troms, Norway

Bioeconomic theory and models have provided considerable management-relevant insight on the dynamics and utilization of renewable resources. Early models focused on explaining the economic and behavioral drivers that led to overutilization and depleted fish stocks (Gordon 1954, Scott 1955). Refinements of the models showed the considerable rents that could be acquired if fishing effort is reduced and the stock allowed growing to optimal levels.

The model time perspective is usually limited to one year and is thus not explicitly taking into account the often strong seasonal variations in parameters such as growth, quality characteristics and costs of harvesting. Optimal resource utilization is likely to depend on these variations. Hence, the timing of harvest is important for rent maximization, named the “time of capture problem” by Wilson (1982).

Intraannual variations in growth rates, prices and quality have been studied in some papers, but none have analyzed the effects of catchability. This paper therefore discusses how optimal stock dynamics are influenced by seasonal variations in catchability. The analysis is carried out using a Gordon-Schaefer type bioeconomic model of a fishery – first from a general optimal control perspective, then the results are numerically employed on a model fishery. We investigate the results for open access and ITQ management regimes. In addition we discuss the optimum adjustment path in moving towards equilibrium.

Session number: 6.5

Paper number: 408

Fishing History Determines Economic Value of Ecological Information in Multispecies Fisheries

Timothy Essington¹, **James Sanchirico² (presenting)**, Marissa Baskett²

1. University of Washington, Seattle, Washington, United States

2. UC Davis, Davis, California, United States

Calls to account for ecological interactions and tradeoffs in fishery management have grown over time. For example, some groups are asking to reduce global forage fish catch by 10-20% to ensure food supplies for other species. These efforts follow advances in ecology and the development of large food web models, such as Ecosim and Atlantis. To help inform ecosystem-based management, we examine the implications of ecological interactions for management, and what are the costs of assuming one type of interaction when in fact another interaction is present? We develop a flexible delay-differential bioeconomic model based on cod and herring fisheries for multiple types of species interactions. We incrementally add complexity to species interactions, from no interactions, cod predation on herring, linear herring predation on cod eggs, and non-linear predation on cod eggs that produces depensation. The latter case has been hypothesized to result in a regime switch whereby cod might not be able to rebuild even in the absence of fishing. We use pseudospectral collocation to solve for the optimal dynamic solution under numerous fishing histories and ecological interactions. We find small deviations in optimal management and net present value across the cases, which imply that assuming the fish stocks are independent (aka single species management) is not necessarily an inferior strategy. The exception to this result is when the fish stocks were severely overfished. In this case, single species management could suppress cod recovery and result in economic losses on the order of 20% over time.

Session number: 6.5

Paper number: 403

An Agent Based Model of South African Demersal Hake Trawling Examining the Dynamics of the Industry Between Target Resource and Markets

Rachel Cooper¹ (presenting), Astrid Jarre¹, Anthony Leiman¹

1. University of Cape Town, Cape Town, Western Cape, South Africa

The offshore demersal hake trawling industry is the largest sub-sector, accounting for 85% of the catch, of South Africa's most valuable fishery, the hake (*Merluccius capensis* and *M. paradoxus*) directed fishery. The companies involved in extraction and processing of hake in the offshore demersal hake trawling sector are completely heterogeneous, with different structures, vessel fleets, product types that they produce, sizes and proportions of quota and presumably markets. We therefore hypothesize that changes in market forces in terms of volume, price, product type demanded (e.g. fresh vs. frozen) will have dissimilar effects on different types of companies. Modelling provides one way of exploring scenarios of such changes. We aim to gain a preliminary understanding of the dynamics of the industry of this sub-sector, i.e. the post-harvest industry between target resource and market of offshore demersal hake trawl, with regard to its structure and the relative importance of internal and external drivers, such as consumer preferences and demand for fresh or frozen fish. We produced an agent based model prototype of the post-harvest industry that is capable of taking into account the heterogeneity of companies, their fleets and behaviours, since it models individual companies, vessels and importing countries, their attributes and their interactivity, and used it to examine a range of scenarios. We emphasize the importance of a prototyping approach in developing this type of model, particularly where the ultimate aim is to use it in conjunction with ecological models in an ecosystem approach to fisheries framework.

Session number: 6.5

Paper number: 256

Assessing social – ecological trade-offs to advance ecosystem-based fisheries management

Rudi Voss¹ (presenting), Martin F. Quaas¹, Jörn Schmidt², Olli Tahvonen³, Martin Lindegren⁴, Christian Moellmann⁵

1. University of Kiel, Kiel, Schleswig-Holstein, Germany

2. Christian-Albrechts-Universität zu Kiel, Department of Economics, Sustainable Fisheries, Kiel, Schleswig-Holstein, Germany

3. Department of Forest Sciences, University of Helsinki, Helsinki, Helsinki, Finland

4. Scripps Institution of Oceanography, University of California, La Jolla, California, United States

5. Institute for Hydrobiology and Fisheries Science, Center for Earth System Research and Sustainability (CEN), KlimaCampus, University of Hamburg, Hamburg, Hamburg, Germany

Modern resource management faces trade-offs in the provision of various ecosystem goods and services to humanity. For fisheries management to develop into an ecosystem-based approach, the goal is not only to maximize economic profits, but to consider equally important conservation and social equity goals. Here, we introduce such a triple-bottom line approach to the management of multi-species fisheries using the Baltic Sea as a case study. We apply a coupled ecological-economic optimization model to address the actual fisheries management challenge of trading-off the recovery of collapsed cod stocks versus the health of ecologically important forage fish populations. We show that cod recovery strategies based on profit maximization may cause the risk of stock collapse for forage species with low market value, such as Baltic sprat. Economically efficient conservation efforts to protect sprat would be borne exclusively by the forage fishery, challenging resource use equity between fishing sectors. Optimizing equity instead of sprat biomass would reduce potential profits of the overall Baltic fishery, but may offer an acceptable balance between overall profits, species conservation and social equity. Our case study shows a practical example of how an ecosystem-based fisheries management will be able to offer society options to solve common conflicts between different resource uses. Approaches like ours, adding equity considerations to the traditional trade-off between economy and ecology, will greatly enhance credibility and hence compliance to management decisions, a further footstep towards healthy fish stocks and sustainable fisheries in the world ocean.

Session number: 6.6

Paper number: 339

Te Arawa: Kaitiakitanga - Traditional Customary Practices for Freshwater and Fisheries Management: The Challenges and Successes for Te Arawa to Manage Freshwater Environments and Fisheries in Aotearoa/New Zealand.

Roku Mihinui¹ (presenting), Hera Smith², Tracey Kingi³, Leilani Ngawhika¹

1. Te Arawa Lakes Trust, Rotorua, North Island, New Zealand

2. Te Arawa Lakes Trust, Rotorua, North Island, United States

3. KIC LTD, Nelson, South Island, New Zealand

This paper is a compilation of several themes that addresses how Te Arawa iwi Trusts are utilising kaitiakitanga; traditional methods, practices and customs to manage freshwater environments and freshwater fisheries. Te Arawa is a central north island indigenous tribe of Aotearoa/New Zealand. Several deeds of settlement have been signed with Te Arawa iwi (tribal groups) and the Crown. The settlements have included regulations, protocols and cultural rights to manage freshwater and freshwater fisheries, within the Rotorua and Waikato region. Te Arawa iwi Trusts have freshwater and fisheries management responsibilities over significant freshwater lakes, rivers, springs, and tributaries.

This paper addresses the challenges and successes of delivering kaitiakitanga, traditional customary practices for freshwater and fisheries management. This paper will be delivered by Te Arawa iwi representative to present their experiences, aspirations, and goals to deliver outcomes for iwi members, a juxtaposition of maintaining iwi traditions and customs and working within a legislative framework. The key themes are:

- Kaitiakitanga - traditional methods, practices and customs;
- Nga taonga ika- indigenous treasured fisheries
- Tau koura –a traditional method utilised for sustainable management; and a traditional method for aquaculture: a non profit approach to sustain cultural customs.
- Regulation, legislation, settlement; experiences of working within a legislative process and with Crown agencies.
- Economics (Politics) of freshwater in Aotearoa/New Zealand: Freshwater management/ownership; allocation issues and habitat restoration.
- Nga taonga ika- Indigenous treasured fisheries at risk; Koaro- *Galaxias brevipinnis*- a pilot study; and Kakahi- *Hyridella menziesii*.

Session number: 6.6

Paper number: 442

Fisheries Sustainability Challenges Embedded in Individual Transferable Quota Systems: Knowledge, Technology and Indigenous Fisheries Development in New Zealand

Hekia Bodwitch, University of California, Berkeley, Berkeley, CA, United States

In 1986, New Zealand implemented the world's first comprehensive individual transferable quota management system for fisheries, designed to ensure sustainable use of fish resources by restricting take levels. Today, fewer people are fishing less frequently, often using with more efficient capture technologies. Drawing on ethnographic research with Maori fishing communities in New Zealand's South Island, in this paper I demonstrate how this outcome

operates in contrast to the quota system's sustainable development goals for in-shore fisheries on two fronts. First, quota was not allocated to part-time fishers, many of whom are Maori. These individuals can no longer afford to fish as frequently as they were previously. As a result, less information about the status of the fishery is gathered, posing a challenge to fishery restoration efforts, most of which are tribally-led. Second, the tradable nature of quota corresponds to a concentration of capital resources, enabling the purchase of more intensive commercial fishing technologies. Commercial fishers now engage with the fishery less frequently but more invasively, drawing in less precise knowledge about the status of the fishery.

Proposing an alternative to the quota system's restrictions on take, I examine how restrictions on gear technology may have a greater impact on ecological and social metrics of sustainable fishery development. I highlight the methods and marketing strategies of Maori eel fishers in Lake Ellesmere to show that developing high-end direct-to consumer markets for fish caught with traditional fishing technology is an economically viable option for prompting social and ecological sustainability.

Session number: 6.6

Paper number: 3

The Roles of Family Conflict and Identity in the Theory of Planned Behaviour

Lê Chí Công, Nha Trang University, Nha Trang, Vietnam, Viet Nam

This study extends the theory of planned behaviour (TPB) so that it incorporates family conflict and identity, in order to explain Vietnamese families' fish consumption behaviour. A sample of 487 Vietnamese consumers participated in this study. Structural equation modeling was applied in order to test the relationship between the constructs, and to evaluate their reliability and the validity. As expected, the findings highlight the importance of incorporating the roles of family conflict and identity within the traditional TPB variables. Thus, this study provides a better understanding of the roles of social variables in explaining food consumption behaviour.

Keywords: Fish consumption, preference conflict, identity

Session number: 6.6

Paper number: 339

Te Arawa: Kaitiakitanga - Traditional Customary Practices for Freshwater and Fisheries Management: The Challenges and Successes for Te Arawa to Manage Freshwater Environments and Fisheries in Aotearoa/New Zealand.

Roku Mihinui¹ (presenting), Hera Smith², Tracey Kingi³, Leilani Ngawhika¹

1. Te Arawa Lakes Trust, Rotorua, North Island, New Zealand

2. Te Arawa Lakes Trust, Rotorua, North Island, United States

3. KIC LTD, Nelson, South Island, New Zealand

This paper is a compilation of several themes that addresses how Te Arawa iwi Trusts are utilising kaitiakitanga; traditional methods, practices and customs to manage freshwater environments and freshwater fisheries. Te Arawa is a central north island indigenous tribe of Aotearoa/New Zealand. Several deeds of settlement have been signed with Te Arawa iwi (tribal groups) and the Crown. The settlements have included regulations, protocols and cultural rights to manage freshwater and freshwater fisheries, within the Rotorua and Waikato region. Te Arawa iwi Trusts have freshwater and fisheries management responsibilities over significant freshwater lakes, rivers, springs, and tributaries.

This paper addresses the challenges and successes of delivering kaitiakitanga, traditional customary practices for freshwater and fisheries management. This paper will be delivered by Te Arawa iwi representative to present their experiences, aspirations, and goals to deliver outcomes for iwi members, a juxtaposition of maintaining iwi traditions and customs and working within a legislative framework. The key themes are:

- Kaitiakitanga - traditional methods, practices and customs;
- Nga taonga ika- indigenous treasured fisheries
- Tau koura –a traditional method utilised for sustainable management; and a traditional method for aquaculture: a non profit approach to sustain cultural customs.
- Regulation, legislation, settlement; experiences of working within a legislative process and with Crown agencies.
- Economics (Politics) of freshwater in Aotearoa/New Zealand: Freshwater management/ownership; allocation issues and habitat restoration.
- Nga taonga ika- Indigenous treasured fisheries at risk; Koaro- *Galaxias brevipinnis*- a pilot study; and Kakahi- *Hyridella menziesii*.

Session number: 6.6

Paper number: 442

Fisheries Sustainability Challenges Embedded in Individual Transferable Quota Systems: Knowledge, Technology and Indigenous Fisheries Development in New Zealand

Hekia Bodwitch, University of California, Berkeley, Berkeley, CA, United States

In 1986, New Zealand implemented the world's first comprehensive individual transferable quota management system for fisheries, designed to ensure sustainable use of fish resources by restricting take levels. Today, fewer people are fishing less frequently, often using with more efficient capture technologies. Drawing on ethnographic research with Maori fishing communities in New Zealand's South Island, in this paper I demonstrate how this outcome operates in contrast to the quota system's sustainable development goals for in-shore fisheries on two fronts. First, quota was not allocated to part-time fishers, many of whom are Maori. These individuals can no longer afford to fish as frequently as they were previously. As a result, less information about the status of the fishery is gathered, posing a challenge to fishery restoration efforts, most of which are tribally-led. Second, the tradable nature of quota corresponds to a concentration of capital resources, enabling the purchase of more intensive commercial fishing technologies. Commercial fishers now engage with the fishery less frequently but more invasively, drawing in less precise knowledge about the status of the fishery.

Proposing an alternative to the quota system's restrictions on take, I examine how restrictions on gear technology may have a greater impact on ecological and social metrics of sustainable fishery development. I highlight the methods and marketing strategies of Maori eel fishers in Lake Ellesmere to show that developing high-end direct-to consumer markets for fish caught with traditional fishing technology is an economically viable option for prompting social and ecological sustainability.

Session number: 6.6

Paper number: 3

The Roles of Family Conflict and Identity in the Theory of Planned Behaviour

Lê Chí Công, Nha Trang University, Nha Trang, Vietnam, Viet Nam

This study extends the theory of planned behaviour (TPB) so that it incorporates family conflict and identity, in order to explain Vietnamese families' fish consumption behaviour. A sample of 487 Vietnamese consumers participated in this study. Structural equation modeling was applied in order to test the relationship between the constructs, and to evaluate their reliability and the validity. As expected, the findings highlight the importance of incorporating the roles of family conflict and identity within the traditional TPB variables. Thus, this study provides a better understanding of the roles of social variables in explaining food consumption behaviour.

Keywords: Fish consumption, preference conflict, identity

Session number: 6.7

Paper number: 116

Source of Uncertainty in Indonesian Tuna Fisheries Management and the Effect of Uncertainty on Economic Value

Shinta Yuniarta¹, **Rolf Groeneveld² (presenting)**

1. Environmental Economics and Natural Resources, Wageningen University, Bogor, West Java, Indonesia

2. Wageningen University, Wageningen, The Netherlands, Netherlands

Management of the Indonesian tuna fisheries is limited by the quality of the available fisheries data, which currently does not meet international standards of scientific stock assessment. This paper aims to provide an indicative range of the main sources of uncertainty in data needed for Indonesian tuna fisheries management. Surveys were conducted with pole-and-line, handline, purse seine and longline vessels in Oceanic Fishing Port Bitung (North Sulawesi), which is the most productive tuna fishery in eastern Indonesia. Inaccuracies are found both in catch and effort data. Catch data are affected by unreported transshipments to other ports, use of (juvenile) catch as bait or for on-board consumption, and lack of staff capacity in data collection, the existence of several private landing sites in Bitung, and illegal landings outside the Indonesia area. Effort data are affected by unreported sets and miscalculation of gross tonnage in small-scale fisheries. The paper gives an indicative range of the magnitude of these uncertainties, which represent a loss of economic value due to biased reference points and fisheries management.

Session number: 6.7

Paper number: 344

Having a Crack at MEY when Time, Money and Data are Short.

Roger Edwards¹, **Julian Morison (presenting)**, Lisa Rippin², Sean Sloan³

1. Goolwa Pipi Harvesters Assoc Inc, Unley, SA, Australia

2. EconSearch, Adelaide, South Australia, United States

3. PIRSA Fisheries, Adelaide, South Australia, United States

A Fishery Gross Margin (FGM) model has been used, as a cost-effective and practical alternative to more complex economic modelling, to inform the development of structured TACC decision rules as part of the formal harvest strategy adopted for the South Australian Pipi (*donax Deltiodes*) fishery since 2012.

The primary economic objective of the harvest strategy is to ensure that sustainable harvest levels maximise Fishery Gross Margin (FGM) as a proxy for maximum economic yield (MEY). Measuring MEY requires sophisticated modelling tools and data which are cost prohibitive in this case. FGM is calculated as total fishery income less total variable costs, where variable costs are proportionate to fishing effort.

Increases in TACC can only occur if FGM is expected to increase by at least 1.5% and TACC decreases are triggered if FGM is expected to increase by at least 1.5%. In 2012, biological assessment and subsequent application of the biological TACC decision rule supported a TACC increase from 400 tonnes to 500 tonnes. The TACC increase was not implemented because the economic assessment resulted in an expected reduction in FGM. In 2013 the TACC increased as the assessment resulted in an expected increase in FGM above the required 1.5%, due to a planned value adding initiative.

The model strengths and weaknesses, industry and manager responses and issues with the approach are presented.

Session number: 6.7

Paper number: 370

The Information Value of Full-Retention Policies

Rolf Groeneveld¹ (presenting), Jan-Jaap Poos²

1. Wageningen University, Wageningen, The Netherlands, Netherlands

2. Wageningen IMARES, IJmuiden, Noord-Holland, Netherlands

Discard rates in marine fisheries have been estimated at more than 80% for some individual fisheries, with an average global discard rate of 8%. Discarding of catch can be problematic for three main reasons: (1) in the absence of accurate and precise discards estimates, unreliable catch data distort estimation of the appropriate quotas; (2) bycatch imposes a cost on the resource as survival rates are generally low; and (3) bycatch-induced mortality of charismatic species presents a loss of non-use values. Policy instruments to limit discarding vary from taxes on bycatch, to subsidies for selective fishing gear, to outright bans on discarding, also called full-retention policies. The 2013 reform of the European Union's Common Fisheries Policy features the introduction of such an obligation to land all catches "of species which are subject to catch limits." In this paper we aim to estimate the economic effects of a full retention policy in a mixed fishery. More specifically, we estimate the economic value of the data distortion caused by discarding of fish, and how these economic losses are ameliorated by a ban on discards. We present a bioeconomic model capable of investigating these questions in a mixed fishery for a variety of stock assessment methods, harvest control rules, and discarding policies. We apply the model to the North Sea demersal fishery, focusing on the two main commercial species plaice (*pleuronectes platessa*) and sole (*solea solea*). We find that the information value of discard bans depends largely on the prevailing harvest control rule.

Session number: 6.7

Paper number: 381

Proxy Measures for Economic Target Reference Points in Data Poor Multispecies Fisheries

Sean Pascoe¹ (presenting), Trevor Hutton, Olivier Thebaud³, Roy Deng, Neil Klaer, Simon Vieira

1. CSIRO, Australia

2. CSIRO,

3. IFREMER, PLOUZANE, Bretagne, France

The Australian Harvest Strategy Policy requires that maximum economic yield (MEY) be the target in all Commonwealth managed fisheries. For multispecies fisheries, unlike single species fisheries, the optimal yield is not independent of the optimal yield of the companion species (i.e. those species with which it is caught). In fisheries with many species, the cost of undertaking assessments of all species is prohibitive and may be more than the actual rent generated. As a result, the species have a varying level of information, and targets are often defined primarily for those species with good information with others being given "precautionary" targets that may not be consistent with maximising economic returns from

the fishery. In our study, we use simulation/optimisation modelling approaches to estimate rules of thumb for improving catch targets in multispecies fisheries when full stock assessment are unavailable. A stochastic multispecies bioeconomic model is developed and used to assess target reference points (expressed in terms of B_{MEY}/B_{MSY}) under a wide range of biological and economic conditions. The information derived is summarised through the use of Bayesian networks and regression trees to derive “models” for assessing proxy reference points when information on the species is limited.

Session number: 6.7

Paper number: 116

Source of Uncertainty in Indonesian Tuna Fisheries Management and the Effect of Uncertainty on Economic Value

Shinta Yuniarta¹, **Rolf Groeneveld**² (presenting)

1. Environmental Economics and Natural Resources, Wageningen University, Bogor, West Java, Indonesia

2. Wageningen University, Wageningen, The Netherlands, Netherlands

Management of the Indonesian tuna fisheries is limited by the quality of the available fisheries data, which currently does not meet international standards of scientific stock assessment. This paper aims to provide an indicative range of the main sources of uncertainty in data needed for Indonesian tuna fisheries management. Surveys were conducted with pole-and-line, handline, purse seine and longline vessels in Oceanic Fishing Port Bitung (North Sulawesi), which is the most productive tuna fishery in eastern Indonesia. Inaccuracies are found both in catch and effort data. Catch data are affected by unreported transshipments to other ports, use of (juvenile) catch as bait or for on-board consumption, and lack of staff capacity in data collection, the existence of several private landing sites in Bitung, and illegal landings outside the Indonesia area. Effort data are affected by unreported sets and miscalculation of gross tonnage in small-scale fisheries. The paper gives an indicative range of the magnitude of these uncertainties, which represent a loss of economic value due to biased reference points and fisheries management.

Session number: 6.7

Paper number: 344

Having a Crack at MEY when Time, Money and Data are Short.

Roger Edwards¹, **Julian Morison (presenting)**, Lisa Rippin², Sean Sloan³

1. Goolwa Pipi Harvesters Assoc Inc, Unley, SA, Australia

2. EconSearch, Adelaide, South Australia, United States

3. PIRSA Fisheries, Adelaide, South Australia, United States

A Fishery Gross Margin (FGM) model has been used, as a cost-effective and practical alternative to more complex economic modelling, to inform the development of structured TACC decision rules as part of the formal harvest strategy adopted for the South Australian Pipi (*donax Deltiodes*) fishery since 2012.

The primary economic objective of the harvest strategy is to ensure that sustainable harvest levels maximise Fishery Gross Margin (FGM) as a proxy for maximum economic yield (MEY). Measuring MEY requires sophisticated modelling tools and data which are cost prohibitive in this case. FGM is calculated as total fishery income less total variable costs, where variable costs are proportionate to fishing effort.

Increases in TACC can only occur if FGM is expected to increase by at least 1.5% and TACC decreases are triggered if FGM is expected to decrease by at least 1.5%. In 2012, biological assessment and subsequent application of the biological TACC decision rule supported a TACC increase from 400 tonnes to 500 tonnes. The TACC increase was not implemented because the economic assessment resulted in an expected reduction in FGM. In 2013 the TACC increased as the assessment resulted in an expected increase in FGM above the required 1.5%, due to a planned value adding initiative.

The model strengths and weaknesses, industry and manager responses and issues with the approach are presented.

Session number: 6.7

Paper number: 370

The Information Value of Full-Retention Policies

Rolf Groeneveld¹ (presenting), Jan-Jaap Poos²

1. Wageningen University, Wageningen, The Netherlands, Netherlands

2. Wageningen IMARES, IJmuiden, Noord-Holland, Netherlands

Discard rates in marine fisheries have been estimated at more than 80% for some individual fisheries, with an average global discard rate of 8%. Discarding of catch can be problematic for three main reasons: (1) in the absence of accurate and precise discards estimates, unreliable catch data distort estimation of the appropriate quotas; (2) bycatch imposes a cost on the resource as survival rates are generally low; and (3) bycatch-induced mortality of charismatic species presents a loss of non-use values. Policy instruments to limit discarding vary from taxes on bycatch, to subsidies for selective fishing gear, to outright bans on discarding, also called full-retention policies. The 2013 reform of the European Union's Common Fisheries Policy features the introduction of such an obligation to land all catches "of species which are subject to catch limits." In this paper we aim to estimate the economic effects of a full retention policy in a mixed fishery. More specifically, we estimate the economic value of the data distortion caused by discarding of fish, and how these economic losses are ameliorated by a ban on discards. We present a bioeconomic model capable of investigating these questions in a mixed fishery for a variety of stock assessment methods, harvest control rules, and discarding policies. We apply the model to the North Sea demersal fishery, focusing on the two main commercial species plaice (*pleuronectes platessa*) and sole (*solea solea*). We find that the information value of discard bans depends largely on the prevailing harvest control rule.

Session number: 6.7

Paper number: 381

Proxy Measures for Economic Target Reference Points in Data Poor Multispecies Fisheries

Sean Pascoe¹ (presenting), Trevor Hutton, Olivier Thebaud³, Roy Deng, Neil Klaer, Simon Vieira

1. CSIRO, Australia

2. CSIRO,

3. IFREMER, PLOUZANE, Bretagne, France

The Australian Harvest Strategy Policy requires that maximum economic yield (MEY) be the target in all Commonwealth managed fisheries. For multispecies fisheries, unlike single species fisheries, the optimal yield is not independent of the optimal yield of the companion species (i.e. those species with which it is caught). In fisheries with many species, the cost of undertaking assessments of all species is prohibitive and may be more than the actual rent generated. As a result, the species have a varying level of information, and targets are often defined primarily for those species with good information with others being given “precautionary” targets that may not be consistent with maximising economic returns from the fishery. In our study, we use simulation/optimisation modelling approaches to estimate rules of thumb for improving catch targets in multispecies fisheries when full stock assessment are unavailable. A stochastic multispecies bioeconomic model is developed and used to assess target reference points (expressed in terms of B_{MEY}/B_{MSY}) under a wide range of biological and economic conditions. The information derived is summarised through the use of Bayesian networks and regression trees to derive “models” for assessing proxy reference points when information on the species is limited.

Special Session B.1: Understanding Responses to Catch Share Systems in Marine Fisheries (continued)

Paper number: 432

Rights Based Management in International Tuna

Dale Squires, San Diego, CA, United States

The established of exclusive rights to fish is essential for tuna-Regional Fisheries Management Organizations to prevent overfishing, achieve sustainability, and to realize maximum economic benefits. Exclusive use or property rights may be based on catch, effort, or licenses, and similar systems can be used for bycatch. Unique issues arise compared to national systems. Two rights are entailed, access and catch/effort/capacity: Under international law, states hold the rights to fish and would receive the allocations. Individual states would distribute use rights to vessels, gear types or sectors. Systems for the creation and transferability of rights can accommodate diversity in national legal systems and issues and rights between coastal developing and small island states and distant water fishing nations. Allowing for those with a "real interest" and new entrants must be accommodated under international law. Unique compliance and monitoring issues arise, including rights based management instituted under self-enforcing multilateral cooperation in tuna-RFMOs and in accordance with international law, and trade and port state measures, bans on transshipment, inclusion on IUU vessel lists. Rights-based management also helps break the deadlock facing RFMOs, since different management decisions implicitly differentially allocate opportunities, employment, assets, and benefits among member parties, and growing capacity and delay accentuate the difficulty of governance reform and addressing root causes. After allocation, decentralized secondary markets replace on-going and contentious deliberations.

Paper number: 472

For the Common Good – ITQs as Wrong Instrument to Manage a Common Resource?

Ralf Doering¹ (presenting), Leyre Goti², Lorena Fricke³, Katharina Jantzen⁴

1. TI-Institute of Sea Fisheries, Hamburg, Hamburg, Germany
2. THÜNEN Institute of Sea Fisheries, Hamburg, Hamburg, Germany
3. Kiel University, Kiel, Schleswig Holstein, Germany
4. Hochschule Bremerhaven, Bremerhaven, Bremen, Germany

Fish stocks are belonging to the 'commons' – resources which can be owned by no-one in particular. We are allowed to use without abusing them.

However, we have international agreements, national jurisdiction etc. to manage stocks or, more precisely, who is allowed to fish. All regulations are based on our decisions, formation of international institutions and the idea that the population of a coastal state 'owns' the resource up to the continental shelf. Management should therefore try to optimize the resource use for the benefit of all and not only a small group.

There is a long debate on instruments to manage fish stocks or how to distribute access rights in light of this idea of states as 'owners'. However, there is little discussion on justice issues especially equity and fair distribution of rights.

Session number 7.1

ITQs are considered one of the main instruments to achieve a sustainable and efficient use of stocks. However, the 'owner' of the resource receives mostly no returns. The rights were given to an existing group of fishermen without payment and forever. Newcomers have to pay for getting rights, concentration of rights in a few hands is common and the owners have to be compensated if a government decides to redistribute rights.

I, first, describe the background of the fish stocks as 'common goods', then give an overview on the equity issues regarding ITQs and in a third part use Denmark and Germany as examples for existing ITQ and IQ systems.

Paper number: 479

Individual Transferable Quota contribution to environmental stewardship: A theory in need of validation

Ingrid Van Putten¹ (presenting), Olivier Thebaud², Elizabeth Fulton, Fabio Boschetti³, Anthony D.M. Smith

1. CSIRO, Hobart, Tasmania, Australia
2. IFREMER, PLOUZANE, Bretagne, France
3. CSIRO, Perth, WA, Australia

We explore the extent to which i) Individual Tradeable Quotas (ITQs) may lead to changes in environmental stewardship and ii) environmental stewardship may in turn contribute to explain the success or otherwise of ITQs in meeting sustainability objectives. ITQs are an example of incentive-based fisheries management in which fishing rights can be privately owned and traded. ITQs are aimed at resolving the problems created by open access fisheries. ITQs were proposed to promote efficiency and there is growing empirical evidence that ITQs meet a number of economic and social fisheries management objectives. Even though improved stock status arises as a consequence of the total allowable catch levels implemented together with ITQs, the effect is difficult to separate from the improvement due to existing and new management changes. However, stock status improvements have also been attributed to increased environmental stewardship resulting from the allocation of individual fishing rights.

While psychological theory suggests that there may be a relationship, there is insufficient evidence to draw the conclusion that improved environmental outcomes are due to *changes* in stewardship ethics arising from the combined effect of allocating fishing rights and co-management in ITQ managed fisheries. Complexity added by the move to fewer and generally larger-scale fishing operations, the concentration of ownership with processors and investors, increasing numbers of lease fishers, and corporate membership on co-management committees may all affect stewardship and more research is needed to establish in which direction these effects are in fact playing out.

Session number 7.1

Paper number: 457

Catch Share Systems Need Bioeconomics and Government – How the Theory of Stewardship Was Not Enough in Australian Southern Rock Lobster Fisheries

Caleb Gardner (presenting), Klaas Hartmann, Eriko Hoshino, Tim Emery², Rafael Leon, Rick McGarvey³

1. UTAS,
2. IMAS, University of Tasmania, Hobart, Tasmania, Australia
3. SARDI Aquatic Sciences, Henley Beach , SA, Australia

Catch shares were implemented in five different Southern Rock Lobster fisheries across southern Australia from 1993 to 2003. In all cases this led to a greater degree of co-management, in part because of the expectation that catch shares would lead to stewardship in decision making. The general pattern across these fisheries in recent years has been of below average recruitment to the fishery which has tested management systems and the stewardship of industry. In all cases, reductions in catch were required to prevent stock decline, which has been implemented by Government but always encountered resistance from industry (to varying degrees). Target reference points that aim for MEY have been implemented in some cases but decisions on total commercial catch linked to these have also been resisted. Bioeconomic analyses have identified numerous possible refinements to rules that would increase economic yield but these have generally struggled to be implemented. Examples include changes to gear limits, size limit changes, and spatial management within fishing zones- with some of these potentially transformational in terms of economic yield. There were numerous barriers to industry support for change but consistently the solution to higher economic yield lies with the need for Government to make unpopular decisions supported by bioeconomic analyses.

Session number: 7.2

Paper number: 200

Potential Benefits of a Transboundary Marine Protected Area Under no Cooperation Between Countries

Renato Molina, Sustainable Fisheries Group, University of California at Santa Barbara, Santa Barbara, California, United States

There is a considerable amount of work done in transboundary fisheries and the implications of non-cooperative scenarios using game theory; there is also plenty of research about Marine Protected Areas (MPA) and their role on improving biomass, fishing yields and fishermen profits. However, there is still a lack of studies about the potential benefits of implementing (MPA) in order to alleviate biological and economic inefficiencies that result from competitive scenarios. We modified the benchmark model proposed by Levhari and Mirman (1980) in order to account for a transboundary fishery scenario under different movement patterns for a theoretic population over a spatial setting. By confining the stock between two Exclusive Economic Zones, we simulated two countries that differ in harvesting strategies and share equal proportions of the stock habitat.

We found that MPAs have the potential to overcome both biological and economic inefficiencies in the fishery when the species movement is sufficiently high and the MPA is set in the optimal location. However, they can also have negative consequences when they are poorly designed or when the species movement is not high enough to generate significant spillover effects.

Session number: 7.2

Paper number: 179

Global Benefits of Marine Protected Areas

James Rising¹ (presenting), Geoffrey Heal²

1. Columbia University, New York, NY, United States

2. Columbia Business School, New York, NY, United States

Case studies suggest that Marine Protected Areas (MPAs) can be effective tools for fishery management. This study uses global datasets of MPAs and stock assessments to estimate the strength and robustness of their benefits. We apply multiple models, including a treatment-control pairing, a logistic model estimated with fixed-effects, and a regression tree to identify key characteristics. We find that regions with significant MPA designations increased their yearly yield by 17e3 MT/yr while those without experienced a loss of 20e3 MT/yr. On average, a 1% increase in protected area results in an increase in the growth rate of fish populations by about 1%. Considering only IUCN classified protected areas, and only marine portions of MPAs, growth rates increase 2% per percent area protected. MPA size is a key parameter which determines their per-area effectiveness. Using these results, we produce an estimate of the economic benefits of protected areas, relative to their costs. About 60% of country regions currently have insufficient protected areas to generate economic benefits, where the average break-even point for economic benefits of MPAs is at 8.5% of marine area.

Session number: 7.2

Paper number: 475

Regulatory Impacts on Exit from the California Drift Gillnet Swordfish Fishery: A Treatment-Control Duration Model

James Hilger, NOAA SWFSC, La Jolla, CA, United States

This paper reports an estimate of the impact of fishery regulations on vessel exit rates and fleet size. It provides a study of the duration of initial participation from entrance to exit of US fishing vessels engaged in the commercial California drift gillnet swordfish fishery between 1989 and 2010. The impact of the regulation is estimated using a treatment-control approach. Patterns of entry and exit across multiple strata of the fishery are documented. Multiple duration-modeling approaches are discussed and investigated. The Gompertz parametric hazard model is selected as the model of best fit based on statistical tests and graphical analysis. An approach for modeling the counterfactual fleet size is developed. Counterfactual hazard rate and fleet size estimates are produced for the counterfactual state of non-implementation of a time-area closure regulation initiated beginning with the 2001 season. Empirical results suggest that the regulation had a significant impact on exit rates and fleet size. These findings are consistent with the hypothesis that increased regulatory policies impact fleet participation rates and led to larger exit rates and smaller fleet size.

Session number: 7.2

Paper number: 460

Evergreen Licences, Resource Shares and Share Trading – Taking Them Out Of The 'Too Hard Basket'.

Roger Edwards¹, Kelly Crosthwaite², **Sean Sloan³ (presenting)**

1. Goolwa Pipi Harvesters Assoc Inc, Unley, SA, Australia

2. Consultant, Alphington, Victoria, Australia

3. PIRSA Fisheries, Adelaide, South Australia, United States

In 2007 the Fisheries Management Act passed through the South Australian parliament. The Act includes several new provisions which substantially changed the nature of commercial fishing rights, resource sharing between competing sectors and rights based management.

These interrelated provisions include:

- (1) Commercial licences are issued for the duration of a management plan;
- (2) Requirement for a replacement management plan to come into effect on the expiry of the existing plan;
- (3) That each management plan specify the share of aquatic resources to be allocated to each fishing sector under the plan (based on existing shares, which must be quantified);
- (4) Requirement for an open and transparent process for determining the method for adjusting allocations of aquatic resources between the different fishing sectors during the term of the plan; and
- (5) Provision for compensation to persons whose licences or licence entitlements are compulsorily acquired in order to reduce the share of aquatic resources allocated to the commercial fishing sector and increase the share allocated to another sector.

The 5 provisions, when considered as a package, have in effect established evergreen commercial fishing licences, explicit resource shares for sectors accessing a fishery and transparent compensable processes for resource share adjustments.

A number of management plans are now in place which meet these new requirements of the Act. The resultant management planning process, plan provisions impacts on the strength of fishing rights and management are presented.

Session number: 7.2

Paper number: 200

Potential Benefits of a Transboundary Marine Protected Area Under no Cooperation Between Countries

Renato Molina, Sustainable Fisheries Group, University of California at Santa Barbara, Santa Barbara, California, United States

There is a considerable amount of work done in transboundary fisheries and the implications of non-cooperative scenarios using game theory; there is also plenty of research about Marine Protected Areas (MPA) and their role on improving biomass, fishing yields and fishermen profits. However, there is still a lack of studies about the potential benefits of implementing (MPA) in order to alleviate biological and economic inefficiencies that result from competitive scenarios. We modified the benchmark model proposed by Levhari and Mirman (1980) in order to account for a transboundary fishery scenario under different movement patterns for a theoretic population over a spatial setting. By confining the stock between two Exclusive Economic Zones, we simulated two countries that differ in harvesting strategies and share equal proportions of the stock habitat.

We found that MPAs have the potential to overcome both biological and economic inefficiencies in the fishery when the species movement is sufficiently high and the MPA is set in the optimal location. However, they can also have negative consequences when they are poorly designed or when the species movement is not high enough to generate significant spillover effects.

Session number: 7.2

Paper number: 179

Global Benefits of Marine Protected Areas

James Rising¹ (presenting), Geoffrey Heal²

1. Columbia University, New York, NY, United States

2. Columbia Business School, New York, NY, United States

Case studies suggest that Marine Protected Areas (MPAs) can be effective tools for fishery management. This study uses global datasets of MPAs and stock assessments to estimate the strength and robustness of their benefits. We apply multiple models, including a treatment-control pairing, a logistic model estimated with fixed-effects, and a regression tree to identify key characteristics. We find that regions with significant MPA designations increased their yearly yield by 17e3 MT/yr while those without experienced a loss of 20e3 MT/yr. On average, a 1% increase in protected area results in an increase in the growth rate of fish populations by about 1%. Considering only IUCN classified protected areas, and only marine portions of MPAs, growth rates increase 2% per percent area protected. MPA size is a key parameter which determines their per-area effectiveness. Using these results, we produce an estimate of the economic benefits of protected areas, relative to their costs. About 60% of country regions currently have insufficient protected areas to generate economic benefits, where the average break-even point for economic benefits of MPAs is at 8.5% of marine area.

Session number: 7.2

Paper number: 475

Regulatory Impacts on Exit from the California Drift Gillnet Swordfish Fishery: A Treatment-Control Duration Model

James Hilger, NOAA SWFSC, La Jolla, CA, United States

This paper reports an estimate of the impact of fishery regulations on vessel exit rates and fleet size. It provides a study of the duration of initial participation from entrance to exit of US fishing vessels engaged in the commercial California drift gillnet swordfish fishery between 1989 and 2010. The impact of the regulation is estimated using a treatment-control approach. Patterns of entry and exit across multiple strata of the fishery are documented. Multiple duration-modeling approaches are discussed and investigated. The Gompertz parametric hazard model is selected as the model of best fit based on statistical tests and graphical analysis. An approach for modeling the counterfactual fleet size is developed. Counterfactual hazard rate and fleet size estimates are produced for the counterfactual state of non-implementation of a time-area closure regulation initiated beginning with the 2001 season. Empirical results suggest that the regulation had a significant impact on exit rates and fleet size. These findings are consistent with the hypothesis that increased regulatory policies impact fleet participation rates and led to larger exit rates and smaller fleet size.

Session number: 7.2

Paper number: 460

Evergreen Licences, Resource Shares and Share Trading – Taking Them Out Of The 'Too Hard Basket'.

Roger Edwards¹, Kelly Crosthwaite², **Sean Sloan³ (presenting)**

1. Goolwa Pipi Harvesters Assoc Inc, Unley, SA, Australia

2. Consultant, Alphington, Victoria, Australia

3. PIRSA Fisheries, Adelaide, South Australia, United States

In 2007 the Fisheries Management Act passed through the South Australian parliament. The Act includes several new provisions which substantially changed the nature of commercial fishing rights, resource sharing between competing sectors and rights based management.

These interrelated provisions include:

- (1) Commercial licences are issued for the duration of a management plan;
- (2) Requirement for a replacement management plan to come into effect on the expiry of the existing plan;
- (3) That each management plan specify the share of aquatic resources to be allocated to each fishing sector under the plan (based on existing shares, which must be quantified);
- (4) Requirement for an open and transparent process for determining the method for adjusting allocations of aquatic resources between the different fishing sectors during the term of the plan; and
- (5) Provision for compensation to persons whose licences or licence entitlements are compulsorily acquired in order to reduce the share of aquatic resources allocated to the commercial fishing sector and increase the share allocated to another sector.

The 5 provisions, when considered as a package, have in effect established evergreen commercial fishing licences, explicit resource shares for sectors accessing a fishery and transparent compensable processes for resource share adjustments.

A number of management plans are now in place which meet these new requirements of the Act. The resultant management planning process, plan provisions impacts on the strength of fishing rights and management are presented.

Session number: 7.3

Paper number: 437

Economics of Commercial Aquaponics: Hydroponic Vegetable Production as a Potential Aquaculture Water Treatment System

Kanae Tokunaga¹ (presenting), Clyde Tamaru¹, Harry Ako, PingSun Leung²

1. University of Hawaii at Manoa, Honolulu, Hawaii, United States

2. University of Hawaii at Manoa, Honolulu, HI, United States

Aquaponics is a sustainable aquaculture technology that utilize waste nutrient produced from fish production as natural fertilizer for hydroponic vegetable production. Though there are some anecdotal evidences, only a few formal economic analysis are conducted.

To evaluate economic feasibility of commercial scale aquaponics, we collect economic and operational data from operating commercial aquaponic farms in Hawaii. We find that commercial scale aquaponics is commercially feasible with a modified internal rate of return of 7.36%. Our estimate is more conservative compared to previous economic analyses of aquaponics. This can be attributed to the fact that our information is based on actual operating commercial farms, who often face logistical challenges as well as environmental risks such as pest infestation. Decision reversal analysis indicates that revenue cannot fall more than 11% and operational cost cannot increase more than 15% from the baseline for commercial aquaponics to be a worthwhile investment. We also conduct sensitivity analysis to further investigate how output prices and operational cost parameters influence overall economic outcome.

We also discuss economics of different type of aquaponics technology. Recent development in aquaponics that uses nutrient film technique simplifies the setup of vegetable production and hence, can potentially become cost-effective and sustainable aquaculture water treatment system. We conduct simple life cycle assessment to compare aquaponics and inland aquaculture to identify the benefit of hydroponic vegetable production as a mean of water treatment.

Session number: 7.3

Paper number: 260

Putting a Price on Lice: Quantifying the Biological and Economic Impacts of Sea Lice on Farmed Salmonids

Jay Abolofia¹ (presenting), Frank Asche, James Wilen¹, Atle Guttormsen

1. University of California, Davis, Davis, CA, United States

Sea lice are a common native marine ectoparasitic copepod of salmonids that have been shown to reduce fish growth and appetite, and pose a significant threat to the sustainability of salmonid farming worldwide. Using an extensive panel dataset that tracks the reported abundance of sea lice and chemical treatment events over time on all producing salmonid farms in Norway, we identify the impact of infective lice on the biological growth and appetite of fish stocks. Results suggest that the percent of total biomass growth lost per production cycle due to average infestations despite control range from 3.62% for Northern region farms, 11.82% for Central region farms, and 16.55% for Southern region farms. Using a discrete version of a harvesting model we simulate the economic impact of average infestation and treatment scenarios on farm profits over typical production cycles. For

example, results suggest that an average infestation despite control over a typical Spring-release production cycle for a Central region farm will generate damages of \$0.46 per kg of harvested biomass – equivalent to 9.01% of farm revenues. In the sense that such estimates represent the value of maintaining a farm entirely free of lice, this research is essentially putting a price on lice.

Session number: 7.3

Paper number: 276

Sustainable (biological) control of sea lice in Norwegian Atlantic salmon farms: a system dynamics approach

Kanar Hamza (presenting), Karl Rich

1. University of California, Davis, Davis, CA, United States

Sea lice (*Lepeophtheirus salmonis*) are a type of ectoparasite that hosts on Atlantic salmon (*Salmo salar*), weakening the fish and slowing its growth rate. In addition to the direct losses associated with reduced fish growth, sea lice also cause significant economic losses to salmon industries in Norway due to the costs associated with conducting chemical treatments to control sea lice populations. Moreover, chemical treatments can induce mortality in salmon themselves. Biological treatments such as sea wrasse (natural predators that prey on sea lice in farmed Atlantic salmon) are a promising alternative to control lice populations, but their cost-effectiveness vis-a-vis conventional treatment options has not been adequately explored quantitatively. A system dynamics model was developed that looks at the cost-effectiveness of sea wrasse control, taking into account the feedbacks between host-parasite interactions and fish management strategies. Model results showed that using sea wrasse is extremely efficient in controlling sea lice at low levels in salmon farms, which significantly reduced the need of using multiple chemical treatments to control lice populations. In turn, the reduced use of chemical treatments leads to a significant reduction in costs to control sea lice relative to conventional measures. Reducing the dependency on chemicals further benefits the salmon industry through reducing environmental footprints and enhancing the social responsibility of the industry.

Session number: 7.3

Paper number: 136

Efficiency of fish Production under three different culture systems in Rivers State, Nigeria

Catherine Onu¹ (presenting), Ruben Adeniyi¹, Siyanbola Omitoyin¹

1. Bowen University, Iwo, Osun, Nigeria

This study compared the technical efficiency of fish production under three management systems in Rivers State, Nigeria. Primary data for the study were collected from 99 fish farmers using well structured questionnaires. Descriptive statistics involving frequencies and percentages were used to analyze the farmers' socio-economic characteristics. The Stochastic Frontier production function was employed for the determination of technical efficiency of the fish farmers. Results revealed that the average age of fish farmers were 39, 40, 41 years for the earthen, concrete ponds and plastic tank technologies respectively. The farmers were mostly males and educated. The technical efficiency for the earthen and concrete tanks were fairly high (0.61 and 0.55), while that of the plastic tank was highest (0.95). Significant variables affecting the productivity (positively) of the concrete ponds were pond size (α_{01}),

stock size ($\alpha_{.01}$) and labour ($\alpha_{.05}$). For the earthen ponds, the significant variables affecting productivity (positively) were labour ($\alpha_{.01}$) and feed ($\alpha_{.01}$). Furthermore, pond size ($\alpha_{.01}$), and labour ($\alpha_{.01}$) affected productivity positively and stock size ($\alpha_{.10}$) affected productivity negatively. The study therefore recommended among others that fish farmers should be organized into formidable groups such as cooperatives; to enjoy economies of scale in the purchase of inputs and sale of output. The formation of the cooperative should also be done towards ensuring labour availability as a precursor towards increasing technical efficiency of fish production.

Session number: 7.3

Paper number: 437

Economics of Commercial Aquaponics: Hydroponic Vegetable Production as a Potential Aquaculture Water Treatment System

Kanae Tokunaga¹ (presenting), Clyde Tamaru¹, Harry Ako, PingSun Leung²

1. University of Hawaii at Manoa, Honolulu, Hawaii, United States

2. University of Hawaii at Manoa, Honolulu, HI, United States

Aquaponics is a sustainable aquaculture technology that utilize waste nutrient produced from fish production as natural fertilizer for hydroponic vegetable production. Though there are some anecdotal evidences, only a few formal economic analysis are conducted.

To evaluate economic feasibility of commercial scale aquaponics, we collect economic and operational data from operating commercial aquaponic farms in Hawaii. We find that commercial scale aquaponics is commercially feasible with a modified internal rate of return of 7.36%. Our estimate is more conservative compared to previous economic analyses of aquaponics. This can be attributed to the fact that our information is based on actual operating commercial farms, who often face logistical challenges as well as environmental risks such as pest infestation. Decision reversal analysis indicates that revenue cannot fall more than 11% and operational cost cannot increase more than 15% from the baseline for commercial aquaponics to be a worthwhile investment. We also conduct sensitivity analysis to further investigate how output prices and operational cost parameters influence overall economic outcome.

We also discuss economics of different type of aquaponics technology. Recent development in aquaponics that uses nutrient film technique simplifies the setup of vegetable production and hence, can potentially become cost-effective and sustainable aquaculture water treatment system. We conduct simple life cycle assessment to compare aquaponics and inland aquaculture to identify the benefit of hydroponic vegetable production as a mean of water treatment.

Session number: 7.3

Paper number: 260

Putting a Price on Lice: Quantifying the Biological and Economic Impacts of Sea Lice on Farmed Salmonids

Jay Abolofia¹ (presenting), Frank Asche, James Wilen¹, Atle Guttormsen

1. University of California, Davis, Davis, CA, United States

Sea lice are a common native marine ectoparasitic copepod of salmonids that have been shown to reduce fish growth and appetite, and pose a significant threat to the sustainability of salmonid farming worldwide. Using an extensive panel dataset that tracks the reported abundance of sea lice and chemical treatment events over time on all producing salmonid farms in Norway, we identify the impact of infective lice on the biological growth and appetite of fish stocks. Results suggest that the percent of total biomass growth lost per production cycle due to average infestations despite control range from 3.62% for Northern region farms, 11.82% for Central region farms, and 16.55% for Southern region farms. Using a discrete version of a harvesting model we simulate the economic impact of average infestation and treatment scenarios on farm profits over typical production cycles. For example, results suggest that an average infestation despite control over a typical Spring-release production cycle for a Central region farm will generate damages of \$0.46 per kg of harvested biomass – equivalent to 9.01% of farm revenues. In the sense that such estimates represent the value of maintaining a farm entirely free of lice, this research is essentially putting a price on lice.

Session number: 7.3

Paper number: 276

Sustainable (biological) control of sea lice in Norwegian Atlantic salmon farms: a system dynamics approach

Kanar Hamza (presenting), Karl Rich

1. University of California, Davis, Davis, CA, United States

Sea lice (*Lepeophtheirus salmonis*) are a type of ectoparasite that hosts on Atlantic salmon (*Salmo salar*), weakening the fish and slowing its growth rate. In addition to the direct losses associated with reduced fish growth, sea lice also cause significant economic losses to salmon industries in Norway due to the costs associated with conducting chemical treatments to control sea lice populations. Moreover, chemical treatments can induce mortality in salmon themselves. Biological treatments such as sea wrasse (natural predators that prey on sea lice in farmed Atlantic salmon) are a promising alternative to control lice populations, but their cost-effectiveness vis-a-vis conventional treatment options has not been adequately explored quantitatively. A system dynamics model was developed that looks at the cost-effectiveness of sea wrasse control, taking into account the feedbacks between host-parasite interactions and fish management strategies. Model results showed that using sea wrasse is extremely efficient in controlling sea lice at low levels in salmon farms, which significantly reduced the need of using multiple chemical treatments to control lice populations. In turn, the reduced use of chemical treatments leads to a significant reduction in costs to control sea lice relative to conventional measures. Reducing the dependency on chemicals further benefits the salmon industry through reducing environmental footprints and enhancing the social responsibility of the industry.

Session number: 7.3

Paper number: 136

Efficiency of fish Production under three different culture systems in Rivers State, Nigeria

Catherine Onu¹ (presenting), Ruben Adeniyi¹, Siyanbola Omitoyin¹

1. Bowen University, Iwo, Osun, Nigeria

This study compared the technical efficiency of fish production under three management systems in Rivers State, Nigeria. Primary data for the study were collected from 99 fish farmers using well structured questionnaires. Descriptive statistics involving frequencies and percentages were used to analyze the farmers' socio-economic characteristics. The Stochastic Frontier production function was employed for the determination of technical efficiency of the fish farmers. Results revealed that the average age of fish farmers were 39, 40, 41 years for the earthen, concrete ponds and plastic tank technologies respectively. The farmers were mostly males and educated. The technical efficiency for the earthen and concrete tanks were fairly high (0.61 and 0.55), while that of the plastic tank was highest (0.95). Significant variables affecting the productivity (positively) of the concrete ponds were pond size ($\alpha_{.01}$), stock size ($\alpha_{.01}$) and labour ($\alpha_{.05}$). For the earthen ponds, the significant variables affecting productivity (positively) were labour ($\alpha_{.01}$) and feed ($\alpha_{.01}$). Furthermore, pond size ($\alpha_{.01}$), and labour ($\alpha_{.01}$) affected productivity positively and stock size ($\alpha_{.10}$) affected productivity negatively. The study therefore recommended among others that fish farmers should be organized into formidable groups such as cooperatives; to enjoy economies of scale in the purchase of inputs and sale of output. The formation of the cooperative should also be done towards ensuring labour availability as a precursor towards increasing technical efficiency of fish production.

Special Session B.4: Market access issues related multiple certification schemes for fish and fishery products in international trade (continued)

Paper number: 37

Strategies for Market Inclusion of Small Scale Fish Farmers of the Tocantins State / Brazil

Renata Barroso¹ (presenting), Manoel Pedroza², Roberto M. V. Flores², Adriano Prysthon¹

1. Embrapa, Palmas, TO, Brazil

2. Embrapa Fisheries and Aquaculture (Brazilian Agricultural Research Corporation), Palmas, Tocantins, Brazil

Fish farming play an important role in the Brazilian household agriculture, in terms of food security and income generation. However, smallholder fish farmers are facing challenges to access markets and they are struggling to maintain a sustainable position in the chain, given the difficulty in producing a competitive cost and the volume required by these current retail channels. Nevertheless, to access the opportunities of adding value requires a high level of organizational management among fish farmers. An increased production scale, quality and logistics efficiency, are key factors to ensure access to these opportunities. From the analysis of the structure of the global value chain of fish farming in Tocantins State, some strategies were drawn to provide an effective mechanism to assist small-scale producers overcome these challenges and contribute to influence modern market chains and trade. It is evident that the sustainability of small-scale fish farming in Tocantins depends on increasing the added value to fish through different initiatives, whether directly related to product differentiation (e.g., Processing, seals of quality) or through access to new markets and marketing channels. New markets would be outside the production area and more specifically in large consumer centers - whether inside or outside the state of Tocantins. In terms of new marketing channels, selling arrangements such as public programs for food acquirement; live fish trade; Fair Trade certification; processing, and so on are examples of strategies that should be further explored.

Session number: 7.4

Paper number: 495

Trade Standard Compliance Failure Study as an Indicator of Market Access Problems

Karunasagar Iddya¹ (presenting), Esther GarridoGamarro

1. Food and Agriculture Organisation, Rome, Rome, Italy

Most seafood production takes place in developing countries. For example, Asia accounts for over 85% of global aquaculture production. Major seafood importing countries such as members of the European Union, United States of America and Japan account for over 60% of global seafood imports. Therefore most seafood producing countries want to access these markets and the regulatory requirements in these markets are becoming more stringent. When a consignment of seafood arrives at border posts, in addition to documentary checks, a small proportion of consignments are tested to see if they comply with regulatory standards. An analysis of the causes of import refusals indicate that a range of issues are involved including microbiological issues, presence of contaminants, residues of veterinary drugs at

Session number 7.4

unacceptable levels and also issues like labelling. The analysis indicates that as issues arise, the seafood producing countries are responding rapidly and trying to comply, but new issues keep cropping up and some of the requirements are not harmonised in different importing markets. Though implementation of Hazard Analysis Critical Control Point (HACCP) is part of national regulation and certified by National Competent Authority, some processors have additional private HACCP certification indicating that convincing the buyers about the quality of the product and compliance with the requirements is given great importance by the producers.

Session number: 7.4

Paper number: 500

The Chain of Certification - Thai Frozen Shrimp

Panisuan J, Bangkok, Bangkok, Thailand

For many years, Thailand has been among world's leader in producing and exporting frozen shrimp, mostly from aquaculture. Thai shrimp can be found in restaurants and supermarkets all over the world. Annual export volume has steadily risen to around 350,000 metric tons of finished product. With such a large scale of output comes the concern of importers and consumers about food safety, quality and ethical practices. Audit and certification schemes are implemented to ensure certain standards are maintained.

In the 1980's, the certifications such as ISO were voluntary. Then the HACCP and GMP became mandatory for processing plants. Eventually GAP was applied to farms. Once in place, these certifications are considered minimum requirement for market entrance. To differentiate one's product from the rest the Private Label Certifications were introduced on top of those mandated by government authorities. Because the aim was to be different, each new certification program added more details. In another dimension, the Certifications themselves are the product in service form, e.g., ASC, BAP, WWF, Naturland.

The study offers a view point of producer and processor on why certain programs are more successful. Considerations were given to perceived degree of difficulty, potential benefit, cost and competitive advantage when compared to non-certified operations.

Session number: 7.5

Paper number: 417

FishSET: a Spatial Economics Toolbox to Better Incorporate Fisher Behavior into Fisheries Management

Alan Haynie, NOAA/NMFS/AFSC, Seattle, WA, United States

NOAA Fisheries and partners have developed the Spatial Economics Toolbox for Fisheries (FishSET) to improve predictions about fleet behavior. Since the 1980s, economists have modeled the factors that influence fishers' spatial and participation choices to understand the trade-offs of fishing in different locations. This knowledge can improve predictions of how fishers respond to and are economically impacted by the creation of marine reserves, to changing climate conditions, or to management actions such as the implementation of catch shares. With FishSET, designing and utilizing state-of-the-art models can be done in weeks rather than years.

In this talk, we provide an overview of the modeling approach, details of project implementation, and a demonstration of FishSET software. An initial step of the project is the development of best practices and tools to improve data organization. A second component is the development of estimation routines that enable comparisons a wide range of fisher location choice models. FishSET enables new models to be more easily and robustly tested and applied when the advances lead to improved predictions of fisher behavior. FishSET efficiently organizes statistical code so that leading innovators can build on each other's work and methods can be widely available. We present examples from pilot projects that utilize FishSET in different US Regions, discuss modeling challenges, and outline new opportunities for modeling fisher behavior. Implementing pilot projects in various environments also provides insight into how economic and fisheries data requirements for effective management may vary across different types of fisheries, management systems, and ecosystems.

Session number: 7.5

Paper number: 421

An Empirical Analysis of Portfolio Management as a Tool for Implementing Ecosystem-Based Fishery Management

Di Jin¹, Geret DePiper², **Porter Hoagland¹ (presenting)**

1. Woods Hole Oceanographic Institution, Woods Hole, MA, United States

2. NOAA Fisheries, Woods Hole, MA, United States

Many experts have argued that the traditional management of commercial fish stocks as single-species is short-sighted, wasteful, and ineffective. Ecosystem-based fisheries management (EBFM) now is being promoted as a potential solution to the problem. While much attention has been directed recently at the potential benefits of implementing EBFM for commercial fisheries, the realization of a more comprehensive management that takes into account the broader effects on the ecosystem and associated human communities remains elusive. Portfolio management has been suggested as a practical tool for helping to implement EBFM. The portfolio approach involves the application of financial portfolio theory to multispecies fishery management to account for species interdependencies, uncertainty, and sustainability constraints. We have developed a portfolio model for the US northeastern region, using empirical data from NMFS for 1964-2012 and species groupings

used in food web models of the same region. We develop annual performance measures of the northeast fisheries over the five decades. The performance measures capture the inefficiencies (in terms of risk level for a given level of revenue) in the fisheries, and thus the potential for improvements. We demonstrate the usefulness of the model and results through case studies of different portfolios by ecological production unit (EPU) and by fishing port. Results of our research will further improve understanding of the potential for portfolio management as a practical approach to help achieve EBFM in the northeastern region.

Session number: 7.5

Paper number: 186

Supporting bio-economic evaluation of spatial planning constraining fishing activities: be quantitative, spatially-explicit, vessel-oriented, stochastic, and dynamically coupled to fish populations

Francois Bastardie¹ (presenting), J. Rasmus Nielsen², Heino O. Fock³, Patrik Jonsson⁴, Valerio Bartolino⁴

1. DTU-Aqua, Charlottenlund, Denmark, Denmark

2. Technical University of Denmark, Charlottenlund, Sjaelland, Denmark

3. Thünen Institute of Sea Fisheries, Germany, Hamburg, Germany, Germany

4. Swedish University of Agricultural Sciences, Lysekil, Sweden, Sweden

Maritime spatial planning and fishery management are likely to generate extra costs for the fisheries by constraining fishermen activity with conservation areas and new utilizations of the sea such as offshore windmill parks. Growing concerns for greener and energy efficient fisheries are also likely to alter existing fishing patterns already varying from fishery to fishery and from vessel to vessel. In this context, impact assessment of new spatial plans should support quantitative analyses that take into account individual vessel behaviour, local practices and tradeoffs in conflict resolutions. We used a vessel-oriented decision-support tool (the DISPLACE model) for combining stochastic spatial fishing activities to harvested resource dynamics over time in scenario projections. The impact assessment computes time series of economic and stock status indicators by considering the activity of Danish, Swedish and German vessels (>12m) in the international western Baltic Sea, together with the underlying size-based distribution dynamics of sprat, herring and cod. The outcomes of alternative solutions in spatial effort allocation and displacement are exemplified by evaluating the fishermen capacity to adapt to spatial plans under various constraints. The DISPLACE model serves as a benchmark tool for management strategy evaluations which are able to capture short-term economic behavioural reactions from individual tactical decision-making. This study is conducted in association with a number of EU and national research projects and the development of a spatial explicit bio-economic model that covers both many stocks and fisheries has the potential to form near future developments in ICES and EU within the context of maritime spatial planning.

Session number: 7.5

Paper number: 360

Fisheries and Optimal Eutrophication Management: A Bayesian Approach

Soile Oinonen¹ (presenting), Heikki Peltonen¹, Outi Heikinheimo¹, Laura Uusitalo¹, Marko Lindroos²

1. Finnish Environment Institute, Helsinki, Uusimaa, Finland

2. University of Helsinki, Helsinki, University of Helsinki, Finland

The paper puts forward a Bayesian Network model to study the optimal eutrophication control in coastal waters by reducing nutrient loads and removing fish biomass (bottom-up and top-down ecosystem mechanisms). The model combines an aquatic ecosystem model with an economic model and examines the economic and ecological consequences of nutrient reduction and fisheries policies. The existing literature mostly focuses on bottom-up (nutrients) control of eutrophication, while the combined effect of top-down (fisheries) and bottom-up control remains unknown. The fisheries management options include subsidizing fisheries with low or no commercial value to improve water quality. Removal of fish feeding on zooplankton or on benthic fauna may affect the nutrient dynamics and eutrophication via several mechanisms, but the relative strengths of these processes are uncertain. The Bayesian Network model allows studying uncertain causal linkages within the aquatic ecosystem and between the ecosystem and its management. The social utility function accounts for both the market and non-market values of the ecosystem goods and services – fish and water quality – provided by the studied aquatic ecosystem. The results suggest the most efficient set of management options to achieve good environmental status of the coastal waters of the Baltic Sea requested by the European Union's Marine Strategy Framework Directive

Session number: 7.5

Paper number: 417

FishSET: a Spatial Economics Toolbox to Better Incorporate Fisher Behavior into Fisheries Management

Alan Haynie, NOAA/NMFS/AFSC, Seattle, WA, United States

NOAA Fisheries and partners have developed the Spatial Economics Toolbox for Fisheries (FishSET) to improve predictions about fleet behavior. Since the 1980s, economists have modeled the factors that influence fishers' spatial and participation choices to understand the trade-offs of fishing in different locations. This knowledge can improve predictions of how fishers respond to and are economically impacted by the creation of marine reserves, to changing climate conditions, or to management actions such as the implementation of catch shares. With FishSET, designing and utilizing state-of-the-art models can be done in weeks rather than years.

In this talk, we provide an overview of the modeling approach, details of project implementation, and a demonstration of FishSET software. An initial step of the project is the development of best practices and tools to improve data organization. A second component is the development of estimation routines that enable comparisons a wide range of fisher location choice models. FishSET enables new models to be more easily and robustly tested and applied when the advances lead to improved predictions of fisher behavior. FishSET efficiently organizes statistical code so that leading innovators can build on each other's work and methods can be widely available. We present examples from pilot projects that utilize FishSET in different US Regions, discuss modeling challenges, and outline new opportunities for modeling fisher behavior. Implementing pilot projects in various environments also provides insight into how economic and fisheries data requirements for effective management may vary across different types of fisheries, management systems, and ecosystems.

Session number: 7.5

Paper number: 421

An Empirical Analysis of Portfolio Management as a Tool for Implementing Ecosystem-Based Fishery Management

Di Jin¹, Geret DePiper², **Porter Hoagland¹ (presenting)**

1. Woods Hole Oceanographic Institution, Woods Hole, MA, United States

2. NOAA Fisheries, Woods Hole, MA, United States

Many experts have argued that the traditional management of commercial fish stocks as single-species is short-sighted, wasteful, and ineffective. Ecosystem-based fisheries management (EBFM) now is being promoted as a potential solution to the problem. While much attention has been directed recently at the potential benefits of implementing EBFM for commercial fisheries, the realization of a more comprehensive management that takes into account the broader effects on the ecosystem and associated human communities remains elusive. Portfolio management has been suggested as a practical tool for helping to implement EBFM. The portfolio approach involves the application of financial portfolio theory to multispecies fishery management to account for species interdependencies, uncertainty, and sustainability constraints. We have developed a portfolio model for the US northeastern region, using empirical data from NMFS for 1964-2012 and species groupings used in food web models of the same region. We develop annual performance measures of the northeast fisheries over the five decades. The performance measures capture the inefficiencies (in terms of risk level for a given level of revenue) in the fisheries, and thus the potential for improvements. We demonstrate the usefulness of the model and results through case studies of different portfolios by ecological production unit (EPU) and by fishing port. Results of our research will further improve understanding of the potential for portfolio management as a practical approach to help achieve EBFM in the northeastern region.

Session number: 7.5

Paper number: 186

Supporting bio-economic evaluation of spatial planning constraining fishing activities: be quantitative, spatially-explicit, vessel-oriented, stochastic, and dynamically coupled to fish populations

Francois Bastardie¹ (presenting), J. Rasmus Nielsen², Heino O. Fock³, Patrik Jonsson⁴, Valerio Bartolino⁴

1. DTU-Aqua, Charlottenlund, Denmark, Denmark

2. Technical University of Denmark, Charlottenlund, Sjaelland, Denmark

3. Thünen Institute of Sea Fisheries, Germany, Hamburg, Germany, Germany

4. Swedish University of Agricultural Sciences, Lysekil, Sweden, Sweden

Maritime spatial planning and fishery management are likely to generate extra costs for the fisheries by constraining fishermen activity with conservation areas and new utilizations of the sea such as offshore windmill parks. Growing concerns for greener and energy efficient fisheries are also likely to alter existing fishing patterns already varying from fishery to fishery and from vessel to vessel. In this context, impact assessment of new spatial plans should support quantitative analyses that take into account individual vessel behaviour, local practices and tradeoffs in conflict resolutions. We used a vessel-oriented decision-support tool (the DISPLACE model) for combining stochastic spatial fishing activities to harvested resource dynamics over time in scenario projections. The impact assessment computes time series of economic and stock status indicators by considering the activity of Danish, Swedish and German vessels (>12m) in the international western Baltic Sea, together with the underlying size-based distribution dynamics of sprat, herring and cod. The outcomes of alternative solutions in spatial effort allocation and displacement are exemplified by evaluating the fishermen capacity to adapt to spatial plans under various constraints. The DISPLACE model serves as a benchmark tool for management strategy evaluations which are able to capture short-term economic behavioural reactions from individual tactical decision-making. This study is conducted in association with a number of EU and national research projects and the development of a spatial explicit bio-economic model that covers both many stocks and fisheries has the potential to form near future developments in ICES and EU within the context of maritime spatial planning.

Session number: 7.5

Paper number: 360

Fisheries and Optimal Eutrophication Management: A Bayesian Approach

Soile Oinonen¹ (presenting), Heikki Peltonen¹, Outi Heikinheimo¹, Laura Uusitalo¹, Marko Lindroos²

1. Finnish Environment Institute, Helsinki, Uusimaa, Finland

2. University of Helsinki, Helsinki, University of Helsinki, Finland

The paper puts forward a Bayesian Network model to study the optimal eutrophication control in coastal waters by reducing nutrient loads and removing fish biomass (bottom-up and top-down ecosystem mechanisms). The model combines an aquatic ecosystem model with an economic model and examines the economic and ecological consequences of nutrient reduction and fisheries policies. The existing literature mostly focuses on bottom-up (nutrients) control of eutrophication, while the combined effect of top-down (fisheries) and bottom-up control remains unknown. The fisheries management options include subsidizing fisheries with low or no commercial value to improve water quality. Removal of fish feeding on zooplankton or on benthic fauna may affect the nutrient dynamics and eutrophication via several mechanisms, but the relative strengths of these processes are uncertain. The Bayesian Network model allows studying uncertain causal linkages within the aquatic ecosystem and between the ecosystem and its management. The social utility function accounts for both the market and non-market values of the ecosystem goods and services – fish and water quality – provided by the studied aquatic ecosystem. The results suggest the most efficient set of management options to achieve good environmental status of the coastal waters of the Baltic Sea requested by the European Union's Marine Strategy Framework Directive

Session number: 7.6

Paper number: 199

Community-Based Sport Fishing as a Sustainable Development Path in Remote Regions in Developing Countries

James Kahn¹ (presenting), Carlos Freitas²

1. Washington and Lee University, Lexington, Virginia, United States

2. Federal University of Amazonas, Manaus, Amazonas, Brazil

Remote regions in developing countries have often not shared in the increase in income and quality of life associated with economic growth in the industrial and service sectors. This is particularly true in countries with a rapidly developing economy and middle class, such as Brazil. Remote regions remained trapped in extractive activities of past generations, where income potential is very limited due to the economic power of intermediaries, the cost of getting products to the market, and the lack of value added in the remote region. In many remote regions, sport fishing opportunities are plentiful and since the expenditure will be based in the region, many of the problems associated with extractive output could be avoided. This paper examines the potential of sport fishing as a sustainable development path in remote regions, with an example from Barcelos, Amazonas, Brazil. The first part of the paper examines alternative income possibilities, and shows why community-based sport fishing has the potential to generate more income and other beneficial improvements in quality of life. The second part of the paper discusses the investments in facilities and human capacity that need to take place in order for community-based sport fishing to be successful. The third part of the paper discusses a bio-socioeconomic model for assessing the impact of sport fishing on community quality of life and environmental quality. The paper concludes by examining our initial efforts and discussing steps for the future.

Session number: 7.6

Paper number: 111

Estimate of recreational fishermen preferences and willingness to pay for a license under several regulatory regimes using a discrete choice model.

Doron Schultz¹ (presenting), Anat Manes, Yehuda Benayahu

1. Tel Aviv University, Ashkelon, Ashkelon, Israel

Unlike Australia and most of the other developed economies, other than banning fishing with underwater breathing devices, Israel has no regulatory system or management protocols in regard to recreational fishing activity. This has raised concern among researchers regarding potential negative externalities on local fish populations. To date, however, no studies have examined the scope and characteristics of recreational fishing, its growth potential, economic impact, and ecological effects in the eastern Mediterranean basin. Our research goals were twofold: first, to examine the characteristics of this activity as well as its current ecological and economic impacts; and second, by using a discrete choice model framework with a stated preferences technique, we sought to estimate the sport fishers' preferences regarding the different attributes pertaining to their fishing activity. In addition, we estimated their willingness to pay for the use of natural resources by purchasing a license under various (regulated) fishing activity scenarios, taking into account the variety of target species, quantity of fish, quality of fishing experience and fishing sites (e.g., clean beaches, piers, roads, parking lots, etc.). An experimental design was applied, employing Bayesian efficient design, and the model parameters were estimated using the Random Parameter Logit model.

The findings indicate a higher willingness among recreational fishers to pay for a fishing permit if commercial fishing is regulated, than to pay for a permit related to improved facilities and variety of target fish; while the regulation of recreational fishing was reflected in their reduced willingness to pay.

Session number: 7.6

Paper number: 71

The Value of Recreational Fishing in Shanghai

Ye Chen, College of Economics & Management, Shanghai Ocean University, Shanghai, Shanghai, China

Recreational fisheries, also called sport fisheries, are fishing for pleasure or competition. Recreational fisheries can advance fisheries technology and benefits related industries. Recreational fisheries can also diversify and increase the income of fishermen. Recreational fisheries promote mutual understanding between urban dwellers and fishermen, which is important to “Harmonious Society”. Last but not least, recreational fisheries can raise the ordinary people’s awareness of the importance of environment protection and territorial waters, which is especially important after China outlined the "maritime power" strategy in 2012. Shanghai, the most modern city in China, is just beside East China Sea (Shanghai means “above the sea” in Chinese language.). Shanghai is also the birthplace of China’s tourism industry. Shanghainese spent a lot of money on tourism annually. Recreational fisheries have the potential to be a big and profitable industry in Shanghai. As people’s income increases, the value of recreational fisheries in Shanghai became more obvious.

Session number: 7.6

Paper number: 335

Frameworks for Measuring the Economic Value of Australia’s Recreational and Commercial Fisheries

Robert Curtotti¹ (presenting), Kasia Mazur

1. Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), Canberra, ACT, Australia

Australia’s marine fisheries resources are shared extensively by commercial and recreational fishers. Frequently issues surrounding access to fisheries stocks arise between these two sectors with claims about their respective economic contribution used to bolster the argument for preferential access to these resources. The economics profession offers a range of techniques to value fisheries resources to the commercial and recreational fishing industry. This paper summarises the economic frameworks used for valuing recreational and commercial fisheries and highlights the differences in techniques that are applicable for both sectors. Recent studies conducted by the Australian Bureau of Agricultural and Resource Sciences are used to illustrate how some of these techniques can be used to provide an economic valuation of commercial and recreational fishing. These examples include a recent analysis of the economic value of gamefishing at three sites in eastern Australia, and the estimation of net economic returns derived from Australia’s most valuable commercial Commonwealth fisheries.

Session number: 7.6

Paper number: 199

Community-Based Sport Fishing as a Sustainable Development Path in Remote Regions in Developing Countries

James Kahn¹ (presenting), Carlos Freitas²

1. Washington and Lee University, Lexington, Virginia, United States

2. Federal University of Amazonas, Manaus, Amazonas, Brazil

Remote regions in developing countries have often not shared in the increase in income and quality of life associated with economic growth in the industrial and service sectors. This is particularly true in countries with a rapidly developing economy and middle class, such as Brazil. Remote regions remained trapped in extractive activities of past generations, where income potential is very limited due to the economic power of intermediaries, the cost of getting products to the market, and the lack of value added in the remote region. In many remote regions, sport fishing opportunities are plentiful and since the expenditure will be based in the region, many of the problems associated with extractive output could be avoided. This paper examines the potential of sport fishing as a sustainable development path in remote regions, with an example from Barcelos, Amazonas, Brazil. The first part of the paper examines alternative income possibilities, and shows why community-based sport fishing has the potential to generate more income and other beneficial improvements in quality of life. The second part of the paper discusses the investments in facilities and human capacity that need to take place in order for community-based sport fishing to be successful. The third part of the paper discusses a bio-socioeconomic model for assessing the impact of sport fishing on community quality of life and environmental quality. The paper concludes by examining our initial efforts and discussing steps for the future.

Session number: 7.6

Paper number: 111

Estimate of recreational fishermen preferences and willingness to pay for a license under several regulatory regimes using a discrete choice model.

Doron Schultz¹ (presenting), Anat Manes, Yehuda Benayahu

1. Tel Aviv University, Ashkelon, Ashkelon, Israel

Unlike Australia and most of the other developed economies, other than banning fishing with underwater breathing devices, Israel has no regulatory system or management protocols in regard to recreational fishing activity. This has raised concern among researchers regarding potential negative externalities on local fish populations. To date, however, no studies have examined the scope and characteristics of recreational fishing, its growth potential, economic impact, and ecological effects in the eastern Mediterranean basin. Our research goals were twofold: first, to examine the characteristics of this activity as well as its current ecological and economic impacts; and second, by using a discrete choice model framework with a stated preferences technique, we sought to estimate the sport fishers' preferences regarding the different attributes pertaining to their fishing activity. In addition, we estimated their willingness to pay for the use of natural resources by purchasing a license under various (regulated) fishing activity scenarios, taking into account the variety of target species, quantity of fish, quality of fishing experience and fishing sites (e.g., clean beaches, piers, roads, parking lots, etc.). An experimental design was applied, employing Bayesian efficient design, and the model parameters were estimated using the Random Parameter Logit model. The findings indicate a higher willingness among recreational fishers to pay for a fishing permit if commercial fishing is regulated, than to pay for a permit related to improved facilities and variety of target fish; while the regulation of recreational fishing was reflected in their reduced willingness to pay.

Session number: 7.6

Paper number: 71

The Value of Recreational Fishing in Shanghai

Ye Chen, College of Economics & Management, Shanghai Ocean University, Shanghai, Shanghai, China

Recreational fisheries, also called sport fisheries, are fishing for pleasure or competition. Recreational fisheries can advance fisheries technology and benefits related industries. Recreational fisheries can also diversify and increase the income of fishermen. Recreational fisheries promote mutual understanding between urban dwellers and fishermen, which is important to “Harmonious Society”. Last but not least, recreational fisheries can raise the ordinary people’s awareness of the importance of environment protection and territorial waters, which is especially important after China outlined the "maritime power" strategy in 2012. Shanghai, the most modern city in China, is just beside East China Sea (Shanghai means “above the sea” in Chinese language.). Shanghai is also the birthplace of China’s tourism industry. Shanghainese spent a lot of money on tourism annually. Recreational fisheries have the potential to be a big and profitable industry in Shanghai. As people’s income increases, the value of recreational fisheries in Shanghai became more obvious.

Session number: 7.6

Paper number: 335

Frameworks for Measuring the Economic Value of Australia's Recreational and Commercial Fisheries

Robert Curtotti¹ (presenting), Kasia Mazur

1. Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), Canberra, ACT, Australia

Australia's marine fisheries resources are shared extensively by commercial and recreational fishers. Frequently issues surrounding access to fisheries stocks arise between these two sectors with claims about their respective economic contribution used to bolster the argument for preferential access to these resources. The economics profession offers a range of techniques to value fisheries resources to the commercial and recreational fishing industry. This paper summarises the economic frameworks used for valuing recreational and commercial fisheries and highlights the differences in techniques that are applicable for both sectors. Recent studies conducted by the Australian Bureau of Agricultural and Resource Sciences are used to illustrate how some of these techniques can be used to provide an economic valuation of commercial and recreational fishing. These examples include a recent analysis of the economic value of gamefishing at three sites in eastern Australia, and the estimation of net economic returns derived from Australia's most valuable commercial Commonwealth fisheries.

Session number: 7.7

Paper number: 240

Disjuncture in Environmental Policymaking: A case of Trout in the Alien Invasive Species Regulatory Reforms in South Africa

Juniours Marire¹ (presenting), Jen Snowball¹, Gavin Fraser¹

1. Rhodes University, Grahamstown, Eastern Cape, South Africa

The paper examined the process of establishing institutional arrangements for sustainably managing “wicked” environmental policy problems in a multicultural context. Recently, the South African government promulgated disputed alien invasive species regulations. A case study of the policy debate and regulatory reform aspects relevant to trout in South Africa was used to demonstrate how institutional isolation evolved insofar as multiple opposing value systems were not accounted for in the reform process. While previous studies have focused on the likely magnitude of economic losses induced by the regulations, none has examined the process of institutional adjustment. Using document analysis within a joint instrumental valuation theory and Peircean semiotic framework, the paper examined the evolutionary process of the regulations. Data were drawn from official documents, submissions by the flyfishing community and peer reviewed work of aquatic scientists. Findings suggest that, despite the democratic policymaking provisions of the post-apartheid constitutional dispensation, the process of regulatory change was regressive. There is little discernible difference between the environmental policymaking culture during the apartheid and post-apartheid dispensations, with both eras revealing a non-discursive approach, and pointing towards institutional path dependence. The findings suggest that, while institutional change is a necessary condition for sustainably managing wicked problems, a change in the governance culture is the sufficient condition. The socioeconomic aspects of trout fishing tourism were crowded out in the regulations, notwithstanding effective institutional entrepreneurship by the trout fishing sector, because of the policy advisory hegemony of biological invasion scientists.

Session number: 7.7

Paper number: 244

Evaluation of importance of Orinoco Sailfin Catfish (*Pterygoplichthys multiradiatus*) as a food source

Durayalage Suseema Ariyaratna¹ (presenting), Ahmad Shakeela Begum Nasir², Badigama Kamkanange Kolitha Kamal Jinadasa², Wickramasinghe Indira³, Jasenthuhewage Kosala nuwan Jayarathna³

1. National Aquatic Resources Research and Development Agency, Colombo, Western province, Sri Lanka

2. National Aquatic Resources Research and Development Agency, Colombo, Western, Sri Lanka

3. University of Sri Jayawardenapura, Nugegoda, Western, Sri Lanka

The Orinoco Sailfin Catfish (OSC) is an invasive fish species introduced into local water bodies through the ornamental fish industry in Sri Lanka. Freshwater aquaculture is a key element that strengthens the rural economy while fulfilling nutritional needs of rural populations. At present, growth of OSC is adversely affecting the freshwater fishery industry. The objective of this study was to evaluate the nutritional and economic importance of OSC to turn this tragedy into wellbeing of fisherfolk. Samples collected from inland reservoirs

were analyzed for edible flesh yield, proximate composition, trace metal content, fatty acid profile and consumer acceptance. Edible portion of the flesh was about $30.62 \pm 2.98\%$ from total weight. Moisture, protein, fat and ash were 81.02 ± 0.90 , 17.79 ± 0.72 , 0.58 ± 0.18 and 1.12 ± 0.11 , respectively. According to the fatty acid profile total PUFA and DHA were approximately 33.70% and 12.99%, respectively. Ratios of PUFA/SFA and Ω -6/ Ω -3 were approximately 1.29 and 0.75, respectively. Mean values of trace metal such as Hg, Pb, and Cd were below the safety limits of EU regulations. Consumer acceptance was evaluated for the fresh, fried and salted dried OSC fillets and compared with *Thilapia (Oreochromis mossambicus)*. Salted dried OSC fillets obtained the highest rank for the hedonic test indicating significant difference ($p < 0.05$) from the salted dried *Thilapia* fish fillets. Based these findings, it can be concluded that OSC can be used effectively to strengthen the rural economy and fulfill the nutrient requirements of the rural population.

Key words- Orinoco Sailfin Catfish, flesh yield, nutritional value, safety

Session number: 7.7

Paper number: 319

Emerging Jellyfish and its Significance in Local Fisheries - a Periphylla Story in the Trondheimsfjord

Yajie Liu¹ (presenting), Jarle Mork²

1. SINTEF Fisheries and Aquaculture, Trondheim, Sør-Trøndelag, Norway

2. Department of biology, NTNU, Norway, Trondheim, Trøndelag, Norway

Crown jellyfish (*Periphylla periphylla*) has become an increasing biological and economic problem for the fishermen in many Norwegian fjords. It is known to prey on a variety of planktonic species including small crustaceans like krill and calanus as well as fish eggs and larvae. Thus, this jellyfish is both a predator and a food competitor to gadoid fish species. Recent studies suggest that an increasing abundance of jellyfish may have contributed to a decline in the cod stock size and productivity in some Norwegian fjords. Abundant local jellyfish populations may cause substantial economic loss for fishermen, particularly in small-scale fisheries, due to the reduction in annual fish catches and extra effort required for cleaning and fixing fishing nets. This, in turn, has led to changes in the fishing behavior and well-being of the local fishermen. This paper explores the potential ecological and economic consequences of an ongoing periphylla bloom on the cod fishery in the Trondheimsfjord, Norway. A bioeconomic model of cod fishery is developed which incorporates these impacts. The model is tested by simulations based on data collected from commercial fishermen surveys and milieu-related monitoring series. The study provides valuable insights into the impact of a newly established but permanent jellyfish population on the ecologically and commercially important cod species, and how fishermen might adopt such a continued high local jellyfish presence in their prospects for a future as fishermen, and also help policy makers on how to incorporate the experience from this emerging issue into future management and policy process.

Session number: 7.7

Paper number: 240

Disjuncture in Environmental Policymaking: A case of Trout in the Alien Invasive Species Regulatory Reforms in South Africa

Juniours Marire¹ (presenting), Jen Snowball¹, Gavin Fraser¹

1. Rhodes University, Grahamstown, Eastern Cape, South Africa

The paper examined the process of establishing institutional arrangements for sustainably managing “wicked” environmental policy problems in a multicultural context. Recently, the South African government promulgated disputed alien invasive species regulations. A case study of the policy debate and regulatory reform aspects relevant to trout in South Africa was used to demonstrate how institutional isolation evolved insofar as multiple opposing value systems were not accounted for in the reform process. While previous studies have focused on the likely magnitude of economic losses induced by the regulations, none has examined the process of institutional adjustment. Using document analysis within a joint instrumental valuation theory and Peircean semiotic framework, the paper examined the evolutionary process of the regulations. Data were drawn from official documents, submissions by the flyfishing community and peer reviewed work of aquatic scientists. Findings suggest that, despite the democratic policymaking provisions of the post-apartheid constitutional dispensation, the process of regulatory change was regressive. There is little discernible difference between the environmental policymaking culture during the apartheid and post-apartheid dispensations, with both eras revealing a non-discursive approach, and pointing towards institutional path dependence. The findings suggest that, while institutional change is a necessary condition for sustainably managing wicked problems, a change in the governance culture is the sufficient condition. The socioeconomic aspects of trout fishing tourism were crowded out in the regulations, notwithstanding effective institutional entrepreneurship by the trout fishing sector, because of the policy advisory hegemony of biological invasion scientists.

Session number: 7.7

Paper number: 244

Evaluation of importance of Orinoco Sailfin Catfish (*Pterygoplichthys multiradiatus*) as a food source

Durayalage Suseema Ariyaratna¹ (presenting), Ahmad Shakeela Begum Nasir², Badigama Kamkanange Kolitha Kamal Jinadasa², Wickramasinghe Indira³, Jasenthuhewage Kosala nuwan Jayarathna³

1. National Aquatic Resources Research and Development Agency, Colombo, Western province, Sri Lanka

2. National Aquatic Resources Research and Development Agency, Colombo, Western, Sri Lanka

3. University of Sri Jayawardenapura, Nugegoda, Western, Sri Lanka

The Orinoco Sailfin Catfish (OSC) is an invasive fish species introduced into local water bodies through the ornamental fish industry in Sri Lanka. Freshwater aquaculture is a key element that strengthens the rural economy while fulfilling nutritional needs of rural populations. At present, growth of OSC is adversely affecting the freshwater fishery industry. The objective of this study was to evaluate the nutritional and economic importance of OSC to turn this tragedy into wellbeing of fisherfolk. Samples collected from inland reservoirs were analyzed for edible flesh yield, proximate composition, trace metal content, fatty acid profile and consumer acceptance. Edible portion of the flesh was about $30.62 \pm 2.98\%$ from total weight. Moisture, protein, fat and ash were 81.02 ± 0.90 , 17.79 ± 0.72 , 0.58 ± 0.18 and 1.12 ± 0.11 , respectively. According to the fatty acid profile total PUFA and DHA were approximately 33.70% and 12.99%, respectively. Ratios of PUFA/SFA and ω -6/ ω -3 were approximately 1.29 and 0.75, respectively. Mean values of trace metal such as Hg, Pb, and Cd were below the safety limits of EU regulations. Consumer acceptance was evaluated for the fresh, fried and salted dried OSC fillets and compared with *Thilapia (Oreochromis mossambicus)*. Salted dried OSC fillets obtained the highest rank for the hedonic test indicating significant difference ($p < 0.05$) from the salted dried *Thilapia* fish fillets. Based these findings, it can be concluded that OSC can be used effectively to strengthen the rural economy and fulfill the nutrient requirements of the rural population.

Key words- Orinoco Sailfin Catfish, flesh yield, nutritional value, safety

Session number: 7.7

Paper number: 319

Emerging Jellyfish and its Significance in Local Fisheries - a *Periphylla* Story in the Trondheimsfjord

Yajie Liu¹ (presenting), Jarle Mork²

1. SINTEF Fisheries and Aquaculture, Trondheim, Sør-Trøndelag, Norway

2. Department of biology, NTNU, Norway, Trondheim, Trøndelag, Norway

Crown jellyfish (*Periphylla periphylla*) has become an increasing biological and economic problem for the fishermen in many Norwegian fjords. It is known to prey on a variety of planktonic species including small crustaceans like krill and calanus as well as fish eggs and larvae. Thus, this jellyfish is both a predator and a food competitor to gadoid fish species. Recent studies suggest that an increasing abundance of jellyfish may have contributed to a decline in the cod stock size and productivity in some Norwegian fjords. Abundant local jellyfish populations may cause substantial economic loss for fishermen, particularly in small-scale fisheries, due to the reduction in annual fish catches and extra effort required for cleaning and fixing fishing nets. This, in turn, has led to changes in the fishing behavior and well-being of the local fishermen. This paper explores the potential ecological and economic consequences of an ongoing periphylla bloom on the cod fishery in the Trondheimsfjord, Norway. A bioeconomic model of cod fishery is developed which incorporates these impacts. The model is tested by simulations based on data collected from commercial fishermen surveys and milieu-related monitoring series. The study provides valuable insights into the impact of a newly established but permanent jellyfish population on the ecologically and commercially important cod species, and how fishermen might adopt such a continued high local jellyfish presence in their prospects for a future as fishermen, and also help policy makers on how to incorporate the experience from this emerging issue into future management and policy process.

Session number: 8.1

Paper number: 21

Testing for the influence of global trade on local fish prices and food security in an African coral reef fishery

Andrew Wamukota¹ (presenting), Tim McClanahan²

1. Linnaeus University, Mombasa, Coast, Kenya

2. Wildlife Conservation Society, New York, Bronx, United States

This study evaluated the potential impact of global fish trade on local food prices and potential food security and associated adaptation by analyzing a locally-collected time series of disaggregated coral reef fish prices by types of fish that differed in their market chain linkages – ranging from local to international markets. Using stepwise regression and cointegration, we did not find evidence that export of marine products (octopus) led to higher prices of locally consumed low quality but high diversity fish eaten by the poorest fishers. Long-term relationships were found between the price of local staple (maize) and octopus catch per unit effort (CPUE/area) suggesting increased affordability of maize relative to the octopus export, arising from increasing global trade. The increases in CPUE with prices of maize and octopus indicate that fishers are adjusting effort within their day to get enough staples or make more profit from octopus. Consequently, low prices of staples can reduce fishing effort on low quality fish where as high prices of export products can increase effort on export items. There is, therefore, an opportunity to increase profits by allowing the resource to replenish during low price periods but may require coordination between fisheries management and market prices. Results indicate that improved management that increases fish supply can maintain high prices and that low prices of food staples, often a result of global trade, can reduce fishing pressure on the high diversity of coral reef fishes eaten by the poor.

Session number: 8.1

Paper number: 315

Reciprocal business practices among fishermen, middlemen, and merchants in the dagaa processing industry in a coastal community on Zanzibar Island, Tanzania

Mariko Fujimoto, Graduate School of Asian and African Area Studies, Kyoto

University, Japan Society for the Promotion of Science, Kyoto city, Kyoto prefecture, Japan

Dagaa, the general name for small fish in Swahili, is a very important protein source for middle-income people at home and abroad. In Tanzania, sun-dried dagaa is fished by both freshwater and marine fisheries and distributed to neighboring countries. In 2013, I conducted a survey about the dagaa distribution system in a small fishing village on Zanzibar Island, Tanzania. A huge amount of dagaa from the Indian Ocean is landed and processed in coastal villages, and a large part of it is distributed to the Democratic Republic of Congo (DRC). In recent years, demand for dagaa has increased in DRC, with many local merchants visiting Zanzibar to buy dried dagaa. This paper examines the dagaa distribution channels and business practices, including the reciprocal trading relationships among fishers, middlemen and merchants. The presented findings suggest that some of these reciprocal business practices are not focused on profit maximization, but could contribute to poverty reduction among the local communities.

Key words: Zanzibar Island, dagaa, distribution channel, business practice, reciprocity

Session number: 8.1

Paper number: 433

Patron-Client Relationship (PCR) in Fresh Fish Trade (FFT) at Lake Chad, Cameroon

Hiroyuki Inai, Kyoto, Japan

Lake Chad is important supply center of fish in semi-arid zone of West Africa. Processed fish have been widely-distributed to neighboring countries for long time. FFT became active by introducing modern technology. And fish species was replaced the ones suited to FFT by droughts. FFT has been increased recently. In addition, migrant fishermen increased and engaged in fishing for FFT at the same time.

Relationship between fishermen and middlemen is explained as PCR. It has been often described functions like reciprocal agreement and enclosing fishermen. But there is diversity of relationship between both. The objective of this study was to report a case of PCR in FFT comparing with processed fish trades. Field survey was conducted at Commune of Darak in Cameroon on Mars, 2011.

Almost of all middlemen dealt with fishermen who got fishing gears by themselves. Quoted market price of major species (Cichlidae) was stable. There were some cases deviated from the price by fishermen borrowed from middlemen to make good. Almost of all trade were occasional. Middlemen had to deal with unspecified number of fishermen. And it is difficult for middlemen to gain a privilege from PCR as referred to above. Therefore, Middlemen must observe the quoted market price (if not, they may lose their client). Relationship in FFT there is more free for fishermen and equivalent to middlemen.

Session number: 8.1

Paper number: 21

Testing for the influence of global trade on local fish prices and food security in an African coral reef fishery

Andrew Wamukota¹ (presenting), Tim McClanahan²

1. Linnaeus University, Mombasa, Coast, Kenya

2. Wildlife Conservation Society, New York, Bronx, United States

This study evaluated the potential impact of global fish trade on local food prices and potential food security and associated adaptation by analyzing a locally-collected time series of disaggregated coral reef fish prices by types of fish that differed in their market chain linkages – ranging from local to international markets. Using stepwise regression and cointegration, we did not find evidence that export of marine products (octopus) led to higher prices of locally consumed low quality but high diversity fish eaten by the poorest fishers. Long-term relationships were found between the price of local staple (maize) and octopus catch per unit effort (CPUE/area) suggesting increased affordability of maize relative to the octopus export, arising from increasing global trade. The increases in CPUE with prices of maize and octopus indicate that fishers are adjusting effort within their day to get enough staples or make more profit from octopus. Consequently, low prices of staples can reduce fishing effort on low quality fish whereas high prices of export products can increase effort on export items. There is, therefore, an opportunity to increase profits by allowing the resource to replenish during low price periods but may require coordination between fisheries management and market prices. Results indicate that improved management that increases fish supply can maintain high prices and that low prices of food staples, often a result of global trade, can reduce fishing pressure on the high diversity of coral reef fishes eaten by the poor.

Session number: 8.1

Paper number: 315

Reciprocal business practices among fishermen, middlemen, and merchants in the dagaa processing industry in a coastal community on Zanzibar Island, Tanzania

Mariko Fujimoto, Graduate School of Asian and African Area Studies, Kyoto University, Japan Society for the Promotion of Science, Kyoto city, Kyoto prefecture, Japan

Dagaa, the general name for small fish in Swahili, is a very important protein source for middle-income people at home and abroad. In Tanzania, sun-dried dagaa is fished by both freshwater and marine fisheries and distributed to neighboring countries. In 2013, I conducted a survey about the dagaa distribution system in a small fishing village on Zanzibar Island, Tanzania. A huge amount of dagaa from the Indian Ocean is landed and processed in coastal villages, and a large part of it is distributed to the Democratic Republic of Congo (DRC). In recent years, demand for dagaa has increased in DRC, with many local merchants visiting Zanzibar to buy dried dagaa. This paper examines the dagaa distribution channels and business practices, including the reciprocal trading relationships among fishers, middlemen and merchants. The presented findings suggest that some of these reciprocal business practices are not focused on profit maximization, but could contribute to poverty reduction among the local communities.

Key words: Zanzibar Island, dagaa, distribution channel, business practice, reciprocity

Session number: 8.1

Paper number: 433

Patron-Client Relationship (PCR) in Fresh Fish Trade (FFT) at Lake Chad, Cameroon

Hiroyuki Inai, Kyoto, Japan

Lake Chad is important supply center of fish in semi-arid zone of West Africa. Processed fish have been widely-distributed to neighboring countries for long time. FFT became active by introducing modern technology. And fish species was replaced the ones suited to FFT by droughts. FFT has been increased recently. In addition, migrant fishermen increased and engaged in fishing for FFT at the same time.

Relationship between fishermen and middlemen is explained as PCR. It has been often described functions like reciprocal agreement and enclosing fishermen. But there is diversity of relationship between both. The objective of this study was to report a case of PCR in FFT comparing with processed fish trades. Field survey was conducted at Commune of Darak in Cameroon on Mars, 2011.

Almost of all middlemen dealt with fishermen who got fishing gears by themselves. Quoted market price of major species (Cichlidae) was stable. There were some cases deviated from the price by fishermen borrowed from middlemen to make good. Almost of all trade were occasional. Middlemen had to deal with unspecified number of fishermen. And it is difficult for middlemen to gain a privilege from PCR as referred to above. Therefore, Middlemen must observe the quoted market price (if not, they may lose their client). Relationship in FFT there is more free for fishermen and equivalent to middlemen.

Session number: 8.2

Paper number: 461

South Australia's Marine Park Catch/Effort Reduction Program – Implications for Fisheries Management

Roger Edwards¹, Mehdi Doroudi² (presenting), Andrew Burnell³, Sean Sloan⁴

1. Goolwa Pipi Harvesters Assoc Inc, Unley, SA, Australia

2. Primary Industries and Regions SA, Adelaide, South Australia, Australia

3. Dept of Environment, Water and Natural Resources, Adelaide, South Australia, Australia

4. PIRSA Fisheries, Adelaide, South Australia, United States

In 2009 a network of 19 multiple-use Marine Parks was created in State waters under the South Australian *Marine Parks Act 2007*. Section 21 of the Act contains compensation provisions where rights of fishing licence holders are affected by the creation of marine parks.

Management plans and zoning regulations were established in 2012 and are timed for implementation in October 2014. The likely displacement impacts on the commercial fishing industry were estimated by the South Australian Research and Development Institute, the South Australian Government research agency, using available commercial fishing data provided by fishers and held by The Department of Primary Industries and Regions, South Australia.

In order to manage any potential adverse impacts on fisheries management, the Government developed and implemented a voluntary catch/effort reduction program for the South Australian commercial fishing and charter boat sectors. The objective of the program was to purchase, using market mechanisms, fishing entitlements with sufficient catch/effort history to offset the estimated displacement.

The program criteria developed with the assistance of independent expertise ensured that catch/effort was effectively removed (including spatial considerations), that public funds were spent efficiently and appropriately and that future fisheries management impacts were minimised. The criteria developed and process followed contributed to willing participation by industry and successful program implementation. Whole licences and catch/effort units were surrendered through the program and the catch/effort reduction was completed for 5 sectors out of 6 affected sectors in December 2013.

The approach taken, the process involved, the outcomes and fisheries management considerations involved are discussed.

Session number: 8.2

Paper number: 239

A Deliberative Approach to Valuation of Cold Water Corals - Investigating Opportunity Costs and the Precautionary Principle

Jannike Falk-Petersen, University of Tromsø, Tromsø, Tromsø, Norway

Focus groups were combined with surveys to inform policy making regarding precautionary measures to protect cold water coral (CWC). CWC represent complex environmental public goods involving irreversibility and uncertainty. Respondents believe CWC is valuable and should be protected. Use-values, particularly habitat for fish, dominated the focus group discussions, whereas non-use and intrinsic values were emphasised in the survey. The

dilemma of implementing precautionary measures was highlighted as respondents rejected the use of temporary closures to gain information on CWC presence. Reasons were costs to fishers, or the rejection of the premise that lack of precautionary closures would prevent further damage.

Session number: 8.2

Paper number: 465

Considering the Costs of Enforcement: Improving Marine Spatial Planning

Katrina Davis¹ (presenting), David Pannell², Marit Kragt, Stefan Gelcich³, Steven Schilizzi⁴

1. Centre for Environmental Economics and Policy, West Perth, Western Australia, Australia

2. Centre for Environmental Economics and Policy, Crawley, Western Australia, Australia

3. Centro de Conservación Marina & Laboratorio Internacional en Cambio Global (LINCGlobal), Santiago, Santiago, Chile

4. Centre for Environmental Economics and Policy (CEEP), Crawley, Western Australia, Australia

Growing industrial and consumer demands are negatively affecting fish stocks, which are extracted above sustainable levels. Successful conservation of marine resources through restricted-use zoning systems such as marine reserves and territorial user rights schemes relies on support from marine stakeholders – particularly coastal fishing communities. Restricted use zoning will result in management costs to stakeholders but also delivers benefits. To increase support for management decisions, these costs and benefits need to be taken into account when designing optimal marine management.

We developed a linear spatial optimisation model to identify zoning solutions which maximize fishers' revenue, while meeting conservation targets for two invertebrate and three reef fish species in Chile. The model maximises revenue by allocating the study area to different management zones: no-take, territorial user rights for fishing (TURFs), or open access. Enforcing no-take and TURF areas will be costly, but will result in higher species abundance by preventing poaching and overfishing. We analyse scenarios to determine the impact of enforcement on revenue.

Results demonstrated net benefits from enforcement: revenue under scenarios with enforcement was approximately 50% higher than under scenarios without it, and enforced-TURF areas were preferentially selected over other zones. High enforcement costs may be a disincentive to fishers to manage marine areas. Our analysis, however, demonstrates that the often hidden benefits of enforcement far exceed the visible costs. These findings highlight the importance of accounting for both the benefits and costs of management in marine conservation; particularly as they relate to marine stakeholders.

Session number: 8.2

Paper number: 461

South Australia's Marine Park Catch/Effort Reduction Program – Implications for Fisheries Management

Roger Edwards¹, **Mehdi Doroudi**² (**presenting**), Andrew Burnell³, Sean Sloan⁴

1. Goolwa Pipi Harvesters Assoc Inc, Unley, SA, Australia

2. Primary Industries and Regions SA, Adelaide, South Australia, Australia

3. Dept of Environment, Water and Natural Resources, Adelaide, South Australia, Australia

4. PIRSA Fisheries, Adelaide, South Australia, United States

In 2009 a network of 19 multiple-use Marine Parks was created in State waters under the South Australian *Marine Parks Act 2007*. Section 21 of the Act contains compensation provisions where rights of fishing licence holders are affected by the creation of marine parks.

Management plans and zoning regulations were established in 2012 and are timed for implementation in October 2014. The likely displacement impacts on the commercial fishing industry were estimated by the South Australian Research and Development Institute, the South Australian Government research agency, using available commercial fishing data provided by fishers and held by The Department of Primary Industries and Regions, South Australia.

In order to manage any potential adverse impacts on fisheries management, the Government developed and implemented a voluntary catch/effort reduction program for the South Australian commercial fishing and charter boat sectors. The objective of the program was to purchase, using market mechanisms, fishing entitlements with sufficient catch/effort history to offset the estimated displacement.

The program criteria developed with the assistance of independent expertise ensured that catch/effort was effectively removed (including spatial considerations), that public funds were spent efficiently and appropriately and that future fisheries management impacts were minimised. The criteria developed and process followed contributed to willing participation by industry and successful program implementation. Whole licences and catch/effort units were surrendered through the program and the catch/effort reduction was completed for 5 sectors out of 6 affected sectors in December 2013.

The approach taken, the process involved, the outcomes and fisheries management considerations involved are discussed.

Session number: 8.2

Paper number: 239

A Deliberative Approach to Valuation of Cold Water Corals - Investigating Opportunity Costs and the Precautionary Principle

Jannike Falk-Petersen, University of Tromsø, Tromsø, Tromsø, Norway

Focus groups were combined with surveys to inform policy making regarding precautionary measures to protect cold water coral (CWC). CWC represent complex environmental public goods involving irreversibility and uncertainty. Respondents believe CWC is valuable and should be protected. Use-values, particularly habitat for fish, dominated the focus group discussions, whereas non-use and intrinsic values were emphasised in the survey. The dilemma of implementing precautionary measures was highlighted as respondents rejected the use of temporary closures to gain information on CWC presence. Reasons were costs to fishers, or the rejection of the premise that lack of precautionary closures would prevent further damage.

Session number: 8.2

Paper number: 465

Considering the Costs of Enforcement: Improving Marine Spatial Planning

Katrina Davis¹ (presenting), David Pannell², Marit Kragt, Stefan Gelcich³, Steven Schilizzi⁴

1. Centre for Environmental Economics and Policy, West Perth, Western Australia, Australia

2. Centre for Environmental Economics and Policy, Crawley, Western Australia, Australia

3. Centro de Conservación Marina & Laboratorio Internacional en Cambio Global (LINCGlobal), Santiago, Santiago, Chile

4. Centre for Environmental Economics and Policy (CEEP), Crawley, Western Australia, Australia

Growing industrial and consumer demands are negatively affecting fish stocks, which are extracted above sustainable levels. Successful conservation of marine resources through restricted-use zoning systems such as marine reserves and territorial user rights schemes relies on support from marine stakeholders – particularly coastal fishing communities. Restricted use zoning will result in management costs to stakeholders but also delivers benefits. To increase support for management decisions, these costs and benefits need to be taken into account when designing optimal marine management.

We developed a linear spatial optimisation model to identify zoning solutions which maximize fishers' revenue, while meeting conservation targets for two invertebrate and three reef fish species in Chile. The model maximises revenue by allocating the study area to different management zones: no-take, territorial user rights for fishing (TURFs), or open access. Enforcing no-take and TURF areas will be costly, but will result in higher species abundance by preventing poaching and overfishing. We analyse scenarios to determine the impact of enforcement on revenue.

Results demonstrated net benefits from enforcement: revenue under scenarios with enforcement was approximately 50% higher than under scenarios without it, and enforced-TURF areas were preferentially selected over other zones. High enforcement costs may be a disincentive to fishers to manage marine areas. Our analysis, however, demonstrates that the often hidden benefits of enforcement far exceed the visible costs. These findings highlight the importance of accounting for both the benefits and costs of management in marine conservation; particularly as they relate to marine stakeholders.

Session number: 8.3

Paper number: 424

Assessing the Impact of Chinook Bycatch Reduction Incentives in the Bering Sea Pollock Fishery

Alan Haynie, NOAA/NMFS/AFSC, Seattle, WA, United States

Chinook and chum salmon are prohibited species catch (PSC) which are taken as bycatch in the Bering Sea pollock fishery, the largest fishery in the United States. While salmon cannot be completely avoided in the harvest of pollock, salmon PSC must be discarded or donated to food banks and cannot be sold or consumed. In 2011, a new Chinook salmon bycatch management program, Amendment 91 to the Bering Sea Aleutian Islands Fishery Management Plan, was implemented. This program consists of two elements: a hard cap on the total Chinook PSC that is sub-allocated to individual vessels and an industry-developed Incentive Plan Agreements (IPAs) that provides additional incentives for bycatch reduction at levels below the hard cap.

We examine a number of behaviors and bycatch outcomes to determine if measurable changes in behavior in the fishery are evident. The Chinook bycatch rate for the first three years since Amendment 91 was implemented is the lowest for any recorded 3-year period. However, because there typically are large variations among years, this is not conclusive evidence for the effectiveness of the program. There is also a large change in the distribution of large bycatch events and vessel-level bycatch rates. We explore a range of behavioral changes to determine if there have been changes in fishing strategy that have led to additional Chinook bycatch avoidance since 2011. We also examine the current IPA mechanisms, assess the strength of the incentives in those programs, and discuss other means to reduce bycatch below the hard cap.

Session number: 8.3

Paper number: 201

Implications of Different Spatial Management Strategies when Establishing Territorial User Fishing Rights and Marine Protected Areas for Interconnected Marine Systems

Renato Molina, Sustainable Fisheries Group, University of California at Santa Barbara, Santa Barbara, California, United States

The lack of property rights in fisheries is a well-known source of undesirable outcomes in terms of sustainability and profitability for fisheries. Both Territorial User Fishing Rights (TURF) and Marine Protected Areas (MPA) have been proposed as a tool for managing coastal fisheries, recovering stocks and improving fishing yields; it has been well argued that proper sizing and network design can lead to significant improvements from open access (OA) and over fishing situations. In this work, we study the implications of spatial management for an interconnected marine system in Valdivia, Chile. We test several spatial strategies and look at 1) Competitive and 2) Cooperative management scenarios at each section. We found that establishing MPAs in the system decreases inefficiencies caused by competition from individually managed TURFs, and that eliminating open access can generate significant gains as well in both competitive and cooperative schemes. We test these results in a wide range of movement scenarios to establish the best strategies for the system, given the diversity of species that could be relevant in a TURF-NTZ network such as the one in Valdivia.

Session number: 8.3

Paper number: 348

Valuing Fishing Grounds and the Cost of Displaced Fishing

Tracey Osborne¹ (presenting), Scott Walker²

1. Ministry of Primary Industries, Nelson, -, New Zealand

2. Ministry of Transport, Wellington, -, New Zealand

A GIS for mapping area fished in each and all fishing events has improved the quality of advice to marine resource decision makers. Summary maps of fishing effort, catch, and value per unit area have proven very effective for communicating advice. We demonstrate how we quantify fishing in any area of interest. Value of production is estimated using port price, the annual value of leased quota (a measure of willingness to pay for access to fish), or economic return using multipliers from an economic model.

On its own, quantifying affected fishing has been useful in spatial allocation advice, but the cost of displacement depends upon the destination of displaced fishing effort which in turn depends upon the uniqueness of the lost space and availability of other fishing opportunities. We present our progress on defining and encapsulating uniqueness values into our GIS for routine reporting. Examples are space that is critical to maintaining continuity of supply, critical for certain catch compositions for balancing quota in mixed species fisheries, and critical for supporting local infrastructure.

We briefly present progress on our work with CSIRO fisheries economists to predict spatial reallocation of displaced fishing effort using random utility models. Estimated costs of displacement in terms of reduced profit from fishing and increased impact of fishing at downstream locations will be valuable additions to debates in marine spatial planning. Improved spatial resolution on the utilisation of fishing grounds is also important for the progression from stock-based to ecosystem-based management of New Zealand's fisheries.

Session number: 8.3

Paper number: 424

Assessing the Impact of Chinook Bycatch Reduction Incentives in the Bering Sea Pollock Fishery

Alan Haynie, NOAA/NMFS/AFSC, Seattle, WA, United States

Chinook and chum salmon are prohibited species catch (PSC) which are taken as bycatch in the Bering Sea pollock fishery, the largest fishery in the United States. While salmon cannot be completely avoided in the harvest of pollock, salmon PSC must be discarded or donated to food banks and cannot be sold or consumed. In 2011, a new Chinook salmon bycatch management program, Amendment 91 to the Bering Sea Aleutian Islands Fishery Management Plan, was implemented. This program consists of two elements: a hard cap on the total Chinook PSC that is sub-allocated to individual vessels and an industry-developed Incentive Plan Agreements (IPAs) that provides additional incentives for bycatch reduction at levels below the hard cap.

We examine a number of behaviors and bycatch outcomes to determine if measurable changes in behavior in the fishery are evident. The Chinook bycatch rate for the first three years since Amendment 91 was implemented is the lowest for any recorded 3-year period. However, because there typically are large variations among years, this is not conclusive evidence for the effectiveness of the program. There is also a large change in the distribution of large bycatch events and vessel-level bycatch rates. We explore a range of behavioral changes to determine if there have been changes in fishing strategy that have led to additional Chinook bycatch avoidance since 2011. We also examine the current IPA mechanisms, assess the strength of the incentives in those programs, and discuss other means to reduce bycatch below the hard cap.

Session number: 8.3

Paper number: 201

Implications of Different Spatial Management Strategies when Establishing Territorial User Fishing Rights and Marine Protected Areas for Interconnected Marine Systems

Renato Molina, Sustainable Fisheries Group, University of California at Santa Barbara, Santa Barbara, California, United States

The lack of property rights in fisheries is a well-known source of undesirable outcomes in terms of sustainability and profitability for fisheries. Both Territorial User Fishing Rights (TURF) and Marine Protected Areas (MPA) have been proposed as a tool for managing coastal fisheries, recovering stocks and improving fishing yields; it has been well argued that proper sizing and network design can lead to significant improvements from open access (OA) and over fishing situations. In this work, we study the implications of spatial management for an interconnected marine system in Valdivia, Chile. We test several spatial strategies and look at 1) Competitive and 2) Cooperative management scenarios at each section. We found that establishing MPAs in the system decreases inefficiencies caused by competition from individually managed TURFs, and that eliminating open access can generate significant gains as well in both competitive and cooperative schemes. We test these results in a wide range of movement scenarios to establish the best strategies for the system, given the diversity of species that could be relevant in a TURF-NTZ network such as the one in Valdivia.

Session number: 8.3

Paper number: 348

Valuing Fishing Grounds and the Cost of Displaced Fishing

Tracey Osborne¹ (presenting), Scott Walker²

1. Ministry of Primary Industries, Nelson, -, New Zealand

2. Ministry of Transport, Wellington, -, New Zealand

A GIS for mapping area fished in each and all fishing events has improved the quality of advice to marine resource decision makers. Summary maps of fishing effort, catch, and value per unit area have proven very effective for communicating advice. We demonstrate how we quantify fishing in any area of interest. Value of production is estimated using port price, the annual value of leased quota (a measure of willingness to pay for access to fish), or economic return using multipliers from an economic model.

On its own, quantifying affected fishing has been useful in spatial allocation advice, but the cost of displacement depends upon the destination of displaced fishing effort which in turn depends upon the uniqueness of the lost space and availability of other fishing opportunities. We present our progress on defining and encapsulating uniqueness values into our GIS for routine reporting. Examples are space that is critical to maintaining continuity of supply, critical for certain catch compositions for balancing quota in mixed species fisheries, and critical for supporting local infrastructure.

We briefly present progress on our work with CSIRO fisheries economists to predict spatial reallocation of displaced fishing effort using random utility models. Estimated costs of displacement in terms of reduced profit from fishing and increased impact of fishing at downstream locations will be valuable additions to debates in marine spatial planning. Improved spatial resolution on the utilisation of fishing grounds is also important for the progression from stock-based to ecosystem-based management of New Zealand's fisheries.

Session number: 8.4

Paper number: 187

The Economic Impact of Offshore Wind Development on Northwest Atlantic (US) Fisheries

A. Justin Kirkpatrick, NOAA/NMFS/Northeast Fishery Science Center, Woods Hole, MA, United States

There is growing emphasis on spatial ocean planning with the explicit goal of maximizing net benefits and balancing conflicts. Regulators have proposed wind energy areas totalling 10,000 km² along the US Atlantic coast, where there is a potential use conflict with the fishing-dependent communities that land over \$USD1.6B landings annually. Best management practices for assessing net benefits recommend quantitative modeling of economic changes (UK-SEAFISH, US-NMFS), giving rise to the question: how does one quantify the value of a patch of ocean while accounting for fishery reaction?

We use a discrete choice methodology to model selected multi-species fisheries relying on the areas proposed for development. Models accounting for gear, vessel characteristics, trip length, distance, and environmental variables estimate expected catch, and an integrated cost model is employed to reveal probabilistic determinations of vessel-level location choices. Furthermore, we incorporate changes in commercially exploitable biomass, as observed in Danish and UK developments.

When aggregated to the fleet level, we are capable of simulating a variety of scenarios, including full area closure, area-specific gear restrictions, and weather-specific safety closures. The model is also unique in that trip costs are included, allowing for estimation of changes in profit, rather than revenue. In addition to being a step forward in fishery location-choice modeling, the project results in fascinating findings on fishery behavior and helps to resolve a long-standing source of conflict and litigation.

Session number: 8.4

Paper number: 292

Exploring incentive based management options for regulating mine and dredge spoil dumping in the marine environment

Samantha Paredes¹ (presenting), Sean Pascoe², Louisa Coglan³

1. Queensland University of Technology, Brisbane, Queensland, Australia

2. CSIRO, Australia

3. QUT, Australia

The expansion of port developments to facilitate the export of mineral and energy commodities in Australia and around the world has led to significant consequences for both coastal and marine environments. More specifically, the dumping of dredged spoils (tailings) at sea has direct impacts on marine biodiversity and fisheries. The marine environment may also be further placed at risk given the possibility of the mining industry to expand into offshore mining activities. In this paper, we review the current Australian regulatory framework for the dumping of mining and dredging tailings at sea and the incentives created within this framework for marine conservation. We examine the potential of other economic incentive based management options to limit marine damage and enhance the protection of fisheries, the marine environment and ecologically sensitive areas such as the Great Barrier Reef. The role of offsets in compensating for this type of damage is examined, as well as the

social acceptability thereof.

Session number: 8.4

Paper number: 434

Coastal and Marine Spatial Planning in the Context of Ecosystem-Based Fisheries Management: Assessing Tradeoffs between Wind Farms and Marine Fisheries in New England

Porter Hoagland¹ (presenting), Di Jin¹, Tracey Dalton², Joseph Dwyer²

1. Woods Hole Oceanographic Institution, Woods Hole, MA, United States

2. University of Rhode Island, Kingston, RI, United States

Coastal and marine spatial planning (CMSP) is a process for improving the management of ocean resources in order to promote their sustainable development. One of the most challenging spatial planning issues in New England now concerns the siting of offshore renewable energy facilities, mainly wind farms. Commercial fishermen are among the leading opponents to wind farms, arguing that their construction and operation could lead to lost fish yields and sales. We develop an approach to CMSP “decision support,” comprising a regional computable general equilibrium (CGE) framework. We employ the framework to examine the interactions among the different industrial sectors of a coastal economy, where a commercial fisheries sector may be displaced in part by a renewable energy sector, and where the fisheries are affected by alternative realizations of a marine food web. Introduction of the food web into the framework allows resource managers to assess broader ecosystem-based concerns. We consider a case involving the leasing of outer Continental Shelf lands at a proposed “area of mutual interest” (AMI) located off the coasts of Massachusetts and Rhode Island. Through comparative analyses, we show how economic and distributional tradeoffs among alternative leasing policies can be evaluated by examining changes in several metrics of interest to coastal and marine resource managers, including changes in measures of economic surplus and employment.

Session number: 8.4

Paper number: 435

Irrigation Development on Lagoon Fisheries and Fishing Communities: A case study of Malala Lagoon in Sri Lanka.

Mohottala Gedara Kularatne , University of Kelaniya, Kelaniya, Western, Sri Lanka

“Human choices affect nature and nature affects human choice”. This research is investigated irrigation development on lagoon fisheries in Sri Lanka. Spatial variation of the lagoon system is derived from the land use maps. Information on biological changes of the lagoon and bio-economic conditions were obtained from the secondary data. Socio-economic information was collected from sample survey of by 32 fisher and 18 non-fisher households in Palle Malala and Kiripattiya Villages.

Changes of land use pattern in upper stream area are increased the water level and decrease the salinity content in the lagoon. It is estimated that some 212 ha of water surface has been added what used to be forest pastureland and bird habitat in the lagoon system. The salinity level of the lagoon decreased from 10 - 41ppt with a mean value of 18.5ppt in 1985 to 1-7ppt in 1992. Changes of salinity content results in the changes in the fish species composition, which leads to decrease of economically valuable shrimp fish production. Increases water

level also affects to desalinate the paddy fields and the decrease grazing lands. Altered water regime in the lagoon system causes the changes of economic behavior of the community and use of other natural resources in area. The prevailing problem cannot solve only by implementing regulations or any other controlling measures. Diversion of discharge water directly to the sea, avoiding the lagoon is the most appropriate solution, which in deed can enhance both bio-physical and socioeconomic systems associated with the Malala lagoon.

Key words: Land use, water quality, Biophysical system, socioeconomic system, Lagoon fishery

Session number: 8.4

Paper number: 187

The Economic Impact of Offshore Wind Development on Northwest Atlantic (US) Fisheries

A. Justin Kirkpatrick, NOAA/NMFS/Northeast Fishery Science Center, Woods Hole, MA, United States

There is growing emphasis on spatial ocean planning with the explicit goal of maximizing net benefits and balancing conflicts. Regulators have proposed wind energy areas totalling 10,000 km² along the US Atlantic coast, where there is a potential use conflict with the fishing-dependent communities that land over \$USD1.6B landings annually. Best management practices for assessing net benefits recommend quantitative modeling of economic changes (UK-SEAFISH, US-NMFS), giving rise to the question: how does one quantify the value of a patch of ocean while accounting for fishery reaction?

We use a discrete choice methodology to model selected multi-species fisheries relying on the areas proposed for development. Models accounting for gear, vessel characteristics, trip length, distance, and environmental variables estimate expected catch, and an integrated cost model is employed to reveal probabilistic determinations of vessel-level location choices. Furthermore, we incorporate changes in commercially exploitable biomass, as observed in Danish and UK developments.

When aggregated to the fleet level, we are capable of simulating a variety of scenarios, including full area closure, area-specific gear restrictions, and weather-specific safety closures. The model is also unique in that trip costs are included, allowing for estimation of changes in profit, rather than revenue. In addition to being a step forward in fishery location-choice modeling, the project results in fascinating findings on fishery behavior and helps to resolve a long-standing source of conflict and litigation.

Session number: 8.4

Paper number: 292

Exploring incentive based management options for regulating mine and dredge spoil dumping in the marine environment

Samantha Paredes¹ (presenting), Sean Pascoe², Louisa Coglan³

1. Queensland University of Technology, Brisbane, Queensland, Australia

2. CSIRO, Australia

3. QUT, Australia

The expansion of port developments to facilitate the export of mineral and energy commodities in Australia and around the world has led to significant consequences for both coastal and marine environments. More specifically, the dumping of dredged spoils (tailings) at sea has direct impacts on marine biodiversity and fisheries. The marine environment may also be further placed at risk given the possibility of the mining industry to expand into offshore mining activities. In this paper, we review the current Australian regulatory framework for the dumping of mining and dredging tailings at sea and the incentives created within this framework for marine conservation. We examine the potential of other economic incentive based management options to limit marine damage and enhance the protection of fisheries, the marine environment and ecologically sensitive areas such as the Great Barrier Reef. The role of offsets in compensating for this type of damage is examined, as well as the social acceptability thereof.

Session number: 8.4

Paper number: 434

Coastal and Marine Spatial Planning in the Context of Ecosystem-Based Fisheries Management: Assessing Tradeoffs between Wind Farms and Marine Fisheries in New England

Porter Hoagland¹ (presenting), Di Jin¹, Tracey Dalton², Joseph Dwyer²

1. Woods Hole Oceanographic Institution, Woods Hole, MA, United States

2. University of Rhode Island, Kingston, RI, United States

Coastal and marine spatial planning (CMSP) is a process for improving the management of ocean resources in order to promote their sustainable development. One of the most challenging spatial planning issues in New England now concerns the siting of offshore renewable energy facilities, mainly wind farms. Commercial fishermen are among the leading opponents to wind farms, arguing that their construction and operation could lead to lost fish yields and sales. We develop an approach to CMSP “decision support,” comprising a regional computable general equilibrium (CGE) framework. We employ the framework to examine the interactions among the different industrial sectors of a coastal economy, where a commercial fisheries sector may be displaced in part by a renewable energy sector, and where the fisheries are affected by alternative realizations of a marine food web. Introduction of the food web into the framework allows resource managers to assess broader ecosystem-based concerns. We consider a case involving the leasing of outer Continental Shelf lands at a proposed “area of mutual interest” (AMI) located off the coasts of Massachusetts and Rhode Island. Through comparative analyses, we show how economic and distributional tradeoffs among alternative leasing policies can be evaluated by examining changes in several metrics of interest to coastal and marine resource managers, including changes in measures of economic surplus and employment.

Session number: 8.4

Paper number: 435

Irrigation Development on Lagoon Fisheries and Fishing Communities: A case study of Malala Lagoon in Sri Lanka.

Mohottala Gedara Kularatne , University of Kelaniya, Kelaniya, Western, Sri Lanka

“Human choices affect nature and nature affects human choice”. This research is investigated irrigation development on lagoon fisheries in Sri Lanka. Spatial variation of the lagoon system is derived from the land use maps. Information on biological changes of the lagoon and bio-economic conditions were obtained from the secondary data. Socio-economic information was collected from sample survey of by 32 fisher and 18 non-fisher households in Palle Malala and Kiripattiya Villages.

Changes of land use pattern in upper stream area are increased the water level and decrease the salinity content in the lagoon. It is estimated that some 212 ha of water surface has been added what used to be forest pastureland and bird habitat in the lagoon system. The salinity level of the lagoon decreased from 10 - 41ppt with a mean value of 18.5ppt in 1985 to 1-7ppt in 1992. Changes of salinity content results in the changes in the fish species composition, which leads to decrease of economically valuable shrimp fish production. Increases water level also affects to desalinate the paddy fields and the decrease grazing lands. Altered water regime in the lagoon system causes the changes of economic behavior of the community and use of other natural resources in area. The prevailing problem cannot solve only by implementing regulations or any other controlling measures. Diversion of discharge water directly to the sea, avoiding the lagoon is the most appropriate solution, which in deed can enhance both bio-physical and socioeconomic systems associated with the Malala lagoon.

Key words: Land use, water quality, Biophysical system, socioeconomic system, Lagoon fishery

Session number: 8.5

Paper number: 334

Ecosystem Economics: The Baltic Cod Fishery Case

Peder Andersen¹ (presenting), Hans Frost², Ayoe Hoff³, Hans Lassen⁴, søren Anker Pedersen

1. Department of Food and Resource Economics, University of Copenhagen, Frederiksberg C, Frederiksberg, Denmark

2. Department of Food and Resource Economics, University of Copenhagen, Frederiksberg, Frederiksberg, United States

3. Department of Food and Resource Economics, University of Copenhagen, Frederiksberg, Frederiksberg, Denmark

4. International Council for the Exploration of the Sea (ICES), Copenhagen, Copenhagen, Denmark

Conventional bioeconomic analyses focus on the economically optimal exploitation of the fish resources by maximizing the resource rent subject to a resource restriction. This paper expands this type of analysis by addressing the fishing activity's impact on the ecosystem biologically as well as economically. A dynamic bioeconomic model is used to estimate the development with respect to fish stock recovery and then by use of an ecosystem model the development of a number of indicators for the ecosystem services are estimated. A case study suggests that stock recovery by use of fish quota management entails higher profit in the industry and at the same time results from the ecosystem estimations show that the changes in most of the indicators are relatively small, which leads to the conclusion that the pursuit of stock recovery and increased profit is not at the expense of the underlying ecosystem.

Session number: 8.5

Paper number: 337

Interpreting Output From an Ecosystem-Based Model with Various Degrees of Complexity in the Specification of the Fleet Dynamics

Trevor Hutton (presenting), Wayne Rochester, Elizabeth Fulton, Sean Pascoe²

1. CSIRO, Australia

2. CSIRO, Australia

The use of ecosystem-based models to support multiple-use management (with a focus on fisheries) has been proposed although the tactical application of these tools is limited. The specification of a whole-of-system ecosystem-based model often includes very detailed bio-economic sub-models which capture complex interactions between the fish stocks and the various fishing fleets. Typically bio-economic sub-models at alternative time steps (day, month, year) simulate optimum allocation of effort in time and space. Additional dynamics such as quota trading in TAC managed fisheries, choice of port for landing catch and longer-term investment decisions have added to the complexity. Situations exist where ecosystem-based model scenario runs to evaluate bycatch reduction measures (using economic incentives) produced results that were not easily interpretable. A whole-of-system ecosystem-based modelling framework – ‘Northern Atlantis’ has recently been parameterised in order to construct a spatially explicit, coupled biophysical-geochemical ecosystem model of the Coral Sea and East marine region. This represents a large-scale tropical-temperate ecological system with multiple fisheries. Alternative management strategies could be tested and indicators assessed for performance evaluation. The aim of this study is to strategically

evaluate the potential for systematically interpreting the model output by controlling for the complexity in the specification of the fleet dynamics. An attempt is made to highlight model output sensitivity to various assumptions and biological and economic sources of uncertainty, as well as, if possible model specification. The objective is to increase the utility of simulation-based approaches that include economic evaluations of management options in ecosystem models.

Session number: 8.5

Paper number: 351

Anticipating the Unintended Consequences of Environmental Management in a Marine Socio-Ecological System using Qualitative Loop Analysis.

Giles Austen¹ (presenting), Sarah Jennings²

1. University of Tasmania, Hobart, Tasmania, Australia

2. University of Tasmania School of Economics and Finance, Hobart, Tasmania, Australia

Balancing the goals of economic development and sustaining ecosystem services remains a challenge for policymakers, particularly in the marine environment where ecosystem dynamics and human interactions are both complex and poorly understood. Implementing environmental management policies, such as environmental restoration, is a common response by policymakers where economic and environmental goals conflict. However, evaluation of such policies in complex socio-ecological systems (SES) is problematic as interventions will have effects which are difficult to predict, and consequences beyond those intended. Qualitative loop analysis provides a tool for unpacking the complexity of SES, for understanding their stability, and predicting the response of system variables to perturbation. We develop a stylised model of a regional-fishery based SES comprising linked ecological and human subsystems. Our model allows for commodities and non-provisioning ecosystem services to affect the human system differently and includes a process whereby pressure on policymakers to manage the environment reflects social preferences. Using loop analysis we contrast the effectiveness of various environmental management policies in maintaining ecosystem variables and the effect of a pulse in economic development under these alternative regimes. We reveal differences in system behaviour between postulated alternative model specifications of i) habitat-species relationships and ii) the social value of ecosystem services. We highlight the potential for loop analysis to improve understanding of complex marine socio-ecological systems and to better anticipate the unintended consequences of environmental management.

Session number: 8.5

Paper number: 355

Modelling the Potential Fisheries Impacts on the Trophic Structure of Moreton Bay, Australia

Esther Fondo¹ (presenting), Greg Skilleter¹, Milani Chaloupka¹

1. University of Queensland, Brisbane, Queensland, Australia

Tropical and sub-tropical coastal and estuarine ecosystems are complex, dynamic systems that are important in providing numerous ecological services. Globally, these ecosystems are threatened by anthropogenic activities and climate change and these, together with their complex nature, makes management of tropical and sub-tropical coastal and estuarine ecosystems difficult.

Ecosystem models (e.g. Ecopath, EcoTroph,) have been useful in helping to understand the structure and functioning of these systems and are increasingly being used to help in management of human use of these ecosystems. Several models use qualitative data to help understand these systems, despite their uncertainty. Key in management of productive tropical ecosystem would be a model that can be easily applied for policy making and management decisions. However there is a problem of few or no data.

In this project a heuristic approach is used to give an overview of a general subtropical coastal ecosystem using Ecopath with Ecosim (EwE) software. The potential impact of fisheries on the trophic structure in Moreton Bay are modelled using EwE; with the aim of explaining EwE as a useful management tool by developing a trophic mass-balance model. A prototype of the model will be explained where 12 functional groups (including primary producers (seagrasses/ macroalgae), detritivores (prawns), small pelagics (sardines), large pelagics (sharks), marine turtles, dugong and shorebirds) are used in the model; with the input parameters derived from data in databases, literature and stock assessments.

Session number: 8.5

Paper number: 334

Ecosystem Economics: The Baltic Cod Fishery Case

Peder Andersen¹ (presenting), Hans Frost², Ayoe Hoff³, Hans Lassen⁴, søren Anker Pedersen

1. Department of Food and Resource Economics, University of Copenhagen, Frederiksberg C, Frederiksberg, Denmark

2. Department of Food and Resource Economics, University of Copenhagen, Frederiksberg, Frederiksberg, United States

3. Department of Food and Resource Economics, University of Copenhagen, Frederiksberg, Frederiksberg, Denmark

4. International Council for the Exploration of the Sea (ICES), Copenhagen, Copenhagen, Denmark

Conventional bioeconomic analyses focus on the economically optimal exploitation of the fish resources by maximizing the resource rent subject to a resource restriction. This paper expands this type of analysis by addressing the fishing activity's impact on the ecosystem biologically as well as economically. A dynamic bioeconomic model is used to estimate the development with respect to fish stock recovery and then by use of an ecosystem model the development of a number of indicators for the ecosystem services are estimated. A case study suggests that stock recovery by use of fish quota management entails higher profit in the industry and at the same time results from the ecosystem estimations show that the changes in most of the indicators are relatively small, which leads to the conclusion that the pursuit of stock recovery and increased profit is not at the expense of the underlying ecosystem.

Session number: 8.5

Paper number: 337

Interpreting Output From an Ecosystem-Based Model with Various Degrees of Complexity in the Specification of the Fleet Dynamics

Trevor Hutton (presenting), Wayne Rochester, Elizabeth Fulton, Sean Pascoe²

1. CSIRO, Australia
2. CSIRO, Australia

The use of ecosystem-based models to support multiple-use management (with a focus on fisheries) has been proposed although the tactical application of these tools is limited. The specification of a whole-of-system ecosystem-based model often includes very detailed bio-economic sub-models which capture complex interactions between the fish stocks and the various fishing fleets. Typically bio-economic sub-models at alternative time steps (day, month, year) simulate optimum allocation of effort in time and space. Additional dynamics such as quota trading in TAC managed fisheries, choice of port for landing catch and longer-term investment decisions have added to the complexity. Situations exist where ecosystem-based model scenario runs to evaluate bycatch reduction measures (using economic incentives) produced results that were not easily interpretable. A whole-of-system ecosystem-based modelling framework – ‘Northern Atlantis’ has recently been parameterised in order to construct a spatially explicit, coupled biophysical-geochemical ecosystem model of the Coral Sea and East marine region. This represents a large-scale tropical-temperate ecological system with multiple fisheries. Alternative management strategies could be tested and indicators assessed for performance evaluation. The aim of this study is to strategically evaluate the potential for systematically interpreting the model output by controlling for the complexity in the specification of the fleet dynamics. An attempt is made to highlight model output sensitivity to various assumptions and biological and economic sources of uncertainty, as well as, if possible model specification. The objective is to increase the utility of simulation-based approaches that include economic evaluations of management options in ecosystem models.

Session number: 8.5

Paper number: 351

Anticipating the Unintended Consequences of Environmental Management in a Marine Socio-Ecological System using Qualitative Loop Analysis.

Giles Austen¹ (presenting), Sarah Jennings²

1. University of Tasmania, Hobart, Tasmania, Australia

2. University of Tasmania School of Economics and Finance, Hobart, Tasmania, Australia

Balancing the goals of economic development and sustaining ecosystem services remains a challenge for policymakers, particularly in the marine environment where ecosystem dynamics and human interactions are both complex and poorly understood. Implementing environmental management policies, such as environmental restoration, is a common response by policymakers where economic and environmental goals conflict. However, evaluation of such policies in complex socio-ecological systems (SES) is problematic as interventions will have effects which are difficult to predict, and consequences beyond those intended. Qualitative loop analysis provides a tool for unpacking the complexity of SES, for understanding their stability, and predicting the response of system variables to perturbation. We develop a stylised model of a regional-fishery based SES comprising linked ecological and human subsystems. Our model allows for commodities and non-provisioning ecosystem services to affect the human system differently and includes a process whereby pressure on policymakers to manage the environment reflects social preferences. Using loop analysis we contrast the effectiveness of various environmental management policies in maintaining ecosystem variables and the effect of a pulse in economic development under these alternative regimes. We reveal differences in system behaviour between postulated alternative model specifications of i) habitat-species relationships and ii) the social value of ecosystem services. We highlight the potential for loop analysis to improve understanding of complex marine socio-ecological systems and to better anticipate the unintended consequences of environmental management.

Session number: 8.5

Paper number: 355

Modelling the Potential Fisheries Impacts on the Trophic Structure of Moreton Bay, Australia

Esther Fondo¹ (presenting), Greg Skilleter¹, Milani Chaloupka¹

1. University of Queensland, Brisbane, Queensland, Australia

Tropical and sub-tropical coastal and estuarine ecosystems are complex, dynamic systems that are important in providing numerous ecological services. Globally, these ecosystems are threatened by anthropogenic activities and climate change and these, together with their complex nature, makes management of tropical and sub-tropical coastal and estuarine ecosystems difficult.

Ecosystem models (e.g. Ecopath, EcoTroph,) have been useful in helping to understand the structure and functioning of these systems and are increasingly being used to help in management of human use of these ecosystems. Several models use qualitative data to help understand these systems, despite their uncertainty. Key in management of productive tropical ecosystem would be a model that can be easily applied for policy making and management decisions. However there is a problem of few or no data.

In this project a heuristic approach is used to give an overview of a general subtropical coastal ecosystem using Ecopath with Ecosim (EwE) software. The potential impact of fisheries on the trophic structure in Moreton Bay are modelled using EwE; with the aim of explaining EwE as a useful management tool by developing a trophic mass-balance model. A prototype of the model will be explained where 12 functional groups (including primary producers (seagrasses/ macroalgae), detritivores (prawns), small pelagics (sardines), large pelagics (sharks), marine turtles, dugong and shorebirds) are used in the model; with the input parameters derived from data in databases, literature and stock assessments.

Session number: 9.1

Paper number: 230

Asymmetric Transmission between Farm Price and Export Price: The Case of Vietnam Pangasius Industry

Giap Van Nguyen¹, Duc Nguyen², **Thong Tien Nguyen³ (presenting)**

1. Institute of policy and strategy for agriculture and rural development, Ho Chi Minh, Ho Chi Minh, Viet Nam

2. Nong Lam University, Ho Chi Minh, Ho Chi Minh, Viet Nam

3. Nha Trang University, former fellow of UNU-FTP, Nha Trang, Khanh Hoa, Viet Nam

This study estimates price transmission between farm and export prices in Vietnamese pangasius industry. More than 80 percent of farm-raised pangasius production volume is processed for export markets. Fresh pangasius accounts for about 75% of production cost of frozen pangasius fillet; other costs include labor, energy, water, and machine. Economic theories show that, in a perfect competitive market, any change in farm price will be transmitted perfectly to export price. Therefore, the predicted price transmission elasticity (PTE) should be close to 0.75, if there is no other cost added frozen fillets from processors to export borders. The estimated price transmission elasticity is 0.2, much smaller than the predicted one. It suggests two possible explanations: first, changes in farm price are not perfectly transmitted to export price due to the existence of imperfect market powers in the industry; second, there are additional transaction costs added to frozen pangasius fillets from processors to export borders. We further tested the existing of asymmetry in price transmission and found out that when farm price increases, the magnitude of PTE is greater than that when farm price decreases. The asymmetry in price transmission suggests an imperfect market power to exist in the industry. Finally, we tested the causality between farm and export prices, and found export price having significant causal effect on farm price, but not the opposite way; it implies that export price is the leading price. Therefore, pangasius farmers are in a passive position to fully receive price fluctuation risks from markets.

Session number: 9.1

Paper number: 341

Household Consumption Patterns in the U.S. Southeast from Panel Scanner Data: Market Comparison and Demographic Preference Analysis

Matthew Gorstein¹, **Sherry Larkin¹ (presenting)**

1. University of Florida, Gainesville, FL, United States

Scanner data that's collected on consumer purchases falls into two main groups: point-of-sale scanner data and household-based scanner data. Point-of-sale scanner data can identify the products that are purchased, the quantity sold, and the price of the product. Household scanner data comes from a sample of survey participants that scan universal product codes (UPCs) of all products that were purchased on a trip to the grocery store. While the use of stated preference data (obtained from surveys) is critically important for determining potential demand for new products, revealed preference data (obtained from past behavior) is more credible for assessing tradeoffs between products and product attributes necessary for marketing decisions. The homescan data used in this project was obtained from AC Nielsen and consists of weekly purchases by UPC and household for five major market areas in the Southeastern US: Miami, Chicago, Houston, Memphis, and New Orleans-Mobile. The data cover a three year period beginning June 2008. The objective is to test for differences in

consumption of major seafood species and product forms by price, income, city, race, and other demographic variables, as well as test for substitutability among seafood products within demographic groups. Results from the analysis will be used to summarize purchase information by demographic groups and will serve to help firms create opportunities or dispel myths, help marketers target specific species to compare regional preferences and the demographic variables that affect these preferences, gather information on coupon use for seafood products, and information on substitutability of seafood products.

Session number: 9.1

Paper number: 438

A Weekend Effect in Expenditure Levels for Fisheries Products in Japan's Consumer Market

Nobuyuki Yagi¹ (presenting), Ryoko Arai²

1. The University of Tokyo, Bunkyo-ku, Tokyo, Japan

2. Te University of Tokyo, Bunkyo-ku, Tokyo, Japan

Research was conducted on differences in household expenditure levels for fisheries products by day of the week, and the effectiveness of the existing fish value chains in Japan was discussed. Analysis was conducted using figures for daily household expenditures on fishery products (two-or-more-person households) published by the Statistics Bureau of the Japanese Ministry of Internal Affairs and Communications. It was found that family expenditures on tuna were significantly higher on Saturdays and Sundays, while those for mackerel and sardines were significantly lower on Sundays. On the other hand, expenditures for mackerel and sardines were significantly larger on Tuesdays. Overall expenditures for aggregated food items, which according to the government's definition includes all food and beverages, were also higher on Saturdays and Sundays. It can be argued that household expenditure patterns for tuna are in alignment with those for the aggregated food items. Weak retail sales for sardines and mackerel on Sundays, as well as their strong sales on Tuesdays, could be explained by (i) differences in consumer food preferences according to the day of the week and/or (ii) differences in supply side push of certain fresh food due to logistical constraints in the value chain. In relation to the second possible explanation, responses to our survey of fish dealers in Tokyo highlighted that the Sunday closure of the Tsukiji wholesale market could have influenced such differences.

Session number: 9.1

Paper number: 395

Comparative Economics of Fresh and Smoked Fish Marketing in some Local Government Areas in Adamawa State

Lucky Onyia¹, **Elizabeth Adebayo² (presenting)**, Kolawole Adewuyi³, Godfrey Ekene Ekwunife⁴, Jane Ochokwu⁴

1. Modibbo Adama University of Technology, Yola, Yola, Adamawa, Nigeria

2. Modibbo Adama University of Technology, Yola, Nigeria, Yola, Adamawa, Nigeria

3. Educational Institution, Mubi, ADAMAWA, Nigeria

4. Educational Institution, YOLA, ADAMAWA, Nigeria

The study compared fresh fish and smoked fish marketing in Adamawa state. Primary data were collected with the aid of well-structured questionnaires from marketers in 13 major fish markets in seven local government area of Adamawa state. Findings from the study revealed

that majority of the fish sellers were female (70%) and (64%) for smoked and fresh fish marketers respectively. Middle-aged class were (87%) and (86%) for fresh and smoked fish marketers respectively (70%) and (76%) were married. The result also indicate that (36%) and (29%) of the people involved in fish marketing had no formal education, (37%) and (43%) respectively had primary six education and below, while only (8%) and (7%) had school certificate requirement and post-secondary school education majority (79%) and (97%) of the fish sellers were engage in full time participation in marketing as their major occupation. The commonest fish in the surveyed markets include catfish, tilapia, snake head and Heterotis. Personal savings, support from friends and relations form the major source of capital invested on the business. The study revealed that with an average gross margin of N28, 209 and 33,099 and return to variable cost of N1.18 and N1.09 for fresh and smoked fish marketing respectively, fresh fish marketing was more profitable than smoked fish marketing. The constraints for fish marketing were highlighted in this work. It is recommended that loans be given to prospective fish marketers, provision of storage facilities, adequate space for selling of fish product to enhance the business among others

Session number: 9.1

Paper number: 230

Asymmetric Transmission between Farm Price and Export Price: The Case of Vietnam Pangasius Industry

Giap Van Nguyen¹, Duc Nguyen², **Thong Tien Nguyen³ (presenting)**

1. Institute of policy and strategy for agriculture and rural development, Ho Chi Minh, Ho Chi Minh, Viet Nam

2. Nong Lam University, Ho Chi Minh, Ho Chi Minh, Viet Nam

3. Nha Trang University, former fellow of UNU-FTP, Nha Trang, Khanh Hoa, Viet Nam

This study estimates price transmission between farm and export prices in Vietnamese pangasius industry. More than 80 percent of farm-raised pangasius production volume is processed for export markets. Fresh pangasius accounts for about 75% of production cost of frozen pangasius fillet; other costs include labor, energy, water, and machine. Economic theories show that, in a perfect competitive market, any change in farm price will be transmitted perfectly to export price. Therefore, the predicted price transmission elasticity (PTE) should be close to 0.75, if there is no other cost added frozen fillets from processors to export borders. The estimated price transmission elasticity is 0.2, much smaller than the predicted one. It suggests two possible explanations: first, changes in farm price are not perfectly transmitted to export price due to the existence of imperfect market powers in the industry; second, there are additional transaction costs added to frozen pangasius fillets from processors to export borders. We further tested the existing of asymmetry in price transmission and found out that when farm price increases, the magnitude of PTE is greater than that when farm price decreases. The asymmetry in price transmission suggests an imperfect market power to exist in the industry. Finally, we tested the causality between farm and export prices, and found export price having significant causal effect on farm price, but not the opposite way; it implies that export price is the leading price. Therefore, pangasius farmers are in a passive position to fully receive price fluctuation risks from markets.

Session number: 9.1

Paper number: 341

**Household Consumption Patterns in the U.S. Southeast from Panel Scanner Data:
Market Comparison and Demographic Preference Analysis**

Matthew Gorstein¹, **Sherry Larkin¹ (presenting)**

1. University of Florida, Gainesville, FL, United States

Scanner data that's collected on consumer purchases falls into two main groups: point-of-sale scanner data and household-based scanner data. Point-of-sale scanner data can identify the products that are purchased, the quantity sold, and the price of the product. Household scanner data comes from a sample of survey participants that scan universal product codes (UPCs) of all products that were purchased on a trip to the grocery store. While the use of stated preference data (obtained from surveys) is critically important for determining potential demand for new products, revealed preference data (obtained from past behavior) is more credible for assessing tradeoffs between products and product attributes necessary for marketing decisions. The homescan data used in this project was obtained from AC Nielsen and consists of weekly purchases by UPC and household for five major market areas in the Southeastern US: Miami, Chicago, Houston, Memphis, and New Orleans-Mobile. The data cover a three year period beginning June 2008. The objective is to test for differences in consumption of major seafood species and product forms by price, income, city, race, and other demographic variables, as well as test for substitutability among seafood products within demographic groups. Results from the analysis will be used to summarize purchase information by demographic groups and will serve to help firms create opportunities or dispel myths, help marketers target specific species to compare regional preferences and the demographic variables that affect these preferences, gather information on coupon use for seafood products, and information on substitutability of seafood products.

Session number: 9.1

Paper number: 438

A Weekend Effect in Expenditure Levels for Fisheries Products in Japan's Consumer Market

Nobuyuki Yagi¹ (presenting), Ryoko Arai²

1. The University of Tokyo, Bunkyo-ku, Tokyo, Japan

2. Te University of Tokyo, Bunkyo-ku, Tokyo, Japan

Research was conducted on differences in household expenditure levels for fisheries products by day of the week, and the effectiveness of the existing fish value chains in Japan was discussed. Analysis was conducted using figures for daily household expenditures on fishery products (two-or-more-person households) published by the Statistics Bureau of the Japanese Ministry of Internal Affairs and Communications. It was found that family expenditures on tuna were significantly higher on Saturdays and Sundays, while those for mackerel and sardines were significantly lower on Sundays. On the other hand, expenditures for mackerel and sardines were significantly larger on Tuesdays. Overall expenditures for aggregated food items, which according to the government's definition includes all food and beverages, were also higher on Saturdays and Sundays. It can be argued that household expenditure patterns for tuna are in alignment with those for the aggregated food items. Weak retail sales for sardines and mackerel on Sundays, as well as their strong sales on Tuesdays, could be explained by (i) differences in consumer food preferences according to the day of the week and/or (ii) differences in supply side push of certain fresh food due to logistical constraints in the value chain. In relation to the second possible explanation, responses to our survey of fish dealers in Tokyo highlighted that the Sunday closure of the Tsukiji wholesale market could have influenced such differences.

Session number: 9.1

Paper number: 395

Comparative Economics of Fresh and Smoked Fish Marketing in some Local Government Areas in Adamawa State

Lucky Onyia¹, **Elizabeth Adebayo**² (presenting), Kolawole Adewuyi³, Godfrey Ekene Ekwunife⁴, Jane Ochokwu⁴

1. Modibbo Adama University of Technology, Yola, Yola, Adamawa, Nigeria

2. Modibbo Adama University of Technology, Yola, Nigeria, Yola, Adamawa, Nigeria

3. Educational Institution, Mubi, ADAMAWA, Nigeria

4. Educational Institution, YOLA, ADAMAWA, Nigeria

The study compared fresh fish and smoked fish marketing in Adamawa state. Primary data were collected with the aid of well-structured questionnaires from marketers in 13 major fish markets in seven local government area of Adamawa state. Findings from the study revealed that majority of the fish sellers were female (70%) and (64%) for smoked and fresh fish marketers respectively. Middle-aged class were (87%) and (86%) for fresh and smoked fish marketers respectively (70%) and (76%) were married. The result also indicate that (36%) and (29%) of the people involved in fish marketing had no formal education, (37%) and (43%) respectively had primary six education and below, while only (8%) and (7%) had school certificate requirement and post-secondary school education majority (79%) and (97%) of the fish sellers were engage in full time participation in marketing as their major occupation. The commonest fish in the surveyed markets include catfish, tilapia, snake head and Heterotis. Personal savings, support from friends and relations form the major source of capital invested on the business. The study revealed that with an average gross margin of N28, 209 and 33,099 and return to variable cost of N1.18 and N1.09 for fresh and smoked fish marketing respectively, fresh fish marketing was more profitable than smoked fish marketing. The constraints for fish marketing were highlighted in this work. It is recommended that loans be given to prospective fish marketers, provision of storage facilities, adequate space for selling of fish product to enhance the business among others

Session number: 9.2

Paper number: 313

Of sets of offsets: cumulative impacts and strategies for compensatory restoration

Olivier Thebaud¹ (presenting), Fabio Boschetti², Sarah Jennings³, Anthony D.M. Smith, Sean Pascoe⁴

1. IFREMER, Plouzane, Bretagne, France

2. CSIRO, Perth, WA, Australia

3. University of Tasmania School of Economics and Finance, Hobart, Tasmania, Australia

4. CSIRO, Australia

Biodiversity offsets are increasingly considered as an option to compensate for the ecological costs of development. Despite their increasing popularity as a flexible approach to the reconciliation of economic development with biodiversity conservation, a number of studies have also pointed to the potential limitations of offsets in achieving ecologically sustainable outcomes. In particular, the issue of how to address cumulative impacts is often poorly addressed. We explore the effectiveness of alternative approaches to implementing biodiversity offsets in the coastal and marine domain in the presence of cumulative impacts. We develop a simple model representing the dynamics of a biological resource providing a range of services, and impacted by human-induced modifications of its habitat. The model is used to assess offset management approaches under alternative scenarios relating to (i) the cumulative impact of multiple offset actions, (ii) ecological response to the implementation of offset actions, (iii) time lags involved in ecological recovery, and (iv) societal response to the damages caused by development and how this influences the objectives set for compensatory restoration actions.

Session number: 9.2

Paper number: 380

Licensed to Kill: Can we use Quota Markets to Conserve Seabirds?

Sean Pascoe, CSIRO, Australia

Despite substantial technological developments over the last two decades, incidental catch of charismatic species still occurs in many world fisheries. Short of ceasing fishing activity, some bycatch is inevitable. In some cases, populations of these species are at low levels, and in several instances the species have been listed as endangered or threatened under national conservation legislation. For many of these bycatch species, however, fishing is not the sole anthropogenic threat to their population, and populations potentially can be restored through removing other externalities. However, the lack of any cost to fishers associated with declining bycatch populations and the free rider problem associated with any environmental restoration process result in no incentives for the fishing industry to undertake other population restoration measures.

In this paper, the potential for individual bycatch quotas to provide both an incentive to minimise bycatch as well as a mechanism to finance biodiversity offsets is examined. Different models of implementation, involving different conditions on ownership, are examined, including an option for conservation group ownerships as a means to raise finance for offsetting conservation activities. The incentives facing the different groups under different implementation approaches, and implications for the effectiveness of the scheme,

are assessed using a simple bioeconomic model of the fishery.

Session number: 9.2

Paper number: 330

Economic Value of Wildlife-Tourism to maximize benefits for Conservation of Coastal Fisheries in a Natural Protected Area.

Eduardo Galicia¹ (presenting), Eucario Gasca-Leyva, Edgar Torres-Irineo
1. CINVESTAV Unidad Merida, Merida, Yucatan, Mexico

Wildlife-based tourism in natural protected areas is a growing activity worldwide. Fisheries in coastal zones are usually over exploited because the increase of fish product demand and coastal fishing fleet. Economic alternatives for coastal fishermen are needed. Celestun is a Biosphere Reserve at the northwestern coast of the Yucatan Peninsula, facing the Southern Gulf of Mexico. The coastal fishing town of Celestun is within the Reserve boundaries. An elongated coastal lagoon runs parallel to the coast, inhabited by Caribbean Flamingos. Fishermen lifestyle changed in recent years, since the introduction of a Flamingo watching activity in the coastal lagoon, aimed to reduce coastal fishing pressure and provide alternative income.

We conducted a visitor's survey to identify the economic value for the recreational use of flamingos in Celestun, and a fishermen survey to identify the value they place on flamingo watching activities. We found a high economic value that visitors place on flamingo watching activities, and a positive response about the flamingo watching activity by fishermen. All of the flamingo-watching motorboat drivers are former fishermen. Only 20% of them still perform fishing activities for living, but most have replaced tourism by fishing. We used a General Lineal Model with Gamma distribution to obtain a visitor's demand function for flamingo watching, and estimate the consumer surplus as the economic value for the conservation of the species. We propose this value as a proof of the importance of the activity that can bring benefits for an ICZM strategy within the coastal biosphere reserve.

Session number: 9.2

Paper number: 313

Of sets of offsets: cumulative impacts and strategies for compensatory restoration

Olivier Thebaud¹ (presenting), Fabio Boschetti², Sarah Jennings³, Anthony D.M. Smith, Sean Pascoe⁴

1. IFREMER, Plouzane, Bretagne, France

2. CSIRO, Perth, WA, Australia

3. University of Tasmania School of Economics and Finance, Hobart, Tasmania, Australia

4. CSIRO, Australia

Biodiversity offsets are increasingly considered as an option to compensate for the ecological costs of development. Despite their increasing popularity as a flexible approach to the reconciliation of economic development with biodiversity conservation, a number of studies have also pointed to the potential limitations of offsets in achieving ecologically sustainable outcomes. In particular, the issue of how to address cumulative impacts is often poorly addressed. We explore the effectiveness of alternative approaches to implementing biodiversity offsets in the coastal and marine domain in the presence of cumulative impacts. We develop a simple model representing the dynamics of a biological resource providing a range of services, and impacted by human-induced modifications of its habitat. The model is used to assess offset management approaches under alternative scenarios relating to (i) the cumulative impact of multiple offset actions, (ii) ecological response to the implementation of offset actions, (iii) time lags involved in ecological recovery, and (iv) societal response to the damages caused by development and how this influences the objectives set for compensatory restoration actions.

Session number: 9.2

Paper number: 380

Licensed to Kill: Can we use Quota Markets to Conserve Seabirds?

Sean Pascoe, CSIRO, Australia

Despite substantial technological developments over the last two decades, incidental catch of charismatic species still occurs in many world fisheries. Short of ceasing fishing activity, some bycatch is inevitable. In some cases, populations of these species are at low levels, and in several instances the species have been listed as endangered or threatened under national conservation legislation. For many of these bycatch species, however, fishing is not the sole anthropogenic threat to their population, and populations potentially can be restored through removing other externalities. However, the lack of any cost to fishers associated with declining bycatch populations and the free rider problem associated with any environmental restoration process result in no incentives for the fishing industry to undertake other population restoration measures.

In this paper, the potential for individual bycatch quotas to provide both an incentive to minimise bycatch as well as a mechanism to finance biodiversity offsets is examined. Different models of implementation, involving different conditions on ownership, are examined, including an option for conservation group ownerships as a means to raise finance for offsetting conservation activities. The incentives facing the different groups under different implementation approaches, and implications for the effectiveness of the scheme, are assessed using a simple bioeconomic model of the fishery.

Session number: 9.2

Paper number: 330

Economic Value of Wildlife-Tourism to maximize benefits for Conservation of Coastal Fisheries in a Natural Protected Area.

Eduardo Galicia¹ (presenting), Eucario Gasca-Leyva, Edgar Torres-Irineo

1. CINVESTAV Unidad Merida, Merida, Yucatan, Mexico

Wildlife-based tourism in natural protected areas is a growing activity worldwide. Fisheries in coastal zones are usually over exploited because the increase of fish product demand and coastal fishing fleet. Economic alternatives for coastal fishermen are needed. Celestun is a Biosphere Reserve at the northwestern coast of the Yucatan Peninsula, facing the Southern Gulf of Mexico. The coastal fishing town of Celestun is within the Reserve boundaries. An elongated coastal lagoon runs parallel to the coast, inhabited by Caribbean Flamingos. Fishermen lifestyle changed in recent years, since the introduction of a Flamingo watching activity in the coastal lagoon, aimed to reduce coastal fishing pressure and provide alternative income.

We conducted a visitor's survey to identify the economic value for the recreational use of flamingos in Celestun, and a fishermen survey to identify the value they place on flamingo watching activities. We found a high economic value that visitors place on flamingo watching activities, and a positive response about the flamingo watching activity by fishermen. All of the flamingo-watching motorboat drivers are former fishermen. Only 20% of them still perform fishing activities for living, but most have replaced tourism by fishing. We used a General Lineal Model with Gamma distribution to obtain a visitor's demand function for flamingo watching, and estimate the consumer surplus as the economic value for the conservation of the species. We propose this value as a proof of the importance of the activity that can bring benefits for an ICZM strategy within the coastal biosphere reserve.

Session number: 9.3

Paper number: 25

Technical Efficiency of Artisanal Fisheries in the Southern Sector of Ghana

Justin Otoo¹ (presenting), Edward Ebo Onumah², Yaw Osei-Asare³

1. University of Ghana, Legon-Accra, Greater Accra, Ghana

2. University of Ghana, Accra, Greater Accra, Ghana

3. University of Ghana Legon, Legon, Greater Accra, Ghana

Ghana's coast is identified with artisanal fishers who use wooden carved canoes and traditional fishing gears. However, little study has been conducted to assess the performance of this industry in terms of its efficiency. This study aims to analyse the technical efficiency and its determinants of the artisanal fishers in the southern sector of Ghana using the stochastic frontier analysis. The study also identifies and ranks constraints facing the industry using Kendall's coefficient of concordance. Adopting a multistage sampling technique, the study obtains a cross sectional data on 280 fishers from the Greater Accra and Central regions of Ghana. The results demonstrate that crew size, fuel cost, hours at sea and canoe size positively influence output with a return to scale of 1.9. The mean technical efficiency score is estimated to be 0.51 which indicates that averagly the industry obtains 51% of the frontier output. The results also show that the combined effect of operational and industry-specific factors influence technical efficiency although individual effects of some variables are not significant. It is also identified that high cost of inputs was the most important constraints faced by the artisanal fisheries followed by bad weather and activities of trawlers.

Availability of canoes is found to be the least constraint facing the industry. The study concludes that the possibility of improving production given the present state of technology and input level can be achieved in the short run by increasing technical efficiency by 49%.

Key words: Stochastic frontier analysis, return to scale, Kendall's coefficient of concordance and wooden carved canoes.

Session number: 9.3

Paper number: 74

Production constraints and the impact of globalization on inland fishing products in Mexico

Carmen Pedroza¹ (presenting), Jorge López²

1. UNAM, Jiquilpan, Michoacan, Mexico

2. UNAM, Sisal, Yucatan , Mexico

Inland fisheries in Mexico represent a source of protein, income and employment, for rural communities. Although the most consumed fish in the country are fresh water fishes in the national statistics they only account for 3% of the total fish catch volume (marine fisheries account for 97%). Demand is higher than supply and the national market can only provide 50% of this consumption.

These fisheries are currently passing thorough a complex situation that prevents increasing production levels and fishers' income. Considering a value chain analysis approach, this paper aims to examine main production constraints to increase production to satisfy national demand.

Fieldwork was carried out in two periods of a three month lapse during 2011 and 2012 on four lakeside communities around two different lakes: Lake Chapala, the largest in the country and Lake Yuriria, one of the first reservoirs created in modern Mexico. Catch volume statistics were obtained from local fishing offices, fishers' cooperatives and middlemen. The methodological approach considers socioeconomic factors and catch volume temporal variability in both lakes.

Results show that production constraints, besides being environmentally related, also have roots in organizational problems among fishers, IUU fishing, structural factors related to national policies and the import market. Thus, while national production is trying to mature and improve within a problematic framework, imports are imposing prices that affect national producers' competitiveness.

Session number: 9.3

Paper number: 123

Efficiency analysis of offshore fishing fleet in the South-eastern Sea (Vietnam) using DEA

Thanh Viet Nguyen, VNU University of Economics and Business, Hanoi, Hanoi, Viet Nam

This study uses input-orientated Data Envelopment Analysis (DEA) to evaluate the performance of fishing fleets in the South-eastern Sea (Vietnam). Selected fishing gears include longlines, trawl, gill nets, purse seines and other groups. Each fishing gear group is divided into four fishing fleets based on power: fleet with power higher than 250 HP, 150-249 HP, 90-149 HP and 50-89 HP. Selected data include number of days at sea, number of crew, variable costs, catch and revenue from fishing trips. A total of 8,619 survey samples were collected monthly from May 2012 to April 2013. Activity of the fleet in a month is considered a decision-making unit (DMU) in the DEA analysis. The results show that the fleet with power 50-89 HP is the most efficient fleet and the fleet with power higher than 250 Horse Power (HP) is inefficient compared to other fleets for all fishing gear groups. This result suggests that investment in fishing vessels with high capacity (greater than 90 HP) does not bring higher economic efficiency than the fleet with low capacity (50-89 HP) .

Session number: 9.3

Paper number: 295

Estimating Technical Efficiency for Abalone Fisheries in Victoria, Australia

Paul Mwebaze, CSIRO, Brisbane, QLD, Australia

There has been little empirical analysis of industry technical efficiency for commercial fisheries in Victoria. This study examines technical efficiency in the Victorian Abalone fisheries using a stochastic production frontier model for the period from 1978/79 to 2009/2010. Estimates of technical efficiency are calculated and compared across fishing zones. Of the estimated model parameters, the coefficient of diver hours, number of fishers and a time trend to measure technical change have the expected signs and are statistically significant. A dummy variable for the different fishing zones provides a good explanation for the inefficiency component. The average technical efficiency for Abalone Fisheries are estimated to be 0.82. The analysis indicates that fishers operating in the Eastern and Central Abalone zones enjoy a significantly higher level of technical efficiency than those in the

Western Abalone zone. We discuss these results and their management implications.

Session number: 9.3

Paper number: 25

Technical Efficiency of Artisanal Fisheries in the Southern Sector of Ghana

Justin Otoo¹ (presenting), Edward Ebo Onumah², Yaw Osei-Asare³

1. University of Ghana, Legon-Accra, Greater Accra, Ghana

2. University of Ghana, Accra, Greater Accra, Ghana

3. University of Ghana Legon, Legon, Greater Accra, Ghana

Ghana's coast is identified with artisanal fishers who use wooden carved canoes and traditional fishing gears. However, little study has been conducted to assess the performance of this industry in terms of its efficiency. This study aims to analyse the technical efficiency and its determinants of the artisanal fishers in the southern sector of Ghana using the stochastic frontier analysis. The study also identifies and ranks constraints facing the industry using Kendall's coefficient of concordance. Adopting a multistage sampling technique, the study obtains a cross sectional data on 280 fishers from the Greater Accra and Central regions of Ghana. The results demonstrate that crew size, fuel cost, hours at sea and canoe size positively influence output with a return to scale of 1.9. The mean technical efficiency score is estimated to be 0.51 which indicates that averagly the industry obtains 51% of the frontier output. The results also show that the combined effect of operational and industry-specific factors influence technical efficiency although individual effects of some variables are not significant. It is also identified that high cost of inputs was the most important constraints faced by the artisanal fisheries followed by bad weather and activities of trawlers. Availability of canoes is found to be the least constraint facing the industry. The study concludes that the possibility of improving production given the present state of technology and input level can be achieved in the short run by increasing technical efficiency by 49%.

Key words: Stochastic frontier analysis, return to scale, Kendall's coefficient of concordance and wooden carved canoes.

Session number: 9.3

Paper number: 74

Production constraints and the impact of globalization on inland fishing products in Mexico

Carmen Pedroza¹ (presenting), Jorge López²

1. UNAM, Jiquilpan, Michoacan, Mexico

2. UNAM, Sisal, Yucatan , Mexico

Inland fisheries in Mexico represent a source of protein, income and employment, for rural communities. Although the most consumed fish in the country are fresh water fishes in the national statistics they only account for 3% of the total fish catch volume (marine fisheries account for 97%). Demand is higher than supply and the national market can only provide 50% of this consumption.

These fisheries are currently passing thorough a complex situation that prevents increasing production levels and fishers' income. Considering a value chain analysis approach, this paper aims to examine main production constraints to increase production to satisfy national demand.

Fieldwork was carried out in two periods of a three month lapse during 2011 and 2012 on four lakeside communities around two different lakes: Lake Chapala, the largest in the country and Lake Yuriria, one of the first reservoirs created in modern Mexico. Catch volume statistics were obtained from local fishing offices, fishers' cooperatives and middlemen. The methodological approach considers socioeconomic factors and catch volume temporal variability in both lakes.

Results show that production constraints, besides being environmentally related, also have roots in organizational problems among fishers, IUU fishing, structural factors related to national policies and the import market. Thus, while national production is trying to mature and improve within a problematic framework, imports are imposing prices that affect national producers' competitiveness.

Session number: 9.3

Paper number: 123

Efficiency analysis of offshore fishing fleet in the South-eastern Sea (Vietnam) using DEA

Thanh Viet Nguyen, VNU University of Economics and Business, Hanoi, Hanoi, Viet Nam

This study uses input-orientated Data Envelopment Analysis (DEA) to evaluate the performance of fishing fleets in the South-eastern Sea (Vietnam). Selected fishing gears include longlines, trawl, gill nets, purse seines and other groups. Each fishing gear group is divided into four fishing fleets based on power: fleet with power higher than 250 HP, 150-249 HP, 90-149 HP and 50-89 HP. Selected data include number of days at sea, number of crew, variable costs, catch and revenue from fishing trips. A total of 8,619 survey samples were collected monthly from May 2012 to April 2013. Activity of the fleet in a month is considered a decision-making unit (DMU) in the DEA analysis. The results show that the fleet with power 50-89 HP is the most efficient fleet and the fleet with power higher than 250 Horse Power (HP) is inefficient compared to other fleets for all fishing gear groups. This result suggests that investment in fishing vessels with high capacity (greater than 90 HP) does not bring higher economic efficiency than the fleet with low capacity (50-89 HP) .

Session number: 9.3

Paper number: 295

Estimating Technical Efficiency for Abalone Fisheries in Victoria, Australia

Paul Mwebaze, CSIRO, Brisbane, QLD, Australia

There has been little empirical analysis of industry technical efficiency for commercial fisheries in Victoria. This study examines technical efficiency in the Victorian Abalone fisheries using a stochastic production frontier model for the period from 1978/79 to 2009/2010. Estimates of technical efficiency are calculated and compared across fishing zones. Of the estimated model parameters, the coefficient of diver hours, number of fishers and a time trend to measure technical change have the expected signs and are statistically significant. A dummy variable for the different fishing zones provides a good explanation for the inefficiency component. The average technical efficiency for Abalone Fisheries are estimated to be 0.82. The analysis indicates that fishers operating in the Eastern and Central Abalone zones enjoy a significantly higher level of technical efficiency than those in the Western Abalone zone. We discuss these results and their management implications.

Session number: 9.4

Paper number: 249

Moving Towards Market Based Approaches for Tuna Management in the Western and Central Pacific- The Case of the PNA.

Agnes Yeeting¹ (presenting), Simon Bush², Megan Bailey², Vina Ram Bidesi, Hans-Peter Weikards

1. University of the South Pacific, Suva, Fiji, Fiji
2. Wageningen University, Wageningen, Gelderland, Netherlands

Tuna management in the Western and Central Pacific (WCP) is complicated given the dynamic and sometimes conflicting interests of participating countries and actors over the tuna resource in the region. Pacific Island Countries (PICs) through the Fisheries Forum Agency (FFA) and the Parties to the Nauru Agreement (PNA) have developed a number of institutional and regulatory arrangements to control tuna fishing effort within the Exclusive Economic Zones (EEZs) but with minimal success. In more recent times market and incentive based approaches are being adopted to support and complement existing conservation and management measures (CMMs). Market and incentive based approaches provide fishers with the motivation and incentive to practice sustainable fishing by creating economic advantages for states and actors involved. The paper aims to analyse the shift from regulatory management framework to New Institutional Economics (NIEs) within the context of PNA by addressing the question of whether moving towards market and incentive based mechanisms have improved cooperation within PNA. The paper provides i) an overview of tuna regional treaties, regimes and agreements in the pacific region ii) understand how dynamic interests of participating parties structure states' position and decision making in tuna management at regional and international level; and iii) highlight the shift in regional treaties and regimes towards market based approaches. The paper concludes that market based mechanisms has brought in changes and much improvements to tuna negotiations and agreements among parties and actors compared to past experiences.

Session number: 9.4

Paper number: 347

How Do Fishing Access Agreements Affect Harvesting Decisions of Small Island Nations?: The Case of the Western and Central Pacific Tuna Fishery

Satoshi Yamazaki¹ (presenting), Rachel Nichols¹, Sarah Jennings², Reg Watson¹

1. University of Tasmania, Hobart, Tasmania, Australia
2. University of Tasmania School of Economics and Finance, Hobart, Tasmania, Australia

The tuna fishery in the Western and Central Pacific Ocean (WCPO) is the largest and most valuable tuna fishery globally. The small developing island nations of the Pacific region are heavily reliant on the tuna resource for social and economic development. These nations however, often lack the capacity to capture the full benefits of the resource themselves, and so allow distant water fishing (DWF) nations to access their territorial waters in exchange for access payments. In this paper, we use a bio-economic model and empirical analysis to examine the effect such access agreements and their associated payments have on the fishing behaviour of the Pacific island nations. We develop a bioeconomic model which assumes profit-maximising decisions of both island and DWF nations and incorporates the establishment of exclusive economic zones (EEZ) and bi-lateral access agreements. Our model suggests that the effects of access payments on the fish biomass and island nations'

fishing effort depends on the level of access payments and on whether the island nation had exclusive fishing rights prior to the access agreement being struck. We further examine empirically the effects of the current institutional arrangements, namely the EEZs and access agreements, on the Pacific island harvest of tuna. To this end, we compile a panel data set that consists of time series of tuna catch in territorial waters by Pacific island and DWF nations for four major species in the WCPO and other governance and socio-economic variables spanning the period 1970 to 2010. .

Session number: 9.4

Paper number: 444

**Fishery Performance Indicators for Regional Fishery Management Organizations:
Global Tuna Fisheries**

Chris Anderson (presenting), Jessica McCluney, James Anderson¹

1. The World Bank, Washington, DC, United States

The Fisheries Performance Indicators (FPIs) are a rapid assessment instrument for benchmarking and tracking wealth generation from fisheries resources. Applied once to a single fishery, the FPIs provide a snapshot of where fishery-based wealth is accumulating (e.g., with capital owners, with crew or with processors) and of levels of factors thought to affect wealth accumulation. We present results for an extensive sample of tuna fisheries around the world, characterizing outcomes under major regional management initiatives for distant-water, industrial, semi-industrial and artisanal fleets in different regions of the world. We compare those outcomes to those from a global database of non-tuna fisheries.

Session number: 9.4

Paper number: 449

Comparative Study on the Fishery Labor Supply in East Asian Countries/Region

Haruko Yamashita, Daito Bunka University, Higashi Matsuyama, Saitama, Japan

In this paper, we discuss the solution for the shortage of labor supply in the fishing industry by comparing three countries/region in the East Asia; Japan, Taiwan and Korea. Fishery is a so-called 3D (Dirty, Dangerous and Difficult) industry as it requires hard work on the ocean often through the night. Some of the fishing sectors cannot afford higher payment enough to compensate 3D works, and it result in the shortage of young workers. In the case of Japan, aged coastal fishers who take 3D work for granted continue working by themselves or even accompany their wives as a helper while receiving pensions. Introduction of foreign workers are limited in terms of the number and province. On the contrary in Taiwan where foreign workers are utilized everywhere, offshore/coastal fishery sectors are not exceptions. Fishers manage to utilize foreign workers with diverse origins. So far, monetary incentives for young Taiwanese entrants to fishery sector do not function in spite of the amount of subsidy equivalent to the annual salary. In Korea, offshore purse-seine fishery obtains temporary young workers since this fishery is officially accepted as a substitute of compulsory military service. In other fishing in Korea, foreign workers are introduced. Thus, these countries/region fulfill the needs of 3D labor at the affordable wage level. We investigate the reason why such differences in the way of fulfillment arise by questioning the migration policies as well as the motivation of existing and potential fishers.

Session number: 9.4

Paper number: 249

Moving Towards Market Based Approaches for Tuna Management in the Western and Central Pacific- The Case of the PNA.

Agnes Yeeting¹ (presenting), Simon Bush², Megan Bailey², Vina Ram Bidesi, Hans-Peter Weikards

1. University of the South Pacific, Suva, Fiji, Fiji

2. Wageningen University, Wageningen, Gelderland, Netherlands

Tuna management in the Western and Central Pacific (WCP) is complicated given the dynamic and sometimes conflicting interests of participating countries and actors over the tuna resource in the region. Pacific Island Countries (PICs) through the Fisheries Forum Agency (FFA) and the Parties to the Nauru Agreement (PNA) have developed a number of institutional and regulatory arrangements to control tuna fishing effort within the Exclusive Economic Zones (EEZs) but with minimal success. In more recent times market and incentive based approaches are being adopted to support and complement existing conservation and management measures (CMMs). Market and incentive based approaches provide fishers with the motivation and incentive to practice sustainable fishing by creating economic advantages for states and actors involved. The paper aims to analyse the shift from regulatory management framework to New Institutional Economics (NIEs) within the context of PNA by addressing the question of whether moving towards market and incentive based mechanisms have improved cooperation within PNA. The paper provides i) an overview of tuna regional treaties, regimes and agreements in the pacific region ii) understand how dynamic interests of participating parties structure states' position and decision making in tuna management at regional and international level; and iii) highlight the shift in regional treaties and regimes towards market based approaches. The paper concludes that market based mechanisms has brought in changes and much improvements to tuna negotiations and agreements among parties and actors compared to past experiences.

Session number: 9.4

Paper number: 347

How Do Fishing Access Agreements Affect Harvesting Decisions of Small Island Nations?: The Case of the Western and Central Pacific Tuna Fishery

Satoshi Yamazaki¹ (presenting), Rachel Nichols¹, Sarah Jennings², Reg Watson¹

1. University of Tasmania, Hobart, Tasmania, Australia

2. University of Tasmania School of Economics and Finance, Hobart, Tasmania, Australia

The tuna fishery in the Western and Central Pacific Ocean (WCPO) is the largest and most valuable tuna fishery globally. The small developing island nations of the Pacific region are heavily reliant on the tuna resource for social and economic development. These nations however, often lack the capacity to capture the full benefits of the resource themselves, and so allow distant water fishing (DWF) nations to access their territorial waters in exchange for access payments. In this paper, we use a bio-economic model and empirical analysis to examine the effect such access agreements and their associated payments have on the fishing behaviour of the Pacific island nations. We develop a bioeconomic model which assumes profit-maximising decisions of both island and DWF nations and incorporates the establishment of exclusive economic zones (EEZ) and bi-lateral access agreements. Our model suggests that the effects of access payments on the fish biomass and island nations' fishing effort depends on the level of access payments and on whether the island nation had exclusive fishing rights prior to the access agreement being struck. We further examine empirically the effects of the current institutional arrangements, namely the EEZs and access agreements, on the Pacific island harvest of tuna. To this end, we compile a panel data set that consists of time series of tuna catch in territorial waters by Pacific island and DWF nations for four major species in the WCPO and other governance and socio-economic variables spanning the period 1970 to 2010. .

Session number: 9.4

Paper number: 444

**Fishery Performance Indicators for Regional Fishery Management Organizations:
Global Tuna Fisheries**

Chris Anderson (presenting), Jessica McCluney, James Anderson¹

1. The World Bank, Washington, DC, United States

The Fisheries Performance Indicators (FPIs) are a rapid assessment instrument for benchmarking and tracking wealth generation from fisheries resources. Applied once to a single fishery, the FPIs provide a snapshot of where fishery-based wealth is accumulating (e.g., with capital owners, with crew or with processors) and of levels of factors thought to affect wealth accumulation. We present results for an extensive sample of tuna fisheries around the world, characterizing outcomes under major regional management initiatives for distant-water, industrial, semi-industrial and artisanal fleets in different regions of the world. We compare those outcomes to those from a global database of non-tuna fisheries.

Session number: 9.4

Paper number: 449

Comparative Study on the Fishery Labor Supply in East Asian Countries/Region

Haruko Yamashita, Daito Bunka University, Higashi Matsuyama, Saitama, Japan

In this paper, we discuss the solution for the shortage of labor supply in the fishing industry by comparing three countries/region in the East Asia; Japan, Taiwan and Korea. Fishery is a so-called 3D (Dirty, Dangerous and Difficult) industry as it requires hard work on the ocean often through the night. Some of the fishing sectors cannot afford higher payment enough to compensate 3D works, and it result in the shortage of young workers. In the case of Japan, aged coastal fishers who take 3D work for granted continue working by themselves or even accompany their wives as a helper while receiving pensions. Introduction of foreign workers are limited in terms of the number and province. On the contrary in Taiwan where foreign workers are utilized everywhere, offshore/coastal fishery sectors are not exceptions. Fishers manage to utilize foreign workers with diverse origins. So far, monetary incentives for young Taiwanese entrants to fishery sector do not function in spite of the amount of subsidy equivalent to the annual salary. In Korea, offshore purse-seine fishery obtains temporary young workers since this fishery is officially accepted as a substitute of compulsory military service. In other fishing in Korea, foreign workers are introduced. Thus, these countries/region fulfill the needs of 3D labor at the affordable wage level. We investigate the reason why such differences in the way of fulfillment arise by questioning the migration policies as well as the motivation of existing and potential fishers.

Session number: 9.5

Paper number: 174

Seaweed value chain: a case study in Pantar Island, Eastern Indonesia

Ria Fitriana¹ (presenting), Natasha Stacey²

1. Charles Darwin University, Jakarta, DKI Jakarta, Indonesia

2. Charles , Darwin, NT, Australia

Indonesia is the biggest seaweed producer in the world. Seaweed (*Eucheuma spp*) has become a popular alternative livelihood activity in Indonesia as a way to diversify livelihood activities and thereby improve household livelihood outcomes with added incomes. It is relative easy form of aquaculture to implement at the producer level. However, there are problems in maintaining and increasing local seaweed production and upgrading the value of seaweed. In this paper we report on the results of research using a value chain analysis (VCA) of seaweed production in Pantar Island in order to identify constraints in the development of seaweed industry in the region and identify ways to improve the participation of coastal communities in the value chain. The data was collected through focus group discussions with local producers in four villages in Pantar and key informant interviews with traders, industry players and policy makers in Indonesia. A discussion of key issues, relative benefits obtained by producers and other actors from the value chain and ways to enhance the livelihoods of coastal communities is provided. The results reveal how the trade in seaweed is embedded in complex social, economic and cultural contexts which determine the form of business transactions from one actor to others along the chain.

Session number: 9.5

Paper number: 285

Scenarios for feasible algaculture using a techno-economic model.

Amar Doshi¹ (presenting), Sean Pascoe², Thomas Rainey³, Louisa Coglan⁴

1. Queensland University of Technology, Brisbane, Queensland, Australia

2. CSIRO, Australia

3. QUT Science and Engineering Faculty, Brisbane, Queensland, Australia

4. QUT, Australia

The aquaculture of microalgae (i.e. algaculture) has become increasingly discussed for its potential as a feedstock for biofuels in addition to uses for stockfeed and human nutrition. This preliminary micro-economic study aims to extend the use of a conventional techno-economic model for microalgae cultivation and downstream processing by testing potential feasible scenarios in relation to production inputs and multiple output allocations. Although there have been similar models with regards to microalgae production for biodiesel in the engineering discipline, this analysis attempts to account for multiple and alternative (to biodiesel) output uses for the resulting biomass, and the corresponding downstream processes. Optimal output allocations for these scenarios are also estimated in relation to sensitivities in nutrient saturation of the culture and potential cost-savings from recycling of residual by-products to capture potential externalities of algaculture. The findings from this analysis adds to the current feasibility and production economics literature of microalgae-related aquaculture, and forms the basis for future study on the macro-economic implications of policy support for microalgae cultivation for biodiesel.

Session number: 9.5

Paper number: 103

Economics of Community-Based Stock Enhancement of Abalones in Sagay Marine Reserve, Negros Occidental, Philippines

Nerissa Salayo¹ (presenting), Teruo Azuma²

1. Southeast Asian Fisheries Development Center/ Aquaculture Department (SEAFDEC/AQD), Quezon City, Metro Manila, Philippines

2. Southeast Asian Fisheries Development Center/ Aquaculture Department (SEAFDEC/AQD), Tigbauan, Iloilo, Philippines

Abalone, *Haliotis asinina*, is a high value shellfish for export trade that provide cash income to fishing households in some coastal communities in the Philippines. Stock enhancement is one of the fisheries management strategies that enable recovery of overfished stocks through release of juveniles and consequent stock increase through recruitment. This option is frequently associated with high investments, often using government funds, and involves critical participation of fishers and other fishery stakeholders. With the primary goal of developing a community-based stock enhancement protocol that will contribute to rehabilitation of abalone stocks and supplement fishing incomes, hatchery-bred abalone juveniles were released in a stock enhancement demonstration site in coral patches around Barangay Molocaboc, an island within the Sagay Marine Reserve in the Visayan Sea in central Philippines. This paper aims to estimate the costs and benefits of producing abalones for commercial trade through community-based stock enhancement. Results of a seven-year community-based stock enhancement activity showed that the strategy is feasible under tri-party stakeholder collaboration involving: (1) an organized group of fishers and traders that executes the project activities, (2) the relevant local government for oversight and regulatory functions, and (3) a technical donor organization that provides science-based project advice. Community-based stock enhancement proved economically viable considering lower cost and ease of abalone grow-out in near-shore reef areas. It also offered equitable economic opportunities that benefit women, older men and children that may glean abalones in coral patches in intertidal zones instead of diving for abalones in remote reef areas.

Session number: 9.5

Paper number: 174

Seaweed value chain: a case study in Pantar Island, Eastern Indonesia

Ria Fitriana¹ (presenting), Natasha Stacey²

1. Charles Darwin University, Jakarta, DKI Jakarta, Indonesia

2. Charles , Darwin, NT, Australia

Indonesia is the biggest seaweed producer in the world. Seaweed (*Eucheuma spp*) has become a popular alternative livelihood activity in Indonesia as a way to diversify livelihood activities and thereby improve household livelihood outcomes with added incomes. It is relative easy form of aquaculture to implement at the producer level. However, there are problems in maintaining and increasing local seaweed production and upgrading the value of seaweed. In this paper we report on the results of research using a value chain analysis (VCA) of seaweed production in Pantar Island in order to identify constraints in the development of seaweed industry in the region and identify ways to improve the participation of coastal communities in the value chain. The data was collected through focus group discussions with local producers in four villages in Pantar and key informant interviews with traders, industry players and policy makers in Indonesia. A discussion of key issues, relative benefits obtained by producers and other actors from the value chain and ways to enhance the livelihoods of coastal communities is provided. The results reveal how the trade in seaweed is embedded in complex social, economic and cultural contexts which determine the form of business transactions from one actor to others along the chain.

Session number: 9.5

Paper number: 285

Scenarios for feasible algaculture using a techno-economic model.

Amar Doshi¹ (presenting), Sean Pascoe², Thomas Rainey³, Louisa Coglan⁴

1. Queensland University of Technology, Brisbane, Queensland, Australia

2. CSIRO, Australia

3. QUT Science and Engineering Faculty, Brisbane, Queensland, Australia

4. QUT, Australia

The aquaculture of microalgae (i.e. algaculture) has become increasingly discussed for its potential as a feedstock for biofuels in addition to uses for stockfeed and human nutrition. This preliminary micro-economic study aims to extend the use of a conventional techno-economic model for microalgae cultivation and downstream processing by testing potential feasible scenarios in relation to production inputs and multiple output allocations. Although there have been similar models with regards to microalgae production for biodiesel in the engineering discipline, this analysis attempts to account for multiple and alternative (to biodiesel) output uses for the resulting biomass, and the corresponding downstream processes. Optimal output allocations for these scenarios are also estimated in relation to sensitivities in nutrient saturation of the culture and potential cost-savings from recycling of residual by-products to capture potential externalities of algaculture. The findings from this analysis adds to the current feasibility and production economics literature of microalgae-related aquaculture, and forms the basis for future study on the macro-economic implications of policy support for microalgae cultivation for biodiesel.

Session number: 9.5

Paper number: 103

Economics of Community-Based Stock Enhancement of Abalones in Sagay Marine Reserve, Negros Occidental, Philippines

Nerissa Salayo¹ (presenting), Teruo Azuma²

1. Southeast Asian Fisheries Development Center/ Aquaculture Department (SEAFDEC/AQD), Quezon City, Metro Manila, Philippines

2. Southeast Asian Fisheries Development Center/ Aquaculture Department (SEAFDEC/AQD), Tigbauan, Iloilo, Philippines

Abalone, *Haliotis asinina*, is a high value shellfish for export trade that provide cash income to fishing households in some coastal communities in the Philippines. Stock enhancement is one of the fisheries management strategies that enable recovery of overfished stocks through release of juveniles and consequent stock increase through recruitment. This option is frequently associated with high investments, often using government funds, and involves critical participation of fishers and other fishery stakeholders. With the primary goal of developing a community-based stock enhancement protocol that will contribute to rehabilitation of abalone stocks and supplement fishing incomes, hatchery-bred abalone juveniles were released in a stock enhancement demonstration site in coral patches around Barangay Molocaboc, an island within the Sagay Marine Reserve in the Visayan Sea in central Philippines. This paper aims to estimate the costs and benefits of producing abalones for commercial trade through community-based stock enhancement. Results of a seven-year community-based stock enhancement activity showed that the strategy is feasible under tri-party stakeholder collaboration involving: (1) an organized group of fishers and traders that executes the project activities, (2) the relevant local government for oversight and regulatory functions, and (3) a technical donor organization that provides science-based project advice. Community-based stock enhancement proved economically viable considering lower cost and ease of abalone grow-out in near-shore reef areas. It also offered equitable economic opportunities that benefit women, older men and children that may glean abalones in coral patches in intertidal zones instead of diving for abalones in remote reef areas.

Special Session A.1: Making Integrated Ecological-Economic Models Useful

J. Rasmus Nielsen¹, Jörn Schmidt², Eric Thunberg³, **Dan Holland**

1. Technical University of Denmark, Charlottenlund, Sjaelland, Denmark

2. Christian-Albrechts-Universität zu Kiel, Department of Economics, Sustainable Fisheries, Kiel, Schleswig-Holstein, Germany

3. NOAA Fisheries, Woods Hole, MA, United States

Session Description

There is increasing interest in integrating ecological and economic analysis and advice for managing fisheries and other marine resources. A wide range of models have been developed, some designed to inform tactical decisions like setting effort levels or TACs in the near term. Others are focused on longer term management strategy evaluations for a specific fishery or broader questions of how to manage a range of interrelated activities in a marine ecosystem.

But what makes a model informative and useful to the policy makers and stakeholders that make the decisions that determine outcomes? How can we best communicate model structure and meaning of model outputs to decision makers?

This special session will combine presentations and a panel discussion to address the question: what makes an integrated ecological-economic model useful.

As we discuss in this session, a number of factors may be important including model complexity, flexibility, breadth, user friendliness, and not least the interaction between the modeler and model users in model development and use. The objective of this session is to explore how to better communicate advice generated by integrated ecological-economic models and how various characteristics of models impact their usefulness for informing different types of decisions.

A moderated panel discussion will follow the individual presentations in the special session. Panelists will include the individual presenters from the session and three other individuals that can provide insights on how Ecological Economic models have been used to inform actual fishery management decisions and what made them more or less useful for that purpose. Panelists will each give a short opening statement on what types of models they have found to be of practical use and why. The audience and other panelists will be invited to pose questions or make comments on this topic. The objective of the discussion and the overall session is to inform both modelers and fishery/ecosystem managers how integrated ecological-economic models can be designed to have greater practical utility for informing management decisions.

Attendees will be encouraged to share their experiences through panel and open discussion.

Individual paper abstracts

Paper number: 494

Evaluation of Integrated Ecological-Economic Models - What are they used for?

J. Rasmus Nielsen¹, Jörn Schmidt², Dan Holland, Eric Thunberg³, Rosa Mato Amboage⁴, Francois Bastardie⁵, Eckhard Bethke⁶, José M. Da-Rocha⁷, Ralf Doering⁸, Dorleta Garcia⁹, Ayoe Hoff¹⁰, Claire Macher, Stéphanie Mahévas¹¹, Artur Palacz¹², Raul Pallezo¹³, Sarah Simons¹⁴, Clara Ulrich¹⁵, Staffan Waldo

1. Technical University of Denmark, Charlottenlund, Sjaelland, Denmark
2. Christian-Albrechts-Universität zu Kiel, Department of Economics, Sustainable Fisheries, Kiel, Schleswig-Holstein, Germany
3. NOAA Fisheries, Woods Hole, MA, United States
4. Spain
5. DTU-Aqua, Charlottenlund, Denmark, Denmark
6. Thünen Institute of Sea Fisheries, Hamburg, Hamburg, Germany
7. University of Vigo, Vigo, Vigo, Spain
8. TI-Institute of Sea Fisheries, Hamburg, Hamburg, Germany
9. AZTI, Bilbao, Bilbao, Spain
10. Department of Food and Resource Economics, University of Copenhagen, Frederiksberg, Frederiksberg, Denmark
11. Ifremer, Nantes, FRANCE, France
12. Technical University of Denmark, Charlottenlund, Denmark
13. AZTI, Bilbao, Spain
14. TI, Hamburg, Germany
15. DTU Aqua, Charlottenlund, n/a, Denmark SLU, Göteborg, Sweden

This study compares globally available integrated ecological-economic models with focus on use and implementation in scientific and advisory contexts. The Ecosystem based Approach to (Fisheries) Management (EAM) calls for an understanding and management of fisheries and other uses of the marine environment that explicitly take into account ecological, economic and social considerations. Though it is acknowledged that only human activities can be managed, their optimal management will depend on the ecosystem in which they take place and the ecosystem goods and services. Hence, the direct and indirect impact of fisheries on the marine ecosystem and vice versa must be assessed and predicted. This entails a move from single species to multispecies and to ecosystem assessments. Also, successful marine management needs involve economic and social sustainability of the activities. Therefore, explicit incorporation of economic and social components of fisheries and marine management needs be included in management evaluation. Accordingly, tools need to be developed and implemented, which take the ecological-economic-social-governance interactions into account. The aim of this study is to compare relevant models from around the world, to discuss their development and level of implementation, and to develop a sound basis for evaluating and comparing these tools, including their robustness. It will analyse the needed characteristics for the use in advisory context through a comparative and descriptive matrix and summary table. Based on this analysis we make re-recommendations for future research, development and advisory structures that can increase the level of use and implementation of the models.

Paper number: 483

Application of Integrated Ecological-Economic Models – Experiences from the STECF with Assessments of Long Term Management Plans

Ralf Doering, TI-Institute of Sea Fisheries, Hamburg, Hamburg, Germany

In 2002 within the previous basic regulation of the European Union Common Fisheries Policy (CFP) a new instrument, long term management plans, was introduced. The aim was to give the fishing sector a longer term perspective by setting clearer objectives (like achievement of MSY by 2015) and apply instruments which would reduce the fluctuation of fishing opportunities between years. Part of the management plans is also a requirement for regular evaluations of the consequences of the plan. The Scientific, Technical and Economic Committee for Fisheries (STECF), the main advisory body for fisheries management in the EU, was requested to do these evaluations. Another overall requirement for the European Commission is to apply impact assessments for any new or revised regulation. For the evaluation of running long term management plans and the assessment of new or revised plans STECF applied several ecological-economic models. In the paper I will give an overview on the applied models and then describe some of the experiences (positive and negative) with the application of the models.

Paper number: 490

To Integrate or Inform: Experience Using Fisheries Ecological - Economic Models in Chesapeake Bay

Douglas Lipton, NOAA Fisheries, Silver Spring, MD, United States

Ideally, we seek to develop perfectly integrated ecological-economic models, drawing on the best data, modeling and knowledge of each of the disciplines, into one coherent model to inform policy. The realities of achieving such are thwarted by data and model compatibility issues. For example, ecological data may be available on different spatial and temporal scales than the economic data, forcing one to aggregate data and perhaps lose information. As an alternative to the full integrated approach is one where one discipline incorporates data and some of the model structure from the other in a way that produces outputs that are meaningful to management. This is the process that has evolved in Chesapeake Bay ecosystem and fisheries management.

The Chesapeake Bay is the largest estuary in North America, and it is heavily influenced by land use resulting in nutrient (nitrogen and phosphorus) and sediment pollution. The general belief is that this pollution has resulted in a reduction in fish production. Early economic models that attempted to measure this reduction were not well-informed about estuarine ecological processes. While sophisticated economically, these models often simply added nitrogen as an explanatory variable. This had two effects: 1) the models performed poorly because they didn't capture the appropriate link between nitrogen and fish production through its effect on dissolved oxygen; and 2) were not well-accepted by ecologists because of their ecological naivety. Once economic models incorporate the estuarine ecology in an informed way, they became more widely accepted and used by managers to drive policy.

Paper number: 481

Building Ecological-Economic Models and Scenarios of Marine Resource Systems

Olivier Thebaud¹, Luc Doyen², James Innes³, Michel Lample, Claire Macher⁴, Stéphanie Mahévas⁵, Christian Mullon⁶, Benjamin Planque⁷, Martin F. Quaas⁸, Anthony D.M. Smith, Youen Vermard⁹

1. IFREMER, PLOUZANE, Bretagne, France
2. CNRS-Gretha, France
3. CSIRO Marine and Atmospheric Research, Saint Lucia, Queensland, Australia
4. Ifremer, UMR AMURE,, Plouzané Cedex, Bretagne, United States
5. Ifremer, Nantes, FRANCE, France
6. IRD, Sète, FRANCE, France
7. IMR, Tromso, NORWAY, United States
8. University of Kiel, Kiel, Schleswig-Holstein, Germany
9. IFREMER, Boulogne-sur-mer, n/a, France

As part of the ecosystem approach to managing fisheries and other uses of marine ecosystems, there has been a growing call for the development of integrated assessment tools to support the provision of both tactical and strategic management advice. Of particular importance in this domain is the development of models that capture the dynamic interactions between social and economic systems, and marine ecosystems. In February 2013, a workshop jointly organised by the ICES working group on Integrative, Physical-biological and Ecosystem Modelling and researchers attending the "Mathematics of Bio-economics" initiative, a contribution to the international event "Mathematics of Planet Earth 2013" , brought together experts to discuss recent advances and key methodological challenges posed by this field of research. The presentation will provide a brief report of the key points discussed during the workshop, including identification of the research which may help progress both the development of these modelling approaches and their application to actual management decision problems.

Paper number: 505

Experiences with the use of bioeconomic models in the management of Australian fisheries

Sean Pascoe¹, Dichmont Cathy², Trevor Hutton

1. CSIRO, Australia
2. CSIRO, Australia
3. CSIRO, Australia

Australian Commonwealth fisheries have adopted maximum economic yield as a target reference point. A bioeconomic model has been developed for one key fishery - the Northern Prawn Fishery - and is used in the provision of management advice. The development and application of this model has highlighted some challenges for implementing MEY in a real fisheries management context. The aim of this paper is to highlight the development of this model, and the issues and challenges that are faced with estimating MEY for the purposes of management target setting in a real management setting.

Special Session A.2: Socio-economic assessment of the new Common Fisheries Policy of the EU

Ralf Doering, TI-Institute of Sea Fisheries, Hamburg, Hamburg, Germany

Session Description

The new basic regulation of the EU Common Fisheries Policy (CFP) was adopted in 2013 and is now implemented. In the SOCIOEC project, an interdisciplinary, European wide project bringing together scientists from several fisheries sciences with industry partners and other key stakeholders, the aim is to improve our knowledge especially in the following areas (with connection to the new CFP):

- Objectives in fisheries management (in general and locally applicable)
- Economic incentives in existing and future management measures
- Possible socio-economic impacts of the new management measures
- Improvement in methodologies and development of a tool-box for socio-economic impact assessments

The project started in March 2012 and will be in its final year at the time of the IIFET conference. The work on the objectives is finalized and will now inform the work on the improvement of methodologies for impact assessment (assess scenarios against the proposed applicable objectives). The analysis of incentive structures in existing management measures is well on its way and preliminary results can be presented.

The main task of the project is to assess the socio economic impacts of the new CFP. Therefore, several of the papers will cover important aspects regarding the new instruments in the CFP like:

- Art. 15 (Landings obligation) including the ban of discards for regulated species. Due to several possibilities to get exempted the regulation will be complicated to implement. Simulations of possible effects of these exemptions shall be presented.
- Socio-economic effects of marine protected areas as a management tool for fisheries and to implement the Natura 2000 regulation

The session will be a follow up of the special session at the IIFET 2012 conference in Tanzania.

The special session also continues into Session 2.2. The allocation of papers between the two sessions may change

Individual paper abstracts

Paper number: 477

Socio-Economic Effects of Management Measures of the Future CFP – Overview on the European FP 7 Project SOCIOEC Including First Results

Ralf Doering, TI-Institute of Sea Fisheries, Hamburg, Hamburg, Germany

The talk will give an overview on the EU FP 7 project ‘SOCIOEC’ which started in March 2012 and the ideas for this special session.

SOCIOEC is an interdisciplinary project bringing together scientists from several fisheries sciences with industry partners and other key stakeholders to work on solutions for future fisheries management that can be implemented at a regional level. The project is in its final year and we are in the midst of the quantitative analysis of a wide range of management measures especially discard ban, long term management plans or marine protected areas. At the special session several papers will be presented covering the different case studies and wide range of fisheries especially in European Waters.

Paper number: 398

Fisheries Management Measures: Incentives and Governance Issues Implemented in European Western Waters in The Context of the CFP

Pascal le Floc’h, Quimper, France, France

Pascal Le Floc’h*, University of Brest, UMR Amure,
Arantza Murillas, Martin Aranda, Fabienne Daurès, Mike Fitzpatrick, Olivier Guyader,
Aaron Hatcher, Claire Macher, Paul Marchal,

The list of past and existing management measures applied to different fisheries developed in Western waters is analysed by a typology of co-management between government and stakeholders. Restrictions on fish stocks access have changed fishermen behavior in several major ways. A comparative methodology, based on qualitative data collected through interviews and focus groups, is developed for fisheries commercially exploited by fishing fleets from different European countries: France, Ireland, Spain and the United Kingdom.

Keywords: Management, Fishery governance, Common Fishery Policy (CFP)

Paper number: 333

What’s Going to Happen with the CFP Reform Discard Policy?

Peder Andersen¹ (presenting), Ayoe Hoff², Jesper Andersen, Simon Mardle

1. Department of Food and Resource Economics, University of Copenhagen, Frederiksberg C, Frederiksberg, Denmark

2. Department of Food and Resource Economics, University of Copenhagen, Frederiksberg, Frederiksberg, Denmark

The European Common Fisheries Policy Reform includes new discard regulation that is likely to have the greatest impact on fisheries and fleets of any recent regulation. However, there is a distinct lack of data or empirical knowledge available to inform the effects on fleets. This has the potential to result in a step change in fishing behaviour. There is much written on the economics of discards, for example the knowledge of what is rational

behaviour regarding discarding Vs incentives driven by policy not to discard. In this paper, we consider what fisheries economics theory tells us as well as exploring gaps in our knowledge regarding a discard ban. We use an empirical example of the North Sea demersal fisheries to consider implications further.

Paper number: 473

Minimising Conflicts in Mixed-Fisheries Management Using Flexible Harvest Control Rules

Clara Ulrich¹ (presenting), Paul Dolder², Ayoe Hoff³, Alexander Kempf⁴, Jan-Jaap Poos⁵, Anna Rindorf¹, Youen Vermard⁶

1. DTU Aqua, Charlottenlund, n/a, Denmark

2. CEFAS, Lowestoft, Suffolk, United Kingdom

3. Department of Food and Resource Economics, University of Copenhagen, Frederiksberg, Frederiksberg, Denmark

4. Thünen Institutes of Sea Fisheries and Fishery Ecology, Hamburg, n/a, Germany

5. Wageningen IMARES, IJmuiden, Noord-Holland, Netherlands

6. IFREMER, Boulogne-sur-mer, n/a, France

When different species are caught together in mixed-fisheries but are managed under single-species management plans may lead to TACs of some species being exhausted before other. This leads to conservation and socio-economic problems in fisheries, where agreed harvest levels cannot be obtained for some stocks, while other stocks may be overharvested, and catches may be discarded by fishers on board. Socio-economic problems become more serious if landing obligations are put in place and discarding is no longer allowed. One way forward would be to develop integrated and flexible harvest control rules, where annual targets of fishing mortality by stock would be those minimizing mismatches across the sets of TACs and reducing risks of adverse economic incentives, within the range of those achieving “Pretty Good Yield” around MSY targets. In this study, we do simulations for the demersal fisheries in the North Sea. These simulations evaluate the harvest rates, resource rents and landings for several management strategies and incorporate the uncertainty in future stock productivity. Parameterization of the simulation model includes most demersal stocks and fishing fleets in the North Sea. Our results shed light on the benefits of different strategies that aim for achieving both the biological and the economic objectives of the European Common Fisheries Policy.

Special Session A.2: Socio-economic assessment of the new Common Fisheries Policy of the EU (continued)

Paper number: 87

Exploring fisheries dynamics according to different quota governance mechanisms: application to the Bay of Biscay sole fishery

Manuel Bellanger¹ (presenting), Mathieu Merzereaud, Olivier Guyader, Claire Macher
1. Ifremer, Plouzané, Technopole Brest Iroise, France

Integrating governance mechanisms into bio-economic modeling tools is a key challenge for the assessment of fisheries management plans. Impact assessments are carried out without considering real management options and institutional context. Only fishing mortality changes and their impact on fish stocks are considered. The Bay of Biscay sole fishery offers a good example to integrate current governance mechanisms for quota management - mainly relying on “fishery cooperatives” - and consequences of possible alternatives - market or centralized based approaches - especially in the context of the Common fisheries Policy reform. Based on a simulation bio-economic tools developed in cooperation with Bay of Biscay fisheries stakeholders, we explore the consequences of modeling different governance mechanisms options for quotas. The results are analyzed according to a set of multi-criteria indicators with the perspective of improving cost-effectiveness analysis in fisheries impact assessment.

Paper number: 471

Analysis of Management Measures of an MPA: The Case of the German Small Scale Gillnet Fisheries around the Island of Fehmarn in the Baltic Sea

Leyre Goti, THÜNEN Institute of Sea Fisheries, Hamburg, Hamburg, Germany

Analyzing the socioeconomic impacts of fisheries management requires a distinctive array of information that has so far been less developed than the biological data used in stock assessment. In the case of the European Common Fisheries Policy the project SOCIOEC studies the socioeconomic effects of the new European fisheries management framework regulation, with an emphasis on identifying particularities and common issues in each group of management measures (input, output and additional regulations) and analyzing their effects in the particular ecological, economic and social context of six representative European case studies. In the case of the German small scale fisheries around the island of Fehmarn the management process involves setting restrictions to fisheries to protect other species (harbor porpoises and sea ducks) under the Natura 2000 umbrella. With the tools developed in SOCIOEC we aim at further developing the methodology of impact assessment for data poor cases, which, when taken into context, asks for a wider look at the objectives of the policy as well as the incentives arisen from the management measures and the effects of different levels of governance in their implementation. A special emphasis will be given to governance issues as participation has been key to management design in this area. All these stages of policy formation and the specific methodological and data requirement issues that apply to them help us understand better the effects of the European Common Fisheries Policy.

Session number 2.2

Paper number: 474

Management of the North Sea Flatfish Fishery: Exploring Alternative ITQ Systems

Katell Hamon¹ (presenting), Heleen Bartelings², Frederik Buisman, J. A. E. van Oostenbrugge, Birgit de Vos

1. LEI part of Wageningen UR, The Hague, ZH, Netherlands

2. LEI, The Hague, Zuid Holland, Netherlands

For decades, the management of the Dutch flatfish fishery has included a variety of measures including individual transferable quotas (ITQ) and the implementation of a co-management system without succeeding in recovering the fishery to sustainable levels partly because of the multispecies aspect of the fishery with the two main commercial species being two main species sole (*Solea solea*) and plaice (*Pleuronectes platessa*). Although fishers must hold quota for both species, discarding and highgrading are allowed i.e. catch can legally be above the TAC. Only since the long-term management plan was implemented in 2008, have the stocks of the sole and plaice recovered close to or within safe biological limits. In this study we investigate the Dutch ITQ system and the influence of its design on the behaviour of the fishers and subsequently on the outcomes of the flatfish management. We use a bioeconomic model to explore the impacts of changing the trade mechanism and trade structure of individual quotas and for example allowing international tradability of quota. The socio-economic effects of quota tradability are examined.

Special Session A.3: Cost-Recovery Principles for Fisheries and Biosecurity

Paul Mwebaze¹, Michael Harte²

1. CSIRO, Brisbane, QLD, Australia

2. Oregon State University, Corvallis, Oregon, United States

Session Description

Cost recovery refers to fees and specific purpose taxes used by government agencies to recoup costs. One of the objectives of cost recovery is to improve efficiency of resource use in the economy by sending a ‘price signal’ to the users. Another objective is equity—those that use or benefit from a government service, or that contribute to the need for government services, should pay the associated costs.

The principles of cost recovery stipulate that it should be considered where there are identified risk creators or beneficiaries, and where it is cost-effective to implement. However, in practice, cost recovery is often poorly understood and inconsistently implemented.

The aim of this session is to revisit the principles and key issues associated with the application of cost recovery in fisheries and biosecurity. We will draw on the experiences in a number of countries, including Australia, New Zealand, Iceland and other countries.

Individual paper abstracts

Paper number: 484

A Principles-Based Cost-Recovery Framework for Biosecurity and Wider Government Investment Decisions

Harley Smith¹ (presenting), Stewart Webster¹

1. NSW Trade & Investment, Sydney, NSW, Australia

Australian governments spend millions of dollars each year on pre-border, border and post-border biosecurity programs. The majority of these programs are resourced through existing deeds of agreement, but some currently fall outside of these funding frameworks. Frameworks not based on economic principles have the potential to deliver sub-optimal outcomes with regard to the efficiency and equity of cost-recovery arrangements. This paper presents a principles-based biosecurity investment decision framework that is designed to produce objectively determined decisions in the absence of suitable quantitative evidence. The framework is an extension of past research by the Productivity Commission into cost recovery by government agencies. It equips the decision maker to determine whether a role exists for government to intervene in relation to a problem being considered. The framework encourages the application of a market failure test and then guides the decision maker to both identify the most appropriate government initiative to put in place and to establish the most efficient cost-recovery mechanism. The framework has been adopted by NSW Trade & Investment for program evaluation purposes and for the NSW Biosecurity Strategy. While presently customised for biosecurity, this framework would be suitable for wider government application.

Key words: biosecurity investment, cost recovery, decision framework, market failure, risk creator.

Paper number: 504

Getting the incentives right: prospective cost recovery

Paul Mwebaze¹, **Mark Edwards² (presenting)**

1. CSIRO, Brisbane, QLD, Australia

2. Department of Environment and Primary Industries, Melbourne, Victoria, Australia

On 1 April 2014 Fisheries Victoria implemented a revised cost recovery regime for services provided to the commercial fishing and aquaculture sectors across the state. This regime was developed in consultation with an industry advisory committee over 18 months. A key feature is schedules for the 42 licence classes setting out a description of services, performance milestones and FTEs and costs associated with each category of service. These schedules provide transparency to industry about the nature and extent of services to be provided, and accountability through quarterly reporting against the milestones and return of levies for non-provision of services. They also provide the basis for consideration of efficiency improvements through discussion about redesign of services, contestability or direct purchase. The introduction of the scheme has resulted in substantial increases in levies for management, compliance, research and administration services. The impacts have been ameliorated by careful consideration of which services are recoverable, phasing in the charges, and concessions on full recovery to recognise the value of production from fisheries, while avoiding cross subsidisation.

Paper number: 498

Funding of Fisheries Services: An Application of Cost Recovery Principles to Commercial Fisheries In Victoria, Australia

Paul Mwebaze, CSIRO, Brisbane, QLD, Australia

Through Fisheries Victoria, the Victorian Government provides a range of services to the commercial wild catch fisheries and aquaculture industries. These services aim to ensure that fisheries are sustainable and that secure access rights support use of fisheries resources. The cost of providing these services is recovered through a set of levies and fees, commonly referred to as 'cost recovery'. This report represents the first, major review of Victoria's cost recovery system since commencement in 2004. The objective of the review was to assess the performance of the current cost recovery arrangement and identify opportunities for improvement. The assessment is based on appropriate objectives and principles for cost recovery systems consistent with the Victorian Government's cost recovery guidelines. The review also draws on insights into practices and experiences in other fisheries jurisdictions in Australia and globally. The review identified weaknesses in the current cost recovery system. For example, aspects of the cost recovery arrangements that could be improved include:

- Moving to a prospective system rather than a retrospective calculation of levies
- Limited consultation with industry participants on services
- Poor systems for recording actual costs
- Volatility in levies paid by industry if the annual cost of services is recovered

To be confident that a redesigned system will improve efficiency, it is necessary to compare the estimated benefits and costs of implementing a redesigned system. This review sets out a preliminary assessment of the benefits and costs for a redesigned system. The analysis suggests a robust transition and implementation plan will be necessary to ensure that benefits are at the high end of the estimates, and the set up and on-going costs are at the low end.

Paper number: 478

Fisheries Management Services in Iceland: Costs and Arrangements

Ragnar Arnason, University of Iceland, Reykjavik, Reykjavik, Iceland

To run the ITQ system as well as other components of the fisheries management system, the Icelandic government conducts a number of activities which may be regarded as fisheries management services. The most important of these are performed by (i) the Fisheries Directorate which maintains the quota registry and enforces ITQ and other fisheries management rules, (ii) the Marine Research Institute which carries out biological research on which TAC decisions and other fisheries management measures are based and (iii) the Coast Guard which assists in the fisheries management enforcement activity. In addition to this, a substantial proportion of the activities of the Ministry of Fisheries is devoted to what may be called fisheries management services.

There is a long tradition of the Icelandic fishing industry paying fees toward the costs of fisheries management services. More recently, following the economic success of the ITQ system, these charges have been greatly increased and currently substantially exceed these management costs. Thus, on top of standard company taxation, the Icelandic fishing industry, one of very few in the world, is currently paying a significant extra tax.

This paper reviews these developments and provides quantitative information about fisheries management costs and the extent to which the fishing industry refunds them by special charges. It further considers the advisability of the way in which this provision of and payment for fisheries management services is arranged and suggests a more efficient arrangement.

Special Session A.4: Extending the Business Case for Traceability from the Global North to the Global South

Megan Bailey¹, Alex Miller²

1. Wageningen University, Wageningen, Gelderland, Netherlands

2. Gulf States Marine Fisheries Commission , Ocean Springs, MS, United States

Session Description

Concerns over seafood sustainability, food provenance, quality and safety, fraud, and illegal, unregulated and unreported (IUU) fishing have led to an increase in traceability programs aimed at providing information about the identity and source of seafood products. These are systems that allow one to follow seafood from “boat to plate”. The drivers of traceability in regions such as North America, Australia, and the European Union have primarily been attributed to government regulation and the retail sector, where companies are seeking to reduce their reputational and business risk.

Implementing traceability programs can be costly, and as such, most programs implemented to date have been done in the global North: those economies generally associated with developed countries. And while there are noticeable benefits of traceability programs to downstream actors in global value chains, such as retailers, economic benefits accruing to upstream actors, such as fishers, suppliers, or traders, are poorly understood.

In this panel, we bring together traceability experts from the global North (Thisfish (Canada), Trace Register (US) and Marine Economic Development (New Zealand)) with companies and researchers in the global South to discuss the economic benefits of traceability programs to fishers, companies, and traders in developing countries. Implementing traceability in the global South, where much of the seafood consumed in the North actually originates, brings benefits to Northern consumers and security to importing governments. But it could also allow fisheries in the global South to access highly-regulated markets, participate in Fishery Improvement Projects (FIPs), and even to apply for the Fair Trade standard. Our global South experts explore these opportunities, and discuss a newly launched scientific research project (Improving Fisheries Information and Traceability for Tuna) aimed at analyzing the benefits of traceability in Southeast Asia.

Individual paper abstracts

Paper number: 502

The Incentives Towards Vested Interests in Seafood Traceability Expansion

Mark Soboil, Marine Economic Development, Devonport, Devonport, New Zealand

Can government regulations and company concerns to reduce their reputational and business risk lead to an increase in traceability programs? Are the drivers of traceability attributed to concerns over seafood sustainability, food provenance, quality and safety, fraud, and IUU fishing? These questions suggest there is a change in incentives and seafood companies will introduce traceability because the sustainability of fish stocks, illegal fishing and food safety are inherently important to them. I argue that given the right incentives seafood companies will have a vested interest. The risk of not having a vested interest is that government regulations that actually have any real benefit will only be in more advanced fisheries management regimes with good compliance, where the real benefits of those regulatory changes are usually the most negligible. Without a vested interest, seafood companies will always be exploring trade strategies where they can take advantage of import/export loopholes or restrictions and avoid getting involved in fisheries management and seafood provenance if they can reduce costs. The challenge is how do we change those incentives? When we see the economic benefits of good stewardship accruing to fishers, processors and distributors - it's manifested to retailers and other downstream players in global supply chains through the default traceability programs that are created.

Paper number: 486

Faceability: Consumer Motivations and Perceptions of Putting a Face on Seafood Through Traceability

Eric Enno Tamm, ThisFish / Ecotrust Canada, Vancouver, British Columbia, Canada

Most seafood businesses value traceability as insurance against recalls or to track production efficiencies for yields, grading, etc. While there is a plethora of ERP (enterprise resource planning) and traceability software dedicated to internal business processes and B2B data sharing, there are only a handful of producer-to-consumer traceability systems that provide the public with unprecedented transparency about the provenance of their seafood. In 2010, Ecotrust Canada launched ThisFish, an online seafood traceability system that combines social networking with food traceability to allow consumers to trace products and to connect to those who harvested their seafood. ThisFish coins its system as "faceability," allowing consumers to put a face on the harvester who caught their seafood. What are the competitive advantages of this new transparency and social connectivity? What motivates consumers to trace their seafood? What are consumer perceptions of traceable seafood? Who are the early adopters among conscientious consumers? Can businesses extract value from consumers for traceability as a product attribute? ThisFish will share insights into these questions from a consumer survey and data on system analytics.

Paper number: 489

Traceability: Is the Investment Worth the Benefit?

Momo Kochen, Masyarakat dan Perikanan, Indonesia (MDPI), Denpasar , Bali, Indonesia

Within Indonesia and across the region the requirement for traceability within the seafood supply chain is limited to meeting the basic standard of HACCP, namely that the individual fish be traceable back to the 1st supplier, for quality sampling purposes. No common template for traceability exists and hence companies follow the requirements of their buyers from the north to develop their own traceability systems, resulting in a complicated, unapproachable aspect of the fishery sector, which many local companies do not embrace with conviction. Traceability, on top of the ever increasing list of requirements which the north is pushing on its southern suppliers such as sustainability and socially responsible compliance, is increasing the financial burden further and further upstream.

Traceability is not important from a fisherman's perspective, in general he doesn't even know where his fish goes after it leaves his village, and certainly not which continent it is consumed in, so why spend unnecessary time and effort on it? However, doing the right thing from a sustainability and socially responsible perspective has made this increasingly important. Fish coming from a sustainability project or a Fairtrade implementing project should be differentiated from those which are not. This is what a group of fishermen in central Maluku are realizing and hence are pushing for a robust traceability system to be implemented within the supply chain. The Fairtrade fish which they will send through the system will potentially bring a premium but are the initial costs involved too high a risk for a small scale fishery and how detailed does the system really need to be?

Paper number: 485

Can Consumer-Facing Traceability Govern Sustainability?

Megan Bailey¹, **Simon Bush**¹

1. Wageningen University, Wageningen, Gelderland, Netherlands

Consumer-facing traceability systems are emerging in the global seafood sector as a way for companies to reduce their reputational risk, access certain markets, and to generally communicate production practices to downstream actors. What are the characteristics of these systems, what benefits do they bring to different value chain actors, and to what extent do they inform or govern sustainable production and consumption? These questions are being asked and answered in a current research program called IFITT: Improving Fisheries Information and Traceability for Tuna, spearheaded by Wageningen University. The framework for this project draws on the theories of value chain and informational governance, analysing if and how improved information generation and transmission alters value chain governance, including enabling upgrading for developing country fisheries. Further to this, IFITT investigates if information from traceability systems can link up with government management systems, to better inform regulatory practices. The scientific agenda for traceability research in the future should include studies aimed at better understanding under what conditions value chain actors stand to benefit from engaging in consumer-facing traceability systems, and what conditions enable these systems to influence consumption and production practices.

Paper number: 487

Gulf Seafood Trace: A Robust Electronic Traceability Program for the U.S. Gulf of Mexico Seafood Industry

Alex Miller, Gulf States Marine Fisheries Commission , Ocean Springs, MS, United States

Demand for seafood is partially driven by market confidence in the product. Confidence is driven by information. Creating assurances about seafood depends on the management and timely access to critical information about the product as it moves through the supply chain—vessel to plate. This information can be shared electronically with buyers, consumers, and other stakeholders for the purposes of innovative marketing, proving regulatory and buyer specification compliance, communicating safety and quality, demonstrating certifications, and improving labeling. A voluntary electronic seafood traceability program called Gulf Seafood Trace was created in 2011 to help drive increased market demand for U.S. Gulf of Mexico seafood by telling its unique story and ensuring confidence in the market. The program consists of an Electronic Traceability Platform, a Data Quality and Confirmation component, and a Marketing Module. To date, the GST program has made great strides in achieving its programmatic goals. The effort to gain support among Gulf seafood businesses has resulted in over 1,000 total program participants (987 fishing vessels, 38 processors, 19 dockside facilities, and 8 distributors), 70 unique enrollees across all five Gulf states, and over 42 million cumulative pounds of seafood traced. Perhaps most importantly, the GST program has helped Gulf seafood businesses reach their individual goals of increased buyer confidence and higher profitability with some participants experiencing a 15-30% increase in business.

Special Session B.1: Understanding Responses to Catch Share Systems in Marine Fisheries

Olivier Thebaud¹, James Innes², Dan Holland, Thorolfur Matthiasson³

1. IFREMER, PLOUZANE, Bretagne, France

2. CSIRO Marine and Atmospheric Research, Saint Lucia, Queensland, Australia

3. The University of Iceland, Reykjavik, Reykjavik, Iceland

Session Description

Catch share systems have existed for several decades in numerous parts of the world, and are increasingly advocated to address some of the key sustainability issues arising from the common pool nature of marine fisheries resources. While their effectiveness in principle is by now well established, studies have also highlighted the fact that their actual impacts may vary from fishery to fishery, according to the context and the details of their implementation. A growing number of studies have stressed the need for more applied research on the operation of catch share systems, in order to better understand the key processes that determine the economic, social and ecological consequences of catch share systems in marine fisheries.

The session will examine case studies of catch share systems, with the aim to document the anticipated and un-anticipated responses to these interventions, their key economic and social drivers, and the influence of the context in which they were adopted. Contributions will be sought that propose empirical analysis of fisheries managed using catch shares around the world, as well as modelling studies aimed at exploring the social and economic processes which determine the evolution of fisheries under these regulatory regimes.

The special session also continues into Session 7.1. The allocation of papers between the two sessions may change

Individual paper abstracts

Paper number: 188

The Dynamic Role of Sablefish in a Multispecies, Multigear IFQ Fishery

Dan Holland (presenting), Erin Steiner¹

1. Northwest Fisheries Science Center, Seattle, WA, United States

Individual fishing quota (IFQ) systems are typically expected to increase the profitability of a fishery and improve sustainability by ensuring catches remain within quotas. They can also have important distributional and ecological implications that result from shifts in catch and effort between different gears, regions, and habitats. In multispecies fisheries these changes may be hard to predict since the value of quota and the amount and distribution of catch of primary target species may be dependent on prices, abundance, distribution, and quota availability of other jointly caught species.

We analyze how the implementation of IFQs in the Pacific groundfish fishery has, and may in future, shift the distribution of catches, effort and revenue in the fishery. We focus on the most valuable component of the groundfish fishery that targets sablefish, either independently using fixed gear, or jointly with dover sole and thornyhead rockfish using trawl gear. We simulate the effects of changes in prices of sablefish, dover sole and fuel on trip level profitability. Our analysis suggests significant differences in the value of sablefish quota by gear and some regional differences that could lead to shifts in where and how sablefish quota is used. These shifts can have important ecological as well as distributional consequences. Our analysis also shows that relative profitability is quite sensitive to changes in fish and fuel prices with the range of changes seen in recent years. Thus movement of sablefish spatially and between gears is likely to be dynamic going forward.

Paper number: 458

Missed Opportunity for a Golden Handshake? Why Did So Many Fishers Stay After the Introduction of ITQs?

Katell Hamon¹ (presenting), Olivier Thebaud², Little Rich, Stewart Frusher³

1. LEI part of Wageningen UR, The Hague, ZH, Netherlands

2. IFREMER, PLOUZANE, Bretagne, France

3. IMAS, Hobart , TAS , Australia

Individual transferable quotas (ITQs) have been used in several countries worldwide to regulate access to marine fisheries. While ITQs can improve the economic efficiency of fisheries, in practice their application rarely has the expected effects. In this study we compare the output predicted by an individual based model of quota market with what really happened in the Tasmania rock lobster fishery since the introduction of ITQs in the fishery. When ITQs were introduced, some vessels left the fishery but it appears from the simulations that the fishery retained some over-capacity.

The model assumes a profit driven behaviour where fishers will fish only if their expected profit from fishing is higher than the price of quota and fishers who are more profitable will continue fishing until they reached a maximum effort. The difference between the simulated and observed fishing distribution within the fleet can be explained by several factors not accounted for in the model, some impact the expected profit (e.g. perfect knowledge of all fishing areas) and others can be social drivers that were not taken into account (e.g. time to

spend with the family). The importance of the societal factors in the decisions of should be further investigated.

Paper number: 283

Market effects of catch share management: the case of New England Multispecies groundfish

Andrew Scheld (presenting), Chris Anderson

1. LEI part of Wageningen UR, The Hague, ZH, Netherlands
2. IFREMER, PLOUZANE, Bretagne, France
3. IMAS, Hobart , TAS , Australia

In 2010, management of New England Multispecies groundfish transitioned from input restrictions on harvester effort to collective rights-based management. Faced with a large reduction in harvesting days, 432 active vessels, representing 98% of historical landings, joined one of the 17 sectors allocated catch shares. The incentives presented under sector management, combined with regulations of several separately managed, revenue-important species, led to changes in harvest strategies and the timing of landings for both Multispecies groundfish and many other species targeted by the sector vessels. Temporally modified landings altered the ex-vessel market mix of different species throughout the fishing year, significantly impacting prices received as well as annual harvester revenues. Two counterfactual individual harvester landings' timing scenarios for 25 species are combined with independent fixed effects models of inverse dealer demand in estimating the revenue effects of catch shares during their first year. Aggregate gains of over \$30,000,000 were found to result from advantageous market timing changes brought on by more flexible catch share management.

Paper number: 331

Evidence of Package Trading in a Mature Multi-Species ITQ Market

James Innes¹ (presenting), Olivier Thebaud², Ana Norman, Little Rich, John Kung⁴

1. CSIRO Marine and Atmospheric Research, Saint Lucia, Queensland, Australia
2. IFREMER, PLOUZANE, Bretagne, France
3. CSIRO,
4. QLD Department of Agriculture, Fisheries and Forestry, Brisbane, QLD, Australia

In multi-species fisheries managed under ITQs, the existence of joint production may lead to complex catch-quota balancing issues. Previous modelling and experimental research suggest that, in such fisheries, some fishers may benefit from the ability to trade packages of fishing quotas, rather than fulfil their quota needs by simultaneously bidding on separate single-species quota markets. This note presents evidence of naturally occurring package trades in a real fishery. Based on this evidence, we suggest that further empirical and modelling research is required on the potential and limitations of package quota trading in mixed fisheries managed with ITQs.

Paper number: 439

Implied Discount Rates in Gulf of Mexico ITQ Fisheries

Andrew Ropicki¹, Sherry Larkin² (presenting)

1. University of Florida Food and Resource Economics, Gainesville, Florida, United States
2. University of Florida, Gainesville, FL, United States

This research inspects the link between ITQ lease and sale prices using survey data and examines the possibility that quota share, as an asset, can fall into two distinct markets with different values. The first market is as a fishing asset. In this market the value of quota is determined by the fishers cost of capital. The second market is quota as an investment asset. In this market the value of quota is derived from the ability to lease the quota each year, and the discount rate used to calculate the present value of all future leasing of quota is governed by the rates of return of other investments available to the quota owner with risk levels similar to owning quota. We use survey data from the Gulf of Mexico Red Snapper and Grouper-Tilefish IFQ programs to examine our hypothesis. IFQ participants were surveyed to determine at what prices they would buy and sell quota and lease in and out quota, their expectations about future growth of the quota, and their expectations regarding the longevity of IFQ management in the reef fish fishery. By accounting for participants expectations regarding the growth of the quota and the future of IFQ management in the fishery we are able to control for difference in quota valuation due to factors other than the implied discount rate.

Paper number: 456

Self-Imposed Catch Shares by French Producers Organizations

Guyader Olivier¹ (presenting), Metz Sébastien, Claire Macher², Mathieu Merzereaud, Fabienne Daurès³, Pascal Le Floch⁴

1. IFREMER UMR AMURE, PLOUZANE, BRETAGNE, France
2. Ifremer, UMR AMURE,, Plouzané Cedex, Bretagne, United States
3. IFREMER-UMR AMURE, PLOUZANE Cedex, Bretagne, France
4. Université de Brest, UMR AMURE, OSU-IUEM, Quimper, Bretagne, France

Since 2006, French quotas are shared out into annual catch entitlements per producer organizations (PO) according a stable allocation key. On this basis, PO's have imposed catch shares to their own members but allocation and management rules are heterogeneous between PO's. The objective of the paper is i) to assess the importance and the attributes of these catch shares programs in the Atlantic fisheries ii) to seek to explain the reasons for their adoption. The results are based on a national PO's survey carried out to collect detailed information on PO's considering their management capacity but also their current practices in terms of membership, catch share allocation and monitoring, capacity adjustment. The results are discussed in relation to the literature on the factors explaining co-management practices.

Special Session B.2: Collaborating for Ocean Health: A discussion by the Blue Ribbon Panel – Special Advisory Body to the Global Partnership for Oceans

Timothy Bouley¹, James Anderson², **James Wilen**

1. World Bank, Washington, DC, United States

2. The World Bank, Washington, DC, United States

Session Description

Launched at Rio+20, the Global Partnership for Oceans (GPO) creates a new way of working multilaterally and multi-sectorally for the oceans, with a diversity of partners, including governments, the private sector, UN agencies, and civil society organizations. To date, there are more than 150 such partners who have come together in support of collective and sustainable ocean investment for ocean action under this new umbrella.

In 2013, a Blue Ribbon Panel of experts was convened by the World Bank to advise this Partnership. Comprising 21 thought leaders from business, conservation, government, and academia, the panel provided guidance to the Global Partnership for Oceans through the publication of *Indispensable Ocean: Aligning Ocean Health and Human Well-Being*. Internationally launched, the report achieved widespread public attention with over 100 million internet impressions and featured stories in Reuters, the BBC, and National Geographic, among others – and has provided invaluable input to be used in the implementation of the GPO.

This session will present the context, implication, and relevance of this work to the fisheries economics community. Dr. Anderson (study co-director) will describe the impetus and context for the panel within broader international financial institution work. Dr. Arnason (BRP member) will describe the overall findings of the panel and implications for the broader ocean community and marine resource economists. Dr. Hannesson will critique the panel report and its relevance to the IIFET community.

For more information on the Global Partnership for Oceans:

<http://www.globalpartnershipforoceans.org/>

To read the Blue Ribbon Panel report:

<https://www.globalpartnershipforoceans.org/indispensable-ocean>

Marine Resource Economics review article:

<http://www.jstor.org/action/showMostAccessedArticles?journalCode=mariresoecon>

Special Session B.3: Integrating the Social in Marine Environment Governance

Kate Barclay, University of Technology Sydney, Broadway, NSW, Australia

Session Description

The session will explore the integration of social analyses of marine and coastal environmental governance through the conceptual framework of 'interactive governance' and 'governability' (Kooiman et al 2005; Bavinck et al 2013).

The papers will focus on two main topics:

- 1) Why it is important to integrate social understandings within governance for marine and coastal environments with economic and ecological understandings (as opposed to including a social analysis as a stand-alone investigation in an impact assessment, for example).
- 2) Methods people have used in meeting the challenge of integrating social with other disciplinary modes of knowledge, and the challenge of inserting social understandings of marine ecologies effectively into political processes.

Some of the empirical areas to be covered by the papers include:

- 1) The difficulties implementing meaningful consultation and co-management for marine protected areas;
- 2) Identifying the ideological aspects of environmental science shaping the framing problems and solutions around coral reefs and food security; and
- 3) The social contexts of fisheries in Pacific islands countries affecting economic behaviour and regulatory frameworks.

Individual paper abstracts

Paper number: 156

Lessons from Coastal Marine Resource Management in Pacific Island Countries. 'Interactive Governance' Sheds Light on Coastal Zones as Social Systems.

Kate Barclay¹ (presenting), Jeff Kinch²

1. University of Technology Sydney, Broadway, NSW, Australia

2. National Fisheries College, Kaviang, New Ireland Province, Papua New Guinea

Since the 1990s Pacific island countries have been host to a plethora of projects to improve the management of coastal marine environments. Some of these have been about strengthening Indigenous and community-based forms of resource management. Some have been about building government capacity and strengthening legislative frameworks. Marine Protected Areas (MPAs) have been established in many locations. After more than twenty years, however, in most areas coastal environments are still not well protected from the deleterious effects of fishing or other human activities. This paper builds on a review of coastal marine resource management projects, drawing on the lessons learned to identify what needs to be done to improve protection of coastal environments. The main problems visible in the projects reviewed result from inadequate understanding of, and attention to, the various stakeholders involved, and their relations with each other. It is widely accepted that greater understanding of the social is needed to understand the human dimensions of natural resource management, but policy makers have struggled to move beyond the inadequate response of contracting a social impact assessment. The Interactive Governance approach offers a way of understanding the social aspects of coastal environments that integrates social with ecological and economic knowledge that is potentially far more useful.

Paper number: 491

Developments and Directions in Marine and Fisheries Management Social Sciences Research – Progress from the Australian FRDC Social Sciences Research Coordination Program 2009 – 2014

Kate Brooks, FRDC Social Sciences Research Coordination Program, Prahran East, VIC, Australia

In 2009 the Fisheries Research and Development Corporation (FRDC) established the Social Sciences Research Coordination Program (SSRCP) to increase industry and government understanding and uses of social sciences in marine and fisheries management. Since that time a number of projects have been funded and promoted by the FRDC through the Program, ranging from a simple audit of all social sciences research undertaken in Australia between 1990 and 2010, to an examination of the values that underpin public attitudes and perceptions of fisheries management. The projects (some 24) cover the disciplines of historical, economic, ethnographic, demographic and sociological research approaches and methodologies.

This paper presents a summary of the work championed by the FRDC and the themes of endeavour it has supported to date, and the future directions that are currently envisaged. It seeks to explore the rationale for those directions and invite debate around the gaps that may remain from the existing research, and currently envisaged avenues of ongoing and future research. Specifically, it touches upon the urgent need for the integration of social science (in all its forms) research with other forms of knowledge (specifically ecological) and the

governance decision making processes that confound decision making bodies, and which currently often become politicised as a consequence.

Paper number: 359

Transformation of Coastal Communities: Where is the Marine Sector Heading?

Ingrid Van Putten¹ (presenting), Sarah Metcalf², Stewart Frusher³, Nadine Marshall, Malcolm Tull

1. CSIRO, Hobart, Tasmania, Australia

2. Murdoch University Murdoch Business School, Murdoch, Western Australia , Australia

3. IMAS, Hobart , TAS , Australia

Much has been said about migration to coastal areas and the consequent change in coastal community demographics. The commercial fishing sector is contracting and communities are re-orienting to other marine sectors such as marine tourism and aquaculture, and some non-marine sectors often with a net loss of employment opportunities. Our aim is to examine the additional pressure of climate change on coastal communities typically referred to as ‘fishing towns’. Climate change may prove to be the ‘tipping point’ for both the fishing fleet and coastal fishing towns. Our approach is to identify the climate change effects in the marine environment and to consider a coastal community’s vulnerability in the context of its size, demographics, and economic characteristics. We find that small coastal communities characterised by an older demographic, high unemployment, a declining commercial fishing fleet, high participation in the marine sector, and limited local sea-based or land-based employment opportunities are assumed to be especially vulnerable to the effects of climate change in the marine environment. Our results suggest that the effects of climate change such as declines in fish abundances and coastal inundations, are likely to affect small coastal communities that were previously ‘fishing towns’. Moreover, transformations of structure and function of communities are likely to occur as the fishing component of communities’ declines further. Unless skills commensurate with the existing and emerging local industries are developed and effective strategies are evolved to cope with marine climate change, small coastal communities may be at risk of terminal decline in which cast the future of coastal communities in Australia is likely to look very different.

Paper number: 189

Exploring the Social Dimensions of MPA Governance using Interactive Governance Theory

Michelle Voyer, University of Technology, Sydney, Kiama Downs, NSW, Australia

‘Interactive governance’ is an emerging theory gaining traction in the field of fisheries social science but as yet largely unexplored in the field of Marine Protected Area (MPA) planning and management. According to ‘interactive governance theory’, MPAs are a form of ‘governing system’ established to manage the interaction between natural and social ‘systems to be governed’ in a way that maximizes conservation outcomes, while minimizing impacts on the social ‘system to be governed’. This is necessary because it is well recognized that social acceptance of an MPA is crucial to its success. To date, in Australia, incorporating social considerations into MPA planning has largely involved conducting socio-economic assessments and public participation exercises, often in isolation of each other, and using this information to apply social and economic constraints to a biological (or ‘ideal’) MPA model. Yet a series of interviews with coastal users of NSW marine parks suggest stakeholders have

a complex, interconnected relationship with the coast which incorporates ecological, economic and social concerns. It is the relationship between different images, values and principles that appear to determine the way the parks are accepted, rather than the presence or absence of individual values, ideas or knowledge. This research suggests that considering social, economic and biological subsystems in isolation can be problematic and may result in over-simplification of the complex ways in which people form their responses to MPAs. It also highlights the dangers of treating stakeholder groups as homogenous subcultures with uniform ideas, concerns and ideas about MPA management.

Paper number: 250

Why We Care About Coral Reefs

Simon Foale, James Cook University, James Cook University, QLD, Australia

The Coral Triangle Initiative is a large and expensive conservation program that aims to preserve coral reef biodiversity and improve food security in six tropical countries, where there are high levels of poverty among coastal fishers, who are expected to bear most of the short-term costs of proposed conservation measures. I examine the extent to which the food security agenda is subordinate to, contingent upon and in many ways constrained by the biodiversity preservation agenda, in contrast to the 'win-win' congruence of the two agendas asserted by the CTI. I argue that most of the coastal poor in the region do not share the scientific and aesthetic values underpinning the biodiversity preservation agenda, and that this presents problems for effective fisheries governance. Case study data on the economic and food security importance of high-yielding small and large pelagic fisheries (sardines, scads and tunas) in Solomon Islands and elsewhere question the assertion that coral reefs are pivotal to food security throughout the region. While this implies that the costs of permanent no-take zones on coral reefs are less for coastal fishers who target pelagics, it raises important questions about criteria used for zoning protection (do reef closures block access to small pelagics?), and how the catches and profits from industrial pelagic fisheries are distributed. Achieving real-world fisheries governance and food security outcomes will require a critical examination of the epistemological foundations of the CTI's biodiversity conservation program, and a scrupulous disentangling of environmentalist ideology from both fisheries ecology and economic development.

Special Session B.4: Market access issues related multiple certification schemes for fish and fishery products in international trade

Karunasagar Iddya¹, Audun Lem¹, Nguyen Huu Dung², Panisuan J, Thomas Darmawan³

1. Food and Agriculture Organisation, Rome, Rome, Italy

2. VASEP, Ha Noi, Ha Noi, Viet Nam

3. Seafood Processor Association, Jakarta, Indonesia, Indonesia

Session Description

Globalisation of the fisheries sector and expansion of trade has also led to expansion of market requirements. At the international level, the Codex Alimentarius Commission is developing Standards, Codes of Practices and Guidelines related to food safety and fair practices in trade. The WTO Sanitary and Phytosanitary (SPS) Agreement recognises Codex standards as the benchmark in food safety area.

In most seafood processing countries, the national competent authorities are inspecting and certifying the implementation of good hygienic practices, HACCP and traceability along the value chain. However, some of the food safety scares, though not directly pertaining to seafood safety have led to the emergence of private certifications covering the entire food safety area. Thus in addition to implementing regulatory requirements like GHP and HACCP, most fish processing establishments are required to have non-regulatory certifications with respect of food safety. In addition, certification is being demanded to cover sustainability issues - e.g. ecolabels for fish produced by capture fisheries and aquaculture certifications.

It is common to see multiple certification requirements covering the same area. This is demanding considerable resource and is reducing the returns to producers and processors as well as adding costs to importers, retailers and ultimately to consumers in importing countries. Achieving equivalency among comparable standards would therefore benefit the sector while maintaining quality and safety levels. Speakers from Asia, Africa, Latin America and FAO would be speaking about problems of multiple certifications in their regions and looking at costs and benefits of meeting these non-regulatory requirements.

The special session also continues into Session 7.4. The allocation of papers between the two sessions may change

Individual paper abstracts

Paper number: 497

Market access for seafood in a globalized world

Audun Lem, Food and Agriculture Organisation, Rome, Rome, Italy

The fisheries sector is one of the world's most globalized food producing sectors with almost 40 % of total production now entering international markets. Trade has a particular relevance and importance for developing countries who represent more than 50% of global fish exports thereby generating important benefits in terms of livelihoods, employment and export earnings.

In line with a general liberalization in international trade, the import tariffs on fish and fishery products applied by developed countries are generally low or non-existing. However, market access still remains an issue for exporters because of a number of mandatory import requirements especially related to quality and safety.

In recent years, market-based or voluntary instruments related to the sustainability of sourcing have become an additional requirement in many markets, especially as they relate to sustainable fishing practices or aquaculture production. This presents another challenge to producers in both developed and developing countries.

For developing country imports, import duties continue to be significant in many countries. This presents obstacles to the development of regional trade as well as limits the availability of fish and fishery products to local consumers.

Market access continues to be a major issue in international fish trade with wide implications for both the creation of economic benefits as well as for local food security.

Paper number: 493

Multiple Certification Practices in Fisheries in Morocco

Nada Bougouss, INFOSAMAK, Casablanca, Morocco, Morocco

Certification and labeling are important schemes especially for exporting countries. They have emerged as voluntary, sometime obligatory, processes amongst many stakeholders as a means to ensure food safety, quality and environmental sustainability in the growing fisheries and aquaculture industry.

This paper analyses types of private standards and multiple certification practices in Morocco and presents costs and benefits of complying with these certification schemes. It will attempt to compare costs incurred in getting each of the certifications and analyze general economic impacts for the fish industry. It will also examine their policy and governance implications and their role in traceability.

Paper number: 499

Costs and Benefits of Aquaculture Certifications

Nguyen Dung, Vietnam Association of Seafood Exporters and Producers, Ho Chi Minh City, Ho Chi Minh, Viet Nam

Increased global demand can threaten sustainability and environment, if not adequately regulated. Globalization also promotes sustainability by integrating standards, enabling partnerships, capacity building and technological transfer, but need global cooperative mechanisms. Non-transparent sustainable standards can impede global integration.

Present status of sustainable aquaculture certifications is a real "jungle". Many certification & rating systems exist, both national GAPs (like ThaiGAP, VietGAP,...) or international (like BAP, GlobalGAP, ASC etc.) but limited transparency on systems' performance, causing confusion and mismatch between producers and markets; unnecessary costs for certification; opportunities for "green-washing" schemes and reduced consumer confidence due to inconsistent messaging. It is clear need for transparency and harmonization of aquaculture certifications and ecolabels considered credible and acceptable by large seafood buyers; of key performance requirements for credible certification and ecolabelling systems; of methodology to determine compliance with these key requirements; of communication around performance of seafood ecolabels by environmental NGO's to the public.

Aquaculture Stewardship Council (ASC) aims to be the world's leading certification and labelling programme for responsibly farmed seafood. ASC runs an ambitious programme to transform the world's seafood markets and promote the best environmental and social aquaculture performance. By the end of July 2013, 454 approved products in 22 countries; 364 (80%) of products are Pangasius, 90 (20%) of products are Tilapia. But it is seen declining demand trend in ASC certification in Pangasius industry of Vietnam. The report tries to provide and analyse a study on cost and profit of certification for pangasius industry.

Paper number: 501

Complying with Market Based Certification Schemes in Indonesian Fisheries and Aquaculture

Thomas Darmawan, Seafood Processor Association, Jakarta, Indonesia, Indonesia

Indonesia, with a coastline of over 95,000 KM and brackish water area of 1.2 million hectares has very vast fisheries potential. In 2013, Indonesia exported seafood worth 4.16 billion US\$. The major markets for Indonesian fisheries are USA, EU, Canada, Japan and China. Indonesian fisheries producers and processors take care to comply with both regulatory as well as non-regulatory requirements. Considering the emerging importance of aquaculture certification for supply chain management, Indonesian Government has introduced IndoGAP, which is based on biosafety, food safety and environment. Over 200 aquaculture companies and 2500 individual farms are GAP certified. IndoGAP covers fresh water aquaculture of carps, catfish and tilapia, brackish water shrimp, as well as marine aquaculture of seabass, groupers and seaweed. Some Indonesian producers and processors have also subscribed to private certifications such as GlobalGAP and Fairtrade. For food safety related issues, BRC, SQF and FSSC 22000 are also popular. Large processors do not see certification as a trade barrier because they get good returns from their customers. But small producers and processors who cannot recover the cost of certification through their products perceive certification as a trade barrier.