Global Sustainability of Billfish -
Research, Assessment and Management in the 21st Century

Radisson Plaza Hotel
Cairns Australia
19 - 23 August 2001

Event Manager
OzAccom
Conference Services
PO Box 164
Fortitude Valley
QLD 4006
Telephone
07 3854 1611
International
+61 7 3854 1611
Facsimile
07 3854 1507
International
+61 7 3854 1507
Email
billfish2001@
ozaccom.com.au

International Host Body

The Third International Billfish Symposium

Principal Investigator
Dr John Glaister

Project No. 2000/192

Table of Contents

Non-Technical Summary

FRDC Project 2000/192
The Third International Billfish Symposium held in Cairns, Queensland on 19 – 23 August 2001.

Principal Investigator: Dr John Glaister
Address: Sport & Recreation Queensland
PO Box 187
BRISBANE QLD 4001
Tel: 07 3237 1356
Fax: 07 3235 4723
Email: john.glaister@srq.qld.gov.au

Objectives:

1. Organise the Third International Billfish Symposium
2. Publish the Proceedings of the Symposium
3. Conduct a workshop entitled Management of the Australian Billfish Fishery.

Non-Technical Summary:

The Third International Billfish Symposium was hosted by The Billfish Foundation, an international non-profit organisation with a very clear objective: the conservation and enhancement of billfish populations through scientific research, education, and advocacy. The Symposium was held 19 – 23 August 2001 at the Radisson Plaza Hotel, Cairns.

The Symposium was a landmark meeting which brought together the world's leading billfish researchers and managers to present papers and discuss the future of billfish on a global scale.

The Symposium was anticipated by the world's fisheries community for some time. There had been two previous International Billfish Symposia. Both were held in Hawaii, the first in 1972, and the second in 1988. Those meetings were watersheds in the advancement of knowledge of these important fishes, but since the last meeting in 1988, little worldwide attention had been focused on the group as a whole.

The 2001 Symposium provided an opportunity for the latest information on billfish to be presented to a fully international audience. The Symposium more importantly stimulated scientists around the world to conduct the work necessary to attempt reliable stock assessments of billfishes in the three major oceans of the world. Exciting developments have taken place recently in the field of electronic tag technology and some of these results were presented at the Symposium.

The Symposium was very successful, attracting 108 registrants from 21 countries.

The overall Symposium theme was Global Sustainability of Billfish – Research, Assessment and Management in the 21st Century. Abstracts were called from throughout the international Billfish community to address the theme and the following subthemes.

Subthemes

- Stock structure of the world's billfishes (based on recent genetic studies and tagging data)
- Stock assessment of billfish populations (stimulated by the holding of the Symposium).
- Biological studies (including age and growth, reproduction and behavioural studies)
- Management of the world's billfish
- Socio-economic value of billfish (both commercial and recreational, and including consideration of cost-benefits to developing island nations)
- The status of broadbill swordfish around the globe

In total 51 oral and 14 poster presentations were presented.

Seven keynote speakers were invited to present the leading papers to each theme. These were:

1. Big Fish Down Under: A Brief History of Contact between Billfish and Man – Dr Julian Pepperell, Pepperell Research & Consulting Pty Ltd, Australia
2. Stock Structure of the World's Billfishes – Professor John Graves, Virginia Institute of Marine Science, USA
3. Historical Perspective of Global Billfish Stock Assessment - Yuji Uozumi, National Research Institute of Far Seas Fisheries, Japan
4. Billfish Biology – Dr Kim Holland, Hawaii Institute of Marine Biology, USA
   Social and Economic Benefits of Billfish Fisheries – Professor Robert Ditton, Texas A&M University, USA
5. Management of the World's Billfish - Dr Bill Hogarth, National Marine Fisheries Service, USA **(presented onsite by Dr Jill Stevenson)**
6. The Status of the Broadbill Swordfish: Experience from the Atlantic to Mediterranean – Mr Gerry Scott, National Marine Fisheries Service, USA **(presented onsite by Dr Victor Restrepo of ICCAT)**

The Symposium received excellent national and international financial support – the major funding providers was The Billfish Foundation. This combined with the funding from FRDC ensured that the Symposium did not run at loss.

What has The Third International Billfish Symposium achieved?

- An international focusing of attention on billfish biology and fisheries, the first such major meeting since 1988.
- Bringing together a high proportion of the world's specialist researchers and managers who are concerned with billfish.

- The presentation of 51 papers and 14 posters, many of which were major new contributions to the understanding of billfish biology, behaviour, fisheries and stock status.
- New stock assessments being undertaken for several important billfish species.
- A report on a workshop held during the Symposium to assist future management of billfish by Australian managers.
- Increased personal contact and cooperation among the far-flung researchers and managers concerned with billfish.

Acknowledgements

The following organisations should be acknowledged for their financial and promotional support:

International Host Body

The BILLFISH FOUNDATION
CONSERVATION THROUGH RESEARCH EDUCATION AND ADVOCACY

Sponsored by:

Joint Principal Sponsors:

FISHERIES RESEARCH & DEVELOPMENT CORPORATION

AUSTRALIA
Department of AGRICULTURE FISHERIES & FORESTRY - AUSTRALIA

AGRICULTURE FISHERIES FORESTRY

Major Sponsor

NOAA Fisheries

Sponsors

CSIRO
MARINE RESEARCH

GFAA RESEARCH & DEVELOPMENT FOUNDATION

Media Supporter

TRADE-A-BOAT'S
BlueWater
BOATS & SPORTSFISHING

Background

Billfish stocks are an important recreational and commercial fisheries resource in Australia, and have significance in terms of international management and treaty obligations, due to their high migratory nature. Australian pelagic research has been principally directed towards SBT and more recently, Yellowfin Tuna, whilst Billfish stocks have been largely ignored. Recent Billfish research has been limited to analyses of long-term tagging results from the gamefish tagging program and more recent smart-tag work by Pepperell-CSIRO on migratory pathways. The only other work of note is that of Williams (AIMS), who analysed long line CPUE data. An increasing interest in fisheries management has been shown by Australian agencies and organisations not traditionally involved in fisheries. This has been especially so in the World Heritage Area within the Great Barrier Reef. Billfish stocks could become increasingly important to fisheries agencies and commercial and recreational fishing sectors. The Symposium represented a strategic opportunity for involvement and a world-class program was developed to ensure greater understanding of this important resource.

Need

The Third International Billfish Symposium was anticipated by the world's fisheries community since the previous two such meetings (1972,1988) were watersheds in the advancement of knowledge of these important fishes. There have been significant increases in the world's understanding of Billfish species stock structure and population dynamics, and corresponding increases in concerns for some global stocks. The Australian populations of Billfishes occur in waters off most States and are especially well represented in the region of the Great Barrier Reef. Much of this area has been recently declared to be of World Heritage value and management arrangements for natural resources has been under considerable scrutiny from agencies and organisations not usually concerned with fisheries management. There was a need to examine the global status of our understanding of these fishes and the management regimes adopted around the world. The Broadbill Swordfish is in decline in parts of the Northern Hemisphere and remedial action is needed to protect these stocks. Australia, by hosting the Symposium, benefited from an understanding of past and present management practices for this species.

Objectives

1. Organise the Third International Billfish Symposium

2. Publish the Proceedings of the Symposium

3. Conduct a workshop entitled *Management of the Australian Billfish Fishery*

Methods

Organisation

The Symposium Organising Committee was established to oversee the development and implementation of the Symposium. Members of the committee included prominent representatives from the Billfish community, both nationally and internationally.

In order to develop and organise the program schedule, a Program Committee was established. This committee was responsible for the selection of keynote speakers, the abstract review process and the final scheduling of presentations.

Both the Symposium Organising Committee and the Program Committee were supported by the Professional Conference Organiser.

Destination

An important decision was the selection of an appropriate location for the Symposium. It was decided that Cairns was the preferred location for a range of reasons:

Cairns is internationally recognised at the main marlin fishing destination in the world, a fishery which has been sustained for over 30 years. The main reason for this is that 99% of the billfish are tagged and released. Researchers have employed 'state of the art' technology – satellite tagging and global positioning systems – in co-operation with operators, to monitor and collect scientific information about the billfish movements and stock structure.

Facilities

The Symposium was held at the Radisson Plaza Hotel Cairns which was an ideal venue for the event. The Radisson was large enough to accommodate all sessions, the trade exhibition, the Welcome Reception and Symposium dinner, therefore, allowing ample opportunities for delegates to discuss issues 'out of sessions'.

Results/Discussion

Attendance

Delegate Breakdown by Registration Code
A total of 108 delegates attended the conference. The Registration type breakdown was as follows:

Registrations – Early Bird
86 Fulltime delegates
2 Student
1 Day (Tuesday) delegate

Registrations – Full
19 Fulltime delegates

Delegate Breakdown by Country

47 Australia
1 Bermuda
1 Canada
1 Chile
1 Federated States of Micronesia
2 France
1 Italy
5 Japan
1 Malaysia
4 Mexico
1 New Caledonia
5 New Zealand
1 Papua New Guinea
1 Republic of China
1 Seychelles
1 Solomon Islands
1 South Africa
2 Spain
1 United Arab Emirates
29 United States of America
1 Venezula

Symposium Program

The effort put in by all members of the Program Committee, chaired in Australia by Dr Julian Pepperell, ensured that the program was topical and relevant. The sessions were very well attended, even up to the last afternoon, highlighting the quality of the speakers and papers presented.

Posters

A poster program complemented the oral program. Fourteen authors presented their work via the poster format.

Workshops

One main workshop was offered to delegates and this was the FRDC initiative *Management of the Australian Billfish Fishery.* The main aim of this workshop was to explore the experience of members participating in the Symposium including options for future management of the Australian Fishery. There was no charge to delegates for attending the workshop. The workshop was extremely well attended, and lively discussion from the floor ensured that many points of view were put. The experiences of many overseas agencies in management of billfish were heard. A full summary of the workshop was prepared by Mr Peter Rogers and Dr Julian Pepperell, and is appended to this report.

Social Program

The Symposium social program consisted of a welcome reception, two happy hours and the dinner.

The welcome reception was held at Tjapukai Aboriginal Cultural Park and was attended by just over 100 people. Members of the local Billfish industry attended the function. The evening was a mixture of Aboriginal performances and networking for the delegates. Many delegates (both international and national) commented how excellent the evening was. It certainly help set the tone and atmosphere for the Symposium.

Two happy hours were held around the trade and poster area at the conclusion of the day's sessions. This allowed the delegates ample opportunity to view the trade and poster displays.

The Symposium dinner was the highlight of the social program and was held on the final night after the business part of the Symposium had concluded. Over 120 people attended the dinner.

Benefits

Fishery (including aquaculture) Managed by:	Commercial Sector	Recreational Sector	Traditional Fishing (by Aboriginal & Torres Strait Islander people) Sector
QLD	0.05	0.25	-
WA	0.05	0.15	-
AFMA – Eastern Tuna	0.2	0.3	-
TOTAL	0.3	0.7	-
Non Fisheries Beneficiaries (eg grain producers)			
Tourism Operators			-
Charter Boat Operators			-
TOTAL			-
Summary Flow of Benefits			
Sub Total Commercial Sector			.3
Sub Total Recreational Sector			.7
Sub Total Traditional Fishing Sector			-
Sub Total Non-Fisheries Beneficiaries			-
TOTAL			1

Further Development

The Proceedings of the Symposium will be published in late 2003 as part of the Journal, Marine and Freshwater Research. All scientific papers are currently undergoing peer review.

Planned Outcomes

1. Broader Understanding of the Status of Major Billfish Stocks

This outcome was certainly achieved. The stock structure of billfishes was addressed in an excellent overview by Dr John Graves, and several new studies on stock structure of sailfish and broadbill swordfish were presented. A major multi-authored paper synthesising all tag-recapture results from the past three decades of tagging billfish was also prepared and presented for the Symposium.

World stock assessment of billfishes, in particular, striped marlin, blue marlin, white marlin and broadbill swordfish, was covered in considerable detail during the Symposium. Healthy debate regarding methodologies employed in stock assessment of billfishes was generated. Many of the stock assessments presented were generated by the holding of the Symposium.

2. Understanding of the Latest Biological Information

The keynote presentation on Biology of Billfish, presented by Dr Kim Holland, was a highlight of the Symposium. Dr Holland noted the strides made in electronic tagging, involving surgery, on a wide range of other fishes, and marine mammals, and suggested novel approaches to conducting similar work on billfish. Several papers were presented on the latest popup satellite technologies being applied to billfishes around the world, and considerable new information on reproduction and spawning of different species of billfishes was presented.

3. Insight into International Management of Billfish Resources

As part of the FRDC requirement for its support of the Symposium, a workshop was held to consider international lessons for management of billfishes in the Australian context. Although held in the evening, the workshop attracted strong attendance (over 60 delegates). A full report on the workshop is appended to this report.

4. Publication of Symposium Proceedings

An importance outcome of the Symposium, will be the publication of the proceedings. The CSIRO Journal, *Marine & Freshwater Research* will publish the proceedings in its first issue of 2003. All papers are currently being peer reviewed and the journal editor, Ann Grant, is supervising the review and production of the proceedings.

Conclusion

The Symposium was very successful in achieving its objectives. Many important papers were presented which were precipitated by the holding of the Symposium. Contacts made during the Symposium will ensure future cooperation among the farflung billfish workers around the world. The peer reviewed published Proceedings will form a permanent record of the current status of knowledge regarding billfish biology, behaviour, status and fisheries.

Appendix 1 – Intellectual Property

Not applicable.

Appendix 2 – Staff

The following personnel participated in the development and organisation of the Symposium:

CONFERENCE ORGANISING COMMITTEE

Chair: Captain David Tomlinson, Flamingo Bay Research Pty Ltd, Australia
Dr John Glaister, Sport & Recreation Queensland, Australia
Dr Michael Hinton, Inter-Amercian Tropical Tuna Commission, USA
Dr Julian Pepperell, Pepperell Research & Consulting Pty Ltd, Australia
Dr Eric Prince, National Marine Fisheries Service, USA
Dr Ziro Suzuki, National Research Institute of Far Seas Fisheries, Japan

PROGRAM COMMITTEE

Chair: Dr Julian Pepperell, Pepperell Research & Consulting Pty Ltd, Australia
Dr Richard Brill, Pelagic Fisheries Research Program, USA
John Gunn, CSIRO Marine Research, Australia
Dr John Kalish, Bureau of Rural Sciences, Australia
Dr Eric Prince, National Marine Fisheries Service, USA
Wade Whitelaw, Australian Fisheries Management Authority, Australia

PROFESSIONAL CONFERENCE ORGANISER

Event Manager: Rochelle Manderson, OzAccom Conference Services
Sponsorship & Trade Manager: David Hughes, OzAccom Conference Services
Registration & Accommodation Manager: Sharon Lindsay, The OzAccom Group

Appendix 3 – Report from *Management of Australian Billfish Fishery Workshop*

Report on Billfish Management Workshop

Third International Billfish Symposium

19-23 August 2001
Radisson Plaza Hotel
Cairns, Australia

Objectives of the Workshop

Explore the experience of members participating in the Symposium and possible options for future management of the Australian Billfish Fishery.

Facilitator	**P Rogers**
Rapporteur	**J Pepperell**

Workshop Outcomes

Some understanding of the world situation which is reported briefly hereunder.

United States (Atlantic)

In the Atlantic area, there is a Billfish Fishery Management Plan. The recreational fishery is managed through ICCAT as well as domestic controls. The predominant legislation is the Magnussen Stevenson Management Act.

The recreational fishery is managed by size limits. There is a requirement for tournament registration and catch effort reporting is mandatory but the fishery was said to be largely unregulated. There is a cap on marlin landings of 250 fish this year (both blue and white marlin) limited to recreational take.

Importantly the commercial possession of Isiophorids(all marlin, sail fish, spear fish) has been prohibited in the US for some time. Incidental bycatch by the commercial fleet for these species is therefore released dead or alive.

Monitoring of the commercial bycatch through a log book program is required by law (US vessels) but analysis shows substantial under reporting. In order to improve the quality of bycatch information the observer program (5% coverage) is to be expanded to about 10%.

In order to minimise bycatch of Isiophorids an examination of the need for seasonal closures was undertaken. This has led to time/area closures and gear modifications along with a prohibition in the use of live bait by longliners. The latter has "probably" led to reduced bycatch.

A view was expressed that whilst ICCAT was seen as arguably the most advanced forum in the world for within ocean management of tunas and billfish, it was at a critical stage of its development. Management approaches thus far have been remarkably unsuccessful in preventing over fishing for virtually all fish stocks with the commercial realities around management of tunas dominating agendas. Commercially driven litigation on closure issues tied to bycatch management and compliance measures (e.g. introduction of Vessel Monitoring technology) were frustrating management needs.

United States (Pacific)

The Western Pacific Fisheries Council (Westpac, Honolulu) has responsibilities for the Pacific. There were reported about 120 US longline vessels based in Honolulu until last year. Many of these vessels target swordfish thousands of miles from Hawaii. Vessel Monitoring Systems for compliance have been in place since 1994. There are observers on all vessels (US?) and log books were compulsory. Bycatch includes marlin, mainly blue and striped.

One third of the fleet has been lost through litigation. Some had gone to the west coast. It is not legal to land billfish (isiophorids) in California, but is in Washington and Oregon. These states are part of the Pacific Management Council, but as yet a fishery management plan for pelagic fishes on the west coast of the United States is not completely in place.

There are no regulations per se for billfish in Hawaii, nor other island territories. Recent stock assessments for blue marlin is probably at MSY in the Western Pacific.

For many of the island territories there are no controls on the recreational sale of billfish. There is an increasing trend of charter/small boat fisheries being developed throughout the Pacific to service recreational fisheries tourist developments focused on game fishing including billfish. This in turn is leading to increasing conflict between commercial longline and other small boat fleets. Long lining is now no longer permitted within 50 to 75 nautical miles of the main Hawaiian Islands. This was mainly to separate the modern longline fleet from the charter and small boat fisheries. In north western Hawaii, the 50n mile closure is to protect mainly the endangered Hawaiian monk seal.

These closures have had limited reported success in improving billfish stocks.

For commercial trolling vessels, one quarter of the catch is blue marlin. Catch rates were reported as having been relatively flat in the '80's but gone down during the 1990s'. For charter boats, catch rates have been in a long continuing downward trend for CPUE for blue marlin since the 1980s'.

For striped marlin, from the 1970s' to the mid 1990s', there has been a gradual increase in CPUE, however whether it was due to the closure was indeterminate.

Japan and Taiwan (Pacific)

There was no reported significant controls on istiophorids.

Australia (Pacific)

There was reported no effective management of billfish or the charter fleet by the Australian Fisheries Management Authority. This was clearly an issue for the Australian states. New South Wales reported licensed control of the charter fleet, a ban on landing of billfish in inshore waters of New South Wales and bag limits for billfish.

Papua New Guinea (Pacific)

Gamefishing was unregulated but tag and release is widely practiced. A major problem is EEZ enforcement. On the northern side of Papua New Guinea, and effectively the region around Indonesia, Philippines and adjacent waters of the central western Pacific, the tuna/billfish fisheries were unregulated.

New Zealand (Pacific)

The only billfish that can be taken commercially in New Zealand EEZ was broadbill swordfish. There were no regulations covering recreational fishing for billfish.

Indian Ocean

Western Australia indicated specific controls limiting landing of any billfish other than swordfish by commercial vessels. Recreational fish has specific bag limit controls covering all billfish.

Others reported virtually unregulated commercial and recreational fishing for tunas and billfish across the entire Indian Ocean with substantial growth in fishing pressure particularly in the last five years.

The Indian Ocean tuna/billfish fishery were essentially unregulated.

However, management of the Australian commercial tuna fleet in the Indian Ocean, in addition to specific controls for Southern Blue fin tuna (quota managed since 1983) were progressing from licence limitation to a proposed quota management regime.

Lessons for the Australian Billfish management from the author's perspective

1. An observer program is essential for the monitoring of bycatch by the Australian commercial tuna fleet. As a minimum figure, surveillance should provide 20% coverage in addition to a complete log book program to guarantee data quality.

2. The ICCAT model whilst seen by some as being a moderately successful international forum for managing tuna/billfish fisheries, in terms of real fisheries management performance for sustaining stocks, stronger more effective management action is urgently required. Australian Governments and fisheries managers must take a stronger position in international tuna fora on high seas tuna/billfish management issues or face the increasing risk of significant stock failure in its own domestic fisheries and intervention in management by legal and political means from environmental bodies.

3. Separation of commercial/recreational fleets through temporal/spatial closures must be provided serious consideration in resolving and managing differing objectives and outcomes sought.

4. There is a real prospect despite Australia's best endeavours in management, that the real abundance of tunas/billfish within its EEZ will seriously decline through international unregulated effort within the central/south Pacific and the Indian Ocean. Those risks need to be better understood by all stakeholder interests in seeking to influence the outcomes in management of billfish stocks in particular.

Report on Billfish Management Workshop

Third International Billfish Symposium

19-23 August 2001
Radisson Plaza Hotel
Cairns, Australia

Objectives of the Workshop

Explore the experience of members participating in the Symposium and possible options for future management of the Australian Billfish Fishery.

Facilitator	**P Rogers**
Rapporteur	**J Pepperell**

Workshop Outcomes

Some understanding of the world situation which is reported briefly hereunder.

United States (Atlantic)

In the Atlantic area, there is a Billfish Fishery Management Plan. The recreational fishery is managed through ICCAT as well as domestic controls. The predominant legislation is the Magnussen Stevenson Management Act.

The recreational fishery is managed by size limits. There is a requirement for tournament registration and catch effort reporting is mandatory but the fishery was said to be largely unregulated. There is a cap on marlin landings of 250 fish this year (both blue and white marlin) limited to recreational take.

Importantly the commercial possession of Isiophorids(all marlin, sail fish, spear fish) has been prohibited in the US for some time. Incidental bycatch by the commercial fleet for these species is therefore released dead or alive.

Monitoring of the commercial bycatch through a log book program is required by law (US vessels) but analysis shows substantial under reporting. In order to improve the quality of bycatch information the observer program (5% coverage) is to be expanded to about 10%.

In order to minimise bycatch of Isiophorids an examination of the need for seasonal closures was undertaken. This has led to time/area closures and gear modifications along with a prohibition in the use of live bait by longliners. The latter has "probably" led to reduced bycatch.

A view was expressed that whilst ICCAT was seen as arguably the most advanced forum in the world for within ocean management of tunas and billfish, it was at a critical stage of its development. Management approaches thus far have been remarkably unsuccessful in preventing over fishing for virtually all fish stocks with the commercial realities around management of tunas dominating agendas. Commercially driven litigation on closure issues tied to bycatch management and compliance measures (e.g. introduction of Vessel Monitoring technology) were frustrating management needs.

United States (Pacific)

The Western Pacific Fisheries Council (Westpac, Honolulu) has responsibilities for the Pacific. There were reported about 120 US longline vessels based in Honolulu until last year. Many of these vessels target swordfish thousands of miles from Hawaii. Vessel Monitoring Systems for compliance have been in place since 1994. There are observers on all vessels (US?) and log books were compulsory. Bycatch includes marlin, mainly blue and striped.

One third of the fleet has been lost through litigation. Some had gone to the west coast. It is not legal to land billfish (isiophorids) in California, but is in Washington and Oregon. These states are part of the Pacific Management Council, but as yet a fishery management plan for pelagic fishes on the west coast of the United States is not completely in place.

There are no regulations per se for billfish in Hawaii, nor other island territories. Recent stock assessments for blue marlin is probably at MSY in the Western Pacific.

For many of the island territories there are no controls on the recreational sale of billfish. There is an increasing trend of charter/small boat fisheries being developed throughout the Pacific to service recreational fisheries tourist developments focused on game fishing including billfish. This in turn is leading to increasing conflict between commercial longline and other small boat fleets. Long lining is now no longer permitted within 50 to 75 nautical miles of the main Hawaiian Islands. This was mainly to separate the modern longline fleet from the charter and small boat fisheries. In north western Hawaii, the 50n mile closure is to protect mainly the endangered Hawaiian monk seal.

These closures have had limited reported success in improving billfish stocks.

For commercial trolling vessels, one quarter of the catch is blue marlin. Catch rates were reported as having been relatively flat in the '80's but gone down during the 1990s'. For charter boats, catch rates have been in a long continuing downward trend for CPUE for blue marlin since the 1980s'.

For striped marlin, from the 1970s' to the mid 1990s', there has been a gradual increase in CPUE, however whether it was due to the closure was indeterminate.

Japan and Taiwan (Pacific)

There was no reported significant controls on istiophorids.

Australia (Pacific)

There was reported no effective management of billfish or the charter fleet by the Australian Fisheries Management Authority. This was clearly an issue for the Australian states. New South Wales reported licensed control of the charter fleet, a ban on landing of billfish in inshore waters of New South Wales and bag limits for billfish.

Papua New Guinea (Pacific)

Gamefishing was unregulated but tag and release is widely practiced. A major problem is EEZ enforcement. On the northern side of Papua New Guinea, and effectively the region around Indonesia, Philippines and adjacent waters of the central western Pacific, the tuna/billfish fisheries were unregulated.

New Zealand (Pacific)

The only billfish that can be taken commercially in New Zealand EEZ was broadbill swordfish. There were no regulations covering recreational fishing for billfish.

Indian Ocean

Western Australia indicated specific controls limiting landing of any billfish other than swordfish by commercial vessels. Recreational fish has specific bag limit controls covering all billfish.

Others reported virtually unregulated commercial and recreational fishing for tunas and billfish across the entire Indian Ocean with substantial growth in fishing pressure particularly in the last five years.

The Indian Ocean tuna/billfish fishery were essentially unregulated.

However, management of the Australian commercial tuna fleet in the Indian Ocean, in addition to specific controls for Southern Blue fin tuna (quota managed since 1983) were progressing from licence limitation to a proposed quota management regime.

Lessons for the Australian Billfish management from the author's perspective

1. An observer program is essential for the monitoring of bycatch by the Australian commercial tuna fleet. As a minimum figure, surveillance should provide 20% coverage in addition to a complete log book program to guarantee data quality.

2. The ICCAT model whilst seen by some as being a moderately successful international forum for managing tuna/billfish fisheries, in terms of real fisheries management performance for sustaining stocks, stronger more effective management action is urgently required. Australian Governments and fisheries managers must take a stronger position in international tuna fora on high seas tuna/billfish management issues or face the increasing risk of significant stock failure in its own domestic fisheries and intervention in management by legal and political means from environmental bodies.

3. Separation of commercial/recreational fleets through temporal/spatial closures must be provided serious consideration in resolving and managing differing objectives and outcomes sought.

4. There is a real prospect despite Australia's best endeavours in management, that the real abundance of tunas/billfish within its EEZ will seriously decline through international unregulated effort within the central/south Pacific and the Indian Ocean. Those risks need to be better understood by all stakeholder interests in seeking to influence the outcomes in management of billfish stocks in particular.

Abstract Submission Form

Paper/ Poster title

.....

Authors & Institution (please * presenting authors)

.....

.....

.....

.....

Presentation type preference (at least one to be selected)

☐ Paper ☐ Poster

Subtheme

(at least one to be selected)

- ☐ Stock structure of the world's billfishes (based on recent genetic studies and tagging data).
- ☐ Stock assessment of billfish populations (stimulated by the holding of the symposium).
- ☐ Biological studies (including age and growth, reproduction and behavioural studies).
- ☐ Management of the world's billfish
- ☐ Socio-economic value of billfish (both commercial and recreational, and including consideration of cost-benefits to developing island nations).
- ☐ The status of broadbill swordfish around the globe.

Please attach your abstract as per the format requirements. Maximum length 200 words.

Speaker Timeline

Deadline for receipt of abstracts	8 December 2000
Notification of acceptance	5 February 2001
Deadline for receipt of final paper	29 June 2001

Sponsorship and Trade Opportunities

Organisations are invited to enhance their profile within the world billfish community, through sponsorship of the symposium, or by holding a trade exhibit. A range of options and tailored packages are available. Please contact the Symposium Manager for further details.

Symposium Manager

Third International Billfish Symposium
PO Box 164
Fortitude Valley QLD 4006
Australia

Deliveries

Level 2, 15 Wren Street,
Bowen Hills QLD 4006
Australia

Email

billfish2001@ozaccom.com.au

Website

www.flamingobay.com.au/billfish2001

3RD INTERNATIONAL BILLFISH SYMPOSIUM
Cairns 2001
19 - 23 AUGUST

Announcement and Call for Papers

3RD INTERNATIONAL BILLFISH SYMPOSIUM
Cairns 2001
19 - 23 AUGUST

Global Sustainability of Billfish - Research, Assessment and Management in the 21st Century

Radisson Plaza Hotel • Cairns • Australia
19 - 23 August 2001

International Host Body

The BILLFISH FOUNDATION
CONSERVATION THROUGH RESEARCH EDUCATION AND ADVOCACY

Background

The Third International Billfish Symposium is hosted by The Billfish Foundation, an international non-profit organisation with a very clear objective: the conservation and enhancement of billfish populations through scientific research, education, and advocacy.

The Symposium will be a landmark meeting which will bring together the world's leading billfish researchers and managers to present papers and discuss the future of billfish on a global scale. News of the Symposium has already generated considerable interest, and it is clear that the time is right to hold the Third International Billfish Symposium.

Symposium Overview

The Third International Billfish Symposium has been anticipated by the world's fisheries community for some time. There have been two previous international billfish symposia. Both were held in Hawaii, the first in 1972, and the second in 1988. Those meetings were watersheds in the advancement of knowledge of these important fishes, but since the last meeting in 1988, little worldwide attention has been focused on the group as a whole.

The 2001 meeting will provide an opportunity for the latest information on billfish to be presented to a fully international audience, and perhaps more importantly, will stimulate scientists around the world to conduct the work necessary to develop reliable stock assessments of billfishes in the three major oceans of the world. Exciting developments are taking place in the field of electronic tag technology that is currently being applied to unlocking many of the secrets of billfish biology and biogeography. The timing of this meeting will enable much of these data to be presented at an appropriate forum.

Symposium Theme and Subthemes

The theme for the Symposium is:

"Global Sustainability of Billfish - Research, Assessment and Management in the 21st Century".

Symposium subthemes are:

1. Stock structure of the world's billfishes (based on recent genetic studies and tagging data).
2. Stock assessment of billfish populations (stimulated by the holding of the symposium).
3. Biological studies (including age and growth, reproduction and behavioural studies).
4. Management of the world's billfish
5. Socio-economic value of billfish (both commercial and recreational, and including consideration of cost-benefits to developing island nations).
6. The status of broadbill swordfish around the globe.

Venue

The Third International Billfish Symposium will be held at the Radisson Plaza Hotel at the Pier, Cairns Far North Queensland, Australia.

Cairns is the acknowledged world's premier location for fishing for large black marlin, a fishery which has continued in a sustainable fashion for over 30 years. Over 25,000 black marlin have been tagged and released in waters off Cairns in that time.

Cairns is located in tropical far north Queensland and enjoys year round warm weather in a pristine natural environment. Cairns International Airport is just 10 minutes drive from the city heart. The airport is serviced by most international airlines. The city boasts excellent shopping facilities, accommodation ranging from 5 star through to budget style, the Reef Hotel Casino and an internationally diverse array of restaurants, all within easy walking distance.

Call for Papers

The symposium organisers invite papers and poster presentations in the outlined symposium subthemes.

Conditions of Participation

Presentations are expected to run for twenty minutes duration, including question time. These presentations will contribute significantly to the symposium program and should be of the highest professional standard. Accepted papers will be required in a prescribed electronic format. Preparation guidelines will be forwarded with notice of acceptance. Papers not submitted by the dates outlined in the guidelines may, at the committee's discretion, be excluded from the symposium. Authors must release their presentation from copyright for inclusion in the symposium proceedings. Accepted papers must not be presented to any other body before the symposium.

All presenters are required to pay their own registration, accommodation and travel expenses. The Third International Billfish Symposium is unable to subsidise registration fees, travel or accommodation costs.

Submission Format: Abstracts must include authors, presentation type preference/s, and relevant subtheme/s. Abstracts are to be a maximum of 200 words in Microsoft Word, text (txt), or rtf format and submitted in one of the following ways:

Mailed submissions: Please complete the enclosed form and attach a 3.5" PC formatted disk containing your abstract in the prescribed format. Hard copies of the abstracts are to be attached in triplicate and forwarded to the symposium managers.

Electronic submissions: Abstracts may be emailed in the prescribed format, including all details indicated on the submission form, to billfish2001@ozaccom.com.au. On-line submissions may be made via the symposium website www.flamingobay.com.au/billfish2001

Expression of Interest Form

☐ I do not wish to submit an abstract but require further information about the symposium

☐ Please find attached an abstract for consideration and details completed overleaf

☐ Please send me information on sponsorship and trade

Title: Dr/ Ms/ Mrs/ Mr/ Other .....

Given Name .....

Family Name .....

Position .....

Organisation .....

Postal Address: .....

.....

..... Post/ Zip code .....

Telephone: .....

Facsimile: .....

Email: .....

Symposium Manager
Third International Billfish Symposium
PO Box 164, Fortitude Valley QLD 4006, Australia

3RD INTERNATIONAL BILLFISH SYMPOSIUM
Cairns 2001
19 - 23 AUGUST

Earlybird Closes 30 June 2001

Third International Billfish Symposium

19–23 August 2001
Radisson Plaza Hotel,
Cairns, Australia

International Host Body
The Billfish Foundation

The BILLFISH FOUNDATION
CONSERVATION THROUGH RESEARCH EDUCATION AND ADVOCACY

3RD INTERNATIONAL BILLFISH SYMPOSIUM
Cairns 2001

Registration Brochure

Website: www.flamingobay.com.au/billfish2001/

Joint Principal Sponsors

FISHERIES RESEARCH & DEVELOPMENT CORPORATION

AUSTRALIA

Department of AGRICULTURE FISHERIES & FORESTRY - AUSTRALIA

AGRICULTURE FISHERIES FORESTRY

Major Sponsors

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Sponsors

CSIRO
MARINE RESEARCH

GAA RESEARCH & DEVELOPMENT FOUNDATION

Media Supporter

Blue Water
BOATS & SPORTSFISHING

Invitation to Attend

On behalf of the Organising Committee, I take pleasure in inviting you to attend the Third International Billfish Symposium in beautiful Cairns. The Symposium is a landmark event in global scientific research and management of billfish.

The Third International Billfish Symposium has been anticipated by the world's fisheries community for some time. There have been two previous international billfish symposia. Both were held in Hawaii, the first in 1972, and the second in 1988. Those meetings were watersheds in the advancement of knowledge of these important fishes, but since the last meeting in 1988, little worldwide attention has been focused on the group as a whole.

The 2001 meeting will provide an opportunity for the latest information on billfish to be presented to a fully international audience, and perhaps more importantly, will stimulate scientists around the world to conduct the work necessary to develop reliable stock assessments of billfishes in the three major oceans of the world. Exciting developments are taking place in the field of electronic tag technology that is currently being applied to unlocking many of the secrets of billfish biology and biogeography. The timing of this meeting will enable much of this data to be presented at an appropriate forum.

The program committee has worked diligently to bring you a program which is relevant and thought provoking and includes many of the leaders in billfish science and research from around the world.

I look forward to welcoming you to beautiful Cairns and more importantly, this significant fisheries event.

Captain David Tomlinson
Organising Committee Chair
and TBF Trustee

Symposium Organising Committee

Chair:
Captain David Tomlinson,
Flamingo Bay Research Pty Ltd, Australia

Dr John Glaister,
University of Queensland, Australia

Dr Michael Hinton,
Inter-Amercian Tropical Tuna Commission, USA

Dr Julian Pepperell,
Pepperell Research & Consulting Pty Ltd, Australia

Dr Eric Prince,
National Marine Fisheries Service, USA

Dr Ziro Suzuki,
National Research Insitiute of Far Seas Fisheries, Japan

Program Committee

Chair:
Dr Julian Pepperell,
Pepperell Research & Consulting Pty Ltd, Australia

Dr Richard Brill,
National Marine Fisheries Service, USA

Dr John Kalish,
Bureau of Rural Sciences, Australia

Dr Eric Prince,
National Marine Fisheries Service, USA

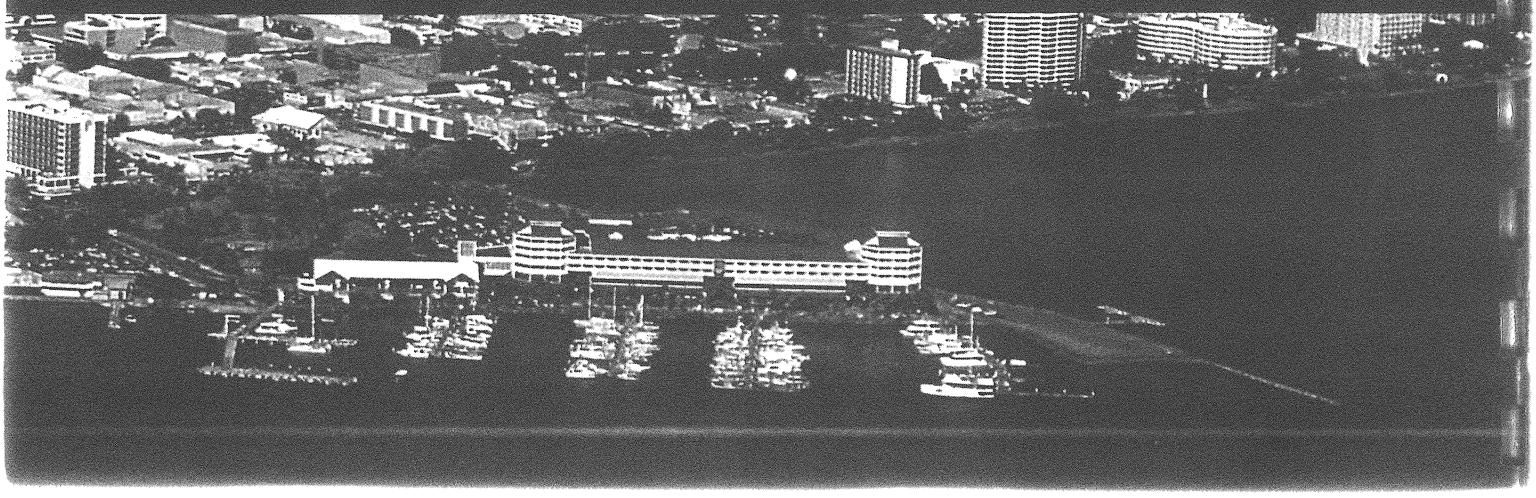
Wade Whitelaw,
Secretariat of the Pacific Community, New Caledonia

Venue

The Third International Billfish Symposium will be held at the Radisson Plaza Hotel at the Pier, Cairns Far North Queensland.

Cairns is internationally recognised as the main marlin fishing destination and has successfully managed and sustained this fishery for over 30 years. The main reason for this is that 99% of the billfish are tagged and released. Researchers have employed 'state of the art' technology – satellite tagging and global positioning systems – in co-operation with operators, to monitor and collect scientific information about the billfish movements and stock structure. Over 25,000 black marlin have been tagged and released in waters off Cairns.

Cairns is located in tropical far north Queensland and enjoys year round warm weather in a pristine natural environment. Cairns International Airport is just 10 minutes drive from the city heart. The airport is serviced by most international airlines. The city boasts the closest proximity to the World Heritage Great Barrier Reef, excellent shopping facilities, accommodation ranging from 5 star through to budget style, the Reef Hotel Casino and an internationally diverse array of restaurants, all within easy walking distance.



Keynote Speakers

Mr Akau'ola
Ministry of Fisheries, TONGA
'Akau'ola is the Secretary for Fisheries, the CEO of the Ministry for Fisheries of the Kingdom of Tonga. He has held this post for the last 6 years and was previously Director of the Commonwealth Foundation, the second of the Commonwealth of Nation's two international bodies with headquarters in Marlborough House, London. He was Director of the Management Development Program at the Commonwealth Secretariat from 1982–85. Prior to that he served as his country's High Commissioner and Ambassador to a number of countries including Great Britain, USA, France, Germany, USSR, Belgium, Italy from 1972–1982 and was Doyen of the diplomatic corps to the court of St. James in London. From 1970–1972 he was on secondment to the University of the South Pacific as Human Resources and Development Officer. Formerly Secretary to Government and Head of the Civil Service of the Government of Tonga.

Professor Robert Ditton
Texas A&M University, USA
Bob Ditton is a professor in the Department of Wildlife and Fisheries Sciences at Texas A&M University. Here he teaches a graduate course and directs a research program dealing with the human dimensions of fisheries. Bob has published extensively in the human dimensions literature on topics including specialization, demographic change, fishing satisfaction and substitution behaviour in fishing. Bob and his associates have completed social and economic studies of billfish fisheries in the U.S. Atlantic, Puerto Rico, Pacific coast of Costa Rica, and in Baja, Mexico as well as numerous studies of billfish tournament events. Over the past 30 years, he has completed human dimensions research in local, state, federal, and international fisheries jurisdictions.

Dr John Graves
Virginia Institute of Marine Science, USA
Dr John Graves is Professor and Chair of the Department of Fisheries Science at the Virginia Institute of Marine Science, College of William and Mary. In addition to his academic responsibilities, Dr Graves has served as chair of the U.S. ICCAT Advisory Committee for the past six years. His research involves the application of molecular genetic techniques to fisheries science, and includes studies of stock structure, forensic identification, and phylogeny. He and his students have published on a wide variety of marine organisms, with an emphasis on fishes of the pelagic environment.

Dr Kim Holland
Hawaii Institute of Marine Biology, USA
Dr Kim Holland is a Researcher on the faculty of the Hawaii Institute of Marine Biology, University of Hawaii. Dr Holland's research has focused on elucidating the physiology and behaviour of large marine fishes as they move through their natural environments. He pioneered the use of small research vessels as platforms for sonic telemetry and has used this technique to investigate the movements of a variety of species such as bigeye and yellowfin tuna, tiger sharks and Pacific blue marlin.

Dr Julian Pepperell
Pepperell Research & Consulting Pty Ltd, Australia
After gaining his Ph.D. at Sydney University, Julian Pepperell was appointed 'Marine Angling Biologist' with New South Wales Fisheries where he studied many aspects of recreationally important marine fish species. Through his efforts, the Australian gamefish tagging program became the largest of its kind in the world. Since 1990 he has operated an independent fisheries research consultancy, and has become a well known writer and communicator. He is a recognized authority on the billfishes of the Indo-Pacific, and is currently writing a major book on the Fishes of the Open Ocean. He is a member of several national and international research and advisory boards, and is a past president of the Australian Society for Fish Biology.

Dr Julie Porter
Fisheries and Oceans Canada, Canada
Dr. Julie M. Porter has directed the Canadian Atlantic research program for swordfish and tunas since 1989. These species are managed in the Atlantic by the International Commission for the Conservation of Atlantic Tunas (ICCAT). Since 1994, Dr. Porter has chaired the ICCAT Swordfish Species Group of international scientists who conduct the swordfish stock assessments. She has been an external expert in national reviews of swordfish in both the USA and Australia. Recently, she has initiated an international scientific and industry research collaboration deploying satellite tags on bluefin tuna. Her current research interests are the population ecology of swordfish and bluefin tuna, including movements and stock structure.

Dr Yuji Uozumi
National Research Institute of Far Seas Fisheries, Japan
Yuji Uozumi earned a MS Degree in 1978 ad a PhD in 1997 from Kyoto University, Japan. From 1979 to 1991, he majored in the fishery biology of the groundfishes and squids, and from 1992 to present time he has been in charge of research on fishery biology and stock assessment of tunas and billfishes. Yuji is now director of Western Pacific Tuna and Skipjack Resource Division in the National Institute of Far Seas Fisheries, Fisheries Agency of Japan.

Symposium Website

www.flamingobay.com.au/billfish2001/

Sponsors

The committee sincerely thanks our sponsors for their support. It is their support that has enabled this Symposium to be held.

International Host Body

The Billfish Foundation (TBF) is a non-profit organisation that works worldwide to influence the development of constructive management and conservation strategies for the world's billfishes through research, education, and advocacy. TBF distinguishes itself by actually funding independent research for billfish. Research proposal guidelines can be obtained from the Research Section on TBF's website at www.billfish.org.

Joint Principal Sponsors

FISHERIES RESEARCH & DEVELOPMENT CORPORATION

Department of AGRICULTURE FISHERIES & FORESTRY - AUSTRALIA

Major Sponsors

Sponsors

CSIRO MARINE RESEARCH

Media Supporter

Sponsorship and Trade Opportunities

Organisations are invited to enhance their profile to the International Billfish Community, through sponsorship of the Symposium or by displaying their goods and services at the trade exhibition. A range of options and tailored packages are available. Please contact David@ozaccom.com.au for further details.

Provisional Program*

* please note that this program is subject to change

Sunday 19 August 2001

12.00 Registration commences

6.00–8.00 Welcome Reception
Tjapukai Aboriginal Cultural Park

Monday 20 August 2001

9.00 Opening Ceremony

9.10 *Big Fish Down Under: A Brief History of Contact between Billfish and Man* **Julian Pepperell, Pepperell Research & Consulting Pty Ltd, Australia**

9.30 *Stock Structure of the World's Billfishes* **John Graves, Virginia Institute of Marine Science, USA**
Keynote Speaker Session Proudly Sponsored by National Marine Fisheries Service, USA

10.30 Morning Tea in Trade Exhibition

Theme: Stock Structure of the World's Billfishes

11.00 *Global Stock Structure of the Sailfish,* Istiophorus platypterus, *based on analyses of Mitochondrial and Nuclear DNA Markers* **Jan McDowell, Virginia Institute of Marine Science, USA**

11.20 *An Analysis of the Major Constituent-Based Billfish Tagging Programs in the Worlds Oceans* **Eric Prince, National Marine Fisheries Service – Miami, USA** Co-Authors: Mauricio Ortiz, David Holts, Kay Davy, Julian Pepperell, Michael Lowry, John Holdsworth

11.40 *Arabian Gulf Sailfish Movements – A Summary of Tagging Efforts* **John Hoolihan, Environmental Research and Wildlife Development Agency, United Arab Emirates**

12.00 *Genetic Analyses of Nuclear and Mitochondrial DNA Data indicate Heterogeneity of Swordfish within the Pacific Ocean* **Jaime Alvarado Bremer, Texas A&M University, USA** Co-Authors: Michael Hinton, Thomas Greig

12.20 Lunch in Trade Exhibition

1.40 *Historical Perspective of Global Billfish Stock Assessment* **Yuji Uozumi, National Research Institute of Far Seas Fisheries, Japan** ***Keynote Speaker Session Proudly Sponsored by Fisheries Research and Development Corporation, Australia***

2.40 Afternoon Tea in Trade Exhibition

Theme: Stock Assessment of the World's Billfish

3.00 *Status of Striped Marlin,* Tetrapturus audax, *Stocks of the Eastern-Central Pacific* **Michael G. Hinton, Inter-American Tropical Tuna Commission, USA** Co-Authors: Mark Maunder, Yuji Uozumi

3.20 *Stock Assessment of Blue Marlin in the Pacific with Multifan-CL* **Pierre Kleiber, National Marine Fisheries Service – Honolulu, USA** Co-Authors: Michael Hinton, Marc Maunder, Yuji Uozumi

3.40 *Integration of Habitat Preferences into Population Abundance Indices: Robustness Tests using Simulated Data* **Phil Goodyear, USA**

4.00 *Relationship between Catch, Effort, CPUE and Local Abundance for a Non-Target Species caught by a Long Line Fishery* **Alain Fonteneau, Institut de Recherches pour le Développment, Seychelles**

4.20 *ICCAT's Stock Assessment of Atlantic Billfish* **Victor Restrepo, International Commission for the Conservation of Atlantic Tunas, Spain** Co-Authors: Eric Prince, Gerald P Scott, Yuji Uozumi

4.40 *An Estimation of Effective Fishing Effort of Japanese Longliners on Atlantic Blue Marlin,* Makaira nigricans, *in the Atlantic Ocean* **Kotaro Yokawa, National Research Institute of Far Seas Fisheries, Japan** Co-Authors: Makoto Okazaki, Hiroshi Okamura, Takayuki Matsumoto, Yuji Uozumi, Hirokazu Saito

5.00 Happy Hour & Poster Viewing & Trade Exhibition

6.00–7.00 Special Interest Meeting/Panel Discussion

Tuesday 21 August 2001

9.00 *Billfish Biology* **Kim Holland, Hawaii Institute of Marine Biology, USA**

10.00 Morning Tea in Trade Exhibition

Concurrent Session 1:
Theme: Biological Studies

10.30 *Electronic Tagging Technologies and their Potential use in Studying Billfish Movement, Behaviour, Habitat Preferences and Mortality Rates* **John Gunn, CSIRO Marine Research, Australia** Co-Author: Heidi Dewar

10.50 *An Estimation of Vertical Distribution Pattern of Atlantic Blue Marlin in the Tropical Central Atlantic based on the Archival Pop-Up Tag* **Hirokazu Saito, National Research Institute of Far Seas Fisheries, Japan** Co-Authors: Kotaro Yokawa, Makoto Okazaki, Harumi Yamada, Yuji Uozumi

11.10 *Early Results from Pop-Up Archival Tagging Experiments with Black Marlin in the Coral Sea* **John Gunn, CSIRO Marine Research, Australia** Co-Author: Julian Pepperell

11.30 *Post-Release Mortality Rate of Striped Marlin Caught with Recreational Tackle* **Michael Domeier, Pfleger Institute of Environmental Research, USA** Co-Author: Heidi Dewar

11.50 *Modelling Visual Behaviour of Billfish* **Kerstin A Fritsches, University of Queensland, Australia** Co-Author: Eric Warrant

12.10 *Environmental Factors Influencing the Activity of Black Marlin* **Peter Speare, Australian Institute of Marine Science, Australia** Co-Author: Craig Steinberg

Concurrent Session 2:
Theme: Stock Assessment of the World's Billfish

10.30 *Striped Marlin Catch Rates in the New Zealand Recreational Fishery* **John Holdsworth, Bluewater Marine Research, New Zealand** Co-Author: Peter Saul

10.50 *Trends in Billfish Catch from Longline Fisheries of the Western & Central Pacific Ocean* **Peter Williams, Secretariat of the Pacific Community, New Caledonia**

11.10 *Use of Charter Boat Catch and Effort Data to Infer Annual Indices of Black Marlin Availability in the Cairns-Lizard Island Region Between 1970–1977* **Robert Campbell, CSIRO Division of Marine Research, Australia** Co-Authors: Julian Pepperell, Tim Davis

11.30 *Striped Marlin Abundance Trends in the Northeast Pacific from Angler Catch Rates and Historical Sportfishing Club Records* **David Holts, National Marine Fisheries Service – La Jolla, USA** Co-Author: Douglas Prescott

11.50 *Trends In Billfish Catches By Venezuelan Longline And Artisanal Gillnet Fisheries In The Caribbean Sea And The Western Central Atlantic* **Freddy Arocha, Instituto Oceanografico De Venezuela, Venezuela** CoAuthor: Luis Marcano

12.10 *Indicators of the Exploitation Level in the Sailfish Fishery in the Western Coast of Mexico* **Rene Macias Zamora, Fishery National Institute, Mexico** Co-Authors: Ana Vidaurri-Sotelo, H Santana-Hernandez, Javier Valdez-Flores

12.50 Lunch in Trade Exhibition

2.00 *Socio-Economic Values of Billfish* **Robert Ditton, Texas A&M University, USA**

3.00 Afternoon Tea in Trade Exhibition

Concurrent Session 3:
Theme: Socio-Economics of Billfish Fisheries

3.30 *Gamefishing Facilities and Recreational Billfish Catches of Pacific Island Nations in the Western and Central Pacific* **Wade Whitelaw, Secretariat of the Pacific Community, New Caledonia**

3.50 *Historical Development of Recreational Billfishing in Bermuda and the Significance of Catches of Very Large Blue Marlin,* Makaira nigricans **Brian Luckhurst, Division of Fisheries, Bermuda**

4.10 *Economic Valuation of the Benefits of Recreational Billfishing in Manzanillo, Colimo, Mexico* **Juan Carlos Chavez-Comparan, Universidad de Colima, Mexico** Co-Author: Cesar A Liceaga-Torres

4.30 *Estimating the Economic Value of the New Zealand Recreational Billfish Fishery* **John Holdsworth, Bluewater Marine Research, New Zealand** Co-Authors: Rick Boyd, Peter Saul

Concurrent Session 4:
Theme: Biological Studies

3.30 *Evidence of Blue Marlin,* Makaira nigricans, *Spawning in the Vicinity of Exuma Sound, Bahamas* **Joseph Serafy, University of Miami, USA** Co-Authors: Robert Cowen, Claire Paris, Thomas Capo, Stacy Luthy

3.50 *Reproductive and Larval Studies of Billfish in the Eastern Tropical Pacific off Mexico* **Rogelio González-Armas, Cicimar-Ipn, Mexico** Co-Authors: Alexander Klett-Traulsen, Agustín Hernández-Herrera

4.10 *A Molecular Approach to the Identification of Larval Istiophorid Billfishes* **Stacy Luthy, University of Miami, USA** Co-Author: Jan McDowell

4.30 *Trophic Overlap between Three Billfish Species from Cabo San Lucas, Mexico* **Felipe Galvan-Magaña, Centro Interdisciplinario De Ciencias Marinas, MEXICO** Co-Authors: L. Andres Abitia-Carenas, Victor H. Cruz-Escalona, Francisco J. Gutierrez-Sanchez

4.50 *Analysis of Sportfishing Catch Rates of Striped Marlin,* Tetrapturus audax *at Cabo San Lucas, Baja California Sur, Mexico, and their Relation to Sea Surface Temperature* **Sofia Ortega-Garcia, Cicimar-Ipn, Mexico** Co-Authors: Alexander Klett-Traulsen, German Ponce-Diaz

5.10 *Biological and Fishery Aspects of the Mediterranean Spearfish,* Tetrapturus belone *Rafinesque, 1810* **Antonio Potoschi, University of Messina, Italy** Co-Authors: Silvana Campagnuolo, Rosetta Bruno, Franco Andaloro

5.30 Happy Hour & Poster Viewing & Trade Exhibition

Wednesday 22 August 2001

9.00 *Management of the World's Billfish* **Akau'ola, Ministry of Fisheries, Tonga** ***Keynote Speaker Session Proudly Sponsored by Department of Agriculture, Fisheries and Forestry – Australia***

10.00 Morning Tea in Trade Exhibition

Theme: Management of Billfish

10.30 *Managing Billfish in the Eastern Tropical Pacific: Past, Present and Future* **Russell Nelson, Nelson Consulting, USA** Co-Author: Ellen Peel

10.50 *Managing Marlin as Bycatch under ICCAT, the Fork in the Road – Recovery or Collapse* **Ellen Peel, The Billfish Foundation, USA** Co-Authors: Phil Goodyear, Russell Nelson

11.10 *Reducing Bycatch and Bycatch Mortality in the US Atlantic Pelagic Longline Fisheries* **Buck Sutter, National Marine Fisheries Service, USA** Co-Authors: Jill Stevenson, Karyl Brewster-Geisz

11.30 *Marlin – A Shared Resource in Australia?* **James Findlay, Australian Fisheries Management Authority, Australia** Co-Authors: Colleen Cross, Andrew Bodsworth

11.50 *Pelagic Fisheries Catching Marlins in the US Western Pacific Region* **Paul Dalzell, Western Pacific Regional Fisheries Management Council** Co-Authors: Kevin Kelly, Chris Boggs

12.10 *NSW Fisheries Gamefish Monitoring Program* **Michael Lowry, NSW Fisheries, Australia**

12.30 *Are Increases in the Minimum Size Limits of Landed Billfish an Effective Management Approach to Reduce Total Landings?* **Arietta Venizelos, National Marine Fisheries Service, USA**

12.50 Lunch in Trade Exhibition

1.30 *The Status of the Broadbill Swordfish around the Globe* **Julie Porter, Fisheries and Oceans, Canada**

2.30 Afternoon Tea in Trade Exhibition

Theme: Biology & Status of Broadbill Swordfish

3.00 *Swordfish Fisheries* **Peter Ward, Bureau of Rural Sciences, Australia**

3.20 *Swordfish Fishery Operational Model* **Marc Labelle, Secretariat of the Pacific Community, New Caledonia**

3.50 *Status of Fisheries and Swordfish in the Eastern Pacific Ocean* **Michael G. Hinton, Inter-American Tropical Tuna Commission, USA** Co-Author: Mark Maunder

4.10 *Monitoring and Assessment of the Chilean Swordfish,* Xiphias gladius, *Fishery* **Eleuterio Yáñez, Universidad Católica De Valparaíso, Chile** Co-Authors: Maria Angela Barbieri, Francisco Ponce, Karen Nieto, Jose Acevedo, Claudio Silva

4.30 *Reproductive Biology of Broadbill Swordfish,* Xiphias gladius, *from Eastern Australia* **Jock Young, CSIRO Marine Research, Australia** Co-Authors: Anita Drake, Thor Carter, Michael Brickhill, Jessica Farley

4.50 *The Reproductive Strategy and Survival of Swordfish,* Xiphias gladius, *in the Northwestern Atlantic* **Freddy Arocha, Instituto Oceanografico De Venezuela, Venezuela**

5.10 *Analysis of Swimming Behaviour of a Swordfish using an Archivaltag* **Mio Takahashi, National Research Institute of Far Seas Fisheries, Japan** Co-Authors: Makoto Okazaki, Kotaro Yokawa

5.30 Closing Ceremony

6.00 Symposium Concludes

7.30 Symposium Dinner
Radisson Poolside
Sponsored by The Billfish Foundation

Thursday 23 August 2001

Post symposium touring/fishing

Workshop

Tuesday 21 August 2001
6.30 - 7.30pm

Management of the Australian Billfish Fishery

Facilitator: Dr John Glaister, University of Queensland, Australia

The principal sponsor, Fisheries Research & Development Corporation (FRDC), has suggested that a management workshop on the above topic be held as part of the Symposium. The intent of such a workshop would be to explore the experience of members participating in the Symposium including options for future management of the Australian fishery. It is intended that the workshop will be very focused and that the outcomes will be delivered to FRDC. Participation is invited from all sectors of the fishery. Please nominate your attendance on the registration form. There is no charge to attend the workshop.

Poster Program

Please note that the following posters will be in place for the duration of the Symposium – viewing times are as listed in the program.

Genetic Analyses of Swordfish around South African Waters indicate Indian Ocean Origin **Jaime Alvarado Bremer, Texas A&M University, USA** Co-Authors: Marc Griffiths, Thomas Greig

Spatiotemporal Distribution of Atlantic Marlin Longline CPUE and Sea Surface Temperature **Phil Goodyear, USA**

Simulated Responses of the Size Distribution of Blue Marlin to Fishing Mortality **Phil Goodyear, USA**

Economic Impact of the Sport Fishing at La Paz Bay, Baja California Sur, Mexico **Adrian Moyron, Centro De Investigaciones Biologicas Del Noroeste, Mexico** Co-Authors: German Ponce-Diaz, Sofia Ortega-Garcia

Lunar Phase and Success of Catch of the Striped Marlin, Teterapturus audax **Germán Ponce-Díaz, Centro De Investigaciones Biológicas 'El Comitán', Mexico**

Mexican Swordfish Longline Fishery Project – Two Years of Scientific Data Collection **Patricia Rojo-Díaz, Mexican National Fishery Institute, Mexico** Co-Authors: Miguel Angel Cisneros-Mata, Luis Vicente Ania-Gonzaléz

Ecological Aspects of the Billfishes and Associated Species Captured by the Mexican Longline Fleet during the Period 1983–1996. **Heriberto Santana-Hernández, National Fisheries Institute, Mexico** Co-Author: Réne Macías-Zamora, Ana Luisa Vidaurri-Sotelo, Juan Javier Valdez-Flores

Effective Utilisation of Billfish in Japan **Kazushige Usui, Kanagawa Prefectural Fisheries Research Institute, Japan**

Biological Observations of the Sailfish, Istiophorus platypterus, *in the Mexican Pacific Ocean and its Management.* **Ana Luisa Vidaurri Sotelo, National Fishery Institute, Mexico** Co-Authors: Réne Macías-Zamora, Heriberto Santana-Hernandez, Juan Javier Valdez-Flores

Distribution and abundance of blue marlin larvae off Kona Hawaii **Andrew West, University of Technology Sydney, Australia**

Post Symposium Activities

Great Barrier Reef Adventure Tour

The Great Barrier Reef is Australia's greatest natural treasure, stretching more than 3000 kilometres off the east tropical coast of Queensland. Beautiful beyond description, it is the world's largest marine park with the world's largest collection of living corals and more than 1400 species of fish and marine creatures. Take the opportunity to visit this magnificent area by joining Reef Magic Cruises. Included in the ticket price are:

- 5 full hours at one of 10 reef sites for snorkelling and diving
- Glass bottom boat cruises
- Great Barrier Reef presentation by our on board Marine Naturalist
- Morning and afternoon teas
- Sumptuous tropical hot/cold smorgasbord lunch
- All snorkel equipment with instruction and lessions

Special offer – fare also includes either a free introductory scuba dive (subject to onboard medical questionnaire) or a free marine snorkel tour per adult.

This is an optional function and not included in the registration fee. Tickets are at a Special Delegate Rate of AUD$97.00 per person (inclusive of GST and Reef Tax).

Certified Diving is also available as an additional option of $50.00 per person – this price includes all equipment and two dives with a Dive Guide.

Please note that the tour is based on a maximum number of 100 delegates.
Please book early to avoid disappointment.

Light Tackle Marlin Fishing Tour

Cairns is world renowned as the black marlin fishing destination. To organise your chance to 'tag and release' these wonderful creatures, please contact:

Captain David Tomlinson, Flamingo Bay
Telephone: +61 (0) 7 4035 2772
Fax: +61 (0) 7 4035 2550
Email: david@flamingobay.com.au

One Day Helifishing Safari

Picture yourself on a safari deep into Far Northern Australia, fishing remote jungle streams; a unique experience for two people who will have exclusive use of their own helicopter. In mangrove-lined estuarine creeks, fish for Australia's top sporting fish, the barramundi, renowned for their fighting ability and spectacular jumping displays when hooked. We may see huge saltwater crocodiles basking on the banks of coastal rivers, before it's back in the chopper and up into the dense jungle streams, where we will set down and try our luck with the beautiful jungle perch. Our safaris are flexible, and the focus is on individual preferences whether it be fishing, photography, or sightseeing. All you will need is cool, sun-protective clothes and a hat. We provide the rest. Helifishing safaris cost $3850 per day for two people.

One hour joy flights over Cairns, the rainforest, waterfalls and jungle streams cost $385 per person.

Contact: Brazakka's Cape York Helicopters
Telephone: +61 (0) 7 40930250
Email: brazakka@brazakka.com.au
Fax: +61 (0) 7 40930251

All prices are in Australian dollars and include GST.

Social Functions

Lunches

Lunches will be served on Monday, Tuesday and Wednesday in the trade exhibition and poster program areas. Lunches are included for fulltime delegates and day delegates on their nominated day. Additional tickets are AUD$25.00 per person.

Happy Hours

Happy Hours will be served in the trade exhibition and poster program areas and are included for fulltime delegates.

19 August 2001

Welcome Reception
Tjapukai Aboriginal Cultural Park
6.00–8.00pm

To welcome delegates to the Symposium and to Cairns a special cocktail reception will be held at the Tjapukai Aboriginal Cultural Park. In addition to enjoying delicious bush tucker canapés with accompanying beverages, delegates will be treated to a performance of traditional songs and dances. Delegates will also experience the Creation Theatre, which features a performance using live actors and holograms retelling the Dreamtime stories of the Tjapukai people of the Cairns region. This performance is translated into 8 languages.

Attendance is included in the fulltime registration fee. To assist with catering numbers, please indicate your intention to attend on the registration form. Additional tickets may be purchased for AUD$55.00 per person.

22 August 2001

Symposium Dinner
Radisson Plaza Hotel, Cairns
From 7:00pm until midnight
Sponsored by: The Billfish Foundation

The dinner promises to be a Symposium highlight, and an opportunity to relax and converse with colleagues over a sumptuous Queensland meal. Attendance is included in the fulltime registration fee. To assist with catering numbers, please indicate your intention to attend on the registration form. Additional tickets may be purchased for AUD$75.00. Dress code: Lounge Suit.

Air Travel

Within Australia

We are pleased to announce that Ansett has been appointed the official airline for the Third International Billfish Symposium, with all domestic bookings within Australia being processed through Ozwings, a division of The OzAccom Group. Non-Conditional and Conditional discounts of up to 60% off the full economy airfare at time of booking have been negotiated, subject to seat availability in economy class at time of booking. As special discount airfares have been negotiated for delegates and partners, we suggest you contact Ozwings (details below) to secure the conference discount, or any other promotional fare which may be applicable. Please quote the Billfish Symposium when making your reservation.

For all Domestic Air Travel enquiries, please telephone Ozwings on:

Australian National Toll Free:	1 800 814 611
Brisbane Metropolitan Area:	07 3854 1611

Accommodation in Cairns

RADISSON PLAZA HOTEL AT THE PIER ★★★★★
(your conference venue)

Premier Room:	AUD$192.50 per night
Bay View Room:	AUD$203.50 per night
Marina View Room:	AUD$214.50 per night

Radisson Plaza is a 5 Star Hotel that is distinctively Queensland in design and style. Radisson offers the best of everything for both the leisure and business traveller. Rooms feature individually controlled air-conditioning and ceiling fans, mini-bar, in-house movies and marble bathrooms. 24 hour room service, business facilities and modem connections are available. Hotel Facilities also include 3 Pools, Spa, Sauna, Fitness Centre and the adjoining Pier Market Place with over 100 specialty shops.

MATSON PLAZA ★★★★

Single/Double/Twin Hotel Room:	AUD$135.00 per night
One Bedroom Tower Apartment:	AUD$185.00 per night
Two Bedroom Tower Apartment:	AUD$250.00 per night

Located on the Esplanade a short 10-minute stroll to the Radisson, this 4 star hotel offers stunning ocean and mountain views. Rooms offer a private balcony, tea and coffee facilities, air conditioning, mini-bar, in house movies, in room safe and 24 hour room service. Hotel facilities also include 2 restaurants and 3 bars, 3 Pools, 2 Tennis courts, Health Club as well as its own Supermarket, Hair and Beauty Salon and Gift shop.

ALL SEASONS ESPLANADE HOTEL ★★★

Single/Double/Twin Room:	AUD$103.00 per night

Located on the Esplanade, overlooking Trinity Bay, this 3 star hotel is a 5 minute walk to the Radisson. Facilities include, private balconies, TV, air conditioning, tea/coffee making facilities, minbar, iron/ironing board and in house movies. The hotel features indoor/out door pool, guest parking, laundry and laundry facilities and offers business centre services.

To secure and confirm your accommodation, credit card details are required as a guarantee. These details will be passed on to the hotel and it is at the hotel's discretion as to whether a deposit will be charged prior to arrival. An imprint will be required upon check in and your full account is to be settled with the hotel on departure. NB. No monies will be debited from your credit card by The OzAccom Group for accommodation. Alternatively, a deposit of one night's tariff by cheque is acceptable. Cheque payments should be made payable to the Third International Billfish Symposium. International delegates wishing to pay by cheque must provide an international bank draft, in Australian Dollars and drawn on an Australian Bank and Branch.

Registration Fees

	Before 30 June 2001	*After 30 June 2001*
Fulltime registration	AUD$595.00	AUD$795.00
Day only registration	AUD$295.00	AUD$345.00

Full-time delegate registration includes:

- Attendance at all Symposium sessions
- Welcome Reception
- Symposium Dinner
- Morning and Afternoon Teas
- Daily Lunches
- Happy Hours*
- A satchel containing the Symposium handbook/abstracts and other important information
- Symposium Proceedings (published after the Symposium)

Day only registration includes:

- Attendance at all Symposium sessions on nominated day
- Morning Tea, Lunch, Afternoon Tea and Happy Hour* on the nominated day
- A satchel containing the Symposium handbook/abstracts and other important information
- Symposium Proceedings (published after the Symposium)

* Please note that a Happy Hour will be held on Monday and Tuesday only.

Cancellation and Refund Policy

Cancellations for registration and accommodation will only be accepted in writing. Cancellations made prior to Tuesday 31 July 2001 will be refunded less AUD$150 to cover administration costs. **No registration refunds will be made after this date.** As an alternative to cancellation, your registration may be transferred to another person without penalty.

Flight cancellations will be subject to the conditions specified on your ticket. Please enquire with Ozwings when purchasing your ticket regarding cancellation conditions.

Cancellation of additional tickets for social functions will be available if participation is cancelled more than 48 hours prior to the function.

Disclaimer

The information in this brochure is correct at the time of printing. The Organising Committee of the Third International Billfish Symposium reserve the right to change without notice any aspect of the program.

Payment

All prices are in Australian dollars and are GST inclusive. Cheques or drafts must be made out in Australian currency and drawn on an Australian bank. Alternatively, payment by credit card is acceptable. Registration forms may be sent by facsimile only if payment is by credit card.

For Your Information

Symposium Office

On arrival at the Symposium, please register at the registration desk located in the Foyer of the Radisson. After Sunday, the registration desk will move to the conference level 2.

Office hours

Sunday 19 August 2001
12.00 noon – 5.00pm (Foyer level)

Monday 20 August 2001
7.00am – 5.30pm (Conference level 2)

Tuesday 21 August 2001
8.00am – 5.30pm (Conference level 2)

Wednesday 22 August 2001
8.30am – 5.30pm (Conference level 2)

Messages

A message board will be located near the registration desk. Please advise potential callers to contact the Radisson Plaza Hotel Cairns by telephone on +61 7 4031 1411 or facsimile +61 7 3854 1507 and attention to the Third International Billfish Symposium.

Personal Mail & Deliveries

Personal mail & deliveries should be sent to your accommodation address.

Tickets

Tickets are required for entry to lunches and social functions. Tickets for all activities must be pre-booked.

Baby Sitting

Please contact your accommodation venue for local sitting services.

Airport Transfers

Airport transfers are $15.00 approximately by taxi or $7.00 per person on the airport shuttle. Australia Coaches operates the airport shuttle and forward bookings can be made by calling +61 (0)7 4048 8355.

Dress & Climate

In August the temperatures range between 25–29°C with warm and sunny days enjoyed for most of the month. Dress for Symposium sessions and the welcome reception is smart casual. The Symposium dinner is lounge suit.

Car Parking

Car parking for inhouse guests is complimentary and a special rate of AUD$5.00 per day is available for non-house guests.

Visa

Please note that visas may be required to enter Australia. Please check with your travel agent or contact your local Australian Embassy.

Travel Insurance

The conference organisers recommend that all delegates purchase travel insurance including cover for non-refundable registration fees.

For further information contact the Conference Managers:

OzAccom Conference Services
PO Box 164
FORTITUDE VALLEY QLD 4006
AUSTRALIA
TOLL FREE: 1 800 814 611 (within Australia only)
TEL: +61 (0) 7 3854 1611
FAX: +61 (0) 7 3854 1507
EMAIL: billfish2001@ozaccom.com.au
WEBSITE: www.flamingobay.com.au/billfish 2001/

Registration Form

Please complete and return this form with payment to:
Third International Billfish Symposium
c/– OzAccom Conference Services
PO Box 164
FORTITUDE VALLEY QLD 4006
AUSTRALIA
Fax: +61 7 3854 1507
Please complete one form per delegate. The form may be photocopied.

The below prices are quoted in Australian Dollars and are inclusive of GST.

SECTION A: Personal Details

Surname: ..... Title (eg Mr/Mrs/Ms/Dr): .....

Given Name: .....

Organisation: .....

Position: .....

Postal Address: .....

Suburb/Town: ..... State: ..... Postcode: .....

Telephone: (work) ..... Facsimile: .....

Telephone: (home) ..... Email: .....

Special Requirements: Please note any specific dietary, medical or other requirements, eg. wheel chair access, vegetarian meals, allergies.

.....

.....

SECTION B: Registration Fee

	Before 30 June 2001	*After 30 June 2001*
Fulltime Delegate	☐ $595.00	☐ $795.00
Day only registration	☐ $295.00	☐ $345.00

Please indicate day/s required: ☐ Monday ☐ Tuesday ☐ Wednesday

Sub-Total $.....

Name for lapel badge: .....

SECTION C: Full-time Delegates Inclusive Social Functions

(For catering purposes, please tick the functions you will be attending)

☐ Welcome Reception ☐ Monday Lunch ☐ Tuesday Lunch ☐ Wednesday Lunch ☐ Symposium Dinner

SECTION D: Additional Social Function tickets

(Please indicate the number of extra tickets required)

	No. of tickets	*Cost*	*Total*
Welcome Reception	.....	$55.00	.....
Monday Lunch	.....	$25.00	.....
Tuesday Lunch	.....	$25.00	.....
Wednesday Lunch	.....	$25.00	.....
Symposium Dinner	.....	$75.00	.....

Sub-Total $.....

SECTION E: Workshop

Tuesday 21 August 2001 6.30 - 7.30pm
Management of the Australian Billfish Fishery

☐ Attending ☐ Not Attending

No Charge

SECTION F: Post Conference Tour

Thursday 23 August 2001 (not included in registration fees – please indicate the number of tickets required)

Great Barrier Reef Adventure Tour ..... $97.00 .....

Sub-Total $.....

SECTION G: Accommodation

Please note: A deposit of one night's tariff, or your credit card details as a guarantee, are required to secure your accommodation booking. Please indicate your first and second preference (refer to Accommodation section on page ??). Although every effort is made to secure your first preference, your second will be automatically selected if there is no availability at your first preference.

Preferences

1st..... 2nd .....

Please indicate the type of room required: ☐ Single ☐ Twin ☐ Double

Arrival date ...../...../01 Estimated time of arrival ..... am/pm

Departure date ...../...../01 Estimated time of departure ..... am/pm

I will be accompanied by, or have arranged to share with .....

Please note any special requirements (eg, cot, smoking) .....

SECTION H: Air Travel Request

Departure Date:.....Departure Airport:.....Preferred Time: .....

Return Date:.....Return Airport:.....Preferred Time: .....

Class of Travel (Please indicate)

Frequent Flyer No & Airline: .....

☐ Economy Class – Group Fare – up to 50% off full economy (ANSETT only) – Non-Conditional
☐ Economy Class – Advance Purchase Fare – up to 60% off full economy
– Minimum Saturday Night Stay and Conditions Apply
☐ Business Class

Please fill in the above details and our travel consultants will contact you to finalise details and arrange payment.

SECTION I: Payment

Section B: Registration fees $.....

Section D: Additional Tickets $.....

Section F: Post Symposium Tour $.....

Section G: Accommodation (if paying by cheque) $.....

TOTAL: $.....

☐ Please find enclosed my cheque/Money order
Please make cheques/money orders payable to *Third International Billfish Symposium*

☐ Please debit my credit card for $ .....

☐ Bankcard ☐ Mastercard ☐ Visa ☐ Amex ☐ Diners Club

Cardholder's name .....

Account number.....Expiry date ...../.....

Signature .....

Please note that debits to your credit card will appear as *Ozaccom* on your statement.

For more information contact OzAccom Conference Services on:
Telephone: + 61 7 3854 1611, Facsimile: + 61 7 3854 1507, or Email: billfish2001@ozaccom.com.au

COPY

Third International Billfish Symposium

19–23 August 2001
Radisson Plaza Hotel,
Cairns, Australia

International Host Body
The Billfish Foundation

BILLFISH
CONSERVATION THROUGH RESEARCH EDUCATION AND ADVOCACY

3RD INTERNATIONAL BILLFISH SYMPOSIUM
Cairns 2001

Handbook & Abstracts

Website: www.flamingobay.com.au/billfish2001/

Joint Principal Sponsors

FISHERIES RESEARCH & DEVELOPMENT CORPORATION

Department of Agriculture Fisheries & Forestry - Australia

Major Sponsors

NOAA Fisheries

Sponsors

CSIRO MARINE RESEARCH

GAA Research & Development Foundation

Media Supporter

BlueWater

FISHERIES
RESEARCH &
DEVELOPMENT
CORPORATION

FISHERIES RESEARCH AND DEVELOPMENT CORPORATION

The FRDC is a federal statutory authority that plans, funds and manages fisheries research and development in Australia, to:

- ensure that fisheries natural resources are used in a sustainable way
- enhance the profitability, international competitiveness and social resilience of the fishing industry
- develop and use the knowledge and skills of people in the fishing industry and the wider community

Expenditure

Total actual investment in projects under FRDC management in 1999-2000 was $47 million of which FRDC invested $17.2 million.

The FRDC seeks to maximise the effectiveness of its expenditure by:

- providing leadership in fisheries R&D
- investing in high-priority R&D that has the potential to deliver the highest benefits
- managing R&D programs effectively and efficiently, and
- making R&D results widely known, and facilitating their adoption and (if appropriate) commercialisation.

Vision

The FRDC's vision is three-fold:

For the industry

An Australian fishing industry in which:

- the commercial, recreational and traditional sectors are forward-looking, innovative and socially resilient, and use fisheries natural resources in an ecologically sustainable way; and
- the commercial sector is profitable and internationally competitive.

For the community

A community that is well-informed about, and supportive of, the fishing industry and the natural resources on which it depends.

For fisheries research

An excellent fisheries research sector that is forward-looking, innovative and responsive in supporting the industry and the community.

Mission

The FRDC's mission is to increase economic and social benefits for the fishing industry and the people of Australia, through planned investment in research and development, in an ecologically sustainable framework.

MORE INFORMATION:

For more information on the FRDC please check out our website: www.frdc.com.au

PO Box 222, Deakin West ACT 2600
Fisheries Research House, 25 Geils Court, Deakin
Phone: 02 6285 0400
Fax: 02 6285 4421
Email: frdc@frdc.com.au

The Fisheries Research and Development Corporation is a statutory authority of the Commonwealth Government's Department of Agriculture, Fisheries and Forestry – Australia

Welcome

On behalf of the Organising Committee, I take pleasure in welcoming you to the Third International Billfish Symposium. The Symposium is a landmark event in global scientific research and management of billfish.

I would like to thank our sponsors for supporting the Symposium – without their support, it would not have been possible to stage the event.

I encourage you over the next few days to enjoy the hospitality of Cairns.

Captain David Tomlinson
Organising Committee Chair

Symposium Organising Committee

Chair: Captain David Tomlinson,
Flamingo Bay Research Pty Ltd, Australia

Dr John Glaister,
Department of Sport & Recreation, Australia

Dr Michael Hinton,
Inter-Amercian Tropical Tuna Commission, USA

Dr Julian Pepperell,
Pepperell Research & Consulting Pty Ltd, Australia

Dr Eric Prince,
National Marine Fisheries Service, USA

Dr Ziro Suzuki,
National Research Institute of Far Seas Fisheries, Japan

Program Committee

Chair: Dr Julian Pepperell,
Pepperell Research & Consulting Pty Ltd, Australia

Dr Richard Brill,
Pelagic Fisheries Research Program, USA

John Gunn,
CSIRO Marine Research, Australia

Dr John Kalish,
Bureau of Rural Sciences, Australia

Dr Eric Prince,
National Marine Fisheries Service, USA

Wade Whitelaw,
Australian Fisheries Management Authority, Australia

Symposium Website

www.flamingobay.com.au/billfish2001/

3RD INTERNATIONAL BILLFISH SYMPOSIUM
Cairns 2001
19 - 23 AUGUST

Sponsors

The committee sincerely thanks our sponsors for their commitment to this event. It is their support that has enabled this Symposium to be held.

International Host Body

The BILLFISH FOUNDATION
CONSERVATION THROUGH RESEARCH EDUCATION AND ADVOCACY

Joint Principal Sponsors

FISHERIES RESEARCH & DEVELOPMENT CORPORATION

Department of AGRICULTURE FISHERIES & FORESTRY - AUSTRALIA

Major Sponsors

NOAA Fisheries

Sponsors

CSIRO MARINE RESEARCH

GBA RESEARCH & DEVELOPMENT FOUNDATION

Media Supporter

BlueWater

Symposium Program

Sunday 19 August 2001

12.00pm	Registration commences
5.30pm	Coaches depart from the Radisson Plaza Cairns to Tjapukai Aboriginal Cultural Park
6.00-8.00pm	Welcome Reception Tjapukai Aboriginal Cultural Park

Monday 20 August 2001

	Chair: David Tomlinson, Symposium Chairman and TBF Board Member
9.00am	Opening Ceremony
9.10	*Big Fish Down Under: A Brief History of Contact between Billfish and Man* **Julian Pepperell, Pepperell Research & Consulting Pty Ltd, Australia**
	Chair: Eric Prince, National Marine Fisheries Service, USA
9:30	*Stock Structure of the World's Billfishes* **John Graves, Virginia Institute of Marine Science, USA** ***Keynote Speaker Session proudly sponsored by National Marine Fisheries Service, USA***
10.30	Morning Tea in Trade Exhibition
	Chair: Alain Fonteneau, Institut de Recherches pour le Développment
	Theme: Stock Structure of the World's Billfishes
11.00	*Global Stock Structure of the Sailfish,* Istiophorus platypterus, *based on analyses of Mitochondrial and Nuclear DNA Markers* **Jan McDowell, Virginia Institute of Marine Science, USA**
11.20	*An Analysis of the Major Constituent-Based Billfish Tagging Programs in the Worlds Oceans* **Eric Prince, National Marine Fisheries Service – Miami, USA** Co-Authors: Mauricio Ortiz, David Holts, Kay Davy, Julian Pepperell, Michael Lowry, John Holdsworth
11.40	*Arabian Gulf Sailfish Movements – A Summary of Tagging Efforts* **John Hoolihan, Environmental Research and Wildlife Development Agency, United Arab Emirates**
12.00	*Genetic Analyses of Nuclear and Mitochondrial DNA Data indicate Heterogeneity of Swordfish within the Pacific Ocean* **Jaime Alvarado Bremer, Texas A&M University, USA** Co-Authors: Michael Hinton, Thomas Greig
12.20pm	Lunch in Trade Exhibition
	Chair: Sandy Wood-Meredith, Fisheries Research & Development Corporation
1.40pm	*Historical Perspective of Global Billfish Stock Assessment* **Yuji Uozumi, National Research Institute of Far Seas Fisheries, Japan** ***Keynote Speaker Session proudly sponsored by Fisheries Research & Development Corporation, Australia***
2.40	Afternoon Tea in Trade Exhibition
	Chair: Victor Restrepo, International Commission for Conservation of Tunas
	Theme: Stock Assessment of the World's Billfish
3.00	*Status of Striped Marlin,* Tetrapturus audax, *Stocks of the Eastern-Central Pacific* **Michael G. Hinton, Inter-American Tropical Tuna Commission, USA** Co-Authors: Mark Maunder, Yuji Uozumi
3.20	*Stock Assessment of Blue Marlin in the Pacific with Multifan-CL* **Pierre Kleiber, National Marine Fisheries Service – Honolulu, USA** Co-Authors: Michael Hinton, Marc Maunder, Yuji Uozumi
3.40	*Integration of Habitat Preferences into Population Abundance Indices: Robustness Tests using Simulated Data* **Phil Goodyear, USA**
4.00	*Relationship between Catch, Effort, CPUE and Local Abundance for a Non-Target Species caught by a Long Line Fishery* **Alain Fonteneau, Institut de Recherches pour le Développment, Seychelles**
4.20	*ICCAT's Stock Assessment of Atlantic Billfish* **Victor Restrepo, International Commission for the Conservation of Atlantic Tunas, Spain** Co-Authors: Eric Prince, Gerry P Scott, Yuji Uozumi
4.40	*An Estimation of Effective Fishing Effort of Japanese Longliners on Atlantic Blue Marlin,* Makaira nigricans, *in the Atlantic Ocean* **Kotaro Yokawa, National Research Institute of Far Seas Fisheries, Japan** Co-Authors: Makoto Okazaki, Hiroshi Okamura, Takayuki Matsumoto, Yuji Uozumi, Hirokazu Saito
5.00	Happy Hour & Poster Viewing & Trade Exhibition
6.00–7.00pm	Special Interest Meeting/Panel Discussion

Tuesday 21 August 2001

Chair: Ellen Peel, The Billfish Foundation

9.00am *Billfish Biology* **Kim Holland, Hawaii Institute of Marine Biology, USA**
Keynote Speaker Session proudly sponsored by the Billfish Foundation, USA

10.00 Morning Tea in Trade Exhibition

Chair: Richard Brill, National Marine Fisheries Service

Concurrent Session 1:
Theme: Biological Studies

10.30 *Electronic Tagging Technologies and their Potential use in Studying Billfish Movement, Behaviour, Habitat Preferences and Mortality Rates* **John Gunn, CSIRO Marine Research, Australia** Co-Author: Heidi Dewar

10.50 *An Estimation of Vertical Distribution Pattern of Atlantic Blue Marlin in the Tropical Central Atlantic based on the Archival Pop-Up Tag* **Hirokazu Saito, National Research Institute of Far Seas Fisheries, Japan**
Co-Authors: Kotaro Yokawa, Makoto Okazaki, Harumi Yamada, Yuji Uozumi

11.10 *Early Results from Pop-Up Archival Tagging Experiments with Black Marlin in the Coral Sea* **John Gunn, CSIRO Marine Research, Australia** Co-Author: Julian Pepperell

11.30 *Post-Release Mortality Rate of Striped Marlin Caught with Recreational Tackle* **Michael Domeier, Pfleger Institute of Environmental Research, USA** Co-Author: Heidi Dewar

11.50 *Modelling Visual Behaviour of Billfish* **Kerstin A Fritsches, University of Queensland, Australia**
Co-Author: Eric Warrant

12.10 *Age and Growth of Black Marlin,* Makaira Indica, *In East Coast Australian Waters* **Peter Speare, Australian Institute of Marine Science, Australia** Co-Author: Craig Steinberg

Chair: Michael Hinton, Inter-American Tropical Tuna Commission

Concurrent Session 2:
Theme: Stock Assessment of the World's Billfish

10.30 *Striped Marlin Catch Rates in the New Zealand Recreational Fishery* **John Holdsworth, Bluewater Marine Research, New Zealand** Co-Author: Peter Saul

10.50 *Trends in Billfish Catch from Longline Fisheries of the Western & Central Pacific Ocean* **Peter Williams, Secretariat of the Pacific Community, New Caledonia**

11.10 *Use of Charter Boat Catch and Effort Data to Infer Annual Indices of Black Marlin Availability in the Cairns-Lizard Island Region Between 1970–1977* **Robert Campbell, CSIRO Division of Marine Research, Australia**
Co-Authors: Julian Pepperell, Tim Davis

11.30 *Trends In Billfish Catches By Venezuelan Longline And Artisanal Gillnet Fisheries In The Caribbean Sea And The Western Central Atlantic* **Freddy Arocha, Instituto Oceanografico De Venezuela, Venezuela**
Co-Author: Luis Marcano

11.50 *Indicators of the Exploitation Level in the Sailfish Fishery in the Western Coast of Mexico* **Rene Macias Zamora, Fishery National Institute, Mexico** Co-Authors: Ana Vidaurri-Sotelo, H Santana-Hernandez, Jávier Valdez-Flores

12.30pm Lunch in Trade Exhibition

Chair: Bob Lowe, Game Fishing Association of Australia

2.00 *Social and Economic Benefits of Billfish Fisheries* **Robert Ditton, Texas A&M University, USA**
Keynote Speaker Session proudly sponsored by the GFAA Research and Development Foundation

3.00 Afternoon Tea in Trade Exhibition

Chair: Julian Pepperell, Pepperell Research and Consulting Pty Ltd

Concurrent Session 3:
Theme: Socio-Economics of Billfish Fisheries

3.30 *Gamefishing Facilities and Recreational Billfish Catches of Pacific Island Nations in the Western and Central Pacific* **Wade Whitelaw, Australian Fisheries Management Authority, Australia**

3.50 *Historical Development of Recreational Billfishing in Bermuda and the Significance of Catches of Very Large Blue Marlin,* Makaira nigricans **Brian Luckhurst, Division of Fisheries, Bermuda**

4.10 *Economic Valuation of the Benefits of Recreational Billfishing in Manzanillo, Colimo, Mexico* **Juan Carlos Chavez-Comparan, Universidad de Colima, Mexico** Co-Author: Cesar A Liceaga-Torres

4.30 *Estimating the Economic Value of the New Zealand Recreational Billfish Fishery* **John Holdsworth, Bluewater Marine Research, New Zealand** Co-Authors: Rick Boyd, Peter Saul

	Chair: Michael Laurs, National Marine Fisheries Service, USA
	Concurrent Session 4: **Theme: Biological Studies**
3.30	*Evidence of Blue Marlin,* Makaira nigricans, *Spawning in the Vicinity of Exuma Sound, Bahamas* **Joseph Serafy, University of Miami, USA** Co-Authors: Robert Cowen, Claire Paris, Thomas Capo, Stacy Luthy
3.50	*Reproductive and Larval Studies of Billfish in the Eastern Tropical Pacific off Mexico* **Rogelio González-Armas, Cicimar-Ipn, Mexico** Co-Authors: Alexander Klett-Traulsen, Agustín Hernández-Herrera
4.10	*A Molecular Approach to the Identification of Larval Istiophorid Billfishes* **Stacy Luthy, University of Miami, USA** Co-Author: Jan McDowell
4.30	*Trophic Overlap between Three Billfish Species from Cabo San Lucas, Mexico* **Felipe Galvan-Magaña, Centro Interdisciplinario De Ciencias Marinas, MEXICO** Co-Authors: L. Andres Abitia-Carenas, Victor H. Cruz-Escalona, Francisco J. Gutierrez-Sanchez
4.50	*Analysis of Sportfishing Catch Rates of Striped Marlin,* Tetrapturus audax *at Cabo San Lucas, Baja California Sur, Mexico, and their Relation to Sea Surface Temperature* **Sofia Ortega-Garcia, Cicimar-Ipn, Mexico** Co-Authors: Alexander Klett-Traulsen, German Ponce-Diaz
5.10	*Biological and Fishery Aspects of the Mediterranean Spearfish,* Tetrapturus belone *Rafinesque, 1810* **Antonio Potoschi, University of Messina, Italy** Co-Authors: Silvana Campagnuolo, Rosetta Bruno, Franco Andaloro
5.30	Happy Hour & Poster Viewing & Trade Exhibition
6.30	**Workshop – Management of the Australian Billfish Fishery** Facilitator: Peter Rogers, Western Australia Fisheries Rapporteur: Julian Pepperell, Pepperell Research and Consulting Pty Ltd

Wednesday 22 August 2001

	Chair: Department of Agriculture, Fisheries and Forestry, Australia
9.00am	*Management of the World's Billfish* **Dr Bill Hogarth, National Marine Fisheries Service, USA** ***Sponsored by Department of Agriculture, Fisheries, Forestry – Australia***
10.00	Morning Tea in Trade Exhibition
	Chair: Ziro Suzuki, National Research Institute of Far Seas Fisheries, Japan
	Theme: Management of Billfish
10.30	*Managing Billfish in the Eastern Tropical Pacific: Past, Present and Future* **Russell Nelson, Nelson Consulting, USA** Co-Author: Ellen Peel
10.50	*Managing Marlin as Bycatch under ICCAT, the Fork in the Road – Recovery or Collapse* **Ellen Peel, The Billfish Foundation, USA** Co-Authors: Phil Goodyear, Russell Nelson
11.10	*Reducing Bycatch and Bycatch Mortality in the US Atlantic Pelagic Longline Fisheries* **John Graves, Virginia Institute of Marine Science, USA** Authors: Buck Sutter, Jill Stevenson, Karyl Brewster-Geisz
11.30	*Marlin – A Shared Resource in Australia?* **James Findlay, Australian Fisheries Management Authority, Australia** Co-Authors: Colleen Cross, Andrew Bodsworth
11.50	*Pelagic Fisheries Catching Marlins in the US Western Pacific Region* **Paul Dalzell, Western Pacific Regional Fisheries Management Council** Co-Authors: Kevin Kelly, Chris Boggs
12.10	*NSW Fisheries Gamefish Monitoring Program* **Michael Lowry, NSW Fisheries, Australia**
12.30	*Are Increases in the Minimum Size Limits of Landed Billfish an Effective Management Approach to Reduce Total Landings?* **Arietta Venizelos, National Marine Fisheries Service, USA**
12.50pm	Lunch in Trade Exhibition
	Chair: Freddy Arocha, Instituto Oceanografico De Venezuela
1.30	*The Status of the Broadbill Swordfish: Experience from the Atlantic to Mediterranean* **Gerry Scott, National Marine Fisheries Service, USA**
2.30	Afternoon Tea in Trade Exhibition

	Chair: Michael Leech, International Game Fish Association
	Theme: Biology & Status of Broadbill Swordfish
3.00	*Swordfish Fishery Operational Model* **Marc Labelle, Secretariat of the Pacific Community, New Caledonia**
3.20	*Status of Fisheries and Swordfish in the Eastern Pacific Ocean* **Michael G. Hinton, Inter-American Tropical Tuna Commission, USA** Co-Author: Mark Maunder
3.50	*Monitoring and Assessment of the Chilean Swordfish,* Xiphias gladius, *Fishery* **Eleuterio Yáñez, Universidad Católica De Valparaíso, Chile** Co-Authors: Maria Angela Barbieri, Francisco Ponce, Karen Nieto, Jose Acevedo, Claudio Silva
4.10	*Reproductive Biology of Broadbill Swordfish,* Xiphias gladius, *from Eastern Australia* **Jock Young, CSIRO Marine Research, Australia** Co-Authors: Anita Drake, Thor Carter, Michael Brickhill, Jessica Farley
4.30	*The Reproductive Strategy and Survival of Swordfish,* Xiphias gladius, *in the Northwestern Atlantic* **Freddy Arocha, Instituto Oceanografico De Venezuela, Venezuela**
4.50	*Analysis of Swimming Behaviour of a Swordfish using an Archivaltag* **Mio Takahashi, National Research Institute of Far Seas Fisheries, Japan** Co-Authors: Makoto Okazaki, Hiroshi Okamura, Kotaro Yokawa
5.10	Closing Ceremony
5.30	Conference Concludes
7.00	Pre-dinner drinks
7.30pm	Symposium Dinner Radisson Poolside ***Sponsored by The Billfish Foundation***

Poster Program

1. *Genetic Analyses of Swordfish around South African Waters indicate Indian Ocean Origin* **Jaime Alvarado Bremer, Texas A&M University, USA** Co-Authors: Marc Griffiths, Thomas Greig
2. *How do Pelagic Fish Home to Fish Attraction Devices (FADS): An Investigation of the Role of Chemical Cues* **Tim Dempster, University of Sydney, Australia**
3. *Spatiotemporal Distribution of Atlantic Marlin Longline CPUE and Sea Surface Temperature* **Phil Goodyear, USA**
4. *Simulated Responses of the Size Distribution of Blue Marlin to Fishing Mortality* **Phil Goodyear, USA**
5. *Economic Impact of the Sport Fishing at La Paz Bay, Baja California Sur, Mexico* **Adrian Moyron, Centro De Investigaciones Biologicas Del Noroeste, Mexico** Co-Authors: German Ponce-Diaz, Sofia Ortega-Garcia
6. *Sexual cycle of swordfish* (Xiphias gladius) *from the western Indian Ocean* **Francios Poisson, IFREMER, France** Co-Authors: C Marjolet, C Fauvel, M Taquet
7. *Batch Fecundity and Sqawning Frequency of Swordfish* (Xiphias gladius L.) *in the South-west Indian Ocean,* **Francios Poisson, IFREMER, France** Co-Authors: C Marjolet, C Fauvel, M Taquet
8. *Lunar Phase and Success of Catch of the Striped Marlin,* Teterapturus audax **Germán Ponce-Díaz, Centro De Investigaciones Biológicas 'El Comitán', Mexico**
9. *Mexican Swordfish Longline Fishery Project – Two Years of Scientific Data Collection* **Patricia Rojo-Díaz, Mexican National Fishery Institute, Mexico** Co-Authors: Miguel Angel Cisneros-Mata, Luis Vicente Ania-Gonzaléz
10. *Ecological Aspects of the Billfishes and Associated Species Captured by the Mexican Longline Fleet during the Period 1983–1996.* **Heriberto Santana-Hernández, National Fisheries Institute, Mexico** Co-Author: Réne Macías-Zamora, Ana Luisa Vidaurri-Sotelo, Juan Javier Valdez-Flores
11. *Environmental Factors Influencing the Activity of Black Marlin* **Peter Speare, Australian Institute of Marine Science, Australia** Co-Author: Craig Steinberg
12. *Effective Utilisation of Billfish in Japan* **Kazushige Usui, Kanagawa Prefectural Fisheries Research Institute, Japan**
13. *Biological Observations of the Sailfish,* Istiophorus platypterus, *in the Mexican Pacific Ocean and its Management.* **Ana Luisa Vidaurri Sotelo, National Fishery Institute, Mexico** Co-Authors: Réne Macías-Zamora, Heriberto Santana-Hernandez, Juan Javier Valdez-Flores
14. *Distribution and abundance of blue marlin larvae off Kona Hawaii* **Andrew West, University of Technology Sydney, Australia**

Social Functions

Lunches

Lunches will be served on Monday, Tuesday and Wednesday in the trade exhibition and poster program areas. Lunches are included for fulltime delegates. Additional tickets are AUD$25.00 per person.

Happy Hours

Happy Hours will be served in the trade exhibition and poster program areas and are included for fulltime delegates.

Sunday 19 August 2001

Welcome Reception

Tjapukai Aboriginal Cultural Park
6.00–8.00pm

Coaches will depart from the Radisson Plaza Cairns at 5.30pm – please assemble in the foyer at 5.15pm. Coaches will return you to your preferred hotel at the end of the welcome reception.

Attendance is included in the fulltime registration fee. Additional tickets may be purchased for AUD$55.00 per person.

Wednesday 22 August 2001

Symposium Dinner

Poolside, Radisson Plaza Cairns
Pre-dinner drinks commence at 7.00pm
Dinner commences at 7.30pm
Sponsored by: The Billfish Foundation

Take the opportunity to relax with colleagues over a sumptuous Queensland meal. Attendance is included in the fulltime registration fee. Additional tickets may be purchased for AUD$75.00. Dress code: Dinner Jacket.

Post Symposium Activities

Thursday 23 August 2001

Great Barrier Reef Adventure Tour

Tickets are still available, please contact the staff at the registration desk. Tickets at the special delegate rate are AUD$97.00 per person.

Accommodation

Radisson Plaza Cairns
Tel: 07 4031 1411

Matson Resort
Tel: 07 4031 2211

All Seasons Esplanade Hotel
Tel: 07 4051 2311

For Your Information

Symposium Office

The registration desk will be located in the Radisson Foyer on Sunday and then will move to the conference level 2 on Monday until Wednesday.

Office hours

Sunday 19 August 2001
12.00 noon–5.00pm (foyer level)

Monday 20 August 2001
7.00am–5.30pm (conference level 2)

Tuesday 21 August 2001
8.00am–5.30pm (conference level 2)

Wednesday 22 August 2001
8.30am–5.30pm (conference level 2)

Messages

A message board will be located near the registration desk. Please advise potential callers to contact the Radisson Plaza Hotel Cairns by telephone on +61 7 4031 1411 and ask for the Third International Billfish Symposium.

Dress

Dress for the Symposium including the Welcome Reception and Symposium Dinner is smart casual.

Tickets

Tickets are required for entry to lunches and social functions. Tickets for all activities must be pre-booked and will be in your registration envelope. If you have any problems with regards to your tickets, please see the Symposium registration desk.

Airport Transfers

Airport transfers are approx. $15.00 by taxi or $7.00 per person on the airport shuttle. Please contact your hotel concierge to arrange your transport to the airport.

Event Managers

OzAccom Conference Services
PO Box 164
FORTITUDE VALLEY QLD 4006
TOLL FREE: 1 800 814 611
TEL: 07 3854 1611
FAX: 07 3854 1507
EMAIL: ozaccom@ozaccom.com.au
WEBSITE: www.flamingobay.com.au/billfish 2001/

Name Badges

Upon registration all delegates will be issued with a name badge and are requested to wear it all times during the Symposium. Please note the following colour coding:

White = delegates
Yellow = committee
Blue = keynote speakers
Green = session chairs

Trade Exhibition

All morning and afternoon teas, lunches and happy hours will be served in the trade exhibition and poster areas.

Telephones

As a courtesy to speakers and other delegates, please ensure that all mobile phones & pagers are turned off during sessions.

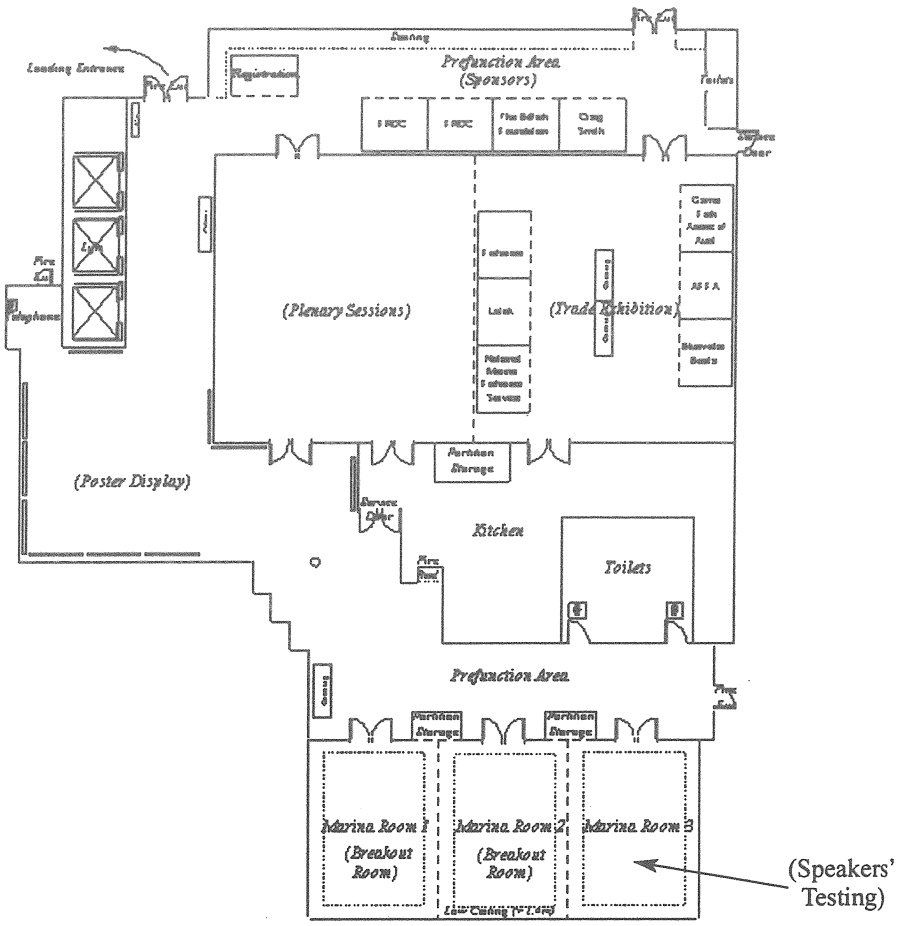
Disclaimer

All information disclosed in the Symposium program is correct at the time of printing. The organising committee reserves the right to alter the program in the event of unforeseen circumstances.

All speakers were asked to provide abstracts for this handbook, unfortunately, not all were able to provide us with their papers.

Trade Exhibition

Floor plan



Bluewater Boats and Sportsfishing Magazine

BlueWater Boats & Sportsfishing is the only gamefishing magazine dedicated to the Pacific.

Since its establishment, it's earned an enviable reputation for quality gamefishing editorial content, high production values and its commitment to gamefish conservation.

Published six times per year, each issue includes a range of features and the latest gamefishing news from around the Pacific. How tos, boat reviews, destination features and the latest techniques, it's all in every issue of BlueWater.

With subscribers in 41 nations around the globe, BlueWater has a strong following. In fact, it boasts many of the Pacific Rim's elite anglers as readers and contributors alike.

Currently BlueWater is available

via newsstands in Australia, Singapore and New Zealand,
via selected outlets on the West Coast of the United States
via subscription worldwide

Craig Smith Marine Art

Cairns-based Craig Smith, the designer of the Symposium logo, illustrates and paints sportfishing subjects exclusively. His work covers scientific and identification species studies, regular sportfishing magazine contributions, cartoons, paintings on global navigation charts and a variety of original commissions. Craig regularly attends billfishing tournaments around the Pacific and plans travelling to coastal USA in 2002.

FRDC

The FRDC is a rural research and development corporation within the Commonwealth Government portfolio of Agriculture, Fisheries and Forestry – Australia (AFFA) responsible to its stakeholders for:

- planning, funding and managing R&D programs; and
- facilitating the dissemination, adoption and commercialisation of the results of R&D.

The FRDC's mission is to increase economic and social benefits for the fishing industry and the people of Australia, through planned investment in research and development, in an ecologically sustainable framework.

The FRDC has become widely recognised as the leading Australian agency concerned with planning, funding and managing fisheries R&D.

GFAA R&D Foundation: The Australian Gamefish Foundation

Bob Lowe
8/765 Princess Hwy, Tom Ugly's Point, NSW

The GFAA Research & Development Foundation and The Australian Gamefish Foundation were established in 1994 by the Game Fishing Association of Australia, to focus on environmental and conservation issues associated with recreational game fishing.

Current projects are:

- Colour vision in Billfish
- Archival satellite transmitting tags

Lotek Wireless Inc.

Keith Stoodley
114 Cabot St., St. John's, NF, A1C 1Z8

Lotek Wireless is a full service manufacturer of innovative electronic products and systems designed for tracking fish and wildlife.

Products include:

archival tags (time/depth recorders or TDR's, temperature/Time/depth recorders or TTDR's, and geolocation data-storage tags), acoustic monitoring systems (manual tracking and data logging), radio telemetry, and GPS tags.

NSW Fisheries

Vera Fiala
Manager, Communications & Marketing

John Diplock
Recreational Fisheries Manager

As managers of Gamefish Tagging Programs, with responsibility for a component of the game fishing off eastern Australia, NSW Fisheries is pleased to support the Third International Billfish Symposium.

Our gamefish tagging program has become the largest recreational tagging program in the world. It is an example of responsible and progressive attitude of anglers to the use of fisheries resources.

The National Marine Fisheries Service

The National Marine Fisheries Service (NOAA Fisheries) is responsible for rebuilding, sustaining and protecting the nation's living marine resources. Scientists at NOAA Fisheries Southeast Fisheries Science Center in Miami, Florida, are involved in a number of cooperative research projects to help answer some of the more challenging problems involved with sustainable management and rebuilding of Atlantic highly migratory species. Many of these species, including blue and white marlin, are considered over-exploited . Working in partnership with the University of Miami, NOAA Fisheries scientist Joe Serafy will present his findings to the Symposium on work to profile and understand essential "spawning" habitat of blue marlin in Exuma Sound in the Bahamas, where large concentrations of blue marlin larva have been found. In addition, NOAA Fisheries scientist Eric Prince, and John Graves, Virginia Institute of Marine Science, are currently publishing the results of their work over the last few years on popup satellite archival tags and the application of this cutting edge technology to estimate post-release survival rates of marlin. In cooperation with commercial pelagic longline fishermen and recreational anglers, pop-off satellite archival tags have and are currently being been deployed in the North Atlantic ocean, to assess reproductive behavior and post release survival of adult billfishes. The United States is confident that research projects such as these will provide valuable insights into fisheries management and the sustained international exploitation of these species. For more information regarding this research and other Highly Migratory Species work in science and management, *please contact Chris Rogers, Acting Director for Highly Migratory Species (301) 713-2347.*

The Billfish Foundation

Ellen Peel
PO Box 8787, Fort Lauderdale, Florida USA 33310-8787
Tel: (954) 938 0150
Fax: (954) 938 5311
Email: tbf@billfish.org

The Billfish Foundation (TBF) is a non-profit organisation that works worldwide to influence the development of constructive management and conservation strategies for the world's billfishes through research, education and advocacy. TBF distinguishes itself by actually funding independent research for billfish. Research proposal guidelines can be obtained from the Research Section on TBF's website at www.billfish.org

Table of Contents - Abstracts

Genetic Analyses of Swordfish Around South African Waters Indicate Indian Ocean Origin

Jaime Alvarado Bremer
Texas A&M University, USA

Co-Authors: Marc Griffiths, Thomas Greig

Genetic studies using both mitochondrial DNA and nuclear data have indicated strong differentiation between Indo-Pacific and Atlantic Ocean populations of swordfish. However, no study has determined the boundary, either temporal or geographical, which separates these populations. Ocean current patterns suggest that the waters around South Africa may contain primarily swordfish of Indian Ocean origin. Assigning the stock origin to swordfish caught around South Africa has important management implications. We examined the temporal and the geographical distribution of both nuclear and mitochondrial markers in samples of Atlantic and Indian Ocean origin. Data for the D-loop region and three nuclear genes, aldolase-B and lactate dehydrogenase-A and calmodulin gene intron 4 were analyzed. Temporal analyses of variation showed no within-sample differences for both nuclear and mitochondrial data. However, significant pair-wise differences involved comparisons of mtDNA and nuclear data of South African samples with Atlantic samples from the western coast of Africa. These results indicate that the level of ongoing gene flow between the Indian Ocean and the South Atlantic population is low. These results underscore the importance of oceanographic factors or phylopatric behavior in limiting the levels of gene flow in a highly migratory species.

Genetic Analyses of Nuclear and Mitochondrial DNA Data indicate Heterogeneity within the Pacific Ocean

Jaime Alvarado Bremer
Texas A&M University, USA

Co-Authors: Michael Hinton, Thomas Greig

Recent analyses of both mitochondrial DNA and nuclear data have indicated genetic differences among Pacific Ocean samples of swordfish. The pattern of distribution and heterogeneity of genotypes appears to be complex, with no clear resolution in the total number of demes, nor on the boundaries in time and space separating these putative subunits. Here we present the results of mtDNA D-loop sequence data as and that of two nuclear genes, aldolase-B (aldB) and lactate dehydrogenase-A (ldhA) for samples collected over a widespread area of the Pacific. Temporal analyses of variation showed no within-sample differences for both nuclear and mitochondrial data. Similarly, the hierarchical analysis of molecular variance (AMOVA) of D-loop sequences revealed no differences among the samples collected in Ecuador, Hawaii and Mexico. However, significant pair-wise differences involved comparisons of mtDNA data for the samples from Australia and California. Both nuclear markers revealed small but significant differences in frequency distribution among EPO samples, which are confirmed by significant AMOVA results. However, there is no clear geographic demarcation that explains this heterogeneity. Significant differences were observed in the comparison of Hawaii with Australian sample. Overall, the Australian sample showed the highest level of differentiation among the samples surveyed.

Trends in Billfish Catches by Venezuelan Longline and Artisanal Gillnet Fisheries in the Caribbean Sea and the Western Central Atlantic

Freddy Arocha
Instituto Oceanográfico de Venezuela, Universidad de Oriente, VENEZUELA

Co-Authors: Luis Marcano

The Venezuelan official scientific fishery agency (INIA, formerly FONAIAP) and the Instituto Oceanográfico de Venezuela with the support of the International Commission for the Conservation of Atlantic Tunas (ICCAT) Enhanced Research Program for Billfish (ERPB) has been monitoring the billfish catches in Venezuela since 1991. A large pelagic observer program in the longline fleet and a port sampling program for the artisanal fleet has been implemented to collect data on billfish catches more efficiently. Information of observer trip coverage and observed bycatch of billfish by species is presented. The observed covered trips showed a steady increase, from 16 covered trips (99 sets) in 1991 to leveling around 35 trips/year since 1993 (320–488 sets). The billfish catch in numbers for the overall period (1991–1999) amounted to 9.80% of the total catch, where white marlin represented 4.0% and blue marlin 2.4%. Length frequency distribution for each billfish species showed clear modes, 150 cm LJFL in white marlin, 175 cm LJFL in sailfish, 190 cm LJFL in blue marlin and 170 cm LJFL in longbill spearfish. Seasonal billfish catch rate from longline catches by species is presented as number of specimens by 100 hooks. The artisanal gillnet fishery is localized offshore from La Guaira, an area known for large concentrations of billfish species. The billfish catch in numbers for the overall period (1991–1999) amounted to 60% of the total catch, of which 46% were of blue marlin, 50% of sailfish and 4.0% of white marlin. Catches for sailfish and blue marlin from 1991 to 1999, showed a steady increase from 1995 through 1999, most likely due to the increase in the number of trips during the same period of time. Length frequency distribution for each billfish species caught by the artisanal gillnet fishery showed clear modes of 165 cm LJFL in white marlin, 170 cm LJFL in sailfish, and 200 cm LJFL in blue marlin. Catch at size between the two fisheries are compared and discussed.

The Reproductive Strategy and Survival of Swordfish *Xiphias gladius* in the Northwestern Atlantic

Freddy Arocha
Instituto Oceanográfico de Venezuela, Universidad de Oriente, VENEZUELA

The reproductive strategy of a species can be seen as a complex of reproductive traits that fish display to ensure perpetuity of the species. Such traits include time and length of the reproductive season, size and age at maturity, degree of parity (sex ratio), size and age-specific fecundity, oocyte size, and in some cases sex reversal. For a reproductive strategy to be successful, the fish must make tactical changes in the details of the reproductive strategy, such as variations in its reproductive output in response to fluctuations in the environment. In the case of swordfish, the analysis of

recognizable traits should reveal the tactics the species uses to achieve its reproductive strategy. The traits analyzed in swordfish were, the spatio-temporal spawning pattern as expressed by a relative gonad index, the size and age at maturity, the sex ratio, the size and age-specific fecundity, the size and age-specific of energy allocation to the oocytes and spatio-temporal fluctuations in dry mass, size and energy content of vitellogenic oocytes. The changes in some of these traits in relation to environmental fluctuations were used to define the reproductive strategy of swordfish in the northwestern Atlantic. Examination of the changes in the reproductive traits in relation to environmental fluctuations showed that the reproductive strategy displayed by swordfish in the northwestern Atlantic consists of females with long life spans, most likely up to or exceeding 20 years old, a late age at maturity and very high potential annual fecundities (probably one of the highest in teleost fishes). Large females seem to display movements between feeding in highly productive grounds in the temperate area during the summer-fall months and spawning in subtropical areas during the winter-spring months. Spawning takes place when upper layer temperatures are around 24–25°C and salinity is around 36.5–37.0 ppt. Males show an early age at maturity and are mostly restricted to warmer waters of the northwestern Atlantic. Males attain smaller sizes than females due to differential growth between the sexes, although appear to have equal longevity to females. The reproductive strategy displayed by swordfish in the northwestern Atlantic maximizes survival of the larvae in the pelagic environment by: (1) taking advantage of inshore and offshore spawning grounds in warm subtropical waters during the winter and spring to coincide with sparsely distributed prey at mid-depths; (2) having a very high total potential fecundity, spawning about every 3 days through most months of the year; (3) larvae having anatomical features which promote survival and fast growth mid-pelagic waters; (4) using "brain heaters" to maximize the ability to feed at depths with sharp temperature changes; (5) spawning at mid-depths swordfish larvae avoid competition with the larvae similar species that predominate in surface waters; (6) once spawning ends, post-spawned fish move to highly productive waters to fulfill their energy requirements.

Use of Charter Boat Catch and Effort Data to Infer Annual Indices of Black Marlin Availability in the Carins-Lizard Island Region between 1970-1977

Robert Campbell
CSIRO, Australia

Co-Authors: Julian Pepperell, Tim Davis

The recreational fishery which targets black marlin in the Cairns/Lizard Island region off north-eastern Australia is world renowned, with many world record fish having been caught in the region. However, despite the well-developed nature of this fishery, and similar fisheries in other regions of the Pacific, annual indices of stock size for black marlin are not well developed. To help overcome this problem, catch data recorded in daily logbooks and diaries kept by the skippers of charter boat operators in the Cairns/Lizard Island region were collected and used to calculate annual indices of fishing success (catch per day) of black marlin in this fishery. These indices were standardised (using Generalised Linear Models) to account for a number of features which possibly influence catch rates, such as skipper, area fished, water temperature, moon phase and the strength and direction of prevailing currents. The annual indices of fishing success were then correlated with the longline effort in the region in order to assess the potential size of an interaction between the recreational and longline fisheries. The results from the models fitted to the data for the period 1970–97 indicate a high degree of inter-annual variability in the catch rates of black marlin taken by charter boats operating in the fishery. Despite this, the results also indicate that there has been a long-term decline (between 20–30%) in the catch rates over this period. However, the models fitted to the data for the period 1987–96 indicate that several environmental factors may have a significant influence on catch rates. In particular, seasonal variations in sea-surface temperature explain some of the inter-annual variations in catch rates. Indeed, the poor catch rates reported during the 1998 season are strongly correlated with unusually high sea-temperatures at the time. Moon-phase was also found to significantly influence daily catch rates. The correlation of catch rates with longline effort within the inshore region close to the recreational fishery was found to be non-significant, explaining only about 20 percent of the annual variation inn catch rates for the period 1970–97. The lack of a strong relationship is also supported by the absence of significant changes in catch rates after the two spatial closures to longlining in 1980 and 1991. However, more data from the charter fishery, especially for the period of increasing longline effort during the 1990s, would help clarify the present situation. In particular, data for the relatively poor and good years in 1998 and 1999 respectively would provide some good contrast in the data and help determine the strength of this relationship with greater precision.

Economic Valuation of the Benefits of Recreational Fisheries In Manzanillo, Colimo, Mexico

Juan Carlos Chavez-Comparan
Universidad De Colima, MEXICO

Co-Authors: Cristian Daniel Ortega Ortiz, Cesar Augusto Liceaga Torres

Recreational fisheries are important economic resources affected by conflicts with commercial fisheries. In order to generate information for management support of recreational fisheries, contingent valuation and travel cost methods were applied to estimate the economic value of angling billfish in Manzanillo, Colima, Mexico. The results indicate that recreational fisheries in Manzanillo generate important economic benefits, including not only direct economic impacts to the local economy, but also net economic benefits that anglers may experience. Fishery managers in Mexico should consider incorporating into their decisions information on net economic benefits of recreational resources instead of using only market information.

Pelagic Fisheries Catching Marlins in the US Western Pacific Region

Paul Dalzell
Western Pacific Regional Fishery Management Council, USA

Co-Authors: Kevin Kelly, Chris Boggs

Pelagic fisheries in the US Pacific Islands capture substantial quantities of marlins, particularly blue and striped marlins. This includes two longline fisheries, four small vessel

commercial troll fisheries, two charter vessel fisheries and one handline fishery. Catch records for these fisheries typically extend over one or two decades and in the case of Hawaii's small vessel troll and longline fisheries between 3 and 5 decades respectively, allowing comparison of catch rate time series over a wide area of the Pacific. A major decline in Hawaii longline fishery blue marlin CPUE was evident between 1959 and 1970 which was coincident with expansion of longline fishing throughout the Pacific. The CPUE' trends for troll and handline fisheries were highly variable but suggested declining CPUE's for blue and striped marlins in most fisheries during the latter half of the 1990s. The potential for interactions between offshore longline fishing and near shore troll and handline fisheries continues to generate tension between these fisheries, particularly in Hawaii and Guam. The landing of marlins for consumption by both longline and small vessel troll fisheries in the Western Pacific Region also continues to attract criticism and a call for greater volume of marlins to be tagged and released. There are no specific managment restrictions on the catching of marlins in any pelagic fishery in the Western Pacific Region but management of longline fishing in Hawaii and Amercian Samoa may have some impact on near shore troll fisheries catching blue and striped marlins.

Detection of Fish Attraction Devices (FADS) by Pelagic Fishes: An Investigation of the Role of Chemical Cues

Tim Dempster
University Of Sydney, AUSTRALIA

Co-Authors: Michael Kingsford

Natural and artificial fish attraction devices (FADs) attract pelagic fishes in great number and diversity. Visual cues have long been thought to be important in attraction of fish to FADs. Large fish, however, can return to FADs despite swimming beyond visual range, suggesting other mechanisms drive association. A manipulative experiment to test the importance of chemical cues for fish finding FADs was conducted around two heavily fouled buoys moored 11 km off Sydney. Juvenile dolphinfish, Coryphaena hippurus, were captured close to FADs in both 2000 (n=58) and 2001 (n=63). Fish were marked with dart tags coloured for individual recognition and released across- or down-current of the buoy at one of three distances (20m, 75m and 275m). 'Returnees' were counted during a series of drift dives around the buoy; overall rates of return were close to 50% in 2000, but were significantly lower in 2001 (8%). Dolphinfish released both across-current and down-current at all distances returned in similar proportions. Chemical cues, therefore, did not appear to increase the rate of return of dolphinfish to FADs at the scale of 275 m. Other possible mechanisms by which fish find and maintain their association with FADs will be discussed.

Social and Economic Benefits of Billfish Fisheries

Robert Ditton
Texas A&M University, USA

At the Second International Billfish Symposium, it was reported little was known about the social and economic aspects of recreational billfish fisheries. There was lots of background, some good questions, but few answers. There had been a tradition of little social science involvement in fisheries management at the time (this is still the case today!) and even less in billfish fisheries. Whether authorized or not, fishery management decisions worldwide are going to be made on the basis of 'best available' social and economic understandings. Unfortunately, the values held by many in the billfish angler community are not likely to be well represented in the mix for various reasons. Research in the USA and in Latin America over the past 13 years has provided an understanding of the billfish angler constituency, its commitment to catch and release and support for resource conservation, its local and regional impacts on tourism economies, and its willingness-to-pay above and beyond trip costs (a measure of user value) in the U.S. Atlantic, Puerto Rico, Costa Rica, and Mexico Pacific. While knowledge of the recreational billfish fishery has improved, comparatively little is known about the social and economic benefits associated with commercial (direct and by-catch) billfish fisheries. With little more than dockside prices available in many locales, it is difficult to know their value in comparison to recreational fisheries. In addition to describing what is still not known, this paper will take a values perspective on the billfish fishery to demonstrate why billfish resources have different meanings for people and their implications for international billfish management.

Post-Release Mortality Rate of Striped Marlin Caught with Recreational Tackle

Michael Domeier
Pfleger Institute Of Environmental Research, USA

Co-Authors: Heidi Dewar

An ambitious project was undertaken late in December, 1999, that attempted to document the post-release mortality rate of striped marlin caught on recreational fishing tackle. Forty satellite tags were deployed with new software and a mechanism that would allow for tags to detach and transmit early if the fish died. At the same time, this study was designed to also compare the effectiveness and associated mortality of circle hooks vs. standard J-hooks. To this end, twenty of the satellite tags were deployed on marlin caught with circle hooks and twenty deployed on fish caught with J-hooks. An additional 82 fish were caught to collect comparative data on the two hook types. All fish were caught on live bait. Circle hooks were found to be equally effective in hooking and landing striped marlin, and far less likely to become lodged in areas other than the mouth. Mortalilty rates associated with the two hook types are currently being analyzed as the satellite data continues to be collected*.
* Note: We are accumulating massive amounts of data from the satellite tags at this time and are just now beginning analyses. This study will be completed in the next few months and the abstract can be modified to give specific results or left general with the details being presented at the meeting. Sorry for the late submission, but we were in the field putting the tags in fish during the beginning of December. The new equipment and magnitude of this study will be of extreme interest to the audience.

Marlin – A Shared Resource in Australia?

James Findlay
Australian Fisheries Management Authority, Australia

Co-Authors: Andrew Bodsworth & Colleen Cross

The domestic management of marlin resources is a highly contentious issue within Australian fisheries. While there are a range of issues facing domestic marlin management (including increasing accusations of fishing cruelty), the most vocalised area of contention is the strong polarity of views on commercial (ie for sale of catch) versus recreational (including charter) fishing for marlin.

It is readily accepted that good 'governance' or management is the provision of the greatest amount of 'good' for the most people. Demand for access to finite marlin resources by both recreational and commercial users continues to increase. Within the context of increasing demand and ensuing conflict, how should domestic marlin resources be managed to deliver good governance?

Both recreational and commercial fishing result in mortality of marlin and both recreational and commercial users agree that total mortality of marlin should not exceed ecologically sustainable levels. Both recreational and commercial use of marlin resources provides economic and social benefits to the Australian public. However, these user groups have quite different views on the form of use that provides the greatest benefit per unit of mortality and correspondingly for whom the resource should primarily be managed.

Accepting that, at a minimum, management should be able to deliver reasonable confidence that marlin resources will not be over-exploited, historical and existing management arrangements for marlin are reviewed against that target. In an effort to identify possible strategies to minimise direct and/or perceived sectoral conflict in the future, existing management arrangements are compared to a range of alternate sectoral-access scenarios.

Relationship between Catch, Effort, CPUE and Local Abundance for a Non-Target Species caught by a Long Line Fishery

Alain Fonteneau
Institut De Recherches Pour Le Developpment, SEYCHELLES

Co-Authors: Nicolas Richard

This paper analyses at the local level of small strata (5 month) the relationship between effort, catches, cpue and biomass for target species (such as tunas) and for non target species (such as billfishes). The goal of this study is to evaluate the potential bias in the relationship between local cpue and local abundance, when the fishery is exploiting the strata with a low or with a high local fishing effort. This potential problem is first explained comparing specific cpues by small strata calculated in values (dollars per 1000 hooks) and showing the importance of this parameter to drive the behaviour of longline fisheries. Simulated exploitation of 5 month strata for a combination of two species (migratory species), a target species wich is increasingly fished, and a non target species will be presented based on an ad hoc model. Both the resources and the fisheries are mobile in this simulated ocean. The last point of this presentation will present results obtained from a statistical analysis of longline fishery data from the Indian Ocean during the period 1952–1998, a period during which most of the longline fisheries in the Indian Ocean were covered by statistics. A global overview of trend in this fishery will be shown. The statistical analysis of this data base takes into account the total effort exerted by the longliners in each 5 month strata as an explicit parameter of the statistical model. This study tend to confirm that the cpue of secundary species may be heavily driven by the concentration of fishing efforts in strata of large abundance of the target species. In such conditions, the trend of its cpue can provide biased estimates of biomass trends. This new statistical approach could provide more realistic trends of estimated biomass for the billfishes stocks.

Modelling Visual Behaviour of Billfish

Kerstin A Fritsches
VTHRC, University Of Queensland, AUSTRALIA

Co-Authors: Eric J Warrant

Billfish venture in deep, dark water and also hunt at high swimming speeds. This behaviour poses considerable challenge to the fishes visual system and it is unknown yet if and how the animal maintains its visual capabilities in these conditions. In this study we obtained anatomical data from the retina of the blue marlin (Makaira nigricans) and used a mathematical model (1) to test how well the visual system of the behaving marlin copes with diving and fast swimming. While the anatomical parameters allow estimates of quality of vision in a static environment, the mathematical model also takes into account dynamic factors encountered by the behaving fish. The optics of the blue marlin eye and photoreceptor dimensions result in a relatively high optical sensitivity allowing high photon catch. However the sensitivity provided by the optics and cell densities alone do not support sufficient vision at depth and swimming velocities known of the behaving marlin (2). The model, on the other hand, predicts good visual acuity to considerably deeper depth and higher swimming speeds due to neural summation in the space and time domain, a strategy which is thought to be present in most visual systems. The combination of anatomical study and modelling presented here could be a useful tool to estimate visual capabilities in fish with which behavioural experiments are impossible to undertake. 1. Warrant (1999) Vision Research 39: 1611–1630 2. ie. Holland et al. (1990) Fishery Bulletin 88(2): 397–402

Trophic Overlap between Three Billfish Species from Cabo San Lucas, Mexico

Felipe Galvan-Magaña
CICIMAR-IPN, MEXICO

Co-Authors: L. Andres Abitia-Cardenas, Victor H. Cruz-Escalona, Francisco J. Gutierrez-Sanchez,

Cabo San Lucas is an important sport fishing zone, characterized by the sea mounts presence and by reaching depths of up to 3000m close to the coast. Also is an area with strong upwellings, which permit the presence of various trophic chains. This environmental heterogeneity permits the presence of various billfish species of interest for sport fishing, mainly striped marlin (Tetrapturux audax), blue marlin (Makaira mazara) and sailfish (Istiophorus platypterus). We analyzed 708 stomachs to know the food habits and trophic overlap between these species. Even

though the food spectra of the three billfish species were constituted by a high number of prey, some of them had important contributions. In this sense the diet of striped marlin was constituted mainly of species that form large schools as sardines and mackerels, while in blue marlin and sailfish, the principal diet component was the bullet mackerel (Auxis spp). The striped marlin trophic habitat is mainly close the coast, whereas blue marlin and sailfish are more oceanic predators. Sailfish also feed close to the bottom on mesopelagic species and reef fishes. The significant biological overlap (>80%) was determined between blue marlin and sailfish.

Reproductive and Larval Studies of Billfish in the Eastern Tropical Pacific Off Mexico

Rogelio González-Armas
CICIMAR-IPN, MÉXICO

Co-Authors: Alexander Klett-Traulsen, Agustín Hernández-Herrera

In order to assess reproductive activity of billfish in the so-called core area in the eastern Tropical Pacific off Mexico, we took monthly samples of adult billfish from the sport fishery at Cabo San Lucas and Buenavista, Baja California Sur. Oceanic and coastal larval survey cruises to the south of the Gulf of California were also conducted. 7065 adult fishes were sampled from January 1990 to June 2000: 69.5% striped marlin, 15.6% blue marlin; 14.1% sailfish; and 0.8% black marlin and swordfish. Gonad index and some histological preparations for striped marlin females showed that the coastal zone around the southern tip of the Baja California Peninsula is used to prepare for reproduction, as indicated by the prevalence of early vitelogenic stages, and the absence of advanced mature and spawned organisms. Immature females predominated for blue marlin, while the proportion of mature female sailfish increased during warm seasons. Larval research cruises in oceanic waters of the ETP located striped marlin and sailfish larvae along a 180 miles coastal band, from June to November. In coastal larval studies, striped marlin was recorded close to Isla Cerralvo in September and over a seamount next to Isla Espíritu Santo. The larval sizes indicate recent spawning.

Integration of Habitat Preferences into Population Abundance Indices: Robustness Tests using Simulated Data

Philip Goodyear, USA

Integration of habitat preference information with fisheries catch-rate data to develop standardized indices of abundance for use in stock assessments makes intuitive sense to most biologists because abundance is associated with the distribution of preferred habitat. One application of a method employing habitat in stock assessment calculations for Pacific blue marlin reversed the perceived status of the stock from an overfished condition to one nearer MSY. However, the same method failed to describe the distribution of Atlantic blue marlin catches during a recent ICCAT stock assessment, highlighting a need to evaluate the robustness of such models for characterizing trends in abundance. This paper describes a computer model designed to simulate longline catch-effort data, and its application to simulate Atlantic blue marlin catch-effort data. The model partitioned simulated 1956–1999 blue marlin population abundance by month, area and depth based on the temperature distribution of their environment. The resulting distribution was integrated with a separate model of the fishing characteristics of the gear to compute catch rates by set and depth. The simulated longline gear changed from predominately shallow sets (5 hooks between floats) to predominately deep sets (15 hooks between floats) from 1956 to 1999, and was spatially distributed proportional to the average longline cpue for bigeye tuna. The actual depth distributions of the deep sets, the propensity of marlin to bite stationary vs. moving baits, and the assumed habitat preference were each varied. The resulting simulated catch rates were analyzed using simple annual means, a general linear model (GLM), and standardized using habitat data. The habitat standardizations included both correct and incorrect assumptions about the underlying marlin distribution, feeding propensity and actual gear depth. The simple annual mean cpue showed a strong bias that suggested a greater than true decline in population abundance. Results from the habitat standardization proved very accurate if the assumptions used in the analysis were precisely correct, but were often strongly biased when the assumptions were not accurate. In most cases evaluated, this bias led to a prediction at the end of the simulation that the population was larger than the true condition. The GLM results accurately reflected the simulated population trends. These results suggest that the habitat standardization of cpue time series is potentially useful if there is accurate knowledge of the distribution of the population, the distribution of the gear with respect to the population, and factors that may affect the fish's propensity to take a bait. Absent certain knowledge of these factors, the GLM is a much more robust method for standardizing catch rate data.

Stock Structure of the World's Billfishes: Perspective is Everything

John Graves
Virginia Institute of Marine Science, USA

Billfishes are highly migratory species that inhabit warm epipelagic waters of the world's oceans – a large, relatively homogeneous environment that lacks significant physical barriers. Based on these observations alone, one would not expect billfishes to exhibit substantial stock structure within a given ocean. This assumption has been evaluated with genetic analyses, tag and recapture analyses, analyses of morphological characters, spatial and temporal analyses of catch per unit effort (CPUE) data, and analyses of the distribution of spawning individuals and larvae. In general, although significant structuring exists between ocean populations, results of most studies indicate little or no population structuring of the various billfish species within an ocean basin. However, differences exist among billfishes in the level of population structuring exhibited both within ocean basins as well as between oceans. Not unexpectedly, results from different methods of analysis have afforded diverse insights into stock structures, and in some cases have challenged conventional taxonomic relationships. This talk will focus on inferences derived from analyses of genetic data, and these inferences will be compared to results from analyses of tag and recapture data, morphology, CPUE, and the distribution of reproductively active adults and larvae. The contributions and limitations of the insights provided by each method of analysis will be discussed, and a synthesis attempted. In addition, suggestions for future avenues of research to better understand the stock structure of the world's billfishes will be presented

Early Results from Pop-Up Archival Tagging Experiments with Black Marlin in the Coral Sea

John Gunn
CSIRO Marine Research, AUSTRALIA

Co-Authors: Julian Pepperell

In November 2000, we released five pop-up archival tags on 200–600 lb black marlin east of Cairns, in the species' spawning area in the NW Coral Sea. The tagging was conducted from game fishing charter vessels, using methods first developed by Dr Barbara Block of Stanford University and her collaborators within the North Carolina Giant Bluefin sportfishing community. We were lucky enough to work with Captain Peter B. Wright, who has extensive experience in both the North Carolina and Cairns fisheries. Tagging operations involved attaching the external pop-up tags to the upper shoulder of the fish as they were brought alongside the vessels, using either IBF nylon dart anchors, or titanium anchors designed and manufactured at the Hopkins Marine Laboratory. The experimental design was to stagger the pop-up times of tags in an attempt to map the hypothesised movement of the fish away from the spawning ground/Cairns region. As this was a pilot study, two tags were programmed to pop-up after 4 days, one after a month, one two months and the last after 4 months. To date, the first three tags have popped up on schedule, and produced data on the depth and temperature habitat preferences of black marlin in the Coral Sea. It is to be hoped that by the time of the Billfish Symposium all five tags will have successfully transmitted. The presentation will summarise the habitat and behavioural data transmitted. As the fish tagged ranged in size from 200–600 lb, there may be the scope to compare the behaviour of different sized fish as they migrate away from the continental shelf. The scope for further work on black marlin using pop-up tags will also be discussed. Although the cost of a large program is undoubtedly a challenge, perhaps more important issues are the capabilities of current and future generations of pop-up tags, and how these can be used (or limit our ability) to examine key questions in marlin biology.

Status of Fisheries and Swordfish in the Eastern Pacific Ocean

Michael G. Hinton
Inter-American Tropical Tuna Commission, USA

Co-Authors: Mark Maunder

Swordfish (Xiphias gladius) are harvested in target and non-target fisheries throughout the eastern Pacific Ocean [EPO: east of 150 W]. The status of these exploited stocks has not been well determined, due in part to questions about the structure of swordfish stocks in the region. Previous research and results from analyses using non-integrated models has indicated that when considered as a single stock, the resource is exploited at less than AMSY, though caution has been urged due to the declining trends in catch rates for various fisheries and subareas in the EPO. Presented herein are results of analyses of fisheries and swordfish stocks taken by them in the eastern Pacific under three hypotheses of stock structure. The results are contrasted with previous findings, and they reflect recent developments in the understanding of stock structure, and spatial and temporal distributions of stocks in the region based on analyses of nuclear and mtDNA, in conjunction with other fisheries and biological data. Analyses were obtained using an integrated model fitted using AD Model Builder.

Status of Striped Marlin, *Tetrapturus audax*, Stocks of the Eastern-Central Pacific

Michael G. Hinton
Inter-American Tropical Tuna Commission, USA

Co-Authors: Mark Maunder, Yuji Uozumi

Striped marlin provide important catches to the recreational and longline fisheries of the eastern-central Pacific Ocean. While previous analyses of stock status have assumed either a single or a north/south stock structure in the Pacific, complex migration models have been proposed for striped marlin, and analyses of fisheries interactions have demonstrated local depletion is possible in at least some regions of its range. More recently, genetic analyses have indicated significant partitioning of genetic variation in striped marlin and have suggested that management should be for stocks in regions much reduced from those that have been previously considered. Presented herein are results of analyses of striped marlin stocks in the eastern-central Pacific Ocean under hypotheses of stock structure that incorporate the more recent information on spatial and temporal distributions of the stocks from fisheries and from genetic studies. Results were obtained using a fully integrated meta-analysis fitted using AD Model Builder.

Striped Marlin Catch Rates in the New Zealand Recreational Fishery

John Holdsworth
Bluewater Marine Research, NEW ZEALAND

Co-Authors: Peter Saul, Gene Browne

Striped marlin is the primary target species in the recreational gamefish fishery in Northern New Zealand. There has been a dedicated gamefish charter fleet in the Bay of Islands for over 70 years. Well organised gamefish clubs were established to provide facilities for anglers. They have kept accurate catch records for marlin and other species that show recreational catches of striped marlin (STM) have increased significantly during the 1990's to a peak of 2358 weighed or tagged fish in the 1998/99 season. Recreational Catch Per Unit Effort (CPUE) data have been collected from selected charter skippers since 1976. CPUE was relatively high in the 1979-80 season (0.25 STM/boat day), was very low in the mid 1980s (0.06 STM/boat day) and has been consistently above the long term average since 1994. In 1987, following three years of low recreational CPUE, the Government placed a Moratorium on commercial tuna longlining around northern New Zealand. In 1990 this provision was replaced by regulation prohibiting commercial fishers from taking Istiophorid species. Correlations were investigated between trends in recreational striped marlin CPUE and sea surface temperature, SOI, longline CPUE in the wider Pacific or longline striped marlin catch in New Zealand economic zone. An area having consistently high average striped marlin catch was identified in the Tasman Sea with higher and more variable CPUE. Longline CPUE for the south western Pacific was therefore split into western Tasman (150°W to 165°W) and the rest (165°W to 160°E). The factors that produced a general linear model showing the highest correlation with recreational CPUE were, longline CPUE in the general SW Pacific

(excluding the western Tasman Sea), and the longline catch of striped marlin in New Zealand (adjusted r^2=0.5715). Other possible factors influencing this relationship are discussed.

Estimating the Economic Value of the New Zealand Recreational Billfish Fishery

John Holdsworth
Bluewater Marine Research, NEW ZEALAND

Co-Authors: Peter Saul, Rick Boyd

New Zealand is a maritime nation. Access to and enjoyment of marine recreation is an important pastime or holiday activity for a large segment of the population. Since the 1920s there has been a charter boat gamefish fishery targeting billfish in northern New Zealand. This has catered for international tourists as well as resident anglers. Face to face interviews were conducted with one angler per boat about catch and expenditure for their fishing trip. Questions aimed at establishing recent capital expenditure and a contingent valuation question were also asked. Interviews were conducted from January to May 2001 from nine fishing locations and the survey was stratified by region and trip type (charter or private). End of season telephone interviews were also conducted. Over the last 30 years improvements in the standard of living and the availability of reliable, safe, trailer boats and launches have seen the expansion of the number of private boats involved in fishing for billfish. A network of sport fishing clubs has developed to provide facilities in ports, harbours and holiday destinations. However the total number of billfish anglers is still likely to be a small proportion of the total population. There is no robust estimate of the numbers of fishers who participate in the billfish fishery each year as there is no system of licensing for marine recreational fishers or recreational vessels in New Zealand. The small total number of billfish anglers within the total New Zealand population rules out a nationwide random telephone survey on practical and cost grounds. Furthermore, this approach would not provide a sample of billfish anglers from overseas, and these people cannot be overlooked as they account for a significant proportion of the New Zealand billfish fishing effort. The method described in this paper takes the total billfish catch from club records and recreational CPUE to calculate total angler days fished by strata. Mean expenditure per day is calculated from individual trip expenses divided by the number of days fished. The data collection phase finished in July 2001 so this paper focuses on the methods used in this survey. The regional economic contribution of game-fishers to the Northland and Bay of Plenty regional economies will be calculated using standard multiplier analysis. We will use regional multipliers generated by a private economist to estimate the additional output, value added and employment generated in each of these regions as a result of the activities of game-fishers in the billfish fishery.

The Biology of Billfish

Kim Holland
Hawaii Institute of Marine Biology, USA

This presentation will review some of the advances in the understanding of billfish biology – particularly physiology and behaviour – that have occurred since the last Billfish Symposium in 1988. A review of the literature shows that progress has been slow. This is not surprising given the large size and open-ocean, pelagic habitat of these animals; behavioural and physiological data are acquired with great difficulty and cost. By necessity, much of what is known must be acquired from in vitro experiments (e.g., the physiology of vision) or from dead animals dead (e.g., food habit analyses). Despite the development of improved tags, tag-and-release experiments continued to be disappointing in terms of the number of animals recaptured. Possible reasons for this low return rate will be discussed. One area of investigation that has burgeoned since the last symposium is the use of various types of electronic tags (sonic telemetry, archival and satellite tags) and, despite some setbacks, this field of investigation has yielded important new data concerning billfish behavior and the extent of post-release mortality. Various aspects of the electronic tagging data will be reviewed and suggestions made for future research directions.

Arabian Gulf Sailfish Movements– A Summary of Tagging Efforts

John Hoolihan
Fisheries Scientist, Marine Environmental Research Center, Environmental Research and Wildlife Development Agency

In Arabian Gulf waters of the United Arab Emirates sailfish, Istiophorus platypterus, are seasonally resident from October through April. Recreational anglers started occasional, self-initiated tagging in 1983. Tags originating from one local and five foreign agencies have been deployed. Early tagging and recovery data was often obscure or lost. In 1997 a concerted effort to understand migration cycles began by consolidating tagging practices and monitoring tag recoveries. Conventional dart tags were deployed on 1871 sailfish from 15 April 1996 to 21 April 2001. Recovered tags (n=92), as of 16 July 2001, depict a recapture rate of 4.91%. Of these, 90.21% (n=83) were concentrated during May-June in Iranian waters and represent springtime migratory movement leading northwest, further into the Gulf. Time at large for all recaptures ranged from 17 to 1148 days, while point to point travel extended from 2.5 to 697km. Sailfish recaptured in the same year (n=56) and exhibiting migratory movement traveled a mean distance of 466km. Location of sailfish during late July through September is unknown due to deficiencies in tag recoveries, catch data and anecdotal information. Deployment of pop-up satellite tags is underway to address this question.

Keywords: sailfish, Istiophorus platypterus, tagging, migration, Arabian Gulf

Swordfish Fishery Operational Model

Marc Labelle
Oceanic Fisheries Program, NEW CALEDONIA

By contrast to several tuna species, relatively little known about swordfish, and the associated catch and effort statistics in the Pacific are characterised by a substantial level of uncertainty and incompleteness. An operational model was designed to help evaluate the performance of stock assessment and fishery management procedures in this 'data poor' context. This model incorporates key features of aged-structured and length-based models, and accounts for growth, reproduction, mortality, recruitment, exploitation and movement. It can be used to project trends in abundance, catch and stock composition, recruitment patterns, spawning biomass and so forth, for multiple stocks and fleets, under user-specified levels of process and observation error, sampling regimes, and exploitation patterns. This model has been used to test the performance of stock-assessment

procedures, and generate preliminary estimates of biological reference points for specific combinations of hypotheses about the fishery. The presentation will describe the features of the model, it's underlying hypotheses, limitations, and user interface. The results of tests and probing studies conducted with it for the National Fisheries Service (Honolulu Lab.) are also presented.

NSW Fisheries Gamefish Monitoring Program

Michael Lowry
NSW Fisheries, AUSTRALIA

The east coast gamefish fishery is a diverse, multi-species fishery that targets billfish, sharks, tuna and other pelagic fish along the east Australian seaboard. NSW Fisheries works closely with the recreational gamefish sector through the Gamefish Tagging Program (GTP), Gamefish Tournament Monitoring Program (GTMP) and Charter Boat Monitoring Program (CMP), as part of an integrated approach in the assessment of the recreational catch and effort associated with the principal gamefish species. This presentation describes the results of the Gamefish Tournament Monitoring Program, which reports on trends in fishing effort and directed effort, catch rates, catch composition, proportions of captures tagged and released and spatial distribution of catches for the principal recreational billfish species, over seven successive years (1994–2000). Eighty four percent of the gamefishing fleet targeted billfish and/or tunas almost exclusively with the remainder of the fleet (16%) targeting shark species. Twenty-three species of gamefish were recorded, with billfishes comprising the majority of the catch (59.6%). Black marlin (Makaira indica) was the most common billfish species (53.1% of billfish catch). Catch rates for all species were calculated according to the main target preference of the gamefishing fleet. Catch rates were found to vary for most species indicating year to year fluctuations in the availability and relative abundance of most species.

Historical Development of Recreational Billfishing in Bermuda and the Significance of Catches of Very Large Blue Marlin *(Makaira nigricans)*

Brian Luckhurst
Bermuda Division Of Fisheries, BERMUDA

Directed fishing effort for blue marlin (Makaira nigricans) and white marlin (Tetrapterus albidus) in Bermuda commenced in the early 1970s. The first annual billfish tournament was held in 1974. This four day tournament has been held every year since its inception and with improvements in charter fishing vessels and fishing gear, local captains have become increasingly proficient at catching marlin. The development of a strong conservation movement for billfish in the mid-1980s in the tropical western Atlantic promoted tag and release of marlin. This conservation ethic has been translated into release rates in Bermuda of 80 – 90% over the past 10 years. The billfish tournament has become primarily a release event due to the 227 Kg (500 lbs) minimum size for landing blue marlin. The catch of a blue marlin weighing 512 Kg (1,130 lbs) in 1984 gave Bermuda prominence in the billfishing world at that time. Since that event, an additional six blue marlin weighing over 454 Kg (1,000 lbs) have been landed in Bermuda giving the island a reputation as a primary site for very large fish. This has had socio-economic benefits for the island as foreign anglers contract local charter fishing vessels in search of a trophy blue marlin and foreign fishing boats come to fish Bermuda waters with attendant economic benefits for the island.

A Molecular Approach to the Identification of larval istiophorid billfishes

Stacy Luthy
University Of Miami Rosenstiel School Of Marine And Atmosphe, UNITED STATES

Co-Authors: Jan McDowell

The identification of larval istiophorid billfishes inhabiting the Western Atlantic Ocean has been problematic since the inception of istiophorid early life history research in this area. Although diagnostic characters have been described for billfishes in the Pacific Ocean, these may not be valid for Atlantic specimens. Two of these diagnostic characters, the position of the tip of the snout with regard to the center of the eye and whether the anterior edge of the orbit projects, are assessed subjectively and are easily distorted or destroyed during the capture process. Furthermore, for specimens less than 5 mm, only one character is diagnostic for each species, with no method of confirming the identification. In this study, we have positively identified larval istiophorids from the Straits of Florida using a molecular approach that was developed for forensic identification of istiophorid adults. A single copy anonymous nuclear gene was amplified for each fish, and restriction fragment length polymorphism (RFLP) analysis with two restriction enzymes was used to identify the fishes. Using these molecular identifications has allowed work on confirming traditional diagnostic characters and choosing new diagnostic characters to proceed. This will also allow species-specific distribution and age and growth studies.

Indicators of the Exploitation Level in the Sailfish Fishery in the Western Coast of Mexico

Rene Macias Zamora
Fishery National Institute, MEXICO

Co-Authors: Ana Luisa Vidaurri-Sotelo, Heriberto Santana-Hernandez, Javier Valdes-Flores

The sailfish (Istiophorus platypterus) is the most abundant of the billfishes species in the catch of both, sport fishing and commercial fishing in the South and center of Mexican Pacific Ocean. Information of annual tournaments of sport fishing carried out in 6 ports of the Mexican Pacific during the period 1959–2000 is analysed. Data of logbooks and observers on board of the longliners of commercial fishing ships with Mexican flag are included. this fleet has been operating in a discontinuous way since 1980. The tendency of the catch per unit of effort and the trend of the length and weight average and the results about evaluations of the fishery through structured models in the western Coast of Mexico are included. Apparently, the fishery present two periods. The first of them characterized by the development of the fishery until reaching maximum catch with growing effort associated to a decrease of the CPUE, and the second stage characterized by a marked decrease of the fishing effort and the sustained

recovery of the index CPUE. The results of the evaluation indicate a resource able to support a bigger effort to has been exerted in the last 20 years in this region . Their abundance, availability and average size in the catches have been affected strongly by the changes in the environment associated to the phenomenon “ El Niño”.

Global Stock Structure of the Sailfish, *Istiophorus platypterus*, based on analyses of Mitochondrial and Nuclear DNA Markers

Jan McDowell
Virginia Institute Of Marine Science, USA

Sailfish, *Istiophorus platypterus*, samples were collected from 15 locations from throughout the Atlantic, Pacific, and Indian Oceans over a period of 6 years. Sample size totaled over 700 individuals. Both mitochondrial and nuclear DNA markers were used to assess the degree of inter and intra-ocean stock structure. For mitochondrial DNA, a combination of restriction fragment length polymorphism (RFLP) analysis and sequencing of the D-loop region were used. Nuclear DNA variation was assessed using four hypervariable microsatellite markers. As in other billfish species, analysis of mitochondrial DNA reveals the presence of two divergent clades with unique geographic distributions. Similarly, analyses of microsatellite DNA show a heterogeneous distribution of alleles.

Economic Impact of the Sport Fishing at La Paz Bay, Baja California Sur, Mexico

Adrian Moyron
Centro De Investigaciones Biologicas Del Noroeste, MEXICO

Co-Authors: German Ponce-Diaz, Sofia Ortega-Garcia

A description of the sport fishing at La Paz Bay, B.C.S., Mexico is presented. It began around the 40's with the availability of some services of fishing trips and hotel infrastructure. This activity is made by mexican people, foreing tourists, and members of fishing clubs. The economic impact of this activity is estimated from indicartors as the number and type of crafts dedicated to the sport fishing, the number of tournaments carried out at the bay, granted prizes, captured species, participants' number in tournaments, and the number of fishing permits given by the fishing authority. During the last years, sport fishing has been increased mainly by mexican people, compared with other regions where the activity is supported by foreign people.

Managing Billfish in the Eastern Tropical Pacific: Past, Present and Future

Russell Nelson
Nelson Consulting, USA

Co-Authors: Marcos Ostrander, Ellen Peel

The authors examine the recent history of billfish management and assessment efforts in the eastern tropical Pacific, where a pattern of national action to protect resources important to sport fishing and tourism is emerging within the vacuum of international management. The potential impacts of this incipient allocation policy emerging from the Americas are explored in light of international management needs. The conflicts involved in managing for optimum access to large-scale stocks between mobile, high-seas commercial fleets and geographically fixed recreational angling centers are described within the context of emerging assessment methodologies. Modest attempts towards looking to alternative future assessment and conservation strategies are proposed.

Analysis of Sportfishing Catch Rates of Striped Marlin, *Tetrapturus audax*, at Cabo San Lucas, Baja California Sur, Mexico, and their Relation to Sea Surface Temperature

Sofia Ortega-Garcia
CICIMAR-IPN, MEXICO

Co-Authors: Alexander Klett-Traulsen, German Ponce-Diaz

Cabo San Lucas, B.C.S. is the main sportfishing location for striped marlin, with a mean annual catch rate of 0.6 fish per fishing trip. We analyzed interannual and seasonal variation of sportfishing catch rates from 1990 to 1999, and their relation to mean monthly sea surface temperatures, derived from the Reynolds series. Although the interannual variation was not significant, the highest annual catch rate was recorded in 1998, with a value of 0.8 fish/fishing trip. Seasonal variation showed a significant variation with high catch rate average in winter, and a low average in summer (0.9 and 0.3). Interanual significant differences with a decreasing tendency was found both in length and weight analysis. On average smaller males and bigger females were recorded in summer. A significant relationship with sea surface temperature ($r = -0.62$) was found, but no significant changes of catch rates could be measured during the 1992–93 and 1997–98 ENSO events, even in spite of an apparent catch rate increase during the first quarter of 1998.

Managing Marlin as Bycatch Under ICCAT, the Fork in the Road – Recovery or Collapse

Ellen Peel
The Billfish Foundation, USA

Co-Authors: Phillip Goodyear, Russell Nelson

Managed as bycatch species under the jurisdiction of the International Commission for the Conservation of Atlantic Tunas (ICCAT), the relative stock abundance of Atlantic blue marlin and white marlin, as indicated by stock assessments, is severely overfished with no leveling off in the decline. The primary source of their mortality comes when they are taken as bycatch in the pelagic longline fisheries for tuna and swordfish. Given less management priority than the targeted species, the decline of Atlantic marlin, as bycatch, will not likely level off to allow recovery to begin until restraints are placed on the targeted fishery, which consider differences in the species. The low management priority continues despite the fact that some countries, ICCAT member and non-member countries, reap significant economic benefits from the recreational marlin industry, a predominately catch and

release fishery. Current ICCAT management measures for marlin, alone, are inadequate to halt their population declines. The reason is due, in large part, to the fact that the targeted fishery is managed with the goal of MSY, which does not account for different rates of mortality between the species. Unless adjustments are made for these differences, marlin stocks will be driven to collapse or possible extinction. Recovery is dependent upon a change in ICCAT’s management paradigm for these bycatch species. Some countries are reacting to a call for greater conservation of Atlantic marlin by questioning assessment results that indicate both species are severely overfished. The paper reviews (1) international management regimes, (2) ICCAT’s management, (3) Atlantic marlin fisheries, (4) the continuing decline of the stocks, (5) the bycatch/targeted catch dilemma, and (6) possible options.

Big Fish Down Under: A Brief History of Contact between Billfish and Man

Julian G Pepperell
Pepperell Research & Consulting Pty Ltd, Australia

Perhaps the earliest evidence of human contact with billfishes is provided by the discovery of marlin bones in archeological sites from the Marianas Islands, dating back to about 2,000 years ago. Of similar antiquity are accounts of broadbill swordfish being hunted in the Mediterranean by harpoon, from vessels painted and shaped to resemble their quarry.

From early times, the billfishes were held in considerable fear and awe since they were alleged to attack, ram and even sink ships! Accounts of attacks on ships by billfish exist from Roman times, and early European mariners also recorded attacks and found bills embedded in wooden hulls. No doubt, some of the earliest depictions and legends of sea monsters are based on such observations and encounters.

Apart from such chance contacts with large billfish, knowledge of their existence, especially of the Istiophorids, was extremely scant. Most early descriptions were based on specimens which had been stranded by storms, and, being too large to transport and preserve in Museums, many of the early illustrations of billfish are highly fanciful. It was not until the late eighteenth century that western scientists began to describe and depict at least some of these fishes with any accuracy.

Worldwide commercial fisheries for billfish commenced in earnest after the Second World War when the Japanese longline fleet expanded its operations throughout the world. Although mainly regarded as a bycatch, the careful recording of billfish catch and effort during that period forms an invaluable record of the distribution and relative abundance of billfishes in their virgin state. Recreational fishing for billfish began in the late 19th century. Dedicated fishing clubs had been formed in several countries by the 1920s and expeditions to far flung locales were mounted by pioneering anglers in the 1930s and 1940s. Today, the majority of billfishes are tagged and released and recreational billfish fisheries are important export dollar earners for many nations.

At the beginning of the 21st century, billfish are probably more important than ever, both commercially and recreationally. The challenge is now even greater to wisely and sustainably manage these human interactions with these amazing fishes.

Sexual maturity, sex ratio and size composition of Swordfish *(Xiphias gladius)* caught by the Réunion-based pelagic longline fishery (South West Indian Ocean)

Francios Poisson
Ifremer, Laboratoire Ressources Halieutiques, France

Co- Authors: C. Marjolet, C. Fauvel, and M. Taquet

The Indian Ocean swordfish longline fishery based in Réunion Island started operating in 1991. Since May 1998, Ifremer has been compiling information on domestic longline fishery fishing in the French EEZ. Data are collected from logbooks, from regular at-sea and landing samplings and from on-board scientists. One of the aims of this programme (PPR), financed by the European Union and Reunion Local Councils, is to contribute to the management and conservation of the species taken in SWOI fisheries through a larger scale project monitored by IOTC. Some aspects of the reproductive biology of swordfish around Réunion Island (between 19° and 25° South and 48° and 58°E) were studied from a sample of 1727 gonads (1107 ovaries and 620 testes) collected between may 1998-january 2001 during 52 campaigns onboard domestic longliners. The sample represented about 1.65% of the total number of swordfish onloaded by the domestic fleet. Spawning was estimated to take place mainly from october to April. The vitellogenesis was characterised by Histological features and relations were made with macroscopic maturation index. Moreover, Characteristic dispersions of oocyte diameter were found for different sexual development stages. Median body size at sexual maturity (L_{50}) for female and male were 170.4 cm±2.4 cm and 119.8 cm±1.9 cm lower jaw fork length (LJFL) respectively.

Batch fecundity and spawning frequency of swordfish *(Xiphias gladius L.)* in the southwest Indian Ocean

Francois Poisson
Ifremer, Laboratoire Ressources Halieutiques, France

Co- Authors: C. Marjolet, C. Fauvel and M. Taquet

First aspects of fecundity of swordfish from the southwest Indian Ocean were analyzed from gonads collected during campaigns onboard domestic longliners between May 1998–March 2001. Batch fecundity and spawning frequency were estimated respectively from 7 pairs of ovaries and 184 female in a reproductively active condition caught around Reunion Island (between 19° and 25° South and 48° and 58° East). The individual batch fecundity fluctuated from 900 000 hydrated oocytes for the smallest ripe female measured 124 cm lower jaw fork length (LJFL) to 4,19 millions for a large female sampled (225 cm LJFL). Two positive linear relationships were established between (1) batch fecundity (F_b, in number of hydrated oocytes) and ovaries weight (M_o in g) then (2) batch fecundity and LJFL (cm): (1) F_b=0,0003*M_o+0,3735, (2) F_b=0,0232*L–1,308. The relative batch fecundity reaches from 23 to 66 hydrated oocytes/g body weight. Over October to April, the local reproductive season, females spawned 76 times that is to say less than every three days.

Lunar Phase and Success of Catch of the Striped Marlin, *Tetrapturus audax*

Germán Ponce-Díaz
Centro De Investigaciones Biológicas Del Noroeste, MÉXICO

Co-Authors: Sofía Ortega-García, Sergio Hernández-Vázquez

The influence of the lunar phases on the capture by unit of effort (CPUE) of the stripped marlín (Tetrapturus audax) captured by the sport fleet that operated from October of1987 to June of 1989 in the area of Cabo San Lucas, B.C.S. Mexico was analyzed. The used information corresponds to 3377 fishing trips carried out by 13 vessels that represents approximately 10% of the total fleet. The analysis of the CPUE showed a maximum in January of 1988 with 4 org./trip and a minimum in February of 1989 with 1.15 org./trip. Regarding the possible effect of the lunar phase in the CPUE, nevertheless that a decrement of its value is appreciated during the full moon the difference it was not significant comparing with the other lunar phases. According with the results from the statistical point of view significant difference doesn't exist between the different lunar phases and the success of capture of the striped marlin Tetrapturus audax in the recreational fishing of Los Cabos Baja California Sur, Mexico.

Biological and Fishery Aspects of the Mediterranean Spearfish, *Tetrapturus belone* Rafinesque, 1810

Antonio Potoschi
University of Messina, ITALY

Co-Authors: Silvana Campagnuolo, Rosetta Bruno, Franco Andaloro,

Several specimens of *Tetrapturus belone,* ranging from 97.5 to 210 cm fork length, were caught by harpoon in the Strait of Messina during the swordfish fishing seasons 1997–1998. Age was estimated by annual growth increments counts on the sections of the first ray of the second dorsal fin and validated by length frequency analysis. Growth parameters calculated by von Bertalanffy equation were Linf=288 cm; K=0.196; t0= –1.738; r2=0.9998 for males and Linf=271 cm; K=0.407; t = –1.112; r2=0.9956 for females. Five classes of age were identified and a fast growth rate in length and weight evidenced. The length-weight relationship was also calculated. The ratio between the sexes was 2:1 for females. The histological analysis of gonads and the gonado-somatic index (GSI) trend both indicate that T. belone probably spawns in late spring-summer, between May and August. The catch of young specimens also confirms the Strait of Messina as a spawning area of this species. Analysis of the stomach content, based on 35 specimens, showed that T. belone fed mostly on fish, such as Belone belone, Sardinella aurita, Scomberesox saurus. Cephalopods were frequent and abundant prey as well, but their weight importance was low.

An Analysis of the Major Constituent-Based Billfish Tagging Programs in the World's Oceans

Eric Prince
National Marine Fisheries Service, USA

Co-Authors: Mauricio Ortiz, David Holts, Kay Davy, Julian Pepperell

Tag release and recovery files from the five major constituent based conventional billfish (Istiophoridae) tagging programs throughout the worlds oceans were assembled into a common data base, with a common format, and assessed in terms species, ocean body, and individual program operation. Sources of data included the National Marine Fisheries Service's (NMFS) Cooperative Tagging Center in the Atlantic Ocean, the NMFS's Cooperative Billfish Tagging Program in the Pacific and Indian Oceans, The Billfish Foundations' (TBF) tagging program in the Atlantic, Pacific, and Indian Oceans, the Australian Cooperative Tagging Program in the Pacific and Indian Oceans, and the New Zealand Cooperative Game fish tagging in the Pacific Ocean. Tagging results of the programs are compared and contrasted in a series of similar analyses based on species, ocean body, tag type, tag recapture rates, days at large, and straight line distanced moved. World-wide, there were a total of 53,514 blue marlin (Makaira nigricans), 41,919 black marlin(Makaira indica), 42,379 white marlin (Tetrapturus albidus), 37,933 striped marlin (Tetrapturus audax), and 126,649 sailfish (Istiophorus platypterus) tagged and released from the five major programs since the mid-1950s. Of these, 648 blue marlin (1.2%), 286 black marlin (0.68%), 836 white marlin (1.97%), 393 striped marlin (1.04%), and 1,925 sailfish (1.52%) have been recaptured. Recommendations for improving constituent based billfish tagging programs, including tag recapture rates, are presented.

ICCAT's Stock Assessments of Atlantic Billfish

Victor Restrepo
International Commission for the Conservation of Tunas, SPAIN

Co-Authors: Eric Prince, Gerry Scott, and Yuji Uozumi

This paper presents a historical overview of the assessments of the Atlantic stocks of blue marlin, white marlin and sailfish that have been conducted by ICCAT scientists since 1977. Details are presented about the data sets used and the models applied, with emphasis on the strengths and weaknesses of the assessments. The major causes of uncertainty in the current perception of the status of the stocks are related to some of the data used and to their interpretation, in particular historical trends in CPUE. The paper concludes with an account of the efforts that are being made to reduce these uncertainties.

Mexican Swordfish Longline Fishery Project – Two Years of Scientific Data Collection

Patricia Rojo-Díaz
INP-CICESE, USA

Co-Authors: Miguel Angel Cisneros-Mata, Luis Vicente Ania-Gonzaléz

This paper presents two years of continuos scientific data collection on swordfish (Xiphias gladius) caught by the commercial longline fishery from December 1998 to December 2000. This project was born with joint efforts of the National Fisheries Institute (INP, Mexico) and the PNAAPD, placing observes on board Mexican longline fishing boats in the eastern Pacific. The main goal is to generate further scientific information on the biology of X. gladius, in order to foster the development of a resource management framework. In addition, the swordfish project carries out a multispecific analysis of other species caught during fishing operations. This incidental catch is mainly represented by two species of sharks: blue (Prionace glauca) and mako (Isurus oxyrinchus). We present preliminary results of 22 months of sampling from 23 fishing trips with a total of 180 sets. Basic information on geographic distribution of these catches and their temporal variation is shown. We also indicate preliminary values of CPUE, length-weight relationships, and sex ratios.

An Estimation of Vertical Distribution Pattern of Atlantic Blue Marlin in the Tropical Central Atlantic based on the Archival Pop-Up Tag

Hirokazu Saito
National Research Institute Of Far Seas Fisheries, JAPAN

Co-Authors: Kotaro Yokawa, Denzo Inagake, Kyohei Segawa, Makoto Okazaki, Harumi Yamada, Yuji Uozumi

Blue marlin is distributed mainly in upper part of mixed layer based on the former studies such as those using biotelemetry system and archival pop-up tag in near shore area. On the contrary, Japanese deep longliners targeting bigeye tuna catches many Atlantic blue marlins in the tropical central and eastern Atlantic. In these areas, depth of mixed layer becomes rather shallow by influence of strong up-welling and almost all the hooks of Japanese deep longline goes down to the lower part of mixed layer if theoretical catenary shape of longline gears are assumed. These contradicting information suggests a variety of possibilities that Atlantic blue marlin goes down to its lower part of the mixed layer or bites in shallow layers only when setting and retrieving time of the longline operation, or the hooks are blown-up in offshore area of the central and eastern Atlantic. To test these hypotheses, the archival pop-up tags were attached to Atlantic blue marlin in the tropical central Atlantic during research cruise of the Japanese RV Shoyo-maru. Attached tags were successfully recorded data of water temperature and light intensity in every one hour for more than a few weeks. This paper analyses these aspects.

Status of Broadbill Swordfish: Experience from the Atlantic and Mediterranean

Gerald P. Scott
NOAA Fisheries, Southeast Fisheries Science Center, USA

Over the past half century, the global fishery harvest of swordfish has grown from less than 20,000 MT to about 100,000 MT per year. To a large degree, this has been the result of expansion of longline fisheries throughout the world's oceans. The patterns of fishery expansion and resulting swordfish catch and fishing effort trends in the Atlantic and Mediterranean have been under intense study by the International Commission for the Conservation of Atlantic Tunas for the past 15 years due to concern about the status of swordfish stocks in the region and the desire to manage the resource at levels which could provide for Maximum Sustainable Yield. Catches of swordfish from the North Atlantic rapidly increased beginning in the late-1970s to levels in excess of MSY by the mid-1980s. The most recent North Atlantic swordfish stock status assessment carried out by ICCAT's Standing Committee on Research and Statistics indicated that by the mid-1980s fishing mortality rates were in excess of F_{msy} and that by the early-1990s the biomass of North Atlantic swordfish had fallen below B_{msy}, declining to about 35% below B_{msy} by 1999 with Fs still about 30% above F_{msy}. The assessment indicated that conservation actions taken prior to that time had not resulted in measurable increased stock biomass. Based on these results, the Commission agreed to additional conservation measures, which could result in recovery of the stock to B_{msy} within a 10-year time frame. An updated assessment of North Atlantic swordfish is planned for 2002, at which time stock status and recovery potential relative to the Commission's North Atlantic Swordfish Stock Recovery Plan will be re-evaluated.

The fisheries for swordfish in the South Atlantic started to expand quickly after the North Atlantic swordfish resource had declined. The pattern of rapid build-up in catch in the South Atlantic in the 1990s is similar to that observed in the North Atlantic during the early-1980s, owing, in part, to a movement of fishing effort from the north to the south and also to expansion of coastal Nations' fishing. For the South Atlantic swordfish stock, the resource assessment is less certain than for the North Atlantic stock, due to shorter time-series of catch and effort information useful for status evaluations and less detailed information from the range of fleets harvesting swordfish from this region. The provisional South Atlantic stock assessment conducted in 1999 indicated that the biomass of South Atlantic swordfish in 1999 had declined to a level close to that which could produce MSY and that fishing mortality rates had increased to levels close to F_{msy}. The Commission is currently debating conservation steps needed to maintain the South Atlantic stock at biomass levels that could support MSY, but criteria for allocation of harvest limits have not yet been established.

In 1996 an evaluation of the limited Mediterranean swordfish catch and effort information was conducted leading to a finding that fishing mortality rates in 1994 were likely in excess of yield per recruit benchmarks $F_{0.1}$ and F_{max}. Concern over the high levels of small fish catch from the Mediterranean has lead to implementation of minimum size limits for swordfish by a number of Mediterranean fishing nations. As detailed data is lacking for a large proportion of the catch, more recent assessments of stock status have not been undertaken. The absence of a substantial portion of recent data, the short time series of reliable data and the long history of exploitation in the Mediterranean, makes it

uncertain where the Mediterranean stock is in relation to unexploited stock levels. Efforts are underway to improve the data collection within the Mediterranean.

Evidence of Blue Marlin, *Makaira nigricans*, Spawning in the Vicinity of Exuma Sound, Bahamas

Joseph Serafy
US National Marine Fisheries Service, USA

Co-Authors: Robert Cowen, Claire Paris, Thomas Capo, Stacy Luthy

Exuma Sound is a semi-enclosed body of water bounded by islands of the Bahamas. During July 2000, we sampled for larval billfish throughout the Sound's surface waters as well as in adjacent, open waters of the Atlantic Ocean. A total of 99 larval billfish were collected. Most (90) of the larvae were identifiable as blue marlin (Makaira nigricans), and four as either sailfish (Istiophorus platypterus) or white marlin (Tetrapturus albidus). The remaining larvae were of Subfamily Istiophorinae, but were too damaged to be identified to species; no larval Xiphias gladius were collected. Larval blue marlin densities ranged from 0 to 3.4 larvae 1000 m-2; their sizes ranged from 3.1 mm notocord length to 22.6 mm standard length. Densities tended to be highest northeast of the Sound's central axis, especially within the two regions where exchange with the Atlantic is greatest. Mean densities tended to decrease in the direction of mean flow; mean lengths increased from 8.08 mm at the Sound's mouth to 14.7 mm at its upper reaches. Length-based estimates of larval age ranged 3.7 to 17.2 days. Given these age estimates and assuming passive, surface transport, spawning likely occurred in waters within or near the 'triangle' of Rum Cay, San Salvador and Conception Islands. This study suggests that Exuma Sound functions as a nursery area for blue marlin, and possibly other billfish species, at least during the summer. However, our limited sampling just outside Exuma Sound, in the Atlantic Ocean proper, also yielded blue marlin larvae. For this species, therefore, insight into the nursery role of Exuma Sound and other semi-enclosed pelagic waters relative to open- ocean environments may be gained through further sampling and comparison of larval condition, diet and growth rate.

Age and Growth of Black Marlin, *Makaira Indica*, In East Coast Australian Waters

Peter Speare
Australian Institute of Marine Science, AUSTRALIA

Sagittae, anal and dorsal fin spines were collected from black marlin, *Makaira indica*, in eastern Australian waters to evaluate and interpret age information from these structures. Presumed annual marks in sections of the third anal and third dorsal spines were examined from 69 fish ranging in size from 8.5kg to 451kg. Sectioned otoliths were also examined for presumed daily microincrements using both light and scanning electron microscopy. Spine radius and sagitta weight each varied predictably with the length and weight of the fish. The time period between consecutive growth marks was checked against the growth of these hardparts recovered from a tetracycline injected and recaptured fish at large for 6 months. With the assumption that the growth of the fin spine is proportional to it's cross-sectional area (i.e. $radius^2$), the increase in size of fin spines from the recaptured fish confirmed that translucent bands in the spines are laid down annually. Lengths and weights at age, based on these bands, are presented for black marlin. External ridges were observed on the edge and ventral surface of the rostrum of the sagitta but they were inconsistently clear to be reliably counted. Sagittae displayed an internal record of microincremental growth on a scale which suggested a daily periodicity. Confident and consistent enumeration of these increments was restricted to fish <40kg (~1600mm LJFL). A daily cycle of increment deposition was not confirmed by a count from the recaptured fish which fell short of the 198 days at large. The ages assigned to black marlin in this study support ages suggested from analysis of length frequency data on juvenile fish. They underline the restraints previously recognised in decoding sagittae of blue marlin and, confirm the utility of fin spines in providing age information for Istiophorids.

Reducing Bycatch and Bycatch Mortality in the US Atlantic Pelagic Longline Fisheries

Buck Sutter
National Marine Fisheries Service, USA

Co-Authors: Jill Stevenson, Karyl Brewster-Geisz

Pelagic longline gear is a dominant commercial fishing gear used by U.S. fishermen to target Atlantic swordfish and tunas, which are managed under both domestic and international policies. Use of this gear results in catch and discard of non-target finfish species (bycatch) such as blue and white marlin, sailfish, and undersized swordfish, and of protected species (marine mammals and turtles). Most of the finfish caught incidentally are considered to be overfished/overexploited by both the United States and the International Commission for the Conservation of Atlantic Tunas. The National Marine Fisheries Service (NMFS) has adopted a strategy for rebuilding these stocks through international cooperation, which primarily involves reducing fishing mortality through the negotiation of entity-specific catch quotas. However, the contribution of bycatch to fishing mortality must be considered when rebuilding these stocks. NMFS recently issued regulations to prohibit pelagic longline fishing at certain times and in certain areas in U.S. waters and to prohibit the use of live bait in the Gulf of Mexico to reduce bycatch and incidental catch of overfished and protected species by pelagic longline gear, while minimizing the reduction in target catches of tuna, swordfish, and other commercially-viable species.

Analysis of Swimming Behaviour of a Swordfish using an Archival Tag

Mio Takahashi
National Research Instisute Of Far Seas Fisheries, JAPAN

Co-Authors: Makoto Okazaki, Hiroshi Okamura, Kotaro Yokawa

A swordfish which was harpooned with an archival tag in plastic case was released in July 1999 off the east coast of Japan, and it was recaptured by harpoon boat in June 2000 at almost the same area. The fish size was around 120kg at recapture. This record would be the longest time at liberty at present as far as the archival tag experiment. This tag recorded ambient water temperatures and swimming depths of the fish. The swimming behavior of the tagged swordfish showed a

specific diurnal vertical migration pattern from 2nd day after release. It swam mainly in the cold water(3–6?) probably deeper than 200m during the day, and mainly stay near the surface (21–27?) at night. The maximum swimming depth was thought to be 800–900m by ambient water temperature data. For days after the fish moved to the colder waters, the fish also made one or two excursion from depth to the surface in the daytime. We also estimated the migration route of this tagged swordfish from the daily ambient water temperature records (depth of 0m, 80m, 160m) by using monthly sea temperature data in oceanographic database.

Historical Perspective of Global Billfish Stock Assessment

Yuji Uozumi
National Research Institute Of Far Seas Fisheries, JAPAN

Historical Perspective of the Billfish Stock Assessment in the World – Problems and Future – Yuji Uozumi National Research Institute of Far Seas Fisheries In spite of substantial increase of information on billfishes in the last decade, especially for the landing and catch/effort statistics for some of the commercial and recreational fisheries, basic biological information on billfishes such as growth, maturation, catch at age, and sex ratio by size is still insufficient for the application of more analytical models. Therefore a family of the production models is still the major tool for the stock assessment of billfishes. Even though there are significant increases of the information on catch and effort, it is still hard to obtain reliable results in most cases from the production models without putting subjective constrains on the model parameters. In addition to the uncertainty on the catch information, major uncertainty of the results of stock assessment comes from the difficulties in the realistic estimation of effective fishing effort of each fishery for billfishes. In this paper, the actual situation and problems of recent stock assessments of billfishes are reviewed, and the future direction of billfish researches are discussed.

Effective Utilisation of Billfish in Japan

Kazushige Usui
Kanagawa Prefectural Fisheries Research Institute, JAPAN

In the species of billfish, blue marlin, black malin, striped malin, swordfish, sailfish,and spearfish(in the order of the amount of catch)are utilized in Japan. The price of striped marlin and swordfish is two to three times that of other billfish.There two fish are mostly consumed as sashimi(raw fish)and steak because of their whitish meat color and fairly large amount of lipids.On the other hand, most of blue marlin and black marlin, which contain very small amount of lipids, are utilized as processed seafood. Those fish meats are mostly marinated and processed with fermented soybean paste (miso) or sake lees,which are traditional Japanese food ingredients. However, the development of value-added new products from blue and black marlin meats is necessary, because the comsumption of existing processed seafoods from these two fish meats is limited to some extent. In our laboratory, novel products such as surimi-type food, ham-like product, dried and smoked product from blue marlin meat have been prepared and a quality test of merchandize has been under way.

Effects of Minimum Size Limits on Recreational Billfish Landings in the United States

Arietta Venizelos
National Marine Fisheries Service, USA

Co-Authors: Frank Sutter, Joseph Serafy

In 1998, the International Commission for the Conservation of Atlantic Tunas (ICCAT) recommended that all member nations reduce landings of blue marlin (Makaira nigricans) and white marlin (Tetrapturus albidus) by at least 25% for each species from 1996 landings. In response, the US National Marine Fisheries Service (NMFS) implemented rulings that increased the minimum size limit for landing Atlantic marlins. Since commercial fishing operations inside the US Exclusive Economic Zone are required to release all Atlantic billfish, whether alive or dead, increases in minimum sizes affected the US recreational sector only. This paper reviews methodology used for setting minimum size limits for billfish in the US. Size distributions of billfish landed at recreational tournaments were used to evaluate size limit alternatives. Additionally, this paper re-examines the impact of the most recent minimum size increases on the US recreational fishery for marlins. The effectiveness of setting minimum size limits as a primary management approach is discussed, as well as the increase in catch and release fishing in the US recreational marlin fishery.

Gamefishing Facilities and Recreational Billfish Catches of Pacific Island Nations in the Western and Central Pacific

Wade Whitelaw
Australian Fisheries Management Authority, AUSTRALIA

Gamefishing is a developing industry for many of the Pacific Island Nations with a number of countries encouraging the industry with tax relief and tourism promotion. The level of development of gamefishing varies among Pacific Island Nations with some countries only carrying out subsistence fishing (including billfish) while others have a well-developed game-fishing infrastructure. The game-fish facilities of each country are described including charter operations, number of private vessels and berthing facilities. The main game-fishing areas are also described along with the main target species and seasonal availability. Estimates of recreationally caught billfish are also provided for each Pacific Island Nation. These estimates have been facilitated by the development of a gamefish catch and effort database by the Secretariat of the Pacific Community. Presently an estimated 1,600 mt of billfish are caught by gamefishing in the central and western Pacific, which compares to an estimate of around 32,500 mt (including broadbill) caught by commercial longline and purse-seine vessels.

Trends in Billfish Catch from Longline Fisheries of the Western & Central Pacific Ocean

Peter Williams
Secretariat Of The Pacific Community, NEW CALEDONIA

The longline fishery provides the longest available time-series of catch for four species of billfish (blue marlin (Makaira mazara), black marlin (M. indica), striped marlin (Tetrapturus audax) and swordfish (Xiphias gladius). Billfish catch data are primarily available from logbooks, but potential biases have been identified with this source of information in the past. This paper briefly describes these biases, and how they have been corrected with the use of other sources of information (for example, observer data). The variation in billfish species composition in longline catches over broad areas of the WCPO is described. Annual and seasonal trends in billfish catch are presented in the form of graphs showing nominal CPUE for each billfish species. Factors likely to be used in standardising the CPUE for billfish species taken in the longline fishery are also described, along with some comments on the dangers in interpreting nominal CPUE. Size composition data are presented to show variations in the size of the billfish species catch over broad areas and time. Preliminary interpretations of the data are provided, but no attempt has been made to infer stock status of the billfish species at this stage.

Monitoring and Assessment of the Chilean Swordfish, *Xiphias gladius*, Fishery

Eleuterio Yáñez
Universidad Católica De Valparaíso, CHILE

Co-Authors: María Angela Barbieri, Francisco Ponce, Karen Nieto, José Acevedo

The swordfish, Xiphias gladius (Linnaeus 1758), landings in Chile are traditionally made by artisanal fishermen and the information is available from 1938. From 1986, a remarkable growth of this fishery is observed, associated to the increase of the exporting activity, the incorporation of gillnets and the use of sea surface temperature (SST) satellite (NOAA) images. In addition, from 1991 the long-line industrial fleet of oceanic characteristics is developed. From 1986, this fishery is monitored with the purpose of gathering biological, fishery and oceanographic information (catches, fishing effort, fishing grounds, lengths and weights, SST, among others). With this information the distribution of the CPUE abundance index and the satellite SST is analyzed altogether; in addition, a Bayesian model of probable fishing grounds estimation is established. On the other hand, the stocks status is analyzed through production models, integrating the environmental variability using the interactive software CLIMPROD. In addition, the biological data allowed the stock assessment analysis using the CAGEAN age structured model. The stock assessment model indicates a certain degree of overexplotation, associated to a remarkable decrease of the parental stock. Key words. swordfish, monitoring of the fishery, SST, stock assessment, Chile.

An Estimation of Effective Fishing Effort of Japanese Longliners on Atlantic Blue Marlin, *Makaira nigricans*, in the Atlantic Ocean

Kotaro Yokawa
National Research Institute Of Far Seas Fisheries, JAPAN

Co-Authors: Makoto Okazaki, Hisoshi Okamura, Hirokazu Saito, Takayuki Matsumoto, Yuji Uozumi

In the Atlantic Ocean, CPU of blue marlin caught by Japanese longliners has been used for the abundance index and it was standardised by General Linear Models. The result of standardization indicated higher fishing efficiency of deep setting than of shallower setting, which is clearly inconsistent with already known underwater behaviour of blue marlin. One of the main reasons of this contradiction could be attributed to the drastic change of gear configuration and fishing ground of Japanese longliners in the tropical are of the Atlantic i.e. change from shallow to deep longline method occured in a very short time during 1980–1985. This drastic change of operation pattern of Japanese longliners would severely hamper the model to make exact comparison of catch rate by different gear configuration if no actual hook depth informnation were available. In the present study, estimation of effective information about vertical and temporal distributions of the relative abundance of blue marlin obtained from recent archival pop-up tag experiements, environmental condition such as temperature and current, as well as the underwater movement of longline gear.

Reproductive Biology of Broadbill Swordfish, *Xiphias gladius*, from Eastern Australia

Jock Young
CSIRO Marine Laboratories, AUSTRALIA

Co-Authors: Anita Drake, Thor Carter, Michael Brickhill, Jessica Farley

The reproductive ecology of broadbill swordfish was examined from ~2000 fish caught from the domestic longline fishery off eastern Australia between May 1999 and March 2001. The size of fish sampled ranged in size from 90 to 240 cm orbital fork length (OFL) with an apparent decline in the size of fish sampled over the winter months. Using the largest oocyte method we determined a minimum size of maturity for females at 156 cm OFL. The gonad index indicated a spawning period covering the months October through May. This pattern was supported by histology although hydrated oocytes, reflecting imminent spawning, were found from December through to March. Oocyte development was asynchronous and the presence of hydrated oocytes and post ovulatory follicles in the ovaries of many females indicated multiple spawning. There was little indication of seasonality in the males examined (using histology and gonad index) although a slight rise in the proportion of mature males was found in the Australian spring. Spawning activity was not limited to one particular region within the study area. Overall a sex ratio of 1m:2.25f was recorded with variations between seasons and with fish length. The proportion of males to females was relatively constant up to 170 cm OFL thereafter decreasing to zero for fish greater than 230 cm OFL. Preliminary estimates of batch fecundity show a range between 1.2 and 1.9 million hydrated oocytes for fish ranging in size from 173 to 190 cm OFL.

Notes


3RD INTERNATIONAL BILLFISH SYMPOSIUM
Cairns 2001
19 - 23 AUGUST

Notes


3RD INTERNATIONAL BILLFISH SYMPOSIUM
Cairns 2001
19 - 23 AUGUST

Notes


3RD INTERNATIONAL BILLFISH SYMPOSIUM
Cairns 2001
19 - 23 AUGUST

SUPPORTING RESEARCH TO FIND CONSTRUCTIVE MANAGEMENT & CONSERVATION SOLUTIONS FOR BILLFISH WORLDWIDE

2161 EAST COMMERCIAL BLVD., SECOND FLOOR
FORT LAUDERDALE, FLORIDA 33308
OR
177 RIVERSIDE AVENUE
SUITE F, #1034
NEWPORT BEACH, CALIFORNIA 92663
E-MAIL: tbf@billfish.org PHONE: (954) 938-0150 WEBSITE: www.billfish.org