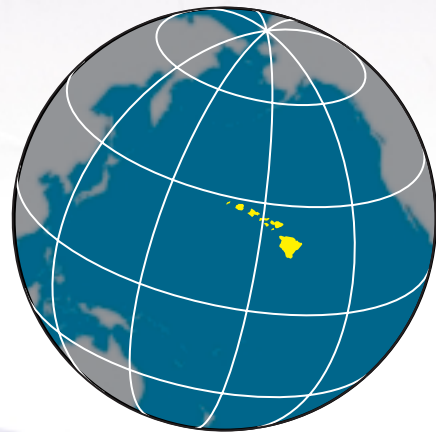


PROCEEDINGS OF THE 1998 PACIFIC ISLAND GAMEFISH TOURNAMENT SYMPOSIUM

Facing the Challenges
of Resource Conservation,
Sustainable Development,
and the Sportfishing Ethic

29 July – 1 August 1998 • Kailua-Kona, Hawaii



Edited by Marc L. Miller, Charles Daxboeck,
Christopher Dahl, Kevin Kelly, and Paul Dalzell

August 2001 • Honolulu, Hawaii
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Western Pacific Regional Fishery Management Council
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Editors' Note

These proceedings contain original material of many authors. The papers included have been edited for consistency in format and length; minor changes have been made in language, syntax, and punctuation. The authors' bibliographic and abbreviation styles, however, have generally been retained. For those presenters who did not also submit a written paper, a summary of their talk has been included instead. The opinions of the authors do not necessarily reflect those of the Western Pacific Regional Fishery Management Council or of other sponsors.

Cover photo: 1996 North Shore Hana Pa'a Tournament, Haleiwa, Oahu.

Copies

The *Proceedings of the 1998 Pacific Island Gamefish Symposium* are available as a publication from:

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Preface

This volume of papers is a record of the *Pacific Island Gamefish Tournament Symposium* convened 29 July through 1 August 1, 1998 at the King Kamehameha Hotel in Kailua-Kona, Hawaii. The purpose of the symposium was to draw attention to the great variety of gamefish tournaments in the Central-Western Pacific, and to consider how these and future tournaments might be conducted in ways attuned to the ideals of resource conservation, sustainable development, and a sportfishing ethic with biological, ecological, economic, social, and cultural consequences appropriate to the setting.

Participants in the symposium came from the public, private, and alternative sectors and included sport and other fishermen, scientists, government officials, tournament promoters, and members of non-governmental and marine environmental organizations. Authors of papers in these *Proceedings* traveled to Kailua-Kona from some sixteen beautiful nations and island entities located in Polynesia, Micronesia, Melanesia, and around the Pacific Rim.

The symposium was scheduled to take place concurrently with the 40th Hawaiian International Billfish Tournament and affiliated tournaments. This choice of venue and timing allowed participants in the symposium who were able to arrive in Hawaii a few days before the event, or who were able to extend their stay, an opportunity to witness a public meeting of the major US federal fishery management entity in the Pacific as well as several different kinds of billfish tournaments:

- 97th Meeting of the Western Pacific Regional Fishery Management Council
The Council received island reports from American Samoa, Guam, the Northern Mariana Islands, Hawaii, and from a variety of fishery agencies. Agenda topics included the management of pelagic, crustacean, precious coral, and bottomfish fisheries. Ecosystem, habitat, Native rights, and indigenous fishing issues were also discussed.
- The 40th Hawaiian International Billfish Tournament
The HIBT was a five-day “prestige tournament” with no money prizes. Teams of amateur anglers fished with a different captain and crew on each day.
- The HIBT Pro-Am
The Pro-Am was a four-day “prestige tournament” with no money prizes. Teams of amateur anglers fished with the same captain and crew every day.
- The Pacific Ocean Research Foundation (PORF) Shootout
The Shootout was a one-day “jackpot tournament” with money prizes; a portion of the entry fees was dedicated to support continuing scientific efforts of the Foundation.

The symposium program incorporated two keynote addresses, 31 individual paper presentations, four panel discussions, and several concluding assessments with opportunities throughout for members of the audience to raise questions and contribute their own recommendations, opinions, and insights. The symposium began in traditional Hawaiian fashion with an *e komo mai* (welcome) and *pule* (blessing), and culminated with a symposium *pau hana* (ending), song, and *aloha*. Time was allocated at points throughout the symposium for the sharing of food and conversation, as well as for an *aloha* reception.

Overall, the *1998 Pacific Island Gamefish Tournament Symposium* was judged to be substantially successful in fostering interactions among participants that support resource conservation, sustainable development, and a compatible sportfishing ethic. All who attended left expressing their intentions to meet again to sustain the Pacific Island gamefish tournament dialogue.

Marc L. Miller
Charles Daxboeck
Paul Dalzell
Symposium Conveners

Acknowledgements

The *1998 Pacific Island Gamefish Tournament Symposium* reflected the interests and work of an exotic international mixture of anglers, charterboat captains and crew, fishery managers and scientists, others in government (e.g., fishery, coastal zone, natural resource, tourism and environmental managers and staff), tournament organizers, members of non-governmental organizations (NGOs), and representatives of gamefishing clubs and associations, among others.

The symposium was sponsored by the Western Pacific Regional Fishery Management Council (WESPAC), the National Marine Fisheries Service (NMFS), the State of Hawaii Department of Land and Natural Resources (DLNR), the Pacific Ocean Research Foundation (PORF), the Hawaiian International Billfish Association (HIBA), the United States Fish and Wildlife Service, the University of Hawaii Sea Grant Program, the International Game Fish Association, the Game Fishing Association of Australia, the New Zealand Big Game Fishing Council, and the Japan Game Fish Association.

A Steering Committee for the symposium consisted of Kitty Simonds (Executive Director of WESPAC), Edwin A. Ebisui, Jr. (President of the PORF), Roy N. Morioka (President of HIBA), Michael Wilson (Chairperson of DLNR), and William Hogarth (Acting Director of NMFS Southwest Region).

Charles Daxboeck and Marc L. Miller contributed as Program Coordinators. Fishery Management Council Liaison tasks were coordinated by Paul Dalzell. Event Management and Promotion was handled by Michael A. Nelson. Audio tapes of the symposium were recorded by Audio Transcribers of Hawaii and transcribed by Diann Keliikoa. These *Proceedings* were compiled and edited by a team consisting of Marc L. Miller, Charles Daxboeck, Christopher Dahl, Kevin Kelly, and Paul Dalzell.

It goes without saying that the event could not have been the success it was without the assistance of a great number of people. While it is impossible to name and fully thank all those who contributed, the efforts of several fishery management personalities must be acknowledged. Peter S. Fithian, innovative founder of the Hawaiian International Billfish Tournament and HIBA Chairman, supported the concept of a gamefish symposium from the very beginning and facilitated plans to schedule the event concurrent with the 40th HIBT and its affiliated tournaments, the HIBT Pro-Am and the PORF Shootout. Marty F. Golden of the NMFS Southwest Region's Office of Intergovernmental and Recreational Fisheries strongly advocated the idea of a symposium addressing sportfishing dimensions of marine fisheries and lent considerable support to the project. Gratitude for support is also extended to Michael Wilson of Hawaii's DLNR.

Finally, the special commitment and inspirational leadership of Kitty Simonds from the conception of the symposium idea to the publication of this volume must be underscored. Her understanding of the unique features of fisheries throughout the Pacific and the importance of fishing traditions motivated everyone concerned with the project to bring people together to share their gamefish tournament experiences and insights. Accordingly, we dedicate this volume with great appreciation to her.

Mahalo to everyone.

Marc L. Miller
Charles Daxboeck
Paul Dalzell
Symposium Conveners

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Introduction

Pacific Island Gamefish Tournaments: Mechanisms for Sustainable Fishery and Marine Tourism Management

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Paul Dalzell
Western Pacific Regional Fishery Management Council

Ho`opau maunu i ka i`a li`ili`i; e ki`i no ma ka i`a nunui.

A waste of bait to go for the small fish; go for the big ones.

– Hawaiian proverb
(Mary Kawena Pukui, 1983: 118)

“What a grand tuna!” ejaculated Captain Mitchell, in heartfelt admiration and wonder. “Indeed you have beaten my record. ... Old man, I congratulate you. I am honestly glad.”

They all had something fine to say to me, but I could not reply. I seemed struck dumb by the bulk and beauty of that tuna. ... If it were possible for a man to fall in love with a fish, that was what happened to me. I hung over him, spellbound and incredulous.

– Zane Grey (1927: 95)

Introduction

In general terms, a *gamefish tournament* is a ritual event focused on anglers who compete among themselves in the pursuit of fish prized for their size, fighting abilities, beauty, taste, and market value.¹ (Notes may be found at the end of this paper.) In demonstrating their prowess, anglers agree to abide by a code of conduct covering issues that include technique, technology, and resource conservation.

A great variety of developed and developing island nations and entities in the Central-Western Pacific have either established recreational gamefish fisheries and a tradition of tournaments (e.g., Australia, Fiji, French Polynesia, Hawaii, Guam, New Zealand, American

Samoa), or are now showing interest in moving in this direction (e.g., Palau [Belau], Cook Islands, Samoa, Tonga; see Figure 1).

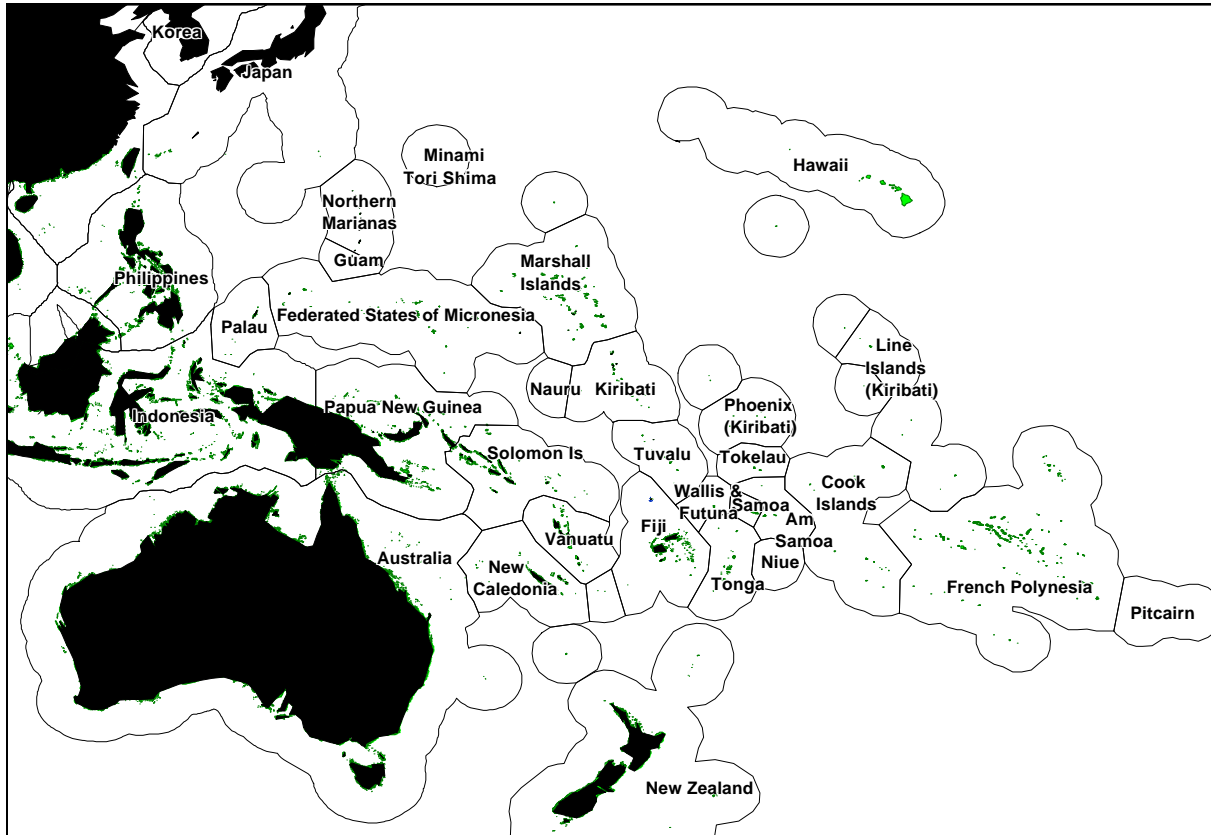


Figure 1: Map of the Central-Western Pacific, showing the Pacific Islands, Southeast Asia and Australasia

The future of many of these nations depends on the responsible management of the fisheries and marine tourism sectors. Two especially important national goals are resource conservation and sustainable development. Accordingly, fishery and coastal zone managers strive to design, implement, and enforce policies that are attuned to both of these goals.

The Pacific Island gamefish tournaments that are examined in these Proceedings vary considerably from one another in such terms as number and origin of anglers, involvement of professional charterboat captains and crew, organizing body, sophistication and cost of vessels and fishing gear, kinds of fishing successes that merit (monetary and non-monetary) prizes, tournament rules, and tournament activities associated with the events. Some gamefish tournaments are small-scale community derbies involving only local fishermen who perhaps share membership in a club or association. Others are highly publicized international contests organized so a winning angler might qualify for a world record. Events of this last kind resemble the Hawaiian International Billfish Tournament (HIBT) in that they are supported by business sponsors, media coverage, and in some instances multidisciplinary fishery science.

From a sociological point of view, gamefish tournaments provide “action windows” in which individual anglers can exhibit their passion for a sport as they contend with the uncertainty

inherent in fishing. In short, gamefish tournament fishing is a reputation gamble. Anglers who ultimately prevail as winners (as well as those who show exceptional courage, finesse, or other knowledge and abilities in failure) find their reputations enhanced. Of course, the reputations of those who make fishing mistakes or are seen to disrespect the rules suffer accordingly.

Pacific Island gamefish tournaments offer more, however, than opportunities for anglers to receive the accolades of their peers. These tournaments also have economic, ecological, and cultural significance. This point is most easily grasped with the realization that many gamefish tournaments are simultaneously embedded in fishery and marine tourism systems.

As a reoccurring event in a fishery system, a gamefish tournament underwrites a linkage between people and living marine resources. While some anglers choose to maintain an amateur status and are concerned only with the sporting experience, others benefit economically from cash prizes. In some tournaments charter captains and crew are remunerated for services provided to anglers and for fish that are sold. In many of the smaller-scale tournaments, anglers take the fish they catch home and distribute it among relatives and friends for personal consumption. Tournaments are important to fishery management entities both for the biological consequences, and for the cultural and economic consequences of the ways in which this fishing overlaps with commercial, recreational, and subsistence fishing.²

As a reoccurring event in a marine tourism system, a gamefish tournament figures as a driver that influences the interaction of tourists (e.g., anglers and audiences who travel to a tournament), tourism brokers (e.g., those who organize a tournament and those who provide touristic performances, products, and services as part of a tournament), and tourism locals (e.g., those who reside in the area of a tournament but who are not involved in any remunerative or organizing way).³

A premise of this volume is that gamefish tournaments are important events for the implementation of rational fishery management and also marine tourism management in the Pacific. In this context, it is our hope that the sportfishing ethic can be refined to emphasize the twin ideals of resource conservation and sustainable development. This can occur with a continuing dialogue between those who plan tournaments and those who make fishery and tourism policies.

The success of the 1998 Pacific Island Gamefish Tournament Symposium gives us confidence that organizational frameworks and scientific procedures can be designed so that gamefish tournaments that take place in the future are both 1) biologically and environmentally appropriate, and 2) culturally and economically appropriate to their particular Pacific settings.

The 1998 Pacific Island Gamefish Tournament Symposium

1. Themes and Goals

The *Pacific Island Gamefish Tournament Symposium* was convened in Kailua-Kona on the Big Island of Hawaii 29 July - 1 August 1998. The symposium focused on the importance of sportfishing to society and also its consequences for fishery conservation and marine tourism management. The rationale for the symposium was also rooted in the desire of many Pacific Island governments to improve their tourism industry through developing gamefishing and charter fishing opportunities, and mounting their own big gamefish tournaments.

In planning the symposium, organizers recognized needs in the Central-Western Pacific for:

- a better understanding of gamefish tournaments in their environmental, biological, cultural, and economic totality,
- a better understanding of the role of gamefish tournaments as mechanisms of resource conservation⁴ and sustainable development,⁵ and
- implementation of a gamefish tournament system for the monitoring of scientific processes, the standardization of statistical practices, and the refinement of the sportfishing ethic.⁶

The symposium was the first event of its kind to analyze the human as well as the biological aspects of gamefish tournaments.⁷ In summary, the symposium was conceived to explore the ways in which Pacific Island nations might best utilize gamefish tournaments as mechanisms to respond to the linked challenges of resource conservation, sustainable development, and the promotion of the principles of sportsmanship.

2. Agenda and Participants

The *Pacific Island Gamefish Tournament Symposium* entailed three and one-half days of sessions devoted to invited and volunteered papers, and panel and open discussions (see *Appendix 1* of the *Proceedings*). Authors of the papers in the *Proceedings* reside in a wide range of Pacific places. These included Guam, Australia, Fiji, the Philippines, Palau, Tahiti, New Zealand, Saipan, Papua New Guinea, American Samoa, Okinawa, the Cook Islands, Niue, Taiwan, Tonga, the Hawaiian Islands, and the US mainland.

A “Pacific Island Style” of interaction was adopted in which everyone in attendance was encouraged to participate and to talk whenever they felt so moved. The symposium—punctuated with breaks for sharing food and informal conversation—was effective in bringing together Pacific Island experts and a diverse audience.

Participants in the symposium included invited speakers, other speakers presenting papers, panel members, and an audience of experts and interested parties. Those who attended the

symposium in these capacities fall into several general categories (see *Appendix 2* of the *Proceedings*):

- Anglers
- Fishery resource managers and scientists
- Other government and agency officers (coastal zone, natural resource, and environmental managers and staff)
- Tournament organizers and promoters
- Charterboat owners, captains, and crew
- Other members of the fishing industry
- Members and representatives of gamefishing clubs and associations
- Members of marine environmental and non-governmental organizations

3. Symposium Opportunities

The Pacific Island Gamefish Tournament Symposium provided an important opportunity for the presentation of “First Reports” documenting the diversity of gamefish tournaments and conditions of fishery resources across the Pacific. Moreover, the symposium fostered the identification of gamefish tournament problems and opportunities (both common and unique) faced in individual Pacific states, and panel discussions on scientific and other data collection needs, and features of the sportfishing ethic.

In invited and volunteered papers and overviews, participants connected their ideas to the three overarching symposium themes of sustainable development, resource conservation, and sportfishing ethics. Four panel sessions were organized to address issues having to do with 1) rules and tournament organization, 2) management implications, 3) fisheries-tourism interactions, and scientific data needs.

These topics in turn sparked discussion of related issues concerning, for example, business aspects of gamefish tournaments; differences between “prestige tournaments,” “jackpot tournaments,” “club tournaments,” “invitational tournaments,” and variations on gamefish derbies; the roles of professional charterboat captains and crews in tournaments; implications of interactions between fishermen engaged in tournaments and subsistence, commercial, and other recreational fishermen; and the recruitment of young people and women to gamefish tournaments.

The papers, addresses, and discussion in the symposium strongly confirmed that gamefish tournaments in the Central-Pacific exhibit substantial diversity in structure, purpose, participants, audience, investment, and scope. While all tournaments foster constructive competition (and ceremony), the rules and rewards were shown to differ considerably. Sharply different perspectives emerged, for example, on the desirability of catch-and-release rules. Similarly, while some of those at the symposium opposed tournaments with cash prizes, others in attendance promoted alternatives to amateur or prestige tournaments with equal vigor.

Considerable attention at the symposium was paid to tournaments targeting big game fish such as marlin, large tunas, and other pelagic species. However, discussion was also held about the development of smaller, more modest fishing events and activities. Participants shared experiences and ideas about casting from shore for reef fish such as small jacks and snappers. In this regard, it was pointed out that not all anglers—whether these are local residents or tourists—have the means to charter a vessel (and, in some situations, a captain and crew) for big game fishing. With time, the growth of such recreational and sport fisheries could foster tournament fishing and stimulate local economies.

At several junctures in the symposium, conversation centered on the role of gamefishing clubs as generators of long-term catch-and-effort data through the maintenance of club records. It was also noted that in some locations where offshore fishing is not traditionally practiced (*e.g.* Vanuatu) gamefishing clubs can be major sources of high quality pelagic fish for local markets.

These are, of course, only a few examples of the many issues examined in the symposium. As the text of this volume amply displays, a rich variety of related topics were raised, debated, and elaborated in the symposium.

4. *Symposium Successes*

The success of the symposium is measured not only by the production and publication of the many papers (and the original ideas in these) in this volume, but also by the usefulness of insights gained at the symposium by both those who attended and those who sponsored the event.

Benefits to Symposium Participants and the General Public: It can be hoped that first-order benefits for participants and the general public will be found in 1) better communication about opportunities and problems that characterize gamefish tournaments and fisheries, 2) greater public awareness of the importance of gamefish tournaments and fisheries, 3) greater international cooperation in the resolution of pressing fisheries management problems, and 4) continuing attention to the refinement of the sportfishing ethic in the gamefish tournament setting.

Beyond this, it is also anticipated that general benefits of the symposium will emerge in the implementation throughout the Central-Western Pacific of gamefish tournament systems or frameworks tailored explicitly to the goals of sustainable development, resource conservation, and the sportfishing ethic.

Benefits to Sponsors: Symposium sponsors in a first category include those with established ties to gamefishing tournaments and/or associated fisheries (*e.g.*, fishery agencies, fishery scientific organizations, game fish associations). For these sponsors, the benefits of the symposium will be the same as those mentioned above for participants and the general public. In addition, these sponsors stand to benefit from an enhanced reputation 1) for sensing the importance of addressing gamefishing tournament issues in a comprehensive manner, and 2) for

taking the responsibility of examining gamefish tournament issues with explicit attention to resource conservation, sustainable development, and sportfishing ethic considerations

Falling in a second category are those sponsors (*e.g.*, agencies with mandates for land use and natural resource management, educational and outreach entities of government) which are rather less directly involved with matters of gamefish tournaments and fisheries. The reputation of these sponsors stands to be enhanced for taking the initiative through supporting the symposium to encourage direct attention of opportunities and problems of marine affairs that involve more than a single sector.

Conclusion

In a closing comment, it is to be hoped that continued attention to Pacific Island gamefish tournaments will contribute to the realization of their potential as mechanisms for the attainment of resource conservation, sustainable development, and sportfishing ethic goals. As this is accomplished, sustainable fishery and marine tourism management can become an integrated reality in Pacific settings.

Endnotes

¹ Borrowing a cultural anthropological terminology from Turner and Turner (1982: 202), gamefish tournaments are structured (for example, with competitive and festive performances, ceremonies, sacred objects, and ambiguities) so that participants enter:

“a ritual time and space that are betwixt and between those ordered by categories of past and future mundane social existence. The cultural guidelines of secular conduct are now erased and obscured. Something weird and numinous replaces them.”

² In Hawaii, many fishermen who have recreational and sportfishing motives possess fishing licenses that allow them to sell the fish they catch. This kind of fishing can be termed *expense fishing*.

³ For elaboration on the “broker-local-tourist” model of tourism, see Miller and Auyong (1991, 1998).

⁴ In the context of fishery management, resource conservation signals a commitment to maintain the viability of the fishery system. The Optimum Yield policy-making process established by the Magnuson-Stevens Fishery Conservation and Management Act of 1976, for example, is founded on two coupled fishery management decisions. The first of these—the *conservation decision*—refers to the quantity of fish that can be harvested on a sustainable basis. The second—the *allocation decision*—concerns the way in which access to harvestable fish should be distributed across fishing constituencies.

- Conservation (or Quantity) Decision

The canonical fishery management question for the scientific study of the fish side of the fisheries equation may be phrased in the following way:

What is the value/significance/importance/meaning of fishing a) to target species, and b) to other species and the habitat?

- Allocation (or Distribution) Decision

The canonical fishery management question for the scientific study of the human side of the fisheries equation may be phrased in a similar way:

What is the value/significance/importance/meaning of fishing a) to people who fish, and b) to other members of society?

⁵ Perhaps the two most widely known statements on sustainable development have been generated in publications by the World Commission on Environment and Development (WCED), and the World Conservation Union (IUCN) together with the United Nations Environment Programme (UNEP), and the World Wide Fund for Nature (WWFN):

- “Economic growth always brings risk of environmental damage, as it puts increased pressure on environmental resources. But policy makers guided by the concept of sustainable development will necessarily work to assure that growing economies remain firmly attached to their ecological roots and that these roots are protected and nurtured so that they may support growth over the long term” (WCED, 1987: 40).
- “[Sustainable development means] improving the capacity to convert a constant level of physical resource use to the increased satisfaction of human needs” (IUCN, UNEP, and WWFN, 1990: 10).

An excellent review of the multiple meanings of sustainable development with recommendations for enhancement of the concept are found in Lele (1996: 610; see also Callicott, 1990):

- “In the mainstream interpretation of Sustainable Development, ecological sustainability is a desired attribute of any pattern of human activities that is the goal of the developmental process. In other words, Sustainable Development is understood as a form of societal change that, in addition to traditional development objectives, has the objective of constraint of ecological sustainability. ... Tradeoffs may sometimes have to be made between the extent to and rate at which ecological sustainability is achieved *vis-à-vis* other objectives. In other cases, however, ecological sustainability and traditional development objectives (such as satisfaction of basic needs) could be mutually reinforcing.”

Finally, it should be noted that the ideal of sustainable development is not exclusively a Western construct. Many traditional Pacific Island societies have proverbs and “mythologies” that transmit instructions and lessons about the wisdom of constraining ambitions and desires in the interests of the non-human world.

⁶ A sportfishing ethic implies a willingness to impose constraints on available technology and human conduct so that power in the predator-prey relationship between anglers and fish is not overwhelmingly in the hands of humans. As long ago as 1927, legendary fisherman Zane Grey alerted his peers to the fact that simply choosing a weight of line presents a two-part ethical question. To choose an extra-strong line trivializes the act of playing a fish; to select an extra-light line (for the purpose of demonstrating technique):

“And there you are. This new method of angling was simply, when feeding a bait to a swordfish, to slack off a lot of line, and let it hang loose. If the swordfish struck, the chances were a hundred to one he would get tangled. And if he was tangled he might as well have been lassoed.”

(On the use of unsportsmanlike use of extra-strong airplane-wire leaders. Grey: 1927: 194)

“Before I had taken to heavy tackle on heavy fish, I had for twelve years used light tackle. ... But [now] I cannot see light tackle, that is to say, a nine-thread line and six-ounce rod, for swordfish and tuna. Elsewhere, more than once, I have told why. The advocates of light tackle, rather few in number at that, claim it is more sportsmanlike to catch a big fish on a delicate rig.

That sounds all right. It sounds fine, but it is deceptive to the inexperienced angler and the layman. How about the ten-to-one ratio of heavy fish that break the light tackle and swim away with hooks in their throats?"

(On the use of extra-light line. Grey: 1927: 190)

For a fine discussion of gamefish tournament rules and problems in their enforcement, see Goadby (1992: 288-296).

⁷ Two relevant literatures that can inform treatment of issues connected to marine gamefish tournaments concern billfish and recreational fisheries. In this regard and in the US context, see Shomura and Williams (1974, 1975a, 1975b) and a numbered series of volumes published for the International Game fish Association, the National Coalition for Marine Conservation, and the Sport Fishing Institute beginning with Clepper (1976) and embracing Stroud (1989, 1990).

References

- Callicott, J. B. 1996. "Ecological Sustainability as a Conservation Concept," *Conservation Biology* 11: 32-40.
- Clepper, H. (ed.). 1976. *Marine Recreational Fisheries 1*. Washington, D.C.: Sport Fishing Institute.
- Goadby, P. 1992. *Saltwater Gamefishing: Offshore and Onshore*. New York: McGraw-Hill (International Marine).
- Grey, Z. 1927. *Tales of Swordfish and Tuna*. New York: Harper and Brothers.
- Lele, S. M. 1996. "Sustainable Development: A Critical Review," *World Development*: 600-)
- Miller, M.L., and J. Auyong. 1991 "Coastal Zone Tourism: A Potent Force Affecting Environment and Society," *Marine Policy*. (March) pp. 75-99.
- Miller, M.L., and J. Auyong. 1998. "Remarks on Tourism Terminologies: Anti-tourism, Mass Tourism, and Alternative Tourism," *In: Proceedings of the 1996 World Congress on Coastal and Marine Tourism*. (M.L. Miller and J. Auyong, eds.; 19-22 June 1996, Honolulu, Hawaii, USA). Seattle, WA: Washington Sea Grant Program and the School of Marine Affairs, University of Washington and Oregon Sea Grant College Program, Oregon State University. pp. 1-25
- Pukui, M.K. 1983. *Olelo No`eau: Hawaiian Proverbs and Poetical Sayings*. (Bernice P. Bishop Museum Special Publication No. 71) Honolulu: Bishop Museum Press.
- Shomura, R.S. and F. Williams. 1974. *Proceedings of the International Billfish Symposium*. (Kailua-Kona, HI, 9-12 August, 1972; *Part 2. Review and Contributed Papers*). Seattle, WA: US Department of Commerce (NOAA Technical Report NMFS SSRF-675).
- Shomura, R.S. and F. Williams. (eds.). 1974/1975a/1975b. *Proceedings of the International Billfish Symposium*. (Kailua-Kona, HI, 9-12 August, 1972; *Part 1. Report of the Symposium, Part 2. Review and Contributed Papers, Part 3. Species Synopses*). Seattle, WA: US Department of Commerce (NOAA Technical Report NMFS SSRF-675).
- Stroud, R.H. (ed). 1989/1990. *Planning the Future of Billfishes: Research and Management in the 90s and Beyond*. (*Marine Recreational Fisheries 13 [Part 1 and 2]*). Savannah, GA: National Coalition for Marine Conservation.
- Turner, V. and E. Turner. 1982. "Religious Celebrations," *In: Celebration: Studies in Festivity and Ritual*, (V. Turner, ed.). Washington, D.C.: Smithsonian Institution Press. pp. 201-219.
- World Commission on Environment and Development (WCED). 1987. *Our Common Future* (also known as "*The Brundtland Commission Report*"), New York: Oxford University Press.
- World Conservation Union (IUCN), the United Nations Environment Programme (UNEP), and the World Wide Fund for Nature (WWFN). 1990. *Caring for the World: A Strategy for Sustainability* [second draft], Gland, Switzerland: IUCN.

Keynote Addresses

Managing Hawaii's Marine Resources

Mike Wilson, Chair
Hawaii Department of Land and Natural Resources

This symposium represents a tremendous opportunity, because the Hawaii fishing community has become very vigilant and, along with the Department of Land and Natural Resources, concerned that we do something to help the fishing industry. I would like to discuss the concept of conservation along with sportfishing and put it in a little bit of perspective.

With the growth in world population, there has been an enormous focus on the remaining fish harvest for both commercial and sportfishing. Since 1944 the population of the earth has doubled and will probably rise to about eight billion within the next 40 to 50 years. So this idea that we have to sustain natural resources is one that has become pretty straightforward in fisheries management.

If we consider that in 1994 US fishermen landed 4.7 million mt of fish, valued at \$3.81 billion, fishing is a significant industry. It makes a huge difference, not only in the United States, but here in Hawaii. Because of the techniques that we have, the total catch has doubled since 1970.

The Council on Environmental Quality publishes an annual report that summarizes some of these issues. Citing from this most recent report, at the global and national level there are many troubling signs that fisheries resources are in peril. The Food and Agriculture Organization of the United Nations estimates that of 200 fish stocks worldwide, more than 25 percent are over-exploited, depleted, or recovering, while 38 percent are fully exploited. In the United States, which accounts for an estimated six percent of the global catch, the situation is similarly alarming. Thirty-six percent of the 158 stock groups in the United States, whose biological status is known and monitored by the National Oceanic and Atmospheric Administration, are currently below estimated optimal long term levels. As measured in terms of fishery utilization of the resource, NOAA estimates that 28 percent, or 56 of 157 known stock groups, are over-utilized. So we are using the maximum sustainable yield concept, but our scientists tell us that the fish population is being over-utilized. More and more people that aren't fishermen are getting concerned about the depletion of fish. So what is the consequence? Somewhat like the hunting issue in the United States, there are a lot of people that think maybe we should shut down fishing.

Their concept of fishing doesn't come from growing up as a fishing person. I have to confess, I grew up as a fisherman. From small-kid time, I can remember the incredible excitement of catching fish. There was an unbelievable mystery that surrounded bringing something out of the water and perhaps eating it. Fishing helps you relate to the incredible experience of being in the ocean and it gives you an understanding of the idea that fishing is part of our primitive

nature. We do eat fish, as we eat other animals to survive. So the idea that we shouldn't be fishing just seems inconsistent in some ways with the idea of our relationship to the natural world, the ocean, and the planet. But I do get concerned, because in my present position, no longer just swimming around for fun, we are supposed to do something other than *wala'au*, which is the Hawaiian term for saying things that sound good, but you don't really do anything. We are supposed to do something other than *wala'au* and figure out a way to manage these fish resources.

That brings me to Hawaii. Hawaii is a place where, if you just look at the statistics, most of the people have fished before or are fishermen. Angler expenditures are about \$138 million a year. That equates to about nine million dollars in State taxes and about seven million dollars in Federal taxes. Fishing is a serious industry here. The Council on Environmental Quality report says that in the Western Pacific Region (the Hawaiian Islands, American Samoa, Guam and, Northern Mariana Islands) fisheries resources include highly migratory pelagic fish, bottom fish, near-shore reef fish, and invertebrates. Of the 15 stock groups of highly migratory pelagics, 12 stocks are near their long-term sustainable levels. Among Western Pacific bottomfish, which are harvested from a variety of rock and coral habitats, stock assessments indicate that some important species are only 10 to 30 percent of original stock levels and over-utilization is a concern.

I think pelagic fishermen know that our striped marlin population is in pretty good shape but that our blue marlin population is somewhat questionable. However, a couple of years ago the Western Pacific Regional Fishery Council made an appearance in the legislature and said that they thought they were going to have to take over managing our bottomfish, because we weren't doing anything. Our bottom fish were crashing and the State was uncomfortable with the idea of doing something about it, because if you do something about it, it means you have to speak to people who are fishing and say, "Maybe we shouldn't do it the same way we have been." We managed to move forward with a little bit of impetus from the Council and are now meeting with commercial fishermen; we have come up with some rules and regulations to manage bottomfish stocks.

Let me talk about more than rules and regulations, and more than statistics. I will talk about the culture, so to speak. There was a time when the Hawaiian community was here and wasn't visited by any other cultures. You could assume that maybe 90 percent of the people that used the ocean were taught to have respect for it. Today, it is our Department that plays the role of the *kapuna*, so to speak, and is supposed to communicate culturally what we can do to take care of natural resources. Let me discuss the way we are trying to approach at a cultural level how to get this idea of taking care of the ocean in place.

Hawaii is the most remote land mass on earth and a place famous for great natural beauty. In fact, it is so famous that we have had a couple of astronauts come to Hawaii and explain that from space Hawaii is the most beautiful place on earth. One of them came back to earth with the idea that he would come and thank our resource managers for taking care of the most beautiful place on earth. After he had been here and explained this to our aquatic biologists,

our land managers, the folks that deal with fisheries, the folks that deal with our forests and our watersheds, we were profoundly affected by it. He thought of this as earth's best resource.

The Constitution of the State of Hawaii is an unusual one, because it talks about our department having a commitment to take care of resources for future generations. It uses the word "future." So we are supposed to actually look into the future and have an idea of what is happening. It says we are supposed to protect and preserve the natural resources of the State of Hawaii for future generations and promote the development and utilization of those resources in a manner consistent with our self-sufficiency. Obviously, the goal is to try to promote the use of the resources to better the population, but in a manner that focuses on self-sufficiency.

In most constitutions where they list the natural resources that the state is supposed to take care of, they put land, mineral water, and energy. Ours does that too, but we add natural beauty. We are supposed to take care of it because it is one of the main reasons people come to Hawaii. It is also a great symbol of something beyond man's imagining and creation.

However, all of the western states—Arizona, Wyoming, Montana, Nevada, etc.—have fisheries budgets that way exceed Hawaii. So when we talk about what is really happening, this indicates that we have to pay attention to our natural resources more than other places, because right now, we don't have a lot of funding. Why we have half the budget that Wyoming does is a mystery, but it shows that we haven't gotten a commitment at a cultural level to take care of some of our more magnificent resources.

We have a whale watching industry. The whale is something that can capture people's imagination at an international level. For that reason it makes a big difference to us with such a small budget to be able to give people a reason why, for example, they shouldn't step on coral, and why they should take seriously the idea of not allowing coastal pollution. Turning to another animal, if the marlin is going to capture people's imagination, we need to recognize its place in the wild and in gamefishing, and not just as a trophy that hangs on the wall. This is a challenge for the Hawaii International Billfish Tournament.

One of the things that makes a huge difference in our resource management is when people understand the importance of an animal, like the Hawaiian crow, that we are spending money on to conserve. For example, I think that if people knew how magnificent gamefish are, especially when we are catching them, some might become less critical of gamefishing. This conference represents the notion that we are no longer focusing on just blind exploitation.

The words that are being used at this symposium—resource conservation, sustainable development, sportfishing ethics—give another complexion. It shows fishermen as complete citizens, if you will. It shows that they are concerned about the species that they are catching. It shows that they have a connection to them. It makes sense, therefore, for a symposium like this to inform the public.

I want to give to you an example, the *ahi* tuna. Many people only appreciate it on their table as sashimi. But when fishermen are able to speak about the magnificence of the animal before it becomes sashimi, it communicates a completeness, a respect. Many other pelagic fish and billfish are incredible creations of the natural world. I would submit that as time goes on, people are going to be more and more focused on that and it is going to be more and more important to understand the animals that we are fishing for.

Let me just conclude by talking about catch-and-release and the fishing license. Catch-and-release is a problematic thing, because if you catch a really big marlin, and you make it tired enough, it might not survive. On the other hand, when we talk about trying to wake up the culture, the idea that somebody is releasing them, so some of them can survive, goes back to this idea of sustaining the natural resource and recognizing that we don't always have to take the animal's life in order to be able to appreciate its strength and some of its magnificent qualities.

I really credit the Hawaii International Billfish Tournament. Many of you, maybe all of you, know that you get extra credit if you release the animal and I guess there have been winners in certain categories that have won without even landing a marlin, because they got extra credit for releasing it. Again, that sends a message, it completes the idea of a fisherman. A fisherman is not just somebody that is interested in brutally killing something for fun.

Then there is this idea of a license. There is a really fascinating thing that happens in our department every year when we have out-of-state visitors that come here to pay for their license to catch a billfish. I have had to come out of my office and explain to them, "Look, I know what you're trying to say, to take that animal out of the ocean you want to do something to contribute to it, you want to pay a license fee, but in the State of Hawaii, that isn't the way it works. You go out and take what you want, all you want, and enjoy yourself and go home."

Now, this is an incredibly important debate when it comes to who is a fisherman, because if you are taking that animal—and it is a public resource, a marlin belongs to all of us—out of the ocean, is it too much to contribute to managing that animal by paying something? Commercial fishermen do this, of course. That brings up the big issue. Our commercial fishermen have said that they don't want to engage in some kind of imaginary management process; they want to make sure that the money from licensing goes to managing the fish.

For gamefishing, we have a sportfishing fund. This is one of the areas where we have been allowed to have a special fund where money can go back to contribute to management and then potentially we can get beyond *wala'au*. It is a good step for us to say we care about billfish, that we want to study them, we want to know what is happening with the striped marlin, the blue marlin. We want to know what impact the longliners are having. It is a good thing for us to have the idea, but it is *wala'au* right now, because we don't have the studies, we don't even have a licensing system. As a result, we don't know how many fish are being caught.

This is of interest to the gamefishing community. They are helping us by tagging a lot of fish voluntarily. But we need to get organized and put together a plan to have some kind of a licensing system, so that we can manage these fish, and get the kind of information I'm talking about. The sportfishing industry needs to be part of this.

I don't mean to say that we have a big problem with our pelagic species. But if we can try to wake up the culture by showing appreciation for these animals maybe an understanding of how to sustain critical life-supporting resources—like the magnificent fish that we have in the ocean—will become a source of planetary pride. And we will gain a lot more appreciation for those magnificent resources if we can continue to engage in recreational fishing, which keeps us in contact with these magnificent creatures.

Mahalo for my invitation and I congratulate everybody. I welcome the folks from so many different places, New Guinea, New Zealand, the Cook Islands, and other Pacific Islands. It is really exciting to have all of you here. We welcome you. The 40th Hawaii International Billfish Tournament brings us international attention and prestige. We can add depth to it, and newness, and a fresh approach, by explaining why these animals are so great.

Thank you very much.

This is a summary of Mr. Wilson's presentation.

NOAA-NMFS Sportfishing Programs in the Western and Central Pacific

William T. Hogarth, Ph.D., Administrator
National Marine Fisheries Service, Southwest Region*

Abstract

The role of the National Marine Fisheries Service, NOAA (NOAA-NMFS) in support of recreational fishing was reiterated in Presidential Executive Order 12962 (June 1, 1995). Along with our many partners, NOAA-NMFS plays a key national role supporting the wise development, management, and conservation of US aquatic resources to increase recreational fishing opportunities. This presentation will focus on NOAA-NMFS efforts at the national, regional, and local levels to fulfill the President's mandate. Information on NOAA-NMFS programs and research activities will be presented to allow for a full exploration of current and future opportunities, as well as constraints. Specific applications such as NMFS scientific research related to the HIBT and sportfishing in the central and western Pacific are detailed to further explore future research and development opportunities in this important marine resources sector.

Introduction

I'd like to extend on behalf of National Marine Fisheries Service an aloha to everyone who came to this symposium. I know a number of you have come from distant places. I see faces from Palau, from Tonga, from Guam, and America Samoa. Clearly, everybody thinks that it is important to come from such faraway places to attend this Symposium. I know that we at NMFS think it is an important thing and we are very pleased to be able to participate in sponsoring the Symposium and helping to put it on. I am going to discuss some of the things that we do in the National Marine Fisheries Service to produce data and then to show you some of the things that can be done with the information that we collect.

Western and Central Pacific Recreational Fisheries

As an agency, we are taking recreational fisheries seriously. Why are recreational fisheries important? People enjoy fishing, but it also generates revenue for the US economy and for the State of Hawaii. Data from 1982 suggest that the net benefit to the Hawaii economy was about \$250 million from recreational fishing, and it provided 3,000 jobs. Approximately

* Dr. Hogarth's position at the time of the Symposium. He is now Assistant Administrator for Fisheries (Acting), NMFS.

250,000 marine anglers in Hawaii make one million fishing trips per year. Roughly 3,200 vessels in a number of different categories land almost 3.5 million lbs. of fish. Those fish, if you sold them in the market, would be worth \$9 million. We believe that these 1982 estimates have probably now doubled in the contribution that they make to the US economy.

More recent data for the “recreational” and charter boat fishery in Hawaii indicates that there are at least 4,000 vessels that make over 73,000 trips per year. They catch over 3.4 million lbs. of fish, worth \$9 million. This figure includes the sale of fish and charter fees, but does not include non-market value of the recreational fishing experience. These values compare favorably with the preliminary value of Hawaii’s *commercial fisheries*, which in 1997 were estimated to have landed 36 million lbs. of fish valued at \$68 million. There are also significant numbers of marine anglers in Guam, American Samoa, and the Northern Mariana Islands. As in Hawaii, the standard definition of a “recreational fisher” usually does not apply in these areas because fishing is not only recreation, but an integral part of daily life.

NOAA-NMFS Mission Related to Recreational Fisheries

Recreational Fisheries Executive Order (E.O.) 12962 was signed on June 1, 1995. This Executive Order directs all federal agencies “to the extent permitted by law and where practicable, and in cooperation with the States and Tribes, improve the quality, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities...” Among other things, the Executive Order:

1. Requires each Federal agency to develop a five year plan to implement the E.O.
2. Provides an additional tool for creating partnerships with States, Tribes and non-government organizations.
3. Requires Federal agencies to report annually to the Sport Fishing and Boating Council on specific accomplishments implementing the E.O. and Five Year Plans.

NMFS Recreational Fishery Resources Conservation Plan (1996-2001)

There are four strategies for implementing the NMFS Recreational Fishery Resources Conservation Plan, all of which are incorporated into the NMFS National and SWR Strategic Plans. These strategies are:

1. Conserve, enhance, and restore recreationally important fish stocks and their habitat.
2. Develop opportunities for increased recreational fishing access and facilities in the marine environment.
3. Promote public education and support for marine resource conservation, and angling ethics.
4. Work cooperatively with State and Tribal governments, industry, user, and conservation groups and other potential partners to advance marine resource conservation, enhance recreational fishing opportunities, and establish cost share programs.

NMFS Marine Recreational Fisheries Statistics Survey

The NMFS plans to spend \$12 million nationwide over the next three years (1999-2001) to improve data collection through its Marine Recreational Fisheries Statistics Survey (MRFSS), which tracks saltwater recreational fishers' catch and effort. The survey has been conducted on portions of the mainland since 1979. They indicate that more than 200 million lbs. of fish are taken each year by the 70 million saltwater recreational fishing trips by the nation's 17 million anglers. On the West Coast the survey has been conducted through a cooperative agreement with the Pacific State Marine Fisheries Commission.

The MRFSS has not included the Western Pacific since 1982. (The results of the 1982 suggested that up to 25 percent of the residents of the State of Hawaii participated in various fishery-related activities, as did a significant number of tourists.) The 1999-2001 MRFSS Statement of Work currently includes the ability to sample Hawaii in the "contract base." The option for conducting the MRFSS in the Western Pacific (American Samoa, Guam, and the Northern Mariana Islands) is also being considered. We are working hard to insure that the survey will include the Western Pacific. In addition, NOAA-NMFS made a one million dollar supplemental budget request for FY 1999/2000 to design and implement a Western Pacific recreational fisheries statistics program, in coordination with other agency and Council programs. On top of this, we have requested \$275,000 for Western Pacific economic and socio-cultural work and data collection. Much of this will help us to better understand and quantify the behavior and motivations of fishers in the recreational or sportfishing sectors.

Pelagic Fisheries Research Program and Oceanic Institute Activities

Pelagic Fisheries Research Program

NOAA-NMFS support goes to the Pelagic Fisheries Research Program based at the University of Hawaii's Joint Institute of Marine and Atmospheric Research (JIMAR). Some of these resources have supported sportfishing research and management studies. The Pelagic Fisheries Research Program (PFRP) provides scientific information on pelagic fisheries to the Council for use in developing fishery management policies. The PFRP works with many partners, including NMFS researchers at the NMFS Southwest Fisheries Science Center's Honolulu Laboratory (SWFSC HL). Currently the PFRP is supporting a study on the economics of recreational fishing for pelagics in Hawaii. The study will estimate the marginal economic value of catching pelagic fish by small-boat anglers in the saltwater recreational sector of the main Hawaiian islands. This research helps us understand the substitution between pelagics and other fish sought by small boat anglers, and to assess the magnitude of the aggregate economic value of small boat fishing by sport anglers. The PFRP has also supported studies on the socio-economics of the charter boat fleet here in Hawaii. Later in the symposium you will hear the results of a charter boat cost-earning study by Marcia Hamilton of JIMAR, who worked with the SWFSC HL on this study.

Oceanic Institute

NOAA-NMFS also provides support to the Oceanic Institute (OI) on Oahu for the recovery and enhancement of near-shore recreational fisheries. The Oceanic Institute's stock enhancement program has developed responsible fishery enhancement technologies for marine fish culture, including spawning, rearing, and genetic maintenance. The Oceanic Institute has demonstrated that depleted stocks of striped mullet can be replenished and that hatchery-reared fish could comprise as much as to 25 percent of recreational fishers' catch. NOAA-NMFS supports OI's *moi* (Pacific threadfin) enhancement program, which has released over 350,000 tagged fish along Oahu's windward coast. It is conducting research to rear '*omilu* (bluefin trevally) , *uku* (gray snapper), *opakapaka* (pink snapper) and *mahi mahi*.

NOAA/NMFS Saltonstall-Kennedy Grant Program Activities

NOAA-NMFS also supports sportfishing research and development in the Western and central Pacific via the Saltonstall-Kennedy (S-K) competitive grant program. The S-K program is based on federal and in-kind support from a wide range of potential applicants for projects focused on fishery research, management and development.

In the 1980's the S-K program provided direct grants for infrastructure development in the Western Pacific (e.g., boat ramps in Guam and docks in the Northern Mariana Islands). But program priorities focused on research and development support for fish aggregation devices (FADs), or activities directly related to the sportfishing sector. For example, the program supported the deployment of FADs in American Samoa, the Northern Mariana Islands, the Republic of the Marshall Islands, the Federated States of Micronesia, and more recently, in the Republic of Palau. Working with local and regional partners (e.g., the South Pacific Commission) later FAD research focused on improving the longevity of FADs on-site and overall attractiveness. The S-K FAD projects or demonstration activities have led to the establishment of successful locally-implemented FAD programs in many US-associated Pacific Island areas. These programs are now principally supported by the Sports Fishing Restoration Act fund of the Department of the Interior's Fish and Wildlife Service. As a result, the need for S-K program support has diminished.

In the mid- to late 1980's the program provided support for sportfishing feasibility studies in Yap, Federated States of Micronesia, and Guam. More recently the program has supported sustainable sportfishing development in Palau by working with the local Marine Resources Division and local NGOs. You will hear more about later in this Symposium.

The S-K program continues to support innovative research in the sportfishing area. For example, on the West Coast we recently supported the production of an award-winning video, entitled "Fish for Tomorrow," promoting conservation by educating anglers about fishing techniques and fish identification. We are now working on developing a non-lethal deterrent that sportfishing boats can use against seals and sea lions.

Recreational Fisheries Accomplishments

NMFS Southwest Region (SWR) has begun collecting essential fish habitat (EFH) information for amending Fishery Management Plans. This work will be the first step in assisting in the conservation and enhancement of habitat important to recreationally and commercially caught species. For example, we are expanding GIS capabilities for managing data that will support EFH-related Fishery Management Plan amendments.

NMFS-SWR publishes the annual Billfish Newsletter, reporting results of NMFS Southwest Fisheries Science Center's billfish investigations to more than 2,000 volunteer anglers throughout the Pacific area. Marty Golden will be discussing this in detail later in the program.

The SWR has developed a web site to provide sportfishing information and links to other web sites of interest to anglers. Finally, we are working to reduce bycatch in both commercial and recreational fisheries.

Local Research Activities - Honolulu Laboratory

The NMFS SWFSC Honolulu Laboratory has a long history of association with the Hawaiian Invitational Billfish Tournament (HIBT) and other gamefish organizations in the State of Hawaii. Given the relevance to this group, I will take some time to provide details on their past and current activities to demonstrate NMFS's local research and development efforts.

Research on the biology of big gamefishes in Hawaii

Data on species, lengths, weights, stomach contents, sex and sexual maturity, parasites, and other noteworthy items have been collected by NMFS scientists on gamefish species in conjunction with local tournaments. We have made several interesting discoveries based on our work with the Hawaii International Billfish Tournament (HIBT). For example, there is a high ratio of males to females in the catch of blue marlins, female are considerably heavier than males. Findings also suggest that marlins are opportunistic feeders, and low or slack tide appeared be the best time for fish strikes while flood tide is the worst.

Research on movement patterns of blue marlin and yellowfin tuna

The SWFSC NMFS, working with JIMAR and PORF, have found that the gamefish tag-and-release program has been popular with anglers and yields considerable information on the movements of marlins. Over the years, several thousand blue marlin and yellowfin tuna have been tagged and released by fishermen. Although the number of recoveries have been relatively low (less than one percent for blue marlin), the data suggest marlin caught off Kona, Hawaii move throughout much of the Pacific Ocean.

NMFS scientists have measured small-scale movement patterns of individual blue marlin and yellowfin tuna in relation to oceanic conditions and features using acoustic tracking tech-

niques from fishing and research vessels. These studies reveal that blue marlin have a relatively short residence time in the waters off Kona and that individual fish may move through the area in a few days or less. In contrast, yellowfin tuna have much longer residence times and may remain in the area off the island of Hawaii for many days. The latter has also been confirmed for yellowfin and bigeye tunas by independent conventional tagging studies, and recently for bigeye tuna using electronic archival tag technology.

Research and information on the oceanography in the Big Island area

In the late 1960's HIBT-related vessels provided detailed information on the positions of plastic drift panels that were released in the fishing area from NMFS research vessels as part of a study of surface currents off Kona. The result revealed the existence of a pair of large eddies in the fishing area. This eddy pattern has been shown to have profound effects on fish distribution, availability, and catchability in the Kailua-Kona fishing area. In 1995, a thorough examination of these oceanographic conditions showed the areas of highest blue marlin catches coincided with regions with the strongest oceanic fronts and gradients of surface temperature.

Beginning in 1995, specialized charts showing ocean temperature, derived from satellite remote sensing, were provided to HIBT officials by the NOAA CoastWatch station located at the SWFSC HL. This information is posted at the HIBT office for fishermen and skippers to view before starting each day's fishing. This year a special web site was established to make this satellite ocean temperature information more easily available to HIBT officials and participants.

These efforts underscore the importance of sound scientific information to the management process. We need to know how many fish are out there, where they go, and what conditions are like. I think the SWFSC HL has been able to do that kind of work on a shoestring budget. Hopefully, we can work to provide more in-depth into analyses like the efforts I have just discussed.

Insights for the Future

The Multilateral High Level Conference process is intended to develop a convention for management of highly migratory species in the Western, Central, and South Pacific. This will have a significant impact on Pacific-wide pelagic resources. MHLC participants have set a target of completing their negotiations and implementing a convention by June 2000. Parties agreed to hold a plenary session in late January or early February 1999 in Honolulu. A NMFS working group has been formed—we encourage your participation in the process.

I will now stop and wish you all a good symposium, I want to see everybody having sweat dripping off their brows from the hard work that they do!

Again, thank you for coming. Aloha and mahalo.

Papers

Charter and Derby Fishing in Guam

John Eads
Guam Charter Vessels

Introduction

I'm glad to be here. I have run a 31 ft Bertram out of Guam for the past six years. Before that, I fished commercially, mostly for *onaga* and *opakapaka*. I spent a couple of years in Palau and a couple of years in Yap running fisheries patrol boats. I've had a little experience in the field and a little experience being a Council member, the latter being a lot harder.

I'd like to give you a little general information about Guam. It is at 13° N, 144° W and is part of the Mariana Islands. The Mariana Trench, to the east of Guam, is created by the Pacific tectonic plate diving under the Philippine plate. This intersection also creates our chain of islands, which are volcanic in origin.

The island chain stretches over 400 miles, with Guam the most southern island. Most of the islands are about 40 miles apart, allowing one to see from one island to the next. There are many banks to the east and west of the main islands.

Guam is not a very big island, about 30 miles long, running northeast to southwest. About 130,000 people live on Guam. It has a military base, a big Air Force base, and a fairly big Navy base. Tourism is the base for the economy; on the order of a million, mostly Japanese, tourists arrive per year.

The Charter Fleet

There are two small boat harbors, Agana to the north and Agat to the south. Agana has a capacity of about 40 boats and Agat holds about 150.

Guam has about 800 registered boats, based on police department registration records. I don't know where these boats are, maybe rotting in somebody's yard. I see about 300 boats, with maybe 500 boats total, but that calculates to a boat for every 200 people, which is a high percentage of boat owners. Most boats are 18 to 22 ft outboards.

The charter fleet consists of about 12 core boats, 30 to 50 ft in length. Most are 30 to 36 feet. They are all powered by twin diesel engines.

Some boats specialize in deep jigging. Most of the core fleet shares trips that are set up by Japanese tour agents. Most of the fishermen from Japan are fist-timers, so trips are really

short, about three hours. The captains try and target on a couple of small tuna for sashimi back at the dock and if they get lucky, they get a marlin.

My clientele is made up of local guys, mostly military, Feds, INS, FBI, and guys like that. We do six hour trips and fish a little further out.

Tournaments

We have two tournaments in Guam that have been running for a number of years. The first, the IGFA Guam Game Fish Association Tournament, is in conjunction with the Japan Game Fish Association and is a true tournament, very much patterned on the Kona Billfish Tournament. We just had our tenth annual tournament. It is pure tag-and-release. Usually, 13 boats and 13 Japanese teams participate in a two-day, eight-hour-day tournament. It is strictly a sportfishing tournament with no cash prizes. All fish under 200 lbs. are worth more tagged and released than they are at the dock. In recent years in the tournament, because Guam is a small fish place, almost all of the fish have been tagged and released.

The other tournament, the Liberation Day Tournament, originated in 1976. This is a jungle rules tournament, mostly for small boats. In 1998 there were about 80 entries, but most years there are about 100 boats. The tournament goes for three days. There are four categories of fish; marlin, yellowfin, mahi mahi, and wahoo. This year and last year they added skipjack tuna or bonito, mainly because it is a small-boat tournament.

The tournament lasts three days from 6:00 AM to 6:00 PM, and typically, the winning billfish is around 300 lbs. This year we had a horrible year for marlins in Guam. I understand this is true in most places above the equator due to El Niño. Only eight marlin were caught from 80 boats fishing for 72 hours. The largest marlin was 154 lbs.

I might also add that this time last year, I caught about 50 marlin, and only 15 this year. We are not having a good year for marlin or yellowfin. This year has been excellent for wahoo and mahi.

Tournament and Industry Issues

Sportfishing in Guam is doing well, but our tournaments have become less well structured and less well sponsored. What was the Guam Game Fish Association Tournament in conjunction with the IGFA, has now become strictly an IGFA event. The anglers from Japan set everything up and come over. We provide the boats.

The major tournament, the Liberation Day Tournament, usually comes at the end of July. We used to publish a little pamphlet, receive a lot of media attention and the governor and some of the senators would come by. This year's event had, as far as I can tell, no media coverage and no booklet was published. This tournament has been ongoing since 1976, making 1998 the twenty-third or twenty-fourth tournament. In my view, the same people have been putting on tournaments for the last 15 or 20 years and they're getting tired. There is very lit-

the public recognition of people that put on the tournaments, and this is mostly to field complaints.

The charter boats tag-and-release tournament has also had recent problems. Part of the charter fleet felt that this tournament was held to benefit only those boats who deal strictly with the Japan Game Fish Association and regularly take out those anglers. Perhaps Guam is unique in that the charter boat fleet does not have an association of any kind and the competition for the Japanese agents who provide the tourists causes problems among the vessels.

I wish that some of the people from the Council were here, because I've brought this problem to their attention. Guam is a major transshipment point, with approximately 1,000 port calls a year from Taiwanese, Japanese and Korean longliners.

What's happened in recent years is that fish unsuitable for transshipment are sold locally at cannery prices of 25 cents a pound. I believe this policy encourages the retention of bycatch. We have had a big problem this year with wahoo and mahi mahi, especially during our season, when those fish are dumped on Guam's small market. Most of the fish sold go to the hotels.

I don't believe any island managed under the Magnuson Act and the Western Pacific Fishery Management Council should encourage foreign vessels to retain bycatch and sell it on the US market. This bycatch, which includes blue marlin, consists mostly of yellowfin tuna that are either too small for the Japanese market or don't meet the quality grade. It is a huge problem and I would like to go on record again, because I'd like to see something done about it.

There is one more thing interesting about Guam and its billfish. Of the billfish we catch, 80 percent are under 150 lbs., and 90 percent under 200 lbs. Most of my clientele are not interested in tag-and-release, so I cut the fish for them on the dock. This allows me a unique chance to check stomach contents and sex them. The fish are all males and they are mature.

I believe one of the reasons we catch so many small males in Guam is because the marlin are in a heat pack configuration where a number of small males surround a female. When we troll, the males come out and take the bait. I think it is important to consider conservation efforts for marlin in this part of the Pacific because it has an intense longline base, and is a major transshipment point. We need to look into the old catch rate records for blue marlin in our area. The rate is over four per 1,000 hooks, a tremendously high rate. It appears that these marlin are actively spawning, and that is why I think we catch the little ones. If we are going to actively conserve billfish, Guam is the place to start looking and gathering data.

Discussion

In response to several questions, Mr. Eads briefly discussed the availability of data on Guam charter vessel catch. He noted that there is ample data on blue marlin, yellowfin, wahoo, and mahi mahi. Catch rates for these species, except yellowfin, have remained fairly constant.

Tournaments: Their Importance and Influence on Australian Gamefishing

Peter Goadby
Game Fishing Association of Australia

Introduction

For more than 60 years, saltwater gamefishing tournaments have been a very important facet of Australian offshore fishing. In 1910 the world's first record setting rod-and-reel caught black marlin was landed at Port Stevens, Australia. Today, Port Stevens is the scene of the biggest tournament held in Australia. Australians have long been interested in the rules, ethics, and organization of sportfishing. Prior to World War II Australian clubs and associations were usually affiliated with clubs outside Australia. In 1938, Australia's Sesquicentennial marking 150 years since the arrival of Europeans, an Australia-wide fishing tournament was part of the celebration. This tournament is historically important because it brought together clubs and associations from all of Australia's states. They then recognized the need for a national body and the Game Fishing Association of Australia (GFAA) was formed. Sixty years after its formation, the Association is still important to its state and territory members, and it is a leader in offshore fishing. Every state and territory is involved. They meet regularly to work on rules, fishing ethics, and relations with government. It should be noted that the GFAA also inspired formation of the International Game Fish Association (IGFA).

Saltwater fly fishing is the latest addition to the tournament agenda. This has opened up a whole new vista of tournaments. We have even got a listing for the barramundi, a freshwater fish caught with salt-water fly tackle.

Forty-one species have been awarded records from the IGFA in Australia. So you can see it is a highly competitive atmosphere. These world records for various tackle classes and disciplines are vivid reminders of the size and number of the big fish Down Under.

The Australian fishing scene is divided into big boats and small boats. It is quite incredible to be out 20 miles at sea on a relatively rough day and suddenly find a 14 or 15 foot-long boat alongside, with three people in it and perhaps a 200-300 lb. marlin stuck in it. And they are still looking for more, or they have got three or four tags.

I suggest that in this symposium we talk about recreational gamefishing as an industry. I have found that we get a much better reaction describing it as an industry, as opposed to simply recreational fishing.

Tournament Organization

Australian offshore tournaments cover all recognized pelagic gamefish species and all line classes, reflecting the size of the gamefish sought. Tournaments are held in all six Australian states and its two territories. Important tournaments occur in Broome, Western Australia; Lizard Island, near Cairns; and in New South Wales, where there is virtually a year round fishery. The whole range of angler interests are covered across Australia. International, national, state, and club tournaments accommodate individual anglers, teams of anglers, team of club boats, and club tournaments.

The majority of Australian tournaments are organized and staffed by the gamefishing clubs, with their officials serving in an honorary capacity. The club itself takes the responsibility for the tournament, but it is sanctioned by the state body and, in many cases, by the GFAA. It is incredible that a state association can run a tournament for as many as 260 boats and do it with only one paid secretary. Often the club committee becomes the tournament committee and then—as happens in tournaments all around the world—the other officers all come in under the same umbrella. These links between fishing administration and tournaments have been of great benefit in Australia and an integral part of the Australian offshore fishing scene. But tournaments take a lot of preparation and it is imperative that the tournament committee meet regularly.

Australian gamefishermen and club or association tournament officials benefit from regular competition in raising skill and competitive level that generates tournament-hardened, experienced, and successful fishermen and administrators. Australia's saltwater gamefish tag-and-release program is the biggest in the world and creates awareness of conservation of fish and bait stocks.

Some money tournaments are organized and run by entrepreneurs utilizing club weighing facilities. Successful anglers and teams in Association and club tournaments are awarded sponsor products, trophies, and sometimes money. Sponsors are a necessary, integral, and important component in all tournaments. At Port Stevens, once the established tournaments have set the best fishing time, an entrepreneur might come in with a backing of a major sponsor and run a money tournament. But it is interesting that the biggest and most popular tournament in Australia—as with the Hawaii International Billfish Tournament—awards trophies that are simply pieces of wood. In the other tournaments there will be some money or a product from the sponsor, but they are not tremendously valuable yet. I believe that our attitude of live-and-let-live between the two types of tournaments has paid off.

It is very important when you get a sponsor that he fully participates and is given maximum identification before, during, and after the tournaments. Some people want to take their money and the product and forget about the sponsor, but believe me, we have learned the hard way that you cannot live without them.

The number of boats in Australian tournaments range from as many as 260 boats in the annual New South Wales Interclub Tournament to 20-50 boats in most tournaments. The

heavy tackle tournaments for black marlin on the Great Barrier Reef are influenced by the number of charter boats available plus entries of privately skippered and crewed boats.

The majority of competing boats on the East and West Coasts are privately skippered and crewed, with the addition of resident and circuit traveling charter boats. Particularly in New South Wales, there are only a few charter boats; the majority of boats are privately owned and privately crewed by friends and family. They will go and compete in all the tournaments, because when you look at a map of Australia, you can see that you can go along the coast from one tournament to another and perhaps be away from home only a month, but fish three tournaments.

The Port Stevens tournament generates at least \$1.7 million in direct income during the week of that tournament. The tiny port of Bermagui hosts seven annual tournaments and each one of those tournaments brings in about a million dollars. They vary in size, but you can see that they are an important part of its economy. Those are just some of the benefits that come to tournament ports.

Tag-and-release is the basic philosophy of Australian tournaments, and this suits the sponsors. You get much more support from tag-and-release than you do from a capture tournament. The underlying spirit of Australian tournaments is that anglers are pitted against the instinct and strength of the fish, and the latter is entitled to an even chance for its life.

Tag-and-Release

Tag-and-release has been an integral part of the Australian scene, both in and outside of tournaments. New South Wales figures indicate that the more than 90 percent of the marlin hooked and brought to the boat are tagged and released. The importance of tag and release can be seen in gamefishing on the Great Barrier Reef, where every year quite a few marlin over 1,000 lbs. are deliberately tagged and released, instead of being killed.

As in Guam, black marlin form breeding aggregations of many small males around a large female. But we believe it is imperative to release the big female fish that have survived for so long, as well as the small males, so that those big lovely things can breed.

Some of the fish have been caught and re-caught several times. It is interesting to note that the shark angler specialists in our tournaments (and they are an important part of all our tournaments in New South Wales) are tagging and releasing sharks. They might get a 400 lb. tiger shark on a 30-lb. line, and instead of bringing it in to weigh it, as they would have once, even those big sharks are being released and given another chance.

The tag-and-release program is going forward all the time. Recreational fishermen are invited on government committees and have input to policy.

Tournament Scoring

Our tournaments take in both tag-and-release and capture, so that in one tournament you have two facets of administration. Inter-club tournaments have two complete sections: you end up with a champion boat, a champion tag-and-release team, and a champion boat capture. The clubs take a great pride in winning one or even both of them. We found it was important to score tournaments in such a way that no one fish dominates. We have maximum points for a fish and that is worked out with a formula. As a result, you don't really get much beyond 25,000 points for a fish, no matter how big it is or how light the line class is. Point scoring is also an important part of weekend fishing in Australia. The clubs will be running a year round award for champion boat and that will be on every second Sunday.

Australian tournaments are generally decided on points awarded in the tag-and-release ethic. Many tournaments also have trophies and awards for heaviest and most meritorious captures. The point score has been worked out very carefully. In the case of marlin, they get a flat rate tag-and-release of 2,000 points. White fish might not get that much. A factor system also applies in the point score, and the Association has got all the weights worked out. For example, if a fish weighs 450 kg on a 10 kg line, you look up the relative weight and the relative line class and then you know the exact number of points you are awarded. You can vary tag-and-release points to give the scientific weight to the things that the scientists want to study. Apart from the cost of the tags and the necessary statistical work it costs nothing. Right now we are encouraging people to release marlin, so the tag points are high on marlin, and we are particularly encouraging people to release yellowfin.

These are the basic rules on tag-and-release that the Australian tournaments organize under. In summary, the Australian philosophy is that the fish are too valuable a resource just to be caught once and that is why tag-and-release is so important.

Scientific Involvement

You can support the scientific community if you know what they want to do. If the scientists come to us and say, "Hey, we would like to look at a range of tiger sharks, which tournament do you suggest that we attend?", or they want to get samples of yellowfin from the tag-and-release program, or study marlin, the tournament officials (often with help from the state association) will come up with a policy to cover that. For example, a scientific organization might have one of their scientists looking at the sharks that are coming in. The few marlin that are landed are weighed completely, checked for parasites, and have their stomach contents examined. All of this is done with any fish that is brought in. There are also financial surveys going on to find out what this is worth to a town. So there is a very big scientific involvement. I know that Julian Pepperell will explain it much better than I can.

This is a summary of Mr. Goadby's presentation.

Discussion

Mr. Goadby added to his discussion of scientific involvement in tournaments, in response to a question. CSIRO (a scientific organization) scientists examine sharks that are landed. They also weigh, check for parasites, and measure stomach contents for landed marlin. He reiterated that tournament organizers can help scientists if they have a good idea of what the scientists are looking for.

Fishery Conservation and Gamefishing in Fiji

Albert A. W. Threadingham
Royal Suva Yacht Club

Introduction

You are probably aware of my involvement in gamefishing as a sport and my support of the tourist industry. I was appointed an International Game Fish Association Representative in Fiji in 1979 and a Governor of Hawaiian International Billfish Association in September 1993. I formed the Royal Suva Yacht Club Game Fishing Association in October 1974 and the Fiji International Game Fishing Association in July 1985, having started International Tournaments in 1981. I have been associated with International Tournaments since 1977 and have had close contact with marine biologists and government fishery management institutions since 1966. I have been interested in fish species and fishing all my life and can be relied upon to give an accurate account of what I know or have learnt.

This paper discusses conservation issues and proposed solutions for Fiji, and reports on gamefish and fishing in Fiji waters.

The Depletion of Fiji's Marine Resources

We are talking about a fragile resource, which always starts out looking very rosy. Commercial fisheries always look good, and steadily look better as more and more boats are brought into the area and more boats catch more fish in any one area. This is true even in gamefishing situations!

I thoroughly believe that we must have commercial fisheries. Foreign earning capacity is just as important as any other industry—not more important and not less important. However, I do not have to be a Rhodes Scholar or a business genius to tell you that if it is not regulated and handled very carefully it will fail as surely as every commercial fishery has failed in other parts of the world. Even in Fiji we have some failing marine resources. Have you considered why? Here are a few examples:

- Even though the Australian Government spent a considerable sum of money on the Giant Clam Project, they were over-exploited. This is due to foreign pirating, not just local exploiters.
- *Opakapaka* (the broad name for deep-water species) are just as fragile and have been over-fished.

- How much do you now pay for a string of *qari* (mud crabs)? They are over-fished and Fiji has no law to prevent female crabs from being caught and sold, in contrast to the strict laws in Australia.
- How much do you now pay for *maga*? Many marine experts have written articles on their demise. What would happen to the swamps without them?
- How much do you now pay for tropical crayfish? It is considerably more because of over-exploitation. We have small industries set up to buy any amount of crayfish our villagers can supply. No one cares if egg-carrying females are harvested. Now that the crayfish have been over-fished, some of the small industries have closed.
- A considerable amount of time and money has been spent to determine whether the stocks of baitfish used in pole fishing are depleted and the impact to our local fisherman. (This includes all indigenous fisherman, whether rural subsistence or artisanal.)
- What has happened to the *beche-de-mer*? Some of our divers have been crippled because of the lure of heaps of money received from unscrupulous operators; now the output has fallen.

For many years the people in the tourism industry—wholly based on sportfishing—have claimed that billfish is only a minor by-product of the catch. They say that longline fishing is aimed solely at tuna species. The general opinion seems to be, “because they migrate through our waters we must catch as many of these fish *while they are here*”—regardless of species. But for some years now we have known that this is not entirely true. What if they don’t come next year? The foreign fishing boats will move to other small nations and “shag” their seas also. We should entirely dismiss this idea that migratory fish must be caught at any sacrifice to their existence while in Fiji.

Now if my words are not true, consider some examples from other countries:

- We all know that Australia’s once rich southern bluefin tuna is now nearly extinct.
- Australian salmon, which once migrated up the Australian coast in large schools, have been depleted because very long nets were put out and around the schools and dragged ashore by tractor-type trucks and winches.
- Not many of this same species, known in New Zealand as *kawhai*, are left there. Now nobody can fish in large designated areas because of the pressure put on this species.
- Trawlers moved into New Zealand in a big way and exported thousands of tons of snapper. This species was so badly depleted that for some years bathers were bitten by big “puddler crabs,” which got out of control.
- Crayfish areas in the Chatham Islands of New Zealand are now depleted, like our industry in Fiji.
- Longliners “shagged” New Zealand waters of striped marlin to the point that tourist fishing and related industry jobs were lost.
- Many foreign fishing boats (some from Hawaii) are in Fiji because they were kicked out of Hawaii and some other areas.

What we can do in Fiji to clean up our act? We should take a serious look at the effect of thirty-odd locally licensed longline boats on local tourist-type fishing operations. You need careful management of the areas you fish. Commercial operators only think about catching, processing, and exporting fish. But “shag” the seas and you will suffer the same fate as other countries with failed fishing industries. Because they have all the licenses and there are no proper management regulations, the fishery is a law unto themselves. Unless regulations are put in place they are doomed to financial failure.

Although local longliners state they do not target billfish, there has been a marked increase in processing sailfish, striped marlin and other billfish, demonstrating that when more lucrative species are not available, the fisherman will take what they can. During our winter, longliners target striped marlin because this species has an attractive overseas market.

One final observation on the depletion of our fish stocks. I started the International Game Fishing Tournaments based on our own stocks of wahoo. From the start, we gained international recognition for our large wahoo. If a wahoo of this size, 80 lbs., were captured in Hawaii today it would be front-page news. We have seen them brought in below 12 lbs. (6 kg) in Hawaii; we never allowed this size even to be weighed! Just recently a new potential world record of 63.8 kg, caught on 24 kg tackle, was landed. Provided that the line tests satisfactorily, I am happy to say that the World Record will be granted. We know that longlines have also been set in the most productive area in Fiji for this species. You still wonder why we are concerned?

Proposed Conservation Measures for Fiji’s Gamefish

I propose a closed area where no longliners will be permitted to set lines. Initially, it would extend 20 miles from the main reef of Viti Levu island. This will serve to increase the catch of local and visiting anglers alike throughout the year. We should also be talking about a safe distance which lines can be set from the breeding areas of the tunas and billfish in Fiji.

Preliminary discussions with the major commercial fishing companies in Fiji have revealed that they do not fish close to the reefs, because sharks reduce catches on longlines, and there are no fish left in that zone. Since the closed area would be near the reef, there can be no objection to the closure of the zone to longlines. In contrast, most indigenous fisherman rely on catching their fish close to the reef. Where stocks are depleted, the cost of moving further out quickly increases, while the chance of safely returning is reduced.

The closed area has many conservation benefits:

- It will ensure that the various gamefish species will have the opportunity to procreate for generations to come.
- Drop-lining for deep-water species, such as *opakapaka*, would not be affected.
- The indigenous fishermen’s catch would be increased.
- Deep-water trapping for sea shrimp would be enhanced.

- Drop-lining for epipelagic and demersal species would not be affected.
- Gamefishing, which mostly occurs during the day, would be more productive.
- Poling for tunas would not be affected. Rather, it would be more productive to our economy.

In summary, the closed area would not affect our commercial catch. Rather it would increase the overall catch. There would be more fresh fish caught for the local market. It would ensure that our local and visiting anglers would have an increase in the number of strikes, or capture/loss per hour fishing effort.

Encouraging commercial fishermen to release gamefish could be promoted by providing a small reward to release fish. How often fishermen fail to grasp the future financial gains of releasing fish: one fish produces up to one million eggs several times a year. If a billfish is caught as a byproduct of the catch, then 90 percent of these fish could be released with minimal care, and there should be a small reward for this. Tags can easily be arranged and, as it has been in the past, Fiji could set a worldwide example in being the first country where commercial fisherman would start to tag and release billfish. Later this could be extended to juveniles and other species. What a great way to ensure your future income. We have to start educating local people who think “catch today and forget tomorrow.”

Since tag and release was introduced in Fiji in 1990 there have been some 7,196 billfish tagged and released by gamefishers. With a little education I am sure that commercial fisherman could do similar work with billfish. We are not advocating a lot of tag-and-release. This has to be on a voluntary basis and in accordance with the fish's ability to survive tagging. We do not intend to forget the importance of commercial fishing. It definitely has a very important part in our economy.

Recreational Angling in Fiji

It would appear that some of the first attempts at gamefishing were made by the Harbor Master, named of Captain Sanders, resident at the old capital of Fiji in Levuka on Ovalalau Island, some time in 1918. The top prize in the Annual Fiji International Game Fishing Tournament is the Captain Sanders Game Fishing reel, which is now mounted in a glass case. Other well known personalities were to follow in his footsteps in the same area between Ovalau Island, Wakaya Island and Makogai Island.

Fish move through the Fiji group on migratory tracks, giving anglers year round fishing activity as the fish move through and back again. Because of Fiji's geographic location, it is difficult to know in what direction the fish are migrating. We have made our own observations in relation to neighboring countries. For instance, we know from participation in New Zealand tournaments that our winter—June, July, and August—are likely to produce the best catches of striped marlin (*Tetrapturus audax*). We appear to be too distant from other major marlin species' territories, such as Cairns in Queensland, Australia and Kona in Hawaii to determine their movement through our group. Black marlin (*Makaira indica*) and blue marlin (*Makaira nigricans*) are taken practically at any time of the year. While many very large specimens

have been hooked and lost, captures over 900 lbs. have been made. Sailfish (*Istophorus platypterus*) appear to be present throughout the year, since they have been caught in every month.

Wahoo (*Acanthocybium solandri*) are our main species, as these appear from early May and are best through July to August. In recent years the length of season has been erratic.

Tuna species include yellowfin, bigeye, dogtooth, skipjack, kawakawa (mackerel), and Pacific bonito.

- Yellowfin tuna occur from November to March and migrate back through the group from May to August and occur in schools with skipjack and kawakawa. The start of the season in November coincides with the blooming of the poinciana flame tree (*Delonix regia*).
- Bigeye tuna are less available to anglers in large form and are usually caught on live bait at depth when fishing for yellowfin or marlin. Juveniles are taken up to 20 kg in schools, sometimes mixed with yellowfin.
- Dogtooth tuna are fished for at depth with down riggers or drop lines with dead or live bait around ridges, drop-offs, and seamounts.
- Skipjack tuna occur in large schools and are usually easily caught and used with lures or as dead bait. They are cut in strips to troll or with “spike” lures such as jet heads. They are available in most months with the middle of winter producing the largest specimens.
- Kawakawa (mackerel) tuna occur mainly about passages and large areas of lagoons, often in less than clear water, where they feed on a number of bait fish, such as hering, squid, and crustaceans. Best times are November to May.
- Pacific bonito occur in schools and sometimes mix with Skipjack. They are not recorded often.

Dolphin fish (*Coryphaena hippurus linnaeus*) are abundant in almost all months of the year and the largest attain a weight of approximately 19 kg. These fish appear to take almost all known baits and lures and many have been taken on Fiji’s traditional *viavia* lure. It is fashioned from a plant that has a silver shiny texture similar to onion flesh. It is rolled around the hook and trace and cut to desired shape. Kona head or bullet nosed lures are also used, depending on the angler’s choice. This type of lure has caught many other species as well. However, modern lure technology has seen a marked decline in its use.

Barracuda species occur throughout the year and the main species are *Agriposphyraena barracuda* and *Sphyraena jello*. A lesser species, *Sphyraenella obtusata* is caught mainly at night and is a valuable bait for trolling, either whole or as strip bait. Some very large specimens of both have been known to attack fishermen and divers in our waters; some attacks have been fatal. The largest recorded *Agriposphyraena* barracuda is over 100 lbs., while many have been taken over 50 lbs. A world record was granted for an individual of this species caught in Fiji. *Sphyraena jello* reaches a weight of 100 lbs., although rare, and many are taken over 30 lbs. The Fijian name for *Agriposphyraena* is *ogo* and for *Sphyraena jello* it is *ogo leka*.

Narrowband mackerel, or *Scomberomorus*, are known locally as *walu* and are highly priced in markets because this fish is the basis of *kokoda*, the traditional raw fish delicacy of Fiji. This species, apart from being one of the food sources of Fiji, is sought after by anglers as a gamefish. This fish occurs in our waters mainly from February to July. Schools also occur off the north coast of Vanua Levu from July to September, where it is believed they spawn. Some large specimens, weighing over 47 kg, have been caught in this area. However, the average weight is around 18 kg.

The most successful rig for this species is a specially designed shaped lead weight created by an avid local angler, Mr. Harry Houng Lee, and this rig is aptly named the “Houng Lee” rig. It consists of a short trace attached to the lead mould and two rather short hooks, but still in accordance with IGFA rules, onto which a small bait fish known locally as *salala* (similar to scad) is attached. The best speed to troll this rig is whatever the rigged bait “swims” at. Therefore, the sizes of baitfish determine the speed at which the bait swims. A rigged bait trolled at the correct speed looks so lifelike that a novice would take it for a live fish.

Trevally: (*Caranx* family). All species listed by the IGFA are taken quite regularly in Fiji waters. The giant of them all, *Caranx ignobilis*, has been recorded in Fiji to at least 150 lbs. The most common size is from 30 to 50 lbs. and all species are taken when spin casting from the beach, a pier, a wharf or a boat. As with other pelagic fish, this species schools and hunts for herring that occur in great schools. The Fijian name for trevally is *saqa* and for herring it is *daniva*. A world record was granted for a trevally caught in Fiji.

Rainbow runner: (*Elagatis bipinnulata*) are common in Fiji; size ranges to 10 kg.

We have not kept separate records for jacks and horseye and Pacific crevalle. Similarly, permit (*lati ni daveta*) have not been caught on line, although the Fijian word implies that they are numerous in Fiji. Some species occur in Fijian waters and are not generally caught by many anglers, such as pompano. A lesser tropical species, ox eye herring, occurs and is usually used whole as trolling bait. Threadfin, king, and a lesser mangrove species (*ucu luka*) occur. However, the king has not been recorded over 0.6 kg. Big eye trevally occurs in large schools at night; the largest taken on rod-and-reel is 2 kg. Swordfish are caught commercially by longliners; as yet none have been recorded on rod-and-reel.

The only freshwater gamefish in Fiji is the largemouth bass. They were introduced into the lake behind Vaturu Dam, Nadi’s main water supply. Sportfishing techniques have recorded these fish up to 2 kg.

Table 1 lists the IGFA world record gamefishes by common and Fijian name and gives the all tackle record for each. Table 2 lists current and previous IGFA world records for Fiji.

Table 1: Gamefish records.

Common Name	Fijian Name	Weight (kg)
Albacore	<i>yatu</i>	23.0
Barracuda	<i>ogo</i>	30.9
Bass, largemouth	-	2.0
Bonefish	<i>yawakio</i>	1.5
Bonito, Pacific	<i>yatu</i>	2.5
Dolphin	<i>ika narokaveisau</i>	26.76
Kawakawa	<i>yatu</i>	6.5
Mackerel, narrowbarred	<i>walu</i>	33.0
Marlin, black	<i>sakuvorowaqa</i>	184.6
Marlin, Blue	<i>sakuvorowaqa</i>	447.0
Marlin, striped	<i>sakuvorowaqa</i>	133.0
Rainbow runner	-	5.89
Sailfish	<i>sakulaca</i>	77.11
Shark, hammerhead	<i>uluvai</i>	134.0
Shark	<i>mako qio</i>	156.4
Shark, thresher	<i>qio</i>	172.5
Shark, tiger	<i>qio</i>	61.3
Spearfish	<i>sakulaca lailai</i>	22.0
Trevally, bluefin	<i>saqa</i>	5.89
Tuna, bigeye	<i>yatu</i>	64.8
Tuna, dogtooth	<i>yatu</i>	74.39
Tuna, skipjack	<i>yatu</i>	12.5
Tuna, yellowfin	<i>yatu</i>	111.5
Wahoo	-	63.8

Table 2: Fiji international gamefish records.

Weight Class	Weight	Catch Location	Date	Angler	Vessel
Existing world record fish caught in Fiji waters					
Great Barracuda					
W -24 kg	28.30 kg	Serua	28.07.88	Sharon Anne Light	Deep Six
Pacific Sailfish					
W - 60 kg	85.72 kg	Yanuca	07.12.67	Mrs. C.L. Foster	
Previous world records (some remain as national records)					
Kawakawa					
M - 10 kg	6.1 kg	Bau Waters	30.05.77	Albert A. W. Threadingham SVW	
Dogtooth Tuna					
M - 24 kg	59.42	Taveuni	11.09.82	Charlie Wakeham, M.D.	
Giant Trevally					
W - 15 kg	30.39 kg	Soliaga	19.01.86	Pauline Threadingham	VMQ
Wahoo					
M - 24 kg	53.75 kg	Vatulele Island	12.07.64	Noel T. Langham	The Mistress
M - 24 kg	63.8 kg	South Beqa Light	14.10.94	Phillip E. Butler	G.T.Stopper
M - 24 kg	51.26 kg		30.6.67	Jan C. Bates	Sere Ni Wai

This is a summary of three papers submitted by Mr. Threadingham.

Discussion

Mr. Threadingham discussed the tournament scoring system in Fiji. He emphasized that it favors tag-and-release. It is necessary to land a much heavier fish to score the same number of points for an equivalent-sized fish that is tagged and released. Some participants resist this emphasis on tag-and-release. They complain that longline vessels are catching many billfish while they are being asked to release their catch. Tournaments sponsored by other organizations put less emphasis on tag-and-release. They like to see fish landed in order to make the tournament look good.

Tuna Tagging by the Numbers: Structured Tagging Experiments or Sportfish Tagging?

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Abstract

The Hawaii Tuna Tagging Project (HTTP) is an example of a structured tagging experiment, designed to investigate movement patterns and catch rates of yellowfin and bigeye tuna throughout the Hawaii Exclusive Economic Zone and between Hawaii and other regions and fisheries of the Pacific. The study also examines the influence of seamounts, fish aggregation devices (FADs) and inshore “tuna holes” or *ahi koas* on the movement and vulnerability of tuna throughout the Hawaiian archipelago. Results and data derived from a structured tagging experiment are based on recapture rates, which makes the replication of a standardized quality of tag releases of primary importance. In contrast, opportunistic tagging of sport caught tuna often represent tag releases with widely varying quality of fish condition, tag placement and data recording. However, sport tagging of large pelagic species has proved to be the best means to obtain some forms of information; such as long distance movements of billfish and cost effective means to implant archival tags in large tuna. Both types of tagging have their specific place in research and contribute as a whole to better understanding and management of pelagic resources.

Introduction and Background Information

The Hawaii Tuna Tagging Project (HTTP) began tagging operations on bigeye and yellowfin tuna in Hawaiian waters in March 1998. This project is one of several studies currently funded by the Pelagic Fisheries Research Program (PFRP) of the University of Hawaii. The PFRP funded a pilot tagging study, the development of a tag simulation model and a tagging workshop specific to the central Pacific situation that were utilized to focus the objectives and implement the HTTP. This federally funded project was established to provide information necessary for the management of sustainable offshore fisheries in the Hawaii and western Pacific region.

Large-scale tagging of tuna amounts to tagging quantities of fish with a standardized, rapid methodology that minimizes fight times, exposure time out of water and handling while assuring complete and accurate data recording. Each tagging operation should be a virtual “clone” of the entire data set to minimize tagging induced mortality and predation while obtaining accurate data.

Physical environment: bathymetry and oceanography

Hawaiian Islands are the emergent expression of the Hawaiian Ridge, which stretches over 2,500 km from the island of Hawaii (19° N, 155° W) west-northwest to northwest of Kure Atoll (30° N, 180°). Westward of Kure, the ridge joins the Emperor Seamounts extending north to 50° N. The Hawaiian Island archipelago consists of the eight populated main Hawaiian Islands (MHI) and the northwest Hawaiian Islands (NWHI), which extend to the northwest of Kauai as a chain of basalt outcroppings, atolls, submerged banks and seamounts. Below a depth of 2,000 m, the chain forms a nearly continuous mid-Pacific feature, which exerts a tremendous influence on oceanic current patterns and the movement patterns of pelagic fishes found in this area (see Figure 1).

Extensive seamount fields to the north and south of the MHI play an important role to off-shore tuna fisheries of the Hawaii region. To the south lie the Navigator Seamounts, located between 18° - 20° N and 156° - 160° W with the deeper Musicians Seamounts located to the north of the MHI (25° - 29° N and 158° - 163° W). The Navigator group includes the Cross Seamount that rises to within 330 m of the surface and is the site of a productive handline fishery for bigeye and yellowfin tuna (see Figure 1).

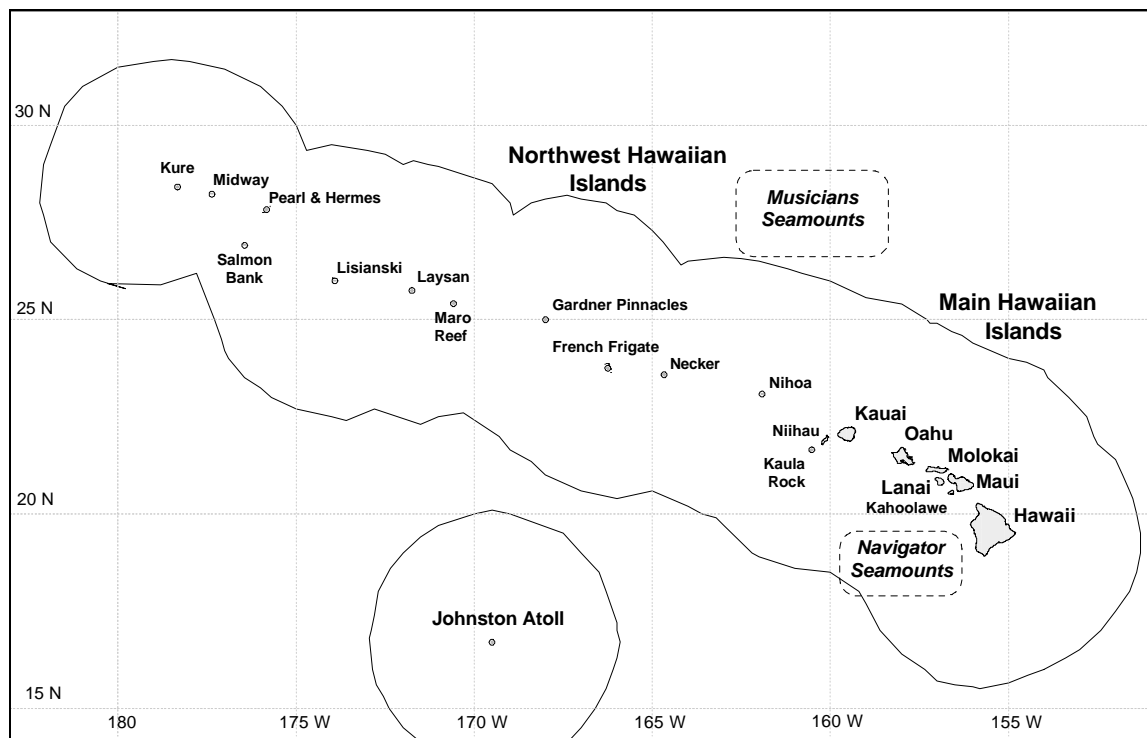


Figure 1: The main Hawaiian Island (MHI) and northwest Hawaiian Island (NWHI) groups.

The Hawaiian Islands are positioned within the North Pacific subtropical gyre and subject to northeast Trade Winds and the westward flowing North Equatorial Current (NEC). This westward movement of water divides near the island of Hawaii with the northern portion flowing northwest along the Hawaiian Ridge (Mysak and Magaard, 1983; White, 1983). Large-scale eddies form in the lee (westward) of the main Hawaiian Islands as a result of wind

driven surface currents flowing between the islands and the islands blocking the westward flow of the NEC (Patzert, 1969; Patzert and Wyrski, 1974). Qiu et al., (1997) proposed the existence of an eastward flowing Hawaiian Lee Counter Current (HLCC) at the interface between two elongated gyres set up in the lee of the MHI between 170° W-158° W and forming the HLCC along 19° N. It has been suggested that these gyres play an important role to local productivity and recruitment of fish and invertebrates in the Hawaii region. The far western portion of the northwest Hawaiian Islands become seasonally influenced by the Kuroshio Extension system that circulates throughout the western north Pacific (Mizuno and White, 1983).

The oceanographic influences on the Hawaiian Ridge and associated bathymetric features create favorable year-long habitat for bigeye and yellowfin tuna, as well as for many other pelagic species. The ready availability of both species at juvenile and adult stages has resulted in a variety of tuna fisheries competing for the same resources. The PFRP tuna tagging projects were designed to examine many of these interaction issues and to examine movement patterns, exploitation rates and the role of aggregation to gear vulnerability.

Hawaiian tuna fisheries

Tuna are harvested in Hawaii by longline, pole and line, troll and handline gear, with commercial landings in the range of 13,000-15,000 mt during recent years (Anon, 1998). In decreasing order of importance by weight and value, the tuna species of interest are bigeye, yellowfin, skipjack, albacore and northern bluefin tuna. Pelagic longline fishing in the Hawaii region is regulated by a vessel permitting system and area restrictions. There are 164 longline permits currently issued for longline fishing for pelagic species in Hawaii. Hawaii-based longline vessels concentrate on tuna and/or swordfish and operate both within and outside the Hawaii EEZ. Recent court action has virtually eliminated the swordfish targeting component of the fishery in response to bycatch issues, but tuna longline fisheries remain active. Within about 50 mile of shore, a small domestic pole and line fishery targets skipjack for local consumption (Boggs and Kikkawa, 1993) but takes a small, utilized bycatch of juvenile bigeye and yellowfin. Near-shore small-scale troll and handline fisheries concentrate on yellowfin tuna, skipjack, dolphin fish and wahoo. Boggs and Ito (1993) summarized the history and recent status of Hawaii pelagic fisheries.

In Hawaii, handline fishing for tuna takes many forms. Three main categories exist. *Palu ahi* fishing is conducted during the daytime and is a modern adaptation of the ancient Polynesian “drop stone” fishing technique. A weighted handline and single baited hook is lowered in an area where sub-surface tuna concentrate. Yellowfin and bigeye are taken, normally of a medium size, approximately 10 to 25 kg whole weight. *Palu ahi* fishing is normally conducted at near-shore areas and near anchored fish aggregation devices (FADs).

The *ika shibi* handline fishery uses a night handline technique that originated on the island of Hawaii, evolving from an *ika*, or squid fishery. Each boat carries a crew of one or two that work two to four lines baited with squid or small fish. Underwater bait attraction lights are used (Yuen, 1979). The fishery peaks during the summer months and focuses on large yel-

lowfin tuna (approximately 40-80 kg) caught close to the main Hawaiian Islands. Medium to large bigeye tuna also contribute to *ika shibi* landings in some years but are likely to have been incorrectly reported as yellowfin tuna and are under represented in catch statistics (Boggs and Ito, 1979). Albacore bycatch can also be an important component of the landed catch during some years.

A third important category of handline fishing has developed in recent years which targets bigeye and yellowfin found in association with offshore moored buoys and some seamounts, especially the Cross Seamount. This fishery normally operates greater than 160 km from shore, hence the name “offshore handline fishery”, and employs a variety of gear types and methods (*ika shibi*, *palu ahi*, jigging, trolling, pole-and-line) to land juvenile bigeye and yellowfin tuna. The vessels are relatively small (typically between 12-18 m in length, with two to four man crews) but range up to 330 km offshore. Most of the catch by weight consists of juvenile bigeye ranging between 6-25 kg. These fish supply the medium-grade domestic markets for fresh tuna. Catch rates from the fishery are relatively high with landings often ranging between 2,000-5,000 kg for two to five days of effort.

Fishing grounds

Longline

Pelagic longline gear is prohibited within 25 to 75 nautical miles of the main Hawaiian Islands and within 50 miles of the NWHI (see Figure 2). These closed zones were established in an attempt to decrease interactions with protected species (such as turtles, sea birds and the Hawaiian Monk seal) and reduce gear interaction with small inshore gear types—mainly small-scale commercial handliners and recreational and subsistence trollers. Hawaii based longliners now travel large distances from shore in search of swordfish but most of the vessels targeting tuna tend to set close to the islands or seamounts which are often just outside the restricted areas. Isolated seamounts bordering the MHI and NWHI longline restricted zones are also fished.

Longline landings of bigeye tend to occur south of 30° N and peak during the first and fourth quarters close to the main Hawaiian Islands (Curran et al., 1996). Higher yellowfin catches occur in warmer waters south of 20° N and peak during the second and third quarters. High catch rates of bigeye and yellowfin also occur near Johnston Atoll (16°30' N, 169°25' W) and south of the main islands near Palmyra Atoll, between 5°-10° N latitude.

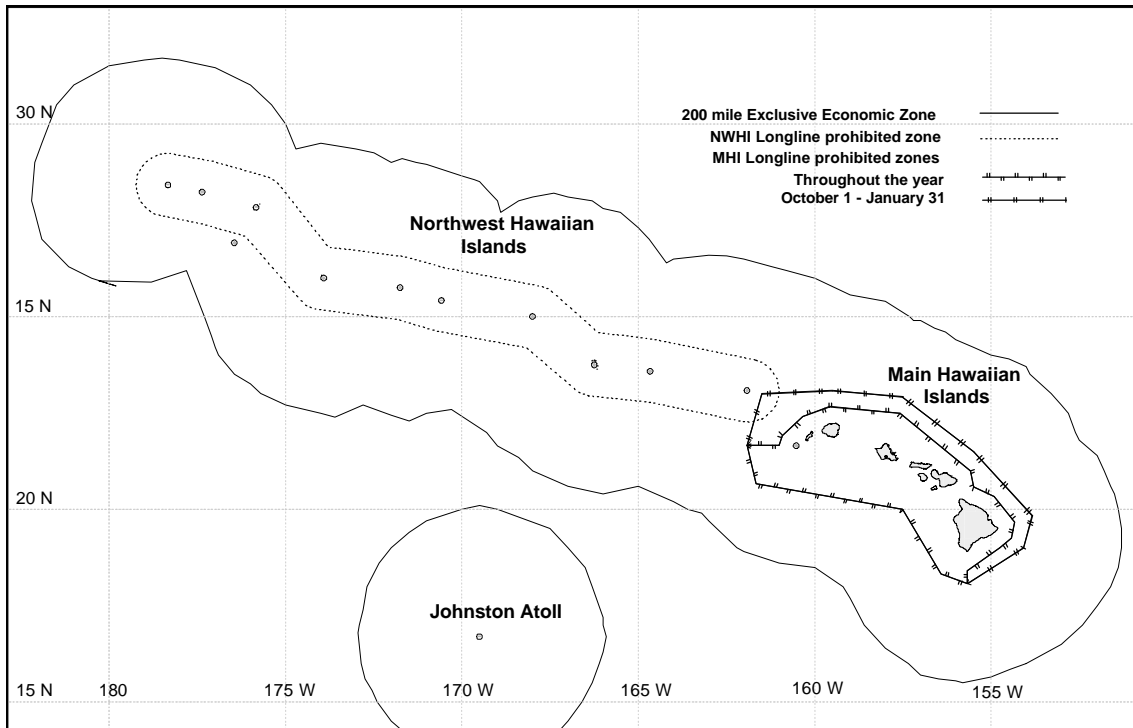


Figure 2: Longline prohibited zones around the Hawaiian Islands.

Offshore handline

The offshore handline fishery is based on high catch rates of juvenile bigeye and yellowfin tuna found in association with offshore weather monitoring buoys and the Cross Seamount. This deep-sea feature is located at 18°42' N, 158°16' W and rises from depths greater than 2,000 m to 330 m and is located approximately 250 km southwest of the island of Hawaii and 290 km south of Oahu. Several other seamounts of the Navigator group surround the Cross but none rise to depths shallower than 600 meters. None of the other seamounts aggregate concentrations of bigeye and yellowfin tuna vulnerable to surface gear although many of them are fished by longline vessels.

Handline vessels operating on the Cross Seamount also fish bigeye and yellowfin tuna found in association with four weather monitoring buoys moored in the outer Hawaii EEZ, referred to here as B1, B2, B3 and B4. The US National Data Buoy Center of the National Oceanic and Atmospheric Administration (NOAA) maintain the buoys to provide meteorological and wave height data which is relayed to NOAA receiving stations via Geostationary Operational Environmental Satellites (GOES). The buoys are moored in depths ranging from 3,200-5,200 meters and are located 270-340 km offshore and have become *de facto* fish aggregation devices that are known to concentrate large schools of bigeye and yellowfin tuna (see Table 1).

Table 1: National Oceanic and Atmospheric Administration weather monitoring moored buoys in the Hawaii EEZ.

NOAA name	Local name	Latitude	Longitude	Moored depth	Location offshore
51001	Buoy 1	23°04' N	162°16' W	3257 m	50 km NW of Nihoa I. 270 km NW of Kauai I.
51002	Buoy 2	17°11' N	157°50' W	5002 m	290 km SW of Hawaii I.
51003	Buoy 3	19°10' N	160°44' W	4943 m	320 km SSW of Kauai I.
51004	Buoy 4	17°26' N	152°32' W	5304 m	330 km SE of Hawaii I.

Inshore fisheries and inshore FADs

The state of Hawaii maintains a network of moored FADs around all inhabited main Hawaiian Islands to enhance the fishing success and profitability of Hawaii based small boat fishermen (Holland et al., 1999). The program holds permits for 60 surface and four subsurface FAD sites, about 53 of which are actively maintained. Deployment depths range from a few hundred to 2,761 meters and most are located within 15 km from shore. The majority of inshore FADs are set in depths of 900-1,650 meters.

Most trolling or inshore handline trips include a visit to one or more FADs. In a collective sense, they form one of the most frequently visited “fishing grounds” for the diverse small boat fleet around the main Hawaiian Islands. Fishing methods on or near FADs include surface trolling, sub-surface slow trolling, live baiting, jigging and handlining. The small fleet of Hawaii based commercial pole and line vessels also fish for mixed species schools of tuna on the inshore FADs. Figure 3 depicts the inshore FAD locations and popular tuna fishing grounds of the main Hawaiian Islands referred to in this paper.

Banks, ledges and other areas

Troll and handline fishing trips that do not visit the inshore FADs often fish near some sort of structure, such as near-shore banks or ledges. Trolling and some handline trips also target the 1,000 fathom (1,829 m) depth contour, which is believed to be a productive area for large tuna and marlin around the main Hawaiian Islands. Trollers also search for current lines containing flotsam to target tuna and other pelagic species found in association with drifting objects. Smith (1993) provides a detailed description of near-shore geography and fishing locations within the main Hawaiian Islands. As in other areas of the Pacific, there are certain near-shore areas in Hawaii that traditionally yield higher tuna catches than other, adjacent areas. These *ahi koa* or “tuna holes” are targeted by troll and handline fishermen.

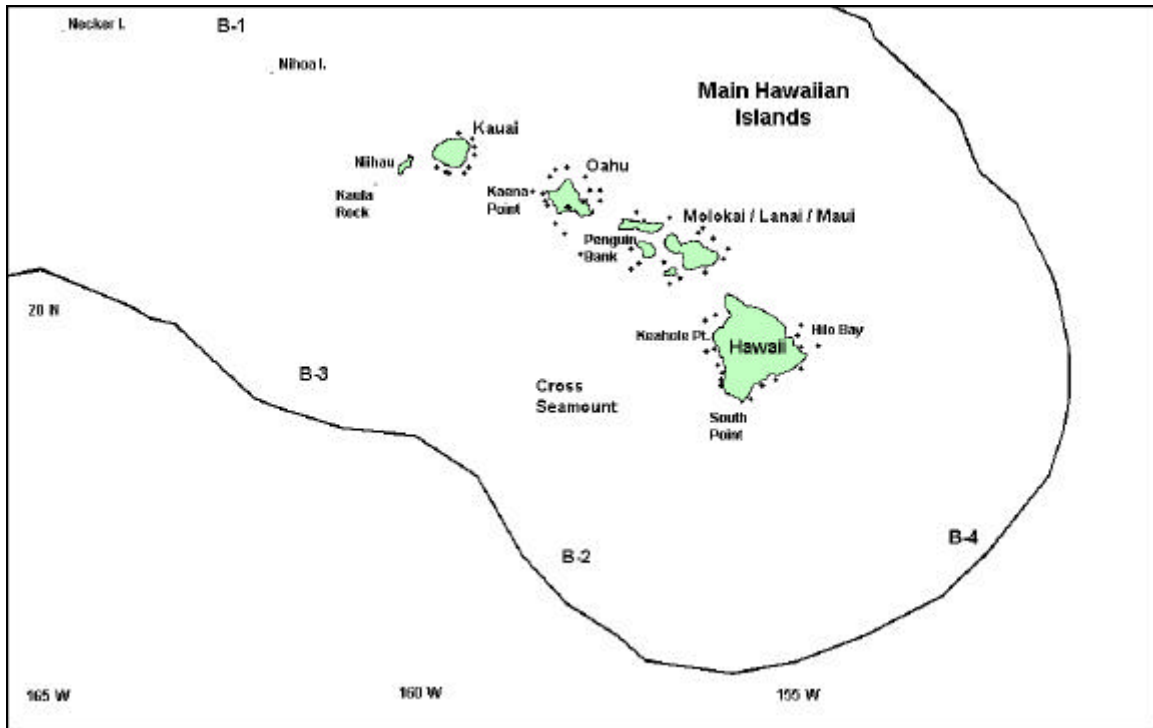


Figure 3: Inshore and offshore FADs and tuna fishing grounds.

Hawaii Tuna Tagging Project

In August 1995, the Hawaii Seamount Tagging Project was initiated to address issues related to aggregation and interaction issues related to bigeye and yellowfin fisheries focused on the Cross Seamount. Tagging efforts were later expanded to cover the entire Hawaii EEZ through the Hawaii Tuna Tagging Project (HTTP). The project focuses on issues relevant to Hawaii, but long-term and long distance movements of tagged fish will contribute to knowledge on stock structure, exchange rates and interactions throughout the Pacific. The objectives of the tagging project are to examine:

- Movements of bigeye and yellowfin within the Hawaii EEZ and between major fishing grounds.
- Interactions:
 - Direct gear interaction. Concurrent interaction between competing fisheries in the same time/area strata for the same sized fish, including surface and sub-surface gear types.
 - Sequential or progressive interactions. Interactions which occur as fish grow and recruit to different fisheries.
 - Spatially segregated interaction. Interactions where fish move between fishing grounds and enter new fisheries remote in time and space.
- Exploitation rates and differential vulnerability (local fishing mortality) of tuna around seamounts and Fish Aggregation Devices (FADs).

- Aggregation effects. Retention rates of tuna around seamounts, FADs and local fishing grounds.

Tag release strategy

Bigeye and yellowfin tuna were selected as the target species of interest to the HTTP, due to their importance to Hawaii based commercial, recreational and subsistence fisheries. Both species are harvested at juvenile through adult sizes by different fisheries, which create interaction problems that can be addressed by a well designed tagging study.

Tagging studies attempt to release marked fish in a broad size range throughout the area of interest over as broad a time frame as is practical. However, these goals are often overly optimistic in when confronted by finite budgets, limited manpower, equipment problems, and the reality of conducting field work with unpredictable weather conditions, animal behavior, etc. The determination of spatial and temporal tag release strata was assisted by a PFRP tag specific study: *Design of tag-recapture experiments for estimating yellowfin tuna stock dynamics, mortality, and fishery interactions* (Bills and Sibert, 1997). However, primary release areas were modified to reflect the reality of where significant numbers of tag releases could be achieved given equipment and budgetary restrictions. Generally, adequate tag release numbers for a specific fishery should be based on expected rates of recapture. For example, for a fishery with high CPUE, relatively few tags need to be released compared to a fishery with low CPUE, where few tags will be returned. The objective is to obtain statistically valid numbers of recaptures from all fisheries of interest to your study.

The project proposed to tag and release 12,000 bigeye and yellowfin tuna over a two-year period from as broad a size range as possible at four main release areas in the Hawaiian archipelago. It is important to tag a wide range of fish size to examine catch rates and recruitment to specific fisheries. The four main release areas were chosen based on their anticipated value to discerning movement and exploitation patterns and practical considerations of where significant quantities of releases could be made:

- inshore areas of the main Hawaiian Islands, including FADs and natural aggregation points;
- Cross Seamount;
- central region of Northwest Hawaiian Islands; and
- Midway Atoll.

Tagging gear

The project used serially numbered plastic dart tags (11 cm orange tags for tuna > 40 cm FL; yellow 9 cm dart tags for tuna 20-40 cm FL). As much as possible, equal numbers of bigeye and yellowfin were tagged at each location to obtain species specific parameters of exploitation and movement. The preferred gear type for mass tagging experiments is pole-and-line, where tuna are chummed to the surface with live bait and poled to the tagging stations at a

high rate. This form of tagging, using barbless lures and padded tagging cradles or mattresses is the fastest means to capture individual tuna in good condition for release. Fish handled in this manner can usually be measured, tagged and returned to the water in less than ten seconds.

Unfortunately, effort in the Hawaii pole and line skipjack fishery is at a historical low while the few remaining vessels supply a strong market for fresh, line caught skipjack. Normally, these vessels take small quantities of juvenile yellowfin and bigeye and were difficult to use for the HTTP. However, a pole-and-line vessel was used to tag yellowfin and bigeye on near-shore FADs during a short period when the vessel was not able to locate adequate supplies of skipjack. The majority of tag releases were taken by handline gear where fish are chummed to the surface and taken on short handlines, which resulted in tag releases similar in quality as achieved by pole and line gear. Trolling, pole and line and short longlines were used throughout the project as well.

Tagging methodology

The HTTP adopted much of the tuna tagging methodology developed by the large-scale tagging programs of the South Pacific Commission (Anon, 1982). No matter which gear type was used, all lures or baited lines were rigged with barbless hooks or standard hooks having their barbs flattened with pliers to minimize unhooking trauma and time. Fish were placed on a wetted, padded and vinyl covered mattress clearly marked in centimeters. All tagging personnel wore the same type of soft cotton gloves that were wetted before each tagging operation and kept clean by daily immersion in a bleach solution. Fish handling was kept to a minimum, but when necessary, fish were gently cradled by the head and mid-section, or carefully held in a mid-body grip. Fish were never lifted solely by the tail as damage to the vertebrae can result. To reduce struggling, a wetted imitation chamois cloth or clean cotton cloth was placed over the eyes which has a marked calming effect on tuna.

All tagging operations were conducted by the project manager or a small group of field technicians employed by the project. Each tagger was carefully trained by the project manager, so that each tagging operation was as similar to each other as possible.

Speed is of primary importance when tagging tuna. Normally, fish should be out of water for less than 15 seconds, stressing the importance of rapid and accurate data recording. Fish were unhooked, transported to the tagging mattress and assessed to condition. Tuna with hooking injuries to the eye or gills or that exhibited significant and rapid bleeding were rejected for tagging and discarded or retained by the vessel for commercial sale or consumption.

A cloth was placed over the eyes of tuna judged to be suitable for tagging and measured to the nearest centimeter with the tag inserted below the second dorsal fin. Tag placement is critical with the barb passing through the median plane of the body and securely locking in the fin ray supports that extend below the second dorsal fin. The species, tag number, fork length, capture gear type and fish condition were noted on portable cassette tape recorders

made water resistant in sealed plastic bags worn around the neck. Tagged fish were released into the water head first to reduce disorientation and predation.

Tagging data was entered on a database program designed to store and analyze tag release and recapture data. Each tag is linked to databases recording the species, fork length, date of release, time range of release, location of release, gear type, tagger name, fish condition, vessel name, school type, and school association. Credibility, quality and condition codes can be assigned for tag placement, species, fish condition, and fork length.

Modified capture techniques—the Midway experience

The HTTP had to adapt commercial and recreational fishing practices to suit the needs of a tag and release program. For example, most mass tagging programs use a purpose built tagging cradle that stands at hip level for tagging and tag storage. Most of the vessels used by the program were too small to accommodate these cradles, so all tagging took place on portable mattresses that could be placed on fish boxes or directly on the deck. Commercial handline gear was usually suitable for a tagging project after large barbed hooks were replaced with smaller, barbless hooks.

In Midway Atoll, the project utilized 38 ft big game type sportfishing vessels equipped for trolling with standard gamefish rods and reels. Penn International 130-two speed reels loaded with 130-lb. test monofilament were the heaviest gear available. Medium to large sized yellowfin of 70 to 125 cm fork length were common with the most consistent fishing located on seamounts near the Atoll. However, these seamounts had never been fished commercially, and held large populations of large Galapagos sharks (*Carcharhinus galapagensis*). The sharks located the vessel soon after tagging began and would attack and kill every tuna hooked on troll gear after the first hour.

The solution was to strengthen all components of the gear to allow a rapid retrieval of the tuna soon after the strike. A hydraulic pinch puller was mounted to the transom and adapted to operate on a 12 volt DC system operating off a heavy duty battery charger linked to a 110 volt generator. Line strength on the Penn 130 International reels was increased to 450 lbs. test with 500-lb. test leaders. Standard big game trolling lures were modified with heavy duty polypropylene skirts for durability which reduced time spent in changing lures. All swivels and hooks had to be increased in size to accommodate the heavier loads.

When a hookup occurred, the fish was stopped as soon as possible without damaging the mouth, the line placed in the hydraulic pinch puller and the fish hauled directly to the transom. Slack line coming out of the back of the hydraulic hauler was then spooled onto the fishing reel for rapid deployment on the next school. With this system, several hundred large yellowfin tuna were tagged and released with no losses to shark bite.

Publicity and tag rewards

Prior to the commencement of the tag release period, notification of the intent to begin tagging and releasing bigeye and yellowfin tuna in Hawaii was widely distributed by mail and electronic mail to research organizations, fisheries institutes, commercial fishing companies and tuna transshipment and processing centers. Colorful tag reward and publicity posters in English, Japanese, Korean and Chinese language versions were widely distributed throughout the Pacific region and beyond. The posters provide details describing the project objectives, requested recapture information, rewards and contact information. Each tag was also labeled with the tag number on the head and tail of the tag, the project name, and a toll free telephone number and a note on a reward. The telephone number connects to a 24-hour recording that provides specific information on tag reporting and reward procedures. Fishermen often need an incentive to assist research, and attractive tag rewards are given to anyone returning a project tag. The tag finder is also issued a personalized letter from the project detailing release data and area and information on time at liberty, growth at liberty, and distance between release and recapture points.

Bigeye and yellowfin tuna have life expectancies that exceed the funded length of the project. However, the long-term data that may result from the project beyond the four year funding period could prove very interesting toward life history and stock structure studies. This long-term data needs to be collected and entered, meaning that a long-term commitment to house the data and tag recapture rewards must be established. The HTTP has assurances that the University of Hawaii will fill these roles for as long as necessary, provided that adequate supplies of tag rewards are stockpiled before the end of the funded period.

Tag shedding and reporting rates

Data and analytical results from a tagging experiment depend on recapture rates. Some valid means of estimating rates of tag retention and reporting rates of recaptured tags needs to be incorporated into the experiment to refine tag recapture data. Double tagging of a subset of releases by tagger is normally the best way to gather species specific estimates of tag shedding and retention that can be applied to the release data set. Estimates of reporting rates are normally handled by discrete tag seeding operations, where tagged fish are placed in fish holds without the knowledge of the fishermen. The number of tags from these seeding experiments can be used to estimate the rate at which individual or groups of fishermen are reporting tags.

In the Hawaii fisheries, the small size of the vessels offers few or no opportunities to seed tags into the hold without the knowledge of the crew. Simple interviews with trusted fishermen and informants were used to assess rates of reporting. The best solution to maximize reporting rates is a thorough and ongoing publicity campaign to inform the fishermen and processors of the importance of reporting tags and tag recapture information.

Tag Releases and Recaptures

Tag releases - status to October 31, 2000

Tag releases by species and area. As of October 31, 2000, a total of 15,134 releases consisting of 7,665 bigeye (50.6 percent) and 7469 yellowfin (49.4 percent) had been tagged and released throughout the Hawaii EEZ. The size distributions of tag releases have been similar for both species, with mean fork lengths of 61.45 (std dev 14.37) and 58.05 cm (17.52) for bigeye and yellowfin respectively. Fork lengths ranged from 29-133 cm for bigeye and 20-43 for yellowfin, but modal lengths were 53 and 48 cm respectively. Length frequency distributions for each species are shown in Figure 4.

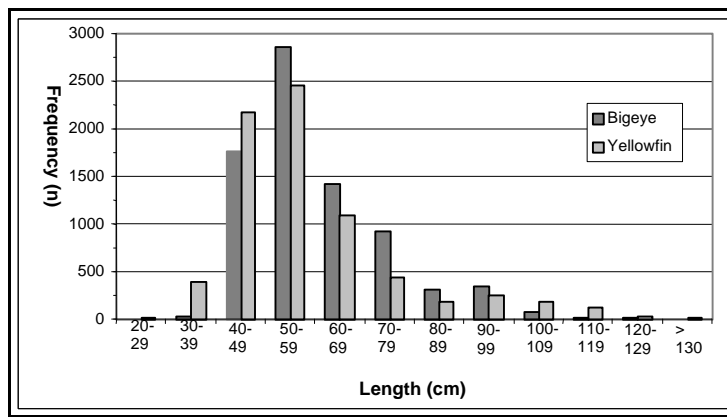


Figure 4. Length frequency distribution of bigeye and yellowfin tag releases (n=7552 bigeye, 7427 yellowfin).

The majority of tag releases were made at the Cross seamount, accounting for 63.5% of all releases. The areal distribution of tag releases by species differs somewhat as yellowfin appear to be more abundant (or vulnerable) near the main and northwest Hawaiian Islands while bigeye dominate in catches and tagging efforts on the Cross seamount and B2, B3 and B4.

Tag recaptures

Recapture rates. As of October 31, 2000, a total of 2,131 tuna of both species had been recaptured at an overall recapture rate of 14.08 percent. Bigeye tuna had been recaptured at a slightly higher rate (14.99 percent) than yellowfin (13.12 percent). Table 2 lists tag recapture numbers and recapture rates from seven different release areas or categories.

Recapture rates for both species have been high for fish released from the Cross Seamount, the offshore weather buoys B2, B3, B4), the inshore FADs, and Buoy 1. Recaptures from the northwest Hawaiian Islands and Midway have been very low, though include the only recaptures reported to the west of the Date Line. Some recaptures from Midway releases have been made very close to the Japanese coast.

Table 2. Tag recapture rates from releases at certain locations within the Hawaii EEZ.

	Yellowfin		Bigeye		TOTAL releases	TOTAL recaptures	Yellowfin recapture rate %	Bigeye recapture rate %	Total recapture rate %
	releases	recaptures	releases	recaptures					
Cross Seamount	3,604	675	6,002	808	9,606	1,484	18.73	13.46	15.45
Offshore FAD	241	53	1477	317	1718	371	21.99	21.46	21.59
Inshore FAD	1,127	199	134	22	1,261	221	17.66	16.42	17.53
Nihoa, Necker, B1	239	35	5	1	244	36	14.64	20.00	14.75
NWHI	701	5	16	0	717	5	0.71	0.00	0.70
Midway	1,556	13	8	0	1564	13	0.84	0.00	0.83
Longline	1	0	23	1	24	1	0.00	4.35	4.17
TOTALS	7,469	980	7,665	1,149	15,134	2,131	13.12%	14.99%	14.99%

Recaptures by association type: Table 3 lists all tag recaptures by species when the recapture was supplied with an accurate position useful to assign the school association type. The importance of seamounts and FADs is clear, with these three categories accounting for 95.7 percent of all tag recaptures. Only 2.5 percent of recaptures were designated as unassociated, and most of these were larger sized bigeye or yellowfin taken by longline gear. Recapture numbers of bigeye and yellowfin were similar on the seamounts although far more bigeye were tagged in these locations, possibly due to a very high vulnerability of yellowfin on these structures. Bigeye recaptures were more abundant on the offshore FADs while yellowfin were more common from the MHI inshore FAD network.

Table 3. Tag recaptures with reliable school association type recorded.

Species	Seamount	Offshore FAD	Inshore MHI FAD	Island or bank	Unassociated	Total
Bigeye	719	346	29	4	33	1131
Yellowfin	612	88	193	34	19	946
Total	1331	434	222	38	52	2077
% of Total	64.1 %	20.9 %	10.7 %	1.8 %	2.5 %	

Summary

A large body of useful data on the movement patterns, aggregation effects, exploitation, and interaction rates relevant to bigeye and yellowfin resources of the central Pacific is emerging from the HTTP. A structured tagging experiment such as this consists of several necessary components. Tagging studies need to be designed around a specific set of objectives to assure the utility of the generated data set. Ideally, a tag release strategy should be designed that is specific to the relevant fisheries and geography of the region. Tagging studies need adequate returns to produce statistically valid results, meaning that the areal and spatial distribution of tag releases needs to be designed with the expected numbers of tag recaptures in mind. Adequate catch per unit effort data are essential to this process.

The primary results of tagging experiments are based on raw tag recapture data. This means that every effort should be made to maximize reporting of recaptures with accurate release and recapture data. Important components of this process include:

1. thorough and ongoing publicity for project, tag reporting mechanisms, rewards;
2. standardized tag release methodology, thorough training of taggers, good tag anchoring technique;
3. strict selection criteria for fish to tag, high quality of fish condition at release;
4. regular calibration of release measurements, good data quality control;
5. responsive and thorough tag reward mechanisms;
6. means to estimate tag shedding and reporting rates; and
7. return of information to the public to maintain interest level and reporting.

Sportfish tagging programs typically have lower recapture rates compared with structured tagging experiments. The reason has often been explained by higher rates of post-release, tagging-induced mortality caused by poor condition of the fish at the time of tagging. Factors such as longer fighting times, lower condition criteria for fish selected for tagging, non-standardized tagging techniques, poor tag anchoring rates, and the fact that most fish are tagged in the water under difficult conditions suggest this may be a problem.

However, sportfish tagging of pelagics has proved very beneficial in many cases, particularly for large, solitary species, such as for billfish. Most of what we know of long distance movements and the life history of marlin have come from voluntary sportfish tagging programs. Sportfish tag and release of marlin and large tunas has also been integral to research on large pelagics using internal archival and pop up satellite linked devices. Each type of tagging has their place in research and contributes to the overall knowledge base necessary for sustainable management.

Acknowledgments

I would like to thank my colleague Dr. K.N. Holland for the full support of his research experience and laboratory to the HTTP, Mr. Steven Kajiura for maintaining the tagging project database and efficiently coordinating tag recapture and reward mechanisms, and Mr. Johnoel Ancheta for assistance with general computer and network facilities. Special thanks are due to several commercial fishermen who have provided valuable time, experience, and vessels during tagging cruises: Mr. Gary Dill, Gary Eldridge and Randall Kosaki for their diligence and attention to detail when conducting tagging cruises and the many fishermen, fish processors, and fisheries agencies who have cooperated in the return of tags and recapture information. This work is supported by the Pelagic Fisheries Research Program with funding from Cooperative Agreement Number NA 67RJ0154 from the National Oceanic and Atmospheric Administration.

References

- Anon., 1982. *Methods used by the South Pacific Commission for the survey and assessment of skipjack and baitfish resources*. (R.E. Kearney, ed.). South Pacific Commission. Noumea, New Caledonia. Tuna and Billfish Assessment Programme, Technical Report No. 7. 122 pp.
- Anon., 1998. *Pelagic Fisheries of the western Pacific region, 1997 Annual Report*. Western Pacific Regional Fishery Management Council, Honolulu, Hawaii. USA.
- Bills, P.J., Sibert, J.R., 1997. *Design of tag-recapture experiments for estimating yellowfin tuna stock dynamics, mortality, and fishery interactions*. SOEST Publication 97-05, JIMAR Contribution 97-313, 80 pp.
- Boggs, C.H., Ito, R.Y., 1993. Hawaii's pelagic fisheries. *Mar. Fish. Rev.* 55(2):69-82.
- Boggs, C.H., Kikkawa, B.S., 1993. The development and decline of Hawaii's skipjack tuna fishery. *Mar. Fish. Rev.* 55(2):61-68.
- Curran, D.S., Boggs, C.H., He, X., 1996. *Catch and effort from Hawaii's longline fishery summarized by quarters and five degree squares*. NOAA Technical Memorandum NMFS. NOAA-TM-NMFS-SWFSC-225. 68 p.
- Mizuno, K., White, W.B., 1983. Annual and inter-annual variability in the Kuroshio Current System. *J. Phys. Oceanogr.*, 13 (10), 1847-1867.
- Mysak, L.A., Maggaard, L., 1983. Rossby wave driven eulerian mean flows along non-zonal barriers, with applications to the Hawaiian Ridge. *J. Phys. Oceanogr.*, 13, 1716-1725.
- Patzert, W.C., 1969. *Eddies in Hawaiian Waters*. University of Hawaii at Manoa. Hawaii Institute of Geophysics, HIG- 69-8, 51 pp. with figures 1-71.
- Patzert, W.C., Wyrski, K., 1974. Anticyclonic flow around the Hawaiian Islands indicated by current meter data. *Phys. Oceanogr.*, 4 (4), 673-676.
- Smith, M.K., 1993. An ecological perspective on inshore fisheries in the main Hawaiian Islands. *Mar. Fish. Rev.* 55(2):34-49.
- White, W., 1983. A narrow boundary current along the eastern side of the Hawaiian Ridge: The north Hawaiian Ridge current. *J. Phys. Oceanogr.*, 13, 1726-1731.
- Yuen, H.S.H. 1979. A night handline fishery for tunas in Hawaii. *Mar. Fish. Rev.* 41:7-14.

Pacific Ocean Gamefish Tagging Programs of the National Marine Fisheries Service Southwest Region

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Abstract

Well designed gamefish tagging programs provide valuable information about fish biology and ecology, monitoring of stocks, and can help develop good fisheries conservation and management policies. National Marine Fisheries Service (NMFS) activities in the Pacific Ocean related to recreational gamefish tagging are discussed. The presentation describes NMFS programs, provides examples of the kinds of information that are collected, importance of the information, and the benefits of having angler involvement. The *NMFS International Billfish Angler Survey*, *NMFS Cooperative Billfish Tagging Program*, and the *AFTCO Annual Tag/Flag Tournament* are focused on. These programs provide an opportunity for anglers to play an active role in the conservation and management of our ocean resources. The rate of return for tags in these programs is usually less than two percent. The success of these programs depends heavily on anglers to completely fill out and send in all tagging cards, as well as recovered tags with date, location, species, length and weight of fish. Don't let recovered tags end up in the bottom of your tackle box.

We provide an overview of the National Marine Fisheries Service (NMFS) activities in the Pacific related to recreational gamefish tagging, talk about the importance of angler involvement, and the value of such programs to you the anglers.

The Tournament Connection

According to the International Gamefish Association (IGFA) 1988 publication *World Record Game Fishes*, there are at least 62 ocean gamefish tagging programs that include anglers as cooperators world wide, and about 50 percent (29 tournaments) of them are in the Pacific Region. More and more of these tournaments involve tagging, although all fish are not necessarily tagged in a given tournament. Tagging is a way to get you, the anglers, involved in fishery management and promote a conservation ethic at the same time. Examples of tournaments that include tagging in some way are the:

1. AFTCO Tag/Flag Tournament,

2. Yamaha Miami Billfish Tournament,
3. Bahamas Billfish Championship,
4. Bisbee's Black & Blue Marlin Jackpot Tournament-Baja, Mexico,
5. California Masters Tournament,
6. Aloha Friday Kona Shoot Out, and
7. Hawaiian International Billfish Tournament.

Tagging, however, is not appropriate for all situations. Tagging should only be done as part of a scientifically sanctioned program, and if part of a tournament, it is important that tournament rules are designed to ensure that tagging is done properly. I think it's a great idea to have a pre-tournament seminar on tagging. Such a seminar could among other things involve a showing of The Billfish Foundation video, Tag & Release—Make it Happen. The video shows you how to go about tagging and serves as a refresher, even for veteran taggers.

Program Objectives

The NMFS program objectives related to billfish are divided into three categories:

1. Study Biology and Ecology of Billfish,
2. Monitor Fisheries, and
3. Provide Advice for Conservation and Rational Management of Billfish.

NMFS tagging projects and gamefish surveys are an important component of all three program objectives. Three gamefish programs of particular interest to anglers in the Pacific Ocean are the NMFS International Billfish Angler Survey, NMFS Cooperative Billfish Tagging Program, and the AFTCO Annual Tag/Flag Program. Program descriptions are provided below:

- NMFS International Billfish Angler Survey: The survey began in 1969 and is based on annual voluntary survey card returns from anglers. This survey tracks changes in catch and effort over time. The survey covers both the Pacific and Indian Oceans for all species of billfish. It is very simple to participate in the survey, just fill out the self addressed survey post card and drop it in the mail. It is important to send these cards in, EVEN if you don't catch a billfish. Sending in your cards ensures that you stay on our mailing list for our free annual Billfish Newsletter (see Figure 1) and it is crucial to developing our effort calculations.
- NMFS Cooperative Billfish Tagging Program: The program began in 1963 and involves cooperation with anglers, commercial fisheries and other research agencies for tagging fish and the return of recovered tags. This program provides information on distribution, migration and growth rates for tagged fish. The survey covers both the Pacific and Indian Oceans for all species of billfish in most areas. Anyone that tags a fish gets a red, green or blue NMFS Cooperative Billfish Tagging Program ball cap. Gray caps are reserved for an-

glers that return tags. Returning tags is the most important part of the program; because of the small number of tags that are recovered, every one returned makes a difference.

- **AFTCO Tag/Flag Program:** The program was started in 1998 for the Pacific Ocean (a comparable program with NMFS has been ongoing in the Atlantic Ocean/Gulf of Mexico since 1987). This program was designed specifically to provide non-cash incentives (i.e. trophies and certificates) for anglers to become more conservation oriented and be involved in sanctioned tagging programs. The NMFS cooperates with AFTCO Mfg. Co. (see Figure 2) on this program by compiling information on the names of anglers and boat captains that tagged and/or returned recaptured tags during a given year. The program covers the Pacific Ocean from the North American coast, west to the International Date-line (includes Hawaii), for all blue, black and striped marlin, sailfish, mako and thresher shark, and bluefin tuna.

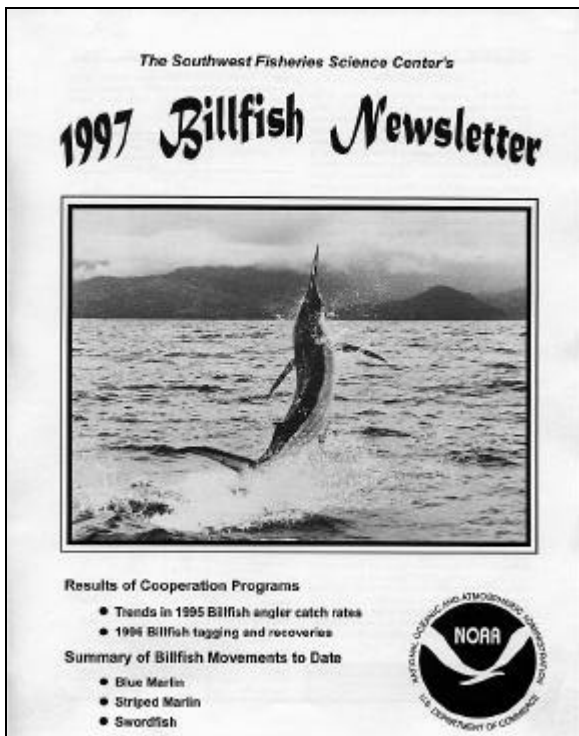


Figure 1: NMFS Billfish Newsletter (cover).



Figure 2: AFTCO Tag/Flag Tournament brochure.

Additional details related to these programs are provided in the NMFS Southwest Fisheries Science Center annual Billfish Newsletter (web site <http://swfsc.ucsd.edu:80/billfish.html>), which is available for free by writing the NMFS at Post Office Box 271, La Jolla, California 92038. Information specifically about the AFTCO Tag/Flag Program is provided in a brochure available directly from AFTCO Mfg. Co., 17351 Murphy Ave., Suite B, Irvine, California 92614, contacting NMFS at the above address, or contacting the authors of this paper.

Source of Tagging Results by Area

The scope of the NMFS Cooperative Billfish Tagging Program in the Pacific Ocean is comprehensive as revealed by the following list of locations that are a source of tagging program recapture data:

Australia	Marshall Islands
Columbia	Mexico
Costa Rica	New Guinea
Ecuador	New Zealand
Guam	Panama
Guatemala	Philippines
Fiji	Solomon Islands
Hong Kong	Tahiti
Kiribati	Tonga
Malaysia	USA - Southern California
Japan	USA - Hawaii
American Samoa	Kenya
Cook Islands	Nicaragua
Micronesia	United Arab Emirates

This is not a complete list of all areas where we are getting tag return data, but it does include areas where returns are the highest.

Data

The billfish survey, in conjunction with the various gamefish tagging programs that the NMFS is involved with, collects several kinds of data including:

- Migration routes by season by species
 - Distances traveled by species
 - Rate of movement
- Biological information such as
 - Age
 - Size
 - Growth rate
- Behavioral patterns
 - Feeding locations

- Depth by time of day
- Spawning information
- Names of anglers & captains participating in programs.

The migratory data can be useful to anglers planning trips or tournaments so that they can enhance their chance of a good catch. The biological and behavioral information is the kind of information needed for stock assessments. Good stock assessments are important to determine abundance trends and develop management plans that are likely to protect stocks from over-fishing. Last but not least, getting the names of anglers and captains participating in the program allows for their recognition and helps ensure their continued support.

The following series of figures provides a quick overview of some the kinds of information we can learn from tagging programs. Figure 3 shows natural distribution of billfish in the Pacific and Indian Oceans, which ranges from about 40° N to 44° S latitude and extends from the west coast of North/South America to the east coast of Africa. Principal sportfishing grounds are shown along most of the west coast of North/South America, Hawaiian Islands, other Pacific islands, Australia, New Zealand, New Guinea, Cambodia, Vietnam, and areas around Madagascar Island (Malagasy Republic).

The kind of information provided in Figure 3 can be shown in more detail for each species of billfish. For example, Figure 4 highlights blue marlin. Distribution of blue marlin in the Pacific ranges from about 40° N to 30° S latitude and extends from the west coast of North/South America to Asia and Australia. The heaviest distribution of blue marlin is the central and western portion of its range, reaching to eastern Australia. Almost overlapping the high distribution area is the spawning area, which extends a little more to the north and

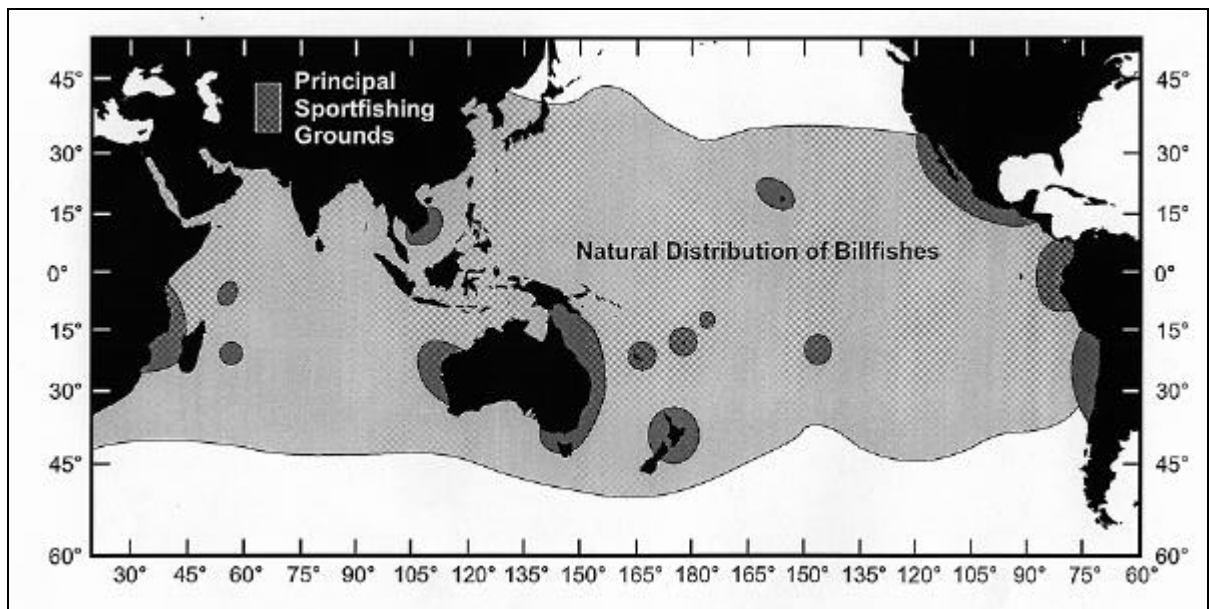


Figure 3: Pacific and Indian Ocean distribution of billfish.

south of the high distribution area.

An historical summary of the Billfish Tagging Program is provided in Figure 5. This graph, shows the tag and release effort from 1963 to 1997. As you can see, tagging effort is usually above 1,200 fish per year with occasional dips to about 800. We believe that in years when tagging numbers are high the billfishing is good and conversely low tagging numbers are likely associated with low catch rates.

Digging through the data reveals a number of other interesting facts. For example, since 1963, 44,434 fish were tagged, including 79 different species, and of these 90 percent were billfish. In 1996, 758 anglers and 254 captains participated in the program. What is even more interesting and maybe a surprise to some, since 1963 the recovery rate for tagged fish has only been 1.41 percent. Swordfish have the highest recapture rate, at 2.85 percent, while the striped marlin recapture rate is 1.63 percent. For most marine tagging programs the rate of return on tags is, at best, only a few percent. The take home message from this is that the return of every tag is important, don't let them end up in the bottom of your tackle box. Additionally, any influence you can have on your angling buddies to return their tags is equally valuable.

You may wonder how this information is used in management evaluations. Figure 6 provides an example of how tagging data can be used to influence management decisions. Figure 6 shows the catch-per-unit effort for billfish anglers in Baja, California between 1967 and 1986. As you can see from 1967 to 1978, there was a six percent per year decline in billfish catch rate—this trend, occurred during a period when a significant long line fishery was going on

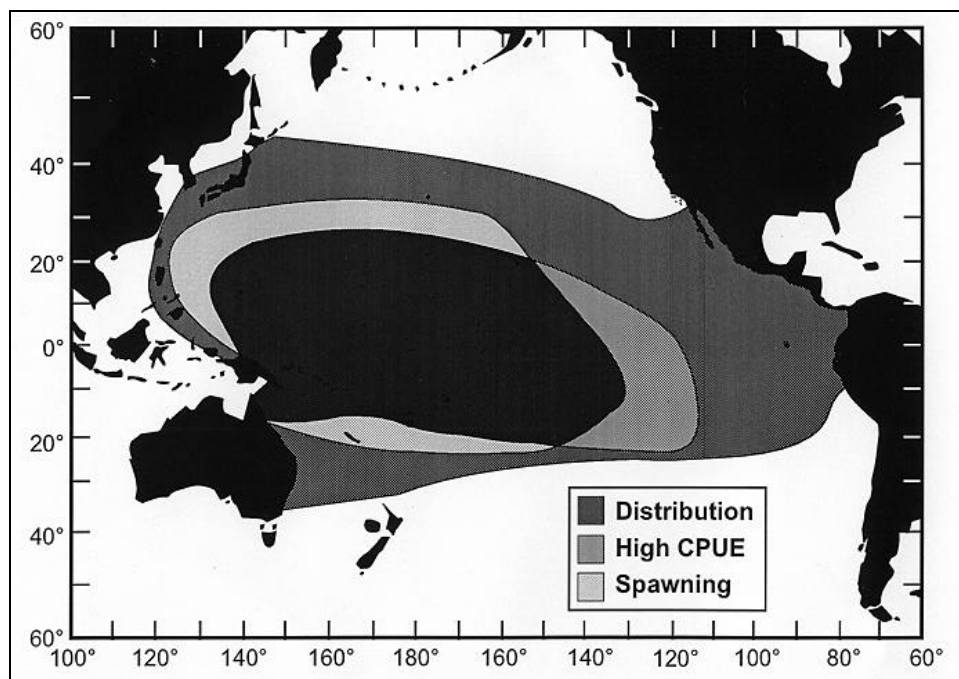


Figure 4: Blue marlin Pacific Ocean distribution and spawning grounds. (Adapted from Suzuki, 1989.)

in the same area. In 1976 longline fishing was prohibited in the coastal and offshore areas to a distance of 200 miles from shore. The angler catch rate showed an immediate increase and within two years was increasing at ten percent per year. Again, in 1980, a limited longline fishery was reinstated in the area, and as you can see the angler catch rate fell off again, at a rate of 2.8 percent per year. The data in this case certainly call attention to a possible connection between the long line fishery and angler catch rates. However, a direct cause and effect relationship can not be demonstrated in this case due to other unknown factors. The example does show the importance of getting good tagging data.

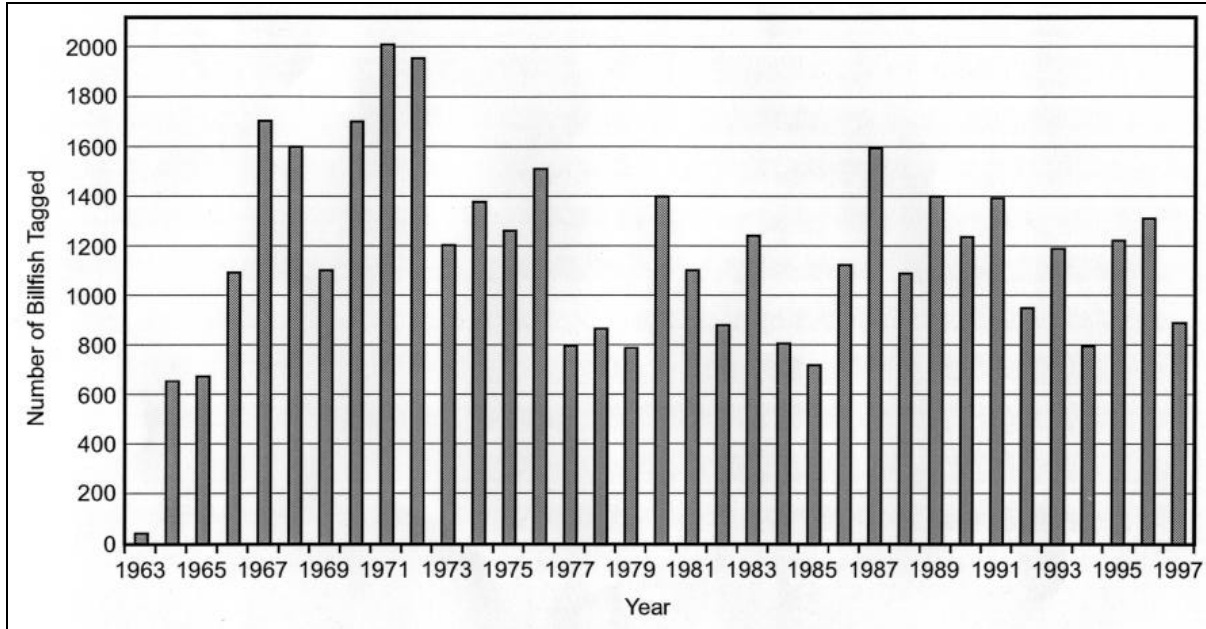


Figure 5: Billfish from the Pacific and Indian Oceans, tagged and released, 1963-1997.

Tagging Program Benefits

The primary benefits of tagging programs to anglers & managers can be grouped in five ways.

First it enhances fishery conservation by making anglers more aware of resource management issues. Secondly, it provides an opportunity for fish to be caught more than once. Third, it sets an angling ethics example for others to follow. It shows that the sportfishing community is really concerned about conservation, to anglers and non-anglers, alike. Fourth, it provides anglers an opportunity to play an active role in billfish conservation and management. Last but not least, it provides information and data for better management of both sport and commercial fisheries.

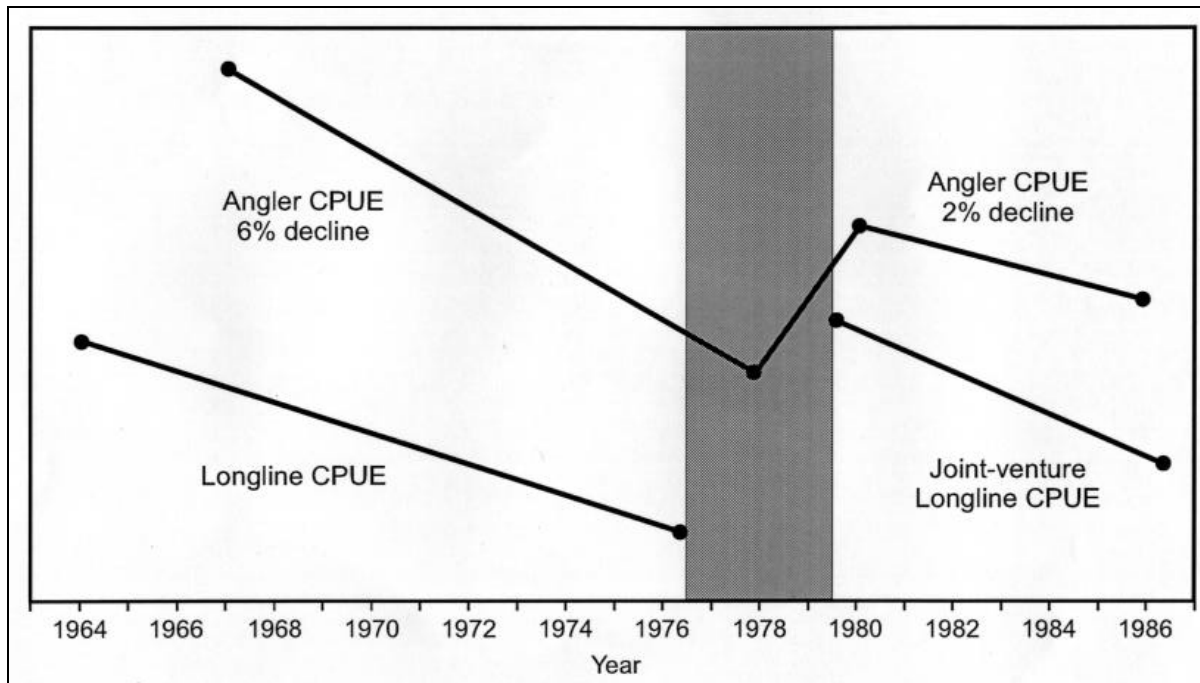


Figure 6: Catch per unit effort for longline and angler catches for Baja California Sur declined around the tip of Baja during 1964 to 1976. Mexico began enforcing its Exclusive Economic Zone in 1976 and longline fishing effort was restricted until 1980. Angler catch rates increased during the period but declined after Mexico entered into joint-venture longline operations with Japan in 1980. (Adapted from Squire and Au, 1980.)

Future of Tagging Programs

There will always be a need for tag data, as long as there is a concern for the management and well being of billfish stocks. Even after a general descriptions of migratory patterns and other life history data are known, there will still be a need for continuing data collection because:

- Maintaining a strong conservation ethic among gamefish anglers is enhanced by having appropriately designed tagging and catch-and-release programs in place to give anglers a hand in contributing to sound fishery management,
- Increases or decreases in billfish population size or age structure, and/or prey may cause changes to migratory patterns,
- In order to make good management decisions this kind of information needs to be current and consistent. The identification of trends is an important part of stock assessment and requires this kind of high quality data, and
- Migration routes, timing of movements, and abundance of fish on any particular route are likely to change in relation to short and long-term climate shifts.

Tags of Today and Tomorrow

What about the future in terms of how we go about tagging?

As better tags are developed, they are likely to stay with the fish for longer periods of time, giving even greater value to tagging programs. An example is the new nylon tag point, which we hope will be a great improvement over older designs. The nylon tag was developed by the Billfish Foundation in cooperation with NMFS.

In addition to the conventional tags noted above, we are also developing and improving on so-called “high tech tags.” “High tech tags” include electronic packages that are getting smaller and capable of capturing more and more data. These tags include:

- **Sonic tags:** Tags are usually surgically implanted in a fish, the fish is released, and then tracked by a boat with a hydrophone. Fish carrying sonic tags may be tracked for several days. Linking this system with a GPS navigation system can provide a very accurate track of where a fish goes, and often includes other data such as depth and temperature.
- **Archival tags:** Tags are usually surgically implanted in a fish, the fish is released, then hopefully, it's recaptured days or years later and the tag is recovered. Tags of this type can provide depth data over time, water and body temperature, light levels, and other biological or environmental data, depending on the specific tag design.
- **Pop-off tags:** Tags are attached to outside of the fish and then after a specified period of time, pop to surface and transmit data directly to a satellite. These kind of tags provide data similar to archival tags, but do not require the recapture of the tagged fish. When the tag is at the surface it also provides location information via the satellite link.

Closing

I hope that you now have a little better feeling for the scope of NMFS gamefish tagging programs, their value to you the anglers and the importance of angler involvement inside and outside of the framework of tournaments. Tagging is a well accepted tool in fisheries management—let's do our part to see that when it is done, that it is done in a wise and prudent manner. Remember, for most marine tagging programs the rate of return on tags is, at best, only a few percent—pointing out the importance of returning every tag you get. Don't let them end up in the bottom of your tackle box.

Worldwide, anglers are becoming more involved with conservation and management of our marine resources. In many cases, the anglers contribution to these efforts are significant. The NMFS applauds these efforts and encourages you to continue to work with us and other organizations to ensure that there will be fish for tomorrow.

References

Collette, B.B., and C.E. Nauen. 1983. *Scombrids of the world; an annotated and illustrated catalogue of tunas, mackerels, bonitos and related species known to date*. FAO species catalogue,

Fisheries Synopsis No. 125, Vol. 2. Food and Agriculture Organization of the United Nations, Rome. 137 pp.

The Billfish Foundation. 1993. *Tag & Release—Make it Happen*. 16 minute video.

The International Game Fish Association. 1988. *1988 World Game Fishes*. International Game Fish Association, Pompano Beach, FL. 352 pp.

Klimley, P., E. Prince, R. Brill, and K. Holland. 1994. *Archival tags 1994: present and future*. NOAA Technical Memorandum NMFS-SEFSC-357. Miami, Florida 42 pp.

Nakamura, I. 1985. *Billfishes of the world; an annotated and illustrated catalogue of marlins, sailfishes, spearfishes, and swordfishes known to date*. FAO species catalogue, Fisheries Synopsis No. 125, Vol.5. Food and Agriculture Organization of the United Nations, Rome. 65 pp.

Squire, J.L. and D.W.K. Au. 1990. Striped marlin in the Northeast Pacific—A case for local depletion and core area management. In Stroud, R.H. (ed.). 1990. *Planning the future of billfishes—research and management in the 90s and beyond, Part 2, Contributed papers*. Marine Recreational Fisheries 13-Proceedings of the Second International Billfish Symposium, Kailua-Kona, HI, August 1-5, 1988. National Coalition for Marine Conservation, Inc. Savannah, Georgia. 321 pp.

Suzuki, Z. 1989. Catch and fishing effort relationships for striped marlin, blue marlin, and black marlin in the Pacific Ocean, 1952 to 1985. In Stroud, R.H. (ed.). 1989. *Planning the future of billfishes—research and management in the 90s and beyond, Part 1, Fishery and stock synopses, data needs and management*. Marine Recreational Fisheries 13-Proceedings of the Second International Billfish Symposium, Kailua-Kona, HI, August 1-5, 1988. National Coalition for Marine Conservation, Inc. Savannah, Georgia. 361 pp.

Discussion

John Holdsworth asked if there was a difference between catch-effort data derived from survey cards versus data gathered at tournaments. Mr. Golden replied that they believe the survey card data is of better quality. Another person asked if it were possible to get information back about fish that have been recaptured. Mr. Golden emphasized that it was essential that the initial tag data be submitted for them to be of value. NMFS can only provide information about recaptured fish if they also have this information.

Developing Inshore Sportfishing in Palau

Noah Idechong and Tom Graham
Palau Conservation Society

Pre-project Situation

Fish stocks and fishing: The importance of fish and fishing to Palauans is enormous. But fishermen in Palau have increasingly complained about the depletion of their reef fish resources, and most fishermen have recognized that limitations on fishing pressure must be put in place in order to stem the decline (see Figure 1 for Palau's location in the Western Pacific).¹ Fishing effort continues to increase, however, and most of the increase has been in the commercial sector, with more and more of the catch exported to feed the growing demand from Guam and Saipan. Within Palau, fishing pressure has been spreading farther and farther from the urban center of Koror where the demand is greatest.

Larger boats and higher fish prices have allowed Koror-based commercial and recreational fishermen² to make more distant fishing trips to the waters of Palau's outlying (and much less populous) states. Ngarchelong and Kayangel in the far north, for example, have only a few hundred residents each, but together own about one third of Palau's reef and lagoon areas—about 500 km² (see Figure 2). Fishermen in these states have increasingly felt a loss of control over their marine resources and blame the depletion they see largely on outside fishermen.³ And the fishermen in these outlying states, partly in response to government initiatives during the last decade to develop the inshore fishery,⁴ have also been fishing more and more for commercial purposes, supplying Koror, Guam, and Saipan with reef fish.

Tourism development: Palau has been seeking alternative economic opportunities, especially since its gradual weaning from US government funding after independence in 1994. Tourism is decidedly the most promising sector, and it has been growing steadily since the early 1980's. Tourism, however, has been almost totally based on scuba diving and has thus been mostly confined to Palau's southern lagoon—an area that offers spectacular diving on the steep bar-

¹See Johannes, R.E. (1991). *Some suggested management initiatives in Palau's near-shore fisheries, and the relevance of traditional management*. Palau Marine Resources Division Technical Report 91.14, Republic of Palau.

²There are few people in Palau that rely exclusively on fishing for their livelihoods, but there are many "week-end" fishermen that fish for fun and a little profit, sometimes making distant day trips.

³Although there are only a couple dozen fishermen that reside in these communities, there are others from these communities that reside in Koror; these have a status somewhere between "insider" and "outsider."

⁴Many of these initiatives were funded through Japanese grant aid; activities included the provision of fishing boats and gears, development of port and ice-making facilities, and development of village-based fishing cooperatives.

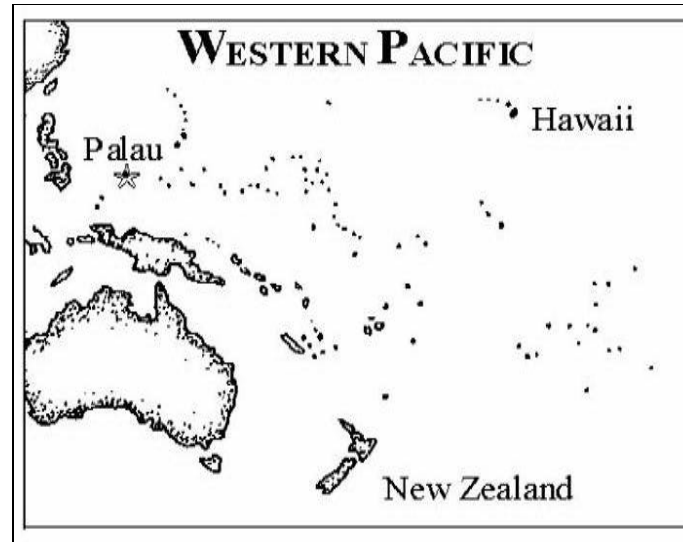


Figure 1: The Western Pacific.

rier reef walls, the beautiful scenery of the Rock Islands, and ready access from Koror. The economic benefits from tourism have not been making their way beyond Koror (except the large portion of benefits that flow directly out of Palau—a separate problem). Certainly, the many immigrants to Koror from Palau’s outlying states have participated in the economic activity in Koror, and benefits have made their way to those states through family connections and through government taxation and spending.

The problem has been that there are few opportunities to benefit from tourism without being based in Koror. Koror has become overcrowded while the communities of the outlying states have shrunk. While the outlying states have complained about fishermen from Koror taking their fish, Koror has complained about immigrants from the outlying states burdening their infrastructure and social services, as well as taking fish from Koror’s waters.

Another problem has been the “intrusion” of tourism—mostly scuba diving—into waters traditionally used by fishermen, and the resultant tension between fishermen and tour operators. As tourism has effectively edged fishermen out of the southern lagoon’s most popular dive sites, fishermen have felt their fishing grounds dwindle in size.

In 1995, for example, Koror State declared off-limits to fishing a 30 km² area of reef that includes many of Palau’s most popular dive sites. The growth of dive-based tourism has provided alternative opportunities for fishermen, with many switching occupations to dive guide. Tension between the two groups has continued due to the importance of fishing to Palauans. Whether it be for subsistence, fun, or commercial purposes, fishing plays such a central role in Palauan culture that any changes or threats to traditional fishing rights and patterns are sure to be met with some resistance.

Sportfishing: Sportfishing has long been an activity available to tourists in Palau, but few tourists have taken advantage of the opportunity—most of them only as a secondary activity. Very few have visited Palau for the primary purpose of sportfishing. Many of the thirty-odd

Koror-based tour companies offer fishing, but there are no companies that offer nothing but fishing. There probably hasn't been enough sportfishing to cause much resentment among local fishermen, but the potential for conflict has been an important concern. A bigger cause of resentment among Palauans has been tourists harvesting giant clams and removing corals and shells.

Project Purpose

In 1993 a team that included the marine resources office of the Palau national government, The Nature Conservancy, and several of Palau's outlying communities and local governments embarked on a project to develop a tourist-based inshore sportfishery. After two years the newly founded Palau Conservation Society took over as project leader. Funding was provided by the US government through the Saltonstall-Kennedy program of the National Marine Fisheries Service. Other collaborators included the Palau Visitors Authority, the South Pacific Commission, the Forum Fisheries Agency, the Guam Division of Aquatic and Wildlife Resources, and the Japan Tourism Bureau.

The project responded to two main problems: disappearing reef fish resources from fishing and the failure of Palau's outlying communities to receive an adequate share of the benefits from Palau's growing and most promising economic sector—tourism. From the perspective of resource management, these problems could together be described as one of Palau's reef fish



Figure 2: Map of Palau.

resources not being put to the best possible use.

Given Palau's relatively abundant fish resources, its natural beauty, and its growing reputation as a desirable vacation destination, a sportfishery would almost certainly have developed without the "intervention" of this project. But the purpose of the project was not just to see the development of the sportfishery; it was to see it develop with certain characteristics:

- The sportfishery would contribute to the conservation of fish resources rather than to their depletion.
- The emerging sportfishing businesses would be controlled to the extent possible by local interests, and especially by people in the target communities.
- Participation in the industry by Palauans would be maximized to the extent possible, and fishermen in the target communities would participate as fishing guides as an alternative to commercial, extractive fishing.
- The reputation of Palau as a fishing destination would be a positive one from the beginning, helping to ensure the sustainability of the industry—that is, visiting anglers would be satisfied through great fishing, safe boats and equipment, and good services, as well as positive non-fishing experiences.
- The sportfishery would develop in harmony with, rather than in conflict with, the subsistence and commercial fisheries, as well as with scuba diving and other marine tourism activities.

Progress to Date

The sportfishing development project has progressed through two main phases, assessment and demonstration. Concurrent with those phases, several communities have been taking initiatives to conserve and make better use of their inshore resources. These initiatives were aimed at issues of resource management broader than just the development of a sportfishery, but to the extent that they related to sportfishing, they are discussed here.

Assessment: The first two years of the project were dedicated to assessing the feasibility of developing an inshore sportfishery and identifying the issues that would have to be addressed in such development.⁵

Vessels and gear: An assessment of equipment and gear needs recognized that the vessel and gear requirements for offshore trolling would be well beyond the means of all the target fishermen. Thus the preferred strategy was to focus on inshore fishing (casting and near-shore trolling), which can be done from smaller boats and with less sophisticated gear. Most of the boats already owned by the fishermen—generally open fiberglass boats in the 20 to 24 ft range with single outboards—would not be quite adequate, twin engines being an important requi-

⁵The results of this assessment are available in: Anon. (1996), *Small-scale sustainable sportfishery development for Palau: assessment, strategy, and consensus-building*. Report by Division of Marine Resources, Bureau of Natural Resources and Development, Republic of Palau.

site for safety. An investment of \$20,000 to \$25,000 would be needed for an ideal boat. An additional few thousand dollars would provide for the fishing, safety, and other gear needed for inshore casting and trolling.

Economics: An assessment of the economic feasibility of small-scale inshore sportfishing businesses concluded that a fisherman that switched occupations from commercial fisherman to fishing guide would stand to make about the same level of profits. The assessment, however, did not account for the possible “conservation” benefits that development of the fishery might bring to Palau’s inshore fisheries as a whole.

Fishing action: An assessment of fishing grounds and target species found that the far northern waters of Ngarchelong and Kayangel probably offered enough variety of habitat and species and enough fish to provide a satisfactory fishing experience to most anglers. An assessment to the south, in the waters of Peleliu and Koror, was less positive. In both cases, the assessment found that the perpetual protection of some areas (e.g., establishment of catch-and-release-only zones), would probably be necessary to guarantee an adequate number of fish to satisfy visiting anglers.

Tourist markets: An assessment of Japan’s tourist market recognized the large potential of drawing both serious anglers and marine enthusiasts that would engage in sportfishing as a secondary activity. Markets not assessed but recognized to also have considerable potential were the US and Europe.

Community interest: Community meetings and workshops with fishermen in Kayangel, Ngarchelong, and Koror were held in order to gauge the local interest in developing a sportfishery and to identify outstanding issues. In general, the local leadership and residents saw sportfishing as a desirable economic alternative, but only if the community maintained adequate control and if an adequate level of benefits ended up in the community. In general, the fishermen were interested in sportfishing as an alternative occupation. It was recognized that the profound differences between sportfishing as a service occupation and fishing for food and income as an occupation that values independence would limit interest to only some of the fishermen. The fishermen received preliminary training in safety and other service-related aspects of sportfishing in order to better assess their own interest in the business.

Institutions and resource management: The importance of both fishing and tourism to Palau’s economy and way of life has led to the Palau government having a substantial institutional system dedicated to both these sectors.⁶ But sportfishing is not a traditional component of either sector. The central government objectives in fisheries have been developing underutilized resources, improving marketing, and protecting vulnerable reef-associated species. The central objective in tourism has been promoting scuba diving. Non-government groups involved in fishing and tourism include a tourism industry association and a sportfishing asso-

⁶The Division of Marine Resources is concerned with fisheries management and development; it has sections devoted to foreign offshore fishing, marketing, and aquaculture; the Palau Visitors Authority is in charge of tourism development.

ciation.⁷ The latter has mostly occupied itself with organizing offshore fishing tournaments. Inshore sportfishing has generally fallen between the institutional cracks.

An assessment of the institutional environment found that legislative and other initiatives would be necessary at the national and local levels in order to create an environment conducive to sportfishery development. At the national level, initiatives would be desirable to provide incentives for fishermen to switch to sportfishing, such as tax breaks and low-interest loans. Safety in the industry would have to be ensured through a national system of certification or licensing for guides and boat operators. Participation in the industry by Palauans might be controlled through occupation restrictions, such as those already in place for tour guides and taxi drivers. The Palau Visitors Authority would have to actively promote sportfishing abroad.

At the local level, the state governments (e.g., Kayangel and Ngarchelong), would have to put in place systems to: 1) better control access to their fisheries resources, 2) conserve adequate fish and fishing grounds for visiting anglers, and 3) extract rent from the fishery.⁸ The first could be done through restrictions on who could act as fishing guides in the states waters (e.g., as part of the national guide certification system). The second could be done through the establishment of catch-and-release fishing zones. The third could be done through permit systems that levy fishing fees on tourists.⁹ Because separate permit systems in each of the states could cause unreasonable hassles for the visiting angler, another chore for the national government would be to harmonize and possibly act as clearinghouse for the state permit systems.

Both national and model state-level laws were drafted that would accomplish all of the above institutional and policy objectives. At the national level, legislation was introduced in 1996 but no action has been taken. Actions taken at the state level are discussed further below.

Demonstration

During 1996 and 1997, the project team undertook a series of activities to test the fledgling sportfishery "system" including the services of guides, boat operators, and hotels as well as the fishing itself. Experienced anglers were recruited from the Japan and the US and put in the care of local fishing guides for a few days of fishing in the waters of Kayangel and Ngarchelong.

Because the target fishermen in those communities were still not adequately equipped with

⁷The Belau Tourism Association and the Palau Sport Fishing Association, respectively.

⁸The 16 states of Palau are accorded "exclusive ownership" of living and non-living resources out to 12 miles from the outer reef. It follows that any public sector benefits gained from those resources should be directed to the state governments rather than the national government.

⁹Kayangel and Koror are the only two states with such systems in place. Koror's applies to all visitors to its Rock Islands, regardless of activity; Kayangel's applies to virtually all tourists, with the fee level depending on the activity.

vessels and fishing gear, the vessels and services of experienced Koror-based tour/fishing guides were used in these fishing trials. But prospective guides from Ngarchelong and Kayangel accompanied these guides as “apprentice” guides. While the Koror-based guides were more experienced in serving tourists, the fishermen from Ngarchelong and Kayangel were more knowledgeable about the local fishing grounds. Together, they made very effective teams.

At the end of the trials, anglers provided detailed assessments of their fishing experiences, with evaluations of fishing action, vessels and gear, the services of guides and others, accommodations, and their non-fishing experiences while in Palau. The assessments were generally positive, but highly variable from angler to angler. To some, for example, fishing action was the only important attribute to be judged. For others, scenery, accommodations, food, comfort, and other attributes were just as important as the fishing itself.

Fishing action: There was a consensus among the test anglers that Palau’s northern reefs held enough fish to satisfy most anglers. The second of two trials saw especially good fishing, and one very experienced angler ranked Palau as his third favorite fishing destination in the world, behind Panama and Midway. There was concern among the anglers, however, that Palau’s reefs were not very extensive, and might be vulnerable to being fished-out. Controls would have to be put in place to protect the fish stocks. A little offshore trolling was done in addition to reef casting, but the results were not impressive. The anglers attributed it to either Palau not having much pelagic fish, or the guides not being knowledgeable enough about the times and places to find the various species of pelagic fish. Although the anglers found the vessels and gear to be adequate, they offered numerous recommendations for minor improvements.

Services: The services of the guides, boat operators, and others were generally rated as good, but it was acknowledged that the fishing guides would need more experience and training in order to better know what kind of experience visiting anglers are looking for.

Accommodations: The assessments of the accommodations in Koror were, almost without exception, very good. The northern fishing grounds, however, are about two hours by boat from Koror. The anglers that chose to make the trip every day from Koror found it too long. Those that chose to lodge near the fishing grounds found the accommodations inadequate. Clearly, improved lodging at Kayangel and/or Ngarchelong would be necessary.

Non-fishing experiences: Except for the few anglers who had no interests beyond fishing, there was a consensus that Palau offers a lot besides good fishing. The scenic value of its coastlines and reefs especially impressed the visitors. The city attractions of Koror received moderate evaluations from the anglers.

Conservation: One anticipated outcome and benefit of the sportfishery development project was that communities that stood to benefit from the sportfishery, as well as the national government, would put in place controls over-fishing that would safeguard the fish stocks necessary to sustain the fishery. For example, catch-and-release would be the general rule for visiting anglers, and fishing zones would be established that allowed only catch-and-release

fishing. As the fishery developed, it was expected that nationwide controls less directly related to sportfishing would also be put in place, such as limits on the amount of reef fish exported from Palau.

Several relevant pieces of legislation have been considered by the national legislature. One would prohibit the export of reef fishes from Palau. Another would create a marine reserve in the far north of Palau. But no relevant national laws have been enacted since 1994, when groupers were protected from fishing for four months a year and the export of lobsters, giant clams, coconut crabs, mangrove crabs, humphead parrotfish, and napoleon wrasse was prohibited.

Some of Palau's 16 states have recently taken some steps towards protecting and making better use of their fisheries resources. In 1994, the traditional leaders of Ngarchelong and Kayangel put a seasonal ban on fishing in certain reef channels known to hold spawning aggregations of groupers. In 1996, partly as steps towards pursuing sportfishing as an alternative enterprise, the leadership of Kayangel enacted two laws. The first established a permit system whereby all tourists, including anglers, would have to pay a permit fee to engage in any marine activities in the state. The second established the Ngaruangel Reserve, 35 km² of excellent fishing habitat comprising Ngaruangel atoll, about 10 km north of the community of Kayangel. The law puts the atoll completely off-limits for three years, during which time the community will prepare a long-term management plan for the Reserve. One option being considered is for Ngaruangel to be reserved for catch-and-release fishing and perhaps diving.

With this option in mind, the second sportfishing trial, conducted in May 1998, focused its fishing at Ngaruangel—both to assess the reef in general, and, if possible, to see whether the previous 18 months of closure had had any effect on the atoll's fish stocks. Although only preliminary, the results were impressive. Fishing action was non-stop at times, and two desired species, the giant and bluefin trevallies, were especially abundant and large. The giant trevally had been completely absent during a fishing trial two years before. The positive fishing results provided important reassurance to the people of Kayangel that their Ngaruangel Reserve initiative was on the right track.

Outstanding Issues

Important progress has been made in seeing a sportfishery with the right characteristics develop in Palau. Most important have been the local conservation initiatives, the positive assessments of fishing action and economic feasibility, and the gaining of consensus in the communities and among fishermen that such a fishery is desirable. There remain a number of outstanding issues.

Distribution of benefits: First, there is uncertainty as to how to make sure the benefits from the fishery get to the people who need them (e.g., the communities that own the fisheries resources). Although the entrepreneurial prospects of a sportfishing business look good, no village-based fishermen have yet made the leap of investing in the necessary equipment and gear. In the meantime, experienced and well-financed Koror-based tour businesses are gear-

ing up for fishing. A group of Koror-based boat owners and fishing guides recently organized themselves into a loose sportfishing association, with the idea of cooperating at least in promotion. Although such steps reflect positively on the prospects for developing a successful industry, there is the concern that the village-based fishermen will be left behind. It appears that the best strategy, at least initially, will be to encourage the Koror businesses to team up with the village fishermen, the former taking advantage of the fishermen's superior knowledge of the northern fishing grounds.

Limited fishing grounds: The conservation initiatives taken by the community of Kayangel have been very encouraging. But a single reef full of fish in the extreme north of Palau may not be enough to sustain a flourishing sportfishery. Protection of other fishing grounds, such as the more accessible and sheltered reefs between Kayangel and Ngarchelong, may be necessary. Consultations with Ngarchelong regarding sportfishing and fish conservation have received feedback just as positive as in Kayangel, but little action has been taken by the local leadership. Another area with sportfishing potential—especially deep jigging and trolling—is Velasco, the extensive deep reef extending north from Ngaruangel.

Difficult access to fishing grounds: The long boat ride to the northern reefs and lack of adequate accommodations in the northern villages is a serious constraint to the growth of the industry. Options are now being examined for developing a fishing lodge near the northern reefs. By the year 2002, there will be a new surfaced road around the island of Babeldaob. The road will allow quick and easy access to the northern tip of Babeldaob, perhaps allowing development of Ngarchelong as a staging area for sportfishing in the northern waters of Palau.

National government leadership: The Palau national leadership, including representatives of the legislature, resource management agencies, and the tourism office, has been involved in this project from the beginning, and support is generally universal. But the only national-level action taken so far in support of sportfishery development has been some promotion of sportfishing abroad. In addition to its role in creating an environment conducive to industry development, it would seem important that the national government recognize, support, and work to harmonize the community-level management initiatives. Especially for local initiatives that require some degree of enforcement effort, such as area closures and permit requirements, national support—both moral and material—is essential for success.

Acceptance of sportfishing: The transition from the occupation of subsistence or commercial fisherman to the occupation of fishing guide is a dramatic one. It is a change from a livelihood in which independence and freedom are central attributes to a service occupation in which the wants of the customer are most important. It will certainly not appeal to all fishermen. But judging from the high level of participation by Palauans—all of whom are fishermen—in Palau's scuba diving industry, this does not seem to be a serious constraint to the growth of sportfishing. Another question is how prospective guides and others will adjust to the exotic idea of catching fish (and releasing them) for the sake of fun rather than for food. Again, judging from the success of the scuba diving industry, in which guides take visitors in search of fish merely to look at them, it shouldn't be much of a problem.

Industry development: The most important achievement of the project so far has been gaining a consensus among interested parties—from the resource owners to the business sector—that inshore sportfishing offers a viable long-term alternative use of Palau's fish resources. Without that consensus, it is likely that as the industry developed, sportfishing guides would have found themselves battling with fishermen over access to dwindling resources, local communities would have felt cheated, visiting anglers would have left disappointed, and Palau would be struggling to improve its second-rate reputation as a sportfishing destination. Perhaps the project cannot be credited with having avoided quite so much mayhem. But it is clear that the project's step-by-step approach to industry development has resulted in an environment where all the players are more aware of the risks and rewards of developing a sportfishery and more prepared to work together towards mutually beneficial goals. One of these players is the entrepreneur who is going to take the risk of putting money into a sportfishing business or a fishing lodge. It is not clear whether these investors are going to be Palauan, foreign, or joint venture. But after the intervention of this project, it is clear that they will have to be committed to working closely with the communities that own the fish and committed to maintaining the long-term viability of the resource.

This paper is adapted from an informational paper from the Second Pacific Community Fisheries Management Workshop (Noumea, New Caledonia, 12-16 October 1998) and previously published in the SPC Fisheries Newsletter #86/87.

Discussion

The question-and-answer period began with a discussion of catch-and-release. Noah Idechong pointed out that catch-and-release runs counter to Palauan cultural values. Nonetheless, fishing guides are willing to support the practice because they recognize that some tourists value it. More generally, Mr. Idechong believes that it should be practiced more widely for sportfishing in Palau. Local commercial and subsistence fishermen already fully exploit marine resources; sportfishing should not remove too many additional fish. At the same time, the sportfishing development project is examining ways for sportfishermen to take their catch back to the hotel to be cooked. In response to a question, he said that they are not yet tagging fish in Palau. He also discussed local control of reefs in Palau and noted that the pairing of Koror-based guides with local guides helped resolve assess issues.

Mr. Idechong talked about local tournament fishing in offshore waters. He believes that Palau is still at a very elementary level in developing policies for tournament fishing, particularly regarding conflict between gamefishers and longliners over billfish. Development of a tournament system would be another way to collect data. Ray Clarke noted that Micronesian governments get substantial revenue from foreign fishing vessel licenses so it may be difficult for them to implement policies that favor gamefishing. However, in comparison to the Federated States of Micronesia, Palau receives relatively less revenue, so the government may be more willing to address potential conflicts.

In response to a question, Mr. Idechong discussed guide training. He said that they are trying to develop a training program for about ten guides.

Two audience members discussed conflicts between sportfishermen and personal water craft users in Maui and Guam. In both cases management and regulation were necessary to resolve the conflicts.

Marc Miller commended Mr. Idechong for the precedent-setting work he had done in Palau, recognizing that sportfishing development must simultaneously address fishery and tourism issues. In response, Mr. Idechong emphasized that they took a bottom-up approach, involving local communities. He also said that legislation was important and needed to address a diverse set of issues, from zoning for tourism to bycatch of billfish by longliners. He believes that sportfishing-based tourism offers a viable alternative source of income to pelagic longlining.

Mr. Idechong, in response to a comment, concluded by emphasizing that Palau has a wide range of attractions for tourists and sportfishing can build on this base.

Guam's Sport Fishing History, Evolution, and Progress

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How do you determine when sportfishing began and subsistence fishing stopped? The Pacific islands are rich with fishing history. Anyone who has tried to use a cast net (called a *talava* in Guam) or has gone free-dive spearfishing knows each method requires considerable patience and skill. Typically, these forms of fishing would be considered subsistence by both Pacific Islanders and western onlookers. However, if one considers it is common for today's typical sportfishing angler to pursue a selected species of fish and keep a few if caught to consume, the similarities are striking. Both require specialized equipment, skill, and for the most part, some degree of enthusiasm. Free-diving spear fishermen and cast netters have long been judged by their ability to capture highly prized species and therefore in their own way could be considered among the earliest of all sportfishermen.

Culturally, all tropical Pacific islands have to some degree subsistence-based fisheries and therefore the idea of catching fish for "fun" is typically not practiced. There may be significant financial benefits in the non-consumptive approach to developing sportfishing industries, but certain practices seen as standard for sportfishermen may not be readily accepted in Pacific Island settings. Yet many of the standard Western methods or procedures may not be essential to the development of this type of fishery or sector. Both practices (traditional or subsistence and sportfishing as practiced in Western societies) can co-exist and be mutually beneficial. For instance, the cultural and traditional knowledge associated with harvest of food fish (e.g., species availability, behavior, tides, food, habitat, danger) can be an invaluable attribute for the development of a cadre of local tour guides. Likewise, developing specific areas for sportfishing may offer significant economic opportunities as well as enhancing fishery management options. But there may also be some conflicts with other resource users. All these factors require some degree of consideration in attempt to develop sportfishing activities. What is essential is that the local community is fully involved in the plans or optimally provides the impetus for development.

Sportfishing as an open-ocean fishery appeared some time in the 1950's using small outboard vessels, 20 feet in length or smaller, in pursuit of tuna, marlin, wahoo, and mahi mahi. This is not to say that there were not occasional attempts to sportfish in boats well before this time, but it was not common until this time. The early weapons of choice were conventional reels spooled with nylon or monofilament line mounted on stiff cane poles. Artificial lures (lead heads with feathers) were trolled along deep drop-offs or around offshore banks. This fishery originally started as a subsistence/sport activity but soon changed more toward commercial

harvest when it was realized that it was easier to obtain large volumes of highly marketable fish. This fishery remained pretty much the same until the mid-1970's when Guam hosted its first fishing derby. The derby idea became popular because it provided a mechanism for business to attract customers and it was good for fishing because it brought fishermen together in a competitive spirit.

The decline of many coastal fish species is due to large scale habitat degradation or loss, resulting from storm drainage high in petroleum and freshwater, sewage outfalls, pesticides, herbicides, and sedimentation. Additionally, research at the University of Guam has demonstrated that all of these contaminants, particularly the use of land based pesticides and herbicides, can reduce or stop reproduction of fish, corals, and other invertebrates. Field surveys have found there has been an island-wide decline in coral cover—in many areas there is 40 to 60 percent less coral than only 15 years ago. There has also been observation of very low levels of coral recruitment during this same time period. The habitat loss is further compounded by the significant problems caused by personal watercraft (jet skis) that are being operated in shallow reef flat areas. The sedimentation and petroleum products produced by these vessels have caused the loss of habitat. Other areas have been negatively impacted by high recreational use by beach walking, snorkeling, or diving—activities typically considered rather benign.

In the early 1980's tourism had grown on Guam to the point that charter fishing began to be a viable marine-based recreational activity. With increased demand, local entrepreneurs responded and developed a local sportfishing charter boat industry. These vessels were generally larger, in the 27 feet range, and concentrated on trolling. By the late 1980's the charter industry had grown to a fleet of approximately 20 vessels, taking advantage of the ever increasing number of Japanese tourists coming to Guam. This success also marked a shift in thinking for many local fishermen, who may of taken the occasional paying customer out fishing on a weekend. A significant number of the charter operators were once full-time commercial fishermen. The once standard commercial fishing operation shifted to a service oriented industry based on the marine environment. This represented a sound economic decision, given the strength of the economy in Guam and the increasing demands for marine-based recreational activities by the growing tourist industry. The sport charter sector represented equivalent or greater income but significantly less risk. It was certainly less physically demanding than commercial trolling.

On Guam the success of the sport charter business in part relies on the proximity of fishing grounds and the high probability of catching small Pacific blue marlin, mahi mahi, small yellowfin, skipjack (bonita) or wahoo. Although these fish are small, the typical clientele are not looking for trophy fish but rather the prestige of chartering a large vessel and hoping to have some fresh sashimi. This industry continues to grow and now has expanded to bottomfishing as an alternative to pelagic trolling. The bottomfishing experience is also not focused on catching a lot of large fish but rather is using light spinning gear to catch small reef fish. Guam's sport charter industry would not normally fall in to the true sportfishing category but more reasonably be considered recreational fishing, since the anglers are not necessarily there for the fight but more the opportunity.

The concept of sportfishing in the Pacific Islands is very different from the conventional forms practiced in the United States. The focus on sportfishing tournaments, although valuable to business and to fishermen, in the big scheme of things represents a small segment of the sportfishing effort within Guam's community. Tournaments can provide important biological and effort data for fisheries management purposes, but it is important that the data are scrutinized carefully if compared or expanded. For instance, on Guam we have found that confounding factors, such as changes in fishing strategy and catchability during tournaments, makes gathering the tournament data a lower priority than conducting random surveys throughout the year. The Guam Department of Agriculture, Division of Aquatic and Wildlife Resources has conducted recreational coastal fishery effort and harvest surveys, typically creel censuses, for 20 years. This information reports effort by gear type and harvest for the entire island. While this data-collection program has proven relatively effective at monitoring the local fisheries, it comes at a cost of significant manpower and financial investment annually. While the data collected have been very valuable in managing local fisheries, there is the constant need to ensure that biologists and managers understand the variables and confounding factors before falsely comparing dissimilar data. Sportfishing has a bright future in Guam but only if community awareness, significant water quality improvement, and the use of special management areas are employed. There is a growing consensus that coral reef and open ocean resources are limited. Most Pacific Island areas, including Guam, have experienced, at varying levels, the negative impacts of pollution and over-exploitation. We recommend that other Pacific Islands interested in developing sportfisheries focus management efforts on special management areas that employ limited takes or catch-and-release fishing, with a concerted effort at preserving traditional or cultural activities. To take full advantage of this unique opportunity it is critical that the managers and developers consider the culture and the resource together. Community involvement from the beginning is considered a fundamental determinant of success.

This paper is adapted from an informational paper from the Second Pacific Community Fisheries Management Workshop (Noumea, New Caledonia, 12-16 October 1998)

Discussion

In response to a question, an audience member discussed the early development of offshore sportfishing on Guam. The concept was introduced to Guam by US Navy personnel in the inter-war period. Only three people were allowed to take vessels beyond the reef due to security concerns. After the war, the Navy made available high speed runabouts that had been used for search and rescue. A few individuals began to fish for marlin. Four or five boats fished competitively, catching 14-15 marlin in a year.

Sport Fishing in the Philippines

Ruben Ganaden

Phillipines Bureau of Fisheries and Aquatic Resources

Fisheries in the Philippines

First, I would like to thank the organizers for inviting me to participate in this symposium. This is timely because we just implemented a new fishery code last March. Before that, sportfishing was not regulated in the Philippines. With the new fishery code the Bureau of Fisheries of the Philippines must develop some regulations in sportfishing.

The Philippines is an archipelago, consisting of more than 7,100 islands. We have a territorial water area about 2.2 million km², including our exclusive economic zone. The Philippines is the twelfth-largest fish producer in the world and the second biggest producer of tuna and tuna-like species in the Southeast Asian Region.

Tuna and billfishes account for a majority of the gamefishes in the Philippines. This includes yellowfin tuna, bigeye tuna, dogtooth tuna, black marlin, Pacific sailfish, swordfish, great barracuda, dolphin fish, mahi mahi, and some sharks. It is important to note that tuna resources, particularly the yellowfin, are considered the most commercially important species. It is the number one export commodity in terms of volume and value, amounting to about 4.5 million pesos in 1996. In fact, yellowfin tunas represent about 15 percent of the total marine catch of the Philippines. Overall, we are producing more than two million metric tons from all fishery sectors, with marine fisheries contributing about 1.4 million mt. Billfish statistics, compiled by our Bureau of Agriculture of Statistics from 1992 to 1996, show that the average annual catches of sailfish, swordfish, and marlin from the commercial fishery sector was 3,876 mt for sailfish, 4,146 mt for swordfish and 1,000 mt for marlins.

We divide our marine fishery sector into a municipal fishery sector, comprising those boats that are three gross tons and less, and a commercial sector, composed of boats more than three gross tons. Several gear types are used by the commercial sector, in addition to hook-and-line and purse seine. The Sulu Sea, Palawan waters, and southern Mindanao are the most important fishing grounds in the Philippines for tunas and the billfish. The municipal fishery sector use mainly handlines to catch tuna around FADs. This is mostly south of Mindanao in the Moro Gulf. These FADs are also used by purse seiners to catch tuna. If the purse seiners are not operating in the area, then the handliners go there to handline for the big tunas. In fact, every day in General Santos City in Southern Mindanao they are landing fish averaging 50 kg. But the average weight has become lower through the years.

Sportfishing

Sportfishing is a relatively old activity in the country. The Philippine Game Fishing Foundation, the organization at the forefront of the sport in the Philippines, has been in existence for about 58 years. However, considerable progress in terms of tournaments was only recorded in 1987. Several marine and a few freshwater fishes have been targeted during gamefishing activities or tournaments.

When I was invited here, I contacted the Philippine Game Fishing Foundation and they were able to give me a list of record catches from tournaments between 1987 and 1996. About 23 species of finfish were caught from around 34 fishing grounds during these tournaments. A great variety of species and size ranges are being caught. One of the earliest gamefishing records was set in Fuga Island, somewhere in the north, where a 29.9 kg dogtooth tuna was caught with a 30-lb. test line. The largest marlin, 313 kg, was taken east of the Philippines.

The northern tip of the Philippines has become a favorite place for this sport. This has also become the site of the Triple B Annual Philippine International Billfish Tournament, hosted by the Philippine Gamefishing Foundation.

In 1996, nine gamefishing tournaments were held in various places in the country, including the Philippine National Billfish Tournament, the Subic Bay Maritime Area Sports Fishing Tournament, the Masaki Sport Fishing Tournament, the Atlanta Tuna Fishing Tournament in Puerto Princesa, and the Standard Insurance Tuna Fishing Tournament in the same place.

Gamefish Management

Gamefishing has been under the auspices of the Department of Tourism, mostly to attract tourism to the country. Since there are 70 million people in the Philippines, we would like to look at sportfishing as also a food source. Whatever catch we have should be for consumption, because our per capita consumption of fish is one of the highest in the world, 40 kg per capita.

Although we do not yet have any gamefishing regulations in the Philippines, with the approval of our fisheries code, we hope to be able to come up with some regulations. This conference is an opportunity for us to gain some information on how we would go about regulating sportfishing in the Philippines. Right now we do not have much data, such as how many tournaments there are, aside from the information provided by the Philippine Game and Fishing Foundation. Very recently we have begun to collaborate with them. They asked us for tags so they could tag the fish that they catch during fishing tournaments. Hopefully, this collaboration will continue until the necessary regulations are in place.

This is a summary of Mr. Ganaden's presentation.

Discussion

Discussion centered on whether the new regulations will require data collection and the kinds of data that might be collected. It was emphasized that detailed catch data should be collected, rather than just recording record catches. It was noted that if commercial vessels are excluded from an area, then it is even more important to collect data from recreational fishers. Mr. Ganaden agreed that data collection should be a part of any new regulations for sportfishing. Mr. Ganaden was asked if conflicts between commercial and recreational fishers had been recorded in the Philippines. He responded that his agency had not received any reports about conflicts between these sectors. Instead, there are conflicts between artisanal and large commercial fishers.

Billfish Resource Allocation—Commercial and Recreational: An Australian Example with Pacific Implications.

A. Wade Whitelaw
Secretariat of the Pacific Community

Summary

There is a lack of reliable accurate recreational catch and effort data throughout the Pacific. This needs to be remedied to be better able to observe and monitor changes in the recreational fisheries, especially in relation to concerns by the recreational lobby of over-fishing by commercial vessels. Secretariat of the Pacific Community (SPC) is presently trying to improve the collection of commercial and recreational billfish catch and effort data.

Scientific observer studies on black marlin off Cairns have shown that the level of bycatch by commercial longliners can be decreased if they follow a few management suggestions. It was found that most black marlin are caught mainly during the day time in the top 80 m of the water column with mortality increasing with time on the hook. Mortality for black marlin caught on longline was observed to be around 30 percent—this can be decreased by deep setting at night time, preferably only utilizing short duration sets.

Introduction

This paper describes how recreational fisheries issues are intimately linked with commercial fisheries and that there is a need to manage pelagic species in a cooperative and consultative manner.

A few years ago the recreational fishing lobby in Cairns (black marlin fishing capital of the world) made it known that they felt that the commercial longline industry was having adverse impacts on their black marlin fishery. Consequently a study was carried out by CSIRO (Division of Marine Research, Hobart, Australia) to look at the recreational and commercial black marlin catches over time and to instigate a scientific observer programme to verify catches and to determine a number of parameters in regard to the commercial catch of black marlin, being:

- Evaluate catch of tuna and billfish in relation to gear configuration.
- Determine time of capture.
- Determine vertical distribution.
- Evaluate billfish bycatch by season.

- Examine mortality with time of capture and length of time on the hook.

The objective of this study was to provide management advice to attempt to decrease the by-catch and mortality of black marlin by commercial longline fishing.

The longer-term implications of this study suggested there was a need to improve the collection of gamefish catch and effort data from throughout the Pacific area. This present study showed that existing gamefish data collection practices were inadequate to provide suitable data to analyze short and long-term changes in billfish Catch Per Unit of Effort (CPUE). As such, there is an urgent need in the Pacific to develop and implement a gamefish catch and effort database. The SPC is now implementing such a database and is looking for assistance and support from SPC member countries, gamefish organizations, charter boat operators and individuals to further this objective.

Methods and Materials

A study was carried out off Cairns (see Figure 1, Queensland, Australia) to look at black marlin catch rates over time by both the recreational and commercial fisheries and to implement a scientific observer project on commercial vessels. This study included analysis of existing gamefish data as well as implementing an experimental observer program. The intent of the observer program, utilizing local longliners, was to:

- Verify catch and effort data.
- Evaluate the catch of tunas and billfish in relation to gear configuration.
- Determine time of capture.
- Determine the vertical distribution of the fish species.
- Evaluate billfish bycatch by season.

Two 'observed' surveys were carried out, one in October-December (main black marlin season) and one in May-August (winter). Data collected by the observers included:

- Setting and hauling information.
- Gear details.
- Catch details.
- Output from hook monitors (record depth and temperature of hooks).
- Output from hook timers (records when fish are caught and the duration of time hooked).

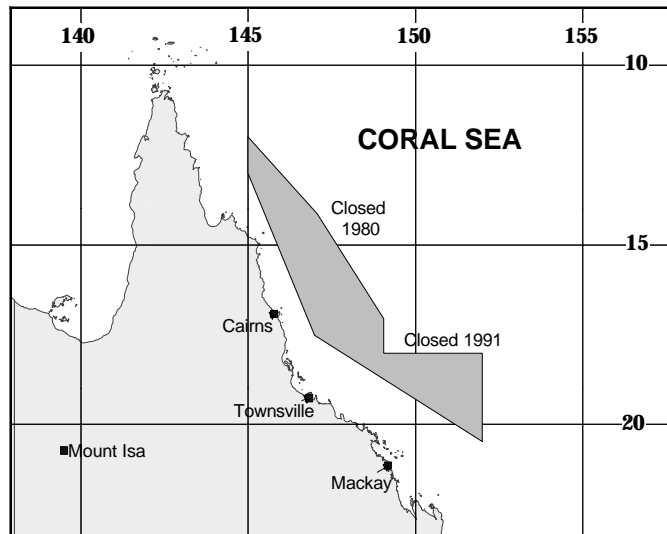


Figure 1: Commercial longline study area.

Results

Analysis of recreational data was very limited due to the fact that there really wasn't much data available to analyze. While there had been considerable charter and tournament fishing for black marlin out of Cairns, there was very little usable data that allowed the determination of changes in CPUE over time. A similar problem was encountered with commercial catch and effort information on black marlin as this species was seldom recorded on the log-books as the commercial fishermen seldom retained this species and consequently did not record their catch.

The results from the two observer surveys were more definitive. There were two 'sets of observations' carried out by the observers on the domestic longline vessels operating out of Cairns, being in spring (October-December, 73 sets) and winter (May-August, 36 sets).

Catch composition by season

The catch composition differed significantly between spring and winter (see Figure 2). In spring a total of 1,467 fish were caught, with yellowfin and bigeye tuna comprising 37 and 17 percent of the catch respectively. The third most caught species was black marlin which comprised 15 percent of the total catch by number, followed by shark (13 percent). Three broadbill swordfish and one blue marlin were also caught. A total of 34 different species were identified in the total catch. The winter catch composition differed in that the main species caught were yellowfin and albacore tuna (37 and 11 percent respectively) with no black marlin caught at all, though broadbill swordfish constituted three percent of the total catch. A total of 35 different species were identified in the total catch.

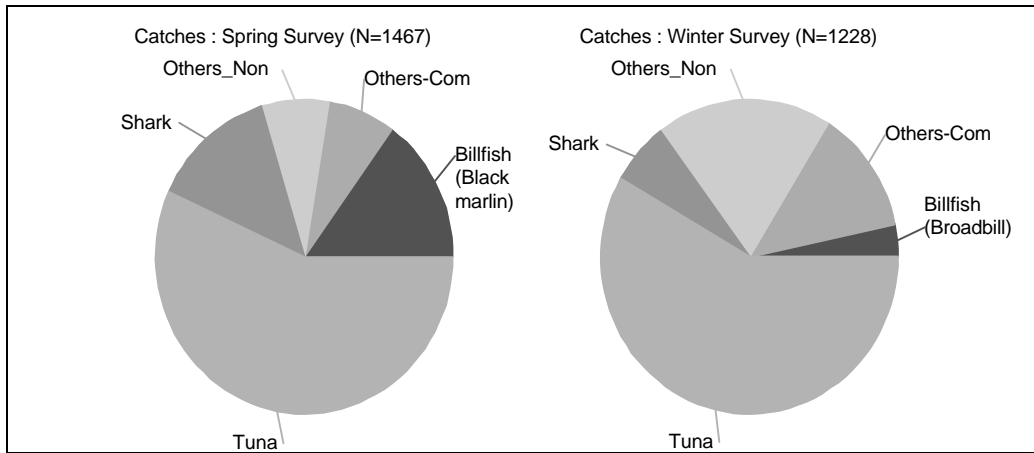


Figure 2: Catch composition by season.

Marlin and tuna catch by set time

Figure 3 shows the percentage of catch depending on whether the longline was set during the day or night (most sets or soaks were around 10-18 hour duration). The results show, for the spring season, that the black marlin are mainly caught during the daytime sets (around 20 percent compared to ten percent during the night), while bigeye tuna, being the main target species, were caught mostly during the night sets.

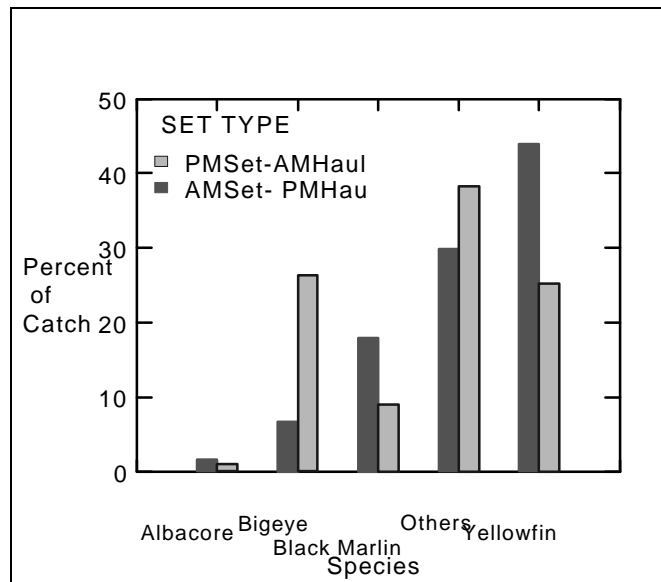


Figure 3: Percentage of catch in relation to set type (spring).

Life status

One other objective was to look at the life status or survivability of the fish while hooked on the longline, or in other words, 'How long can a fish survive on the line?' This was determined by placing 'hook timers' on a number of the hooks, which recorded when the bait was

taken and how long the fish was on the hook. The results show, for the spring survey, that around 30 percent of black marlin are either dead or injured upon retrieval of the line (see Figure 4), with bigeye tuna having a similar mortality rate, yellowfin a higher mortality rate while sharks have the lowest mortality with only around 17 percent dead or injured.

Upon closer examination of life status in regard to ‘time on hook’ (see Figure 5), results for the black marlin show an increase in mortality on the line with time, with mortality reaching nearly 50 percent after 17 hours (1,020 minutes).

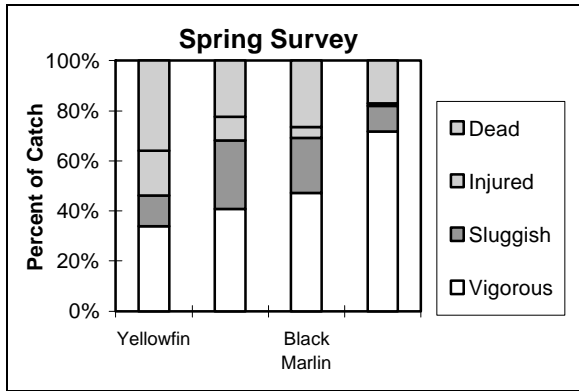


Figure 4: Overall fish mortality

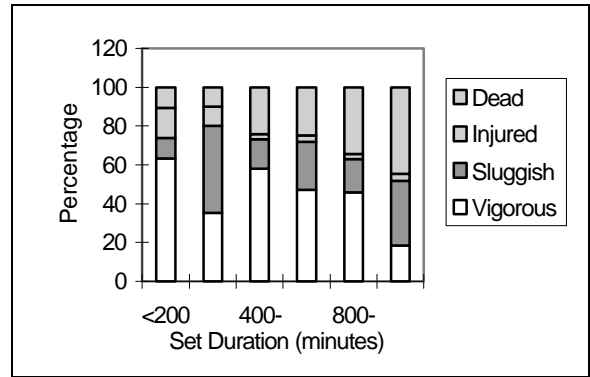


Figure 5: Black marlin survivability (spring).

Hook depth

The study also looked at hook depth in regard to setting techniques (mainly the number of hooks between floats or baskets (HBF). Results showed, not surprisingly, that the range of depths fished increased with an increased number of HBF (see Figure 6). Depending on the line configuration the ‘Effective Fishing Depth’ (range of depths fished from the shallowest to the deepest) ranged from 40-80 meters for 10 HBF to 45-120 meters for 14 HBF. This effectively increased the amount of the water column being fished by the hooks.

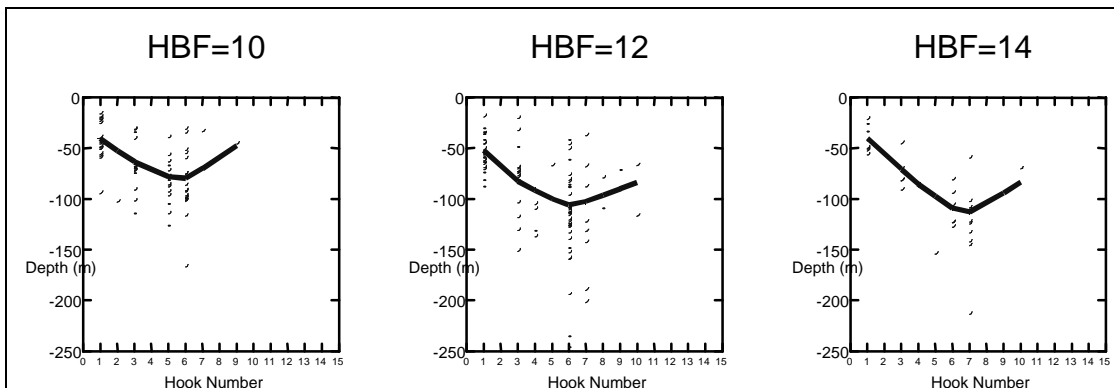


Figure 6: Hook depth by number of hooks between floats.

Catch by depth and time

Figure 7 shows the percentage of catch by species by depth as determined by the hook position on the line (in conjunction with the hook depth temperature monitors). The results show a strong 'catchability' depending on the hook depth with the catch of black marlin decreasing with increased depth. The opposite was true for yellowfin and bigeye tuna.

Figure 8 shows that black marlin tended to 'strike' at the baits more in the first 40 percent (time) of the set, though also 'struck' consistently during the remainder of the set with most black marlin strikes occurring from 0900-1500h.

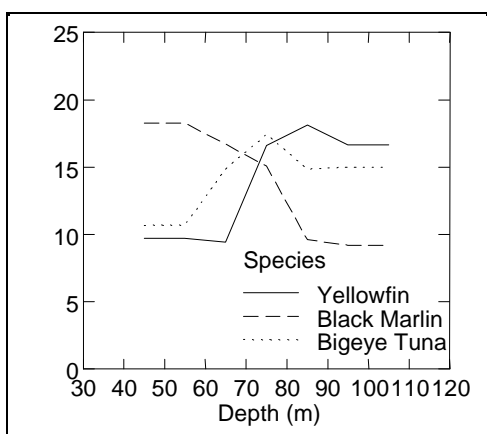


Figure 7: Catch by depth.

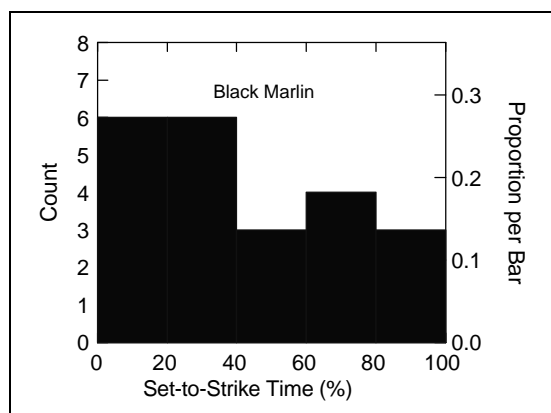


Figure 8: Strike rate in relation to set.

Overall Results of Longline Observations

A number of general results were apparent from the observer data (see Figure 9). These were:

- Black marlin are caught mainly during daylight hours.
- Bigeye tuna are mainly caught at night.
- Black marlin longline mortality, for this study was around 30 percent.
- Black marlin mortality increases with time on the hook.
- Black marlin were mainly caught shallower than 80 m.
- Bigeye and yellowfin tuna (main target species) were mainly caught deeper than 70 m.
- Black marlins tend to 'strike' fairly evenly throughout the set with some preference for the first 40 percent of the set soak time.

Potential Management Actions

The intent of the 'observer' study was to improve our knowledge on the catching habits of black marlin from longliners and as such this was successful. The concept was then to make management recommendations to decrease the catch of black marlin while sustaining the catch of the main target species. Management suggestions included:

- Improving cooperation between commercial and recreational fishers.
- Improving collection of recreational catch and effort data.
- Non-retention of marlin (live or dead) by commercial longliners.
- Establishing responsible fishing / code of practice.
- Establishing seasonal commercial closure.
- Recommending deeper setting of hooks.
- Recommending shorter sets.
- Recommending night sets.

The results from this Australian study have implications for the wider Pacific for all the marlin species in that marlin constitute around 5 percent of the longline catch, and as such, there is impetus by recreational fishing groups to reduce the by-catch of these species.

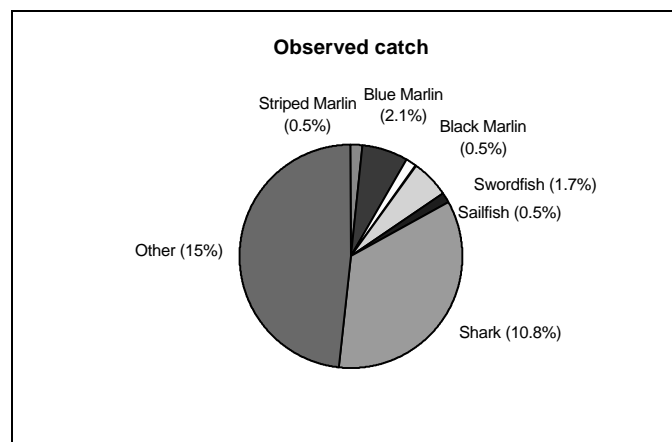


Figure 9: Percentage of billfish as bycatch from longliners.

While many areas and organizations state that commercial fishing is reducing the recreational catch of marlin species, very few of the recreational groups or organizations can back up their claims with accurate and reliable catch and effort data over time. One of the objectives of the Oceanic Fisheries Program (within SPC) is to initiate and archive the collection of this important recreational data.

There is a need for cooperation and collaboration between the recreational fishing organizations, researchers and managers to better understand these fisheries and in turn to better manage them.

SPC has now recruited a 'billfish biologist' whose role is to:

- Review billfish biology and exploitation in the Pacific.
- Assemble information on billfish availability for member countries.
- Assist with billfish stock assessments.
- Initiate / nurture billfish data collection, both recreational and commercial.

- Help develop future data collection and research priorities.
- Develop gamefishing contacts.
- Qualify and quantify gamefishing in the Pacific.
- Develop data collection protocols, both through logbooks and the collection and archiving of historic data.

Acknowledgements

Much of the results presented herein come from reports carried out by the CSIRO Division of Marine Research (Hobart, Australia). Other results have been derived from the SPC commercial fishing database.

References

- Campbell, R., Whitelaw, W. and McPherson, G. (1997a). *Domestic longline fishing methods and the catch of trash and non-target species off N.E. QLD*. First Survey: Oct-Dec 1995. CSIRO Report to ECTUNAMAC. 100p.
- Campbell, R., Whitelaw, W. and McPherson, G. (1997b). *Domestic longline fishing methods and the catch of trash and non-target species off N.E. QLD*. Second Survey: May-Aug 1996. CSIRO Report to ECTUNAMAC. 100p.

Discussion

In response to a question, Mr. Whitelaw discussed targeting of billfish by longliners. He said that longliners mainly target bigeye and yellowfin tuna, depending on season and area. He didn't know whether they also targeted marlin or just considered them a valuable incidental catch. He also discussed regulations that regulate the retention of billfish by longliners, arguing that they discourage targeting these species.

In response to another question, he discussed developing a Pacific-wide database for data reported by sportfishers. He emphasized that any data repository should be centralized and region-wide.

Gamefishing in Tahiti Waters

By Alban Ellacott

President and Founder Tahiti International Billfish Association and Tournament

The Daily Fishing Methods Practiced by the Ancient Tahitians

The daily fishing methods practiced by the Tahitians, and in fact by nearly all Polynesians since well before the time of the first European contact, had the general character of sportfishing. Except for the fact that fishing equipment and tackle and gear have benefited greatly from technological advances since the era when fishermen went out only to feed their families, the actual techniques used in sportfishing today are not very much different from those used by the ancient Polynesians.

Captain James Cook's Notes

In 1769, Captain James Cook was one of the first Europeans to drop anchor in Tahiti. He noted in his ship's log that as he approached Matavai Bay, near Venus Point, he saw many Tahitians sailing outrigger canoes racing around in the breeze. Had he actually looked a bit closer, he would no doubt have noticed that these same canoes were trolling fishing lines behind them.

Tahitians' Daily Fishing Captures

Before the European era, Tahitians had already fished for skipjack tuna (the large ones over 30 lbs. called *toheveri*) since time began, using trolling lures, made of pearl oyster shells; from lines fashioned from coconut husk fibers; or from the bark fibers of a coastal tree, the *purao*, or *hao* in Hawaii. And hooks were made of either wood or from sea mammal bones. They also targeted *ono*, *ulua*, mahi mahi, tuna and marlin using flying fish (*marara* or *malolo*) as bait. These bait fish were actually caught the night before, on the outside of the reef, by trolling a small lure made of pig hair, or bird feathers, with a small hook, behind a paddled outrigger canoe.

Zane Grey's Fishing Adventures

Until 1930, sportfishing techniques evolved slowly and naturally. Then the exploits of the famous fisherman and adventurer Zane Grey and his modern fishing innovations became widely publicized. Zane Grey wrote of his fishing adventures in Polynesia in great detail in his book *Tales of Tahiti Waters*. I would like to remind you that it was Zane Grey who recorded the world's first capture of a 1,000-plus lb. marlin using sportfishing tackle, and he did it in Tahiti in 1930. His blue marlin weighed in at 1,040 lbs., even though it was estimated that

sharks ate about 200 lbs. of his fish while it was being brought to the scales. In addition to his big blue, Zane Grey also caught a world record 163 lb. sailfish and a record 63 lb. mahi in Tahitian waters.

Gamefishing Evolves in Tahiti

Organized gamefishing in Tahiti has developed relatively recently, with the adoption of international (IGFA) rules and regulations since the early sixties, and more specifically since the creation of the Haura Club de Tahiti, our largest gamefishing club, in 1962. Actually, the Haura Club has been instrumental in standardizing fishing tackle and gear, and with the Club's participation in the HIBT since 1969 we have managed to bring back and instill the sportfishing ethic in Tahiti, following the spirit of sportsmanship and IGFA rules.

I would just like to pay homage to our friend and co-founder of the Haura Club de Tahiti, Mr. Leo Longomazino, who promoted sportfishing in Tahiti as an IGFA representative from 1966 until his passing in 1983. It should also be mentioned that Leo was also an early Governor of Pacific Ocean Research Foundation.

Tahiti's Fishing Waters Seem Particularly Blessed All Year Round

It is obvious that gamefishing cannot be developed without fish, and more specifically without those species we target for their elegance and combative nature. In this regard, Tahiti's waters seem particularly blessed all year round. We have seasons: from November to April marlin, *ulua* and *ahi* are more abundant, while *ono*, mahi mahi, and the large skipjack tuna (which can weigh in excess of 40 lbs.) are found between June and October. Even with the advent of the infamous El Niño, this seasonality is displaced by only a couple of months.

'Granders' Caught in Tahitian Waters

The blue marlin, which is without much debate, the oceans' "royal" gamefish *par excellence*, is by far our most important species, both in number and size. Even with our small fleet of sportfishing boats, we register at least five to ten marlin over 1,000 lbs. each year, and at least 100 fish of more or less 600 lbs. each. Blue marlin are particularly excellent fighting fish and it is not an easy thing to land a "big mama." Their capture in Tahiti is complicated by the fact that our waters are very deep, from 1,000-3,000 m immediately off-shore, and that these waters do not have a very well defined thermocline, which would normally tend to somewhat restrict these big fish from sounding beyond the line capacity of your reel.

World Record Captures in Tahiti Waters

There have been at least 12 world record fish caught in Tahitian waters, and I would just like to cite a few of them in the following table:

Past Records			Current Records		
Fish	Size and line test	Date	Fish	Size and line test	Date
Mahi Mahi	21 kg (46.2 lb.) on 8-lb. test	1973-1984	Dogtooth Tuna	9 kg (20 lb.) on 6-lb. line	1976
Skipjack Tuna	16 kg (35.2 lb.) on 20-lb. test	1975-1978	Blue Marlin for woman angler	37.2 kg (81.8 lb.) on 8-lb. test	1990
Blue Marlin for woman angler	385 kg (847 lb.) on 130-lb. test	1992-1994			

Captures of Note From Tahiti

In addition to the records already cited, I would like to add the following captures of note from Tahiti:

- October 1974, a 405 kg (891 lbs.) blue marlin on 130-lb. test.
- November 1978, a 385 kg (847 lbs.) blue marlin on 80-lb. test.
- March 1979, I had the pleasure and honor of capturing a potential world record of 565 kg (1,243 lbs.) blue marlin on 80-lb. line using an artificial lure. This fish was missing about 70 kg (150 lbs.) of flesh, taken by sharks after capture, while it was being towed to the pier.
- In October of 1995, the last official record for French Polynesia was registered, with a 429 kg (944 lbs.) blue marlin on 80-lb. line with an artificial lure.

I would also like to mention that the largest blue marlin that I have personally weighed and certified was caught in March of 1986 by one of our small coastal fishing boats, a *poti marara*, using an artificial lure and 160-lb. line. It weighed a very respectable 709 kg (or 1,560 lbs.). There have even been blue marlins caught in Tahiti which exceed 2,000 lbs., using hand lines and live bait while fishing on our traditional skipjack pole-and-line boats; in 1960, 1972 and 1976 in Tahiti, and in 1968 in Raiatea.

Captures During Our Last Inter-Island Fishing Tournament

During our March 1998 Inter-Island competition, with 24 boats and three days fishing, we had captured six blue marlin weighed in at 122 kg (265 lbs.), 129 kg (283 lbs.), 141 kg (311 lbs.), 184 kg (405 lbs.), 228 kg (501 lbs.), and the winner at 426 kg (938 lbs.) on 130-lb. line. Two days after the end of the tournament, another *bonitier*, or one of our traditional pole-and-line tuna boats, weighed in a 655 kg (1441 lbs.) blue. He used live bait and a heavy hand line, which does not really count as a sport-caught fish. However, it does show that we have quality gamefish in our waters. The week following the Tournament, one of our Haura Club

team boats brought in a blue marlin estimated at 480 kg (1,056 lbs.), unfortunately mutilated by sharks.

So, as you can see we do have fish in Tahiti. In addition to our blue marlin, we see the occasional black marlin, striped marlin, and large sailfish. Although rare, our striped marlin and sailfish are often of world record size.

Migratory Species

Marlin and *ahi*, or yellowfin tuna, are essentially migratory species. Their travels take them all over the South Pacific, as witnessed by results of tag-and-release programs, where fish tagged in New Zealand have been caught in Tahiti. The details of these migrations still escape even the most intense scrutiny of scientists who specialize in such matters. Nonetheless, according to our own observations from French Polynesia, blue marlin seem to form aggregations during the breeding season around Tahiti and in the Tuamotu-Gambiers Islands.

Aggregations During Breeding Season

Early in this season, around September and October, we start to see large females, “big mamas.” The much smaller males start to arrive between November and February, with a very marked peak in abundance at the end of January and beginning of February. Between late November through March, captured females are ripe with eggs in their ovaries and males are ready to release their milt.

Late in the season, in the end of March and early April, we catch the biggest females, but they are nearly always empty of eggs, signaling that they have already spawned. It appears then that these “big mamas” start slowly arriving in our waters in about September and the males start showing up about one month later. After spawning, males continue their migrations to who knows where, getting a one or two month head start on the females. It may be that the large females need to stay longer to feed actively and regain their strength before continuing on their northward migration route toward the Marquises Island, where blue marlin season is between May and September.

Even during what we might call our “off-season,” we still can catch quite a respectable size fish, probably because there is a resident population that does not migrate. Let us not forget that Zane Grey caught his historic 1,000 pound-plus blue in May of 1930, just a few nautical miles off the coast of Tahiti.

Nonetheless, there is still a question to be answered. Are blue marlin really in the same migratory pattern year after year? The answer must rest with scientists and their research. We sportfishers can only give our interpretations based on fishing experience and observations.

The Best Fishing Season in Tahiti

As you may have noted, the best fishing in Tahiti, between December and March, is not the same as for our neighbors in the Pacific, where it is normally,

- between July and September in Hawaii,
- between September and December in Australia, and
- from February to April for Fiji and New Zealand.

So, you can get good fishing all year round in the Pacific, if you just pick your spots correctly.

Networks and Infrastructure for Fishing Activities

Therefore, given our spawning aggregations of marlin in Tahiti waters during the “off-seasons” of the other renowned fishing areas, we can assume that, with the appropriate development, the future looks fairly bright for our gamefishing activity. It remains for us to carefully and progressively increase our network possibilities and infrastructure, to better accommodate visitors with more charter boats, increase capacity at our marinas, increase hotel capacity, etc. Witness the fact that at this very moment, we only have nine registered charter boats in Tahiti. This is obviously insufficient to satisfy the needs of those wishing to fish in our tournaments on foreign teams. So, when the request arrives, we make available about 30 well-equipped fishing boats, which are normally run privately by members of our own fishing clubs.

During sanctioned International Tournaments, numerous club members volunteer to give up their place in the competition, and themselves become “charter boats,” just to assure foreign participation. Aside from our International competitions, we are normally limited to about 30 teams for any one tournament.

Special Tahitian Ambiance and Hospitality at Tournaments

What the limited number of available boats loses in terms of economics, we more than make up for with our hospitality. The boat owners and operators themselves get involved directly in assuring that their angler guests are well served and taken care of. The boat captains are hosts for our angler friends from far away, in the grand tradition of Polynesia. This Tahitian hospitality gives our tournaments a special ambiance which seems to be much appreciated by all who participate.

Tahitian Billfish Tournaments

The Society Islands of French Polynesia have eight official gamefish associations who organize about 40 plus tournaments each year:

On Tahiti:

- The largest organization, the Haura Club de Tahiti organizes nine or ten tournaments each year.
- The Punaruu fishing club holds six or seven per year, and
- the Taiarapu Fishing club, four or five.

On Moorea: the Moorea fishing organizes one or two contests per year.

On Raiatea: the Haura Club de Raiatea holds six or seven tournaments.

On Borabora: the Bora Bora Fishing club has six or seven tournaments each year, while their Women's Club, the Vahine Here, organizes three or four Women's Tournaments, one of which is an "International" event.

Tahitian International Billfish Association and Tournaments

The Tahitian International Billfish Association, since its creation in 1984, has coordinated all the International Tournaments, and with the support of the Haura Club de Tahiti, the Tahitian International Billfish Tournament (T.I.B.T.) is held every two years. The Haura Club de Tahiti, the Haura Club de Raiatea and the Bora Bora fishing Club each take turns organizing an Inter-Island Tournament in the alternate years of the T.I.B.T. As you can see, we have quite a few tournaments each year at which we can practice our sport and they are attracting more and more foreign participation. Over the last few years even our Inter-Island Tournaments have seen the entry of more and more foreign teams and in the very near future we will have in effect an International Tournament each year.

Bora Bora March 2000, Special Tahitian International Billfish Tournaments

In 1999 Bora Bora will hold its International Women's Tournament in February followed at the beginning of March by the Inter-Island Tournament on Raiatea. And for something special at the turn of the century, Bora Bora will be the site for the Women's International and the Tahitian International Billfish Tournaments all at the same time in the first week of March 2000. We expect to have at least 50 boats entered, with about half these for foreign team entries.

Sport Fishing and the Tourist Industry

Sportfishing is becoming increasingly more important for our tourist industry, witnessed simply by the fact that each year at least 50 foreign anglers participate in our club tournaments and this lends an international flavor. If each angler injects about US \$15,000 into our economy, it begins to add up.

Value and Protect our Ocean

The islands and atolls of French Polynesia are spread out over an area about the size of Europe with an EEZ close to two million square miles. This represents more than one third of the total EEZ belonging to France. French Polynesia is also blessed with extraordinary pollution-free waters. Our population seems to be becoming more and more aware of the real value of its ocean riches, and is also becoming more involved in active measures to protect these riches.

The Commercial Fishing Fleet

Since 1990, French Polynesia has launched an exploitation program of the resources within its EEZ by expanding and constructing its own commercial fishing fleet.

Today, our professional fleet consists of:

- 50 tuna longliners,
- 30 smaller combination long line/pole-and-line tuna boats (actually re-fitted traditional pole-and-line wooden tuna boats of about 40 ft,
- more than 140 *poti marara*, the small open boats under 24 ft used to track down mahi, skipjack and flying fish, and
- another at least 120 traditional pole-and-line tuna boats, the *bonitiers*.

By the year 2000, this fleet will increase with the addition of another 15 tuna longliners of 25 meters plus, each having about 100 mt freezer capacity, five of which will be in the water by the end of this year. Add to that another 24 longliners of less than 25 m, which will target for the fresh-chilled tuna market.

Ocean Resources Exploitation and Tuna Production

Our production of tuna has risen from 2,000 mt in 1990 to 6,300 mt in 1997. We project that by the year 2003, we will be producing 11,000 mt annually, of which we expect to export about 7,000 mt, for a value of \$20 million. These exports started in earnest in the first four months of 1996, and by 1997 we exported 1,300 mt, mostly to the US mainland, Hawaii, and France. We also export high quality frozen albacore tuna to the canneries in American Samoa.

Effects of Commercial Fleet

The expansion of the commercial fleet has not gone unnoticed by the sportfishing community. However, for the time being, there has been little concern expressed, and no real effects have been noted. At this time we do not have much of a gear interaction problem, since the longliners tend to set a minimum of 12 nautical miles from shore and in areas where there is very little recreational fishing.

In fact, the development of the commercial fleet may actually yield benefits for the sportfishing sector, because with industrial fleet expansion comes increased research activity concerning, among other topics, the status and size of stocks in our EEZ, migration patterns, fish behavior, and regions of fish concentration or aggregations. This information can only help us in our own understanding of where and why we fish the way we do.

Gamefishing Clubs Assist in Research

Gamefishing Clubs themselves assist in research by practicing tag-and-release, and by keeping their own catch statistics. Since the early 80's, we have progressively put into practice rules and regulations for marlin tag-and-release points during our tournaments, and T/R rules have been in place for each T.I.B.T. since the beginning. In addition, all Haura Club and Inter-Island tournaments have had T/R points in their rules since 1990.

It should be pointed out that the concept of tag-and-release is not an easy thing for Polynesians to readily accept. As I already mentioned, we have traditionally gone fishing to feed our families, and this has not changed with time. Add to this the fact that marlin are a highly esteemed food fish, especially when prepared as the traditional *poisson cru* or lime-marinated fish. We have no specific permit requirements, regulations or documentation demands for sportfishing or for the sale of any fish caught. Permits are only needed to navigate and own a boat. Therefore, you can see why the installation of T/R in Tahiti is a rather important event, since you may be taking food and income from fishermen.

Protect the Ocean Environment and International Conventions

However, we hope that in the not too distant future we will put into action regulations to protect the whole ocean environment of our EEZ from pollution and the over-exploitation of its resources, and will assure the wise sharing of these resources by all concerned user groups. This is in fact the intent of the Montegobé Convention of 1982, with its Article 11 of July 1994, as yet not ratified by the United States. This Convention takes its text from the 1958 Geneva Accord on the Law of the Sea, in which the world's oceans are considered an inheritance to be protected for all humanity. As you know, this is the United Nations Malta Accord. These International Conventions put the responsibility of protecting the environment and its resources, and to conduct the relevant research to assure that these goals are met within each EEZ, squarely on the shoulders of the coastal states.

The Responsibility of Our Territorial Government

Now, following adoption of article 6 of the 1996 statute for the Territory of French Polynesia, the government of France transferred all rights and responsibilities for the control and management of the EEZ of French Polynesia to the Territorial Government. It is a considerable responsibility, and we hope that our Government will use all appropriate means to assure that our actions will always be within the spirit and context of the Montegobé and its amendments for the protection and wise use of our ocean resources.

Safeguard Our Common Ocean Heritage

The future of both commercial and recreational gamefishing in French Polynesia therefore depends on the success of programs put into place to protect the environment, to protect and share the ocean resources, and all within the framework of the Law of the Sea Accord. In concluding, I call on all of us to safeguard our common ocean heritage, and to also safeguard the future of our beloved sport. I would like simply to cite a passage from French poet and writer Charles Beaudelaire:

As free men, you shall always cherish the sea.

Discussion

In response to a question, Mr. Ellacott noted that his gamefishing club compiles their own catch statistics, since there is very little scientific research being conducted on his island.

CPUE Trends in the Striped Marlin Sport Fishery From Northland, New Zealand

John Holdsworth
Blue Water Marine Research
Peter Saul
The New Zealand Big Game Fishing Council

Abstract

A sportfishery based on seasonal catches of striped marlin has existed in New Zealand since 1924. From the late 1970's, attempts to collect Catch Per Unit Effort (CPUE) from the charter boat and private boat fleets included voluntary logbooks, monitoring of major tournaments, and an annual postal survey of charter skippers. The most consistent data series from 1976 to 1996 is the catch and number of days fished per season by gamefish charter boats in the main New Zealand striped marlin fishery off east Northland.

Almost all angling catches of striped marlin and other game species are made by members of fishing clubs affiliated to the New Zealand Big Game Fishing Council. Consequently, catch figures reported in the annual postal surveys can be verified from club records. Catch per charter boat day, averaged over the whole season, is considered a robust measure of CPUE. Changes in fishing area and techniques over the survey period and their potential impact on CPUE are discussed.

Management strategies aimed at protecting the recreational striped marlin fishery began in 1987. Exclusion of the foreign licensed vessels and a ban on commercial capture of all marlin species within the New Zealand Exclusive Economic Zone (EEZ) were the principal components of the new strategy.

Survey results have shown that catch rates for striped marlin improved significantly within two years of the change in management strategy. Overall there has been an increasing trend in catch rates over the nine years since 1987, with CPUE reaching record levels in 1995. This trend combined with record total catches seen over the last three years surveyed, leads us to conclude that the principle pelagic gamefish fishery in New Zealand is in good heart.

Introduction

The New Zealand striped marlin fishery

The recreational fishery for gamefish off northeastern New Zealand is an important component of the local tourist industry and is seasonal, with activity peaking between December

and May. The standard fishing year for all New Zealand gamefishing clubs begins on 1 July and ends on 30 June.

The main area of the striped marlin target fishery is on the Northland east coast with charter vessels based in the Bay of Islands, Tutukaka, Whangaroa, Mangonui and Houhora (see Figure 1). Striped marlin is the mainstay of the gamefishery in this area, with small numbers of blue marlin, black marlin, shortbill spearfish, and swordfish also caught. Yellowfin tuna and mako sharks are largely an incidental bycatch of the billfish fishery.

Surface trolling with baits and artificial lures is the predominant method of fishing with the majority of marlin caught on artificial lures trolled at speeds ranging from 4 to 10 knots. Since 1997 there has been a trend towards the use of live baits, either slow trolled or drifted, but the great

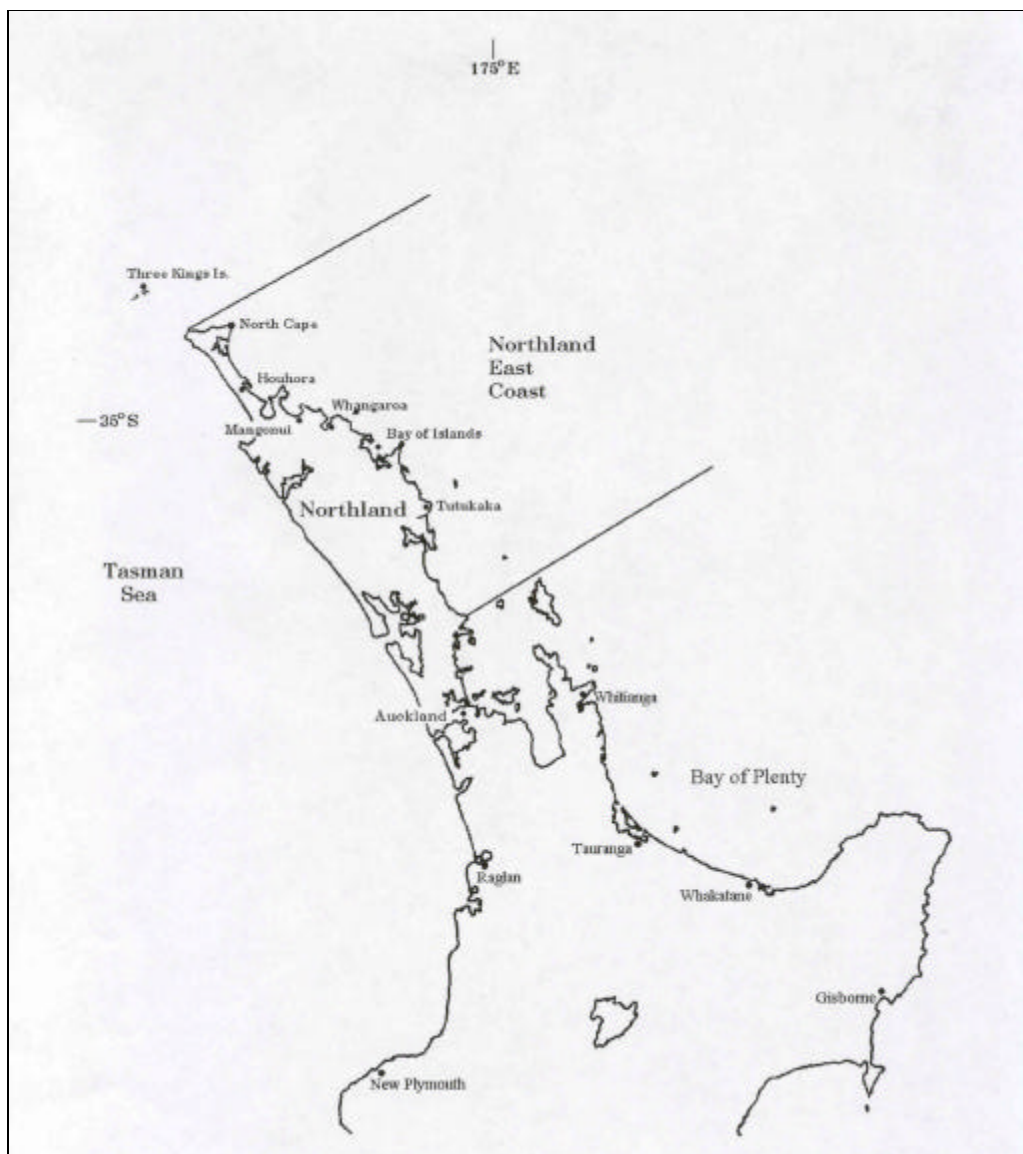


Figure 1: Northern New Zealand with the main gamefish ports.

majority of striped marlin are still caught on lures.

Recreational gamefish boats

Marlin fishing is extremely popular in northern New Zealand. In addition to the charter fleet, there are some hundreds of private boats ranging in size from five to 20 m, that participate to varying degrees in this fishery. However, the exact numbers and details of these vessels are unknown, since there is no system of licensing for recreational vessels or marine recreational fishers in New Zealand.

The charter boat fleet, on the other hand, is relatively small. There are approximately 40 charter boats between 11 and 18 m in length that have formed the core of the gamefish charter fleet on the northeast coast for the last 20 years. The operators of these vessels provide the professional base for the fishery, covering a wide area and fishing over the whole extent of the season. The charter vessels, while relatively few in numbers, are responsible for a large proportion of the billfish catch each year.

Catch records

The recreational marlin fishery in New Zealand is almost unique in that there are accurate club records for at least 95 percent of all billfish caught in the country since 1924. A breakdown of catch by species over the last 30 years from these records reveals that 93 percent of recreationally caught billfish were striped marlin, three percent pacific blue marlin, two percent black marlin and one percent each for broadbill swordfish and shortbill spearfish.

The Maori people fished with nets, traps and handlines but historically did not target billfish. In the early years gamefish were not sold or eaten in New Zealand. The primary reason sportfishers targeted these fish was to bring them to the scales to be recorded against the anglers name, just as Zane Grey had in his book *Anglers Eldorado*. A strong network of fishing clubs developed in each port that had ready access to prime fishing grounds. Clubs soon had a records officer, weigh master and published their catches in annual yearbooks. A commercial fishing licence is required to catch fish for sale in New Zealand. Consequently, recreationally caught striped marlin cannot be sold, though today it is never wasted, as it is highly regarded as smoked fish by anglers and their friends.

There have been attempts to collect gamefish CPUE through vessel logbooks, which were tried in the 1970's and again recently, but the response rate from charter skippers was poor and there was no long-term funding. Contest catch and effort has been collected. It provided reasonable snap shots of marlin catch rates in a particular area over four or five days. Anglers at some contests were interviewed in 1990 and 1991 to collect data on the number of hours fished, the number of lines used, location, etc., but it proved relatively expensive to collect this level of detail and this was not continued. CPUE from contests within the same season could vary considerably. This was likely to be due to changes in marlin distribution or summer storms that reduce fishability, rather than changes to overall striped marlin abundance.

Professional fishers have a more consistent level of experience than private vessel owners, they normally fish throughout the season, have good quality fishing tackle and have a radio network that can help target their effort. A day fishing for marlin by a charter boat is considered a more consistent unit of effort than a day fished by a participant in a contest. Charter boat CPUE averaged over the whole season, from a number of boats, may provide a reasonable index of striped marlin abundance when looking for trends across seasons.

Methods

The survey

Striped marlin CPUE data were collected via an annual postal survey of charter boat operators as a means of collecting information for the Ministry of Fisheries that could be used to review management of the New Zealand marlin fishery.

Questionnaire forms were sent to all operators running gamefish charter vessels from base ports on the Northland east coast at the conclusion of each season. They were asked for the total number of days fished for marlin, whether chartered or not, and their catch of striped marlin for the season. Some skippers were personally reminded to complete the questionnaire in order to maintain a complete time series for particular vessels.

The hours fished per day, number of lines used or number of anglers cannot be collected with this type of post season survey, as these factors may change from day to day. Charter skippers have indicated that a typical gamefish charter day consists of eight hours fishing with four or five lines deployed. The average weight of striped marlin caught in New Zealand is 95 kg, so skippers have predominantly used 24 kg and 37 kg line throughout the survey period. Very few skippers keep records of striped marlin strikes or hook ups throughout the season.

Days fished for each vessel could not be independently verified but their catch tallies could through the respective club records. Catch tallies for billfish were obtained from club and New Zealand Big Game Fishing Council records back to 1945 to show catch trends prior to the CPUE survey and to compare with the data collected.

Changes in the fishery

There have been a number of fishery-dependent changes over the survey period that may affect catchability (i.e., changes in technology, vessel type, fishing area and method). These are discussed below with a view of producing a more refined data set. The data is then standardised by effort (the days fished in a season by each boat).

Over the last ten years new charter boats have entered the fleet and there has been a revolution in electronic technology. Color sounders with temperature readouts, GPS navigation systems, and better communication networks are now available. These innovations may help charter boats target areas of marlin abundance more effectively but there is a widely held view that experienced charter skippers would catch similar numbers of marlin with or without their electronic

aids. There may be an advantage to less experienced charter skippers, however there is no data to quantify the effect of improved technology on east Northland catch rates.

Larger, faster boats and improved navigation technology have contributed to a recent trend for a few boats to safely fish new, distant fishing grounds to the north of New Zealand. At times, catch rates in the vicinity of the Three Kings Islands, where the Tasman Sea and Pacific Ocean meet, can be significantly higher than on the northeast coast. In 1995/96 six boats identified as fishing predominantly in the area north of New Zealand had an average catch rate of 0.51 striped marlin/day (sd 0.180) while the rest of the fleet fishing traditional areas averaged 0.20 striped marlin/day (sd 0.017) for that season. It is therefore important to standardise the area fished throughout the survey period by excluding CPUE records from the portion of the fleet that fishes the Three Kings area.

Another change that has occurred during the survey period that may influence catchability is the change from trolling baits to fishing with lures. This change occurred progressively between 1987/88 and 1990/91 seasons. At the time, there was some considerable debate about the catch rates of bait fishing versus lure fishing but there were other key reasons that prompted the switch to lures. Firstly, during the late 1980s the surface schools of kahawai (*Arripis trutta*), the most commonly used bait fish, started to disappear. Fishers were at times taking hours to catch sufficient baits for a day's fishing. Secondly, lures are generally towed faster, meaning boats can cover a wider area or go further offshore in a day. Thirdly, skippers who had experienced fishing in Hawaii realized they could increase their catch of yellowfin tuna and blue marlin by towing lures. Today charter skippers generally believe that there is no significant difference between catch rates from trolled baits and lures. Most agree that they have a higher strike rate while lure fishing but fewer firm hookups. There is no data from New Zealand to suggest a significant shift in catch rate occurred between 1988 and 1991 attributable to the switch to lures.

Standardising the data

One skipper was able to back date his catch and estimate his effort between 1968/69 and 1971/72. Two skippers provided data back to 1974/75 and three for 1975/76. The standardised means were only calculated for years where three or more skippers provided data. See Table 1 for the number of survey responses for each season.

Some skippers, for various reasons, fished only a few days a season. Some caught no marlin while a few had high catch rates. The CPUE recorded for these boats may not be representative of the season. Boats that fished less than 20 days per season were excluded from the standardised database.

The distribution of CPUE within seasons is approximately normal, so mean CPUE is used to compare striped marlin catch rates between seasons. Boats that fish most or all of a season are likely to give a better estimate of striped marlin availability and abundance than boats that fish some or part of the season. The standardised CPUE for each season was weighted by effort (number of days fished) for each boat. Effectively, boats that fished less in a season were given proportionally less weight than boats that fished more days. The weighted mean

was calculated using Formula 1, but a simple way to approximate this is by dividing total striped marlin caught by total days fished for all boats in each season.

Table 1: Details of the catch and effort collected in the East Northland charter boat survey used to calculate standardized striped marlin CPUE.

Season	Number of Responses	Striped Marlin Caught	Total Days Fishing	Standardised CPUE	Standard Deviation
1975/76	3	11	143	0.077	0.029
1976/77	14	140	1,301	0.108	0.012
1977/78	5	70	385	0.182	0.027
1978/79	9	150	862	0.174	0.012
1979/80	6	136	545	0.250	0.024
1980/81	6	84	508	0.165	0.023
1981/82	6	127	580	0.219	0.032
1982/83	8	126	802	0.157	0.030
1983/84	14	149	1361	0.109	0.008
1984/85	13	66	1247	0.053	0.008
1985/86	12	67	982	0.068	0.015
1986/87	13	51	905	0.056	0.007
1987/88	24	163	1,505	0.108	0.010
1988/89	30	401	2,049	0.196	0.012
1989/90	28	301	1,830	0.164	0.011
1990/91	21	149	1,563	0.095	0.010
1991/92	26	197	1,586	0.124	0.011
1992/93	26	226	1,538	0.147	0.014
1993/94	25	356	1,435	0.248	0.025
1994/95	20	384	1,516	0.253	0.018
1995/96	20	275	1,367	0.201	0.017
Totals	329	3629	24,010	Mean 0.150	

Formula 1: Mean effort-weighted striped marlin CPUE for each season where i = boat season, E = effort and $CPUE_i$ is catch divided by effort for each boat.

$$\overline{CPUE} = \frac{\sum_i^n CPUE_i E_i}{\sum_i^n E_i}$$

Weighting CPUE by boat days also has another advantage. Experienced skippers tend to fish more days in a season because they have built up a reputation and clientele. The catch rate of new charter skippers may be low in the first few seasons. By weighting the CPUE by days

fished, it reduces the weight given to inexperienced fishers who generally fish fewer days, and increases the weight given to the experienced skippers who generally fish more days.

Results

The average response rate to the postal survey since 1987 is 62 percent. Prior to 1987 there is no record of the number of questionnaires posted. Six skippers replied every year over ten or more years while others replied occasionally, or were charter fishing for a short time.

Data presented as standardised New Zealand charter boat CPUE for striped marlin excludes records prior to 1975/76 and data from the new fishery around the Three Kings Islands. Boats that fished less than 20 days in a season are excluded and mean CPUE is weighting by effort (see Table 1). The sample size varies between three and 30 respondents per season, representing 143 to 2,049 fishing days respectively. Over the 21 years surveyed, 3,629 striped marlin were caught by vessels in the survey from 24,010 days fishing.

Trends in the fishery

Striped marlin catch rates rose over the first five years surveyed, were relatively high between 1977/78 and 1982/83, then fell significantly by 1984/85 season (see Figure 2). After three poor years in the mid eighties catch rate rose in 1987/88. This was the first season after the distant-water tuna longlining vessels were excluded from northern New Zealand. However, a severe tropical storm in mid-March that year, brought a promising season to an early end. CPUE in 1988/89 season rose to a level similar to the that in the early eighties then dropped back over the

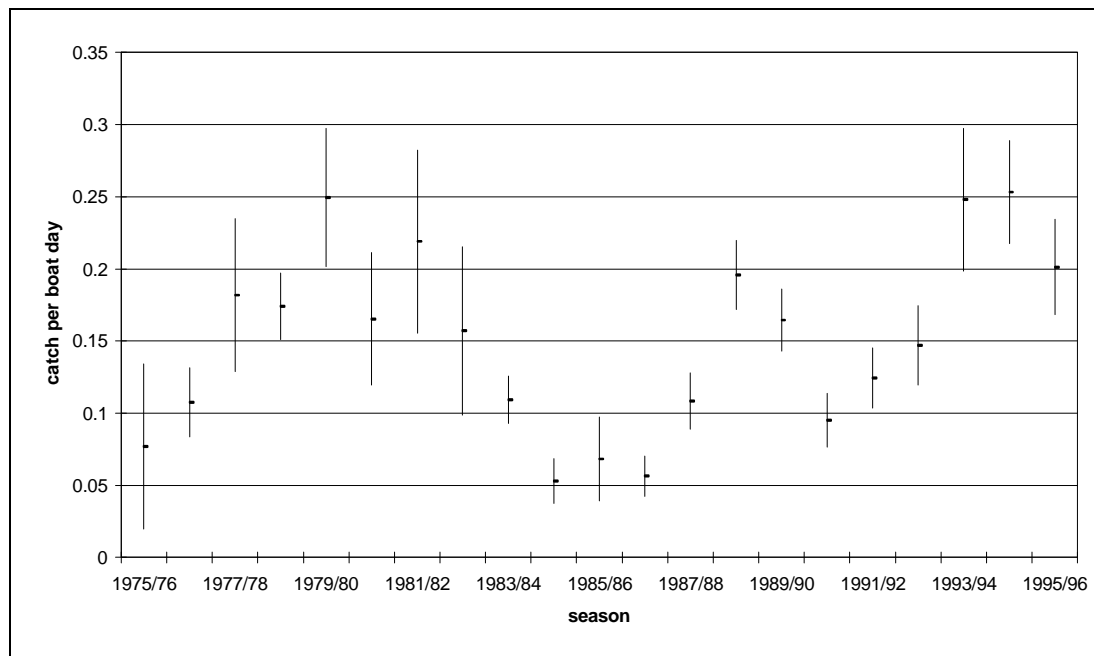


Figure 2: Mean CPUE (striped marlin per boat day) from annual charter boat surveys (± 1.96 * standard deviation)

next two years then rose sharply between 1992/93 and 1993/94 seasons. Overall, there has been a strong increasing trend in catch rates shown over two periods. Firstly, at the beginning of the survey period 1976 to 1980 and then from 1987 to 1995. The range in mean CPUE recorded since 1988, of 0.11 to 0.25 striped marlin per boat day, is on a par with marlin catch rates described for the Hawaiian International Billfish Tournament (Davies, 1995).

Striped marlin annual catch totals for all of New Zealand, which include fish landed and fish tagged and released, are available from New Zealand Big Game Fishing Council records. These records include at least 95 percent of all recreationally caught striped marlin. When plotted alongside mean CPUE a strong relation is apparent, with catch rates tracking changes in the total catch (Figure 3). National catch tallies have generally increased since the low in 1970/71 of 75 striped marlin to the peak in 1994/95 of 1950 striped marlin. CPUE shows peaks of similar magnitude in the early 1980's and in the mid 1990's. The much higher national catch during the mid 1990's with a comparable CPUE to the early 1980's indicates that there has been a significant increase in effort, particularly by private boats over this time.

The average number of days fished by each charter boat per season has dropped over the survey period. It fell by approximately a third between 1984/85 and 1987/88 as angler expectations of being successful were reduced over this period. There is a noticeable delay of three years between the drop in catch rate and fall in days fished. The average number of days fished per charter boat has not increased significantly since 1987/88 averaging 66 days per season (Figure 4).

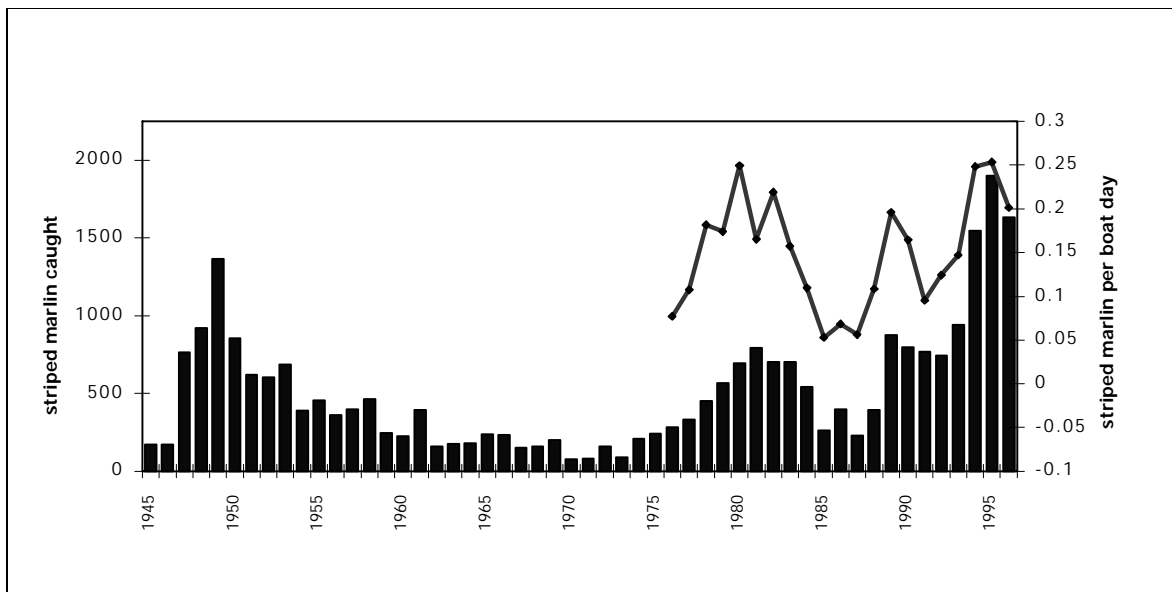


Figure 3. Total recreational striped marlin catch in New Zealand (left-hand axis) and the average catch per unit effort (striped marlin per boat day, right hand axis) per fishing season.

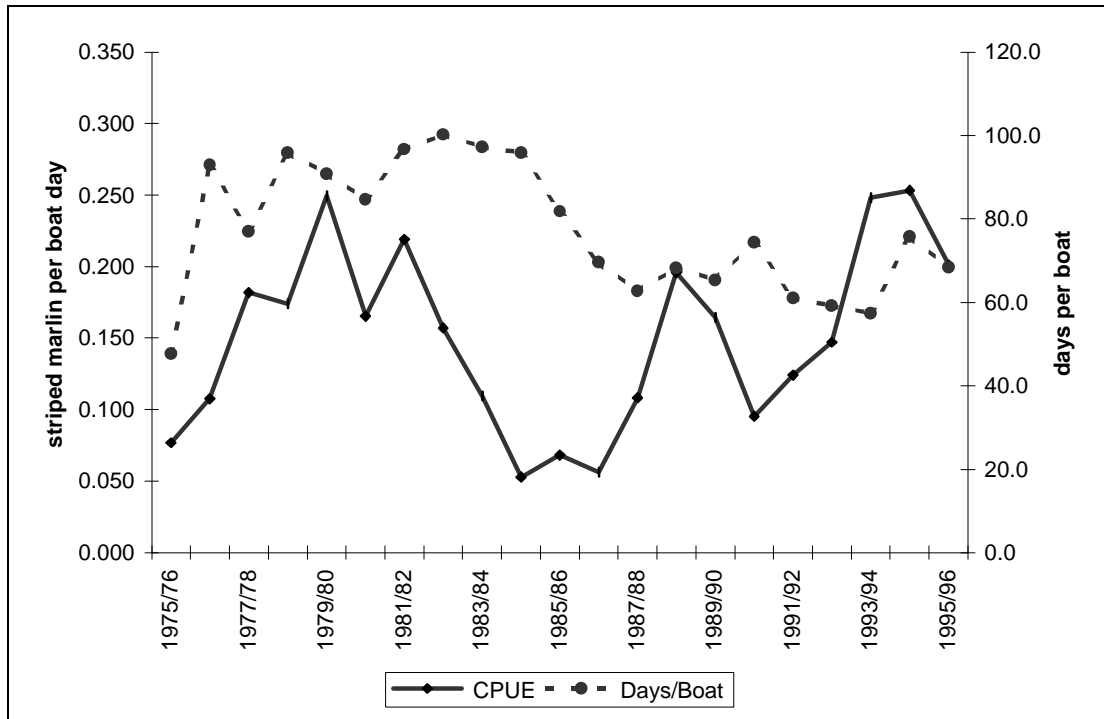


Figure 4: Mean striped marlin CPUE vs mean days fished per season by surveyed charter boats.

Discussion

The plot of mean CPUE can be viewed as bimodal with peaks in 1979/80 and 1994/95 seasons. (A project is underway to collect data for the 1996/97 and 1997/98 seasons but general comments from skippers indicate the catch rates are falling again.) A smaller peak appears in 1988/89. Looking at this data on its own, there may be some suggestion of a long-term cycle, but this is not apparent in the catch statistics during the 1960's and early 1970's (see Figure 3). The absence of these peaks does not appear to be due to reduced effort. There were 16 marlin charter boats working the Bay of Islands area in 1961. The number increased to 22 by 1968 and fell sharply after the disastrous 1970/71 season, then rose to 23 boats in 1981. If there had been an increase in the number of marlin available during the 1960s and early 1970's, these boats alone would have been sufficient to translate that peak into the catch records. A strong peak in catch recorded in 1948/49 is apparently not part of a discernible cycle.

The distant-water tuna longline fleet expanded significantly in the 1950's through the 1960's. Total commercial landings of striped marlin in the South Pacific are reported as 1,200 to 3,000 mt between 1954 and 1960, rising to 6,000-10,000 mt between 1962 and 1971, then falling (5,700 to 2,600 mt) between 1972 and 1985. Japanese longline CPUE for striped marlin in the South Pacific shows a declining trend from 1952 to 1978 (Suzuki, 1989). It seems that the near virgin South Pacific striped marlin population was fished down over this period, largely as a bycatch of the tuna fisheries.

The CPUE time series starts in 1976 and climbs steadily over the next four years, as does total catch. CPUE was relatively high (0.22 striped marlin/day) in 1981/82 then declined to 0.06 striped marlin per day by 1986/87. Part of the commercial longline fleet fishing in New Zealand waters appeared to be adopting strategies which increased the amount of marlin taken as by-catch between 1983 and 1987. In particular, they were fishing closer to the edge of the New Zealand shelf (about the 200 m depth contour) and began fishing earlier, thereby increasing the overlap of their fishing season with the season of striped marlin abundance in New Zealand (Murray and Taylor, 1992).

Late in 1987 the New Zealand government announced a moratorium on longline licences in the northern fishery. Catch rates recorded in this survey increased sharply from 0.068 to 0.196 in the first two years following the introduction of the moratorium. A similar lift in recreational CPUE was reported after a period of restricted commercial fishing off Mexico (Squire and Au, 1989). Commercial striped marlin catch does seem to be a factor that influences the recreational catch and CPUE in New Zealand. There have been attempts to quantify this and other factors using this CPUE time series.

In 1992, an analysis of a number of potential influences on marlin availability, using stepwise multiple regression of charter boat CPUE, was presented to a meeting of commercial and recreational fishers reviewing billfish management. The possible predictor variables used were:

- striped marlin catch by tuna longline vessels within 180 nautical miles of Tutukaka,
- the frequency of wave height above 2 m on the northeast coast,
- the Southern Oscillation index,
- the sea surface temperature at Leigh marine laboratory,
- the number of weeks at the beginning of the fishing season where the 20° C isotherm was present on the east Northland coast but not the west.

From the model all of these environmental and catch variables explain some percentage of the variation in recreational striped marlin CPUE. The only variable to be statistically significant at the $\alpha = 0.1$ level was the relative movement of 20° C water, which explained 32 percent of variation. A further 13 percent variation was explained by tuna longline catch within 180 nautical miles of Tutukaka, but this was not significant at the $\alpha = 0.1$ level (Murray and Taylor 1992). The indication is that the movement of surface water warmer than 20° C down the east and west coasts of New Zealand and hence the availability of striped marlin habitat varies at the start of good and poor fishing seasons. Recreational marlin catch was above average on the northeast coast in seasons when the 20° C isotherm impinges on North Cape, then moved slowly southward down the east coast, but did not move down the west coast for a further four to seven weeks. In poor seasons this isotherm moved southward more rapidly down both coasts. Updating this analysis to include the good fishing years in the mid-1990's when there was no commercial take of marlin in New Zealand waters may see the amount of variation explained by these variables change.

Changes in mean CPUE between seasons is at times quite consistent, as seen by the linear rises and falls over three or four seasons. These smooth transitions are often hard to see in contest CPUE, which tends to be more variable. Catch rates are nearly five times better in the best season compared with the worst (see Figure 3). It is unlikely that the abundance of striped marlin in the South Pacific is varying this much. This indicates that overlaying the trends in abundance are changes in availability.

Conclusion

In the New Zealand situation, where the charter fleet is relatively small and good catch records are kept, an annual postal survey has proved the most cost effective way of collecting a CPUE time series. Precision may be improved by taking account of changes in the fishery that affect catchability. Catch per charter boat day averaged over the whole season was deemed to be a robust measure of recreational fishing success for the 21-year span of the survey.

CPUE peaks in 1979/80 and again in 1994/95 season. No similar cycle is apparent from the catch records of the 1960's and early 1970's. Total catch reaches record levels during the mid-1990's was due to an increase in effort, particularly from private boats. The number of days fished per charter boat declined during the poor seasons in the mid 1980's and have not regained their former levels.

In the relatively small area encompassed by this fishery, availability can be affected by environmental factors, such as current changes that affect the distribution of warm oceanic water that striped marlin prefer. Behavioural factors may play their part through changes in the distribution of marlin or prey species. Catch by surface longliners adjacent to the recreational fishery also appear to have affected marlin abundance and availability in the recreational fishery since the 1950's.

Armed with a good CPUE time series, the effect of a range of environmental and fishery-related factors may be investigated. Analysis of El Niño effects, the relative movement of 20° C water around northern New Zealand, and commercial catch of striped marlin, need to be updated. Results from 1992 describe a significant effect of 20° C water moving mainly down the east coast early in the season.

It is recommended that CPUE data from other recreational target fisheries in the Pacific be collected. Collecting contest data can be a good start. Often this data can be backdated using contest records. Charter boat surveys such as described here can provide a more complete picture of the whole season.

In the New Zealand situation, prohibiting commercial marlin take from the 200-mile exclusive economic zone has had an affect on marlin abundance. Overall there has been an increasing trend in New Zealand striped marlin catch rates over the nine years since 1987. This trend combined with record recreational catches seen over the last three years surveyed, leads us to conclude that the principle pelagic gamefish fishery in New Zealand is in good heart.

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References

- Davie, P.S. 1995. *HIBT catch and fishing effort since 1959. A statistical perspective*. Pacific Ocean Research Foundation report.
- Holdsworth, J. and Saul, P. 1998. *New Zealand billfish and gamefish tagging, 1995–96*. National Institute of Water and Atmospheric Research Technical Report 16.
- Murray, T. and Taylor, P. 1992. *Variable striped marlin catches in New Zealand waters: the influence of tuna longline catches and climate on a recreational fishery*. Unpublished report for New Zealand Ministry of Agriculture and Fisheries.
- Saul, P and Holdsworth, J. 1992. *Cooperative gamefish tagging in New Zealand waters, 1975-90*. New Zealand Fisheries Technical Report No. 33.
- Squire, J.L. and Au D.K.W. 1989. Trends in the Fisheries for Billfishes in the Pacific. *Proceedings of the Second International Billfish Symposium*, Kailua-Kona, Hawaii, August 1-5, 1988. Part 2, pp 199-214.
- Suzuki, Z. 1989. Catch and Fishing Effort Relationships for Striped Marlin, Blue Marlin, Black Marlin in the Pacific Ocean, 1952 to 1985. *Proceedings of the Second International Billfish Symposium*, Kailua-Kona, Hawaii, August 1-5, 1988. Part 1, pp 165-177.

Discussion

Discussion centered on marlin migration patterns. In response to a question, Mr. Holdsworth noted that striped marlin occasionally move rapidly through New Zealand and into French Polynesia. They may also migrate towards Brisbane, Australia. However, there may be some stock separation, considering that the striped marlin in New Zealand are generally larger. Another audience member asked whether striped marlin movements are correlated with skipjack tuna and Mr. Holdsworth said he believed not. He also discussed migration patterns around New Zealand in relation to the 20° C isotherm.

The Saipan International Fishing Tournament: The Event and its Potential as a Conservation Tool

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Abstract

In the Commonwealth of the Northern Mariana Islands, the annual Saipan International Fishing Tournament has been held for 14 consecutive years. The tournament is organized each year by the Saipan Sportfisherman's Association.

Fishing tournaments are useful in promoting conservation of fishery resources. They focus attention on sportfishing rather than on commercial fishing. During the annual Saipan tournament, the Division of Fish and Wildlife collects biological data on all species brought in and this helps to educate the public and enhances public relations.

Billfish have been overexploited in both the Atlantic and the Pacific oceans and tag-and-release is the standard method for collecting biological data on these fishes. In the Northern Mariana Islands, tag-and-release is foreign to most local fishermen but can be effectively introduced through tournaments organized around tag-and-release and by promoting tag-and-release in the annual Saipan International Fishing Tournament.

Introduction

The Commonwealth of the Northern Mariana Islands (CNMI) encompasses 14 islands stretching over 400 nautical miles from Farallon de Pajaros in the north (20.5° N latitude) to Rota in the south (14° N latitude). Guam is also part of the Mariana archipelago although it is politically distinct from the CNMI.

Most CNMI residents live on the three southern islands. Saipan is the capital of the Northern Mariana Islands and hosts the majority of the population (population 60,000). A few miles south lies Tinian (population 2,700) and to the south of Tinian is Rota (population 3,500). Rota and Tinian are much less developed than Saipan. Saipan's main industries are tourism and garment production. In addition to the islands, there is a distinct chain of submerged seamounts located approximately 120 nm to the west—also in a north-south pattern and parallel to the islands.

Like most Pacific islands, the CNMI has a solid history of fishing. Fish represents a substantial part of the local diet. Trolling has evolved as the favorite method of fishing and trollers represent a significant portion of the fishing community. Most trollers fish out of small out-

board vessels and carry ice. Over the last 10 to 15 years, a roadside fish cooler market has developed where fish peddlers market whole fish caught by the day trollers. Larger fish is often sold to the hotels.

History of the Saipan International Fishing Tournament

Fishing tournaments are not new in the Northern Mariana Islands. Small tournaments for spear fishing, cliff fishing, bottom fishing, and trolling have been held in Saipan, Tinian, and Rota for a number of years. However, the Saipan International Fishing Tournament is relatively new.

The annual Saipan International Fishing Tournament was first held in 1985. That first tournament included a broad gambit of fishing methods: spearing, shore casting, cliff fishing, bottom fishing, and trolling. To organize this event, the Saipan Sportfisherman's Association was formed. The Association is made up of fishermen, businessmen, and other interested parties or individuals. Several CNMI government agencies are also involved, and these are: Division of Fish and Wildlife, Marianas Visitors Bureau, Saipan Mayors Office, and the Boating Safety Division. The Coast Guard Auxiliary also participates. Members of the Association are organized into various committees to oversee the components of the tournament. After the confusion and organizational chaos resulting from the myriad of categories inherent in that first tournament, pelagics became the only legitimate category making up the agenda of subsequent tournaments.

The Saipan International Fishing Tournament has grown into an annual event of major importance for the Northern Mariana Islands. Prizes and prize money are generously donated by local businesses and individuals. Major prizes have included airline tickets to overseas destinations, hotel accommodations, and boats and engines. The two largest traditional donors are Duty Free Shoppers with perennial donations of around \$3,000, and Mobile Oil Corp., which donates around \$8,000 worth of cash and prizes each year.

Proceeds brought in by the annual Tournament are first utilized to purchase prizes and the excess is donated to charitable organizations, such as the Catholic Social Services Program, the Saipan Youth Football League, and the American Red Cross. Nineteen-ninety-one represented the best year for proceeds (including all entrance fees, donations, etc.) was \$75,000. That year a Saipan boat retailer sold 22 boats. The lowest year for proceeds was in 1996, when only \$20,000 was received. The average total economic expenditure or benefit each year to the CNMI economy as a result of the Saipan International Fishing Tournament has been estimated to be about \$100,000.

Each year the Marianas Visitors Bureau sends Tournament invitations to various fishing associations throughout Micronesia, Guam, Japan, and Hawaii. In any given year, three to ten vessels motor to Saipan from Guam, 150 miles to the south, to participate in the Tournament.

In recent years, the number of entrants averaged around 60 vessels. Each vessel participating in the Tournament must first be safety inspected and passed by Boating Safety. To pass, a vessel must have a radio (either VHF or CB), Coast Guard certified life jackets, and other Coast Guard required safety equipment. Tournament vessels may only accommodate as many passengers as the vessel is rated for. And finally, each vessel captain must file a float plan before leaving the dock each day of fishing. As a courtesy service, the Coast Guard Auxiliary offers free vessel inspections and certifications for vessels meeting Coast Guard standards.

The Tournament is always held in August, which corresponds with the billfish season and usually offers the calmest weather for fishing. It is held on Saturday and Sunday, by the official clock, starts promptly at 6 AM and ends exactly at 6 PM. Boats may depart from any of three launch ramps along Saipan's west coast after they have been inspected and cleared by Boating Safety. However, they must return to Smiling Cove Marina to weigh-in.

The Rules Committee of the Saipan Sportfisherman's Association consists of seven officers and it alone decides the winning fish based on the weigh-ins. Contestants must pass through the Smiling Cove Marina entrance by 6 PM to qualify a fish. The only exception to this rule is when a contestant is assisting another vessel in distress and cannot make the deadline. The ultimate qualifying decision rests with the Rules Committee.

A participant may file a protest in writing to the Tournament Director or Rules Committee within one hour of closing. In the 14 years of the Tournament history, only one protest has ever been filed. In 1987 an entrant claimed he was unable to make the deadline because he was caught in a squall. The Rules Committee disqualified him.

How the Saipan International Fishing Tournament Can Foster Conservation

Staff from the Department of Lands and Natural Resources, Division of Fish and Wildlife, perform the weigh-ins and collect biological data on each fish weighed. Biologists and technicians measure the fish and dissect them to examine gonads and stomach contents. Data collected is added to a database for use in fisheries management and conservation. Biologists answer questions generated from the spectators and point out interesting items found in the stomach contents. This public display of scientific analyses draws attention from the crowd second only to the weigh-ins and promotes the value of science to the spectators. It offers an example of work with which the Division of Fish and Wildlife is involved, helps foster the concept of conservation and fisheries management, and improves the relationship between government and the oftentimes skeptical public.

Fishing tournaments in the Northern Mariana Islands have traditionally been kill tournaments. The concept of catch-and-release is foreign to most islanders. In the past, fish caught have always been used for family food or bartered or sold for other needs. To return a fish back to the sea is almost unthinkable. In 1967, while a Peace Corps Volunteer in Palau, I was spin-fishing from the seawall for needlefish. Needlefish are surface feeders and when hooked on light tackle, fight much like marlin. I would hook and fight a fish, then release it.

My Palauan friend, fishing nearby and obviously irked by my actions, asked me why I was throwing the fish back. I attempted to explain the reasoning behind my actions but then my friend said, "Those are good to eat." Fishing is not a game to the Micronesians. To the Micronesians, fish are food. This deeply ingrained island habit of keeping what one harvests is a difficult concept to overcome in getting across the ideas of conservation of resources.

The Billfish Example

Fishing tournaments are useful for focusing attention on sportfishing rather than on commercial fishing. Most big gamefishing tournaments revolve around billfish, and in particular marlin because they are generally the largest and most magnificent gamefish. Conservation groups are paying great attention to the overexploitation of billfish in all the oceans. It is appropriate that we focus on this group of fish. While it is realized that most billfish are captured by high seas longlining through both targeting and as bycatch, the domestic sportfishing sector also catches significant numbers of billfish.

Billfish are analogous to lions and tigers on land. They are the top carnivores and their numbers are by design far fewer than the herbivores upon which they feed. On a hunting safari to Africa in 1909 and 1910, Teddy Roosevelt and his party trophied over 300 large wild animals, returning to America a hero. This type of slaughter today is considered reprehensible. Yet in the world's oceans, this is exactly what is happening to billfish both through sportfishing and commercial efforts. Today, the annual commercial harvest of blue marlin in the Pacific Ocean alone approaches 21,000 mt.

In the Atlantic, great strides have been taken for the conservation of billfish. In the Atlantic, it is now prohibited for US commercial vessels to take marlin. More recent international agreements in the Atlantic are aimed at decreasing international commercial and recreational marlin harvests 25 percent by November 1999. But more effort is needed by conservation groups to spearhead efforts to rehabilitate billfish stocks in all the oceans.

The Role of Billfish Tagging

The International Game Fish Association has promoted tag-and-release as a conservation strategy worldwide for over 50 years. The Southwest Fisheries Science Center of the National Marine Fisheries Service sponsors billfish research in the Pacific and Indian Oceans through the International Billfish Angling Survey and the Cooperative Billfish Tagging Program. The Billfish Foundation and the Pacific Ocean Research Foundation both sponsor research programs aimed at improving the effectiveness of tag-and-release. Tag-and-release is considered by fisheries scientists an essential tool to better understand the overall biology and ecology of these fishes. It is a scientific method that works nicely with the sportfishing community. Billfish tagging increases awareness of resource conservation and of the importance of tag-recaptured data to fisheries managers. Recreational fishermen worldwide are becoming more conservation minded through catch-and-release programs.

On the local level, increasing awareness of conservation can be accomplished by introducing the concept of tag-and-release through tag and release tournaments. By sponsoring a tag-and-release tournament just prior to the major Saipan tournament, fishermen will be indoctrinated into a conservation mode. It is an exceptional experience to bring a big marlin alongside the vessel, effectively tag that fish, photograph it with the tag, and then return it to the sea. Local fishermen who accomplish a tag-and-release will be hooked and the word will spread; not about the big one that was caught, but about the big one that was caught, tagged, and released to fight again. It will be up to the Saipan Sportfisherman's Association to incorporate provisions for tag-and-release as part of the Saipan International Fishing Tournament. A simple observer program using Division of Fish and Wildlife personnel to record the tag-and-release can be utilized for documentation. The Division of Fish and Wildlife has plans to encourage tag-and-release in the future by offering free tagging sticks and tags to those interested in the conservation of billfish. DFW also wants to sponsor a tag-and-release only tournament on the weekend prior to the Saipan International Fishing Tournament. Through these efforts, it is hoped that fishermen might elect to tag rather than kill in the Saipan International Fishing Tournament.

Of course there are obstacles to this approach. In the CNMI, billfish, while not the most sought after for food, are still brought in to sell for “gas and beer money”—and also for the prestige. A monumental obstacle is a trait of most fishermen and what I call “fish macho.” It is the prestige that comes with bringing in a dead billfish for all to observe. Fishermen are highly competitive and the bigger the catch the better. This is part of the fishing tradition. Last year during the HIBT, I stood on the dock out here in Kailua with Kitty Simonds and several other people from the WPRFMC. Boats were coming in and the announcer was barking in the background. We were just part of the crowd, milling around waiting for something to happen. Finally, Kitty said, “Gee, No Fish!” And her remark said it all. All the billfish had been tagged and released and only through the announcer's proclamation of a tag-and-release of a certain size billfish by vessel “so and so” did we know what billfish had been caught. There was “nothing to see.” Only a few years ago the dock would have been laden with hanging marlin—dead marlin for all to observe and ogle over. So, for the bystander, tag-and-release may not be as exciting as witnessing a dead marlin. But for those fishermen who take part in a tag-and-release, the experience is substantial and exhilarating. Enough so to overcome those macho feelings of “kill and bring in.” “Where's the beef?” as Kitty had asked. Well, the beef is swimming free, but marked for science, until the next time.

References

- Anonymous. 1997. *The 1997 Billfish Newsletter*. Southwest Fisheries Science Center, NOAA/NMFS Pub., 6 pp.
- Eldredge, L. G. 1983. *Marianas Active Arc: A Bibliography*. UOG Tech. Rpt. #82. 19 pp.
- Hamm, D., N. Chan, and M. Quach. 1996. *Fishery statistics of the Western Pacific. Vol. XI*. NMFS Southwest Fisheries Center, Honolulu Laboratory, Admin. Rpt. H-96-08.

Uchida, R. N. 1983. *Summary of environmental and fishing information on Guam and the Commonwealth of the Northern Mariana Islands: A review of the plankton communities and fishery resources*. NOAA/NMFS Tech. Mem. #NOAA-TM-NMFS-SWFC-33, 150 pp.

Goadby, P. 1970. *Big Fish and Blue Water*. Angus and Sydney, Australia: Robertson Pty Ltd. 333 pp.

Discussion

An audience member asked about the status of conservation groups in Micronesia. Mr. Bryan indicated that there are no local conservation groups in the Northern Mariana Islands; another audience member added that there is a non-government conservation organization in Pohnpei, FSM.

Data Collection at Australian Gamefishing Tournaments: Long-term Monitoring of Catch and Effort and Biological Sampling

Dr. Jullian Pepperell
Pepperell Research and Consulting

Introduction

I am going to talk about catch effort monitoring in recreational fisheries. Commercial fisheries managers deal with catch-effort data all the time because it is an essential tool of fisheries management. Therefore, managers find it a bit hard to deal with the lack of data from recreational fisheries. As we all know, there are logistical problems in monitoring recreational catch and effort. Luckily, gamefish fisheries tend to be much more structured than other recreational fisheries. Therefore, catch and effort monitoring becomes somewhat easier, although it still has its problems.

In Australia, and in other areas as well, the gamefish fishery is a mixed fishery. Billfish are the pinnacle target, but sharks also play a very important role. Most of the tournaments in Australia have a point score system that incorporates shark and billfish and most of the prizes are won by the shark anglers. Mahi mahi and all the smaller tunas are the other gamefish that are very important. They are all part of the whole gamut of species that really needs to be monitored in order to understand fluctuations in catch effort. Fluctuation in catch-effort presumably give you a surrogate indicator of fluctuations in abundance, but that can be due to a whole range of things, including environmental conditions. The availability of data on many gamefish species can help to understand the whole ecology.

Tag-and-release is also important and increasing all the time. In Queensland, nearly all tournaments are all tag-and-release these days. The bulk of gamefishing, in terms of boat numbers, occurs in New South Wales and tag-and-release is upwards of 90 percent of the catch. Sharks and other gamefishes are also part of tagging efforts.

Tournaments are also about people. The social and economic aspects are very important: what the people are doing there, why they are there, what motivates them, and what they expect to get out of a tournament. It is also about big bucks: there is a lot of money that comes into coastal towns because of tournaments.

Biological monitoring of tournaments

Because tournaments are organized events, with a captive audience, it is relatively straightforward to come up with a system for monitoring each event. In my opinion the minimum

daily requirements are the number of boats that fish each day, fishing methods, and catch composition and amount. You need to know not just that so many boats fished on so many days, but the actual hours that they fished. The fishing method is extremely important in mixed gamefish fisheries. Out here you have two fishing methods, live bait and trolling lures. But in shark areas you may have trolling lures, drifting with live bait, or drifting with dead bait. The method obviously has a marked influence on the catch, so you need to be very much aware of not just the catch, but the method that was used for the catch. And then on a daily basis, you need to know the number of captures, the number of tag and releases, and the weights of landed fish.

It should be noted that the landed component of the catch is not just the fish that are brought to the dock and to the weigh station. A lot of statistics will only deal with that part of the catch, ignoring the landed but non-presented catch. This includes a lot of the smaller gamefish species, such as skipjack tuna, bonita, mutilated fish (cut by the propeller, for example), and non-line class fish (fish that weigh less than the breaking strain of the line). These are fish that are not going to score points in the tournament, so that they are not presented to be weighed, but they are definitely caught in quite large numbers.

We tried a gamefishing logbook many years ago in the Australia, and it didn't work. Certainly, people did fill it in, and some of them filled it in very enthusiastically. Unfortunately, that is the problem with logbooks: you get the enthusiastic fishermen who fill them in and the people who aren't too enthusiastic don't. Therefore, you get a very strong bias in your data towards the keener person, who probably has a higher catch rate than the average angler. Logbooks will only really work in a situation where there are strong incentives. For example, commercial fishermen fill them in because if they don't, they will lose their license or be fined.

Data Collection on Australia's East Coast

The data collection system that we have developed is intended to cover the entire East Coast of Australia, which is several thousand miles long. It is logistically difficult to cover that sort of spread. In Northern Queensland there are two main areas where billfish are targeted, Cairns and Townsville. Moving south, there is quite a big gap where there are few gamefishing tournaments. Tournaments around Brisbane target juvenile black marlin and sailfish. There are a whole gambit of tournaments in New South Wales; they dominate the tournament scene in terms of fishing effort. These tournaments are usually geared to coincide with the appearance of billfish, but sharks are a magic opponent as well. Bermagui is also an important gamefishing spot. The continental shelf at this point is the narrowest of the whole coast. It is only about six miles offshore from the coast to the edge of the continental shelf and it is a real hot spot for gamefishing.

Tournaments are held in all of those areas, so in order to get a handle on what was actually happening independent of formal monitoring, we looked at a few of the radio schedule sheets that were being operated. The whole system that we developed is based on mandatory radio reporting at regular intervals. Every two or three hours, vessels usually report their position,

which is based on a grid chart, and what they have caught. They use a zero zero zero system, which is used pretty well universally. That means strikes, hookups, and captures or tags and release.

Each club developed their own system and all these data were kept during the tournaments for safety and for general interest, but at the end of the tournaments they were just thrown away. This has been going on for quite a long time and I came up with 20 or 30 different sorts of sheets. Some were very detailed and some were just scribbles on the backs of envelopes. Since these systems already exist, the idea was to tap into them and to try and standardize the schedule sheet. We developed a standard schedule sheet in discussion with all of the radio operators that is computer compatible and friendly to a computer data entry person. It was distributed amongst the clubs. Some radio operators fill it in unassisted, but in many cases we have a port sampler who records the data on the sheet.

There is a network of volunteer coastal patrol organizations up and down the coast and the gamefishing clubs tap into that system. We have a very sophisticated mobile communication center that one of those groups has set up. That truck goes around to different tournaments and perches on a high spot to get in touch with the whole fleet.

The port sampler also does dockside interviews to get the non-weighed component of the landed catch. Not all boats are interviewed after a tournament, but as many as possible are, not only to find out what fish are being caught that are not going to be weighed, but also to validate the radio skid data. We found the dockside interviews to be much more important than we originally suspected. I also found that female interviewers got better cooperation than gray-haired blokes like me. Fleet cooperation has been very good; they see that there is value in it.

The next step was to develop the database and the data entry screen for ease of data entry. The database, in Microsoft Access, is very flexible.

Database Results

Information from the database indicates that there is year-to-year variability in the species composition of the billfish catch off New South Wales, and striped marlin have been the dominant species over that period. Striped marlin were not a dominant part of the billfish catch in the late 70's and early 80's, so we may have had a Southwest-Pacific-wide phenomenon during the mid 90's that increased striped marlin, for whatever reason. In Queensland, striped marlin are not a big component of the catch, while sailfish and juvenile black and adult black marlin are. Albacore tuna show quite a marked variation in availability from year to year. Tiger sharks are targeted and basically killed in not massive numbers, but significant numbers. There has been a drop-off in their numbers in one particular year. Whether that is due to biological factors or not, we don't know. In other words, we have a variable fishery, but at least we are getting a handle on this variability.

I mentioned that fishing method is very important. Database results allow you to examine these differences. Trolling lures or bait, compared with drifting and chumming for sharks, is very effective. Drifting and chumming is very good at catching sharks, but also catches a few billfish. Trolling doesn't catch very many sharks at all. You would expect that, but you need to tease it out of the data. You can't lump the catch and effort of both sectors, because the proportions of trollers and drifters changes all the time.

It is also possible to look at the how far off shore different components of the fleet fished in different years and how that affects the catch rate of billfish. It has quite a marked effect: most of them are caught offshore.

Biological Sampling

I will now talk briefly on the biological sampling and monitoring. These are the minimum sorts of things that I like to see happen when you are confronted with a billfish or any other species.

First of all, a person—such as a weigh master—needs to be able to identify the species and that is why identification guides are important. For example, over the years we have found that there are a lot of problems with people misidentifying large striped marlin as blue marlin. Occasionally we also find that recaptured billfish have changed species, which is a real problem. A lot of them shrink, too. We put out a field identification guide for billfish in the Indo-Pacific, primarily because commercial fishermen cannot retain blue and black marlin in Australia. Therefore, commercial fishermen should be able to identify their catch alongside the vessel. The guide is also designed to help identify billfish along side the boat for tag-and-release.

Good length measurements are important. But the fish have to be measured properly, in a straight line with a taut tape. A lot of the big fish have a curve in their body and that can give you a bit of an error. But if everybody is measuring the fish in the same way, at least we will have compatible data. Every fishery biologist carries a tape measure in his back pocket and uses it as often as possible. We always take three measurements on billfish: from the tip of the bill to the fork in the tail, from the tip of the lower jaw with the mouth closed to the fork in the tail, and from the rear of the eye orbit to the fork in the tail. The last measurement is necessary because historic Japanese data always records the length from the rear of the eye orbit, since they chopped off the bill.

Sexing fish is important, especially big ones, even though we know that all those 1,000 pound marlin are female. Of course, sexing takes a bit of training. I was just talking to a few people about the idea of having a kit or guide for sexing billfish. For example, I think a photographic guide showing a mature fish, an immature fish, a male, and a female would be a great idea. It isn't an easy thing to do if you haven't been trained, but once you're aware of what to look for, it's not that hard.

Finally, there is sampling different tissues for various routine studies or for specific research projects. For example, anal spines or other hard parts can be taken to age fish. A lot of genetic work has been done on billfish in recent years and a lot of the samples have come from tournaments. In fact, a striped marlin study reveals that the stock of striped marlin in the southwestern Pacific is separate from the eastern Pacific stock, and probably from the northern Pacific stock too. It looks like there are three stocks, which is very hard to explain, but the genetics certainly show that.

The future of billfish is partly in our hands and partly in commercial fisheries managers' hands. But with better monitoring, better sampling, and better research, I think we can all look forward to a long history of billfish fishing in the future.

This is a summary of Dr. Pepperell's presentation.

Discussion

In response to two questions, Dr. Pepperell described utilization of landed gamefish. Marlin is cut into chunks and given to friends; shark meat is often donated to charity. But tiger sharks, although large, are discarded. This is one of the few sources of criticism from tournament observers.

Dr. Pepperell noted that the presence of scientists at tournaments over a long time period allows rapport to develop between them and participants. This generally increases the level of cooperation when it comes to data gathering.

In response to several questions, he further discussed the data gathering program and results. He provided detailed information gathered in surveys on fishing methods and mentioned a full economic study of a tournament that was carried out. In relation to results, the data reveals a "pulse" or strong year class for particular species. This was evidenced in 1997. But club catch records, going back 40 years, show this phenomenon occurs regularly.

In response to another question, he agreed that it is important to distinguish between and compare angler-operated vessels and charter vessels. However, some tournaments are dominated by private vessels, while charter vessels are the primary participants in others.

A final question touched on the proportion of gamefishers that participate in club activities. Based on surveys in tackle shops, Dr. Pepperell argued that it was greater than 50 percent, so the data gathered through his monitoring program are representative.

Developing Gamefishing Tournaments in the Pacific Islands

Jody Bright
Tropidilla Productions

Introduction

My company (Tropidilla Productions) produces about 12 gamefish tournaments per year, and we have completed four tournaments in the past two months alone. In total this involves about 265 boat days, 109 teams, 12 cocktail parties, two award banquets, and \$303,300 in prize money. The tournaments my company promotes are for cash prizes, and this means different things to different people. Six different formats are used in mounting the 12 annual tournaments. Prize money amounts to between \$250 per team to about \$7,000 per team.

I became a professional fisherman in 1980 and up to 1995 fished up to 300 days a year, but nowadays fish only about 100 to 150 days per year. When not fishing, I am engaged as a consultant with organizations such as South Pacific Destinations on fishery destination development in all sorts of areas: fishery development management, tackle and gear testing, marketing, and promotions. I also arrange custom charters for individuals, and will shortly be taking a customer on an individual charter to Australia. I have conducted similar charters in French Polynesia.

Following my first season fishing in Australia, I began learning about spawning aggregations and large fish. When fishing other locations like St. Thomas and Venezuela I noted how these were all seasonal aggregations; fish were present for a couple of months and then they would disappear. Finding spawning concentrations of Pacific blue marlin is a difficult thing to do. Some spawning locations are known, such as the one in Kona, but most are difficult to access for one reason or another. The limiting factor is most often fuel, as many spawning aggregations are in the middle of the ocean. However, fishing for marlin is now an international sport and it had evolved in different ways in different parts of the world.

My father founded a fishing tournament in Texas, which at one time had the largest prize money in the world, which reflected the wealth generated by oil in the state. At its peak the largest prize was \$775,000, although these days the largest prize tends to be around \$300,000. This is a private tournament, held on private property, with no sponsors or advertising, and participation is by invitation only, as compared to *Bisbey's*, which is a big commercial event with many sponsors, and prize money of over a million dollars. In the past, many tournaments were used to either to promote a new fishing destination or launch a new marina.

Prior to going to the University of Texas, I decided to take a year off and go fishing. That was 20 years ago! I began working for a famous blue marlin skipper, Bobby Brown, and fished in locations such as Kona, Australia, Tahiti, and St. Thomas. During this period, I learned about seasonal spawning aggregations of large gamefish. In Tahiti I met with people involved in pelagic fisheries management and began to study longline information to determine the whereabouts of these spawning aggregations. At this time I was made aware of the South Pacific Commission and began requesting data from them. In summary, I have been studying longline fisher data with the purpose of finding new fisheries. I have also taught alternatives to longline fishing in Tahiti, where local people have an antipathy to such a passive fishing method, preferring instead more active methods of fishing.

In 1990, I worked for the *Madam and the Hooker*, who sent me to Vanuatu, the Solomon Islands, and Papua New Guinea to scout ahead for areas to fish when their boats were in those countries. Once again I was obliged to consult fishery data to ascertain the quality of fishing in these islands. I have also received fishing data from individuals in places such as the Solomon Islands during work there and during a period in Papua New Guinea when working for the Forestry Department. Getting data directly from the countries allows comparison with the information disseminated by international agencies such as the South Pacific Commission and FAO. In 1997, the University of Hawaii's Sea Grant Office asked me to make a presentation on the number of blue marlin being caught in the different islands of the Pacific. I also discussed my findings with the Western Pacific Council, who urged me to present this material, which is what I have been doing over the past few weeks at Council meetings.

Developing Tournaments in the Pacific Islands

If you want to have a successful fishing tournaments, you have to do the type of research and investigating that I have just mentioned. Each country in the Pacific will have its own unique suite of problems and you will encounter these when you begin talking to fishery managers and bringing gamefishing and fishing tournaments to their attention. If I am asked to develop a tournament or a charter fishing industry, the first question to be answered is the availability of fish and how this compares with other locations globally. Once it is established that there is a marketable fishery, you need to figure out costs to run boats in your particular location and where you fit on the price scale on the world market. These are the basic elements of getting a gamefishing industry up and running.

However, there are still many countries in the Pacific that do not have the right type of boats for tourist-oriented gamefishing. This requires investment in boats. Tahiti now by far has the biggest fleet that I know of in the Pacific Islands.* There are 12 or 15 suitable boats in Vanuatu now. Papua New Guinea has many boats and many gamefishing clubs, but most of them are private vessels, including a variety of trailer boats but they don't really have an organized fleet. The Solomon Islands has nothing. This is the only country in the South Pacific where I have been where there is no game-fishing club. They do have a sailing or yacht club, but it

* New Caledonia may exceed Tahiti in the number of gamefishing vessels.

is not a gamefishing club. Everybody else, especially, the Commonwealth countries, have plenty of gamefishing clubs, including centralized data collection and other related features. Across the Pacific, you encounter all these different aspects of gamefishing development.

Apart from fish and boats, other requirements include airline frequency, hotels and fuel. Those are the fundamentals. Most gamefishermen tend to be in a high income bracket and are plugged into information networks. News about catches of particularly large fish spreads rapidly, particularly now with the advent of personal computers, email, and web sites. Consequently, if you do have good gamefishing, you need to attract anglers and let them know about fishing in your area. Data plotting programs are freely available and are helpful in displaying information on catch and fishing effort. However, if you are thinking about developing a tournament, you should realize that you will be competing with places such as Abidjan (Ivory Coast), Canary Islands, Madeira, Portugal, Bermuda, the Turks and Caicos Islands, Puerto Rico, and all the Caribbean Islands that are developing their gamefishing industries.

More than 200 boats descend on four locations in Yucatan, Mexico, from the US during the two to three months of the sailfish season. Cabo San Lucas and other locations along the west coast of Mexico aggressively lure Californian boaters during the off-season and this is now big business. Costa Rica is still a big fishery, but it's more of a nature resort, or mother-ship type of operation. The same is true with Panama, but they have good fishing, with large numbers of fish and they've done a good job of marketing themselves. There are a couple of operations in Guatemala with several boats, and it is not unusual to catch 1,000 sailfish every year. Mexico has a day fishery for swordfish, which is unusual, as well as a blue marlin fishery. Elsewhere in the Pacific, Tahiti has a long-established gamefishery as does Hawaii. And now Midway competes with Hawaii in the same EEZ.

Of countries in the western Pacific, Tahiti is established, Guam has charter boats, and New Zealand and Cairns, Australia are very well developed. In the Indian Ocean, well developed gamefish fisheries exist in the Seychelles, Kenya, and South Africa. These are the developed gamefishing industries. Other countries have boats and gamefishing clubs. Countries with developing economies must keep in mind the investment of boats, availability of gamefish stocks, and the commercial gamefishing that already exists, and whether vessels have far seas access or whether they can only fish in near-shore coastal waters.

Tournament Development Guidelines

My work in the Solomon Islands was to ascertain how to establish sustainable sportfishing in that country. The first step for the Solomon Islands is to domesticate the commercial fishing industry, and this will take a long time. Most of the of the fishing pressure is generated by distant-water fishing nations granted access to the Solomon EEZ. As this is allied with low observer coverage, little is known about what is being caught beyond the target tuna species. Plenty of local people are excellent boatmen and would like to be employed in fishing. The only way to achieve this is to phase out the foreign vessels and localize the fishing industry. Once local dominance of the fishery is established, small boats (less than 60 ft) should be sufficient and can be outfitted with a variety of gear other than longlines. I have used short,

mile-long lines in Tahiti before, and you cannot do a lot of damage with this gear on a moving school of fish, but 30 or 50 miles of line creates a different situation. Purse seiners in your EEZ are another factor with which to contend and to possibly compete with. Access to information about all of these elements is necessary.

If you are a part-time fisherman, or a club member trying to run both a business and a tournament, you may need to talk with fishery managers to assess what is happening locally. Note that when you talk with fishery managers you should understand the background of commercial fishing in your country and learn about its role in the economy, how many people are involved, what is actually caught, and what is not caught. This can take a considerable amount of time and this is where people such as myself can assist in providing the answers to these type of questions

With respect to tournaments with prize money, you will need to find out if you have any local gambling laws that might be violated. The State of Hawaii has very strict gambling laws and the types of tournaments that we are allowed to do here are dissimilar to the ones that my family is allowed to do back in Texas. In the State of Hawaii one cannot conduct *Calcuttas*,* or a variety of other permutations on prize money awards. You need to research the specifics of the gambling laws in your country.

Conclusion

In conclusion, if you want to develop a gamefishing industry, including tournaments, without hiring professional help, then you will need to network with each other and pool the data you have available. A prime rule of marketing is to avoid spending money trying to attract customers from overseas until you have already accessed every single customer you already have at home. So use everything that is at your disposal before you go looking somewhere else. Try to conduct studies that determine the value of different sectors of your fishing industry, and how much impact gamefishing is likely to have. In many cases there are significant impacts. Keep accurate accounts of the spending and earnings of your fishing clubs and learn about the business of fishery management and the politics attached to it. Try and approach fishery management problems from different perspectives.

When you encounter problems and become frustrated, step back, put yourself in other people's shoes and look at problems from a variety of perspectives. People have different approaches. Some people make money from fishing, some people will never make money from it, some people do a little bit of both. The bottom line is, nobody is absolutely right, nobody is absolutely wrong. It is people and it is business. Of course, you can forget about management involvement and simply go fishing, but with the state of fish stocks these days, it will be

* *Calcuttas* are a form of gambling that is legal in some areas, but not Hawaii, to boost the total value of tournament winnings. A person entering a *Calcutta*, purchases the rights to half his or her potential winnings with the entry fee. The rights to the other half are placed for bid in an auction. The highest bidder buys the other half of the rights to the potential winnings. A person can buy the other half themselves, or someone else can outbid them. The higher the bidding, the higher the tournament prize money.

difficult to ignore being involved in management issues. If you are involved in management issues, be persistent and persevere. Gamefishermen have as much right to public resources as anybody else does.

Finally, I want to comment on the notion of marlins as bycatch. Striped marlin have a very high oil content and at certain times of the year they are worth more than yellowfin and bigeye in the Japanese and Asian markets. Longline vessels will target this species and if they cannot catch tuna, they will go to seamount areas to fill up with high value striped marlin.

This is a summary of Mr. Bright's presentation.

Gamefishing in Papua New Guinea

Robert O'Dea
Port Moresby Game Fishing Club

Introduction

I am going to talk to you about the structure of gamefishing in Papua New Guinea (PNG), which is very club oriented. I will talk about our tournaments. We have tournaments that international anglers visit, but we don't have any large international tournaments, per se. I will also talk a little bit about the National Fishing Authority, the fish that we catch, and the future of gamefishing in PNG.

I should also tell you that I have got a couple of other hats I am wearing today. One is as a representative from the Game Fishing Association in PNG. I also have a brief to report back to the PNG government's National Fishing Authority.

PNG is the largest island country in the South Pacific. In land area it is about twice as big as New Zealand. The population is about four million people. It is very resource rich, but very under-developed. I think the per capita GDP is about US \$500. About 85 or 90 percent of the people in Papua New Guinea live a very traditional village lifestyle. Although it is very under developed, some aspects are very pretty and there is a very large traditional component in everything in PNG.

PNG Gamefishing Clubs

The Port Moresby Club has about 200 members and about 40 active boats. There would be another 20-30 boats that are registered with the club but don't go out a lot. These boats range from 18 to 25 ft. There is a fair spread of boat types.

We have monthly competitions, all of which are like mini tournaments. They are sponsored and geared towards a particular species, line class, or area. It is fun to do it that way. Our sponsors are pretty generous, so most of our tournaments have got some sort of prize attached to them: cash, fishing tackle, or fuel.

The Lae Club is the biggest club in the country. It is very active, with nearly 300 members. They also have monthly competitions. The Madang Club, the third largest club on the PNG mainland, is a lovely little club. It is smaller than the others, but it is a very beautiful part of the world there. It may have the best fishing. The Port Moresby Club is blessed with a very nice, new marina. Madang has a small marina.

Moving on to the clubs based on the islands around PNG, the New Britain Club is reestablishing itself after losing all of its clubhouse and a lot of the boats to that volcano eruption a few years ago in Rabaul. They are getting up and running again right now. There is a fairly new, small club at Kimbe, which is on the other side of the same island. Although a very small community, they are active, they fish. There is one on Lihir Island where that big new gold mine is. It is expected that the population will grow rapidly because of the mine and they are establishing a small gamefishing club too.

To sum up, there are six clubs, with about 700 members. All of them are affiliated with the Game Fishing Association of PNG. I would also point out that I, like a lot of other anglers, regard this as my sport. It is competitive: we fish competitively year in, year out, or day in, day out, during the year.

The PNG Game Fishing Association is a properly constituted body with all of the things that hang off that. All of the gamefishing clubs in PNG are affiliated with the IGFA of PNG, as are some of the other sportfishing clubs. We even have sportfishing clubs in PNG that fish in the estuaries and target species like barramundi, black bass, and spottail bass. They are also associated with the IGFA of PNG, but its main roles are to administer our national records, which we control and run it in the same way as the IGFA does, and it to control an annual event called the PNG National Fishing Titles. This tournament is fished by anglers from PNG, Australia, and occasionally Kiwis. It is an event that is rotated through most of the clubs that can mount a fairly significant tournament.

The GFA is going to try to involve itself a little more in the lobbying aspects of representing clubs to the government and to the fishing industry. Gamefishing is strong in PNG and it is growing. We feel it is probably time for the GFA to say “we’re here, we want to talk.”

Fishery Management

The National Fishing Authority has a fishery management and conservation mandate. It also has a mandate to interest itself in sportfishing. But they don’t do anything about it, they don’t collect any data. They know that there are clubs in PNG that go sportfishing, but that is about all. We do talk with them and we know who they are and they know who we are.

Briefly, they control the issue of licenses to fish in PNG’s declared fishing zone or EEZ. And to give you a fix on that, there are about 20 longline licenses issued to PNG-based vessels and about ten purse seine licenses. There are also bilateral and multilateral treaties with the distant water fishing nations and cooperation under the FSM Agreement. Under this agreement with a lot of our neighbor countries—like Palau, the FSM, Nauru, the Solomon Islands, and the Marshall Islands, which are parties to the Nauru Agreement—we can fish in each other’s waters.

The National Fishing Authority also has a charter to oversee policing of these waters, which is extremely difficult. I think we have three boats in the Navy and they are usually in one place all the time. We rely fairly heavily on a lot of surveillance from Australian aircraft in

PNG and the National Fishing Authority has got to deal with lots of different government departments to make that happen. They have to work with the Defense Force, Customs, and the police; it is a difficult job for them.

They also need to deal with conservation issues and they work closely with organizations like the SPC, to insure that PNG fits in with western South Pacific fish stock conservation issues. Of course, they recommend policy to the national government and they also try to encourage PNG-based longline and purse seine operations.

In each of our own countries we need to try and discourage distant-water fishing nations from fishing in our waters, provided that we can establish local industries. We certainly need to recognize the fishery resource. But local industries are easier to control. They are easier to monitor and they certainly provide a lot more reward to the country from the fish they catch.

Tournaments

I think all the clubs run an annual competition, so you can fish on certain nominated days in some clubs. For instance in my club, Port Moresby, you can fish any day at any time to catch fish that contribute to your annual competition points. We have a big presentation night where you win all sorts of prizes for all sorts of different fishing categories.

The PNG National Titles is traditionally held at Easter time and the host club will run it over the two weekends of Easter and the whole week in between. This allows the local guys to fish their boats during the first weekend and during the week. They then make them available for visiting anglers on the final Easter weekend. This year the tournament was held in Lae. There were nearly 300 anglers fishing on 50 boats and we had quite a few people up from Australia, including Julian Pepperell, who came up to pinch bits of blue marlin and give us little talks about it.

The budget for that tournament was something like US \$75,000. We have two major sponsors that we look after very, very well: BP Oil and Rothmans. They are allowed to do that sort of thing in PNG. It is highly geared towards teams, rather than individuals. As of last year, there are equal prizes for tag-and-release and for capture, which is good. The champion team for capture on heavy tackle wins the same prize as the champion team for tag-and-release on heavy tackle. They are pretty serious prizes.

PNG has had a long history of tag-and-release. We have been associated with the New South Wales tag-and-release program for probably twenty years, so tag-and-release is very, very hot and strong in PNG.

Our major tournaments in Port Moresby, are the two-day cups that we run Saturday and Sunday. The shark derby is sponsored by SP, our local brewery. We had a big fish shoot-out, which is sponsored by different sorts of people each year, where we just mainly target big fish and kill them. We have a two day billfish tournament, which is probably half-and-half between tag-and-release and capture. We have a yellowfin tournament each year in February

when we get a run of reasonably sized yellowfins through Port Moresby. That is probably our premier tournament in terms of the number of people that turn up and the level of sponsorship we have.

The Lae Club has two major tournaments. The two day billfish-yellowfin tournament is run, I think, right after Easter. Their other main tournament is the South of Salamo Tournament. (Salamo is a region just a little bit to the west of Lae.), They also have a number of other smaller monthly cups that are run or tournaments throughout the year.

The Madang Club has got a billfish competition the name of which changes from year to year and an old tournament they have been running for years called the Karkar Classic. Karkar is a large volcanic island just off the coast of Madang.

We have no big money tournaments except for our National Titles. Although there is a fairly big budget to run it, the prizes are spread over a very large number of categories. If you are lucky enough to hook a really big blue and clean up, you might take away \$3,000-\$4,000 in prizes across several categories.

Record Fish in PNG

Some of our PNG record fish are a 600-lb. plus black marlin caught in Port Moresby quite a few years ago. The Pacific blue marlin record, 650 lbs., was caught in Lae. A decent size striped marlin was caught in Madang not so long ago, and also a 176 lb. Pacific sailfish. A 163 lb. yellowfin tuna, caught in Port Moresby, is our all-tackle record. A few bluefin tuna were caught in Port Moresby years ago. I think they must have been chasing the cold currents up. The biggest was about 648 lbs.

I have a few anecdotes regarding recent fish seen in PNG. A blue marlin well over 1,000 lbs. was hooked and boated in Madang very recently. Unfortunately, there was no meat left on it because the sharks had got at it. In the photo I saw, it just had a head and a tail with a core down the middle. But there was enough of it in the length and the bill to know the fish was well over 1,000 lbs. It was caught by Bret Middleton, one of the only charter boat operators up there.

There is another story about a black marlin that was killed by a stingray off of Lae about 18 months ago. Some local guys were out fishing in a small runabout, and they came in towing this thing into the wharf at Lae. They said that they had seen two giant marlin fighting each other out at sea. It would appear that what they actually saw was a huge black marlin jumping out of the water with a stingray hanging off of it. It must have been a huge stingray, because we have seen the tail of the stingray. It went in near the eye of the marlin and up into its brain and killed it. I have seen the head and the hole and the stinger of this thing, it is at least 1,000 lbs. or perhaps 800 lbs. It was just a huge black marlin for shallow water.

There was a photograph in our local paper about three or four months ago of a swordfish that had driven herself up onto the beach at Copper Bay, which is just down from Rabaul. It was

obviously chasing bait fish and had run itself up onto the beach and got its bill caught in some volcanic rocks on the edge of the beach. The locals all rushed down, put a tarp over it and dragged it away, but it was well over 300 lbs.

I am interested in the discussions about fish aggregation. We haven't been able to find where there are aggregations of blue marlin. We reckon that they are definitely breeding somewhere off PNG. In some areas there have been very small blue marlin seen and caught. They are spawning there, but we just haven't been lucky enough to find them yet.

The Future of Gamefishing

On the club level gamefishing is strong and growing in PNG. There are two excellent marinas in Port Moresby and Madang, and the Lae Club is building one as we speak. I am sure that club-based gamefishing in PNG will continue to grow. It is very heavily geared towards the expatriate community; Papua New Guineans hate tagging and releasing fish. The Papua New Guineans that I have taken out fishing on my boat all hate it when I tag a fish and let it go. They just really don't understand the concept of doing that.

In fact, it is quite difficult to talk to those guys about the concept of fishing for sport. Even if you are killing the fish, they really don't understand why you go out there and spend two or three hours trying to land a tuna on six or eight kilo line when you could put a decent heavy line out the back and get it in the boat very quickly and go out and catch another one. So that is an issue.

We only have two real charter operations in PNG. One is in Lae, with a decent 40 odd foot boat. The other is based in Madang. That is a great place to go and catch blue marlin and sailfish in a beautiful part of the world.

There are a number of factors specific to PNG. Security is a problem. It gets us a bad reputation in a lot of newspapers, particularly in Australia, New Zealand, and some of the neighboring Pacific Island countries. It is a result of youth unemployment in Port Moresby, Lae, and the bigger cities in PNG. Second, it is relatively expensive to travel to PNG, and relatively expensive to stay in PNG. With the American dollar exchange rate at the moment, it is probably okay for my American brethren, but it is a difficult place to get to and a difficult place to accommodate yourself.

There are also social issues; I mentioned before the PNG attitude towards sportfishing. Sportfishing within about ten miles of the coast in remote areas raises another issue. You are really fishing in someone else's backyard. I like to use the analogy of sitting in your backyard having a barbecue with your family when some guy jumps over your back fence and says, "Hi, I'm just going to sit in this corner." You would probably be fairly pissed off. Well, a lot of Papua New Guineans also get pissed off when people come and gamefish on their reefs. Papua New Guineans are not unique; I am sure most South Pacific Islanders would share their attitude. It is their water and we as gamefishermen need to be very sensitive to that. A lot of us are. Unfortunately a lot of us aren't, which ruins it for those of us who make the ef-

fort to go and talk with the people who own the water and squaring it away before fishing in their water.

Nevertheless, PNG is a beautiful place. Despite being hard to get to and having some security problems, those of us that live there and fish there certainly enjoy it, and I hope we continue to do it for many years.

This is a summary of Mr. O'Dea's presentation.

Discussion

In response to a question, Mr. O'Dea briefly discussed traditional black marlin fishing off the north coast of PNG. Another questioner asked if PNG is a breeding area for swordfish and Mr. O'Dea responded that he didn't think so. There was also some discussion about the capture of bluefin tuna, which are rare in tropical waters. Mr. O'Dea suggested that deep ocean trenches allow these and other uncommon fish to occasionally occur in PNG waters. Mr. O'Dea also briefly discussed FADs in PNG. The Lae Club has been active in deploying them. They are effective, but some have been lost due to dynamite fishing or problems with the anchor.

Big Fish From Small Boats: Challenge, Competition and Camaraderie in Hawaii Small-Scale Trolling Tournaments

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Every spring members and supporters of Hilo Trollers, a local style small boat fishing club on the windward side of the Big Island of Hawaii begin thinking of big fish and preparing for the annual season's slate of tournament competitions. The club operates on voluntary support and donations and deliberately tries to keep membership and entry fees low to encourage broad "local" participation. Hilo Trollers tournaments thus represent an intermediate category of small boat tournament that differs from both the smallest scale and the better known big money jackpot tournaments and prestigious international gamefishing tournaments held in Hawaii. This paper will summarize club history and operations, present some financial and effort data, discuss angler motivations and satisfactions, and suggest avenues for further research into the social values involved in tournament participation. These data are derived from the anthropological perspective of ten years of informal participant observation as a weigh-in crew member, captain of participating small boats, board member and past president. Extensive informal ethnographic interviewing of current and past members and supporters and review of club records contribute to the discussion.

Hilo Trollers fishing club has its beginnings in informal jackpot competitions held on summer weekends in the late sixties and early seventies by local commercial and part-time commercial/recreational fishermen who trolled from small boats for pelagic fish. These fishermen included experienced trollers and handliners, and some newcomers with their own boats who saw an opportunity to enjoy friendly competition and learn more about fishing techniques and grounds.

The distinction between commercial and recreational fishermen in Hawaii has been historically blurred, since commercial licenses have been inexpensive and many part-timers who primarily fish for pleasure and recreational value are licensed and legally sell a portion of their catch to offset expenses. Such "expense fishermen" represent a significant portion of Hawaii's small-boat fleet, while the portion of the fleet that is strictly recreational is not well documented.

In the early days of Hilo Trollers development, some sampans and larger vessels in the 30 to 40 ft range fished in these informal tournaments, but the bulk of the vessels are said to have been similar to those in the current fleet, primarily owner-operated outboard and inboard-outboard trailered vessels in the 19 to 24 ft range. Hilo harbor faces the windward side of the Big Island of Hawaii and is exposed to regular northeast trades. Thus, rougher seas prevail

compared to those in Kailua-Kona on the lee side, where the charter fleet and Hawaii's early gamefishing tournaments such as the HIBT came to be known internationally. There has been no active charter fleet in Hilo to support the larger-scale tournaments, although marlin and ahi are present in good numbers. Capturing such fish from your own small boat in rougher waters with only two or three people on board is viewed by some anglers as a greater challenge than fishing with an experienced charter captain and crew in the flatter waters of Kona.

Early members of the initial group of fishermen who formed Hilo Trollers had fished smaller scale tournaments in Kona such as those conducted by Kona Mauka Trollers, Kona Iki Trollers, and were familiar with IGFA rules. When Hilo Trollers became more formally organized around 1975, slightly modified IGFA rules were adopted and a slate of monthly summer tournaments was established. Trollers' rules allow the rod to be passed to the angler, but require all fish to be fought from a gimble. This is for the safety of the small crews in the rougher waters of Hilo. Lures may be releadered for reuse and a maximum of 130-lb. rated test line rather than tournament grade has generally been allowed. An experiment with a rules change to allow up to 180-lb. class line in order to encourage additional boats to participate is in progress but will probably end in 2000, as many members want to stick closer to IGFA rules and be more "sporting." Since 1991, there has been a standing active offer made by a club member who fishes in the HIBT to give \$100 to the first boat from Hilo Trollers to document a tagged and released Marlin during a tournament. So far, no boat has taken up this offer at least partly because of the need and demand for marlin, especially for smoking and a perception of possible waste through significant mortality rates for released marlin.

The pattern of summer tournaments culminating in year-end prizes as well as tournament rules and club bylaws have changed relatively little over the years. The club has managed to survive ups and downs in participation and remain continuously active through the efforts of volunteers and supporters. Tournament participants and supporters thus have a common interest in keeping the club operational, creating a small-scale networked community with shared interests and support of fishing in general. This is expressed through discussion of fishing conditions, peak fishing experiences, gear and techniques, and a general willingness to help each other and any other vessel at sea. Volunteer standbys with vessels in difficulty and tow-ins are common. The club engages in other forms of community service such as boat ramp cleanups.

Club Operations

Club bylaws establish the normal club officers of President, Vice President, Treasurer and Secretary as well as a tournament chair and set of directors and advisors that make up the governing board. The board is authorized to make rules changes, to set tournament dates, and make decisions on tournament prizes. The incoming president generally selects his own slate of officers and presents them at the general spring meeting, although nominations from the floor are accepted. As these are all voluntary positions that require a time commitment, social pressure on crew members and friends is sometimes used to get people to serve. Since 1991, the club presidency has been an obligation imposed on the captain who wins the cov-

eted but sometimes avoided position of “Fisherman of the Year.” This honor is won by the boat captain with the highest combined weight of the largest individual fish weighed-in under the four flag fish categories: marlin, *ahi*, *ono* and mahi mahi during the regular monthly tournaments from April through Labor Day. Historically, the “Fisherman of the Year” has received a Penn-130 gold reel from the club, a bowl from the governor, and a trophy from Suisan Fish Auction in recognition of their skill and success. Accepting the reel obligates one to serve as president, and a fisherman’s reputation and social recognition within the club and among fishermen generally, depends on their willingness to volunteer their time.

At the spring general informational meeting in February or March, new members are recruited, tournament dates are approved, possible rules changes may be discussed, and safety and radio protocol reminders are given. With significant continuity in membership and captains, no captain’s briefing occurs before the monthly tournaments. Tournament registrations are dropped at any of the five supporting tackle shops in the greater Hilo area on Friday before each Sunday tournament. A boat and crew list of registered members is developed at that night’s board meeting so the radio control volunteers and the volunteer weighmaster have checklists for the tournament.

Decisions about possible postponement or cancellation due to weather are made by the president and tournament chair in consultation with those board members who are available shortly after the Saturday evening NOAA forecast. By club rules, tournaments may run if caution is advised, but not if small craft advisories are posted. Postponement decisions may be controversial, since the forecast may change up or down before the 5:30 A.M. “start fishing” time. Some boats will choose to fish on their own even if the tournament is off due to small craft advisories, since they have had to prepare the boat and ice down prior to any postponement decisions. The board must balance the desires of experienced captains with boats that have self draining flush decks, who may share the perception that *ahi* come to the surface more in rough weather, against safety concerns and the need for smaller and family-crewed boats to have comfortable and pleasant fishing experiences.

Following each tournament, a board meeting is held to review the weighmaster’s fish tickets and tally and the cumulative fish tally of largest and total combined weight for each of the four flag fish and for any non flag fish weighed-in under the general category of “others.” This is reported in that month’s newsletter so all members know where each boat stands for year-end awards as the season progresses (see Figure 1). Any issues that arose during the tournament, plans for T-shirt design, fundraising and the annual Fall Banquet are discussed. Fish-talk, good local style food, teasing, and interethnic humor are important to the conviviality of these meetings, and the social aspects of this participation are part of the return for all of the work that is done to keep the club going.

Each tournament depends heavily on the radio control crew (two long-term volunteers) and the weighmaster and weigh-in crew (four or more volunteers, including the weighmaster, recorder, photographer and fish handlers). Early Sunday morning of each tournament, registered boats get a fishbox check before launching at Wailoa Boat ramp in Hilo bay, check in with radio control, report any crew changes, and line up by the breakwater for a 5:30 AM

Hilo
Trollers

Fish Tracking

1998, July

BOAT NAME	Largest MARLIN	Total	Largest AHI	Total	Largest ONO	Total	Largest MAHIMAHAI	Total	Others	Sum of Largest	Sum of Total	TOTAL FLAG FISH
AILINA			123.5	232	39	189			3	162.5	421	2
AYA T			140	343	45.5	45.5	9	9		194.5	397.5	3
CARLA H			120	223	39	354.5	14.5	23.5		173.5	601	3
DANETTE K			151.5	387	46.5	159			73	198	546	2
IPO KAI II			115.5	225	38	298.5				153.5	523.5	2
JENA	26.5	26.5	97	97	40	86	36	66.5	73.5	199.5	276	4
KAY LC III			128	349	39.5	76.5	16.5	25.5	348	184	451	3
KILISOU			125	125	22	40	21.5	74.5	17.5	168.5	239.5	3
LAURIE MARIE III			92.5	92.5	38.5	277.5	24	34.5		155	404.5	3
LAWA'IA			162	623	54.5	248.5	7.5	7.5		224	879	3
MAHALO							6.5	6.5	101.5	6.5	6.5	1
MAILE II					49.5	301				49.5	301	1
MAMO IKI			151	276.5			29	80	103.5	180	356.5	2
OLENA												
PUNOHU'ULA			107	107	15.5	30.5	8.5	16	50	131	153.5	3
ROBIN J					32	32	20	28		52	60	2
SLASH	193	193			47	167.5				240	360.5	2
TIFFY SY			126	227.5	39.5	272				165.5	499.5	2
TUTU LADY					38	72	22.5	22.5	18	60.5	94.5	2

Figure 1: Hilo Trollers tally sheet.

flying start. A captain and crew's strategy will depend partly on the season, and their standings and partly on their network of friends who may share information about where fish or bait has been reported earlier in the week. Information is also gleaned by hanging around the Suisan wholesale fish auction and listening to fishtalk on the morning prior to the tournament. Some captains may gain additional information by taking to nighttime handline fishermen on incoming boats, usually by tuning to an agreed upon CB radio channel or using a cell phone. This gives a perceived and real advantage to those members who fish more actively and commercially, than to weekenders and newcomers. Newcomers can learn from this and from listening to radio chatter as each hookup and each fish landed must be called into radio control giving the boat's location on the tournament grid (see Figure 2).

Generally, captains will work the Ono Grounds at Cape Kumukahi early in the season before the *ahi* have arrived to get their *ono* on board, and to have a shot at half of the \$10 per vessel side jackpot which is divided between the largest *ono* and the largest fish of the tournament. They may then go offshore or to one or more of the buoys to look for mahi mahi or live bait. If *ahi* or marlin are known to be around, many captains will concentrate on lure trolling or livebaiting for them since cash prizes for each individual Tournament are awarded for the first and second largest fish, as well as the largest of each of the flag fish, with more prize money going for marlin and *ahi* than for *ono* and mahi mahi. Hence a vessel with the largest marlin or ahi may well earn two cash prizes as well as half of the side jackpot.

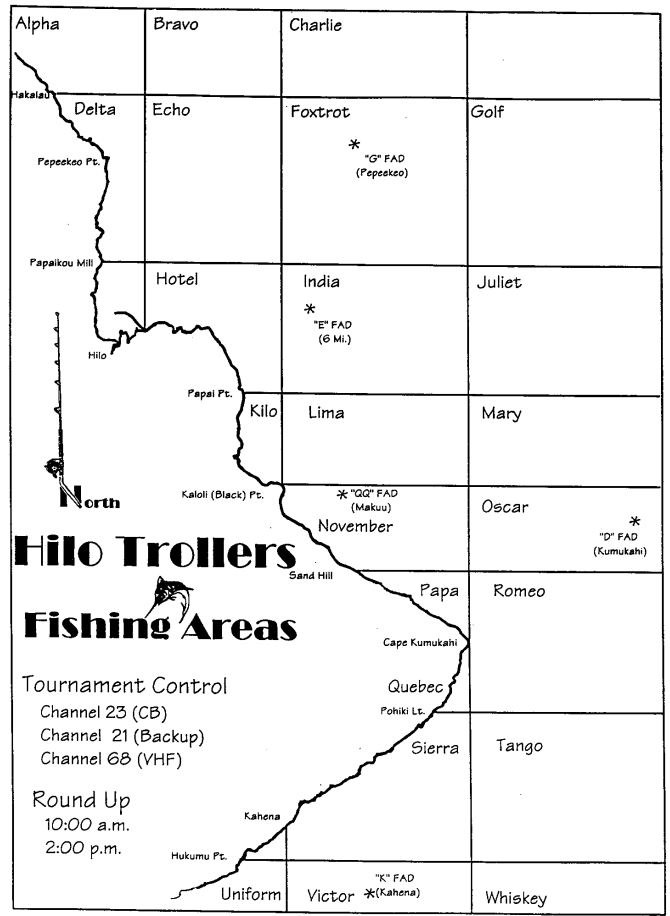


Figure 2: Hilo Trollers fishing areas.

For the more competitive captains, the strategy for each tournament is to maximize the prize money for that tournament while keeping an eye on the year-end. For the less competitive captains, the strategy appears to be to have fun, and maybe catch some fish, especially if children are aboard. The decision as to whether to go to grounds north or south of Hilo, and how far to go, depends partly on weather, and mostly on the captain’s information and strategy, since it is often too rough to change strategies or locations in midday by powering off to new grounds. Boats are expected to work their way back toward Hilo Bay by the afternoon 2:00 PM radio roundup since “stop fishing” is at 3:30 PM. and all boats must be back in the breakwater by 4:00 PM, unless they are hooked up to a fish. A reasonable but not excessive time may be granted to such vessels but the volunteer workers cannot finish their tasks until all vessels have been checked in and all fish have been officially weighed.

Suisan Fish Auction generously allows the Trollers to set up a certified scale on their fish hoist and to conduct the weigh-ins at the Suisan section of the Wailoa estuary pier. This is a popular gathering spot and there are always a number of people watching the fish be hoisted from each boat’s fishbox to be officially weighed-in. Captains and anglers get their photos taken with the fish and receive public social recognition for their skill and success.

The weighmaster and treasurer double check the fish tallies, determine the winners of the side jackpot, and write checks for the prizes for that tournament, which are given out that afternoon in a public presentation at the boat-ramp. Most fishermen wash down and park, so they can hang around talking story about fish and fishing and see the prizes given. Labor Day Tournament prizes and Keiki-Wahine prizes, if that tournament is held, are presented at the annual banquet along with year-end prizes that have been sweetened with donations from all the local tackle shops. Labor Day determines who becomes fisherman of the year and next year's president and that individual receives a public ritual dunking in the Wailoa river as a part of the Trollers' tradition.

Suisan Fish Auction sells ice to many of the Trollers and in recent years has kept an employee there on Sunday afternoons to receive any fish that are dropped off after weigh-in for the following morning's auction. Larger fish and a significant portion of a catch of numbers of fish are likely to be dropped off for sale, or kept and trucked in ice to the auction the following morning. A captain's catch distribution strategy depends on a number of factors that includes at least the following: the need to offset trip and tournament costs, which varies depending on the captain's degree of "commercial" orientation (influenced by occupation and socioeconomic status of the owner/captain); whether prize money is received; the need to share with family and crew; any upcoming social obligations or events where the captain may be expected to donate fish because of their reputation for being a source of fish; and a desire to donate some fish to radio control and the weigh-in crew. Smaller *ono*, mahi mahi and *aku* (counted in the others category for year-end and less prestigious), are most likely to be kept or shared and larger *ono* and mahi mahi, as well as *ahi* and marlin, are more likely to be sold. A rough estimate based on informal observation of fish dropped at Suisan after weigh-in during five tournaments in the summer of 1999 is that 70 to 80 percent are sold through this outlet and appear in State catch statistics.

A common local custom is to cut the first *ahi* of the season and give chunks to family and friends as a way of bringing luck for the rest of the season. Some trollers also consider giving fish to the weigh-in crew and radio control to be a source of luck, and may check if others have already donated before deciding on the distribution of their catch. The work and effort of the volunteers is appreciated and a number of vessels donate food, cash or beverages during tournament check-in. These donations are reported to the membership in the monthly newsletter and the cash donations are used to provide a year end gift and recognition for the weigh-in crew and radio control at the fall meeting and annual banquet. One captain has successfully convinced other captains that adding new members and taking beginners along brings "beginners luck." Nevertheless, most captains operate with trusted and experienced crews of one or two.

Club Finances and Tournament Costs

By club rules, all persons onboard participating vessels must be paid members except during the two-day Labor Day Invitational Tournament, which allows non-member participation. Still, Labor Day fish only count towards year-end prizes if all fishers onboard are club members. The club's liability insurance now requires at least one member to be onboard each

participating Labor Day vessel, and the invitational tournament now draws few additional vessels. Club membership is \$50 per person for which one receives a club T-shirt. It is considered customary for captains to pay for crew memberships, and most do. The majority of boats have at least three paid members, but may often run with only a captain and one regular crew member. A few boats have crews of four or five but usually don't run with more than three or four people onboard because of space constraints. Membership money is used for club expenses, but it is important to note that in contrast to many jackpot tournaments in Hawaii, there is no profit taken by the club as organizer. Aside from carry-over money to start the club off for the year with scale rental, insurance costs, and radio repair, all money goes into year-end prizes and the banquet. There are no paid positions and computer; office space, and often copying, are all donated.

Tournament entry fees are kept limited to \$40 per tournament day with the \$10 side jackpot optional, since it is recognized that higher entry fees are burdensome for many of the smaller boat owners and likely to reduce participation. Thirty percent of a regular tournament's entry fees are kept for expenses, including a small amount of money for lunches for the weigh-in crew and radio control volunteers. The remainder is divided into prize money for that specific tournament. The amount of prize money given for each boat depends on the number of participating boats and whether fish have been landed in all categories. A participating captain/owner/operator thus feels the need to offset some operating expenses (\$50 per crew or guest per season, \$50 per tournament entry, \$60-100 for gas and \$20 for ice per tournament, and leader and lure replacement) with fish sales and prize money. It is doubtful that many of the weekend warrior participants actually make any real profit, unless they win a number of prizes including year-end, given vessel and gear repairs and amortization costs. The overt costs of participation are reduced and thus justified to oneself and perhaps to one's spouse, and the pleasure and camaraderie of participation are gained whether many big fish are caught or not.

Some Trollers boat fish in additional Big Island tournaments, including an informal Fourth of July Jackpot, Wee Guys, Alii Kai, Kona Gold, and the larger jackpots, and a few members have fished the Pro-Am and the HIBT on larger vessels. Such participation enlarges a crew's competitive experience, and their network of fishing acquaintances but usually has significantly added costs of higher entry fees and hotels, which are offset only if significant prize money is earned. These participants tend to have higher incomes than the average club member.

The number of participating boats in Hilo Trollers tournaments is said to have been small in the 70's and to have grown in the 80's. It grew from approximately 30 vessels in the early 90's to over 45 vessels in the mid-90's and has hovered around 19-20 vessels per tournament since 1998. A number of former members have gone into commercial handlining, which has lower fuel costs and higher catch rates. Their participation in the trollers has improved their skill level and probably broadened their information networks, which increases their commercial competitiveness. Others have stopped out to have children, build houses, or have had employment changes that affect their ability to participate. The kinds of factionalism inherent in any organization may also play a role, but the economic downturn on the east side of the

Big Island, higher fuel costs, and a perception of declining fish stocks are viewed as the main causes of a decline in participation.

Recent club boards have operated under the premise that, given the current fee structure of the club, 16-18 participating vessels represents the bare minimum to maintain the club's viability as an organization. Tournament costs need to be kept low, while tournament prizes need to be kept adequate to keep the membership happy. Fortunately for the Trollers, all five tackle shops in the greater Hilo area, a number of local luremakers, and other businesses have been quite generous with donations of fishing gear and other prizes for the annual banquet and angler recognition. The board must hustle to get enough donations to make the banquet and banquet raffle an occasion memorable enough to draw returning members the following year and keep any grumbling under control. The budget totals for 1998 and for 1999 were roughly \$20,000, with all volunteer labor, no organizer profit, and all funds going back to the membership in year-end prizes except \$2,000 to \$3,000, which was held back for insurance and start-up for the following year.

Social Value of Participation

Formal social surveys of any activity group are best developed out of extended informal ethnographic interviewing and general familiarity with cultures of the participants. Trollers' members have participated in formal surveys (Miller, 1995) and are likely to do so in the future. The qualitative interpretations presented here are best understood as preliminary statements that are subject to test and refinement through future social research. Hilo Trollers membership crosscuts all ethnic identities represented in the greater Hilo area and a range of occupations and socioeconomic statuses. Japanese, Portuguese, *Haole*, Filipino, and Hawaiian are represented with a "Local" identity and style of communications prevailing. Occupations range from physician, insurance agent, small business owner, teacher, mechanic, truck driver, and accountant, to college professor. Participation in the common activities of the club links members and supporters with a common interest and purpose, and gives them a common discourse. When members meet, there is an awareness of shared experience and interest, and there is usually sharing of information about recent trips, fish availability, and future plans. People are more likely to share "real" fish information with other trollers than with non-trollers, and coaching and advice on gear and techniques does occur.

There is also a sense of shared responsibility for providing satisfying fishing experiences and intergenerational continuity. Some older captains have passed on responsibility for boat operations to their sons and others are grooming sons for participation by teaching them tournament rules and a sense of responsible fishing. The club, with assistance from Big Island Fishermen's Association, provided all the volunteered labor and equipment to match the State of Hawaii's gravel contribution to level and grade the enlarged boat parking area at Wailoa ramp. The club regularly participates in voluntary ramp cleanups and board members monitor harbor improvement plans and participate in the public hearing process by representing fishermen's concerns.

Participation in the Trollers tournaments provides members with a focused opportunity for friendly but serious competition in sometimes challenging ocean conditions. Members hone and practice their skills and can learn from each other. They can also take pride in each others successes. Newcomers are often told that participating in the Trollers will give them opportunities to learn the grounds and appropriate gear. When a large fish is landed after a long fight, congratulatory messages are sent over the CB radio channel by other vessels.

The public weigh-in and photo-taking brings social recognition of skill and competence to the captain, crew and angler on each participating vessel. The public giving of the prize envelopes also gives social recognition and a sense of pride, as well as offsetting some of the trip costs. The annual banquet gives social recognition to the captain, crew and boat for each year-end award, as they must come forward to receive it in front of all the Trollers members, supporters and families who attend. Winners of donated raffle prizes also receive recognition, and there is much joking and teasing, including the interethnic teasing that is part of Hawaii's contemporary "local style".

The camaraderie that is shared through participation in the club, in tournaments, and in all ancillary club activities enhances the social recognition and gives members a sense of belonging to a special group. This sense of camaraderie may be an important reason for continued participation in the club along with the opportunities for serious but friendly competition. The recreational value of tournament competition is central, even if money is earned through tournament prizes and fish sales. The shared experience of competing with each other over a seasonal slate of tournaments where a degree of luck and chance is recognized by all, brings trollers together in camaraderie.

Opportunities for Future Research

Hilo Trollers is one of a number of small boat fishing clubs in Hawaii that organize tournaments. How representative its membership is of the larger tournament scene and the recreational/commercial fishery can only be determined by comparison with an adequate social profiling of the larger community of vessels and anglers in Hawaii. This description of one club's operations and style does give a "slice" of the small boat tournament angling experience. Future research done in collaboration with clubs like the Trollers, and by larger scale angler surveys could lead to an increased understanding of angler motivations, patterns of decision making and the social value of participation in tournaments.

The complex issue of sorting the strictly recreational from the recreational/commercial and the more fully commercial segments of the fishery could be approached through voluntary responses to questions about commercial license holding by participants, catch distribution decisions and the social and ceremonial obligations that may lead captains to give fish. This could represent an independent check on state estimates of the number of strictly recreational vessels and the unsold portion of the catch without raising major issues of question sensitivity and violating confidentiality. Club catch and effort records, where adequate, could be examined for trends in catch rates and size frequency data. An incentive for clubs with

adequate records to share this data could be a graphic representation of hookups and landings by species, time and grid to be shared with members.

Angler motivations, attitudes about selling fish, and decisions about remaining commercially licensed under changing conditions could also be assessed by working with clubs. We would anticipate better response rates to interviews and social surveys supported by clubs than those that come directly from state or federal agencies. At least two members of Hilo Trollers have recently decided not to renew their commercial licenses and stop selling fish because of increased enforcement of Coast Guard safety regulations and the perceived excessive cost of a commercially-required life float or inflatable buoyant apparatus. Under current state reporting requirements the catch of these anglers, and by extension their future stake in the fishery, will no longer be recorded.

The recreational value of the angling experience and the social recognition and camaraderie shared by small-scale tournament participants is an important focus of activity, whether one sells fish or not. The opportunity and ability to catch and display one or more *ahi* or perhaps a marlin per tournament season has continuing and important social value to the anglers who have invested in boats, equipment and friendship through clubs. Any future management planning and regulation, especially quota-based management that may allocate between recreational and commercial sectors, will need to take the social value of small scale tournament fishing into account. Involving clubs in the research and educational aspects of the management process should improve the quality of the data and may make management decisions more acceptable.

Acknowledgments

Deepest appreciation to all the volunteers who have kept Hilo Trollers alive, to the past and current presidents and board members who have supported the idea of my writing about the club and granted access to club records, to Marc Miller and Chuck Daxboeck who encouraged my symposium participation, and finally to Auntie Kitty Simonds whose Hawaiian good luck wishes as I left the symposium to ice down for the following day's tournament brought us the largest marlin of the season, a good *ahi*, the title of fisherman of the year, the club presidency for 1999 and all of the voluntary work that entails!

Reference

Miller, Marc. 1996 *Social Aspects of Pacific Pelagic Fisheries, Phase 1: The Hawaii Troll and Handline Fisheries*. University of Hawaii, SOEST 96-04, JIMAR Contribution 96-302.

This paper is a substantially revised version of an informal presentation at the Pacific Island Gamefish Symposium.

Discussion

Dr. Miller asked if the Hilo Trollers club has difficulty recruiting new members, especially among the young. Dr. Severance replied that there are two married couples in the club that fish together. This could be one form of recruitment. More generally, recruitment is difficult and membership is down. Some fishers outside the club, who fish in jackpots and the HIBT, consider the Trollers' prizes too small.

Gamefish Tournaments: Perceptions of Public and Press

Ray Pendleton
Mid-Pacific Information

Over the years, I have had the opportunity to view many gamefish tournaments from several different vantage points: as a participant, an organizer, a publicity and media coordinator, and as a member of the press. From the combined experience provided by those views, I have worked to develop some insight into the thinking of the press corps and the general public regarding such tournaments. One caveat must be made, though—the following is how I perceive the perceptions of others, and so, of course, no real science should be inferred.

First, in defining fishing tournaments, I usually separate them into two general categories: amateur contests, such as the Hawaiian International Billfish Tournament, where winning anglers are awarded nothing more than trophies, and “jackpot” tournaments, in which anglers vie for cash rewards and other valuable prizes. I have seen nothing to suggest that either style is perceived more favorably by the public or press.

Those two categories may then be divided further into tournaments having rigid guidelines regarding methods of catching fish—that is, those following International Game Fish Association rules—and those with more relaxed standards, such as the locally popular “jungle rules” tournaments. Because the latter tends to weigh-in more undersized and mutilated fish, the former may have a better public image; but in reality, I should add that the effect to the fishery is nearly the same for both.

Additional subcategories may also be made for tournaments having, or not having, a tag-and-release element—that is, a method for awarding points to contestants for fish caught, but not killed. In general, tag-and-release rules in tournaments seem to be perceived as a positive step in fishery conservation by the public and the press. Of course, that could change if a study found a high mortality rate of released fish, due to the stress of the fight or other factors.

The public and the media develop their perceptions about fishing tournaments by what they have witnessed or information they received second hand. And, naturally, those perceptions are continually influenced by society’s ever-evolving sensitivities toward the environment. What was once viewed as acceptable behavior, may no longer be valid.

Traditionally, fishing tournaments have always been about the biggest and the most. An angler or team catching the biggest fish, or the most fish, was the winner, and the proof—the

catch—was displayed at the official weigh-in for all to see and admire. The bigger the fish, or the catch, the bigger the story for the press and the public.

But, that was largely before fishery depletion became a worldwide concern and terms like fishery sustainability and resource conservation became a part of the general public's lexicon. Now, tournament organizers must be concerned with being perceived as a threat to the environment, even when it is obvious that any gamefish tournament's take from the fishery is minuscule compared to commercial fishing operations using 30-mile longlines or acres of driftnets.

The following story, I think, illustrates one aspect of individual perception. Last year, on the island of Oahu, a fishing tournament—Ahi Fever in Waianae—was run simultaneously with a fishermen's open forum, a part of a Hawaii Fishermen's Festival. The tournament was wildly successful, with a record number of boats (230) bringing in, literally, tons of fish.

Meanwhile, at the fishermen's forum, because the tournament anglers were busy fishing, the only ones left to speak to the issues were local subsistence fishermen. They questioned the wisdom of a tournament taking such large numbers of fish, even though they knew that in Hawaii, such catches were never wasted. Their fishing was becoming less productive each year, so they perceived killing so many fish "just to win a contest" was not in their best interest.

The eventual use of a tournament's catch is another important issue. The public and the press tend to disapprove when they perceive that fish brought to the scale are nothing more than trophies and will not be consumed, or at least used in scientific studies. So far, big gamefishing has not acquired the generally negative image of big game hunting, but the potential is always there.

Having a positive image is important from a financial standpoint, as well. When much of a tournament's operating revenue comes from corporate sponsorship, how potential sponsors view gamefishing can be crucial.

In conclusion, I would suggest that fishing tournament organizers and participants constantly monitor how their activity is being perceived by the public and the media. Ultimately, it will be those opinions which will dictate the continued success and longevity of their contests.

Discussion

The discussion, with several comments from the audience, centered public perceptions of gamefish tournaments and, more generally, sportfishing. An audience member emphasized that there is a lot of tag-and-release at the HIBT but not all fish can be treated this way. Mr. Pendleton said that this tournament has a generally positive public image and tag-and-release enhances this image. Another audience member said that in Atlantic fisheries the longliners are trying to promote an image that tournament fishing is wasteful, for example by showing pictures of the many unutilized sharks caught by tournament fishers. Mr. Pendleton replied that tournaments, such as the HIBT, actively encourage media attendance as a way of improving their image before the public.

An audience member noted that even tag-and-release may be perceived as inhumane by animal rights groups, who wish to end all sportfishing. Mr. Pendleton recalled that several years previously a journalist in New Zealand was writing inflammatory articles in the same vein. However, an audience member indicated that in Australia the public perception of tournaments is positive. But even if most of the fish are tagged and released, and the few that are landed are later consumed, some environmentalists do not want to convey that information because it ruins their message.

An audience member stressed that low survivorship of tagged and released fish is a serious issue and, more generally, the public is probably more concerned about perceptions of waste rather than cruelty. Mr. Pendleton agreed, recalling that as a child he remembered the many billfish landed in California tournaments, only to be turned into cat food. Another speaker reiterated the point that it is important to reduce post-release mortality of angler-caught gamefish.

Marlin Colors—The Perfect Disguise

Andrew R. Parker

Department of Zoology, University of Oxford

Marlins are highly sophisticated visual predators. They use their sight to hunt but avoid being seen themselves by their sighted prey. This is a useful character when hunting—it adds an element of surprise. So how do the marlin achieve invisibility when they look so conspicuous in many color paintings or on land? To answer this question it is helpful, and interesting, to consider the known roles of color in the natural world and even military systems. Then we can put marlin coloration in perspective.

Is There a Suitable Single Color for Camouflage?

Airborne objects within the earth's atmosphere are illuminated from above by sky-shine and below by earth-shine, of which the former is far brighter. Gulls are typically countershaded; that is, they have dark colored dorsal surfaces and lighter ventral surfaces, which serve to conceal their silhouette from above or below in sunlight. They have rounded bodies, which result in their undersides gaining earth-shine and some sky-shine while airborne.

Like the gull, shallow or near-surface fishes employing countershading can obtain enough light from below to light up their white undersides and blend into their pale background when viewed from below. Deep-water fishes are not so fortunate. To overcome this obstacle some deep-sea fishes produce bioluminescent lights (the result of a chemical reaction, like that in 'lightsticks' used as night fishing lures). The deep-sea fishes shine their bioluminescence downwards in order to match the light field directly below them with that of the surrounding water. These fishes possess light sensors on top of their bodies, enabling them to detect the precise intensity of the downwelling light at their position in the water column. Interestingly, project Yahudi involved fitting lights to the underside of B24 bombers, which flew over the Atlantic during World War II. Photocells were used as sensors to correlate the brightness of the lights with the background radiation. Yahudi was a very successful concept during the 1930's and right up to the point when radar was introduced in the 1940's. Marlin have not evolved bioluminescence for camouflage purposes probably because they produce a large silhouette, which would require a relatively massive lighting system to conceal, but also because camouflage from below is not so important. The marlin is generally the hunter rather than the hunted, and prey is usually approached from behind or the side.

Would Black or Red Skin Suit Marlin?

Although black is now agreed to be spectrally neutral, after Goethe believed it was a color, it can be very conspicuous as a consequence of high contrast against a colorful background. The

marker flags for Australian fishing traps are testament to this. Traps are set on the sea floor and are linked to buoys at the surface by a rope. These traps are retrieved the following day, and the buoys are located by spotting the flags attached to them. A long-term project at the Australian Museum ('SEAS' Project), lead by Dr Jim Lowry, made use of a similar protocol but at the beginning encountered problems in finding the flags on the ocean surface. Bright blue flags, then orange flags were used, but in both cases the flags could only be seen when the boat was fairly close to them. As a result of the current-induced movement of the traps, finding the buoys became time-consuming. But it was noticed that commercial trap fishermen in Tasmania were using black flags on their buoys. These fishermen too had experimented with different colors, but surprisingly black was found to be the most conspicuous. The SEAS Project immediately switched to black flags, with instant success. The penguins with black backs that live in these southern Australian waters may therefore be more conspicuous than previously thought.

So why are nuclear submarines painted black? This may be to minimise reflection of light, which would be the best visual camouflage in deep water. The high absorption of light in water means that negligible light would be returned to the surface from reflection from the bottom in deep water. So the water would look black except for the small amount of light returned by scattering from particles in the water (just like those in the sky, see below), and most of this would come from the shallowest particles (because the longer the path length, the more energy lost). This scattered light would be predominantly blue because this is the color that loses the least energy by absorption, although it would be a dark shade of blue because considerable absorption is still involved. In conclusion, visual camouflage by a submarine in shallow water or at the surface could be maximised using a dark blue color, at least on its top surface. However, a submarine viewed from below is seen against a pale background, and so a different color is required to provide camouflage from below.

At depths below most of the scattering particles, black, or indeed any color but blue, would provide invisibility, because beyond about 200 m light in the ocean is exclusively blue. Many deep-sea animals living on the sea floor have red pigments, for example, to avoid visual detection by predatory fishes in the water column above. The fact, therefore, that marlin are not colored red or black indicates that they spend most of their life in the water above 200 m depth.

Camouflage Against a Changing Background

Sometimes countershading alone is insufficient to make an animal effectively disappear. A fixed color/pattern will not provide visual camouflage over a range of backgrounds. Instead animals opt for one of three alternatives. The first is transparency; an option only viable when the internal parts can be made transparent. This is possible for the larvae of many crustaceans for example, but impossible for machines made from metal. The second option is to have a mirrored surface. Many fish appear silver in order to reflect the surface of the water into the eyes of predators positioned below. Hence when the predator looks at the fish, it sees only the water surface and the fish appears non-existent—an optical illusion is created. Unfortunately, this camouflage mechanism only works when the light field is fairly uniform,

such as below surface waters in the sea. On land, a uniform light field is only approached in a forest, because leaves scatter sunlight into all directions.

The final option for universal camouflage is to change color as the color of the background changes. The famous experiment of a flatfish on a chessboard, where the fish takes on the chequered pattern, is an obvious case, although the squid, cuttlefish and chameleon provide other classical examples of chromatophores at work. Chromatophores are color cells capable of regulating their host's visual appearance. But considering the vast number of different colored chromatophores packed into a small area, the electrical wiring would seem endless and outside the realms of practical engineering.

Evolution's Answer in Marlin

Marlins have evolved a number of the above mechanisms. They are countershaded—they have a dark dorsal surface for camouflage from above and a silver ventral surface. The dark surface is an optimal shade of blue. This is achieved through the combination of black chromatophores and bright blue reflectors. The blue reflectors consist of fine particles suspended within cells. Leonardo da Vinci was the first to postulate that the sky is blue due to the action of small, suspended particles. Less than the wavelength of red light in size, these particles scatter the blue (short) wavelengths in sunlight the most. We view this scattered light against the darkness of space, which enhances the color effect because there is little white or other colored light passing through the blue zone towards earth, which would otherwise dilute the blue color. The same happens within the marlins' blue cells, except the background can be either black or silver. Black chromatophores behind the blue cells can expand to provide an absorptive screen, causing a strong blue color overall. However, when the black chromatophores contract they reveal a new background that is silver, and the overall effect is a pale, more dilute blue color. This mechanism is most prominent on the sides of the marlin.

The lower surface of the marlin is also silver, acting like a mirror to reflect the marlin's surroundings, making the marlin appear to disappear from below. The mirror is achieved by a collection of guanine crystals lying parallel with the skin surface. Each crystal has a precise thickness and this can reflect a specific color. Collectively, crystals with a range of thicknesses are represented in the skin. Therefore all the colors in the spectrum are reflected and overlap to form white light—the reverse effect of a prism, which splits white light into a spectrum.

In addition to varying the shade of the body color to adjust to the changing light intensity of the marlins' environment, chromatophores achieve the appearance and disappearance of vertical stripes along the length of the body. In the unlikely event that a potential prey fish actually catches sight of a marlin, stripes serve to break up the overall image of the marlin, so that it no longer appears as a large predator. Additionally, moving vertical lines may confuse a potential prey fish. All in all, the marlin effectively disappears to the eye underwater.

Final Thoughts: The Arms Race

Just as defence researchers continuously strive to provide new forms of weaponry because their current inventions will inevitably meet with countermeasures, evolution has created its own arms race. The fish that are silver to act as a mirror and consequently gain invisibility cannot rest on their laurels. The eyes of predators may have evolved to exploit a fault in the system—that although the light reflected by the fish has the same chromatic and intensity properties as the incident light from the surface, it has different polarisation properties. The fishes' reflector-type causes a change in polarisation, and this may have become a selection pressure for the vision of predatory fishes. And of course nature may have found a solution—the vision of predatory fish could be strongly polarisation sensitive. This should be tested for in marlins. So is the next stage in this evolutionary cat-and-mouse game the loss of silver reflectors in prey species of fish, making the vision of predatory fish highly adaptive for... nothing useful? Maybe a head start could be gained in defence research by investigating nature's adaptations to radiation, including counter weapons.

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References

- Denton, E.J. 1970. On the organization of reflecting surfaces in some marine animals. *Philosophical Transactions of the Royal Society of London, Biological Sciences* 258: 285-313.
- Endler, J.A. 1990. On the measurement and classification of color in studies of animal color patterns. *Biological Journal of the Linnean Society* 41: 315-352.
- Herring, P.H., A.K. Campbell, M. Whitfield, and L. Maddock (eds.). 1990. *Light and life in the sea*. Cambridge, England, Cambridge University Press.
- Haamedi, S.N. and M.B.A. Djamgoz. 1996. Effects of different patterns of light adaptation on cellular and synaptic plasticity in teleost retina: comparison of flickering and steady lights. *Neuroscience Letters* 206: 93-96.
- Lythgoe, J.N. 1979. *The Ecology of Vision*. Oxford, England, Clarendon Press.
- Parker, A.R. 1998. The diversity and implications of animal structural colours (Perspective). *The Journal of Experimental Biology* 201: 2343-2347.
- Parker, G.H. 1948. *Animal Color Changes and their Neurohumours*. Cambridge, England, Cambridge University Press.

Discussion

Marc Miller commented on the social role of scientists in the tournament scene.

The Importance of National Club Structure in the Preservation of Recreational Sports Fishing

G. S. Traill
J. E. Hough
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New Zealand Big Game Fishing Council

A Brief Resume on New Zealand

This South Pacific nation is 1,200 miles from the coast of Australia and consists of two main islands and many attendant smaller offshore islands. New Zealand, 1,200 miles in length, enjoys a sub-tropical climate in the north with a latitude 32° S and a sub-Antarctic climate in the south at a latitude of 48° S. The economic fishing zone is the world's fifth largest and a recent survey established the new Zealand population at 3.5 million, with one-third of these people fishing on a regular basis.

Fish Species

Because the geographical lineage of New Zealand is north and south, there is a great variance in the fish species that are available to anglers. The northern waters provide unequalled fishing for the world's largest striped marlin, and New Zealand-based anglers hold world records in most line weights. Black and blue marlin also frequent these shores in the summer months. Broadbill swordfish, spearfish, several species of tuna, and game sharks are plentiful. Currently 23 world records for yellowtail kingfish have been claimed by anglers fishing in New Zealand. In the South Island waters, a variety of game sharks are targeted, together with southern bluefin tuna, albacore and in the warmer areas, yellowtail kingfish.

The New Zealand Big Game Fishing Council

The New Zealand Big Game Fishing Council body was formed in 1957 by the five major gamefishing clubs of this period: the Bay of Islands Swordfish Club, formed in 1908; the Whangaroa Big Gamefish Club; the Whangarei Deep Sea Anglers Club; the Mercury Bay Ocean Sports Club; and the Tauranga Game Fishing Club.

Currently the new Zealand Big Game Fishing Council has a membership of 45 sportfishing clubs from both the North and South Islands, encompassing some 25,000 members. Each club appoints a delegate or delegates, this according to their membership, and these delegates form the New Zealand Big Game Fishing Council, together with IGFA Representatives and Life Members.

For the ease of administration and economy, clubs are then divided into six zones, these based on the geographical proximity of the clubs and the size of their membership. Each zone then appoints a representative to a Management Committee, which also includes the Council President, two Vice Presidents, the immediate past President, and a representative from the IGFA and Life Members. The Council's full-time secretary, who provides continuous liaison with clubs, collates the catch data and deals with the general business that is generated by a body dealing with 25,000 members, also attends. Management Committee members meet five times a year and on demand as required.

A full two-day Annual General Meeting of all delegates is held each September to elect officers, conduct general business and give the management committee guidance for the ensuing year. After the business is completed a social event is held for delegates, their partners, and visitors. Hosted annually by different clubs, this event not only develops camaraderie within the New Zealand Big Game Fishing Council umbrella, but also allows delegates an insight into the workings of fellow clubs.

Funding

As with all organizations, unless funding is available, successful operation is difficult. The New Zealand Big Game Council sets an annual levy, which is based on each club's membership. An additional levy was previously imposed, which provided the initial sponsorship finance for the New Zealand Recreational Fishing Council, a body that encompasses all water-related clubs and deals with Government-related issues in the management of the national fisheries and the preservation of sport and recreational fishing.

To provide additional funding, the New Zealand Big Game Fishing Council has also instigated an annual national big gamefishing tournament involving affiliated clubs, which attracts up to 2,000 anglers. This is the largest tournament held in New Zealand waters and provides substantial additional funding for the organization. A major section in the tournament is built on the tag-and-release of the gamefish, a practice which is actively encouraged and is widely accepted by New Zealand anglers.

Achievements

The Billfish Accord is an example of successful negotiation, where pressure on Government has resulted in marlin being declared a recreational only fish and if commercially caught within the New Zealand Economic Zone, must be released dead or alive.

From the late 1960's onwards, it became apparent that the New Zealand marlin fishery was in a decline. It was felt that this was the direct result of over-fishing by the foreign fishing vessels that plied the coastal waters. Concerns expressed to Government fell on deaf ears until the 1980's, by which time the law of the sea was being developed to allow control of the territorial and economic zones up to 200 miles off the New Zealand coast.

The Bay of Islands Swordfish Club, considered the over-exploitation of the fishery by commercial interests to be a breach of the directions in the new legislation and set out to sue the Government for the mismanagement of the marlin fishery. The case was based on the catch records of the Bay of Islands Swordfish Club, which had been kept up to date since 1924.

The club's catch register showed an increase and decrease in catches that were directly related to major events, such as World War II and the fuel crisis of 1972, when all long-range foreign commercial fishing vessels were recalled to their home ports while a re-evaluation of the cost of their overseas operations was undertaken.

When there was a downturn in the sportfishery catch, the effect was not only on the charter boat industry, but also on regional economies, causing hardship for many of the coastal towns, especially those in northern New Zealand. It was then established that the sportfishing marlin catch was of far more value to the country than it was as a commercial fishery.

After many meetings with government and the fishing industry, and without the necessity to exercise the threatened legal action, the Minister of Fisheries of the day agreed to put a fishing regulation in place. It prohibited the commercial taking of marlin on the northeast coast of New Zealand out to the edge of the 200 mile economic zone, this to be reviewed after a trial period of three years.

Any marlin that were taken commercially by any method were to be returned to the sea dead or alive. It was also expected that sportfishers were to tag and release 50 percent of their catch as their contribution to the preservation of the species. There was a great deal of speculation by many scientists and other officials, as to what the new regulation would achieve. Their attitude was, "If they can't catch it within the zone, they will catch it outside." However, this regulation has proved to be a notable success, as the marlin have returned to the New Zealand waters in great numbers and the sportfishing industry now enjoys catch levels not seen for many years.

This regulation is now reviewed and renewed annually and is unlikely ever to be changed. It has resulted in improvement in the charter boat industry and regional towns' economies. In addition, the increased facilities necessary to cater to the greater number of both overseas and New Zealand anglers now enjoying the sport is now substantial.

The regulation has now been in place for twelve years and has been extended to include the total New Zealand economic zone. Recreational anglers now tag and release 70 percent of their marlin catch, with a much higher rate of release for sharks. Any attempt by government or industry to abolish or amend the regulation, would be bitterly opposed by the Council.

As the marlin and tuna species in New Zealand waters are highly migratory, it is vital this country retains a sound fishery management structure and participates in the growing effort to manage fish stocks in the wider Pacific Ocean. It is also vital that the New Zealand Big Game Fishing Council continues to pursue this initiative by encouraging the Government to be increasingly pro-active in the related forums.

It is important that when Government officials are making decisions on the sustainability of the fishery, that they take into consideration the economic and public value of the resource to the country, as well as the impact that commercial pressure has on the species.

This paper was presented by John Chibnall and John Hough.

Discussion

Discussion centered on legal measures that prohibit the retention of billfish by commercial fishers. An audience member noted that Coral Sea waters off Queensland, Australia are an important breeding area for black marlin. This has been declared a closed area. In addition, the Australian Parliament passed legislation prohibiting retention of certain billfish by commercial vessels. Some discussion followed about the possibility of retaining billfish that are already dead when brought on board. It was argued that this would encourage retention, since it would be difficult to monitor fishers' compliance in releasing live fish. It was also pointed out that gamefishing organizations in both Australia and New Zealand prohibit members from retaining certain fish species that are considered threatened or endangered. The discussion also turned to prohibitions on the taking of sharks. Few regulations exist in New Zealand, except the Big Game Fishing Council prohibits its members from taking sharks under 15 kg. In Australia the great white shark has been declared an endangered species and no one may take this species. An audience member argued that this prohibition is not based on science and that most information from sharks come from angler tag-and-release programs. In New Zealand most anglers are not interested in retaining sharks except for the mako.

Gamefishing and Tournaments in American Samoa

Ray Tulafono

Department of Marine and Wildlife Resources, American Samoa

History

Fishing tournaments have been an important gathering platform for fishermen in American Samoa for many years. Let me briefly give you the history of how these tournaments came about in the territory.

In 1974, a small group of sportfishermen got together and formed a fishermen's organization known as the American Samoa Game Fishing Association. In November of that year they put together a tournament and they asked our department to assist in its organization. This tournament was held for two days during the Thanksgiving weekend, and from what I heard it was a successful tournament. Since then, our department has been taking an active role in club organization: advising, providing logistical support, and also record keeping for all the tournaments that have been held in the territory. The American Samoa Game Fishing Association became inactive in early 1991. We presume that this happened because a hurricane that hit American Samoa in 1990 destroyed many of the small fishing boats used in these tournaments.

In 1992 another group of fishermen, including not just sportfishermen, but also commercial and subsistence fishers, got together and formed the Tautia Samoa Fishing Association. This fishing association has been active in organizing and sponsoring fishing tournaments in American Samoa. Since 1992 one to three day tournaments have been held, mostly on holidays and weekends. This allows the working people to participate—because some sportfishermen are part-time commercial or subsistence fishermen.

Tournament Organization

Tournament rules and prizes are discussed during tournament meetings and captains' meetings. All of these tournament meetings have been held in our office. This is one of our responsibilities, since we are the government agency that helps fishermen. We are also trying to get the information that is needed to properly manage the fishery resources in our territory.

These tournaments vary in terms of regulation and also in terms of price. From time to time, some of our local businesses donate tournament prizes. Sometimes we have jackpot tournaments, in which the winner takes all. By winner take all I mean there that there is only one prize for the biggest fish caught in that tournament. The largest prize donated by our local business community was \$2,000. One of our well-known businessmen donated a pickup

truck for a jackpot tournament. But to win, a fishermen had to catch a 1,000 lb. plus fish, which would probably be a marlin. That jackpot was never won.

The Game Fishing Association has rules and a tournament committee. A longstanding rule is that every boat must leave harbor at 4:00 AM and return at 6:00 PM. We enforce these rules by the honor system. As a result, everybody feels good about it, because we don't have to have people enforcing the rules, it's up to the fishermen.

Our tournaments usually target four gamefish species: billfish, yellowfin, wahoo, and mahi mahi. Sometimes we give prizes for total pounds, or everything that has been caught in the tournament.

Because we feel that data collection is important, in 1992 my department came up with a special prize for all the miscellaneous fish caught in the tournament. Miscellaneous fish include shark, *aku*, dogtooth tuna, rainbow runners, and other non-target fish. This way all of the fish that were caught in the tournament are brought in. We feel that all fish should be recorded as part of our data collection program.

During these tournaments we collect information on the area fished, type and number of gear units, number of fish on a boat, hours fished, fish species, and weights. We have collected this information ever since we started the tournaments in our country.

I would like to briefly describe our prize-giving banquets. All the fishermen look forward to them after tournament days because we provide free food and free drinks. They also look forward to receiving their prize. We give out cash prizes and merchandise donated by our business community. They always donate rod-and-reels, fuel, and fishing gear.

We usually invite all the participants and all of the tournament sponsors. The participants may invite a guest to attend with them. But something very interesting happens: there are usually about three or four times more people than expected attending those banquets. Like I said, because we are providing free food and free drinks, it's not just a meal, it's a feast. Our tournaments have been very good for our fishermen. They enjoy the banquets and share their experiences by telling fish stories.

A Recent Trend

I would like to talk about a recent trend in American Samoan fishing tournaments, because this is sort of sad. The tournaments remained popular for many years. Since 1974 we have had a total of 64 tournaments, averaging two to three tournaments per year and 10 to 20 vessels in each competition. The majority of the vessels that participated in these tournaments were 28 foot catamarans, commonly known as *alias*. A few of those big high-tech boats have also been involved. But in the past two years more emphasis seems to have been placed on commercial longline fishing, rather than recreational tournament fishing. The last tournament, held in May of this year, only attracted three participating boats. Most fishermen went about their daily business of longlining for albacore tuna to sell to the canneries. The reason

for this decline is not entirely clear. It may be that the shift from commercial trolling to longlining is a factor. Fishermen are more interested in earning income. In addition, it is time consuming to switch from longline to troll gear for a weekend of tournament fishing. Because the longline fishery is new and evolving, we feel optimistic that once the fishermen and boat owners adjust, their interest in tournaments will once again rise. It will also take continued effort from fishing organizations and our department to organize, encourage, and support tournament fishing.

I would like to conclude by touching on the conservation ethic. Throughout this symposium, I have heard a lot about tag-and-release. Tag-and-release is something that our fishermen would not like to hear. Fishing is our way of life: what I catch is mine and you don't play around with it. It will take a lot of work to educate our people about conservation so that our resources are conserved for our future generations.

This is a summary of Mr. Tulafono's presentation.

Discussion

Initially, discussion centered on involvement by the Department of Marine and Wildlife Resources in tournament organization and data gathering. Mr. Tulafono noted that they are not involved in soliciting sponsors and prizes. With regard to data gathering, Department personnel at times act as tournament weigh masters and gather detailed information on catch and effort. However, they don't regularly collect biological data, such as measuring sexual maturity. Specific research projects may collect this type of information.

The importance of tourism was raised and Mr. Tulafono responded that tourism is not a significant factor in American Samoa sportfishing. There are few charter-type boats and the government does not actively promote tourism because local infrastructure for this is limited.

Cultural factors were discussed at the end of the session. Fish that are landed in tournaments are usually shared among friends and family, who come down to the dock at the end of the tournament day. In other areas culture change has eroded this ethic; fishermen may try to avoid these obligations by landing their fish elsewhere. In American Samoa people avoid the landing area only if they don't have fish to share. Finally, an audience member commented on the cultural barriers to tag-and-release. Landing fish in order to meet social obligations is important in many Pacific Islands. Releasing fish would be considered a failure to meet these obligations.

Analyses of Hawaiian International Billfish Tournament Records

Peter S. Davie

Comparative Physiology and Anatomy Section, Institute of Veterinary Animal and Biomedical Science, Massey University

Abstract

Fisheries management requires good data in order to be effective. Recreational fisheries often generate poor data on catch per unit effort. The approach explored in this study is to collate information carefully gathered by tournament officials and judges into a relational database so that the information can be mined.

Catch records of 36 years of Hawaiian International Billfish Tournaments (HIBTs) have been entered into a relational database (Paradox, Borland International Inc). Analyses has revealed no overall trend in catch per unit effort since 1970. The first 11 years have been excluded because of the impact of boat and gear improvements early in the history of the HIBT. It is suggested that data from the HIBT are not representative of the Hawaiian marlin fishery overall. In other countries trends in pelagic fisheries are apparent in the annual recreational catches.

Approximately 2,500 marlin have been caught at the HIBT since its inception: about half a million pounds of fish. Marlin weighing over 368 lbs. are in the top ten percent by weight. Day of the tournament is not related to numbers of Marlin caught.

Tagged and released fish have capture times which are less than half those of fish boated during the same tournaments. Average capture times of tagged and released fish taken on different line classes (50-lb., 22-kg; 80-lb., 37-kg) are the same (20 minutes).

Recreational tournaments are about fishing activity or contact with the fish—strikes hookups and landings. A detailed analysis of strikes hookups and landings in individual fishing areas off the coast of Kona through the fishing day is presented. This analysis allows a rational assessment, in hindsight, of the wisdom of decisions made about where to fish and when to move to new water.

Introduction

This report has two aims. First, to collate analyses of the catch and fishing effort for the Hawaiian International Billfish Tournament (HIBT) from 1959 to 1994 inclusive. This was undertaken in an attempt to gain an historical perspective of the recreational fishery and reveal

any trends with time. The second goal is to inform anglers and tournament participants including officials, of the patterns of fishing in the Hawaiian International Billfish Tournament.

Informed commentary on the fishery from a recreational perspective has in the past been influential in setting fisheries management objectives. Thus the Pacific Ocean Research Foundation (PORF) has undertaken to analyse data on the gamefish fishery off Kona, Hawaii in a form which is readily interpretable so that the gamefish conservation lobby may be more effective wherever it operates.

The report has four main parts. The first presents and discusses the catch data from the tournaments. Time related trends apparent in the catch with the years are discussed. The second part examines the tournament and focuses on angling. Data on tag-and-release and capture times are discussed in the third section. The fourth section takes a close look at the fishing activity in the 1993 and 1994 tournaments. Strikes, hookups and captures are presented by area fished and related to fishing effort. In the last section some conclusions are drawn about the data to hand.

The Database

A comment about the database used for this analysis is in order since it is apparent that the numbers don't always add up. The principal reason for discrepancies is incomplete data for every catch entry, especially for the earlier years. For example there are 295 blue marlin, 22 yellowfin tunas, and three striped marlin for which there is no record of area in which the catch was made and likewise for other features of the data including line strength, capture time, etc. A second reason for the less than perfect database quality is minor differences in spellings in records of angler and boat names etc have meant that it has been impossible in some cases to decide whether two entries represent the same individual or boat. For example, there are five different boats called Kealia (Kealia, Kealia II, Kealia III, Kealia IV, Kealia VII) with four skippers. Four boats have the name "Aerial" with seven skippers. With boat and skipper performance of commercial significance, comment on these data must await improved quality of information before definitive statements can be made. That the data are as good as they are is a tribute to those who have collected and maintained them throughout the history of the tournament.

Anyone interested in information about the HIBT tournaments is welcome to approach PORF, but the accuracy of the data cannot be guaranteed to 100 percent. As part of our on-going commitment to improving the quality of the database PORF welcomes comments and queries from anglers, skippers and those whose knowledge of the tournaments extends beyond the numbers recorded and presented here. Without tournament participants and record keepers there is no information.

The Fishery

Catch data from 36 years of HIBT shows that after the first decade, that is since 1970, there has been no overall trend in catch or catch per unit effort (see Figure 1). This suggests that

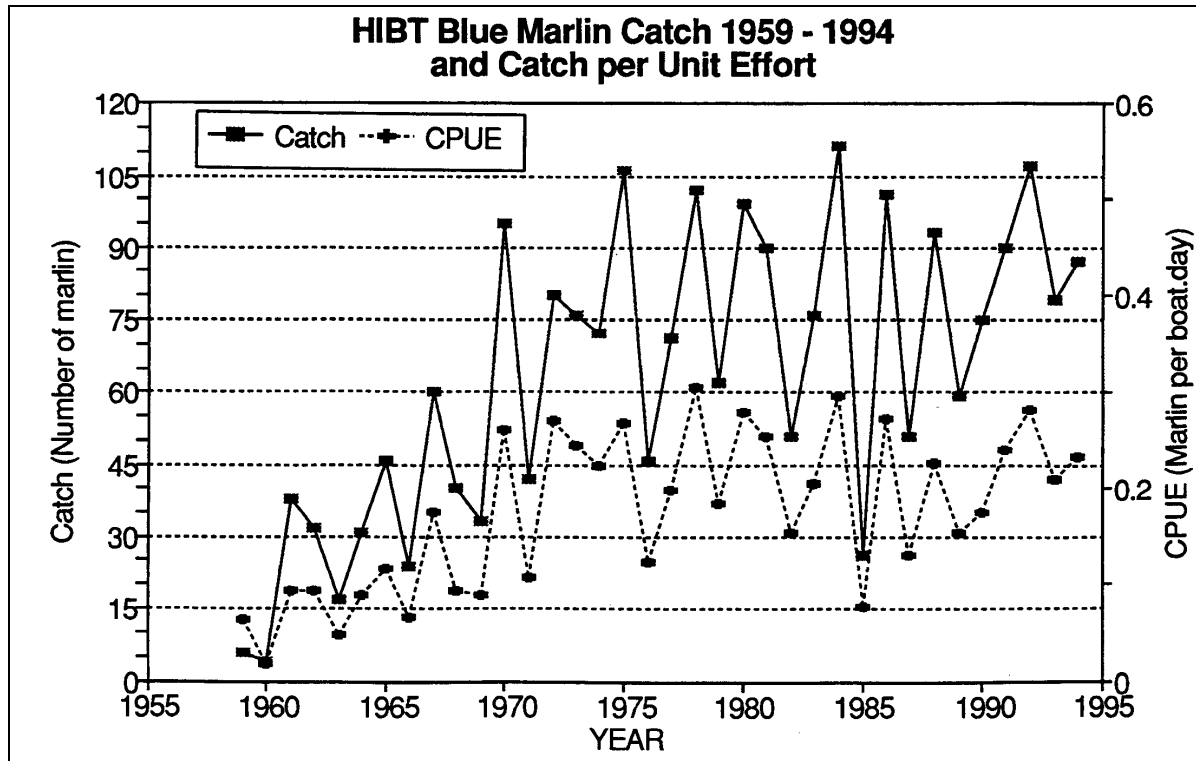


Figure 1: Catch (number per tournament) and catch per unit effort (marlin caught per boat.day).

as far as can be detected from these data there is no decline in the availability of Pacific blue marlin off Kona.

This raises some very important questions. First, it is known that there has been an impressive increase in the commercial longline catch and fishing effort in Hawaiian waters over the last ten years mainly as a consequence of increased domestic longline fishing. An explanation is required to explain why no effect of this pressure is apparent in the HIBT data. Second, if the Pacific wide CPUE is in decline, as it has been since 1960, why also is this overarching trend in CPUE not reflected in the HIBT data? Third, HIBT data do not reflect the trend in increasing local recreational fishing CPUE as assessed by recreational angler surveys. This indicates that HIBT catch and CPUE data may not be representative of the overall patterns of fishing. This is probably so as a consequence of them being collected from a restricted period of the year and can easily be influenced by short term events such as weather or seismic activity, a feature of the Kona coast. The fact that they are taken in a single week means that they are a “snapshot” rather than a full length feature movie of the total picture. While these are drawbacks, they also can also lend weight to the analysis since the data are taken at the same time of the year, each year and the “sample” is collected in the same manner each year by people whose skills and backgrounds are very similar using relatively standard gear. The validation of this “sample” may never be achieved in a rigorous sense but the time span of the collection is a strong factor in its favour and, despite some apparent contradictions.

Does recreational billfish catch data from other parts of the world show trends and influences of commercial fishing pressure? In short, yes. Australia, Mexico and New Zealand have now experiences that demonstrate clear but not necessarily tight relationships between commercial fishing pressure and recreational fishing catch per unit effort (CPUE). These have most often been as a consequence of fishing area closures where gear conflict has been excluded and the result has most often been dramatic increases in the recreational catch. We are cognizant of the fact that the size of the ocean billfish "pool" into which Hawaii provides a window may be very large and that significant changes may take decades to become apparent. The down side is that it may take decades for any improvements to appear, unlike the rapid responses seen in Mexico and New Zealand.

The rise in catch through the first ten years is thought to be derived in part from application of improved technology to the recreational fishery. For example faster boats which cover more ocean. Until 1970, 11 or fewer areas were fished. After 1970 11 or more areas were fished with two exceptions, 1983 and 1993. During the 1970's, improved lines and tackles and increased skills in recreational fishing are also components of this increase. Such improvements seem to have resulted in a general decline in capture times. In the 1960's average capture times ranged between 50 and 60 minutes. In the 1970's there was a decrease from around 50 minutes toward the 30-40 minute range where we currently see average capture times.

The data show a two or three year cycle of high and low catch per tournament. This is matched by CPUE showing that more fish means more fish caught. This trend is apparent in the yellowfin catch data as well, although the match between the two dominant species is not always perfect. The two year gyre is also apparent in bait fish species and is documented for the Hawaiian waters. Should this regular fluctuating pattern cease and the good and not so good years become random, then we will have cause for concern even although the overall trend may not yet have become apparent.

The Catch

In addition to 2,207 Pacific blue marlin (78 percent of tournament catch by number) and 578 yellowfin tuna caught during the tournaments small numbers of other billfish taken in the HIBT include spearfish (long and shortbilled), striped marlin, and black marlin (see Table 1). The patterns of their catch with year is depicted with blue marlin and yellowfin tuna in Figure 2. In 1987 there was a bumper year for striped marlin (17) but no yellowfin tuna were landed and 1987 was an average year for blue marlin (51; average 61 per tournament). This was the height of the El Niño effect and the oceanic systems were experiencing oceanographic patterns which disrupted most normal seasonal cycles. Most black marlin were caught in the earlier years of the tournament with seven out of ten before 1968) probably reflecting fishing effort nearer to the shore. The spearfish catch is confined to the 70's. Catch patterns for these other species do not represent the tournament fishery and are incidental to the targeted species, namely blue marlin and yellowfin tuna.

Table 1: Numbers of various species caught during HIBT Tournaments since 1959. Tagged and released fish are included in the 2,877 catches for the HIBT since 1959.

Species	Number	Total weight and average weight (lb.)
Blue marlin	2,207	452,207 212
Black marlin	11	3,145 285
Striped marlin	50	3,748 78
Spearfish (long and short billed)	25	855 34
Sailfish	4	134 34
Yellowfin tuna	578	89,872 156

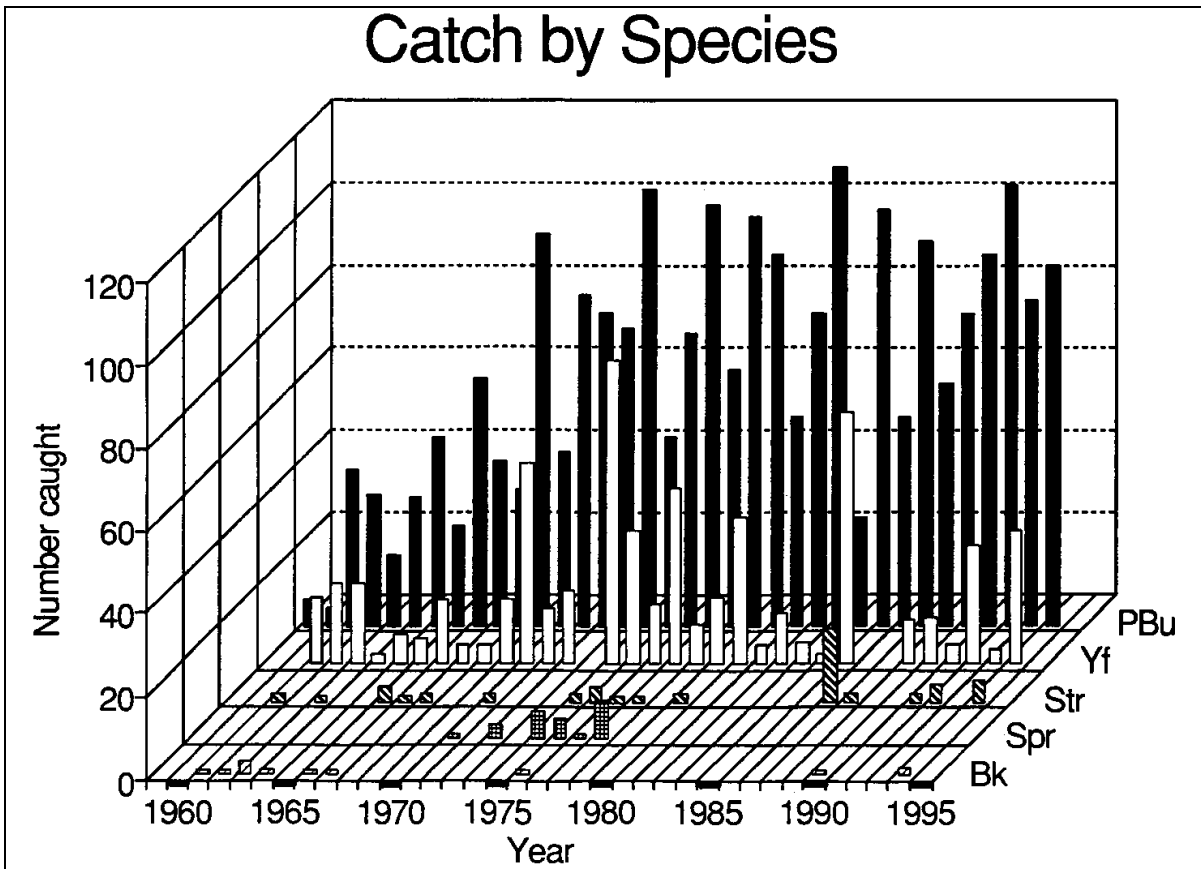


Figure 2: Catch (number per tournament) of Pacific blue marlin (PBu), yellowfin tuna (Yf), striped marlin (Str), spearfish (Spr) and black marlin (Bk) between 1959 and 1994. Sailfish have been omitted.

Fish are caught in almost all areas covered by the tournament. It is clear from Figure 3 however that near to Honokohau Harbour and on “the grounds” there is a concentration of catch. It is significant that areas **I J K L** account for 44 percent of both the blue marlin and

yellowfin catches throughout the tournament history. Only area **S** seems distinctly better for marlin compared to tuna (9.2 percent of marlin catch versus 5.0 percent of the tuna catch).

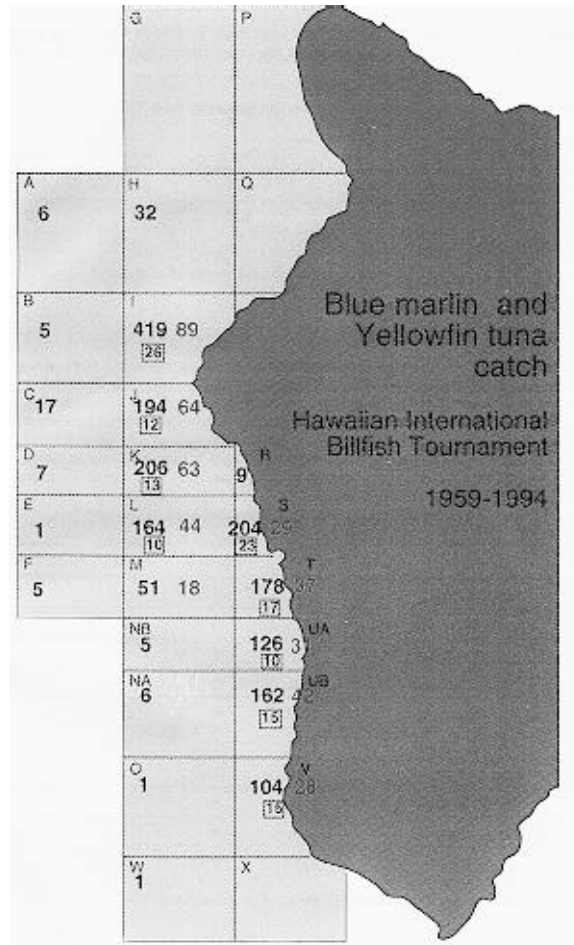


Figure 3: Catch of Pacific blue marlin (dark numbers) and yellowfin tuna (light numbers) by area between 1959 and 1994. Numbers in boxes are of marlin greater than 400 lbs.

Marlin weights show a typical distribution about the average (see Figure 4). The average was 212.6 lbs. with a median of 170 lbs. Blue marlin weighing more than 368 lbs. are in the top ten percent by weight. Areas **V** and possibly **S** have a higher percentage of marlin greater than 400 lbs. (14.4 percent and 11.3 percent respectively) compared with 6.3 percent big fish (> 400 lbs.) over all areas.

Intensive gamefishing in a limited area for a week might be thought to affect the fishing success. A quick look at catch by day of the tournament shows that the last day is, on average, as good as the first (see Table 2).

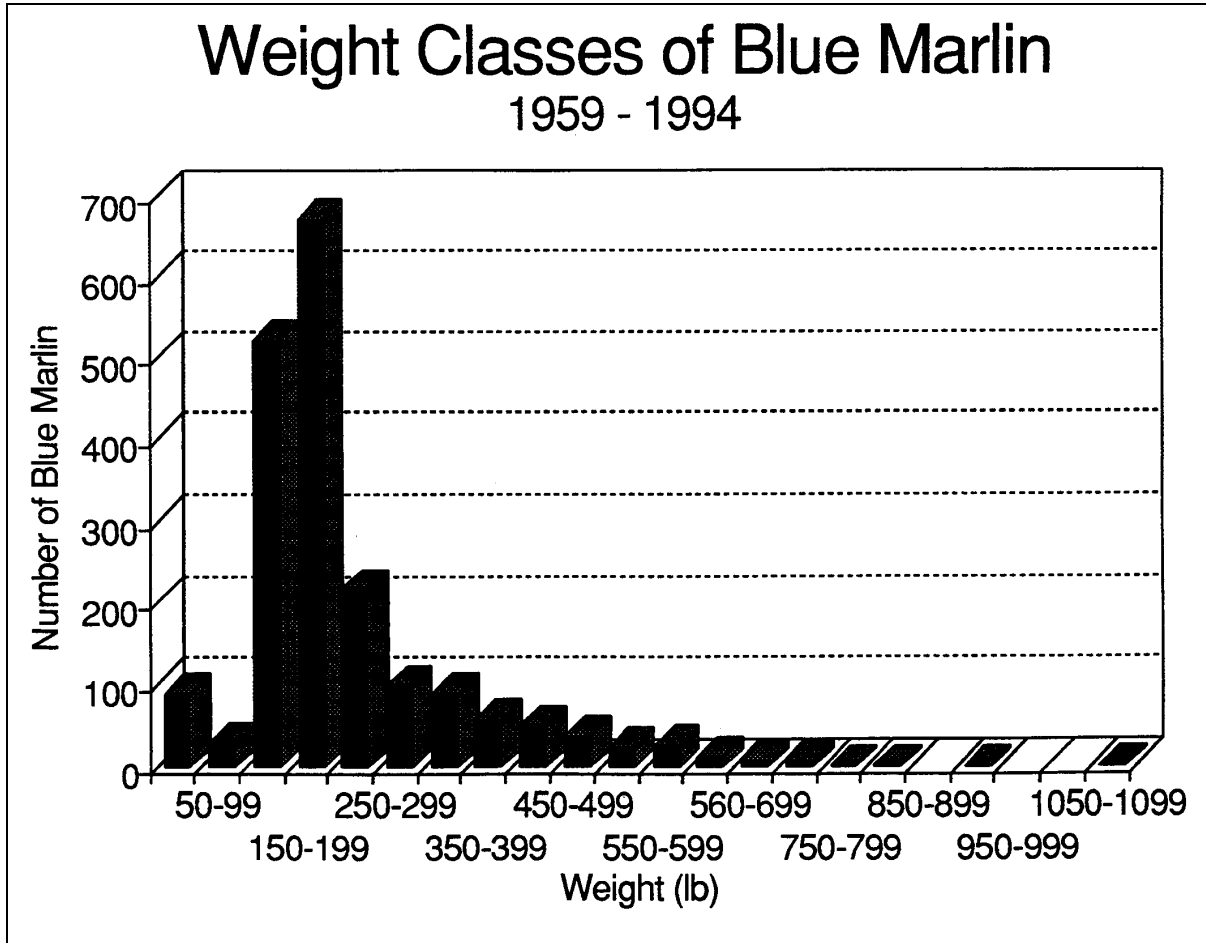


Figure 4: Blue marlin weight by 50 lb. classes.

Table 2: Number of fish caught catch by day of tournament, 1959-1994.

Species	Day 1	Day 2	Day 3	Day 4	Day 5
Blue marlin	443	422	473	428	441
Yellowfin tuna	146	138	102	85	107

Numbers and average weights have not been affected by day of tournament.

The Tournament

Between 1959 and 1994, almost 50,000 angler.days have been spent fishing; about 136 years of angler fishing time (see Table 3). The 1959 and 1960 tournaments were slightly different in that there were fewer anglers (120 and 225 respectively) and fewer fish caught (six and four respectively). Since the 1961 tournament however team, angler (and fish) numbers have remained much the same. The average number of teams has been 70 with an average in five members of each team. Of the 1791 anglers who caught fish, 71.6 percent have had a single catch, 14.6 percent have had two catches while 5.6 percent have had three and 3.7 percent have had four catches.

Between 1959 and 1994 only 51 anglers have had more than one catch on any single day (2.6 percent). A single case is recorded of four catches by a single angler in one day. Kevin Crosbie caught three blue marlin and one yellowfin tuna on the second day of the 1970 tournament. Winston Hoshino caught three yellowfin tuna on day five in 1975 while back in 1962 Nort Norton caught two blue marlin and one yellowfin tuna on day two.

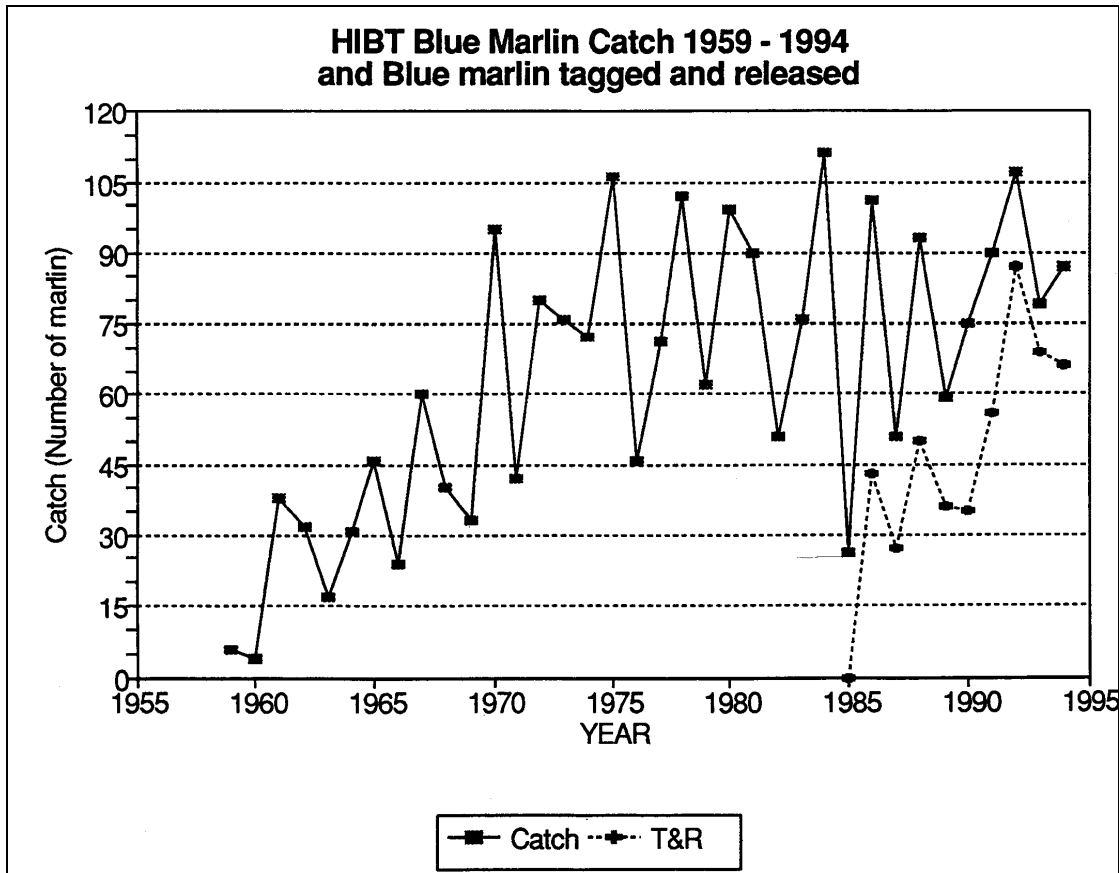


Figure 5: Catch and numbers of Pacific Blue marlin tagged and released by year since 1980.

Table 3: Top 10 point scoring anglers in the HIBT since 1959.

Angler	Points	Blue marlin	Yellowfin tuna	Spearfish
Ken Brown	4,476	13	3	
Sanbo Sakaguchi	4,085	14	1	
Rufus Spalding	3,831	7	5	1
Gamo Takashi	3,703	13	1	
Ray Martinson	3,253	10	2	1
Pierre Letourneur	3,167	7	6	
Steve Zuckerman	3,130	7	2	
Eddie Sicilia	3,008	4	1	1
Rocky Franich	2,861	6	1	
Alban Ellacott	2,597	5	2	

Tag-and-Release

Since 1986 tag-and-release (T&R) has become a major component of the tournament with 70-90 percent of the blue marlin caught, and tagged and released. The trend is toward higher percentages as the years go by (see Figure 5). The estimated weight of T&R fish has been significantly lower than those boated and the capture time for T&R fish is about 1/3 of non-T&R fish (see Table 4). There is the suggestion that the average weight of T&R marlin is creeping up nearer to the average weight, meaning that larger fish are being tagged and released.

Table 4: Capture times, weight and line strength for blue marlin tagged and released since 1986.

	All fish mean weight (lbs.)	All fish Mean capture time (min)	1986 - 1994			
			Weight (lbs.) (estimated)	Mean capture time (min)	50-lb. line test mean capture time (min)	80-lb. line test mean capture time (min)
Tag and release	225	20	158	20	20	20
Non-tag and release	159	46	270	60	55	75

Capture times appear to be determined by the fish rather than angler or gear. With a couple of exceptions, capture time are not lower for anglers with multiple T&R catches on different days, often in different years. Of the 51 people with multiple catches in a single day, not necessarily T&R, capture time on average is shorter for the second fish, down from 20.5 to 14.8 minutes and clearly an experience factor is present, at least in the short term.

The 1993 and 1994 Tournaments

Fish contact, including strikes and hookups, are often more important to recreational anglers in a billfish tournament than boating (equals landing) a fish. During the course of each day's fishing in the HIBT, regular radio roundups of fishing activity are recorded at 10:00 AM, 12:00 noon, and 3:00 PM and at the end of fishing at 4:00 PM. These data allow examination of fishing activity patterns through the day and tournament, and since each boat and team is recorded regardless of whether it has had any success, the fishing effort for each area is likewise available. Thus we can ask questions about the fishing such as whether or not fish are driven from high activity areas over the course of the week of intensive fishing?

These data are not easily presented in a readily digestible form. In this report, information for each area fished is presented as a pie chart showing the proportion of strikes, hookups and landings (including of course T&R) and the size of the pie illustrates the amount of fish activity (estimated by adding number of strikes, hookups and boatings) divided by the average number of boats in that area per hour. Effort information in the form of average number of

boats per hour of tournament appears in the bottom left of each fishing area. Figures 6A and 6B represent these data for 1993 and 1994 respectively.

Thus, for example, if we look at the data for the whole of the 1993 tournament, we can see that in area **K** (kilo) there were four strikes, seven hookups and ten landings with an average of 5.2 boats in **K** during any one hour. This resulted in about a one in eleven (11.9 percent) chance of fish contact per boat.hour in **K**. Of the 14 areas fished in 1993, **K** was the sixth best in terms of activity per boat.hour. It is clear that over the 1993 Tournament **UA** and **UB** were the most productive and areas **B C** and **E** the least productive. In 1994 areas **H, L** and **UA** and **UB** were the most productive.

Interestingly, the average number of boats in any one area per hour does not always reflect the activity. For example in 1993 **UA** and **UB** were very active areas but only one to two boats were on average in these zones. Similarly in 1994 one to two boats were present in **UA** and **UB** on average despite it being active. When combined with the higher than average likelihood of catching large fish in these areas (see Figure 3) this seems rather surprising. In 1993 twice as many boats were in **UA** and **UB** at the 10.00 AM roundup than later in the day. In 1994 the numbers of boats in **UA** and **UB** at 10:00 AM and 12:00 noon were the same while later in the day it was about 2/3 of the earlier numbers. This was against an increase in activity per boat hour through the day going from about one contact per boat hour at 10:00 AM to between seven (1994) and 15 (1993) contacts per boat hour at the 3:00 PM roundup. Thus, while the time cost of reaching **U** areas is a major factor, there are factors other than fish contact which have resulted in a decision to leave area **Uniform**. Why they chose to leave is unclear.

Interpretation of, and drawing conclusions from these data is difficult since there are so many local factors involved. Their presentation in this form will, however, add fuel to the discussions amongst all participants in the Tournament.

Conclusions

The major findings to date of this analysis are:

- There was an increased catch and catch per unit effort (CPUE) from 1959 until about 1970.
- A steady overall catch and catch per unit effort is observed for the HIBT since about 1970.
- The HIBT data on catch and CPUE follow the trends for the Hawaiian recreational fishery as assessed angler surveys over the whole year.
- The HIBT data do not reflect the Pacific Ocean trends toward reduced catch and CPUE seen in data from longline vessels.
- Average catches and weights of Pacific blue marlin have changed little over the years of the HIBT.

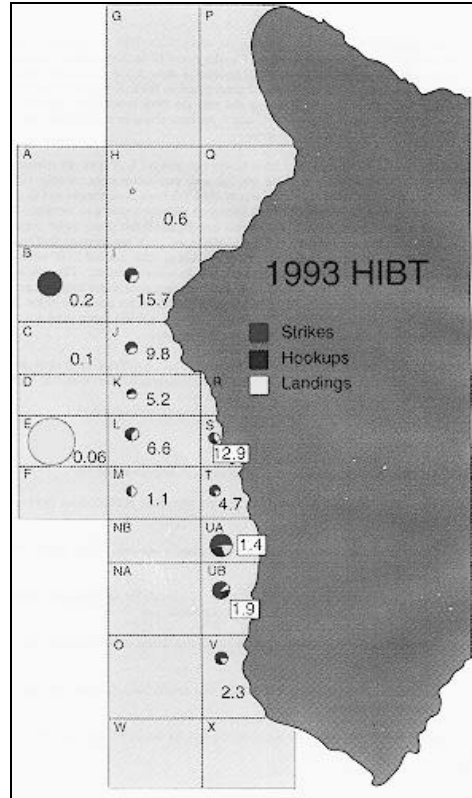


Figure 6A: Fishing activity and fishing effort in areas fished during the 1993 HIBT.

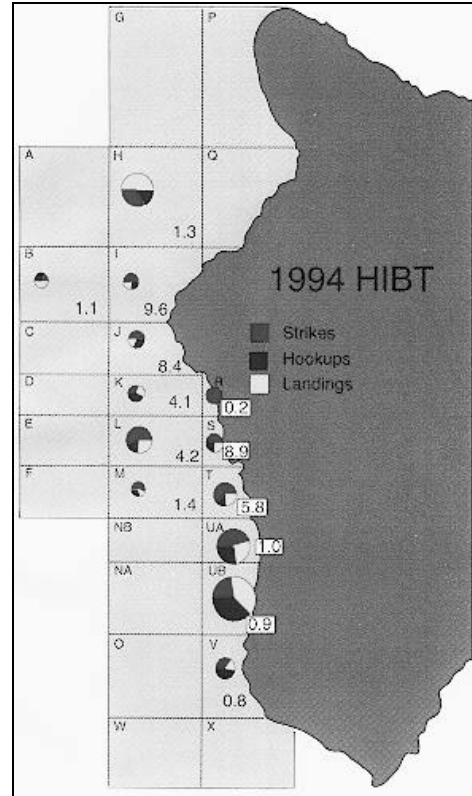


Figure 6B: Fishing activity and fishing effort in areas fished during the 1994 HIBT.

Acknowledgement

The financial and logistic support of the Pacific Ocean Research Foundation and the Hawaiian International Billfish Association in the execution of this research and production of the report is gratefully acknowledged. No part of the report may be reproduced without the express permission of the Pacific Ocean Research Foundation.

Discussion

An audience member commented on the importance of moon phase to fishing success. Other comments touched on catch-and-release and the possibility of biases in the data due to different size fishing areas and other factors.

Reeling in the Next Generation: Marine Sport and Gamefish Tournament Fishing

Brandon Miner
National Fishing Week

Introduction

Let me tell you a little bit about my background. I have been in the sportfishing industry for about ten years. I started as the government communications director for the American Fishing Tackle Manufacturers Association. I went on to coordinate National Fishing Week, which was largely started by the American Fishing Tackle Manufacturers Association. Initially, it was intended to increase sales and the customer base. But it has evolved into a program that emphasizes sportfishing skills, conservation principles, and ethics. To address the question that I am asked most often, yes, I am an avid angler.

National Fishing Week is one of the largest annual public-private partnerships. I will use the National Fishing Week program throughout this talk because it is a very successful program. Every year it attracts hundreds of thousands of youth and their families to various events.

Youth Participation and Recruitment

A recent American Sport Fishing Association study found that if youngsters do not actively participate in sportfishing by the age of ten, they will not become lifelong anglers. That gives us a very important benchmark: we need younger participants than we have had at some of our events.

The principle partners in freshwater-oriented youth recruiting programs are government agencies at the federal, state, and local level. The fishing industry—consisting of manufacturers, wholesalers, and retailers—is also a big partner in these programs. State and local clubs can also contribute valuable resources, such as volunteer instructors, to events. We also work with organized youth groups, such as Big Brothers, Big Sisters, the 4H or the scout clubs. Since they already have a systematic program, it simplifies event organization. Sponsors are also very important. But volunteers are the most critical component. There are thousands of individuals that donate time, experience, and resources to events.

When you are working with youth, the ratio of adults to youth participants is very important. The more volunteers that you can have, the more attention the youngsters can get from an individual to help them in this activity, particularly if the event only lasts for several hours or a day.

Organizing an Event

Starting with federal agencies, you may work with the National Park Service, the National Marine Fisheries Service, or the US Fish and Wildlife Service, perhaps combined with the state fish and game agency. You may involve a local fishing club, and you may branch out to the local Wal-Mart or Target store and ask them if they would like to be involved. By building these partnerships, you have everything in place, perhaps including marinas and charter boat captains.

Now, you need to attract the participants, which requires a little marketing. Contact youth groups, schools, scouts, churches, or fishing clubs. Their pre-organized structure will help you get the number of children that you need: perhaps 30 or 50 in a classroom. You want to be able to handle the number of participants; in our experience hundreds of children may attend a National Fishing Week program. Organizers need to prepare camera-ready ad slips for newsletters, or a press release, to generate recognition interest. The ad slip can be something simple: your club logo, or a logo for the program that you are doing. It should be easily reproduced in newspapers, magazines, or newsletters.

At the event itself you want to provide a total fishing experience. We have learned that rather than just giving participants a rod and reel, and saying, "go fish," it is better to provide them with some basic skills prior to the event.

First, instill ethics. Children need to know proper conduct and understand the rules. Be prepared to answer tough questions. Kids will surprise you with a lot of different things that they want to know. Sometimes I think of them as sponges; they are striving for information and knowledge.

Next, educate them. We have found that they should understand fish: their habitat, their anatomy, where they live, how they feed, and what they feed on. The child then has a better picture of what they are trying to accomplish when fishing. You can also teach things such as water safety.

Third, you want to talk to them about some basic skills. They need to know about the rod-and-reel, threading the line, tying knots, and most important, hook etiquette. Then they can go back out fishing again on their own, without someone always helping them.

In our program these instructional elements are always done on shore, prior to the actual fishing opportunity. Do it beforehand so you have the kids' attention. They want to go fishing and they will listen to anything that you have to say just to get out there and start the activity.

The Pathway to Fishing Program

I will now describe an ongoing program that I think would work very well in a marine setting. It was developed as a cooperative program through federal agencies and several manufacturers.

The Pathway to Fishing program is interesting because it has been designed to handle large numbers of participants. It is set up with seven to ten stations, but the number can be adapted. Small groups of participants go to each station and learn something that helps get them to the water's edge. For instance, the first station may describe the habitat, so they know where fish can be found. The second station might describe the anatomy of the fish. They will learn how the hook is being set. Other stations cover things like casting; they can test their casting skill and they get to practice. The children move right along through a sequence of stations. Once they finish, they have the beginning knowledge to help them with the event. This approach works very well for large groups and it works very well in partnerships. It has been conducted in parking lots and other areas where they do not actually fish. But following that they could fish with another partner.

The hands-on fishing experience is important to youth participants. Preferably, it is an experience that provides the reward of seeing a fish or having an opportunity to get the fish on the boat. We encourage organizers to structure their event so that there will be a successful ratio of fish being caught. This helps the participants get hooked, if I may use that phrase.

The competitiveness of fishing is another issue that has come up in several of the presentations. For youth participants, we have found it important to take competitiveness out of fishing. If there are only a few prizes, the kids cannot understand why they don't get a prize even though they have been fishing all morning. We recommend that the children should be recognized for participating. You can give them something like a certificate of accomplishment. Most organizations can easily design and produce one on a computer. Perhaps organizers can take a photo. It is something that lasts, a reminder of having fun that they can leave with. The ideas are endless, but the point is that children should enjoy the activity and feel that they are accomplishing something without a large competitive burden.

In order to ensure lifelong anglers it would be much better to have a program that has follow-up. A program that allows children to go out again will likely complete the recruiting process.

What do the youths take away from an event like this? We work with children from inner cities, children that have disabilities, children that have never been to the water's edge. For many of them it is an entirely new experience. Even where there's water at the foot of your door, it may be an entirely new experience for some children to get out and learn about fishing. Second, fishing builds self-esteem and confidence. It is an alternative to some of the pressures in society and helps them be healthy, responsible citizens. For example, there is a program called "Hooked on Fishing, Not on Drugs." Third, youth will take away your message from the event instead of anti-fishing feelings. The People for Ethical Treatment of Animals (PETA) are already distributing books to schools. This may be the child's first introduction to fishing, and it presents a negative message.

Hopefully, each participant leaves the event with a feeling that they want to do this again. It is a beginning step in developing a lifelong, healthy recreational activity. They have had a great time and they want to come back and do it again.

What does the volunteer or event planner get out of it? For those of us who already love the sport and the beauty of the marine environment, events like these provide an opportunity to give something back and pass along conservation ethics to the future keepers of marine resources.

Developing Programs for Marine Angling

I would like to make it clear that in the US, recruiting efforts have been primarily freshwater-oriented. But I believe there are obvious lessons that can be applied to the marine setting.

First, in 1995, President Clinton issued an executive order on recreational fisheries to federal natural resource agencies. As a result of this executive order, the National Marine Fisheries Service created an office for recreational and intergovernmental fisheries. This office subsequently produced a specific plan to meet the directive specified in the executive order. It has three elements:

1. Support, develop and implement programs designed to enhance public awareness and understanding of marine conservation issues relevant to the well-being of marine recreational fishing.
2. Establish and encourage the establishment of partnerships between government and the private sector to advance aquatic resource stewardship and enhance recreational fishing opportunities.
3. Establish partnerships with appropriate organizations to provide for environmentally responsible expansion of recreational fishing opportunities for both young and elderly Americans.

The National Marine Fisheries Service is in the process of establishing formal partnerships with groups such as the Girl Scouts of the USA, the International Association of Fish and Wildlife Agencies, the International Game Fish Association, the American Sport Fishing Association, Fishing Has No Boundaries, Inc., and the Paralyzed Veterans Association of America. These last two groups work with disabled anglers. Discussions are also underway with the American Association of Retired Persons and the National Marine Educators Association. It is our hope that these national-level partnerships stimulate on-the-ground programs in marine settings nationwide. I hope that we can introduce the next generation of marine anglers to the wonderful gamefish sport that we all enjoy.

This is a summary of Ms. Miner's presentation.

Discussion

In response to a comment from the audience, Ms. Miner agreed that parental participation in events is a good idea and helps address the follow-up issue. She also discussed the issue of anti-fishing campaigns. Children can ask very intelligent questions about ethics during events but they are not dissuaded from participating in the sport.

Gamefish Tournaments and FAD Fisheries in Okinawa, Japan

Shinichiro Kakuma
Okinawa Fisheries Experimental Station

Abstract

Six billfish tournaments have been held annually in Okinawa, Japan. Two are supported by the Japan Game Fish Association (JGFA). Six to forty teams attended the two- to three-day tournaments in 1997. Approximately 60 billfish (4,800 kg in weight) were caught in these tournaments, while roughly 150,000 kg (1,875 in number) of blue marlin were caught by fisheries at Fish Aggregating Devices (FADs) in 1997. Targeting mainly yellowfin tuna, 177 FADs occur around Okinawa. Yonaguni Island is one of the most productive sites for blue marlin where the main fishing season is from March to September. Through analysis of the weight composition of blue marlin, two modes emerge, around 50 kg and 100 kg. The fishing in the tournaments seems to have little effect to the stocks of the billfish; and the catch and CPUE of the blue marlin fisheries do not show a clear declining trend.

Introduction

Billfish tournaments are becoming popular in Okinawa. The development of the tournaments is significant; for the tourist industries in general, and for the fisheries sector, which is able to hire out their fishing boats at a high rate during the tournaments, offering a profitable new business venture.

Blue marlin (*Makaira mazara*) is the biggest catch among the billfish species in both the tournaments as well as in the fisheries at Fish Aggregating Devices (FADs) around Okinawa. The catch in the FAD fisheries is far greater than that in the tournaments. However, resource conservation would become a main concern for both of the fishing groups.

There are few studies on the effects to the blue marlin stocks by the tournaments and by the FAD fisheries in Okinawa. In this report, I outline both the billfish tournaments in Okinawa and examine the statistics of the blue marlin fisheries at FADs.

Billfish Tournaments in Okinawa

Six billfish tournaments have been held annually in Okinawa. Two are supported by the Japan Game Fish Association (JGFA). Six to forty teams attended the two- to three-day tournaments in 1997. Approximately 60 billfish (4,800 kg in weight) were caught annually in the tournaments (see Table 1).

Table 1: Billfish tournaments in Okinawa. The number of teams and the number of billfish caught were roughly estimated by interviewing.

Location	Starting year	Number of teams	Number of billfish caught	Supported by JGFA
Manza	1987	30	10	yes
Nah	1994	35	10	yes
Kumejina	1987	17	17	no
Yonaguni	1990	40	17	no
le	1995	6	3	no
Ginowan	1992	10	3	no

Blue Marlin Fisheries in Okinawa

Roughly 150,000 kg (1,875 in number) of blue marlin were caught by FAD fisheries in 1997, in which 50 percent and 20 percent were caught at Yonaguni and Itoman, respectively. Table 2 shows catch, number of fish, average weight and maximum weight of blue marlin caught at these locations from 1989 to 1997. At Yonaguni, catch ranged from 24,904 kg to 76,503 kg; number of from 248 to 842; average weight from 87 to 100 kg; and the maximum weight was 260-484 kg.

Table 2: Blue marlin catch at Yonaguni and at Itoman.

Yonaguni	1989	1990	1991	1992	1993	1994	1995	1996	1997
Catch (kg)	75,503	74,871	68,223	45,207	44,240	24,904	50,574	55,929	66,917
Number	812	842	781	451	462	248	552	568	778
Average (kg)	94	89	87	100	96	100	92	98	90
Max (kg)	484	466	282	398	260	360	420	395	460
Itoman	1989	1990	1991	1992	1993	1994	1995	1996	1997
Catch (kg)	32,728	14,830	14,820	14,343	16,257	11,325	18,927	19,305	29,510
Number	361	238	204	200	195	131	263	231	398
Average (kg)	91	62	73	72	83	86	72	84	74
Max (kg)	380	216	380	247	247	185	300	324	200

Figure 1 illustrates the transitions of the blue marlin catch in Okinawa, at Yonaguni and at Itoman from 1973 to 1997. The total catch in Okinawa increased until 1986, presumably according to the increase of FADs. Then suddenly it decreased in 1987 and 1988, following another peak in 1989. Since 1990, the catch has fluctuated. At Yonaguni, the catch had a decreasing trend prior to 1988; however, it has increased since 1994. The catch has also been increasing recently at Itoman.

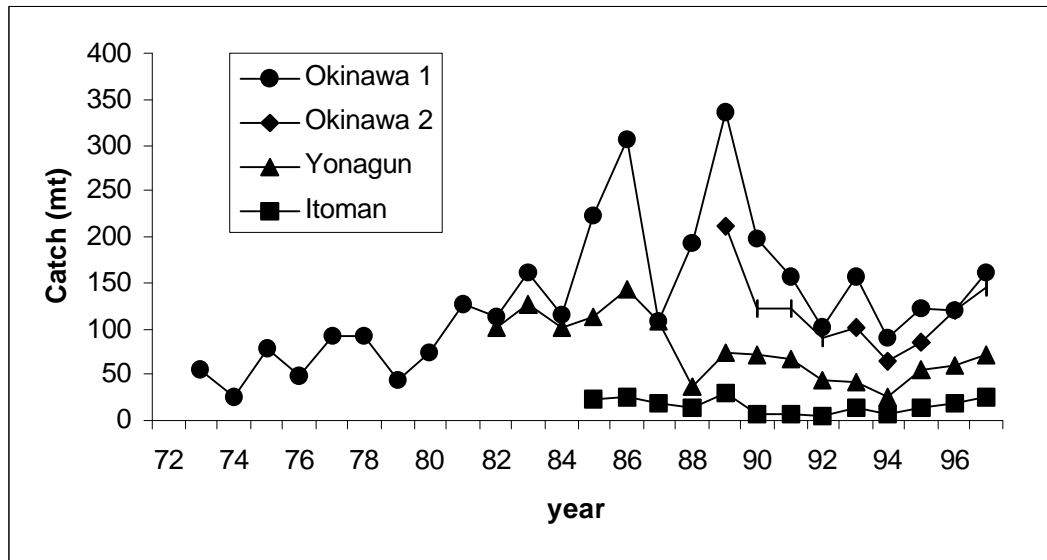


Figure 1: The catch of blue marlin in Okinawa, at Yonaguni and at Itoman. Data of “OKINAWA1” was derived from the national government statistics. Data of “OKINAWA2”, “YONAGUNI” and “ITOMAN” were derived from the statistics of Okinawa prefecture fisheries experimental station.

The fishing season of blue marlin at Yonaguni is from March to September, mainly from April to August, with peaks in April and July. Figure 2 shows the catch by month in 1995, 1996, 1997 and the average from 1989 to 1997.

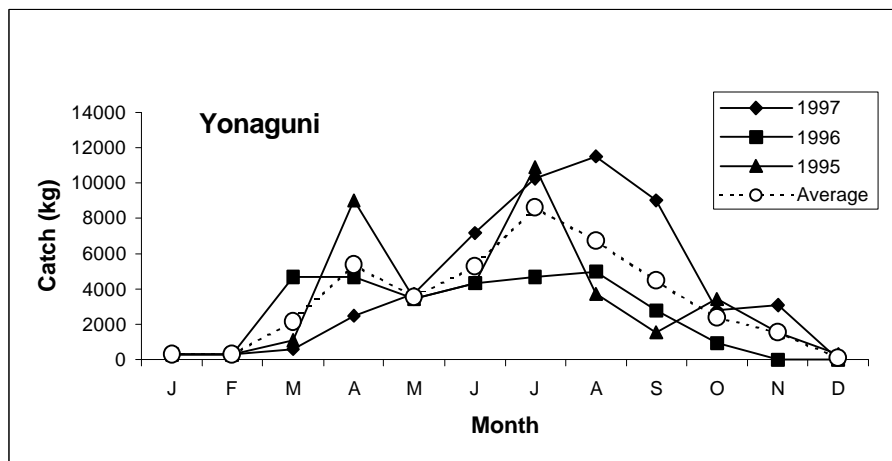


Figure 2: The blue marlin catch at Yonaguni by month in 1995, 1996, 1997 and the average from 1989 to 1997. The catch was greater in summer.

The fishing season at Itoman is also from March to September, but begins later and ends earlier than that at Yonaguni. Figure 3 shows the catch by month in 1995, 1996, 1997 and the average from 1989 to 1997.

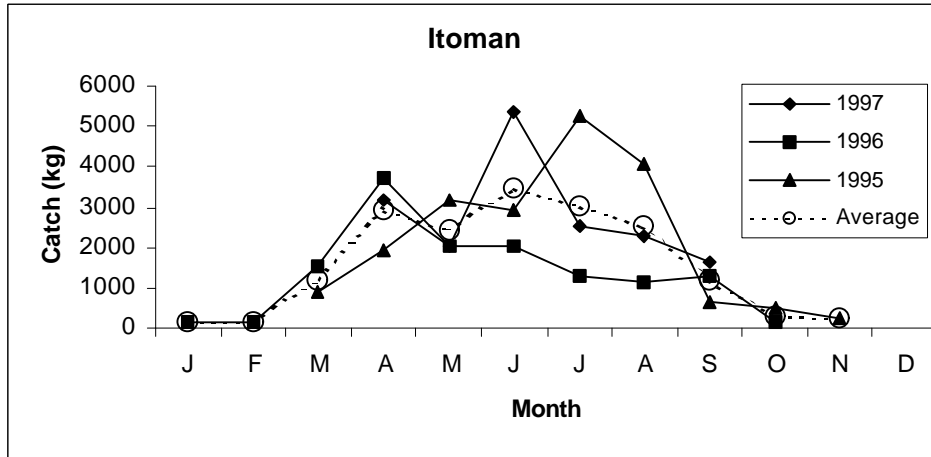


Figure 3: The blue marlin catch at Itoman by month in 1995, 1996, 1997 and the average from 1989 to 1997.

The weight composition of blue marlin caught at Yonaguni in 1997 is illustrated in Figure 4. Two modes, at around 50 kg and 100 kg, presumably represent males and females, respectively. Masuda et al. (1989) investigated the blue marlin catch at Yonaguni from 1982 to 1986. They found two weight groups of blue marlin, around 50 kg and 100 kg; and they mainly consisted of males and females respectively. Females tended to come earlier in the fishing season to the waters off Yonaguni Island creating the catch peak in April, with the male group arriving later creating the catch peak in July.

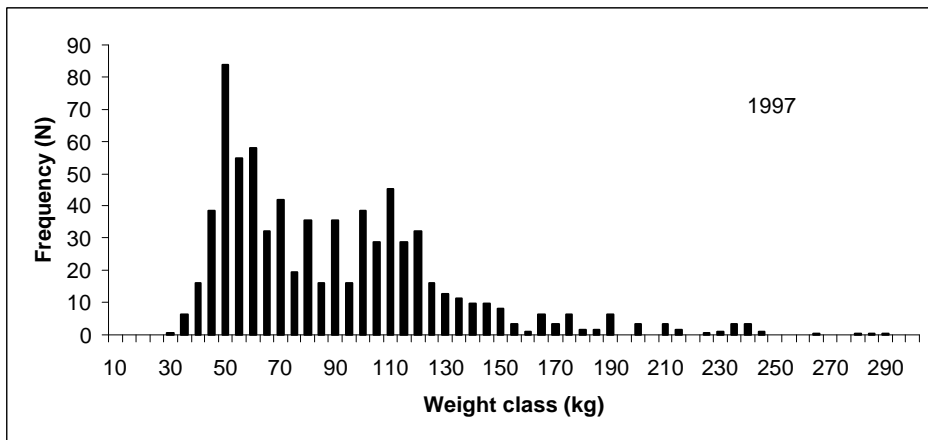


Figure 4: The weight composition of blue marlin at Yonaguni in 1997. There were two modes at 50kg and at around 100kg; presumably represent males and females respectively.

Figure 5 shows the transitions of the catch of the blue marlin at Yonaguni and Catch Per Unit of Effort (CPUE). Here, effort equals the number of blue marlin fishermen multiplied by fishing days. We assumed that fishing days are days when at least one blue marlin was caught and the number of fishermen equals all the fishermen who caught at least one blue marlin in the fishing term.

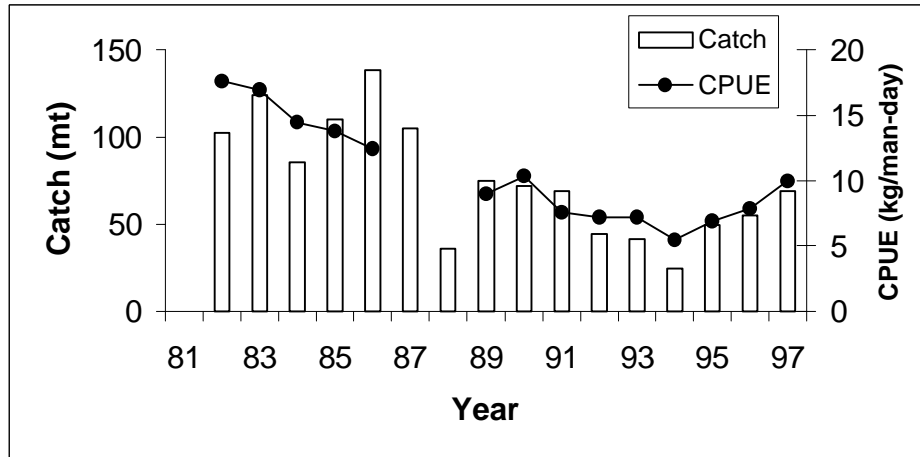


Figure 5: The catch and the CPUE (kg/Day*Man) of blue marlin at Yonaguni from 1982 to 1997. The CPUE from 1982 to 1986 were derived from Masuda et al. (1989).

The CPUE from 1982 to 1986 were derived from Masuda et al. (1989). It showed a decreasing trend. Since CPUE is considered as an index of the stock level, it caused some worries on the blue marlin stocks off Yonaguni. The CPUE continued to decrease until 1994, however, it has increased since that year.

FAD Fisheries and Research

There are 177 FADs around Okinawa, where fishermen target mainly yellowfin tuna. Each FAD is far bigger than normal FADs and cost more than US \$1,000,000. To date, the prefectural government has deployed eight FADs. To examine the relation between the catch from the FADs and the current or the water temperature, we have been setting current meters and thermometers on the big FADs.

Conclusion

Regarding the small amount of billfish caught, the fishing in the tournaments seems to have little effect to the stocks of the billfish; and the catch and CPUE of the blue marlin fisheries do not show clear declining trends. From this viewpoint, we have much room for developing billfish tournaments in Okinawa.

Reference

Masuda, Y., Fujikura, H. & Ozawa, T. (1989) Catch Analysis of Blue Marlin off Yonaguni Island, Southern Japan. *Bull. Japan. Soc. Fish. Oceanogr.* Vol.53 No. 3. 255-262.

Discussion

Questions centered on FAD design and deployment. Mr. Kakuma indicated that the lifespan of FADs has been increasing to about three years. FADs are paid for through subsidies from the Japanese national government, and fishers are thus free to deploy very expensive FADs. There was also some discussion about the market for marlin. Mr. Kukuma said that marlin caught in Okinawa are mostly exported to mainland Japan.

Sportfishing in the Cook Islands

Michael J. Henry, President
Aitutaki Game Fishing Club

The Cook Islands are located between 156° and 167° W and 8° and 23° S. They comprise 15 islands and atolls. They extend over 1,500 km of ocean, roughly in a north-south orientation. It is impossible for us to monitor our very large EEZ. We rely on our neighbors—French Polynesia, Australia, and New Zealand—to provide both aerial and sea surveillance. As a result, when we sell licenses to foreign fishing vessels, we can make them adhere to our fishing regulations.

In the Cook Islands you mainly go fishing to catch something and take it home and eat it, or feed your family. But it's also a skill and a sport. For hundreds of years we've had competitions that highlight the skill of fishermen. Competitions ranged from chasing fish onto the reef with a single-pronged spear to huge community-type competitions using coconut fronds. They encircled large areas of the lagoon and chased the fish in and caught them with their hands.

Our fishing club was formed ten years ago. About a year after we formed, we affiliated ourselves with the IGFA and all of our competitions operate under the rules of the IGFA. Our club was formed around a very simple thing: a scale. In the Cook Islands we enjoy having a drink occasionally, and it was at one of these occasional drinks that we began discussing who caught the biggest fish that day. But we didn't have a way of determining which was the biggest fish except by looking at them. After a few days of discussion, a New Zealand expatriate suggested that we get some certified scales so whatever we catch can be internationally recognized. We did this. And our club formed around that simple thing, buying scales. Our club now has 60 dues paying members.

We have a competition every month. I won't call it a tournament, it's a competition. We normally fish over one day from 5:00 AM until 5:00 PM.

Our boats and tackle are probably on a par with what you get here, except we don't go in for the very heavy gear. Generally, our fish are not huge fish. We've never caught on rod-and-reel a 1,000-lb. marlin, for example. About eight months ago we caught a very big marlin. I didn't see it before it got cut up, so there is some debate now as to whether it was a black marlin or a blue marlin, and it was about 420 kg chopped up. We recently bought a new digital scale, that can weigh anything up to 1,000 kg in 0.2 kg increments. So we won't have this problem again in the future. We caught this marlin near a FAD. When the tuna are running fishermen tie it to the FAD. They fish with vertical longlines on a buoy off the boat and vertical handlines with drop stones and one hook and a bait.

Marlin often come around the boats if they have live bait out. We regularly catch marlin, but for us it is bycatch. We don't actually target them. We don't normally go out and just troll big lures or big live bait in an effort to catch marlin because of the high cost of fuel. It gets expensive if you're going to drive around all day and come home with nothing. So we normally fish close to the reef.

Captain Rick Pollack, from New Zealand, is a regular visitor to the Cook Islands, and brings with him IGFA certified scales, and quite a bit of camera gear. We are planning to go to an uninhabited island right next door to our island, just 60 miles away, and make a big effort to catch some world class fish, including bonefish, on saltwater fly and light tackle. We know we have world record size bonefish; our club record is 5 kg and I have seen bonefish approaching 10 kg.

Traditionally, we caught these fish with a net. But we would like to stop net fishing because our resources are becoming depleted. As a club we are trying to instill the conservation ethic in our youth. We are going to try and convince them to protect areas in the lagoon, then after a few years we will be able to catch fish with rod-and-reel and nets again.

This symposium has been an opportunity for me to learn from the experiences of all of you and to meet and network with some of my Pacific cousins. It's been great and I really appreciate the opportunity.

This is a summary of Mr. Henry's presentation.

Discussion

In response to a question, Mr. Henry noted that there are no regulations in the Cook Islands governing the sale of fish to the local market by sportfishermen. In response to another question, he said that when fishing around FADs, fishermen target albacore tuna, using live bait.

Pop-up Satellite Tag Technology and Its Application to Sportfishing

Barbara Block

Tuna Research and Conservation Center, Stanford University

Introduction

This afternoon I will discuss some of the technology that we first began using here in Kona in 1995 with many of my colleagues from the Pacific Ocean Research Foundation. I also want to relate how tournament structure and tournament fishing is helping scientists get this technology out in the field on both tuna and marlin. Recreational sportfishing tournaments are one of the major points of access that we have. Pelagic animals are difficult to study, that's why we know so little about them. We would be lost as scientists if we couldn't have recreational fishermen out there fishing for these animals. Here in Kona there has been a 30-year tradition of the HIBT having scientific participation in the tournament. The founding fathers of this tournament should be applauded for their efforts to bring scientists in 30 years ago.

At the HIBT we scientists get access to the fish and are allowed to do things such as put on satellite tags or take DNA samples prior to weighing the prize fish at the scale. In fact, HIBT-associated research studies have resulted in over 70 peer-reviewed publications on blue marlin and yellowfin tuna.

Satellite and Archival Tags

My colleagues at Stanford and I have for many years been interested in methods to learn more about what these fish do in the open ocean environment. The primary techniques we have had up until the early 90's have been tag-and-release and acoustic tracking. Acoustic tracking has provided us with many bird's eye views of what pelagic fish do. But as everybody knows, we get data for periods of one to seven days. We also get very detailed data at second intervals about what a fish does for a couple days or up to a week, but we don't really know the big picture. This lack of the big picture has motivated many of us across the globe to try to take advantage of the communication capabilities of satellites and the power of computer microprocessors in order to get information from big fish.

The field is moving forward on two fronts; one front is called archival tagging, in which a data logger tag takes data while it is inside the fish. Another technique that is becoming popular—first pioneered by marine mammal and sea turtle biologists—is satellite tags. We in the big fish community have pioneered a new type of satellite tag called the pop-up satellite tag. These tags send data up to the ARGO satellite system. This satellite has the advantage that

it can receive data from instruments with very low power. Cellular phones require much more power to communicate than does the ARGO system. This low power requirement means that we can actually build instruments that have very small batteries inside them and hence can be carried by animals in the open ocean.

With satellite tags we are able to get a position based on a radio signal that is being sent up from the tag to the satellite, which then uses the Doppler effect to determine the position of that radio transmission. Data can also be stored on a tag and sent in small amounts to the satellite system. This is also a disadvantage of the ARGO system: we can only send very small amounts of data at any one time. But satellite tagging potentially has a great advantage over traditional tag-and-release because it gives us a fishery-independent measure of where marlin or tunas go. However, in the past these tags were large in size—up to 0.5 kg. But more recent models only weigh about 67 gm. The only disadvantage of these tags is that they are carried externally by the animal, and whenever you put something externally on any organism, it will suffer from drag. This increases the likelihood of tag loss.

In contrast, archival tags are inserted into heavily exploited fish, such as the bluefin tuna. They have up to two megabytes of data storage. The tag wakes up every two minutes and records data from a depth sensor, an ambient temperature sensor, an internal temperature sensor, and a light sensor. The most interesting aspect of these tags to most fishery managers, as well as most of the public, is we can use the light sensor to determine the fish's position. From local noon on a clock, you can accurately determine longitude. It is a little more challenging to use sunrise and sunset times to determine latitude. They can be off as much as a degree or two in their latitude accuracy, but to date there has been no better mechanism that we have to follow a fish every day in the sea than this light-based method.

Pop-up Tag Development

Beginning in about 1993 we toyed around with the idea of putting the type of satellite transmitter, that had previously been used to study sea turtles on to a marlin captured in the HIBT, but in a much smaller, 500 gm package. We tagged six marlin but only had three uplinks. It was really the failure of this experiment, like many things that happen in science, that fueled my interest in making this method work. So we went back to the Stanford lab and we spent two years working with our group, as well as collaborating with other scientists, both in Australia and NMFS, to think about how best to pop off the tag that would ride on a tuna or a marlin and then download the data. In the early days we put these tags on some of our captured tunas up in Monterey in order to see how best to keep these tags on and do complete testing for up to six months to a year prior to trying this in the wild.

The final design that became the first generation pop-up satellite tag was a torpedo design in which the electronics are packed in a bicycle tube. The electronics weigh about 50 gm. At the top there is a 17 g foam float that can actually bring this tag to the surface very quickly. We can control tag release by means of a corrosive linkage. After successfully testing it first in the tank environments and then in a pen environments, we then proceeded with a large experiment out in the Atlantic, in February 1997.

After testing, we initiated a tagging program called Tag-a-Giant in Hatteras, North Carolina. In this program we have a tournament in which all we do is tag and release bluefin tuna. We offer prizes based on where the tagged fish went, how far they went, and which archival tag came back the soonest. The recreational community is helping our research by getting people to sponsor these tags, which cost \$1,500-\$2,500.

During the program, when a fish is brought on the boat it is measured to be sure that it is the size fish that we want to tag. The tag is then placed on the second dorsal fin. We know from the captive experiments that this is the place where the tag will be retained for the longest period. It goes in about four inches deep and then gets locked into some bones that extend out to the second dorsal. Simultaneously, with some of these fish, an archival tag is surgically implanted. All together, over 200 fish were tagged in this experiment.

In another experiment, we put out the tags to be sure that these fish were surviving the handling procedures. Pop-up satellite tags may have the largest use in recreational fisheries as a means to measure survivorship. These tags that were put on for periods of 3-14 days and there was one 100 percent success at recovering the tags.

The other test that went on in the early phases of this work in 1997 was to make a better float for the top half of this tag. Once we chose the design, we did a larger experiment with approximately 28 giant bluefin. The pop-up satellite tags were released after 60 to 90 days. It turns out that when the tags popped off after 90 days, they were in the Western North Atlantic, as much as 1,900 nm away from Cape Hatteras. The main result of this experiment is to show that this technology is reliable and it works. There was 97 percent recovery of the tags.

Average temperature data compiled as a single point are reported in this first generation tag for only 60 of the 90 days, but they are very important data. It tells us whether the fish survived or not and it tells us a little bit about the behavior of the fish. If the fish died, we would see a constant record of cold temperature. If the tag came off, we would see a constant record of the tag floating at the surface.

We are getting enough information from these first tags to actually piece together a little bit of the story of what these animals are doing. We can combine the pop-up data with remote sensing data and get nice confirmation that the temperature data from the tag is actually reliable. So the temperature data in the first generation tags was about plus or minus one degree. That is a good correlation for this particular tag.

To conclude this discussion of the bluefin tuna work, we have learned that 97 percent of tag-and-release bluefin reported back. Importantly, what we gained from this first experiment was an awareness of this species' remarkable ability to range within 90 days 2,000 miles away from the point of tagging, which will become important as we move forward in trying to learn more about this particular animal.

I wanted to briefly mention archival tags and the way that we get them back. The disadvantage of the implantable archival tag strategy is you have to get the fish back, you have to have

a fishermen recover the animal, which requires, in the case of the Atlantic bluefin and most tunas and billfish, an international recovery plan. The data you get back, though, are spectacular, and hence, worth the wait.

I want to emphasize that what made this project completely successful was the cooperation of the recreational community. Commercial fishers also cooperated with us. But what was remarkable was how recreational tournament-style fishing together with sponsorship has led very quickly to a large-scale effort at tagging these fish in the Atlantic Ocean. The future is great for archival and pop-up tagging of bluefin tuna; with our federal and philanthropic funding we plan to tag 500 fish by the year 2000.

Tagging Marlin

In 1996 the brain trust of the Pacific Ocean Research Foundation began trying to figure out how to put a pop-up tag on a marlin. In 1996 we put out some dummy tags in the HIBT and tried to get this tournament focused on putting out an expensive device in a tournament setting. Pop-up tags have now been put on a total of 18 marlin by our group, and I'm going to tell you about some of those marlin now.

Here in Kona during the 39th HIBT we tagged ten fish during the tournament. Of those ten fish, we recovered four tags. (One of those tags was recovered because someone caught the fish and not because it popped off.) We used light tackle. All the fish except for one were tagged on 50-lb. test.

One fish traveled from Kona, Hawaii to about 500 miles west of the Galapagos in 90 days. It looks like this blue marlin, which is a relatively small fish, swam straight for the hot water. That is a record for a pop-up fish right now; it is a long distance to travel in 90 days. Of the other two fish, one was relatively close to the Hawaiian Islands, just to the west. The other one was very close to Christmas Island. What we see as a general pattern on all the marlin tags that we have put on to date is a trend of being in warm water with much less fluctuation than one would see in a bluefin tuna experiment.

I want to briefly discuss the major difference between the two studies. I spoke of 97-99 percent tag recoveries in bluefin tuna tagging. In the case of blue marlin, there is, in my accounting, less than 40 percent success rate. Something is not working.

One idea, of course, is that there is a lot of light tackle involved here. We have all known for a long time that while light tackle is a lot of fun to catch fish on, it actually stresses these fish physiologically. Upon release, they don't recover and this could be a sign of mortality. Even in our own dealing with these fish right here in Kona, we know that we have problems with mortality and it is possible that this lack of success I speak of in this first-try experiment is a sign that there may be bad news to come.

So we have some guidelines for the future for blue marlin work that we are going to try to follow with funding from the Billfish Foundation. First, we need to work with tournaments in

a survivorship study and find out if tag-and-release is working. We recommend that at least 100 fish should be tagged in this first experiment. These are expensive tags, so there is a financial limitation on what we can do. We think that the tag duration should be very short, 30 to 60 days. We also want to keep the variables more controlled by just having five or six crews working with these tags. These crews should be trained by an experienced tagging scientists, but do the actual work on their own. Finally, the tags would be equipped with an indicator to help us understand whether they are coming off prematurely, or if mortality is the problem.

Future Developments

I want to just end by telling you that the future is bright for this type of tagging. The tags are evolving, several more tag manufacturers are entering the fray, which is great, because competition will cause prices to drop. At Stanford we are building an in-house tag that is going to be cheap, as little as \$500, which is a nice break in price from the current \$3,000 price tag.

A second tag is being built collaboratively with Wildlife Computers. It is a pop-up satellite archival tag. This tag will geo-position the fish, providing position about once a week. These tags are called pop-up satellite archival tags. This summer they are in their final phase of testing.

In conclusion, the pop-up archival satellite tag and the pop-up satellite tag offer the research community, as well as the recreational and commercial community, tools that can get us some answers that we have needed for a long time. These tools are going to allow us to finally figure out where these fish go, what their stock structures are, and what their fidelity to particular areas are. I think that with increasing fishing pressure it is time that all of us—the scientists in recreational fisheries community as well as the scientists in the commercial community—get together and try to use these instruments to figure out the answers to some of these questions before it's too late.

This is a summary of Dr. Block's presentation.

Discussion

Discussion centered on the problems of tagging marlins. An audience member asked if the pop-up tag interfered with the marlin's swimming. Dr. Block said that these tags do not bump into the fish if they are placed correctly. Instead, they tend to pull up off the fish. However, they had to redesign the antenna because this was interfering with the fish and becoming damaged. In comparison to bluefin tuna, marlin are more difficult to successfully tag because tuna have more space in the tail region.

Another audience member asked if researchers might have more success tagging other marlin species. But Dr. Block indicated that researchers have tagged both striped and black marlin with poor results.

An audience member speculated that commercial fishers may be recovering the tags but not returning them. Dr. Block didn't think this was likely, although they did have a case where an Italian fisher caught a fish with both external tags and an internal archival tag. Although he returned the external tags, because he was unaware of the internal tag, he did not remove it. That kind of mistake is likely to happen often.

Dr. Block concluded by saying that low cost pop-up tags will greatly improve this kind of work. Then it can become much more like conventional tag-and-release.

Gamefish Tournaments, Computer Technologies and the Internet

Dan Toye
Holoholo Hawaii Marine News

We are using tournament web sites to provide an online archive for most, if not all, of the major happenings that occur during gamefish tournaments. In fact, the web site primarily serves as a press room, with instantaneous access by the worldwide media interested in covering these tournaments. It also allows the consumer to access information directly, without having to look for it in magazines or on TV shows. We are trying to provide coverage, which if not actually live, occurs as soon as possible after the event takes place. This benefits the folks back home who have friends and relations participating in the tournaments; they can find out how their buddies did today during the fishing. We provide web services for other events such as sailboat races. We have a large following that visits the site everyday to see what's going on.

Web sites can dramatically reduce the cost of distributing information because, once the pages and the data are assembled and uploaded to the internet, anybody can get it anytime they want. For example, a media staff providing fax services is unnecessary. The cost is pretty minimal in comparison to previous information distribution methods using printed media, or more recently, faxes. People in the South Pacific are paying \$2-\$4 per page to send faxes. In the amount of time it takes to fax one page, I could send you the entire web site, which would be two weeks' worth of activity.

We try to focus on human interest features. For instance, one web page displays this year's Miss Billfish. It gives her the opportunity to get in front of a global audience. We also try to provide photographs that highlight the most featured of the newsworthy items. They can be used by the media if they need something to make a deadline for tomorrow morning's newspaper. For example, the biggest fish of the Pro-Am appeared on television news that night. We make sure that the information is available as soon as possible so that the media can make their deadlines.

We are also making an effort to keep an accurate account of the daily catch statistics and daily standings. This year we are trying to photograph everybody who pulls up to the weigh-in with a fish, whether it be tag-and-release or a weighed fish.

As far as the amount of work that it takes for the two-week event, I think you're probably looking at something on the order of 40 to 50 person-days in the production of the web site. And while it may seem like a lot of work up front, I think the benefits of it accrue over time. Ten to twenty times more people will look at the web page than will actually show up out

here at the dock. Surfing web sites—the Triple Crown of Surfing, for instance—get 25,000 people a day, versus 500-600 people who show up on the beach. I think the same thing will hold true for any of the gamefishing tournament web sites that are produced.

When you have a tournament in a remote location like Hawaii not many people can get there. The Web presents another opportunity for them to be here, as it were, and this is why we make an effort to make the information available as near to live as possible. In fact, during the tournament that follows the Pro-Am, we are going to try and upload photographs right at the dock. If somebody brings a fish to the dock, we are going to snap a digital photograph and immediately upload it to the net. The Web allows event organizers to get information into the hands of interested people immediately, as opposed to the televised or print media with a time lag of days, weeks, or months.

The Web gives organizers, and particularly the sponsors, an opportunity to reach a new market: people who have grown tired of television and are looking for new sources of information. The Web is a great medium for these people.

This is a summary of Mr. Toye's presentation.

Discussion

Mr. Toye noted that fishing tournament web sites do not receive as many visits as sailboat racing sites.

He uses Use Net discussion groups to alert people to the contents of his site. He makes sure that there are postings on the Use Net all the time with the URL for his web site.

An audience member commented that the Web has revolutionized the way traditional media cover events. It is more common for reporters to gather all their information, including photographs, from the Web without actually visiting an event. As a result, there may be a smaller media presence at fishing tournaments.

Mr. Toye emphasized that people in remote locations, such as many Pacific Islands, can use the Web as an effective and low cost promotional tool.

The Web can also help event participants, especially for international events, by making information and registration materials widely available. This should increase the number of first-time participants, who may find out about the event from its web page.

The Web can facilitate record-keeping. Information can be stored in Web-accessible databases. Faster access to information would also improve event planning.

Cost-earnings Study of Hawaii's Charter Fishing Industry, 1996-1997

Macia Hamilton

Pacific Islands Area Office, National Marine Fisheries Service

Abstract

The focus of study was Hawaii's 1996-1997 charter fishing industry. Vessel operators at major harbors statewide were surveyed through direct in-person interviews. Information was obtained on 62 moored, six-passenger charter fishing vessels. Data includes information on vessel operations and characteristics, investment, fixed costs, trip costs, annual catches and gross revenue, as well as operator demographics and the degree of involvement in the business by the vessel owner. Owners were classified into three groups: absent owners who have little to no involvement, active owners who run the business but generally do not captain the boat, and owner operators who run both the business and the boat. Surveys were post-stratified by port, owner involvement and vessel size. Variations in vessel operations were observed between all groups but differences in the annual number of trips taken per vessel were greatest between vessel ports, with Lahaina based vessels being the most active followed by Kauai, Maalaea, Kewalo, and Honokohau based vessels respectively.

Introduction

This project focused on Hawaii's sportfishing charter boat industry in 1996-1997 and was undertaken in order to gain a better understanding of both the current status of this sector and the factors which influence it. This is a baseline study which provides economic and operational information to both industry members and fishery managers. Problems exist with the identification of charter fishing fishermen and vessels in Hawaii records. There are two specific requirements to operate a charter fishing boat (with six or less passengers) in Hawaii. First, the captain must hold a valid captain's license which is issued by the US Coast Guard, and second, the vessel owner must hold a valid commercial permit issued by the Hawaii Department of Land and Natural Resources, Division of Boating and Ocean Recreation. A commercial permit authorizes a vessel operator to conduct commercial operations at the harbor for which it is issued, and allows activities such as parasailing trips, snorkel or dive trips as well as charter fishing trips. There are a limited number of commercial permits issued for moored vessels at each harbor, in general ten percent of slips are designated as commercial slips (for use by vessels with commercial permits). Due to the multiple uses of commercial permits they do not provide an accurate count of moored charter fishing vessels in Hawaii. Charter fishing (and all other) vessels must be either registered by the state of Hawaii or, if over approximately five net tons, documented by the Coast Guard. Those registered with the state of Hawaii receive vessel identification numbers with suffixes thought to represent the

vessel's main activity. The determination of a vessel's main activity is left up to the operator. If they indicate that their vessel's main activity is commercial fishing they will receive a registration number ending in CF; if they indicate that their main activity is carrying commercial passengers they will receive a registration number ending in CP. Charter fishing vessel operators applying for Coast Guard documentation for their vessels will be categorized as receiving a Coastwise endorsement if they do not sell fish, and a Fishery endorsement if they sell at least one fish. Unfortunately, neither the state or federal system provide unique identification of charter fishing vessels as each group contains non-charter fishing vessels as well as charter fishing vessels. The only identification of the charter boat operator as an individual takes place when (and if) they apply for a Commercial Marine License from Hawaii's Department of Land and Natural Resources, Division of Aquatic Resources (HDAR). Unlike many other states, Hawaii law allows the sales of fish caught during sportfishing charter boat trips provided that the seller (usually but not always the captain) possesses a Commercial Marine License (CML) which is available for a \$25 annual fee. Based on the survey results presented here, the majority of charter fishing operators in Hawaii sell at least some portion of their catch. The specific question, which is included on the CML application, is:

"Charters? Yes/No"

As this is an application for a license to sell fish, it seems likely but is not obvious that it is fishing charters that are being referenced. According to Commercial Marine License applications, there were 265 license holders who answered in the affirmative as of December 1996. When aggregated by vessel, 253 fishermen were associated with 187 separate vessels, 12 license holders did not indicate a vessel name on their applications (and were deleted). Of the 187 vessels thus identified, 27 were listed as trailered vessels, leaving a statewide count of 160 moored charter fishing vessels. However, in the course of this project 199 vessels were identified as being moored, six passenger charter fishing vessels. Identification came via survey interviews, observation and information from key respondents at major harbors.

Survey Methodology

Information for this project was collected from charter boat owners and operators through direct in-person surveys. Development of the survey instrument began in August 1997 with a draft form which was reviewed and pre-tested by key respondents. Following revisions, the survey process then began at Kewalo Basin in Honolulu in September 1997. The survey was administered at six harbors on five islands over a six month period, with respondents being questioned about their operations over the previous 12 months. There was one interview done in June of 1998, it focused on 1997 operations. Charter vessel operators were either intercepted as they returned from fishing trips or approached at their slips while they were cleaning or working on their boats. All interviews were conducted by a single researcher and were generally conducted with the operator (captain) of the vessel, whether they owned the vessel or not. Figures 1-5 (found at the end of this paper) illustrate the locations of Hawaii's harbors, with survey sites indicated. I began each interview by approaching the captain, introducing myself, explaining the purpose of the survey and asking if they would be willing to participate. Of the 64 captains and or vessel owners approached, three declined to partici-

pate, yielding a successful response rate of 98 percent. The survey process took 20-40 minutes and at the conclusion participants received a correspondence address for further comments or questions. Respondents were also offered summaries of recent catch statistics and other fishery related publications in order to provide them with useful information in return for their assistance.

Survey Instrument

Based on Walker's report (1996), three types of charter fishing operations were anticipated. First were those that were owner operated, meaning that the vessel owner captained the majority of trips; second were those that had out of state or absent owners who hired local captains to run their business, and lastly were those which used hired captains but closely supervised them and the business (termed active owners). Due to the mix of owner-operators and hired captains, as well as the difficulty of contacting and interviewing out-of-state owners, the survey form was constructed so that consistent information could be collected from vessel operators, whether they owned the vessel or not. There were five major areas within the survey: owners motivations, vessel and operating characteristics, fixed and variable costs, catch and revenues, and respondents demographics. Vessels were stratified into three groups (owner operated, absent owner, or active owner) based on owners' involvement as revealed by the respondents answers to the questions:

1. "Do you own this vessel?"
2. "How many of the past 12 months did the owner (you) spend in Hawaii?", and
3. "How involved is the owner (are you) in the operation of the boat and/or business"

Participants were also asked:

4. "How would you describe the owner 's (your) major motivation for owning a charter boat in Hawaii?"

Responses to the last question were grouped into four categories:

- to work the business themselves,
- to make income,
- to have a boat (with a slip) available for fishing by the owner, and
- other, including "*I don 't know*" and "*I want to get out.*"

The most common response to the latter question by owner operators was that they love to fish and thus that they own their vessel in order to work the business themselves. Respondents on vessels owned by active owners largely believed that the owner's motivation was a combination of wanting to work the business themselves and also having a boat available when they wanted to go fishing. For vessels owned by absent or out-of-state residents, survey participants (the vessel's captain) generally answered that they felt that the owner's motivation was to have a boat available for themselves when they wished to use it. This type of op-

eration exists due to a shortage of slips in Hawaii and, at some harbors a long (ten years) waiting list for any that become available. Each harbor has fixed numbers of moored vessel recreational and commercial permits, which cannot be sold or transferred to a new owner. However, commercial vessel operators have discovered that they can incorporate their company and then, under certain circumstances, sell the corporation, which includes the vessel and the slip. Because the ownership of the slip stays in the same company name, it apparently does not count as a sale or transfer and the new user does not have to go through the long waiting process. Use of a commercial slip is contingent on the operation being a commercial one. In order to be seen as a commercial operation for this purpose, typical six passenger charter boat operations must report a gross income of at least \$15,000 per year. That is what leads many absent owners to maintain active charter boat operations largely in order to have a (moored) boat available for themselves.

Sample Frame

Information on 63 vessels was collected, however a single trailered vessel was dropped as its operations were not directly comparable with those of moored vessels. Thus our database consists of 62 vessels. Data were collected via interviews with 60 individuals (two owners ran three vessels each, one ran two vessels, and for three active owner vessels, both the captain and the owner were surveyed). A relatively recent development in Hawaii is the use of small trailered vessels for charter fishing. Although legal, this practice has made the owners of moored vessels unhappy as trailered vessels generally have lower costs and thus can charge lower prices to patrons. These vessels are mostly favored only by patrons on tight budgets as they are smaller and have less amenities. This is a relatively small group and they were not sought out due to the difficulty in locating them as well as the fact that their operations are not easily compared to those of moored vessels.

The types of vessel owners for which surveys were completed were distributed as indicated in Tables 1 and 2.

Table 1: Number of vessel by owner type.

	Absent owner	Active owner	Owner operated	Total
Number of vessels	13	22	27	62
Percent of sample	21%	36%	44%	100%

Table 2: Number of vessels by port and owner type.

Island	Port	Absent owner	Active owner	Owner operated	Total
Hawaii	Honokohau	11	7	10	
Oahu	Kewalo Basin	1	4	8	13
Maui	Lahaina	0	8	3	11
	Maalaea	1	2	1	4
Kauai	Nanwiliwili	0	1	3	4
	Port Allen	0	0	1	1
Molokai	Kaunakakai	0	0	1	1
Total		13	22	27	62

Vessels were also stratified into size classes based on overall vessel length as follows:

- Small less than 35 ft
- Medium 35 ft to less than 45 ft
- Large 45 ft or larger

These size classes were chosen to reflect at sea limitations as well as expected variations in costs and earnings. The number of vessels in each size class is presented in Tables 3 and 4.

Table 3: Number of vessels by size class.

Size class	Number of vessels	Percent of sample
Small	13	21%
Medium	36	61%
Large	11	18%
Total	62	100%

Table 4: Number of vessels by port and size class.

Island	Port	Absent owner	Active owner	Owner operated	Total
Hawaii	Honokohau	4	19	5	28
Oahu	Kewalo Basin	0	7	6	13
Maui	Lahaina	4	7	0	11
	Maalaea	2	2	0	4
Kauai	Nanwiliwili	2	2	0	4
	Port Allen	0	1	0	1
Molokai	Kaunakakai	1	0	0	1
Total		13	37	11	62

The ethnicity of respondents is presented in Table 5 and summarizes their answers to the question “How would you describe your ethnicity?”. In Hawaii this question is normally taken to refer to one’s ancestry. There were a total of 60 respondents but in cases where both the owner and the captain were interviewed, only the demographics of the owner were collected. Thus we have demographic information on 57 individuals.

Table 5: Ethnicity of respondents.

Ethnicity of respondent	Number of respondents	Percent of sample
White/Caucasian	33	57.9%
Part-Hawaiian	6	10.5%
American	5	8.8%
European	5	8.8%
Portuguese	4	7.0%
Japanese	2	3.5%
Greek	2	3.5%
Other/Missing	2	1.8%
Total	57	100.0%

Conclusions

This project found substantial differences in operations of Hawaii’s charter fishing fleet. Of greatest importance to industry members may be variations in the number of charter fishing trips booked. There was a 42 percent difference in number of trips in the range of both vessel sizes and owner types, and a 48 percent difference in number of trips between ports. This was not unexpected as it is well known that some harbors are busier than others, and this is an important determinant of vessel profitability. Lahaina harbor was found to have the highest average number of charter fishing trips taken (243) and Honokohau the least (126) with Kauni, Maalaea and Kewalo falling in between the two extremes. Reasons for these differences are not obvious based on survey data. The charge for a full day exclusive fishing trip is highest for Kauai-based vessels (\$725), lowest for Honokohau boats (\$524). One might expect that vessels with lower rates would take more trips than those with higher rates but this was not the case.

Mean vessel lengths were lowest for Kauai based vessels (34 ft) and highest for Kewalo boats (45 ft). One might expect that larger vessels would be more popular (take more trips) than smaller ones, especially given that charter charges are not directly related to vessel lengths, but again this is not the case. Inspection of mean advertising costs incurred by vessels at each harbor shows that Kauai based operators had the lowest advertising costs (\$3,420) and Kewalo based operators the highest (\$10,940). Clearly, it was not advertising expenditures which were most instrumental in attracting patrons. Finally, when harbors are ranked by mean catch per trip (calculated as the mean pounds caught annually on charter fishing trips divided by the mean total number of charter fishing trips for each harbor) the highest catch rate occurred on Kauai based vessels (57 lbs. per trip) followed by Lahaina vessels (50 lbs. per

trip), Honokohau (47 lbs. per trip) and Maalaea (26 lbs. per trip). These rankings do not explain the differences in the number of charter fishing trips taken.

Given this lack of relationships between charter rates, vessel lengths, advertising, catch per trip and the number of trips booked, other explanatory factors may be considered. Some physical and operational differences between harbors are largely external to vessel operations and beyond the control of industry members. Most important to securing bookings are sufficient foot traffic, the presence of sales booths at the docks, referrals from hotel or activity desks, and the number of boats competing for patrons. Based on observation, Lahaina harbor clearly had the most foot traffic, partly because it is located in the center of town but also because of the many other ocean activities (parasail, dive boats, dinner cruises, etc.) available there. The presence of sales booths at Lahaina ensured that there was someone available at all times to solicit business, answer questions, and book trips. In addition to trips booked at their sales booths, Lahaina based vessels also secured an average of 41 percent of their trips via hotel or activity desks. Finally, these vessels also benefited from limited competition with only 18 charter fishing vessels available. By contrast, Honokohau harbor is located approximately 3 miles out of town, offers few other ocean activities, and has low foot traffic. Sales booths are not permitted at Honokohau harbor and, in addition these vessels had the lowest rate of trips booked via hotel or activity desks (2.1 percent). Finally and perhaps most importantly, there were 128 charter fishing vessels operating out of Honokohau harbor. With this level of competition it is extremely difficult for any one operation to succeed.

Based on open-ended questions contained in the survey, Hawaii's charter fishing industry is concerned about the management of Hawaii's fisheries. Issues of primary concern include catch competition from Hawaii-based longliners, and possible negative perceptions of local stocks due to Hawaii's unique state law which allows the sale of blue marlin. The lack of a cohesive industry organization makes concerted efforts towards management changes difficult, and the lack of a system to identify charter fishing vessels in Hawaii state records means that data to support any calls for change have been unavailable.

Reference

Walker, J. 1996. *Sociology of Hawaii Charter Boat Fishing*. Pelagic Fisheries Research Program Report. Honolulu: University of Hawaii, Joint Institute for Marine and Atmospheric Research.



Figure 1: The Island of Hawaii

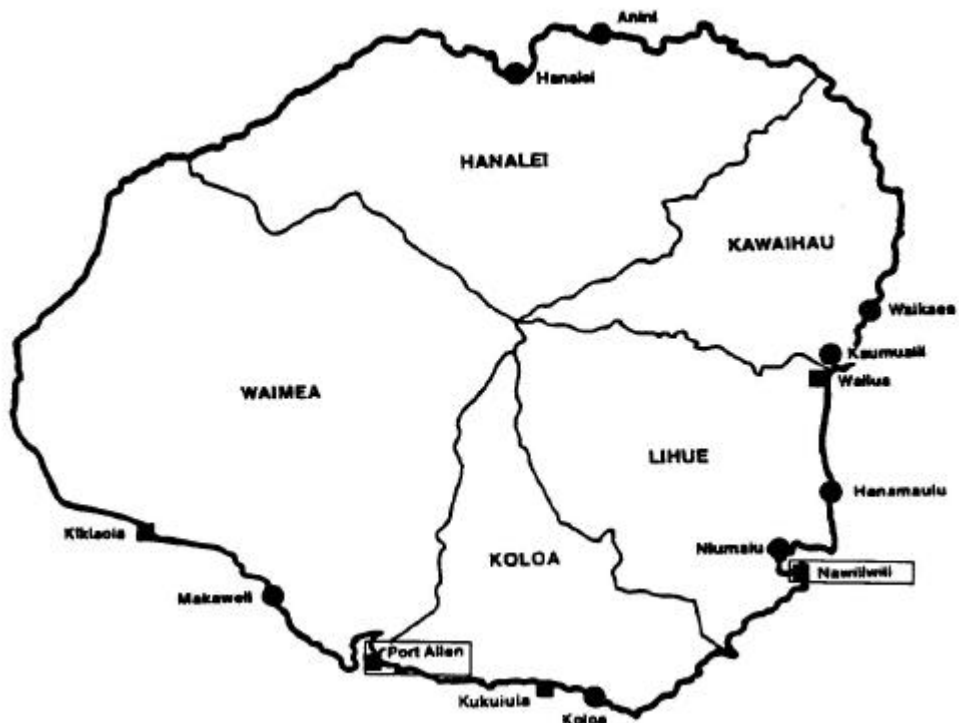


Figure 2: The Island of Kauai.

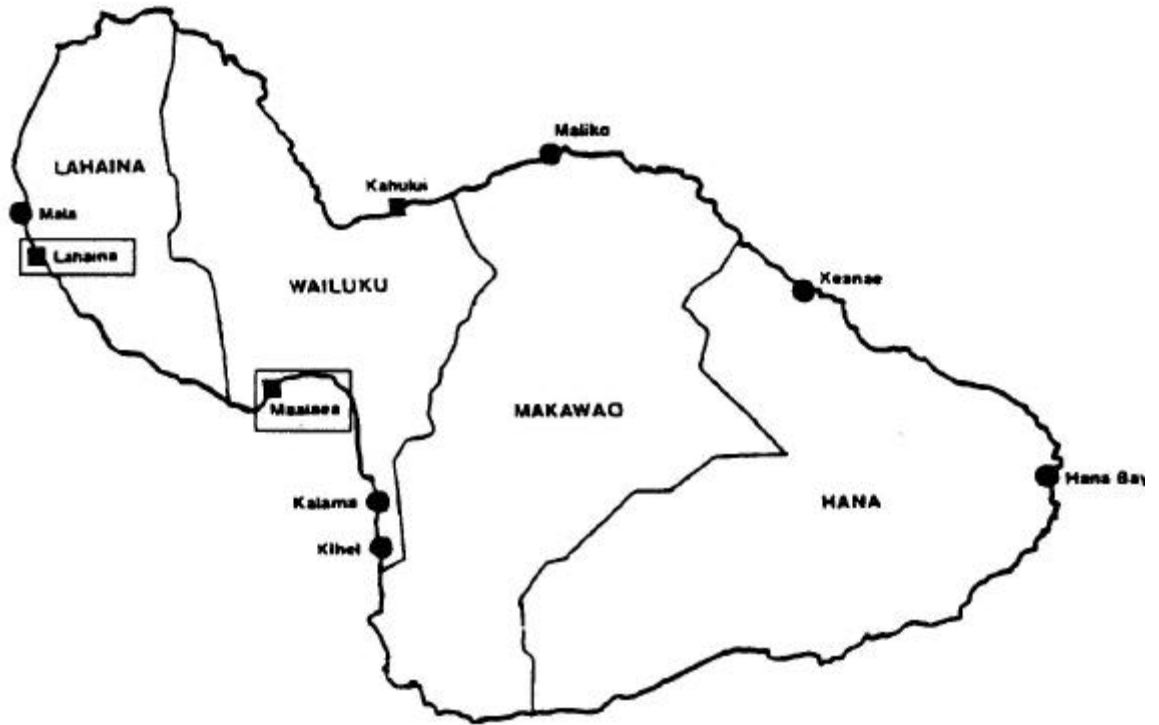


Figure 3: The island of Maui.



Figure 4: The island of Molokai.



Figure 5: The island of Oahu.

Discussion

In response to a comment, Ms. Hamilton emphasized that she assessed gross revenues and not net revenue, which can be difficult to determine because of the many variables. Question-and-answer centered on the reasons why charter boats have low returns, including over-supply.

The Economics of Gamefishing in Niue

Graham Marsh
Wahoo Fishing Charters

About Niue Island

Niue Island is an uplifted coral atoll, with a population of 2,000 people. It is 259 km², 410 km east of Tonga and south of the Samoas, situated at 19° S and 170° W in the tradewind belt. It is a single island surrounded by very deep water close to shore. Niue has no offshore reefs, islands or lagoons. The Island has a narrow fringing reef along approximately 50 percent of its coastline with the remaining 50 percent made up of rugged coral cliffs.

Niue has no sheltered harbor, only an open roadstead wharf, where boats are lifted in and out of the water for each trip, by way of a derrick. This derrick has only recently been electrified to make it easier to launch and retrieve the bigger boats of up to 8 m long. Nevertheless, the launching and retrieving of boats is still very dependent on favorable weather and sea conditions. The majority of the local fishing boats are between 3.5 and 4.8 m, with only two bigger boats of 6 to 8 m doing sport/gamefishing charters.

The local boat fishing consists of mainly trolling for pelagic species, with wahoo the main target species. Yellowfin and skipjack tuna are also targeted. Marlin and sailfish are sometimes caught as a bycatch while trolling. Trolling is conducted approximately within 500 m of shore, except when chasing schools of tuna. Deep-water bottom fishing is also carried out in this zone, as the bottom drops off very quickly close to shore.

There are still reasonable numbers of traditional outrigger canoe fishermen, although they are declining, who also do all their fishing in this zone, and fish with handlines mainly using drifting live or chunk bait targeting mainly yellowfin tuna and wahoo, but also catch some marlin and sailfish as well.

Niue has a number of Fish Aggregation Devices (FADs). Five of these are within 500 m of shore and one is approximately two kilometers offshore. Canoe and boat fishermen use the near-shore FADs while only the boats are able to get to the far one. Both trolling and drift fishing is carried out around the FADs and bait fish can sometimes be caught as well when in season. It is my belief that FADs are the biggest asset to increase pelagic fish catches on Niue, if they are designed right and located in the right places. Currently, this is not always the case. In a small country, politics seems to overrule common sense.

How Sport-Gamefishing Fits Into This Situation

Rod-and-reel fishing has been used in the past by a few local fishermen. Invariably, the recommended line size gets replaced with much heavier line, the drags are tightened up, and broken rods and reels result. This can be related back to the traditional fishing methods: heavy hand lines and fixed pole-and-line methods. Indeed, for the local fisherman, the only reason to catch fish is for food.

Fish is Niue's main natural source of protein, and the traditional technology used to catch them is cheap and practical for this purpose. There is also the belief amongst some local fishermen that by landing the fish as quick as possible, it doesn't disturb the other fish as much as playing them on a rod-and-reel does.

At a meeting between the Niue Island Fishermen's Association, which is mainly involved with the local fishing methods, and the Niue Island Sport-fishing Club, some of the members of the Fishermen's association executive wanted those boats using rod-and-reel to only be allowed to fish outside of three miles from shore. This has not happened and I would be surprised if it does.

I believe that by using rod-and-reel that is well maintained and rigged properly, you actually have more chance of landing individual fish, although it may take longer in some cases.

As fish is also a valuable source of income to the fishermen on Niue, with wahoo and yellow-fin tuna fetching around NZ \$7.00 per kg on the local market, there is a lot of competition to catch fish, and rod-and-reel fishing could be seen as an unfair advantage. A lot of fishermen can't afford this gear type and are uneducated in its use, which creates jealousy amongst the fishermen on the Island.

People paying to go out fishing, as with fishing charters, is a relatively new concept on the island and can create some dissension between the two types of fishing, when the charter operators can take clients out, and get paid for it, even if they don't catch any fish. What is not appreciated, is the cost of setting up and operating a charter business to cater for tourists and visiting anglers.

As Niue has promoted tourism as its main economic development strategy, there was a need to establish a sport-gamefishing club, so that anglers could claim club, national, and international records. This is an incentive for the visiting angler to come to Niue: to catch a Niue record, as the club is young and the record books are virtually blank.

Gamefish Tournaments

In Niue's case, these are going to be very difficult to organize, for a number of reasons:

- The number of boats available and set up for this type of fishing.

- The smallness of our fishing area. This is due to the size of the boats that can be used and the fact that over 50 percent of the island (the prevailing trade wind side) is usually very rough and thus inaccessible.
- The lack of fish, especially major gamefish species.
- The nature of our launch-and-retrieve facilities. (A slight swell, coming in on the western side of the island, can prevent us from launching our boats.)
- The cost of getting to Niue is considerably more than other destinations in the region.
- By law, fishing is not allowed on Sundays.

All these factors, however, make for a natural form of conservation of the pelagic fish resource available to the local inshore fishermen.

The fishermen on Niue cannot supply enough fish to satisfy the local consumption needs for a population of around 2,000 people. One way, and maybe the only way, to enhance the availability of pelagic species for both the local consumption and sport-gamefishing activities, is the installation of some major FADs on the western (sheltered) side of the island, and more importantly, the development of a sheltered boat harbor, that would allow the safer launching and retrieving of boats and thus allow more fishing days.

My views on gamefishing tournaments are that the benefits are many for our island states, as follows:

- They could help with the economic development of island states' economies by providing an activity for people to visit these countries and bring with them valuable overseas funds.
- Help with piscatorial information, both for the host country, and regionally and globally.
- Help with the creation of better facilities for sea users, such as better wharves and launch-and-retrieve facilities and general fishing infrastructure.
- Introduce new and modern technology and easier access to this technology and equipment.
- These benefits mentioned above will help the development of subsistence and commercial fishing interests and should filter through to the wider community.

For this to happen there would need to be some issues addressed, such as: education, or awareness, campaigns about gamefishing and the gear used and a change in the organization of gamefish tournaments. I will make my own personal suggestion as follows:

- That all tournament host clubs be affiliated to the IGFA. This may already be the case.
- That all tournaments abide by the IGFA fishing rules.
- That all fish caught and landed, or tagged and released, in any gamefishing tournament be weighed and measured (for landed fish) or estimated (for tag-and-release).
- That all this catch and tag-and-release data be submitted to the IGFA.

- That the IGFA collate all this information and then make it available to the members, which would mean those who have an interest in the information would need to become members. This would include scientists, regional fisheries managers etc. (This may be one way to help offset extra costs involved in collating all the information.)

I have suggested the IGFA as they are an international organization who already do this to a lesser extent, and may be the best body to expand on their data collection and collation.

These are my own views and is only a hypothetical suggestion to stimulate some debate on this matter and the IGFA has not been approached by me regarding these suggestions. Thank You.

This paper was presented by Paul Dalzell.

Discussion

An audience member asked that the prohibition on Sunday fishing be explained. Mr. Dalzell (who presented the paper) said that this is a religious prohibition on many Pacific Islands, and in some cases is written into local law.

Atlantic Highly Migratory Species: Recreational Fisheries

Rebecca Lent

Buck Sutter

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Abstract

Atlantic large pelagics such as tunas, billfish and sharks provide important opportunities for recreational fishing, including tournaments. These stocks, which are considered fully to over-fished, are managed at the international level through the International Commission for the Conservation of Atlantic Tunas (ICCAT) and at the domestic level by the Secretary of Commerce rather than by any of the five Councils within which these species migrate. Some species, such as North Atlantic swordfish, have become truly rare event recreational fisheries due to their over-fished status. By September 30, 1998, a new Highly Migratory Species Fishery Management Plan (HMS FMP) and Billfish FMP will establish domestic rebuilding programs for these species. Atlantic HMS tournaments are monitored through a mandatory registration and reporting system which has recently been revised and expanded, particularly for billfish. There are approximately 300-400 tournaments per year for all HMS, with the focus on billfish (over 100 tournaments on average each year), giant bluefin tuna, offshore sharks and certain multi-species tournaments. Entry fees range from \$20-\$8,000, and average \$546. Average expenditures at billfish tournaments were estimated at \$1,600. Prizes at these tournaments range from \$20 to \$100,000, with "calcuttas" paying even more funds. Billfish tournaments have a relatively high release rate, and tournaments for other species are increasingly subject to high minimum sizes. With their high profile, relatively low fishing mortality rate, and significant economic impact, Atlantic gamefish tournaments are an integral part of a viable management program to rebuild these stocks.

Introduction

Atlantic Highly Migratory Species (HMS) include the following species: blue and white marlin; west Atlantic sailfish; longbill spearfish; swordfish (north and south Atlantic stocks); west Atlantic bluefin, yellowfin, bigeye, skipjack, and albacore tunas; and sharks, which are subdivided into large coastal sharks (LCS), small coastal sharks (SCS), and pelagic shark species groupings. In addition to their commercial value (except marlin, sailfish and spearfish which can not be sold, bartered or traded by US commercial vessels operating in the Atlantic

* Ms. Lent's affiliation at the time of the Symposium. She is now Regional Administrator, Southwest Region, NMFS.

Ocean), Atlantic HMS species provide important opportunities for recreational fishing, including catch-and-release, retention for consumption or trophy mounts, and tournament participation from private vessels, and/or charter/headboats. These fishery resources also present a unique challenge for fisheries management in the United States due to their distributional and behavioral patterns. Atlantic HMS management strategies, with the exception of sharks, are guided by both international fishery management through International Commission for the Conservation of Atlantic Tunas (ICCAT), and national mechanisms through the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The United States is required by the Atlantic Tuna Convention Act (ATCA) to implement ICCAT recommendations concerning Atlantic HMS fishery resources.

Passage of the 1996 Magnuson-Stevens Act initiated fundamental changes in US fishery management policy, shifting emphasis to precautionary management strategies. In September 1997, the National Marine Fisheries Service (NMFS) listed fishery resources considered to be over-fished, including Atlantic blue and white marlin, north Atlantic swordfish, western Atlantic bluefin tuna, and the Large Coastal Shark management unit. Further, in 1998, west Atlantic sailfish and bigeye tuna were added to the list of over-fished species. The over-fishing designation of several HMS species triggered a suite of management requirements, including development of a comprehensive HMS Fishery Management Plan (FMP) for Atlantic tunas, swordfish and sharks, thereby replacing the current Atlantic swordfish FMP and Atlantic shark FMP. Amendment 1 to the Atlantic billfish FMP is also being developed to address over-fished billfish stocks.

These FMPs provide rebuilding strategies for over-fished stocks and management alternatives to reduce bycatch and bycatch mortality, as required by the Magnuson-Stevens Act and following the guidelines set forth by the ten National Standards*. However, one of the major challenges in the management of Atlantic HMS fishery resources, whether from a commercial or recreational perspective, is the small portion of US landings of HMS relative to total Atlantic-wide levels, as reported to ICCAT (see Table 1). Since US management policies must comply with both Magnuson-Stevens Act directives and ICCAT recommendations, as required under the ATCA, efforts to establish rational management strategies can be problematic. Rebuilding of over-fished swordfish, tuna, and billfish resources will necessitate international cooperation. The HMS FMP and Amendment 1 of the Atlantic Billfish FMP will guide the management of the commercial and recreational components of US Atlantic HMS fisheries into the next century.

* Defined in Section 301(a) of the Magnuson-Stevens Act and following guidelines published on May 1, 1998 (63 FR 24212).

Background and Description of Atlantic HMS Recreational Fisheries

Atlantic Billfish

In waters off of the US Atlantic coast, the primary traditional use of Atlantic billfish resources has been in recreational fisheries since the early 1900's, with a significant increase in participation after World War II. Until the early 1950's, the fishery was concentrated in only a few areas along the Atlantic and Gulf Coasts. Largely as a result of improvements in off-shore sportfishing vessels and equipment, there has been rapid expansion in both the number of anglers and the fishing grounds utilized. Fisheries in waters off Puerto Rico traditionally included a small-scale, handline subsistence fishery in addition to a recreational fishery. With the exception of a small harpoon fishery for white marlin that used to exist in the waters off of southern New England, there are no directed commercial activities for billfish. However, billfish caught incidentally in commercial fisheries were marketed prior to the late 1980's, and were usually processed and sold as smoked fish product. As a result of the 1988 Atlantic billfish FMP, US commercial entities operating in the Atlantic are prohibited from possession, sale, bartering or trading of billfish from their management unit.

Sportfishing for billfish on private recreational and charter boats is conducted in nearly all warm water ocean areas, generally in relatively deeper waters of tropical and subtropical areas. The recreational US Atlantic billfish fishery is concentrated from Massachusetts to North Carolina, southeast Florida, the northern Gulf of Mexico and the Caribbean (including Puerto Rico and the US Virgin Islands), depending upon the species and season. Blue marlin are most abundant off the mid-Atlantic coast in the summer, off the east coast of Florida and Bahamas in the spring, off Puerto Rico and the Virgin Islands in the summer and fall, and off the Florida Keys in the fall. White marlin are available to the recreational sportfisheries in the Gulf of Mexico from June into October, with peak abundance in the northern Gulf in July and August. The northeastern limit of the east coast summer coastal occurrence of white marlin is off Nantucket Island, south of eastern Cape Cod. Spring is the peak season for sportfishing for white marlin in the Straits of Florida, Bahamas, Puerto Rico and the Virgin Islands. Most of the recreational fishing effort for billfish along the US Atlantic coast, Gulf of Mexico, and in the Caribbean Sea is concentrated either around key ports, fishing centers, or billfish tournaments, in relatively deep waters from 120 to 6,000 ft.

Recreational angling for Atlantic billfish by US citizens can be sub-divided for analytical purposes into non-tournament and tournament trips. Ditton and Stoll (1998) reported in summarizing an analysis by the American Sportfishing Association of the 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, that 230,000 anglers in the United States spent 2,136,899 days fishing for various billfish species. They noted that the ten states with the highest number of billfish anglers were: 1. Florida (159,575); 2. California (31,162); 3. North Carolina (30,071); 4. Hawaii (26,588); 5. Texas (23,714); 6. New Jersey (17,687); 7. New York (12,671); 8. South Carolina; 9. Maryland (9,959); and 10. Delaware (8,666). Most recreational anglers consider themselves to be strong advocates for conservation of Atlantic billfish resources.

There are nearly 200 billfish tournaments per year along the US Atlantic coast (including the Gulf of Mexico and Caribbean). The number of vessels range from 5 to 150 per tournament, with the number of anglers ranging from 10 to 1,000 per tournament. Offshore fishing tournament anglers target blue marlin, white marlin, tuna (generally yellowfin tuna), dolphin-fish (mahi mahi) and wahoo, generally by high-speed trolling with artificial lures. Sailfish tournaments, which are found almost exclusively in south Florida and the Florida Keys, operate closer to shore than most billfish tournaments and fish mostly with live or dead bait. Billfish tournaments may be categorized into three general types. Fishing organizations support club series tournaments and usually award trophies for various angling categories. Club series tournaments can last from a single weekend event to an entire fishing season. Commercial concerns, such as restaurants, Chambers of Commerce, groups of charter boat captains or marinas, can sponsor rodeo and promotional tournaments. In addition, there are high profile tournament events which are characterized by large vessels and big prizes. Tournament entry fees range from \$20 to \$8,000, with the high-profile events being the most expensive. Cash prizes range from \$20 to more than \$100,000. In August, 1997, the Pirate Cove Billfish Tournament awarded \$217,000 to the participant who landed a 670 pound blue marlin. Other prizes sometimes awarded include expensive watches, fishing equipment, and even boats. Tournaments can also involve calcuttas, which generally consists of cash contributions from a group of tournament participants. The calcuttas are subsequently won by a member of the group who catches-and-releases, or lands the largest, or most fish.

In their survey targeting anglers who participate in billfish tournaments, Fisher and Ditton (1992) reported that anglers make an average of 13 billfish trips per year. The number of trips over the survey year varied by region, with the maximum number taken in the Caribbean (17.3 per year), and the least in the Gulf of Mexico (8.7 trips per year). Billfish trips averaged 2.6 days, with each angler, on average, landing less than one billfish each year. The success rate also varied among regions. The highest number of successful trips taken during the year of the survey, relative to the total number of trips taken, was in the mid-Atlantic region (45 percent of trips resulting in the catch of a billfish). Recreational billfish trips in the Gulf of Mexico were the least successful, with approximately 28 percent of trips resulting in the catch of a billfish. A total of 71 percent of the 1,171 anglers responding in the Fisher and Ditton study indicated that they did not land a billfish during the year of the survey, therefore 29 percent of anglers accounted for all angler-induced mortality. During 1989, it took an average of 6.3 days of fishing to boat a billfish. Mid-Atlantic anglers caught the most billfish per angler, and had the highest release rate (95 percent) and lowest retention rate per angler. Gulf of Mexico anglers caught the fewest billfish per angler (0.83), and Caribbean anglers had the highest retention rate per angler.

Fisher and Ditton (1992) estimated that there were 7,915 US tournament billfish anglers in the western Atlantic Ocean during 1989, making a total of 102,895 billfish fishing trips (90 percent confidence interval equals 6,512), including tournament and non-tournament participation. In 1989, these trips resulted in a catch distribution (by percentage) of 38 percent sailfish, 33 percent blue marlin, 29 percent white marlin, and less than 1 percent spearfish. They found the average tournament fee in 1989 was \$546. Additional estimated expenditures of \$1,600 per angler per tournament, included loading, boat operation, food, bait and

tackle, transportation, and captain/charter fees. The average amount spent *annually* on billfish tournament fees was \$1,856, or \$546 per tournament, giving a \$2,147 total expenditure per angler per trip. The total annual expenditure estimates generated from the Fisher and Ditton study indicated that in 1989, billfish tournament anglers spent an estimated \$180 million in attempting to catch billfish (tournament and non-tournament trips), giving an average equivalent expenditure of \$4,242 for each fish caught or \$32,381 for each billfish landed.

Ditton and Clark (1994) provided a description of the economics associated with recreational billfish anglers participating in at least one of 14 billfish tournaments held between August, 1991 and October, 1992 in Puerto Rico. A total of 885 resident (of an estimated 1,475 resident billfish participants) and 154 non-resident anglers (82 were from the mainland United States or US Virgin Islands; 72 were from other countries) were surveyed. Trip expenditures per resident averaged \$711 per trip (average of 21 trips/year) and \$3,945 for non-resident anglers fishing in Puerto Rico (average seven billfish trips/year in Puerto Rico). Resident angler expenditures averaged \$1,963 per billfish caught, while expenditures for non-residents averaged \$2,132 per billfish caught. Ditton and Clark estimated the net economic benefits per trip at \$549, yielding total annual net economic benefits of \$18 million. Total resident and non-resident (US citizens and foreign countries) angling expenditures were over \$21 million and \$4 million, respectively.

Recreational fishing can result in either intentional mortality (retention of an Atlantic billfish), or unintentional mortality as a result of the capture and release process, whether from directed recreational billfish angling or incidental catch in association with other recreational fishing efforts. Although recreational release rates have been estimated to be in excess of 90 percent, without studies on post-release mortality, it is not possible to accurately estimate the total fishing mortality caused by recreational fishermen. It is important to note, however, that US Atlantic recreational anglers have voluntarily increased release rates of billfish as part of the general conservation ethic of this user-group. In fact retention of a billfish is becoming increasingly “socially unacceptable.”

Atlantic Bluefin Tuna and BAYS

The recreational tuna fishery is comprised of bluefin tuna (BFT), as well as bigeye, albacore, yellowfin and skipjack tunas which constitute the HMS management group designated as “BAYS” tunas. These tunas support extensive recreational fisheries, and they are an important source of direct income to charter and headboat vessels, and an indirect source of income to US firms that supply recreational fishery participants with associated goods and services. In the early 1900’s, a sportfishery developed for small and medium tunas off New Jersey and New York, and for giant bluefin tuna in the Gulf of Maine. The rod-and-reel fishery expanded rapidly during the 1950’s and 1960’s, as hundreds of private, charter and headboats targeted tunas along the mid-Atlantic coast. This recreational fishery continues today and has expanded to include recreational fisheries in the Gulf of Mexico and US Caribbean territories that mainly target yellowfin tuna.

Nearly 8,000 US vessels held Angling category permits for Atlantic tunas in 1997, and over 10,000 vessels purchased or renewed Angling category permits for 1998; there were 20,194 total tuna permitted vessels in 1998 for all bluefin tuna categories. The total number of trips targeting large pelagics in 1997, by vessel type and by state is shown in Table 2.

The recreational bluefin tuna (BFT) fishery is composed of private vessels, charter vessels, and headboat vessels. These vessels have different patterns of fishing and catch rates and may attract anglers from various experience levels ranging from novice to world record-holding anglers. Tournaments constitute a distinct fishery, because they tend to concentrate fishing effort into a small area. BFT is the intended target on many angling trips; however, other tunas and large pelagics, including sharks, are taken as bycatch on trips directed at bluefin. During 1996, rod-and-reel gear was used to harvest 97 percent of total US skipjack landings. Only 17 percent of total US bigeye landings in 1996 were attributed to rod-and-reel, with most activity occurring between Cape Hatteras and Massachusetts. Roughly half of total US catch of yellowfin tuna were landed by rod-and-reel. In the NW Atlantic, however, the amount of yellowfin harvested with rod-and-reel was more than five times the amount of yellowfin harvested by longlines in 1996. Recreational catch of albacore has been increasing, with near-shore anglers landing 65 percent of all US albacore in 1996.

Fishing for medium and giant BFT with rod-and-reel generally takes place between December and February off North Carolina. Giant BFT are caught in Cape Cod Bay, the Gulf of Maine, and other New England waters during summer and early fall with all types of handgear. Smaller BFT are targeted off Virginia, Delaware and Maryland in early to mid-summer, with the center of activity moving northward into the New York Bight as the season progresses. Fishing usually takes place between 8 and 200 km from shore. Sporadic rod-and-reel catches of giants have been reported in late spring from the Gulf of Mexico. Beyond these general patterns, the availability of fish at a specific location and time is highly dependent on environmental variables that fluctuate from year-to-year and can be quite unpredictable.

In the past few years, a recreational fishery has developed off the coast of North Carolina as concentrations of large bluefin tuna began appearing from January through March. Catch rates in 1996 and 1997 were extremely high as compared to catch rates off the New England coast. This rod-and-reel fishery is primarily catch-and-release; landings are restricted to one fish (27" to 73") per vessel, with a no-sale provision. As part of the program to monitor the recreational North Carolina fishery, anglers are required to fill out a catch reporting card in exchange for a landing tag, which is required for offloading bluefin tuna.

The direct income associated with the Angling category is limited to charter/headboat vessel operations because of the ban on the sale of BFT under 73". In 1997, based on the Large Pelagic Survey (LPS), an estimated 6,612 charter boat trips targeted BFT from Maine to North Carolina. Of these trips, 2,527 targeted commercial-sized BFT which, if caught, were sold under the General category quota. Assuming that charter boats charge about \$800 per day, the gross revenues from BFT fishing would be about \$5.3 million. These direct revenues represent greater than 20 percent of the total gross revenues to the other commercial permit categories, and is likely an underestimate of revenues accruing to the charter boat sector be-

cause some of the large mediums or giant BFT landed may be sold by the captain or mate. Additionally, tips that are typically given to the mate (about \$100 per trip), are not included. The producer surplus component of the bluefin tuna fishery would thus be these gross revenues minus costs incurred in providing the charter boat services. Variable costs incurred in providing charter boat services are described below, and are estimated at \$392 per trip. This estimate results in a producer surplus for charter boat operations targeting BFT of \$800 or \$408 per trip, not including tips. Assuming 6,612 charter boat trips targeted BFT, this results in a total producer surplus for the charter boat BFT fishery of approximately \$2.7 million in 1997.

It should be emphasized that net revenues from the charter boat fishery are only a part of the dollar value of the recreational fishery, since angler consumer surplus (ACS) is another important component. ACS is generated from charter/headboat vessel services as well as from private vessel participation in the recreational fisheries. Preliminary estimates of ACS in the private BFT fishery are \$1,132 per fishing trip. Using this estimate of ACS per trip and an estimated 16,868 recreational BFT trips per year (based on 1997 LPS data), total ACS for the recreational BFT fishery was \$19,094,576 in 1997.

In a recent study of the winter recreational BFT fishery, angler expenditures in North Carolina were estimated to be \$3.8 million in 1997 (Ditton et al., 1998). Angler "willingness to pay" above trip costs was found to be \$344 to \$388 per person; multiplying this range by the average number of anglers per trip (5.3) results in an ACS of \$1,479 to \$1,668. The North Carolina BFT fishery is unique, as anglers travel great distances to participate in a primarily catch and release fishery for large BFT.

In most fisheries in the United States a clear distinction is possible between "commercial" and "recreational" fishermen. This distinction is not always obvious in the Atlantic tuna fisheries. Even after NMFS implemented a ban on the sale of BFT under 73" CFL in 1992, anglers who may otherwise have been considered recreational fishermen were allowed to sell a fish over 73". Under current regulations, the Angling category permit allows the harvest one BFT over 73", per year, for trophy purposes only (no sale). However, there is still some overlap among commercial and recreational fishermen, such as operators who choose to purchase a General category permit in the event they land a commercial sized BFT. A more recent rule prohibits persons aboard vessels permitted in the General category from retaining BFT less than the large medium size class. This action effectively separated the commercial and recreational BFT fisheries, with the exception of charter/headboats.

Atlantic Sharks

Recreational fishing for Atlantic sharks occurs in federal and state waters from New England to the Gulf of Mexico and Caribbean Sea. US recreational shark catches have declined somewhat from the peak recorded catches in 1983. In 1990, the International Game Fishing Association named the following Atlantic sharks as those typically targeted by recreational fishers: blue, shortfin mako, porbeagle, and thresher sharks (in the pelagic shark management unit); and the tiger and hammerhead sharks (in the LCS management unit). Atlantic sharp-

nose sharks (of the SCS management unit) play an important role in private angler and charter/headboat fisheries, particularly in the southeastern United States.

Shark tournament fishing is usually conducted from vessels that vary in size from small out-board engine vessels to sportfishing yachts of 15 m or greater. The number of participants and boats varies: a two-day Long Island, New York shark tournament has drawn 300 boats and about 1,500 anglers annually in recent years, but some tournaments limit the number of boats to less than 150 because of limited shore facilities. More exclusive tournaments charge high entry fees on a first-come, first-served basis, and offer a top prize of \$50,000 or more. One major shark tournament in the mid-Atlantic, which has been held since 1988, offers prizes for the largest makos and blue sharks (with minimum sizes of 200 lbs. and 150 lbs., respectively). Nearly 200 vessels participate in this two-day event. Some tournaments encourage catch and release fishing by offering prize points for released sharks. The increase in eastern Gulf of Mexico shark fishing tournaments since 1973 underscores the popularity of this activity among anglers. Previously, there were only about a half dozen such tournaments in the region, but by the late 1980's there were about 65 each year.

Recreational shark fisheries are exploited primarily by private boat, charter boat, and head boat-based fishermen although some shore-based fishers are active in the fishery in the mid-Atlantic and southeastern United States. Fisher and Ditton (1992) found that anglers spent an average of \$197 per trip and were willing to spend on average an additional \$105 rather than stop fishing for sharks. Given the fact that most anglers release the fish that they catch, it is unlikely these estimates have changed substantially since 1992. Analyses presented at the 1998 Stock Evaluation Workshop found that an average of 886 trips that caught a shark were taken annually from 1994 through 1996. Using these figures, the annual total spent by anglers who caught sharks (there may have been additional trips that targeted sharks but did not catch one) on average is \$174,542 and the annual angler consumer surplus is \$93,030 for a total gross value of \$267,572 per year. Fisher and Ditton (1992) also found that 32 percent of shark anglers said that no other species would be an acceptable substitute for sharks.

Atlantic Swordfish

The swordfish recreational fishery has existed along the US Atlantic coast since the 1920's, when small boats caught swordfish off Martha's Vineyard and Nantucket by trolling. Prior to 1967, approximately 50 swordfish were caught annually with rod-and-reel in about 1,000 attempts from Massachusetts to Long Island. During the 1970's, recreational fishing for swordfish expanded all along the Atlantic coast due to new techniques and the development of night fishing. Tournaments were held in a number of states including South Carolina and New Jersey in 1978 and in Florida from 1977 through 1983. However, the recreational fishery began to decline in 1978 due to decreasing catch rates.

There are minimal data available on current rod-and-reel fishing for swordfish. In 10,790 intercepts by the 1993-1997 Large Pelagic Survey (LPS), which surveys recreational catch and effort from Maine through Virginia, only 15 swordfish were reported as caught in the recreational fishery from 1993 to 1997. Reported swordfish were landed from North Carolina

north to Rhode Island. Sampled swordfish ($n = 8$) ranged in length from 84.7 cm to 291 cm. The Marine Recreational Fisheries Statistics Survey did not collect any information on swordfish from 1994 to 1997 either as landed or released. Based on the Southeast Fisheries Science Center Cooperative Tagging Center (CTC) database, 190 swordfish were caught by rod-and-reel gear and tagged and released between 1966 and 1997 between 31° and 24° N latitude (South Carolina through south Florida) and 76° and 87° W longitude (Florida Straits through the Gulf of Mexico). This gear is sometimes used by commercial fishermen, and so is not a perfect proxy for recreational fishing catch. Of the 190 swordfish tagged, length measurements were taken from 172 with a mean length of 33". Most fish, however, were 26 inches, with a range of 8" to 216". There were 15 documented rod-and-reel recaptures, 13 of which were measured. Mean size of recaptures was 29 inches. All rod-and-reel recaptured swordfish were caught between 24° and 31° N. latitude (south Florida to South Carolina).

Based on NMFS tournament data, swordfish are rarely encountered in tournaments targeting billfish or other HMS. For example, in tournaments taking place along the Atlantic coast of Florida and the Florida Keys (historical area of fishery), no swordfish were caught in 18,566 hours of fishing effort (NMFS, 1997). The Cooperative Tagging Center at the Southeast Fishery Science Center occasionally encounters swordfish entries, although they are considered rare event species caught incidental to other trolling recreational fisheries. There are anecdotal reports of recreational fishermen catching swordfish. Fishermen have reported catching swordfish in the Hudson Canyon at night during the summer of 1997.

While recreational anglers no longer target Atlantic swordfish, the recreational fishery was active in the 1980's. At that time, recreational anglers spent between \$200 and \$800 for an overnight fishing trip, depending on region and proximity to fishing grounds. Generally, swordfishing grounds are 70 to 100 miles offshore along much of the Atlantic coast, making the costs for recreational fishing for swordfish much higher than for most other species (SAFMC, 1985). As the north Atlantic stock rebuilds so that the fish are more available, recreational anglers' catch rates of swordfish are likely to increase, and tournaments may again include swordfish on their list of prized gamefish. The revival of this recreational fishery would lead to increased fishing opportunities and economic benefits for associated industries and the coastal communities where recreational fishing occurs.

Monitoring Recreational HMS Fisheries

NMFS conducts statistical surveys of portions of HMS recreational fisheries. These survey programs have been used for well over a decade. The two primary survey vehicles of the recreational sector conducted by NMFS are the Marine Recreational Fishing Statistics Survey (MRFSS) and the Large Pelagics Survey (LPS). The MRFSS is a survey designed to provide regional and state-wide estimates of recreational catch for the entire spectrum of marine fish species in the Atlantic. It was not designed to account for the unique characteristics of HMS recreational fisheries, although information on these species is frequently obtained by the survey. The MRFSS is a random-dial telephone survey, restricted to coastal counties from Virginia through Louisiana. The MRFSS does not cover the state of Texas nor does it cover the charter/headboat fisheries. Therefore, data about the charter/headboat sector of the fishery

are provided by an independent survey in the State of Texas and by the NMFS Headboat Survey in the southeast United States. Because the recreational fisheries for blue marlin and white marlin are not often observed within the MRFSS statistical framework, surveys of billfish tournaments are independently conducted by the SEFSC to obtain catch estimates from this sector. Information collected by the MRFSS on recreational shark landings is used to estimate the number of fishing trips, the number and species of sharks caught and/or landed, the weight of these sharks, and the number of persons fishing. Sharks species are identified to the extent possible.

The LPS was originally designed to estimate annual recreational catches of bluefin tuna from North Carolina through Massachusetts in the summer months (primarily for small and medium bluefin) and to evaluate abundance trends of bluefin by monitoring catch and effort associated with all sizes of bluefin. Although it was designed for bluefin, the LPS collects catch information on other HMS at certain times and in certain areas. There are two phases to this survey: 1) dockside interviews and observation to obtain number, species, and sizes of fish caught during a trip; and 2) a telephone survey directed at those people likely to be active in the HMS fishery to obtain the amount of effort during the prior reporting period and corroborative information about the number of fish captured. In 1992, the LPS was redesigned to focus on the need for within-season monitoring of recreational catches of bluefin tuna relative to a landing quota. This was done by increasing the frequency of the reporting period, increasing both dockside and telephone sampling frequency, expanding the areas and times of monitoring, and focusing the sampling in the times and areas most important for the bluefin catch estimation. Although the LPS was designed for bluefin tuna, the data are also used to estimate catch information for other HMS and monitor catch-per-unit-effort trends which is reported to ICCAT.

Recreational landings of billfish species are estimated using: a) the NMFS Recreational Billfish Survey, which collects information on the number of billfish caught during tournaments held along the southeastern US coast (south of 35° N latitude), in the Gulf of Mexico, and US Caribbean Sea regions (i.e., US Virgin Islands and Puerto Rico); and b) the LPS, which provides estimates of billfish catch from May through October for waters along the northeastern US (north of 35° N latitude). Estimates of billfish harvests compiled from these sources are considered underestimates of the total recreational harvest. However, suitable survey data from which to estimate coast-wide recreational harvests of these species are not available due to the rare nature of billfish landings over a wide geographic area. As of April 1998, NMFS has implemented a mandatory registration system for all tournaments directed at HMS. This measure is intended to improve estimates of billfish and other HMS landings by tournament participants.

In addition to these surveys, NMFS conducts a charter boat survey in the southeast for monitoring catch-per-unit-effort trends. This fishery encounters HMS fairly frequently. A NMFS pilot program to supplement data collection in the charter boat fishery in the Gulf of Mexico includes a telephone survey of charter boat operators and a logbook panel survey of charter boat operators. This supplemental survey will be conducted through August, 1998, in cooperation with the Gulf States Marine Fisheries Commission, the Alabama Department of

Conservation and Natural Resources, the Florida Department of Environmental Protection, the Louisiana Department of Wildlife and Fisheries, and the Mississippi Department of Marine Resources. Catch and effort data collected by the charter/headboat surveys will be evaluated along with data collected by the existing MRFSS survey in the Gulf of Mexico. The charter boat study will determine the relative accuracy of the estimates, survey costs, cooperation rates of captains and anglers, and reporting burden on the industry.

In 1997, NMFS instituted a mandatory Automated Catch Reporting system to supplement monitoring of the recreational fishery for Atlantic bluefin tuna. Although this call-in requirement (1-888-USA-TUNA) is an integral part of the Angling category monitoring system, it has not replaced traditional survey methods in the recreational fishery. The recreational surveys described above are conducted simultaneously in order to provide a measure of comparison for the reported catch estimates. All vessels catching bluefin tuna less than 73" are required to participate in both the call-in reporting and survey programs. NMFS will examine the results from these quota monitoring approaches together to enhance the accuracy and timeliness of quota monitoring in the Angling category for bluefin tuna.

NMFS is committed to working with the states to develop more effective partnerships for monitoring all HMS recreational BFT fisheries. For example, as part of a pilot program launched in 1998, fifteen reporting stations have been established in North Carolina, and Angling category vessel operators in the winter fishery are required to fill out a catch reporting card for each BFT. Information on these angler catch cards is entered into a database in the Northeast Regional Office on a weekly basis. This program, coordinated by NMFS in cooperation with the North Carolina Division of Marine Fisheries, will be continued in 1999. Other mid-Atlantic states, including the Maryland Department of Natural Resources, have demonstrated an interest in establishing a similar program. There are significant challenges associated with developing tagging programs for the recreational fishery, since the participants are widely dispersed and recreational landings are not channeled through any central points of contact (e.g., fish dealers in the commercial fishery). NMFS believes that a successful tagging program depends upon effective state-federal coordination that takes into account regional differences in the fishery, as well as cooperation with the recreational industry.

Update on Atlantic HMS Recreational Issues Since the Conclusion of the Symposium

Since this paper was presented at the 1998 Gamefish Symposium, NMFS has completed a number of key actions that directly impact management of the Atlantic HMS recreational fishery. In 1997, ICCAT adopted the first binding recommendation for Atlantic billfish by requiring the reduction of blue marlin and white marlin landings by at least 25 percent from 1996 levels, starting in 1998, to be accomplished by the end of 1999. Atlantic-wide landings of marlin in 2000 were to be held to 1999 levels as a result of a 1998 ICCAT recommendation. To comply with the ICCAT recommendation for billfish, NMFS increased the minimum size limits for blue and white marlin. The 25 percent reduction in blue and white marlin landings would result in reductions of US recreational landings of approximately 21,000 lbs.; more importantly, this recommendation will result in nearly a 3.4 million pound decrease

in Atlantic-wide marlin landings from 1996 levels by other ICCAT member countries. However, given current levels of Atlantic-wide fishing mortality and stock biomass resulting from the 1999 assessment by ICCAT's Scientific Committee on Research and Statistics (Table 5), even with full compliance with the required 25 percent reduction in landings of blue marlin and white marlin, current yield is not sustainable and is too high to rebuild these over-fished stocks.

The NMFS completed the HMS FMP and Amendment 1 to the Atlantic billfish FMP in April 1999. The final regulations implementing these FMPs were published on May 28, 1999. The following list summarizes the pertinent management measures that directly impact Atlantic HMS recreational fisheries:

- Three yellowfin tuna recreational bag limit;
- Mandatory tournament registration and reporting for all tournaments involving any HMS species;
- Charter/headboat permit and logbook requirements established along with a voluntary observer program;
- Increase in minimum size limits established for blue marlin (99 inches LJFL), white marlin (66 inches LJFL), sailfish (63 inches LJFL), and sharks (54 inches; except for Atlantic sharpnose);
- No retention of longbill spearfish, as well as a suite of 19 shark species;
- Catch-and-release fishery management program established for billfish; and
- Foundation for rebuilding programs established for over-fished species (an international rebuilding program for North Atlantic swordfish was adopted by ICCAT in 1999).

NMFS recently completed Regulatory Amendment 1 to the HMS FMP for the reduction of bycatch, bycatch mortality and incidental catch in the Atlantic pelagic longline fishery. The final rule, which published on August 1, 2000, established time/area closures along the southeastern US EEZ and prohibited the use of live bait in the Gulf of Mexico. Recreational HMS fishermen will likely experience an increase in angling opportunities for billfish, yellowfin tuna, and swordfish, in some areas, as a result of the time/area closures.

The recreational swordfish fishery is quickly growing in popularity and productivity particularly off the southeast US Atlantic coast, mid-Atlantic and New York Bight areas. The magnitude of recreational swordfish landings is difficult to monitor because it is conducted almost exclusively during late-night hours, which is outside the time frame of the sampling regimes of dockside samplers from existing NMFS recreational fishery surveys. However, anecdotal reports indicate that it is not unusual to see 15 to 25 vessels targeting swordfish off the east coast of Florida, with multiple catches of swordfish in excess of 100 lbs. Continued growth of the recreational swordfish fishery is expected as the stock rebuilds.

Table 1: 1998 US vs International Catch of HMS (mt ww).

Species	Total International Reported Catch	Region of US Involvement	Total Regional Catch	US Catch	US % of Regional Catch	US % of Total Atlantic Catch
Atlantic Swordfish	31,119 (Atlantic and Mediterranean)	North Atlantic (NA) and South Atlantic (SA)	26,156 (12,157 NA, 13,486 SA)	3,656 (443 mt discards) (3,053 + 433 mt discards NA, 170 + 10 mt discards SA)	13.98% (28.67% NA, 1.26% SA)	11.20% (includes Med catches)
Atlantic Bluefin Tuna	44,610	West Atlantic	2,643	1,302 (67 mt discards)	49.26%	2.92%
Atlantic Bigeye Tuna	94,768	NA	NA	928	NA	0.98%
Atlantic Yellowfin Tuna	147,434	West Atlantic	25,310	5,621	22.21%	3.81%
Atlantic Albacore Tuna	58,371	North Atlantic	25,697	829	3.23%	1.42%
Atlantic Skipjack Tuna	133,181	West Atlantic	30,046	104	0.35%	0.08%
Atlantic Blue Marlin	3,198	North Atlantic	1,243	99 (50 mt discards)	7.96%	3.10%
Atlantic White Marlin	1,118	North Atlantic	480	34 (32 mt discards)	7.08%	3.04%
Atlantic Sailfish	1,713	West Atlantic	1,542	28 (27 mt discards)	1.82%	1.63%

Table 2: Estimated number of rod-and-reel/handline fishing trips targeting large pelagic, 1997 (1997 Large Pelagic Survey).

State	Private	Charter	All Vessels
North Carolina*	1,335	1,558	2,893
Virginia	8,190	2,470	10,660
Maryland to Delaware	2,112	5,761	26,873
New Jersey	39,813	8,557	48,370
New York	26,568	6,881	33,449
Connecticut to Rhode Island	9,675	3,449	13,124
Massachusetts	46,068	3,489	49,557
New Hampshire to Maine	23,177	1,596	24,773
Total	175,938	33,761	209,699

* North Carolina estimates are from a separate telephone survey, for bluefin tuna only

Table 3: Updated domestic recreational landings for the Atlantic tunas, swordfish and billfish recreational rod-and-reel fishery: 1995-1998 (mt ww)*.

Species	Region	1995	1996	1997	1998
Bluefin tuna**	NW Atlantic	402	362	299	184
Bigeye tuna	NW Atlantic	11.8	108.2	333.5	228.0
	GOM	0	0	0	0
Albacore	NW Atlantic	19.1	277.8	269.5	601.1
	GOM	0	61.7	65.2	0
	Total	19.1	339.5	334.7	601.1
Yellowfin tuna	NW Atlantic	4125.4	4484.8	3560.9	2845.7
	GOM	31.7	13.2	7.7	80.9
	Total	4157.1	4498	3569	2927
Skipjack tuna	NW Atlantic	20.5	48.1	42.0	49.5
	GOM	0	36.4	21.7	37.0
	Total	20.5	84.5	63.7	86.5
Blue marlin***	NW Atlantic	23.0	17.0	25.0	34.1
	GOM	14.0	8.3	11.5	4.5
	Caribbean	6.0	9.6	8.6	10.6
	Total	43.0	34.9	45.1	49.2
White marlin***	NW Atlantic	8.0	2.7	0.9	2.4
	GOM	1.0	0.6	0.9	0.2
	Caribbean	0.0	0.0	0.0	0.02
	Total	9.0	3.3	1.8	2.6
Sailfish***	NW Atlantic	9.0	0.2	0	0.1
	GOM	1.0	0.8	0.4	1.0
	Caribbean	0.0	0.2	0.2	0.05
	Total	10.0	1.2	0.6	1.15

* Rod-and-reel catches and landings for Atlantic tunas represent estimates of landings and dead discards based on statistical surveys of the US recreational harvesting sector.

**Rod-and-reel catch estimates for bluefin tuna in the US National Report to ICCAT include both recreational and commercial landings. Rod-and-reel catch of bluefin less than 73" curved fork length (CFL) are recreational, and rod-and-reel catch of bluefin 73" CFL or greater are commercial. Rod-and-reel catch of bluefin > 73" CFL also includes a few metric tons of "trophy" bluefin (recreational bluefin 73").

***Blue marlin, white marlin, and sailfish landings are estimated based on the SEFSC Recreational Billfish Survey and the Large Pelagic Survey.

Table.4: 1998 Recreational Landings of Atlantic Sharks by Number.

Large Coastal Sharks	Recreational Landings (number)
Bignose	none reported
Blacktip	76,522
Bull	802
Dusky	4,277
Hammerhead	384
Hammerhead, Great	441
Hammerhead, Scalloped	1,101
Hammerhead, Smooth	370
Lemon	1,992
Night	none reported
Nurse	2,690
Reef	none reported
Sand Tiger	none reported
Sandbar	33,245
Silky	5,039
Spinner	7,119
Tiger	1,302
Large Coastal	16,505
Unclassified	none reported
Unclassified Fins	none reported
Total:	151,791
Pelagic Sharks	
Bigeye thresher	none reported
Blue	6,003
Shortfin Mako	5,581
Longfin Mako	none reported
Mako	none reported
Oceanic Whitetip	none reported
Porbeagle	none reported
Thresher	36
Pelagic	none reported
Unclassified	none reported
Total:	11,620

Table 4 (cont.)

Small coastal sharks	Recreational Landings
Atlantic Angel	107
Atlantic Sharpnose	42,048
Blacknose	9,578
Bonnethead	26,191
Finetooth	none reported
Unclassified	none reported
Total:	77,924

Table 5. Summary of results of the July 2000 SCRS blue and white marlin stock assessment.

	1996 Assessment	1999 Assessment
Blue Marlin MSY	4,461 mt	~2,000 mt
Relative Biomass (B_{2000}/B_{MSY})	24% MSY	~40% MSY
Relative F (F_{1999}/F_{MSY})	2.87	4
White Marlin MSY	2,177 mt	~1,300 mt
Relative Biomass (B_{2000}/B_{MSY})	23% MSY	~15% MSY
Relative F (F_{1999}/F_{MSY})	1.96	>7

References

- Ditton, R.B. and D.J. Clark. 1994. *Characteristics, Attitudes, Catch and Release Behavior, and Expenditures of Billfish Tournament Anglers in Puerto Rico*. Report prepared for The Billfish Foundation, Ft. Lauderdale, FL. 27pp.
- Ditton, R.B. and J. R. Stoll. 1998. *A Socio-Economic Review of Recreational Billfish Fisheries*. Texas A&M University and University of Wisconsin-Green Bay, Green Bay, WI.
- Ditton, R.B., B.L. Bohnsack, and J.R. Stoll. 1998. *A Social and Economic Study of the Winter Recreational Atlantic Bluefin Tuna Fishery in Hatteras, North Carolina*. 82pp.
- Fisher, M.R. And R.B. Ditton. 1992. Characteristics of Billfish Anglers in the US Atlantic Ocean. *Marine Fisheries Review* 54(1):1-6.
- NMFS. 1997. *1994/1995 Report of the Southeast Fisheries Science Center Billfish Program*. NOAA Technical Memorandum NMFS-SEFSC-398, 15pp.

Discussion

Initially, the discussion centered on data collection at tournaments. Ms. Lent noted that, although not currently the case, they plan to require all tournaments to register and collect data on all species.

An audience member asked about measuring the experiential value of the charter boat industry. Ms. Lent replied that two studies have been carried out, using willingness-to-pay and travel-cost methods.

In response questions, Ms. Lent also discussed management of the longline fishery and the cost and value of the large pelagic survey.

Gamefishing Activities in Taiwan and the 20th Asian Cup Game Fishing Tournament

By Dr. John S. Y. Chen
Taiwan (Republic of China) Tourism Bureau

Forward

With the growing popularity of gamefishing activities, many more people are spending their spare time engaging in this fun-filled activity. Taiwan, an island surrounded by the Pacific Ocean, contains all qualities that are required by this sport: beautiful oceans, different varieties of fish and enthusiastic fisherman. Although gamefishing was a late-starter in Taiwan, both the qualities of the ocean and the sea life allow it to grow rapidly.

Geography of Taiwan

Taiwan is located in East Asia and on the western rim of the Pacific Ocean. More specifically, she is located between 21° 45' N latitude (at Chi Hain Yuan) and 25° 38' N latitude (at Peng Chia Isle) and between 119° 18' E longitude (at Hus Isles of pasadores) and 122° 00 E longitude (at Cape Sanchao).

Since the end of the Sixteenth Century when certain Portuguese sailors caught sight of Taiwan, Taiwan has been known as “Formosa” or “beautiful island” to Westerners. Taiwan covers an area of 36,000 square kilometers. Her current population is 22 million. Her busy industrial and commercial activities enable her to play a significant role in the world's economic arena. As an island, Taiwan also thrives on fishing. Currently, her fishing populations is about 600,000 generating US\$2.8 billion in gross production. Also as a beautiful island, Taiwan abounds in tourism resources, which makes water activities very popular on the island. For example, estimates place the total number of anglers, divers and surfers, makes the coastal water activity population total to 3 million. The authorities concerned can confirm the above information, other than the number of anglers.

An Introduction to the Gamefishing Activities in Taiwan

Taiwan sits at the focal point where the Eurasian plate collided with the Filipino plate. This makes her East Coast extremely steep and rugged. The sea is more often than not around 100 fathoms deep only tens of meters away from the coast. It takes merely 20 to 30 minute boat ride to reach the dark oceanic trench over 1,000 m deep. The Okinawa Trough interacts with the Asian continental shelf on the seawaters northeast of Taiwan. The complicated and rugged terrain of its sea bottom makes this the intersection an ideal natural habitat for fishes. Moreover, the main Black Current, or the Kalosho, flows northward enabling over-

whelming plankton to grow. The plankton attracts innumerable predators hunting for food. As a result, there is a great deal of migratory and sea bottom fish of high economic value in the area, thereby making the area a godsend for an excellent fishery.

However, to cope with her confrontations with China over the last few decades, Taiwan has enforced a strict coastal waters control policy, thereby depriving her people of their right to enjoy the freedom of fishing at sea. The right was not respected and gradually restricted until a few years ago. In consequence of this, non-professional anglers suffered a general lack of knowledge about fisheries and fishing periods, and have acquired very negligible experience and skills in fishing. They have had few opportunities to observe the ecosystem and the habit of schools of fish. In a word, Taiwan coastal waters remain largely a virgin land to be developed.

Currently, the Chinese Heavy Duty Fishing Association is actively promoting gamefishing activities within Taiwan coastal waters. The association operates more than ten clubs throughout Taiwan, consisting of 200-strong members. In addition to the annual national and local gamefishing contests, it has successfully organized annual Asian gamefishing tournaments with their counterparts in the Philippines, Hong Kong, and Japan on a recreational basis. These big events have won the praise of many anglers in those countries or areas. Given faster opening government policies plus recreational port facilities, the future should witness very promising development of the gamefishing sport in Taiwan.

Fish Resources in the Coastal Waters of Taiwan

A survey of the fisherman's catch in Taiwan disclosed that there are a number of species available for bottom fishing and trolling, e.g., gray snappers or *ehu* in Hawaiian, long-tailed red snapper or *onaga* in Hawaiian, groupers or *hapu'upu'u* in Hawaiian, and amberjacks of *kahala* in Hawaiian, billfish or *a'u* in Hawaiian, tuna or *ahi* in Hawaiian, mackerel or *ono* in Hawaiian and trevally or *ulua/papio* in Hawaiian. On top of that, such fishes fall into many species and some of them are so abundant that their market prices often fall to an incredibly low level in the second quarter of each year, which is the peak season of production. For instance, during the period from April to June of each year, dolphin fish of mahi mahi, cost only US \$2 per kg and sailfish or *a'u'ulepe* in Hawaiian cost US \$6 per kg. An indicator that the Taiwan coastal waters has high potential for development of fishing.

Recent Years' Catch by Trolling in Taiwan's Coastal Waters

According to the information available to the Chinese Heavy Duty Sport Fishing Association, the earliest recorded big-gamefish caught by trolling was in May 1995 in the water around Orchid Island. It was a blue marlin weighing 56 kg or 123 lbs.

Note that such big-gamefish, though small in size, can be said to be rare in that these fish were caught at a time when the port entry/exit restrictions were not yet lifted. Records show that fish in the most recent fishing, also the biggest fish ever certified on record, was caught

in coastal waters in Nanwan, Kenting, Taiwan in May, 1997. It was also a blue marlin weighing at 147 kg (323 lbs.) and was hooked up with a fishing line strength of 30 lbs.

As noted above, Taiwanese anglers do not have very good performance on fishing as they have limited knowledge of fishing period, fisheries and species of fish. In contrast, professional Taiwanese fishermen have oftentimes succeeded in catching marlin weighing 500 lbs. and tuna weighing 80 lbs. Therefore, Taiwanese anglers are risking active efforts for better performance in the future.

Catch During the 20th Asian Cup Game Fishing Tournament Held in Taiwan

The Chinese Heavy Duty Sport Fishing Association in June 1993 organized the 15th Asian Game Fishing Tournament, which was the first of its kind in Taiwan. The performance by anglers during the big event left much to be desired in that the experience and skills of Taiwanese anglers were still in their infancy. Most of the catch of the participants in that tournament was mahi mahi, about two tons in total catch in 30-strong cruises within three days. In May 1998, the association once again was the organizer of the 20th Asian Game Fishing Tournament Under the Assistance of the East Coast National Scenic Area Administration at the Tourism Bureau of the Ministry of Transportation and Communications, the tournament took place in the waters off the County of Taitung in east Taiwan. This time, there were impressive performances in catch, species, and total weight, with 12 sailfish, (the biggest of which weighted 35.6 kg), over 100 mahimahi weighing from 5-13.8 kg and 28 wahoo weighing from 5-11.5 kg. Such performance not only won the repeated applause of anglers from the Philippines and Hong Kong, but also was the most successful in the history of Asian gamefishing cups. The association certainly felt thrilled with the results, considering it as recognition of the potential for the development of gamefishing in the Taiwan coastal waters.

Conclusion: Prospects for Gamefishing Activities in the Coastal Waters of Taiwan

Gamefishing activities did not screech to a halt even after the close of the 20th Asian Game Fishing Tournament. At the end of May 1998, a Hong Kong angler, having heard of the impressive performance, rushed to the coastal waters in Taitung and hooked up a 36 kg sailfish in his first venture and four mahi mahi and one wahoo on the second day, making him smile broadly. Several days thereafter the top winner in the Asian Game Fishing Tournament and another angler flew to Green Island, an island off the eastern coast of Taiwan. During their two-day trolling one sailfish after another was hooked up. Of the catch, one was a 20 kg trawally, not to mention the uncountable number of mahi mahi. Finally, they even hooked up a blue marlin weighing more than 100 kg. After they had fought for more than ten minutes a carelessly-piloted fishing boat buzzed by, breaking their main line and leaving them only with sighs and regret.

These performances have prompted enthusiastic explorations among the anglers in Taiwan. They even have encouraged the authorities concerned, like the Tourism Bureau, the Department of Fishery, and other coastal scenic area administrations to pay increasing attention

to such resources. It is believed that given the concerned efforts of the public and the private sectors, Taiwan can become as good as a fishing spot as Hawaii in the not too distant future.

We open our hearts to welcome Hawaiian anglers to Taiwan for gamefishing purposes. Hopefully, while enjoying the bounty of the sea in Taiwan, our Hawaiian friends can share their experience and skills with Taiwanese anglers. Thank you for your undivided attention.

Table 1: A Summary of Recent Cetacean Boat Surveys Around Taiwan. (Source: Chou, Liensiang et al. 1998. *A Summary of the Cetacean Boat Survey in the Coastal Water of Taiwan.*)

Species	SW Coastal Waters	Hau	Hualien	Taitung
G. griseus	9	6	26	41
L. hosei		2	7	7
Cursips spp.	18	3	10	10
S. longirostris		11	24	16
S. attenuana	7	1	14	8
S. coenleoba				1
Delphinus spp.		1		
P. crassideas	1	1	1	
F. attenuana		2		7
O. orca			1	1
K. simus				1
P. macrocephalus				0*
M. densiostris				2
G. macrochuyinchus		1		
Total species	4	9	7	11
No. of cruises	10**	12	30	56
No confirmed herd	35	28	83	94
Herd/cruises	0.7**	2.5	2.8	1.7
Boat survey period	3 yrs	2 m (spring)	over 3 m (summer)	one yr

*Each cruise lasts five to seven days.

**When duly adjusted, the calculation is based on a cruise that lasts for five days.

Note: Mr. Chen was unable to present his paper at the Symposium.

Marlin Management in Hawaii: Are There Interactions Between Longline Vessels and Charter Vessels Targeting Blue and Striped Marlin?

Paul Dalzell

Western Pacific Regional Fishery Management Council

Abstract

A study was conducted of the Kona-Honokohau charter vessel catches of blue and striped marlins, and the revitalization of the Hawaii-based longline fleet in the late 1980's. An increase in longline catch of marlins was believed to have had a negative effect on the charter vessel blue marlin catches. There was a correlation between annual mean blue marlin charter vessel CPUE and the annual volume of charter vessel activity but the same relationship was not evident for striped marlin. This study was unable to detect any correlation between the annual level of longline fishing inside the US EEZ bordering the Hawaiian Islands and mean annual blue marlin and striped marlin CPUEs of the Honokohau charter vessel troll fishery. However, it is not conclusive proof that there are no interactions between the two fisheries.

Introduction

In this paper I present an update and revision of the paper first delivered to the Symposium on Pacific Islands Gamefish Tournaments, held in Hawaii between July 29 and Aug 1, 1998. The objective of this contribution is to assess the evidence for interactions between Hawaii-based longline vessels and coastal charter vessels based at Kona on Hawaii with respect to blue marlin. Specifically, has the revitalization and expansion of the Hawaii-based longline fishery in the late 1980's and 1990's had a negative influence on the catches of blue marlin by the near-shore charter troll fishery, the largest component of which is based at Honokohau, a small boat harbor near the Hawaiian town of Kona.

In the Western Pacific Region, blue marlin is a target species primarily of recreational game-fishing enthusiasts and charter vessels. Some targeted harvest of blue marlin in Hawaii by commercial trollers occurs between August to October, when large schools of 100-300-lb. fish aggregate around fish aggregating devices (FADs) deployed off the Waianae coast of Oahu. Most blue marlin caught either by charter vessel or commercial trolling in Hawaii is usually sold through the commercial fish auctions. Even predominantly recreational fishers may also dispose of blue marlin through the auction, although a larger percentage is kept for personal consumption. Commercial troll landings of blue marlin in Hawaii during 1997 amounted to

about 760,000 lbs., although this is likely an underestimate due to the non-reporting of “recreational” catches.

The longline fishery in Hawaii, which targets mainly swordfish and tunas, also takes blue marlin as an incidental catch. Landings of blue marlin from the longline fishery presently amount to about 1,000,000 lbs. (WPRFMC 1998), or about four percent of total landings. Logbook estimates suggest that about three percent of the blue marlin caught is discarded. Competitive interactions between trolling vessels targeting marlins and longline fisheries have been the focus of investigations in Hawaii, the Marshall Islands and Mexico. In Hawaii, Boggs (1991) and Skillman et al. (1993) investigated the interaction between longline and troll vessels with respect to a variety of pelagic species. Boggs (1991) showed that there was no apparent relationship between blue marlin troll catch rates and the build up of longline fishing effort in the Hawaii EEZ. However, Skillman et al. (1993) suggested that intense longline fishing near the Hawaiian islands may have the potential to depress catch rates of species such as blue marlin.

Longline fishing has been conducted in Hawaii since the early years of the 20th Century but the fishery experienced a decline in participation from a peak of about 50 vessels in the mid-1950's to less than 20 by the early 1980's. These vessels were generally wooden hulled sampan style vessels using tarred rope longlines stored on deck in baskets and commonly referred to as “basket gear.” The discovery of fishable stocks of swordfish to the north of Hawaii and the advent of larger steel hulled vessels equipped with monofilament line on steel drums revitalized the fishery, which expanded through relocation of vessels from the US mainland. The rapid expansion of the fishery also created problems, particularly the perception that the expansion of longline fishing meant competition with small troll vessels. In a series of amendments to its pelagics fishery management plan, the Western Pacific Council implemented log book and observer programs, and a 50-75 nm closed area around the Main Hawaiian Islands and a 50 nm closed area around the Northwestern Hawaiian Islands.

The displacement of the longline vessels to at least 50 nm miles offshore alleviated most of the tension between small troll vessels and longliners. However, there is still the perception that longliners are catching blue marlin that if left would be caught by troll vessels, particularly charter vessels which target principally big gamefish such as marlins. One recent appeal to the Western Pacific Fishery Council asked for an extension of the present area closure boundary adjacent to the western coast of the Big Island, in an attempt to allocate more blue marlin to the State's main charter vessel fishery based out of Kona (Bright 1997). This request fostered a series of investigations by the Council in partnership with the NMFS Honolulu Laboratory and Hawaii Division of Aquatic Resources, which looked at any evidence that showed the Hawaii-based longline fishery had a strong negative influence on the Kona charter fishery blue marlin catch. The results of this study are summarized in this paper, which focuses primarily on blue marlin but also includes the striped marlin which is also caught in abundance by both longline and charter fisheries.

Methods

Catch and effort data for charter troll vessels based at the Honokohau small boat harbor near Kona for the years 1980 to 1998 were obtained from the Hawaii Division of Aquatic Resources in Honolulu. All commercial fishing vessels in Hawaii are obliged to complete a trip catch report, detailing the catch for each trip and its disposition, i.e., kept or sold. Charter vessels in Hawaii in the main retain and sell their catches to supplement incomes from charter patron fees. Data for Honokohau resident charter vessels were summarized for the years 1980 to 1998. The data included total number of trips by individual vessels in each year and the daily catch by weight and numbers of different species of fish. For this study only blue marlin and striped marlin were extracted from the catch data. The only measure of fishing effort was the individual trip, however, this has been shown by Boggs and Ito (1993) to be a reasonable proxy for true fishing effort in Hawaii small vessel troll fisheries.

Hawaii-based longline vessel operators are obliged to complete daily records of their fishing operations in logbooks supplied by the National Marine Fisheries Service, which include recording catch in numbers of commercial species such as blue and striped marlin. Longline effort is expressed as the number of hooks deployed and catch per effort as catch per 1,000 hooks. Records of longline catches also report the location of the start and finish of a set and the catch data can be expressed spatially in summaries by five degree squares.

Results

The main data set generated from the HDAR charter vessel fishery is shown in Table 1. Also included in Table 1 is the annual fleet size of longline vessels and the number of hooks set each year in the five degree square bounded by the coordinates 155°-160° W, 15°-20° N, and which includes the Kona coast of Hawaii. Figure 1 shows the time series trajectories for total charter vessel trips and blue and striped marlin catches between 1980 and 1998. The most striking feature of the charter vessel fishery over the last 20 years has been the expansion of the charter fishing in the late 1980's and early 1990's. During the 1980's annual charter trips ranged from 1,000 to 1,500 trips annually, while during the 1990's the volume of charter trips ranged from between 3,000 and 3,500 trips per year. This has led to an increase in blue marlin catch and to a lesser extent striped marlin.

Figure 2 and shows the catch per unit effort (CPUE) for blue and striped marlin together with the annual fleet size of longline vessels. Catch rates for blue marlins ranged from 0.2 to 0.6 marlin/trip, with an average of 0.38 marlin/trip, while striped marlin catch rates have ranged from 0.03 to 0.3 marlin/trip, with an average of 0.08 marlin/trip. Both marlins showed a peak in CPUEs in the late 1980's, although the blue marlin peak was sustained over several years. Catch rates of both marlins attained lows both before and after the advent of the revitalized longline fishery.

Table 1: Annual catch, effort, CPUE of the Honokohau charter vessel fishery for blue and striped marlin, annual longline fleet size (1980-1998), and annual number of hooks deployed in the five degree square bordering the Kona coast of Hawaii (1991-1998).

Year		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Striped marlin	no	81	50	39	50	64	56	85	108	285	191
	wt	5,712	3,330	2,777	3,222	4,453	4,686	7,420	7,236	20,504	12,160
	no trips	1,187	1,608	891	1,590	889	1,003	1,153	838	755	1,485
	cpue (n/trip)	0.068	0.031	0.044	0.031	0.072	0.056	0.074	0.129	0.377	0.129
	cpue (lb./trip)	4.812	2.071	3.117	2.026	5.009	4.672	6.435	8.635	27.158	8.189
Blue marlin	no	432	521	360	466	253	628	399	544	508	936
	wt	111,819	142,830	95,510	114,652	62,186	107,784	103,215	115,424	102,014	175,643
	no trips	1,187	1,608	891	1,590	889	1,003	1,153	838	755	1,485
	cpue (n/trip)	0.364	0.324	0.404	0.293	0.285	0.626	0.346	0.649	0.673	0.630
	cpue (lb./trip)	94.203	88.825	107.194	72.108	69.951	107.462	89.519	137.738	135.118	118.278
Longline fleet size (n)		22	25	27	37	38	42	46	45	55	75

Year		1990	1991	1992	1993	1994	1995	1996	1997	1998
Striped marlin	no	179	193	161	356	225	169	213	163	73
	wt	13,757	12,820	12,230	25,817	16,211	10,286	14,490	11,211	4,648
	no trips	3,051	2,270	2,624	3,551	3,443	3,216	3,395	2,752	2,402
	cpue (n/trip)	0.059	0.085	0.061	0.100	0.065	0.053	0.063	0.059	0.030
	cpue (lb./trip)	4.509	5.648	4.661	7.270	4.708	3.198	4.268	4.074	1.935
Blue marlin	no	1,005	774	804	716	1,587	662	1,063	731	717
	wt	246,579	169,315	183,117	149,556	316,510	150,888	220,410	141,499	154,769
	no trips	3,051	2,270	2,624	3,551	3,443	3,216	3,395	2,752	2,402
	cpue (n/trip)	0.329	0.341	0.306	0.202	0.461	0.206	0.313	0.266	0.299
	cpue (lb./trip)	80.819	74.588	69.785	42.117	91.929	46.918	64.922	51.417	64.433
Longline fleet size (n)		100	141	123	122	125	110	103	105	114
Longline effort in 5° square (no. of hooks x 1000)		NA	2,035	2,154	1,444	1,486	1,921	3,099	2,722	2,363

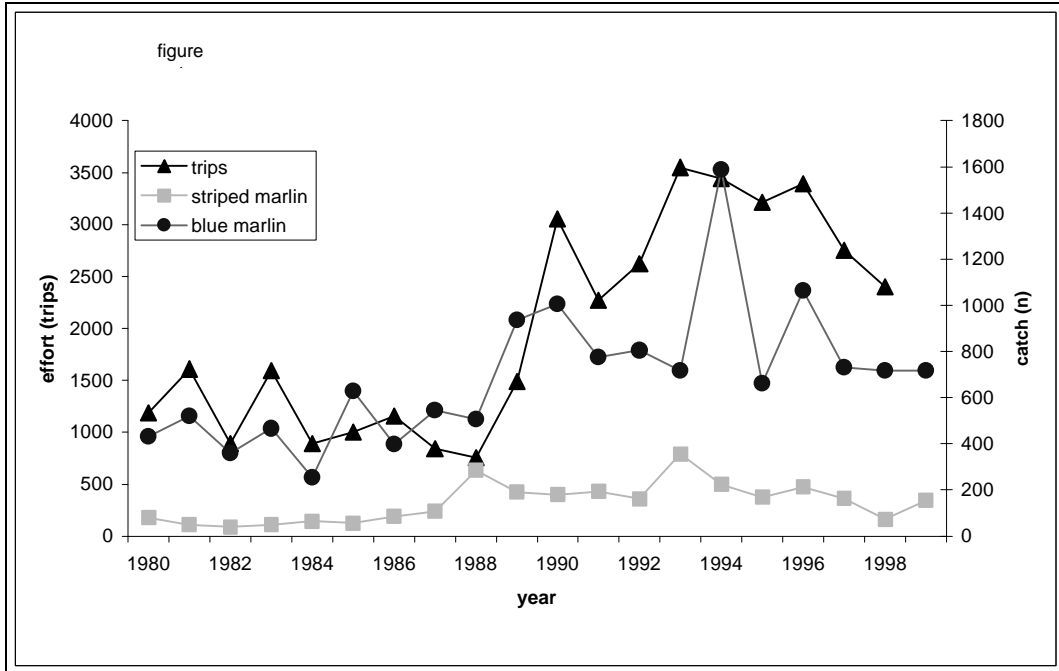


Figure 1: Time series of blue and striped marlin catch (n) and charter vessel fishing effort (trips) for Kona, 1980-1998.

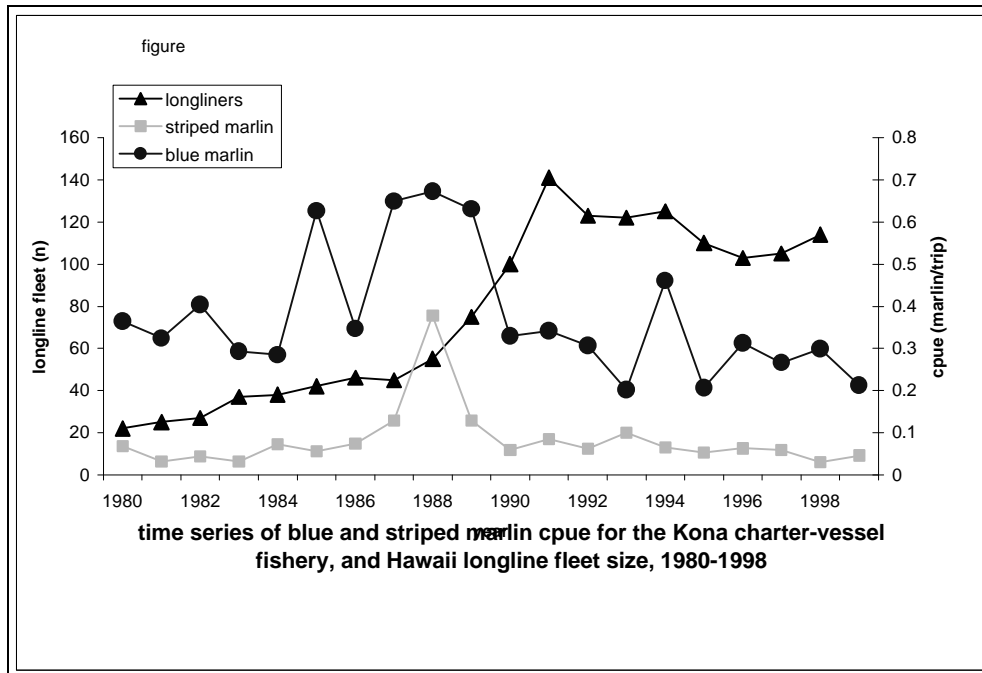


Figure 2: Time series of blue and striped marlin CPUE for the Kona charter vessel fishery and Hawaii longline fleet size, 1980-1998.

Table 2. Summary of regression analyses based on data contained in Table 1.

Factor	Blue marlin charter vessel CPUE (N)	Blue marlin charter vessel CPUE (wt)	Striped marlin charter vessel CPUE (N)	Striped marlin charter vessel CPUE (wt)
Annual longline fleet size (N)	-0.1095	-0.5471*	-0.0794	-0.093
Annual longline effort (hooks) in 5° square	-0.0854	-0.0321	-0.4492	-0.4648
Annual charter vessel effort (trips)	-0.5718*	-0.7361*	-0.3156	-0.3237

* $p < 0.05$

A number of simple linear regressions were conducted on blue and striped marlin CPUE with longline fleet size, annual fishing effort in the 5 degree square containing the Kona coast, and annual charter vessel fishing effort. The matrix of results from these analyses is contained in Table 2. With respect to longline fishing effort, only blue marlin CPUE by weight was significantly correlated to annual fleet size. Fleet size is, however, a very crude representation of annual effort, given the mobility of the fleet and its ability to switch targeting through fishing at different depths. More accurate longline effort data in terms of number of hooks set in a five degree square off Kona from 1991 to 1998 were also available to investigate possible interaction effects.

Regressions of marlin CPUE versus longline effort were also not significant (Table 2), although there may be possibly be some suggestion of a negative relationship between longline effort and striped marlin CPUE (Figure 3). Blue marlin CPUE was negatively correlated with annual charter vessel effort (Figure 4), with the best fit to the data being achieved when blue

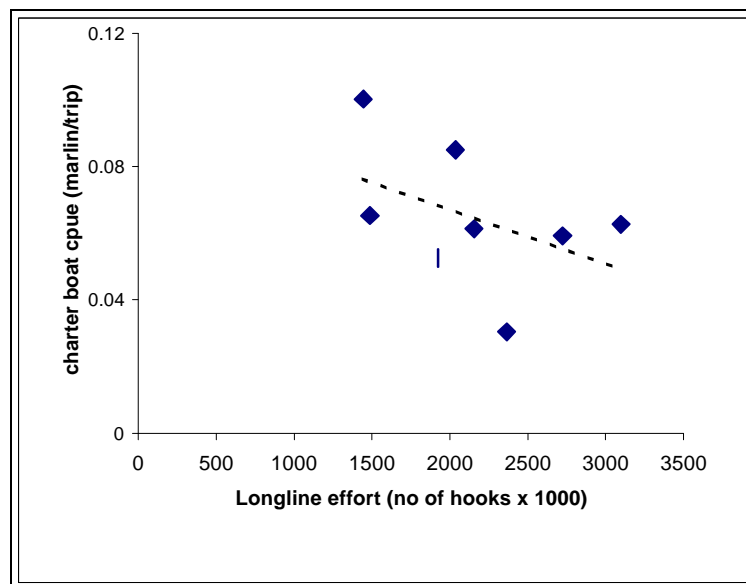


Figure 3: Charter vessel mean annual CPUE for striped marlin versus longline fishing effort in a five degree square bordering the Kona coast. Fitted line is not significant.

marlin CPUE was expressed in weight rather than numbers (Table 2). No relationship was evident for striped marlin CPUE and annual charter vessel effort.

Discussion

Charter vessel CPUEs are highly variable and have attained lows both before and after the revitalization of the Hawaii-longline fishery in the mid-1980's. However, low marlin CPUEs have persisted throughout the 1990's. During this period, the longline fleet size stabilized, but the number of hooks set by the fleet has continued to increase (Ito & Machado 1999; Russell Ito, NMFS Honolulu Laboratory pers comm). Further, an increasing number of the longline fleet have switched from targeting swordfish to targeting for tuna or mixed fishing, which tend to take larger volumes of blue marlin (Ito & Machado 1999).

There was a significant negative correlation between annual longline fleet size and charter vessel blue marlin CPUE in terms of weight, but not CPUE by number. This correlation may be an artifact due to the declining average weight of blue marlin from 1980 onwards (Figure 4). Longline fishing effort in terms of longline hooks set in the five degree square bounding Kona showed no correlation with blue marlin CPUE or for striped marlin (Table 2, Fig 3). However, prior to 1992, longline vessels could fish within the current 50-75 nm exclusion zone and, and before a comprehensive log book program had been implemented. There may indeed have been some stronger evidence for interactions between longliners and charter vessels with respect to marlin CPUEs, for several years, however, there are no log book data to investigate this.

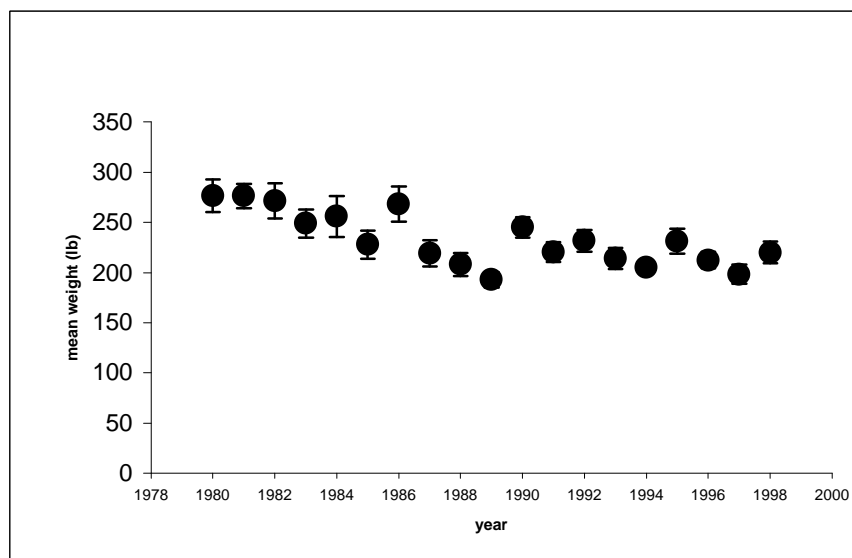


Figure 4 Annual mean size of blue marlin caught by the Kona charter vessel troll fishery. Bars are 95% confidence intervals about the mean.

The best correlations obtained with this data indicate some degree of interaction between Kona-based charter vessels. However, given the limited range of the charter vessel fleet, some degree of interaction between these vessels, who are competing for the same fish within

a relatively limited area of water, is not all that surprising. Another factor not taken into account in this study are the advances in technology, particularly over the past 20 years such as global positioning devices (GPS), color echo sounders, bird-finding radar, forward looking sonar and even cell-phones may contribute to fishing success, which will be masked by a simple CPUE index such a volume of fish caught per trip.

Does the data confirm or disprove competitive interactions between nearshore troll fisheries such as the charter fishery and the Hawaii longline fishery which can operate within the US EEZ around Hawaii? At present there is no strongly compelling evidence based on CPUE data. Detecting interactions between fisheries is difficult and large volumes of data may be required to detect even a relatively weak interactions (Hampton et al. 1996). However, tagging data indicates some degree of interaction between near-shore and offshore pelagic fisheries, as blue marlin tagged by recreational anglers near Kona were subsequently caught on the high seas by Hawaii-based longline vessels (NMFS 2000). Consequently, the belief among commercial and recreational troll fishermen that longliners are intercepting marlins, which could otherwise be taken in the near-shore fishery, will persist among this sector of the fishing community in Hawaii and continue to generate demands for management intervention. This type of issue is not confined to Hawaii but has surfaced in other Pacific Islands (Marshall Islands, Kiribati, Guam) where there is increasing concern over the impacts of large-scale pelagic fisheries on the near shore fishing sector (Hampton et al. 1996; Bigelow and Lewis 1998; SPC 1999)

Besides longliners fishing within the EEZ, the Kona charter fleet is competing with other small vessel pelagic fisheries such as commercial trollers, pelagic handliners and recreational fishers. Unlike the longline fleet which is characterized by high mobility, the Kona charter fleet has only a relatively small area of water in which to fish. The Kona charter fleet and other Pacific Island small vessel fisheries are at the mercy of proximate environmental conditions which may greatly influence abundance or catchability of pelagic fish such as marlin. During a strong El Niño or La Niña, purse seiners and longliners may move several thousand miles to follow fish abundance. By contrast small vessel pelagic fishermen in Hawaii and other Pacific Islands are forced to cope with conditions within the limited ocean areas within which they fish, including competition from other fisheries. Minimization of some of this competition will naturally, therefore, be a goal for small vessel pelagic fishermen. Given the increasing volume of pelagic fishes being harvested from the Pacific, it is likely that allocation and tension between small vessel and large vessel pelagic fisheries will continue to be a major fishery management issue.

Acknowledgments

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References

- Bigelow, K. & T. Lewis. 1998. *Sportsfishing and longlining: a Majuro perspective*. Oceanic Fisheries Program, Secretariat of the Pacific Community, Noumea.
- Boggs, C. 1991. *A preliminary examination of catch rates in Hawaii's troll and handline fisheries over a period of domestic longline fishery expansion*. NMFS SWFSC Admin. Rep. H- 91-05
- Boggs, C.H. & R.Y. Ito. 1993. Hawaii's pelagic fisheries. *Marine Fisheries Review*, 55 (2), 69-82.
- Bright, J., 1997. *Report to the Western Pacific Regional Fishery Management Council on the status of the Hawaii marlin catch and effort with management recommendations*. Presentation to the 94th Council Meeting, Honolulu 12-14th November 1997.
- Davie, P.S. 1995. *HIBT catch and fishing effort since 1959*. Pacific Ocean Research Foundation, Kona, Hawaii, 16 pp.
- Hampton, J., Lawson, T., Williams, P. and J. Sibert, 1996. Interactions between small-scale fisheries in Kiribati and the industrial purse seine fishery in the western and central Pacific Ocean. In *Status of Interactions of Pacific Tuna Fisheries in 1995*. FAO Fisheries Technical Paper No. 365, Rome FAO, 183-223.
- NMFS, 2000. *2000 Billfish Newsletter*. National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla.
- Seki, M., 1995. *Hawaiian International Billfish Tournament: an oceanographic perspective*. NMFS Honolulu Laboratory, 12 pp.
- Skillman, R., Boggs, C., and S. Pooley, 1993. *Fishery interaction between the tuna longline and other pelagic fisheries in Hawaii*. NOAA Technical Memorandum NMFS SWFC 189, 46 pp.
- SPC, 1999. *Mariana Islands 1998 pelagic fisheries assessment*. Oceanic Fisheries Program Country Report No. 12, Secretariat of the Pacific Community, Noumea.
- WPRFMC (Western Pacific Fishery Management Council), 1998. *Pelagic Fisheries of the Western Pacific Region: 1997 Annual Report*. Western Pacific Fishery Management Council, Honolulu.

Discussion

Discussion on Mr. Dalzell's paper focused on the charter vessel catch per unit of effort (CPUE) and how this was calculated. Mr. Dalzell explained that the number of trips was the only measure of effort available from the Hawaii Division of Aquatic Resources database. There was no information on the length of each trip, nor on the number of fishing lines deployed. Mr. Dalzell also noted that the trip volume reflected the number of reported successful trips. There may be trips where fish were caught and not reported, or trips where no catch was made and no report filed. However, Mr. Dalzell stated that work on similar small-vessel troll data for Hawaii by the NMFS Honolulu Laboratory suggested that catch per trip was a reasonable proxy for the true CPUE.

Panel Discussions

Introduction

Marc Miller briefly introduced the panel discussions by reviewing their purpose and format. These panels allowed participants to synthesize what had been learned from earlier presentations. As Dr. Miller put it, *I need your mana'o. I need your advice. We need each others' advice. It's time for recommendations, for ideas, for conclusions.* Panelists identified problems and issues associated with tournament organization and gamefish management and worked towards solutions through collaborative discussion and “brainstorming.” The panels were preceded by a short talk by David Tarnas, of the Hawaii State House of Representatives, which is summarized below. Dr. Miller then introduced Jack Anderson, Vice-Chairman of the International Game Fish Association, one of the conference sponsors. He briefly described his organization.

Quotes (in italics) from panelists annotate the summaries that follow Mr. Tarnas's talk. The material has been reorganized under subheadings to clarify the points that were raised during each panel.

A Participatory Fishery Management Framework For West Hawaii: Opening Remarks to Panel Members

David Tarnas, Representative for District 6 (South Kohala, North Kona) in the Hawaii State House of Representatives*

Aloha and welcome to the participants in the Hawaii International Billfish Tournament. You are part of a Hawaiian tradition going back forty years. You can be very proud of that tradition. I want to talk about the issues that we are facing here in Hawaii and how to make tournaments environmentally, culturally, and economically appropriate.

As Marc Miller's former student at University of Washington, I learned that when you look at an issue, you need to look at more than just the numbers or the management measures. You also need to know about the people represented by those numbers or affected by the regulations: it's a social dynamic. Tournaments are part of this dynamic; they are a kind of social organization reflected in the relationship among participants and between tournaments. There are many different kinds of tournaments, ranging from the shoreline casting tournament to the Hawaii International Billfish Tournament. I found this symposium was very useful because I learned about the many different kinds of tournaments held throughout the Pacific. All of these different tournaments serve much the same purpose: making people more aware of our ocean environment.

I live in the big sky country of Waimea. The cowboys of Waimea are very similar to the anglers out there in the ocean: they too are a very independent lot. The farmers, cowboys, and fishermen in my community are all like that. Everyone speaks out in Kona; they are very opinionated. As a result, when the folks from state or federal agencies hold public hearings in West Hawaii, they get very nervous. As a State Representative I feel like I have 10,000 employers and all of them will not hesitate to tell me when I've done something wrong. But my constituents, fishers, along with farmers and ranchers, are often described as the original environmentalists. Why is that? Because they want to make sure that they can keep on fishing. And they want to make sure that their kids and grandkids can keep fishing.

Sustaining our fisheries, so future generations can enjoy sportfishing, requires good management. And good fishery management, or tournament management, requires gathering scientific information, to help develop management plans. But I want to emphasize the value of involving fishers in management process, including data gathering. Listening to Barbara Block's presentation yesterday reminded me that you fishers are an essential part of the scientific process. You can help scientists to get out on the water. You assist them in trying

* Current affiliation: Marine & Coastal Solutions International.

different tagging techniques. You have shared your experience by allowing social science and economics researchers to interview you. You are essential to the process of information gathering that makes management plans relevant. So it's important that you recognize your valuable contribution. Too often we have management measures that don't make sense, that are not relevant to the fishery, because we haven't consulted with you.

Since I believe that fishers have to be involved in developing management measures, I've been a very strong advocate of changing the way that we actually develop fishery management measures in the State of Hawaii. I would like to change the current system in which the legislature develops fishery management measures. You have elected representatives—most of whom don't know anything about the ocean—making decisions about what is the proper mesh size or what areas should be closed. That just doesn't make sense. Instead, it makes sense for the people who are knowledgeable about the fishery to make those decisions. That includes scientists, fishery managers, and most important, fishery participants.

I have been advocating giving greater rulemaking authority to the Department of Land and Natural Resources. But we must require that the agency work with fishers to develop proposed rules. These rules would then go to public hearing. I think the proposed rules would then actually make sense; they would be both relevant and achievable. This process would help insure that our fishery management schemes within the State of Hawaii are much more effective. Why? Because people buy into it. If fishers are part of the rulemaking process there will be more voluntary compliance.

I would like to give you an example of how this participatory process can work. For many years there has been a conflict over collecting of reef fish for the aquarium trade. Some make their living this way. Others would like to keep the fish in the water, either for their own enjoyment or for commercial enterprises such as charter dive and snorkel operations.

We have tried for years to resolve this conflict. And it was only during this last legislative session that we were able to pass a bill that everyone supported. Why did everyone support it? It sets up a participatory management framework. We now have the West Hawaii Regional Fishery Management Council. The fishers are going to be involved in deciding the management plan for the entire west coast of the Big Island. And conservationists, scientists, and the divers will be involved. The people who know our coastline and waters very well will participate in developing our management measures.

One of the key features of the West Hawaii Fishery Management Area is to close a certain percentage of our coastline to aquarium fish collecting. As Chair of the House Committee on Ocean Recreation and Marine Resources, I had to lead the effort to come up with this percentage. I decided to consult with the grandfather of fish science in Hawaii, Jack Randall. He is somebody that both the sport divers and the collectors trust. He recommended that if at least thirty percent of the coastline is set aside, the fishery will be sustainable along the remaining seventy percent of the coastline.

So I said, great, aquarium fish collecting will be prohibited along at least thirty percent of the coastline. Then Jack said to me, "But I want to have thirty percent where there is no fishing at all. This will ensure that the sustainability of food fish as well." I knew this would raise all kinds of red flags; it's a big step to get people to realize you have to set aside areas to keep your fish stocks replenished. Therefore, I decided not to put an exact percentage on it. Whether that was right or wrong only time will tell. We can always change it next year. But I said a portion of those fish replenishment areas shall be set aside as fish reserves, where no fishing is allowed. I put a date on that a couple years out because, as I said in the preamble, it will take some time to gain the confidence and the acceptance of the fishing community for this to actually work.

This process takes a willingness to work with others who have been your enemies in the past. In so doing it changes attitudes. Recently, I got a call from the leader of the Tropical Fish Association and he said, "David, you know, this process scares me sometimes: the other day when we were deciding on the areas to set aside, I had the leader of the Lost Fish Coalition agreeing with me on my proposal." The Coalition is an organization of adamant conservationists that wants to get rid of all collectors. "I looked at her, and she looked at me, and we kind of frowned... and then we smiled." He continued, "We're unlikely partners, unlikely to agree. But because we both agree on the long range goal of sustaining our near-shore marine resources, and a process to get there, we are finding that we come up with a successful solution in the end."

So I think it can work. We are going to keep on pressing it here. As a political leader, I am certainly going to continue that effort because, frankly, I think that it is the most effective way we can make things happen.

Discussion

In response to a question, Mr. Tarnas briefly discussed efforts to develop a management area similar to what he described in his talk for the coastline of Milolii and Hookena. He advocated coordinating this initiative with the one he described but emphasized that the residents in these areas should participate in the process.

An audience member discussed at length the importance of accommodating subsistence fishing and Native Hawaiian rights. The so-called PASH court decision recognizes Hawaiians' rights of access to certain resources. The speaker argued that this decision should be extended to ocean areas. He also noted that subsistence fishing is carried out by Native Hawaiians and non-Hawaiians alike, so the two issues should be considered separately. He referred to programs that reserve a certain number of limited entry permits as an example of how Native Hawaiian rights and subsistence fishing could be accommodated. But most fisheries are not managed under limited entry so this approach does not have broad applicability.

The speaker noted that there is currently no framework for ocean leasing in Hawaii. This makes it impossible to conduct open-water mariculture ventures. A law needs to be passed to implement such a leasing program. In addition, gross revenue taxes from operations on ceded lands, which fund the Office of Hawaiian Affairs, should not be too high or it will prevent the development of such ventures.

Panel I: Rules and Tournament Organization

Panelists: John Chibnall
Peter Goadby
Mike Leech
Robert Lowe
Sue (Stohlzman) Vermillion
Patricia "Peaches" Stringer
Albert Threadingham

Consistent Tournament Rules

Clear and consistent rules—ideally, internationally recognized—are essential to successfully developing and sustaining tournaments that can attract international interest. As one participant pointed out *...it came out during this symposium that a lot of nations are in their infancy about developing fishing and it's important that they accept the established fishing rules that most other countries are using.* Although these rules need not necessarily be the same as IGFA rules, they need to be consistent over time and for all of the tournaments within a given jurisdiction. Thus there is an advantage to adopting IFGA rules, since they have been tried and tested over a very long period of time. Put another way, *Tournament rules come in if you want to run a fishing adventure for everybody to come along and enjoy in a particular place, be it on a little sandy atoll somewhere, or close to the capital city, where there's a wharf and easy access.* This mix of flexibility and consistency was echoed in remarks by Sue (Stohlzman) Vermillion and Peaches Stringer, organizers of a women's tournament in Kona, which is also a benefit for a local service organization. As they put it, *If an angler does not feel comfortable fishing IGFA rules, she can have some help. She can get some help from the crew or the captain.* While encouraging adherence to IGFA rules, they do not make them mandatory. Nonetheless, two of the winners in their most recent tournament angled under IGFA rules.

Tournament and Association Organization

The discussion of rules also touched on organizational aspects. The Australian association (GFAA) is organized hierarchically, with state, regional, and national levels. GFAA rules are in turn identical with IGFA rules. Therefore, if a local club requests a rule change, it moves up the organizational hierarchy. At the national level, any change in Australian rules must remain consistent with the IGFA; the GFAA may petition the IGFA for it to change its rules in order to ensure consistency. As an Australian participant stated, *we do not ever want to be in conflict with IGFA rules.* The English heritage in Australia and New Zealand has contributed to effective national organizations based on hierarchical systems. However, in countries where only one tournament is held, there is less need for rules that are strictly consistent with

international standards. Rule changes can be reviewed by representatives from established organizations in order to judge whether they are workable.

The rules committee is perhaps the most important organizational element related to tournament rules. As Mike Leech, president of the IGFA stated, *I think it's less important what the rules are than the fact that they apply equally to everybody. And in order to do that, you have got to have an official rules committee. A rules committee can provide backing for tournament judges. If a rules committee is in place, judges are less likely to consult a director or other official who may give an "off-the-cuff" answer. As a result, participants are more likely to recognize judges' decisions as final, right or wrong, and this can prevent subsequent lawsuits. Mr. Leech provided an example from a Caribbean tournament. The sponsors offered a million dollar prize for the all-tackle Atlantic blue marlin record. A participant, fishing by himself, hooked a huge marlin. After several hours of fighting the fish, he asked the rules committee whether the crew from a larger, nearby boat could gaff the fish once the he had reeled the line in to the leader or swivel. Considering the prize money involved, a lot depended on the committee's decision. They disallowed assistance, but as it turned out, the marlin was not record-breaking size. In summary, as Mr. Leech pointed out, *If you've got an official rules committee and you say that the judge's decision will be final, you're pretty much covered and it's probably going to stay out of court.**

Panelists raised two other points related to tournament organization. First, *Most countries, when they start tournaments, don't have enough charter boats.* Fostering the development of a charter boat fleet is crucial to developing a tournament with international participation. If the charter fleet in your port is small, some of the demand generated by an international tournament can be met by "host boats," which take people out but only charge enough to cover costs. By recognizing the importance of three groups—charter, private, and host boats—a tournament director can ensure the success of an international tournament. However, this takes a lot of work on the part of the director; for example, in order to accommodate all participants, he may need to pressure charter boat skippers to work long hours. Second, *If anybody wants to put up a great big money prize we say it has got to be winnable.* In other words, the GFAA won't sanction a tournament where there is no chance for participants to catch a winning fish because the weight has been set too high for a particular area.

Conservation

Although not explicitly under the panel's purview, participants made several points related to conservation. The relationship to this discussion was underscored by one of the panelists: *[In Australia,] if the tournament rules don't support the fundamental ethics and objects of sustainability and of conservation, then it's not easy to get that tournament sanctioned.* More generally, panelists were concerned that their interests be represented in management decision-making: *...when we're deciding the future of a resource, all the extractors have to be involved, not just one section of it. Recreational fishermen are substantial extractors of the whole of the sea and we have to be considered when deciding the future of the fishery.* Peter Goadby expressed concern about the current management regime in the Pacific because it is divided among several inter-governmental bodies. Further, the representatives to these bodies may not be fishery manag-

ers. Mr. Goadby also stressed the importance of an ecosystem approach to management, saying *I think that the food chain is important*. Popular gamefish—like marlin—may be effectively managed, but if the prey they depend on are indiscriminately harvested by distant water fishing vessels, these top-level predators may become imperiled.

Catch-and-Release and Tagging

The intersection of conservation and tournament organization naturally leads to the issue of catch-and-release and tagging policies. In Australia, for example, minimum weight limits are applied, depending on area, as developed by state gamefishing associations. Higher minimum weight limits encourage catch-and-release or tag-and-release fishing since under-weight fish cannot contribute to tournament scores. During question-and-answer, concern was raised about possible cheating in tournaments with catch-and-release prizes. Mr. Lowe described the situation in Australia, noting that most tournaments do not offer cash prizes, lowering the incentive to cheat. In his experience cheating has not been an issue.

Participants also discussed the problems with tagging. Fish may be released in poorer condition if tagged and in tournaments where tagging is mandatory or extra points are given, fish may not be very well tagged. Poor condition upon release may be exacerbated if light tackle is used. On the other hand, the scientific information resulting from tagging efforts may be worth the inevitable loss of some fish. The IGFA encourages tag-and-release whenever possible, but does not insist on it.

Dr. Block pointed out that some gamefish species are sexually dimorphic: females are significantly larger than males. As she said, *We are doing something that is not a conservation policy. We're taking large females with the most reproductive potential and we're releasing small males*. By targeting and keeping larger fish, population structure may be disrupted. Bias may be introduced into tagging data since it is usually the smaller (male) fish that are released with tags. If minimum size limits are instituted, as is the case in Australia, they need to be tailored to the characteristics of specific populations. This may help to reduce bias in the sex of landed and tagged fish.

Panel II: Management Implications

Panelists: Paul Dalzell
Gerry Davis
Ruben Ganaden
Marty Golden
John Hough
Shinichiro Kakuma
Kitty Simonds

Management Planning

Kitty Simonds emphasized the importance of proactive planning. Gathering data on commercial, recreational, and subsistence catches is an important part of the planning process. Tournaments can also play a valuable role in fishery research and data collection. As she put it, *The best advice that I can give to you, my fellow islanders, is that you have in place as quickly as possible a management plan that preserves your way of life.*

Mr. Golden warned participants against complacency. Fishery participants may not perceive the need for regulations. But as he noted, *That attitude only works so long. Sooner or later your resources are going to have a problem. And if you haven't already started to address that problem before it happens, it becomes incredibly difficult to deal with it once the problem is on the table.* At the least, governments should have a management framework in place so that they can rapidly address emerging problems. Paul Dalzell underscored these comments, noting that managers need to *get ahead of the curve, anticipate problems and have a plan or framework in place so that you can react to or anticipate problems.*

Participation by Fishers in the Management Process

Several panelists recognized that data gathered during tournaments can be useful to fishery managers. However, tournament entrants are often unaware of the contribution they can make to management by collecting data or tagging fish. As one panelist put it, *If fishermen in tournaments don't realize the true value of data, then we're missing the boat as far as helping them to understand how they protect their future.* Part of the problem is that management is often “top down” with limited participation by fishers. The kind of information sharing that occurred at this conference is a good start towards greater cooperation between fishery managers and participants. Similar forums should be organized in the future, with even more grassroots participation.

John Hough described how commercial, recreational, and Maori fishers worked with the government in New Zealand to develop management guidelines for depleted rock lobster stocks.

It took some time before representatives from these groups could develop enough trust to work together. Eventually they were able to forge a plan that, once implemented by the government, brought rock lobster stocks back to health. Mr. Hough argued that *we're all part of the same team ... and every one of us should be working right through that whole chain to make sure that we get effective laws put into place to manage our fishery for the future and benefit of everybody.*

Paul Dalzell cited the Council system as another stakeholder driven framework, one that might be suitable in other Pacific Islands. He argued that *the Council's system—with its various panels, teams, review boards, task forces—is a strong analog with Pacific Island consensus decision-building, which has been described under the brackets the Pacific way. I think that the two, both the Council and the way people arrive at decisions in the Pacific, have very strong similarities.* However, another participant argued, *It's very difficult for any fisherman to approach the Council and see any results because the Council's plate is so full.* Because the process is drawn out and meetings cover so many diverse issues fishermen can't afford the time to follow through on initiatives. The process needs to be streamlined—perhaps by holding meetings that focus on one topic—if fishers are going to fully participate.

The Importance of Cooperation Among Fishery Managers

Marty Golden reminded discussion participants that many gamefish travel great distances. As he put it, *They're often referred to as fish without a country.* This migratory behavior makes international cooperation—sharing tournament and tagging data, for example—essential to gamefish management. Cooperation is important at the sub-national level too to develop management measures and avoid duplicative monitoring efforts. Echoing this theme, Paul Dalzell mentioned that the Council can be a source of advice and information for Pacific Island nations that are developing fishery management programs. Because of its location and the fish stocks that it develops management measures for, the Council has a lot of experience in international cooperation.

Allocation

Paul Dalzell argued that allocation—determining how much of a particular species may be caught by commercial versus recreational fishers—will soon emerge as a contentious issue in many Pacific Island nations. The Marshall Islands hopes to develop charter fishing as part of their tourism sector. But distant-water fleets already fish in their waters so there is some concern about the resources available to charter boats. Vanuatu exemplifies another variation on this theme. Artisanal fishers don't go offshore, so its fishing club is an important source of pelagic fish in local markets. Distant-water catches could reduce the number of fish caught by sportfishers, in turn reducing supply in local markets. It was also noted that the lack of data from recreational fishers could influence allocation decisions. Recreational interests have to recognize the economic value of their activities. This would strengthen their hand in negotiations with the commercial sector over allocation.

Observations From the Pacific Rim

Shinchiro Kakumo talked about a documentary film made in a small fishing village on Taiwan. It records an epic struggle between a subsistence fisherman and a marlin, much like the Hemingway story *The Old Man and the Sea*. These stories underscore the social element of fishing, in the pride and respect that fishers bear in relation to their prey. Mr. Kakumo draws the following lesson: *I cannot tell fishermen, 'don't kill the fish, and tag and release them,' unless there is strong evidence of stock depletion.*

According to Ruben Ganaden, fishery managers in the Philippines have paid scant attention to sportfishing. This is mainly due to their large pelagic fisheries, which tend to monopolize the attention of the national fisheries agency. But this conference sparked a lot of ideas for rational management strategies for his nation's sportfisheries.

Panel III: Fisheries-Tourism Interactions

Panelists: C. L. Cheshire
Alban Ellacott
Rick Gaffney
Tammy Harp
Michael Henry
Noah Idechong

Economic Issues and Industry Development

Mr. Cheshire discussed economic development issues in the Federated States of Micronesia (FSM). He outlined some of the constraints and opportunities for sportfishing-based tourism development: limited infrastructure including docks and marinas, an available but untrained workforce, good air transportation links between the main islands and regional centers, and a surplus of hotel rooms. Finally, he noted the difficulty of securing development capital. Loans are available through the national development bank, but there are only a few people with the experience and credit-worthiness to qualify for these loans. This suggests an opportunity for outside partners with requisite experience.

These areas want to develop small-scale tourism. *So you're going to have to come up with another scenario or another model to make sportfishing work as a tourism activity*, according to him. He suggested small lodge-type operations similar to what can be found in Alaska, *where you have a lot fewer tourists, a lot fewer fish, but they're paying a whole lot more to fish them.*

Noah Idechong stressed the role that tourism, and more generally economic development, can play in meeting human needs: *I think the big factor is the people, and mainly the community.* Recognizing cultural values and balancing them with tourists' is therefore an essential aspect of development. Tourists may come to Palau for a good time, but, *We want to enjoy our culture and we want to have things to eat and we want to meet our social obligations.*

It takes a long time to develop an international sportfishery, according to Rick Gaffney. Sportfishing tourism first began in Hawaii, Tahiti, Australia, and New Zealand in the early part of the Twentieth Century. Mr. Gaffney recommended several initiatives that can further development:

- Educate government. *We need to get government to understand what it is that we do. We need to get them to understand what sportfishing is. We need to get them to understand the value of sportfishing.*

- Educate tourism organizations. They must recognize that the needs and interests of sportfishers may be different from more conventional tourists. Promotional organizations, in turn, are very important in spreading the word about sportfishing opportunities in a particular locale.
- Create a good local gamefishing association.
- Carefully develop local tournaments. Think creatively; an unconventional approach may be more effective. *I have a number of ideas for wholly new fishing tournaments that are completely different from anything that's been done so far, and I think that kind of thing is going to bring a lot more attention.*

Mr. Idechong also stressed the important intersection between development and resource conservation. Development must be sustainable, and this means that natural resources have to be conserved. *The fish itself is a resource. It can be used by a country to benefit itself. It can be used by a tourist to have fun, but it is a finite resource and I think we need to take the resource into account....* In addition to balancing conservation and development, Palauans want to sustain *aloha*. *The friendship is important and the partnership is important.* Sportfishing tourism can fit into this vision if it is developed in a culturally appropriate manner and meets the needs of the local people.

Resource Sustainability

Mr. Cheshire recommended that fishery development efforts should avoid reef fisheries. These resources are already fully exploited, both as a subsistence base and in artisanal fisheries that have an export component. The government cannot yet effectively manage these fisheries, adding to the risk of over-exploitation.

Marine resources in the Cook Islands are today over-exploited, due to more effective modern fishing technology and the decline of a traditional conservation ethic, according to Michael Henry. Members of the Cook Island tourism industry promote conservation and remind people that contemporary proposals, such as marine reserves, hark back to traditional practices. *We've reminded them that if you go back forty or fifty years in our islands, we also used to have forms of conservation in different parts of the lagoon.* Tourism is helping to revive a lost conservation ethic: *And now we've recognized, you know, we have to go back to some of the old ways. And it's tourism that was the first driving force to remind us of how it was in the past where we had plenty of everything, and the reasons were because we only took what we needed for that day.*

Addressing Cultural Issues in Sportfishing Development

In relation to fishing, *Having a good time is only a part of it. We go fishing to gather food and we go fishing to meet our obligations,* according to Mr. Idechong. Similarly, resource use in Palau is cast in terms of sharing rather than allocation among competing groups: *We share the resources. We share hard times. We don't simply exclude people and we don't say this is mine and*

that's yours. These values mean that Palauans look askance at catch-and-release fishing since it diminishes the importance of fish and fishing to people.

Tammy Harp talked about the importance of fish and fishing in Hawaiian culture. She argued that *the downside of charter boat fishing for me is the ignorance of the initial sportfishermen who came to Lahaina.* They ignored Hawaiian fishing traditions. She concluded that *commercialism is given priority over traditional utilization of our resources and I feel it's time that traditional uses be given more priority.*

Hospitality gives the Tahiti tournament its special ambience, according to Alban Ellacott. As he said, *When visitors are caught by our fish, they come back year after year. And when they are caught by our wahine, they stay, oh, boy, and they live there.*

Panel discussion elaborated the idea of integrating local culture into sportfishing tourism. Many tourists would be interested in learning about traditional fishing methods and lore. For example, *in Palau the idea is to create a new niche for the Palauan, expert fisherman-storyteller-guide, and talk with the angler tourist and ask what they'd like to do.* Experiences could range from simply going for a boat ride to participating in traditional fishing activities. At the same time, since traditional gear is less efficient than modern tackle, this approach could also help to conserve the resource by lowering catch rates. It might also help to reinforce locals' interest in using traditional techniques.

Rick Gaffney cautioned that the expectations of the tourist must be taken into account if unconventional approaches are employed. If tourism authorities advertise sportfishing, without describing any special attributes, arriving anglers may assume *that they can go there and get on a charter boat and expect to go marlin fishing under the international rules of the International Game Fishing Association.* *So it's very important that as these cultural programs are developed, they are clearly defined for what they are so that there isn't confusion in the international sportfishing industry.* Accurate promotion will ensure that tourists' expectations are met. Too often in the Pacific, promotion authorities presume that the tourist will like to do anything that they offer; they forget that tourists may have a preconceived objective or activities that they want to carry out.

Panel IV: Scientific Data Needs

Panelists: Barbara Block
Peter Davie
Isaac Harp
Guy Harvey
David Itano
Rebecca Lent
Julian Pepperell
Craig Severance
Wade Whitelaw

Coordinating Data Collection

Wade Whitelaw, while noting that a lot of fishery data are collected, emphasized that much of it is not easily available. Key data are location of catch, catch by species, and fishing effort. Ancillary information includes length, weight, sex, stomach contents, and other biometric data. First, these data, collected in many different places, need to be brought together. *Then once the data is together, one of the most important things that needs to happen with it, it needs to be given out again in a form where everybody can use it.* The Standing Committee on Tuna and Billfish, where representatives from Pacific Island and distant-water fishing nations meet annually, has a data and statistics subgroup. This group could oversee collating and disseminating fisheries data. However, there are no representatives from the recreational fishing community on the Standing Committee. Mr. Whitelaw concluded, *...one thing I'd actually like to do as the new billfish person for SPC is ... to try and actually put together what information the different countries do have.*

Julian Pepperell discussed the need to coordinate tagging programs. Communication between programs is generally informal. Coordination should be formalized, perhaps by convening a meeting with recreational fishing organizations. Organization staff, such as club officials, must be trained in data collection techniques. In addition, a guide or kit could be developed along with a hands-on training course. More training would increase the amount and accuracy of data collected by anglers.

David Itano echoed the need for better coordination between tagging programs. He began cataloging all the tagging programs operating in the Pacific, *And pretty soon I had two pages of different kinds of tags for different species of animals with different rewards, different recording agencies, different color tag, different types, all the way down the line.* This diversity poses problems for those expected to return the tags, along with biometric data about the fish it was on, especially since tagging programs may have different objectives. Further, different tagging programs may sometimes come out with identical tags, causing further confusion.

Tagging Programs

Mr. Itano discussed problems with tagging programs. First, relatively few blue marlin tags are returned. Some argue that the foreign longline fleet is not returning tags from fish they catch. Others argue that it is due to post-tagging mortality. Sportfishing organizations should provide funding to resolve the issue, especially if they argue that their tagging efforts do not produce elevated mortality levels. Observer programs on foreign fleets could address the issue of non-reporting by those vessels. He emphasized that he supports sportfish tagging programs. But he noted, *I've only tried to make this point during the week that if you're going to tag a fish, let's get the most information we can out of each fish we tag, and that means tagging fish in good condition, keeping good records, turning in the tags, reporting tag recaptures.*

Funding

Dr. Pepperell also recommended that tournaments budget for scientific programs, since scientists rarely have the funding to collect data during these events. *That can be a great attraction and a great help; let that be known to other institutions too—not just the fishery community but universities as well—that there are opportunities for all sorts of research.*

Barbara Block outlined the shortage of funding for fishery research. She estimates that \$12 million is spent annually for field-level fishery research in contrast to the billions of dollars spent by NASA and on health research. Tournaments can help, by providing some research-related funding. But, *We need governments and we need international policies in place to give funding to the programs that can get us answers to these questions.*

Dr. Block noted that fishery resources are being rapidly depleted and will take many years to recover. The scientific and technological tools are available for better management; scientists need to work closely with fishery managers internationally to develop policies that prevent resource depletion. She concluded, *Let's not preside over our favorite fish being listed on endangered species lists. Let's act now.*

Social and Economic Data

Craig Severance argued for more descriptive data from gamefishing tournaments. Social science research on angler motivation and reward, including social recognition and pleasure from participation, is also important. He also argued for the reinstatement of the national recreational angler survey, but with additional questions tailored to the Western Pacific region.

Rebecca Lent discussed economic measures of fishing activity. She stressed the importance of distinguishing between gross expenditure and net benefit. She also noted that changes in fishery revenue will affect other parts of the economy. Secondly, she emphasized the importance of accurately measuring opportunity cost. Survey questions need to be developed that measure the value of the fishing experience and other opportunities that were forgone to go fishing.

A panelist noted that public perceptions, outside those of participants, can affect policy decisions about a particular fishery. Information on these broader political issues needs to part of the data collection process.

Isaac Harp noted that economic data could be extremely important *if the fisheries in any of your areas come to a point of reaching a quota management system. The data could provide leverage to any particular fishery depending on the amount of benefit it creates economy-wise.* He also argued that more effort should be spent collecting basic catch data. This information is relatively inexpensive to collect but valuable to managers.

Importance of the Subsistence Sector

Dr. Severance called on the NMFS to pay more attention to the subsistence sector, which is especially important in the region. Similarly, and most important, fishery researchers need determine whether indigenous people are *adequately represented in our knowledge and images of different fishery sectors.*

Mr. Harp also stressed the importance of measuring the economic benefits of subsistence fishing. If these resources are lost due to depletion the impact could be easily measured if government aid provides a substitute. This type of research could also tap information available directly from communities. *Most of the knowledge that the communities have, has been gained through generations over hundreds of years of utilizing and observing the resources, and this would be another very inexpensive area to collect data, as compared to scientific data.*

Closing Remarks

Reflections on the 1998 Symposium on Pacific Island Gamefish Tournaments

Address by 'Akau'ola
Secretary of Fisheries, Kingdom of Tonga

Tulou, Tulou, Tulou. Tapu pea moe Hou'eiki 'oe fonua ni pea tapu mo ki moutolu kotoa kuo mou kau mai kihe fakataha mahu'inga ko eni pea talangata 'ia te au 'o fai ki tu'a mama'o kae 'ata kia te au keu fakahoko 'ae fatongia koia kuo vahe'i mai keu fakakaungatamaki ai.

I have sought leave to speak on this mala'e, sacred to the name of Hawaii's illustrious son, Kamehameha the Great, who united these islands in a more distant time, when the Polynesians freely roamed their domain from Makahoa and Kilauea Point to the North, to the lands and seas that included 'Aotearoa to the South; Rapanui, Tu'amotu, Tongareva, Tahiti, Manihiki, Rarotonga, to the East; Samoa and Tonga to the West and all points in between that were encompassed by this great triangle.

Trusting that the formal request to be heard is acceptable to the guardians of this mala'e, as well as the distinguished guests and fellow participants that have joined us in this council, I would wish to pay my respects to David Tarnas, Member of the House of Representatives, of the State of Hawaii and to all those who had the foresight to call us together and to those who provided the means to make this event happen.

There are many of you listed in the programme of events but I know that none will take umbrage if I were to place the burden of our gratitude and thanks on the wide shoulders of Doctors Marc Miller and Charles Daxboeck. May I also be allowed to specially acknowledge Kitty Simmons in our midst. Her skills as a leader and the courage of her convictions has endeared her to all who have had the good fortune to know and to work with her.

It is somewhat of an embarrassment for me to stand in front of you to try and weave the threads of our discussion, linking together this great fishing movement whose fortieth anniversary we celebrate on this occasion, together with the fortunes of the small island states of the Pacific. Having just joined fisheries, I must be the most junior practitioner as well as the most ignorant in the noble art of fishing, its science as well as its management. But I could not make such a confession or plead my ignorance too early lest the golden chance to visit this beautiful island pass me by forever.

I can only assuage my feeling of guilt knowing that all of us have drunk deeply from the well of knowledge that has flowed freely in the three days that we have spent together. We will each take from this meeting according to our needs, the wealth of experience and the wisdom of people who have devoted their life's work to understanding the nature of fish and how we

might collectively work together to ensure that these magnificent denizens of the deep continue to provide nourishment, sport and recreation for the countless generations that will follow us.

Without exception, fish will also be the most important natural resource for the small island states of the Pacific, the engine room that will drive the search for a better economic future. Harnessing this resource to promote the natural beauty of these islands and thereby maximising financial returns must also be part of the overall strategy. Encouraging the visitor and ensuring their welcome and comfort, again something that we have much to learn from this State, will add to our chances of success in building a better tomorrow for our own people.

But it is not enough that we educate ourselves in the pursuit of these goals, promising that we will each do our part to the best of our ability in our own little corner of this great ocean. Noble thoughts inspired by the intimacy of our time spent together, soon lose the sense of immediacy as the daily tasks that we all face in life claim back the focus of our attention. Other priorities will force the memory of this gathering to the recesses of our minds. We have been given a timely reminder that the marvels of modern communication are now readily available so that no person or island state, irrespective of distance or geographical placement need feel isolated, even if costs do not at present favour the more disadvantaged. Steady gains in technology are already impacting on availability and cost. Such considerations will no doubt be taken into account by those that will be entrusted to build on what we have achieved here in Kona. We need to build the promise on a sounder footing.

Throughout the discussions on gamefishing, a number of themes have continued to hold our attention as the practices and the developments in the region began to unfold.

Perhaps the most perplexing must be the different perspectives that are part of our cultural heritage. For the indigenous people of the islands, all fishing are skills that were taught and learnt for one purpose, to feed and to nourish the hunter, the family and the nation.

For the people with a Western tradition, the priority of food has become the role of commercial fishers, people whose livelihood is dependent on their ability to land and market their catch and who have to endure all sorts of weather to fulfil their given quota of fish. The steady growth of wealth in the western world and the clearer divide between work and recreation has given rise to those who can now afford to pursue the excitement and pleasure of fishing as a sport, either to be indulged in for its own pleasure, pitting one's skill against the cunning of the fish and the elements of nature, or spicing the hunt by the challenge of competition and the desire to better the skills of friends and fellow enthusiasts.

The way our young perceive fishing has much to do with the environment in which they are nurtured. As a boy, I learnt to skindive and to fish. The development of those skills went hand in hand with an enhanced standing in the community and a recognition of worth and prestige, not for skills' sake but because of the additional food that broke the monotony of a diet of breadfruit, taro, kumala, and yams. Pork, poultry, and beef were luxuries that happened only on special occasions. One learnt to be selective, to take according to the needs of

the day, which could differ from a simple meal to providing for a family or perhaps a village feast. The habits of the lobster and the crab, as well as the numerous shell fish and the giant clam, were observed and learnt so that harvesting provided a constantly changing diet as well as a reserve food supply when inclement weather made deeper diving too hazardous. The proper husbanding of resources went hand-in-hand with the coordination between eye and hand and were part of our upbringing and training.

And so the two seemingly incompatible practices of kill versus tag-and-release are not opposing philosophies but the utilisation of similar skills in pursuit of differing objectives. Both are legitimate use of the resource, and no doubt, as incomes develop in the island states, this sharp difference will begin to blur at the edges. And as our science develops, so will our perceptions focus more properly on the efficacy of our actions. It is through dialogue and the better understanding of our differing perceptions will common ground emerge and strengthen the morality of our arguments.

I have listened with great interest in the search that is taking place in Palau, a new dimension in our utilisation of resources that has great promise. What was primarily seen as a food resource is now being considered as a major visitor attraction, with the skills of the fisher being utilised to enhance the already renowned beauty of those islands. Provided that the people's natural diet of fish is maintained by fish products from other sources and not replaced by the unhealthy fast foods that have already created serious health problems throughout the region, such an experiment deserves detailed investigation followed by replication in the region as one of the great innovations of our times. That it is being spear-headed by a true son of Palau gives this initiative greater chance of success. His efforts deserve wide support from the greater community of the region.

Alarm has already been voiced about the potential conflict between commercial fishing and the growing demands of the recreational fisher. Once again, both are legitimate users of the resource but there would appear to be a growing evidence of the detrimental impact of one on the other. While this issue is not perceived by the island states as a threat at this stage, since their interests are very much guided by the income derived from fisheries access, there are grounds for real concern. In the references that have been made regarding the High Level Consultations that are currently taking place, and which involve the Distant Water Fishing Nations, and the Pacific Coastal states, no mention was made of the attempt by a number of states to limit the management regime and the utilisation of such a regime's resources to the four main species of tuna only. By definition, this would mean that no organisation would have any responsibility for billfish, which already makes up a major part of the longlining and purse seining bycatch of the large fleets currently operating in the Western and Central Pacific region.

It is a credit to the work of the Oceanic Fisheries Programme of SPC that scarce resources have been allocated to document the available information on billfish. But SPC is basically a scientific body and would have no management role to play, so that by the time that the alarm is sounded in terms of stock depletion, there is a danger that the new management arrangement would be fully occupied with its own priorities. If there is sufficient concern re-

garding the state of these stocks, all national representatives of those nations that will be part of the new regime should press to ensure that billfish is accorded appropriate priority at the start-up phase. To lump billfish together with all other highly migratory species, as some powerful voices have advocated, may mean that we may not recover the high ground in time.

I started my ramblings about the need to develop and strengthen our links to each other and particularly to the islands of the Pacific, as I sense that the links between Hawaii and the two Antipodean states are already in a healthy and well defined state with regards gamefishing.

This meeting has given you all a glimpse—perhaps no more than a peep—at what is developing in our individual states. That you have had the vision to look beyond your borders, to ponder the real state of this sport in the wider context of our ocean, and to see how this fits in with your future is not only commendable but very timely. The combined size of the EEZs of Pacific states—where the Cook Islands alone lays claim to over 2 million square kilometres, and Kiribati even more than that—means that no aspect of fisheries, for whatever purpose, will progress without the active involvement of these states. Working together, the interests of this sport will have a greater opportunity to be adequately represented and feature in the discussions and the decisions that will be made on fisheries conservation and management when the Western and Central Pacific Management Council or whatever it will be named, comes into being in the year 2000.

And if this sport is to develop and grow as you would wish, so that those roots already growing can be further encouraged and added to, then a systematic and sustained effort must be made as you would with any other sport. When I survey the great strides that have been made in the Pacific in practically every sport played, it is because some organisation in the form of people have cared enough to spend time and money to coach the basics, to establish a small management team, and to nurture its growth through its first tentative years of existence. The continuing studies on all aspects of gamefishing, which have so readily been evident here and which we have followed with great interest, is something that we can only dream about but which could be within our reach if transferred through some appropriate mechanism.

To continue what we have started here in Kona is not beyond our capabilities. I have never believed that money, or more properly the lack thereof, can prevent us from travelling together on a road of our choosing. As evidenced last night at the Lu'au and through our short time together, we are surely amongst friends, and the journey holds out promises of wonderful times ahead in each other's company. Together let us agree to make a beginning. Armed with such a mandate, those that will chart the course and make the detailed plans, will in time, communicate to us the path that we might follow.

For those of us who have visited Kona for the first time, the words of Mahatma Gandhi still remain true today as on that day when he first proclaimed that on this earth, there are no strangers; only friends who had never met.

'Ofa atu fau.

Appendices

Appendix I: 1998 Pacific Island Gamefish Symposium Agenda

Note: The Symposium schedule and the papers presented differ slightly from the Agenda.

King Kamehameha Hotel

Wednesday, 29 July
ALOHA AND PAPERS

11:00 – 1:00	Registration (Ballroom Prefunction Room)
1:00 - 2:30	<p>E Komo Mai (Ballroom 1 and 2)</p> <ul style="list-style-type: none"> • Marc L. Miller and Charles Daxboeck <p>Pule (Ballroom 1 and 2)</p> <ul style="list-style-type: none"> • Charles Kauluwehi Maxwell, Sr., Hawaiian Cultural Specialist, and • Nina Maxwell, Kumu Hula <p>Keynote Addresses (Ballroom 1 and 2)</p> <ul style="list-style-type: none"> • Michael Wilson, Chairman, Department of Land and Natural Resources, State of Hawai'i • William T. Hogarth, Regional Administrator, National Marine Fisheries Service <p>Sponsors' Aloha Remarks & Recognition (Ballroom 1 and 2)</p> <ul style="list-style-type: none"> • Michael A. Nelson, Pacific Ocean Research Foundation/Hawaiian International Billfish Association • Peter S. Fithian, Hawaiian International Billfish Association/Pacific Ocean Research Foundation • James D. Cook, Western Pacific Regional Fishery Management Council • Mike Leech, International Game Fish Association • Bob Lowe, Game Fishing Association of Australia • John R. Chibnall, New Zealand Gamefish Council • Hironao Ishii, Japan Game Fish Association • Sara Peck, University of Hawai'i Sea Grant Program

	<ul style="list-style-type: none"> • Ernie Kosaka, United States Fish and Wildlife Service <p>Symposium Format</p> <ul style="list-style-type: none"> • Charles Daxboeck and Marc L. Miller
Talk Story	(Prefunction Room)
Papers	(Room 3)
3:00 - 3:20	John Eads "Charter and Derby Fishing in Guam"
3:20 - 3:40	Peter Goadby "Tournaments: Their Importance and Influence on Australian Gamefishing"
3:40 - 4:00	Albert A.W. Threadingham "Fishery Conservation and Gamefishing in Fiji"
4:00 - 4:20	David Itano (Kim N. Holland, co-author) "Hawai'i Tuna Tagging Project"
4:20 - 4:40	Marty Golden (David Holts, co-author) "NMFS Pacific Ocean Gamefish Tagging Programs"
4:40 - 5:00	Open Discussion
6:00	Aloha Reception--King Kamehameha Formal Gardens

Thursday, 30 July
PAPERS

Papers	(Room 3)
8:30 – 8:50	Noah Idechong, Gerry Davis, and Ray Clarke “Sportfishing Development in Belau (Palau)”
8:50 – 9:10	Noah Idechong, Gerry Davis, and Ray Clarke “Sportfishing Development: in Guam”
9:10 – 9:30	Andy Tafileichig “Gamefishing in Yap State, Micronesia”
9:30 – 9:50	Reuben Ganaden “Sportfishing in the Philippines”
9:50 – 10:10	<i>Open Discussion</i>
<i>Time for Tea and Coffee</i>	(Prefunction Room)
Papers	(Room 4)
10:30 – 10:50	Wade Whitelaw “South Pacific Commission Data-Gathering on Sportfishing”
10:50 – 11:10	Alban Ellacott “Implications of Sportfishing in French Polynesia”
11:10 – 11:30	John Holdsworth (Peter Saul co-author) “CPUE Trends in the Striped Marlin Sportfishery from Northland, New Zealand”
11:30 – 11:50	Robert O’Dea “Gamefishing in Papua New Guinea”
11:50 – 12:10	<i>Open Discussion</i>
<i>Time for Kau Kau (Lunch)</i>	
Papers	(Room 3)
1:30 – 1:50	Patrick Bryan “The Saipan International Fishing tournament: The Event and Its Potential as a Conservation Tool”
1:50 – 2:10	Julian G. Pepperell (co-author Gary Henry) “Data Collection at Australian Gamefishing Tournaments: Long-term Monitoring of Catch and Effort and Biological Sampling”
2:10 – 2:30	Jody Bright “The Relationship of Marlin Stock Levels to Tournament Success”
2:30 – 2:50	<i>Open Discussion</i>

<i>Time for Tea and Coffee</i>	<i>(Prefunction Room)</i>
Papers	<i>(Room 4)</i>
3:10 - 3:30	Craig Severence "Small Boats and Big Fish: Tournament trolling Hilo Style"
3:30 – 3:50	Ray Pendleton "Gamefish Tournaments: Perceptions of the Public and Press"
3:50 - 4:10	Andrew Parker "Optics of the Parasites of Marlin"
4:10 - 4:30	Manny Sonis " <i>Implications of Sportfishing in Chuuk State, Micronesia</i> "
4:30 – 4:50	<i>Open Discussion</i>

Friday, 31 July
PAPERS

Papers	(Room 3)
8:30 – 8:50	Malakai Tuiloa “Gamefishing Implications for Fijian Fisheries”
8:50 – 9:10	John Chibnall (John Hough, co-author) “Sportfishing Statistics and Fishery Management in New Zealand”
9:10 – 9:30	Ray A. Tulafono “Gamefishing and Tournaments in American Samoa”
9:30 – 9:50	Peter Davie “A Twenty-five Year History of Fishery Statistics for the HIBT”
9:50 – 10:10	Open Discussion
Time for Tea and Coffee	(Prefunction Room)
Papers	(Room 4)
10:30 – 10:50	Brandon Miner “Reeling In the Next Generation: Marine Sport and Gamefish Tournament Fishing”
10:50 – 11:10	Shinichiro Kakuma “Gamefish Tournaments and FAD Fisheries in Okinawa”
11:10 – 11:30	Michael J. Henry “Sportfishing in the Cook Islands”
11:30 – 11:50	Dan Toyne “Gamefish Tournaments, Computer Technologies, and the Internet”
11:50 – 12:10	Open Discussion
Time for Kau Kau (Lunch)	
Papers	(Room 3)
1:30 – 1:50	Barbara Block “Pop-up Satellite Tag Technology and Its Application to Sportfishing”
1:50 – 2:10	Marcia Hamilton “The Economics of Charter Fishing in Hawai`i”
2:10 – 2:30	Graham Marsh (presented by Paul Dalzell) “The Economics of Gamefishing in Niue”
2:30 – 2:50	Open Discussion

<i>Time for Tea and Coffee</i>	<i>(Prefunction Room)</i>
Papers	<i>(Room 4)</i>
3:10 - 3:30	Rebecca Lent (Buck Sutter, co-author) “Atlantic Gamefish Fisheries: Monitoring and Management”
3:30 – 3:50	Paul Dalzell “Marlin Management in Hawaii”
4:10 - 4:30	Open Discussion
7:00 – 10:00	<i>Luau (Luau Grounds)</i>

Saturday, 1 August
BREAKFAST AND PANEL DISCUSSIONS

Breakfast and Guest Speaker	<i>(Room 3 and 4)</i>
8:00 – 9:00	Opening Remarks <ul style="list-style-type: none"> • Rep. David Tarnas, Chairman of Ocean Recreation Committee, House of Representatives, State of Hawai`i
9:00 – 9:30	<i>Rules and Tournament Organization</i> Peter Fithian, Robert Lowe, Peter Goadby, Michael Leech, John Chibnall, Albert A.W. Threadingham, Patricia “Peach” Springer
9:30 – 10:00	<i>Management Implications</i> Kitty Simonds, Marty Golden, John Hough, Ruben Ganaden, Julian Pepperell, Jody Bright, Gerry Davis, Paul Dalzell
10:00 – 10:30	<i>Fisheries-Tourism Interactions</i> Noah Idechong, Ray Clarke, David Itano, Alban Ellacott, Wade Whitelaw, Rick Gaffney, C.L. Cheshire
10:30 – 11:00	<i>I. Scientific Data Needs</i> Craig Severance, Gary Henry, Barbara Block, Peter Davie, Rebecca Lent
11:00 – 11:30	Symposium Overview <ul style="list-style-type: none"> • `Akau`ola, Secretary for Fisheries, Kingdom of Tonga
11:30 – 11:45	Symposium Pau Hana and Aloha <ul style="list-style-type: none"> • Charles Daxboeck and Marc L. Miller

Appendix II: Participant List

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