Optimising business structures and fisheries management systems for key fisheries

T.M. Ward

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Abbreviations

ACA	Abalone Council Australia Ltd
ACE	Annual Catch Entitlement
AFMA	Australian Fisheries Management Authority
AIASA	Abalone Industry Association of South Australia
AWA	Australian Wild Abalone™
CDR	Catch and Disposal Records
CL	Carapace length
CPUE	Catch per unit effort
CRA5	New Zealand South Island Western zone Rock Lobster Fishery
CRC	Cooperative Research Centre
CSIRO	The Commonwealth Scientific and Industrial Research Organisation
DPIPWE	Department of Primary Industries, Parks, Water and Environments
ECOT	East Coast Otter Trawl
eCPUE	Estimation of Catch Per Unit Effort
ECTF	East Coast Trawl Fishery
EOSC	Economic Optimisation Sub-committee
FAO	Food and Agriculture Organisations
FC	Fixed costs
FD	Fishery-Dependence
FGM	Fishery Gross Margin
FPIs	Fishery Performance Indicators
FRDC	Fisheries Research and Development Corporation
FTEs	Full Time Equivalent
GOS	Gross operating surplus
GOV	Government
GPS	Global Positioning System
GSP	Generalised Scheme of Preferences
GSV	Gulf St Vincent
GSVPF	Gulf St Vincent Prawn Fishery
GVP	Gross Value of Production
ITEs	Individual Transferable Effort Units
ITF	Individual transferable fishing
ITQs	Individual Transferable Quotas
KUDs	Kernel Utilisation Densities
LPH	Legal Proportion Harvested
MCDA	Multiple Criteria Decision Analysis
Mey	Maximum economic yield
MLS	Minimum Legal Size
MPA	Marine Protected Area
MPI	Ministry of Primary Industries
MSC	Marine Stewardship Council
Msy	Maximum sustainable yield

NMFS	National Marine Fisheries Service
NPF	Northern Prawn Fishery
NPF	Northern Prawn Fishery
NSW	New South Wales
NZ	New Zealand
NZ CRA8	New Zealand Southern zone Rock Lobster Fishery
NZ$	New Zealand Dollars
NZRLFA	Northern Zone Rock Lobster Fishermen's Association Inc.
OHSW	Occupational health, safety and welfare
PI	Performance Indicator
PIC	Paua Industry Council
PIRSA F&A	Primary Industries and Resources South Australia, Fisheries and Aquaculture
PLOS	Public Library of Science
QDPI	Queensland Department of Primary Industries
QMA	Quota Management Area
QMS	Quota Management Systems
R&D	Research and Development
SA	South Australia
SA FARAC	South Australian Fisheries and Aquaculture Research Advisory Committee
SA NZRLF	South Australian Northern Zone Rock Lobster Fishery
SA SZRLF	South Australian Southern Zone Rock Lobster Fishery
SARDI	South Australian Research and Development Institute
SARLAC	South Australian Rock Lobster Advisory Council Inc.
SEPFA	South East Professional Fishermen's Association Inc.
SGPF	Spencer Gulf Prawn Fishery
SGWC	Spencer Gulf and West Coast
SRL	Southern Rock Lobster
SSA	Southern Shrimp Alliance
SZ	Southern Zone
TAC	Total Allowable Catch
TACC	Total Allowable Commercial Catch
Tas	Tasmania
TEPS	Threatened, endangered and protected species
TR	Total revenue
USD	American dollars
VC	Variable costs
Vic	Victoria
WA	Western Australia
WADA	Western Abalone Divers Association

Non-Technical Summary

Optimising business structures and fisheries management systems for key fisheries

Australian Seafood CRC Project No. 2009/715

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PROJECT OBJECTIVES:

1. Assess the performance and identify impediments to wealth creation in selected CRC fisheries;
2. Describe and evaluate innovative systems that have been established to improve the performance of successful fisheries worldwide;
3. Identify practical opportunities for overcoming impediments to wealth creation and improving the performance of selected CRC fisheries.

OUTCOMES ACHIEVED AND PLANNED

Overall

This project is one of a suite of studies funded by the Australian Seafood (Cooperative Research Centre) CRC and the (Fisheries Research and Development Corporation) FRDC that have contributed to the ongoing transformation of Australia's fisheries to include an explicit focus on delivering economic benefits, as well as ecological sustainability. This outcome was achieved by conducting a series of workshops that brought together key industry members and representatives, fisheries managers, scientists and economists to share knowledge and experiences and identify opportunities to improve the economic performance of Australia's prawn, Southern Rock Lobster and abalone fisheries. The project worked with three different sectors and achieved the sector specific outcomes described below.

Prawns

This project provided the impetus for the Spencer Gulf Prawn Fishery (SGPF) to establish an Economic Optimisation Working Group and develop a draft economic optimisation paper (July 2014). The final version of that document will provide a basis for revising the management plan for the SGPF and refining the harvest strategy for the fishery to improve economic performance. A bio-economic model for the SGPF (modified and adopted from Australian Seafood CRC Project No. 2011/750) will contribute critical information to that process of reform. A larval dispersal model developed in FRDC Project No. 2008/011 will be used to ensure that future fishing strategies seek to optimise both successful recruitment and economic performance.

Both the SGPF and Gulf St Vincent Prawn Fishery (GSVPF) have been managed using input controls without transferability for over 50 years. This project contributed to the establishment of a system of tradeable nights in the GSVPF in 2012. A refined Harvest Strategy that includes a system of tradeable units is currently being developed for the GSVPF. The refined harvest strategy being developed for the SGPF is also likely to include economic performance indicators.

Transferable units have already been established in the East Coast Otter Trawl Fishery (ECOTF). The overwhelming problem in the fishery is over-capacity. It seems unlikely that significant reduction in effort will be achieved without some form of buy-out. To be effective, such a buyout would require strong cooperation between industry and government. Currently, the Queensland trawl industry's capacity to engage with government is impeded by the absence of an association that represents its interests.

Southern Rock Lobster

Since this project began, there has been a major cultural shift within the fisheries that target Southern Rock Lobster off southern and eastern Australia. The strong historical focus on maximising catches has been replaced by a vision for fisheries that deliver higher profits whilst catching fewer lobsters. Targeted workshops and conference presentations conducted as part of this project contributed to this cultural change by exposing key industry leaders to the positive economic outcomes that have been achieved in lobster fisheries in New Zealand and Western Australia by reducing exploitation rates to levels that maintain/rebuild biomasses to sizes that deliver higher profits by reducing fishing costs (through increased catch rates). Two other contributions were crucial. Firstly, success over the last decade in educating lobster fishers in the principles of fisheries economics allowed industry to quickly understand the implications of what had been achieved in New Zealand and Western Australia. Secondly, the bio-economic model developed in CRC Project No. 2009/714 provided an effective tool for demonstrating to industry and fisheries managers the costs/benefits of various management scenarios, such as low/high total allowable catches and various minimum and maximum legal sizes. This bio-economic model will be used to refine the harvest strategies for Australia's fisheries for Southern Rock Lobster and ensure that future economic performance is optimised under the range of potential recruitment scenarios that the future may hold. The benefits of collecting the data required to assess economic performance, notably beach and export prices and fishing costs, are now also widely recognised.

Abalone

This project demonstrated that compared to most fisheries Australia's abalone fisheries have relatively limited opportunities for increasing market prices and reducing costs. It was recognised that any opportunities for improving economic performance should be considered at a national level. The potential for GPS tracking systems to transform Australia's abalone fisheries and substantially reduce the costs of fishing and various elements of fisheries management was identified at a series of workshops held in Adelaide in 2013 and 2014. It was also recognised that modifying fishing seasons had the potential to improve productivity. A joint New Zealand and Australia research workshop for abalone in August 2014 identified that a research proposal to address these opportunities would be developed.

Conclusions

The implementation of changes to improve profitability was beyond the scope of the present study. However, this project contributed to the introduction of a system of tradeable fishing nights in the GSVPF and assisted the SGPF to undertake a process of reform that appears likely to transform the structure and economic performance of that fishery. Similarly, this project contributed to the establishment of the strong focus on profitability which is becoming increasingly evident in the management arrangements for Australia's fisheries for Southern Rock Lobster. The project has also assisted the Australian abalone industry to identify two opportunities for improving its economic performance (i.e. reducing costs through implementation of GPS technology and increasing productivity through optimising the timing of harvests). Importantly, the abalone industry has initiated two research projects to facilitate the implementation of these reforms.

RESEARCH SUMMARY

The project had three major elements:

1. Assess the economic performance of selected CRC fisheries.
2. Describe and evaluate the innovative systems that have been established to improve the economic performance of successful fisheries worldwide.
3. Identify practical opportunities for overcoming impediments to wealth creation and improving the performance of selected CRC fisheries.

Prawns

Spencer Gulf Prawn Fishery (SGPF)

Workshops to evaluate the economic performance of the SGPF were conducted in Adelaide and Port Lincoln in February 2012. These workshops were attended by representatives of 30 of the 39 licence holders in the SGPF, as well as the fishery manager, industry members and representatives from the Gulf St Vincent Prawn Fishery (GSVPF) and East Coast Otter Trawl Fishery (ECOTF).

The objectives of these workshops were to:

- Assess economic performance of the SGPF (using the method of Anderson and Anderson 2010);
- Assess economic status of the fishery;
- Introduce industry to options for improving the economic performance of the fishery (four case studies presented by selected guests); and
- Identify options that warranted further investigation with respect to their applicability for the SGPF.

These workshops identified the need for reform and identified several options that warranted consideration: buyback/amalgamations; incorporating economics into stock assessment strategies; decision rules to achieve/retain economic efficiency; and transferable systems (e.g. quota, gear/effort units and tradeable fishing nights).

The success of the workshop led the Spencer Gulf and West Coast Prawn Fishery Management Committee to establish an Economic Optimisation Working Group. A prioritised options paper was developed to support a workshop in Adelaide in August 2012. That paper was refined following the workshop and formed the basis of an economic optimisation paper that was submitted to Primary Industries and Regions South Australia (PIRSA) Fisheries and Aquaculture in late 2014 and will be used to develop a harvest strategy to improve the economic performance of the SGPF.

East Coast Otter Trawl Fishery (ECOTF)

Meetings were held in Brisbane on August 2011 and June 2012 with industry, managers, scientists and economists to plan the Queensland component of the project, apply the method of Anderson and Anderson (2010) and identify options for improving the economic performance of the ECOTF. Workshops held in Cairns, Townsville, Mooloolaba and Hervey Bay in July 2012 identified that: 1) the economic performance of the ECOTF was poor; 2) resolving similar issues in the Northern Prawn Fishery (NPF) had required large investments by both government and

industry; and3) that the SGPF had benefitted from having a strong industry association and working constructively with government. Problems identified for the fishery, included:

- Over-allocation of effort (latent + active);
- Lack of profitability;
- Efficiency constraints (input controls);
- Structure of the fishery;
- Lack of industry voice for trawl sector;
- Lack of investment in the industry (vessels and people);
- Marketing/prices.

It was agreed that the most pressing problem was overcapacity and that this would only be addressed by government and industry working together. Other issues will be difficult to address until that primary issue is resolved. The lack of an industry voice and complexity of the fishery (variety of species, seasons) were identified as key impediments to adopting a stronger co-management approach. It was recognised that a range of other weaknesses in the fishery should be addressed once the issue of over-capacity was resolved.

Rock Lobster

A workshop involving fishers, industry representatives, fisheries managers and scientists from South Australia (SA), Tasmania, Victoria and New Zealand (NZ) was held in Melbourne on 28-29 May, 2013. At this workshop, the management arrangements, status and economic performance of Australia's and New Zealand's fisheries for Southern Rock Lobster (SRL) were summarised and compared. The economic performance of Australia's largest SRL fishery, South Australia's Southern Zone Rock Lobster Fishery, was evaluated using the method of Anderson and Anderson (2010). Presentations were given on the success and limitations of strategies that have been implemented to optimise economic performance in the Western Rock Lobster Fishery (Western Australia), NZ CRA8 and CRA5 Fisheries. A presentation was given on the use of economic data and bio-economic models to evaluate and optimise harvest strategies for SRL. Extensive discussions were undertaken to identify practical options for improving the economic performance of Australia's fisheries for SRL.

The key finding of the evaluation of Australia's SRL fisheries was that the economic performance of these fisheries needed to be improved in all jurisdictions. Most of Australia's SRL fisheries are currently in a biomass rebuilding phase to improve biological, economic and/or social outcomes. It was recognised that most of the existing problems in Australia's SRL fisheries stem from a historical focus on maximising catches and a failure to adjust quickly enough to the low levels of recruitment that have occurred over the last decade. It was acknowledged that future management of Australia's SRL fisheries should focus explicitly on targeting socio-economic outcomes.

Evidence from the NZ SRL Fisheries (e.g. CRA8, CRA5) and Western Rock Lobster Fishery showed that profitability can be significantly improved by reducing exploitation rates to increase spawning biomass and reduce fishing costs (through increased catch rates). Formal harvest strategies based on exploitation rates of between 0.3 and 0.5 and that cap (or at least severely restrict) Total Allowable Commercial Catch (TACC) increases when the spawning biomass (or CPUE proxy) exceeds an agreed threshold have been very successful in increasing the profitability of SRL fisheries in NZ. Experience from WA showed that social outcomes and benefits to the community from fishing (e.g. through employment) can also be addressed by establishing TACCs that deliver high economic yields (profits) but which also provide relatively high Gross Values of Production (GVP).

It was recognised that bio-economic models are a powerful tool for evaluating the economic performance of different management options (e.g. size limits, exploitation rates). The model outputs confirmed that lowering exploitation rates and capping TACCs will deliver strong economic outcomes for Australia's SRL fisheries. Improved data for assessing the economic performance of SRL fisheries, notably beach and export prices and fishing costs, are needed in most jurisdictions (SA is the exception). The focus on profitability at the Lobster Congress in Sydney in 2013 was indicative of change in industry culture that occurred throughout the course of the project and which is being reflected in new management arrangements being established for these fisheries.

Abalone

A workshop held in Adelaide in September 2013 identified that there are important differences among jurisdictions in key elements of Australia's abalone fisheries that affect their economic performance. For example, in Tasmania many divers lease quota whereas in other jurisdictions licence holders employ divers directly. In addition, the costs of management are recovered from industry in South Australia whereas in Tasmania there is no direct link between the license fee and the management, research and compliance costs funded by government.

Southern Rock Lobster and Pipi were used to exemplify the benefits of developing a stronger focus on economic performance. The benefits of collecting economic data were also widely acknowledged. The analysis undertaken using the Anderson and Anderson method showed that, compared to most other fisheries, Australia's abalone fisheries have relatively limited opportunities for increasing prices and reducing costs. However, reducing the costs of fishing and/or management of abalone fisheries was identified as an opportunity that required consideration at a national level.

A workshop involving industry representatives, fisheries managers and scientists from NZ and all Australian jurisdictions that harvest abalone was conducted in Adelaide in May 2014 to: 1) assess opportunities for implementing a Global Positioning System (GPS) for tracking fishing activity and 2) evaluate the benefits of changing fishing seasons to increase productivity.

It was agreed that the GPS tracking systems developed in NZ and Tasmania have the potential to reduce the costs of harvesting abalone (e.g. through identifying areas that have been recently fished), collecting fisheries data, conducting stock assessments and undertaking compliance. It was also recognised that the opportunities/benefits of adopting this technology varied among jurisdictions. Discussions regarding the potential use of the GPS tracking system for compliance purposes were particularly robust. It was recognised that the economic benefits of implementing a GPS tracking system would be maximised if adoption was coordinated at a national level, but that differing requirements among jurisdictions complicated that approach. It was agreed that a research proposal should be developed to assess the full range of benefits that a GPS tracking system could deliver (including reducing compliance costs). The concept for this proposal was further developed at a joint Australia and NZ abalone research workshop Queenstown in August 2014.

The national workshop also acknowledged the potential for increasing productivity and profitability by optimising the timing of the harvesting season. A research proposal to assess cost/benefits of this approach will also be developed at the research workshop in New Zealand.

Progress Against Performance Indicators

KPI 1: EFFECTIVE LEADERSHIP AND CONSULTATION

Performance Indicator

i) Established Leadership Team(s) with relevant expertise in fisheries, business and law.

A wide range of experts provided leadership and direction for the project. Different teams with relevant expertise were developed for each fishery sector.

SGPF

Dr Eriko Hoshino (UTAS)
Ms Annie Jarret (Pro-Fish)
Mr Graham Stewart (Shark Bay Boat Owners Association)
Michael Harte (WWF)
Ms Danielle Adams (Clarence River Fishermen's Co-operative)
Dr Julian Morrison (Econsearch)
Dr Sevaly Sen (Profish Pty Ltd)
Dr Cameron Dixon (SARDI)

ECOTF

Dr Tony Courtney (QDAFF)
Dr Sean Pascoe (CSIRO)
Lisa Rippin (Econsearch)
Mr David Carter (NPF)
Mr Paul Watson (SGPF)

SRL

Mr Daryl Sykes (NZ Rock Lobster Industry)
Mr Malcolm Lawson (Southern NZ Rock Lobster Industry)
Dr Lisa Rippin (Econsearch)
Dr Nick Caputi (Fisheries WA)
Dr Rick McGarvey (SARDI)
Dr Caleb Gardner (UTAS)
Dr Adrian Linnane (SARDI)

Abalone

Dr Stacey Patterson (Econsearch)
Dr Ben Stobbart (SARDI)
Dr Greg Ferguson (SARDI)
Dr Jeremy Cooper (NZ)
Dr Craig Mundy (UTAS)

ii) Established Stakeholder Advisory Group for each participating sector.

SGPF

Mr Andrew Hogg (SGPF)
Mr Andrew Puglisi (SGPF)
Mr Neil McDonald (GSVPF)
Dr Craig Noell (PIRSA Fisheries and Aquaculture)

Mr Sean Sloan (PIRSA Fisheries and Aquaculture)

ECOTF

Mr Eric Perez (QSIA)
Mr Dave Stirling (ECOTF)
Mr Geoff Tilton (ECOTF)
Dr Eddie Jebreen (QDAFF)
Mr Darren Roy (QDAFF)

SRL

Mr Justin Phillips (SARDLAC)
Dr Annabel Jones (PIRSA Fisheries and Aquaculture)
Ms Hilary Revelle (DPIWE)

Abalone

Mr Grant Pullen (DPIWE)
Dr Lianos Triantifilos (PIRSA Fisheries and Aquaculture)
Mr Dean Lisson (ACA)
Mr Jonas Woolford (ACA)
Mr Kerry Rowe (ACA)
Joey McKibben (Tas industry)
Tom McGowan (NZ industry)

KPI 2: FINALISED AND DISSEMINATED ASSESSMENTS OF THE ECONOMIC PERFORMANCE OF FISHERIES IN EACH SECTOR (ONE CHAPTER FOR EACH SECTOR)

Performance Indicator
i) Completed desktop review and interviewed stakeholders in selected CRC fisheries
ii) Completed detailed description of each fishery
iii) Collected financial data on each fishery (for fisheries where data are not collected elsewhere)
iv) Assessed economic performance of each fishery using approach of Anderson and Anderson (2010)
v) Identified opportunities for increasing the profitability of CRC fisheries
vi) Conducted workshop with the Stakeholder Advisory Group for each sector

KPI 2 was a core element of this study. Details are provided in Appendices and the Research Summary.

KPI 3: FINALISED DESCRIPTIONS AND EVALUATIONS OF INNOVATIVE SOLUTIONS TO MAXIMISE WEALTH CREATION IN SUCCESSFUL FISHERIES WORLDWIDE, WITH ASSESSMENTS OF THE POTENTIAL SUITABILITY FOR CRC FISHERIES

Performance Indicator
i) Identified relevant fisheries worldwide with strong performance
ii) Conducted desktop reviews and interviews for each fishery
iii) Completed detailed descriptions of each fishery, focusing on issues affecting performance.
iv) Collected financial data on each fishery for fisheries where data are not otherwise available
iv) Assessed economic performance of each fishery using approach of Anderson and Anderson (2010)
v) Identified and described innovative solutions established to overcome impediments to wealth creation

vi) Conducted workshop with Leadership Team to refine assessments and identify options for improving the profitability of CRC fisheries.

KPI 3 was an element of this study. Details provided in Research Summary.

KPI 4: DESCRIBED A PATHWAY TO ADOPTION FOR FISHERIES WHERE SIGNIFICANT PRACTICAL OPPORTUNITIES EXIST TO IMPROVE ECONOMIC PERFORMANCE.

Performance Indicator
i) Developed and disseminated summaries of the assessments of strongly performing fisheries, focusing on aspects of their innovative approaches that could be adopted to improve the profitability of CRC fisheries
ii) Conducted workshops with each Stakeholder Advisory Group to identify the innovative operational procedures, business structures, and fisheries management systems that could be implemented in each fishery
iii) Estimated potential financial benefits of implementing these changes
iv) Identified and described the impediments to adopting these innovative approaches
v) Identify fisheries where practical opportunities exist to adopt innovative approaches to significantly improve economic performance
vi) Described the complex and inter-related changes to operational procedures, business structures and resource management systems that could be implemented to achieve major improvements in economic performance in selected fisheries

KPI 4 was a core element of this study. Description provided in the Research Summary.

KPI 5: PROPOSAL WRITTEN TO FACILITATE ADOPTION OPPORTUNITIES TO IMPROVE ECONOMIC PERFORMANCE.

Performance Indicator

It was agreed, that the proposal to initiate Phase 2 of this project will only be written if the Leadership and Stakeholder Advisory Groups consider and identify practical opportunities for establishing innovative approaches to significantly improve economic performance of one or more fisheries.

The SGPF has developed a draft economic optimisation paper that will be used to revise the management plan and harvest strategy. Harvest strategies for fisheries for Southern Rock Lobster are being revised to include a strong focus on economic performance. Research proposals to 1) assist implementation of GPS tracking systems and 2) optimise the seasonal timing of harvesting in Australia's abalone fisheries were developed at a joint New Zealand and Australia research workshop in Queenstown in August 2014.

ACKNOWLEDGEMENTS

The valuable contributions made to this project by economists, industry members/representatives scientists, fisheries managers and industry members/representatives are gratefully acknowledged.

Economic input was provided by Professor James Anderson (WorldBank), Dr Julian Morrison, Dr Lisa Rippon, Dr Stacey Patterson (Econsearch), A/Professor Caleb Gardner, Dr Eriko Hoshino (UTas), Dr Sean Pascoe (CSIRO) and Dr Sevaly Sen (Profish Pty Ltd).

Members/representatives of the fishing industry that provided insights into fisheries that have implemented changes to improve economic performance include: Ms Annie Jarret (Pro-Fish), Mr David Carter (NPF), Mr Graham Stewart (Shark Bay Boat Owners Association), Michael Harte (WWF), Ms Danielle Adams (Clarence River Fishermen's Co-operative), Mr Paul Watson (SGPF), Mr Daryl Sykes (NZ Rock Lobster Industry), Mr Malcolm Lawson (Southern NZ Rock Lobster Industry) and Dr Jeremy Cooper (NZ abalone Industry), Joey McKibben (Tasmanian abalone industry) and Tom McGowan (NZ abalone industry).

Industry members/representatives that provided advice on how to maximise benefits of project included Mr Simon Clarke, Mr Andrew Hogg, Mr Andrew Puglisi (SGPF), Mr Neil McDonald (GSVPF), Mr Eric Perez (QSIA), Mr Dave Stirling, Mr Geoff Tilton (ECOTF), Mr Justin Phillips (SARLAC), Mr Dean Lisson, Mr Jonas Woolford and Mr Kerry Rowe (ACA).

Participating fisheries scientists include Dr Cameron Dixon (SARDI), Dr Tony Courtney (QDAFF), Dr Adrain Linnane (SARDI), Dr Steve Mayfield (SARDI), Dr Ben Stobbart (SARDI), Dr Nick Caputi (Fisheries WA), Dr Rick McGarvey (SARDI), A/Prof Caleb Gardner (UTAS), Dr Ben Stobart (SARDI), Dr Greg Ferguson (SARDI) and Dr Craig Mundy (UTAS).

Fisheries managers that contributed to the project included: Mr Sean Sloan, Dr Craig Noell, Dr Annabel Jones, Dr Lianos Triantifilos (PIRSA Fisheries and Aquaculture), Dr Eddie Jebreen, Mr Darren Roy (QDAFF), Ms Hilary Revelle and Mr Grant Pullen (DPIWE).

The efforts of Dr Cameron Dixon (SARDI), Mr Simon Clarke (SGPF), Dr Eddie Jebreen (QDAFF), Dr Adrian Linnane (SARDI), Dr Stephen Mayfield (SARDI), Dr Ben Stobbart (SARDI), Ms Shirley Sorokin (SARDI) Mr Dean Lisson (ACA) and Mr Jonas Wolford (ACA) in conducting workshops was greatly appreciated.

1. Introduction and Background

Overall, Australia has a good track record of managing commercial fisheries sustainably (e.g. Flood et al. 2012). This is because fisheries management has focused almost exclusively on biological sustainability and extensive resources have been expended to ensure that this critical outcome has been achieved. Several elements of fisheries management that have been widely identified as contributing significantly to ensuring sustainability, but which are not fully established in many other countries, are widely established in Australian fisheries. For example, limited entry has been an accepted principle for many years; access rights in the form of Total Allowable Catches (TACs) and Individual Transferable Quotas (ITQs) are widely established; co-management has been practiced for decades, albeit in a variety of forms; robust stock assessments are done regularly in most major fisheries, increasingly under transparent cost-recovery (user pays) arrangements; and the use of explicit harvest strategies (harvest control rules) is becoming widespread.

While extensive efforts have been made to ensure that Australia's fisheries are biologically sustainable, relatively limited public resources have been allocated to ensuring that the economic and social benefits that fisheries deliver to Australian communities are maximised. This is mainly because, to date, the economic aspects of fishing have been widely considered to be issues for which industry has sole responsibility. However, as commercial fisheries are based on the utilisation of community resources, and there is evidence to suggest that economic and social benefits to the Australian community are not always maximised, there is a view that government should take a role in assisting fishing industries to identify and achieve their economic and social objectives. This approach may provide economic gains to individual license holders as well as the community.

Few Australian fisheries have explicitly articulated their key economic and social objectives or priorities. As commercial fisheries essentially exist to make money, it is reasonable to assume that maximising profitability would be a high priority for most fisheries. However, while individual businesses no doubt strive for this outcome (with mixed success), structural aspects of many Australian fisheries prevent profits from being maximised at a whole of fishery scale. In some cases, economically inefficient structures are deliberately maintained to achieve either biological sustainability outcomes or, whether explicitly acknowledged or not, to deliver economic and social benefits to regional communities where there are few other viable industries.

Structural factors that impede the maximisation of profitability in many Australian fisheries include:

1) Intrinsically high infrastructure (vessels and processing facilities) and operating costs (maintenance, fuel, labour);
2) Over-capitalisation, especially in fishing vessels;
3) Input controls established to ensure sustainability that act by limiting operational efficiency, thus increasing the costs of production;
4) Business structures that dissipate earnings by promoting individualism and competition among fishers (hunter-gatherer approach) rather than collaboration to minimise costs and maximise prices (business approach);
5) High fisheries management costs, especially for research and compliance;
6) Inertia and resistance to changing the status quo.

Recent reductions in profitability resulting from increases in the costs of fisheries production (all sectors), decreases in catches (e.g. lobsters) and falling prices of some fisheries products (e.g. prawns and abalone) mean that it is now imperative to identify operational procedures, business structures and fisheries management systems that address these structural inefficiencies. A

recent FRDC study suggests that the economic performance gap for Australia's marine capture fisheries is in the order of 36-46% (Ridge Partners 2009). There is a clear need for stakeholders to explicitly identify the economic, social and ecological objectives for their fisheries and establish operational procedures, business structures and fisheries management systems that will ensure that these objectives are achieved.

This study brought together a team of fisheries experts to identify opportunities for improving the economic performance of fisheries in the Australian Seafood CRC. The team measured the economic performance of each CRC fishery and assessed the effectiveness of factors that enable wealth creation using the wealth-based fishery performance indicators developed by Anderson and Anderson (2010). We then identified innovative operational procedures, business structures and management systems that have been established to overcome impediments to wealth creation in fisheries worldwide and that are successfully generating wealth for their participants. This information was used to identify operational procedures, business structures and management/legislative systems that could be established to improve the economic performance of each participating fishery.

This project is linked to the suite of decision support tool or bioeconomic projects within the Future Harvest Theme of the Australian Seafood CRC. The decision support tools projects are focusing on decisions in the management system – i.e. the government controls. Those projects deal with government rules and stop at the point of how fishing businesses are conducted. This project moves into the area of business operations and looks at their operating environment to identify inefficiencies and develop improvements. To illustrate with examples – one application of the decision support tools projects is to determine profit maximising TACs (amongst other rules affecting harvests). Businesses operating within this rule face issues such as inefficient use of capital where there is competition for space and individual fish, lack of information on markets and patterns in catch rates, and limited ability to control expenditure on enforcement, management and marketing. If the entire fishery was operated as a single business would harvesting patterns change to improve performance? And if so, how can fisheries capture these improvements within our current system of multiple owners? Conversely, changes in the business environment may require changes to the management system. For example, in a fishery managed solely by input controls (e.g. vessel size, gear restrictions, effort limitations) the optimisation of the business structure may require major changes to the management system. This project will also identify management changes that may be required to facilitate improvements in the business structure.

1.1 Need

The main causes of declines in fishery performance are decreases in real prices (prawns, abalone), large increases in costs (all sectors) and, in a few cases, significant reductions in stock size and productivity (rock lobster).

In many fisheries, major improvements in economic performance will only be achieved through major and integrated changes in operational procedures, business structures and resource management systems.

Inertia and active resistance to change, within both government and industry, currently impede the implementation of the cultural shift that is required to revive ecologically-sustainable, but financially-challenged fisheries.

Major, integrated changes and cultural shifts require a clearly articulated vision for the future.

Convincing vision statements require evidence.

This project will provide the information that is needed for industry and government to develop the joint vision statements that are required to chart a clear pathway to a more profitable future for each selected fishery.

Critical information to underpin each vision statement that this project will provide includes:

1. Objective assessments of the key factors limiting fishery performance;
2. Comprehensive evaluations of the options for increasing profitability;
3. Clear advice about the complex and inter-related changes to operational procedures, business structures and resource management systems that are required achieve major improvements in fishery performance;
4. A clear pathway to adoption that recognises the inertia and resistance to change within government and industry that must be overcome for these major and integrated changes to be implemented.

1.2. Objectives

1. Assess the performance and identify impediments to wealth creation in selected CRC fisheries.
2. Describe and evaluate innovative systems that have been established to improve the performance of successful fisheries worldwide.
3. Identify practical opportunities for overcoming impediments to wealth creation and improving the performance of selected CRC fisheries.

2. Methods

Consultation and Development of Project

A Future Harvest Workshop in Melbourne in July 2008 identified the need for projects to:

(i) identify operational procedures, business structures and fisheries management systems to enhance productivity and profitability;
(ii) incorporate consideration of social objectives into fisheries management frameworks;
(iii) facilitate changes in operational procedures, business structures and fisheries management for key fisheries.

A preliminary proposal that addressed these needs was developed following a Workshop in Adelaide in December 2008. That preliminary proposal was submitted to the CRC Board in early 2009 and the concept was approved.

Following discussions with Drs Patrick Hone, Caleb Gardner and Graham Mair, it was agreed that a phased approach would be adopted for this project.

Phase 1 (current report), will identify options for improving the economic performance of selected CRC fisheries.

Phase 2 (following successful completion of Phase 1), will facilitate change in fisheries where significant practical opportunities exist to improve performance.

Workshops were conducted in Adelaide and Hobart in May 2010 to receive input from stakeholders and explain Professor Jim Anderson's system of wealth-based performance indicators. These workshops were attended by members and representatives of the rock lobster, prawn and abalone fisheries and relevant fisheries managers and scientists.

The proposal was submitted to the CRC Research Advisory Committee (RAC) for informal consideration at the meeting on 8 June 2010. Comments from the RAC were incorporated into the proposal. Drafts of the revised proposal were presented to representatives of the SA prawn, lobster and abalone industry associations. In 2010, the proposal was presented to key fisheries groups in the CRC (Australian Council of Prawn Fisheries, Abalone Council of Australia, Australian Southern Rock Lobster Industry) for comment and endorsement. All three provided in principle support for the project.

The project had three major elements:

1. Assess the economic performance of selected CRC fisheries.
    a) Conduct desktop review and interview industry members, fisheries managers and scientists involved in each fishery.
    b) Using agreed template, describe key elements of each fishery, especially those relevant to their economic performance.
    c) Collect financial data on each fishery using an approach that builds on the method applied by Econsearch in SA over the last decade (for fisheries where data are not being collected elsewhere).
    d) Measure economic performance and identify impediments to wealth creation for each fishery using the performance indicators developed by Anderson and Anderson (2010).
    e) Identify the best opportunities for improving the profitability of each fishery, e.g. high operational or management costs and/or poor processing, marketing and pricing.
    f) Conduct workshop with each Stakeholder Advisory Group to assist in finalisation of each assessment.
    g) Finalise and disseminate assessments of the performance of the fisheries in each sector.

2. Describe and evaluate the innovative systems that have been established to improve the economic performance of successful fisheries worldwide.
    a) Identify several fisheries worldwide (including dive, trap and trawl examples) with strong economic performance.
    b) Conduct desktop review and, where necessary, interview industry members, fisheries managers and scientists involved in each fishery.
    c) Provide detailed descriptions of each fishery using an agreed template and focusing on issues affecting economic performance.
    d) Assess each fishery using the performance indicators of Anderson and Anderson (2010).
    e) Identify the innovative solutions (i.e. business structures, operational procedures and fisheries management systems) that have been established to overcome impediments to wealth creation in economically successful fisheries worldwide, including assessments of:
        i) why innovative changes were needed;
        ii) how changes were implemented and the main impediments to change;
        iii) the main advantages of new arrangements (e.g. how do they increase efficiency, reduce costs and enhance marketing);

iv) what are the problems;
iv) how were equity and responsibility transferred (e.g. what was done with extra vessels, if any);
(v) what is the governance system;
(vi) what legislative issues needed to be addressed and what legal instruments were established;
(vii) how was the fisheries management system refined to support the new business structures and enhance marketing.

f) Conduct workshop to refine assessments and identify options for improving the profitability of CRC fisheries.

g) Finalise assessments of the economic performance of these fisheries, including detailed descriptions of the innovative solutions established to overcome impediments to wealth creation and the potential suitability of CRC fisheries (three chapters for final report)

3. Identify practical opportunities for overcoming impediments to wealth creation and improving the performance of selected fisheries.

a) Disseminate a summary of the assessments of strongly performing fisheries, focusing on innovative aspects of their approaches that could be adopted to improve the performance of selected fisheries.

b) Conduct workshops with each Stakeholder Advisory Group to identify innovative business structures, operational procedures and/or fisheries management systems that could potentially be established in each fishery.

c) Identify the impediments to adopting these innovative approaches in each selected fishery.

d) Identify fisheries where practical opportunities exist to adopt innovative approaches to significantly improve performance.

e) Summarise the changes in the fisheries management systems, business structures and operational procedures that could be realistically adopted to improve the performance of each fishery.

f) Describe a pathway to adoption for fisheries where significant opportunities exist to improve their performance.

g) Write a proposal to facilitate the adoption of these opportunities improve performance (if considered appropriate).

Fishery Performance Indicators (Anderson and Anderson 2010)

The wealth-based Fishery Performance Indicators (FPIs) evaluate and compare fisheries management systems. A *wealth-based fishery management system is one that is ecologically sustainable, socially acceptable and generates sustainable resource rents or profits* (Anderson and Anderson 2010). There are two types of FPIs. The first consist of *outputs* which measure factors that reflect success or failure in the creation of potential wealth from fisheries. The second consists of *input* factors that enable or contribute to the process of developing wealth-creating fisheries.

The individual measures are coded in levels from 1 to 5 (high being good) and are easy to collect and score across a wide range of fisheries. They rely on a basic set of data that is widely available (e.g., volumes and prices) and on expert assessment of qualitative indicator levels. No primary data collection is required. Inputs and outputs are grouped into broad categories that are broken into specific dimensions of wealth outputs or inputs. There are 68 measures of fishery performance (outputs) in terms ecological, economic and community sustainability.

There are 54 measures of exogenous factors (inputs) that enable fisheries to perform effectively in terms of wealth creation.

Each of the fisheries considered in this project was assessed using this framework. These evaluations were undertaken by the principal investigator on the project and the key scientist(s) and/or manager(s) for each fishery.

3. Results and Discussion

3.1. Prawns

The Australian Council of Prawn Fisheries (ACPF) suggested that the study should focus on three fisheries: Spencer Gulf Prawn Fishery (SGPF); Gulf St Vincent Prawn Fishery (GSVPF); and East Coast Trawl Fishery (ECOTF). PIRSA Fisheries and Aquaculture requested that the GSVP not be considered explicitly in this study. This request was made because of the pressing need to develop tactical responses to short term management issues in the GSVPF, whereas the CRC project was designed to address strategic opportunities.

3.1.1. Spencer Gulf Prawn Fishery

Representatives of the SGPF advocated their support for this study to the ACPF. The process that was established to support the SGPF to enhance its economic performance was developed at a series of meetings with the SGPF Management Committee and Research Sub-Committee in Adelaide and Port Lincoln in late 2011. Participants in these meetings included industry members (e.g. Andrew Hogg, Andrew Puglisi) and representatives (Simon Clarke, Executive Officer, SGPF), fisheries managers (Sean Sloan, Alice Fistr, Craig Noell, PIRSA Fisheries and Aquaculture), and a fisheries scientist (Dr Cameron Dixon, SARDI) to plan the approach for each fishery. This included presenting the project plan at meetings of the Research Sub-Committee and Management Committee of the SGPF.

Workshops were held in Adelaide and Port Lincoln in February 2012 to:

i) assess economic performance of the SGPF (using Anderson and Anderson model);
ii) assess economic status of the fishery;
iii) introduce industry to options for improving the economic performance of the fishery (four case studies); and
iv) identify options that warranted further investigation with respect to their suitability to the SGPF.

These workshops were attended by 30 of the 39 licence holders in the SGPF, as well as the fishery manager and industry members and representatives from the GSVPF and ECOTF (Appendix 1.1).

The review of the SGPF presented by Dr Cameron Dixon highlighted the success of the co-management approach in maintaining biological sustainability, with an average annual catch of almost 2000 t over the last decade, but noted that the GVP had declined from a high of ~$45M in 200/01 to less than $28M in 2009/10 (Appendix 1.2).

The analysis using the Anderson and Anderson (2010) presented model by A/Prof Tim Ward also suggested that the economic performance of the SGPF was relatively poor. Harvest and

asset performance were low due to inefficiencies resulting from the fishery's strong reliance on input controls (e.g. short season) and absence of framework for consolidating effort/catches to reduce costs. The analysis also identified weaknesses in the marketing system (Appendix 1.3).

The economic analysis of the SGPF by Dr Eriko Hoshino suggested that boat business profit had declined due to a combination of falling prices, caused by the high Australian dollar and increased completion from imported aquaculture prawns, and increasing costs (mainly fuel). The high value of the economic data-set provided by Ecosearch was emphasised. It was suggested that there was a need to explore alternative management options that would improve the profitability of individual operators (Appendix 1.4).

The presentation by Ms Annie Jarret highlighted the benefits of establishing individual transferable fishing rights, including: increasing access security; providing operational flexibility; balancing biological and economical sustainability; supporting cost effective management; and allowing equitable adjustments in fishing mortality. The Northern Prawn Fishery was used as a case study. The long and complex series of buy-back schemes and the introduction and evolution of tradeable effort units was described. A potential move to ITQs was flagged [and has since eventuated). The strengths and weaknesses of different transferable systems were evaluated. It was recognised that there was no perfect system and that implementation was time consuming and difficult, but worth the effort (Appendix 1.5).

Mr Graeme Stewart gave a presentation on the evolution of the prawn fisheries in Shark Bay and Exmouth Gulf. In Shark Bay, loans from the Western Australian Government were used to fund two fisheries adjustment schemes that reduced the fleet from 35 to 18 vessels with only seven owners (only 3-4 active). The operators now work collaboratively to reduce costs (e.g. buy nets in bulk). The fishery targets maximum economic yield. In Exmouth Gulf, the fishery has been taken a further step, with the fleet now owned by a single entity company (*MG Kailis*). The operational efficiencies that this structure provides were strongly emphasised (Appendix 1.6).

The Challenger Scallop Enhancement Company in New Zealand was presented as a case study of the benefits of self-governance and strong fisheries rights (Mr Michael Harte). The company was created in 1992 to establish a structure for collective capital investment. Fishers work together as co-owners, make economically efficient decisions, pay management costs, conduct research and select science providers. A Memorandum of Understanding with the NZ Ministry of Fisheries specifies the responsibility of the company. Management arrangements established in this fishery were the catalyst for changes to NZ's fisheries legislation that provided increased opportunities for devolution of management responsibilities. It was recognised that the biological sustainability and co-management performance of the SGPF provided a sound basis for greater delegation of management responsibilities. It was also suggested that the SGPF could explore the potential benefits and costs of the fishery functioning as a sole operator through collective management of harvest operations and value chain activities, as well as routine management and research activities (Appendix 1.7).

Ms Debbie Adams described the approach and benefits of the marketing and promotion activities undertaken in the Clarence River Fishermen's Co-operative. It was highlighted that many of the problems faced – e.g. declining catches, increasing costs and stagnant prices – were similar to those faced by the SGPF. Business lost ~$1.1M in 2010/11. The focus of the company was changed to emphasise the development of marketing skills, a focus on value-adding, rebranding of the product (*Yamba Prawns*) and building relationships with large buyers. Results have been positive and the focus is still being refined - away from increasing sales and revenue and towards improving profit margins. The company is also trying to establish a good mix of local, export and value-adding opportunities (Appendix 1.8).

Simon Clarke and Cameron Dixon summarised the options for improving the performance of the SGPF that were identified and discussed (Appendix 1.9). The key issues were:

- Prices too low and costs too high;
- Too many restrictions;
- Too inefficient;
- Too many boats to be profitable;
- How to get boats off the water?
- Government buy-back unlikely

Options identified

- Consider options for an industry buy-out
- Challenger Scallop (single company) model may be too big a step right now
- Investigate buyback options/amalgamations
- Incorporate economics into stock assessments and harvest strategies
- Decision rules to achieve/retain economic efficiency
- Need to work out optimal catch per boat and most efficient way to fish the gulf
- Reductions need to be large and fast
- Need to introduce transferable systems (e.g. quota, gear/effort units, tradeable nights)
- Industry buyout warrants consideration
- Need to also consider marketing
- Levy system for marketing an option
- Marketing is always important, but options for buyback or transferability need to be further explored

Conclusions

- Broad recognition of need to establish transferable system (e.g. quota, gear/effort units, tradable nights) and need to consider all options
- Need an options paper

SGPF Response

The outcomes of the initial workshops were discussed extensively by the SGPF Management Committee. The Committee assessed both meetings to be successful. To harness the momentum generated by the workshops a SGPF Economic Optimisation Working Group was established to identify practical options for improving the economic performance of the fishery.

Workshop to prioritise options

The agenda for the workshop to prioritise options for improving the economic performance of the SGPF is provided in Appendix 1.10. The SGPF briefing paper for the meeting is presented in Appendix 1.11. The meeting was attended by a broad spectrum of industry members, fisheries managers, fisheries scientists and two economists with relevant expertise and experience. Dr Julian Morrison presented an economic assessment of the SGPF that confirmed profitability has been declining due to decreases in prices and increases in costs (Appendix 1.12). Dr Morrison also presented outputs of an economic model that will be available for assessing the benefits of various management options (Appendix 1.13). The draft outcomes of the workshop are provided in Appendix 1.14.

In short, the outcomes were: 1) that an options paper would be developed that would focus on two future management options – transferable quota and gear units; and 2) to establish a

process with timelines to work with government to establish new management arrangements to improve the economic performance of the SGPF.

A draft economic optimisation paper was developed and is being considered by industry and government. The final document will contribute to revision of the management plan for the SGPF and the refinement of the harvest strategy to include economic performance indicators. The refined harvest strategy currently being developed for the SGPF is also likely to include a system of tradeable units. A bio-economic model for the SGPF that was established in related Australian Seafood CRC Project No. 2011/750 and a study of larval dispersal and recruitment funded by FRDC (Project No. 2008/011) will also assist in the refinement of the harvest strategy.

3.1.2. Benefits to Gulf St Vincent Prawn Fishery

When this project began it was envisaged that GSVPF would also be used as a case study. However, at the request of PIRSA Fisheries and Aquaculture and representatives of the industry it was decided the project would focus on the SGPF. This decision was made because of the pressing need to develop tactical responses to short term management issues in the GSVPF, whereas the CRC project was designed to address strategic opportunities. Because of the broad similarity of the management systems in the two fisheries (input controls) the content of these meetings and workshops were directly relevant to the GSVPF. GSVPF industry members and representatives attended several meetings and workshops for the SGPF.

As part of the project, the PI has attended various meetings to refine the harvest strategy and develop a new management plan for the GSVPF. For over 50 years, the GSVPF has been managed without the capacity to transfer effort among licenses. The involvement of industry in the SGPF meetings and workshops helped industry to understand the benefits of transferability. This project contributed to introduction of a system of tradable nights into the GSVPF in 2011/12. The harvest strategy for the GSVPF is currently being reviewed.

3.1.3. East Coast Otter Trawl Fishery

Meetings were held in Brisbane on 23 August 2011 with industry members and representatives (Mr Eric Perez, Mr Dave Stirling), fisheries managers (Dr Eddie Jebreen, Mr Darren Roy QDPI), fisheries scientist (Dr Tony Courtney, QDPI) and fisheries economist (Dr Sean Pascoe, CSIRO) to plan the approach to be taken in the project and identify options for improving the economic performance of the ECOTF.

A follow-up meeting was held in Brisbane on 13 June 2012 with industry members and representatives (Mr Geoff Tilton, Mr Dave Stirling). fisheries managers (Dr Eddie Jebreen, Darren Roy QDPI), fisheries scientist (Dr Tony Courtney, QDPI) and fisheries economist (Dr Sean Pascoe, CSIRO). This meeting used the expertise of those present to apply the Anderson model to the ECOTF and developed a plan for workshops along Queensland's east coast.

The agendas of workshops held in Cairns, Townsville, Mooloolaba and Hervey Bay in July 2012 are provided in Appendices 1.16 and 1.17. The workshops provided: an overview of the workshop objectives (Appendices 1.18, 1.19); an assessment of the economic performance of the SGPF using the Anderson and Anderson (2010) model (Appendix 1.20), a simple economic

analysis of the fishery (Appendix 1.21) and presentations of experiences in the Northern Prawn Fishery (Appendix 1.22) and SGPF (Appendix 1.23).

These presentations showed that: 1) the economic performance of the ECOTF was poor; 2) resolving similar issues in the NPF had required large investments by both government and industry; 3) and that the SGPF had benefitted from having a strong industry association and working constructively with government.

The workshops in Cairns and Townsville were poorly attended (~8 industry members/representatives) despite being scheduled to avoid key fishing periods and considerable efforts by QDPI staff to encourage fishers to attend. The workshop at Mooloolaba was well attended but discussions were not particularly constructive. In contrast, the workshop in Hervey Bay (Urangan) was very productive and identified some practical opportunities for improving the economic performance of the fishery (Appendix 1.24). A synthesis of the discussions at the four workshops is provided in Appendix 1.25.

In short, it was acknowledged that there were significant problems in the fishery, including:

- Over-allocation of effort (latent + active)
- Lack of profitability
- Efficiency constraints (input controls)
- Structure of the fishery
- Lack of industry voice for trawl fishery
- Lack of investment in the industry (vessels and people)
- Marketing/prices

It was agreed that the most pressing problem was overcapacity and that this would only be addressed by government and industry working together. The lack of an industry voice and complexity of the fishery were identified as key impediments to adopting a stronger co-management approach. It was recognised that a range of other weaknesses in the fishery should be addressed once the issue of over-capacity was resolved.

3.2. Rock Lobster

A workshop involving fishers, industry representatives, fisheries managers and scientists from SA, Tasmania, Victoria and NZ was held in Melbourne on 28-29 May 2013 (Appendix 2.1). At this workshop, the management arrangements and status of Australia's and NZ's SRL fisheries were summarised and compared (Appendix 2.1). The economic performance of Australia's largest SRL fishery, the SA Southern Zone Rock Lobster Fishery SZRLF), was evaluated using the Anderson and Anderson (2010) method (Appendix 2.2). The economic performance of Australia's fisheries for SRL were compared (Appendix 2.3) Presentations were given on the success and limitations of strategies that have been implemented to optimise economic performance in the Western Rock Lobster Fishery (Appendix 2.4), NZ CRA8 (Appendix 2.5) and CRA5 (Appendix 2.8) Fisheries. A presentation was given on the use of economic data and bio-economic models to evaluate and optimise harvest strategies for SRL (Appendix 2.7). Extensive discussions were undertaken to identify practical options for improving the economic performance of Australia's fisheries for SRL.

The comparison of the management arrangements and status of SRL fisheries identified some interesting contrasts. Most significantly, the status of New Zealand fisheries was considered to be good to excellent, but Australian fisheries were generally rebuilding to address over-fishing

or sustainably fished with rebuilding strategies in place to improve to economic and social outcomes. Importantly, there were fewer regulatory restrictions (pot limits, closed seasons) in the NZ than the Australian fisheries.

The evaluation of the SA SZRLF using the Anderson and Anderson method also identified that harvesting flexibility (seasons, gear) was limited, excess capacity was high and economic performance (return on investment) could be improved. The analysis also suggested that the landings pricing system in the fishery was not transparent and that vertical integration was low. These findings were considered be reflective of the situation in Australia's other SRL fisheries.

The economic evaluation of the fisheries showed that the quality of economic data and level of economic performance varied among jurisdictions. A long time series of detailed economic data was only available for SA. Over the last decade, the SA SZRLF had performed adequately from an economic perspective (consistently positive but with relatively low return on investment) whereas the SA NZRLF had performed quite poorly (negative return on investment over much of last decade) but has recently improved. Boat business profit was negative in the Victorian and Tasmanian fisheries in years for which data were presented (2008/09 and 2010/11, respectively). In contrast, data presented for CRA5 confirmed that this NZ fishery was performing well from an economic perspective. Similarly, the Western Rock Lobster Fishery was shown to be generating high profits despite recent reductions in recruitment. Overall, the economic performance of Australia's SRL fisheries has been relatively poor over the last decade and needs to be improved in all jurisdictions.

The Western Rock Lobster Fishery is Australia's most valuable fishery and is MSC certified (Appendix 2.5). A decline in recruitment (puerulus settlement) required large reductions in fishing effort and led to a switch to quota-based management. An assessment was undertaken to estimate Maximum Economic Yield (MEY) using predicted future recruitment (i.e. not average historical recruitment) to estimate future profits at various effort levels. Maximum profit was generated at 30-50% of 2007/08 effort level. Structural adjustment was autonomous (i.e. no government funding was provided) – fishers made commercial decisions to buy/sell/lease quota. There were significant social costs including reduced employment. Profit was increased by >60% due to the reduction in costs resulting from high catch rates when effort was reduced. TACCs set at the upper level of the optimal MEY range were identified to deliver the best returns to community through a relatively high GVP. The TACC for 2014/15 will be set to achieve socio-economic targets and will be linked to a reduction in input controls. It was noted that a larger breeding stock also provides additional resilience to variations in future recruitment.

CRA8 is the largest and most productive lobster fishery in New Zealand. It is quota managed and operates under formal decision rules or operational management procedures (Appendix 2.6). Decision rules based on a conservative exploitation rate and a TACC cap when CPUE reaches 2.0 kg per pot lift (i.e. no or limited increases in TACC) have led to rebuilding of the biomass, increased catch rates and reduced fishing costs. The presentation concluded that "*it is not all about quantity – increased abundance provides the opportunity to maximise financial returns through providing what the market wants and when*". Specific benefits include: increased returns through targeting optimal sizes, fishing areas and seasons; reduced costs through high CPUE; increased confidence and business planning; greater reinvestment and high breeding biomass providing stock resilience.

CRA5 has also targeted high stock abundance to improve catch rates, lower costs and improve profitability (Appendix 2.7). The mechanisms by which this change has been achieved and the overall benefits are consistent with those identified for CRA8. However, concerns were expressed about the reallocation of forgone commercial catches to the recreational sector or to conservation through establishment of marine parks. Both forms of reallocation have occurred in

CRA5. This case study provides evidence of the need for governments to establish legislative frameworks to address reallocation among sectors, especially when commercial fishers reduce catches to obtain socio-economic outcomes.

Results of CRC Project No. 2009/714 that developed a bio-economic modelling tool for SRL were presented at the workshop (Appendix 2.8). The model evaluated the effects of different harvest strategies on average fisher profit. The study showed that lowering exploitation rates had the strongest effect on profit, through lowering of fishing costs due to increased catch rates at higher biomasses.

The take home messages from the workshop were clear. The economic performance of Australia's SRL fisheries could be improved by establishing formal harvest strategies that reduce exploitation rates with the aim of increasing spawning biomass, reducing fishing costs and increasing profitability. These harvest strategies should also consider social outcomes and GVP provides a good measure of economic benefits to the community. There are clear benefits in collecting economic data for use in models to evaluate the economic benefits of various management options (e.g. size limits, exploitation rates). These tools should be used in the formulation of future harvest strategies for Australia's SRL fisheries.

The success of the workshop was evidenced by invitations for Tim Ward and Rick McGarvey to deliver keynote presentations at the Rock Lobster Congress 2013 which summarised outcomes of the Melbourne workshop and presented the results of bio-economic modelling study (Appendices 2.9 and 2.10). The findings of the project were extended to industry through presentations and discussions at future meetings regarding the management of Australia's SRL fisheries.

3.3. Abalone

3.3.1. Workshop 1

The first abalone workshop was held at the Chifley Hotel, Adelaide (25 September) and SARDI Aquatic Sciences, West Beach, Adelaide (26 September).

This workshop began with an introduction by Tim Ward which outlined the objectives and agenda (Appendix 3.1).

Grant Pullen (Appendix 3.2) gave a general overview of the similarities and differences among Australia's abalone fisheries. He highlighted that Australian fisheries contribute ~25% of global production and noted the large size of the Tasmanian fishery (~56% of Australian production). Grant also highlighted the stability of the Australian fisheries and the important role the legal framework has played in maintaining the fisheries (access rights, management plans, policy and harvest strategies).

Tim Ward (Appendix 3.3) gave a presentation on the economic performance of two blacklip abalone fisheries (SA Western Zone, Tasmania) based on the methods of Anderson and Anderson (2010). Most importantly the outcomes suggested that opportunities for increasing prices and reducing costs in abalone fisheries are limited compared to those in other fisheries.

Reducing the costs of fishing was identified as one of the areas of economic performance that could be improved.

Stacey Patterson (Appendix 3.4) gave an overview of the economics of abalone fisheries and the outcomes of recent research conducted in Tasmania. Stacey noted that the value of abalone fisheries in Australia has decreased over time, and that the real price has almost halved since 2000. Management costs in South Australia have increased from 4% to 8% from 2000 to 2012. Noting the Tasmanian experience, the difficulty in obtaining good quality economic data was highlighted. It was suggested that further exploration of the use of economic data in harvest strategies should start with South Australia where Econsearch has a long term and reliable dataset.

Discussions following the presentations focused on the complexity of abalone fisheries due to the interplay between license holders, divers and processors. It was acknowledged that in order to optimise performance there would be a need for a high level of vertical integration which should include processors and an understanding of the Chinese market. The complication of including social and economic information in harvest strategies was also discussed, emphasising the difficulties in obtaining reliable information and the importance of lifestyle to many members of the abalone industry, which may not always be in line with economic optimisation (e.g. love of fishing important to many divers, happiness index more important than economics). There was agreement that reducing the cost of fishing was one of the main areas in which the fishery could improve performance.

The second day started with a presentation by Jeremy Cooper (Appendix 3.5) on the New Zealand experience with GPS tracking of divers and the subsequent data management system that has been developed for the Paua fishery. The system provides the potential for divers to target fishing in areas that have not yet been fished during the current season and provides a unique opportunity to increase the efficiency of fishing. Importantly the cost of the system is relatively low, it is highly automated and provides the option for gathered information to be split between users depending on access rights (e.g. it can be filtered between licence holders, compliance, managers and scientists). A benefit of the system was also the ability to automatically incorporate shell measurements made onboard into the database and lodge Catch and Disposal Record (CDR) forms. The presentation was well received and the potential of the system to provide benefits to industry was highlighted. In particular the benefits identified included more efficient fishing and a potential reduction in compliance and data management costs.

Ben Stobart (Appendix 3.6) gave a presentation on the benefits that changing the timing of the fishing season could provide to industry. Greenlip abalone weigh more and bleed less if caught in autumn. Thus, the same quota (weight) can be taken while leaving more abalone in the water, or the same number of abalone can be taken with an increased quota. This approach was recognised as one way to improve the performance of the greenlip abalone fishery, although the support of processors and the complexities of marketing abalone caught in autumn need to be addressed.

Greg Ferguson (Appendix 3.7) described the pipi (cockle) fishery in South Australia, which is one of the few examples where economic information is incorporated explicitly into a harvest strategy. This is a good example of a fishery in which volume is not equivalent to profit; GVP has increased despite reductions in catch. In 2012, fishers had the option to increase the TACC but did not adopt it as there was no evidence profit would be increased. Research into 1) modified atmosphere packaging to extend product shelf life has also helped this fishery and 2) targeting size classes to match market requirements have also improved the economic performance of the fishery.

Finally, Rick McGarvey gave a case-study presentation on the economics of the rock lobster fishery, highlighting the importance of data in management decision making and the complexities involved in incorporating costs. Within this fishery, increases in profit can be realised by reducing exploitation rates and promoting increases in abundance which result in higher catch rates (reducing costs).

The last session of the workshop was dedicated to open discussion around the messages delivered during the presentations and options for improving the economic performance of abalone fisheries. Amongst other things, the discussion focused on:

- How the aquaculture industry has influenced the dynamics of the wild caught abalone fishery, reducing price and changing the way wild abalone is marketed;
- The difficulties and costs involved in collecting reliable economic information and the value of the information already available for SA;
- The significant potential to improve the economic performance of abalone fisheries by adopting the automated GPS logging systems;
- The potential to improve fishing efficiency using biological information and the need for further data on the seasonal biology of blacklip abalone.

3.3.2. Primary outcomes from initial workshop

The three primary outcomes from the workshop were: (1) development of a proposal to hold a 'follow-up' workshop focused on discussions of a national 'roll out' of the GPS logger system; (2) consider the development of a research proposal to obtain data on the seasonal biology of blacklip abalone; and (3) review the abalone bio-economic modeling project.

The first two outcomes were identified as the best chance of improving the economic performance of the Australian abalone fisheries.

3.3.3. Workshop 2

The second abalone workshop was held at SARDI Aquatic Sciences, West Beach, Adelaide (1-2 May 2014). The agenda for the meeting is provided in Appendix 3.8 and a list of attendees in Appendix 3.9.

The first day began with a welcome and introduction by Tim Ward, which identified expectations and potential outcomes. Written advice from Harry Peeters, Victoria was tabled and delgates were requested to familiarise themselves with the views of the Victorians who were unable to attend the workshop. Dean Lisson confirmed the importance of the workshop to industry, highlighting the opportunity it presented to adopt the advances in the GPS logger system made by Craig Mundy in Tasmania and Jeremy Cooper in New Zealand, noting the potential to merge these to a single, comprehensive system suitable for broad application across Australia and NZ.

The introduction was followed by a series of presentations from New Zealand (Jeremy Cooper, Erin Breen and Tom McGowan) and Tasmania (Craig Mundy, Grant Pullen and Joey McKibben). These presentations set the scene for subsequent discussions.

Jeremy Cooper talked about the New Zealand experience with GPS tracking of divers and the subsequent data management system that has been developed for the Paua fishery (Appendix

3.10). The system provides the potential for divers to target fishing in areas that have not yet been fished in the season and thus provides a unique opportunity to increase fishing efficiency, and reduce operating costs. Importantly the cost of the system is relatively low, it is highly automated and provides the option for gathered information to be split between users depending on access rights (e.g. it can be filtered between licence holders, compliance, managers and scientists). An advantage of the system is also the ability to automatically incorporate shell measurements made on board into the database and lodge Catch and Disposal Records (CDR) forms.

The driver to develop the system was industry, but other parties see the potential benefits and are now becoming interested as part of the process to improve sustainability, management and compliance. Jeremy highlighted that the scale of management and automation will be key issues to the future of the system, and that there were still elements of the system that require further work for it to be fully automated.

Erin Breen provided a concise view of the New Zealand management perspective (Appendix 3.11). She touched on what the system can achieve, what it could be used for and accountability issues. Most importantly, Erin discussed the relevance of ownership of the system and the data it provides. While its advantages and applicability to assessments seem clear, there are considerable complexities that arise when you decide to use the system for management and compliance. Erin identified that if this system was to be used for compliance, ownership could probably not reside with industry, as managers would require the capacity to control and audit the system.

The level of adoption also becomes an issue as ideally it should be around 100%, particularly if electronic reporting is considered. Thus a lot of consideration would be required to move the use of the system beyond the assessment level. Erin also highlighted the value of the system for self-management. For example, variable size limits are hard to manage at a government level and require a large investment of staff time, but the system would allow fishers to apply relevant size restrictions, by mutual agreement, within their allowed size limit. Diver Nathan Adams from Western Australia agreed that this capacity would have helped them implement voluntary size restrictions as trust between divers was a key issue to obtaining agreements within industry.

Tom McCowan presented the “divers perspective” on the New Zealand system. His presentation highlighted the day to day complexities of running the system and issues that still require further attention (Appendix 3.12). Within the New Zealand fishery, differences in fishing practice affect the data that can be obtained. For example, some divers dive from the shore and thus don’t have the units with them to record bag retrievals, which affects their ability to accurately apportion catch to GPS tracks. Hardware also needs fine tuning and will need to be very adaptable if it is to be adopted by other jurisdictions. In New Zealand, diver opinion is still polarised, but there is expectation that as divers start to see the benefits these attitudes will change.

The Tasmanian system was presented by Craig Mundy (Appendix 3.13). Although the ultimate objective is similar to that in New Zealand, Craig’s approach has been to concentrate less on the hardware and more on data manipulation and analysis to document the potential for the GPS data to improve the precision and reduce the cost of stock assessments. Importantly, Craig has a good dataset to work on because in Tasmania there is now an 85% data return and use of the loggers has been compulsory for two years. The data not provided is the result of equipment failure (5%) and diver non-compliance (10%).

One advantage of the system is accurate estimation of CPUE from GPS records (termed eCPUE). In addition, Craig provided seven examples on the use of spatial data to generate alternative new performance measures. These were site fidelity (metric is dives within 50 m of site), short dives (dive <= 15 minutes), big swims, swimming speed, reef productivity, reef area fished and concentration curves (i.e. the shape of curves provide an estimation of how the most productive areas are performing. Other measures considered were the ratio between exploitation rate and replenishment time, hotspot analysis and depth profiles. This new level of information and accuracy provides significant potential to develop new PIs.

Grant Pullen gave a general overview of the introduction of the GPS loggers into the Tasmanian fishery (Appendix 3.14). In Tasmania, the system was introduced to improve the TACC setting process and management of the fishery and the use of the loggers was made compulsory. Grant also pointed out that the resourcing needed to support the use of loggers is not insignificant and there needs to be funding in place to deal with breakages, management of the loggers and data processing.

Grant's talk gave a good insight into the complexity of managing the abalone fishery in Tasmania, and the challenges that arose when working through the process of making GPS data loggers compulsory for fishers. For example, how should you deal with divers who do not want to adopt the new system and how do you manage equipment failures without adversely affecting fishers? The solution in the case of Tasmania was a good example of careful discussion with fishers to address their needs and ensuring access to replacement equipment was as easy and convenient as possible.

The final presentation for the day was from Joey McKibben who provided a Tasmanian divers perspective on the logger system. Initial concerns of divers mainly focused on privacy of the data, compliance, equipment failure and how it would be managed. One surprising and unexpected obstacle was insurance which arose because, following an accident, there was concern that insurance companies may use logged information to the detriment of divers. This highlights the importance of open dialogue with all users of the system to make sure any obstacles to implementation are considered. As the system has been rolled out in Tasmania most of these issues have been resolved and the system has increasingly been accepted. Joey was optimistic about the benefits the GPS logger system is giving and confirmed that divers and license holders are now seeing the benefits. These include divers being able to see their own data, its use to set quotas and relevance to compliance and management.

Subsequent discussions around the presentations were diverse and the main topics can be summarised as follows:

1. Economics of the system

How cost effective is the system? What are the costs outside hardware development? It was pointed out that a cost benefit analysis has not yet been carried out. However, Dean Lisson commented that there was no point in doing such an analysis until a reliable system could be developed. Once the system was fully functional a cost benefit analysis could be done, allowing recommendations for a package that was both reliable and cost effective. From the Industry perspective there was interest in the savings in research costs that could result from the new system (especially SA).

2. Use of the system for TACC setting and management

How good is such a system for obtaining predictive information to aid TACC setting? Edward Abraham reminded attendees that at this early stage in the project, with only two years data

available, it was a hard question to answer. Craig Mundy pointed out that being able to understand the capacity of particular reef systems to support catch through time would be invaluable for TACC setting. There was also discussion around the use of the system to set variable size limits which would be relatively easy for industry to implement voluntarily within permitted limits, but harder for managers to achieve due to legislative complexities.

3. Hardware development

The New Zealand model, where industry has been leading the development of hardware, is probably the most efficient as the process may have taken longer if run by government. This is because Government is constrained by procurement rules and the need and complexity of undertaking development around legislative requirements.

4. Performance indicators

What performance indicators can come out of the new system and how much better are they than the current ones? There was unanimous agreement that eCPUE derived from GPS loggers would be a lot more reliable than traditional CPUE that is derived from times entered in return forms. Craig Mundy highlighted a suite of possible new PIs for which there was a great deal of interest, particularly from industry and managers. However, it was agreed that before these indicators could be adopted they would need to be "ground truthed" against traditional information, tested with several years' data, as independent as possible and that their interpretation would have to be clear.

5. Data confidentiality and ownership

This is a critical issue and needs to be clearly established prior to any parties obtaining access to data. Data access rights will also need to change depending on what the information is to be used for. All parties agreed that the GPS data is confidential and its storage and use rules need to be agreed by all. Any breaches of confidentiality would be a significant obstacle to its use. It was very clear that if the system was to be used for anything other than stock assessment the complexities escalate because legislative requirements come into play. At this point data ownership becomes a critical issue for managers.

6. System flexibility is a key requirement

Adoption of the GPS system across jurisdictions will be heavily reliant on adapting the system to work within the peculiarities of each fishery and the different management and legislative umbrellas. There was general consensus that while there were still many issues to address, the current systems being developed in New Zealand and Tasmania could be adapted to jurisdictional requirements without too much difficulty. In addition, it was clear that automation would be essential to promote acceptance and continued use of any system developed.

Following this general discussion, a matrix of jurisdictions and components was used to identify areas common to all states that could be used to best direct the focus of future GPS logger research (Appendix 3). There was consensus across all states that the system would be a great asset for stock assessment, particularly due to the perceived greater reliability of eCPUE and the opportunities to develop new, potentially more informative, PIs. There are also benefits to fishers in being able to see their own information and use it to plan their activities. However, as discussion moved to the remaining components (quota management, enforcement and compliance) it was clear that the complexities around legislation and enforcement would be a significant obstacle to implementation of the system.

It was agreed that the best way forward would be to develop the system as a fishery data collection tool and pursue the more complex quota management and enforcement issues progressively at a later stage.

Discussion focused on developing three subsequent projects:

1) Implement the GPS logger system to the South Australian Southern Zone abalone fishery.

The Southern Zone only has six licenses operating and they are already using spatial management, vessel monitoring system (VMS) and also measuring shells. This makes them ideal candidates for a low-cost, pilot project to evaluate the implementation of the GPS system and perform a cost-benefit analysis. The results can be used to highlight the benefits and facilitate adoption in other jurisdictions.

2) Implementation review of GPS logger system.

This project had multiple components (Appendix 4), but the key objective would be to identify and document, across jurisdictions: (1) what has been done (including considering those FRDC projects already underway); (2) future needs from a GPS logger system for managers/industry/researchers (i.e. support tool for industry and/or data for stock assessment and PIs); (3) the need for common hardware and software platforms; (4) legislative and other impediments to implementation; (5) set up and maintenance costs; and (5) data collection needs, access and privacy. Based on the degree of commonality across jurisdictions, this project would also seek to develop the specifications for a common hardware/software platform and engage with suitable contractors (e.g. Scielex, Zebratech) to develop a prototype. This will facilitate a co-ordinated approach with systems adaptable to each jurisdiction's needs whilst avoiding duplication.

3) Ongoing development of performance indicators and the use of GPS information in stock assessments.

This was considered a natural extension to current FRDC Project (i.e. 2011/201 - Implementing a spatial assessment and decision process to improve fishery management outcomes using geo-referenced diver data). The need to consider a national rollout of the approach was recognised. It was agreed that a proposal should be considered/developed following completion of current project.

The final session for the workshop changed focus to consider the potential for the use of blacklip abalone biological information to maximise harvest strategies. As an introduction to the subject, Ben Stobart gave a presentation on the benefits that changing the fishing season of greenlip abalone could provide to industry. Greenlip abalones weigh more and bleed less if caught in autumn. Thus, it is possible to either catch the same quota while leaving more abalone in the water, or catch the same number of abalone and increase the quota. This is one way to improve the performance of the fishery for greenlip that is already being trialled by the Western Zone fishery in South Australia.

Discussion focused on developing a subsequent project for blacklip abalone. Whilst there was broad support across jurisdictions represented, it was considered that the project should largely be undertaken in SA, linking to the (limited) available data from Tasmania and Victoria. It was noted that the SA Fisheries and Aquaculture Research Advisory Committee has ranked this project as a high priority.

3.4 Comparison of the fisheries and synthesis of findings

3.4.1. Fishery performance and impediments to wealth creation

The analysis using the Anderson and Anderson (2010) method provided clear insights into the differing strengths and weaknesses of the fisheries considered in this study (Figure 1). The SGPF performed well scoring less than four out of five in only two of the eleven output categories (harvest asset performance and post-harvest asset performance). In contrast, the ECOTF scored above four out of five in only two of the eleven categories (post-harvest industry performance and processing owners and managers). These differences reflected the sound biological position, but declining economic performance of the SGPF and the generally poor state of the ECOTF. The SZRLF scored less than four out of five in four of the eleven categories (harvest performance, harvest asset performance, risks and post-harvest asset performance) which reflects the recent declines in both the biological status and economic performance of the fishery. The two abalone fisheries that were assessed performed well, with only harvest performance and harvest asset performance being scored at less than four. Excess capacity was the main driver of poor harvest performance; low harvest asset performance reflected recent declines in revenue and asset value.

In terms of inputs (Figure 2) all fisheries performed poorly in terms of gender reflecting the relatively low involvement of women in the Australian fishing industry. The SGPF scored very low (one) in terms of harvest rights, reflecting lack of a tradeable unit, and less than four for markets and market institutions, reflecting in part the lack of vertical integration in the industry. The ECOTF scored less than four in seven of the fifteen categories, performing poorly in terms of participation and collective action, management methods and markets and marketing institutions. The SZRLF and abalone fisheries performed well in most categories, the two notable exceptions being collective action and markets and marketing institutions.

The lack of economic data from most jurisdictions impeded comparison of the long-term economic performance of fisheries outside SA. However, overall it is clear that declining real prices and rising costs have caused long-term declines in the economic performance of most of the fisheries considered in this project. For example, declines in prices and increases in costs, especially fuel, have resulted in declining returns on capital investment in both the SGPF and GSVPF over the last 10 years (Appendix 1). In the SGPF, recent returns on investment have been low and in the GSVPF returns had been negative for six out of the last seven years. The recent economic performance of the two SA lobster fisheries presented a strong contrast, with the Southern Zone consistently generating returns on investment of 2-6%, while the Northern Zone has generated negative returns over much of the last decade (Appendix 2). SA abalone fisheries continue to generate positive returns on investment but these have decreased in size over time due to a steady decline in real prices.

In several fisheries, the generally poor economic outlook is exacerbated by the presence of a large number of licences in the fishery and declines in the biological status of the resource. The key issues that need to be addressed vary among fisheries. In all cases there is a need to reduce fishing costs; opportunities for achieving this goal vary among fisheries. There is also a need to continue efforts to develop new products and markets; however, these efforts alone are unlikely to entirely address the current economic pressures.

3.4.2. Systems that have improved the economic performance of relevant fisheries

Several trawl fisheries that have previously addressed issues similar to those affecting the SGPF, GSVPF and ECOTF were used to demonstrate how economic performance can be improved. In the Northern Prawn Fishery, fishing costs have been reduced and marketing and prices improved following the introduction of individual transferable fishing rights. This re-structure was achieved through a long and complex series of costly buy-back schemes that involved significant government funding. In the Exmouth Gulf and Shark Bay Prawn Fisheries, government funded buy-outs were also undertaken to reduce the number of license holders in the fisheries. In the Shark Bay Fishery, 3-4 active fishers act co-operatively, whereas in the Exmouth Gulf Prawn Fishery all licenses are now owned by a single company. The most extreme example of consolidation of a fishery is the NZ Challenger Enhancement Company, where fishers operate collectively within a single corporate entity. In the Clarence River Prawn Fishery, poor economic performance has been addressed by the more traditional approach of collective marketing through a fishermen's co-operative.

Individual transferable fishing rights have already been established in Australia's lobster fisheries so alternative approaches to improving economic performance needed to be identified. Lobster fisheries in Western Australia and New Zealand (CRA8, CRA5) were used to demonstrate the benefits of focusing on economic performance rather than maximising catches. In each case, the economic performance of these lobster fisheries was improved by reducing exploitation rates to maintain/rebuild the biomasses to levels that maintain/improve catch rates. A bio-economic model developed in a related project (CRC 2009/714) was used to demonstrate the relative economic benefits of changes to current management arrangements (including lower exploitation rates).

For abalone fisheries, it was recognised that: 1) there are relatively few opportunities to improve economic performance as fishing costs are already low and prices are quite high; and 2) opportunities that exist should be evaluated from at least a national perspective and there may be benefits in collaborating more extensively with NZ. GPS systems currently being developed in parallel in NZ and Tasmania were recognised as having the potential to transform Australia's abalone industries by reducing the costs of both fishing and fisheries management and improving the precision and accuracy of future stock assessments. It was also recognised that there are opportunities to improve the productivity of Australia's abalone fisheries by changing fishing seasons to coincide with periods when individuals are largest and flesh quality highest.

3.4.3. Opportunities for improving economic performance

The benefits of establishing individual transferable fishing rights within the SGPF and GSVP are recognised by both industry and government. Information collated as part of this project contributed to the development of an economic optimisation paper that will provide direction for future amendments to the management plan for the SGPF. These amendments will include individual transferable fishing rights. The management plan for the GSVP will also be revised and is likely to incorporate similar change. In the ECOTF, the issues of over-capitalisation are so large that it seems likely that significant government investment will be needed to address this issue.

The benefits of establishing a focus on economic performance is now recognised by fishers who target SRL in southern Australia. Harvest strategies are currently undergoing revision in several fisheries and likely to include lower exploitation rates that address reductions in recruitment

levels over the last decade and help to maintain/rebuild biomasses to levels which support high catch rates. The bio-economic model developed in a related project (CRC 2009/714) will inform that process.

Research proposals are being developed to assist the implementation of GPS tracking systems and changes to harvesting season that will improve the economic performance of Australia's abalone fisheries. The development of these proposals has been endorsed by the ACA and fisheries managers in key jurisdictions.

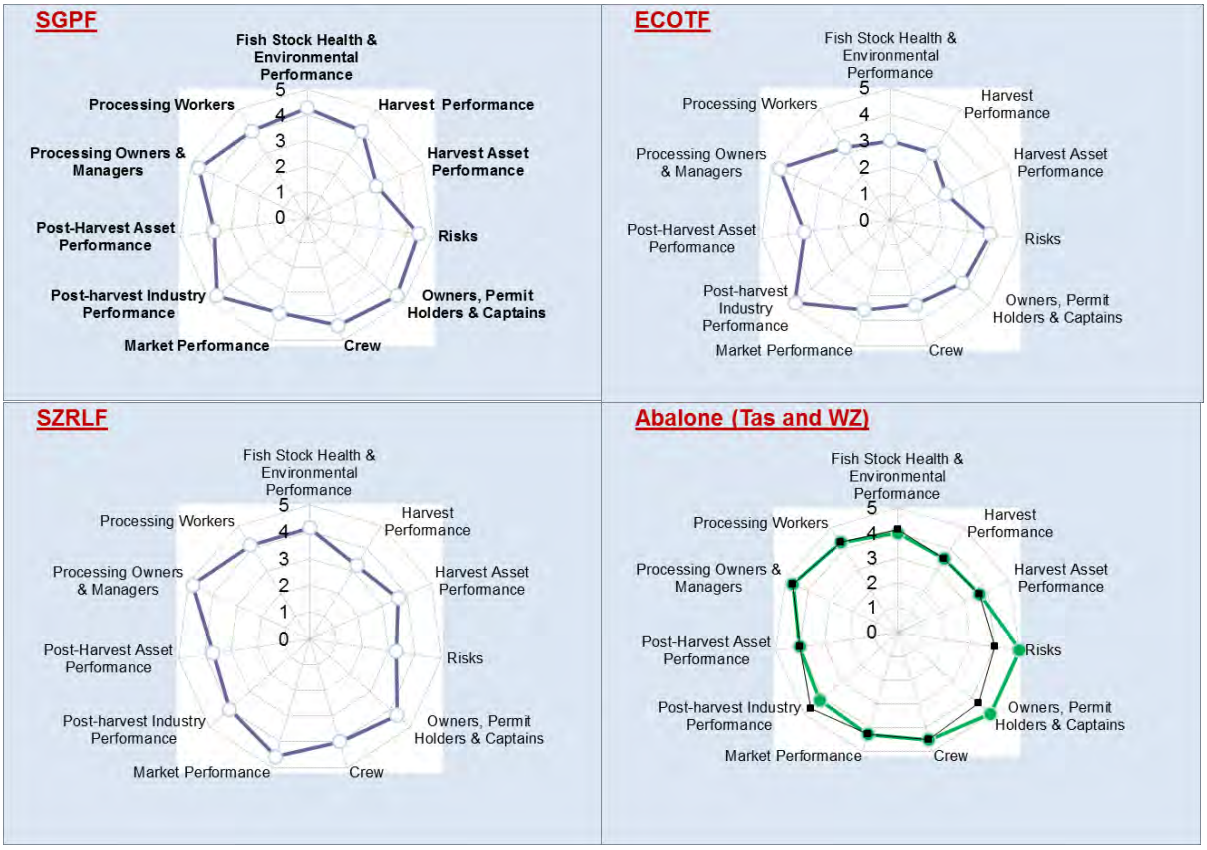

Figure 4.1. Performance Indicators of wealth creation and accumulation (outputs). Tasmanian abalone in black. SA Western Zone in green. Scale 1 to 5, with high values reflecting good performance.

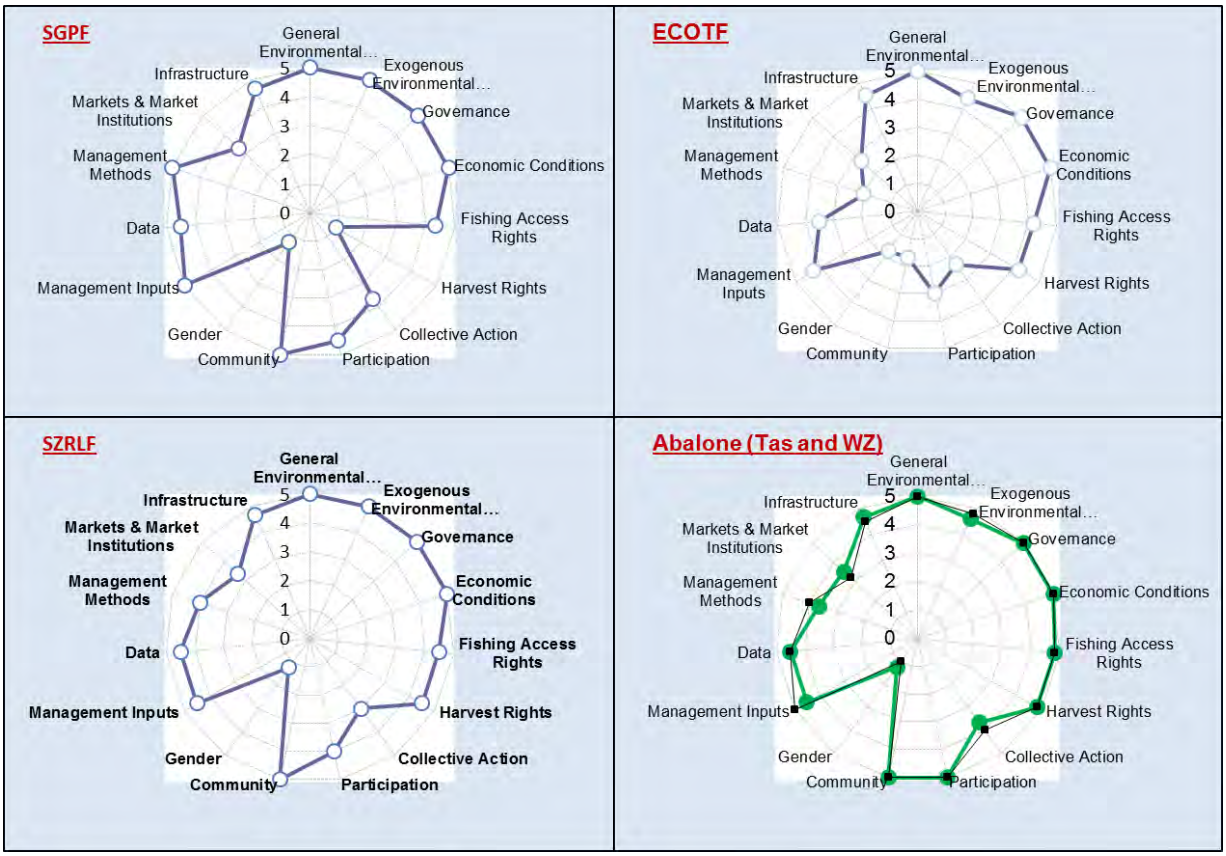

Figure 4.2. Performance Factors that enable wealth creation (inputs). Tasmanian abalone in black. SA Western Zone in green. Scale 1 to 5, with high values reflecting good performance.

5. Benefits, Adoption and Planned Outcomes

5.1. Overall

This project is one of a suite of studies funded by the Australian Seafood CRC and the FRDC that have contributed to the ongoing transformation of Australia's fisheries to include an explicit focus on delivering economic benefits as well as ecological sustainability.

This outcome was achieved by conducting a series of workshops that brought together key industry members and representatives, fisheries managers, scientists and economists to share knowledge and experiences and identify opportunities to improve the economic performance of Australia's prawn, SRL and abalone fisheries.

5.2. Prawns

This project provided the impetus for the Spencer Gulf Prawn Fishery (SGPF) to establish an Economic Optimisation Working Group and develop a draft economic optimisation paper (July 2014). The final version of that document will provide a basis for revising the management plan and refining the harvest strategy to improve economic performance. A bio-economic model for the SGPF (adopted from a model developed by Dr Michael O'Neill, CRC 2011/750) will contribute critical information to that process of reform. A larval dispersal model developed in FRDC Project No. 2008/011 will be used to ensure that future fishing strategies optimise both successful recruitment and economic performance.

Both the SGPF and Gulf St Vincent Prawn Fishery (GSVPF) have been managed using input controls without transferability for over 50 years. This project contributed to the establishment of system of tradeable nights in the GSVPF in 2012. A refined harvest strategy that includes a system of tradable units is currently being developed for the GSVPF. The refined harvest strategy being developed for the SGPF may also include a system of tradeable units and economic performance indicators.

Transferability has already been established in the East Coast Otter Trawl Fishery (ECOTF). The overwhelming problem in the fishery is over-capacity. It seems unlikely that significant reduction in effort will be achieved without some form of buyout. To be effective, such a buyout would require strong cooperation between industry and government. Currently, industry's capacity to engage with government is impeded by the absence of an association that represents the interests of the trawl sector.

5.3. Rock Lobster

Since this project began, there has been a major cultural shift within the fisheries that target Southern Rock Lobster off southern and eastern Australia. The strong historical focus on maximising catches has been replaced by a vision for fisheries that deliver higher profits by catching fewer lobsters. This project contributed to this cultural change by exposing key industry leaders to the positive economic outcomes that have been achieved in the lobster fisheries in

New Zealand and Western Australia by simply reducing exploitation rates to levels that maintain/rebuild biomasses to sizes that deliver higher profits by reducing fishing costs (through increased catch rates). Two other contributions were crucial. Firstly, Associate Professor Caleb Gardner's success over the last decade in educating lobster fishers in the principles of fisheries economics allowed industry to quickly understand the implications of what had been achieved in New Zealand and Western Australia. Secondly, the bio-economic model developed by Dr Richard McGarvey in CRC Project No. 2009/714 provided the perfect tool for demonstrating to industry and fisheries managers the costs/benefits of various management scenarios, such as low/high Total Allowable Catches and various minimum and maximum legal sizes. This bio-economic model will be used to refine the harvest strategies for Australia's fisheries for Southern Rock Lobster and ensure that future economic performance is optimised under the range of potential recruitment scenarios that the future may hold. The benefits of collecting the data required to assess economic performance, notably beach and export prices and fishing costs, are now also widely recognised.

5.4. Abalone

This project demonstrated that, compared to most fisheries, Australia's abalone fisheries have relatively limited opportunities for increasing prices and reducing costs. It was recognised that any opportunities for improving economic performance that do exist should be considered at a national level. The potential for GPS tracking systems to transform Australia's abalone fisheries and substantially reduce the costs of fishing and/or various elements of fisheries management was identified at a series of workshops held in Adelaide in 2013 and 2014. It was also recognised that modifying fishing seasons had the potential to improve productivity. Following a joint New Zealand and Australia research workshop in August 2014, research proposals to address these opportunities were developed.

6. Conclusion

The process of transforming Australia's fisheries to include an explicit focus on economic performance is well underway. However, there is an ongoing need to improve the economic performance of all of the fisheries considered in the current project. Most fisheries have made some efforts to improve and/or maintain prices by developing new products and enhancing marketing systems. These initiatives are needed and should continue, but alone are unlikely to resolve existing and future weaknesses in economic performance. In the fisheries considered, there has generally been less focus on reducing costs; largely because this is a more difficult task and in some cases would require major changes to existing operational, management or business systems. Opportunities for reducing costs vary among fisheries; these opportunities and some of the key issues impeding reform are outlined below.

The greatest need to reduce costs was identified in the prawn fisheries, where real prices have fallen as a result of competition from aquaculture products and sustainability is largely managed through input controls that create operational inefficiencies and increase fishing costs. In the SGPF and GSVPF, three options for addressing the current economic problems were identified: 1) buying-out of some the existing licences; 2) establishing an overarching corporate structure comparable to the Challenger Scallop Enhancement Company; and 3) introducing individual transferable fishing rights. The South Australian Government has indicated that it will not contribute funding to buy-back schemes and initial modelling suggests that industry funded buy-outs may not be economically viable at this point in time. Although the benefits of establishing a

single company to run each or both fisheries are widely recognised, it seems very unlikely the consensus among industry members required to adopt this approach will be obtained in the foreseeable future. It seems clear that the only viable option for reforming South Australia's prawn fisheries is to introduce individual transferable fishing rights. This has already been done in the GSVPF, where a system of tradeable fishing nights was introduced in 2012. However, the limitations of nights as a tradeable unit (e.g. not a good measure of effort) and the need to consider alternative effort/catch units are acknowledged by both fisheries managers and industry. The economic optimisation paper developed by the SGPPF identifies the strengths and weaknesses of various tradeable units and will help to guide the reform of the current management framework.

The study also identified the need to improve the economic performance of Australia's SRL fisheries, where catches have declined over the last decade due to widespread reductions in average recruitment and price volatility has been high because of the strong dependence of the industry on a single market (Hong Kong/China). Industry efforts to expand markets for SRL over the last decade have met with limited success. Experiences in other lobster fisheries show that economic performance can be improved by reducing exploitation rates to levels that maintain/rebuild biomasses to sizes that support high catch rates. There is widespread agreement among Australian fisheries managers and industry members that future harvest strategies for SRL should be refined to include a focus on economic performance and that this process of reform should utilise information provided by the bio-economic modelling tool developed in CRC Project No. 2009/714. It is also recognised that the incorporation of economic performance indicators into future harvest strategies will require the collection of economic data (e.g. fishing costs and beach prices).

Like prawns, the prices paid for abalone have fallen over the last decade due to competition from aquaculture products. To address this issue, industry has established a stronger focus on marketing initiatives, especially in China. This project introduced the Australian abalone industries to two other opportunities for improving economic performance (i.e. reducing costs through implementation of GPS technology and increasing productivity through optimisation of the timing of harvests). Following this project the abalone industry has initiated two research projects to facilitate the implementation of these opportunities into Australia's abalone fisheries.

This project is one of a suite of studies funded by the Australian Seafood CRC and the FRDC that have contributed to the ongoing transformation of Australia's fisheries to include an explicit focus on delivering economic benefits as well as ecological sustainability. This cultural change has extended beyond the three sectors considered in this study. A good example of this transformation is the South Australian Pipi Fishery, which now has formal economic PIs in its harvest strategy. Importantly, in the three sectors considered here industry is now working with fisheries scientists and managers to initiate further reforms to improve economic performance.

7. References

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Appendices

Table of Contents for *Appendix 1. Prawns*

Appendix 1. Prawns

Optimising business structures and fisheries management systems for key fisheries

T.M. Ward

Project No. 2009/715

February 2015

This project was conducted by the South Australian Research and Development Institute

This report may be cited as:
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Appendix 1.1. SGPF Workshops 1 and 2: Agenda

DRAFT

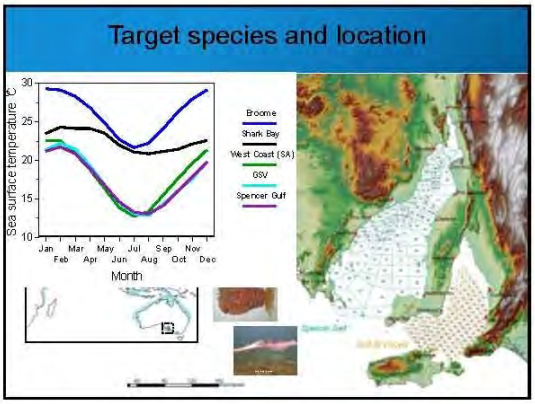
Economic Performance and Management Opportunities

Port Lincoln
Monday 27 February **8:30 – 17:30** **Port Lincoln Hotel**
OR
Adelaide
Tuesday 28 February **8:30 – 17:30** **SARDI Conference Room** **2 Hamra Ave, West Beach**

AGENDA

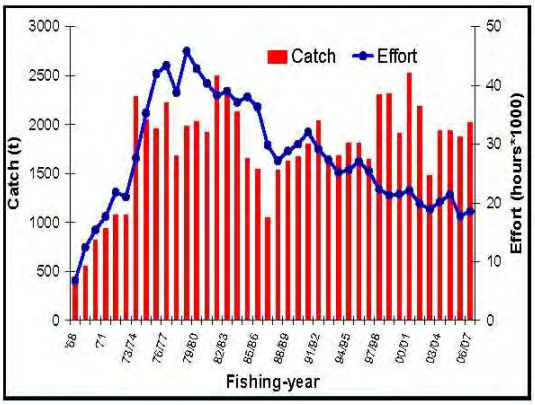
1.	Welcome, introductions & background	Exec/O	8:45
2.	Summary of Spencer Gulf Fishery	C. Dixon	9:00
3.	"Anderson's Assessment" of fisheries	T. Ward	9:20
4.	Economic analysis – summary of Spencer Gulf prawn fishery	E. Hoshino	9:45
	Morning Tea		10:30
5.	Property Rights opportunities: national perspective	A. Jarrett	10:50
	Shark Bay and Exmouth experiences	G. Stewart	11:50
	Lunch		12:30
6.	Property Rights: Case study of Challenger Scallop Enhancement Company	M. Harte	13:00
7.	Clarence River: Marketing and promotions experience	D. Adams	13:40
9.	Discussion and summary	Chairperson	14:10
	Close		16:30

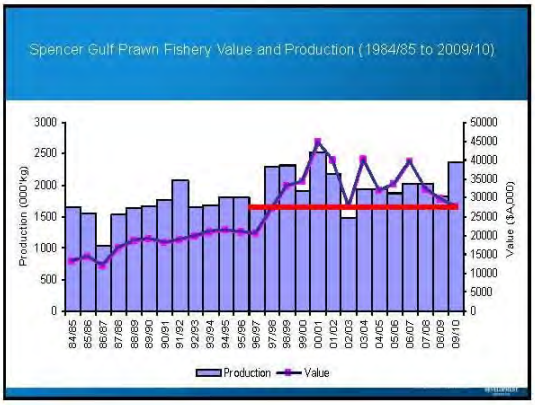
Appendix 1.2. Spencer Gulf Prawn Fishery



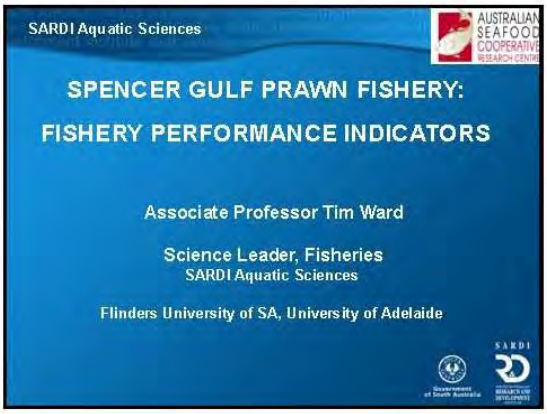
Management controls in the Spencer Gulf Prawn Fishery

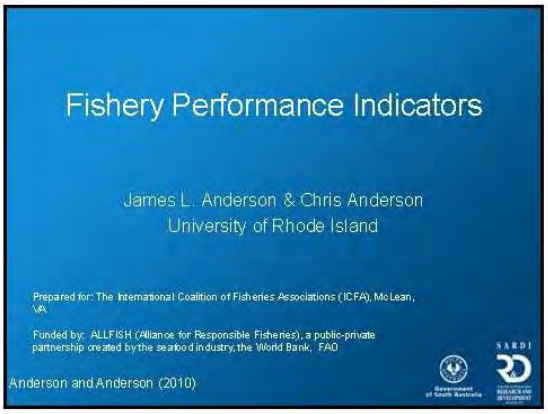
Management tool	Current restriction
Permitted species	Western king prawn (*Melicertus latisulcatus*), slipper lobster (*Ibacus* spp.), Calamari *Sepioteuthis australis*
Limited entry	39 licences
Licence transferability	Permitted
Corporate ownership	Permitted
Spatial and temporal closures	Adjusted based on survey results
Closed areas	No trawling in waters shallower than 10m
Method of capture	Demersal otter trawl
Trawl rig	Single or double rig
Trawling times	Not during daylight hours
Maximum headline length	29.26 m
Minimum mesh size	4.5 cm
Maximum vessel length	22 m
Maximum vessel power	272 kW
Catch and effort data	Daily and monthly logbook submitted monthly
Landing locations	Landings permitted anywhere in the State
Landing times	Landings permitted at any time during the season

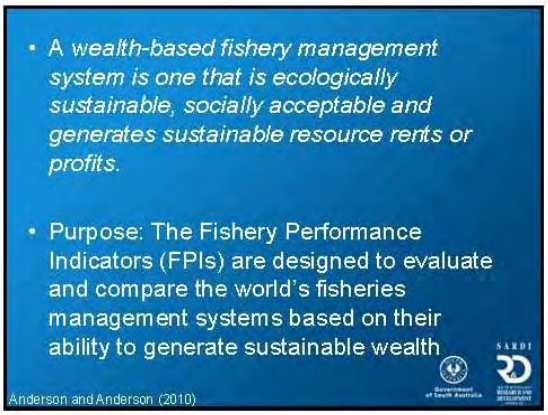


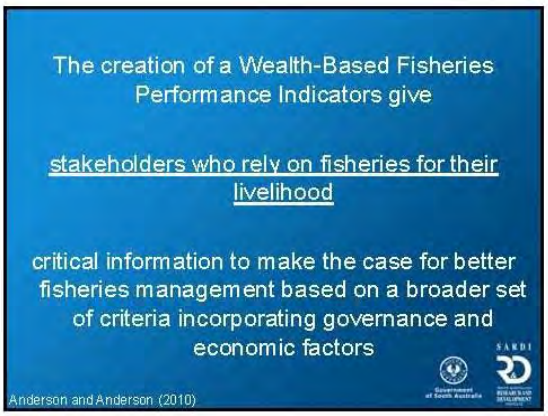


Appendix 1.3. Fishery Performance Indicators









The Performance Indicators are Designed to Incorporate the Three 'Sustainabilties' Necessary for Wealth Creation

1) Economic Sustainability

2) Ecological Sustainability

3) Community Sustainability

Anderson and Anderson (2010)

Characteristics of Indicator Components

- Readily Available
- Accurate
- Quantifiable
- Relevant
- Understandable

Anderson and Anderson (2010)

Two Parts – Outputs and Inputs

1) Performance Indicators of wealth creation and accumulation (outputs)

2) Performance Factors that enable wealth creation (inputs)

Anderson and Anderson (2010)

The Fishery Performance Indicators - Outputs

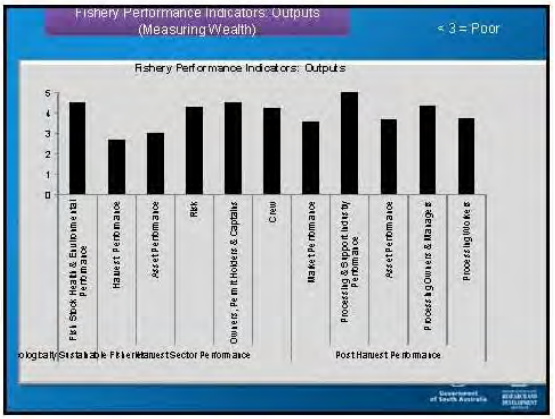
- 54 components covering 11 dimensions:
  - Fish Stock Health & Environmental Performance
  - Harvest Performance
  - Harvest Asset Performance
  - Risk
  - Owners, Permit Holders & Captains
  - Crew
  - Market Performance
  - Processing & Support Industry Performance
  - Post-harvest Asset Performance
  - Processing Owners & Managers
  - Processing Workers

Anderson and Anderson (2010)

The Fishery Performance Factors: Inputs Enabling Wealth Creation

- 39 components covering 8 dimensions:
  - Macro Factors-Environmental, Economic & Community
  - Access Rights
  - Harvest Rights
  - Collection Action
  - Management Inputs
  - Management Participation
  - Markets and Market Institutions
  - Infrastructure

Anderson and Anderson (2010)



Fishery Performance Indicators: Outputs (Measuring Wealth)

< 3 = Poor

COMPONENT	DIMENSION	AVERAGE SCORE	
Ecologically Sustainable Fisheries	Fish Stock Health & Environmental Performance	4.5	agency, by-catch
Harvest Sector Performance	Harvest Performance	2.7	unfished days, # vessels
	Asset Performance	2.8	price down, costs up
	Risk	3.7	low-moderate variability, increasing risk
	Owners, Permit Holders & Captains	4.5	good
	Crew	4.3	good
Post Harvest Performance	Market Performance	3.8	declining prices
	Processing & Support Industry Performance	5.0	most processing on vessel
	Asset Performance	3.7	declining returns, reducing export
	Processing Owners & Managers	4.3	ok
	Processing Workers	3.7	factory workers

Fishery Performance Indicators: Outputs (Measuring Wealth)

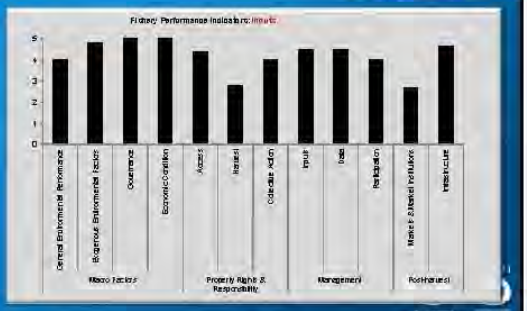
Harvest Performance	Economics	Landings Level	• 5: Harvest is less than MSY (stock is above MSY level) to increase profit; • 4: Harvest is approximately at MSY; • 3: Harvest is directed to promote recovery (stock is below MEY level); • 2: Harvest is constrained as stock recovers (stock is stable but below MEY level); • 1: Harvest is causing overfishing (stock is below MEY and declining)	Average annual harvest over the last three years. Note: In practice, there are few estimates of MEY, however relative to what has been sustainably caught (typically 5-10 percent less than maximum sustainable yield (MSY).
	Economics	Excess Capacity	• 5: Within 5% of days required; • 4: 105-120 or 90-95%; • 3: 120-150% or 75-90%; • 2: 150-200% or 50-75%; • 1: More than 200%, or less than 50%, of days required	Estimate of standardized vessel-days required to catch the maximum economic yield (MEY) compared to the number of standardized vessel-days available. Days are considered not to be restricted by trip limits.
	Economics	Season Length	• 5: Virtually no regulatory closures; • 4: 91-99%; • 3: 51-90%; • 2: 11-50%; • 1: Less than 10%	Ratio of number of days on which fishing occurs to the number of days the species is available in economically feasible quantities.

Fishery Performance Indicators: Outputs (Measuring Wealth)

Asset Performance	Economics	Ratio of Asset Value to Gross Earnings	• 5: 10 or higher; • 4: 7.5-10; • 3: 5-7.5; • 2: 2.5-5; • 1: Below 2.5	Ratio of average price of access to the fishery over the last six years to the average annual landings value for a similarly scaled access right in the same period. Some business or some family sales are excluded, where they cannot be identified.
	Economics	Total Revenue versus Historic High	• 5: Above 95%; • 4: 85-95%; • 3: 71-85%; • 2: 50-70%; • 1: Below 50%	The indicator is the ratio of total revenue to the average of the three highest total revenues in the past 10 years.
	Economics	Asset (Permit / Quota) Value versus Historic High	• 5: Above 95%; • 4: 85-95%; • 3: 71-85%; • 2: 50-70%; • 1: Below 50%	The indicator is the ratio of asset to the average of the three highest asset values in the past 10 years.
	Economics	Borrowing Rate Relative to Risk-free Rate	• 5: Less than 1.75 pc (30 year conforming mortgage); • 4: Less than 2.5 pc (personal bank loan); • 3: Less than 4 pc (good credit card rate); • 2: Less than 7 pc (bad credit card rate); • 1: Greater than 7; usury	Average ratio between the interest rate on loans made in the industry to risk-free rates over the last three years.
	Economics	Source of Capital	• 5: Unsecured business loans from banks/Venture capital; • 4: Secured business loans from banks/Public stock offering; • 3: Loans from banks secured by personal (not business) assets/Government subsidized private lending/Government run loan programs/International aid agencies; • 2: Microlending/Family/community-based lending; • 1: Mostly no capital available	Points to be assigned based on the category of lenders or investors most typically used in the fishery.
	Economics	Functionality of Harvest Capital	• 5: Capital is new; • 4: Capital is older but well maintained, e.g., mostly owned; • 3: Capital is moderately well maintained; • 2: Maintenance is poor; • 1: Serious concerns about seaworthiness or safety throughout fishery	Average age of the key durable harvesting capital unit (vessels, vehicles).

Fishery Performance Indicators: Inputs (Enabling Wealth Creation)

< 3 = poor
Property rights and responsibility
Harvest
Post-harvest
Markets and institutions

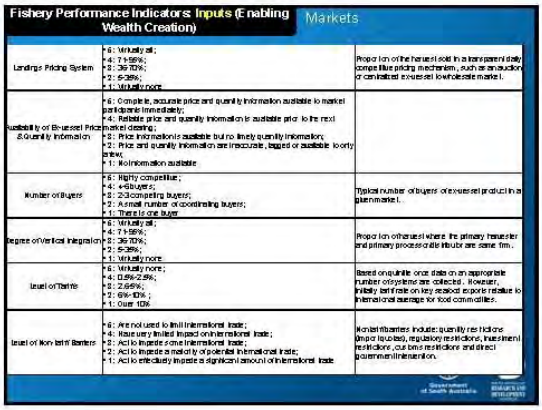


Fishery Performance Indicators: Inputs (Enabling Wealth Creation)

COMPONENT	DIMENSION	AVERAGE SCORE	
Macro Factors	General Environmental Performance	4.0	ok
	Exogenous Environmental Factors	4.3	ok
	Governance	5.0	?
	Economic Condition	5.0	?
Property Rights & Responsibility	Access	4.4	access corridor ice & talent stability, season restrictions
	Harvest	2.8	no quota, can't transfer harvest, input controls
	Collective Action	4.0	associa, co-management, poorly coordinated marketing
Management	Inputs	4.3	good research and management
	Data	4.5	good data collection
	Participation	4.0	co-management, reduced days by effort pool
Post-Harvest	Markets & Market Institutions	2.7	few transpare ncy, lack vertical integration
	Infrastructure	4.7	good infrastructure

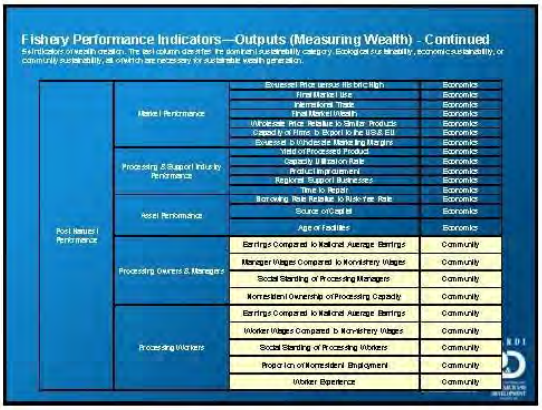
Fishery Performance Indicators: Inputs (Enabling Wealth Creation) — Access

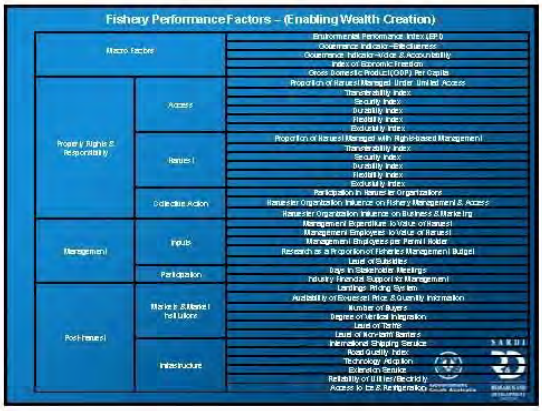
Proportion of Harvest Managed with Rights-based Management	• 5: Virtually all; • 4: 71-95%; • 3: 36-70%; • 2: 6-35%; • 1: Virtually none	The proportion of total harvest that is under rights-based fisheries management (e.g., Initial/Community Quotas, Catch Shares) or Territorial Use Rights (TURFs).
Transferability Index	• 6: Very Strong: Fully transferable through well-established, efficient market institutions; • 4: Strong: Fully transferable, but institutions are poor or illiquid; • 3: Moderate: Transferable, but with severe restrictions on who can sell, or how much; • 2: Weak: Transferable only under highly restricted and limited condition; • 1: Access rights not transferable	
Security Index	• 6: Very Strong: Harvest rights are completely respected and are not diluted (e.g., by issuing more access rights) by the government; • 4: Strong: Rights are mostly respected by the government, generally positive changes in government administration; • 3: Moderate: Rights are at risk of reduction or dilution with changes in administration; • 2: Weak: Rights are highly diluted or there is high political uncertainty; • 1: None: Harvest rights are not protected	Extent to which the government reduces or dilutes the access rights.
Durability Index	• 6: Very Strong: > 10 years to perpetuity; • 4: Strong: 6 to 10 years; • 3: Moderate: 1 to 5 years; • 2: Weak: Seasonal; • 1: None: Non-daily	Duration of the property right.
Flexibility Index	• 6: Very Strong: All decisions on time of harvest, gear used and handling practices are in the owner's control; • 4: Strong: Minimal restrictions on time of harvest and technology; • 3: Moderate: Modest restrictions on time of harvest and technology; • 2: Weak: Significant restrictions on time of harvest and technology; • 1: Time of harvest, gear used and handling practices are not in the owner's control	Ability of right holders to be flexible in the timing and production technology employed.
Excludability Index	• 6: Very Strong: All decisions and access to the property are controlled by the right's owner (rather than those without rights), competing resource users (like recreational or bycatch fisheries); • 4: Strong: Little intrusion on resource by those without rights; • 3: Moderate: Modest intrusion on resource by those without rights; • 2: Weak: Significant intrusion on resource by those without rights; • 1: None: Completely unrestricted open access, despite publicly right	Ability of right holders to exclude those who do not have the right from extracting the resource or market.

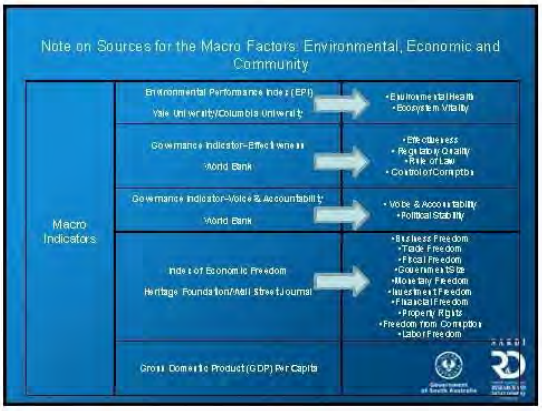

Fishery Performance Indicators: Inputs (Enabling Wealth Creation)
Markets
Landings Pricing System
• 6 : Virtually all;
• 4 : 71-99%;
• 3 : 36-70%;
• 2 : 6-35%;
• 1 : Virtually none
Proportion of the harvest sold in a transparent daily competitive pricing mechanism, such as an auction or consolidated processor/wholesaler market.
Availability of Buyer-Vessel Price & Quantity Information
• 6 : Complete, accurate price and quantity information available to market participants immediately;
• 4 : Reliable price and quantity information is available prior to the next market clearing;
• 3 : Price information is available but no timely quantity information;
• 2 : Price and quantity information are inaccurate, lagged or available to only a few;
• 1 : No information available
Number of Buyers
• 6 : Highly competitive;
• 4 : 4-5 buyers;
• 3 : 2-3 competing buyers;
• 2 : A small number of coordinating buyers;
• 1 : There is one buyer
Typical number of buyers of vessel product in a given market.
Degree of Vertical Integration
• 6 : Virtually all;
• 4 : 71-99%;
• 3 : 36-70%;
• 2 : 5-35%;
• 1 : Virtually none
Proportion of harvest where the primary harvester and primary processor/distributor are same firm.
Level of Tariffs
• 6 : Virtually none;
• 4 : 0.6%-2.5%;
• 3 : 2.6%;
• 2 : 6%-10% ;
• 1 : Over 10%
Based on public ongoing data on an appropriate number of systems are collected. However, widely tariff rate on key seafood export relative to international average for food commodities.
Level of Non-tariff Barriers
• 6 : Are not used to limit international trade;
• 4 : Have very limited impact on international trade;
• 3 : Act to impede some international trade;
• 2 : Act to impede a majority of potential international trade;
• 1 : Act to effectively impede a significant amount of international trade
Non-tariff barriers include: quantity restrictions (import quotas), regulatory restrictions, investment restrictions, customs restrictions and direct government intervention.


SPENCER GULF PRAWN FISHERY:
FISHERY PERFORMANCE INDICATORS
• FPIs capture issues in SGPF quite well
- poor harvest and asset performance
- poor systems for managing harvest and marketing catch
• Issues in fishery are
- input controls cause inefficiency
too many licences/vessels
very short season
can't consolidate effort/catches to reduce costs
- falling prices
competition from aquaculture prawns
low product differentiation
poor marketing
low cohesion
Need to redesign fisheries management arrangements, operational procedures and business structures

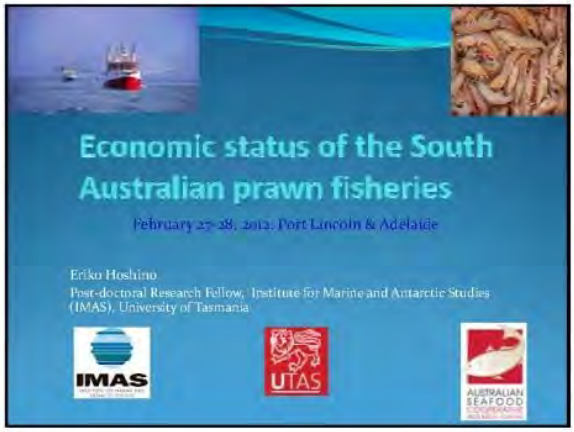

Fishery Performance Indicators—Outputs (Measuring Wealth)
COMPONENT
DIMENSION
MEASURE
DOMINANT SUSTAINABILITY CATEGORY
Ecologically Sustainable Fisheries
Fish Stock Health & Environmental Performance
Proportion of Harvest with 3rd Party Certification
Ecology
Fish Stock Sustainability Index (FSSI)
Ecology
Percentage of Stocks Overfished
Ecology
Non-Landed Mortality
Ecology
Harvest Sector Performance
Harvest Performance
Landings Level
Economics
Excess Capacity
Economics
Seems Caught
Economics
Asset Performance
Retained Asset Value to Gross Earnings
Economics
Total Revenue versus Historic High
Economics
Asset (Vessels, Quota) Value versus Historic High
Economics
Borrowing Rate Relative to Riskfree Rate
Economics
Source of Capital
Economics
Risk
Functionality of Harvest Capital
Economics
Annual Total Revenue Volatility
Economics
Annual Landings Volatility
Economics
Intra-annual Landings Volatility
Economics
Annual Price Volatility
Economics
Intra-annual Price Volatility
Economics
Catastrophic & Legal Challenges
Community
Owners/Permit Holders & Captains
Earnings Compared to National Average Earnings
Community
Fishery Wages Compared to Non-fishery Wages
Community
Social Standing of Boat Owners and Permit Holders
Community
Proportion of Non-resident Employment
Community
Crew
Earnings Compared to National Average Earnings
Community
Fishery Wages Compared to Non-fishery Wages
Community
Social Standing of Crew
Community
Proportion of Non-resident Employment
Community
Crew Supervision
Community
Age Structure of Harvesters
Community

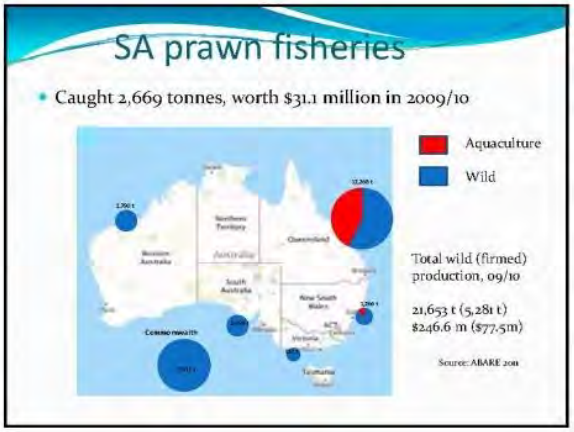

Fishery Performance Indicators—Outputs (Measuring Wealth) - Continued
Post Harvest Performance
Market Performance
Processing & Support Industry Performance
Asset Performance
Processing Owners & Managers
Processing Workers
Harvested Price Versus Historic High
Economics
Final Market Use
Economics
International Trade
Economics
Final Market Wealth
Economics
Wholesale Price Relative to Similar Products
Economics
Capacity of Firms to Export to the USA/EU
Economics
Harvested to Wholesale Marketing Margins
Economics
Value of Processed Product
Economics
Capacity Utilization Rate
Economics
Product Improvement
Economics
Regional Support Businesses
Economics
Time to Repair
Economics
Borrowing Rate Relative to Riskfree Rate
Economics
Source of Capital
Economics
Age of Facilities
Economics
Earnings Compared to National Average Earnings
Community
Manager Wages Compared to Non-fishery Wages
Community
Social Standing of Processing Managers
Community
Non-resident Ownership of Processing Capacity
Community
Earnings Compared to National Average Earnings
Community
Worker Wages Compared to Non-fishery Wages
Community
Social Standing of Processing Workers
Community
Proportion of Non-resident Employment
Community
Worker Experience
Community

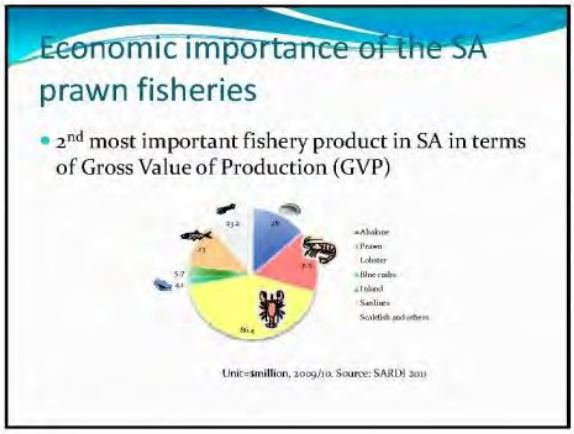

Fishery Performance Factors – (Enabling Wealth Creation)
Macro Factor
Environmental Performance Index (EPI)
Governance Indicator-Effectiveness
Governance Indicator-Voice & Accountability
Index of Economic Freedom
Gross Domestic Product (GDP) Per Capita
Property Rights & Responsibility
Access
Proportion of Harvest Managed Under Limited Access
Transferability Index
Security Index
Durability Index
Flexibility Index
Exclusivity Index
Harvest
Proportion of Harvest Managed with Rights-based Management
Transferability Index
Security Index
Durability Index
Flexibility Index
Exclusivity Index
Collective Action
Participation in Harvest Organizations
Harvester Organization Influence on Fishery Management & Access
Harvester Organization Influence on Business & Marketing
Management
Inputs
Management Expenditure to Value of Harvest
Management Employees to Value of Harvest
Management Employees per Permit Holder
Research as a Proportion of Fisheries Management Budget
Participation
Level of Subsidies
Days in Stakeholder Meetings
Industry Financial Support to Management
Post-Harvest
Market & Market Institutions
Landings Pricing System
Availability of Buyer-Seller Price & Quantity Information
Number of Buyers
Degree of Vertical Integration
Level of Tariffs
Level of Non-tariff Barriers
Infrastructure
International Shipping Service
Road Quality Index
Technology Adoption
Extension Service
Reliability of Utilities/Electricity
Access to Ice & Refrigeration

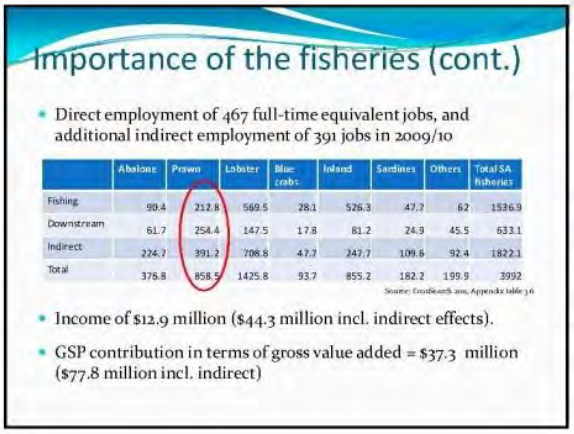

Note on Sources for the Macro Factors: Environmental, Economic and Community
Macro Indicators
Environmental Performance Index (EPI)
Yale University/Columbia University
• Environmental Health
• Ecosystem Vitality
Governance Indicator-Effectiveness
World Bank
• Effectiveness
• Regulatory Quality
• Rule of Law
• Control of Corruption
Governance Indicator-Voice & Accountability
World Bank
• Voice & Accountability
• Political Stability
Index of Economic Freedom
Heritage Foundation/Wall Street Journal
• Business Freedom
• Trade Freedom
• Fiscal Freedom
• Government Size
• Monetary Freedom
• Investment Freedom
• Financial Freedom
• Property Rights
• Freedom from Corruption
• Labor Freedom
Gross Domestic Product (GDP) Per Capita

Appendix 1.4. Economic status



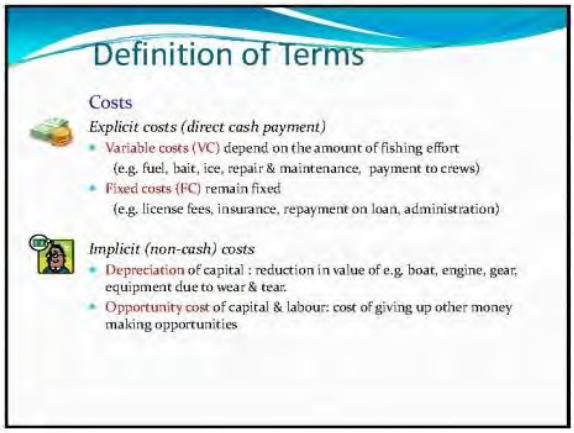






	Abalone	Prawn	Lobster	Blue crabs	Inland	Sardines	Others	Total SA fisheries
Fishing	90.4	212.8	569.5	28.1	526.3	47.7	62	1536.9
Downstream	61.7	254.4	147.5	17.8	81.2	24.9	45.5	633.1
Indirect	224.7	391.2	708.8	47.7	247.7	109.6	92.4	1822.1
Total	376.8	858.5	1425.8	93.7	855.2	182.2	199.9	3992

Source: EconSearch 2011, Appendix table 3.6



Economic indicators: measure of wealth from a fishery

1. Price of the privilege or right to access (e.g. license, lease or quota).
2. (1) relative to gross earning (5 year average value of annual landings) - asset performance
3. Total revenue (TR) relative to historical high (average of 3 highest TRs over the past 10 years)

2009/10 season	GSV	SGWC
1. Aggregated market values of license	$21m	$134m
2. (1)/ annual landing value	7	4
3. TR relative to historic high	42.7%	67.8%

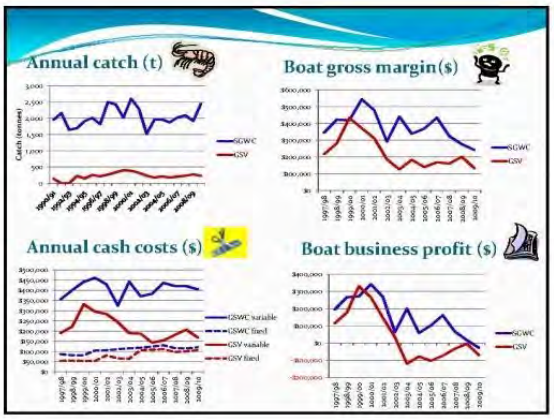
Economic indicators (cont.)

4. Beach price relative to historical high
5. Average boat gross margin
6. Average boat business profit
7. Economic profit (industry as a whole)

Volatility (eg. price, landing, TR) and more....

2009/10 season	GSV	SGWC
4. Beach price relative to historic high	62.0%	59.6%
5. Average boat gross margin ($000)	$132.6	$241.6
6. Average boat business profit ($)	-$70,251	-$26,804
7. Economic profit ($million)*	- $1.59m	-$7.33m

* Opportunity cost of 10% is used (EconSearch 2010)



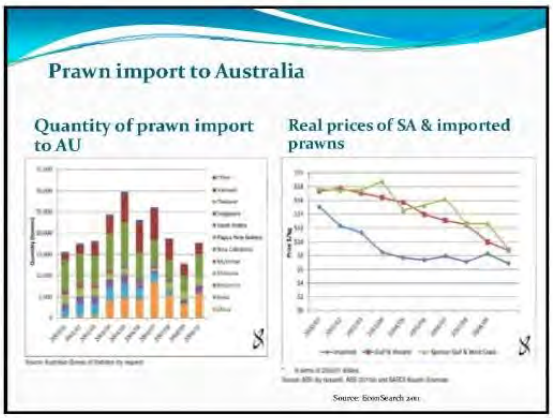
Beach price has declined...

Source: EconSearch 2011

Factor affecting the profitability

1. Decline in beach prices
2. Fuel cost as % of variable costs more than doubled in 10 years (7-12% to 22-23%).
3. Strong Australian dollar (significant proportion of SA prawn are exported overseas until 2005/06).
4. Increase in prawn import to Australia.
5. Increase in global production of farmed prawn.
   - -Farmed prawn production in AU almost doubled to 5,381 tonnes in 09/10 just in 2 years!
   - -Most are sold domestically (Australian Prawn Farmer's Association website)

Prawn import to Australia



Source: EconSearch 2011

Decline in real price of seafood greatest where aquaculture is highly substitutable for capture fishery products ..

Source: Grafton, Hilborn and Squire 2009

Capital investment..

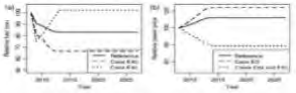
Data source: EconSearch 2011

Discussions

- Low beach price & higher fuel cost (lesser extent) have lower the profitability of the SA prawn fisheries.
- Beach price highest in Nov & Dec ($18.5/kg), lowest in April & May ($11.00/kg) in 2009/10
- Strong exchange rate
- Increased in prawn import and expansion of global aquaculture production appear to have had negative impacts on price.
- Boat capital investment has increased, although declining trends in recent years.
- Future uncertainty (e.g. fuel prices, exchange rate)

How about future?

- Fuel price expected to fall by 16% from its 2008 level over the next 7 years and to remain constant in real terms after 2013 (ABARE 2007).
- The price of tiger prawns increases over the next 7 years in real terms by 12%, owing to a projected softening of the AU$ (Punt et al. 2010).



- Short-term effects: Floods in Thailand, disease outbreaks in Vietnam have reduced supply, pushing up prices in 2011(FAO Globefish)
- Global aquaculture production continues to grow?

Crude oil prices

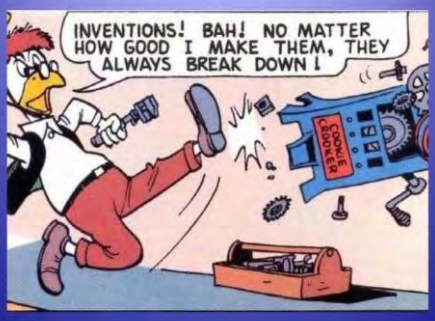
Recommendations

- Continue monitoring of the economic indicators
- Investigate the possible impacts of increased supply of farmed prawn on domestic prices and demand
- Identify harvest strategies that increase the future profits (size, seasons etc.)
- Explore management options (e.g. ITQ, buyback) to improve the profitability of individual operators.

Appendix 1.5. Transferable Fishing Rights

INDIVIDUAL TRANSFERABLE FISHING RIGHTS – A PATHWAY TO $$$$ PROFITABILITY $$$$

Annie Jarrett
Pro-Fish Pty Ltd
February 2012



Fisheries Management: A Delicate Balancing Act

- *Eco-system Based Fisheries Management*
- *Bycatch Reduction*
- *Marine Protected Areas*
- *Environmental Certification*
- *Resource Stewardship – Community Pressure*
- *Harvest Strategies*
- *Fishery reference points – MSY v MEY*
- *Economic Efficiency*

Adjustment

- Globally most fisheries have suffered from over-capacity, effort creep & recruitment overfishing
- Most fisheries have required cuts in fishing effort and adjustments in fishing capacity
- Mechanisms for capacity adjustment :
  - buy backs (govt and/or industry funded eg Qld, NPF, TS)
  - compulsory reductions in TAEs/ TACs
- Capacity adjustment (excluding buy backs) needs basis eg form of individual transferable fishing rights system

But:

ITS HARD TO BE GREEN WHEN YOU'RE IN THE RED

- Unfavourable FX – AUD high & climbing
- Challenging market conditions
- Too much competition (aquaculture & domestic)
- Increasing costs (production, management, research)
- Reducing or static catches
- Too Many Boats??

Australian Prawn Fisheries

Rights Based Management

Individual Transferable Fishing Rights

The Benefits

- SECURE ON-GOING ACCESS (PROPERTY RIGHTS) FOR INDUSTRY; SOUND INVESTMENT BASE FOR FINANCIERS
- FLEXIBILITY FOR OPERATORS – INDIVIDUAL DECISIONS TO BUY, SELL OR LEASE ARE MARKET BASED, NOT GOVERNMENT DRIVEN
- EFFECTIVE TOOL TO BALANCE FISHING EFFORT AND BIOLOGICAL & ECONOMICAL SUSTAINABILITY
- AN EQUITABLE TOOL FOR ADJUSTMENT IN THE FISHERY WHEN REQUIRED - (ADJUSTMENT PROPORTIONAL ACROSS THE FLEET)
- GENERALLY COST EFFECTIVE TO MANAGE AND ENFORCE
- HAVE PROVEN EFFECTIVE IN QLD, TORRES STRAITS & NPF PRAWN FISHERIES

Types of Individual Transferable Fishing Rights

- **Input controls: gear units; boat units; boat days/ time units; effort units; pot units** (Individual Transferable Effort Units or ITEs)
- **Output controls:** Individual Transferable Quotas (ITQs) – issued as kilos of fish/prawns

ASSUMPTIONS FOR SUCCESS

- ALL INDIVIDUAL RIGHTS FULLY TRADABLE (SALE OR LEASE)
- RETENTION OF LIMITED ENTRY
- CLOSURES FOR BIOLOGICAL/ ECOLOGICAL PURPOSES
- CONTINUED USE OF ECBM/ BYCATCH MITIGATION
- ONGOING RESEARCH, DATA COLLECTION & COMPLIANCE PROGRAMS – MAY VARY WITH EACH SYSTEM
- NEED TO CONSIDER ECONOMICS AS WELL AS BIOLOGY

WHO HAS WHAT RIGHTS BASED MANAGEMENT SYSTEMS?

- Northern Prawn Fishery: limited entry/ gear units (ITEs – investigation ITQs)
- QLD Trawl: Limited entry/ effort units (ITEs)
- Torres Straits: Limited entry/ boat days (ITEs)
- South Australia: Limited entry/ boat license
- New South Wales: Limited entry/boat license
- Western Australia: (Exmouth Gulf/ Sharks Bay): Limited entry/boat license

CRITERIA

- Equitable: need to identify existing shares & determine translation formula; the 'share' of rights held under one system must not be diminished in moving to a new system
- Flexible & Adjustable: operators need flexibility to adapt to changing circumstances & to maximise returns; fishery needs to be adjusted to respond to biological or economic changes
- Responsive – capable of adjusting the fishery on either biological or economic grounds in a timely manner
- Transferable: allows operators maximum flexibility to trade up or down to suit their own operational/market demands
- Economically efficient: retaining as few inputs as possible to maximise opportunity for economically efficient exploitation
- Simple & Cost Effective to manage: easily understood by industry; simple administration & enforcement; legally defensible

Input Controls

- **Boat Days/ Time Units; Effort Units; Gear Units; Capacity/ HP Controls**
  - Generally acceptable to industry – often based on catch history
  - Generally more cost effective
  - Not always effective at controlling effort
  - impose economic inefficiencies;
  - Flexible and responsive for adjustment *but*
  - benefits of individual decisions to increase efficiency dissipated across the fleet
  - Rent dissipation can occur if capacity adjustment doesn't occur (fishing inefficiently)

Individual Transferable Quotas -ITQs

- A Total allowable Catch (TAC) determined by bio (+ economic) model - Individual Transferable Quotas allocated (kgs of prawns) allocated
- Requires robust scientific data / stock assessment (+ economics if managing to MEY) & TAC predicting methodology – survey information can assist
- Best results generally in single, long lived species
- Few short life cycle (less than 6 years) multi species fisheries managed under ITQs tho some high volume, high value fisheries eg African anchovy/sardine , NZ arrow squid & Icelandic capelin fisheries
- No prawn fishery managed under ITQs (Mozambique Shrimp fishery closer to Total Allowable Catch system) – NPF investigating ITQs

The NORTHERN PRAWN FISHERY (NPF) Experience

1960's: Exploration followed by commercial trawling - open access fishery (no limited entry)

1974: Biggest banana prawn season on record; expansion of commercial fishery

1980: First 'Management Plan' for the NPF, 302 licenses

1985: The 'A unit' system introduced - individual transferable rights based - combination of hull and horsepower specs/formula

Provided secure legally defensible fishing rights & basis for management costs/ buy back/ adjustment

1985: Industry-initiated buy back scheme; 2 for 1 boat replacement policy

- ITQS CAN PROVIDE MORE EFFICIENCY GAINS THAN INPUT CONTROLS
- FLEXIBILITY TO MAXIMISE CATCH FOR LEAST COST; ECONOMIC EFFICIENCY; FACILITATES TRADE/ AUTONOMOUS ADJUSTMENT; LIMITS CATCH
- ECONOMIC THEORY – MOST BENEFITS ARE FROM QUOTA TRADING
- SINGLE SPECIES NATURE OF SGPF MAY BE SUITABLE TO QUOTA MANAGEMENT, SUBJECT TO STOCK ASSESSMENT
- POTENTIAL LOSS OF REVENUE FROM HIGH GRADING/DISCARDING
- COMPLIANCE, RESEARCH AND ADMINSTRATION COSTS HIGHER – CAN CO-MANAGEMENT OFFSET?
- ISSUES OF 'CORPORATISATION' AND CONCENTRATION OF OWNERSHIP
- REAL TIME MANAGEMENT MAY ALLOW TAC IN-SEASON UPDATES

The NPF Experience Cont.

- A Units ineffective effort control; Operators 'rorted' horsepower and vessel configuration regs; Effort creep and stock depletion
- Inflexible adjustment tool; can only buy or sell under adjustment
- Buy back based on A unit system slow and expensive: $45 million to remove 89 licenses over ten years
- Input restrictions to address stock depletion (twin gear/ closures/ daylight trawl ban) force inefficiencies/ reduce fleet profitability
- Additional 35% compulsory surrender of 'A' UNITS in 1993 – fleet reduced to 130 trawlers

ALLOCATION

- ALLOCATION IS THE MOST CONTROVERSIAL ISSUE IN MOVING TO ANY NEW SYSTEM OR IN IMPLEMENTING ADJUSTMENT PROGRAMS
- FISHERS ARE GENERALLY MORE INTERESTED IN WHAT THEY ARE 'GOING TO GET' THAN HOW A NEW SYSTEM WOULD WORK
- FISHING HISTORY (EG CATCH, VESSEL SIZE; HP) FINANCIAL INVESTMENT; ADMINISTRATIVE DECISION; AUCTION/ TENDER ALL MECHANISMS USED IN ALLOCATIONS

2000: GEAR UNITS INTRODUCED . ALLOCATION PROPORTIONAL TO 'A' UNIT HOLDINGS. TRANSITION INCORPORATES 20% REDUCTION IN TOTAL HEADROPE - 10 BOATS LEAVE

• 2001: BOTH SPECIES OF TIGER PRAWNS CLASSIFIED AS 'OVERFISHED'

• 2002: TOTAL HEADROPE REDUCED 15%. INDIVIDUAL REDUCTION PROPORTIONAL TO GEAR UNIT HOLDINGS. 17 BOATS LEFT THE FISHERY

• 2002: DECREASED SEASON LENGTH TO IMPROVE SUSTAINABILITY OF BROWN & GROOVED TIGER PRAWNS

• 2005: TOTAL HEADROPE REDUCED BY 25% TO IMPROVE ECONOMICS OF THE FISHERY. 11 BOATS LEFT THE FISHERY

• *38 TRAWLERS REMOVED IN 5 YEARS (INTERNAL ADJUSTMENT).*

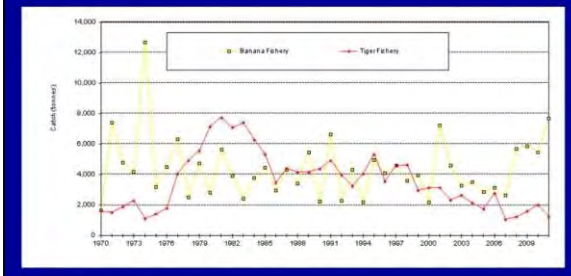
•60% EFFORT REDUCTION IMPOSED MASSIVE ECONOMIC INEFFICIENCY - SMALL GEAR, SHORT SEASONS, LOW PRICES = ECONOMIC DISASTER. 2007 GOVT-FUNDED SAP REMOVES 43 BOATS

GEAR UNITS IN THE NPF

- Total amount of gear and Fishing Season Length / Timing
- determined by bio (+ economic) model
- Allocation of gear units based on agreed formula 9eg catch history)
- Each gear unit entitles operator to % of towable gear eg 1 gear unit = 10 cm
- A gear unit can comprise headrope only or combined headrope & footrope (NPF has a headrope constraint relative to footrope)
- Under adjustment, total number of gear units remains the same - the value of each gear unit changes

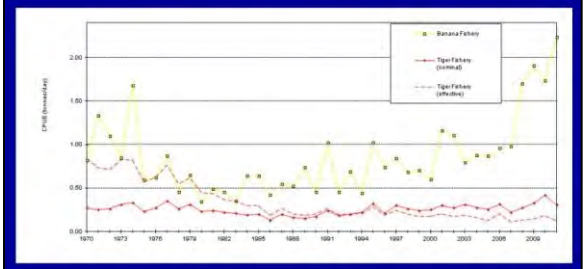
  As an example in the NPF where each gear unit equals 10 cm of headrope & 11.5 cm of footrope, , after a 10% reduction each gear unit would equal 9cm of headrope & 10.35 cm of footrope
- System requires net size identification / gear unit register/ regular net checks
- Transfer of gear units only during closures to reduce compliance costs

Catch in banana and tiger fishery (tonnes) 1970 - 2011



- Headrope (controls swept area) good measure of fishing effort
- Easily measured & enforced - particularly compared to hp
- Enforcement – on shore measuring and net tagging; at sea checks
- System does not impede technical innovation – allows for removal of other inputs eg boat size/ hp restrictions/ gear types
- Operators can trade gear units to suit own operational/market demands
- Flexible tool for adjustment - gives operators option of buying, selling, leasing gear units, amalgamating licenses or fishing with smaller gear
- Potential for effort creep with removal of boat size/ hp restrictions but can be adjusted
- Can result in economic inefficiencies (rent dissipation) if operators tow inefficient gear when adjustment occurs

NPF CPUE 1970 - 2011



The NPF Today

- From 302 to 52 trawlers; flexible gear unit system - no limits on gear: twin, quad, tongue nets ; flexibility/economic efficient
- Bio-economic model for tiger prawns; escapement policy for banana prawns; Catch trigger limits to determine season lengths (economic triggers)
- Harvest strategy includes Maximum Economic Yield (MEY) target reference point; MSY limit reference point
- Both species of tiger prawns now sustainable; 3 high yield banana prawns seasons (5000 – 7000 t)
- Industry Company; Co-management with AFMA – NPFI managing data, out-sourcing of surveys, crew member observer program; in MSC program
- GVP : $63m (130 Boats - 2004/5); $89 m (52 boats 2010/11)

ITQs in NPF

- World class tiger prawn bio-economic model converted to TAC predicting method but failed in 2011 (overestimation by 60%)
- Model heavily reliant on data from annual recruitment and spawning surveys (annual survey cost $750K)
- No stock assessment and TAC setting method for banana prawns due to high recruitment variability . 2010 under-prediction of 2000t ($20 million) but investigating environmental (rainfall) model
- High grading/discarding – trials of e-monitoring (cameras) to reduce observer coverage/cost
- Increased compliance & management costs > $500,000 pa
- Will require retention of some inputs ie seasonal closures to protect juvenile and spawning stock (Dec – March; June – July)
- Kompas et al CBA shows main gains ($50 million over 50 years NPV) from quota trading . Predicated on getting TACs right

Option 1 – ITQs for tigers & Bananas

Cost Type	Area	Option 1			
		Current* (2008-09)	CBA	TACs across the whole fishery (a la)	Spatial Split for bananas
Ongoing	Management	$488,580	$600,000	$600,000	$600,000
	Compliance	$813,975	$935,000	$962,550	$1,000,962
	Data Collection	$82,021	$90,000	$90,000	$90,000
	Licensing/quota monitoring	$37,635	$60,000	$60,000	$70,000
	Observers (15% coverage)	$148,858	$1,180,000	$1,180,000	$1,180,000
Transitional	Staff resources	-	-	$50,000	$50,000
	IT systems	-	-	$75,000	$75,000
	Plan Amendments	-	$60,000	$100,000	$100,000
	IAAP	-	$100,000	$100,000	$100,000
	Compliance		$10,000	$10,000	$10,000
	Sub-total		$170,000	$335,000	$335,000
Total		$1,490,133	$2,726,000	$3,137,550	$3,373,962

THE LESSONS

- There is no 'perfect' management system

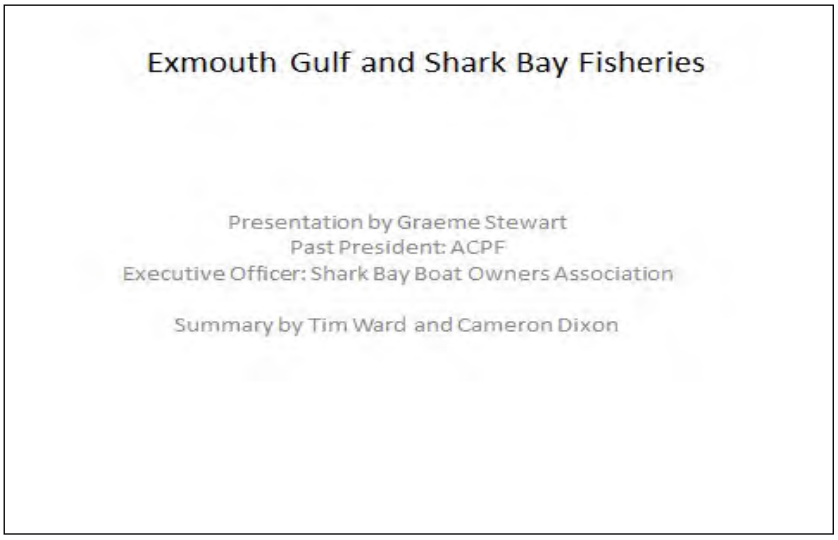
  OUTPUT CONTROLS – INDIVIDUAL TRANSFERABLE QUOTAS (ITQ's): responsive & flexible for adjustment BUT generally inappropriate in short life cycle, multi-species fisheries due to annual variation in recruitment & potential for high grading & discarding; expensive to administer and enforce

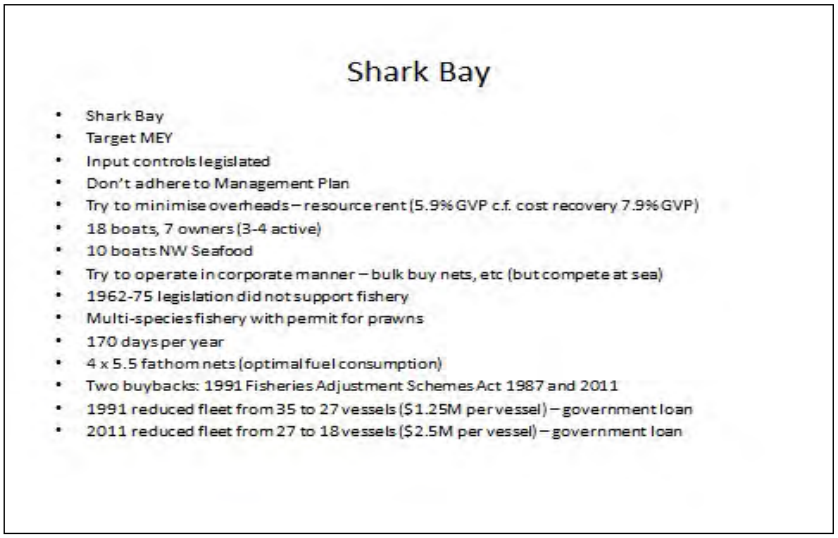
  INPUT CONTROLS – BOAT SIZE /HORSEPOWER CONTROLS: Not effective at controlling effort; not totally flexible or responsive for adjustment; impose economic inefficiencies; benefits of individual decisions to increase efficiency dissipated across the fleet

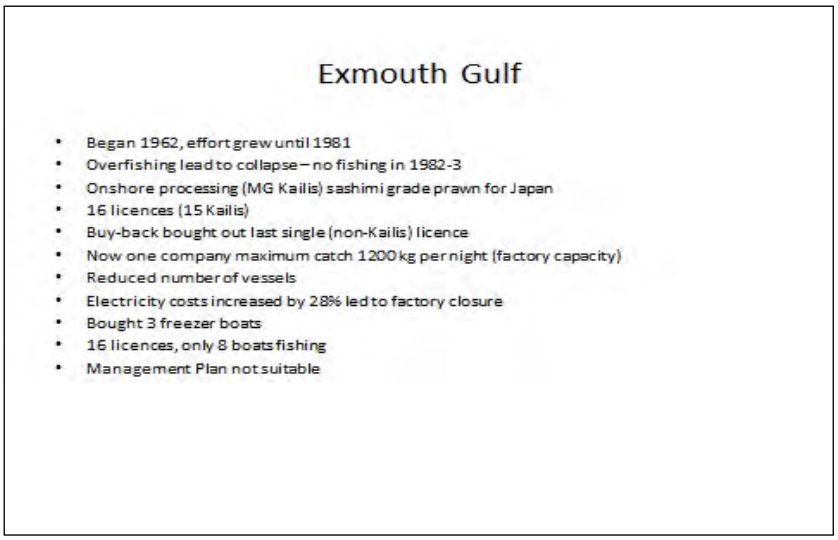
THE LESSONS cont.

- Trade-offs between costs and benefits in all systems
- The balance (competing objectives) changes – subject to complexity of management arrangements and degree of risk
- Closures effective for biological protection (eg seagrass/habitats/ small prawns) but impose economic impediments on operators
- Reductions in fishing effort MUST be implemented through the primary management tool to avoid increasing economic impediments
- Targets are rarely – <u>if ever</u> – met in time, on time, to achieve objectives: harvest strategy should include clear targets, objectives & decision rules, including economics
- Profit is not a dirty word!

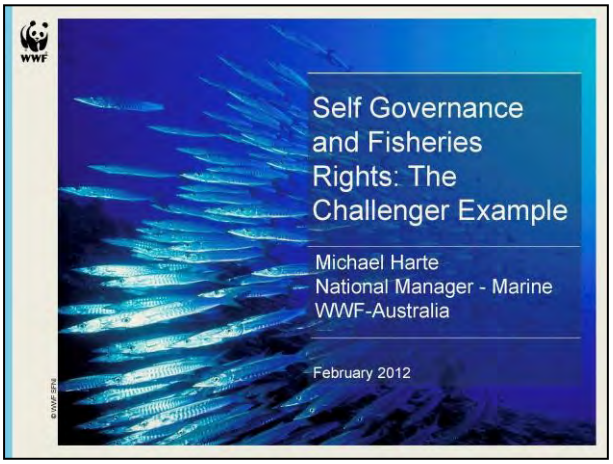
Appendix 1.6. Exmouth Gulf and Shark Bay

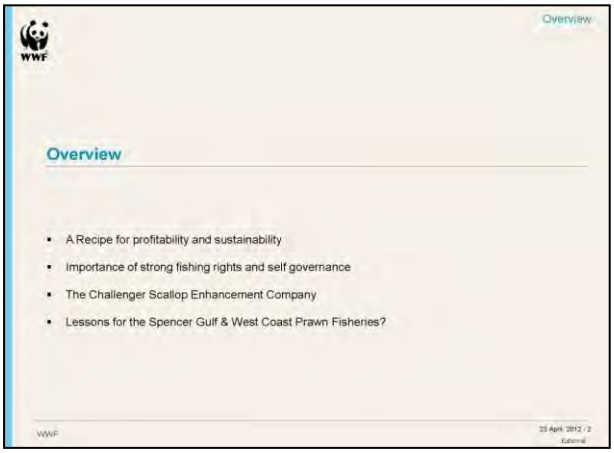






Appendix 1.7. Self Governance: Challenger Scallops





The Southern Scallops fishery

- The southern scallop fishery is located at the top of NZ's South Island.
- Between 30-60 scallop vessels operate in the fishery.
- Relatively small fishery with an annual harvest worth NZ$10-20m.
- Industry self governance is highly developed.
- It is one of NZ's first fisheries to have industry investment in and commitment to self-management.

Challenger Scallop Enhancement Company

- Challenger was created in 1992 to establish an ownership structure for collective capital investments.
- Challenger gives rights holders the ability to "privately" manage the fishery so as:
  - To capture upside benefits of sole ownership management.
  - To minimise free-riding.
  - To collectively control the costs of managing the fishery.

Challenger Company

- Challenger has gone through several major restructurings both internally and externally driven (government and environmental).
- Challenger is not a "sole owner" of the southern scallop fishery.
- Challenger has attempted to capture the benefits of a "sole ownership" management regime by use of civil contracts and regulation to overcome free-riders who might not otherwise pay levies for the costs of management.

Management and decision sharing arrangements

- Challenger has a MOU with NZ Ministry of Fisheries:
  - Specifies the information required by the Minister of fisheries to assess performance.
  - Provides for the Ministry to approve specifications and standards for research.
  - Provides for Challenger to make annual harvest level recommendations.
  - Establishes a process of consultation with recreational fishers, Maori fishers and environmental interests.
  - Makes provision for overcoming harvesting conflicts with recreational fishers (have a directorship on Challenger Board).

Management and decision sharing arrangements

- Challenger carries out its own research and selects its own science provider.
- Produces harvest strategy addressing proposals for:
  - Areas to be closed to commercial fishing under its rotational harvesting strategy
  - Areas to be closed to commercial fishing to allow for recreational fishing
  - % of fishing rights to be shelved each year (TAC is cap and not binding since harvest is less)
  - Daily and weekly catch limits.
- Business plan and harvest strategies approved at AGM by majority vote.

Management and decision sharing arrangements

- Activities funded under compulsory levy ranging from 15-20% of landed value.
- The management plan is implemented under civil contract among rights owners, vessel skippers and Challenger.
- All sign a contract outlining the harvest rules and agreed damages that must be paid in the event of non-compliance.
- Contract provisions are agreed by consensus at the general meeting of the Company.

Compliance and enforcement

- Two types of sanctions:
  - Sanctions that are applied to individual industry participants (e.g. vessel operators) for non-compliance with rules, whether they be regulations or contract rules.
  - Sanctions that apply to the Challenger for none performance under its management agreement with the Ministry of Fisheries.

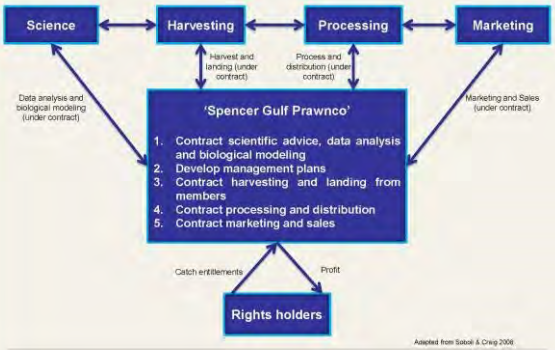
Lessons for Spencer Gulf Prawn?

- Spencer Gulf Prawn fishery has many of the key ingredients for a profitable and sustainable fishery already in place.
- Can you transition from statutory fishing rights to stronger property rights? This could be voluntary or State sanctioned.
- Can you build on existing co-management structures and look for opportunities for greater-self governance by internalising more management responsibilities especially those with major cost saving potential?
- Can you explore potential, benefits and costs for fishery to function like a sole operator through collective management of harvesting operations and value chain activities as well as routine fisheries management and research activities?

Compliance and enforcement

- Individual sanctions are specified in law or in the Challenger contract with scallop fishery participants
- Challenger performance is an organisational issue related to the competency of company and is audited by the shareholders (aligned with the government requirements).
- Challenger operates in many respects like a traditional government regulatory agency yet is managed by fishers for fishers.

Possible model for an integrated Spencer Gulf Prawn industry



Adapted from Sobel & Craig 2006

The wider influence of the Southern Scallop fishery

- Management arrangements in the southern scallop fishery were a catalyst for recent ground breaking fisheries reforms that promote devolution and decentralisation of fisheries management,
- Challenger offers a genuine alternative to centralised government management.
- The fishery is a blueprint for the wider devolution of fisheries management responsibility and for effective sole management by fishery rights holders.

Thank you

wwf.org.au

Appendix 1.8. Clarence River Prawn Fishery

Economic Performance & Management Opportunities
Spencer Gulf Fisheries Conference
Port Lincoln/Adelaide
27th & 28th February 2012

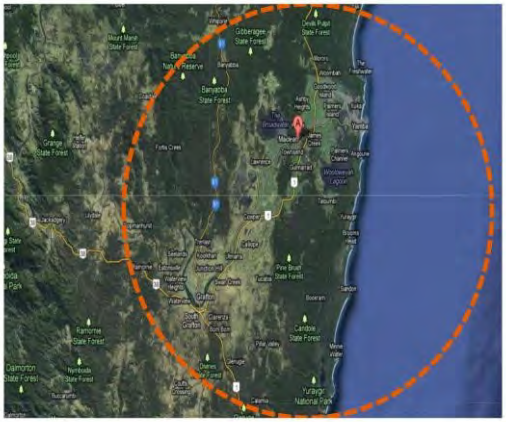
Danielle Adams
General Manager

CLARENCE RIVER FISHERMEN'S CO-OPERATIVE LTD

PRAWN YAMBA

WHERE HAVE I COME FROM??

- Hired – Sales Manager May 2011, promoted Sept 2011 to GM
- "KISS" business principles
- Graduate from school of hard knocks
- Sales experience from 15 years old
- Automotive & Software background
- International business experience – start-up businesses in China, Thailand, Philippines
- Focus on business feasibility, foundation laying, change management, profitability and bottom line impacts
- People growing rather than people management
- Proactive sales versus reactive headaches

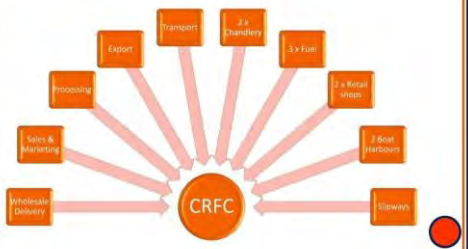


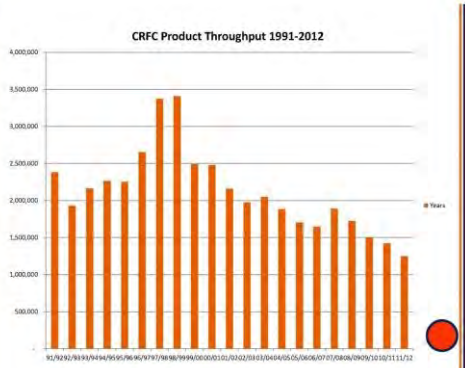
IF YOU CONTINUE TO DO WHAT YOU HAVE ALWAYS DONE, YOU WILL CONTINUE TO GET WHAT YOU HAVE ALWAYS GOTTEN!!

THE CLARENCE RIVER FISHERMEN'S CO-OP (CRFC)

- Incorporated in 1945
- 134 Members (all shareholders) – approx 40 Ocean and 94 Estuary
- Board of 6 – 4 fishers, 2 independants
- Core products – Mullet, School prawns, King prawns, Octopus, Trawl Whiting
- 50 Staff
- 7 hours north Sydney, 3 hours south Brisbane

CRFC Infrastructure (or the beast as I call it)



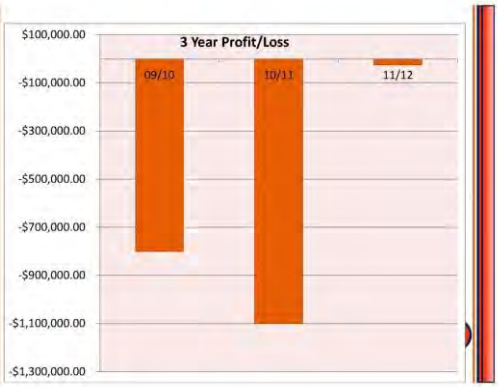


The challenges faced at the CRFC!

- Catch declining
- Detrimental financial losses
- Location
- Aging fleet
- Black market selling
- Industry deregulation (buybacks, fish receivers licenses)
- Imports
- Fewer clients
- 2 Aging facilities, old equipment
- Government controls and restrictions
- Costs increasing, seafood prices maintain same levels
- Operating like the old days not taking into account market/industry/trading downturn
- Angry share holders, negative fishers
- Very unhappy customers
- Natural disasters – 3 floods, 3 years

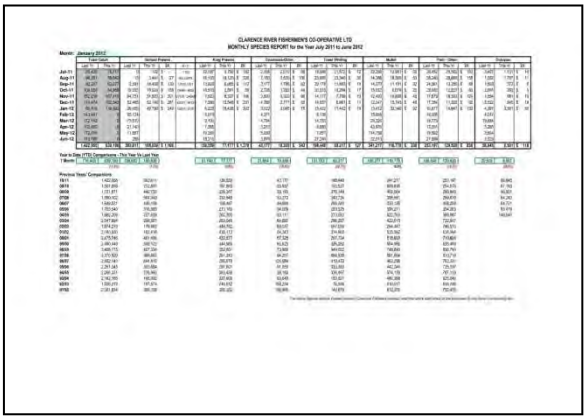
In the first 6 months

- Rebuild internal sales procedures
- Basic sales skills training
- Build relationships with surrounding towns small seafood sellers
- Focus on value adding
- Use shops to push product
- Focus on large buyer relationship from Corporate perspective – work on allocation orders
- Encourage one-on-one relationships with large buyers location managers



In the first 6 months

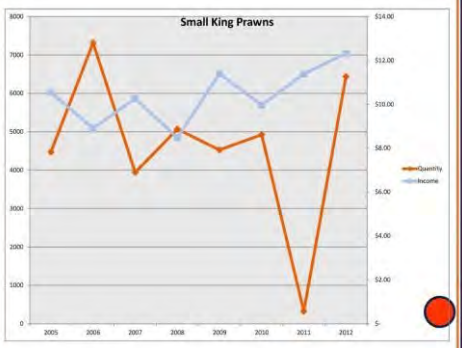
- Rebrand "Yamba Prawn"
- Review and research alternate markets
- Better use of bi products
- Export evaluations
- Encourage new memberships
- Alliances with other Co-Ops
- Sales runs – personalise the sales process
- Reassess processing values & costs (wet weight)
- Revise debtors accounts
- Greater visibility of information



CLARENCE RIVER FISHERMEN'S CO-OPERATIVE LTD
MONTHLY SPECIES REPORT for the Year July 2011 to June 2012

The Next 12 Months

- Yamba Prawn awareness campaign
- Add attention to undervalued species (Mullet) – point of sale material, value add options, how to cook etc
- Focus on "volume for value" projects
- Extend reach of client base and opportunities
- Industry networking
- New project involvement – more value add opportunities
- Export exposure, research markets
- Funding and capital expenditure investments
- Downsize without impacting operations



The Next 12 Months

- Recognise the competition but build your competitive advantage
- Win/win relationships are far more valuable
- Manage cash-flow without just targeting profitability
- Tweak the focus – don't focus exclusively on increasing sales and revenue - improve sales margins
- Balanced mix of sales opportunities and growth targets – more local sales, new export markets, value adding
- SMS communications with buyers
- SMS to members with targeted products, fixed prices, better returns

Evaluate Product Direction

Old direction	New direction
SFM	CRFC Shops
Local Sales	Local Sales
Larger sales/Woolworths (transport)	Larger sales/Woolworths (transport)
CRFC Shops	SFM/MFM

"Coming together is a beginning, keeping together is progress, working together is success"
Henry Ford

Marketing Focus

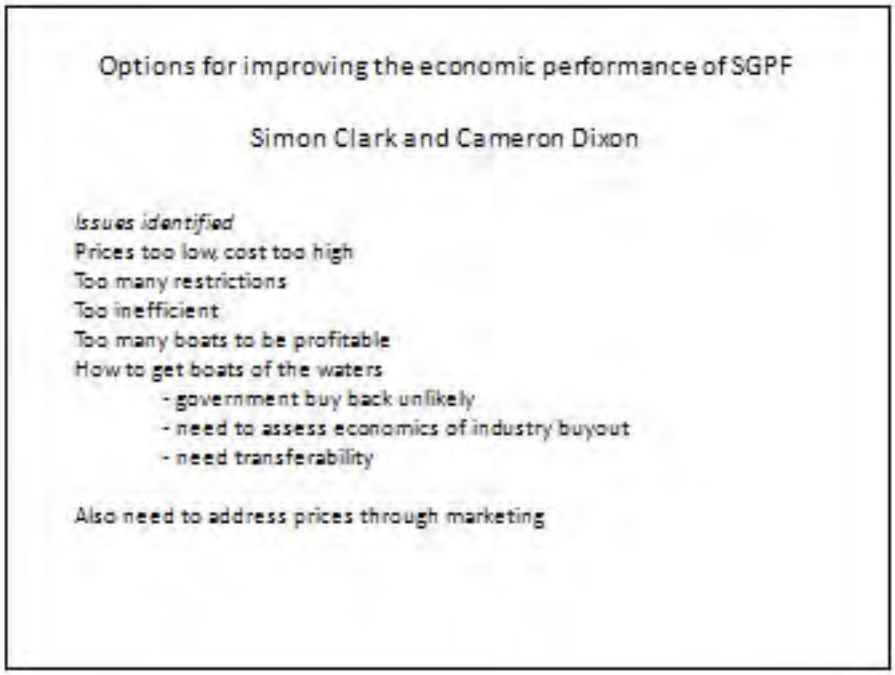
- In shop displays for new clients
- Involvement in Food Festivals/Functions
- Media opportunities
- Buy smarter
- Process faster – new machinery
- Evaluate quick cook/easy serve meals
- Bait market
- Processing for buyers
- Retail shops – no imports, all fresh, mostly local, "home-made, home-grown"

Thank You For The Opportunity To Share Our Company's Challenges, Vision and Plans

CLARENCE RIVER
FISHERMEN'S CO-OPERATIVE LTD

PRAWN YAMBA
CLARENCE RIVER FISHERMEN'S CO-OPERATIVE

Appendix 1.9. Key findings of initial SGPF Workshops

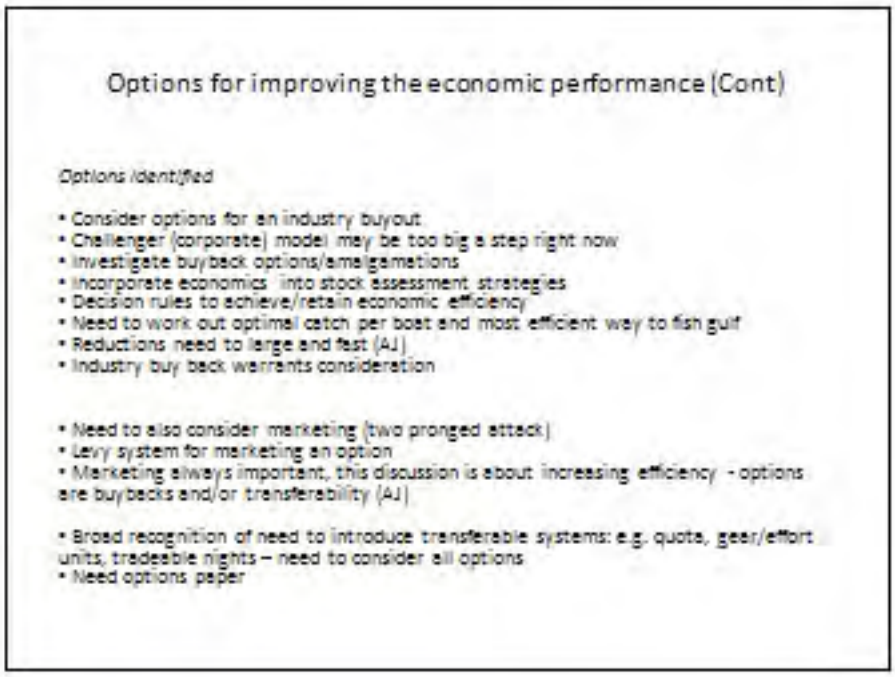


Options for improving the economic performance of SGPF

Simon Clark and Cameron Dixon

Issues identified
Prices too low, cost too high
Too many restrictions
Too inefficient
Too many boats to be profitable
How to get boats of the waters
- government buy back unlikely
- need to assess economics of industry buyout
- need transferability

Also need to address prices through marketing



Options for improving the economic performance (Cont)

Options identified

- Consider options for an industry buyout
- Challenger (corporate) model may be too big a step right now
- Investigate buyback options/amalgamations
- Incorporate economics into stock assessment strategies
- Decision rules to achieve/retain economic efficiency
- Need to work out optimal catch per boat and most efficient way to fish gulf
- Reductions need to large and fast (AJ)
- Industry buy back warrants consideration

- Need to also consider marketing (two pronged attack)
- Levy system for marketing an option
- Marketing always important, this discussion is about increasing efficiency - options are buybacks and/or transferability (AJ)

- Broad recognition of need to introduce transferable systems: e.g. quota, gear/effort units, tradeable nights – need to consider all options
- Need options paper

Appendix 1.10. SGPF Agenda Workshop 3

Economic Optimisation Workshop II

LOCATION: SARDI Adelaide

09:00 – 17:00 29 & 30 August 2012

FASCILITATOR: - Annie Jarrett

PARTICPANTS: Spencer Gulf Economic Optimisation Sub-committee, with supporting Officers, Simon Clark, Tim Ward and Eriko Hoshino

AGENDA

1.	Welcome, introductions & background	Exec/O
2.	Outline of the process and rules of engagement	
3.	Summary of Economic figures and assumptions	
4.	Establish and agree on primary driver for change	
5.	Establish targets that the fishery is setting.	
6.	Review property rights and establish options up for review.	
7.	Buy backs and buy ups.	
8.	Tradable rights – gear unit	
9.	Tradeable rights – gear by time effort units	
10.	Tradable rights - nights	
11.	Tradable right - quota	
12.	Self-governance	
13.	Small improvements – reduce net drag, prop technology etc	
14.	Economic decision rules	
15.	Discussion and summary	Chairperson
	Close	

Appendix 1.11. SGPF Briefing Paper for Workshop 3

Economic Optimisation Sub-Committee
Briefing Paper

Contents

1. Executive Summary

The profitability of businesses in the Spencer Gulf prawn fishery has been declining. Fisheries in similar situations typically undertake a structural adjustment program. The outcome of a structural adjustment is generally to improve profitability by removing inefficient activities or practices. Structural adjustments are often expensive and implemented when a fishery can least afford the change.

The Economic Optimisation Sub-committee (EOSC) will investigate structural adjustment options to improve the future profitability of the business involved in the fishery.

2. Purpose

The purpose of this paper is to provide preliminary background information for the Association's EOSC.

Information and recommendations developed by the EOSC will be submitted to the Management Committee. The Management Committee will then approach the Association's membership for further advice and feedback.

3. Introduction

On reviewing Econsearch's economic evaluations of the Spencer Gulf prawn fishery, in conjunction with regular feedback from membership within the fleet, it has been highlighted to the Association that there are concerns with the future economic viability of the businesses that operate in this fishery. This was reinforced during February's workshop where members provided broad agreement to evaluate future management options for this fishery to improve economic returns.

The Spencer Gulf prawn fishery has, to date, successfully been managed by input controls and real time management. The ecological sustainability of the fishery is of a high standard, as reflected by the Marine Stewardship Council (MSC) certification. Concern with the fishery has been raised through its future economic viability.

The economic performance of the fishery can be referenced back to the Management Plan for the Spencer Gulf prawn fishery (pg 36) which has several performance indicators. Two of these economic indicators have not been realised:

1. Gross Value of Production <0% change
2. Return on Investment <0% change

This is evidenced in the following extracts from the 2009/10 Economic Indicators for the Spencer Gulf and West Coast Prawn Fisheries report by Econsearch.
Average gross boat income fluctuated between years but, overall, between 1997/98 and 2009/10 average income decreased by 8 per cent.
Between 1997/98 and 2009/10 the average cost per kilogram increased by approximately 39 per cent, significantly more than the change in price.
The estimated rate of return to capital peaked at almost 9 per cent in 1999/00 but has followed a declining trend in subsequent years. In 2009/10 the estimated rate of return to capital was just 0.4 per cent. The decrease in rate of return is due to both a decline in profitability in the fishery and an increase in the value of fishing licences.
The Association has also established a set of targets through its annual reports, of which two economic indicators are:

1. Our fishing licence (with boat) is worth more than $4 million.
2. We have made an extra $10 million for the industry through value-adding methods.

The first is difficult to assess as there has not been a licence transfer for over 12 months. However, there have been licences on the market which have resulted in no transaction, indicating that this target is not being realised. The Association has not invested in developing value adding options, except through supporting investigations through the Nuffield Scholarship Candidate, Clinton Scharfe.
Fishermen (investors) have worked towards maximising their fishing operations within the boundaries of input controls, creating a race to the prawns. However, as it has been documented, the limitation of input control has driven inefficiencies into this fishery via the introduction of large expensive vessels which are used for short periods. The fishery has suffered from effort creep, i.e. large boats, greater horsepower leading to increased fixed costs etc. It should be noted that there is still potential for future effort creep, which is currently limited due to low returns leading to subsequent reduced investment capital.

4. Objectives of the Economic Optimisation Working Group

The objective of the EOSC is to evaluate alternative management options outlined in the February workshop by determining:

1. how a management option may be implemented,
2. associated benefits, negatives, implementation barriers,
3. operational costs (science, management, business, restructure)
4. economic return to the fishery of each option,
5. a priority list for the application of an option.

Following is a summary of points discussed at the February workshop.

- Property rights:
    - Quota/TAC
    - Effort units
        - Tradable nights
        - Time units
        - Area trawled
    - Gear units
        - Nets
- Fleet coordination/company structure
- Buy out or buy up licences
- Amalgamations

In order to evaluate options and alternatives, consideration needs to be given to the key driver for change and the new targets set for the fishery. Subsequently, the committee will develop some simple targets.
The topics for determination are:

1. Agree on the key driver(s) for change
2. Set targets
3. Analysis of available options
4. A review of a best fit option.

5. Key Driver for Change

The Committee should agree on a primary (and if necessary secondary) driver for the fishery to change. The primary driver for change that has been discussed in this fishery is declining profitability. There are various factors which have driven changes in the fishery, which include:

- variable costs of running the vessels are rising;
- prices are stagnant and reducing in real terms;
- Australian dollar is high decreasing international competitive edge for exports;
- competing with imported and local wild caught and aquaculture prawns;
- competition with employment packages with mining industry combined with a reduction in (real) wages is driving increasing staff turnover, which are;
    - reducing corporate knowledge in this prawn fishery,
    - leads to a risk of poorer quality prawns.
    - less experience crew intrinsically increases OHSW risks.

The majority of these factors are beyond the influence of the Association. However, changes in these factors can be estimated and subsequent plans established to how the fishery will respond, as such should be considered through the economic analysis of any selected structural adjustment.
To gain a global perspective and develop an understanding of the factors that the Association can directly influence with respect to economic improvement of the Spencer Gulf prawns fishery, and to develop a back ground to other experiences, consider extracts from an FAO report included in Appendix 1.

6. Target

The EOSC needs to set clear targets for this fishery to achieve through any structural adjustment. There are various economic measures which can be identified. The following are examples (taken from Econsearch report):

Boat Business Profit is defined as gross operating surplus (GOS) less depreciation less owner-operator and unpaid family labour. Boat Business Profit represents a more complete picture of the actual financial status of an individual firm, compared with GOS, which represents the cash in-cash out situation only.

Rate of Return to Capital is calculated as Profit at Full Equity divided by Boat Capital multiplied by 100. This measure is expressed in percentage terms and is calculated for an individual licence holder. It refers to the economic return to the total investment in capital items, and is a useful relative measure of the performance of individual firms. Rate of return to capital is useful to compare the performance of various licence holders, and to compare the performance of other types of operators, and with other industries.

Profit at Full Equity is calculated as Boat Business Profit plus rent, interest and lease payments. Profit at Full Equity represents the profitability of an individual licence holder, assuming the licence holder has full equity in the operation, i.e. there is no outstanding debt associated with the investment in boat capital. Profit at Full Equity is a useful absolute measure of the economic performance of fishing firms.

Economic Rent is defined as the difference between the price of a good produced using a natural resource and the unit costs of turning that natural resource in to the good. In this case the natural resource is the Spencer Gulf and West Coast Prawn fishery and the good produced are the landed Prawns.

7. Harvest target

Consideration should be given to the target harvest level and the ability of the management regime to assist in the targets being met. This fishery is currently harvesting at its maximum sustainable yield (Msy).

The alternative is to harvest at maximum economic yield (Mey). Mey sets a harvest strategy which is generally lower than Msy. Importantly, Mey takes into consideration the cost of fishing and price of the product. Bio-economic models provide a tool to assist fisheries in obtaining Mey. The advantages of Mey are that the fished biomass and fishery should be maximising its economic performance and creates a buffer against negative shocks (environmentally and economically).

8. Previous Concepts

There have been several submissions to the Management Committee in the past dating back to the mid-1980s. These options have been described in previous documents, which consider implementing:

- Individual Transferable Quotas (based on real time management)
- Voluntarily combine licenses (involves gear modification)
- Setting quota on one of the following attributes - time/nights/area trawled
- Buy-out effort
- Net transfers i.e. nets become a quota
- Purchase the Gulf of St Vincent fishery.

Other concepts are related to individual vessel cost management:
Reducing individual costs on the vessel:

- consider smaller engines with larger gear ratios and latest propeller and shaft technology to reduce fuel cost.
- modify fishing gear to reduce drag and effort, as demonstrated in the T90 trials or quad rigs.
- investigate options of an alternative to otter boards, such as the ‘batty’ wing.

9. Management Controls

Broadly there are two management controls: input and output controls.

Input controls – Generally simple to design and administer and allows the effort to adjusts to available stock. However there are disadvantages, they don’t necessarily lead to equitable access to resources. The strength of competition between fishers leads to investment into areas of operations that are not controlled by inputs. Structural adjustment is not driven by input controls.

Output controls – Generally output controls still maintain some input measures. These controls reduce competition between fishers, which can reduce capital stuffing. They can maximise operational flexibility and create a more secure access right. They require an economic model which can be expensive to maintain, are vulnerable to data corruption particularly through high grading, increased management costs and can lead to socio-economic changes in the fishery.

10. Individual Transferable Fishing (ITF) Rights

ITF rights refer to fishery being divided into units which are distributed to license holders. The effect of dividing up the fishery into units will generally lead to inefficient operations to be absorbed by efficient operations. ITFs traditionally have strengthened access rights to resources. ITFs can either be based on input or output controls.

Assumptions for success of ITFs

1. All individual rights are fully tradable (sale or lease) (transferable)
2. The rights exist for the long term (duration)
3. Retention of limited entry (exclusive)
4. Closures for biological/ecological purposes
5. Continued use of ECBM/By-catch mitigation gear
6. Ongoing research, data collection & compliance programs – may vary with each system
7. Need to consider economics

Criteria

1. **Equitable:** need to identify existing shares & determine translation formula; the 'share' of rights held under one system must not be diminished in moving to a new system.
2. **Flexible & Adjustable**: operators need flexibility to adapt to changing circumstances & to maximise returns; fishery needs to be adjusted to respond to biological or economic changes.
3. **Responsive:** capable of adjusting the fishery on either biological or economic grounds in a timely manner.
4. **Transferable**: allows operators maximum flexibility to trade up or down to suit their own operational/market demands.
5. **Economically efficient:** retaining as few inputs as possible to maximise opportunity for economically efficient exploitation.
6. **Simple & Cost Effective to manage:** easily understood by industry; simple administration & enforcement; legally defensible.

The benefits

1. Secure on-going access (property rights) for industry, sound investment base for financiers.
2. Flexibility for operators – individual decisions to buy, sell or lease are market based, not Government driven.
3. Effective tool to balance fishing effort and biological & economical sustainability.
4. An equitable tool for adjustment in the fishery when required (adjustment proportional across the fleet).

Types of Individual Transferable Fishing Rights

1. **Input controls**: gear units; boat units; boat days/ time units; effort units; pot units (Individual Transferable Effort Units or ITEs).
2. **Output controls**: Individual Transferable Quotas (ITQs) – issued as kilos of prawns.

Input Controls

The following represent possible input units, through an ITF system:

Boat Days/Time Units – licences are allocated a set number of nights or a time unit which allow access to the fishery. A time unit would be a percentage of total allowable nights allowed for a season which would be adjusted according to the stock levels. The nights or time units could be traded through either leasing or sale.

Effort Units – can represent gear type by time or swept area or vessel size by time. Similarly to time units, a gear unit would be issued to licences on a unit basis. The number of units would be influenced by the available stock.

Gear Units – represent an allocation of equipment which can be transferred between vessels, such as head line length.

Benefit

- Generally acceptable to industry – often based on catch history,

- Generally more cost effective,
- Flexible and responsive for adjustment ,
- Benefits of individual decisions to increase efficiency dissipated across the fleet.

Risk

- Not always effective at controlling effort,
- Can impose economic inefficiencies,
- Rent dissipation can occur if capacity adjustment doesn't occur (fishing inefficiently).

Output Controls

Output controls can be represented by Individual Transferable Quotas (ITQs). The ITQs would be established through a Total allowable Catch (TAC) which relies on research and a proven bio-economic model. ITQs result in an allocation of kg to each licence holder.

Assumptions for ITQ

- Requires robust scientific data / stock assessment (+ economics if managing to MEY) & TAC predicting methodology – survey information can assist. The accuracy of predictive models are important as an under prediction results in underutilisation & an over prediction can result in a stock collapse.
- Models are heavily reliant on data, including annual data collection.
- Best results generally in single long lived species.
- Few short life cycle (less than 6 years) multi species fisheries managed under ITQs though some high volume, high value fisheries eg African anchovy/sardine , NZ arrow squid & Icelandic capelin fisheries.
- No prawn fishery currently managed under ITQs (Mozambique Shrimp fishery closer to Total Allowable Catch system).
- NPF investigating ITQs.
- Flexibility to maximise catch for least cost, economic efficiencies, facilitates flexible trade/autonomous adjustments, limits catch.
- Single species fisheries are more suitable to quota management, subject to stock status.
- Potential loss of revenue from high grading and discards.
- Compliance, research and administrative cost are higher. Need to consider how co-management may offset these costs.
- Issues of 'corporatisation' and concentration of ownership.

Allocation

- Allocation is the controversial issue in moving to any new system or implementing adjustment programs.
- Fisheries are generally more interested in what they are going to get rather than how a new system works.
- Fishing history (catch, vessel size, and horsepower), financial investment; administrative decision; auction/tender are all mechanisms used in allocations.

11. Company model/self-governance

The company model is based on the experience of the Challenger Scallop Company. In response to dwindling stock and the establishment of a seeding program, the individual licences in the scallop industry in New Zealand Challenger region combined to establish a company to manage the business of

reseeding areas. Later further steps were taken to manage the fishery, including the science and data collection resulting in the company moved the fishery towards self-management. The following are key points:

- Self-governance or a company model is focused on internalizing the decisions related to fishing and fisheries management – short term and long-term – within the industry.
- It is about empowering the industry to take advantage of property rights to increase the value derived from the resource.
- Allows licence holders to have more flexibility to take action to make decisions to optimise revenues and reduce costs.
- Strong property rights together with self-governance allows a fishery to operate as a sole operator.
- Internalise decisions about risk and future prices to set catches to maximise the present value of the available resource.
- Make economically efficient decisions about the nature and extent of research services and compliance.
- Fishermen work together as co-owners to make tough economic decisions and collectively benefit from those decisions.

12. Buy outs (or buy ups)

An alternative measure is to buy out boats from the fishery. This in effect will allow the removed effort and catch to be distributed between the remaining vessels, potentially increasing revenue for remaining businesses. A buy out at this point in time would not receive direct financial support from the Government, as such, a funding mechanism would need to be developed.

A buy out of the fishery would need to consider value of removing effort from the fishery against the costs generated by its removal combined with the additional costs incurred through harvesting greater volumes of prawns. Determining the value of licences would need to be considered, which could potentially influence whether they are compulsorily or voluntarily acquired.

A limitation of buy backs is that it is does not establish an ongoing mechanism which can adjust to future changes in economic conditions. There are also risks of increases in capital investment which could lead to erosion of improved revenue in the race to catch more prawns.

The option of buying up the Gulf of St Vincent and other fisheries is a consideration, which will allow an expansion of the fishery. Similar issues surround a buy up as with a buy back, i.e. values, debt levels and benefit.

13. Amalgamations

The concept of amalgamating licences is equivalent to implementing a gear unit, such as headline length, then halving it. Consideration in an amalgamation would require an understanding of the value of the amalgamated licences, transfer of costs associated with the remaining vessels etc. Other factors to consider are whether the amalgamations would be considered compulsory or would be constituted as a component of a buy back scheme as implemented in Shark Bay.

Amalgamations, similarly to buy backs, share similar advantages and disadvantages.

14. Parameters for consideration

The following is a list of parameters that should be considered in determining any future changes. They may assist in clarifying and weighing up options of particular strategies that may be recommended.

- **MSC Certification** – may improve value of product and ensure that changes fit within the MSC criteria.
- **Real Time Management** – current management strategy to use stock assessment and spot surveys to decide on harvest strategies, creating a sustainable flexible approach to access the biomass.

- **Ecosystem and TEPS impacts** – need to consider any changes of risk or impacts on the ecosystem and TEPS.
- **Stock management** – ensure that prawn biomass is managed.
- **Survey Cost** – the cost of undertaking stock assessment and ecological impact research.
- **Culture of SG prawn fishery** – family owned businesses will influence strategies and ability to adapt to change.
- **Crew maintenance** – maintain product quality and low OHSW risks.
- **Compliance cost** – need to consider the changes in compliance costs with any management changes.
- **Management costs** – need to consider any management cost with any changes in the fishery.
- **Co- management** – consider the involvement and tasks of PIRSA and the Association under a new management regime.
- **Internal adjustment costs** – adjustment of the fishery may result in cost associated with making adjustments.
- **Carbon Tax** – manage future impacts of the tax.

APPENDIX 1.

The following extracts have been included from a FAO report; Gillett, R. Global study of shrimp fisheries. *FAO Fisheries Technical Paper.* No. 475. Rome, FAO. 2008. 331p.

> "The recent world shrimp catch is about 3.4 million tonnes per year, with Asia as the most noteworthy area for shrimp fishing. World production of shrimp, both captured and farmed, is about 6 million tonnes, of which about 60 percent enters the world market. Shrimp is now the most important internationally traded fishery commodity in terms of value. In many tropical developing countries, it is the most valuable fishery export; the employment aspect is also significant."

Profitability

In examining shrimp fishing in ten countries, one of the main features to emerge is the current low profitability of many commercial shrimp fishing operations. The typical situation consists of rising costs (mainly fuel) and falling revenue from shrimp sales (resulting to a large degree from competition with lower-cost farmed shrimp) in an environment where there is overcapacity. A number of measures to improve the current situation of poor profitability have been implemented or recommended. The most important measures are: increased attention to fuel costs, fleet reduction, market promotion, subsidies and import barriers. The boldest move to improve the profitability of domestic shrimp fishing in recent years has been the initiative in the United States to restrict the import of farmed shrimp on the basis that it has been dumped on the market.

Resource rent

Resource rent can be defined as the difference between the revenue from a fishery resource and the costs of exploiting it, including capital costs. In a broader sense, if non-monetary costs and benefits are taken into account, rent can be considered as the net economic return from a fishery to society. Good management regimes tend to increase rent; others, especially open access, can dissipate it. Unfortunately, information on the amount of resource rent available appears to have been estimated for only a few of the world's shrimp fisheries.

Prioritizing objectives

It is difficult to prioritize the incongruous and conflicting objectives that are often set for shrimp fisheries. On a practical level, one situation is especially common – attempting to maximize economic yield in an open access regime. An important objective of open access shrimp fisheries, probably more common in the world than restricted access, is often to maximize employment. This is, however, incompatible with the economic efficiency needed to generate maximum economic yield.

Impacts of shrimp farming on shrimp fishing

The main effects of shrimp farming on shrimp fishing are:

- economic impacts in the marketplace;
- the destruction of mangrove forests for shrimp aquaculture operations;
- the capture of shrimp postlarvae and broodstock for farming;
- escapes of cultured shrimp into the wild;
- the "trash fish" issue.

Overall, shrimp farming has had a substantial impact on shrimp fishing activities, from the fishery level to the international level. Interaction in the marketplace seems to have the most effect, at least during the present period of low profitability. The total impact of shrimp farming cannot be quantified, but the net result has been lower prices.

From the mid-1990s to 2005, a major feature in the world shrimp market was generally falling prices. Ward et al. (2004) indicate that from 1997 to 2002 in the United States, ex-vessel prices declined by 27 percent in the Gulf of Mexico and 24 percent in the Southern Atlantic States Shrimp Fishery, as imports increased by 300 percent.

In Japan, there was a general downward trend in prices from the mid-1990s. In the European Union (EU), combined penaeid import prices mostly declined from 2000, but prices for some captured species increased. Cold-water shrimp prices, as judged from Pandalus borealis prices in the United Kingdom, show a downward trend from the mid-1990s. Although increased aquaculture production is the main cause of the fall in prices, Globefish (2003) also notes other causes in the early 2000s.

Demand weakened in key markets, particularly the United States of America, following the events of 11 September. Difficult economic conditions in Japan, as well as the weak yen, meant reduced demand and downward pressure on prices in that market. In the EU, the appreciation of the euro vis-à-vis *the dollar effectively reduced import prices for shrimp products normally quoted in dollar terms.*

Since late 2005, the shrimp price situation has changed. Because of higher demand and lower expected aquaculture production, especially in Thailand, shrimp prices have been increasing. At least part of the increased demand is from Thailand and China where domestic consumption is rising.

Important Issues in the Shrimp Trade

Three important issues in the shrimp trade deserve special attention: the United States trade measures relating to turtle conservation, United States anti-dumping tariffs and ecocertification of shrimp fisheries.

Relative fuel consumption still compares favourably with other animal protein production systems. With an energy used/energy produced ration of 0.095 (about 10 percent), the fuel consumption in 29 North Atlantic fisheries appears to be about five times more efficient than beef production, 4.5 times more than lamb production, three times more than chicken production, 1.5 times more than swine production and much more efficient than most aquaculture systems (Tyedmers, 2004).

Fuel Saving

According to the ten countries studied, operational measures used in shrimp fisheries to mitigate fuel cost increases include: using multiple nets (Figure 24); lightening the fishing gear; using sled-type doors for otter trawling; switching from otter trawling to pair trawling; reducing bycatch; using improved netting material; avoiding trawling against tidal currents; basing shrimp vessels closer to fishing grounds; fuelling offshore; smuggling fuel; and remaining in port until the fuel and/or catch situation improves.

Improving Profitability

A number of measures to improve the current situation of poor profitability have been implemented or suggested. The most important are increased attention to fuel costs (discussed in Chapter 7), fleet reduction, market promotion, subsidies and import barriers.

Considerable optimism is shown by both fishery managers and commercial operators in many parts of the world that reducing the number of vessels participating in a fishery will increase the profitability of the remaining vessels. This is often expressed in general terms but, in Nigeria and the United States, there has been some quantitative work.

- *Economic revival (of the shrimp fisheries in Nigeria) will depend upon either prices rising or catch rates improving, as there is little scope to reduce costs. If prices don't rebound, then the principal option facing the industry must be to reduce overall capacity to allow unit catch rates to increase for the remaining vessels, a situation that may be faced by much of the world's shrimp fisheries. This is already happening with the Nigerian fleet – and an indication of the eventual impact on the fleet if prices remain at current levels can be estimated as follows: to restore profitability, catch rates would need to increase by 50 percent (i.e. from 60 to 90 tonnes per boat per year). This would imply a fleet reduction of at least 35 percent, or reducing the fleet to around 100–110 boats* (Chemonics, 2002).

- Ward *et al*. (2004) examined the economics of the Gulf of Mexico and Southern Atlantic States Shrimp Fishery. Simulation analysis found that with low shrimp prices, economic profits are negative and, at the end of 2004, a reduction of 30 percent of permits/licences of the large vessels would be needed to yield positive economic profits in 2005. For small vessels, positive economic profits can be achieved only for the 50 percent fleet reduction.

Reductions in shrimp fleet sizes to improve profitability have been undertaken in several locations, including Australia and the industrial fisheries in Madagascar. On the other hand, small-scale shrimp fisheries are often unprofitable, but there are few cases, if any, where management has reduced small-scale shrimp fishing fleets to improve economic performance.

Reduction in fleet size or capacity (e.g. through vessel numbers or gear restrictions) will not necessarily increase profitability in the long term. In input-controlled fisheries, which cover most shrimp fisheries, the incentive remains to innovate and rearrange inputs to become relatively more effective. Each operator introducing an innovation (e.g. a new net or otter board design) will enjoy a short-term benefit, but this will diminish as others adopt the new technology and effort creeps forwards, eroding profitability as fishing capacity increases and CPUE falls or seasons shorten.

Market promotion exercises have been carried out in several countries to improve profitability. The Mexican Shrimp Council (*Consejo Mexicano del Camarón*) and Ocean Garden Products of San Diego, the largest Mexican shrimp importer in the United States, launched a marketing campaign in March 2004 to promote the flavour and texture of shrimp from Mexico. The campaign, touted as "The Naked Truth About Shrimp", is designed to give farmed and wild Mexican shrimp the brand recognition that products such as Colombian coffee and Mexican tequila already enjoy.

When you've got something this good, why cover it up? Our south-of-the-border beauties come from the most pure ocean waters of a sun-drenched climate. This nutrient-rich environment paired with the VIP treatment means our happy swimmers come to you perfect in taste and texture – as is. All you'll ever really need are a few culinary essentials to bring out their natural flavor. Simple is good. Naked is best (www.mexicanshrimp.org).

At least some of the premium price paid for Madagascar shrimp in Europe has been obtained through market promotion exercises. The Norwegian Seafood Export Council has also carried out some effective publicity work for cold-water shrimp (Figure 25).

Some market promotion exercises are quick to take advantage of new opportunities. In September 2007, the marketing group Wild American Shrimp (WASI, affiliated with the Southern Shrimp Alliance *[United States anti-dumping action]*) launched a marketing campaign and fund-raising activities associated with new concern in the United States over the safety of Chinese seafood products. WASI feels that this is creating a new selling opportunity for shrimp caught in the United States. To take advantage of this situation, WASI indicates that it needs additional funds to the US$10 million in federal grants received over the last four years for the marketing campaign (IntraFish, 2007).

When profits collapsed in the United States shrimp fishing industry, several measures were proposed by NMFS, including a major marketing programme. Analysis of this proposal (Ward *et al*. 2004) showed that market promotion efforts would have to result in a 15 percent increase in ex-vessel price to eliminate the negative economic profits for smaller vessels. A 5 percent increase in ex-vessel price would increase revenues by 2.25 percent and employment by 2.24 percent. Significantly, the analysis concluded that market promotion and other attempts to improve prices would not be successful unless the number of vessels participating in the shrimp fisheries is limited.

Subsidies are another mechanism that has been used to improve the profitability of shrimp fishing. Most of the obvious subsidies are related to fuel costs (Chapter 7), but others are granted on a per vessel basis, or consist of measures such as tax waivers, low interest loans or provision of infrastructure. Many, but not all, subsidies are harmful (Box 19). Several types of subsidy interventions have been used for shrimp fishing, including those to reduce costs of shipbuilding (Australia), to import vessels (India) and

to fit out vessels (Nigeria). In general, the fully or overexploited nature of many shrimp fisheries has tended to reduce government enthusiasm for subsidies, while shocks such as fuel prices and competition with farmed shrimp have resulted in more pressure on governments to grant subsidies. Subsidies to shrimp fisheries are especially sensitive. Kura *et al*. (2004) make a strong case that government fishing subsidies are a leading factor in the excess capacity of the world's fleets. It is well known that many, if not most, of the world's shrimp fisheries suffer from overcapacity. It is therefore ironic that many of these fisheries continue to receive various types of subsidies.

The boldest move to improve profitability of shrimp fishing in recent years has probably been the initiative in the United States to restrict the import of farmed shrimp on the basis that it has been dumped on the market. In December 2003, the Southern Shrimp Alliance (SSA), a lobbying organization formed by shrimp fishers and processors in eight southern states, filed an anti-dumping petition with the United States Department of Commerce against shrimp farms in Brazil, China, Ecuador, India, Thailand and Viet Nam. In July 2004, the Department imposed duties varying up to 113 percent on these countries. SSA claimed it was seeking protection from an unfair trade practice, but some commentators saw it as a form of unfair protection from foreign competition. The United States shrimp industry is likely to have profited in three ways from the tariff: from reducing the quantity of imported product on the United States market; from a United States law (the "Byrd Amendment"), which gives the duties collected to the aggrieved United States party (some US$150 million); and from a deal between SSA and foreign producers (worth several million) to avoid reappraisal of the dumping duties (The Economist, 2006).

Although SSA efforts were initially successful, subsequent analysis shows that foreign entrepreneurs reacted creatively to thwart the United States restrictions. Shrimp buyers in the United States switched to new suppliers of frozen shrimp, and foreign producers subject to the tariff switched production to shrimp products exempt from the tariff. The amount of shrimp imported into the United States actually increased – including that from many countries subject to the anti-dumping measures. Action by the United States Government also reduced the impact: in February 2007, the "Byrd Amendment", was repealed and in August 2007, Ecuador was removed from the list of countries subject to the extra duty (Mathews and Dunaeva, 2007).

Resource Rent

Resource rent can be defined as the difference between the revenue from a fishery resource and the total costs of exploiting the resource. In a broader sense, if nonmonetary costs and benefits are considered, rent can be considered as the net economic return from a fishery to society. In limited access fisheries, resource rent can be kept by fishers (as super profits) or collected by management authorities (and returned to the public) through licence fees.

Good management regimes tend to increase rent; others, especially open access, can dissipate it. Accordingly, changes in rent can be an indicator of the economic performance of a fisheries management agency. For example, the performance of the AFMA in managing several shrimp fisheries under its jurisdiction is to some extent determined by changes in resource rent levels of these fisheries.

Resource rent has not been determined for many shrimp fisheries in tropical countries. The situation in Indonesia seems typical where, according to the Director of the Centre for Marine and Fisheries Socio-Economic Research, there have been few rent studies on any of the fisheries (A. Purnomo, personal communication, December 2005). Elsewhere, many fishery managers encountered during the present study are only vaguely aware of the concepts related to resource rent. Few managers appear to use the amount of rent when managing shrimp fisheries. Chapter 4 indicates that in many countries, the gross value of the shrimp catch is often used by fisheries managers for making decisions, such as trade-offs between fisheries, simply because the numbers are available and comparable. This is unfortunate, because resource rent is in many respects a better indicator of the value of a fishery to society.

Information on resource rent is readily available for several shrimp fisheries in developed countries.

- Galeano *et al*. (2004) give the rent in the NPF ($A33 million of resource rent in the 2001/01 season), the Torres Strait Prawn Fishery ($A2.8 million in the 2001/01 season), and the Southeast Trawl Fishery ($A2 million average for several years).
- Ward (2006) determines the resource rent level for the Gulf of Mexico shrimp fishery in the United States at US$2.11 billion. By introducing optimal yield management strategies and property rights into the fishery, a rent of US$4.19 billion could be obtained.
- Christensen and Vestergaard (1993) state that in 1991 the rent in the Greenland Shrimp Fishery in the Davis Strait was between US$33.8 million and US$104.8 million.

Limiting access is often difficult but, if implemented in the early stages of a fishery, the transition can be less expensive and more effective. Two examples illustrate the difference. In 1967, commercial prawn fishing began in South Australia's Gulf of St Vincent. Limited entry was introduced in 1968 and participation in the fishery was further reduced in 1987. Indicators show that the management objectives of "optimizing economic returns to stakeholders" are being achieved (Zacharin, 1997).

In Texas, United States, shrimp fishing developed rapidly after 1920 and in the 1930s a closed season and gear restrictions were implemented, but increased participation in the fishery created economic problems for the shrimp fleets. To improve the economic performance of the shrimp fishing, in 1995 the Texas Legislature enacted the first bay and bait shrimp vessel licence limited entry programme. Since the implementation of the licence buy-back programme, the Texas State Government has purchased and retired 815 commercial shrimp boat licences (422 bay and 393 bait) at a cost of approximately US$4.3 million. This represents 25 percent of the 3 231 licences of 1995.

Since the buy-back programme was not entirely successful at restoring profitability, additional management measures were implemented in 2002 (TPWD, 2002).

Economic Impacts in the Marketplace

The best studied example of economic interaction between shrimp fishing and shrimp farming occurred a few years ago, when large amounts of cheap imported farmed shrimp came on the market in the United States. In simplistic terms, the supply of shrimp on the world market soared mainly as a result of farming operations; prices decreased; imports into the United States increased; and prices paid to domestic fishers fell, causing a demise of warm-water shrimp fishing in the country. According to Ward *et al*. (2004), major impacts are the following.

- Since 1980, much of the growth in world shrimp production has been the result of successful farming activities throughout the world, particularly in Asia and, to a lesser extent, in South and Central America. World production of farmed shrimp in 1980 was about 160 million pounds19 (live weight), which accounted for approximately 5 percent of total world production at the time. By 2001, farmed production had advanced to 2.8 billion live-weight pounds, or more than 35 percent of total world warm-water shrimp output.
- There was an 11 percent increase in world farmed shrimp production from 2000 to 2001, representing an additional 280 million pounds of shrimp (live weight) on the world market.
- From 1997 to 2001, import prices (in constant United States dollars) declined from US$5.20 to US$4.25; shrimp imports into the United States increased by about 50 percent; and prices paid to domestic fishers declined from US$2.13 to US$1.73.
- Analysis shows that the ex-vessel shrimp price should decline 84 cents per pound for every hundred million pounds of shrimp imported into the United States.
- Although farmed shrimp imports were responsible for much of the price decrease, other factors could have contributed, including the varying conditions of national economies, tariff structures and tolerance levels for banned chemical substances.

Shrimp price declines, at least partially a result of the increased availability of low cost farmed shrimp, were not confined to the United States. From the mid-1990s to 2005, a major feature in the shrimp markets was that prices were generally falling. In Japan, there has been a general downward trend in prices from the mid-1990s. In the EU, combined penaeid import prices mostly declined from 2000 to 2005.

Since late 2005, the shrimp price situation has changed, with farmed shrimp once again responsible to some degree. Lower than expected aquaculture production, especially in Thailand, together with increased Asian domestic consumption, have been causing shrimp prices to increase.

Globally, the effects of cheap farmed shrimp are felt in most shrimp fishing fleets, especially those that target the major international markets. The resultant income declines are a major component of the current worldwide shrimp fishing "profit squeeze". The typical current situation for shrimp vessels is rising costs (mainly fuel) and falling revenue from shrimp sales (competition with lower-cost farmed shrimp being a major component) in an environment where there is overcapacity.

Several measures are being discussed or implemented to mitigate the adverse economic effects of shrimp farming on shrimp fishing. At the level of the individual vessel, low shrimp prices (from whatever cause) reduce profitability and, consequently, the means to increase revenue (e.g. higher catch rates) or lower expenses (e.g. fuel efficiencies) are pursued. At the fleet level, capacity reduction is often attempted in restricted access fisheries. At the national level, subsidies, trade promotion and trade restrictions are used.

The boldest example of such a trade restriction was the initiative in the United States to restrict the import of farmed shrimp, on the basis that it had been dumped on the market (Chapter 5, section *Important issues in the shrimp trade*). In December 2003, the Southern Shrimp Alliance, a lobbying organization formed by shrimp fishers and processors in eight southern states, filed an anti-dumping petition with the United States Department of Commerce against shrimp farms in Brazil, China, Ecuador, India, Thailand and Viet Nam. In July 2004, the Department imposed duties varying up to 113 percent on farmed shrimp from these countries.

Appendix 1.12. Economic Indicators for SGPF

Economic Indicators for the Spencer Gulf & West Coast Prawn Fishery

Economic Optimisation Workshop
7-8 September 2012

Julian Morison
EconSearch Pty Ltd

econsearch

Overview

- Economic Indicators
- Spencer Gulf & West Coast Prawn Fisheries

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Economic Indicators

- Catch, gross value of production and prices
- Cost of management
- Boat level financial performance indicators
  - average income
  - operating costs
  - cost-price squeeze
  - profitability
  - return on investment

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Economic Indicators

- Economic impacts
  - Output
  - GSP
  - household income
  - employment
- Economic rent
- Other indicators

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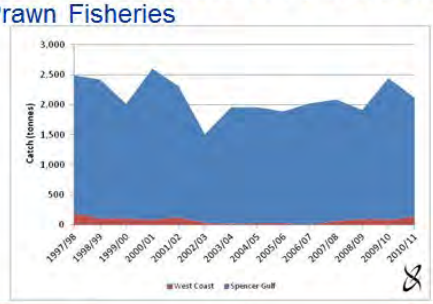
Catch in the Spencer Gulf & West Coast Prawn Fisheries



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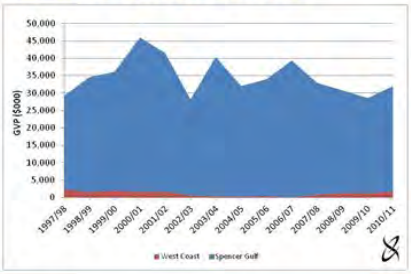
Catch and GVP in the Spencer Gulf & West Coast Prawn Fisheries



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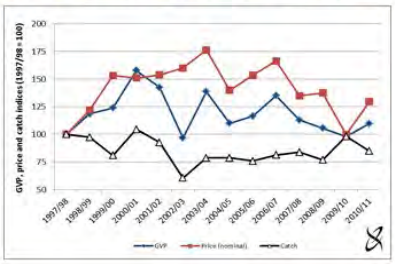
GVP, Price and Catch Indices SGWC Prawn Fisheries (1997/98=100)



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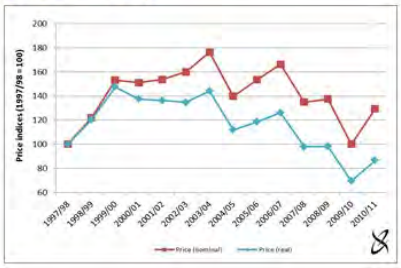
Price Indices SGWC Prawn Fisheries (1997/98 = 100)



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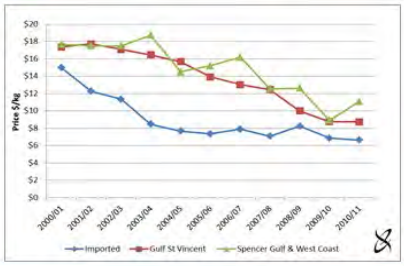
SGWC, GSV and Imported Prawn Prices



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Costs of Management, SG Prawn Fishery

	Licence Fees ($'000)	Gross Value of Production ($'000)	Fees/GVP (%)	Catch (tonnes)	Fee/Catch ($/kg)	Licence Holders (no)	Fee/Licence Holder ($/licence)
Spencer Gulf							
1996/97	648	20,389	3.2%	1,647	$0.39	39	$16,603
1997/98	916	26,859	3.4%	2,300	$0.40	39	$23,490
1998/99	732	33,074	2.2%	2,315	$0.32	39	$18,775
1999/00	653	34,196	1.9%	1,910	$0.34	39	$16,739
2000/01	605	44,518	1.4%	2,522	$0.24	39	$15,508
2001/02	566	39,873	1.4%	2,182	$0.26	39	$14,557
2002/03	671	27,681	2.4%	1,479	$0.45	39	$17,193
2003/04	753	40,171	1.9%	1,943	$0.39	39	$19,316
2004/05	734	31,759	2.3%	1,939	$0.38	39	$18,826
2005/06	803	33,610	2.4%	1,870	$0.43	39	$20,587
2006/07	899	39,386	2.3%	2,024	$0.44	39	$23,053
2007/08	1,012	32,163	3.1%	2,028	$0.50	39	$25,959
2008/09	963	29,549	3.3%	1,821	$0.53	39	$24,700
2009/10	917	27,447	3.3%	2,361	$0.39	39	$23,508
2010/11	921	30,335	3.0%	1,979	$0.47	39	$23,617
2011/12	921	n.a.	-	n.a.	-	39	$23,619

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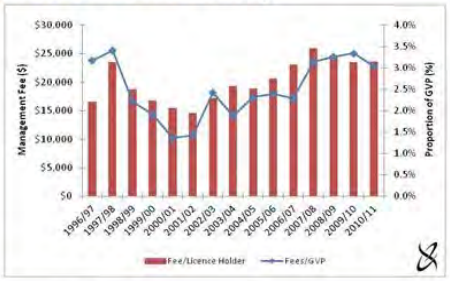
Fee per Licence Holder & Fee as a % of GVP, SG Prawn Fishery



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Survey Results

- Financial performance indicators
  - Income, costs and profitability as an average per boat
- Economic impact of the fishery
  - Direct and flow-on economic benefit created as a result of the operations of the fishing industry
- Economic rent

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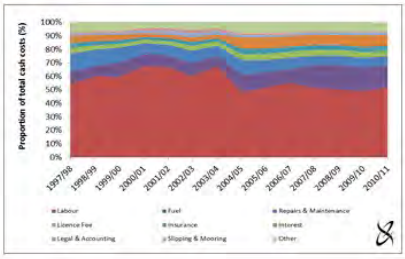
Cost Shares, SGWC Prawn Fisheries



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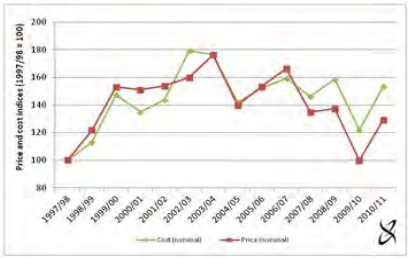
Cost-Price Squeeze, SGWC Prawn Fisheries



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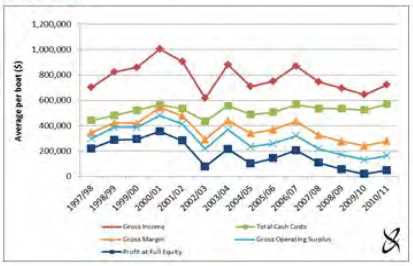
Income and Profit, SGWC Prawn Fisheries



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Return on Investment, SGWC Prawn Fisheries

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Economic Impact of the SGWC Prawns Fisheries in SA, 2010/11

Sector	Output $m	Employment fte jobs	Household Income $m	Contribution to GSP $m
Direct effects				
fishing	32.0	185	12.5	22.1
downstream	30.2	230	8.9	13.6
Flow-on effects	76.9	346	20.9	38.2
Total	**139.1**	**760**	**42.2**	**73.9**
Total/Direct	2.2	1.8	2.0	2.1
Total/Tonne	$65,700	0.36	$19,900	$34,900

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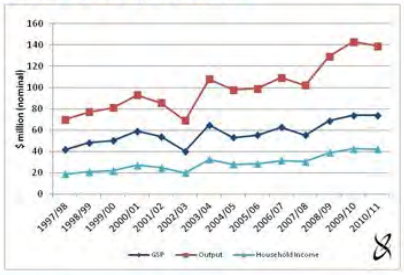
Economic Impact of the SGWC Prawns Fisheries in SA, 2010/11



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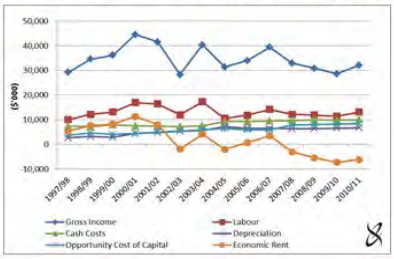
Economic Rent in the SGWC Prawn Fisheries, 1997/98 to 2010/11 ($'000)



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Other Indicators

- Prawn imports to South Australia
- Prawn exports from South Australia
- Exchange rates

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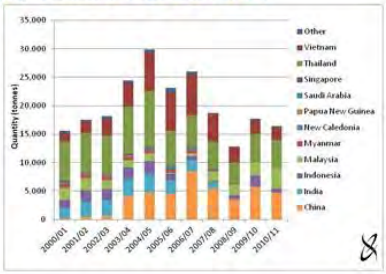
Prawn Imports to SA by Country of Origin, 2000/01 to 2010/11



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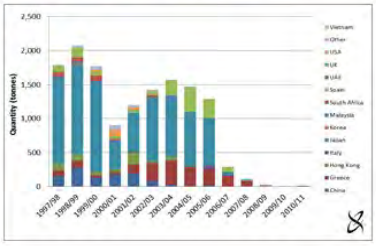
Prawn Exports from SA by Destination Country, 1997/98 to 2010/11



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Exchange rates and SGWC Prawn prices, 1997/98 to 2010/11

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Appendix 1.13. Spencer Gulf Prawn Fishery Economic Model

The model is in a relatively basic form (early stage of development) but suitable for looking at scenarios that involve variations to one or more of the following:

- Annual catch
- Prices
- Effort creep
- No. of boats leaving the fishery annually (assumed to be leaving via a buy-back funded by the remaining boats)

Values for each of these variables can be entered in the first sheet of the model 'Base Assumptions'. Cells that can be changed are coloured green and all others are locked.

The model allows for three scenarios to be calculated at one time (S1, S2, S3).

The model generates outputs over a 10-year period so input assumptions are required over that period as well.

- For the annual catch variable, the last 7 years is taken to be an average of catch in the base year and first 3 years.
- For the price variable, the user inputs a value that will be used for each of the last 7 years.
- Similarly for the effort creep variable, the user inputs a value that will be used for each of the last 7 years.
- For the number of boats leaving the fishery, the user can input the number of boats leaving in each of the 10 years.

Also on the 'Base Assumptions' sheet the user can input:

- The start year for the analysis – currently set at 2012 which means the first year is the 2012/13 season.
- The number of boats in the fishery in the start year – currently set at 39
- The opportunity cost of capital – currently set at 5%. This value is used only in the calculation of economic rent for the industry/fishery level analysis.
- The Licence value/GVP response – this determines how average licence values change when the GVP per boat (gross income) changes. Currently set at 0.4 (or 40%) which means if the GVP per boat increase by 10%, the estimated licence value will increase by 4%.
- Average cost of buyback debt – currently set at 8%. This is used to calculate interest payments for the boats remaining in the fishery.

The only other places for user input are in the:

- 'Boat Costs' sheet, row 43 - Adjustment to Baseline Licence Value, currently set at 20%. This variable allows the user to modify the baseline licence value (=$3.2m), which is likely to be above the current market value. In the model the licence value will determine the cost of the buy back and hence the level of interest payments.
- 'Base Year Data' sheet, cell AM3 – Skipper & Crew share, currently set at 35%. Adjustments to this variable will directly affect the labour cost. This assumption applies to all scenarios, i.e. can't be varied between scenarios.

The boat level data are linked to the baseline data and can't be edited at this stage. The data are identical for scenarios 1, 2 and 3. The objective is to have the option of editing the boat level data or having one of the boats as the fishery average and the others as high catch and low catch or even the user specifying the costs, catch, CPUE, etc. for their own boat, so they could see the implications for them and compare to the fishery average. However, it will take some further development to build that functionality into the model.

The other sheets in the model are either outputs (results), data or calculation sheets, as follows:

- ‘S1 Boat’, ‘S2 Boat’ and ‘S3 Boat’ – detailed results over 10 years for the average boat in the fishery for each of the three scenarios
- ‘S1 Summary’, ‘S2 Summary’ and ‘S3 Summary’ – summary results over 10 years for the average boat in the fishery and for the fishery as a whole for each of the three scenarios
- ‘S1 Licence & Debt’, ‘S2 Licence & Debt’ and ‘S3 Licence & Debt’ – summarise over 10 years the number of boats, GVP, level of debt, repayments, licence fees per boat, etc.
- ‘Mthly catch by grade’, ‘Mthly price by grade’ and ’Mthly GVP by grade’ – sheets calculating catch, price & GVP according to base data and inputs in ‘Base Assumptions’ sheet.
- ‘3yr catch by grade by month’ and ‘20 yr catch & CPUE’ – baseline catch and CPUE data from SARDI.

Please keep in mind that the model was developed to this point just to consider some scenarios at the economic optimisation workshop (West Beach, 6-7 September 2012), so it is quite basic. However, it could be extended to look at other structural change scenarios.

Notes prepared by:
Julian Morison
EconSearch Pty Ltd

Appendix 1.14. SGPF Draft Outcomes for Workshop 3

Economic Optimisation Workshop preliminary draft outcomes

Provided a summary of the fisheries economic statistics.

Agreed the costs of running the prawn boats business are increasing.

There is a large difference between business value of license and owners expected value.

Agreed that the bottom line is getting smaller; payment of crew is a large issue, costs of operating continually creep up.

Need to include forward projections of fuel, Australian dollar, labour and other data that effect operational costs or prices.

Agreed that the major external factors are:

	Rate influence	**Note**
Prices	Low influence.	High investment of marketing costs with no guarantee for a return.
Australian Dollar	No influence	Market forces, predicted that parity in the norm for the medium term.
Imports	Very low likelihood of impacting on any direct changes o imports,	Difficult to influence Cwth trade policy to introduce "tariffs". Not influence production levels.
Employment competition	No influence.	Mining will continue to offer high wages.
Operational costs: Labour/Fuel/insurance	No influence individual business.	Ability to reduce costs on a fleet wide basis through a reduction in the number of operational vessels.

Note that land base businesses are driven to rationalise through high unserviceable debt. – Noted that this is not the current situation for the prawn fishery.

Harvest Strategy

There was discussion around the fact that there is possibly some 'fat' in the harvest strategy and there is potential to push the effort up slightly. It was noted that the fishery had become relatively stable, however to increase effort will increase risks of reduced stock stability, hence business certainty.

ACTION: Investigate the option of pushing up effort in the Nov/Dec harvest strategy to test the current strategies.

Management plan is under review.

ACTION: Management Committee to follow up a review data to push boundary of current fishing volumes. Evaluate the harvest strategy to determine if the current strategies are not being too conservative.

Short discussion with regard to improved efficiency of gear. Quad rigs are considered to improve fuel use and maintain catches, generating a small saving to the fishery.

ACTION: Literature review of net configuration efficiencies. It is recommended that the Management Committee to investigate gear trials.

ACTION: It was recommended that marketing and promotion is should be treated as a work in progress.

Target for establishing sustainable catches

Management Plan should potentially change focus to economic + biological to move towards sustainable profitability, maintaining underlying stock sustainability.

ACTION: It was recommended that the Association improve the understanding and application of Mey.

Indicators

Life style was considered an important aspect in remaining and operating in the fishery. Are there Life style indicators?

Action: Remove GVP as an economic indicator. Use "Whole of fishery profit" (aka economic rent) as an indicator *(what value or change to provide trigger??)*

Restructure through buy backs

Lengthy discussion on Buy-backs – presentation of model. A large challenge is to manage licence value through buy back.

Discussion resulted in more questions. What is license's value? What is economic affordability? What are the new efficiencies?

Two groups reviewed options discussed.

Group 1 review of tradable management options:

Characteristics	**Nights**	**Gear Units**	**Gear x Time**	**ITQs**
Equitable	2.5	3	3	3
Flexible / Adjustable	3	2	3	3
Responsiveness	3	2	2.5	2
Transferable	3	3	3	3
Economically efficient	2	2	2	3
Simplicity / Cost effective	3	2	1.5	1
Legally defensible	3	3	3	3
Allocation complexity	3	3	3	2
	22.5	**20**	**21**	**20**

Additional comments

	Night Units	Gear Units	Gear by Time units	Individual Transferable Quotas
Management Implication	Can vary value of a night on temporal / seasonal considerations. Low cost administratively simple.	Low cost administratively simple once you define the nature of the unit (head rope length).	Can be complex compared to other systems. Need to define the nature of the units. How to monitor against target limits for nightly catches twin v triple?	What process / values would be used to allocate- catch, entitlement, effort? Management systems – TACC setting, reporting, quota, integrity.
Benefits / Negatives	Can create need to fish sub optimally to meet available nights. Fleet has a level playing field on fishing nights now – is a night equal across the season? Can be adjusted.	Can be adjusted up or down to suit sustainability. Can be costly for monitoring, Can lead to greater efficiency and limited effort creep in NPF. Higher level of compliance monitoring required.	Can add costs for implementation, management and monitoring.	Could create allocation based on temporal values x Real Time Management information. Is high grading an issue – manage size by other gear or technologies?
Operational costs	Initial set up of system for monitoring (a register). Low cost options compared to ITQ. Need to maintain current systems and costs	Initial set up of system for monitoring (a register). Low cost options compared to ITQ.	Initial set up of system for monitoring (a register). Low cost options compared to ITQ, but more costly to evaluate all input values.	Initial set up and ongoing costs are high compared to other systems – research, modelling, reporting, monitoring, compliance. How to ensure integrity of systems?
Economic return	To be developed	To be developed.	To be developed.	To be developed.

The group reflected that the scoring did not reflect the “gut feeling” of the groups as to the preferred option.

Group 2 Feedback on evaluation of options:

	Equitable/ secure investment	**Flexible/ Adjustable**	**Responsive**	**Transferable**	**Economic Efficiencies**	**Simple & cost effective**	**Legally defensible**	**Allocation complexity**
Quota	• ✓ • More permanent • Banks favour • Good access right • Poor harvest right	✓ • Flexible if market available. • Set Annually	✓ • Pre and post Christmas quotas	✓ • Market trading, driven by relationship between partners • Knowledge of availability.	✓ • Remove inputs • Depends on level of trading.	- • Simple to set up • Science? • Compliance is the biggest issue, high grading. • Grades/size structure. • Variability of change – gear selectivity.	✓	High degree of difficulty.
Tradable rights – Gear unit/ Nights/ Unit x time	× Gear: Catch variation according to headline length is not linear. Nights: Potentially not even value.	✓ Gear: Market availability ok. Nights: High risk give there is not a strong market seen.	✓ Pre and post Christmas	✓ Gear: ✓ Nights: Not all equal	•Temporal variability. •Effort creep risks with inputs controls remaining. •Less so than catch quota. •Need to maintain input control.	• Nights and gear are relatively simple. • Gear by time units could be relatively complex.	✓	Less complex than quota.

Ranking for group 2:

1. Tradable gear units,
2. Quota (TAC),
3. Tradable nights/effort units.

Additional discussion points

Quota:

1. Higher research and compliance costs, high grading, psychological aspects of deck cameras, loss of flexible access and reward for good fishing.
2. Look at alternative markets (live export etc).
3. Landing quota – simple given few points. Handling.

Gear:

1. Changes are expensive, complex formula to set up gear unit over time, maintain real time management implicit in thinking.
2. Headline length as a unit.
3. Require capping, increase costs over time.
4. Mid season- mid run difficult to change.
5. Trigger to close fishery could related to kg/headline length.

Risks and information gaps

The following table summarises the risks and information gaps relating to the alternative management options discussed.

Risks	Who	Time-line	Information GAP
Quota (kg)			
Costs	PIRSA Manager		Identify compliance (on shore/at sea) (PIRSA), research costs (SARDI), administration costs (PIRSA)
High grading/ discarding	Research Sub-committee	Oct 13	Camera on vessels? Audit gear structure – trigger investigation. Selective gear reduced small catch. Electronic reporting system vs prior reporting. Electronic logs.
Allocation	S. Sen	Nov 12	Advice on allocation methods. Cost to be determined. Explain different methods. A summary of case law trends. Table of past fisheries experiences.
Cost/security of finance[1]	A. Jarrett /G. Palmer	Nov 12	Is quota preferred than other units by banks for security? Considered it is more driven by fishery profitability. How would bank view security of alternative property rights? Based on profitability – understanding of banks. Asset backing influence.
Tradable rights – Gear/Nights/Effort unit			
Cost	PIRSA Manager		Identify compliance (on shore/at sea) (PIRSA), research costs (SARDI), administration costs (PIRSA)
Establishment cost	Research Sub-committee		Gear trials and research establishment and research design. Convert to new gear and trigger limit, universalising trigger limit. (Consult Jack Davis on quad gear).
Effort creep	Executive Office		Controls and management, modelling acceptable change. Dave Stirling fishing power model (with CSIRO).
Unit	SARDI/PIRSA		Developing the gear unit.
Nights/effort unit additional			
Effort creep Nights	SARDI		Understanding temporal variation – run in bio model. Going to be looked through model.
Value and tradability of nights	SARDI		Concern raised that the most efficient nights already fished, which will reduce tradability or value of nights if traded, greatly reducing the effectiveness of this tool to improve economic profitability.

Management Options

Recommendation: Investigate 4 options: Quote, Gear, Nights, Effort Units. Report covers off on all options, majority of investment should be guided into gear and quota.

Recommendation: The EOSC does not support the compulsorily implementation of amalgamations or compulsory buy backs that forces people out of the industry.

Recommendation: It was agreed that the corporate/self-governance model is economically the most profitable option, however this option is not achievable in the next two years given the fisheries culture. Consider incorporating into strategic plan.

Action: Report to members after December 2012 fishing and ongoing through process. Data report October 2013. Final Report 2014 to PIRSA.

Restructure

The option of an immediate restructure was discussed. It was highlighted that the only funding option available would be through the members investing into the buy back. Given current different gap expected license value by owners, against investment value for buyers, it is unlikely that there will be strong support for the buy back.

Resolution: It was considered that a buy back would need to be self-funded.

Recommendation: It was recommended that the members were approached to ascertain their interest in entering debt and request tenders for the sale of their licenses.

Resolution: Amalgamations were considered highly unlikely to be achieved in the short and medium term, given the fact that it would require the formation of partnerships which do not currently naturally exist.

Appendix 1.15. Agenda Industry Workshop 11 June 2014

Spencer Gulf and West Coat Prawn Fishermen' Association

ECONOMIC OPTIMISATION PROGRAM: Does the fishery's management require a change, and if so what type of change?

OBJECTIVE: Consider the development of changes to the fishery's management to allow for greater flexibility, profitability and sustainability.

Key questions:

- Do current management arrangements allow the fishery and individual businesses to adjust so as to continue to produce a profit as economic and biological changes occur?
- If not, does the fishery require management change & why?
- What is/are the preferred management change(s) and their costs and benefits?
- Will these changes make the fishery resilient to factors outside of the fishery's control?
- Where should responsibility lie for driving any changes in the fishery?

Workshop outline
Welcome by the Chair.
Exec/O provide a brief overview of process to date.

Session I: Is there currently a problem or given economic conditions change will there be a problem?
Purpose: ***To evaluate if there is agreement for change now or in the future***.

a. International prawn trends – what do you see in the future?
b. Domestic/ Spencer Gulf prawn trends – what is happening now?
c. Costs of fishing – what is happening to the gap between income and expenditure?

Members should consider the future of the prawn industry from a broad international perspective, such as demand patterns through to trends in factors that effect profitability such as fuel prices and the value of the Australian dollar.

Session II: How do we make a change?
Purpose: ***To establish a structured and agreed process on how and when any changes may be made, i.e. a process of decision making to achieve change including ground rules and triggers, additional to those already in the constitution.***
To discuss the drivers that may influence when a change will be required: i.e. develop triggers, in addition to who should drive any changes and how the members make the decision.

Session III: The preferred alternative management option for the future.
Purpose: ***To generate consensus on the preferred future management model***.
Exec/O will provide a presentation on the options suggested.
Members to work on the alternative options – pros/cons and solutions.

Session IV: Finalise future options and where to from here.
Purpose: ***Identify any gaps in information and members vote on their preferred options.***
The outcome from session IV will ideally be that there is one option from which a strategy can be developed.
Spencer Gulf and West Coast Prawn Fishermen's Association

General Meeting

10:00 – 15:00 11 June 2014

Port Lincoln Hotel, 1 Lincoln Hwy, Port Lincoln

Agenda

Consider the development of changes to the fishery's management to allow for greater flexibility, profitability and sustainability.

	Arrive (tea and coffee.)		9:45 - 10:00
1.	Welcome and Introductions	Chair	10:00 – 10:10
2.	Purpose and back ground	Executive Officer	10:10 – 10:30
3.	Workshop	Ian Cartwright	10:30 – 12:30
	Lunch		12:30 - 13:15
4.	Workshop	Ian Cartwright	13:15 – 14:30
5.	Other business	Chair	14:30 – 15:00

Appendix 1.16. East Coast Trawl Fishery Agenda Northern Workshops

East Coast Otter Trawl Fishery
Economic Performance and Management Opportunities Workshop

Wednesday 25th July 2012 – Cairns		Thursday 26th July 2012 - Townsville	
Time:	***8:30 – 16:30***	***Time:***	***8:30 – 16:30***
Location:	***Admiralty Room***	***Location:***	***Burdekin Room***
	Cruising Yacht Squadron		***Mercure Hotel***
	42-48 Tingira St Portsmith		***Woolcock St Townsville***

AGENDA

1.	Welcome, introductions & Objectives		8:45
2.	Summary of East Coast Otter trawl Fishery	E Jebreen	9:00
3.	"Anderson's Assessment" of fisheries	T. Ward	9:20
4.	Economic analysis – summary of East Coast Otter Trawl fishery	E. Hoshino	9:40
5.	Discussion - do you agree with the assessment?	Group	10:10
	Morning Tea 10:30		
6.	Austral Fisheries - Northern Prawn Fishery experiences	David Carter	10:50
7.	Discussion - what are the key drivers for getting into the current situation?	Group	12:10
	Lunch 12:30		
8.	Spencer Gulf Experiences	SA Industry Reps	13:00
9.	Discussion and summary	Group	14:00
	Afternoon Tea 15:00		
	Discussion - does the Qld fishery need to be reformed to resolve the current situation and if so how should this be done?		
	Close 16:30		

Appendix 1.17. East Coast Trawl Fishery Agenda Southern Workshops

East Coast Otter Trawl Fishery
Economic Performance and Management Opportunities Workshop

Wednesday 1 August 2012 – Mooloolaba

Time: ***8:30 – 16:30***
Location: ***The Yacht Club***
33-45 Parkyn Pde
The Spit

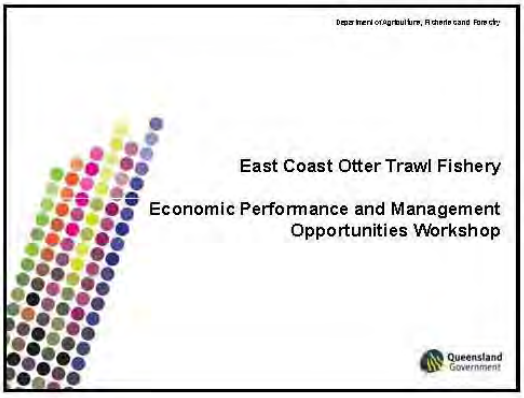
Thursday 2 August 2012 – Hervey Bay

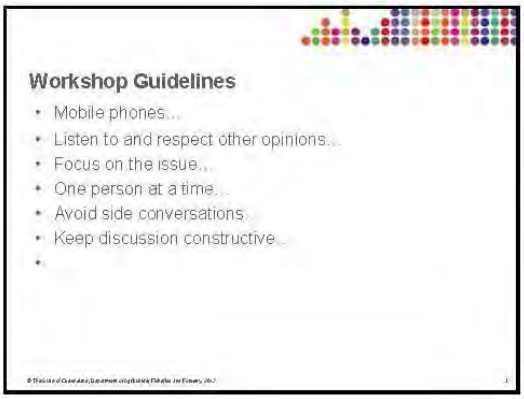
Time: ***8:30 – 16:30***
Location: ***Charlton Room***
Peppers Pier Resort
The Esplanade, Urangan

AGENDA

1.	Welcome, introductions & Objectives		8:45
2.	Summary of East Coast Otter trawl Fishery	E Jebreen	9:00
3.	"Anderson's Assessment" of fisheries	T. Ward	9:20
4.	Economic analysis – summary of East Coast Otter Trawl fishery	E. Hoshino	9:40
5.	Discussion - do you agree with the assessment?	Group	10:10
	Morning Tea 10:30		
6.	Individual Transferable Fishing Rights - A Pathway to Profitability??	Annie Jarrett	10:50
7.	Discussion - what are the key drivers for getting into the current situation?	Group	12:10
	Lunch 12:30		
8.	Spencer Gulf Experiences	SA Industry Reps	13:00
9.	Discussion and summary	Group	14:00
	Afternoon Tea 15:00		
	Discussion - does the Qld fishery need to be reformed to resolve the current situation and if so how should this be done?		
	Close 16:30		

Appendix 1.18. East Coast Trawl Fishery Workshop 1





Appendix 1.19. East Coast Trawl Fishery Workshop 2

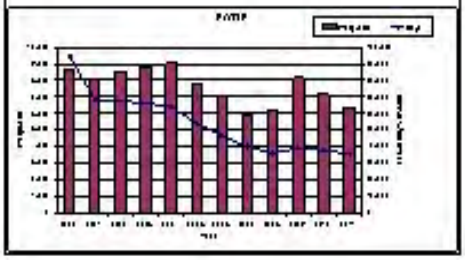
East Coast Otter Trawl Fishery

Queensland East Coast Trawl Fishery

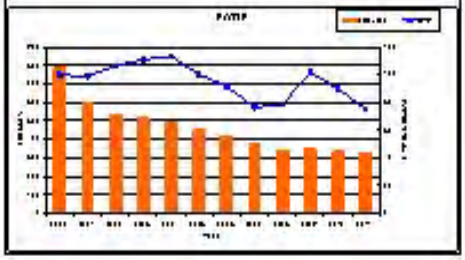
Symbol	Active in 2011		Endorsed (31/12/2011)	
T1	295	310	397	423
T2	15		26	
M1	n/a		47	
M2	22		25	
T5	34		39	
T6	4		11	
T7	4		6	
T8	20		30	
T9	4		23	

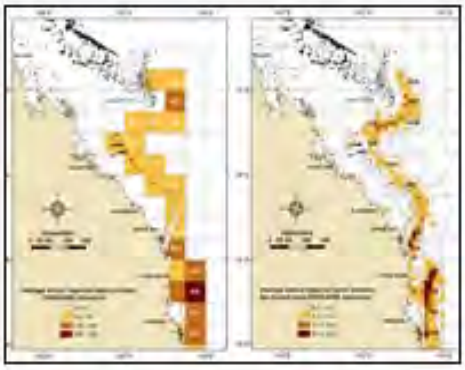
East Coast Otter Trawl
(includes t1/m1 BU usage)

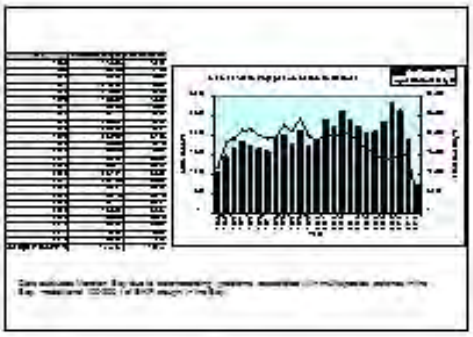
East Coast Otter Trawl
(includes t1/m1 BU usage)

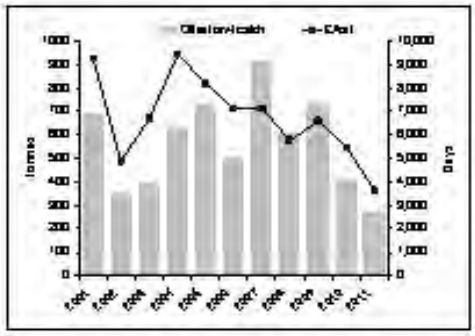


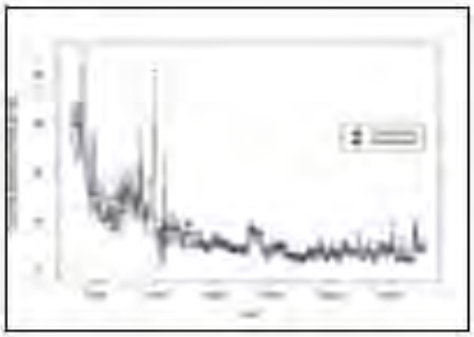
East Coast Otter Trawl
(includes t1/m1 BU usage)

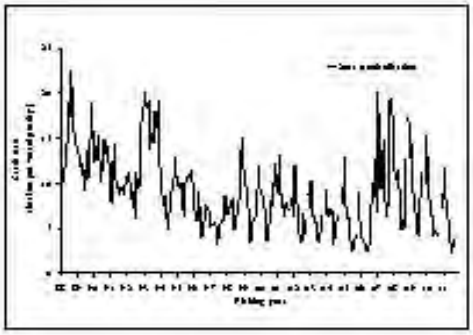


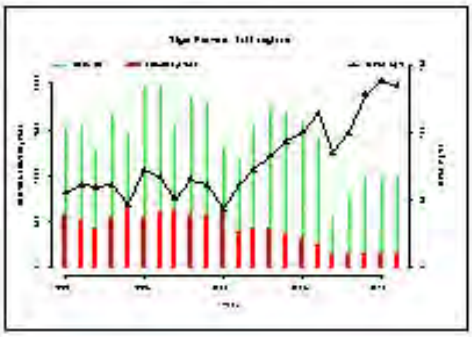


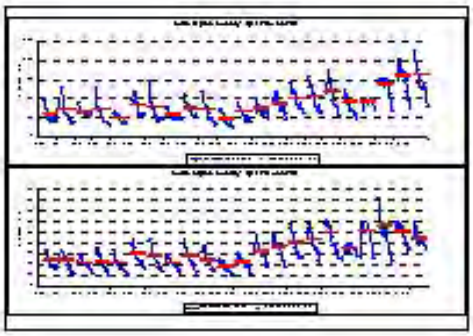






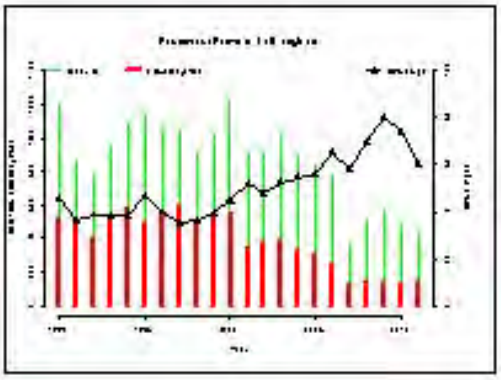


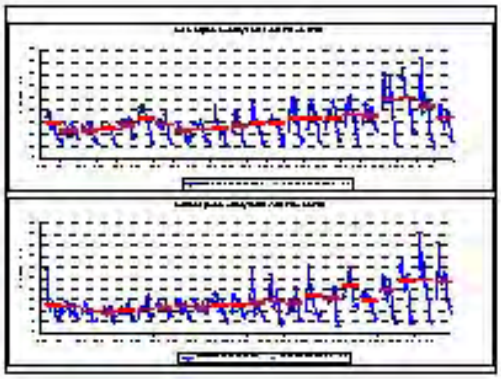




Tiger Prawn

- harvests ~ half of long term
- Effort ~ 30% of long term
- CPUE
  - generally upward since 2000 and
  - 70% higher
- Low harvest, effort and high CPUE are evidence of a low fishing mortality; recruitment overfishing unlikely

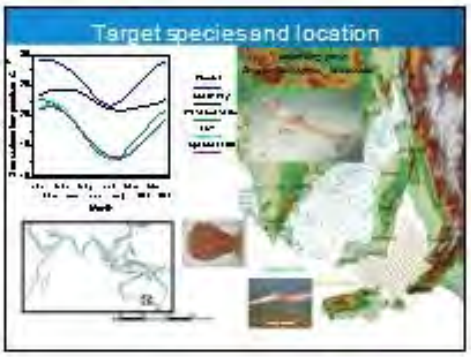


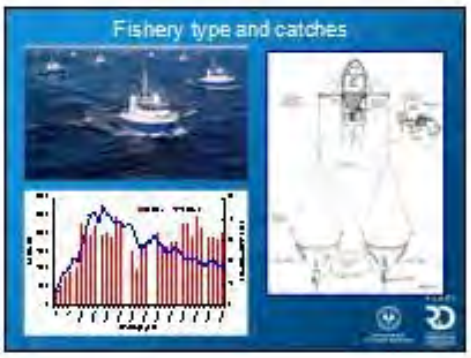


Endeavour Prawn

- harvests ~ half of long term
- Effort ~ 31% of long term
- CPUE
  - generally upward since 1997 and
  - 52% higher
- Low harvest, effort and high CPUE are evidence of a low fishing mortality; recruitment overfishing unlikely

Appendix 1.20. East Coast Trawl Fishery Workshop, Economic Performance





Sustainability

Surveys & harvest strategies

Fishery-independent surveys (Nov, Feb, Apr)

- Collaboration between SARDI & industry
- Stock assessment & other research (by-catch)
- Inform harvest strategy development (closures)

Fishery-dependent surveys (Dec, Mar, May, June)

- Industry driven 'Spot' surveys
- Inform harvest strategy management & adjustment

Spencer Gulf Prawn Fishery Value and Production (1984/85 to 2009/10)

Fishery Performance Indicators

James L. Anderson & Chris Anderson
WB & UW

Prepared for: The International Coalition of Fisheries Associations (ICFA), Vikuen, IS

Funded by: ALLFISH (Alliance for Responsible Fisheries), a public-private partnership created by Transatlantic Industry, the World Bank, FAO

Anderson and Anderson (2010)

Guiding Principles

- COMMERCIAL FISHING is a BUSINESS and should create wealth
- Ecological sustainability is NECESSARY, but NOT SUFFICIENT, for commercial fisheries to generate sustainable income and create wealth
- Community sustainability is necessary for sustainable wealth creation.

Anderson and Anderson (2010)

- A *wealth-based fishery management systemis one that is ecologically sustainable, socially acceptable and generates sustainable resource rents or profits.*
- Purpose: The Fishery Performance Indicators (FPIs) are designed to evaluate and compare the world's fisheries management systems based on their ability to generate sustainable wealth.

Anderson and Anderson (2010)

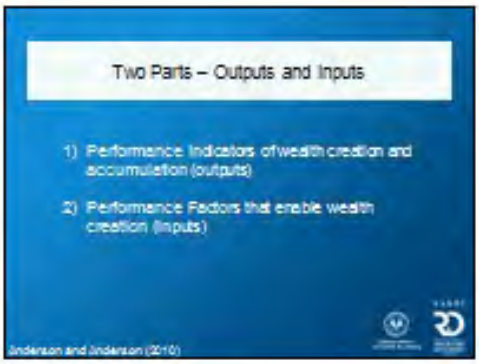
- Greater attention must be focused on governance systems and economic factors
- It is not good enough to be just biologically sustainable; fisheries and the communities that dependent on them must generate sustainable wealth.

Anderson and Anderson (2010)


The creation of a Wealth-Based Fisheries Performance Indicators give
stakeholders who rely on fisheries for their livelihood
critical information to make the case for better fisheries management based on a broader set of criteria incorporating governance and economic factors
Jinderson and Jinderson (2010)


The Performance Indicators are Designed to Incorporate the Three 'Sustainabilities' Necessary for Wealth Creation
1) Economic Sustainability
2) Ecological Sustainability
3) Community Sustainability
Jinderson and Jinderson (2010)

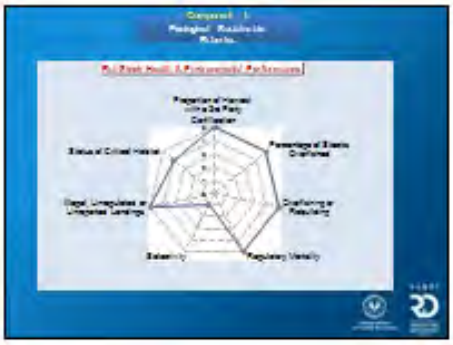

Characteristics of Indicator Components
• Readily Available
• Accurate
• Quantifiable
• Relevant
• Understandable
Jinderson and Jinderson (2010)

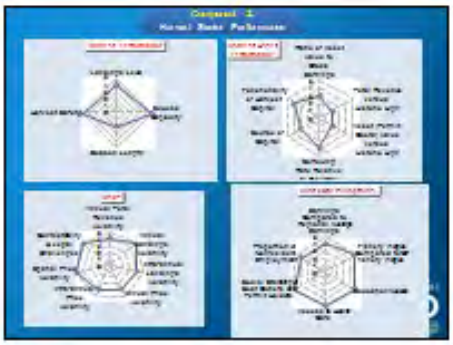

Two Parts – Outputs and Inputs
1) Performance Indicators of wealth creation and accumulation (outputs)
2) Performance Factors that enable wealth creation (inputs)
Jinderson and Jinderson (2010)

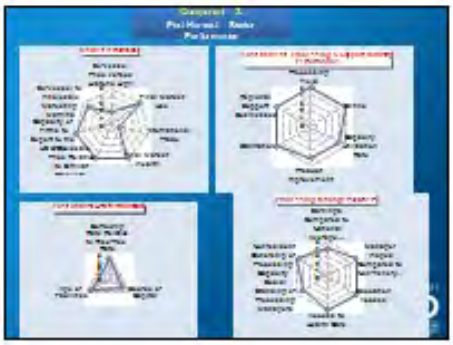

The Fishery Performance Indicators - Outputs
• 54 components covering 11 dimensions:
– Fish Stock Health & Environmental Performance
– Harvest Performance
– Harvester Performance
– Risk
– Owners, Permit Holders & Captains
– Crew
– Market Performance
– Processing & Support Industry Performance
– Post-harvester Performance
– Processing Owners & Managers
– Processing Workers
Jinderson and Jinderson (2010)


The Fishery Performance Factors: Inputs Enabling Wealth Creation
• 39 components covering 8 dimensions:
– Macro Factors-Environmental, Economic & Community
– Access Rights
– Harvest Rights
– Collective Action
– Management Inputs
– Management Participation
– Markets and Market Institutions
– Infrastructure
Jinderson and Jinderson (2010)

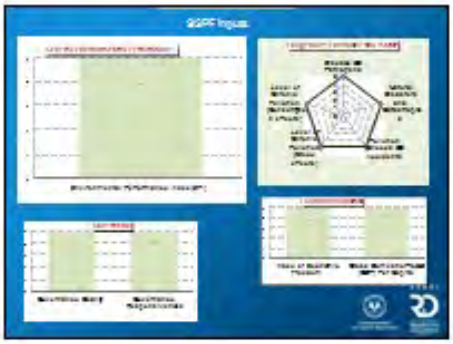

BGPF

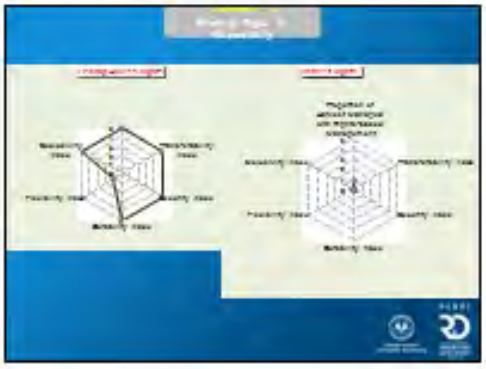


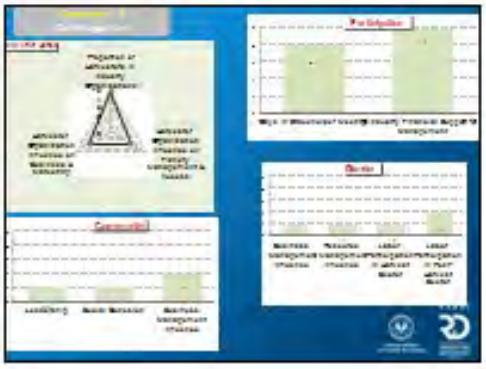


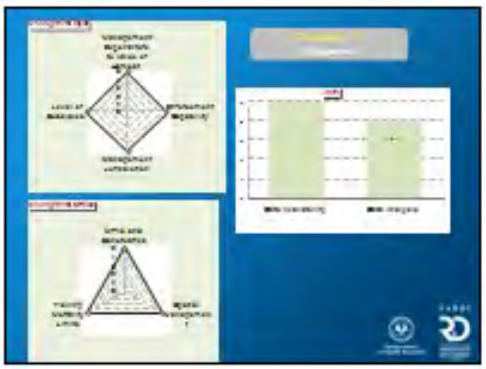


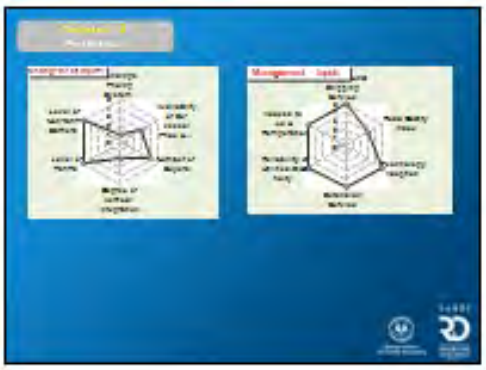

BGPF
Fishery Performance Indicators: Input (Enabling Wealth Creation)









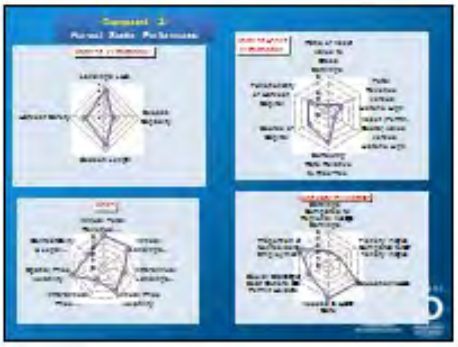


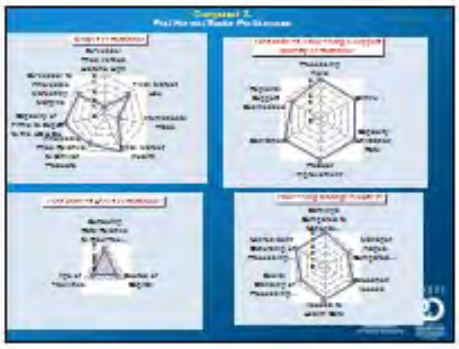
SPENCER GULF PRAWN FISHERY:
FISHERY PERFORMANCE INDICATORS

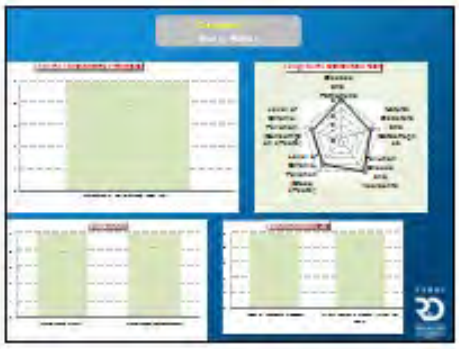
- FPIs capture issues in SGPF quite well
- poor systems for managing harvest and marketing catch
- poor harvest and harvest asset performance

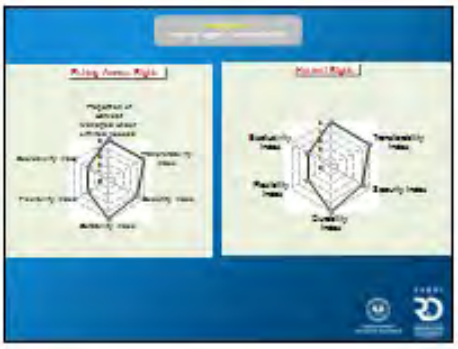
- Issues in fishery are
  - input controls cause inefficiency
    - too many licences/vessels
    - very short season
    - can't consolidate effort/catches to reduce costs
  - falling prices
    - competition from aquaculture prawns
    - low product differentiation
    - poor marketing

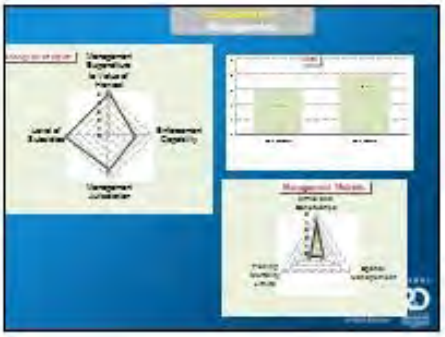
Need to redesign operational procedures, fisheries management arrangements & restructure business structures

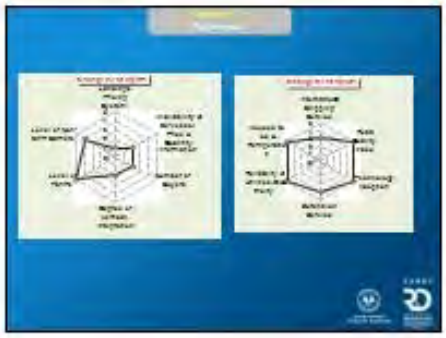












EAST COAST OTTER TRAWL FISHERY: FISHERY PERFORMANCE INDICATORS

- Do FFIs capture issues in SCOTF?
- Poor harvest and harvest sector performance
- Good post-harvest and processor performance

- Issues in fishery are
  - input controls cause inefficiency
    - too many licences/vessels
    - poor industry organization
  - falling prices
    - competition from aquaculture prawns
    - low product differentiation
    - poor marketing systems

Potential to redesign operational procedures, fisheries management arrangements & restructure business structures

Appendix 1.21. East Coast Trawl Fishery Workshop, Economic analysis

Economic Indicators for the East Coast Otter Trawl Fishery

Economic Performance and Management Opportunities Workshop
1 August 2012 Mooloolaba
2 August 2012 Hervey Bay

Lisa Pippin
EconSearch Pty Ltd

Overview

- Economic Indicators
- Spencer Gulf & West Coast Prawn Fisheries
- East Coast Otter Trawl Fishery
- Further Research

Economic Indicators

- Catch, gross value of production and prices
- Cost of management
- Boat level financial performance indicators
  - average income
  - operating costs
  - cost-price squeeze
  - profitability
  - return on investment

Economic Indicators

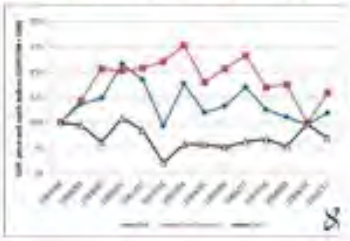
- Economic impacts
  - Output
  - GRP
  - household income
  - employment
- Economic rent
- Other indicators

Spencer Gulf & West Coast Prawn Fisheries

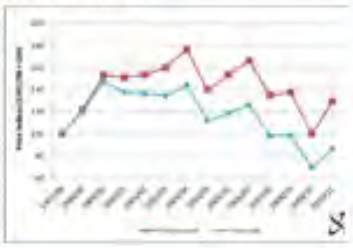
Catch in the Spencer Gulf & West Coast Prawn Fisheries

Catch and GVP in the Spencer Gulf & West Coast Prawn Fisheries

GVP, Price and Catch Indices SGWC Prawn Fisheries (1997/98=100)



Price Indices SGWC Prawn Fisheries (1997/98 = 100)



SGWC, GSV and Imported Prawn Prices

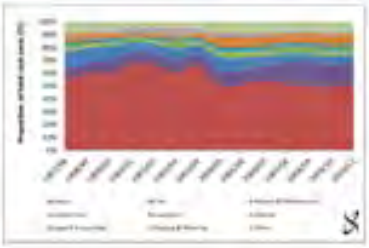
Costs of Management, SG Prawn Fishery

Fee per Licence Holder & Fee as a % of GVP, SG Prawn Fishery

Survey Results

- Financial performance indicators
  - Income, costs and profitability as an average per boat
- Economic impact of the fishery
  - Direct and flow-on economic benefit created as a result of the operations of the fishing industry
- Economic rent

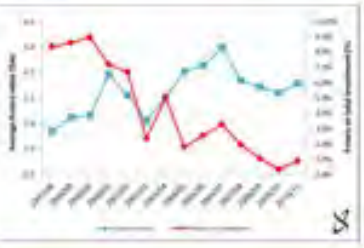
Cost Shares, SGWC Prawn Fisheries



Cost-Price Squeeze, SGWC Prawn Fisheries

Income and Profit, SGWC Prawn Fisheries

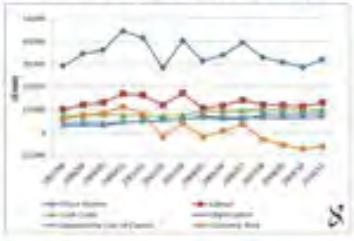
Return on Investment, SGWC Prawn Fisheries



Economic Impact of the SGWC Prawns Fisheries in SA, 2010/11

Economic Impact of the SGWC Prawns Fisheries in SA, 2010/11

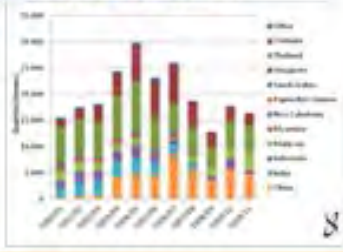
Economic Rent in the SGWC Prawn Fisheries, 1997/98 to 2010/11 ($'000)



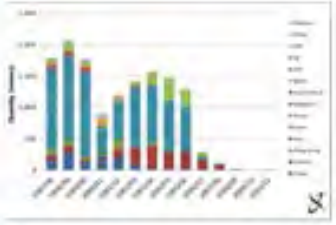
Other Indicators

- Prawn imports to South Australia
- Prawn exports from South Australia
- Exchange rates

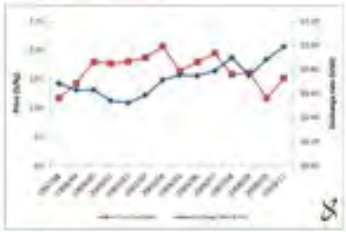
Prawn Imports to SA by Country of Origin, 2000/01 to 2010/11



Prawn Exports from SA by Destination Country, 1997/98 to 2010/11

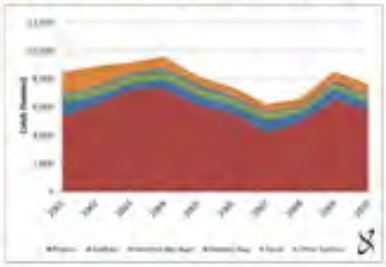


Exchange rates and SGWC Prawn prices, 1997/98 to 2010/11



East Coast Otter Trawl Fishery

East Coast Otter Trawl Fishery – Catch



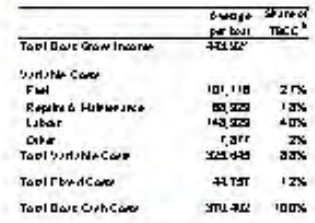
East Coast Otter Trawl Fishery – GVP

East Coast Otter Trawl Fishery – GVP, Price & Catch

East Coast Otter Trawl Fishery – Price

East Coast Otter Trawl Fishery – Price & Exchange Rate

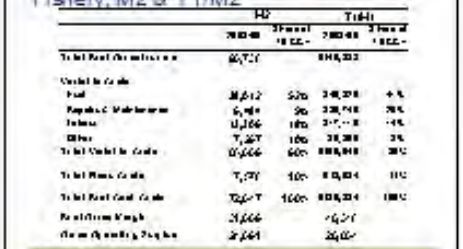
East Coast Otter Trawl Fishery – Cost Shares



East Coast Otter Trawl Fishery – ECOT and SGWC Prawn Fisheries

East Coast Otter Trawl Fishery – Income, Profit & Return on Investment

East Coast Otter Trawl Fishery – ECOT Fishery, M2 & T1/M2



East Coast Otter Trawl Fishery – Further Research

- Last survey 2008/09
  - Need a survey every 3-4 years
  - Collect from all regions and fishery sectors
  - Time series
- Prepare economic indicators based on targets in the management plan
- Consider economic impacts
  - Direct and flow-on
- Others?

Economic Indicators for the East Coast Otter Trawl Fishery

Economic Performance and Management Opportunities Workshop
1 August 2012 Woodgate
26 July 2012 Hervey Bay

Lisa Rippin
EconSearch Pty Ltd

Appendix 1.22. East Coast Trawl Fishery Workshop, Experiences in the Northern Prawn Fishery

INDIVIDUAL TRANSFERABLE FISHING RIGHTS – A PATHWAY TO PROFITABILITY?

Annie Jarrett
Pro-Fish Pty Ltd
February 2012

Fisheries Management: A Delicate Balancing Act

- *Eco-system Based Fisheries Management*
- *Bycatch Reduction*
- *Marine Protected Areas*
- *Environmental Certification*
- *Resource Stewardship – Community Pressure*
- *Harvest Strategies*
- *Fishery reference points – MSY v MEY*
- *Economic Efficiency*

But:

ITS HARD TO BE GREEN WHEN YOU'RE IN THE RED

- Unfavourable FX – AUD high & climbing
- Challenging market conditions
- Too much competition (aquaculture & domestic)
- Increasing costs (production, management, research)
- Reducing or static catches
- Too Many Boats??

4

Adjustment

- Globally most fisheries have suffered from over-capacity, effort creep & recruitment overfishing
- Most fisheries have required cuts in fishing effort and adjustments in fishing capacity
- Mechanisms for capacity adjustment :
  - buy backs (govt and/or industry funded eg Qld, NPF, TS)
  - compulsory reductions in TAEs/ TACs
- Capacity adjustment (excluding buy backs) needs basis eg form of individual transferable fishing rights system

Australian Prawn Fisheries

Rights Based Management

Individual Transferable Fishing Rights

The Benefits

- SECURE ON-GOING ACCESS (PROPERTY RIGHTS) FOR INDUSTRY; SOUND INVESTMENT BASE FOR FINANCIERS
- FLEXIBILITY FOR OPERATORS – INDIVIDUAL DECISIONS TO BUY, SELL OR LEASE ARE MARKET-BASED, NOT GOVERNMENT DRIVEN
- EFFECTIVE TOOL TO BALANCE FISHING EFFORT AND BIOLOGICAL & ECONOMICAL SUSTAINABILITY
- AN EQUITABLE TOOL FOR ADJUSTMENT IN THE FISHERY WHEN REQUIRED - (ADJUSTMENT PROPORTIONAL ACROSS THE FLEET)
- GENERALLY COST EFFECTIVE TO MANAGE AND ENFORCE
- HAVE PROVEN EFFECTIVE IN QLD, TORRES STRAITS & NPF PRAWN FISHERIES

ASSUMPTIONS FOR SUCCESS

- ALL INDIVIDUAL RIGHTS FULLY TRADABLE (SALE OR LEASE)
- RETENTION OF LIMITED ENTRY
- CLOSURES FOR BIOLOGICAL/ ECOLOGICAL PURPOSES
- CONTINUED USE OF ECBM/ BYCATCH MITIGATION
- ONGOING RESEARCH, DATA COLLECTION & COMPLIANCE PROGRAMS – MAY VARY WITH EACH SYSTEM
- NEED TO CONSIDER ECONOMICS AS WELL AS BIOLOGY

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CRITERIA

- Equitable: need to identify existing shares & determine translation formula; the 'share' of rights held under one system must not be diminished in moving to a new system
- Flexible & Adjustable: operators need flexibility to adapt to changing circumstances & to maximise returns; fishery needs to be adjusted to respond to biological or economic changes
- Responsive – capable of adjusting the fishery on either biological or economic grounds in a timely manner
- Transferable: allows operators maximum flexibility to trade up or down to suit their own operational/market demands
- Economically efficient: retaining as few inputs as possible to maximise opportunity for economically efficient exploitation
- Simple & Cost Effective to manage: easily understood by industry; simple administration & enforcement; legally defensible

ALLOCATION

- ALLOCATION IS THE MOST CONTROVERSIAL ISSUE IN MOVING TO ANY NEW SYSTEM OR IN IMPLEMENTING ADJUSTMENT PROGRAMS
- FISHERS ARE GENERALLY MORE INTERESTED IN WHAT THEY ARE 'GOING TO GET' THAN HOW A NEW SYSTEM WOULD WORK
- FISHING HISTORY (EG CATCH, VESSEL SIZE; HP) FINANCIAL INVESTMENT; ADMINISTRATIVE DECISION; AUCTION/ TENDER ALL MECHANISMS USED IN ALLOCATIONS

Types of Individual Transferable Fishing Rights

- Input controls: gear units; boat units; boat days/ time units; effort units; pot units (Individual Transferable Effort Units or ITEs)
- Output controls: Individual Transferable Quotas (ITQs) – issued as kilos of fish/prawns

WHO HAS WHAT RIGHTS BASED MANAGEMENT SYSTEMS?

- Northern Prawn Fishery: limited entry/ gear units (ITEs – investigating ITQs)
- QLD Trawl: Limited entry/ effort units (ITEs)
- Torres Straits: Limited entry/ boat days (ITEs)
- South Australia: Limited entry/ boat license
- New South Wales: Limited entry/boat license
- Western Australia: (Exmouth Gulf/ Sharks Bay): Limited entry/boat license

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Individual Transferable Effort Units (ITEs)

- Boat Days/ Time Units; Effort Units; Gear Units; Capacity/ HP Controls
  - Generally acceptable to industry – often based on catch history
  - Longer Term right than annual boat license
  - Generally accepted as 'property rights' and by financiers as 'collateral'
  - Generally cost effective to manage
  - Very effective at controlling fishing effort – constraints on boat numbers/size; gear; hp; fishing seasons

ITE's

- Not always effective at controlling effort creep
- Impose economic inefficiencies – restrictions/ constraints on gear, boat size, fishing time
- Flexible and responsive for adjustment *but*
- Benefits of individual decisions to increase efficiency dissipated across the fleet
- Rent dissipation can occur if capacity adjustment doesn't occur (fishing inefficiently)

Individual Transferable Quotas -ITQs

- A Total allowable Catch (TAC) determined by stock assessment model - Individual Transferable Quotas allocated (kgs of prawns) allocated
- Requires robust scientific data / stock assessment (+ economics if managing to MEY) & TAC predicting methodology – survey information can assist
- Best results generally in single, long lived species
- Few short life cycle (less than 6 years) multi species fisheries managed under ITQs tho some high volume, high value fisheries eg African anchovy/sardine , NZ arrow squid & Icelandic capelin fisheries
- No prawn fishery managed under ITQs (Mozambique Shrimp fishery closer to Total Allowable Catch system) – NPF investigating ITQs
- Issues: difficulty in TAC-setting; increased costs > $500000 pa

- ITQS CAN PROVIDE MORE EFFICIENCY GAINS THAN INPUT CONTROLS
- FLEXIBILITY TO MAXIMISE CATCH FOR LEAST COST; ECONOMIC EFFICIENCY; FACILITATES TRADE/ AUTONOMOUS ADJUSTMENT; LIMITS CATCH
- ECONOMIC THEORY – MOST BENEFITS ARE FROM QUOTA TRADING
- POTENTIAL LOSS OF REVENUE FROM HIGH GRADING/DISCARDING
- ISSUES OF 'CORPORATISATION' AND CONCENTRATION OF OWNERSHIP
- COMPLIANCE, RESEARCH AND ADMINSTRATION COSTS HIGHER – CAN CO-MANAGEMENT OFFSET?
- SINGLE SPECIES NATURE OF SGPF MAY BE SUITABLE TO QUOTA MANAGEMENT, SUBJECT TO STOCK ASSESSMENT
- REAL TIME MANAGEMENT MAY ALLOW TAC IN-SEASON UPDATES THO IMPACTS ON QUOTA TRADING

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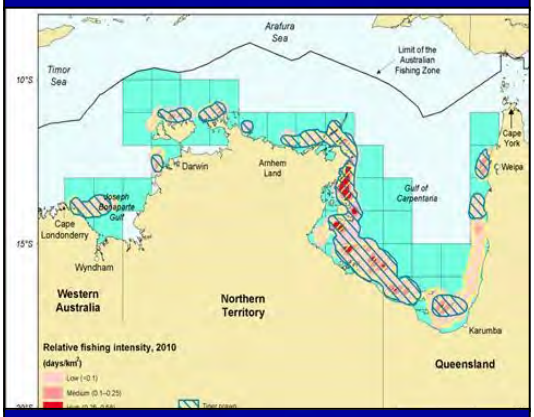
Northern Prawn Fishery

A case study
David Carter
CEO Austral Fisheries
NORMAC Member



Northern Prawn

- Australia's most valuable Commonwealth Fishery: GVP of $89 million
- 770,000 square kilometres; >8% fished; 6 - 7 months
- 52 trawlers; 19 owners
- Banana & Tiger Prawn Fisheries (endeavour/ king)

Northern Prawn

- 2011 – 7000 t banana; 800 t tiger
- Globally recognised as 'best practise' management; world class stock assessment; excellent environmental performance
- Marine Stewardship Council Certification underway
- Strong partnerships; co-management approach

The (NPF) Experience Cont.

1960's: Exploration followed by commercial trawling - open access fishery (no limited entry)

1974: Biggest banana prawn season on record; expansion of commercial fishery

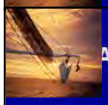
1980: First 'Management Plan' for the NPF, 302 licenses

1985: The 'A unit' system introduced - individual transferable rights based - combination of under deck volume (hull) and horsepower specs/formula

Provided secure legally defensible fishing rights & basis for management costs/ buy back/ adjustment

1985: Industry-initiated buy back scheme; 2 for 1 boat replacement policy to address over-capacity/effort

1986: 25% reduction in season length; twin gear; daylight trawl ban



'A Units' - First efforts at control

- 'A Units' ineffective effort control; Operators 'rorted' horsepower and vessel configuration regs; Effort creep and stock depletion
- Inflexible adjustment tool; can only buy or sell under adjustment, not individually transferable
- Buy back based on A unit system slow and expensive: $45 million to remove 89 licenses over ten years
- Input restrictions to address stock depletion (twin gear/ closures/ daylight trawl ban) force inefficiencies/ reduce fleet profitability
- Additional 30% compulsory surrender of 'A' UNITS in 1993 – fleet reduced to 136 trawlers

2000: GEAR UNITS INTRODUCED . ALLOCATION PROPORTIONAL TO 'A' UNIT HOLDINGS. TRANSITION INCORPORATES 20% REDUCTION IN TOTAL HEADROPE - 10 BOATS LEAVE

• 2001: BOTH SPECIES OF TIGER PRAWNS CLASSIFIED AS 'OVERFISHED'

• 2002: TOTAL HEADROPE REDUCED 15%. INDIVIDUAL REDUCTION PROPORTIONAL TO GEAR UNIT HOLDINGS. 17 BOATS LEFT THE FISHERY

• 2002: DECREASED SEASON LENGTH TO IMPROVE SUSTAINABILITY OF BROWN & GROOVED TIGER PRAWNS

• 2005: TOTAL HEADROPE REDUCED BY 25% TO IMPROVE ECONOMICS OF THE FISHERY. 11 BOATS LEFT THE FISHERY

• *38 TRAWLERS REMOVED IN 5 YEARS (INTERNAL ADJUSTMENT).*

• *60% EFFORT REDUCTION IMPOSED MASSIVE ECONOMIC INEFFICIENCY - SMALL GEAR, SHORT SEASONS, LOW PRICES = ECONOMIC DISASTER.*

• *KOMPAS STUDY DETERMINES OPTIMAL BOAT NUMBERS - 2007 GOVT-FUNDED SAP REMOVES 43 BOATS*

GEAR UNITS IN THE NPF

- Total amount of gear and Fishing Season Length / Timing
- determined by bio-economic model
- Allocation of gear units based on agreed formula 9eg catch history)
- Each gear unit entitles operator to % of towable gear eg 1 gear unit = 10 cm
- A gear unit can comprise headrope only or combined headrope & footrope (NPF has a headrope constraint relative to footrope)
- Under adjustment, total number of gear units remains the same - the value of each gear unit changes

As an example in the NPF where each gear unit equals 10 cm of headrope & 11.5 cm of footrope, , after a 10% reduction each gear unit would equal 9cm of headrope & 10.35 cm of footrope

- System requires net size identification / gear unit register/ regular net checks
- Transfer of gear units only during closures to reduce compliance costs

Gear Units (cont)

- Headrope (controls swept area) good measure of fishing effort
- Easily measured & enforced - particularly compared to hp
- Enforcement – on shore measuring and net tagging; at sea checks
- System does not impede technical innovation – allows for removal of other inputs eg boat size/ hp restrictions/ gear types
- Operators can trade gear units to suit own operational/market demands

Gear units (cont)

- Flexible tool for adjustment - gives operators option of buying, selling, leasing gear units, amalgamating licenses or fishing with smaller gear
- Potential for effort creep with removal of boat size/ hp restrictions but can be adjusted
- Can result in economic inefficiencies (rent dissipation) if operators tow inefficient gear when adjustment occurs

The NPF Today

- From 302 to 52 trawlers/19 owners; flexible gear unit system – (no limits on gear: twin, quad, tongue nets; boat size); economically efficient
- Bio-economic model for tiger prawns; escapement policy for banana prawns; Catch trigger limits to determine season lengths (economic triggers)
- Harvest strategy includes Maximum Economic Yield (MEY) target reference point; MSY limit reference point
- Both species of tiger prawns now sustainable; 4 high yield banana prawns seasons (5000 – 7000 t);
- Industry Company; Co-management with AFMA – NPFI managing data, out-sourcing of surveys, crew member observer program; in MSC program; promotion
- GVP : $63m (130 Boats - 2004/5); $89 m (52 boats 2010/11)

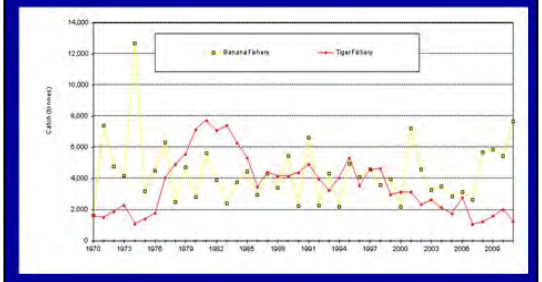


Table 1 Northern Prawn Fishery season dates

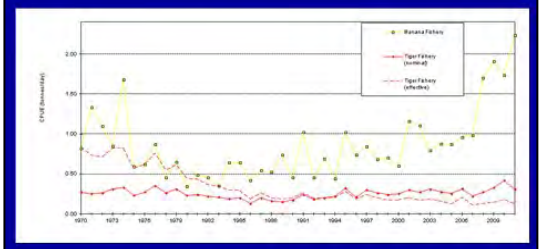
Fishing Seasons

	2008–09	2009–10	2010–11
Tiger prawn season dates	1 August – 28 November 2008	25 July – 5 December 2009	1 August – 29 November 2010
duration	120 days	134 days	121 days
Banana prawn season dates	27 March – 5 June 2009	1 April–10 June 2010	1 April–24 June 2011
duration	71 days	72 days	86 days

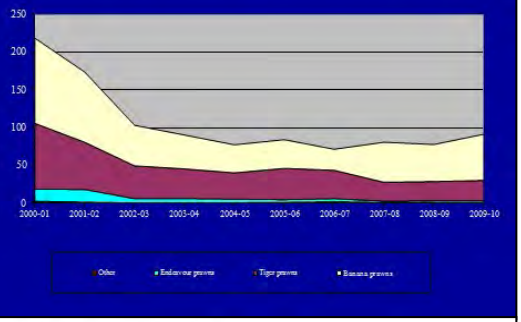
Catch in banana and tiger fishery (tonnes) 1970 - 2011



NPF CPUE 1970 - 2011



Northern Prawn Fishery: GVP 2010–11



THE LESSONS

- There is no 'perfect' management system

OUTPUT CONTROLS – INDIVIDUAL TRANSFERABLE QUOTAS (ITQ's): responsive & flexible for adjustment BUT generally inappropriate in short life cycle, multi–species fisheries due to annual variation in recruitment & potential for high grading & discarding; expensive to administer and enforce

INPUT CONTROLS – BOAT SIZE / HORSEPOWER/GEAR CONTROLS:

Not effective at controlling effort; not totally flexible or responsive for adjustment; impose economic inefficiencies; benefits of individual decisions to increase efficiency dissipated across the fleet

THE LESSONS cont.

- Trade-offs between costs and benefits in all systems
- The balance (competing objectives) changes – subject to complexity of management arrangements and degree of risk
- Closures effective for biological protection (eg seagrass/habitats/ small prawns) but impose economic impediments on operators
- Reductions in fishing effort MUST be implemented through the primary management tool to avoid increasing economic impediments
- Targets are rarely – if ever – met in time, on time. To achieve objectives: harvest strategy should include clear targets, objectives & decision rules, including economics

"The choice is clear – it's either SMART fishing or NO fishing!" - Tony Long, WWF

"Profit is not a dirty word" – Billy Thorpe

Lessons

- There is no right and wrong
  - Decide where you want to go and get on with it.
  - Fisheries management is more about people than fish
  - You can have the right people with the wrong system and you will have a winner.
  - What keeps you awake at night?
    - Fuel cost
    - Availability of good crew
    - Being able to sell your business when the time comes?
    - A succession plan?
    - The price of prawns?
      - Cant differentiate from the imports?
    - Regulators???
    - Profitablity
    - Climate change?

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Appendix 1.23. Spencer Gulf Prawn Fishery

SPENCER GULF & WEST COAST PRAWN FISHERMEN'S ASSOC. INC.

Harvesting with Care in the State of South Australia

Greg Palmer

Co-management – Joint Steering Committee Workshop
6th April 2009

Real Time Management

- Detailed database of catch and effort statistics
- Extensive research since the late 1970's
- First prawn trawl surveys conducted in 1981
- In 1986, catch dropped from 2000t to 1200t
- Start of Real Time Management using area and time closures
- Partnership formed with PIRSA and SARDI

Year	Spencer Gulf
1968	383.7
1969	557.3
1970	815.5
1971	936.5
1972	1076.3
1973	1485.3
1974	2521.1
1975	1736.1
1976	2130.1
1977	2040.7
1978	1734.6
1979	1924.9
1980	2255.0
1981	2186.1
1982	2380.2

Early Beginnings

- Western King Prawns first trawled in 1909
- Fishery began in 1967
- Prawn permits issued (restricted entry) in 1968
- Used to fish 300 nights per year
- Vessels fished anywhere in the Gulf >10m

Benefits of Research

- Benefits of prawn research benefit fishermen
- Reduction in fishing effort – now only fish for approximately 55 nights per year
- 80% of prawns are caught in 8% of the Gulf
- Fishing effort is now focused

Early Beginnings

- Vessels had access to the West Coast
- 2 zones were created in the Spencer Gulf
- Spencer Gulf zones merged in 1971
- Option given to stay in tuna or prawns 1972/73
- 1976 Spencer Gulf and West Coast prawn fisheries separated
- 39 Spencer Gulf prawn fishing licences

3

Evolution of Co-Management

- Goal: Manage the fishery ourselves with minimal involvement of the Government and have the finances to do this
- Cost savings, increased professionalism, forward thinking and planning, independence, autonomy

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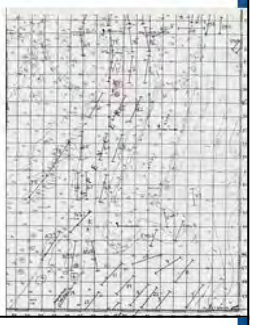
Evolution of Co-Management

- Industry takes on more responsibility in 2004
- Surveys coordinated by government and industry
- Harvest strategies jointly managed by industry, PIRSA and SARDI
- Data collected and reporting is managed by SARDI



The Future of Co-Management

Develop an alternative co-management model that meets requirements

Understand work involved for stakeholders

Implement model 'slowly' to ensure we get it right

Gain the support of all stakeholders

Questions?

Greg Palmer
Coordinator At Sea
Member, Management Committee
Email: palmfish@internode.on.net
Mobile: 0428 840 991

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Appendix 1.24. East Coast Trawl Fishery Workshop, Outcomes

Discussion summary: Hervey Bay (Jebreen)

Drivers

- Stock sustainability;
- Economics/ profitability: inability to adapt to changing trends/ market trend/ regulatory imposts/ increasing operational costs

Challenges

- Individual profitability Vs fleet profitability
- Lack of understanding/acceptance of stock assessment
- Business structures – family/corporate/ succession planning
- Numbers of boats – more difficult for single boat owners
- Age of operators – ability to change careers
- Leadership (or lack there-of) to drive change

Are there any problems? If so, what are they?

- Lack of Profitability
- Over-allocation of effort (latent/unused + operational)
- Industry Voice
- Efficiency/costs
- Investment in the industry (vessels, people,
- Marketing/prices
- Structure of the fishery

Considerations

- Need for/ Mechanisms for adjustment:
  - Compulsory reductions: effective at achieving hard targets/ non-discriminatory/ controversial – will result in immediate benefits
  - Buy backs: Government/Industry funded
    - Voluntary – less controversial, slow, ineffective subject to $$$
    - Compulsory component – effective at achieving hard targets/ non-discriminatory/ controversial but immediate benefits
    - Limited (if any) government funding
    - Difficult to get industry agreement to funding – needs to include hard targets to achieve profitability for those remaining – low interest rates offer opportunities

Over-allocation of effort/licences (latent/unused + operational)

- Agreed that there is excessive effort/licences in the fishery (majority suggest it is the priority)
- The first issue that needs to be addressed
- Separate latent/unused effort and operational effort
- Whatever approach, make sure that there is a reduction in the number of participants
- Too many boats at the fleet level (EJ)
- No management controls at the stock level (EJ)
- Need to keep enough capacity for potential increases (EJ)
- How to fix it?
  - Combination of industry/government strategy/contribution (agreed)
  - Industry need a co-ordinated approach to government (happened?)
  - Dave Sterling – tender process
  - Example only- 20% voluntary 40% government purchase
  - Still need to make sure you remove licences.
  - EJ – might be more costly to voluntarily forgo effort, cheaper to buy it up front on tender (government financed)
  - Other investors

Industry Voice- a co-ordinated industry

- Need leadership and organisation
- Difficult to be an active fisher as well as attending meetings/ think of issues
- Already discussed the establishment of a peak body, fully cost recovered and based on GVP across all fisheries (Steve)
- A lot of industry that don't want to remain in the fishery still have a big say
- Add the costs to licence fees (EJ unsure, but convince the Minister it's a good idea and your nearly there)
- Very diverse ideas on what individuals need/want from or for the fishery
- Need a clearer policy direction for the objectives of the fishery, with reference points etc

Efficiency/costs

- Need to be profitable to keep crews
- Fishing smarter, greater co-management, after effort has been removed.
- EJ- ideally after sustainability issues are removed, can reduce operational limitations ie gear restrictions

- Difficult without output controls
- Need smarter approaches to fish for scallops, structured rotational harvests

Marketing/prices

- Import competition (tough to fix)
- Product differentiation
- Dollar influences import price/competitiveness
- Collaboration/co-ordination between fishers/industries.
- Differentiation by species (ie kings)?
- Timing and volume of catches on the market influence domestic price
- Lack of vertical integration
- Issues with storage, cash flow, etc
- Challenges are there in the post-harvest sector as well

Structure of the fishery

- This is something that can occur more effectively down the track once effort is removed
- Is the current arrangements appropriate?
- Better to break it down to component fisheries?
- Example scallops.
- Dave Sterling – need to have a better understanding of when and where to fish EKP
- Most people like the flexibility to be able to change between species
- EJ- Can still be one fishery, but managed as discrete stocks eg real time management measures of commercial catch rate

Investment in the capacity of the fishery (capitol and people)

- Hard to stay ahead of the game without profitability
- As an example, one company chose to strategically invest in capitol, people up front
- Or, after rationalisation there needs to be investment back into the fishery up front to get it kick started again

Ensure you are geared up to handle the extra piece of the pie.

Appendix 1.25. East Coast Trawl Fishery Workshop, Outcomes 3: Synthesis of regional meetings

Background

The East Coast Otter Trawl Fishery (ECOTF) is a multi-species fishery that operates throughout the waters of Queensland from Cape York to the Queensland/New South Wales border. The fishery has approximately 422 licenses of which 350 are active vessels fishing a total of 37,000 nights per year landing approximately 8,000 t of seafood, directly employing more than 1500 people and has a Gross Value Production of approximately $100M per annum. The main target species have all been recently assessed as sustainably fished with effort at or below MSY levels.

Over the past 20 years the trawl industry has reduced effort, increased efficiency and adopted better fishing practices such as turtle excluder and by-catch reduction devices. These changes have significantly reduced ecological risks presented by the fishery. Some challenges remain for the fishery such as excess fishing capacity, a few high ecological risks for some species and habitats, and low profitability. These remaining problems put pressure on fishing businesses and regional communities.

The fishery experienced a period of improved profitability between 2000 and 2004 following a previous structural adjustment and the introduction of the Trawl Management Plan. Short periods of profitability are commonly experienced after structural adjustments where remaining fishers enjoy reduced competition and a larger share of fishery resources. Post structural adjustment improvements in profitability are rarely maintained in the long term, and this is especially true for fisheries with inadequate management rules to constrain catch (output) or effort (input) to profitable levels. A high Australian dollar combined with increasing input costs, such as fuel, has reduced the profitability and competitiveness of the Queensland East Coast Otter Trawl Fishery.

Recently the opportunity has been taken to review the fishery's management framework and address specific issues that have been identified by industry since the development of the management plan. These issues include:

1. Excess of effort units in the Fishery;
2. Constraints on technical efficiency;
3. The appropriateness of current bycatch mitigation requirements;
4. Spatial management arrangement not covering all relevant areas;
5. Improving the effectiveness of the current seasonal closures;

6. Ensuring the greatest benefit is derived from the scallop replenishment areas;
7. The appropriateness of the current fishing gear restrictions; and
8. Regulatory driven discarding of certain species.

Through the review process stakeholder advisory groups have identified a need for a reduction in real effort in the fishery to reduce competition between fishers. This would lead to improved average catch rates, increased fishing opportunities throughout the fleet, reduced risk to the marine environment through lower bycatch volume and reduced habitat interactions, and would allow for increases in fishing efficiency through regulatory reform. The advisory groups have also identified the need for an adaptive co-management strategy to establish stock specific management controls, to ensure prawns and scallops taken by the fishery are of a valuable size and stocks are not fished below ecologically sustainable levels. This strategy would serve to reduce operating costs, increasing operator flexibility and industry resilience to changing social, economic and environmental pressures on the fishery. As with any change there is a range of challenges that are faced. These challenges include a diversity of operations and business structures, lack of understanding or acceptance of stock assessment processes and a lack of leadership willing to drive change in the industry.

Stakeholder Meetings

A series of regional stakeholder workshops were scheduled as part of the CRC project looking to identify opportunities for improving the economic performance of the East Coast Otter Trawl Fishery.

The project was looking to measure and compare the economic performance of selected prawn fisheries (Spencer Gulf, Gulf St Vincent and ECOTF) as well as rock lobster and abalone fisheries. The aim was to assess the effectiveness of factors that enable wealth creation within the specific fisheries using wealth-based fishery performance indicators. Key speakers from the Spencer Gulf and Northern Prawn Fishery provided attendees with some unique perspectives on common problems faced by all fisheries at some time or another and innovative solutions that have delivered economic improvements in these particular fisheries.

Through identifying innovative operational procedures, business structures and management systems in other fisheries potential options were discussed to improve the economic performance of the ECOTF. At the workshops stakeholders were asked to consider the ideas and experiences presented and discuss these in the context of the issues facing the East Coast Otter Trawl Fishery identifying the benefits, problems, adaptability of the fleet to change and the economic impacts relevant to the fishery.

The meetings were held in Cairns, Townsville, Hervey Bay and Mooloolaba. A total of ~30 industry participants attended across the four meetings with a range of interests represented including fishers, fleet managers, business owners, processors and marketers. Participants engaged in the meetings whole heartedly and provided valuable input into discussions about options to address key issues facing the fishery.

Key Issues Identified

- Over-allocation of effort (unused + active)
- Lack of Profitability
- Efficiency constraints
- Structure of the fishery
- Industry Voice
- Investment in the industry (vessels and people)
- Marketing/prices

Meeting Discussion

Overcapacity

Participants agreed that there is excessive effort/licences in the fishery with the majority suggesting it is the priority issue to be addressed.

Surplus effort stymies any attempts to increase profitability because as profit improves, effort increases and this drives down the profit again.

There is a need to separate latent/unused effort and operational effort in any approach to effort reduction.

Whatever approach, make sure that there is a reduction in the number of participants/boats.

Too many boats at the fleet level dilute profits.

Need to keep enough capacity for potential increases in effort or efficiency.

Participants discussed the potential for a staged effort unit reduction but the situation requires that efficiency is improved now, not in a piecemeal process over time.

How to fix it?

- Combination of industry/government strategy/contribution
- Industry need a co-ordinated approach to government
- tender process
- Still need to make sure you remove licences.
- might be more costly to voluntarily forego effort, cheaper to buy it up front on tender (government financed)
- Other investors

Economics/Profitability

The size of the slice of the pie is critical despite the size of the pie going up and down.

Its not good enough to "just" be biologically sustainable, the fishery needs to be financially viable enough to self fund the required regulatory reform.

Economic survey data required every 3-4 yrs to inform management framework.

The aim should be to get a return on investment to counter opportunity costs.

Operation needs to be profitable to keep crews.

Fishing efficiency

Fishers find it hard to stay ahead of the game without profitability in the industry.

Fishing smarter, greater co-management, after effort has been removed is required.

Ideally after sustainability issues are removed the government can reduce operational limitations ie gear restrictions.

After rationalisation of the effort/fleet there needs to be investment back into the fishery up front to get it kick started again.

Individuals need to ensure they are geared up to handle the extra piece of the pie.

Efficiency increases are difficult to manage without output controls.

Need smarter approaches to fish for scallops, structured rotational harvests.

Regulatory reform

This is something that can occur more effectively down the track once effort is removed.
Need a clearer policy direction for the objectives of the fishery, with reference points.
No current management controls at the stock level.
Are the current arrangements appropriate?
Better to break it down to component fisheries?
Most people like the flexibility to be able to change between species.
Can still be one fishery, but managed as discrete stocks eg real time management measures of commercial catch rate.

Stakeholder Engagement

The fishing industry needs leadership and organisation.
Industry need to develop answers to the issues through a key industry leadership group.
It is difficult to be an active fisher as well as attend meetings/ think of issues
The world is run by those that attend.
Industry needs to value representation.
Discussed the establishment of a peak body, fully cost recovered and based on GVP across all fisheries and add the costs to licence fees
A lot of industry that don't want to remain in the fishery still have a big say
Very diverse ideas on what individuals need/want from or for the fishery

Markets/Pricing

Import competition impacts prices (tough to fix)
Product differentiation needs to be developed
Industry heavily controlled by markets, dollar influences import price/competitiveness.
More collaboration/co-ordination between fishers/industries.
Differentiation of product by species (ie kings)?
Timing and volume of catches on the market influence domestic price, this needs to be better managed to optimise prices.
Lack of vertical integration
Issues with storage, cash flow, etc
Challenges are there in the post-harvest sector as well

Table of Contents for *Appendix 2. Rock Lobster*

Appendix 2. Rock Lobster

Optimising business structures and fisheries management systems for key fisheries

T.M. Ward

Project No. 2009/715

February 2015

This project was conducted by the South Australian Research and Development Institute

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Appendix 2.1. SRL Workshop Agenda

Improving the performance of CRC fisheries through review and reform of operational procedures, business structures and fisheries management systems.

Rock lobster workshop

Date: Tues-Wed, 28-29 May, 2013
Venue: DownTowner Hotel, 66 Lygon Street, Carlton, Victoria 3053 (Tel: 03 9663 5555, email: res@downtowner.com.au)

Agenda

Day 1 (28 May)

11.00 - Welcome and expectations from workshop (Tim Ward)
11.10 - Key differences and similarities in SRL fisheries (Hilary Revelle and Anabell Jones to present and lead a brief discussion)
The main objective here is to recognise that the fisheries are different – especially wrt governance/business/management structures but also operationally – and that these differences will have implications for improvement options that may be suitable in each case. Experience in prawns suggests we need to make it clear from the start that we understand these differences exist. This will also provide a good background for the Anderson analysis.
11.30 - Issues impeding profitability of SRL fisheries: Anderson Analysis (Tim Ward, SARDI)
This talk will identify impediments to economic performance using Jim's method. Results can be compared with perceptions of industry/government/other stakeholders.
12.10 - Summary of economic status/trends in SRL fisheries – (Lisa Rippon, Econsearch)
We have most of the data available for Australian fisheries. Don't have much for NZ. Lisa could you pls liaise with Malcolm/Daryl to get the relevant information).

Lunch (1-2 pm)
2.00 – WA lobster story: how a reduction in catch increased profitability (Nick Caputi, Fisheries WA)
2.30 – New Zealand CRA 8 – another good news story (Malcolm Lawson, CE, CRA8)
3.30 – Bio-economic modelling: tools for assessing effectiveness of options (Rick McGarvey)
4.00 – The challenges of MEY (Daryl Sykes)
4.30 – Group Discussion (All)

Evening – Workshop Dinner for informal discussion on issues and options (Venue TBA)

Day 2 (29 May)

9.00 - Synthesis of issues and options identified during Day 1 (Tim Ward)
9.30 - Facilitated discussion of options that may be suitable for improving the economic performance of each SRL fishery (All)
12.30 Summary of Workshop outcomes (Tim Ward)
1.00 – Workshop conclusion

Attendees

A/Prof Tim Ward (SARDI, A/Prof Caleb Gardner (IMAS), Dr Adrian Linnane (SARDI), Dr Nick Caputi (WA Fisheries), Dr Rick McGarvey (SARDI), Malcolm Lawson (CRA8), Daryl Sykes (CRA5), Annabel Jones (PIRSA), Hilary Revelle (DPIWE), Melissa Schubert (VicDPI), Gary Steele Craig Lawry (South Australian industry), Garry Kerr, Robert Rattray, Michael Blake, John Sansom (Tasmanian industry).

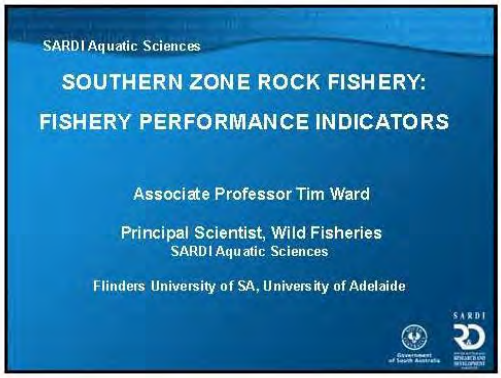
Appendix 2.2. Summary of SRL fisheries

	NEW ZEALAND	Victoria	South Australia	Tasmania
Commercial Fisheries arrangements				
Commercial Management zones	Nine - separate TACC set for each - TAC set for seven	East, West	Northern, Southern	State-wide TACC, spatial management for seasons
Access commercial	3 tonnes minimum ace	Limited licence	Limited licences	Limited licences
Commercial gear	Baited pots	Baited pots	Baited pots	Baited pot
Pot limits	None	Max 140 pots/boat	100/80 pots/boat	By boat length or tonnage and no of quota units
Tacc 11/12	All nz 2847 tonnes	66 (ez) 240 (wz)	1250 (sz) 345 (nz)	1103.24 tonnes
TACC decision period	01 April to 31 March	Annually	Annually	Annually
TACC determined by	Operation of Management Procedure	Minister's Delegate (Fisheries Victoria ED)	Minsters Delegate (PIRSA ED)	Minister, (statutory consultation with com and rec peak bodies and advisory committees
Performance Indicators in TACC decision	CPUE	Egg production, available biomass, commerical CPUE	Commercial CPUE (primary), Recruit CPUE (secondary)	Egg production, legal size biomass, total biomass, commercial CPUE
Effort limit	None	No	No	No
Mls	Varies but most at 54/60 mm tail width	110 (male), 105 (female)	98.5 (sz) 105 (nz)	110 (male) 105 (female)
Season	12 months other than CRA 3 and CRA 7	Male: Nov - Sept, female: Nov - end May	June-Sept (SZ), June-Oct (NZ)	Male Nov – Sept/ Oct, female Nov – Apr
Berried females prohibited	Yes	Prohibited (closed season females 1 Jun - 15 Nov)	Prohibited	Prohibited
Soak time limit	None	No	No	Yes
Vms	None	No	Yes (nz) no (sz)	No
Fishery Stock Assessment (period, empirical, model based)	Modelled at 5 season cycles	Model based	Model based	

Fishery Status	NEW ZEALAND	Victoria	South Australia	Tasmania
Fishery Status	Good to excellent all nine management areas	rebuilding	Sustainably fished (both zones)	Sustainably fished but rebuilding to improve economic and social outcomes
pot lifts 11/12	n/a	EZ 114,000, WZ 475,000	NZ 287,480 potlifts, SZ 1,285,289 potlifts	
total catch 11/12	2748 tonnes	EZ 66 tonne, WZ 240 tonne	NZ 307 t, SZ 1,242 t	1/3/12 - 29/2/13 1100t
Governance structure				
Governance structure	Fisheries Act, regulatory frame work	Fisheries Management Act, Fisheries Regulations.	Fisheries Management Act, Fisheries Regulations.	Living marine Resources Management Act, Management Plan (Rules)
Management struture	Gov department; collectives of rights holders	Gov Dept,(management, licensing, monitoring and compliance) liason between Minister's office, research providers, industry.	Gov Dept,(management, licensing, monitoring and compliance) liason between Minister's office, research providers, industry.	Gov Dept,(management, licensing, monitoring and compliance) liason between Minister's office, research providers, industry, police
Process to change a management measure	Regulatory with consent of Parliament; statutory by Gazette Notice; and/or by Act amendment	Consultation with comm and rec sectors. Reg changes require approval from Governor in Council. Act changes must be approved by Parliament.	Changes to Act or Regs require Parliament decision. No statutory consultation requirements, however understood that changes would not be passed if consultation had not occurred.	Statutory consultation with com and rec industry associations, and fishery advisory committees for any change not in the m'plan. To make a change to a rule – statutory process inc 1 month public consultation and pass thru both houses of Parliament

Recreational Fisheries arrangements	NEW ZEALAND	Victoria	South Australia	Tasmania
Access Recreational	Open access	Recreational Fishery Licence (unlimited)	Pot licences, (max 2 per person)	Recreational Fishery Licence (unlimited)
Recreational bag limit	Yes - 6 lobsters per person per day	Yes	No	Yes
Boat limit	No	No	No	Yes
Recreational Possession limit	Only in one small area	No	No	Yes
Recreational gear	3 pots per person - max 6 per vessel	Hand, hoop nets	Baited pots, hand, drop net	Baited pot, hand, hoop net
Recreational lobster identification, tail clipping, etc	None	Tail clipping/hole punched (landed whole)	Tail clipping	
Recreational TAC	An allowance in setting tacs	Notional	No	Notional
Season	All year	Same as commercial	Same as commercial	Yes
Fleet structure	Potting and diving - proportion varies across all nine management areas		46 vessels NZ, 160 vessels SZ. Variety of operating types.	204 vessels, 10-20m, owner operators, fishers who lease all quota annually, employed skippers
Processing sector	10 major corporate entities		Numerous	15 companies handle about 90% of the land catch
Vertical integration	Limited other than for ACE ownership		Some	Not much
Co management	Attempted but not fully implemented	None	Co-management policy developed	Nothing formal
Industry Association	Yes	SIV, vrfish	SARLAC, SEPFA, NZRLFA	TRLFA

Appendix 2.2. Southern Zone Rock Fishery: Fishery Performance Indicators



Characteristics of Indicator Components

- Readily Available
- Accurate
- Quantifiable
- Relevant
- Understandable

Anderson and Anderson (2010)

The Fishery Performance Factors: Inputs Enabling Wealth Creation

- 39 components covering 8 dimensions:
  - Macro Factors-Environmental, Economic & Community
  - Access Rights
  - Harvest Rights
  - Collection Action
  - Management Inputs
  - Management Participation
  - Markets and Market Institutions
  - Infrastructure

Anderson and Anderson (2010)

Two Parts – Outputs and Inputs

1) Performance Indicators of wealth creation and accumulation (outputs)

2) Performance Factors that enable wealth creation (inputs)

Anderson and Anderson (2010)

SZRLF

Output

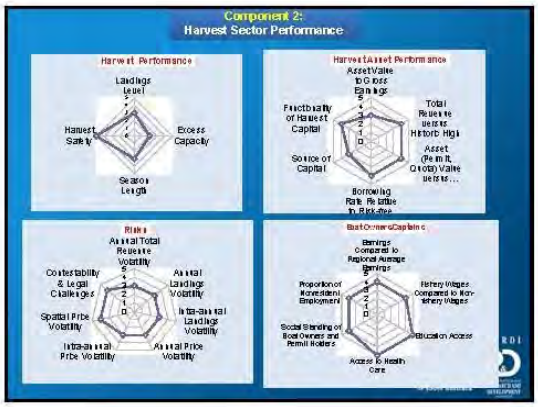
The Fishery Performance Indicators - Outputs

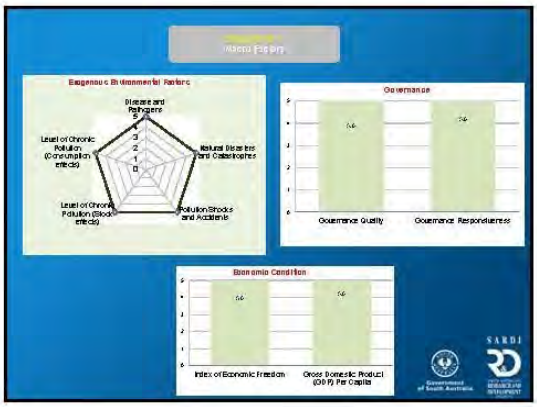
- 54 components covering 11 dimensions:
  - Fish Stock Health & Environmental Performance
  - Harvest Performance
  - Harvest Asset Performance
  - Risk
  - Owners, Permit Holders & Captains
  - Crew
  - Market Performance
  - Processing & Support Industry Performance
  - Post-harvest Asset Performance
  - Processing Owners & Managers
  - Processing Workers

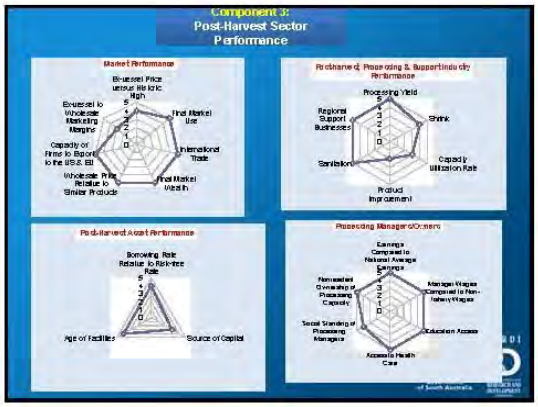
Anderson and Anderson (2010)

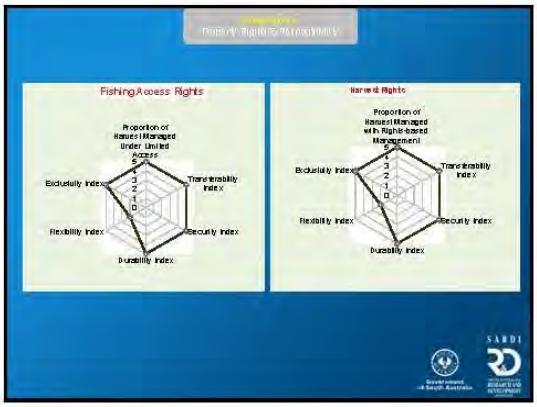
Component 1:
Ecological Sustainable Fisheries

Fish Stock Health & Environmental Performance

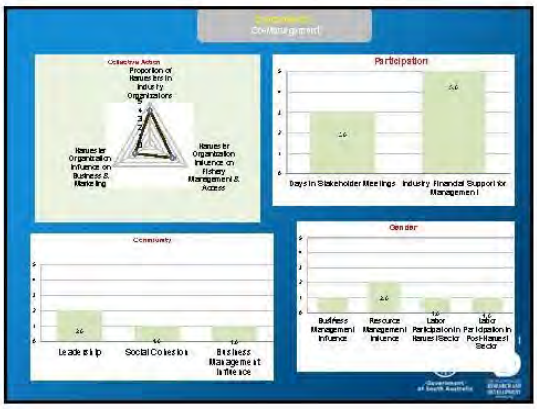

Component 2:
Harvest Sector Performance
Harvest Performance
Landings Level
Excess Capacity
Season Length
Harvest Safety
Harvest Asset Performance
Asset Value to Gross Earnings
Total Revenue Debts Historic High
Asset (Permit, Quota) Value Debts...
Borrowing Rate Relative to Risk-free
Source of Capital
Fixed Quality of Harvest Capital
Risks
Annual Total Revenue Volatility
Annual Landings Volatility
Inter-annual Landings Volatility
Annual Price Volatility
Inter-annual Price Volatility
Spatial Price Volatility
Contestability & Legal Challenges
Boat Owner/Captains
Earnings Compared to Regional Average Earnings
Fishery Wages Compared to Non-fishery Wages
Education Access
Access to Health Care
Social Standing of Boat Owners and Permit Holders
Proportion of Recreational Employment

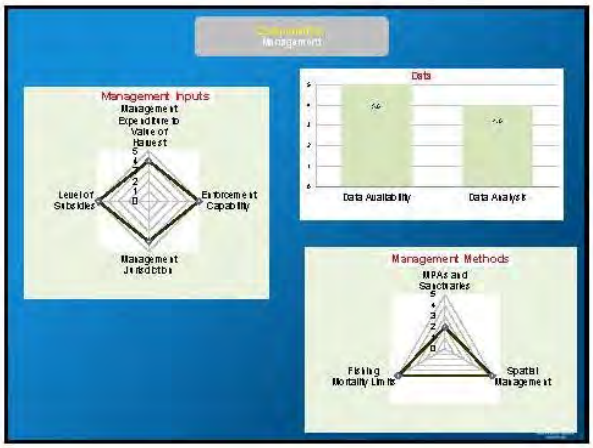

Exogenous Environmental Factors
Disease and Pathogens
Natural Disasters and Catastrophes
Pollution Shocks and Accidents
Level of Chronic Pollution (Shock effects)
Level of Chronic Pollution (Consumption effects)
Governance
Governance Quality
Governance Responsiveness
Economic Condition
Index of Economic Freedom
Gross Domestic Product (GDP) Per Capita

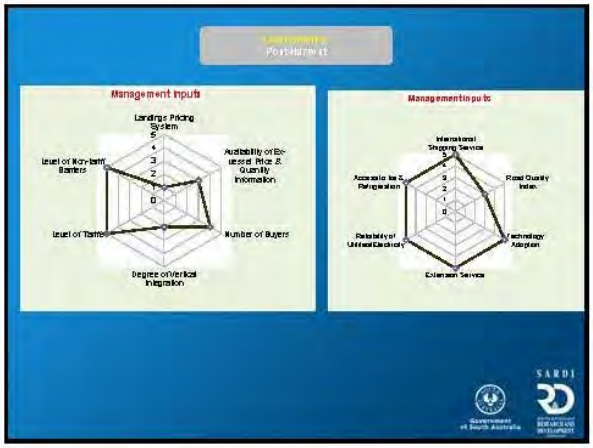

Component 3:
Post-Harvest Sector Performance
Market Performance
Buyers' Price versus Historic High
Final Market Use
International Trade
Final Market Wealth
Wholesale Price Relative to Similar Products
Capacity or Prone to Export to the U.S.A. EU
Excessive Wholesale Marketing Margins
Post-Harvest Processing & Support Industry Performance
Processing Yield
Shrink
Capacity Utilization Rate
Product Improvement
Sanitation
Regional Support Businesses
Post-Harvest Asset Performance
Borrowing Rate Relative to Risk-free Rate
Source of Capital
Age of Facilities
Processing Manager/Owners
Earnings Compared to National Average Earnings
Manager Wages Compared to Non-fishery Wages
Education Access
Access to Health Care
Social Standing of Processing Managers
Processing Capacity


Fishing Access Rights
Proportion of Harvest Managed Under Limited Access
Transferability Index
Security Index
Durability Index
Flexibility Index
Exclusivity Index
Harvest Rights
Proportion of Harvest Managed with Rights-based Management
Transferability Index
Security Index
Durability Index
Flexibility Index
Exclusivity Index


SZ SRLF
Fishery Performance Indicators: Inputs (Enabling Wealth Creation)
Input
General Environmental
Exogenous Environmental...
Governance
Economic Conditions
Fishing Access Rights
Harvest Rights
Collective Action
Participation
Gender
Community
Management Inputs
Data
Management Methods
Markets & Market Institutions
Infrastructure


Collective Action
Proportion of Harvesters in Industry Organizations
Harvester Organization Influence on Fishery Management & Access
Harvester Organization Influence on Business & Marketing
Participation
Days in Stakeholder Meetings
Industry Financial Support for Management
Community
Leadership
Social Cohesion
Business Management Influence
Gender
Business Management Influence
Resource Management Influence
Labor Participation in Harvest Sector
Labor Participation in Post-Harvest Sector





SZ ROCK LOBSTER FISHERY:
FISHERY PERFORMANCE INDICATORS

- FPIs capture issues in SZSRLF quite well

Performance
- Stock OK?
- Harvesting flexibility limited (season, gear)
- Excess capacity is high
- ROI (Asset/earnings)?

Constraints
- limits on flexibility of harvesting
- low harvest organisation influence on business and marketing
- limited transparency of landings pricing system
- limited vertical integration

Appendix 2.3. Economic Indicators for the Southern Rock Lobster Fisheries

Economic Indicators for the Southern Rock Lobster Fisheries

Seafood CRC
Southern Rocklobster Workshop

28-29 May 2013

EconSearch Pty Ltd

econsearch

Potential Economic Indicators

- State and regional economic impacts
  - Output
  - GSP
  - household income
  - employment
- Economic rent
- Other indicators
  - exchange rates, imports, exports, social characteristics

econsearch

Overview

- South Australia
  - Northern Zone
  - Southern Zone
- Victoria
  - Eastern Zone
  - Western Zone
- Tasmania
- New Zealand

econsearch

SOUTH AUSTRALIA

econsearch

Data Sources

- SA data collected every 3 years for Economic Indicator reports to PIRSA
- Vic, Tas sourced as part of the Seafood CRC Rock Lobster bioeconomic modelling project
- NZ data sourced from Daryl Sykes

econsearch

Catch and GVP in the SA Rock Lobster Fisheries

	Southern Zone		Northern Zone		South Australia	
	(tonnes)	($m)	(tonnes)	($m)	(tonnes)	($m)
2000/01	1,716	54.7	846	28.0	2,562	82.7
2001/02	1,717	65.7	675	26.2	2,392	91.9
2002/03	1,766	63.8	595	18.8	2,361	82.7
2003/04	1,896	49.3	504	12.0	2,400	61.4
2004/05	1,897	54.4	446	11.6	2,343	66.0
2005/06	1,889	65.7	476	15.4	2,365	81.2
2006/07	1,894	78.8	492	18.0	2,531	97.5
2007/08	1,850	75.7	459	15.9	2,411	92.2
2008/09	1,407	85.4	403	19.3	1,925	105.4
2009/10	1,243	70.7	310	15.1	1,642	86.4
2010/11	1,244	67.0	313	14.3	1,695	82.4
2011/12	1,242	79.1	307	16.9	1,636	96.7

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Potential Economic Indicators

- Gross value of production and prices
- Cost of management
- Boat level financial performance indicators
  - income
  - operating costs
  - profitability
  - return on investment

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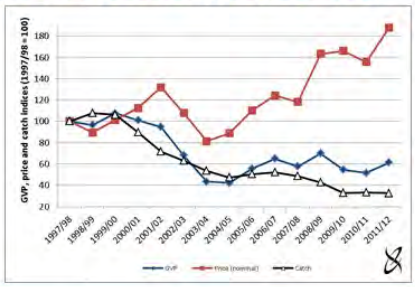
GVP, Price and Catch Indices Northern Zone Rock Lobster (1997/98 =100)



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GVP, Price and Catch Indices Southern Zone Rock Lobster (1997/98=100)

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Survey Results

- Financial performance indicators
  - Income, costs and profitability as an average per boat
- Economic impact of the fishery
  - Direct and flow-on economic benefit created as a result of the operations of the fishing industry
- Economic rent

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Costs of Management, SA Rock Lobster Fisheries

	Licence Fees ($,000)	Gross Value of Production ($,000)	Fees/GVP (%)	Catch (t)	Fee/Catch ($/kg)	No. Licence Holders (no.)	Fee/Licence Holder ($/licence)
Northern Zone Rock Lobster Fishery							
2007/08	$1,175	15,935	7.4%	459	$2.56	68	$17,287
2008/09	$1,118	19,331	5.8%	403	$2.78	68	$16,447
2009/10	$1,165	15,117	7.7%	310	$3.76	68	$17,126
2010/11	$1,179	14,306	8.2%	313	$3.77	68	$17,339
2011/12	$1,066	16,948	6.3%	307	$3.47	68	$15,673
Southern Zone Rock Lobster Fishery							
2007/08	$2,628	75,731	3.5%	1,850	$1.42	181	$14,518
2008/09	$2,523	85,371	3.0%	1,407	$1.79	181	$13,941
2009/10	$2,594	70,720	3.7%	1,243	$2.09	181	$14,332
2010/11	$2,695	67,020	4.0%	1,244	$2.17	181	$14,891
2011/12	$2,608	79,111	3.3%	1,242	$2.10	181	$14,391
Total							
2007/08	$3,803	91,666	4.1%	2,309	$1.65	249	$15,274
2008/09	$3,642	104,702	3.5%	1,810	$2.01	249	$14,625
2009/10	$3,759	85,837	4.4%	1,553	$2.42	249	$15,095
2010/11	$3,874	81,326	4.8%	1,557	$2.49	249	$15,559
2011/12	$3,671	96,059	3.8%	1,549	$2.37	249	$14,741

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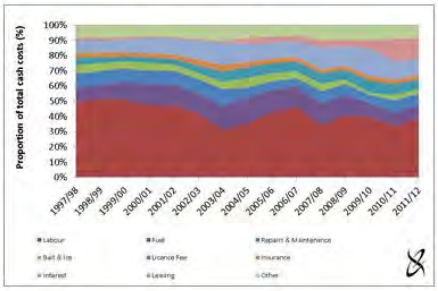
Cost Shares (Northern Zone)



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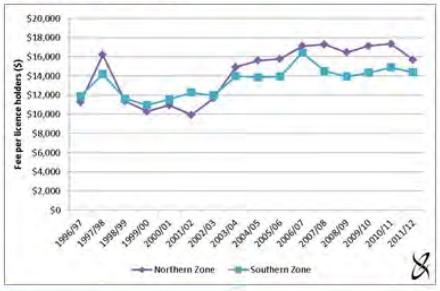
Fee per Licence Holder, SA Rock Lobster Fisheries



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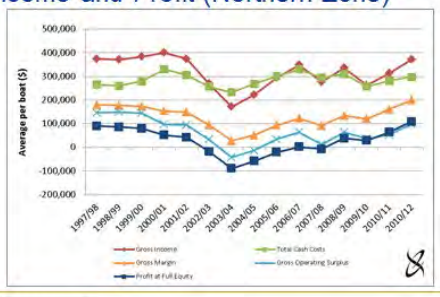
Financial Performance Indicators – Income and Profit (Northern Zone)



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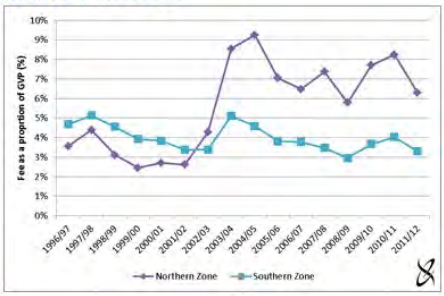
Fee as a Proportion of GVP, SA Rock Lobster Fisheries



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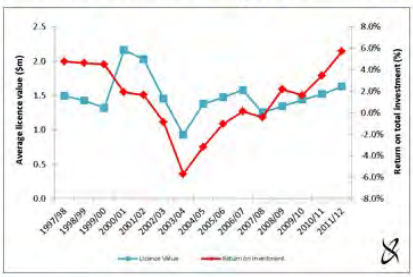
Financial Performance Indicators – Return on Investment (Northern Zone)



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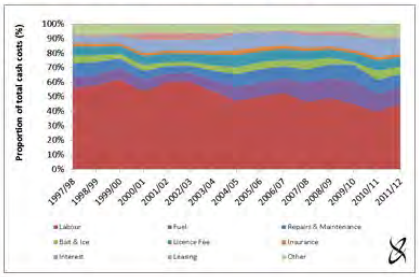
Cost Shares (Southern Zone)



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Economic Impact of the Southern Zone Rock Lobster Fishery in SA, 2011/12

Sector	Output $m	Employment fte jobs	Household Income $m	Contribution to GSP $m
Direct effects				
fishing	79.1	426	23.5	54.7
downstream	20.6	98	5.2	7.7
Flow-on effects	107.7	493	29.5	54.2
Total	**207.4**	**1,017**	**58.2**	**117.1**
Total/Direct	2.1	1.9	2.0	1.9
Total/Tonne	$166,900	0.82	$46,800	$94,200

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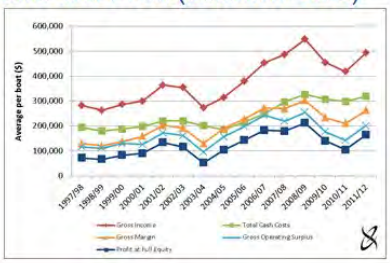
Financial Performance Indicators – Income and Profit (Southern Zone)



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Economic Rent in the SA Rock Lobster Fisheries, 2011/12 ($'000)

	2011/12		
	Northern Zone	Southern Zone	Total SA
Gross Income	16,948	79,111	96,059
Less Labour	5,297	23,010	28,307
Less Cash Costs	6,864	22,706	29,570
Less Depreciation	1,783	7,667	9,430
Less Opportunity Cost of Capital (@10%)	1,285	6,124	7,409
Economic Rent	1,740	19,604	21,344

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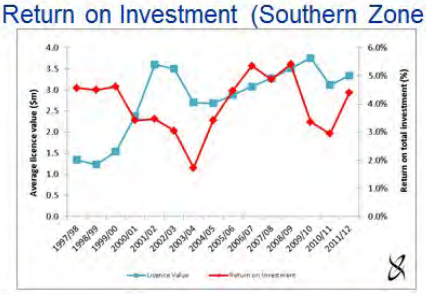
Financial Performance Indicators – Return on Investment (Southern Zone)



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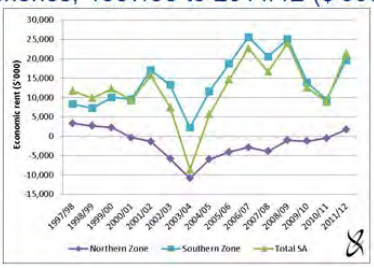
Economic Rent in the SA Rock Lobster Fisheries, 1997/98 to 2011/12 ($'000)



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Economic Impact of the Northern Zone Rock Lobster Fishery in SA, 2011/12

Sector	Output $m	Employment fte jobs	Household Income $m	Contribution to GSP $m
Direct effects				
fishing	16.9	95	7.0	7.5
downstream	5.3	26	1.4	2.1
Flow-on effects	35.4	161	9.8	17.7
Total	**57.7**	**282**	**18.1**	**27.3**
Total/Direct	2.6	2.3	2.2	2.8
Total/Tonne	$188,000	0.92	$58,900	$89,000

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Other Indicators

- Rock Lobster exports from South Australia
- Exchange rates

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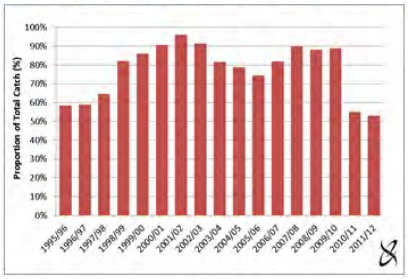
Rock Lobster Exports from SA, Proportion of Total Catch, 1995/96 to 2011/12



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VICTORIA

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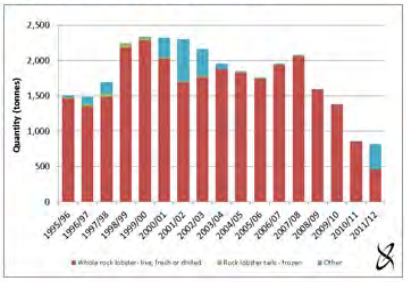
Rock Lobster Exports from SA by Product Type, 1995/96 to 2011/12



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Survey

- Eastern Zone
  - dominated by 1 business, that owns half the quota but no boats.
  - 2 completed surveys
- West Zone
  - Initially 8 licence holders indicated to Vic DPI they would participate
  - 6 completed surveys
  - Dislike of a series of quota cuts, cautious licence holders

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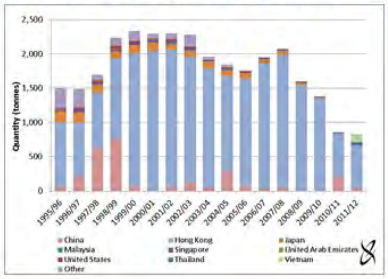
Rock Lobster Exports from SA by Destination Country, 1995/96 to 2011/12



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Survey

- Eastern Zone
  - <1% of TACC
- West Zone
  - ~17% of TACC

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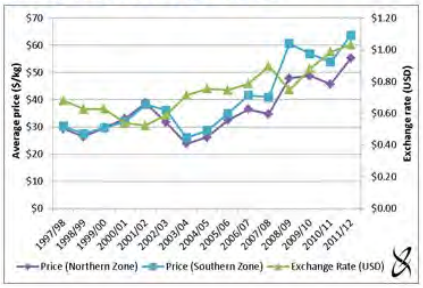
Exchange rates and SA Rock Lobster prices, 1997/98 to 2011/12



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Catch and GVP

Year	Western Zone		Eastern Zone		Victoria	
	(tonnes)	($m)	(tonnes)	($m)	(tonnes)	($m)
1997/98	452	14,528	67	2,257	519	16,785
1998/99	492	14,964	63	1,972	555	16,936
1999/00	515	16,125	75	2,406	590	18,531
2000/01	554	19,525	73	2,586	627	22,111
2001/02	446	19,195	59	2,595	505	21,790
2002/03	438	17,015	50	1,974	488	18,989
2003/04	435	12,159	54	1,574	489	13,733
2004/05	419	12,374	54	1,662	473	14,036
2005/06	405	13,927	55	1,921	460	15,848
2006/07	325	12,820	51	2,061	376	14,881
2007/08	319	12,526	50	1,962	369	14,488
2008/09	241	11,822	41	2,075	282	13,897

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GVP, Price and Catch

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Licences

	Licence Fee ($'000)	GVP ($000)	Fee/GVP (%)	Catch (tonnes)	Fee/Catch ($/kg)	Licence Holders (No.)	Fee/Licence Holder ($/licence)
Eastern Zone							
2004/05	67	1,662	4.0%	54	$1.23	52	$1,279
2005/06	91	1,921	4.7%	55	$1.65	52	$1,741
2006/07	84	2,061	4.1%	51	$1.65	48	$1,755
2007/08	96	1,962	4.9%	50	$1.92	46	$2,091
2008/09	83	2,075	4.0%	41	$2.03	46	$1,810
Western Zone							
2004/05	368	12,374	3.0%	419	$0.88	85	$4,325
2005/06	540	13,927	3.9%	405	$1.33	85	$6,350
2006/07	410	12,820	3.2%	325	$1.26	85	$4,827
2007/08	427	12,526	3.4%	319	$1.34	85	$5,025
2008/09	417	11,822	3.5%	241	$1.73	85	$4,906
Total							
2004/05	434	14,036	3.1%	473	$0.92	137	$3,169
2005/06	630	15,848	4.0%	460	$1.37	137	$4,601
2006/07	495	14,881	3.3%	376	$1.32	133	$3,718
2007/08	523	14,488	3.6%	369	$1.42	131	$3,996
2008/09	500	13,897	3.6%	282	$1.77	131	$3,819

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Financial Performance – Western Zone

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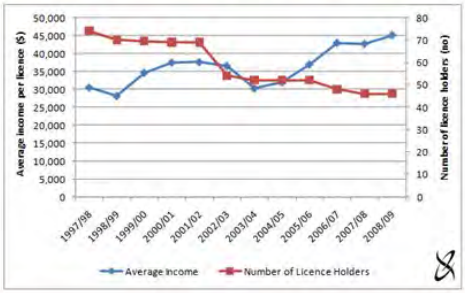
Financial Performance – Eastern Zone



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Financial Performance – Western Zone 2008/09

	Average per Boat			
	Low Catch	Medium Catch	High Catch	All Boats
Number of Boats	20	25	16	61
Income:				
Catch (kg)	1,700	4,000	6,700	4,000
Average Price ($/kg)	$49	$49	$49	$49
Gross Income ($)	84,100	198,100	328,800	198,800
Total Costs	106,800	188,600	306,100	191,700
Boat Cash Income	-21,700	7,600	23,700	2,100
Boat Business Profit	-30,175	-7,595	-15,340	-17,205
Profit at Full Equity	-875	31,905	47,960	23,195
Boat Capital:				
Fishing Gear & Equip	56,300	101,300	261,800	128,700
Licence Value	683,800	962,100	1,566,700	1,028,800
Total Boat Capital	740,100	1,063,400	1,828,300	1,157,500
Rate of Return on Fishing Gear & Equip	-1.5%	31.5%	18.3%	19.6%
Rate of Return on Total Boat Capital	-0.1%	3.0%	2.6%	2.2%
Employment (fte)	1.0	1.3	2.0	1.6

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Financial Performance – Eastern Zone 2008/09

	Average per Boat		
	Low Catch	High Catch	All Boats
Number of Boats	11	10	21
Income:			
Catch (kg)	1,000	3,000	2,000
Average Price ($/kg)	$51	$51	$51
Gross Income ($)	50,600	161,300	93,800
Total Costs	57,100	136,900	84,800
Boat Cash Income	-6,500	15,900	4,200
Boat Business Profit	-14,975	3,420	-6,180
Profit at Full Equity	-6,575	24,620	8,320
Boat Capital:			
Fishing Gear & Equip	56,500	83,200	69,200
Licence Value	156,000	405,000	276,000
Total Boat Capital	212,600	491,200	346,200
Rate of Return on Fishing Gear & Equip	-11.6%	29.6%	12.0%
Rate of Return on Total Boat Capital	-3.1%	5.0%	2.4%
Employment (fte)	1.0	1.3	1.1

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Survey

- A total of 20 responses were received which represented 8 per cent of the total active vessels in the fishery

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Catch and GVP

Year	Catch (tonnes)	Value of Catch ($m)	TACC (tonnes)
1999/00	1,486	42	1,503
2000/01	1,485	50	1,503
2001/02	1,495	59	1,503
2002/03	1,512	64	1,524
2003/04	1,497	48	1,524
2004/05	1,515	42	1,524
2005/06	1,512	48	1,524
2006/07	1,520	58	1,524
2007/08	1,550	62	1,524
2008/09	1,472	70	1,524
2009/10	1,357	64	1,471
2010/11	1,225	64	1,324
2011/12	1,079	59	1,103

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NEW ZEALAND

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GVP, Price and Catch

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Catch and GVP, 2011/12

- Total Catch was 2,752t
- TACC was 2,752t
- GVP of $188m
- 259 Active Boats
- 259 Fishing Permits

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Financial Performance, 2010/11

		2010/11 Average per Licence	Share of TBOC[2]
(1)	**Total Boat Gross Income**	$296,353	
(3)	**Total Variable Costs**	$164,817	60%
(7)	**Total Fixed Costs**	$108,246	40%
(8)	**Total Boat Cash Costs (3 + 7)**	$273,063	100%
	Boat Gross Margin (1 - 3)	$131,536	
(9)	**Total Unpaid Labour (2 + 5)**	$13,295	
	Gross Operating Surplus (1 - 8 + 9)	$36,585	
(10)	**Boat Cash Income (1 - 8)**	$23,290	
(11)	**Depreciation**	$32,113	
(12)	**Boat Business Profit (10 - 11)**	-$8,823	
(13)	**Profit at Full Equity (12 + 4 + 6)**	$58,117	
	Boat Capital		
(14)	Fishing Gear & Equip	$380,745	
	Licence Value	$1,095,725	
(15)	**Total Boat Capital**	$1,476,470	
	Rate of Return on Fishing Gear & Equip (13 / 14 * 100)	15.3%	
	Rate of Return on Total Boat Capital (13 / 15 * 100)	3.9%	

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Licences

- The Government imposes a cost recovery levy of $110.20 per tonne per annum
- General Industry levy was $129.00 per tonne per annum
- Rock Lobster industry levy was $106.00 per tonne per annum
- Total levy per tonne (average across nine zones) = $345.20
- Total levies paid = $964,356 (Approx 0.5% GVP)

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Rent, 2010/11

	2010/11
Gross Income	$63,624
Less Labour	$4,790
Less Cash Costs	$53,834
Less Depreciation	$6,894
Less Opportunity Cost of Capital (@10%)	$8,174
Economic Rent	**-$10,068**

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Financial Performance – CRA 5, 2011/12

	Average per Boat	
Number of Boats	35	
Income:		
Catch (kg)	14,000	
Average Price ($/kg)	$67	
Gross Income ($)	933,999	
Costs:		
Fuel, Bait, maintenance, crew shares	238,000	17.00 per kg
Levies & Charges	5,179	0.3842 per kg
Annual catch entitlement	420,000	30.00 per kg
Other fixed Costs	71,400	30% of variable costs
Total Costs	734,779	
Boat Cash Income	201,121	
Boat Business Profit	117,121	15% Depreciation
Profit at Full Equity	173,121	10% interest
Boat Capital:		
Fishing Gear & Equip	380,000	
Licence Value	7,840,000	196,000,000 total value of quota
Total Boat Capital	8,400,000	
Rate of Return on Fishing Gear & Equip	30.9%	
Rate of Return on Total Boat Capital	2.1%	

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Summary, 2011/12

	South Australia	Tasmania	Victoria *	New Zealand
Total (t)	1,636	1,079	282	2,752
Gross Value of Production ($m)	96.66	58.99	13.90	146.70
Average Price (AU$/kg)	59.08	54.65	49.29	53.31
Number of licences/permits	249	198**	131	259

* 2008/09
** Number of active licences

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Summary, 2011/12

	South Australia Southern Zone	South Australia Northern Zone	Victoria Eastern Zone	Victoria Western Zone *	Tasmania**	New Zealand CRA 3***
Income	488,415	371,180	98,800	193,800	296,353	933,900
Total Costs	319,203	297,520	94,600	191,700	273,083	734,779
Boat Cash Income	174,212	73,660	4,200	2,100	23,290	201,121
Boat Business Profit	126,393	35,036	-6,180	-17,205	-8,823	117,121
Profit at Full Equity	168,809	108,530	8,320	25,195	58,117	173,121
Boat Capital:						
Fishing Gear & Equip	381,939	281,391	69,200	128,700	380,745	960,000
Licence Value	3,336,990	1,628,218	276,000	1,028,800	1,095,725	7,840,000
Total Boat Capital	3,718,929	1,909,609	345,200	1,157,500	1,476,470	8,400,000
Rate of Return on Fishing Gear & Equip	42.9%	38.6%	12.0%	19.6%	15.3%	30.9%
Rate of Return on Total Boat Capital	4.4%	5.7%	2.4%	2.2%	3.9%	2.1%

* 2008/09
** 2010/11
*** NZ$

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Economic Indicators for the Southern Rock Lobster Fisheries

Seafood CRC
Southern Rocklobster Workshop

28-29 May 2013

EconSearch Pty Ltd

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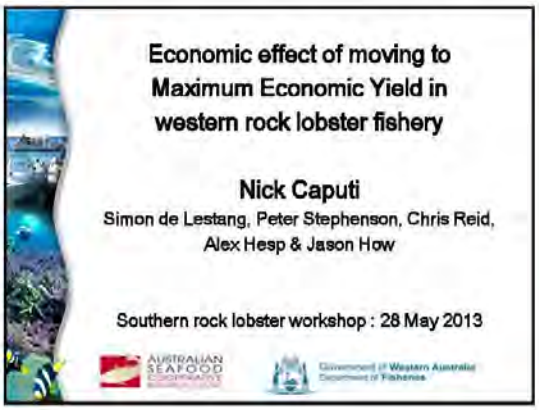
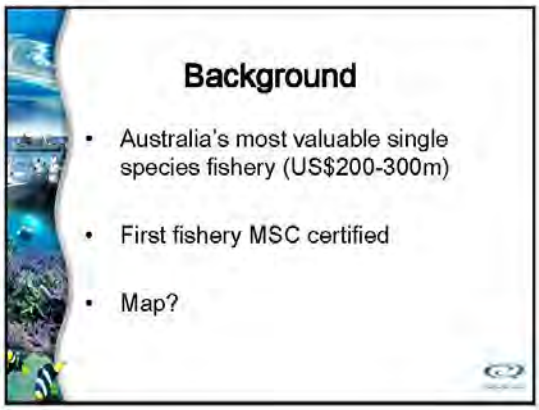
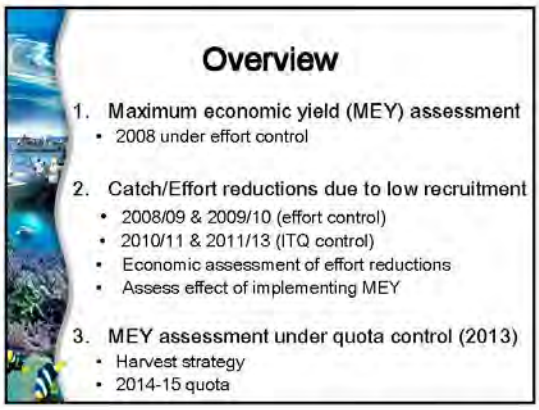
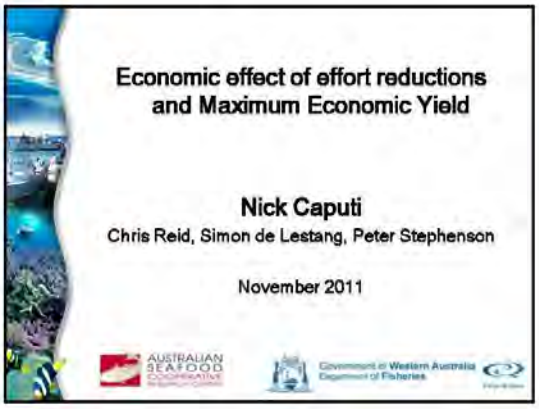
Appendix 2.4. WA Rock Lobster Fishery

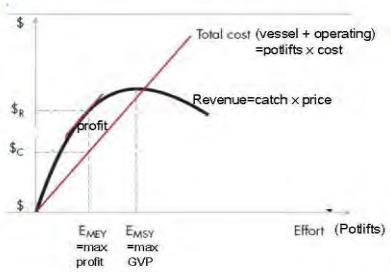








Maximum economic yield (=maximum profit)



MEY Assessment (2008): step 2

2. Economic assessment
   - Maximise 'profit' over long-term (6 yr)
   - 'Profit' = Catch*price – Fishing costs
   - Predicted profit at different levels of fixed effort
   - Fishing Costs
     - Fixed costs (vessel depreciation)
     - Variable costs (bait, fuel, crew)
   - Assumed costs and prices same over 6 years
   - Future profits discounted 10% pa (net present value)

Maximum Economic Yield (MEY) assessment 2008

- Maximise 'profit' over long-term (6 yr)
- 'Profit' = Revenue – Fishing Costs
- Fishing Costs
  - Fixed costs (vessel depreciation)
  - Variable costs (bait, fuel, crew)

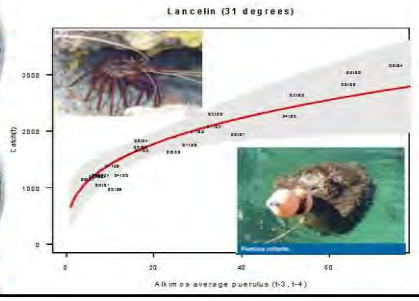
Costs in MEY assessment

- Assessing profits to economy overall not just fishing operators/unit owners
- Cost included:
  - Resources directly producing fishing effort
  - Vessel, bait, fuel, crew
- Assessing level of effort required if you were sole owner of fishery

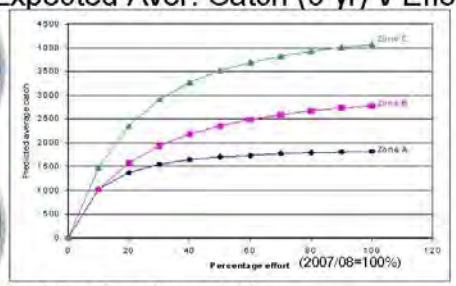
Western rock lobster MEY Assessment (2008): step 1

1. Stock assessment model
   - Puerulus abundance: catch prediction 3-4 yr
   - Predicted future recruitment in model NOT average recruitment
   - Predicted catch (2008/09–2013/14) at different levels of fixed effort

Catch v. puerulus (3-4 years before) (included in stock assessment model)

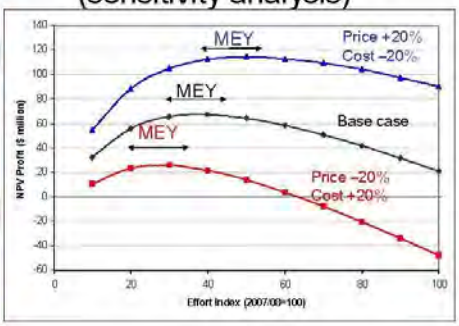


Stock assessment model: Expected Aver. Catch (6 yr) v Effort

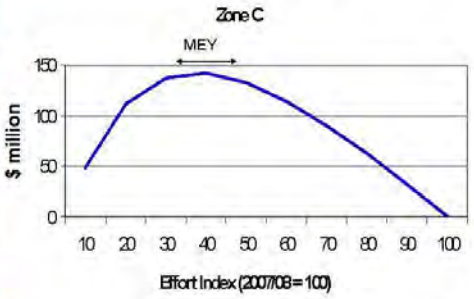


- Prediction of recruitment 4 of 6 years
- Long-term: 50% effort decline = ~10% catch decline

Average NPV Profit v. Effort: (sensitivity analysis)



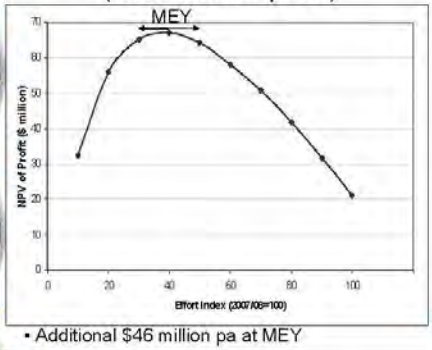
Additional Profit (6 yr) v. Effort



MEY Sensitivity analysis: Prices & cost

- Max Profit (MEY) at 30-50% of 2007/08 effort
- Costs up 20%: MEY effort decreases ~10% (i.e. 20-40% of 2007/08 effort)
- Prices up 20%: MEY effort increases ~10% (i.e. 40-60% of 2007/08 effort)

Average NPV Profit v. Effort (fixed lobster price)



- Additional $46 million pa at MEY

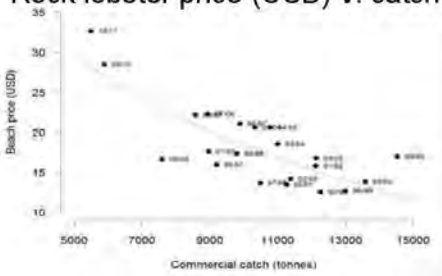
Rock lobster Puerulus settlement

- Catch prediction 3-4 years ahead
- Early management intervention

Effort reductions: 2008/09 – 2010/11

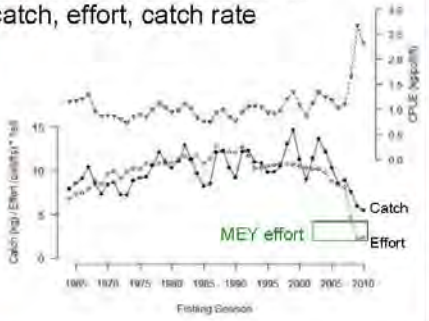
- Effort reduction due to low puerulus settlement
  - Before poor year classes entered fishery
  - Protect future spawning stocks
  - Ensure carryover into poor catch years
- Nominal effort reduction
  - 2008/09: 56% of 2007/08 effort
  - 2009/10: 27% of 2007/08 effort
  - 2010/11: 29% of 2007/08 effort (ITQ)
- MEY effort (30-50% of 2007/08 effort)
- 35-40% reduction in vessels
- Fishers made commercial decisions (sell/lease out or buy/lease in entitlements)
- No government compensation

Rock lobster price (USD) v. catch



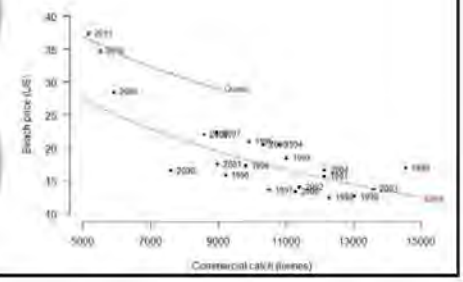
- Higher % catch sold live with lower catch
- MEY assessment assumed fixed price

Effect of effort reduction on: catch, effort, catch rate



Beach Price

- AUD price impacted by landings, exchange rates and quota
- ~$6 premium under quota (product quality, high % live export, reduced peak catches, high grading, extended season)



Catch, effort changes v. 2007/08 effort

Year	Actual Potlift (1000s)	Vessel No.	Actual Catch (t)	Predicted Catch: 07/08 effort	Catch rate kg/ potlift
07/08	8106	460	8942		1.1
08/09	4576 (-44%)	395 (-14%)	7594 (-24%)	9949	1.7
09/10	2204 (-73%)	294 (-36%)	5899 (-34%)	8923	2.7
10/11 (ITQ)	2360 (-71%)	279 (-39%)	5500 (-26%)	7433	2.3

Average NPV Profit v. Effort

- Additional $70 million pa at MEY for variable price

Change in revenue, costs, 'profits' v. maintaining 2007/08 effort

Year	Revenue decline ($m)	Cost decline ($m)	Change 'Profit' ($m)
2008/09	31	44	+13
2009/10	42	91	+49
2010/11 (ITQ)	<30	>90	>60

- Revenue higher than predicted with fixed price
- Improved economic performance after 1-2 yr

MEY analysis

1. Estimate Catch and effort from a range of LPH values
2. For each LPH scenario
   - Determine Income (Catch x Beach Price[1])
   - Determine Costs — Sensitivity ranges
     - Vessels (# vessels[1] x $ per vessel[2]) – ($85 000, $68,000 – $102,000)
     - Potlifts (# potlifts x $ per potlift[2]) – (~$7, $5.60 – $8.40
     - Wages (value of catch x wage %[2]) – (30% of income, 24 – 36%)
3. Profit (Income – Costs)
4. Net Present Value (future profits discounted @ 10% year^{-1})
5. MEY = range of LHP scenarios where NPV is the greatest

- Relatively robust against assumptions

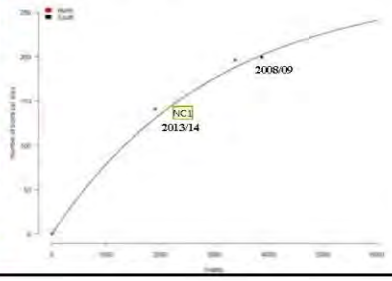
MEY assessment 2013: quota controls

- Harvest rate:
  - Legal proportion harvested (LPH)
  - (Catch/Average legal biomass)
- Assess different levels of LPH (5 years)
- Outputs per year:
  - Catch, effort & catch rate
  - Catch value (GVP)
  - MEY Profit = GVP–Costs (discounting future profits)
  - Egg production

Vessel Numbers per area

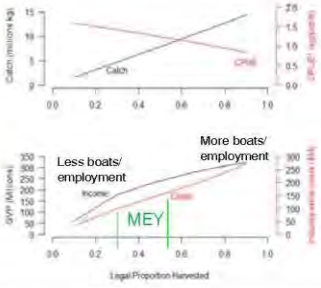
MEY sensitive to assumptions about vessel numbers (sensitivity analysis)

Related to effort levels (potlifts)



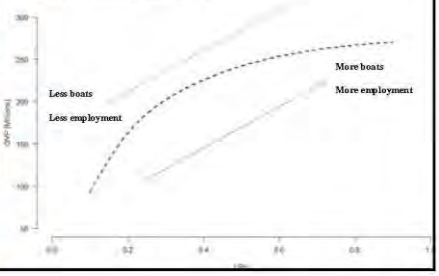
Secondary objective (socio-economic)

- **Tradeoff between catch, effort, CPUE, GVP, costs, employment**

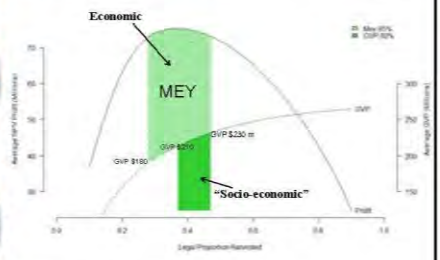


Additional information (Social benefits?)

- **Wide range of catch falls within 'MEY' range**
  - **Significant variation in catch, GVP, vessel numbers**
- **Increasing GVP = social benefits with greater GVP? (more employment boats / community benefits etc.)**



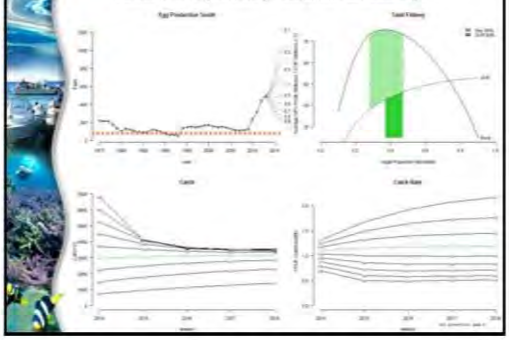
Example of Social/Economic information



1. Target MEY to maximise Industry's profitability
2. Within MEY target larger GVP to maximise benefit to state

Southern Assessment (example)

Current levels of protection (77 mm, Setose and max size)



Example of Social/Economic information

(Current input controls)

LPH	TACC	MEY	GVP	CPUE*	
0.20	3110	$63.2	$119	1.50	
0.25	3890	$70.4	$148	1.46	
0.30	4680	$74.1	$176	1.42	
0.35	5470	$75.1	$194	1.38	
0.40	6258	$75.1	$211	1.33	**Target region**
0.45	7050	$73.9	$226	1.28	
0.50	7850	$71.8	$240	1.24	
0.55	8650	$68.9	$254	1.20	
0.60	9460	$65.2	$266	1.15	

Target = Where profit (economic) and GVP overlap

2014/15 TACC (using socio-economic target)

(changing input controls)

- **Target maintains a similar TACC range under different controls but keep Tar Spot and Berried Female rules**

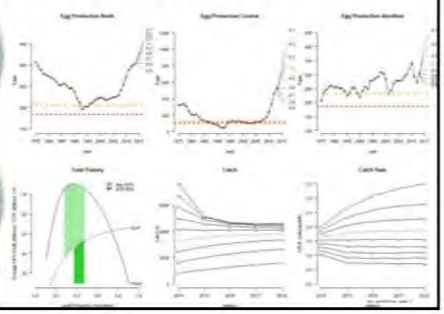
Example using same TACC (6500 t)

- Remove max size **or** setose (cpue increases ~ 8%)
- Change min size (76 mm) (cpue increases ~ 7%)
- Remove max size **&** setose (cpue increases ~ 32%)
- Remove max **&** setose **&** (76 mm) (cpue increases ~ 39%)

- Significant economic benefit to industry ($15 m)
- High grading?
- Whale interactions?

Northern Assessment (example)

Current levels of protection (77 mm, Setose and max size)



Summary

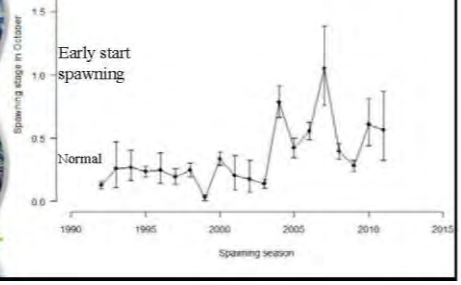
- MEY assessment: economic optimum
  - 30-50% of 2007/08 effort
- Effort reductions due to low puerulus
- Economic effect of effort reductions
  - Fishery 'Profit' increase $10-50m pa
- MEY assessment under catch quotas
  - Harvest rate (LPH ~0.40)
- Socio-economic target considered
- Spawning stock above threshold level
- Reduced ecosystem effect
- Social cost: reduced employment

General issues MEY

- Advantages
  - Lower fishing effort at MEY
  - Lower fishing costs
  - Higher catch rates
  - Higher profits
  - Higher spawning stock
  - Reduced ecosystem effects on bycatch, habitat, protected species, etc
- Disadvantages
  - Social cost
  - Reduced vessel numbers, employment
  - Slightly lower catch

Start Spawning (breeding stock survey

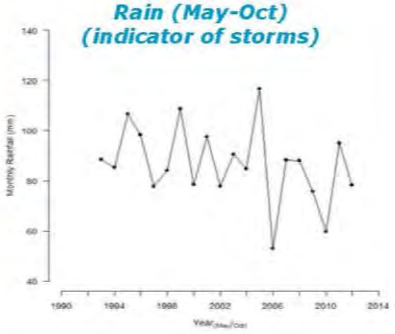
- *influenced by water temperature*



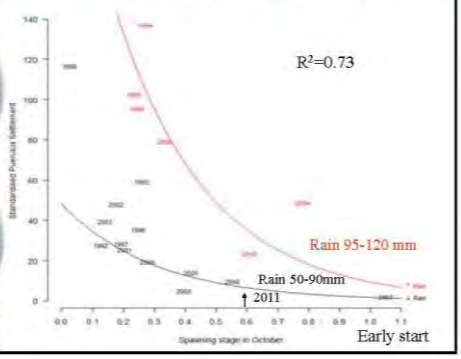
Future research

- Costs 2010/11 (individual catch limits)
  - Effort distribution by month changed
  - Lobster prices, bait & fuel costs changed
- Economic assessment 2010/11
- Assess MEY under catch quota
  - Effect of fixed v. variable quota
- Assess different monthly distributions of catch & effort on MEY
  - Sensitivity analysis ('what if' scenarios)
- Industry input into assessment

Rain (May-Oct) (indicator of storms)



Puerulus v. start spawning, rain (storms)



Appendix 2.5. CRA8 Fishery

THE CRA8 FISHERY

Malcolm Lawson

CRA8

CRA8 Management Committee Inc

Representing the Southern New Zealand Rock Lobster Industry

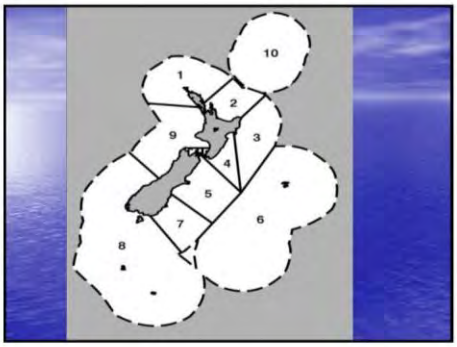
Management of Rock Lobster Fisheries In New Zealand

- Quota Management System (QMS) since 1990
- Eligibility requirements when QMS was introduced
- QMS operates on quota shares and ACE – Annual Catch Entitlement
- 100 million shares are allocated for each quota management area. Quota holdings are expressed in shares
- Quota shares have a weight equivalent
- Quota shares generate ACE. Which is expressed in kilograms

- New Zealand Situation
- Profile of the CRA8 Fishery
- Profile of the CRA8 Participants
- Management of the CRA8 Fishery
- Development of CRA8 Management Strategy
- Impact of Management Strategies
  - Economic
  - Fishing Practices
- Decisions for the Future

Allocation Formula

Total Allowable Catch (TAC)	1053 t
Non-Commercial Allowances	
- Customary	30 t
- Recreational	33 t
- Other fishing related mortality	28 t
Total Allowable Commercial Catch(TACC)	
- Sum of ACE	962 t



NZ Rock Lobster 2007 – 2012

Statistics NZ

Export Value (NZ$ Millions)

2007	2012	% Change
121	223	82

TACC (Tonnes)

2007	2012
2,766	2,810

Export Destinations by Value (NZ$M) All Species

	2007	2012	% Change
China	117	353	+202
Hong Kong	173	118	-32

CRA8 Fishery Facts

- Largest rock lobster Quota Management Area in NZ
- Total Allowable Commercial Catch is largest of all rock lobster QMA's – 34%
- Largest geographically
- Most valuable QMA across all inshore species in NZ
- Market-driven fishery

CRA8 Participants

- Quota Share Owners
  - Fishing
  - Non Fishing
    - Investors
    - Ex Fishermen
- ACE Fishermen
- Processors/Exporters

CRA8 Rules

- Minimum legal size applies
- Females carrying eggs cannot be taken
- Escape gap size in pots applies
- Minimum 3 t ACE required
- ➢ Full 12 month season
- ➢ No pot limits
- ➢ Females can be taken when not carrying eggs
- ➢ Males can be taken at all times
- ➢ High-grading is allowed

Quota Share Owners - Fishing

- Hold a large secure capital base
- Almost all purchase additional ACE annually
- Commonly enter into "tonne for tonne" deals with processors
- Have negotiating power
- Ability to seek and sell at best prices

CRA8 Profile

- 118 quota share owners
- 67 vessels
- 4 (soon to be 5) processing/export companies
- Current ACE purchase cost: ~ $52K per tonne
- Current quota share purchase cost: ~ $600K per tonne equivalent
- Average beach price: $68K - $75K per tonne
- Sales of quota shares are infrequent
- Operated since 1998 under decision rules (Operational Management Procedures)

Quota Share Owners - Non Fishing

Investors

- Aiming for best Return On Investment (ROI) - 10%
- Capital gain possible through:
  - Increase in TACC (weight value of shares)
  - Increase in ACE price
  - Increase in share trading price

Ex Fishermen

- Some look for maximum ROI
- Others take a benevolent approach:
  - discounted ACE price to new entrants

ACE Fishermen

- Reliant on access to ACE on an annual basis to remain in the fishery
- Subject to market rates for ACE
- Limited capital base
- Little negotiating power
- The most economically exposed sector

The Case for Fishermen to Purchase More Quota Shares

- Current price of quota shares is ~ $600K per tonne equivalent
- Current ACE price ~$52K per tonne
- With contribution of some capital towards the purchase price
  - annual repayments are similar to ACE price
  - ability to use it in "tonne for tonne" deal
- Additional capital asset vs "lease"

Processors/Exporters

- All own quota shares directly or through shareholding companies
- Have large capital base
- Financial ability to secure ACE from non fishing quota share owners
- Large influence on ACE prices
- Ability to substantially increase throughput via "tonne for tonne" deals
- Ability to finance private ACE transactions for fishermen
- Payment/Repayment of ACE recovered from beach price

Bio-Economic Modelling

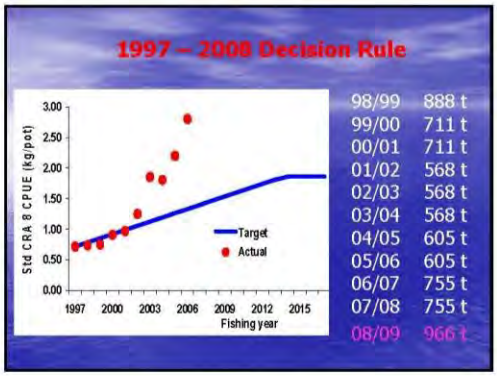
- Carried out in 2005
- During period of rapid rebuild of the fishery
- Biological model projected catches and CPUE but did not project costs or revenues
- Marrying of economic model to biological model enabled evaluation of current management strategy on net industry profitability
- 20 year projections of catch and effort vs revenues and costs

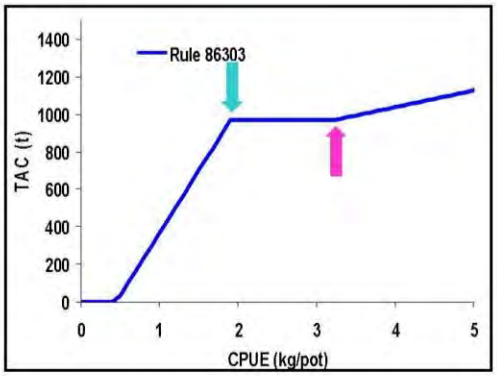
Ngai Tahu Seafoods Development Pool

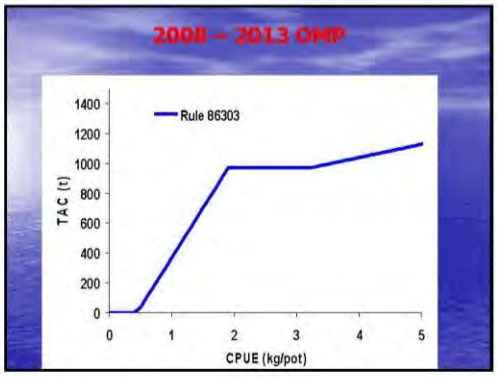
- Quantity of ACE placed into development pool
- Divided amongst participants
- Also provide wet fish ACE to secure year round economically viable portfolio for participants
- 5 year period – subject to conditions – provides certainty for investment in boat/gear
- ACE is at discount rate – 30% of beach price
- Expectations that participants will demonstrate investment in the fishery

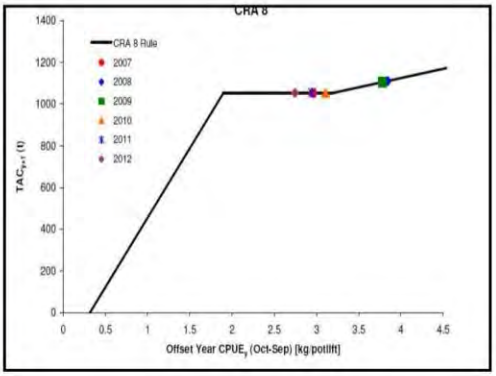
However

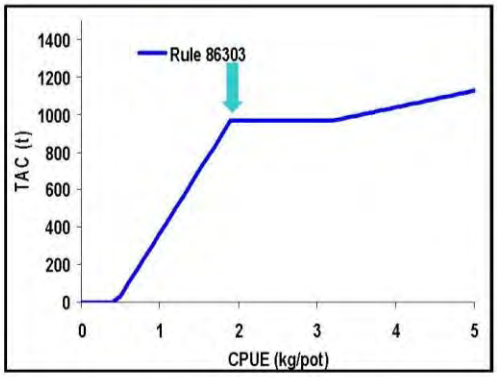
- Results are only valid while the current management strategy is in place
- Any change in indices, parameters, rebuild targets, timeframes etc of the OMP invalidate the bio-economic modelling

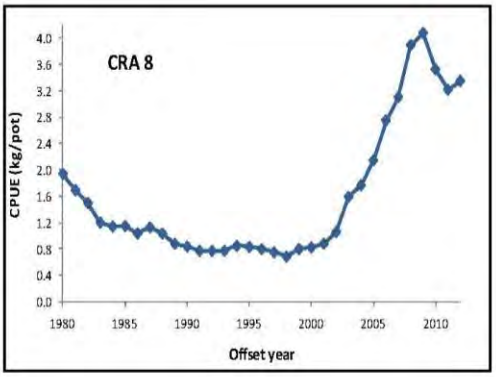

1997 – 2008 Decision Rule
Std CRA 8 CPUE (kg/pot)
Target
Actual
Fishing year
98/99 888 t
99/00 711 t
00/01 711 t
01/02 568 t
02/03 568 t
03/04 568 t
04/05 605 t
05/06 605 t
06/07 755 t
07/08 755 t
08/09 966 t


Rule 86303
TAC (t)
CPUE (kg/pot)


2008 – 2013 OMP
Rule 86303
TAC (t)
CPUE (kg/pot)

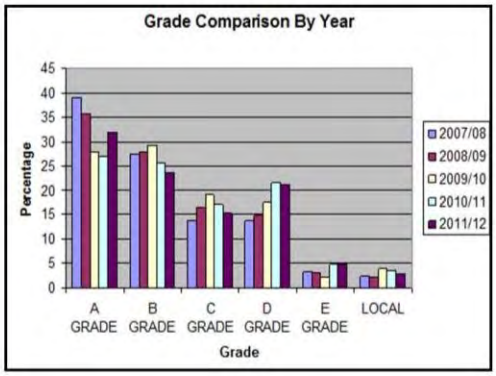

CRA 8
CRA 8 Rule
2007
2008
2009
2010
2011
2012

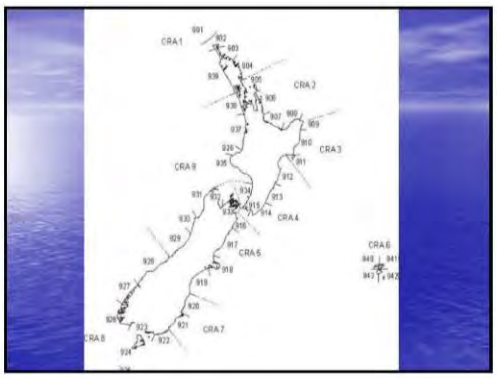

Rule 86303
TAC (t)
CPUE (kg/pot)

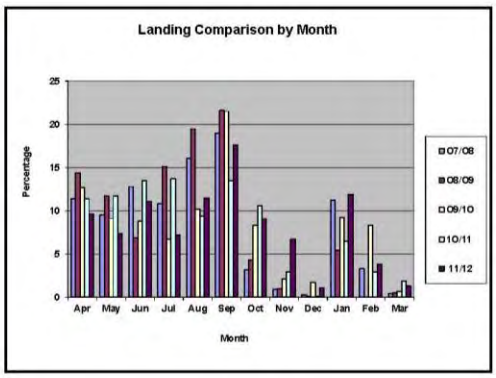

CRA 8
CPUE (kg/pot)
Offset year

What Has Happened? 2002 - 2012

- **CPUE**
  0.94kgs – 2.8kgs (highest 2009: 3.82kgs)
- **TACC**
  568 t – 962 t (highest 2009/10 1019 t)
- **No. of Vessels**
  69 - 65
- **Average Catch Per Boat**
  8.2 t – 14.8 t
- **No. Of Processors**
  8 - 4
- **Quota Trading Price**
  $NZ280K - $NZ540K per tonne
- **ACE Purchase Price**
  $NZ18K - $NZ52K per tonne





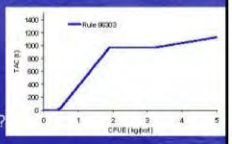


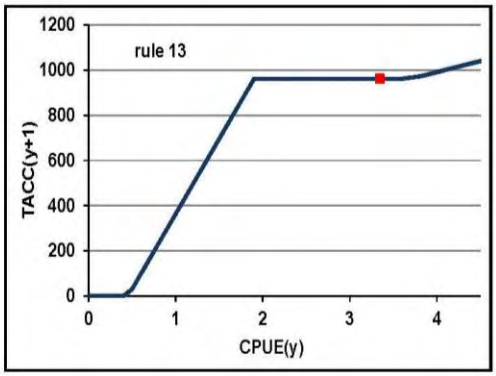
Shift of Effort

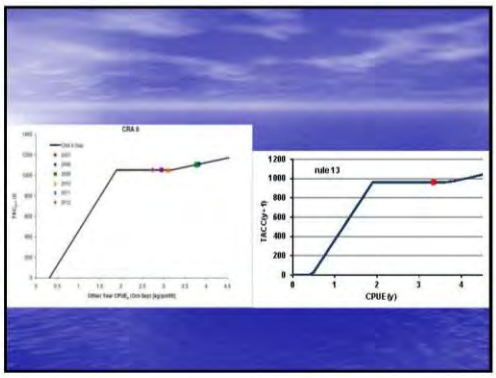
	922	923	924	925	926	927	928
05/06		3	12		46	20	18
06/07		3	13		41	23	18
07/08		3	13	1	37	21	26
08/09	1	0.5	15		29	22	32
09/10	0.6		14		28	21	35
10/11			13		34	25	28
11/12			11		38	24	26

Stock Assessment and Management Procedure Review Considerations

- Has the current MP been successful?
  - provided certainty for the fishery
  - provided certainty for business planning
  - enabled profitability
- Plateau level
- TACC vs CPUE
- Plateau parameters
- Intermediate step: 5% at 2.6kgs?
- Annual operation
- Retention of relativity between CPUE and plateau parameters





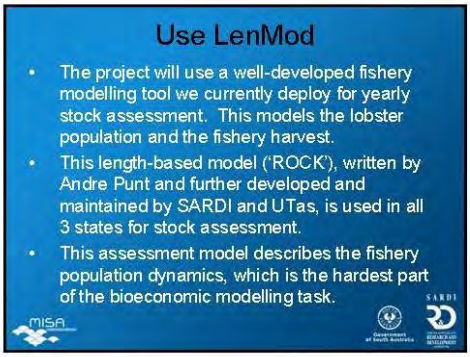


It's Not All About Quantity

Abundance Provides The Opportunity To Maximise Financial Returns Through Providing What The Market Wants And When

- Increased returns through targeting size, areas and time of year
- Reduced costs through high CPUE
- Confidence – business planning
- Reinvestment
- Additional benefits – high breeding biomass

Appendix 2.6. Bioeconomic decision support tools for Southern Rock Lobster



Extending fishery model to account for economics

- To extend the population model to evaluate different harvest strategies, with higher profit as a principal objective, two economic submodels are added:
  - price per kg landed:
  - costs of harvesting that product.
- Gross revenues from landed seafood product are computed directly as catch (by month and lobster size) times price;
- Profit is gross revenues minus fishing costs.

Fishing Costs

- In SA, we are fortunate to have an extensive high-quality data set of fishing costs, from EconSearch interviews with the fishing industry.
- Based on 3-yearly surveys of fishers, these are updated yearly in annual economic reports on the two fisheries (SZ and NZ RL).
- EconSearch reports break costs down between fixed and variable;
  - only variable costs are reduced when fewer pot lifts are set in a given season.
- An EconSearch economic survey was also carried out in Tasmania this year.

Price Data

- Price data, from processors, are gathered and reported by SARDI statistics as a monthly mean price.
- Monthly price data allow the analysis of harvest strategies to account for
  - monthly variations in when catch is taken, and
  - time closures.
- Price is broken down by different lobster size grades, using fisher-suggested price splits.

Harvest Strategy Evaluation

- A range of harvest strategies can be tested using this decision-support tool.
- Strategies that can be evaluated include:
  - different decision rules for setting the yearly TACC,
  - seasonal closures (or lack thereof).
- Scenarios can also be tested for
  - What if lower price comes out of China?
  - What if recruitment stays lower than average for a while?
  - What if fuel costs rise?
- In those scenarios, how can we get the best economic return?

Price by size

- Data are not gathered regularly about size-dependence of price.
- Analysis of Tasmanian processor price data by Eriko Hoshino also show a price split at 2kg.
- We use the monthly average price from processors, and modify it to incorporate the price split.
- Under one scenario for price split, it is assumed:
  - In SZ, 25% lower price for lobsters > 2 kg
  - In NZ, 20% lower price for lobsters > 2 kg.

How long-term average profit is calculated

- For each strategy, we compute the long-term profit over the next 20 years.
- Profits from years farther into the future are given less weight (they're 'discounted') in the 20-year sum of profits.
- This overall discounted profit sum ('net present value' or NPV) is the principal measure of profit that we will report back to the steering committee for each strategy tested.

Current project status

- This lobster fishery economic modelling project started in July 2011.
- Final report is due at the end of 2013.

4 Policies

- We first put the model through its paces by testing broadly different approaches to managing a fish stock.
- This compares the performance of different methods or (call them) policies for managing this lobster population:
  - size policies, min and max size limits
  - constant quotas
  - quotas that vary so as to mimic constant exploitation rates.

Projection Model Verification

- To verify that the projection model is in full agreement with the assessment model, we made sure that the projections give the same outputs as the historical estimates if we
  - plug in the same Recruitment time series,
  - assume the same catches.
- This verified that the projection model recreates the past going forward if the same inputs are used in the future as in the past.

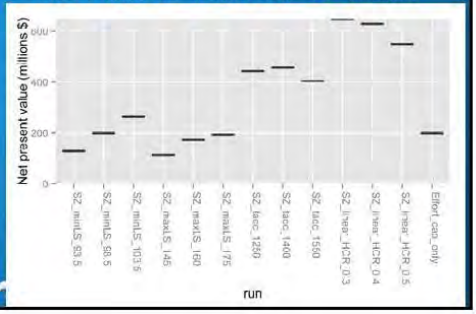
4 Policies: Size limits

- For the size strategies, we assume no catch or or effort controls other than a yearly maximum number of potlifts:
  - SZ yearly effort max = 1,875,929 potlifts
  - NZ yearly effort max = 587,322 potlifts.
- The 'default' run for the 4 policy comparison uses this maximum potlift numbers per season with the current min size of 98.5 mm CL.
- The default strategy is used in the scatterplots and elsewhere as the basis for comparison.

Overview of Results in this Talk

- We consider 3 sets of strategies in what follows:
  - Comparing 4 broadly different ways ('policies') to manage a fish stock,
  - Comparing the harvest control rule adopted in the SZ management plan with the best performing of the 4 policies above,
  - 98.5 minimum size in the NZ.

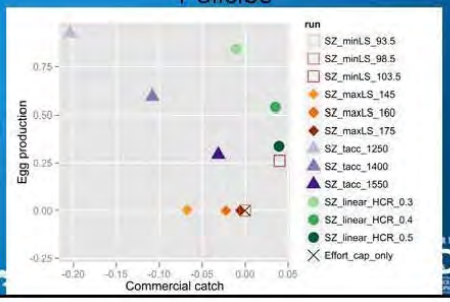
Net Present Value for 4 Policies



Results for size policies: Min limit

- A 5 mm increase in the minimum size limit to 103.5 gave generally positive outcomes:
  - increase egg production by 25%
  - increase long-term average catches a bit, ~4%.
    - This is a yield-per-recruit benefit.
  - A quite substantial increase in NPV over baseline of about 20%.
- The substantial increase in NPV results from small increases in revenue (or small reductions in costs), giving a bigger change in their difference, which is profit.

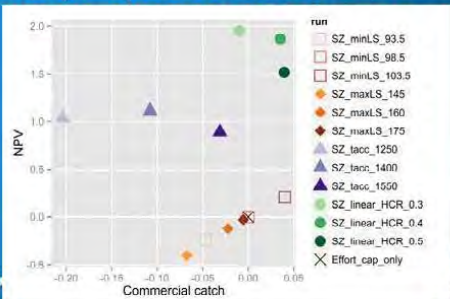
Egg production versus Catch for 4 Policies



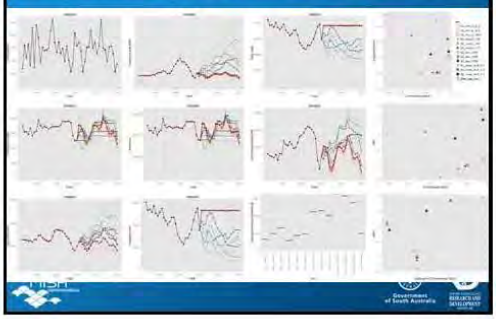
Why do size policies have relatively modest impact?

- Effort maxes out at the upper limit.
- So variable costs also reach high levels.
- But CPUE/biomass has no chance to recover; total catches stay quite ordinary.
- So yearly profits are generally a lot lower than for strategies which lower exploitation rates because costs remain high.
- Also, the benefit as stock recovery is relatively modest.

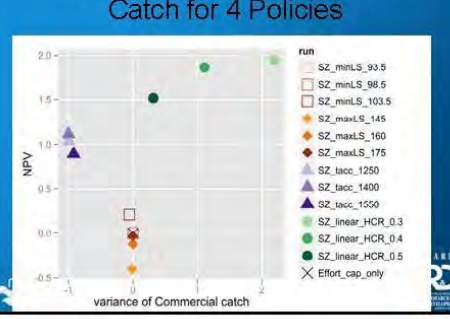
Profit (NPV) versus Catch for 4 Policies



4 Policies: Size policies do less well



Profit (NPV) versus Variation in Yearly Catch for 4 Policies

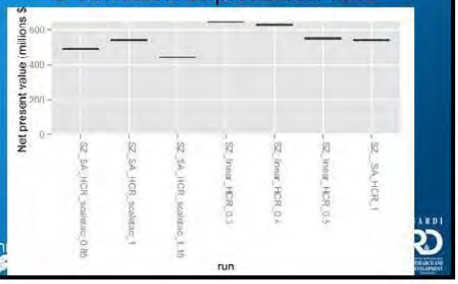


Summary for 2 Policies: Comparing constant TACC w an HCR that seeks a constant exploitation rate

- Policies that vary quota to mimic constant exploitation rate have higher financial return.
- They also give higher catches overall. This occurs with model stock biomass steadily rising at these (lower) levels of exploitation.
- But these policies which vary yearly quota in proportion to abundance have high yearly variation.

NPV with 25% lower R

Net Present Value: Comparing current SZ HCR w a linear HCR both seeking a constant exploitation rate



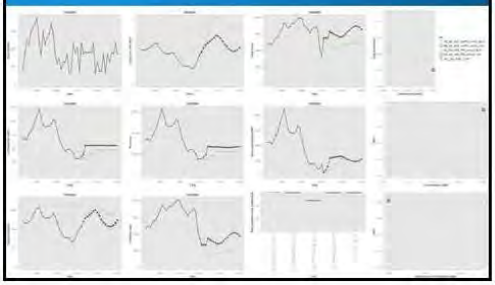
Lowering Size Limit in NZ to 98.5

- NZ representatives on the Res Sub Comm requested that we test a lower size limit.
- 98.5 is the minimum size in the SZ.

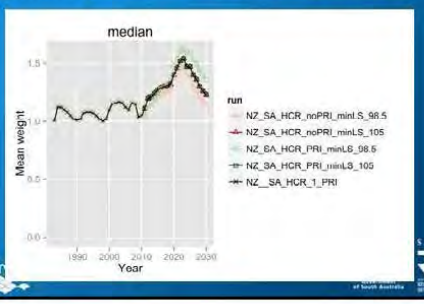
Summary: SZ HCR and a linear HCR, both seeking constant exploitation rate

- The model expects CPUE to generally rise under both Current HCR and a purely linear rule.
- Current HCR (the current management plan) has the advantage of lower yearly variation in TACC.
- Overall, the current HCR performed well. The levels of exploitation seem about right for these model-sampled historical (1983-2010) levels of recruitment.

Lowering Size Limit in NZ to 98.5



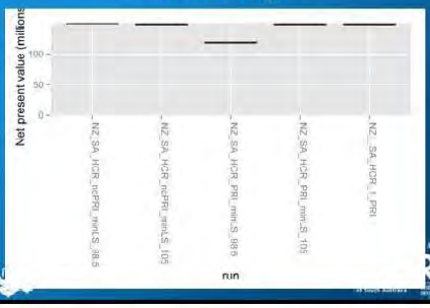
Lowering Size Limit in NZ to 98.5: NPV



Future Work

- The SA rock lobster fishery management plans are scheduled for review in 2014.
- This project could potentially be extended for use during that review.
- It fulfills stated objectives of the Management Plans, profitability with sustainability, as noted earlier.
- It also falls within Objective 2 of SRL Ltd's Strategic Plan:

Lowering Size Limit in NZ to 98.5: Mean weight



Acknowledgments

We thank SRL Ltd, the Seafood CRC, Caleb Gardner, Andre Punt, SARLAC, SEPFA, NZRLFA, lobster fishermen in Tasmania and South Australia, and by the 2010/11 SZ and NZ management working groups.

Lowering Size Limit in NZ to 98.5: Outcome summary

- In the SZ, changing size limits did have a measurable effect.
- In the NZ, lowering size has minimal impact.
- Possible reasons:
  - exploitation rates are lower,
  - NZ length selectivity is slightly (~10-15%) lower at those smaller sizes 98.5 than 105, and
  - taking a few more smaller lobsters means slightly higher price, but a slightly lower catch in weight.

Proposal for Extension of Project

- Industry may wish to support this potential continued use of this modelling tool to find strategies that can enhance fishery-wide profitability.
- If so, we will submit a pre-proposal to the SRL RD&E committee who will review proposals in July.
- Q: Thoughts?
  - On this work, and
  - the idea of its extension.

What industry can do to participate

- This project is designed to involve industry at several stages.
- One possible contribution would be to help us obtain more detailed information about the price split(s).
- A second important role is to suggest management strategies for testing.
  - Do you have any ideas for ways to manage these fisheries in such a way as to enhance industry profitability?

SA Steering Committee

- Originally the SA Rock Lobster Steering Committees were the old management working groups.
- The SA project seeks a new Steering Committee currently.
- Discussions will be held with SRL in the near future, and will include consultation with the new SA RL MACC, to decide on a new form for the SA Steering Committee of this project.

What industry can do to (cont.)

- Economic survey: fishing costs.
- An important input to these models are the estimates of fishing costs.
- EconSearch is currently undertaking their survey of fishers (done every 3 years).
  - More participants improve economic information, about costs and profitability, that go into the models.

Current project status (cont)

- You may wish to begin developing ideas for harvest strategies to test.
- Some strategies that these modelling tools can test, and compare, for how much long-term revenue they generate, include
  - different fixed levels of TACC
  - different versions of the existing industry-proposed harvest control rule, now implemented in both zones.

Acknowledgments

We thank SRL Ltd, the Seafood CRC, Caleb Gardner, SEPFA, NZRLFA, and lobster fishermen in Tasmania and South Australia.

This project was unanimously supported in both NZ and SZ management working groups.

Future Work

- SRL Ltd's Objective 2 states:

Objective 2: Optimize fisheries production

Priority issues to be addressed under this Objective will be:

- 1. Harvest strategies to optimize returns through improved management.
- The first key Deliverable under this Objective is
- 1. Bio-economic modeling to identify harvest strategies that maximize profitability within sustainability limits.

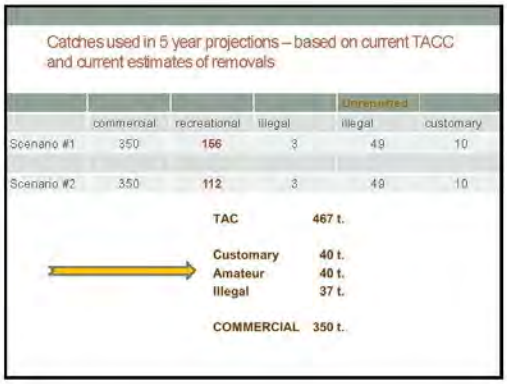
Results for size policies: Max limit

- A max size limit (145, 160 & 175 mm CL), above which lobsters are returned to the water, was the worst performing policy.
- It gave:
  - Nearly identical egg production as the baseline since females never reach these maximum sizes.
  - Lower catch from throwing back large males.
  - Thus lower profit (as lower NPV).
    - (Nearly 50% lower for a maximum size limit of 145 mm)

Steering Committee

- The selection of which strategies to evaluate lies with the project Steering Committee.
- The Steering Committee will receive the results and pass those back along to fishers.
- The Tasmanian Steering Committee has been serving in that role for several years now.
- The new SA RL MAC Research Sub-Committee will serve as the project Steering Committee.

Appendix 2.7. New Zealand Perspective



Catches used in 5 year projections – based on current TACC and current estimates of removals

	commercial	recreational	illegal	Unreported illegal	customary
Scenario #1	350	156	3	49	10
Scenario #2	350	112	3	49	10

TAC 467 t.

Customary 40 t.
Amateur 40 t.
Illegal 37 t.

COMMERCIAL 350 t.

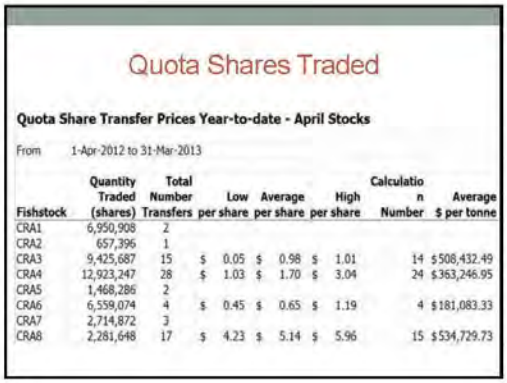
2012-13 Season Review

Catch - Current vs Last Year-to-date - April Stocks

From 1-Apr-2011 to 31-Mar-2012 and
From 1-Apr-2012 to 31-Mar-2013

Date of Report 19-Apr-2013

Fishstock	TACC	Last Year	This Year
CRA1	131,062	130,447	130,915
CRA2	236,083	228,986	232,996
CRA3	193,300	163,918	192,159
CRA4	466,900	466,248	466,049
CRA5	350,000	349,951	349,959
CRA6	360,000	359,478	349,394
CRA7	63,900	45,663	53,806
CRA8	962,000	961,199	957,246
CRA9	47,008	46,968	47,003

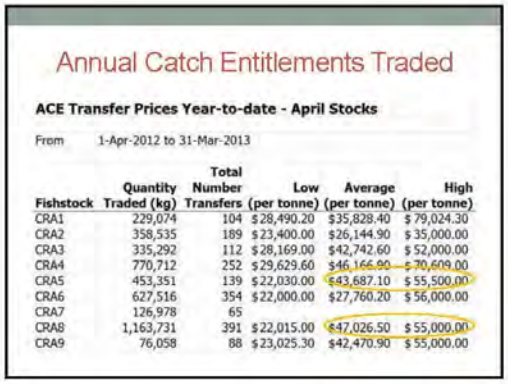


Quota Shares Traded

Quota Share Transfer Prices Year-to-date - April Stocks

From 1-Apr-2012 to 31-Mar-2013

Fishstock	Quantity Traded (shares)	Total Number Transfers	Low per share	Average per share	High per share	Calculation Number	Average $ per tonne
CRA1	6,950,908	2					
CRA2	657,396	1					
CRA3	9,425,687	15	$ 0.05	$ 0.98	$ 1.01	14	$508,432.49
CRA4	12,923,247	28	$ 1.03	$ 1.70	$ 3.04	24	$363,246.95
CRA5	1,468,286	2					
CRA6	6,559,074	4	$ 0.45	$ 0.65	$ 1.19	4	$181,083.33
CRA7	2,714,872	3					
CRA8	2,281,648	17	$ 4.23	$ 5.14	$ 5.96	15	$534,729.73



Annual Catch Entitlements Traded

ACE Transfer Prices Year-to-date - April Stocks

From 1-Apr-2012 to 31-Mar-2013

Fishstock	Quantity Traded (kg)	Total Number Transfers	Low (per tonne)	Average (per tonne)	High (per tonne)
CRA1	229,074	104	$28,490.20	$35,828.40	$79,024.30
CRA2	358,535	189	$23,400.00	$26,144.90	$35,000.00
CRA3	335,292	112	$28,169.00	$42,742.60	$52,000.00
CRA4	770,712	252	$29,629.60	$46,166.90	$70,609.00
CRA5	453,351	139	$22,030.00	$43,687.10	$55,500.00
CRA6	627,516	354	$22,000.00	$27,760.20	$56,000.00
CRA7	126,978	65			
CRA8	1,163,731	391	$22,015.00	$47,026.50	$55,000.00
CRA9	76,058	88	$23,025.30	$42,470.90	$55,000.00

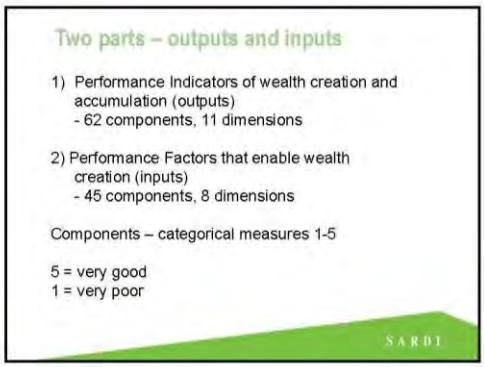
AREA CLOSURES

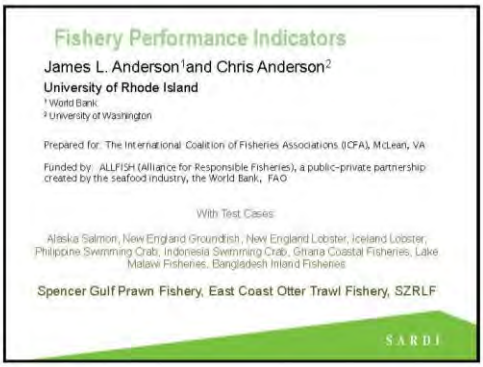
Impacts on commercial rock lobster fishing 'buffered' by high levels of stock abundance

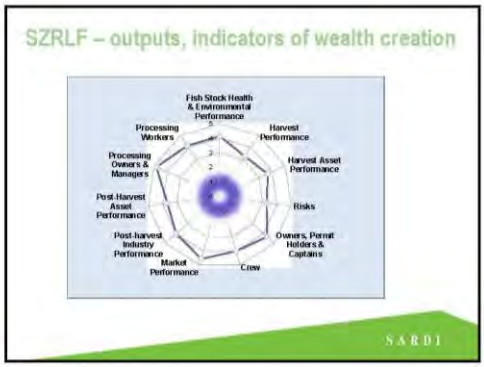
"Good thing/bad thing"

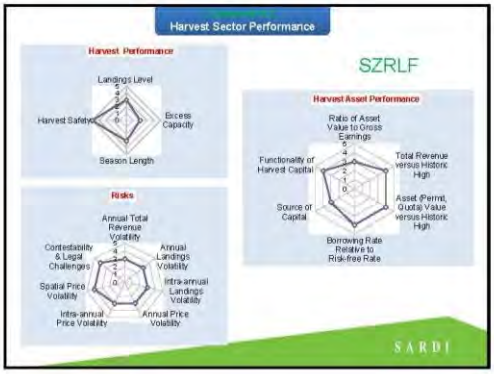
Partnerships and Commitments

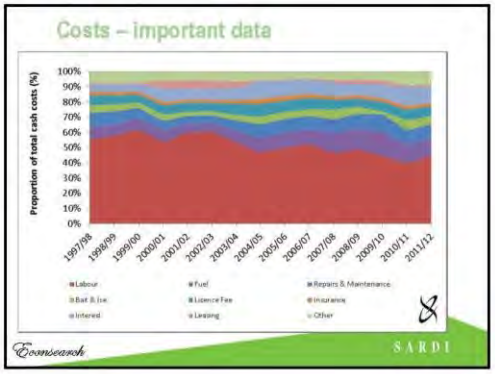
Appendix 2.8. Improving economic performance: findings of an Australian Seafood CRC study





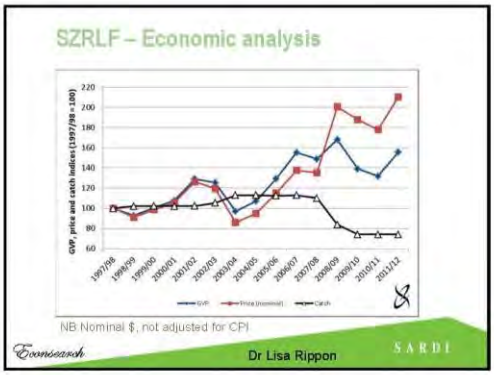


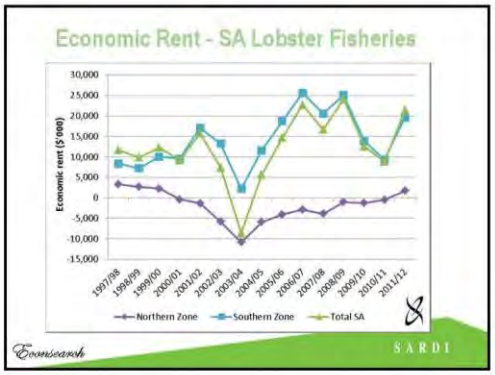

Harvest Sector Performance
Harvest Performance
Landings Level
Excess Capacity
Season Length
Harvest Safety
Risks
Annual Total Revenue Volatility
Annual Landings Volatility
Intra-annual Landings Volatility
Annual Price Volatility
Intra-annual Price Volatility
Spatial Price Volatility
Contestability & Legal Challenges
SZRLF
Harvest Asset Performance
Ratio of Asset Value to Gross Earnings
Total Revenue versus Historic High
Asset (Permit, Quota) Value versus Historic High
Borrowing Rate Relative to Risk-free Rate
Source of Capital
Functionality of Harvest Capital
SARDI


Costs – important data
Proportion of total cash costs (%)
Labour
Fuel
Repairs & Maintenance
Bait & Ice
Licence Fee
Insurance
Interest
Leasing
Other
Econsearch
SARDI

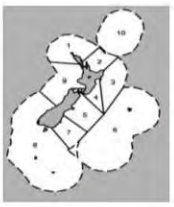

SZRLF - FPIs
• FPIs capture issues in SZRLF quite well
Performance
• Stock OK?
• Harvesting flexibility limited (season, gear)
• Excess capacity is high
• ROI (Asset/earnings)?
Constraints
• low harvest organisation influence on business and marketing
• limited transparency of landings pricing system
• limited vertical integration
• highly dependent on a single market
SARDI


Income and Profit – important for future management
Average per boat ($)
Gross Income
Total Cash Costs
Gross Margin
Gross Operating Surplus
Profit at Full Equity
Econsearch
SARDI


SZRLF – Economic analysis
GVP, price and catch indices (1997/98 = 100)
NB Nominal $, not adjusted for CPI
Econsearch
Dr Lisa Rippon
SARDI


Economic Rent - SA Lobster Fisheries
Economic rent ($'000)
Northern Zone
Southern Zone
Total SA
Econsearch
SARDI

NZ CRA8 FISHERY



Largest NZ lobster fishery (34%)

Rules

- Quota since 1990
- Minimum legal size
- Females carrying eggs cannot be taken
- Escape gaps in pots
- Full 12 month season
- No pot limits
- Females taken when not carrying eggs
- Males can be taken at all times
- High-grading is allowed

CRA 8

Malcolm Lawson

SARDI

Take home message from CRA8

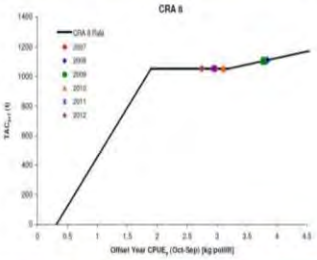
It's Not All About Quantity

Abundance Provides The Opportunity To Maximise Financial Returns Through Providing What The Market Wants And When

- Increased returns through targeting size, areas and time of year
- Reduced costs through high CPUE
- Confidence – business planning
- Reinvestment
- Additional benefits – high breeding biomass

SARDI

Conservative Decision Rules after 1997

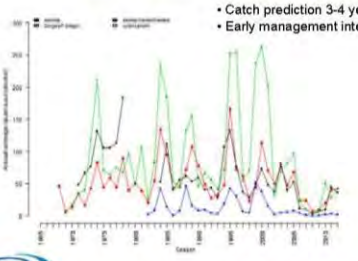


Decision rules refined over time

SARDI

WA Rock Lobster - Puerulus settlement

- Catch prediction 3-4 years ahead
- Early management intervention

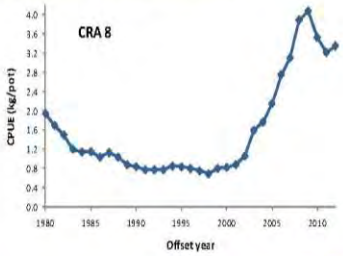


Fish for the future

Dr Nic Caputi

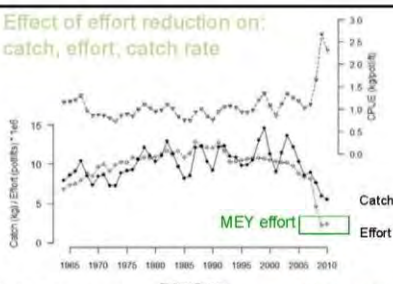
SARDI

Highly successful rebuilding strategy



SARDI

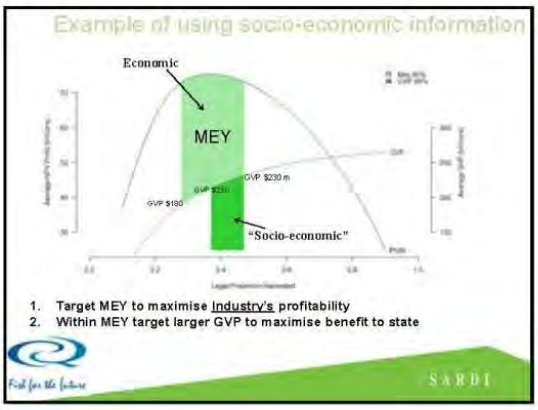
Effect of effort reduction on: catch, effort, catch rate



- 35-40% reduction in vessels
- Fishers made commercial decisions (sell/buy/lease)
- No government compensation
- MEY effort (30-50% of 2007/08)
- ITQ in 10/11

>50% increase in profit

SARDI



Workshop Conclusions

Exploitation rate of about 0.3 seems to be a good target for lobster fisheries

Current exploitation rates too high in several Australian fisheries

Lower catches can mean higher profit

Trade-off between profitability (industry benefit) and GVP (community benefit)

Economic data is critical to optimizing fishery performance – most Australian fisheries have poor economic data

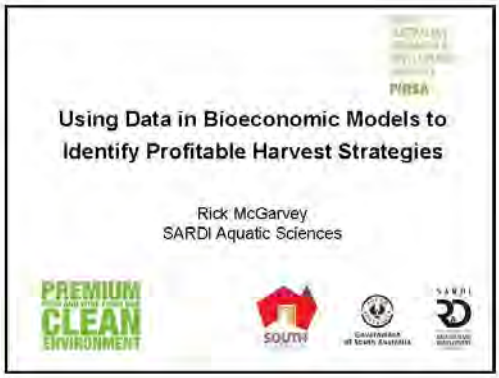
Bio-economic models are a valuable tool but need good data

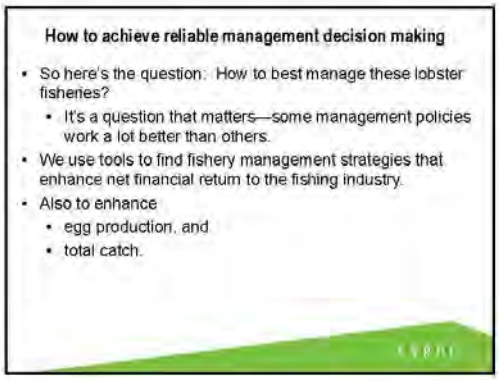
Model structure and inputs need to be tailored to specific circumstances

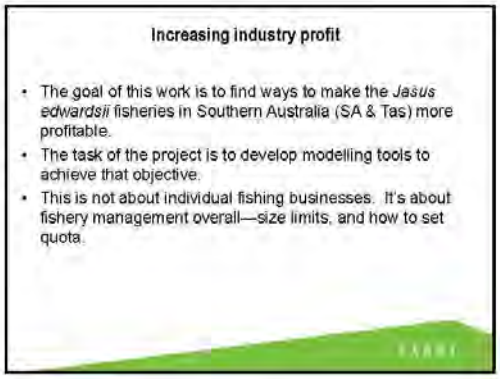
Models should be re-run regularly to assess changing situation

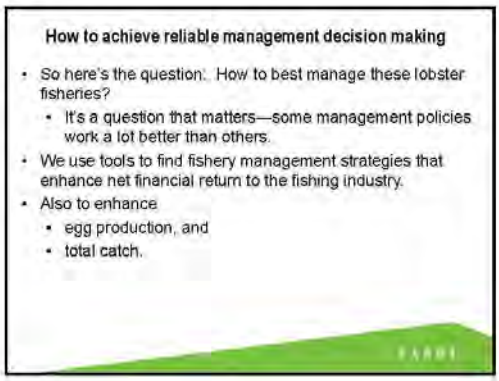
Harvest Strategies should include socio-economic PIs

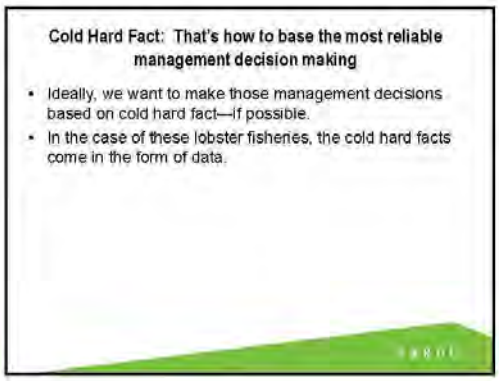
Appendix 2.9. Using data in bioeconomic models to identify profitable harvest strategies











Data on the South Australian lobster fisheries

- Here are data sources available for the SA lobster fisheries:
  - Catch total (in weight, monthly, from logbooks)
  - CPUE (by month, from logbooks)
  - Catch in number landed (by month, from logbooks)
  - Sex ratios (pot sampling)
  - Length frequencies (pot sampling)
  - Tag-recaptures (for growth)
  - Beach price
  - Fishing costs, fixed and variable.
- The puerulus index is not yet used in modelling.

South Australian Lobster Fishery Management Plan Objectives:

- The Management Plan states its 3rd objective as follows:

Profitability

- Decision rules that achieve stock recovery produce higher catch rates; and
- Higher catch rates lead to higher profitability.

Price Data

- Lobster beach price data, reported by processors, are summarised by SARDI Statistics branch as a monthly mean price.
- Monthly prices allow the analysis of harvest strategies to account for
  - monthly variations in when catch is taken, and
  - time closures.
- Price is broken down into two lobster size grades, larger lobsters bringing a lower price.

What questions can a model like this answer?

- How much might catch rates rise if a quota is reduced?
  - (Or decline if it is increased?)
- If catch rates go up, how many fewer pot lifts are needed to take a given catch?
- What cost savings can be gained by setting fewer potlifts?
- How much would profits rise?
- But how much would landings revenue be reduced, in the short term, before catch rates rise?

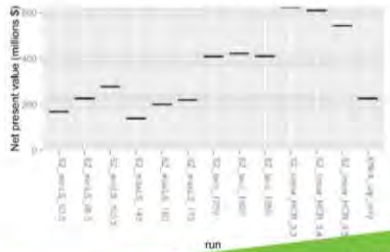
Fishing Costs

- South Australian fisheries are fortunate to have an extensive high-quality data set of fishing costs, from EconSearch interviews with the fishing industry.
- Based on 3-yearly surveys of active fishers.
- These data permit us to break costs down between fixed and variable;
  - only variable costs are reduced when fewer pot lifts are set in a given season.
- An EconSearch economic survey was also carried out in Tasmania this year.

4 Policies

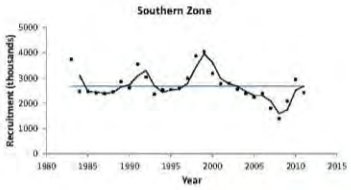
- These are four widely-used policies for managing a fishery.
- Specifically, we present results for the South Australian, Southern Zone lobster population:
- The 4 policies tested are:
  - size limit policies, minimum and maximum size;
  - constant quotas;
  - quotas that vary so as to approximate a constant exploitation rate.

Average profit (net present value) for 4 lobster fishery management policies



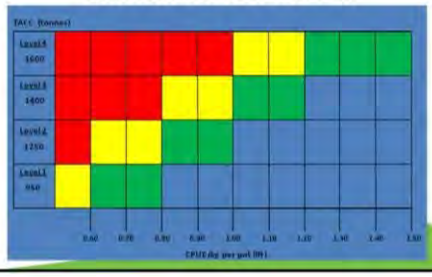
SARDI

Recruitment since 1983: SA Southern Zone



SARDI

Current Southern Zone Harvest Control Rule which approximately seeks a constant harvest fraction

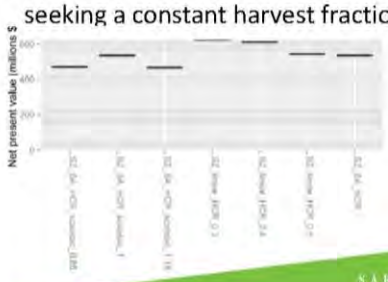


SARDI

NPV with 25% lower R

SARDI

Average profit: Comparing current SZ HCR with a linear harvest control rule: both seeking a constant harvest fraction



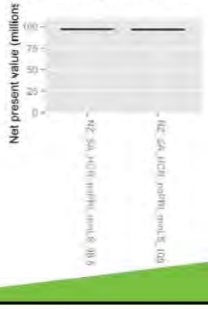
SARDI

Lowering Size Limit in NZ to 98.5

- NZ representatives on the Research Sub-Committee requested that we test a lower size limit.
- 98.5 is the minimum size in the SZ.

SARDI

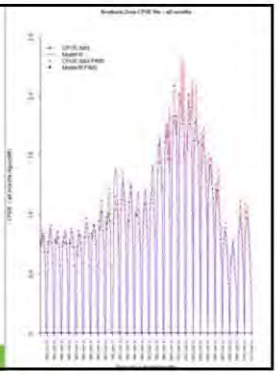
Lowering Size Limit in NZ to 98.5: NPV



SARDI

Model fit to data: CPUE

- This shows the Southern Zone fit of model biomass to monthly logbook CPUE.



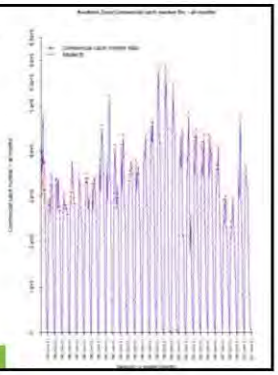
Summary

- So model results are showing that size limits are not a major factor in managing these lobster stocks.
- The model is basically saying that what really matters in managing this lobster stock, is how hard you fish it.
  - One way to quantify that is by the harvest fraction, the amount of the available biomass harvested per year.
- So for lobster fisheries, that basically comes down to how many pot lifts get set every year.
- And when quotas are set yearly, in such a way as to try and keep the harvest fraction roughly constant, the best economic outcomes are achieved.
- When recruitment is lower, higher profit is obtained by fishing at a lower exploitation rate.

SARDI

Model fit to data: Catch in number landed

- This shows the Southern Zone fit of model catch in number to monthly data from logbooks.



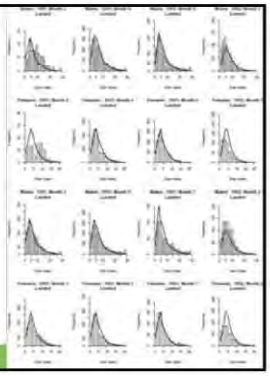
Acknowledgments

We thank SRL Ltd, the Australian Seafood CRC, Caleb Gardner, Andre Punt, SEPFA, NZRLFA, and lobster fishermen in Tasmania and South Australia.

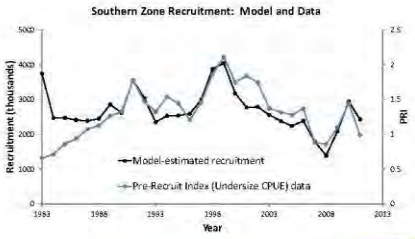
SARDI

Model fit to data: length frequencies

- Southern Zone fit of model length frequency proportions to pot sample data.



Testing the Model: Comparing model recruitment with (independent) undersize PRI data



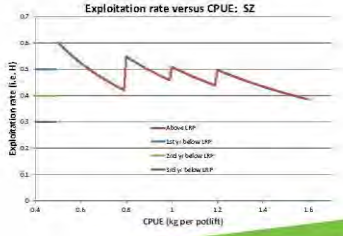
Extending fishery model to account for economics

- To extend the population model to evaluate different harvest strategies, with higher profit as a principal objective, two economic submodels are added:
  - price per kg landed:
  - costs of harvesting that product.
- Gross revenues from landed seafood product are computed directly as catch (by month and lobster size) times price;
- Profit is gross revenues minus fishing costs.

Two goals of fishery management:

- Sustainability: Assuring that the lobster population remains healthy; enhancing egg production. In many fisheries, management focus has been on sustainability.
- Economic return: To target strategies that achieve the highest possible economic output, as profit, from sustainable exploitation of that seafood resource.
- Both objectives are important.
- And sometimes, both are achieved by the same management strategies

Current SZ HCR which approximately seeks a constant exploitation rate



Goal of bioeconomic modelling project

- To build a modelling tool that can estimate economic outcomes (average profit to fishers), under various management harvest strategies.
- Biological performance indicators are also estimated.

Table of Contents for *Appendix 3. Abalone*

Appendix 3. Abalone

Optimising business structures and fisheries management systems for key fisheries

T.M. Ward

Project No. 2009/715

February 2015

This project was conducted by the South Australian Research and Development Institute

This report may be cited as:
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The Australian Seafood CRC is established and supported under the Australian Government's Cooperative Research Centres Program. Other investors in the CRC are the Fisheries Research and Development Corporation, Seafood CRC company members, and supporting participants.

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Appendix 3.1. Abalone Workshop 1 Agenda

Improving the performance of CRC fisheries through review and reform of operational procedures, business structures and fisheries management systems.

Abalone workshop

Date: 25 September: 3pm-5:30pm and 26 September: 9am-3pm

Venues: Chifley on South Terrace, 226 South Terrace, Adelaide, SA (08-8223 4355)
SARDI Aquatic Sciences, 2 Hamra Ave, West Beach, SA (08-8207 5400)

Day 1 (25 Sept – Chifley on South Terrace)

3.00pm – *Welcome and expectations from workshop (Tim Ward, SARDI)*

3.10pm – *Key differences and similarities in abalone fisheries (Grant Pullen, DPIWE)*

The main objective here is to recognise that the fisheries are different – especially wrt governance/business/management structures but also operationally – and that these differences will have implications for improvement options that may be suitable in each case. Experience in prawns suggests we need to make it clear from the start that we understand these differences exist. This will also provide a good background for the Anderson analysis.

3.30pm – *Issues impeding profitability of abalone fisheries: Anderson Analysis (Tim Ward, SARDI)*

This talk will identify impediments to economic performance using Jim's method. Results can be compared with perceptions of industry/government/other stakeholders.

4.15pm – *Summary of economic status/trends in abalone fisheries – (Stacey Paterson, Econsearch)*

5.30pm – *End day 1*

6:30pm – *Workshop Dinner for informal discussion on issues and options ('Greek on Halifax' (500m walk from Chifley), "Banquet Style"; cash bar available for drinks)*

Day 2 (26 September – SARDI Aquatic Sciences)

8.30am – *Fishing smarter: the New Zealand paua experience (Jeremy Cooper, NZ)*

9:15am – *Maximising harvest strategies using biological data (Ben Stobart, SARDI)*

9.40am – *The WA greenlip abalone experience (Kerry Rowe, ACA)*

10.00am – *Managing yield to maximise profitability (Greg Ferguson, SARDI)*

10.15am – *Morning Tea*

10:30am – *Synthesis of issues and options identified from presentations (Tim Ward, SARDI)*

11.00am – *Facilitated discussion of options that may be suitable for improving the economic performance of each abalone fishery (All)*

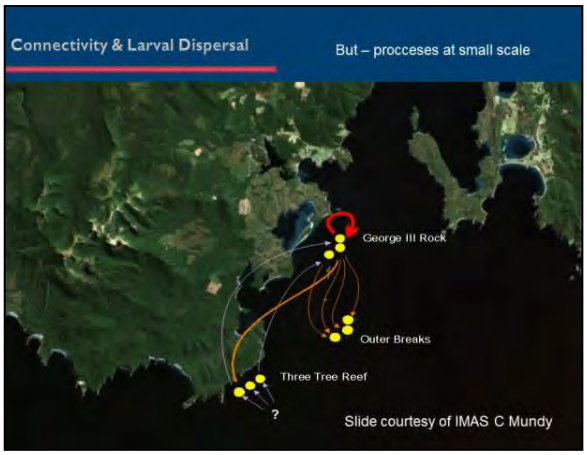
1.00pm – *Lunch*

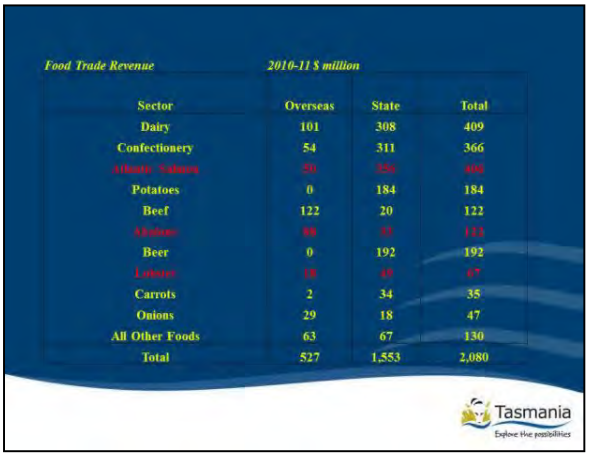
1.30pm – *Facilitated discussion of options that may be suitable for improving the economic performance of each abalone fishery – continued (All)*

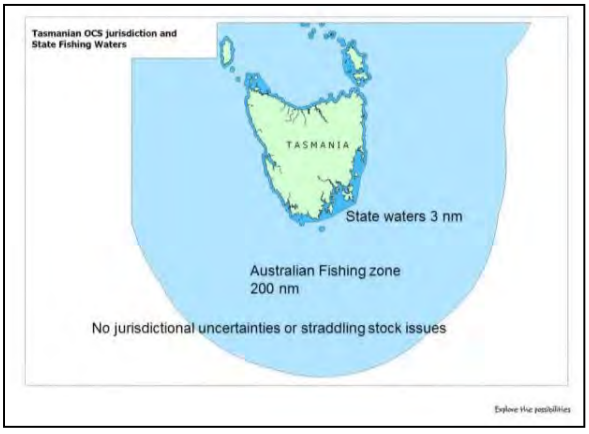
2.30pm – *Summary of Workshop outcomes (Tim Ward, SARDI)*

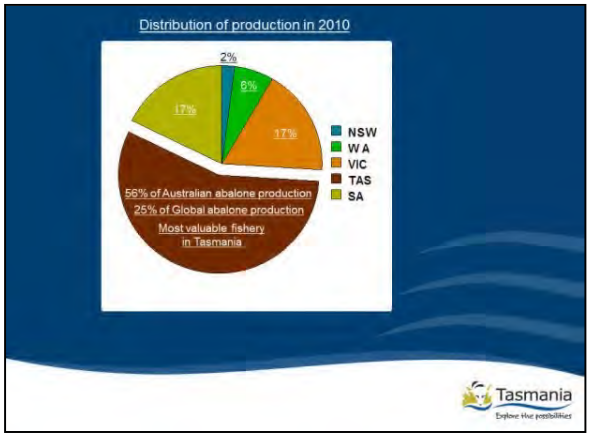
3.00pm – *Workshop conclusion.*

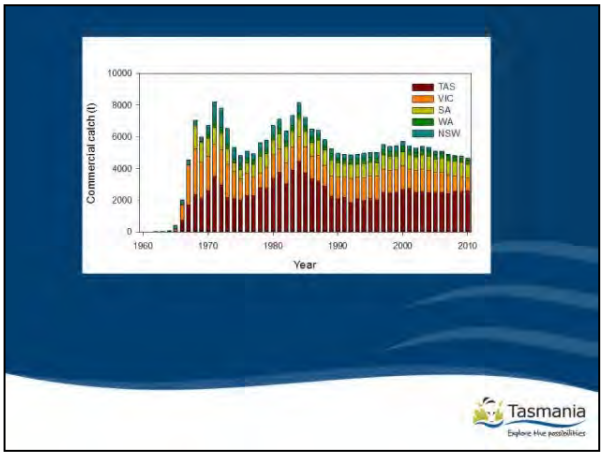
Appendix 3.2. Australian Abalone Fisheries

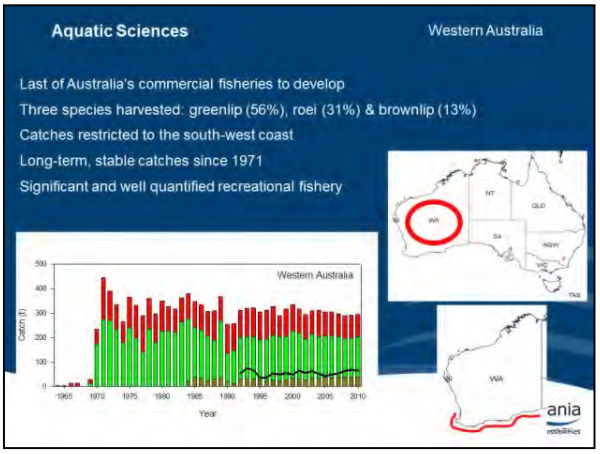


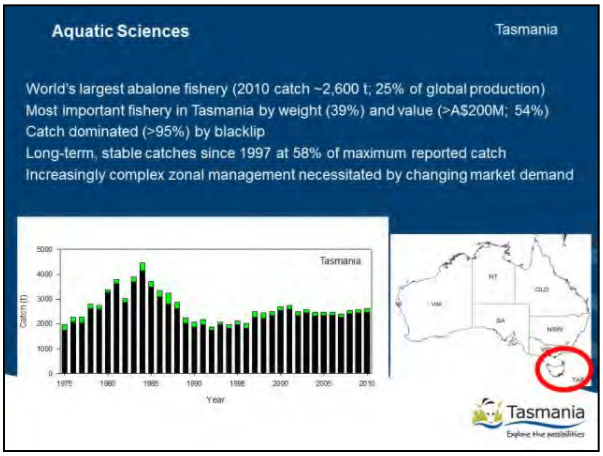


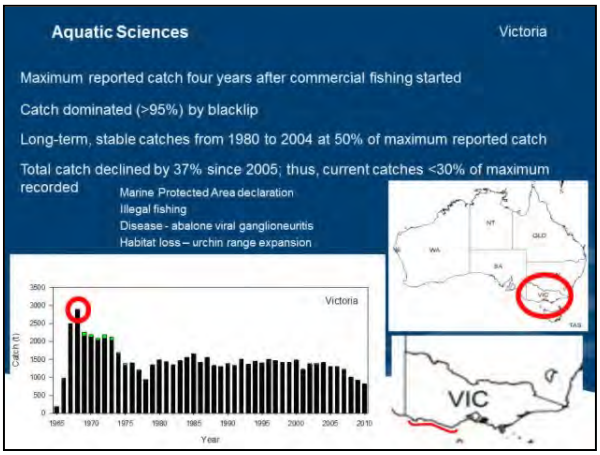


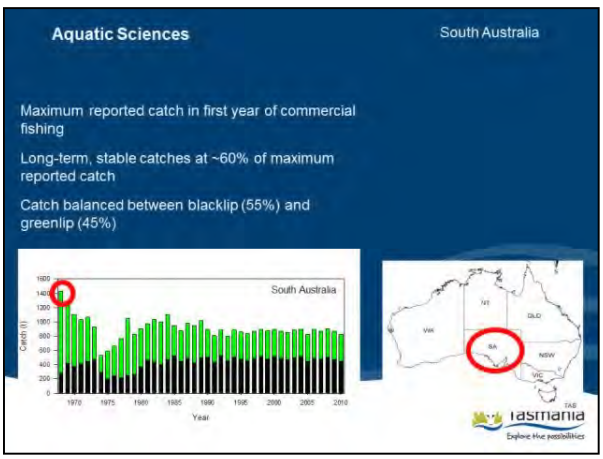


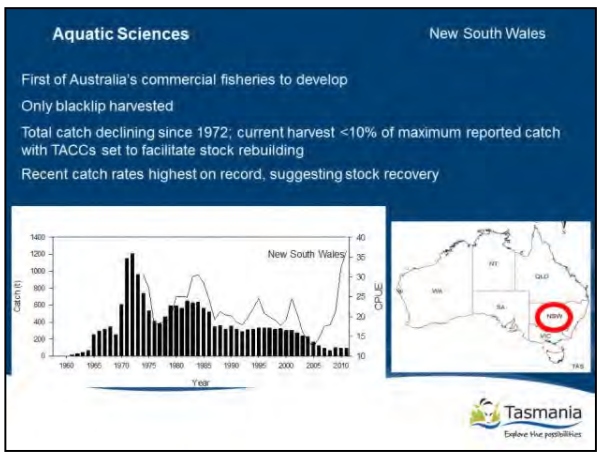

Commercial catch (t)
10000
8000
6000
4000
2000
0
1960
1970
1980
1990
2000
2010
Year
TAS
VIC
SA
WA
NSW
Tasmania
Explore the possibilities


Aquatic Sciences
Western Australia
Last of Australia's commercial fisheries to develop
Three species harvested: greenlip (56%), roei (31%) & brownlip (13%)
Catches restricted to the south-west coast
Long-term, stable catches since 1971
Significant and well quantified recreational fishery
Western Australia
Catch (t)
Year
NT
QLD
WA
SA
NSW
VIC
TAS


Aquatic Sciences
Tasmania
World's largest abalone fishery (2010 catch ~2,600 t; 25% of global production)
Most important fishery in Tasmania by weight (39%) and value (>A$200M; 54%)
Catch dominated (>95%) by blacklip
Long-term, stable catches since 1997 at 58% of maximum reported catch
Increasingly complex zonal management necessitated by changing market demand
Tasmania
Catch (t)
Year
NT
QLD
WA
SA
NSW
VIC
TAS
Tasmania
Explore the possibilities


Aquatic Sciences
Victoria
Maximum reported catch four years after commercial fishing started
Catch dominated (>95%) by blacklip
Long-term, stable catches from 1980 to 2004 at 50% of maximum reported catch
Total catch declined by 37% since 2005; thus, current catches <30% of maximum recorded
Marine Protected Area declaration
Illegal fishing
Disease - abalone viral ganglioneuritis
Habitat loss – urchin range expansion
Victoria
Catch (t)
Year
NT
QLD
WA
SA
NSW
VIC
TAS
VIC


Aquatic Sciences
South Australia
Maximum reported catch in first year of commercial fishing
Long-term, stable catches at ~60% of maximum reported catch
Catch balanced between blacklip (55%) and greenlip (45%)
South Australia
Catch (t)
Year
NT
QLD
WA
SA
NSW
VIC
TAS
Tasmania
Explore the possibilities

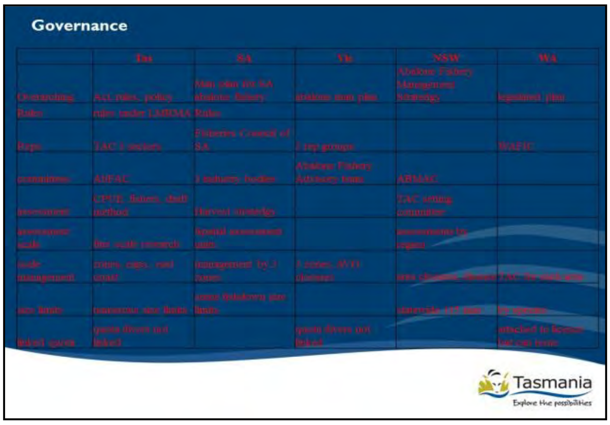

Aquatic Sciences
New South Wales
First of Australia's commercial fisheries to develop
Only blacklip harvested
Total catch declining since 1972; current harvest <10% of maximum reported catch with TACCs set to facilitate stock rebuilding
Recent catch rates highest on record, suggesting stock recovery
New South Wales
Catch (t)
CPUE
Year
NT
QLD
WA
SA
NSW
VIC
TAS
Tasmania
Explore the possibilities


The legal framework
Legislative basis: Living Marine Resources Management Act 1995
Rules
Management plans
Policy/harvest strategies
Tasmania
Explore the possibilities


Assess at fine scale
Management at larger scales??
Catch (zones)
Size limits
Management supported by research

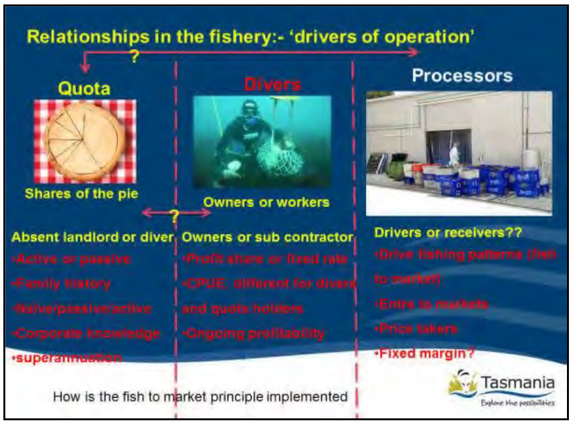

Progressing new rules
New policy
Fishing bodies:
Advisory Committees: provide information and advice to the Minister on matters relating to the administration of the Act
Legal processes
Public consulation
Tasmania
Explore the possibilities


ALMA V
The catching sector is:
•Efficient
•Adaptive
•Reactive
•Mobile
•Underpaid?


Governance

	Tas	SA	Vic	NSW	WA
Overarching	Act, rules, policy	Man plan for SA abalone fishery	abalone man plan	Abalone Fishery Management Strategy	legislated plan
Rules	rules under LMRMA	Rules			
Reps	TAC 3 sectors	Fisheries Council of SA	3 rep groups		WAFIC
committees	[illegible]	3 industry bodies	Abalone Fishery Advisory team	ABMAC	
assessment	CPUE, fishers, draft method	Harvest strategy		TAC setting committee	
assessment scale	fine scale research	Spatial assessment units		assessments by region	
scale management	zones, caps, [illegible]	management by 3 zones	3 zones, [illegible] closures	area closures, [illegible]	TAC for each area
size limits	numerous size limits	[illegible] size limits		statewide [illegible] mm	by species
linked quota	quota divers not linked		quota divers not linked		attached to licence but can trade

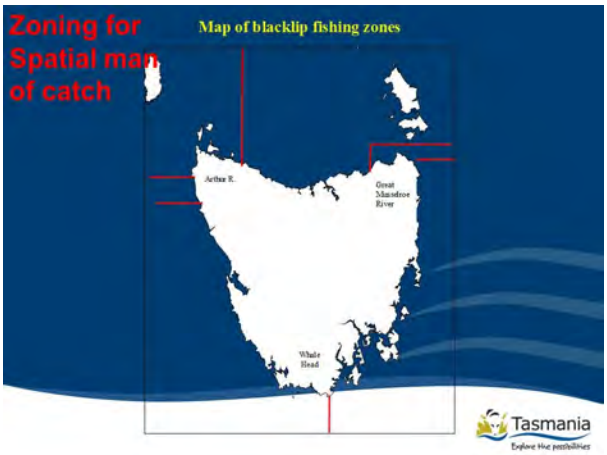
Tasmania
Explore the possibilities

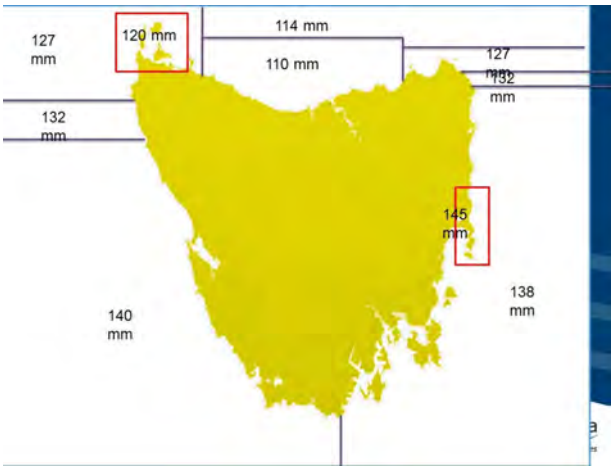

Relationships in the fishery:- 'drivers of operation'
?
Quota
Divers
Processors
Shares of the pie
Owners or workers
?
Absent landlord or diver
•Active or passive
•Family history
•Naïve/passive/active
•Corporate knowledge
•superannuation
Owners or sub contractor
•Profit share or fixed rate
•CPUE, different for divers and quota holders
•Ongoing profitability
Drivers or receivers??
•Drive fishing patterns (fish to market)
•Entre to markets
•Price takers
•Fixed margin?
How is the fish to market principle implemented
Tasmania
Explore the possibilities

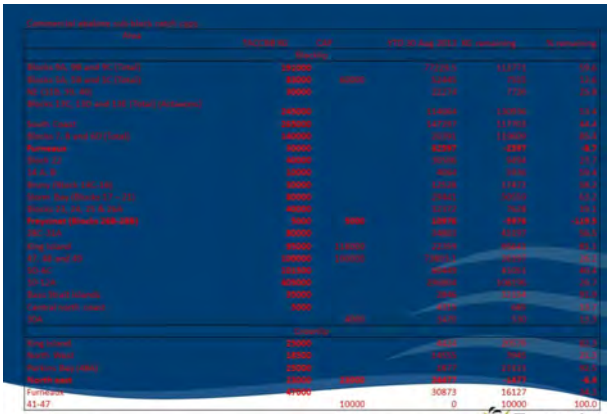
	Tas	SA	Vic	NSW
Divers	125, supervisors, 1 per boatoc	not owner operated, 3 masters per boatoc	not owner operated	not owner operated
dinghy/mother	efficient, mobile adaptive	dinghies	dinghies	dinghies
Quota	3,500 units, perm and temp transfer	perm and temp trans	yes	permanent trans
decoupled	per and temp transfer	no	no?	no
TAC	yes	yes	yes	yes

	Tas	SA	Vic	NSW
TAC	yes	yes	yes	yes
zones	zones, subunits of a global quota unit	management units, fish downs and regions	western, central, eastern. Separate TACs and units	single zone, effort of Perkins as
caps (Mount earlier)	yes numerous	no	no	no
sol caps	no	no	yes?	no

Zoning for Spatial map of catch







When is fine scale too fine (east coast closed 1 Jan to 1 April
TAC needs to be OK

- Scale of management
- A cost benefit exercise, bigger equals more conservative
- Smaller is not necessarily better
- A balance
- Fishery has operational imperatives
- Enforcement
- Maximise return with TAC and size limits
- GET the TAC right

Abalone beach price Tasmania 1990-2013

Price takers

Integration

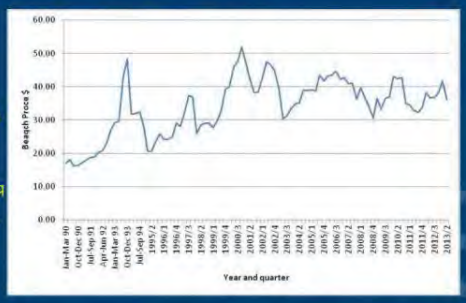
Aust $

Border issues

Free trade

4 course banq

Market dev??



Tasmania

Explore the possibilities

UTAS

INSTITUTE FOR MARINE AND ANTARCTIC STUDIES
UNIVERSITY OF TASMANIA

Risk Assessment of Impacts of Climate Change for Key Marine Species in South Eastern Australia

Part 2: Species profiles

Gretta Pecl, Tim Ward, Zoë Doubleday, Steven Clarke, Jemery Day, Cameron Dixon, Stewart Frusher, Philip Gibbs, Alistair Hobday, Neil Hutchinson, Sarah Jennings, Keith Jones, Xiaozu Li, Daniel Spooner, Richard Stobutzki

FRDC Project No 2009/070

SARDI

SOUTH AUSTRALIA

CLIMATE CHANGE:

- Tas east coast hot spo
- Short larval
- Hotter
- Lower productivity??
- More variable
- Lower TACs ??

Tasmania

Explore the possibilities

Quality Assured
look for the Australian Wild Abalone mark

http://www.australianwildabalone.com.au/

You Tube http://www.youtube.com/watch?v=pbUetlZhBws

Australian Wild Abalone™ (AWA™) represents the best quality wild caught abalone in the world.

This logo indicates:

That the product is premium quality wild harvest Australian abalone

That the supplier has complied with the AWA™ Quality Assurance Code of Practice

That the product is genuine Australian Wild Abalone™ due to the presence of **NanoTag© brand protection technology**

Tasmania

Explore the possibilities

Aquatic Sciences

Five key challenges facing Australia's abalone fisheries:

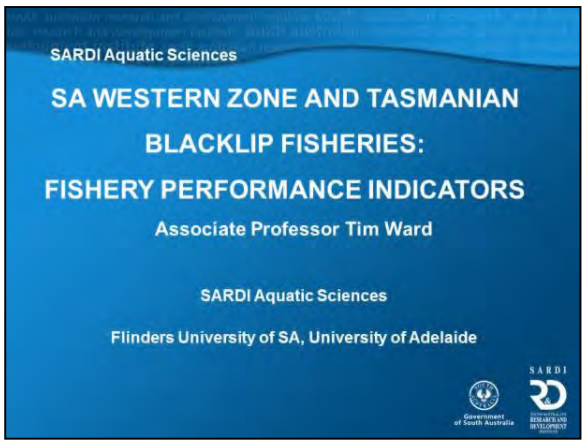
1. Disease; declines in catch in New South Wales and Victoria; loss of fishery value & revenue; costs of disease management
2. Range shifts (e.g. *Centrostephanus*) and changing productivity; climate change
3. IUU fishing (i.e. theft); increasing coastal human population; access
4. Declining profitability; strong AUS and rising operational costs
5. Management complexity; spatial assessment & management

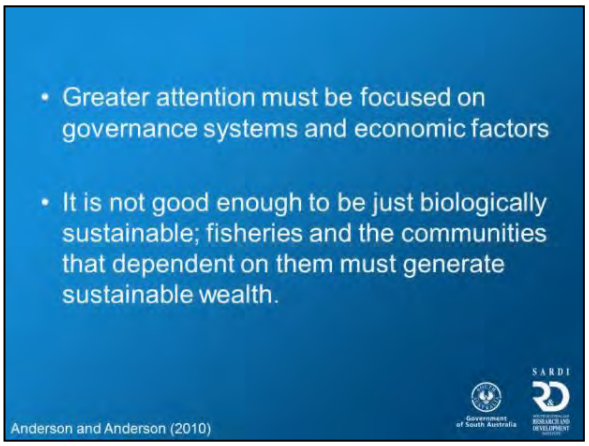
Next decade likely to be pivotal in determining the future directions of these fisheries, and their ability to remain commercially productive and economically viable

Tasmania

Explore the possibilities

Appendix 3.3. Fishery Performance Indicators





Characteristics of Indicator Components

- Readily Available
- Accurate
- Quantifiable
- Relevant
- Understandable

Anderson and Anderson (2010)

The Fishery Performance Factors: Inputs Enabling Wealth Creation

- 39 components covering 8 dimensions:
  - Macro Factors-Environmental, Economic & Community
  - Access Rights
  - Harvest Rights
  - Collection Action
  - Management Inputs
  - Management Participation
  - Markets and Market Institutions
  - Infrastructure

Anderson and Anderson (2010)

Two Parts – Outputs and Inputs

1) Performance Indicators of wealth creation and accumulation (outputs)

2) Performance Factors that enable wealth creation (inputs)

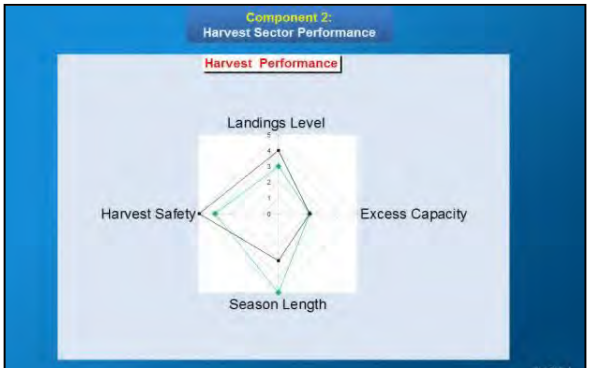
Anderson and Anderson (2010)

Blacklip abalone (WZ and Tas)

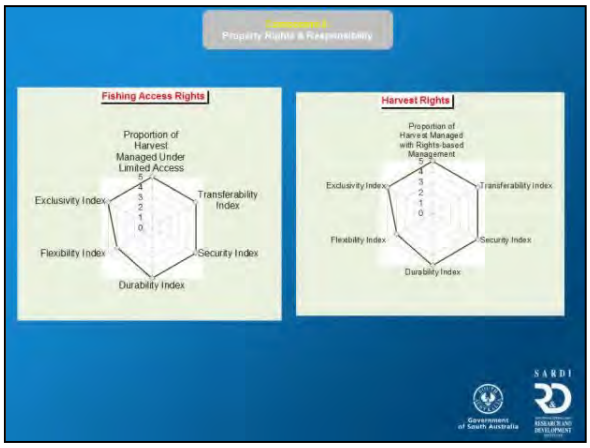
The Fishery Performance Indicators - Outputs

- 54 components covering 11 dimensions:
  - Fish Stock Health & Environmental Performance
  - Harvest Performance
  - Harvest Asset Performance
  - Risk
  - Owners, Permit Holders & Captains
  - Crew
  - Market Performance
  - Processing & Support Industry Performance
  - Post-harvest Asset Performance
  - Processing Owners & Managers
  - Processing Workers

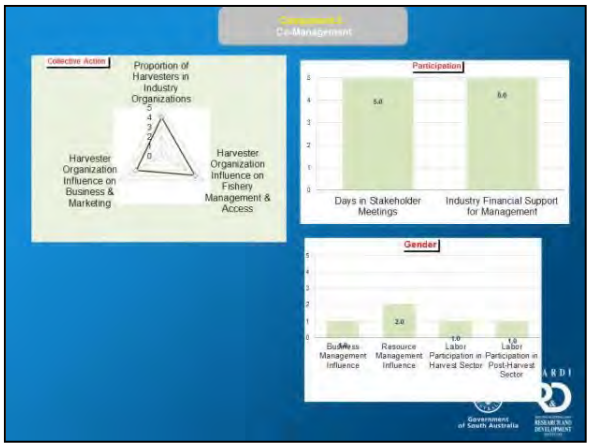
Anderson and Anderson (2010)

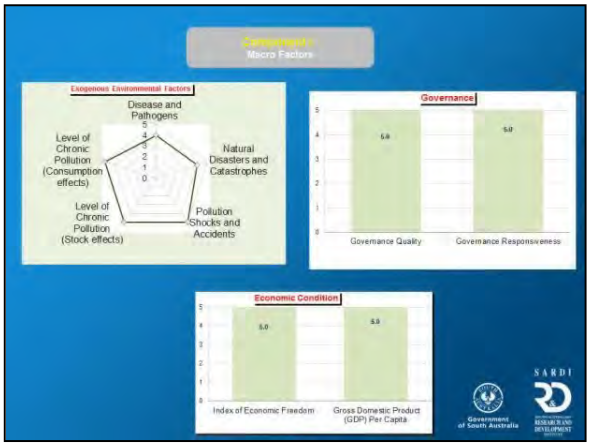


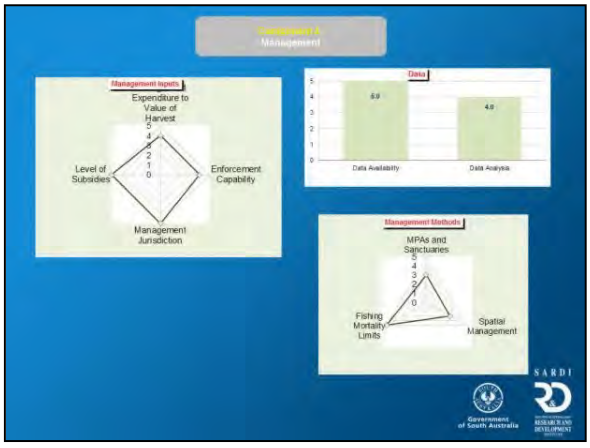

Component 2:
Harvest Sector Performance
Harvest Asset Performance
Ratio of Asset Value to Gross Earnings
Total Revenue versus Historic High
Asset (Permit, Quota) Value versus Historic High
Borrowing Rate Relative to Risk-free Rate
Source of Capital
Functionality of Harvest Capital

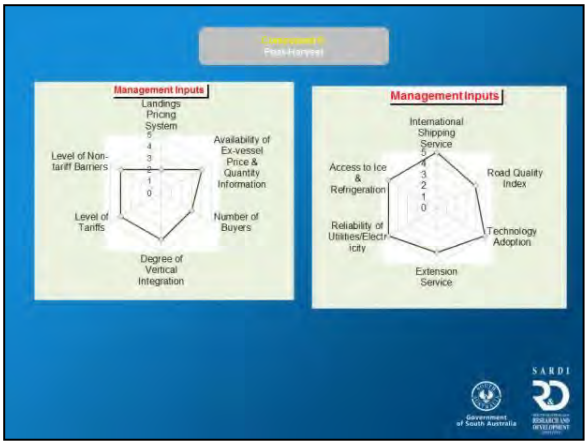

Fishing Access Rights
Proportion of Harvest Managed Under Limited Access
Transferability Index
Security Index
Durability Index
Flexibility Index
Exclusivity Index
Harvest Rights
Proportion of Harvest Managed with Rights-based Management
Transferability Index
Security Index
Durability Index
Flexibility Index
Exclusivity Index


Blacklip abalone (WZ and Tas)
Fishery Performance Indicators: Inputs (Enabling Wealth Creation)
Input
General Environmental Performance
Exogenous Environmental Factors
Governance
Economic Conditions
Fishing Access Rights
Harvest Rights
Collective Action
Participation
Community
Gender
Management Inputs
Data
Management Methods
Markets & Market Institutions
Infrastructure


Co-Management
Collective Action
Proportion of Harvesters in Industry Organizations
Harvester Organization Influence on Fishery Management & Access
Harvester Organization Influence on Business & Marketing
Participation
Days in Stakeholder Meetings
Industry Financial Support for Management
Gender
Business Management Influence
Resource Management Influence
Labor Participation in Harvest Sector
Labor Participation in Post-Harvest Sector


Exogenous Environmental Factors
Disease and Pathogens
Natural Disasters and Catastrophes
Pollution Shocks and Accidents
Level of Chronic Pollution (Stock effects)
Level of Chronic Pollution (Consumption effects)
Governance
Governance Quality
Governance Responsiveness
Economic Condition
Index of Economic Freedom
Gross Domestic Product (GDP) Per Capita


Management
Management Inputs
Expenditure to Value of Harvest
Enforcement Capability
Management Jurisdiction
Level of Subsidies
Data
Data Availability
Data Analysis
Management Methods
MPAs and Sanctuaries
Spatial Management
Fishing Mortality Limits



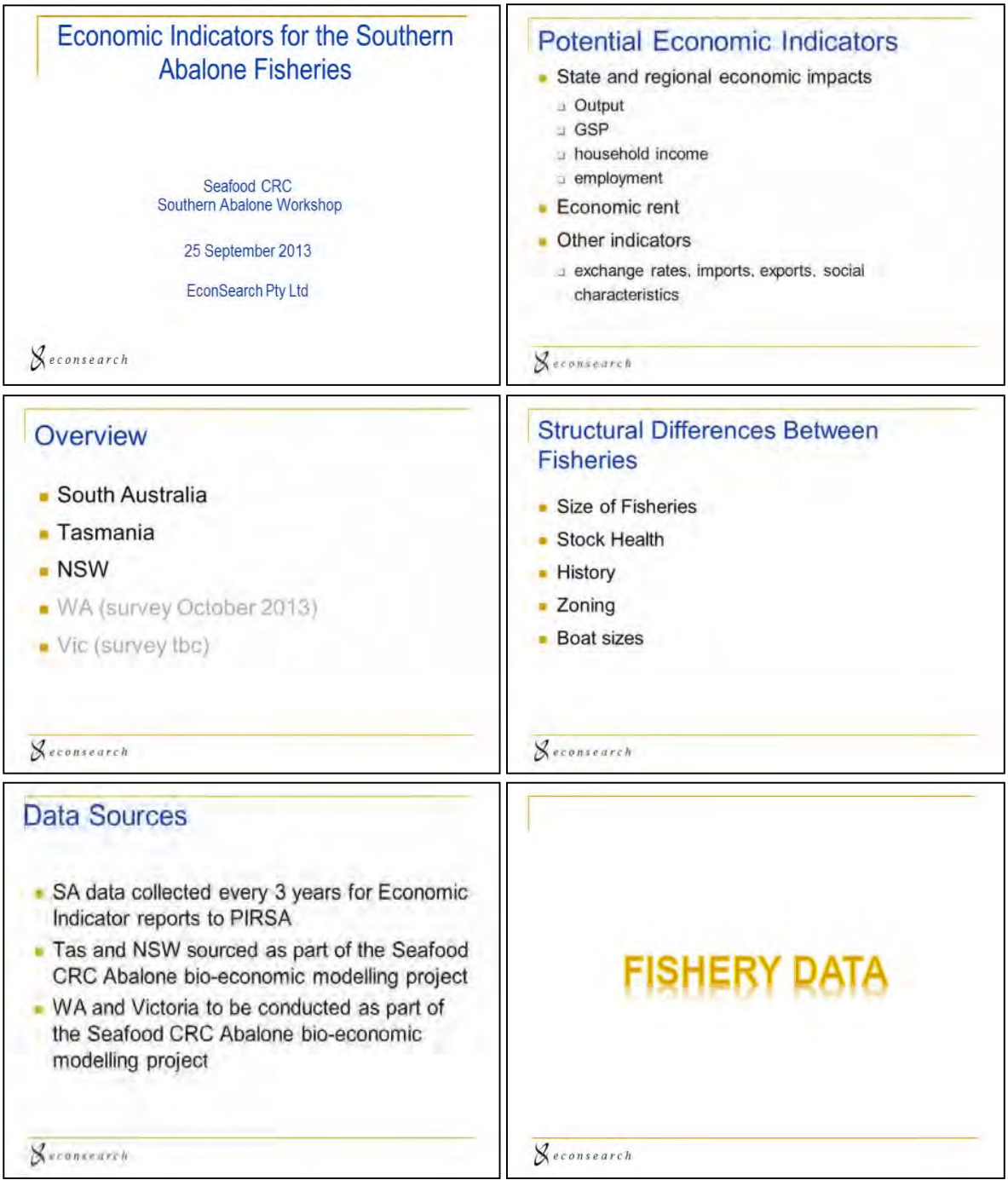
BLACKLIP ABALONE FISHERY: FISHERY PERFORMANCE INDICATORS

- FPIs capture issues in Blacklip Abalone quite well

Performance
- Stocks OK
- Harvesting flexibility – some limits (divers)
- Excess capacity is quite high
- Harvest asset performance (Asset + revenue ↓)

Constraints
- low harvest organisation influence on business and marketing
- low transparency of landings pricing system
- limited number of buyers
- some limits on flexibility of harvesting

Appendix 3.4. Economic Indicators



Catch and GVP in the Southern Abalone Fisheries

Year	South Australia		Tasmania		New South Wales	
	(tonnes)	($m)	(tonnes)	($m)	(tonnes)	($m)
1999/00	889	$32	n.a	n.a	304.8	$16
2000/01	867	$40	n.a	n.a	304.4	$15
2001/02	850	$35	n.a	n.a	276.3	$13
2002/03	890	$36	n.a	n.a	149	$6
2003/04	879	$32	n.a	n.a	242	$8
2004/05	902	$34	n.a	n.a	189	$8
2005/06	896	$34	2,503	n.a	129	$5
2006/07	883	$31	2,433	$82	122	$5
2007/08	889	$31	2,583	$90	109	$4
2008/09	837	$33	2,607	$93	103	$3
2009/10	855	$28	2,660	$104	75	$2
2010/11	815	$28	2,548	$85	94	$3
2011/12	822	$29	2,363	$82	110	$4

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GVP, Price and Catch Indices NSW Abalone (2000 =100)

* January 2002- June 2003. The catch and GVP figures for the January 2002 to June 2003 period have been normalised in this graph to better represent the trend over time.

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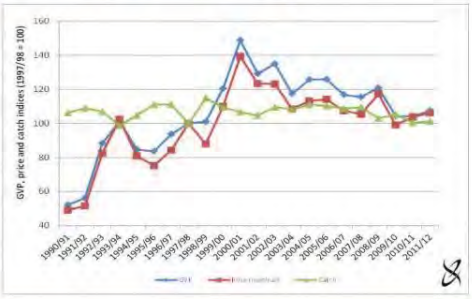
GVP, Price and Catch Indices SA Abalone (1997/98 =100)



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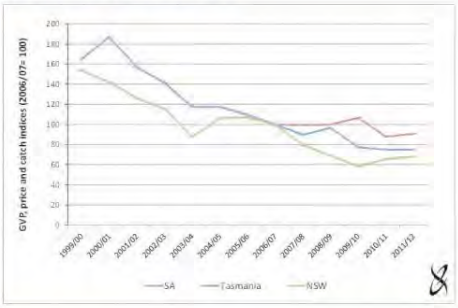
Real Price Over Time Southern Abalone Fisheries



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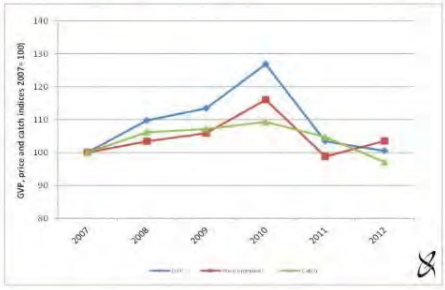
GVP, Price and Catch Indices Tas Abalone (2007 =100)



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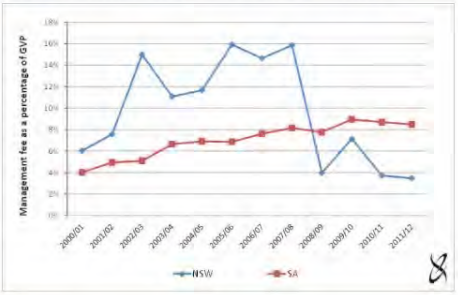
Management Fee as a Percentage of GVP Southern Abalone Fisheries



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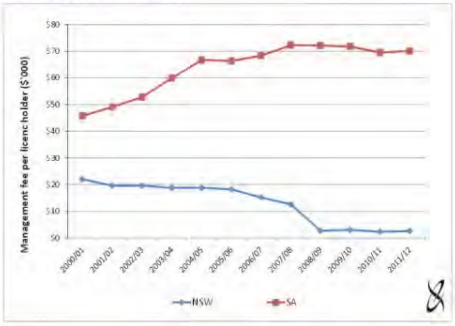
Management Fee per Licence Holder $'000 (nominal)



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Survey (2011/12)

- SA: 19 responses from 35 licence holders (divers usually matched to licence holders)
- Tas: 37 responses from 181 active boats (responses primarily from divers)
- NSW: 17 responses from 47 licence holders (a mixture of licence holders, divers and owner operators- not always matched)

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SURVEY RESULTS

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Financial Performance SA 2011/12 (by zone)

		Western Zone		Central & Southern Zone[a]		South Australia	
		Average per Licence	Share of TBCC[b]	Average per Licence	Share of TBCC[b]	Average per Licence	Share of TBCC[b]
(1)	**Total Boat Gross Income**	**$849,603**		**$791,805**		**$819,183**	
(3)	**Total Variable Costs**	**$291,608**	**61%**	**$213,264**	**54%**	**$250,295**	**58%**
(6)	**Total Fixed Costs**	**$183,248**	**39%**	**$182,849**	**46%**	**$183,089**	**42%**
(7)	**Total Boat Cash Costs (3 + 6)**	**$474,856**	**100%**	**$396,113**	**100%**	**$433,384**	**100%**
	Boat Gross Margin (1 - 3)	**$557,995**		**$578,541**		**$568,888**	
(8)	**Total Unpaid Labour (2 + 5)**	**$14,054**		**$10,241**		**$11,734**	
	Gross Operating Surplus (1 - 7 + 8)	**$388,801**		**$405,933**		**$397,533**	
(9)	**Boat Cash Income (1 - 7)**	**$374,747**		**$395,692**		**$385,799**	
(10)	**Depreciation**	**$55,394**		**$28,758**		**$41,678**	
(11)	**Boat Business Profit (9 - 10)**	**$315,353**		**$366,934**		**$344,122**	
(12)	**Profit at Full Equity (11 + 4)**	**$382,695**		**$464,234**		**$425,337**	
	Boat Capital						
(13)	Fishing Gear & Equip	$235,933		$313,014		$276,502	
	Licence Value	$6,983,333		$6,828,730		$6,901,963	
(14)	**Total Boat Capital**	**$7,219,267**		**$7,141,744**		**$7,178,465**	
	Rate of Return on Fishing Gear & Equip (12 / 13 * 100)	**162.2%**		**148.3%**		**153.8%**	
	Rate of Return on Total Boat Capital (12 / 14 * 100)	**5.3%**		**6.5%**		**5.9%**	

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Survey Results

- Financial performance indicators
  - Income, costs and profitability as an average per boat
- Economic impact of the fishery (SA only)
  - Direct and flow-on economic benefit created as a result of the operations of the fishing industry
- Economic rent

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Financial Performance NSW 2011/12 (by volume of catch)

		2011/12			
		Average per aggregated fishing unit (lower catch)	Share of TBCC[b]	Average per aggregated fishing unit (higher catch)	Share of TBCC[b]
(1)	**Total Boat Gross Income**	**$129,492**		**$213,248**	
(3)	**Total Variable Costs**	**$86,365**	**83%**	**$135,925**	**75%**
(6)	**Total Fixed Costs**	**$18,288**	**17%**	**$45,526**	**25%**
(7)	**Total Boat Cash Costs (3 + 6)**	**$104,652**	**100%**	**$181,450**	**100%**
	Boat Gross Margin (1 - 3)	**$43,127**		**$77,324**	
(8)	**Total Unpaid Labour (2 + 5)**	**$6,045**		**$16,402**	
	Gross Operating Surplus (1 - 7 + 8)	**$30,884**		**$48,200**	
(9)	**Boat Cash Income (1 - 7)**	**$24,839**		**$31,798**	
(10)	**Depreciation**	**$11,063**		**$22,769**	
(11)	**Boat Business Profit (9 - 10)**	**$13,776**		**$9,029**	
(12)	**Profit at Full Equity (11 + 4)**	**$22,628**		**$26,909**	
	Boat Capital				
(13)	Fishing Gear & Equip	$51,200		$109,337	
	Licence Value	$400,833		$688,605	
(14)	**Total Boat Capital**	**$452,033**		**$797,942**	
	Rate of Return on Fishing Gear & Equip (12 / 13 * 100)	**44.0%**		**26.4%**	
	Rate of Return on Total Boat Capital (12 / 14 * 100)	**5.0%**		**3.6%**	

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Financial Performance NSW 2011/12 (disaggregating licence holders and divers)

		2011/12					
		Average per fishing business	Average per 100 shares[a]	Average per shareholder	Average per 100 shares[b]	Average per aggregated fishing unit	Average per 100 shares[b]
(1)	Total Boat Gross Income	$171,370	$100,632	$78,597	$61,755	$171,370	$100,632
(3)	Total Variable Costs	$111,145	$65,267	$28,518	$22,407	$61,088	$35,872
(6)	Total Fixed Costs	$31,907	$18,769	$35,024	$27,519	$71,413	$42,088
(7)	Total Boat Cash Costs (3 + 6)	$143,051	$84,148	$63,542	$49,926	$132,501	$77,842
	Boat Gross Margin (1 - 3)	$60,225	$35,427	$50,079	$39,348	$110,282	$64,872
(8)	Total Unpaid Labour (2 + 5)	$11,223	$6,602	$9,156	$7,194	$21,551	$12,677
	Gross Operating Surplus (1 - 7 + 8)	$39,542	$23,260	$24,210	$19,022	$60,420	$35,541
(9)	Boat Cash Income (1 - 7)	$28,319	$16,658	$15,055	$11,829	$38,869	$22,864
(10)	Depreciation	$16,916	$9,951	$2,467	$1,938	$19,699	$11,587
(11)	Boat Business Profit (9 - 10)	$11,403	$6,707	$12,588	$9,890	$19,171	$11,277
(12)	Profit at Full Equity (11 + 4)	$25,718	$15,128	$26,950	$21,175	$49,687	$29,227
	Boat Capital						
(13)	Fishing Gear & Equip	$80,268	$47,217	$11,693	$9,187	$93,458	$54,975
	Licence Value	$544,719	$320,423	$498,845	$391,950	$1,107,403	$651,414
(14)	Total Boat Capital	$624,987	$367,640	$510,538	$401,137	$1,200,861	$706,389
	Rate of Return on Fishing Gear & Equip (12 / 13 * 100)	32.0%	32.0%	n/a	n/a	53.2%	53.2%
	Rate of Return on Total Boat Capital (12 / 14 * 100)	4.1%	4.1%	5.3%	5.3%	4.1%	4.1%

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Economic Impact of the South Australian Abalone Fishery (Statewide), 2011/12

Sector	Output		Employment [a]		Household Income		Contribution to GSP	
	($m)	%	(fte jobs)	%	($m)	%	($m)	%
Direct effects								
Fishing	28.9	34%	71	22%	6.9	31%	23.3	47%
Processing	12.2	14%	41	13%	2.7	12%	3.9	8%
Transport	2.0	2%	7	2%	0.5	2%	0.9	2%
Food services	0.6	1%	4	1%	0.2	1%	0.3	1%
Capital expenditure [b]	0.7	1%	4	1%	0.2	1%	0.3	1%
Total Flow-on [c]	*41.7*	48%	*189*	60%	*11.5*	53%	*20.9*	42%
Total [c]	**86.1**	**100%**	**316**	**100%**	**22.0**	**100%**	**49.5**	**100%**
Total/Direct	1.9	-	2.5	-	2.1	-	1.7	-
Total/Tonne	$104,700	-	0.38	-	$26,700	-	$60,200	-

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Financial Performance Tas 2011/12 (separating fishing profit from licence profit)

		2011/12			
		Average per aggregated fishing unit	Share of TBCC[c]	Average per boat fishing business	Share of TBCC[c]
(1)	Total Boat Gross Income	$886,332		$256,537	
(3)	Total Variable Costs	$160,701	83%	$102,402	72%
(6)	Total Fixed Costs	$32,727	17%	$40,170	28%
(7)	Total Boat Cash Costs (3 + 6)	$193,428	100%	$142,573	100%
	Boat Gross Margin (1 - 3)	$725,631		$154,134	
(8)	Total Unpaid Labour (2 + 5)	$0		$22,362	
	Gross Operating Surplus (1 - 7 + 8)	$692,904		$136,326	
(9)	Boat Cash Income (1 - 7)	$692,904		$113,964	
(10)	Depreciation	$28,047		$28,047	
(11)	Boat Business Profit (9 - 10)	$664,858		$85,917	
(12)	Profit at Full Equity (11 + 4)	$673,697		$94,757	
	Boat Capital				
(13)	Fishing Gear & Equip	$247,546		$247,546	
	Licence Value	$6,797,329		$724,649	
(14)	Total Boat Capital	$7,044,875		$972,194	
	Rate of Return on Fishing Gear & Equip (12 / 13 * 100)	272.2%		38.3%	
	Rate of Return on Total Boat Capital (12 / 14 * 100)	9.6%		9.7%	

Limited participation from Tas Licence holders, interest and possibly other fixed costs likely understated for Aggregated fishing units

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Economic Impact of the South Australian Abalone Fishery (Eyre peninsula and West Coast)

Sector	Output		Employment [a]		Household Income		Contribution to GRP	
	($m)	%	(fte jobs)	%	($m)	%	($m)	%
Direct effects								
Fishing	17.8	47%	41	34%	4.8	49%	14.1	62%
Processing	7.4	20%	20	17%	1.6	17%	2.3	10%
Transport	0.3	1%	1	1%	0.1	1%	0.1	1%
Food services	0.0	0%	0	0%	0.0	0%	0.0	0%
Capital expenditure [b]	0.3	1%	3	2%	0.1	1%	0.1	1%
Total Flow-on [c]	*12.1*	32%	*56*	46%	*3.1*	32%	*6.2*	27%
Total [c]	**37.9**	**100%**	**121**	**100%**	**9.8**	**100%**	**22.9**	**100%**
Total/Direct	1.5	-	1.9	-	1.5	-	1.4	-
Total/Tonne	$46,100	-	0.15	-	$11,800	-	$27,800	-

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Rent, 2011/12

	2011/12		
	SA	NSW	Tas
Gross Income	$28,671	$3,514	$82,400
Less Labour	$7,094	$727	$1,141
Less Cash Costs	$5,232	$1,364	$844
Less Depreciation	$1,448	$404	$302
Less Opportunity Cost of Capital (@10%)	$968	$192	$266
Economic Rent	$13,930	$827	$79,847

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EXPORT DATA (SA)

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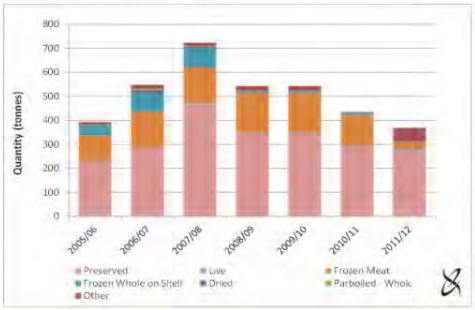
Abalone Exports from SA by Product Type, 2005/06 to 2011/12



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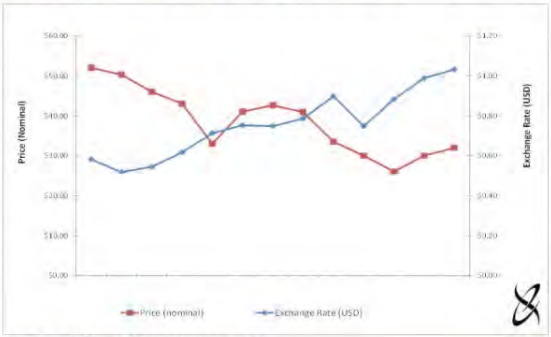
NSW Abalone price and exchange rate (USD)



Co-efficient of correlation -0.78

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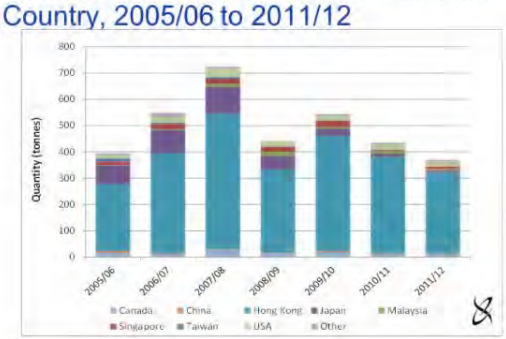
Abalone Exports from SA by Destination Country, 2005/06 to 2011/12



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TAS Abalone price and exchange rate (USD)

Co-efficient of correlation -0.15

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SA Abalone price and exchange rate (USD)

Co-efficient of correlation -0.48

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Economic Indicators for the Southern Abalone Fisheries

Seafood CRC
Southern Abalone Workshop

25-26 September 2013

EconSearch Pty Ltd

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Appendix 3.5: Fishing Smarter

Fishing Smarter

September 2013

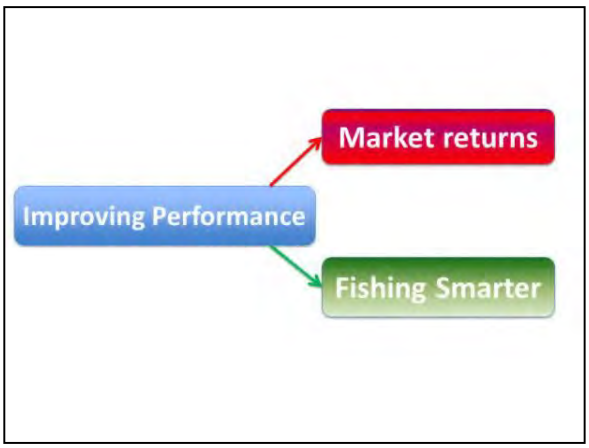
Fishing Smarter

- Reducing Harvesting costs
- Reducing compliance risks / costs
- Reducing assessment / monitoring costs
- Automated "load and go" of relevant data which drive performance indicators which trigger relevant management at applicable scales & timeframes.
- Meet market opportunities & demands
- **The common thread is INFORMATION**

To set the scene – NZ Paua (Abalone)

- 1056 tonne Total allowable commercial catch (TACC) over 8 quota management areas (QMAs).
- Each season 1 t of quota generates 1 t of Annual Catch Entitlement (ACE).
- Individual Quota owners = 245
- 17% of the quota owners own 65% of the TACC.
- The largest quota owner owns 32% of the TACC
- Customary owns 50% + of the TACC (10% + brought since).
- Number of ACE holders = 139
- Number of divers = 180 Est.
- ACE caught by people who own quota < 20%.
- 5 Regional PauaMACs own the Paua Industry Council (PIC) who employs 1.5 FTEs.
- Ministry of Primary Industries (MPI) paua R&D projects are cost recovered from paua quota owners.
- The industry also conducts R&D through PauaMACs and PIC.
- Funding of PauaMAC / PIC is via a Commodity Levy.

"You cannot manage what you cannot measure." **Lord Kelvin.**



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Big Data

The Power to Transform Your Business

Big data is the electricity of the 21st century—a new kind of power that transforms everything it touches in business, government, and private life.
Today, companies use data to model and control processes and run the business. This torrent of new data offers an opportunity to gain unprecedented insight and quickly test new ideas. It also provides the power to fundamentally change business operations.

OUR PAUA (ABALONE) DATA LOGGERS

- BOAT unit logs **CATCH** (kgs).
- TURTLE unit logs **EFFORT** (time)

Diver TURTLE units (effort)

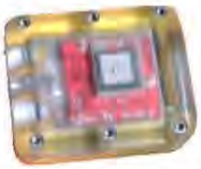
They switch on and off automatically (saltwater switch)

RECORDS

- On the surface the **lat / long / time & date** are recorded
- Saltwater switch automatically turns off GPS when the unit is under water
- When under water **depth / temp / time & date** are recorded at 2 second intervals.

The battery lasts 6 dive days
The memory capacity = 1 year of data

Rated to depths of 30m & 50m



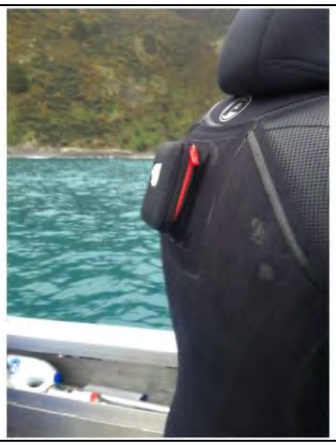
BOAT units (catch)

RECORDS:

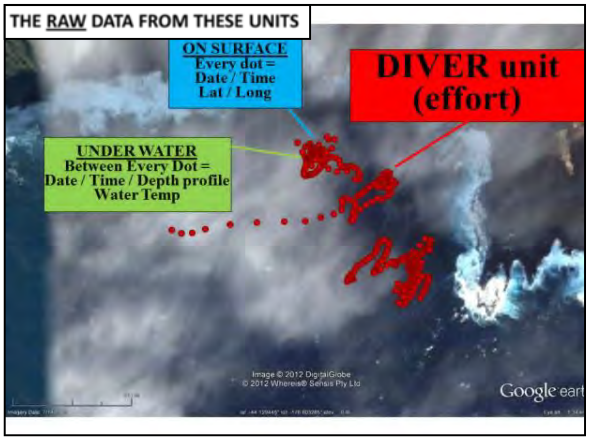
- The **lat / long / time & date** (selectable intervals)
- The **lat / long / time & date** each time a **catch bag is landed and the diver ID.**
- An estimation of each **Divers catch** (kilos) for the dive event.
- Was a **boat boy used, swell, visibility, link to catch sample**

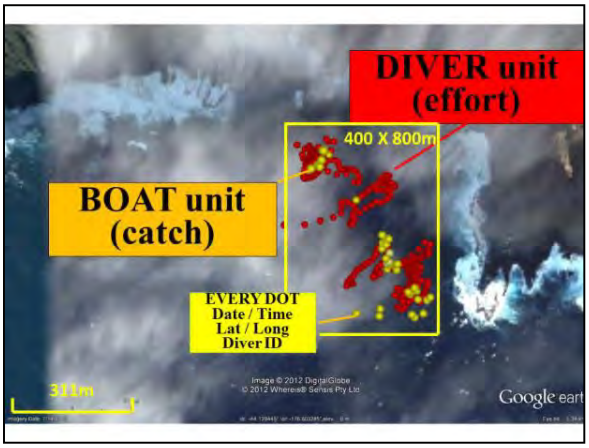
Specifications

- The battery lasts 10 dive days
- The memory = 1 year of data
- The have space for a **satellite modem** & additional batteries
- They have 2 spare serial ports – scales, callipers, shell board etc



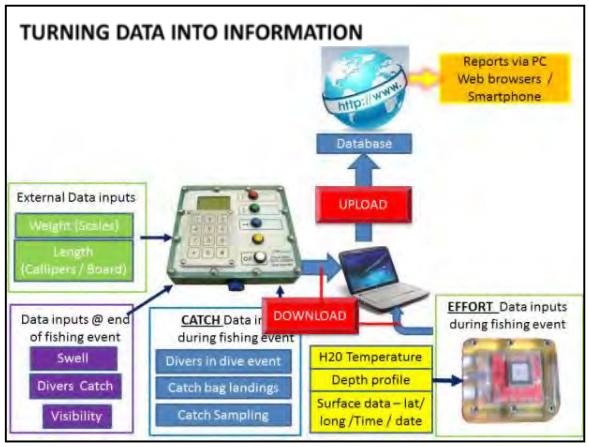
THE RAW DATA FROM THESE UNITS





Different user types

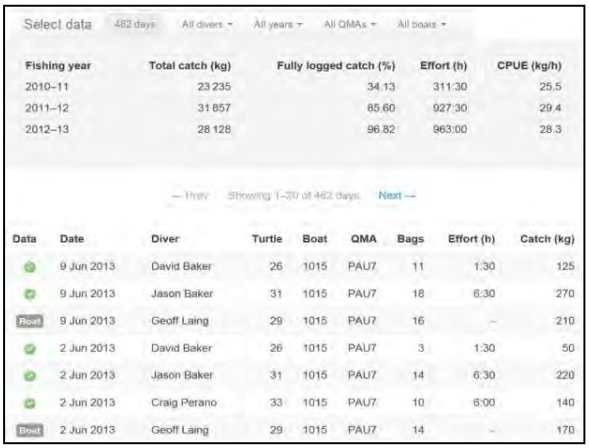
- **DIVER** – can see his own information.
- **ACE holder** – Can see the information from divers he has employed.
- **SHARED** – combined information at scales and details agreed to by each PauaMAC
- **SCIENCE** – aggregated data at agreed scales



ACE holder view

thanks to David Baker & his crew
Nick Cameron & his crew

Viewing the data



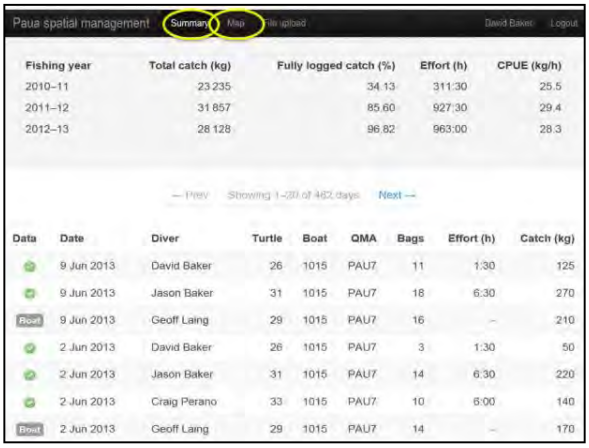
Select data 482 days All divers All years All QMAs All boats

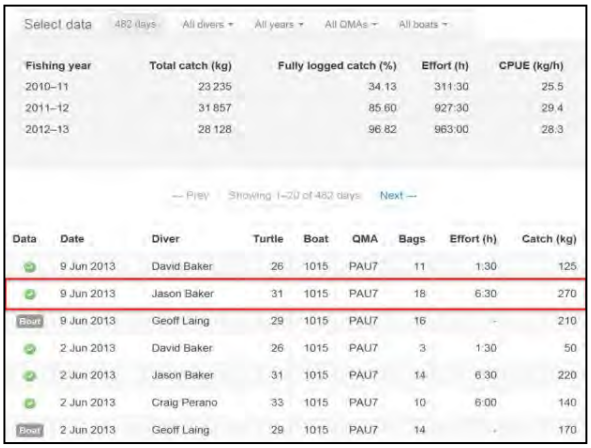
Fishing year	Total catch (kg)	Fully logged catch (%)	Effort (h)	CPUE (kg/h)
2010–11	23 235	34.13	311:30	25.5
2011–12	31 857	85.60	927:30	29.4
2012–13	28 128	96.82	963:00	28.3

← Prev Showing 1–20 of 462 days Next →

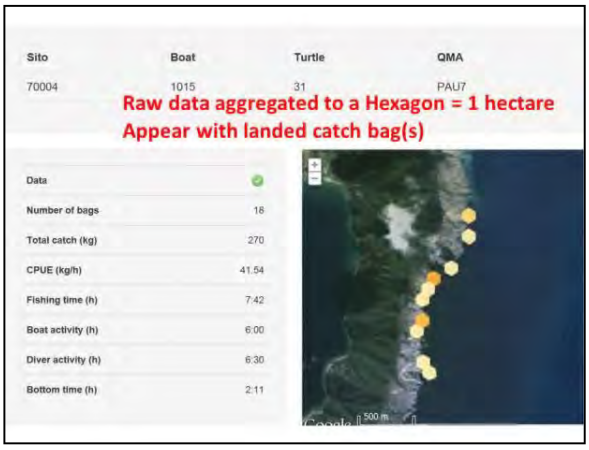
Data	Date	Diver	Turtle	Boat	QMA	Bags	Effort (h)	Catch (kg)
	9 Jun 2013	David Baker	26	1015	PAU7	11	1:30	125
	9 Jun 2013	Jason Baker	31	1015	PAU7	18	6:30	270
Boat	9 Jun 2013	Geoff Laing	29	1015	PAU7	16	–	210
	2 Jun 2013	David Baker	26	1015	PAU7	3	1:30	50
	2 Jun 2013	Jason Baker	31	1015	PAU7	14	6:30	220
	2 Jun 2013	Craig Perano	33	1015	PAU7	10	6:00	140
Boat	2 Jun 2013	Geoff Laing	29	1015	PAU7	14	–	170

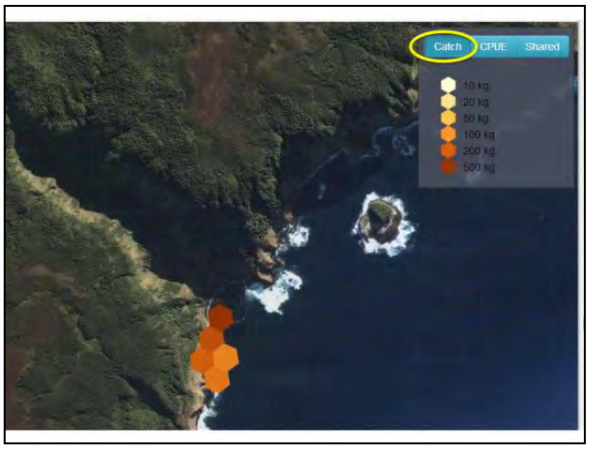

Select data
All divers
Barry Chandler
Craig Perano
David Baker
Geoff Laing
Jason Baker
Nigel Laing
Parke Pittar
Stephen Webb
All years
2010–11
2011–12
2012–13
All QMAs
PAU2
PAU7
All boats
Boat: 1015
Boat: 1021
Fishing year
JE (kg/h)
2010–11 25.5
2011–12 29.4
2012–13 96.82 963:00 28.3
Data Date Boat QMA Bags Effort (h) Catch (kg)
9 Jun 2013 1015 PAU7 11 1:30 125
9 Jun 2013 Jason Baker 31 1015 PAU7 18 6:30 270
Boat 9 Jun 2013 Geoff Laing 29 1015 PAU7 16 - 210
2 Jun 2013 David Baker 26 1015 PAU7 3 1:30 50
2 Jun 2013 Jason Baker 31 1015 PAU7 14 6:30 220
2 Jun 2013 Craig Perano 33 1015 PAU7 10 6:00 140
Boat 2 Jun 2013 Geoff Laing 29 1015 PAU7 14 - 170

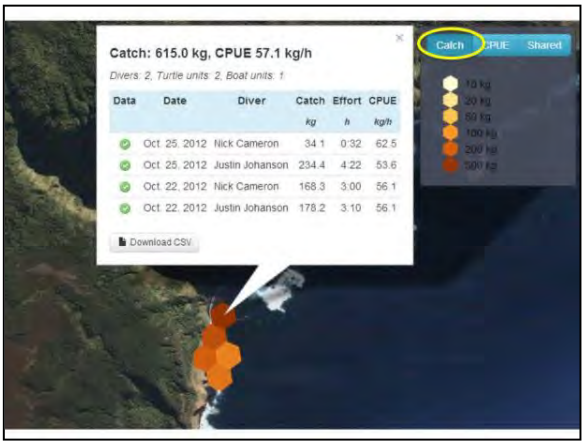

Paua spatial management
Summary
Map
File upload
David Baker
Logout
Fishing year Total catch (kg) Fully logged catch (%) Effort (h) CPUE (kg/h)
2010–11 23 235 34.13 311:30 25.5
2011–12 31 857 85.60 927:30 29.4
2012–13 28 128 96.82 963:00 28.3
Prev
Showing 1–20 of 482 days
Next
Data Date Diver Turtle Boat QMA Bags Effort (h) Catch (kg)
9 Jun 2013 David Baker 26 1015 PAU7 11 1:30 125
9 Jun 2013 Jason Baker 31 1015 PAU7 18 6:30 270
Boat 9 Jun 2013 Geoff Laing 29 1015 PAU7 16 - 210
2 Jun 2013 David Baker 26 1015 PAU7 3 1:30 50
2 Jun 2013 Jason Baker 31 1015 PAU7 14 6:30 220
2 Jun 2013 Craig Perano 33 1015 PAU7 10 6:00 140
Boat 2 Jun 2013 Geoff Laing 29 1015 PAU7 14 - 170

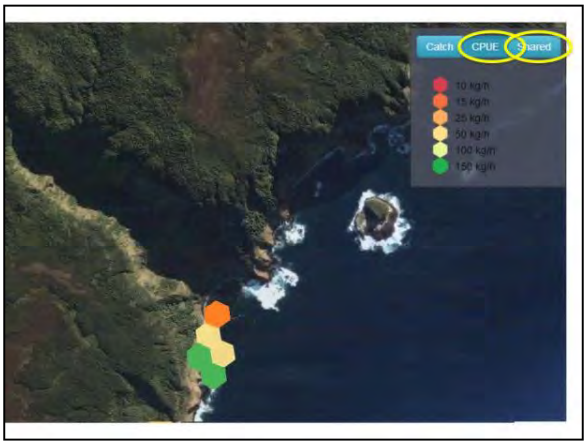

Select data
482 days
All divers
All years
All QMAs
All boats
Fishing year Total catch (kg) Fully logged catch (%) Effort (h) CPUE (kg/h)
2010–11 23 235 34.13 311:30 25.5
2011–12 31 857 85.60 927:30 29.4
2012–13 28 128 96.82 963:00 28.3
Prev
Showing 1–20 of 482 days
Next
Data Date Diver Turtle Boat QMA Bags Effort (h) Catch (kg)
9 Jun 2013 David Baker 26 1015 PAU7 11 1:30 125
9 Jun 2013 Jason Baker 31 1015 PAU7 18 6:30 270
Boat 9 Jun 2013 Geoff Laing 29 1015 PAU7 16 - 210
2 Jun 2013 David Baker 26 1015 PAU7 3 1:30 50
2 Jun 2013 Jason Baker 31 1015 PAU7 14 6:30 220
2 Jun 2013 Craig Perano 33 1015 PAU7 10 6:00 140
Boat 2 Jun 2013 Geoff Laing 29 1015 PAU7 14 - 170

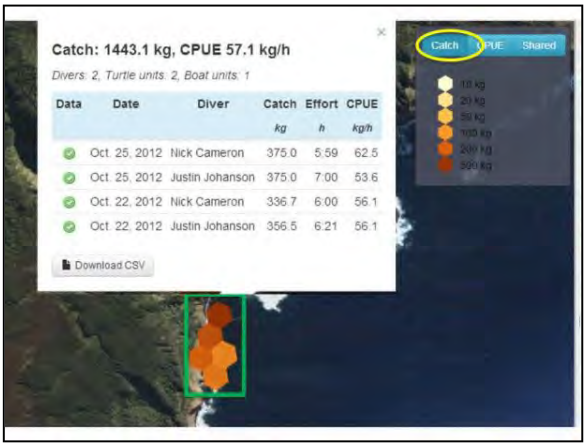

50 km
20 mi

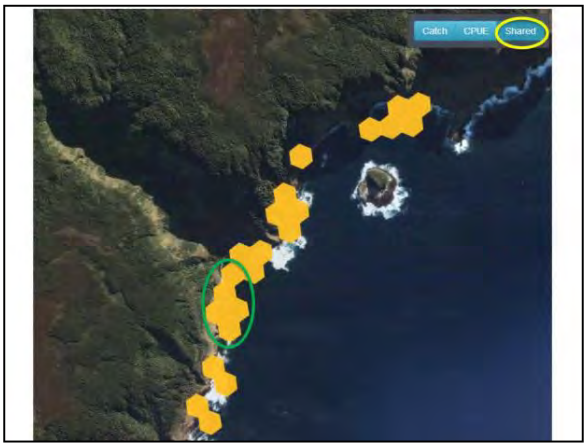

Sito Boat Turtle QMA
70004 1015 31 PAU7
Raw data aggregated to a Hexagon = 1 hectare
Appear with landed catch bag(s)
Data
Number of bags 18
Total catch (kg) 270
CPUE (kg/h) 41.54
Fishing time (h) 7:42
Boat activity (h) 6:00
Diver activity (h) 6:30
Bottom time (h) 2:11
500 m

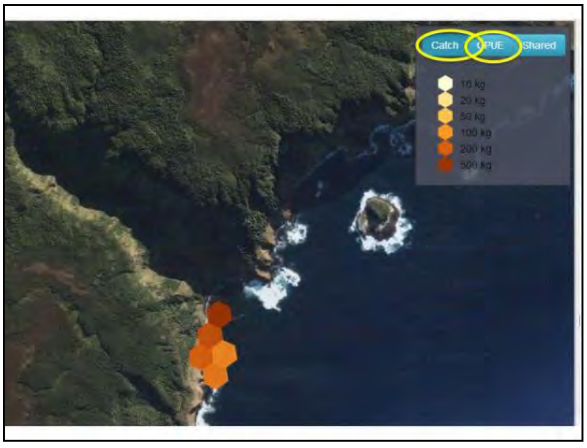

Catch
CPUE
Shared
10 kg
20 kg
50 kg
100 kg
200 kg
500 kg

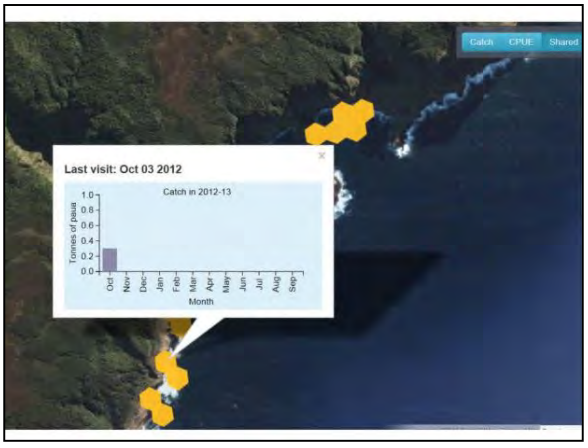

Catch: 615.0 kg, CPUE 57.1 kg/h
Divers: 2, Turtle units: 2, Boat units: 1
Data Date Diver Catch Effort CPUE
kg h kg/h
Oct. 25, 2012 Nick Cameron 34.1 0:32 62.5
Oct. 25, 2012 Justin Johanson 234.4 4:22 53.6
Oct. 22, 2012 Nick Cameron 168.3 3:00 56.1
Oct. 22, 2012 Justin Johanson 178.2 3:10 56.1
Download CSV
Catch CPUE Shared


Catch CPUE Shared


Catch: 1443.1 kg, CPUE 57.1 kg/h
Divers: 2, Turtle units: 2, Boat units: 1
Data Date Diver Catch Effort CPUE
kg h kg/h
Oct. 25, 2012 Nick Cameron 375.0 5:59 62.5
Oct. 25, 2012 Justin Johanson 375.0 7:00 53.6
Oct. 22, 2012 Nick Cameron 336.7 6:00 56.1
Oct. 22, 2012 Justin Johanson 356.5 6:21 56.1
Download CSV
Catch CPUE Shared


Catch CPUE Shared


Catch CPUE Shared


Last visit: Oct 03 2012
Catch in 2012-13
Tonnes of pasut
Month
Catch CPUE Shared

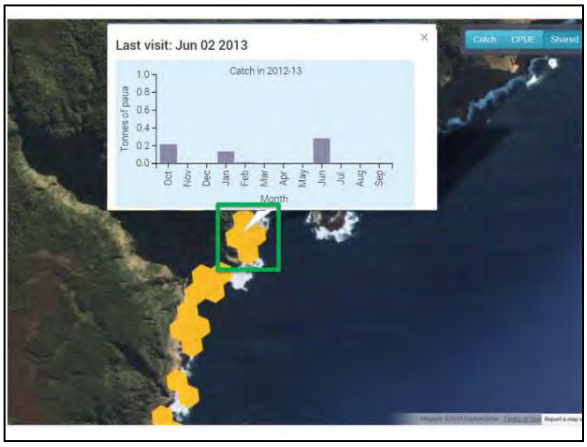
This data creates a wealth of new measurements

Current METRICS

- Catch & Effort (dive event). Location is recorded against a Stat Area

NEW METRICS

- Precise location & fishing event - **surface** = lat/long /time/date & **dive** = depth / time / temperature.
- Bottom time – time actually spent fishing.
- Precise area that the Catch came from (m^2 or Ha).
- Area fished over time – is the fishery expanding or contracting?
- Area searched by divers – are they searching more or less?
- Length of swim in this area & Dives (breaths) taken.
- Each time the boat moved.
- Swell & turbidity.
- How frequently the reefs (or parts of a reef) are fished each season
- How many divers fish a reef each season.



These new metrics create new opportunities

- **Learning the relationship of the new metrics to abundance / stock status / over fishing.**
- **Identify new and useful patterns / trends which weren't previously obvious.**
- **Development of "real time" monitoring instruments and performance indicators.**
- **Development of relevant management tools**
- **Development of real time harvest strategies.**

Metric & performance indicators

Its not just about Catch & Effort

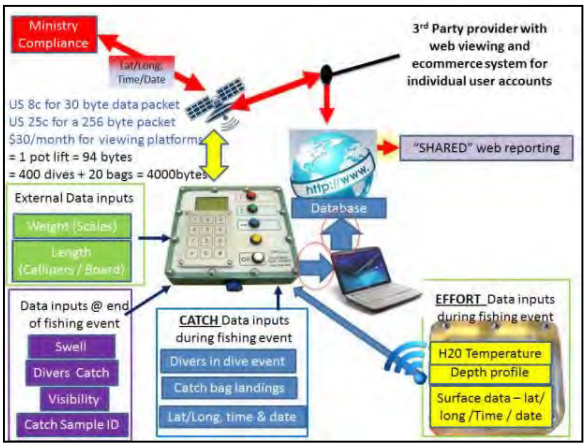
Paua & Rock Lobster

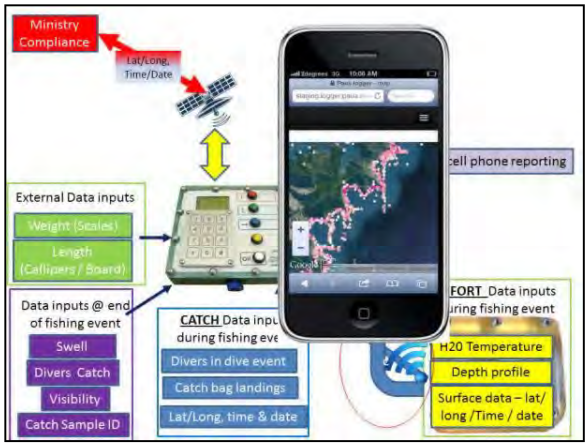
- Matching market demands with harvesting (location & months),
- Forcing the spreading of catch across the whole fishery,
- Carbon footprint - time at sea vs catch,
- Traceability of catch,
- Being able to accurately calculate loss to fishing i.e. MPA
- Advise LFR of in coming catch,

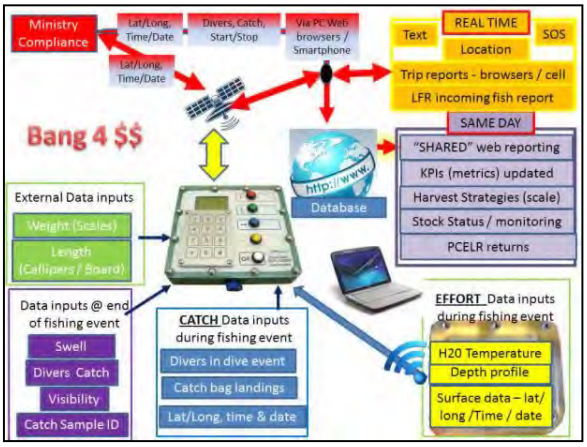
Rock Lobster

- Temp differential - moulting/quality (Delay in temp/currents)
- Incidence of injury / necrosis,
- Performance of pot type (location & months),
- Marine mammal / seabird interactions (time/place)

Work in progress:







Next stages:

The Holy Grail.

Automated “load and go" of relevant data which informs performance indicators which trigger relevant management at applicable scales & timeframes

10 km stretch of coastline - 7 distinct areas of fishing

SAME DAY - Key performance indicators

NEXT DAY - Examples of outcomes and agreed management actions

Signs of overfishing (not necessarily Commercial), is there a need for additional protection such as temporary or rest of season closures, increase or decrease of agreed catch, increase or decrease of MHS etc

Catch Sampling

- PIC has held the Ministry paua Catch Sampling contract since 2006.
- We have developed a simple system where random bins are tagged during a fishing event. The shells from these bins are then measured at the LFR.

Closing data logger comments:

- Technology has reached a stage that we can manage our fisheries with new levels of accuracy & confidence. This technology is available – NOW.
- Its cheap, reliable, trustworthy, simple to operate and much of the backend can be automated.
- This becomes the platform for a potential major paradigm shift for stock assessments – real time - new datasets, new performance indicators, new assessment tools.
- The web database & viewing platforms are available – NOW.
- New eCPUE, performance indicators & Spatial Strategy Evaluation modelling are being worked on.
- Better information = better indicators = better management decisions.
- **Fishing smarter** - At a reduced cost.....

Collecting more data

CATCH SAMPLING

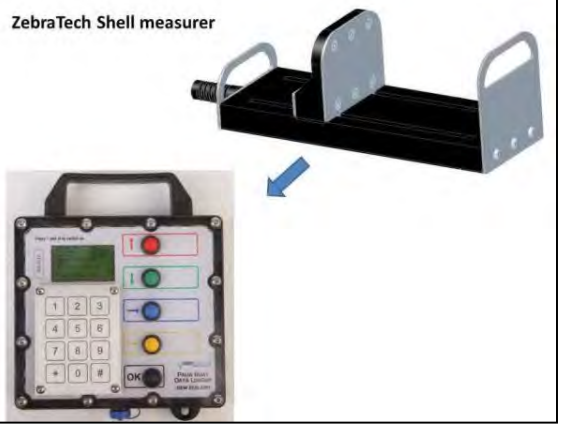
Catch Sampling

- PIC has held the Ministry paua Catch Sampling contract since 2006.
- We have developed a simple system where random bins are tagged during a fishing event. The shells from these bins are then measured at the LFR.
- Since 2006 the number of shells measured has tripled.

Summary of samples

	PAU2	PAU3	PAU4	PAU5A	PAU5B	PAU5D	PAU6	PAU7	TOTAL
2006/07 Shells	4721	2164	4891	3490	3443	2060	0	5466	26,235
2006/07 Samples	36	17	33	20	26	18	0	35	185
2007/08 Shells	2723	5429	5709	2548	4278	1378	152	9355	31572
2007/08 Samples	25	47	42	22	38	12	1	71	258
2008/09 Shells	2908	6368	5999	1653	5016	3270	0	5850	31064
2008/09 Samples	27	65	60	25	49	34	0	54	314
2009/10 Shells	11800	8021	11067	5166	7097	3618	184	11801	58754
2009/10 Samples	118	78	119	64	73	40	2	110	604
20010/11 Shells	12561	8469	13365	2353	5829	1707	101	18863	63248
20010/11 Samples	124	91	150	32	79	24	1	174	675
20011/12 Shells	14000	8636	20287	2396	5472	2549	97	24827	**78264**
20011/12 Samples	140	97	240	31	65	32	1	237	**843**

ZebraTech Shell measurer



Catch Sampling

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- Currently we use the SciElex shell measuring boards but have ordered replacements from Zebratech.

Catch Sampling

- PIC has held the Ministry paua Catch Sampling contract since 2006.
- We have developed a simple system where random bins are tagged during a fishing event. The shells from these bins are then measured at the LFR.
- Since 2006 the number of shells measured has tripled.
- Currently we use the SciElex shell measuring boards but have ordered replacements from Zebratech.
- Divers are “paid” 1 doz beer for every 4 samples of 100 shells.
- Measuring technicians paid $35 / sample.
- A project has just begun to see if we can link the **m²** or the **Ha** that the catch sample has come from.

SciElex shell measurer

Collecting more data

UNDER WATER CALLIPERS

Enhancing Industry Capacity

DOING MORE OURSELVES

Zebratech underwater callipers

We are looking to utilise our harvesting crews and science officer for the collection of more data i.e. perform transects of an area being fished to record abundance / paua under the MLS / habitat type etc.

Things on the Industries "to do" list:

- Data logger coordinator – downloading, uploading & maintenance
- Reseeding - replacing tags with genetics markers
- Catch sampling project - Increase the numbers of shells measured, the spread of samples and linking these to the data loggers.
- Gather more reef data – abundance, sub MLS, habitat type
- Collect more growth data or develop a shell aging process
- Translocation of stunted stocks into spawning banks
- Reseeding coordination
- Looking at whether Protected areas enhanced adjacent fishing grounds
- Assessing whether the MHS should be increased and for what area
- Loss of Macrocystis beds & paua beds to Sedimentation
- Liaison with Universities re student thesis projects.
- Liaise with the Ministry of Primary Industries re research projects
- Do Mussels (marine farms) remove Paua larvae from water column?
- Blog site where divers can report reseeds/ loss of seaweed / loss of habitat / kina barrens
- Keep PIC website updated.

Zebratech underwater callipers

- Logs calliper measurement, depth (with optional depth sensor), time and date at the push of a button
- 0 to 240mm measurement range, 0.5mm resolution
- 30m water depth rating
- Store 8000 measurements in non volatile memory
- Operates for over 40 hours on a charge
- Simple Windows software offloads the data into an Excel format
- Single button or dual log button for measurement differentiation, e.g length and width, or 2 species survey
- 60mm or 90mm jaws, custom shapes on request

Enter TOM MCCOWAN

- Fully qualified Lawyer
- PhD – Paua genetics
- Mad keen free-diver, hunter, fisherman

Thank you

Producers of the data uploading, web database, web reporting, new metrics & new KPIs

www.dragonfly.co.nz

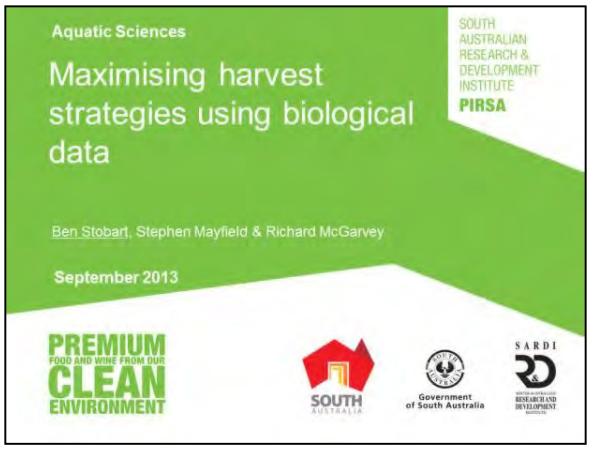
Producers of the hardware and downloading system

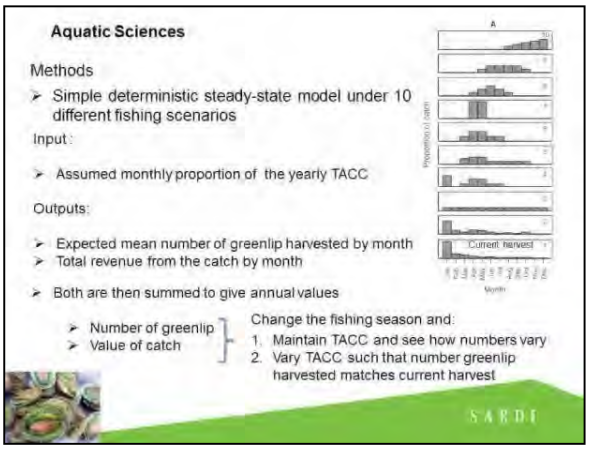
www.zebratech.co.nz

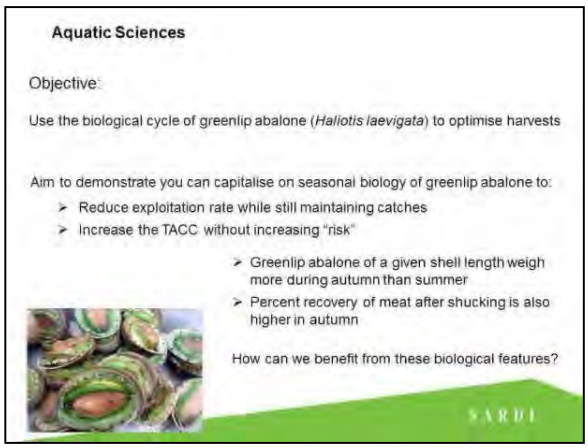
Pricing of Zebratech gear

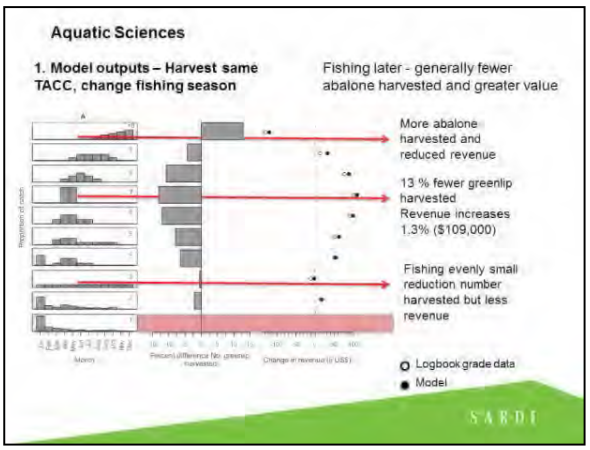
		Aus$	NZ$
Radio Turtle	Turtle Dive Logger with Radio-Link capability for Boat Logger download, 50m depth rated, includes 1 year maintenance contract	727.65	808.50
Radio Boat Logger	Paua Boat Logger (upgradeable to VMS capabilities at a later date), Radio-Link capability for downloading Turtles, includes 1 year maintenance contract	1,264.50	1,405.00
Satellite modem	Satellite modem & additional batteries		$750.00

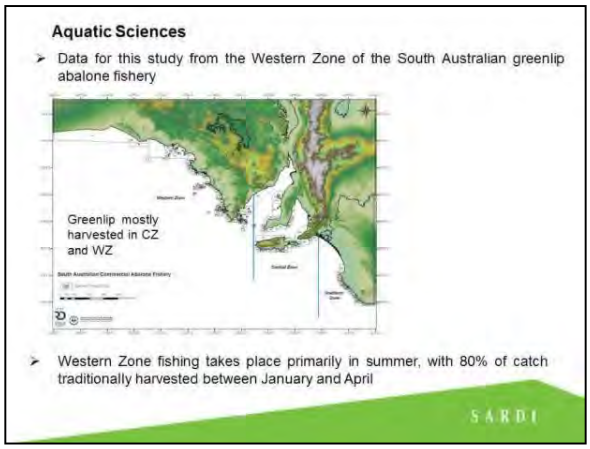
Appendix 3.6. Using Biological Data to Improve Performance

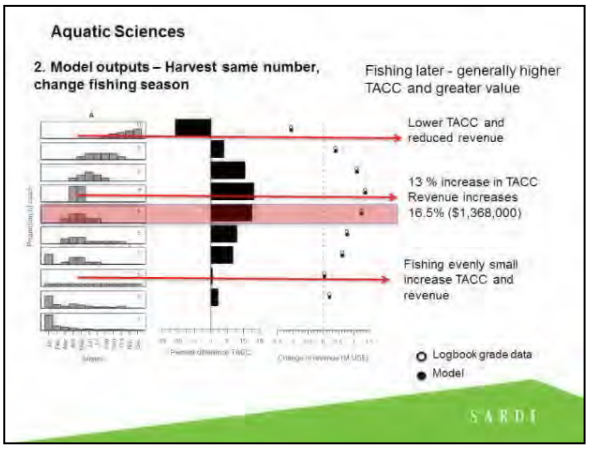






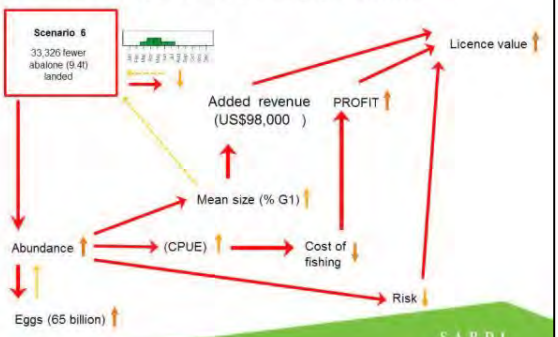






Aquatic Sciences

1. Benefits of harvesting same TACC and changing fishing season?



SARDI

Aquatic Sciences

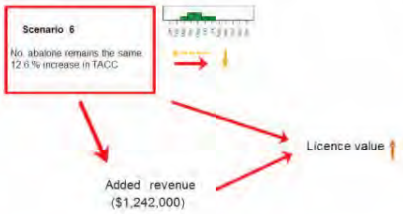
Implementation should consider how to:

- Maintain the market serviced with quality product
- Facilitate cash flow
- Manage risk and cost of product storage (freezer breakdown, product quality, fluctuation in currency markets)
- Access to fishing grounds (weather)
- Possible application to blacklip abalone (75% of Australian catch)

SARDI

Aquatic Sciences

2. Benefits of harvesting same number and changing fishing season?



SARDI

Aquatic Sciences

Conclusions

- Understanding the seasonal biology of an exploited quota-managed species can achieve improved biological sustainability and increase profitability, or allow increases to the TACC without increasing risk
- For greenlip, there are clear biological and economic advantages to targeting fishing in the autumn months
- Up to 33,000 abalone could be left in the water each year

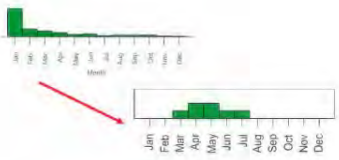
  Ultimately this will lead to:
  - A reduction in risk to the fishery
  - Likely future increases in TACC
  - An increase in the value of fishing licences
- Alternatively the TACC could increase up to 13%

SARDI

Aquatic Sciences

Advantages seem clear

But how do we capitalise on the advantages?



SARDI

Aquatic Sciences

Acknowledgements

Abalone Industry Association of South Australia (AIASA), in particular Jonas Woolford, Samara Miller, John Haagmans and Bill Ford for support and discussion throughout development of this analysis

Fishers and licence holders for logbook data and commercial shell samples

SARDI staff for collection of biological data

Collection predominantly funded by Primary Industries and Regions South Australia (PIRSA) through licence fees

Jim George from Western Abalone Processors for providing price data

Thank you

SARDI

Appendix 3.7. SA Pipi Fishery

SOUTH AUSTRALIAN RESEARCH & DEVELOPMENT INSTITUTE
PIRSA

Managing yield to maximise profitability

Greg Ferguson

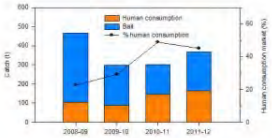
PREMIUM FOOD AND WINE FROM OUR CLEAN ENVIRONMENT

SOUTH AUSTRALIA

Government of South Australia

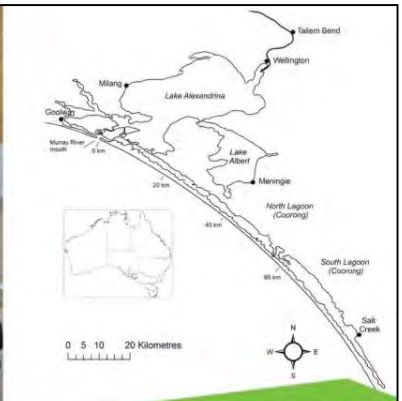
SARDI

Markets



Human consumption market share increased from 23 to 45% from 2008-09 to 2011-12

SARDI



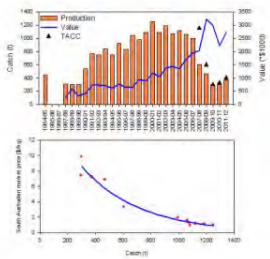
SARDI

Key management measures

- TACC from 2007-08
- Annual fishery closure from May to October
- Size limit of 35 mm
- Harvest strategy introduced in 2011-12

SARDI

Pipi fishery - Catch and Effort



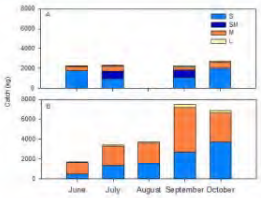
- Following a period of declining catches fishery moved to quota management
- Catches constrained by TACC from 2009-10
- Production value remained high
- Overall trend of declining price ($/kg) with higher production volume

SARDI

Research and harvest strategy development

SARDI

Winter fishing - markets



Pipi placed on market during winter harvest trials in (A) 2010, and (B) 2011. (S = small, SM = small-medium, M = medium, L = large).

SARDI

2º Performance indicator – Fishery Gross Margin

- Fishery Gross Margin = fishery income less total variable costs, where variable costs are proportionate to fishing effort (EconSearch 2013)
- Data required are:
  - price, price elasticity of demand and variable costs and TACC (fisher interviews)
  - market share i.e. % product sent to human consumption or bait markets in previous year (provided by SARDI)
- Provides an estimate of increase/decrease in FGM under a range of TACCs

SARDI

Summary – winter fishing

- Market prices were high during winter under low (12 t) and medium catches (32 t)
- But the market was sensitive to volume
- Pipi stock was not adversely affected by winter fishing

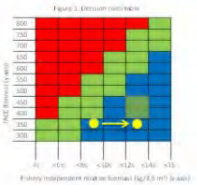
SARDI

Harvest strategy 2012-13

Relative biomass
13.2

Recruitment
Present

Fishery gross margin
<1.5% increase in FGM if maximum allowable catch of 450 t taken



SARDI

Harvest strategy: Three Performance Indicators

Relative biomass
1º PI (biological)
SARDI

Recruitment
2º PI (biological)
SARDI

Fishery gross margin
2º PI (economic)
EconSearch

Harvest strategy
Decision rules to inform TACC

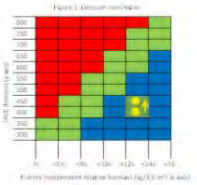
SARDI

Harvest strategy 2013-14

Relative biomass
12.4

Recruitment
Present

Fishery gross margin
>1.5% increase in FGM if maximum allowable catch of 450 t taken



SARDI

Key message

- Pipi price in market is sensitive to production volume
  - Markets responded positively to extending fishing season to winter
  - Changing packaging for shelf life and market presence advantageous
- Winter fishing did not adversely affect stock biomass
- Harvest strategy includes economic PI to maintain profitability

SARDI

Acknowledgements

- FRDC (FRDC 2008/008, FRDC 2010-067)
- Tom Robinson (Director, Coorong Cockles)
- Members of the South Australian Pipi Harvest Strategy Working Group:
  - Richard Stevens (Chair)
  - James Bennett (PIRSA)
  - Jonathan McPhail (PIRSA)
  - Alice Fistr (PIRSA)
  - Sean Sloan (PIRSA)
  - Roger Edwards (Chair, Goolwa Pipi Harvester's Association)
  - Neil MacDonald (Chair, Southern Fishermen's Association)
- Members of the Goolwa Pipi Harvester's Association and Southern Fishermen's Association
- Dr Julian Morison, EconSearch

SARDI

Appendix 3.8. Australian Seafood CRC workshop: Improving the economic performance of the Australian abalone fishery

Background
The abalone workshop held in Adelaide during September 2013, as part of the CRC project on improving the performance of fisheries through review and reform, resulted in three key outcomes. Two of these are relevant to this workshop and were: hold a 'follow-up' workshop targeted to discussions on a national 'roll out' of the GPS logger system; and use the 'follow-up' workshop to assess the need for data on the biology of blacklip abalone for harvest strategy development.

These were identified as the best chance of improving the economic performance of the Australian abalone fishery.

1) Application of spatial (GPS) information to improved economic performance of abalone fisheries
Research teams in New Zealand and Tasmania have been working on ways to track abalone diver activity using GPS technology. The GPS systems developed track each dive-tender vessel, or diver, and, depending on the system, additional information on the depth dived, number of dives, bags up and measurements of shell lengths. The New Zealand system can also be used to lodge CDR forms electronically on site and includes an interactive website. These data have the potential to improve the economic performance of abalone fisheries in at least four ways: (1) provide licence holders and divers information on fishing location so they can plan fishing activities (e.g. avoid areas already fished that season); (2) provide cost-effective and reliable data for stock assessment (e.g. automated gathering and storage of spatial information for spatial performance measures that address weaknesses in the reliance on CPUE data); (3) more reliable stock assessment that may lower risks associated with overfishing these stocks; and (4) providing data for fisheries compliance that could reduce the costs associated with this service. Ultimately, these developments will increase the efficiency and profitability of abalone fisheries and the security of the stocks.

2) Using biological information to optimise harvest strategies
In quota-managed fisheries where the harvestable mass of individuals varies seasonally, harvesting can be tailored to either reduce exploitation rates without lowering quota, or increase catch limits without raising the fisheries' risk profile. Therefore, changing the seasonal timing of harvest can serve to increase landed value, reduce exploitation rate or achieve a combination of these two management objectives. This potential has been investigated for greenlip abalone (*Haliotis laevigata*; Stobart et al. 2013). Greenlip abalone harvested during autumn weigh more and bleed less than those harvested in spring and summer. Thus fishing in autumn provides the potential to fine tune greenlip harvests to maximise biological or economic advantage. Anecdotal evidence suggests similar biological benefits would be achieved by targeting the harvest of blacklip abalone (*Haliotis rubra*) to key months. However, there are currently insufficient data available on the temporal variation in the biology of this species to either confirm this information or quantify the potential benefits.

1st Workshop objectives
Comprehensively evaluate the strengths, weaknesses and opportunities of the New Zealand and Tasmanian (NSW/Vic) GPS logger approaches;
Evaluate the potential for a national roll-out of a spatial information/GPS logger system;
Identify clear objectives of a national spatial system (i.e. is it appropriate for compliance?)
Evaluate the need for blacklip abalone seasonal biology to inform harvest strategies for this species; and
Initiate draft funding proposals for both the GPS/spatial roll-out and blacklip seasonal biology as appropriate.

Draft agenda
The workshop will be held over two days at SARDI (the SA Aquatic Sciences Centre), 2 Hamra Avenue, West Beach, Adelaide on 1 and 2 May 2014. Participants will likely need to arrive in Adelaide on the evening of 30 April and the workshop will conclude late afternoon on 2 May to facilitate return flights. The

first 1.5 days will focus on the national rollout of GPS logger technology. The last 0.5 days will focus on the seasonal biology of blacklip abalone.
The workshop will be chaired by Dr Tim Ward, SARDI.

Day 1

Morning – series of presentations
The New Zealand data logger collection system (presentation - J Cooper)
Strengths, weakness and opportunities of the NZ system – managers perspective (E Breen)
Strengths, weakness and opportunities of the NZ system – divers perspective (T McGowan)
The Tasmanian (NSW/VIC) data logger collection system (C Mundy)
Strengths, weakness and opportunities of the Tas system – managers perspective (M Bradshaw)
Strengths, weakness and opportunities of the Tas – divers perspective (J McKibben)
Afternoon – open forum discussions
Identification of common needs across all jurisdictions
Discussion on application of the system at the national scale (Chair)
Discussion of the two systems (what works best in each?) (Chair)
Identification of key hardware/methodologies from each for national trial selection (Chair)
Discussion of funding for the project, including funding for hardware (Chair)
Evening – workshop dinner

Day 2

Morning – open forum discussions
Detailed discussion of project: participants; objectives; methodologies; data storage, security and processing; outputs and timeframes (Chair)
Afternoon – presentation and open forum discussions
Summary of greenlip season work (Ben Stobart)
Discussion on application of blacklip biology to harvest strategies
Identification of data required for a blacklip seasonal model.
Detailed discussion of project: participants; objectives; methodologies; data storage, security and processing; outputs and timeframes (Chair)

Outputs

The outcome of the workshop will be agreement on the scope for two projects aimed at improving the economics, efficiency and sustainability of abalone fisheries. Amongst others the scope will include a list of participants, main objectives, data storage, outputs and timeframes.

Appendix 3.9. Abalone workshop

Improving the performance of CRC fisheries through review and reform of operational procedures, business structures and fisheries management systems.

Abalone workshop:
Date: 1 May: 9am-4:45pm and 2 May: 9am-4pm
Venue: SARDI Aquatic Sciences, 2 Hamra Ave, West Beach, SA (08-8207 5400)

Agenda:
Day 1 (1 May)
Session 1 – Chair: Tim Ward, SARDI

9.00am	Welcome and Introductions and expectations from the workshop (Tim Ward, SARDI)
9:15am	Presentation: The New Zealand data logger collection system (Jeremy Cooper, NZ)
10:15am	Presentation: Strengths, weakness and opportunities of the NZ system – managers perspective (E Breen, NZ)
10:45am	Morning Tea
11:00am	Presentation: Strengths, weakness and opportunities of the NZ system – divers perspective (T McGowan, NZ)
11:30pm	The Tasmanian (NSW/VIC) data logger collection system (C Mundy, IMAS)
12:30pm	Lunch
1:15pm	Presentation: Strengths, weakness and opportunities of the Tas system – managers perspective (G Pullen, DPIWE)
1:45pm	Presentation: Strengths, weakness and opportunities of the Tas system – divers perspective (J McKibben, Tas)
2:15pm	Short break

Session 2 – Chair: Dean Lisson, ACA:

2:30pm	Open discussion – where to from here? (All) (Potential discussion topics: Identification of common needs across all jurisdictions, application of the system at the national scale, comparison of the two systems (what works best in each?), identification of key hardware/methodologies from each for national trial selection, discussion of funding for the project, including funding for hardware)
3:30pm	Afternoon Tea
3:45pm	Open discussion continues (All)
4:45pm	End of Day 1

Day 2 (2 May)
Session 3 – Chair: Tim Ward, SARDI

9.00am	Review of presentations on Day 1 (Stephen Mayfield, SARDI)
9:15am	Review of discussions on Day 1 (Dean Lisson, ACA)
9:30am	Open discussion continues (All)
10:30am	Morning Tea
10:45am	Finalise future direction/approach for GPS loggers (All)
12:30am	Lunch

Session 4 – Chair: Tim Ward, SARDI

1:00 pm	Presentation: Maximising harvest strategies using biological data (B Stobart, SARDI)
1:30pm	Open discussion – adaptation of greenlip approach to blacklip (All)
3:00pm	Afternoon Tea
3:15pm	Finalise future direction/approach for blacklip biology and harvest strategies (All)
4:00pm	Workshop wrap up and conclusion (T Ward, SARDI)

Name	State	Stakeholder group
John Smythe	NSW	Industry
Stephen Mayfield	SA	Research
Cameron Westaway	NSW	Management
Doug Ferrell	NSW	Management
Jeremy Cooper	NZ	Industry
Erin Breen	NZ	Management
Tom McCowan	NZ	Research
Ed Abrahams	NZ	Research
Tim Ward	SA	Chair
Peter Dietman	SA	Compliance
Jonas Woolford	SA	Industry
Bob Pennington	SA	Industry
Arthur Martel	SA	Industry
Lianos Triantafillos	SA	Management
Matt Hoare	SA	Management
Ben Stobart	SA	Research
Graham Mair	SA	Seafood CRC
Steve Withers	Tas	Compliance
Dean Lisson	Tas	Industry
Joey McKibben	Tas	Industry
Grant Pullen	Tas	Management
Craig Mundy	Tas	Research
Peter Welsh	Tas	Research
Zac Lewis	Vic	Management
Richard Petty	WA	Compliance
Nathan Adams	WA	Industry
Anthony Hart	WA	Research
John Lashmar	WA	Industry
Michael Coates	SA	Industry
Sonia Talman	Vic	Compliance
Paul Staight	NSW	Industry
Kane Williams	SA	Industry
Paul Richardson	Tas	Industry

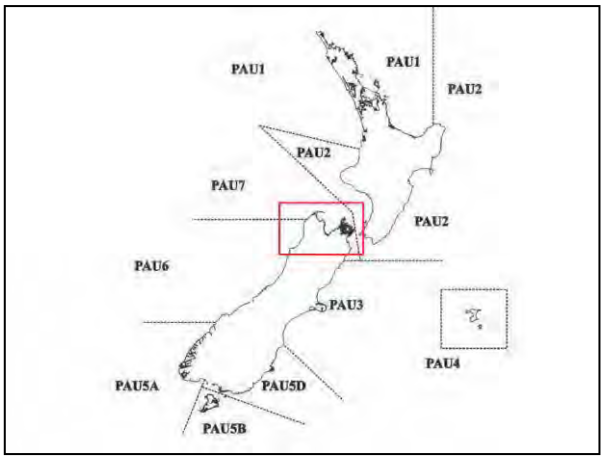
		Jurisdiction					
Component	**Potential Sub-components**	**NZ**	**WA**	**SA**	**Vic**	**NSW**	**Tas**
Fishery data collection	What data (shell length, depth, gps, economic ?)						
	Common hardward platform (customisable by jurisdiction)						
	Common database platform (customisable by jurisdiction)						
	System efficiency and longevity						
	Coverage requirements						
	Real-time data for fishers						
	Replacement of paper						
	Data for spatial (other?) Performance Indicators						
	Performance indicators base of harvest strategy with decision rules						
	Harvest strategy base of TACC setting						
Quota Management	Electronic logbook						
	Linkage to spatial FD data for assessment						
Enforcement & compliance	VMS vs data loggers						
	Pre/Post fishing reports						
Other benefits	Fishery knowledge (saleable item)						
	Social licence						
	Impacts on fishery (MPAs, aquacutlure expansion, customary rights, etc)						

Appendix 3.10. Data Logging NZ

Paua Industry Council

Data logging

March 2014



Our Problem

Our Hardware

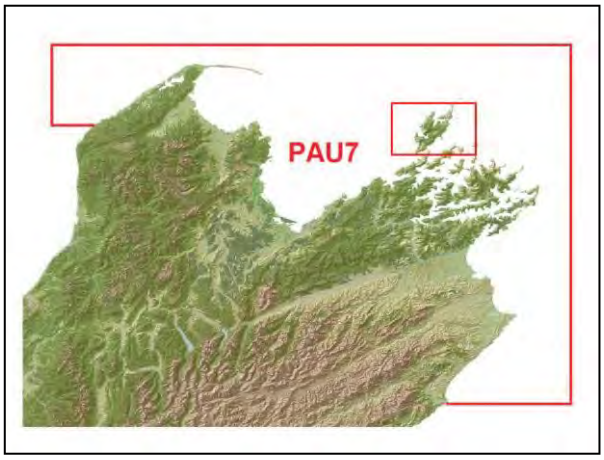
Our Data

Viewing Data

Metrics

Next Stages

The Holy Grail



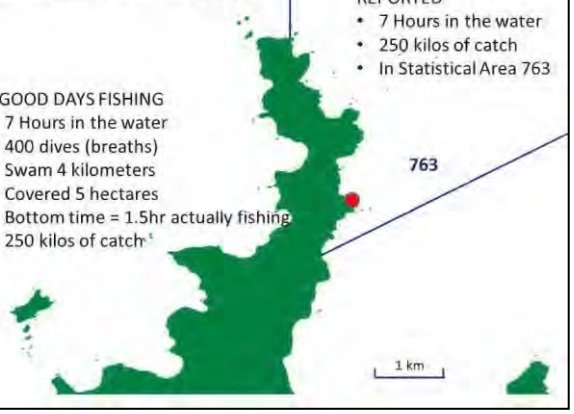
Our problem

THE TYRANNY OF SCALE

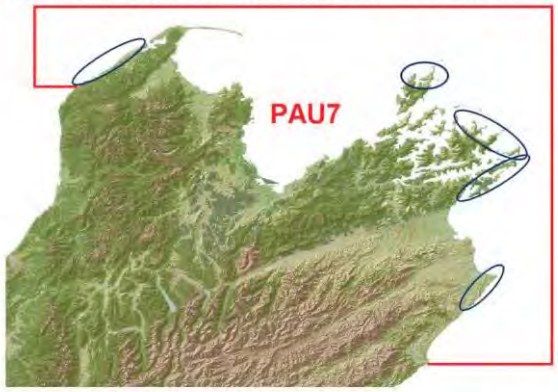
Scale of **fishing** vs scale of **reporting**

REPORTED
- 7 Hours in the water
- 250 kilos of catch
- In Statistical Area 763

A GOOD DAYS FISHING
- 7 Hours in the water
- 400 dives (breaths)
- Swam 4 kilometers
- Covered 5 hectares
- Bottom time = 1.5hr actually fishing
- 250 kilos of catch



Scale of **Total Allowable Commercial Catch** (TACC) – 187 tonne

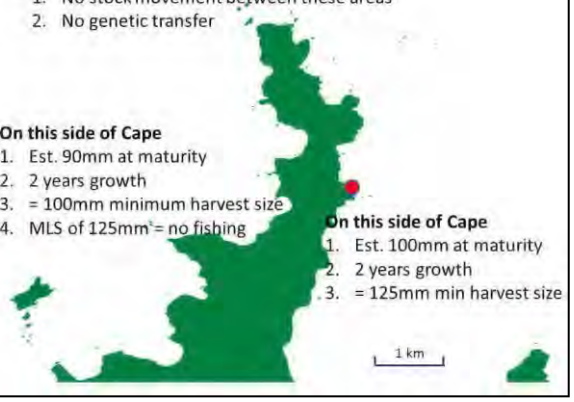


Scale of **biological variance** in the stock

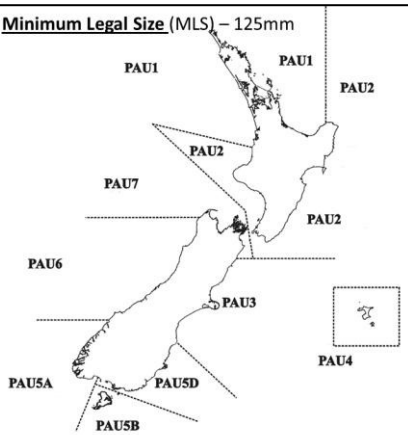
1. No stock movement between these areas
2. No genetic transfer

On this side of Cape
1. Est. 90mm at maturity
2. 2 years growth
3. = 100mm minimum harvest size
4. MLS of 125mm = no fishing

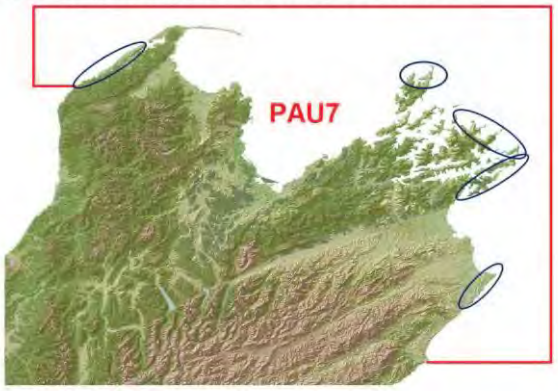
On this side of Cape
1. Est. 100mm at maturity
2. 2 years growth
3. = 125mm min harvest size



Scale of the **Minimum Legal Size** (MLS) – 125mm



Scale of **Stock Assessments** = QMA scale not a stratum scale



The tyranny of scale

	Dive/Breath	Bed	Reef	Statistical Area	Stratum	QMA	Country
	m^2	Ha	Sq Km	10's Km	100's km	1000's Km	1000's Km
Fishing							
Stock Dynamics							
Reporting							
Assessment							
Management						TACC	MLS

We need to measure, monitor & manage paua at these fine scales

"You cannot manage what you cannot measure." **Lord Kelvin.**

BOAT units (catch)

RECORDS:

- The **lat / long / time & date** (selectable intervals)
- The **lat / long / time & date** each time a **catch bag is landed and the diver ID.**
- An estimation of each **Divers catch** (kilos) for the dive event.
- Was a **boat boy used, swell, visibility, link to catch sample**

Specifications

- The battery lasts 10 dive days
- The memory = 1 year of data
- The have space for a **satellite modem** & additional batteries
- They have 2 spare serial ports – scales, callipers, shell board etc

OUR PAUA (ABALONE) DATA LOGGERS

Our data loggers

- BOAT unit logs **CATCH** (kgs).
- TURTLE unit logs **EFFORT** (time)

Diver TURTLE units (effort)

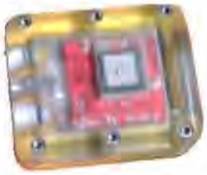
They switch on and off automatically (saltwater switch)

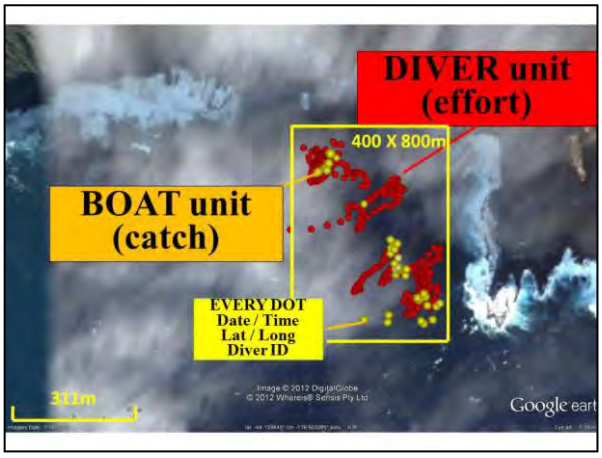
RECORDS

- On the surface the **lat / long / time & date** are recorded
- Saltwater switch automatically turns off GPS when the unit is under water
- When under water **depth / temp / time & date** are recorded at 2 second intervals.

The battery lasts 6 dive days
The memory capacity = 1 year of data

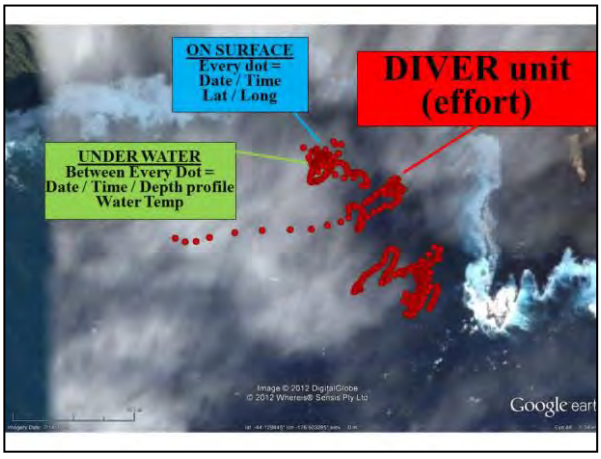
Rated to depths of 30m & 50m

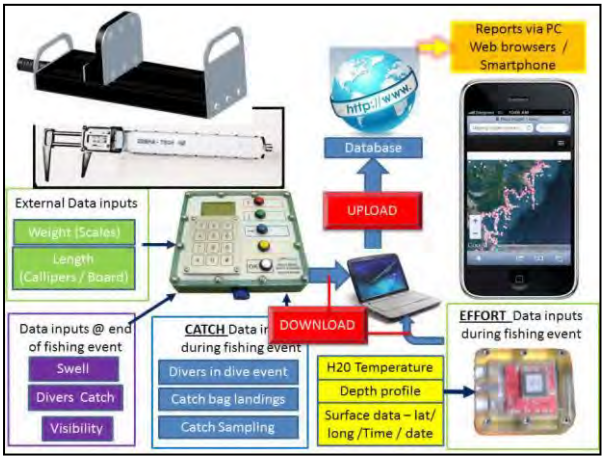




THE RAW DATA FROM THESE UNITS

TURNING DATA INTO INFORMATION





Viewing the data

Select data 482 days All divers All years All QMAs All boats

Fishing year	Total catch (kg)	Fully logged catch (%)	Effort (h)	CPUE (kg/h)
2010–11	23 235	34.13	311:30	25.5
2011–12	31 857	85.60	927:30	29.4
2012–13	28 128	96.82	963:00	28.3

All divers: Barry Chandler, Craig Perano, David Baker, Geoff Laing, Jason Baker, Nigel Laing, Parke Pittar, Stephen Webb

All years: 2010–11, 2011–12, 2012–13

All QMAs: PAU2, PAU7

All boats: Boat: 1015, Boat: 1021

— Prev Showing 1–20 of 462 days Next —

Data	Date	Diver	Turtle	Boat	QMA	Bags	Effort (h)	Catch (kg)
	9 Jun 2013	David Baker	26	1015	PAU7	11	1:30	125
	9 Jun 2013	Jason Baker	31	1015	PAU7	18	6:30	270
Boat	9 Jun 2013	Geoff Laing	29	1015	PAU7	16	-	210
	2 Jun 2013	David Baker	26	1015	PAU7	3	1:30	50
	2 Jun 2013	Jason Baker	31	1015	PAU7	14	6:30	220
	2 Jun 2013	Craig Perano	33	1015	PAU7	10	6:00	140
Boat	2 Jun 2013	Geoff Laing	29	1015	PAU7	14	-	170

ACE holder view

thanks to David Baker & his crew
Nick Cameron & his crew

Select data 482 days All divers All years All QMAs All boats

Fishing year	Total catch (kg)	Fully logged catch (%)	Effort (h)	CPUE (kg/h)
2010–11	23 235	34.13	311:30	25.5
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— Prev Showing 1–20 of 462 days Next —

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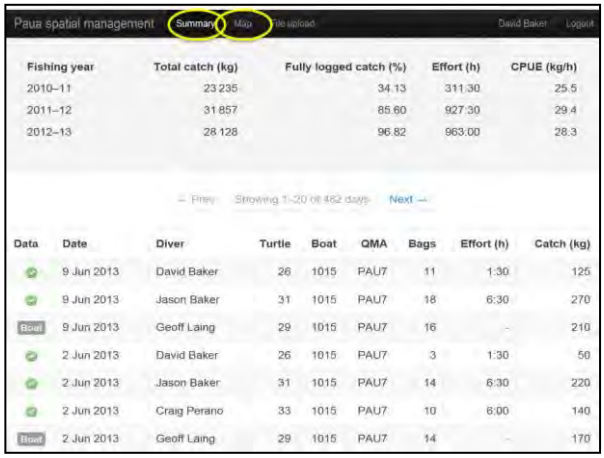
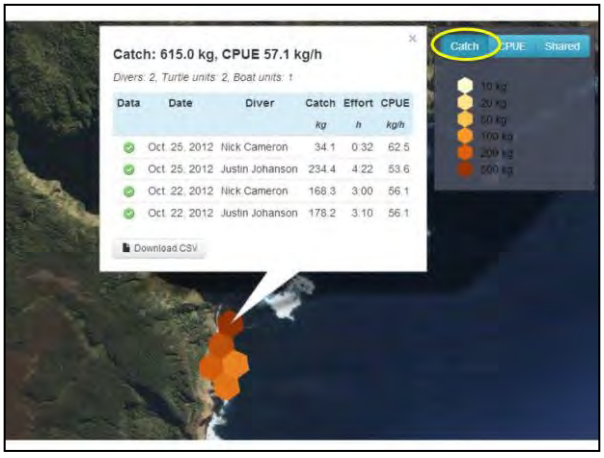
	2 Jun 2013	Craig Perano	33	1015	PAU7	10	6:00	140
Boat	2 Jun 2013	Geoff Laing	29	1015	PAU7	14	-	170

Sito	Boat	Turtle	QMA
70004	1015	31	PAU7

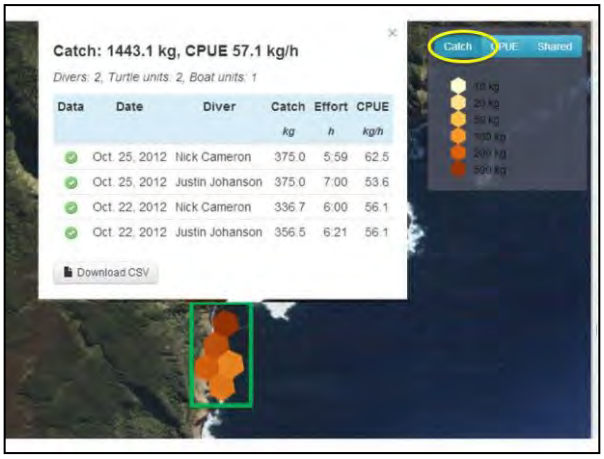
Raw data aggregated to a Hexagon = 1 hectare
Appear with landed catch bag(s)

Data	✓
Number of bags	18
Total catch (kg)	270
CPUE (kg/h)	41.54
Fishing time (h)	7:42
Boat activity (h)	6:00
Diver activity (h)	6:30
Bottom time (h)	2:11

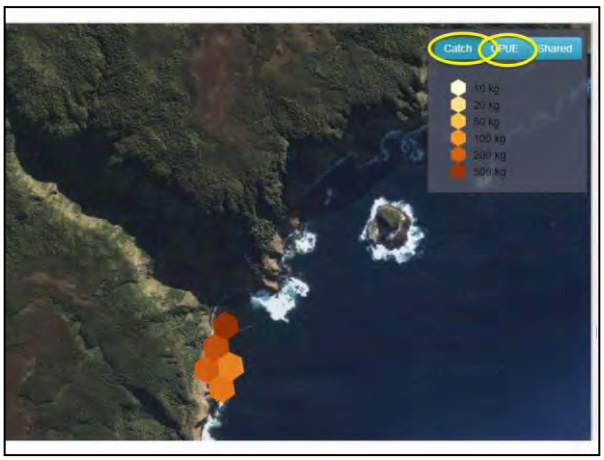

Paua spatial management
Summary
Map
Tile upload
David Baker
Logout
Fishing year | Total catch (kg) | Fully logged catch (%) | Effort (h) | CPUE (kg/h)
2010–11 | 23 235 | 34.13 | 311.30 | 25.5
2011–12 | 31 857 | 85.60 | 927.30 | 29.4
2012–13 | 28 128 | 96.82 | 963.00 | 28.3
← Prev
Showing 1–20 of 462 days
Next →
Data | Date | Diver | Turtle | Boat | QMA | Bags | Effort (h) | Catch (kg)
9 Jun 2013 | David Baker | 26 | 1015 | PAU7 | 11 | 1:30 | 125
9 Jun 2013 | Jason Baker | 31 | 1015 | PAU7 | 18 | 6:30 | 270
Boat | 9 Jun 2013 | Geoff Laing | 29 | 1015 | PAU7 | 16 | - | 210
2 Jun 2013 | David Baker | 26 | 1015 | PAU7 | 3 | 1:30 | 50
2 Jun 2013 | Jason Baker | 31 | 1015 | PAU7 | 14 | 6:30 | 220
2 Jun 2013 | Craig Perano | 33 | 1015 | PAU7 | 10 | 6:00 | 140
Boat | 2 Jun 2013 | Geoff Laing | 29 | 1015 | PAU7 | 14 | - | 170


Catch: 615.0 kg, CPUE 57.1 kg/h
Divers: 2, Turtle units: 2, Boat units: 1
Data | Date | Diver | Catch kg | Effort h | CPUE kg/h
Oct. 25, 2012 | Nick Cameron | 34.1 | 0:32 | 62.5
Oct. 25, 2012 | Justin Johanson | 234.4 | 4:22 | 53.6
Oct. 22, 2012 | Nick Cameron | 168.3 | 3:00 | 56.1
Oct. 22, 2012 | Justin Johanson | 178.2 | 3:10 | 56.1
Download CSV
Catch
CPUE
Shared
10 kg
20 kg
50 kg
100 kg
200 kg
500 kg


50 km
20 mi

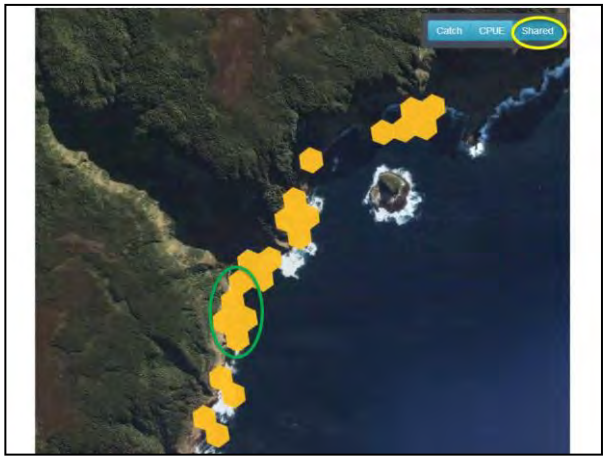

Catch: 1443.1 kg, CPUE 57.1 kg/h
Divers: 2, Turtle units: 2, Boat units: 1
Data | Date | Diver | Catch kg | Effort h | CPUE kg/h
Oct. 25, 2012 | Nick Cameron | 375.0 | 5:59 | 62.5
Oct. 25, 2012 | Justin Johanson | 375.0 | 7:00 | 53.6
Oct. 22, 2012 | Nick Cameron | 336.7 | 6:00 | 56.1
Oct. 22, 2012 | Justin Johanson | 356.5 | 6:21 | 56.1
Download CSV
Catch
CPUE
Shared

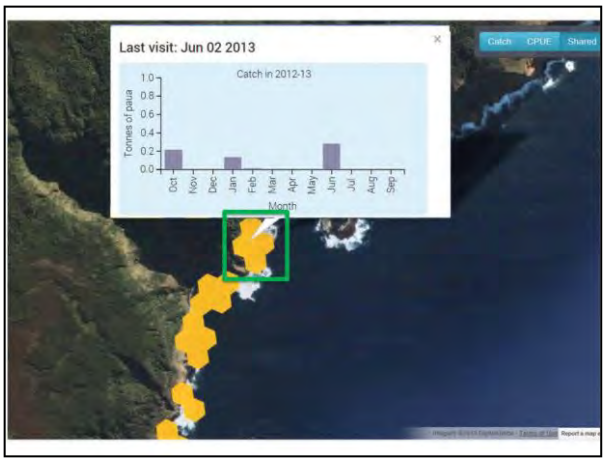

Catch
CPUE
Shared
10 kg
20 kg
50 kg
100 kg
200 kg
500 kg

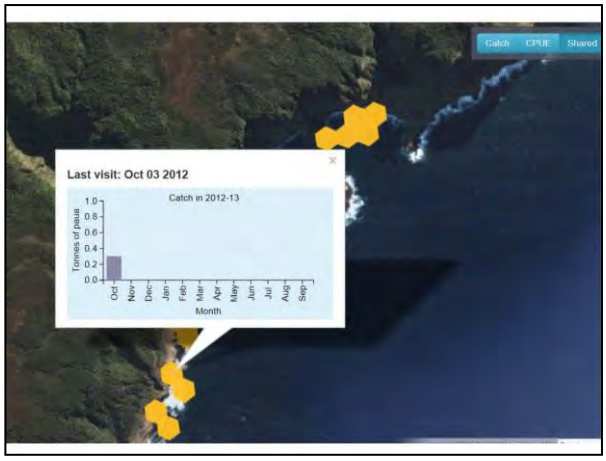

Catch
CPUE
Shared
10 kg
20 kg
50 kg
100 kg
200 kg
500 kg


Catch
CPUE
Shared
10 kg/h
15 kg/h
25 kg/h
50 kg/h
100 kg/h
150 kg/h


Catch
CPUE
Shared


Catch
CPUE
Shared


Last visit: Jun 02 2013
Catch in 2012-13
Tonnes of paua
1.0
0.8
0.6
0.4
0.2
0.0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
Catch
CPUE
Shared


Last visit: Oct 03 2012
Catch in 2012-13
Tonnes of paua
1.0
0.8
0.6
0.4
0.2
0.0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
Catch
CPUE
Shared


Metric & performance indicators

This data creates a wealth of new measurements

Current METRICS

- Catch & Effort (dive event). Location is recorded against a Stat Area

NEW METRICS

- Precise location & fishing event - **surface** = lat/long /time/date & **dive** = depth / time / temperature.
- Bottom time – time actually spent fishing.
- Precise area that the Catch came from (m^2 or Ha).
- Area fished over time – is the fishery expanding or contracting?
- Area searched by divers – are they searching more or less?
- Length of swim in this area & Dives (breaths) taken.
- Each time the boat moved.
- Swell & turbidity.
- How frequently the reefs (or parts of a reef) are fished each season
- How many divers fish a reef each season.

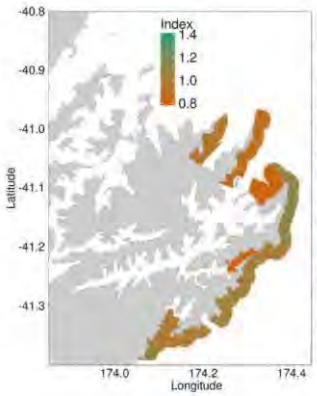
We are starting to see the first "new" indicators being produced from the data logger data.

Traditional CPUE – data from the PCELR standardized for the diver and overall fishing time.

eCPUE - This index of CPUE is standardized for bottom time, depth, individual diver, area fished and fishing concentration.

These new metrics create new opportunities

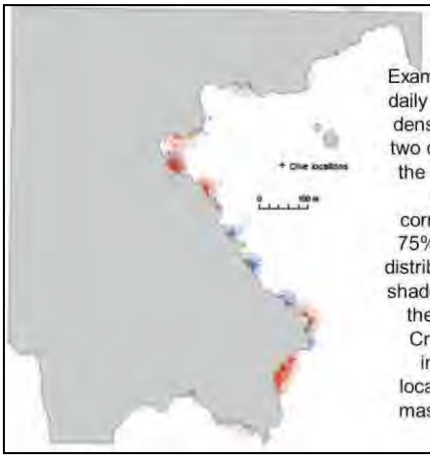
- **Learning the relationship of the new metrics to abundance / stock status / over fishing.**
- **Identify new and useful patterns / trends which weren't previously obvious.**
- **Development of "real time" monitoring instruments and performance indicators.**
- **Development of relevant management tools**
- **Development of real time harvest strategies.**



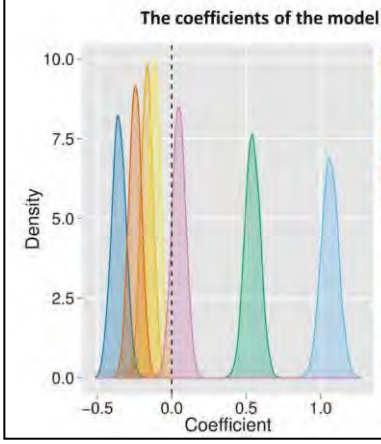
The spatial index tells you the relative catch the same diver would have if they fished for the same amount of time, **in the same way**, in the same conditions, in each of the areas, in a days fishing.
The "in the same way" bit takes account of both how much time they spend on the bottom, and how much area they cover in a day.

Correctly interpreting the data when transforming it into information is the key .

The deciphering of what the metric's are telling us needs a diverse skill set that go beyond marine experts.

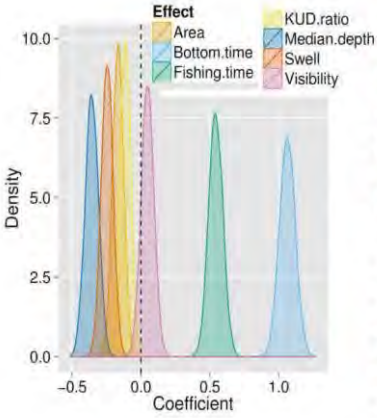


Example of estimated daily kernel utilisation densities (KUDs) for two divers (red/blue), the lighter shade in each colour corresponds to the 75% isopleth of the distribution, the darker shade corresponds to the 25% isopleth. Crosses indicate individual dive locations. The land mass appears in in grey).

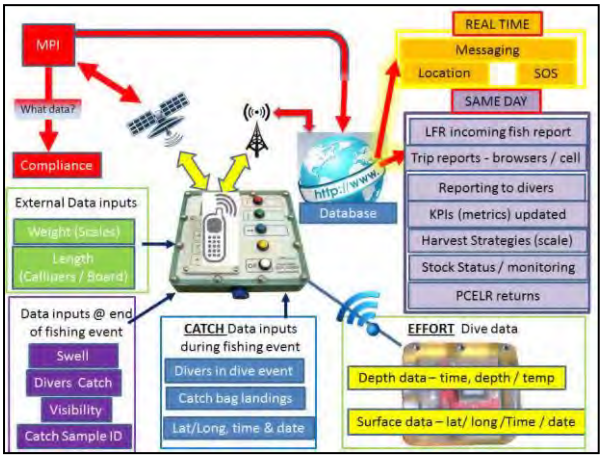


Positive numbers mean that they are associated with an increase in the catch. Negative areas mean they are associated with a decrease.

Next stages:



Depth: If you are diving deeper, you are catching less
Swell: Higher swell means less catch
Area: area fished during a day (if you are covering more area, you are catching less)
KUD ratio: This is about how patchy your fishing is. Spotty fishing means less catch
Visibility: A small effect of visibility (the more visibility the higher the catch, but it isn't a big effect)
Fishing time: If you fish for longer in a day you catch more
Bottom time: The more time you spend underwater, the more you catch



Its not just about Catch & Effort

Paua & Rock Lobster

- Matching market demands with harvesting (location & months),
- Forcing the spreading of catch across the whole fishery,
- Carbon footprint - time at sea vs catch,
- Traceability of catch,
- Being able to accurately calculate loss to fishing i.e. MPA
- Advise LFR of in coming catch,

Rock Lobster

- Temp differential - moulting/quality (Delay in temp/currents)
- Incidence of injury / necrosis,
- Performance of pot type (location & months),
- Marine mammal / seabird interactions (time/place)

Planned R&D

1. **Data management** – automated uploading, validation and warehousing of date (continuing).
2. **Deriving metrics** - looking for signals in the data logger data that explain variations in catch, better than they are explained by the data from the PCELR records (continuing).
3. **Turning data into information** – reporting tools, investigate changes in data, aggregating data etc.
4. **Paua abundance** - The core goal of the logger programme is to use the logger data to monitor changes in the stock.

The Holy Grail.

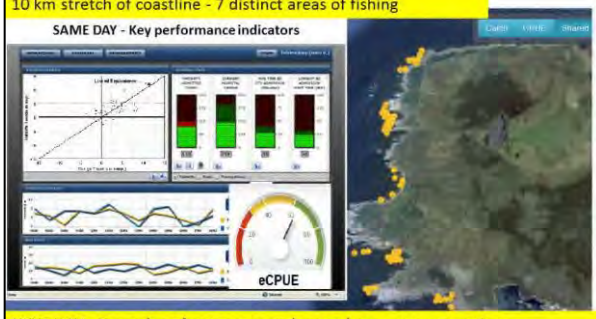
Automated "load and go" of relevant data which informs performance indicators which trigger relevant management at applicable scales & timeframes

Pricing of Zebratech gear

		Aus$	NZ$
Radio Turtle	Turtle Dive Logger with Radio-Link capability for Boat Logger download, 50m depth rated, includes 1 year maintenance contract	727.65	808.50
Radio Boat Logger	Paua Boat Logger (upgradeable to VMS capabilities at a later date) , Radio-Link capability for downloading Turtles, includes 1 year maintenance contract	1,264.50	1,405.00
Satellite modem	Satellite modem & additional batteries		$750.00

10 km stretch of coastline - 7 distinct areas of fishing

SAME DAY - Key performance indicators



NEXT DAY - Examples of outcomes and agreed management actions

Signs of overfishing (not necessarily Commercial), is there a need for additional protection such as temporary or rest of season closures, increase or decrease of agreed catch, increase or decrease of MHS etc

Planned R&D

1. **Automate the uploading, validation and warehousing of date** (continuing)
2. **Analyse data-logger data** (in progress) - **This project is looking for signals in the data logger data that explain variations in catch, better than they are explained by the data from the PCELR records.** *For example, there is variation in catch associated with variation in bottom time, so fishers can compensate for a decreasing stock by increasing their bottom time. The stock could be coming under pressure, without it being evident in the PCELR data that are used for stock assessments.*
3. **Interannual changes in stocks from logger data** (just started). This project has two components. The first is continued **work on the systems for collecting and reporting on the logger data, developing a dashboard to make data issues more visible, and to make some of the lessons from (2) visible.** The second part, is to **take the quality data collected to date and investigate changes in Paua 7**.

Future projects:

4**. Statistical area reporting**. Developing a statistical area view of the data, summarising catch and effort within each statistical area to help manage the fisheries.

5. **Paua abundance**. **The core goal of the logger programme is to use the logger data to monitor changes in the stock**. To do this, we need to understand how changes in paua abundance are reflected in diver behaviour, as monitored by the loggers. We know that the loggers can be used to explain changes in the daily catches of divers, and the missing link is to establish that these changes are related to changes in abundance. This project will carry out targeted survey work (using the logger data as a guide) to determine paua abundance at a range of fished sites. The initial work in Fighting Bay showed that there was a strong relationship between effort measured by the loggers and abundance, and now this needs to be extended to the range of conditions encountered in the fishery.

Thank you

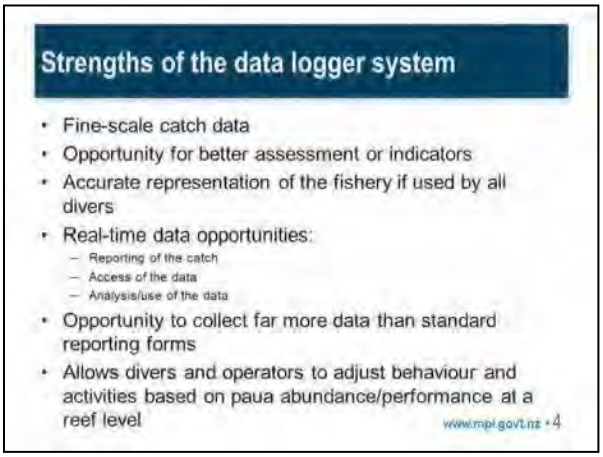
Producers of the data uploading, web database, web reporting, new metrics & new KPIs

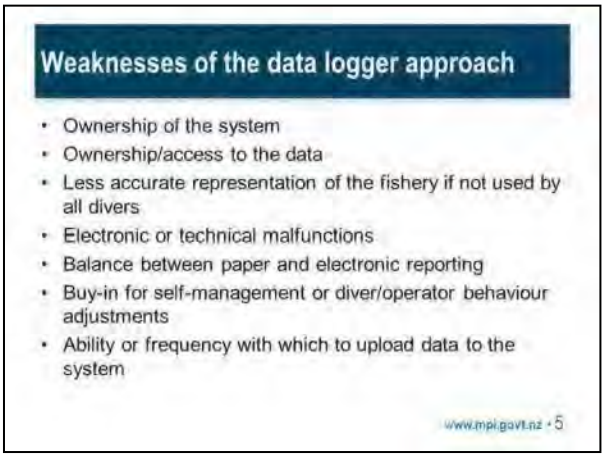
www.dragonfly.co.nz

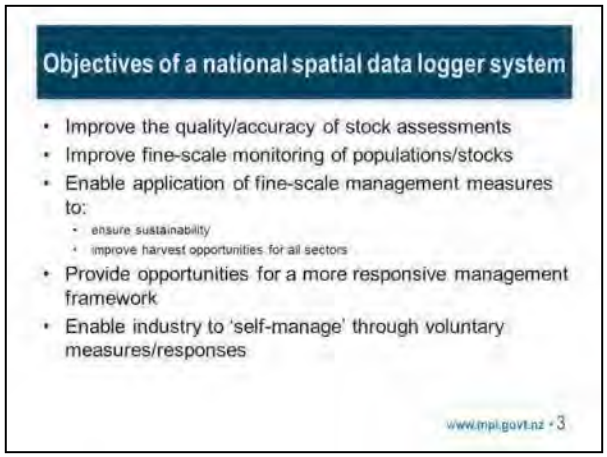
Producers of the hardware and downloading system

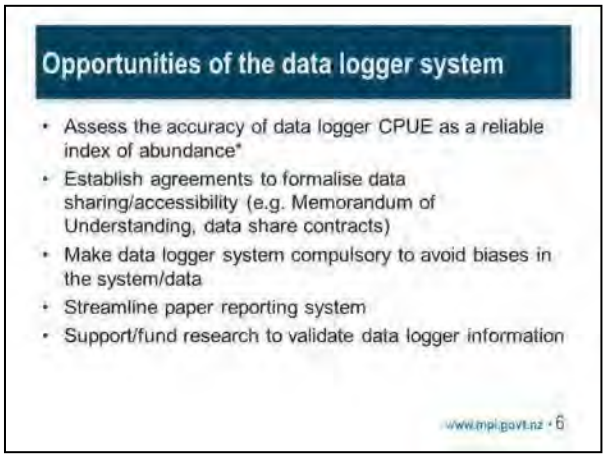
www.zebratech.co.nz

Appendix 3.11. Management Perspective NZ









Threats to the data logger system

- Funding/cost-effectiveness of investing/maintaining the data logger system
- Technical failures
- Accountability of the system if use is compulsory/regulated
- Not all the data that is required to meet Government objectives/needs is provided
- Expectations of what the data can and should be used for are beyond available resourcing

Conclusions

- Real opportunity to advance management of paua/abalone fisheries
- Early indications are the data collected are meaningful and useful
- The real benefits are only as good as the efforts/resources applied to it
- Where to draw the line, where does the costs/benefits 'peak'

Potential for a national roll out

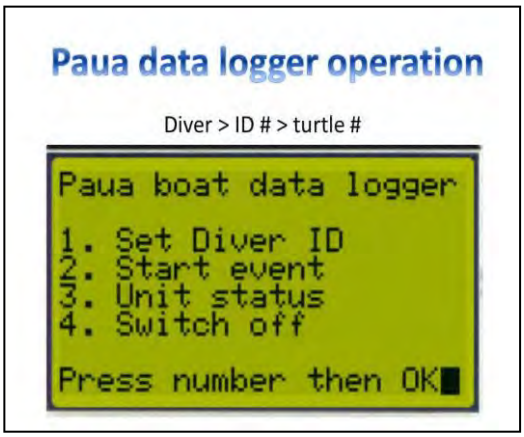
- Consider what coverage we have to date
- Consider the infrastructure that is currently in place
- Funding: hardware, software, analyses,
- Consider the cost and benefits of a national roll out
  - Is the data logger CPUE a reliable index of abundance?
  - Does this system provide other stock health indicators?
  - Accuracy or quality of information obtained currently through voluntary use versus a compulsory requirement to use the system
  - Compliance costs

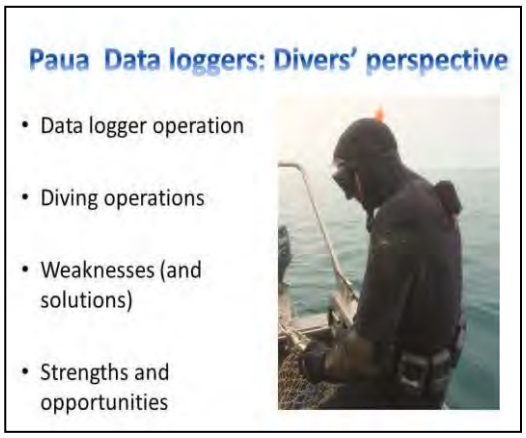
Ministry for Primary Industries
Manatū Ahu Matua

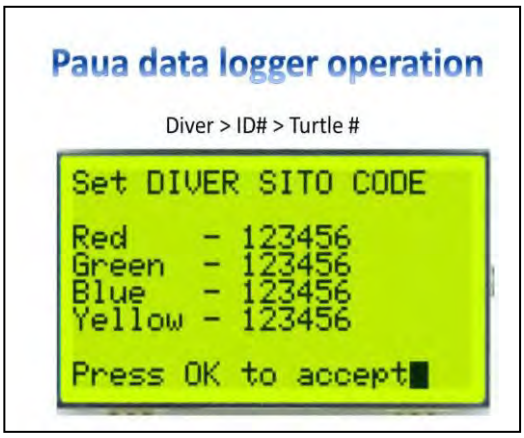
Thank You

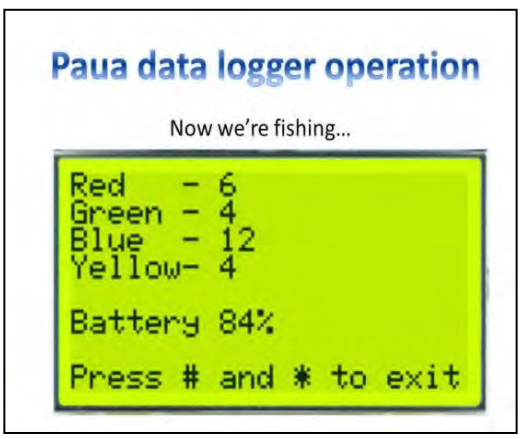
www.mpi.govt.nz

Appendix 3.12. Industry Perspective









Paua data logger operation


Paua data logger operation

Paua data logger operation

Now we're fishing...

```
Red    - 6
Green  - 4
Blue   - 12
Yellow- 4

Battery 84%

Press # and * to exit
```

Paua data logger operation

Other information

```
Swell height ___cm
Visability   ___m
Boat boy     No
Cat Sam Tag  12345


Press OK to accept
```

Paua data logger operation

Entering catch data

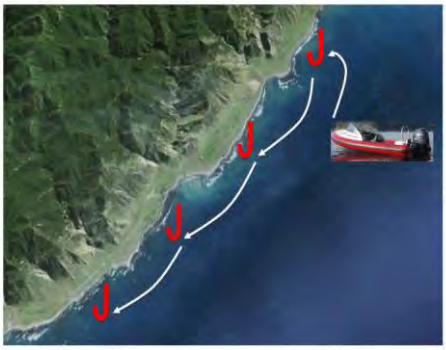
```
Edit catch data
Red    (123456) ----Kg
Green  (123456) ----Kg
Blue   (123456) ----Kg
Yellow(123456) ----Kg
Total                Kg

Press OK to accept
```

NZ paua diving operations

- Boat diving
  - with boat boy
  - without boat boy
- Shore diving

Diving operations: with boat boy

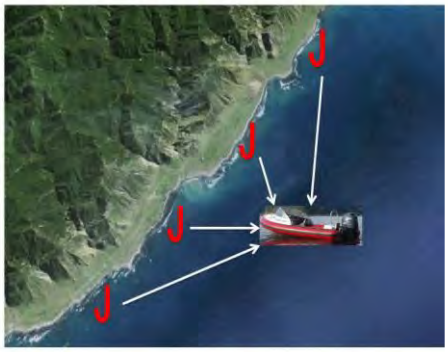


Paua Data loggers: Weaknesses (and solutions)

Operation issues

- Time consuming
- More gear to use and things to remember (charging etc)
- Misunderstanding about the need for boat and turtle unit information
- 'Boat' unit for shore diving
- Lack of familiarity with uploading data, updating software etc.

Diving operations: without boat boy



Paua Data loggers: Weaknesses (and solutions)

Hardware issues

- Reliability of turtle units
- Some charging issues
- Outboards interfering with boat units
- Keypad malfunctions on boat logger
- Screen size

Diving operations: shore diving

Paua Data loggers: Weaknesses (and solutions)

Data security issues – publicizing secret spots

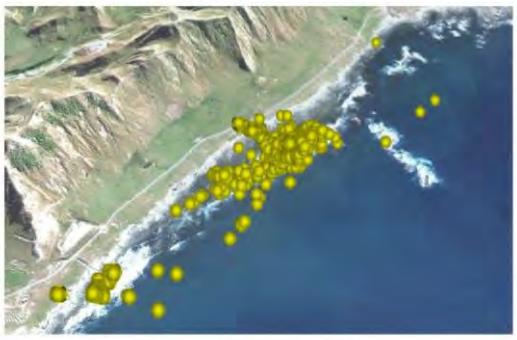
- Human error leading to data sharing between crews
- Data theft?

Paua Data loggers: Strengths and Opportunities

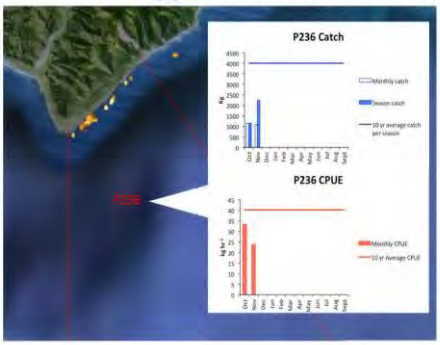
Operator level:

- Improve the efficiency of fishing

Paua Data loggers: Strengths and Opportunities



Paua Data loggers: Strengths and Opportunities



Paua Data loggers: Strengths and Opportunities

QMA level:

- Finer scale management
- Link with QMA based management:
- Using air on Chathams (diving deeper?)
- Changes to size limits
- Fishing stunted stocks

Paua Data loggers: Strengths and Opportunities

Operator level:

- Improve the efficiency of fishing
- Monitor individual diver coverage (in your crew)

Paua Data loggers: Strengths and Opportunities

Paua Data loggers: Strengths and Opportunities

QMA level:

- Finer scale management
- Link with QMA based management:
- Using air on Chathams (diving deeper?)
- Changes to limits
- Fishing stunted stocks
- Compliance

Paua Data loggers: Strengths and Opportunities

QMA level:

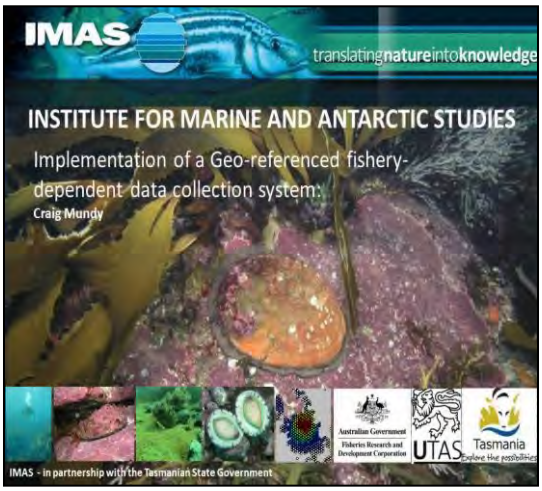
- Novel metrics for fisheries monitoring
- Evidence for catch history/displaced catch in spatial allocation issues
- Public perception of industry

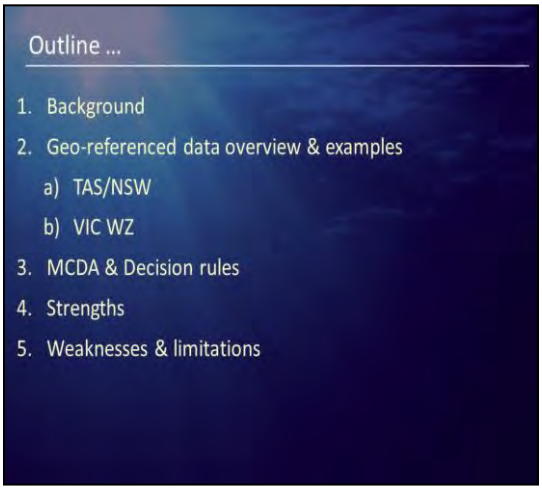
Paua Data loggers: Strengths and Opportunities

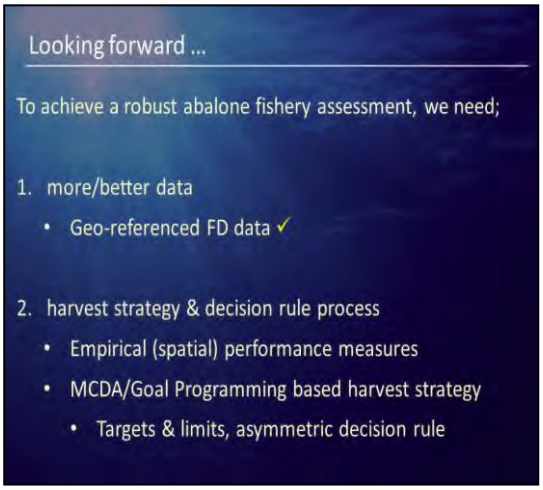
MPI level:

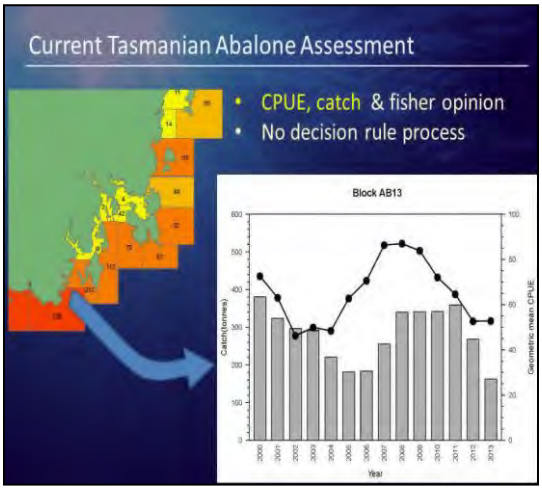
- Ultimately remove the need for paperwork (real-time reporting)
- More reliable, accurate and cheaper inputs for stock assessments
- Data for discussions around shelving and other management measures

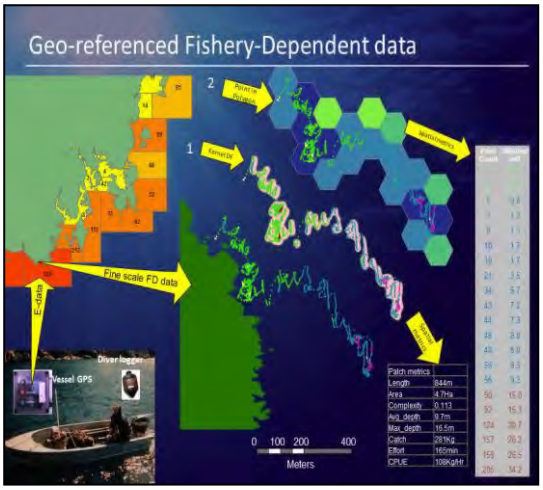
Appendix 3.13. Tasmanian GPS System





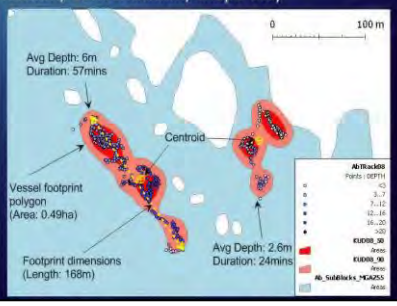






Geo-FD data 1: Dive events as a sample unit

- Characterise each dive (vessel footprint, location, dimension, concentration, shape etc)

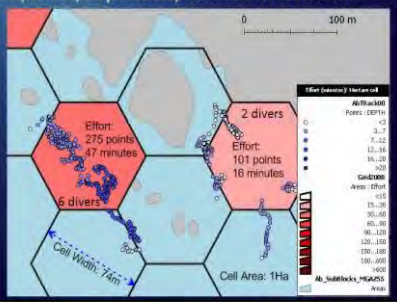


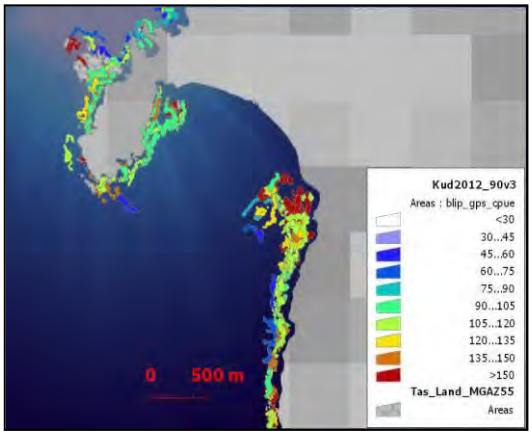
Key spatial indicators of change: Fisher's view

1. Increase/decrease in dives per day
2. Increase/decrease in short unproductive dives
3. Change in rate of swimming
4. Change in frequency of long dives with little catch
5. Change in frequency of return to known sites
6. Depletion of safe anchorages
7. Etc

Geo-FD data 2: Exploitation of specific reef areas

- Characterise exploitation at a specific location (total effort, catch, days fished, number of divers etc





The project: FRDC 2011/201 - Tasmania

- Mandatory use GPS & Depth loggers (2012 - 2015)
  - ~120 fishers
  - ~2100 tonnes abalone (~$80million)
  - > 23,000 dives mapped in 2012
    ~ 21,000 hours of fishing
- Loggers issued/returned quarterly
  - AusPost eParcel contract
- Data screened and uploaded
  - Low level automation
- Daily catch data mapped to spatial/depth data

Seven brief examples of spatial PM's

1. Site fidelity – nearest neighbour methods
2. Short unproductive dives
3. Change in frequency of long dives with little catch
4. Rate of swimming
5. Kg/Ha & Concentration area curves
6. Hotspot analysis/LISA
7. Effort depth profile

1. Site Fidelity/ Diver overlap / revisit times

- For every dive in SAU during 2012;
  - Find neighbour dives (<=50m)
  - Record the diver identity
  - Record the date of the matched dives
  - Record difference in catch rate

  (Exclude dives on the same day if same diver)

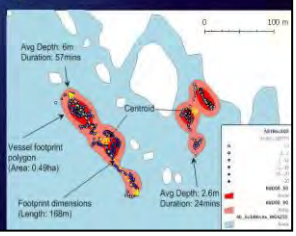
- Indicator of overlap in reef use by same divers
- Indicator of overlap in reef use by different divers

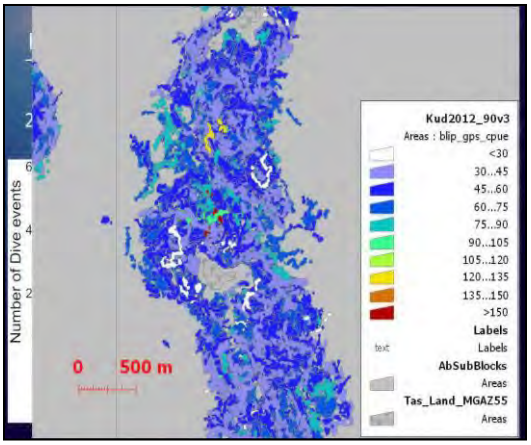
2 & 3. Short dives & big swims

Short Dives (dive <= 15mins)

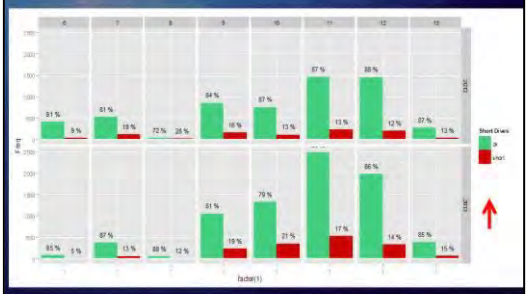
Long unproductive swims

- Dive events spanning more than 200m of coast & catch < 50Kg

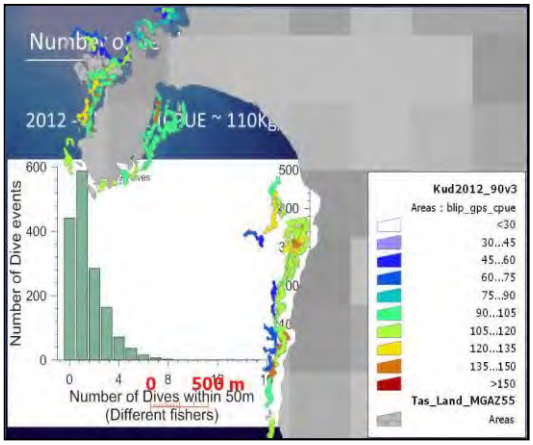




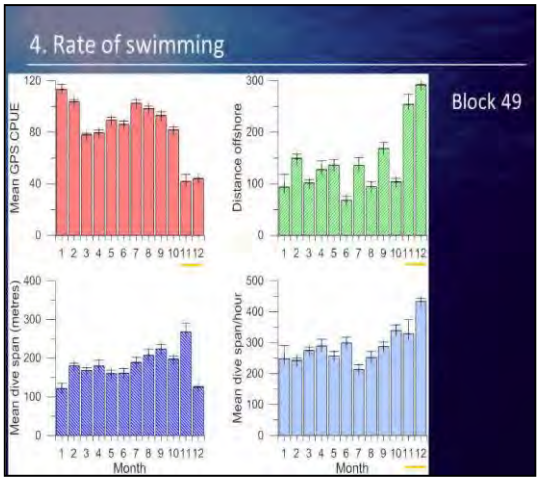
Short dives – Western Zone

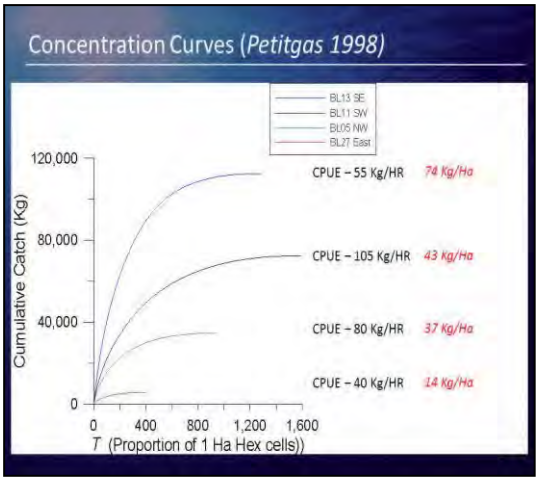


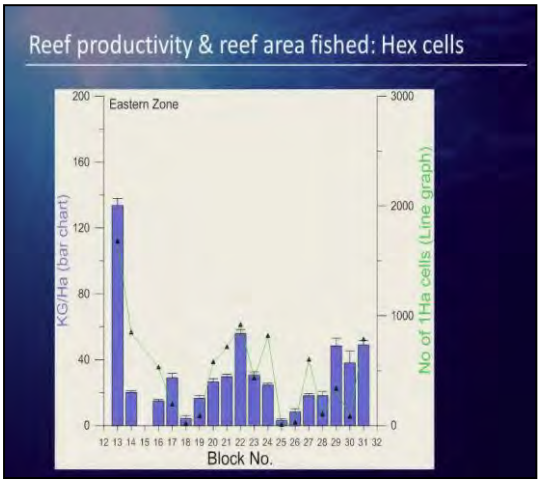
N.b. CPUE declines across all reporting blocks between 2012 & 2013

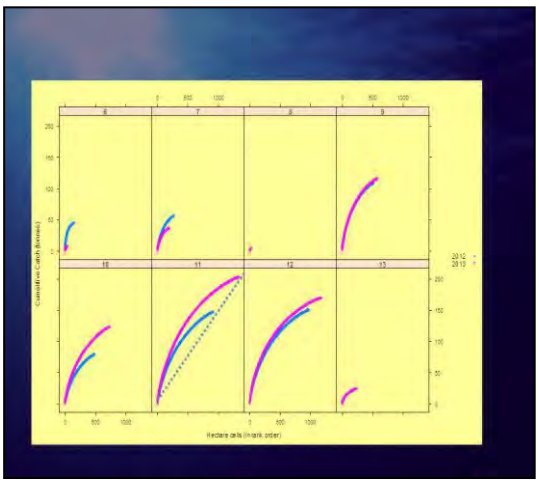


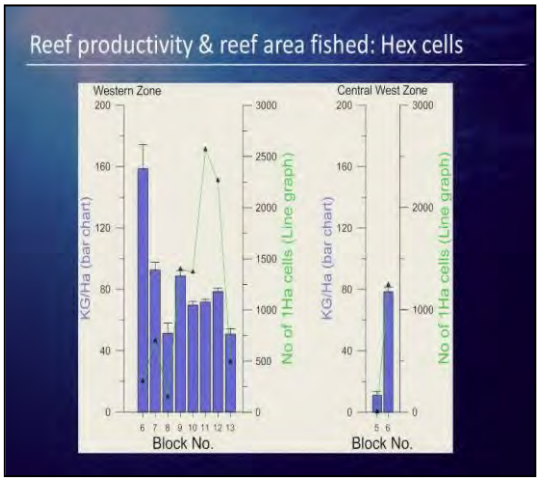
Big swims– Western Zone

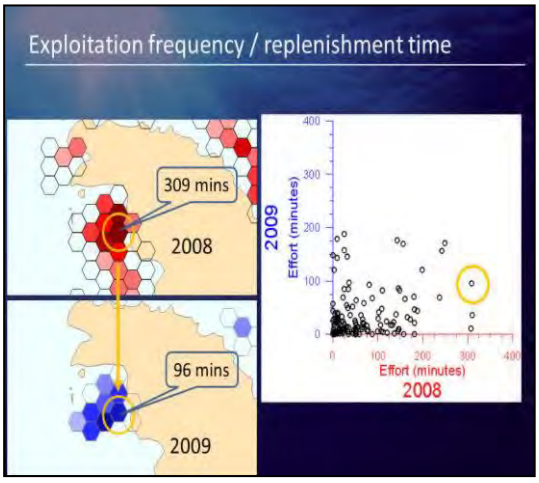

4. Rate of swimming
Block 49
Mean GPS CPUE
Distance offshore
Mean dive span (metres)
Mean dive span/hour
Month
Month

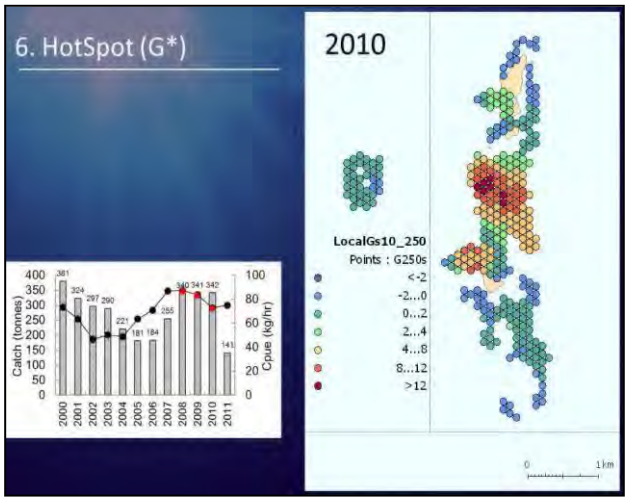

Concentration Curves (Petitgas 1998)
BL13 SE
BL11 SW
BL05 NW
BL27 East
Cumulative Catch (Kg)
120,000
80,000
40,000
0
CPUE – 55 Kg/HR 74 Kg/Ha
CPUE – 105 Kg/HR 43 Kg/Ha
CPUE – 80 Kg/HR 37 Kg/Ha
CPUE – 40 Kg/HR 14 Kg/Ha
0 400 800 1,200 1,600
T (Proportion of 1 Ha Hex cells))

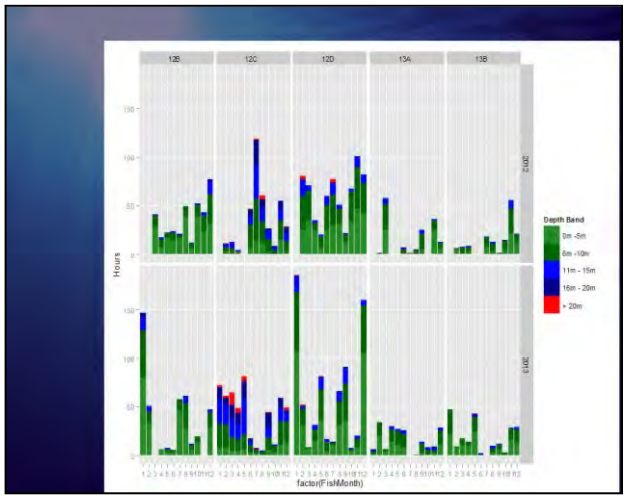

Reef productivity & reef area fished: Hex cells
Eastern Zone
KG/Ha (bar chart)
No of 1Ha cells (Line graph)
Block No.

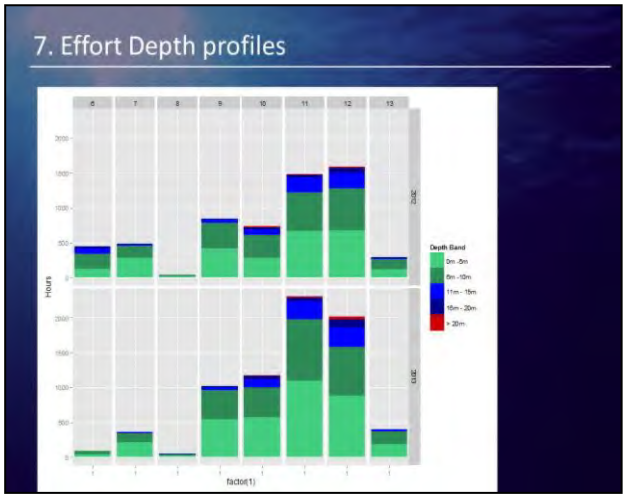


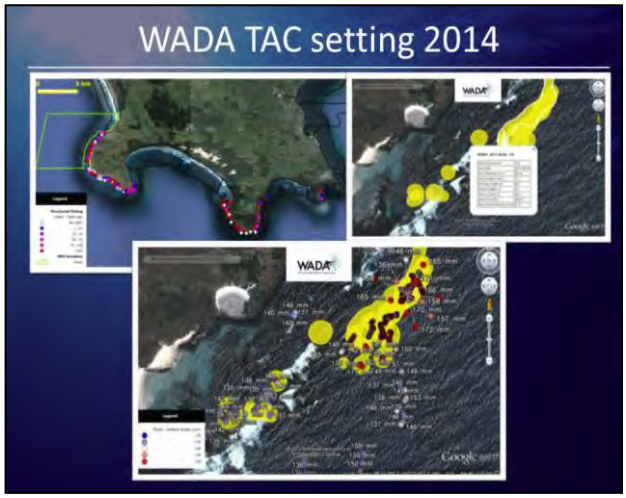

Reef productivity & reef area fished: Hex cells
Western Zone
Central West Zone
KG/Ha (bar chart)
No of 1Ha cells (Line graph)
Block No.
Block No.

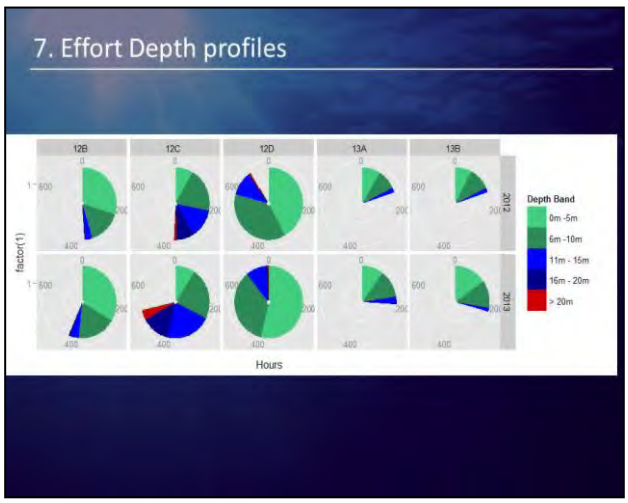

Exploitation frequency / replenishment time
309 mins
2008
96 mins
2009
2009
Effort (minutes)
Effort (minutes)
2008


6. HotSpot (G*)
2010
LocalGs10_250
Points : G250s
<-2
-2...0
0...2
2...4
4...8
8...12
>12
Catch (tonnes)
Cpue (kg/hr)
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011


12B
12C
12D
13A
13B
Hours
Depth Band
0m -5m
6m -10m
11m - 15m
16m - 20m
> 20m
factor(FishMonth)


7. Effort Depth profiles
Hours
Depth Band
0m -5m
6m -10m
11m - 15m
16m - 20m
> 20m
factor(1)


WADA TAC setting 2014
WADA
WADA
Google


7. Effort Depth profiles
12B
12C
12D
13A
13B
2012
2013
factor(1)
Hours
Depth Band
0m -5m
6m -10m
11m - 15m
16m - 20m
> 20m


Crags, strata and 2012-13 heat map
Strata area = 39.7 Ha
2009 density = 610 kg.Ha-1
2012 density =438 kg.Ha-1
Fishing area = 83 Ha
2012-13 density = 440 kg.Ha-1

Crags, 2012-13 and 2013-14 area

Revised biomass

Area	Scenario	Density (kg.Ha⁻¹)	Area (Ha)	Biomass (t)	Catch 2013-14	Harvest fraction		
						5%	7.5%	10%
Mills-Killarney	≥130	390	265	103	9.7	5.2	7.8	10.3
Levys-Wpier	≥130	490	78	38	0.1	1.9	2.9	3.8
Grant-LwRx	≥130	390	43	17	1.2	0.8	1.3	1.7
Nelson	≥130	810	121	98	8.1	4.9	7.4	9.8
Bridgewater	≥130	1060	88	93	10.2	4.7	7.0	9.3
	≥135	770	124	96	0.9	4.8	7.2	9.6
Port Fairy	≥130	920	117	108	8.3	5.4	8.1	10.8
	≥135	610	71	43	5.2	2.2	3.2	4.3
Port Fairy (rev biomass)	≥130	593	117	69	8.3	3.5	5.2	6.9
	≥135	252	71	18	5.2	0.9	1.4	1.8
Total					43.7	29.9	44.9	59.6
(rev biomass)						26.7	40.2	53.2

Crags, last 3 years area

Crags, mean length 2012-13

Fishing effort at Bridgewater

Crags, mean length 2013-14

Crags, mean depth

Mechanics of the MCDA approach

For each spatial unit;

	CPUE	CPUEHist	CatchDev	30min Dives	
Criteria Weight	0.4	0.2	0.1	0.3	(Sum to 1)
Criteria Score	a	b	c	d	
	0.4 x a	0.2 x b	0.1 x c	0.3 x d	SUM(LEFT) Value : 0 - 10

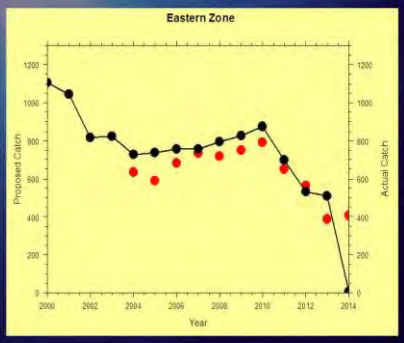
TAC Decision Framework

(Dichmont & Brown (2010) *A Case Study in Successful Management of a Data-Poor Fishery Using Simple Decision Rules: the Queensland Spanner Crab Fishery*)

Score	0	1	2	3	4	5	6	7	8	9	10
TAC Adjustment	-20%	-15%	-10%	-5%	NC	NC	NC	5%	5%	10%	10%

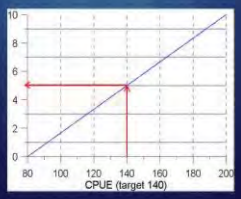
Harvest Strategy/Control Rules

- Spatial Information
  - Demonstrated capacity to deliver valuable information for fishery management
  - How do we use this information in a decision process???



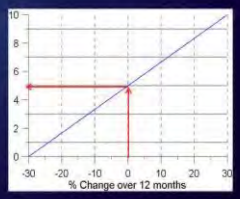
Criteria - CPUE

CPUE 1: Agreed CPUE Target



Target 140 Kg/Hr

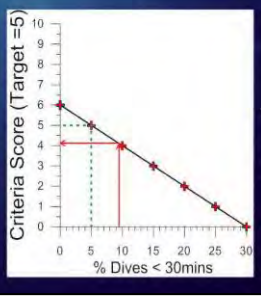
CPUE 2: % change in 12 months



Target 0% change

Scoring function – Spatial PM's

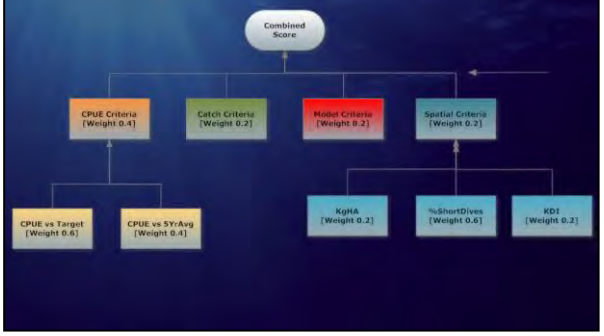
e.g. % short dives (< 15mins)



Target dives < 15 mins = 5%

EZ Block 13
2012 < 15 mins = 9%
2013 < 15 mins = 8%

Hierarchical DSS



Strengths

- Provides broad range of precise information
- Avoids issues associated with using effort
- Cost-efficient

Acknowledgements

IMAS AbTRack Team

Malcolm Haddon
DPIPWE & Abalone Council
Gerald (SciElex)
UTAS & FRDC for financial support

Weaknesses

- Catch per day
  - catch/dive preferred
- Manual uploads
  - Automation of uploads
- Quarterly data retrieval
  - Limits use of information in decision process
- Hardware reliability
  - Harsh environment electronics!!

Appendix 3.14. Management Perspective for Tasmania

Use of loggers mandated 2012

- Need > 80 % data coverage of divers;
- Legal instrument drafted by Office of the Solicitor-General;
- Industry question over whether a policing tool (spatial management tool?);
- But, ultimately, a low number of complaints & legal threats given the sensitivities.

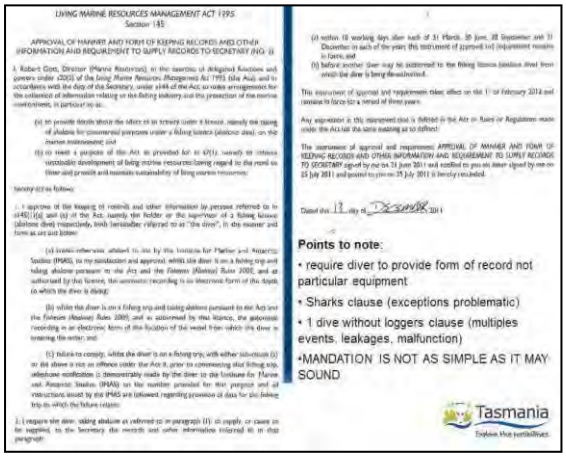
Tasmania
Explore the possibilities

Results of loggers

- Validation of longitudinal paper-docket dive time and depth estimates
- New performance indicators:

1. **Depth:** The mean of the average depth for each dive based on depth logger data.
2. **GPS CPUE**: The mean CPUE, using reported catch & effort from the depth logger.
3. **Length of dive**: The maximum length in metres of the dive, i.e., the largest span of each dive event.
4. **Length of dive per hour**: The length of dive taking into account the time taken to cover that distance.
5. **Distance to coast**: The distance from the centroid of the dive event to the nearest point on the shore.
6. **Kg/Hectare**: The total catch taken in each 1 Hectare grid cell for each quarter.

Tasmania
Explore the possibilities



LIVING MARINE RESOURCES MANAGEMENT ACT 1995
Section 145

APPROVAL OF MANNER AND FORM OF KEEPING RECORDS AND OTHER INFORMATION AND REQUIREMENT TO SUPPLY RECORDS TO SECRETARY (No. 1)

Points to note:

- require diver to provide form of record not particular equipment
- Sharks clause (exceptions problematic)
- 1 dive without loggers clause (multiples events, leakages, malfunction)
- MANDATION IS NOT AS SIMPLE AS IT MAY SOUND

Tasmania
Explore the possibilities

Strengths	Weaknesses
Mandatory	Mandatory
Good coverage of all dives	Must be supported to ensure effective operation, operators have functioning systems and data is collected. Organising people takes time and effort. Handling of loggers, break downs, data - etc. IMAS 1.5 FTE? **Resources, people and money**
Automation	Diver sensitivity
Currently good acceptance	Questions re enforcement
Support slipping?	(rules, MAST etc)
Improved stock assessment, new better indicators?	Logistics of technology
	Consequence of non-compliance
	Swapping loggers
	"Ladder" of consequence - goodwill
Collects accurate, fine scale complex data (lots).	Breakdowns, 'human factor'
Manipulation for more detailed and nuanced performance indicators	Requires storage of large data sets
How much better are they?	Manipulation and analysis of lots of data, presentation
Good acceptance	Who coordinates which parts (who, how who pays how much)
Potential for fine scale management and 'fish downs'	Questions re enforcement
	Potential for increased resistance
	Currently, duplication of systems, still needs catch from other source (i.e. effort but not catch)
Validation of paper cpue	Parallel systems
Benefits of removing paper process	Resourcing
Cost savings?	Funding IMAS & DPIPWE
Speed and efficiency	[illegible]

Objective: cost effective stock assessment and appropriate advice to support setting TAC and other decisions

Tasmania
Explore the possibilities

Roll-out of loggers

- Quarterly download, as per legal instrument;
- Postal tracking failure but exchanges generally work okay and improve over time (DPIPWE policing from year 2);
- Requires resources for logistics and oversight;
- DPIPWE $ for loggers (~$100,000) (for divers, police, damage & loss, new models).

Tasmania
Explore the possibilities

Questions as project moves to completion

- To continue with loggers?
- Ongoing logger logistics: who pays? Technical support?
- Who polices?
- Data logistics?
- Funding within DPIPWE & IMAS
- Future direction of fishery assessment
- Diver resistance?

Tasmania
Explore the possibilities

For the workshop

Where are the benefits

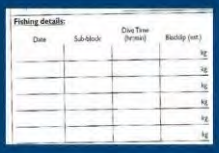
Exactly what is being considered – What is the question

Costs and benefits – different wants

Options for collaborations for fisheries under different jurisdictions, management and research regimes?

Tasmania

Fishing details section of the new commercial abalone dive docket



- Halved the number of columns – loses low quality fields.
- Supplies catch and effort (by diver estimates)

Tasmania

Introduction of GPS loggers into the Tasmanian abalone fishery

Grant Pullen
West Fisheries Management
Marine Resources Division
DPIWE

Tasmania

Parallel data from loggers

- **Parallel** data from loggers except for estimated kilograms (i.e. effort at a high resolution but no catch)
- Loggers can provide date, GPS coordinates instead of sub-block, depth measure instead of range, drops, total dive time, etc.
- Lost 'conditions' off the old docket (qualitative)
- Importantly, replaced human diver record with auto-record (accuracy improved, truth sensitivity [re dive code, MAST regulations, fishery rules, etc.])

Tasmania

Fishing details section of the old commercial abalone dive docket

Fishing Details		Dive time (h:min)					
Date	Block	0-10 m	10-20 m	>20 m	Cond.	Drops	Blacklip(wt.)
		:	:	:			kg
		:	:	:			kg
		:	:	:			kg
		:	:	:			kg
		:	:	:			kg

Sub-block used

Depth used occasionally, total dive time used

Conditions and drops unreliable, not used

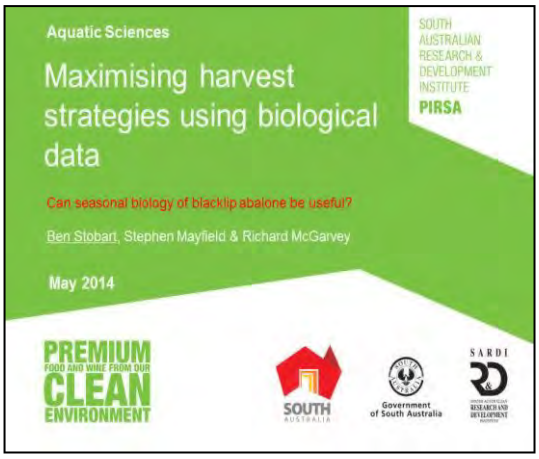
Tasmania

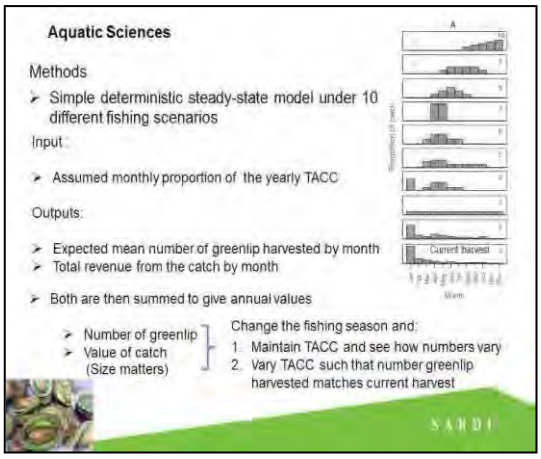
Introduction of loggers: north-west trial

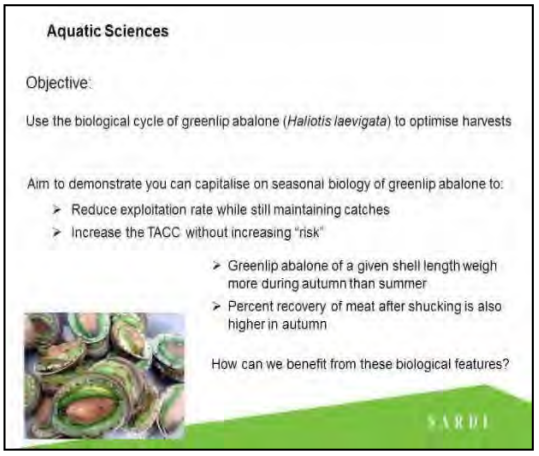
- Commenced 2008;
- Voluntary ;
- Linked with reduced size limits in the north-west;
- Could conclude if logged divers fished differently (they didn't), but not re larger size limit divers;
- Needed greater logger coverage of divers to generalise to area, biomass, etc.;
- Loggers present future opportunity for periodic fishdowns?

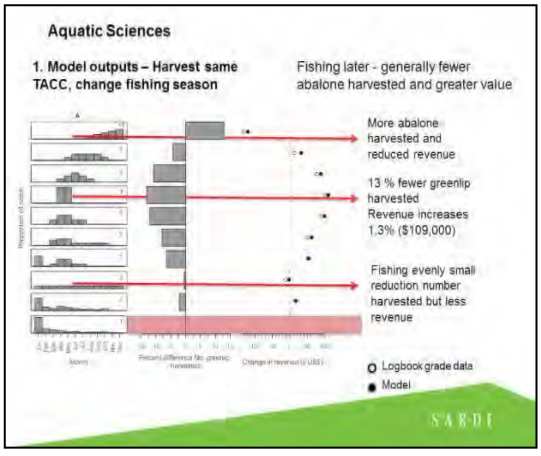
Tasmania

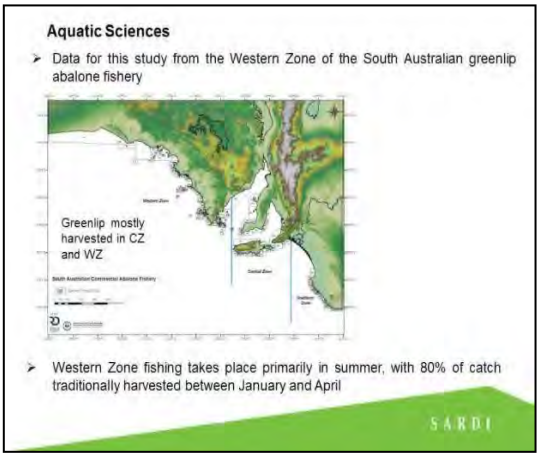
Appendix 3.15. Use of Biological Data

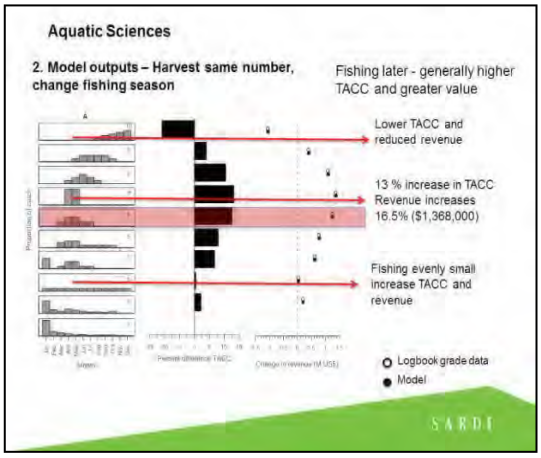






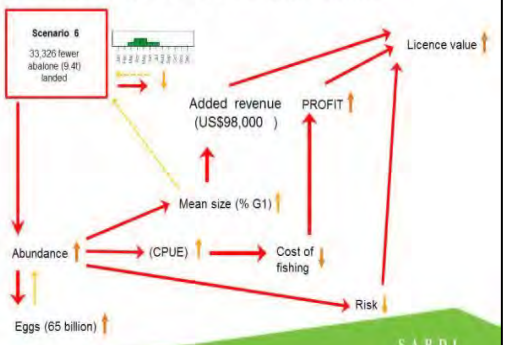






Aquatic Sciences

1. Benefits of harvesting same TACC and changing fishing season?



SARDI

Aquatic Sciences

Implementation should consider how to:

- Maintain the market serviced with quality product
- Facilitate cash flow
- Manage risk and cost of product storage (freezer breakdown, product quality, fluctuation in currency markets)
- Access to fishing grounds (weather)

SARDI

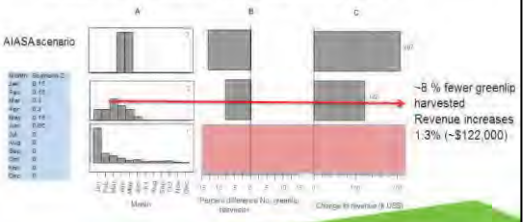
Aquatic Sciences

2. Benefits of harvesting same number and changing fishing season?

SARDI

Aquatic Sciences

- Divers have long been aware of seasonal differences
- Study originated from conversations between SARDI and the Abalone Industry Association of South Australia (AIASA)
- In 2013 AIASA asked us to run a specific scenario with updated grade costings
- Exploration of the scenario with view to increasing the TACC was not considered
- Members voted to accept Jan-Feb 15% cap starting in 2015

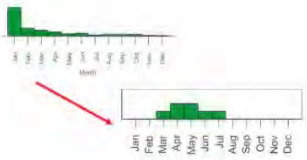


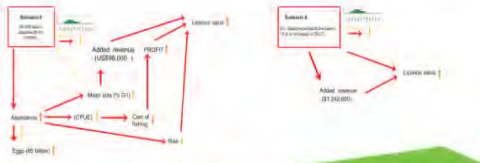
SARDI

Aquatic Sciences

Advantages seem clear

But how do we capitalise on the advantages?





SARDI

Aquatic Sciences

Conclusions

- Understanding the seasonal biology of an exploited quota-managed species can achieve improved biological sustainability and increase profitability, or allow increases to the TACC without increasing risk
- For greenlip, there are clear biological and economic advantages to targeting fishing in the autumn months
- Up to 33,000 abalone could be left in the water each year

  Ultimately this will lead to:
  - A reduction in risk to the fishery
  - Likely future increases in TACC
  - An increase in the value of fishing licences

- Alternatively the TACC could increase up to 13%

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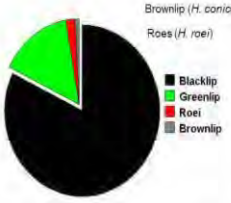
Four species harvested

Blacklip (*H. rubra*)
Greenlip (*H. laevigata*)
Brownlip (*H. conicopora*)
Roes (*H. roei*)



Do blacklip exhibit similar seasonal variation? (>75% of Australian catch)

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Information required?

- Tasmania, South Australia, Victoria (most blacklip)

Data sources for the model

1) LF of commercial catch
2) shell length – whole weight relationship
3) Whole weight – bled meat weight (% recovery)

- Need for systematic sampling (spatial and temporal)

Distribution of production

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Would the benefits we see for greenlip carry over to blacklip?

- Opinion - the seasonal difference is not as clear cut as for greenlip?
- Much of market is canned - Is there demand for larger blacklip?
- How would larger blacklip affect harvesting patterns?
- Live market – bled meat weight not relevant
- Premium paid for large sizes?
- Weather more critical for access to fishing grounds

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Thank you

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