PROCEEDINGS OF THE

# FIFTH INTERNATIONAL FISHERS FORUM

## ON MARINE SPATIAL PLANNING AND BYCATCH MITIGATION

TAIPEI, AUGUST 3-5, 2010

海洋空間規劃與漁業混獲管理之

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# Proceedings of the Fifth International Fishers Forum on Marine Spatial Planning and Bycatch Mitigation

**Shangri-La Far Eastern Plaza Hotel**
**Taipei, August 3-5, 2010**

Western Pacific Regional Fishery Management Council
& Fisheries Agency, Taiwan

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# Foreword from the Co-Hosts

We are pleased to present to you the proceedings of the successful Fifth International Fishers Forum on Marine Spatial Planning and Bycatch Mitigation (IFF5) held in Taipei, August 3-5, 2010.

In the last ten years, the International Fishers Forum (IFF) series has traveled across the Pacific from New Zealand to Hawaii, Japan, Costa Rica, and Taiwan. The Forum began as a gathering to discuss seabird bycatch mitigation in pelagic longline fisheries. It has subsequently expanded to include a number of other pelagic fisheries bycatch and a variety of topics related to sustainable fisheries.

The IFF series has brought together a diverse group of fishermen and representatives from various organizations and academia. All IFF participants have a common interest in the sustainability of pelagic marine capture fisheries, conservation of pelagic fish stocks, and the protection of marine biodiversity.

Marine spatial planning (MSP) is a concept that is rapidly becoming a cornerstone of ocean management. This Fifth Forum of the series provided an opportunity for fishermen, industry representatives, scientists and managers to engage in discussion on spatial planning in the three-dimensional marine environment, specifically, how MSP affects user groups, and its role in conservation.

Participants recognized the growing importance of cross-sectoral coordination among ocean industries as a mechanism to address the cumulative ecological impacts of ocean activities. The recent problems arising from the oil exploration in the Gulf of Mexico have impacted multiple users of different resources and highlighted the key requirements for MSP.

Participants also continued discussions and themes from the previous IFFs in addressing bycatch mitigation. Over the past decade, significant progress has been made in seabird and sea turtle bycatch mitigation through various gear technology approaches, which were reviewed by participants during the meeting. IFF5 participants identified mechanisms to achieve broad uptake of best practice bycatch mitigation methods, and have made commitments to do their part to ensure relevant actions are implemented.

The IFF5 participants, in adopting the Taipei Declaration, recommended fishery-sector involvement in marine spatial planning, and identified considerations in applying this planning method, which represent substantial, positive steps towards achieving environmentally responsible fisheries around the world. We thank all of the IFF5 participants and sponsors for your participation and contribution to this important Forum.

Sincerely,

**James Sha**
Director General,
Fisheries Agency
Council of Agriculture,
Executive Yuan

**Kitty M. Simonds**
Executive Director,
Western Pacific Regional
Fishery Management Council

# Executive Summary

## Proceedings of the Fifth International Fishers Forum on Marine Spatial Planning and Bycatch Mitigation

**PREPARED BY:**
**Dr. Eric Gilman**, Hawaii Pacific University
**Mr. Paul Dalzell**, Western Pacific Regional Fishery Management Council
**Ms. Asuka Ishizaki**, Western Pacific Regional Fishery Management Council
**Dr. Larry Crowder**, Duke University
**Dr. Robin Warner**, University of Wollongong

The Fifth International Fishers Forum on Marine Spatial Planning and Bycatch Mitigation (IFF5) was convened between August 3-5, 2010, bringing together 300 participants from fishing industries, governments, academia, and conservation organizations. IFF5 addressed an extremely timely issue facing the marine capture fishing industry and the broader seafood industry: How can the fishing and broader seafood industry benefit from initiating or augmenting coordination with other industries that use and affect marine resources? IFF5 participants also evaluated progress made during the decade-long period of the Forum series in addressing problematic bycatch in marine capture fisheries.

IFF5 was co-hosted by the Hawaii-based US Western Pacific Regional Fishery Management Council and the Fisheries Agency of Taiwan. The IFF first met a decade ago in New Zealand and was subsequently convened in Hawaii, Japan and Costa Rica.

On the final day of the meeting, the IFF5 participants adopted the *Taipei Declaration*, containing 12 action items. A key action in the declaration is to ensure that the fishing industry has an equal voice in marine spatial planning and ecosystem-based management. Other key actions are to support full consideration of socio-economic effects on fishing communities in marine spatial planning activities and incorporation of mechanisms for reviewing efficacy and response to changing conditions.

The declaration also encourages regional fisheries management organizations to identify areas on the high seas and seabed beyond national jurisdiction that are of high relative importance to marine biodiversity. Participants also expressed support for enhanced use of best practice bycatch mitigation methods, through market-based mechanisms and governance measures.

At the conclusion of the Forum, two awards were presented by the Western Pacific Regional Fishery Management Council, an IFF tradition since the second forum in Hawaii. One award was given to Geoff McPherson, James Cook University, and Tom Nishida, Japan Fisheries Research Agency, for their ongoing investigation of the behavior of false killer whales, particularly the echolocation skills employed by these animals as they forage around longlines. The Council presented a second award to the Fisheries Agency of Taiwan for its decision in 2008 to ban whale shark fishing.

### INCENTIVES FOR MARINE CAPTURE FISHING INDUSTRY SECTOR PARTICIPATION IN MARINE SPATIAL PLANNING

With the escalating use of marine areas by a variety of commercial interests, there are increasingly complex risks from environmental impacts and conflicts in the use of marine space and resources. The best efforts by a single company or industry sector will not be effective in addressing cumulative environmental impacts of a wide range of ocean industries. There is a growing need to coordinate cross-sectoral interactions among ocean industries.

One beneficial outcome of IFF5 was to address the misconception held by many participants in equating marine spatial planning with marine protected areas; that the end result for the fishing sector from any spatial planning in coastal and marine areas is the designation of where fishing can and cannot occur. Instead, marine spatial planning is a process to enable a transition from managing single sectors to comprehensive ecosystem-based management.

In such a process, all place-based ocean activities are managed holistically in an integrated manner to focus on the entire ecosystem — including human activities.

The goal of marine spatial planning is the maintenance of coastal and marine ecosystem structure, function and services on which people depend, and to meet social, economic, cultural and political goals for all stakeholders. The fishing industry, unlike the majority of marine industries, relies directly on the integrity of coastal and marine ecosystems, and thus has more at stake and a strong incentive to ensure the success of marine spatial planning and ecosystem-based management.

IFF5 presenters identified incentives for the fishing sector to formally participate in marine spatial planning and lessons learned from various case studies on effective and ineffective approaches to marine spatial planning. Representatives of both management authorities and fishing industries presented case studies, offering disparate perspectives of the outcomes of these place-based planning activities. These case studies highlighted considerations for effective marine spatial planning, including:

- Mechanisms to ensure equal consideration of the needs of all interest groups;
- Conditions that optimize direct fishing industry involvement in the process and buy-in and ownership for resulting measures, where in some cases, substantial industry economic hardship is required to effectively address overcapacity and overexploitation; and
- The critical importance of sufficient resources for monitoring, surveillance and enforcement.

Representatives of marine capture fisheries that target highly migratory species on the high seas expressed difficulty in identifying short-term and direct value from participating in an all-encompassing, cross-sectoral approach to planning and managing marine activities. They explained that they did not perceive strong incentives or benefits from their participation in processes that plan marine activities of the oil and gas, shipping, offshore wind energy, wave and tidal energy, and other marine industry sectors. Currently, the predominant issues in these high seas pelagic fisheries are overexploitation, bycatch of sensitive species, allocation between gear types, compliance with international measures, and illegal, unreported and unregulated (IUU) fishing. However, marine spatial planning, a precursor to ecosystem-based management, has the capacity to benefit high seas fisheries in addressing these main issues.

For example, spatial planning can protect important spawning grounds, foraging habitat and other areas with spatially and temporally predictable high densities of commercially important marine resources from degradation by other marine industry sectors, such as from pollution and habitat alteration. The Convention on Biological Diversity's development of criteria to identify areas of high relative importance to marine biodiversity on the high seas and seabed beyond national jurisdiction, could be an effective tool to guide high seas marine spatial planning, with implications for zoning marine industry activities, including marine capture fisheries.

Area-based planning also can contribute to addressing conflicts within the fisheries sector, for example, through the creation of zones for different gear types, and area-based restrictions on gear designs and fishing methods. Such place-based planning and management approaches can contribute to achieving equitable and sustainable allocation of fishery resources between gear types, and between small scale and industrial fisheries.

The establishment of time/area restrictions, a zoning tool that is but one spatial planning approach, can contribute to addressing the overexploitation of some fish stocks, the protection of areas used for spawning by target species, and the avoidance of areas of relatively high biodiversity importance, such as bycatch hotspots. Furthermore, successful mitigation of other main global drivers of change and loss in marine biodiversity, including marine pollution, climate change, and the spread of invasive alien species, which adversely affect the fishing industry, will also require the effective collaboration of multiple industry sectors.

There is a need to initiate and increase fishing industry participation in marine spatial planning and ecosystem-based management processes in order to provide the fishing industry with an equal voice in decisions on spatial and temporal allocations of marine areas and resources to different activities. There are numerous examples of marine spatial planning in waters under national jurisdiction, where governance for cross-sectoral engagement is relatively well established. However, the governance framework for cross-sectoral marine spatial planning and ecosystem-based management beyond national jurisdiction is still evolving, and currently, there are but a handful of formal planning and management mechanisms in these areas. In the oceans beyond national jurisdiction, existing multi-sectoral spatial planning mechanisms, in which the fishing sector can become directly involved, include: implementation of the Convention on Biological Diversity's *Scientific Criteria for Identifying Ecologically or Biologically Significant Marine Areas in Need of Protection in Open-Ocean Waters and Deep-Sea Habitats*; the United Nations' *Ad Hoc Open-ended Informal Working Group to Study Issues Relating to the Conservation and Sustainable Use of Marine Biological Diversity beyond Areas of National Jurisdiction*; and initiatives coordinated by the World Ocean Council.

## BYCATCH MITIGATION

The second aim of convening IFF5 was to evaluate progress made during the decade-long period of the Forum series in mitigating bycatch of sensitive species groups, including sea turtles, seabirds, sharks, and marine mammals, and of unmarketable species and sizes of finfish; and to identify priority conservation and management areas in need of increased attention to ensure long-term environmental and socioeconomic sustainability.

There has been mixed progress in addressing unwanted bycatch in longline and purse seine tuna fisheries, as well as in coastal passive net and trap gears. There has been substantial progress in identifying gear technology solutions to seabird and sea turtle bycatch on longlines and direct mortality of dolphins in purse seines. However, more investment in research and development of gear technology bycatch mitigation methods for shark bycatch on longlines and in purse seines, sea turtle bycatch in purse seines, cetacean bycatch on longlines, bycatch of juvenile and undersized tunas in purse seine sets on fish aggregating devices, and billfish bycatch on longlines. Promising findings from recent research in mitigating interactions between longline fisheries and cetaceans were presented. IFF5 participants were introduced to the "Triple D," a passive pinger device that reacts to toothed whale clicks and deters them from interacting with fishing gear.

Regional Fisheries Management Organizations (RFMOs) have begun to adopt best practice gear technology approaches to mitigating problematic bycatch. However, the effective employment of prescribed, legally-binding conservation and management measures is likely to be low due to inadequate resources for onboard observer monitoring, surveillance and enforcement. This governance deficit was evident in the findings of a review of declining trends in populations of seabirds affected by longline interactions, despite the availability of a large number of effective seabird bycatch mitigation methods and adoption of legally binding measures by relevant regional organizations for longline fisheries. Furthermore, the lack of performance standards in RFMOs' conservation and management measures precludes consistent assessments of the efficacy of bycatch mitigation measures – fundamental information needed to guide effective adaptive management.

IFF5 presenters described the challenges of conducting bycatch assessments in small scale fisheries. Key fundamental information is often lacking for small scale fisheries, where data limitations include: levels of fishing effort, the temporal and spatial distribution of fishing effort, and bycatch rates. A mapping tool to estimate regional fishing effort, methods employing low-cost interview surveys, and employment of onboard observer programs were described and contrasted. The benefits of direct participation of artisanal fishers in bycatch assessments and mitigation interventions were highlighted, including commercial demonstrations of promising gear technology bycatch mitigation approaches.

Market-based mechanisms, including eco-labeling and other certification programs for marine capture fisheries, and employment of sustainable seafood sourcing policies by grocery retailers and their suppliers, might be an effective approach to achieve sustainable levels of bycatch in marine fisheries. Improved communication and interactions between retailers, their buyers and suppliers, and the fishing industry was identified as a priority in order to improve the sustainability of fisheries, including the employment of best practice bycatch mitigation methods, and effective resolution of international governance deficits.

## COMMITMENTS BY IFF5 PARTICIPANTS

At each of the International Fishers Forums, participants are invited to make individual commitments to take actions to advance IFF objectives. There were 22 IFF5 participants from 15 countries and territories who contributed individual commitments, focusing on marine spatial planning and bycatch mitigation. The commitments are summarized in Table 1 and placed in 19 categories. The individual commitments are in Appendix 4.

**Table 1. Summary of IFF5 participant commitments**

| Category | Percent of Commitments |
|---|---|
| Develop and implement bycatch mitigation solutions and tools | **16%** |
| Contribute to marine spatial planning through participation, collaboration, and education | **14%** |
| Promote marine spatial planning and encourage fishers and fishery organizations to be involved | **9%** |
| Participate in future forums, organizations, and discussions | **9%** |
| Improve data collection and information-sharing on bycatch and marine spatial planning issues | **9%** |
| Produce education and outreach materials for fishermen | **7%** |
| Collaborate with partners, relevant organizations, and legislators | **5%** |
| Pursue eco-labeling and other certification methods for seafood products | **5%** |
| Encourage others to mitigate bycatch | **2%** |
| Improve techniques for bycatch monitoring through observer programs | **2%** |
| Support creation of code of conduct for captains and crew | **2%** |
| Provide economic analyses for sustainable fisheries | **2%** |
| Improve regional management by fishing communities and organizations | **2%** |
| Promote the use of lower-trophic-level pelagic fishes | **2%** |
| Commit to fisheries conservation and management | **2%** |
| Develop marine protected areas | **2%** |
| Support technological development in developing countries | **2%** |
| Educate others about fisheries sustainability | **2%** |
| Address illegal, unregulated, and unreported fishing issues | **2%** |

# IFF5 Mission and Objectives

## MISSION

The Mission of the Fifth International Fishers Forum was to convene an international meeting of fishers; managers; seafood grocery retailers and distributors; experts in fishing technology, marine ecology and fisheries science; and other interested stakeholder groups and individuals in order to:

- Facilitate the sharing of information and experiences on coastal and marine spatial planning and management as one tool towards achieving sustainable fishery practices, including mitigating the bycatch of sensitive species groups and managing discards; and
- Review progress made during the decade since convening the inaugural Fishers Forum in 2000 through to this final Forum, and provide a forward look through the identification of priority conservation and management areas in need of increased attention to ensure the long-term environmental and socioeconomic sustainability of longline fisheries, coastal passive net fisheries and other small scale fisheries with problematic bycatch of sensitive species groups.

## OBJECTIVES

The Forum pursued the following objectives to achieve its Mission:

### Look Astern

- Review commitments and assess progress since the Fourth International Fishers Forum;
- Review the status and trends in Oceania and global longline fisheries;
- Review and assess the efficacy of inter-governmental organization initiatives to achieve sustainable and responsible longline fisheries, including conservation and management measures on bycatch and discards, and employment of marine spatial planning;
- Share experiences with developing and employing alternative methods for mitigating seabird and sea turtle bycatch, mitigating unwanted shark bycatch, reducing shark and cetacean depredation, and managing discards in pelagic and demersal longline fisheries and coastal passive net fisheries;
- Share lessons learned in applying marine spatial planning to contribute to managing coastal and high seas fisheries, including bycatch and discards; and
- Share evidence of effects on fishing practices from fisheries sustainability assessment activities, including third party eco-labels and consumer guides, retailer programs, and first party assessment programs.

### Look Forward

- Identify effective and collaborative approaches to reduce problematic seabird, sea turtle, shark and cetacean interactions in longline and coastal passive net fisheries, and recommend how to mainstream their future employment;
- Identify priorities for new or continued progress in mitigating problematic bycatch and managing discards in longline and coastal passive net fisheries, and which mitigation and management methods warrant investment;
- Recommend how marine spatial planning can be implemented to effectively contribute to the sustainable management of coastal and high seas fisheries, including mitigating bycatch and managing discards;
- Consider what influence the growing role of market-based mechanisms will have in capture fisheries' practices and long-term sustainability, including bycatch mitigation, and recommend optimal proactive responses by the fishing industry; and
- Identify constructive roles for artisanal and industrial fishers, inter-governmental organizations (including Regional Fisheries Management Organizations and other Regional Fishery Bodies), and environmental non-governmental organizations to mitigate fisheries bycatch and depredation, and manage discards, and recommend how to mainstream the future employment of these constructive roles.

# Taipei Declaration

## Fifth International Fishers Forum on Marine Spatial Planning and Bycatch Mitigation

**August 3-5, 2010**
**Taipei, Taiwan**

**Recalling** that the central objective of convening the Fifth International Fishers Forum was to bring the fishing industry into the relatively recent dialogue of approaches for applying marine spatial planning and management;

**Further recalling** that a second central objective of convening the Fifth International Fishers Forum was to evaluate progress made during the period of the Forum series in mitigating interactions with sea turtles, seabirds, sharks and marine mammals, and to identify priority conservation and management areas in need of increased attention to ensure long-term environmental and socioeconomic sustainability;

**Recognizing** that the United Nations Educational, Scientific and Cultural Organization defines marine spatial planning as, "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process";

**Further Recognizing** that marine spatial planning can be used as a tool to avoid and minimize conflicts, and sustain ecosystem functioning and services, comparable to land-use planning, but in the ocean;

**Considering** that the efforts of the fishing and broader seafood industry to initiate or improve coordination with other industries that use and affect marine resources will contribute to successful mitigation of some of the main global drivers of change and loss in marine biodiversity, including marine pollution, the spread of invasive alien species, and climate change, which adversely affect the fishing industry;

**Recognizing** that the Convention on Biological Diversity's scientific criteria for identifying ecologically or biologically significant marine areas in need of protection, has potential for use as a tool to guide marine spatial planning, with implications for zoning marine capture fisheries;

**Recognizing** that the bycatch of certain species groups, including seabirds, sea turtles, marine mammals and sharks, is an ecological concern as they are particularly vulnerable to overexploitation of older age classes, can decline over short temporal scales, and are slow to recover from large declines;

**Further recognizing** that the bycatch of juvenile and undersized individuals of target species can exacerbate the overexploitation of some stocks, and is an allocation issue between gear types, between small scale and industrial fisheries, and between coastal and high seas fisheries;

**Considering** that fisheries provide a vital source of food, employment, recreation, trade and economic well-being for people throughout the world, both for present and future generations as stated in the FAO's Code of Conduct for Responsible Fisheries as well as FAO's Kyoto Declaration on the Sustainable Fisheries to Food Security;

**Acknowledging** that, since the First International Fishers Forum was convened a decade ago, the Fishers Forum series has catalyzed substantial progress in developing and the sharing of knowledge of effective methods to mitigate problematic bycatch in pelagic and demersal longline fisheries;

We, commercial fishers, management authorities, experts in marine spatial planning, fishing technology experts, seafood retailer representatives, marine ecologists and fisheries scientists, participants of the Fifth International Fishers Forum on Marine Spatial Planning and Bycatch Mitigation, declare that we will carry out and support the following actions:

1. Recognize the important role of marine spatial planning and management in the conservation of marine resources, while acknowledging that such planning and management in areas of the high seas should be addressed by the competent regional fisheries management organizations;

2. To ensure that the marine fishing industry has an equitable voice in decisions on spatial and temporal allocations of marine areas to different human activities, initiate and increase the participation of the marine fishing industry in broad, cross-sectoral marine spatial planning and management;
3. Ensure that socioeconomic effects on fishing communities are fully considered in future marine spatial planning activities;
4. Support the use of relevant marine spatial planning tools to contribute to the equitable and sustainable allocation of fishery resources between gear types, between small scale and industrial fisheries, and between coastal and high seas fisheries, such as area-based planning through the creation of zones for different gear types, and area-based restrictions on gear designs and fishing methods;
5. Conduct research to further elucidate the role of marine spatial planning to benefit fisheries;
6. Ensure that marine spatial planning initiatives incorporate mechanisms for reviewing efficacy and response to changing conditions, recognizing that marine ecosystems are dynamic systems;
7. Consider marine spatial planning as an additional tool to minimize fishery interactions with protected and sensitive species;
8. Encourage the competent regional fisheries management organizations to take measures, in applications of the Convention on Biological Diversity's suite of criteria to identify areas on the high seas and seabed that are of high relative importance to marine biodiversity;
9. Increase awareness of the successes achieved over the past decade by the global pelagic fishing community, fishery managers, fisheries scientists and engineers and the conservation community in researching and implementing bycatch mitigation measures;
10. Support the continued research on pelagic fishing gears to develop environmentally responsible fisheries targeting tunas and related species, with minimal impacts on juvenile and undersized individuals of target species, sea turtles, seabirds, marine mammals, and such sharks species whose stocks have been identified as overfished;
11. Encourage interactions between retailers, seafood buyers and suppliers and marine capture fisheries to achieve improvements in fisheries sustainability, including via employment of best practice bycatch mitigation and improved international governance;
12. Augment the dissemination and broad industry uptake of best practice methods to mitigate unwanted bycatch in longline and purse seine tuna fisheries, and small scale coastal fisheries;

We will transmit this declaration to the Director-General of the United Nations Educational, Scientific and Cultural Organization, the Executive Secretary of the Convention on Biological Diversity, the Executive Director of the World Ocean Council, the Secretary-General of the United Nations, the Director-General of the Food and Agriculture Organization of the United Nations, and the five tuna Regional Fisheries Management Organizations, for their consideration, and we will request that Governments, including the Governments of Taiwan and the United States, support fishers worldwide to implement this declaration.

# Opening Session

Minister Wu-Hsiung Chen

Mr. James Sha

Mr. Wen-Jung Hsieh

Dr. Rebecca Lent

Mr. Sean Martin

Ms. Kitty M. Simonds

# Opening Address and Remarks

## Opening Address

**Wu-Hsiung Chen**
Minister, Council of Agriculture, Executive Yuan, Taiwan

Good morning, Ms. Kitty Simonds, director of the Western Pacific Regional Fishery Management Council of the USA and co-host; Honorable Ministers; Mr. James Sha, director-general of the Taiwan Fisheries Agency; distinguished participants and friends.

First, I would like to extend to all of you my warmest welcome to Taipei. It is an honor to have you here to discuss issues of our common concerns – the conservation of marine resources through marine spatial planning to ensure their sustainability.

Fisheries are one of the few remaining industries that utilize the resources of the wild to support the food security for human beings. To ensure the sustainable use and biological diversity of these resources by future generations, global measures have been adopted for the conservation and management of fisheries resources, whether they are target or non-target species.

Scientists have advocated different approaches to mitigate the taking of non-target species or unwanted species, and one of the approaches being discussed at this forum is marine spatial planning and management. This approach has also been advocated by the United Nations Education, Scientific and Cultural Organization to ensure the integrated management of marine resources. This timely subject is what has brought participants from more than 28 countries together to this Fifth International Fishers Forum on Marine Spatial Planning and Bycatch Mitigation to exchange views and to discuss how to achieve sustainable fisheries.

Marine spatial planning is a major concern of the government of Taiwan. Currently, the authority for our marine affairs is spread among different administrative agencies. To address this in our recent government reform, a new ministerial level institution will be established in 2011, with all future marine-related policies, including marine spatial planning and management, to be formulated by that body.

There has been growing concern about the bycatch of non-target species in fisheries, notably of seabirds, sea turtles, marine mammals and some species of sharks. Effective mitigation measures, supported by international fisheries management organizations, have led to the establishment of International Plans of Action on Seabirds and on Sharks by the Food and Agriculture Organization of the United Nations.

As an important player in high seas fisheries, Taiwan has been actively working with partners in various regional fishery management organizations to formulate bycatch mitigation criteria and measures.

Historically, fisheries have provided human life with food security. In some countries, fisheries are an important source of income, wealth and employment for their populations. While we advocate ecosystem-based conservation and management of fishery resources, the importance of fisheries in ensuring food security to mankind should not be overshadowed.

It is hoped that through the exchange of views and discussions of this forum, commercial fishers, management authorities, experts in marine spatial planning, fishing technology experts, seafood retail representatives, marine ecologists and fishery scientists will gain a better understanding of fishery issues to ensure that a balance between the sustainable utilization and the conservation of marine fisheries resources can be maintained.

Last but not the least, I hope all distinguished participants can also take advantage of this occasion to see Taiwan and get to know a little about its culture and its people. I wish all of you have this opportunity to make your short stay in our country a memorable one.

## Opening Remarks

**James Sha**
Director-General, Fisheries Agency, Council of Agriculture, Executive Yuan, Taiwan

Good morning, Honorable Ministers, distinguished participants and friends. I would like to begin by thanking the Western Pacific Regional Fishery Management Council of the USA, for co-hosting this forum with the Fisheries Agency of Taiwan. On this occasion, I also would like to give my warmest welcome to all of the distinguished guests coming from the different regions and countries to attend this meaningful international event.

In the past several decades, the Taiwan fishing industry has grown rapidly through the concerted efforts of the government, researchers and the business sector. The fishery has contributed greatly to the development of peripheral industries, stability of our national economy, and assurance of a food supply for our people. Taiwan's distant water fisheries have even reached the top six fisheries in the world.

It should be noted that the global production of capture fisheries has already reached its peak and has maintained almost the same level since 2001. The Food and Agriculture Organization estimates that more than half of the world fish stocks are fully exploited and about 28 percent of fish stocks are either overexploited or depleted.

No doubt, many fish stocks with commercial value have reached the status of overfished and responsible actions are needed to address these concerns. As many experts have said, with greater production comes greater responsibility. As a major distant water fishing country, Taiwan has formulated and amended relevant domestic rules and regulations that are in line with the measures adopted by international fisheries organizations to ensure the sustainability of Taiwan's distant water fishery. With that objective in mind, Taiwan will continue to actively participate in the work of various regional fisheries management organizations (RFMOs) and, in cooperation with other partners, establish international fisheries management measures, including bycatch mitigation measures.

The oceans cover over 70% of the Earth's surface. From ancient times to the present, the oceans have played a very important role in sustaining human life. Marine resources are the common property of all people, and they should be utilized and managed in a sustainable manner. As fishers standing at the front line of marine-related industries, we have the responsibility to preserve the marine resources for current and future generations.

In this forum, many outstanding presentations have been prepared on marine spatial planning and bycatch mitigation. Through the presentations and discussions during the forum, it is hoped that all fishery-related stakeholders will have a better understanding of marine spatial planning and the practice of bycatch mitigation measures. And we further hope that stakeholders will make a firm commitment to achieving the goal envisaged in the declaration to be presented before the closing of this conference.

In closing, with participation from all of you, my best wishes for a successful forum. I hope all of you will have a delightful experience during your stay in Taiwan.

Thank you.

**Wen-Jung Hsieh**
Chairman, Taiwan Deep Sea Tuna Longline Boat-Owners and Exporters Association

Minister Chen; co-hosts of this forum, Ms. Simonds and Director-General James Sha; distinguished participants; ladies and gentlemen, on behalf of Taiwan Tuna Association, it is my pleasure to welcome all our foreign friends from around the world to Taiwan to participate in the Fifth International Fisheries Forum.

As we know, the forum is a platform that was created for dialogue between fishers and governance authorities, in order to establish closer cooperation and communication on the international fishery issues of concern to all of us, with the aim of finding an appropriate level of balance between marine conservation and commercial fishing. My heartfelt hope for the next few days is not only to have a successful meeting, but also a meaningful one, in which all of you will have the opportunity to hear the concerns of the commercial fishing industry for their survival.

The First International Fisheries Forum was held in New Zealand in 2000. In 2010, ten years later, the IFF5 meeting is being held in Taiwan with a focus on Marine Spatial Planning and Bycatch Mitigation. Over the past decade, Taiwan Tuna Association recognizes these growing global trends and has learned a lot from the international experts and the world fisher industry.

Through participation and observation, Taiwan's fishing industry has gained a fuller understanding of our obligations on the bycatch issue. Our fishing industry, especially Taiwan's pelagic fishery, would be pleased to share our experiences in diligently controlling bycatch through mitigation efforts that are in line with global standards.

Marine spatial planning is a new topic for us, and I look forward to the meaningful information and ensuing discussions offered by our distinguished participants, and the conclusions we can achieve together on this topic. We are hopeful that any conclusions on marine spatial planning shall take into account the subsistence and livelihood of the fishing community.

Over the past decade, the environment for running a fishery business has significantly changed, mainly due to increasing fuel costs and a variety of expenses that are the result of management requirements imposed by the government. Fuel costs have increased two to three times over the past ten years. Substantial oil price fluctuations have resulted in tremendously unexpected operating risks for fishers. While fuel prices are out of our control, our management expenses can be more controllable. I believe the fishing industry is willing to cooperate with governing authorities for the sustainable use of marine resources. We recognize that without abundant marine resources, the fishing industry cannot survive. We have great confidence that any approaches adopted shall consider the applicability to the fishing industry, as well as the commercial benefits that we fishers rely on for our economic survival.

Our focus is on target fish species, not the accidental bycatch of non-target species. Mitigating bycatch and conserving ocean resources are always the most important long-term objectives for us. We also believe the collection of reliable scientific data on bycatch is important. Neglect in data collection may mislead true assessment, and can result in inappropriate and excessive protection of a particular species that can lead to unnecessary ecological imbalance.

I sincerely hope the IFF5 conference will be a great success and wish your stay in Taipei to be a wonderful and memorable experience. Thank you.

### Rebecca Lent

Director, Office of International Affairs, U.S. National Marine Fisheries Service

Dr. Rebecca Lent began her remarks by thanking the Fisheries Agency of Taiwan and the Western Pacific Regional Fishery Management Council for hosting and organizing IFF5. She announced the new U.S. National Ocean Policy, which recognizes the importance of interagency coordination to ensure a sound, effective, science-based ecosystem approach to stewardship of the ocean and its natural resources. The new policy takes more of the process to the relevant region and has a greater emphasis on stakeholder engagement at the regional level. Dr. Lent concluded by saying that she looked forward to discussing marine spatial planning and bycatch management over the coming days.

### Sean Martin

President, Hawaii Longline Association

I would like to begin by thanking the Western Pacific Regional Fishery Management Council and Fisheries Agency, Council of Agriculture, Taiwan for co-hosting this important fifth and final conference in the International Fishers Forum series and for the opportunity to address you during this morning's opening ceremonies.

The activities of these next few days will address two timely and important issues facing not just the tuna fishing industry, but the broader seafood industry, as well as many other ocean industry sectors.

A first question I would like to address is: How can the Hawaii Longline Association, in particular, but the broader fishing and seafood industry in general, benefit from initiating or improving coordination with other industries that use and affect marine resources?

Marine Spatial Planning is a relatively new initiative to many participating in this conference. Marine Spatial Planning is simply the planning of uses of marine areas by not just the fisheries sector, both recreational and commercial, but by a wide range of users, including transportation, ocean mining, ocean recreation, power generation and many others who will increase the complex risks of environmental impacts and potential user conflicts in the use of marine space and resources. Best efforts by a single company or a whole industry sector will not be able to address the cumulative environmental impacts of a wide range of ocean industries or deal with the growing needs for coordination among interactions across a broad range of ocean industries.

The recently formed World Ocean Council seeks to provide a mechanism for cross-sectoral coordination and we will see a presentation on this later in the session. Many in the seafood industry will find it difficult, in this all-encompassing approach, to identify short-term and direct, or long-term and indirect, value in this cross-coordination. Many of the most important issues in marine capture fisheries do not easily lend themselves to cross-sector involvement. Overexploitation, bycatch, allocation and illegal, unregulated and unreported (IUU) compliance are issues that are most

effectively dealt with within the industry. Issues, such as changes in marine biodiversity, marine pollution, spread of invasive species and climate change that also have impacts on fisheries, lend themselves well to involvement across sector lines.

A second question that will be considered through this conference is: How should tuna fisheries be incorporated as a component of marine special planning and management?

The allocation of tuna resources among gear types, and between small scale and industrial-sized fisheries could be achieved through area-based planning, for example. This could be through the creation of zones for different gear types, area-based restrictions on gear designs and restrictions on fishing methods. As an example, the Parties to the Nauru Agreement have established a seasonal restriction on purse seine set on Fish Aggregating Devices to help reduce bycatch rates of small and juvenile tunas. Another example, closer to home in Hawaii, is a prohibition to longline fishing within the area immediately adjacent to the Main Hawaiian Islands, not only to avoid conflicts with coastal fisheries, but to increase opportunities for smaller vessels to access the resource.

We will hear presentations this week on different perspectives of resource allocation. Some regional fisheries management organizations for tuna and domestic fishery managers employ time area closures. A closure to longline fishing in waters adjacent to the Northwestern Hawaiian Islands, over concerns about impacts on the endangered Hawaiian Monk seals habitat, have the added benefit of setting aside a significant area where no capture fisheries are allowed.

This conference will also review progress-to-date in the mitigation of bycatch in pelagic longline and purse seine fisheries, as well as coastal artisanal fisheries. In the Hawaii longline fishery, you will hear from Eric Gilman about the mixed progress in the development of gear technology solutions to the bycatch of seabirds, marine turtles, sharks and marine mammals in longline fisheries. We will also hear about developments and ongoing work to identify gear technology solutions in tuna purse seine fisheries to reduce their impacts on undesirable take. We will also learn about successful cooperative research that has resulted in the identification of solutions to seabird and sea turtle bycatch in the Hawaii longline fleet.

Internationally, improvements are generally needed in the adoption of conservation and management measures by the five regional fisheries management organizations for tuna to employ gear technology best practices, to provide adequate resources for surveillance and enforcement, and to ensure sufficient on-board observer coverage so that compliance occurs and effective efficacy of these measures can be validated. The regulatory regime that the Hawaii longline fishery currently operates under meets these mandates. The resulting reductions in the incidental take of protected species are a demonstration that a regulatory regime does not necessarily result in reduced catch of target species. The Hawaii Longline Fishery has been twice evaluated against the United Nations Code of Conduct for Responsible Fisheries and has twice achieved a score of over 90%. Yet, the Hawaii fishery operates in an extremely high regulatory environment and continues to be economically viable.

Much progress has been made in bycatch mitigation during the past decade over which this conference has taken place. We can be confident that, given sufficient investment, we can identify methods to nearly eliminate problematic bycatch and hopefully muster the political will to ensure broad uptake of these effective mitigation measures. On behalf of the Hawaii Longline Association, I am pleased to participate in this International Fishers Forum to advance the tuna fishing industry in the application of marine special planning and to review and establish new priorities for the mitigation of bycatch.

# Reporting on Commitments and Progress Since IFF1 and Process for IFF5 Participant Commitments

**Kitty M. Simonds**
Executive Director, Western Pacific Regional Fishery Management Council

I am delighted to be speaking here in Taiwan today, as we celebrate a decade of progress and accomplishments since the First International Fishers Forum in 2000. I would first like to thank our colleagues from the Fishery Agency, Taiwan and Overseas Fisheries Development Council for the opportunity to co-host IFF5 in Taipei, and for their hard work and dedication in preparing for the Forum.

Since the first International Fishers Forum, the IFF series has crisscrossed the Pacific from New Zealand to Hawaii, Hawaii to Japan, and Japan to Costa Rica. Today, we make our greatest migration yet, across the entire Pacific from Costa Rica to Taipei.

As a Polynesian native of Hawaii, I find it appropriate that we have made these vast Pacific journeys in pursuit of responsible fisheries. Even more importantly, we have now come full circle to the origins of many of our IFF participants from the Pacific islands. Studies in archeology, genetics and linguistics suggest that my Polynesian ancestors and those of my fellow brothers and sisters from the Pacific Islands arose in Taiwan over 5,000 years ago. Then in a matter of a thousand years, they then spread out rapidly across the vast ocean, from Taiwan to Polynesia.

As various speakers preceding me have noted, we have come a long way since the first meeting held in Auckland in 2000. At that time, the IFF was concerned only with seabird-longline interactions and how these might be prevented. Successive IFFs have expanded the role and scope of this series of meetings to embrace sea turtles, sharks, marine mammals, responsible fisheries and other gears, especially passive net arrays in coastal waters.

I think we can state, without hubris, that the IFF series has been an unqualified success, especially when measured together with progress towards environmentally responsible pelagic fisheries. At the start of the 21st Century, the task confronting fishermen, scientists, managers and conservationists was monumental. Thousands of seabirds and turtles were being killed in pelagic longline fisheries, and solutions were only just beginning to be tested and adopted. For some countries, the seabird interaction solutions were relatively straightforward, as in the case of the Hawaii longline fishery, where interactions occur primarily with only two albatross species. At higher latitudes, the diversity of species and sheer numbers of seabirds increase the problems by orders of magnitude, but nevertheless, solutions have been found and implemented, both for pelagic and demersal longline fisheries.

The turtle interaction problem closed and then severely constrained the Hawaii longline fishery, but the solution was as simple as it was elegant. Adopting large circle hooks and fish bait reduced the sea turtle interactions in our fishery by over 90%. This solution highlights the need for constant research and understanding of how fishing gear works, or in technical terms, its "catchability."

The progress achieved in developing workable solutions to fishery interactions with sensitive species has also been reflected in the response of regional fishery management organizations or RFMOs and, in particular, the tuna RFMOs. Seabird and sea turtle measures have been adopted by the various RFMOs for tuna, based on the successes achieved in various individual fisheries. Indeed, the current average turtle interaction rate of the Hawaii longline fishery for shallow-set swordfish fishing has been adopted as the minimum standard for the Western and Central Pacific Fishery Commission. It is a standard above that which member countries have to adopt for longline turtle mitigation measures.

The Hawaii longline fishery has continued to play an active role in finding solutions to protected and sensitive species interactions with longlines. It has continued as an active partner in research by making its vessels available for testing technological solutions and new initiatives, such as video monitoring.

The Hawaii longline fishery also participated in the Tri-National Fishermen's Exchange, which facilitated fishermen from Japan, Mexico and Hawaii traveling to each of their respective countries, so that they all might understand how their individual fisheries impact loggerhead turtles and the potential consequences that can result to drive fishery regulations.

This and other progress on bycatch were the focus of the Joint Meeting of Tuna RFMOs or Kobe Process, which convened several meetings in 2010, one of which was held in June in Brisbane, Australia. The objectives of that meeting were to:

- Review available information on incidental catch of non-target species and juveniles of target species.
- Provide advice to tuna RFMOs on best practices, methods and techniques to assess and reduce the incidental mortality of non-target species, such as seabirds, turtles, sharks, marine mammals, and of the juveniles of target species.
- Develop and coordinate relevant research programs and observer programs.
- Make recommendations on mechanisms to streamline the work of Tuna RFMO Working Groups in this field in order to avoid duplication.

It is worth reminding this meeting's participants that a great deal of the content of the Brisbane meeting and of the progress on bycatch mitigation has evolved because of initiatives, such as the International Fishers Forums.

From the last meeting, over 60 individuals from 21 countries and agencies made individual commitments at IFF4. These commitments could be broadly broken down into two major categories: 1) promoting awareness of environmentally responsible fishing, and 2) conducting gear trials with gears, such as circle hooks or modified gillnets to reduce bycatch. About two-thirds of the commitments at IFF4 fell under these two categories.

The remaining one-third of commitments covered issues, such as considering eco-labeling and sourcing of environmentally responsible fishing; implementing conservation of turtles, sharks and other species; and strengthening regional cooperation and legislation and improving fishery data collection and observer programs.

Since IFF4, we have requested reports of progress from those who provided written commitments. Under the category of promoting awareness of responsible fishing, we have received reports of several regional initiatives, such as those of the Secretariat of the Pacific Community (SPC), which serves all the Pacific Island nations and territories. The SPC's Fisheries program has trained Pacific Islanders so that they can conduct their protected species workshops in their own countries. SPC has helped this effort by preparing and making workshop materials freely available, such as guides to longline terminal gears, guides to species caught by longliners, including bycatch, and revised handling guidelines to be consistent with those of the Western and Central Pacific Fishery Commission.

Fishing industry organizations, such as the Pacific Islands Tuna Industry Association (PITIA), have continued promoting fishery sustainability and bycatch mitigation. PITIA acts as an information conduit for domestic commercial fishermen and organizations in the Pacific region and will continue to promote safe environmental practices in accordance with the bylaws of the association. Other regional organizations, such as Central American markets for Biodiversity or CAMBio, have conducted a range of activities, including loan programs and technical assistance to build environmentally responsible fisheries in Central America.

Trials have been conducted with mitigation techniques, such as use of circle hooks around the globe, and reports on their effectiveness have been presented in a variety of different meetings, including tuna RFMOs meetings and symposia, and workshops concerned with turtle conservation. The SPC alone has conducted circle hook trials to reduce sea turtle interaction in the Cook Islands, American Samoa and New Caledonia. The SPC has also looked at longline-cetacean interactions in Fiji, which has also been pursued in Hawaii, where circle hooks and "weak" hooks may be adopted in order to minimize serious injury and mortality to false killer whales. Implementation of proven safe turtle handling and release methods have been adopted around the world and made mandatory in the fishing fleets in the Pacific Islands that are members of PITIA.

In South America, the *Insitituto Nacional de Invetigacion y Desarrollo* (INIDEP) has developed national action plans for sharks and for reducing seabird interactions with demersal longliners targeting Patagonian toothfish. The seabird plan adopted mitigation measures similar to those established by the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) through the use of *tori* lines. Further, the Patagonian toothfish fishery has developed an appliance known as a *cachalotera* or "hood" to minimize interactions with toothed whales.

Finally, there has been significant momentum to strengthen regional cooperation and to implement legislation to reduce fishery interactions between longline fleets and sensitive species. This includes the adoption of conservation and management measures for seabirds, turtles and shark finning by the WCPFC and the introduction of shark finning regulations through industry organizations, such as PITIA.

The 16-member countries of the Forum Fisheries Agency (FFA) adopted and implemented target and bycatch species measures, mitigating problematic interactions with sea turtles, seabirds, sharks and marine mammals and other priority measures, such as spatial/ temporal area and FAD fishing closures. The FFA has also been instrumental in developing effort controls for purse seine fishing and may introduce a similar scheme for longline fishing. The southern members of the FFA are close to concluding the South Pacific Albacore and Swordfish Plan, and a cooperative arrangement was recently signed between southern Polynesia FFA member countries to provide for closer cooperation and collaboration with regard to fishery monitoring control and surveillance.

During this week, there will be a continued focus, as in previous IFFs, on solving the incidental capture of seabirds, sea turtles and marine mammals in longline fisheries through approaches to mainstream effective, commercially viable and equitable bycatch avoidance strategies. The IFF5 scope, however, is broader than in the past Forums by considering the marine spaces in which fisheries operate. A lot of faith has been invested in the concept of marine reserves and their ability to enhance and restore depleted fisheries. Marine reserves have also been promoted for sensitive species conservation and were the focus of a recent workshop in Hawaii for the conservation of marine mammals.

Moreover, there is an increasing recognition, with burgeoning human populations, that the oceans are becoming more crowded with competing resource users. The potential for conflict and disaster has been brought into stark relief by recent events in the Gulf of Mexico, which have significant ramifications not only for future petroleum exploration but for fisheries, tourism and protected species conservation. Not surprisingly, the concept of marine spatial planning has been a major policy initiative by US President Obama's administration. As such, we look forward to hearing this week from IFF5 participants on their experiences with spatial management to moderate the impacts of overlapping ocean users and to promote conservation.

The IFF series is creating a global community, or as we say in Hawaii, an *ohana* (family), which we hope will rise to this challenge. As we did at the last Fishers Forum, we are again asking you to write your commitments to concrete actions to undertake until the next IFF gathering. A Commitments Form is included at the end of your registration binder. Please write your commitments on the form and return the completed form to the registration desk by the end of tomorrow. We will summarize these commitments during the summary session on Thursday afternoon. Mahalo!

TAIPEI

AUGUST 3-5, 2010

FIFTH INTERNATIONAL FISHERS FORUM

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## Session 1: Summary

# Approaches to Coastal and Marine Spatial Planning and Management

**SESSION CHAIR: Dr. Robin Warner,** Australian National Centre for Ocean Resources and Security, University of Wollongong

**TARGET OUTCOMES:** What are the various approaches to coastal and marine spatial planning and can coastal and marine spatial planning contribute to mitigating fisheries bycatch, managing discards and achieving sustainable pelagic fish stocks?

Marine spatial planning (MSP) is a cross sectoral process to determine the spatial and temporal distribution of human activities in coastal and open ocean areas (see abstract by Larry Crowder). MSP is not marine protected reserves re-invented but a process of rationalizing activities in the ocean. MSP is also a method for implementing ecosystem based management. Sustainable fisheries depend on healthy ecosystems in the oceans.

Most MSP takes place in waters under national jurisdiction (territorial seas and EEZs) where the governance framework for cross sectoral engagement is established. The governance framework for cross sectoral engagement on the high seas and the deep seabed beyond national jurisdiction is still evolving and quite fragmentary at present. More links must be forged between global and regional organizations with responsibilities for activities on the high seas and deep seabed beyond national jurisdiction. Users of high seas areas must accept that the freedoms of the high seas are accompanied by responsibilities for sustainable use of its resources and conservation of its biodiversity.

There are a number of initiatives being taken by the Convention on Biological Diversity (CBD) and in the United Nations Working Group on Biodiversity beyond National Jurisdiction, which will eventually strengthen the governance framework for MSP on the high seas and the deep seabed beyond national jurisdiction. In this context, the Convention on Biological Diversity (CBD) has developed the concept and criteria for identifying ecologically and biologically sensitive areas (EBSAs) which are designed to aid in the conservation and sustainable use of biodiversity (see abstract by Daniel Dunn).

The identification of EBSAs can be used for fisheries management as well as conservation. For example, an EBSA might be identified which was highly used by Pacific bluefin tuna and MSP could be applied to prevent other activities in that area that might negatively impact the tuna stock and fishing. EBSAs can reduce bycatch in areas important to fisheries by limiting anthropogenic stressors on the marine environment and protecting sustainable fisheries.

On the high seas, MSP applies to the management and conservation of highly migratory species in two ways. First, marine protected areas devoted to the conservation of highly migratory species can target critical habitats such as breeding and foraging grounds or the sites where they concentrate. Second, fishing areas could be designed to target commercially valuable fish while minimizing bycatch of sensitive species. For example, there are spatial management techniques which may contribute to reducing some of the bycatch of long line fisheries for pelagic fish stocks in the open ocean.

Even though the range of many highly migratory species is too vast to encompass in a spatial zone, the protection of part of their range may still provide important conservation benefits. As such, technology can assist in defining the space used by animals and the scales of aggregation. It is also important to take into account that ecosystems, particularly in open ocean areas, are dynamic.

The capability to study and map dynamic features is developing but is not perfect (see abstract by David Hyrenbach). More information and improved understanding of the distribution and footprints of threats is needed. Further, the impacts of climate change in coastal and open-ocean environments need to be anticipated as this will result in long term environmental and species distribution changes (see abstract by Robin Warner).

MSP decisions can be supported by multifaceted geospatial or geographic information systems (GIS) to map areas and see overlaps in space by users on land and sea (see abstract by Hsueh-Jung Lu). MSP decisions based on GIS data will involve scientific and political trade-offs designed to maximise benefits to relevant stakeholders.

The Great Barrier Reef (GBR) off the Queensland coast in Australia is an example of successful MSP in a coastal area in which integrated management of a multiple use marine protected area takes place (see abstract by Randall Owens). The underlying values of the GBR encompass conservation of its biodiversity, ecosystem health and assessment of commercial and non commercial uses. Successful MSP requires long term political and stakeholder support combined with an effective monitoring and forecasting process.

The World Ocean Council (WOC) is a cross-sectoral business alliance for the oceans which brings fisheries, aquaculture, oil and gas, shipping and tourism together (see abstract by Paul Holthus). It includes direct ocean users, ocean user support industries and ocean use infrastructure providers. WOC members have a shared goal of healthy ecosystems and creating business value for responsible operators.

Ocean uses and their complexity are increasing. Ocean industries are not yet well engaged in the governance process for the oceans. Access to ocean space is fundamental to the continuity of fisheries. It is critical that fisheries engage at the local, regional and global levels with other ocean industries to ensure continued access to ocean space.

## Session 1:
# Abstracts

## The Role of Marine Spatial Planning in Sustaining Pelagic Fisheries: Transitioning from Managing Sectors to Comprehensive Ecosystem-based Management

**Larry B. Crowder**
Duke Center for Marine Conservation, Duke University

### ABSTRACT

Fisheries management is in transition from single species approaches to management toward fully considering the ecosystem context in which these fisheries occur. This trend is often described as ecosystem-based fisheries management. A broader approach to marine ecosystem-based management considers not only the fisheries sector, but other sectors that use ocean resources in one way or the other. Over five years ago, national and international assessments urged the adoption of ecosystem-based management. In June 2009, President Obama created the Interagency Ocean Policy Task Force in the US to flesh out a new integrative national ocean policy and a framework for Marine Spatial Planning (MSP) to implement ecosystem-based management across ocean sectors.

In this talk, I will review the use of MSP around the world in the context of fisheries and in full cross-sectoral mode. I will also extend the idea from demersal and coastal fisheries to off-shore pelagic fisheries. MSP shows promise to be able to support economic, environmental, social and security goals. It has the potential to promote resilient, healthy, functioning ecosystems, while also allowing sustainable use of marine space and resources. But transitioning from "business as usual" to this new approach will require active engagement of ocean users and the environmental community in formulating plans that can meet multiple objectives. This approach will be particularly challenging in pelagic systems due to the limitations of governance institutions.

### INTRODUCTION

While traditional management of marine fisheries has focused on the widespread declines in targeted species, marine food webs have been significantly altered by overfishing (Jackson et al. 2001). Fishing has a variety of direct and indirect effects on interaction webs in marine ecosystems with complex and potentially cascading effects (Figure 1). Many fisheries focus on apex predators and are fished at an unsustainable rate, while others fish from the middle of the web, removing huge biomasses of forage fishes required by apex predators, including fishes, marine mammals and seabirds. Fishing not only removes biomass from particular niches in the food web (as one might do in a controlled ecological experiment), but also has indirect effects such as removing non-target species, altering habitat, and providing subsidies to scavengers.

Researchers have pointed to fishing as one of the oldest and largest factors in modifying marine ecosystems. Fishing, in concert with other anthropogenic effects, has resulted in a staggering loss of biodiversity (Worm et al. 2006) and may have unforeseen effects that propagate throughout ecosystems. Friedlander and DeMartini (2002) found that the mean biomass of apex predators in the un-fished waters of the Northwestern Hawaiian Islands was over 260% greater than that found in the main Hawaiian Islands' waters, where apex predators and other fishes are heavily exploited. Other research has detected rapid, severe declines in coastal and oceanic shark populations, with declines as high as 99% for some species (Baum et al. 2003). Recognizing the difficulties in identifying and managing for the direct effects of fisheries' harvest, much less the indirect effects and potential ecosystem effects, we suggest that the food web be the key nexus of interactions (Mangel and Levin 2005).

To understand the ecosystem effects of fishing, it is necessary to examine the surrounding food web and abiotic processes that influence marine systems. Strong inter-actors shape the resultant food webs through ecological processes, such as predation or competition. When impacted by fisheries, these characteristics of strong interactors can amplify the effects

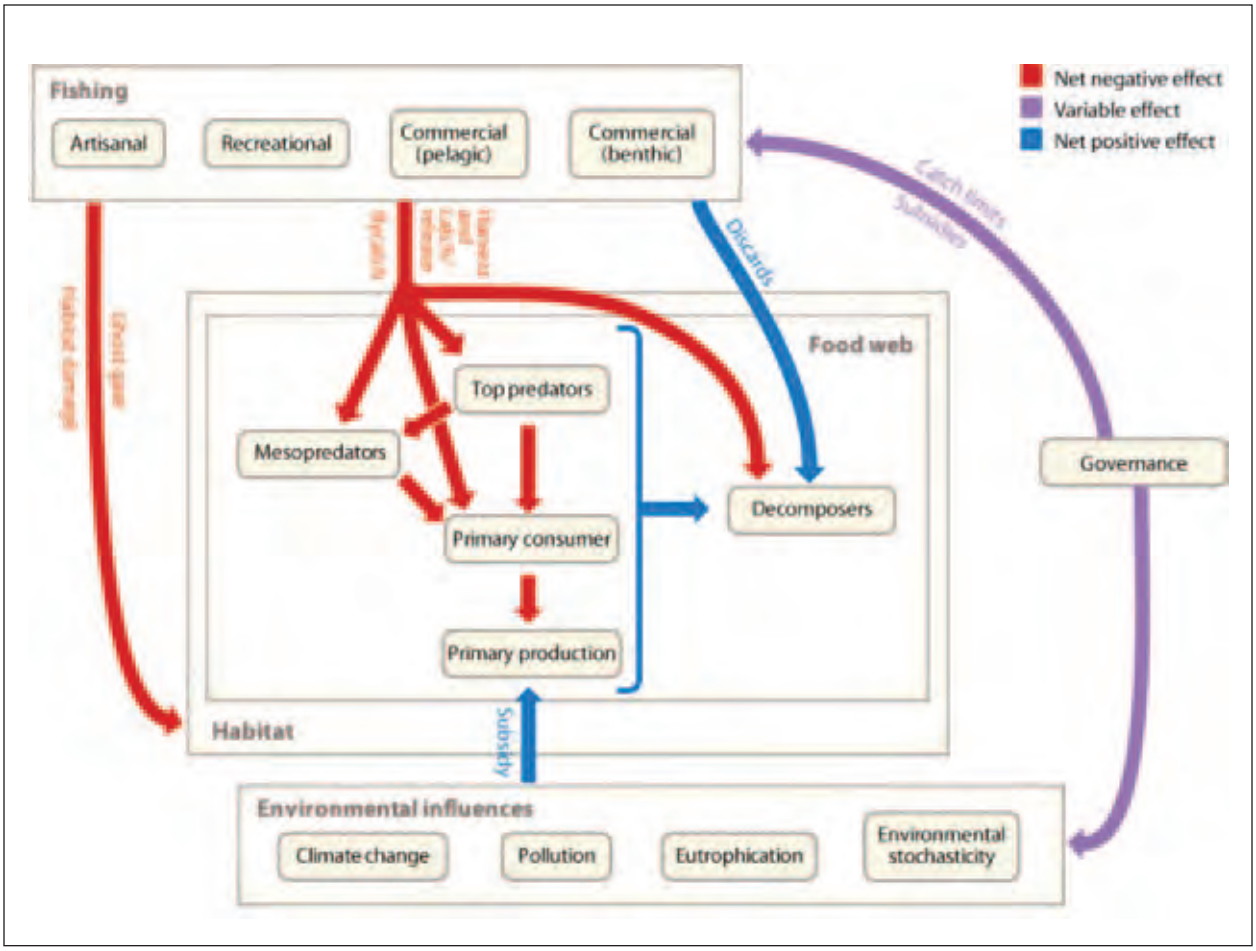


**Figure 1.** Direct and indirect effects of fishing on marine ecosystems, with complex and potentially cascading effects (Crowder et al. 2008)

throughout the food web. Models have shown that food webs with strong interactions and high specialization (e.g. low omnivory) are most susceptible to fisheries-driven collapse (Bascompte et al. 2005).

## FISHING, MARINE ECOSYSTEMS, AND THE TRANSITION TO ECOSYSTEM-BASED MANAGEMENT

How can we address the cumulative impacts of diverse fisheries in the context of other anthropogenic and naturally-driven variation in marine ecosystems? This calls for a dramatic shift in ocean policy, from management of individual sectoral activities, like fisheries, toward ecosystem-based management (Crowder et al. 2006). Ecosystem-based management is "an integrated approach to management that considers the entire ecosystem, including humans" (McLeod et al. 2005). Ecosystems are inherently place-based (McLeod et al. 2005; Crowder et al. 2006; Young et al. 2007). Moreover, social, cultural, economic and political attributes overlay these biophysically-defined places. Therefore, approaches that integrate natural and social scientific perspectives on defining and managing places at sea are necessary to overcome uncontrolled, cumulative impacts of fisheries and other anthropogenic effects (Shackeroff et al. 2008).

Analysts are beginning to agree that the escalating crisis in marine ecosystems is in large part a failure of governance (Crowder et al. 2006). Recent assessments have called for a transition from managing sectoral activities, including fisheries, toward ecosystem-based management. The environmental sector has sought to implement marine reserves to maintain the structure and function of marine ecosystems. But this also is a sectoral approach. Traditional single species management has a clearer recovery goal, specifically a certain spawning stock biomass to support future fishing efforts. However, it is more difficult to define recovery goals in an ecosystem framework.

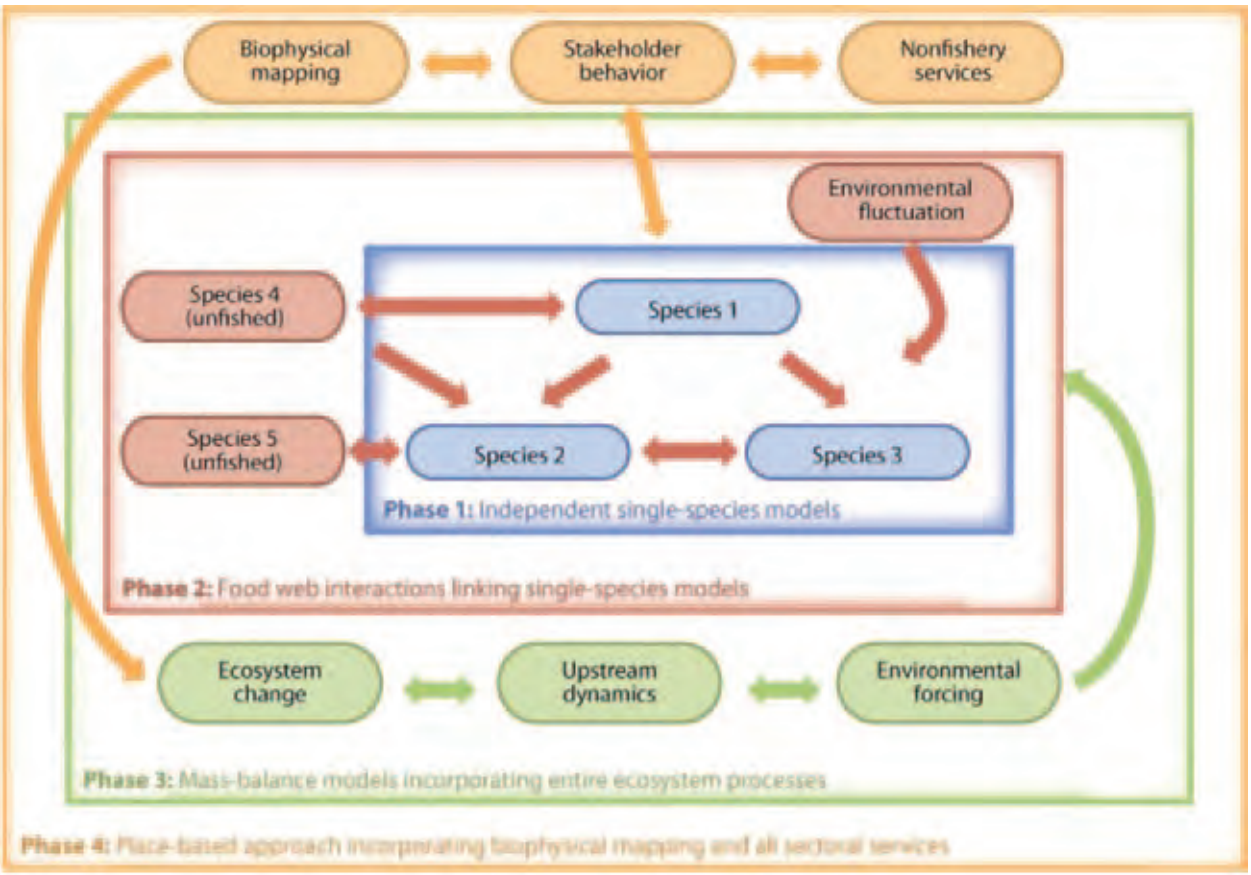


**Figure 2.** Marine spatial planning (Crowder et al. 2008)

Place-based management and marine spatial planning (MSP; Figure 2) can provide a far more promising approach to implementing ecosystem-based management (Young et al. 2007). Rather than individual sectoral agencies managing their specific activities everywhere, responsible sectoral authorities could work together to manage all the human activities in a given place. These places might align with ecosystem boundaries, socio-economical boundaries, and/or jurisdictional boundaries. In practice, management always occurs in a delimited space with processes that cross management boundaries.

The biophysical component of marine ecosystems provides the basic template on which all human activities, including fisheries, occur and also on which various forms of governance regulate. Approaches to MSP and ocean zoning consider basic ecological concepts so that human activities can be conducted in ways that maintain ecosystem functioning, provide sustainable ecosystem services on which people depend, and maintain resilient ecosystems that can respond to environmental change.

Place-based management of marine ecosystems requires a hierarchy of management practices, starting at the most general level with the concept of ecosystem-based management and moving toward the development of an integrated approach that accords priority to the maintenance of healthy, biologically diverse, productive and resilient ecosystems. The key to success in place-based management of marine ecosystems is to design governance systems that align the incentives of stakeholders, in this case, fishermen, with the objectives of management. MSP that fully incorporates the underlying ecosystem template and explicitly integrates the socio-economic and governance overlays can form the basis for adequate protection of marine ecosystems and the sound use of marine resources, including fisheries.

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# Oceanographic Considerations for Marine Spatial Planning on the High Seas


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Marine spatial planning seeks to minimize detrimental ecological and socio-economic impacts by segregating non-compatible activities temporally and spatially. This approach requires the integration of spatially-explicit information on the extent and magnitude of human activities, the distributions of valuable and protected marine resources, and the degree to which these activities and resources interact with each other in time and space. This presentation addresses the application of marine spatial planning to manage fisheries interactions with protected species and their habitats, with an emphasis on the design of marine reserves for highly-mobile pelagic vertebrates (marine birds, mammals and turtles).

Marine conservation is advancing rapidly, spurred by technological developments for biodiversity monitoring (e.g., wildlife tracking, remote sensing) and conceptual advances for determining where and when to make the most effective conservation investments (e.g., population structure, demographics). This enhanced understanding is helping resource managers to identify when, where and how to protect oceanic species and habitats. Accordingly, marine reserves are increasingly being advocated and used for protecting pelagic species and their critical foraging and breeding habitats.

In places where wildlife reserves were first implemented, differences in scale and predictability set aside highly dynamic pelagic systems from terrestrial and benthic ecosystems. Yet, as in static systems, many pelagic species use predictable habitats to breed and forage. In principle, marine reserves could be designed to protect these foraging and breeding aggregations. Pelagic habitats can be classified according to their dynamics into three broad categories: static, persistent and ephemeral (Hyrenbach et al. 2000). While traditional reserve designs are effective in static habitats, many important pelagic habitats are neither fixed nor predictable. Thus, pelagic reserves will require novel concepts and designs, such as dynamic boundaries and extensive buffers, which are defined by the extent and location of specific oceanographic features. This presentation illustrates some of these oceanographic features and offers ideas for potential reserve design concepts.

Because marine ecosystems are spatially-explicit environments, marine spatial planning must address the underlying physical and biological heterogeneity in time and space, as well as the dynamic nature of key life-history processes and human impacts. Thus, a critical goal should be to develop spatially explicit conservation targets. To this end, we revisit five key principles guiding the development of these conservation targets (Crowder and Norse 2008). We will also illustrate their conceptual foundations and practical application for the conservation of pelagic vertebrates: (1) evaluating mismatches between management and ecological processes, (2) accommodating temporal and spatial variability, (3) preserving webs of ecological interactions, (4) acknowledging the heterogeneity of human activities, and (5) embracing place-based management.

An improved understanding of critical habitats and human impacts will facilitate the integration of conservation needs into the development of comprehensive marine spatial planning for territorial waters and the high-seas. Within this context, knowledge of the physical mechanisms that influence the distributions of commercially valuable and protected species, and the formation and persistence of dynamic oceanographic habitats will be essential to design and implement spatially-explicit protective measures.

While recent conceptual and technological advances are facilitating the implementation and monitoring of pelagic reserves, effective protected areas should include enforcement, research and monitoring programs to evaluate their effectiveness. Furthermore, these measures should be nested within a larger management context involving broader fisheries management and ecosystem monitoring tools. Marine spatial planning will provide the critical framework for integrating these diverse approaches into a coherent and comprehensive perspective for managing dynamic seascapes.

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# Using the Convention on Biological Diversity's Scientific Criteria to Identify Ecologically or Biologically Significant Areas in Need of Protection to Inform Fisheries Management and Marine Spatial Planning


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## ABSTRACT

In 2008, the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD) adopted scientific criteria for identifying ecologically or biologically significant marine areas (EBSAs) in need of protection. There is now further movement toward the establishment of an inventory of EBSAs. Although the identification of EBSAs is a purely scientific endeavor, the relevance of identifying EBSAs lies largely in their utility to and incorporation by organizations with mandates to manage marine resources. By identifying EBSAs, we can provide critical information to managers and planners regarding the ecological character of the systems they are acting within. Thus, the identification of EBSAs is crucial to ensuring that our use and management of the marine environment are done in an ecologically relevant and sustainable manner. Here we examine how EBSAs may provide utility to the management of one important anthropogenic stressor (i.e., fisheries), and more generally, to marine spatial planning (MSP). Conversely, we also examine how fishery management organizations can contribute to and participate in the process of identifying EBSAs.


## INTRODUCTION

In 2007, an expert workshop was convened by the CBD in the Azores, Portugal, to develop, refine and consolidate scientific and ecological criteria for the identification of areas in need of protection. The following year, the COP to the CBD adopted these scientific criteria for identifying ecologically or biologically significant areas (EBSAs) in need of protection (Table 1; CBD 2008). The same decision also urged parties and invited other governments and relevant organizations to apply, as appropriate, the Azores scientific criteria. To this end, there is now movement toward the establishment of an inventory of EBSAs.

As this process moves forward, more governments, agencies and organizations are taking note of it and are attempting to understand the role and utility of EBSAs.

Although the identification of EBSAs is a purely scientific endeavor, the relevance of identifying EBSAs lies largely in their utility to and incorporation by organizations with mandates to manage marine resources. To date, illustrations of how to implement the CBD EBSA criteria have largely been based on the examination of data pertaining to a specific habitat or species. Undertaken in this manner, the number of EBSAs that could be identified is infinite. For management

**Table 1.** The Convention on Biological Diversity's scientific criteria for identifying ecologically or biologically significant areas in need of protection (CBD 2008)

| Criteria | Definition | Rationale |
|---|---|---|
| **Uniqueness or rarity** | Area contains either (i) unique ("the only one of its kind"), rare (occurs in only a few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features. | Irreplaceable. Loss would mean the probable permanent disappearance of diversity or a feature, or reduction of the diversity at any level. |
| **Special importance for life history stages of species** | Areas that are required for a population to survive and thrive. | Various biotic and abiotic conditions coupled with species-specific physiological constraints and preferences tend to make some parts of marine regions more suitable to particular life-stages and functions than other parts. |
| **Importance for threatened, endangered or declining species and/or habitats** | Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species. | To ensure the restoration and recovery of such species and habitats. |
| **Vulnerability, fragility, sensitivity or slow recovery** | Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery. | The criteria indicate the degree of risk that will be incurred if human activities or natural events in the area or component cannot be managed effectively, or are pursued at an unsustainable rate. |
| **Biological productivity** | Area containing species, populations or communities with comparatively higher natural biological productivity. | Important role in fuelling ecosystems and increasing the growth rates of organisms and their capacity for reproduction. |
| **Biological diversity** | Area contains comparatively higher diversity of ecosystems, habitats, communities or species, or has higher genetic diversity. | Important for evolution and maintaining the resilience of marine species and ecosystems. To maintain these areas as reference sites. |
| **Naturalness** | Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation. | To protect areas with near natural structure, processes and functions. To safeguard and enhance ecosystem resilience. |

purposes, it may be more pertinent and efficient to identify EBSAs based on their overlap with and vulnerability to specific human activities.

This perspective may, in fact, be inherent in the language adopted by the CBD. The term, "ecologically or biologically significant areas," is always followed by "in need of protection." This infers that the site requires protection *from* something. As anthropogenic activities are the main stressor on the marine environment and the unique focus of any management measure, it is logical that EBSAs "in need of protection" are in need of protection from human impacts. Thus the identification of EBSAs should be related to their vulnerability (one of the EBSA criteria) to such impacts. As mentioned, one efficient method of identifying such areas is to begin by looking at where those activities take place. Performed in this manner, the identification of EBSAs should still be a solely scientific process, based on biological and ecological criteria, but the EBSAs identified will be of more direct use to managers. Here we will examine how EBSAs may provide utility to the management of one important anthropogenic stressor (i.e., fisheries), and more generally to marine spatial planning (MSP). Conversely, we also examine how fisheries management organizations can contribute to and participate in the process of identifying EBSAs.

## THE ROLE OF EBSAS IN FISHERIES MANAGEMENT

The identification of EBSAs is critical to ensuring that our use and management of the marine environment is done in an ecologically relevant and sustainable manner. Marine environments are currently impacted by a wide variety of anthropogenic uses (Halpern et al. 2008). Human activities, such as agriculture, industrial production, energy exploration/production, coastal development, and shipping & transportation, can pollute, contaminate, increase nutrient loads and acidity, and destroy important marine habitats (Bryant 1995; Smith et al. 1999; Islam and Tanaka 2004; Orr et al. 2005). Fisheries represent another such anthropogenic stressor on marine ecosystems (Dayton et al. 1995; Goñi 1998; Jackson et al. 2001) and, in many areas, are one of the most, if not the most important stressor. Among the ecosystem effects of fishing, the detrimental impact of bycatch has been increasingly documented in recent years (Crowder and Murawski 1998; Hall et al. 2000; Lewison et al. 2004; Gilman et al. 2005). The role of fisheries in the decline of populations of protected species (Spotila et al. 1996; Brothers et al.1999; Read et al. 2006) has led to the enactment of conservation policies (Moore et al. 2009) and costly management measures (Curtis and Hicks 2000). Gear alterations to mitigate bycatch have also placed economic burdens on fishers and fishing nations (Gilman et al. 2006).

Due to these economic and ecological impacts, fisheries are beginning to be more explicitly regulated, both for their bycatch and for their spatial extent. As annual catch limits are implemented and bycatch of commercial and protected species becomes more relevant to managers employing ecosystem-based approaches to fisheries management, there is a growing need to increase fishing selectivity (i.e., increase catch/bycatch ratios). As more industries (e.g., mining, shipping and energy) make claims on marine resources and space, such fisheries management approaches must be implemented within a marine spatial planning context. In that way, core areas are reserved for fishing activities and compatible activities. By identifying EBSAs, we provide critical information to managers and planners regarding the ecological character of the systems they are acting within.

There are several criteria that may be used to identify EBSAs of relevance to fisheries management generally and to the reduction of bycatch in particular. For example, the "importance for threatened, endangered or declining species and/or habitats" (threatened/endangered), "special importance for life-history stages of species" (life history), "vulnerability, fragility, sensitivity, or slow recovery" (vulnerability) criteria may all shed light on the dynamics that result in bycatch. EBSAs based on the threatened/endangered criterion may depict habitat important to endangered species (e.g. Pacific Leatherback turtles) that could be avoided by fishermen to reduce bycatch. The life-history criterion might be used to identify essential spawning aggregations or nursery habitat for commercial species. Bycatch data from fisheries management organizations may be used directly to identify EBSAs based on the vulnerability criterion. In the rationale given for the vulnerability criterion, we are specifically asked to consider "the degree of risk that will be incurred if human activities or natural events in the area or component cannot be managed effectively, or are pursued at an unsustainable rate." If bycatch and discards cannot be "managed effectively," the "degree of risk" to protected species and fish stocks is, in many cases, very high (e.g., Spotila et al. 1996; Brothers et al. 1999; Read et al. 2006). Dunn et al. (in review) provide a synthesis of methods to identify spatio-temporal patterns in bycatch data. Such patterns could be used to delineate EBSAs based on high bycatch rates or low fishing selectivity, assuming the bycaught animals are "in need of protection." It is important to note that, in some circumstances, data that might be used to identify EBSAs is already being incorporated into fisheries management (e.g., the voluntary closure of the North Pacific Chlorophyll Transition Front Zone to the Hawaiian pelagic longline fishery; Howell 2008). The identification of such EBSAs and their aggregation in an inventory should be similarly useful in the management of other fisheries.

## THE ROLE OF EBSAS IN MARINE SPATIAL PLANNING

Marine spatial planning offers an integrated framework within which all anthropogenic activities that impact the marine environment can be weighed transparently and equitably dealt with. It affords a means to incorporate multiple objectives and address complex conflicts, to integrate assessments and governance, and to increase investment security for marine resource users and developers (Douvere 2008). If MSP is to assist in reaching sustainability objectives, characteristics of the marine environment must be objectively incorporated into the process. To this end, the use of EBSAs within MSP can help managers understand which human uses may or may not be compatible with the ecology of a given area to avoid user-environment conflicts. The previous integration of sites identified through other programs and initiatives, which also employ suites of criteria to identify areas of ecological or biological importance (e.g., the Ramsar Convention or the Important Bird Area program of Birdlife International) in marine spatial plans, suggests that EBSA may too prove useful to this process (Douvere 2007; Ekebom 2008).

The example above of the use of the threatened/endangered criterion to identify core use areas of endangered species as EBSAs is also demonstrative of how EBSAs can be used within MSP. Clearly, knowledge of such an EBSA would suggest that certain human uses (e.g., fisheries that interact with the endangered species, energy production that produces noise levels harmful to the endangered species, etc.) should be minimized in that area. Conversely, the identification of highly productive EBSAs (based on the biological productivity criterion) might be important to reserve for fishers to minimize risk and impacts from other human activities (e.g. pollution, certain forms of energy production). Thus, the incorporation of EBSAs in the implementation of MSP, both within and beyond national jurisdiction (see Ardron et al. 2008), is essential to both the environmental sustainability of such planning and the economic viability of individual sectors.

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## Marine Spatial Planning in Coastal Zones with Geographic Information System

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Coastal zone environments are usually characterized by abundant fishery resources, beautiful landscapes and rich ecosystems of great importance, all of which attract human activities, such as fishing, aquaculture, tourism and industrial uses. However, the co-existence of human activities and natural resources often results in conflicts over priority. Marine spatial planning (MSP) in the coastal zone presents an opportunity for the implementation of an overall strategy of conservation, sustainability and management to maximize future economic profit. However, unlike spatial utilization on land, MSP in coastal zones is more complex due to a relatively larger number of spatial components.

Geographic Information Systems (GIS) is a computer system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data related to positions on the Earth's surface. As today's principal tool to present and analyze spatial data, GIS would appear to offer a viable solution for supporting the implementation of MSP. There are, especially for coastal uses, many spatial components (e.g., movements and migrations of resources, boundaries of fishing grounds, transportation networks). Many serious issues, such as habitat loss and environmental degradation, have spatial dimensions. As a result, fisheries stakeholders, aquatic resource managers and government decision makers have to address these complex issues. In this regard, GIS technology can help to clarify these issues and lead to solutions by treating many spatial components simultaneously.

Compared to the longstanding practice of land use planning, MSP in coastal areas is subject to a lack of information and a comprehensive planning framework. Collecting sufficient information for MSP is a pervasive problem. Integrating information collected from disparate systems is an additional problem. The coastal zone covers a dynamic area, including the intertidal zone, which receives less attention on both land and maritime charts. The altitudes on land maps are based on the highest tidal level because uplands are defined as the areas above this water level. At the same time, the water depths recorded on maritime charts are usually based on the lowest tidal level, due to a focus on use for navigational safety. The intertidal area, as a result, is not covered in either terrestrial or marine maps. Using GIS, the two mapping systems can be easily combined, and all data sources used for the creation of terrestrial and marine maps can be integrated for MSP in the coastal zone.

The collection and digitization of spatial data into a GIS is the first and most difficult phase, requiring the compilation of a tremendous volume of information in different formats. After the integration of data into a GIS, the spatial information can be further processed into a form that is helpful for the MSP process. Mapping-related information on coastal and marine areas in detail allows the opportunity to identify those areas of risk or conflict and to examine in detail how many activities are occurring. It is essential not only to examine environmental impacts of each individual activity, but also to research cumulative effects of multiple activities occurring within an area. For example, space conflicts between fishery and non-fishery activities can be simply highlighted through overlaying of maps of different activities, which is helpful for MSP and coastal management. In addition to subjective/top-down decision-making, there are many objective/bottom-up decision processes through GIS data analysis, such as multi-criteria analysis, spatial analysis, biodiversity analysis, landscape analysis, topology analysis, CAD cartography, etc.

Taiwan is surrounded by seas and is blessed with diverse landscapes as well as abundant marine resources – the result of the convergence of a complex current system. Rapid economic development in

recent years and the relaxation of controls over coastal activities have resulted in increased marine utilization. However, the lack of comprehensive marine and coastal planning has led to the degradation of the marine environment and terrestrial habitats, threats to public safety and damage to social security. Fishing is the major use of the coastal zones of Taiwan and occurs in almost all coastal waters around the island. To balance the development of fisheries with other coastal activities, it is necessary to effectively manipulate fishery information, such as target species, catches, seasons, fishing grounds, protection zones, management schemes, etc., in order to understand their relationship with non-fishery information within the same areas.

A study entitled, "Fishery multiple use planning in the coastal waters of Taiwan," sponsored by the Fishery Agency in 2001, is a successful case study of GIS-aided MSP. This study produced 10 kinds of zones for fishery use, including three fishing right zones granted by the Fisheries Act, which are the set net fishing right, demarcated fishing right, and exclusive fishing right. Seven other fishery zones were also established, including areas for cage culture, recreational fishery, sea ranching, anchored fish aggregating reefs, fishery resources conservation, marine protection zone, and coastal fishing zones. A Web-GIS (http://fgis.ntou.edu.tw) was established after the study to provide authorized users with integrated information on fishery and non-fishery uses in Taiwan's coastal zone. The GIS was of critical importance during the planning stage and continues to contribute information to MSP.

Taiwan's coastal zone is the most prosperous public property. A lack of comprehensive MSP for the area has led to the degradation of the marine environment and upland habitats. Currently, the government is drafting the National Land Act, the National Land Restoration Act, the Coastal Act, and the Administration Zoning Act. In addition to the fishing sector, authorities of other sectors will be involved in the coastal zone MSP. Consequently, a more comprehensive perspective will be achieved in the future. MSP in the coastal zone should not only be a political trade-off among interested parties, such as merely balancing interests between fishery and non-fishery sectors. More reliable scientific information and objective analysis should be developed to maximize economical profit, while ensuring environment sustainability. GIS will continue to be an important tool to support this MSP process.

## Great Barrier Reef Marine Park Authority: Monitoring, Evaluation and Adaptive Marine Spatial Planning and Management[1]

**Randall Owens**
Great Barrier Reef Marine Park Authority

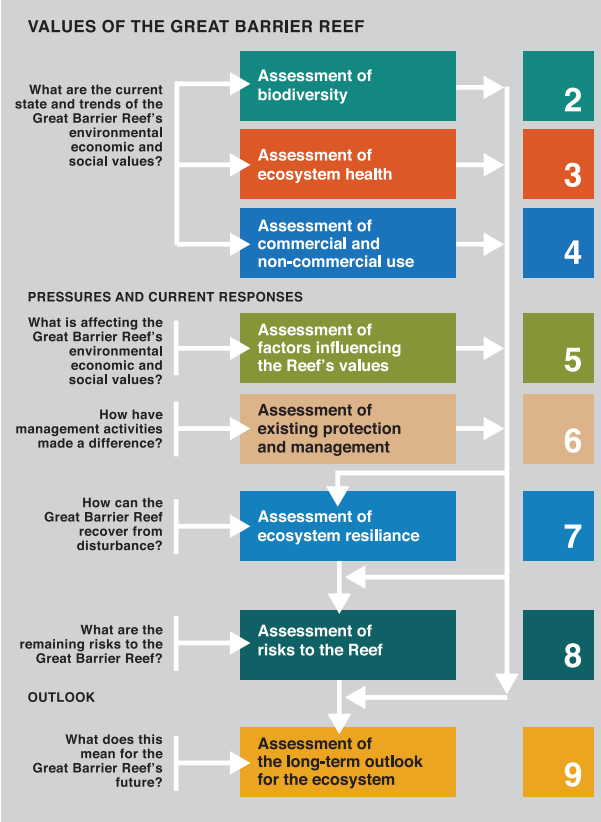
Marine spatial planning (MSP) is unlikely to be successful and to maintain long-term stakeholder and political support unless a strategically planned and coordinated process is implemented. This is necessary to effectively monitor and evaluate the management system. Equally important, there is a need for sufficient resources for adaptation based on the results of evaluations. An objective of monitoring and evaluations should be to forecast or preempt change in order to prepare for management settings to be adjusted to better account for change. When one factors in external global drivers of ecological change, such as climate change, adaptive capacity will be a key element of MSP. In an ideal world of single agency management, this might be relatively straightforward, but in the multi-jurisdictional and multi-management agency world of MSP, the elements of monitoring and particularly of evaluation are complex and can be contentious. In 2007, the *Great Barrier Reef Marine Park Act 1975* was amended to require the Great Barrier Reef Marine Park Authority (GBRMPA) to prepare an Outlook report for the Great Barrier Reef (GBR) region every five years.

The first Outlook report was published in 2009[2]; Figure 1 is an extract from this report.

It demonstrates the breadth of the areas that need to be monitored and assessed. Importantly, at level 6, management effectiveness has to be assessed. This is not only about the effectiveness of GBRMPA. The effectiveness through assessment is also required of other management agencies that have responsibility for activities, such as fishing, which occur in or impact on the Great Barrier Reef Marine Park (GBRMP). The final assessment is a cumulative one: It effectively evaluates the other assessments to derive a judgment of the long-term outlook for the GBR ecosystem. The Outlook report is a public document – a report card if you like – that synthesizes and then sums up the available evidence. Although it does not make management recommendations as such, it points out and scales the threats, deficiencies and gaps that exist. The Web-accessible evidence pages that sit behind Outlook bring together a vast amount of information. Outlook itself provides a

1 The views expressed in this abstract are the author's and do not necessarily reflect the official views or policies of GBRMPA.

2 Available at: http://www.gbrmpa.gov.au/corp_site/about_us/great_barrier_reef_outlook_report.




*The Great Barrier Reef Outlook Report 2009* is structured around the eight assessments specified under Section 54 of the Great Barrier Reef marine Park Act 1975.

**Figure 1.** The Outlook assessment required by the GBRMP Act

new way of looking at this information, but it does not provide new information. The value of Outlook is that it indicates what needs to be addressed and provides clear management priority and a focus for the scientific information needs for the GBRMP[3].

GBRMPA Chair and CEO Russell Reichelt, in his preface to the GBR Outlook Report 'In Brief'[4], writes that Outlook "summarises what is known about the ecosystem, its use, its management and the pressures it is facing, and is a window to the future. It identifies climate change, continued declining water quality from catchment runoff, loss of coastal habitats from coastal development and a small number of impacts from fishing as the priority issues reducing the resilience of the Great Barrier Reef."

3 Available at: http://www.gbrmpa.gov.au/corp_site/info_services/science_management/science_information_needs

4 Available at: http://www.gbrmpa.gov.au/corp_site/about_us/great_barrier_reef_outlook_report

In terms of MSP, the scope and range of the issues addressed in Outlook also reinforce that the 344,400-km$^2$ GBRMP is managed as a multiple-use area within a World Heritage Area and that areas outside the direct jurisdictional control of GBRMPA impact on the values of the GBRMP and also need to be managed. Water quality, coastal planning, shipping, dredging, fishing and aquaculture all impact on or occur within the GBRMP. The need for strong collaborative management and coordination between various levels of government is evident. Outlook amplifies this need, as it similarly does the need to apply and integrate ecosystem-based management (EBM) into the various management systems.

The Outlook approach has provided a way of looking at the totality of the picture and its composite parts. It has provided clarity to objectives (the reasons why we do things) and has brought the various indicators together so that effectiveness can be assessed holistically and critically. It provides a transparent assessment of management performance to achieve ecosystem-based outcomes.

GBRMPA is a well-resourced organization with strong links to the research community, including the Australian Institute of Marine Science (AIMS). Since 1993, various long-term monitoring surveys are in place, including those on reef health at 47 reefs throughout the GBR. We are also fortunate in that we have long-term fish count information for reef-associated species. Larval transport work in progress by Geoff Jones, Gary Russ and others is providing evidence that GBRMPA's no-take green zones are providing recruitment subsidies beyond their boundaries. This is a key question. However, the effects of zoning for pelagic and migratory species are not settled, and we are supporting work in this direction. We are also supporting important work to determine species composition in the gill net fishery for tropical sharks, as we seek to understand how effective zoning is for mobile apex predators. The Outlook approach is helping to provide an integrated evaluation of the management value and need for the various monitoring programs that are in place within and adjacent to the GBRMP, again with a focus on ecosystem and connectivity.

Having the mandated and negotiated agreement across jurisdictions to look into areas "adjacent to" is critically important, as a marine-managed area can basically only be as "healthy" as its surrounding waters. It is the connectivity that is a critical component of EBM. Outlook has determined that water quality is a key threat to the GBR and that is driving negotiated management response and water quality indicators, with improvement targets now in place. Possibly more challenging are dealing with cumulative impact and the range and scope of coastal development. However, because water quality has been transparently identified as a key threat, it is driving management response by showing where focus needs to be. With respect to

fisheries, the key threats identified relate to extraction of top predators, incidental catch of species of conservation concern, illegal fishing and discards, and fishing unprotected fish-spawning aggregations.

Outlook has also assessed positive change in fishing with a range of areas that were previously considered high risk, but are now assessed as low risk due to effective management arrangements. One example is the spatially managed prawn trawl fishery. Being able to identify and assess levels of risk in a transparent way across a large marine area, as is the case with the GBRMP, clearly indicates where the priority actions are and where investment needs to be made. It is also clear for stakeholders, an extremely important component of the application of EBM. The evaluation of management effectiveness of fisheries found that: "A lack of information and coordination, plus variable uptake of best practice management, is limiting the effectiveness of fisheries management." For needed improvements, that statement provides a clear indication of how we need to collaborate and work together and the areas where we should put effort and investment. It has certainly, along with the need to work towards climate change adaptation strategies, provided a direction to work with both management and industry, and has enabled a genuine partnership approach to be developed and invested in.

Table 1 (from Outlook) illustrates broadly the assessment criteria and the assessment grade and provides a useful summary of issues relevant to MSP.

**Table 1.** Broad assessment of the effectiveness of management

| Assessment criteria | Summary | Assessment Grade: Very good | Good | Poor | Very poor |
|---|---|---|---|---|---|
| **Understanding of context** | Understanding of values, threats, national and international influences and stakeholders is strong for all management issues assessed. This reflects a solid information and research base and a very mature understanding of the key values of the Great Barrier Reef in both a national and international context and the actual and potential threats to those values. Understanding of stakeholders is consistently strong across all issues (in fact it shows the strongest performance across the entire range of assessment criteria). | ● | | | |
| **Planning** | Planning performance tends to be strongest where there are few organisations or levels of governance involved in the planning process. There are well developed planning systems in place for all issues except for coastal development where the fractured nature of the planning regime causes problems. Lack of consistency across jurisdictions is the weakest aspect of planning. | | ● | | |
| **Financial staffing and information inputs** | Planning performance tends to be strongest where there are few organisations or levels of governance involved in the planning process. There are well developed planning systems in place for all issues except for coastal development where the fractured nature of the planning regime causes problems. Lack of consistency across jurisdictions is the weakest aspect of planning. | | | ● | |
| **Management systems and processes** | Planning performance tends to be strongest where there are few organisations or levels of governance involved in the planning process. There are well developed planning systems in place for all issues except for coastal development where the fractured nature of the planning regime causes problems. Lack of consistency across jurisdictions is the weakest aspect of planning. | | ● | | |
| **Delivery of outputs** | Planning performance tends to be strongest where there are few organisations or levels of governance involved in the planning process. There are well developed planning systems in place for all issues except for coastal development where the fractured nature of the planning regime causes problems. Lack of consistency across jurisdictions is the weakest aspect of planning. | | ● | | |
| **Achievement of outcomes** | Planning performance tends to be strongest where there are few organisations or levels of governance involved in the planning process. There are well developed planning systems in place for all issues except for coastal development where the fractured nature of the planning regime causes problems. Lack of consistency across jurisdictions is the weakest aspect of planning. | | | ● | |

The beauty of Outlook is that it is predictive and forward-looking, provides reason and substance as to where effort and resources should be invested, and is multi-jurisdictional. In the latter, it addresses the factors and the management effectiveness of all areas that impact on the health and resilience of the GBRMP and World Heritage Area.

The GBRMP situation is complex but not as complex as applying MSP in an oceanic and multi-national situation for – in the fisheries sense – a suite of pelagic and/or highly migratory species. However, the GBRMPA experience and our learning may have application for the way that ecosystem-based management evaluation is approached.


### ACKNOWLEDGEMENTS

Thanks to my work colleague, Jon Day, and former colleague, John Tanzer, and former colleagues from the Fisheries Department of Western Australia with whom I have had many discussions around these issues. I also thank folks from the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz) and the US Western Pacific Regional Fishery Management Council, who enabled me to put the work I do in the GBRMPA in the context of larger international issues and challenges with MSP.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## The Role of Marine Spatial Planning in Governance of Climate Change Mitigation Activities in the Oceans beyond National Jurisdiction


**Robin Warner**

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The adverse impacts of anthropogenically-induced climate change on the terrestrial and marine environments have been acknowledged by a succession of expert reports commissioned by global and national bodies[5]. This recognition has prompted a variety of marine geo-engineering schemes to mitigate the detrimental effects of climate change on the environment, including enhanced schemes to remove carbon dioxide from the atmosphere using the world's oceans. The ocean is already a major sink for carbon dioxide because of its capacity to readily absorb excess atmospheric carbon and convert it to soluble form. Scientists have estimated that approximately 5.5 billion tonnes (or gigatonnes) of carbon are now released into the atmosphere each year as carbon dioxide from the burning of fossil fuels and that a third of that is taken up by the oceans[6].

Many climate change mitigation activities involving the oceans, such as offshore carbon capture, are likely to take place in waters under national jurisdiction where environmental protection measures will be mandated under domestic law. There is at least one climate change mitigation activity that has already been trialed in waters beyond national jurisdiction. Augmenting the rate at which the oceans absorb carbon dioxide is the fundamental objective of a process known as ocean fertilization or ocean nourishment being proposed for iron and other nutrient deficient areas of the ocean, many of which are located beyond national jurisdiction[7]. Ocean fertilization seeks to increase the production of organic material in the surface ocean, with a commensurate rise in "marine snow" or organic

5 Intergovernmental Panel on Climate Change (IPCC), *Fourth Assessment Report 2007*, ('IPCC Fourth Report') <http:www.ipcc.ch/ipccreports/ar4-syr.htm> accessed 13 May 2010; Nicholas Stern et al, *Stern Review: The Economics of Climate Change* (HM Treasury, London, 2006); BL Preston & RN *Jones, Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions. A consultancy report for the Australian Business Roundtable on Climate Change* (CSIRO Canberra, Canberra ACT, 2006).

6 Tony Koslow, *The Silent Deep 2007*, (UNSW Press, University of New South Wales, Sydney, Australia), p.156.

7 Karen N Scott, "The Day After Tomorrow: Ocean CO2 Sequestration and the Future of Climate Change" 2005, 18 *Georgetown International Environmental Law Review*, p. 57.

detritus falling from the upper layers of the water column to the deep ocean. Carbon transported as marine snow into the deep ocean and finally decomposed to inorganic nutrients and dissolved carbon dioxide can remain out of contact with the surface ocean and atmosphere for relatively long time scales associated with ocean currents and circulation[8].

The long-term environmental impacts of ocean fertilization are still uncertain and the regulatory framework for this process is still developing. Climate change mitigation activities, such as ocean fertilization conducted in marine areas within national jurisdiction, may be subject to coastal state legislation and policy on environmental impact assessment. However, strategic environmental assessment and other environmental protection safeguards, the regulatory framework for such activities beyond national jurisdiction, are fragmentary and less defined. General obligations to protect the marine environment beyond national jurisdiction are contained in Part XII of the *United Nations Convention on the Law of the Sea* (*1982 LOSC*)[9]. But these have not been supplemented in the case of marine areas beyond national jurisdiction, with international law instruments applying modern environmental protection principles to the conduct of emerging activities, such as ocean fertilization by flag states, their nationals and corporations. In the absence of systems to monitor and mitigate the adverse impacts of such activities in marine areas beyond national jurisdiction, there is a real risk of irreversible damage to the marine environment of these areas and its biodiversity[10].

Marine spatial planning has a role to play in both facilitating and mitigating the adverse impacts of climate change mitigation activities, such as ocean fertilization. The International Oceanographic Commission defines marine spatial planning as "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that usually have been specified through a political process[11]." The concept of marine spatial planning goes beyond the creation of marine protected areas or ocean zoning, being more in the nature of a comprehensive vision or plan for a marine region that accommodates a variety of objectives including conservation, social and economic development. The process of marine bioregional planning, being undertaken in waters under Australian national jurisdiction by the federal Department of Environment, is an example of marine spatial planning.

In the oceans beyond national jurisdiction, there are very few examples of comprehensive marine spatial planning. There are, however, some single sector ocean zoning processes, such as fisheries closures, and limited regional examples of protected areas beyond national jurisdiction that bind participating members of Oslo and Paris Conventions for the protection of the marine environment of the North-East Atlantic Commission (OSPAR) in the North East Atlantic, and the parties to the Pelagos sanctuary agreement in the Mediterranean. At the global level, there are a number of initiatives taking place that may eventually provide a more established foundation for comprehensive marine spatial planning in waters beyond national jurisdiction. In 2008, the ninth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 9) adopted the scientific criteria, in its decision IX/20 for identifying ecologically or biologically significant marine areas (EBSAs) in need of protection and the scientific guidance for designing representative networks of marine protected areas. COP 9 also decided to convene an expert workshop, which met in Ottawa in September 2009, to provide scientific guidance on the use and further development of bio-geographic classification systems, as well as guidance on the identification of areas beyond national jurisdiction that meet the scientific criteria for EBSAs. At its third meeting in February 2010, the UN Ad Hoc Open-ended Informal Working Group, convened to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction, recognized the work of competent international organizations, such as the CBD, on the use of area-based management tools and the importance of establishing marine protected areas consistent with international law and based on scientific information. These included representative networks by 2012, as called for in the Johannesburg Plan of Implementation (JPOI) of the World Summit on Sustainable Development (WSSD). And the working group called upon states to work through such competent international organizations towards the development of a common methodology for the identification and selection of marine areas that may benefit from protection. This paper will examine the results of these initiatives, some potential options under international law for implementing marine spatial planning in the oceans beyond national jurisdiction, and the implications of such marine spatial planning for proposed climate change mitigation activities in the oceans beyond national jurisdiction.

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8 John L. Cullen and Philip W. Boyd, "Predicting and verifying the intended and unintended consequences of large-scale ocean iron fertilization" 2008, 364 *Marine Ecology Progress Series*, p. 296.

9 *United Nations Convention on the Law of the Sea* opened for signature on 10 December 1982, 1833 UNTS 3(entered into force 16 November 1994) ("1982 LOSC"). The term "marine areas beyond national jurisdiction," when used in this article, refers to all those parts of the sea that are not included in the exclusive economic zone, territorial sea or the internal waters of a state or the archipelagic waters of an archipelagic state and all those parts of the seabed and ocean floor and sub-soil thereof beyond the outer limit of the continental shelf of a state.

10 Koslow, above n.2, pp.159-160; Scott, above n.3, o. 58.

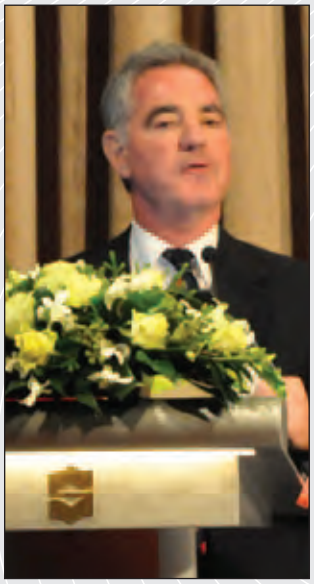
11 UNESCO-International Oceanographic Commission, Marine Spatial Planning, http://www.unesco-ioc-marinesp.be/marine_spatial_planning_msp accessed 13 May 2010.

# Corporate Role in Marine Spatial Planning and Management

**Paul Holthus**
World Ocean Council

Marine spatial planning and management is emerging as a key development in managing marine ecosystems. It is being pursued through a variety of processes and agencies with significant input from NGOs. Marine spatial planning will have major effects on ocean industry access to marine space and resources, e.g., offshore wind energy, wave and tidal energy, oil and gas, shipping, fisheries, aquaculture, etc. Industry must constructively engage with marine spatial management efforts and with the other ocean industry stakeholders to ensure that the process is well informed and balanced. This will increase the potential for newly emerging ocean management to reflect the needs of responsible industry operators. Unfortunately, industry is often not involved in marine spatial planning developments.

Barriers to industry involvement in marine spatial planning and management include: (1) lack of understanding of the process and players involved; (2) limited engagement in the multi-stakeholder process because industry is engaged in sectoral processes; and (3) lack of means for engaging the broader ocean business community on marine management and sustainability. The need and opportunity for constructive industry leadership and collaboration on marine spatial planning and management include: (1) developing an understanding of the issues, stakeholders and process; (2) actively engaging in key multi-stakeholder processes; (3) building constructive relationships among ocean industries and other stakeholders; and (4) creating practical experience by constructively engaging in marine spatial planning and management developments in a specific locations.



**SESSION 2:** CASE STUDIES OF COASTAL AND MARINE SPATIAL PLANNING AND MANAGEMENT

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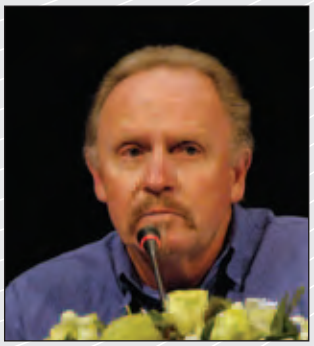

## Session 2A: Summary

# **Case Studies of Coastal and Marine Spatial Planning and Management:** Perspectives from Managers and Planners

**SESSION CHAIRS: Dr. Milani Chaloupka**, Ecological Modeling Services, and **Mr. David Chang**, Overseas Fisheries Development Council, Taiwan

**TARGET OUTCOMES:** Identify lessons learned and best practices for effective and ineffective coastal and marine spatial planning, and implications for marine fisheries governance.

The five presentations focused on putting the concept of marine spatial planning into practice. Two major conceptual issues were identified:

- The role that spatial genetic structure and connectivity between demographic units (source-sink) might play in long-term viability of stocks exposed to various anthropogenic hazards; and
- The effectiveness of marine spatial planning instruments, such as marine protected areas and area rotation, for supporting natural resource conservation and improved fisheries governance.

Case studies from the Papahanaumokuakea Marine National Monument (Northwestern Hawaiian Islands, USA; see abstract by Jo-Ann Leong) and the Great Barrier Reef Marine Park (Australia; see abstract by Randall Owens) were used to showcase the designation of large-scale marine protected areas based on marine spatial planning techniques to limit potential multiple use conflicts and to achieve greater ecosystem resilience. Recognizing the benefit of marine protected areas to marine ecosystems and fishery resources, the Taiwan government is working toward the goal of designating up to 20% of its territorial waters as protected areas by 2020 (see abstract by Mao-Cheng Wang). The success of the rotational fishing area scheme for the New England scallop fishery to increase biomass and improve overall management of fishery resources was also showcased as an example of marine spatial planning instruments applicable to a specific industry (see abstract by Deirdre Boelke). The Puget Sound Partnership (USA) was showcased as a promising science-policy governance structure to promote ecosystem-wide restoration comprising both land and sea components (see abstract by David Fluharty).

The session concluded that the effective application of marine spatial planning and management instruments depends on, but not limited to, the following:

- Developing a better understanding of metapopulation dynamics (source-sink);
- Ongoing spatial and temporal monitoring, which can be expensive;
- Developing community and industry partnerships;
- Developing a consensus on resource equity and allocation; and
- Securing politically supported resource governance.

The major ongoing challenge of applying marine spatial planning instruments for conservation of highly migratory species was recognized but no effective solutions have been proposed.

## Session 2A:
# Abstracts

## Coastal and Marine Spatial Planning and the Northwestern Hawaiian Islands

**Jo-Ann Leong[1] and T. 'Aulani Wilhelm[2]**

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### ABSTRACT

The Papahānaumokuākea Marine National Monument was created by Presidential Proclamation on June 15, 2006, circumventing the process of designating the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve as a national marine sanctuary. The regulations governing the monument define zones for specialized activities and required the phase-out of all commercial fishing by June 15, 2011. Subsequently, under the Consolidated Appropriations Act of 2008, Congress appropriated $6.5 million to compensate commercial bottomfish and lobster fisherman who were displaced by creation of the monument. In return, fishermen were required to surrender their commercial fishing permits. All awards were completed in January 2010, permanently closing both lobster and bottomfish fisheries in the Northwestern Hawaiian Islands. The Monument Management Plan and the draft Monument Science Plan do make provisions for understanding the region's ecosystem and incorporating the information into the monument's adaptive management strategy. This information is and will continue to be used in formulating management actions for the activities permitted in the different zones.

### INTRODUCTION

On June 15, 2006, President George W. Bush issued Presidential Proclamation 8031 establishing the Northwestern Hawaiian Islands (NWHI) Marine National Monument under the authority of the Antiquities Act of 1906 (16 U.S.C. 431). At that moment, the monument, which was renamed the Papahānaumokuākea Marine National Monument (PMNM) on March 6, 2007, became the largest fully protected marine reserve in the United States.

The monument includes a number of existing federal conservation areas: the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, managed by the U.S. Department of Commerce through the National Oceanographic and Atmospheric Administration (NOAA); and the Midway Atoll National Wildlife Refuge, the Hawaiian Islands National Wildlife Refuge, and the Battle of Midway National Memorial, managed by the U.S. Department of the Interior through the U.S. Fish and Wildlife Service (FWS). It also includes the State of Hawaii lands and waters, managed by the state through the Department of Land and Natural Resources as the Northwestern Hawaiian Islands Marine Refuge and the State Seabird Sanctuary at Kure Atoll. All of these areas remain in place and are subject to their applicable laws and regulations in addition to those covered by the Proclamation.

The PMNM encompasses 139,797 square miles of the Pacific Ocean and its extensive coral reefs are home to approximately 8,500 species (24-35% found nowhere else in the world) (Fautin et al. 2010). It covers the northern 1200 miles of the Hawaiian Archipelago, and is the most remote set of islands in the world. Historically, the area provided subsistence fishery resources for Native Hawaiians from 500 A.D. and was heavily fished by foreign fishers for monk seals, whales, fish, lobsters and black-lipped pearls. Since 1991, the Longline Protected Species Zone was designated to prevent interactions with endangered species and no pelagic longline fishing within 50 nautical miles of the NWHI was permitted. No crustacean fishery has operated in the NWHI since 2000. Although the bottomfish fishery remained opened to eight vessels with valid permits, the fishery was scheduled for closure on June 15, 2011. By January 2010, all eligible permitees voluntarily accepted compensation under the Consolidated Appropriations Act of 2008 for their projected losses and surrendered their permits. All commercial fishing has ceased in the PMNM and coastal and marine spatial planning (CMSP), as it relates to its fishery

natural resources, is completed. CMSP for other uses in the monument will continue and research to map, monitor and model the NWHI ecosystem will guide adaptive management of the PMNM.

## COASTAL AND MARINE SPATIAL PLANNING IN THE PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT

The designation of the PMNM was followed by rule-making that was completed jointly by the FWS and NOAA on August 29, 2006 (71 FR 51134). Monument regulations, codified under 50 CFR Part 404, established the scope and purpose, boundary, definitions, prohibitions, marine zones and regulated activities for managing the monument (Figure 1). Entrance into the PMNM is strictly forbidden, unless it is for transit, emergency and law enforcement purposes, and armed forces activities; all commercial fishing was banned after June 15, 2011. Permitted activities include research, education, Native Hawaiian cultural practices, sustenance fishing in the Midway Atoll Special Management Area, recreation, conservation, and management, and an activity known only as "special ocean use." Limited sustenance fishing may be allowed, incidental to a permitted activity, for bottomfish, or pelagic species that are consumed within the monument. The management zones, described in Figure 1, are: Special Preservation Areas, Ecological Reserves and the Midway Atoll Special Management Area. Each zone addresses protection of habitat and foraging areas of threatened and endangered species; and inclusion of a representative range of the diverse array of marine habitats, including shallow coral reef environments, deepwater slopes, banks and seamounts. These zones were recommended through the planning phase and Environmental Impact Statement (EIS) process, initiated by the National Marine Sanctuary Program (NMSP) in 2003 and incorporated into 71 FR 51134, to protect the ecological linkages between habitats and to minimize the risks associated with activities, such as fishing and recreational activities. The NMSP process included six topical fishing discussion groups, each of which met two or three times for a total of 18 meetings (Kittinger et al. 2010). A multidisciplinary team of independent researchers were also charged with providing background research on commercial fishing in the NWHI, and their report was presented to the fishery discussion groups for feedback and refinement (Wilcox et al. 2004).

Fundamental to the management of these zones is an understanding of the NWHI ecosystem. The PMNM Monument Management Plan indicates that knowledge of the monument's marine biodiversity, coral reefs, ecosystem dynamics, potential effects of climate change and the social and economic drivers are needed to inform and refine management strategies and activities in their proposed adaptive management process. Inherent in this process is the possibility of redefinition of marine zones should scientific data support change that is consistent with the Proclamation 8031, which established the monument and the monument goals and desired outcomes. Defining the criteria that will guide any change is the key component for this adaptive management.

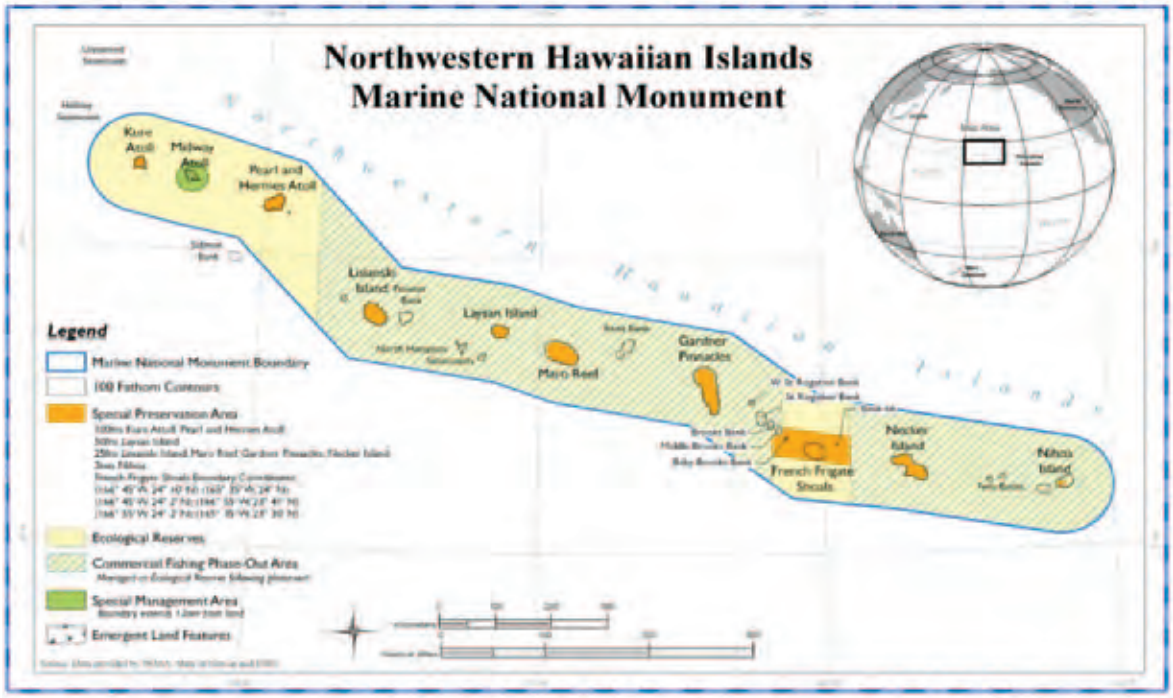


**Figure 1.** Northwestern Hawaiian Islands Marine National Monument Zones (2006; 71 FR 51134)

**Table 1.** Ecological principles for ecosystem-based CMSP (modified from Foley et al. 2010)

| Principle | Important feature | Ecosystem function(s) supported |
|---|---|---|
| Maintain native species diversity | Species diversity and composition<br>Genetic diversity<br>Functional redundancy | Productivity<br>Resilience (resistance and recovery) |
| Maintain habitat diversity and heterogeneity | Habitat representation | Maintenance of species diversity |
| Maintain populations of key species | Keystone<br>Foundations<br>Basal prey<br>Top predators | Species diversity<br>Food web stability<br>Resilience<br>Ecosystem engineering |
| Maintain connectivity | Populations and species persistence<br>Flow of subsidies | Species diversity<br>Metapopulation and metacommunity dynamics |

## PRINCIPLES AND APPROACH FOR CMSP IN THE PAPAHĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT

Spatial management based on an ecosystem approach is now widely accepted as a means to protecting the ecosystem services of a region by separating incompatible uses (Crowder and Norse 2008). At its core is a firm understanding of the ecological attributes of the system under consideration. These attributes are described in Table 1 derived from Foley et al., 2010. The four ecological principles that have been proposed to guide ecosystem-based CMSP maintain or restore (1) native species diversity, (2) habitat diversity and heterogeneity, (3) key species, and (4) connectivity. In the PMNM, the scientific data supporting these principles are not complete and scientific studies continue to add to this data resource.

## OCEAN POLICY TASK FORCE COASTAL AND MARINE SPATIAL PLANNING – PACIFIC ISLANDS

An ecosystem approach to CMSP is an integral component of President Barack Obama's Ocean Policy Task Force response to the call for recommendations for a national policy for our coastal and oceanic resources (June 12, 2009 Presidential Memorandum). On July 19, 2010, an executive order was signed establishing a National Policy for the Stewardship of the Ocean, Coasts, and Great Lakes. The policy was developed by the Interagency Ocean Policy Task Force and includes a framework for effective CSMP. This document further provides the principles and approach for ecosystem-based management of the PMNM (Interagency Ocean Policy Task Force, July 19, 2010, Framework for Effective Coastal and Marine Spatial Planning).

CMSP is defined as a comprehensive, adaptive, integrated, ecosystem-based and transparent spatial planning process, based on sound science, for analyzing current and anticipated uses of ocean, coastal and Great Lakes areas. CMSP identifies areas most suitable for various types or classes of activities in order to reduce conflicts among uses, reduce environmental impacts, facilitate compatible uses, and preserve critical ecosystem services to meet economic, environmental, security and social objectives. The Final Policy outlined essential elements of the CMSP process:

- identify regional objectives;
- identify existing efforts that should help shape the plan throughout the process;
- engage stakeholders and the public at key points throughout the process;
- consult scientists and technical and other experts;
- analyze data, users, services, and impacts;
- develop and evaluate alternative future spatial management scenarios and tradeoffs;
- prepare and release for public comment a draft CMS Plan with supporting environment impact analysis documentation;
- create a final CMS Plan and submit for NOC review; and
- implement, monitor, evaluate, and modify (as needed) the NOC-certified CMS Plan.

Although not defined at the time, these essential elements of CMSP process, aside from the development of regional objectives, were utilized to varying levels in the development of the draft National Marine

Sanctuary Management plan, draft Environmental Impact Statement and draft regulations. Similar principles will likely be applied every five years when the existing management plan will go through review and evaluation. Any changes in the management plan will be framed within the Executive Order and subsequent regulations that were promulgated to bring the monument into effect.

For CMSP purposes, the planning scale for initiating CMSP is at the large marine ecosystem (LME) scale. In the case of the Pacific Islands, this includes the entire Hawaiian Archipelago, the Commonwealth of the Northern Mariana Islands, American Samoa and Guam. The process involves the following:

1. Members are identified of the Regional Planning Body: federal, state, tribal authorities, and indigenous community representatives with jurisdictional responsibilities or other interests.
2. Partners execute a CMSP Development Agreement that would provide a process for resolving conflicts and a process to develop a formal regional work plan.
3. Partners develop a regional work plan that establishes key milestones, identifies resources, specific time frames, and addresses the essential elements for the planning process as identified above.

It is unclear at this time how these LME principles and approaches may impact the Monument Management Plan and the draft PMNM natural resources science plan, as the scope of the existing management plan is already established. The real opportunity to apply the broader CMSP principles and approaches to CMSP in relation to the monument is as a reference or place of comparison to other parts of Hawaii and the Pacific LME. CMSP-like principles and frameworks were utilized over the course of more than five years and this experience holds important lessons for other place-based management regions under development.

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## Great Barrier Reef Marine Park Authority Lessons Learned in Marine Spatial Planning, including Sustainable Marine Fisheries[1]


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In preparing this abstract for the Forum, assumptions have been made that readers have familiarity with the concepts of marine spatial planning (MSP) and have some knowledge of the Representative Areas Program (RAP), as well as the consequent 2004 rezoning of the multiple use 344,400 km2 Great Barrier Reef Marine Park (GBRMP) where, among other things, an increase in no-take area protection from 4.5% to ~34% was achieved.

For this substantial biodiversity conservation achievement and, with respect to fisheries and MSP initiatives that are increasingly being implemented (and refined) by various jurisdictions, it is apparent that the allocation and conservation of fish resources is occurring within an increasingly complex marine and socio-political environment. It is an environment in which, perhaps, the most challenging allocation of all is the determination of an

1 The views expressed in this abstract are the author's and do not necessarily reflect the official views or policies of GBRMPA.

**Figure 1.** The GBRMP extends through 14° of latitude (10°41'S to 24°30' S). It is roughly the size of the Baltic Sea or West Coast USA, but it is only bordered by one state

ecologically effective and socially just balance between ecosystem conservation and resource extraction. With their goal of biodiversity protection, Marine Protected Areas (MPAs) are an important part of the allocation conundrum. However, there are problems because of perceived allocation and socio-cultural deficiencies in MPA planning processes, and their apparent lack of regard for fisheries management processes and objectives and vice versa.

The lessons learned from the Great Barrier Reef Marine Park Authority (GBRMPA) experience relate to the preceding paragraph. We have learned that the GBRMP is large enough and representative enough of an entire ecosystem to allow GBRMPA to achieve (or at least approach), but not on its own, ecosystem-based management (EBM). An important distinction from many smaller MPAs is that the EBM approach GBRMPA has taken occurs critically in a multiple-use context. The objective is to manage the impact of use, on an ecosystem scale, not simply exclude it.

Key points from the GBRMPA experience are that we have[2]:

A sound governance framework, including specific legislation for the GBRMP and World Heritage Area, combined with comprehensive federal environmental legislation and complementary legislation for the adjoining state waters. (It is appreciated that the GBRMP situation is fortunate in that it does not have the jurisdictional and legal difficulties that are MSP realities in international and 'high seas' environments).

- A strong legal mandate to be consistent with ecosystem-based management[3] and the principles of ecologically sustainable use.
- Management influence over a wider context than just the Federal GBRMP, with consideration of connectivity issues, including the adjoining catchments, offshore waters and the islands. Hence, there is consideration of the widest possible aspects of "the ecosystem."
- A comprehensive management system including a statutory zoning plan, which provides a multiple-use zoning network, statutory plans of management, site-specific management plans, a permitting regime and a strategic plan for the entire area.
- Well developed and integrated management with all relevant federal and state agencies, including formal and informal arrangements with the state of Queensland as the responsible jurisdiction for the adjacent tidal waters and most islands.
- Widespread stakeholder involvement through a variety of advisory committees and community engagement processes in both planning and ongoing management.

2 Adapted from a 2010 internal GBRMPA assessment by Jon Day and Peter McGinnity.

3 The GBRMP Act defines EBM as "*...an integrated approach to managing an ecosystem and matters affecting that ecosystem, with the main object being to maintain ecological processes, biodiversity and functioning biological communities.*"

- Strong cooperative partnerships and/or formal agreements with other agencies, commercial (including fishing) and recreational industries, traditional owners, research institutions and universities.
- Strong (though, at times, feisty) political support at all levels (federal, state and local government levels).
- An adaptive management approach, based on monitoring and a range of assessments, including management effectiveness, and continuous improvement.
- National consensus and international recognition that the GBR is "iconic" and worth conserving, with many industries that depend upon its health, and recognize its value and the need for its protection.
- Effective research and monitoring programs, prioritized to provide information on changes to assist management.

This background, along with our primary legislation, the GBRMPA Act, gives GBRMPA strength and purpose in what it does.

It is also important to note that zoning, including highly protected zones, is a critical management tool to achieve our objectives, including EBM in the GBR. But zoning must be supported by other spatial and temporal management "tools." These other tools are necessary to control and mitigate the broad range of impacts associated with human use of the GBR and the impacts stemming from activities occurring outside of the GBRMP. In the GBRMP, these other management tools include: permits (normally tied to defined areas or specific zones); plans of management (developed particularly to regulate tourism and high use areas); site management plans; special management areas (e.g., Dugong Protection Areas) and other legislated spatial restrictions (e.g., defense training areas, designated shipping areas, and agreements with traditional owners); best environmental practices; and industry codes of practice and partnerships with industry. These various management tools overlay the zoning and may have their own objectives or legislative mandates.

Essential to maintain the health of the GBR as a critical global resource are also various other management programs, including the Reef Water Quality Protection Plan, (a negotiated partnership with Queensland directed at catchment management); fisheries management arrangements (GBRMPA influences but does not have responsibility for or management of fisheries); a Climate Change Action Plan; strategically designed collaborative compliance and enforcement programs; and comprehensive monitoring programs.

The preceding summary sounds well, but the "devil," as usual, is in the details. In the confines of this abstract, however, there is only space to summarize, not elucidate, these details. Consequently, as someone who was intimately involved in the RAP and subsequent outcomes,

I will only highlight areas of importance and difficulty, particularly with respect to fisheries. Our experience does not translate directly to high seas and open ocean pelagic governance and environmental issues. However, there are lessons that can be learned and there are commonalities that exist when one considers what spatial management can achieve (and what it might cost), with respect to ensuring the resilience and long-term productivity of marine ecosystems.

The rezoning of the GBRMP was driven by the RAP, which was, among other things, a process of clear objective-setting, based on the best available scientific knowledge and recommendations about what was required to achieve, via a network of no-take areas, a satisfactory level of protection for the biodiversity of the GBRMP. The rezoning was to ensure, as far as possible, that the health and resilience of the GBR ecosystem would be adequately protected into the future.

Through a collaboration of scientific and stakeholder expertise (including fishers), RAP utilized the best collective contemporary scientific knowledge of the GBR ecosystem to identify and map 30 reef and 40 non-reef bioregions of the ecosystem. The process of RAP recognized from the outset that it was not just a science decision. For the RAP to be politically and socially acceptable, socioeconomic considerations and implications had to be effectively taken into account and principles had to be established.

## THE CORNERSTONES OF RAP

First among these were the bioregions[4]. This approach was foreshadowed by Lubchenko et al. in 1991 in "The Sustainable Biosphere Initiative," where the authors recognized that "current research efforts are inadequate for dealing with sustainable systems that involve multiple resources, multiple ecosystems and large spatial scales." They emphasized the need to understand and describe the "underlying ecological processes that affect the sustainability of natural and managed systems."

The second major cornerstone was the development of the 11 "biophysical operational principles" (BOPs), as recommended by a Scientific Steering Committee.

4 Bioregion boundaries are rarely hard-edged; they are, instead, indicative or fuzzy, but they assist greatly in categorizing the biodiversity requiring protection (Day et al. 2003).

**Table 1.** Operating principles (summarized)

| Biophysical Operating Principles |
|---|
| 1. Minimum size 20km across if possible |
| 2. The larger, the better |
| 3. Replicate no-take areas within bioregions to reduce risk |
| 4. Don't 'split-zone' reefs if possible |
| 5. (Reef) & 6 (non-reef). Minimum of at least 20% per bioregion |
| 7. Consideration of cross-shelf & latitudinal diversity |
| 8. Inclusion of examples of all community types & physical environments |
| 9. Consideration of connectivity |
| 10. Consideration of special & unique sites/locations |
| 11. Consideration of adjacent uses |
| **Social, Economic, Cultural & Management Feasibility Operating Principles** |
| 1. Maximize complement with adjacent areas |
| 2. Recognize social benefits/costs |
| 3. Complement existing & future management |
| 4. Maximize public understanding & enforceability |

Supporting the scientific BOPs was a set of four "social, economic, cultural and management feasibility operational principles" (SecBOPs).

Achieving the BOPs drove the placement of the no-take areas. The BOPs were interdependent and needed to "be considered as a 'package' and not in isolation" (Day et al. 2003). This consideration was not easy, as the socioeconomic principles were subject to the scientific BOPs. Trying to meet the objectives of both, to achieve least socioeconomic cost in the ultimate placement of no-take areas, represented a major challenge and exposed weaknesses in the ability to obtain all relevant data. The integrity and transparency of the RAP process, and, ultimately, the retrospective political and social justification of the basis for zoning, depended on the ability to successfully meet both sets of principles.

The application of the BOPs provided a starting point and a reference for what needed to be achieved. Given the scale of the GBRMP, there were literally thousands of candidate area options. These were then redefined many times over, with multiple solutions generated because of stakeholder input, including the comprehensive analysis of some 31,500 submissions from two formal public participations phases.

Through our experience in MSP, it is clear that objectives and operational principles need to be established upfront. They need to be anchored in the best available science, as well as what they are setting out to achieve and why, needs to be documented and publicly available. The whole process needs to be transparent and invite participation. The "problem" needs to be defined and clarified and the "proposed" scale of the solution justified. It is also essential to have staff members interact with and relate to community representatives who understand the implications of what is proposed at a personal level.

In essence, the operational steps are (adapted from Fernandes et al.2004):

- discussion and clarification of the problem;
- decisions on objectives;
- engagement of relevant and independent experts;
- description of the biodiversity, for example, through bioregions;
- definition of the operational principles that will achieve the objectives;
- substantive community input into all of the above;
- collection and layering of data in round-table discussions (and ensuring the appropriate balance of participants to include people who know and understand the uses of the area);
- for each alternative map of a no or restricted take area generated, reports of the degree of achievement of the principles; and
- organized strategies in place to effectively address negative socioeconomic impacts.

The remaining hurdles "will be political and legal and unique to each situation."

In any of these steps, consensus on all points and full agreement with the "certainty" of the science is unlikely to be gained. The level of protection that is sought needs to be defensible within both a political and regional context. If "multiple use," as a concept, is to be a

purpose and intent of MSP, then the protection requirements will need to be balanced against the constituents of wise and reasonable use of the areas in question. Finally, the result is worthless, if it is a "paper park." The resources to implement and effectively manage the area to achieve a satisfactory level of compliance are critical elements of success. These elements will be enhanced considerably if the ground work has been done to engender and maintain broad "area user" support; basically, the work will need to have been done to maximize voluntary compliance.

## THE FISHERIES ISSUES

The final development of the zoning plan was an iterative task force-led process. Candidate areas were examined and re-examined in light of submissions, and other information and data available. For this process to be effective, it was critical that staff members, who had a balanced knowledge-based appreciation of various stakeholder positions, were on hand during the round table decision-making. The processes were difficult and stressful. As a change was made in one place to accommodate legitimate considerations, it upset the degree of achievement with the BOPs in another. From a fisheries perspective, it was, at times, very difficult. It became obvious to those who understood and realized the effects on particular fishers or groups of fishers that some candidate area placements would negatively impact very heavily on them to the extent that their economic viability would be severely compromised.

Of the two sets of principles that had to be met, the socioeconomic principles were the more difficult to achieve. Internally and externally, they elicited the most controversy. Difficulties arise when, working with imperfect data sets, the attempt is made to analyze, then to comparatively evaluate social costs and benefits, including social resilience. The difficulty is compounded when there is widely differing opinion on the human, economic and intrinsic values of ecosystem services and the way that they are used by society (Lubchenko et al. 1991; Costanza and Daly 1992; McManus 1996). However, when resources are being reallocated from generating a private benefit, such as fishing, to a broader public good, such as biodiversity conservation[5], then this evaluation must be made. The costs are real and personal. Evaluation decisions affect people's livelihoods and, despite possible compensation or other remedial actions, they may affect a person's perception of his or her standing in society and, in so doing, affect the social fabric of a community. This "perception of personal standing" may not be an important issue for communities or people far from the areas under consideration. But it is real and socially significant for people living in communities near or adjacent to the areas affected. It is also politically painful and can divide communities.

In the GBRMP, there exists a particular difficulty related to both the range and the interpretation of data sources used to develop robust spatially-based estimates of the gross value of production (GVP) of various fishery activities. Compounding the difficulty was the knowledge, held by staff members with fisheries expertise, of the unreliability of logbook data. Through their collective knowledge of respective fisheries and involvement with the state fisheries management processes on management advisory committees and working groups, these staff members knew that logbook data for a number of fisheries were inaccurate enough, if taken at face value, to distort spatially-based GVP estimates. Although some fisheries spatially reported at 6x6 minutes (6nm$^2$) grid sites, the bulk of data was at the coarser scale of 30x30 minutes (30nm$^2$) grids. Fishing effort is not spread universally over an area; some areas are far more productive than others and fishers apply unique sets of knowledge and fishing strategies to maximize productivity from any given area. Compounding this further is the fact that some fishers work "in patches known to them," well away from others. On a pure, spatially-based GVP estimate, their catch may not be significant, but at the single boat level, a particular area may represent a substantial portion of their expected income.

Engagement with fisheries managers and fishers was problematic. Not only because it was difficult, as it obviously is when an objective of the consultation or negotiation is to find suitable areas to close to extractive activity. It was also difficult, firstly, because there were legal and jurisdictional policy barriers to obtaining all relevant data to support decision-making at the types of spatial scale that is necessary, when one is legitimately trying to minimize the socioeconomic costs of locating a no-take area. Secondly, to achieve the RAP biodiversity protection objectives, it became apparent that required decisions would result in resource reallocation and a serious, and probably unsustainable, displacement of effort in some cases that, if not ameliorated, would be a threat to the sustainability of fish stocks.

These factors made any consideration of who should be compensated, by whom, both political and problematic. That problem remains. Latency concerns in a number of fisheries were a major issue. If, at a spatial level, which is the case with zoning, one is reallocating fishery resources to another sector, and if compensation is being considered, then real effort applicable to the areas under consideration must be removed. Otherwise, little is achieved. In terms of achieving equitable outcomes, it is important that compensation goes to those who deserve it and who can prove that their effort in, and reliance on, a fishery is real.

5 Australian Government, January 2004. "Marine Protected Areas and Displaced Fishing: A Policy Statement."

In fisheries management, the application of an EBM approach designed to preserve the resilience and essential ecological character, and the connectedness of marine ecosystems, requires an interpretive change in some of the assumptions that have underpinned fisheries management. While multiple target and non-target stock structures and predator-prey and other ecological and habitat relationships will need to be examined and accounted for in an integrated way, a primary focus will also need to be on the way that fisheries resources are allocated. Recognition that the ecosystem itself requires an allocation changes the way that the purpose of resource allocation is viewed. It fundamentally changes how a share of a resource might be apportioned. This change of "share" has both an economic and an ecological consequence, and it changes the way that the optimal and efficient use of a resource might be considered.

Despite arguments and misgiving by sections of the fishing industry, it is imperative that fishery management agencies strategically plan to most effectively utilize the biodiversity protection processes and strategies encompassed within MPAs to ensure that resource reallocation, when it occurs, is equitable.

Marine environmental agencies possess and accumulate considerable data, knowledge and skills, as do fishery management agencies. In the fenceless marine environment, both sets of skills are required to conceptually manage ESD on an ecosystem basis. Fisheries agencies are the repository of data and knowledge about the respective fishery activities in their jurisdictions. They need to develop policy positions that enable them to proactively assist in designing MPAs for biodiversity protection. In so doing, they need to contribute and exercise control over information and fine scale data about resource usage so that appropriate and knowledge-informed decisions can be made about minimizing the socioeconomic costs of locating no- or restricted-take areas. The legal issues and jurisdictional conventions pertinent to fisheries data sharing and confidentiality protection need to be re-examined. In large part, when the conventions and rules were formulated, resource reallocation shifts from a private benefit, such as fishing, to a broader public good, such as biodiversity protection, were not normally matters that had to be contended with.

The objectives of fisheries and marine environmental management agencies, though different, should not be mutually exclusive. Both management streams need to weave their objectives together in a more cohesive manner, and they need to collaboratively optimize the use of data and knowledge resources. Extractive activities are a fact in the marine environment, and there is not a convenient set of fences or natural boundaries to separate activities and their impacts and the way that they can be managed. Current administrative and jurisdictional boundaries, coupled with "philosophical mindsets" that are often ideologically or politically-driven, are impairing the bringing together of knowledge that could reshape marine resource management and the optimal use of marine resources to achieve ecologically sustainable development across large tracts of the exclusive economic zones of nations. Importantly, for the community, the demarcation lines that polarize discussion and create angst in coastal communities need to be drawn together, in order to fully operationalize and give ownership to the meaning of ecologically sustainable development. Put simply, the camps need to come together.

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# New England Area Rotation of Scallop Beds

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## ABSTRACT

Area rotation is a form of marine spatial planning that has been used in scallop management in New England since 1998. While it began somewhat accidently, it is now one of the most successful examples of how marine spatial planning can be used to increase biomass and improve overall management of fishery resources. During the 1990s, the scallop fishery was experiencing overfishing and landings were relatively low. In 1998, areas with high concentrations of small scallops were closed to the fishery for three years. After these areas reopened, biomass and catch rates increased, and scallops were larger, leading to higher prices for vessels and lower fishing costs. These things, in turn, resulted in higher profits for the fleet. This program was expanded in 2004 under Amendment 10 to the Scallop Fishery Management Plan (FMP). Minor adjustments are continually made to further improve the program and make it more effective. The primary benefit of area rotation is reduced fishing time, which has positive impacts on the resource, bycatch and ocean bottom, as well as lower fishing costs. In addition, closing areas allows scallops to grow and maximize yield per recruit. This has beneficial impacts for the fishery, because larger scallops have a high price premium in the market. Area rotation does require high-quality, timely data on the size and location of the resource; effective enforcement of closed areas; a relatively rapid and flexible management system; and strong support from the industry, because closing prime scallop fishing grounds can be very controversial. Overall area rotation has been a very successful example of marine spatial planning for New England, because it has helped optimize yield in the scallop fishery and help prevent overfishing.

## BACKGROUND

The Atlantic sea scallop, *Placopecten magellanicus* (Gmelin), is a bivalve mollusk found in the Northwest Atlantic from North Carolina to the Gulf of St. Lawrence, typically in sand and gravel habitats (Hart and Chute 2004). Scallops recruit to the fishery at a shell height of about 90-105 mm, but smaller scallops have been landed in the past (NEFSC 2007). There are currently about 350 limited access permits that harvest scallops, primarily with a New Bedford-style dredge from vessels generally between 70 and 90 feet in length. The primary measures in place to control mortality in this fleet are limits on the number of days a vessel can fish, maximum number of trips a vessel can take in rotational access areas, limits on number of crew, and gear restrictions. A "general category" fleet, made up of smaller vessels, also harvests scallops. It lands less than ten percent of the total catch (NEFMC, 2007). This permit category was open access until recently, but now general category vessels fish under an individual fishing quota (IFQ) program based on catch history and number of years in the fishery.

The US scallop fishery began in the early 1900s with peaks in landings around 1960, 1978, 1990 and 2004 (NEFSC 2007), and low landings during the 1990s, as the stock became overfished. In 1994, large areas on Georges Bank were closed to reduce impacts on overfished groundfish species. Coincidently, these same areas overlapped with portions of scallop fishing grounds, and during the closure, scallop abundance increased dramatically. The fishery was granted limited access in 1999 and 2000 in parts of these areas that were expected to have high scallop catch rates and low groundfish bycatch. At the same time, two areas in the mid-Atlantic were closed to scallop fishing in order to protect small scallops that were found there in high concentrations (Hart 2003).

Since the late 1990s, scallop biomass has increased dramatically due to area closures, reduced effort, changes in fishery selectivity and strong recruitment. The stock is not overfished and overfishing is no longer occurring. Annual catch has been about 55-60 million pounds since 2003. Total revenue for the fishery has increased dramatically, and has been $350-400 million dollars a year since 2005, compared to less than $100 million a year in the 1990s.This is primarily because the average meat count of landed scallops is larger than in the past. Figure 1 depicts commercial landings by meat weight category from 1998 through 2006; the larger scallops (< u20) are just a fraction of the total catch in 1998, compared to the majority of the catch in 2006.

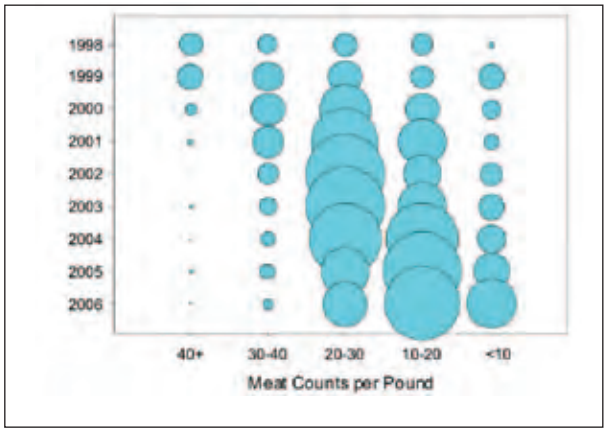


**Figure 1.** Commercial landings by meat count category, 1998-2006 (Source NEFSC 2007)

## AREA ROTATION TODAY

Today, there are six scallop rotational areas along the East Coast of the United States; three within pre-existing groundfish mortality closed areas on Georges Bank, and three more that were identified exclusively to protect small scallops in the mid-Atlantic region (Figure 2). Typically, several areas are open per year on a rotating basis. It is not always possible to have the same number of areas open each year, but the management program strives to maintain consistent catch levels. Area rotation has helped stabilize landings and prevent the "boom and bust" cycles that were evident in this fishery in the 1900s. As the area rotation program has expanded, the percentage of total catch from access areas has increased. For example, in 1998, there was only one area open and catch from that area was on a very limited basis very limited at 5,000 mt or about 20% of total catch. On the other hand, in 2007 and 2008, over 60% of total catch came from access areas (NEFMC 2010).

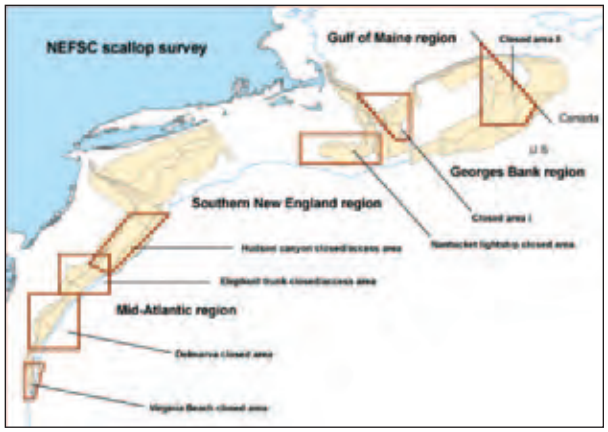


**Figure 2.** Map of scallop access areas and regions (shaded areas are strata from the atNEFSC dredge survey) (Source NEFSC 2007)

## BENEFITS

The primary benefit of area rotation is reduced fishing time, which benefits the resource, bycatch and ocean bottom. The less time scallop fishing gear is in water, the less it catches bycatch, such as flounders and skates. In addition, less fishing time translates into fewer potential interactions with protected resources, such as sea turtles. Lastly, if the gear is in contact with the ocean floor less, there are beneficial impacts on benthic ecosystems and habitats. Reduced fishing time also has benefits for the vessels because costs are reduced. In the past, it could take two weeks to land 18,000 pounds of scallops – the equivalent of one access area trip. In some cases, trips are now as short as five or six days for the same 18,000 pounds. That represents a huge cost savings for vessels. In addition, by closing areas, scallops can grow larger to maximize yield per recruit, which has beneficial impacts for both the stock and the fishery, because larger scallops have higher fecundity and have a high price premium in the market. Now that there is a steady supply of larger scallops from US fishing grounds, the industry has been able to compete in new markets around the world. Lastly, there is some evidence that closing areas may allow for "spillover," in the form of increased scallop recruitment in adjacent areas.

## CHALLENGES

There are some challenges that accompany area rotation. Because it requires detailed surveying of the areas, it is expensive. The federal government supports a dredge survey that has evaluated the scallop resource in the same manner annually since 1979. The management program has solved some of the cost issues associated with area rotation by setting aside 2% of the projected catch each year to fund scallop research. A portion of that catch is used to assess the resource for setting allowable catch levels and identifying new scallop access areas. In addition to survey costs, adjusting the scallop area rotation program takes a considerable amount of resources for data processing, analysis and monitoring. Accurate enforcement is a critical component to the success of area rotation. Vessels are now required to have a vessel monitoring system (VMS) onboard that informs NMFS of their location 24 hours a day to help enforce access area closures. Adjustments to the overall program have been made based on concerns voiced to the Council. For example, there have been safety and fairness issues related to allocating trips that are far from particular ports. Luckily, the system is flexible enough that modifications can be made relatively easily and quickly. Finally, area rotation cannot be the only tool to control mortality. Other measures are necessary to reduce impacts on scallops and prevent overfishing, such as limits on crew size, minimum ring size on gear, and DAS limits to control fishing effort in open areas.

Probably the largest challenge for area rotation in New England is that scallop management is not the only issue facing the Council. Other management programs, such as the Groundfish Plan and the Essential Fish Habitat Plan, are imposing restrictions on the scallop fishery that prevent area rotation from working as effectively as it could. For example, additional closed areas can be imposed outside of the scallop plan that may overlap with future scallop access areas. However, that is a major challenge of the Magnuson Stevens Fishery and Management Act: The Council must continually weigh the costs and benefits of each action and identify the strategy that minimizes the impacts and maximizes the benefits on the ecosystem overall.

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## Taiwan's Experience with Marine Protected Areas

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In 1992, the Fourth World Congress on National Parks and Protected Areas, held in Caracas, Venezuela, explicitly defined a "Protected Area" as "…an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means" (IUCN 1994). For the purpose of protected areas management, the International Union for the Conservation of Nature (IUCN) has defined a suite of six protected area management categories, based on primary management objective:

1. Strict Nature Reserve/ Wilderness Area
2. National Park
3. Natural Monument
4. Habitat/Species Management Area
5. Protected Landscape / Seascape
6. Managed Resource Protected Area

Of these, the category of Managed Resource Protected Area has the most flexibility, with a management target of sustainable use of natural resources. This category of protected area contains predominantly unmodified natural systems, and is managed to ensure long term protection and maintenance of biological diversity, while providing, at the same time, a sustainable flow of natural products and services to meet community needs. Marine protected areas (MPAs) have become a popular tool and have been established by many countries globally, with goals of both conserving the marine environment and ensuring the sustainable use of natural resources within the marine protected area.

Taiwan is an island country surrounded by the sea in the subtropics, between 120 and 122°E° longitude and 22 and 25°N latitude. The west coast of Taiwan is predominantly a flat coastal plain, with an extensive continental shelf and well-developed sand banks, wetlands and tidal flats. Taiwan's east coast is predominantly steep cliffs with a narrow continental shelf, with numerous bluffs, sea caves and reefs. Taiwan's north coast is adjacent to the East Sea, which is adjacent to China, while the southern coastal area abuts the Bashi Channel. Taiwan's coastal and near shore marine ecosystems are highly productive. It has a high diversity of marine ecosystems, including rocky shores, estuaries, sand flats, coral reefs and near shore and pelagic ecosystem, with high marine species diversity.

Over the past several decades, global fisheries have become increasingly industrialized. As a result, 90% of large fish stocks are now overexploited and 75% of commercial fish stocks are depleted. As a result of the pollution of coastal habitats, the diversity of marine species has dramatically declined and many fishery resources are severely depleted. There is a growing body of empirical evidence from global research that MPAs offer an effective and economically viable approach to conserve marine resources. MPAs have been adopted by numerous countries globally and their establishment has been a common objective of several countries.

Management of marine areas in Taiwan is conducted by several authorities, including for fisheries, wildlife conservation, tourism, environmental protection, national parks and cultural resources. For the maintenance of marine ecological diversity, each authority, in accordance with their function and objectives, establishes conservation area zones, which are types of marine protected areas. These include fisheries resource conservation areas, wildlife protected areas, wildlife important habitat environments, nature reserves, national designated scenic areas, coastal protected areas and national parks. In addition, the National Council for Sustainable Development,

Executive Yuan, modified the Taiwan Sustainable Development Indicators on December 31st, 2009, which includes MPAs as one of the indicators. Currently, MPAs in Taiwan cover an area of about 233,000 hectares (excluding Dongsha Atoll National Park), comprising 9.28% of Taiwan's territorial waters (2,511 hectares). Marine national parks are planned near the area of Green Island, Penghu Archipelago and the Three Northern Islands.

MPAs usually overlap commercial or traditional fishing grounds and recreational areas, and impose certain restriction on these activities. Therefore, during the planning process, local fishers and residents usually express opposition to the establishment of MPAs. After their establishment, some protected areas are managed by local governments. However, due their limited budget, staffing and resources for enforcement, such as patrol boats, the protected areas sometimes do not fulfill their objectives.

Surrounded by the sea, Taiwan has a marine environment that is critical to economic development in the nation. Therefore, conserving the marine ecosystem and ensuring the sustainable use of fishery resources are both fundamental tasks for the government. While we can expect opposition to the establishment of MPAs, they are a critical tool in preventing the continued decline of the health of marine ecosystems and fishery resources. In the future, the Taiwan government will expand the fleet of enforcement vessels in protected areas and will enlarge the coverage of MPAs, with a goal of 20% coverage of territorial waters by 2020.

## Incipient Implementation of Marine Spatial Planning in Puget Sound

**David Fluharty**
School of Marine Affairs, University of Washington

Puget Sound (including the Straits of Juan de Fuca), located in northwest United States, is a major estuarine body of water that provides many benefits to residents and visitors to the area in Figure 1. Commercial and recreational fisheries, marine transportation, shellfish aquaculture, beaches, as well as habitat for marine mammals, seabirds and other living marine resources, plus aesthetic and other values, make it a major contributor to quality of life in the region. Over time, many of these qualities have been diminished as a result of complex interactions among overfishing, marine pollution, habitat alteration, etc. Significant efforts to reduce the impacts of society on Puget Sound have not succeeded in reversing many of the negative trends. Recently, serious efforts to restore Puget Sound to a healthier condition have been started.

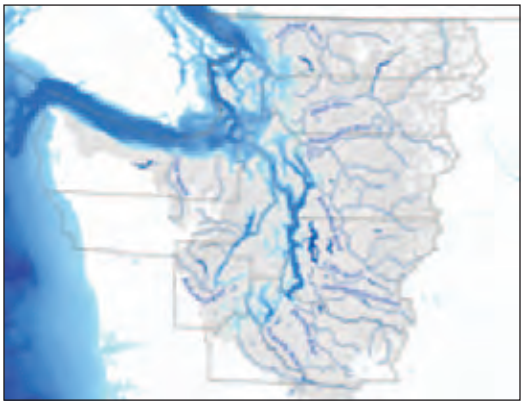

**Figure 1.** Puget Sound and adjacent watersheds

Building off of efforts in the 1970s and 1980s, the Washington State Legislature created the Puget Sound Partnership as a science-policy governance structure that is charged with developing action plans to cause ecosystem-wide restoration. This partnership combines efforts to control marine pollution and habitat degradation, as well as a Shared Salmon Strategy that evolved to solve the problems associated with salmon and other Puget Sound species listed as "endangered" or "threatened" under the US Endangered Species Act. Salmon especially are iconic of the life cycle linkages between watersheds, the Puget Sound estuary and the oceans.

The hallmark of this partnership is a science-based integrated ecosystem assessment that is planned and implemented on a basin-wide scale. While the partnership's action plan is in early stages of implementation, the stepwise program to make progress is clearly spelled out. First, the partnership has articulated the objectives for and scale of management. Second, the partnership is in the midst of developing ecosystem indicators and thresholds. Third, through modeling and scenario-building, ecosystem-scale risk analysis is being performed to identify priorities. Fourth, while management changes are being made, monitoring and management strategy evaluation are being incorporated to inform adaptation and choice of improved management strategies. Finally, the cumulative effect of these steps is implementation of selected management strategies.

Tough management choices have to be made about tradeoffs among management strategies; and ecosystem-based goals are intended to discipline and to make explicit those policy choices. This holistic management approach is being implemented at the local, basin and ecosystem level through efforts to inform and create incentives for the restoration of Puget Sound. Already, it looks as if promising aspects are appearing. However, there is a long way to go to not only maintain, but to restore a healthy Puget Sound in light of increased population and other challenges.

**SESSION 2:** CASE STUDIES OF COASTAL AND MARINE SPATIAL PLANNING AND MANAGEMENT

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## Session 2B: Summary

# **Case Studies of Coastal and Marine Spatial Planning and Management:** Perspectives from the Commercial Marine Capture Fishing Industry

**SESSION CHAIR: Mr. Henk Brus**, Atuna

**TARGET OUTCOMES:** How can marine spatial planning be adapted to meet specific social, economic, cultural, and environmental contexts of fishing communities?

Five case studies, providing the perspectives of the commercial fishing industry, were presented in this session. Each contrasted the management perspective of the same focal area presented in session 2A. Case studies did not include examples of spatial planning in international water, which will involve more complex legal frameworks, and mechanisms for surveillance and enforcement.

Case studies presented from the Northwestern Hawaiian Islands (see abstract by Timm Timoney) and Great Barrier Reef (see abstract by Andrew Tobin) highlighted how the voice of the fishing industry did not receive equitable consideration during planning and establishment of these areas. Those directing the process pursued as a target outcome the elimination of extractive activities, without an empirical basis for why this would or would not contribute to ecosystem maintenance. The Northwestern Hawaiian Islands case study also revealed how, when a small fishing industry has limited resources, it reduces its political negotiating influence relative to other interest groups.

In contrast, the transition of the US New England scallop fishery from an open-access overfished and overcapacity fishery, into a strictly managed, spatially structured fishery demonstrates a successful application of marine protected areas. This case study highlighted the crucial importance of industry buy-in and commitment to the new management plan in achieving the successful transition (see abstract by Bill Wells). The results were stunning in the rebuilding of scallop biomass and landings. Similarly, actions taken to recover rockfish populations on the US West Coast, involving the establishment of areas closed to trawling and hook and line fishing, were successful (see abstract by Marion Larkin). However, in both of these case studies, successful resolution of overfishing and overcapacity was achieved through substantial hardship within the industry and broader communities.

The fishing industry experiences in Taiwan with marine spatial planning in Chunghwa County represent another success story (see abstract by Yi-Ping Hung). In this section of coastal Taiwan, authorities have balanced activities including aquaculture, set net fishing, harvesting of mud shrimp and deployment of artificial reefs.

Examples of successful and unsuccessful approaches to the elimination of fishing capacity were provided. Government assistance through buyouts and retraining can be successful.

Implementing marine spatial planning in developing countries, where resources for surveillance and enforcement are relatively limited, will also require industry buy-in. If the fishing industry believes they will benefit in the long term through reductions in effort and capacity, there is a greater chance that they will undertake these hardships.

In some regions, fishermen have gone beyond marine protected areas, which are only one facet of marine spatial planning, to address how to share marine space with other industry sectors, such as energy industries and the whale watching industry. The Gulf of Mexico oil spill provided a timely example of how increased employment of marine spatial planning is needed; in this case, fishing industries can be heavily impacted as a result of poor governance of other marine industries.

Perspectives from fishermen and discussion from the floor identified the following considerations in adapting marine spatial planning:

- Involvement and adequate representation of fishermen and members of the fishing industry throughout the process will be crucial in gaining their support;
- Buy-in from fishermen and members of the fishing industry in the process and resulting plans will increase the acceptability of temporary hardships that may occur; and
- Balancing commercial and conservation activities instead of excluding commercial activities may lead to successful marine spatial planning.

## Session 2B:
# Abstracts

## Socioeconomic Effects on Commercial Fisheries from Spatial Planning by the US Papahānaumokuākea Marine National Monument

**Timm Timoney**
Northwestern Hawaiian Islands Bottomfish Fisher

As bottomfish fishermen made their last trips to the Northwestern Hawaiian Islands (NWHI) in the fall of 2009, the fishing chapter in the long history of these remarkable Islands was brought to a sad close. Over the years, a variety of fisheries succeeded and failed in this region. The first to harvest the NWHI's bounty were Hawaiians feeding their families and villages. Centuries later, larger commercial endeavors began. These included diving for pearl oysters; longlining for tuna and swordfish; trapping lobster, shrimp and Kona crab; directed longline shark fishing; seining for *ulua* (giant trevally); and even illegal coral dragging. And, of course, there is a long history of bottomfishing for snappers and groupers in the NWHI.

When my husband, Tim, and I started fishing in the NWHI in 1983, we could pretty much fish from Nihoa to Kure. Three mandates changed that access: 1) the Western Pacific Regional Fishery Management Council's (WPRFMC) fishery management plan (FMP) for bottomfish, 2) an Executive Order signed by President Bill Clinton in 2000, and 3) President George W. Bush's Executive Order, which created the NWHI Marine Monument. These three management measures were developed using very different processes.

With input from an array of people, including fishermen, scientists and economists, WPRFMC implemented an FMP that started with dividing the huge area of the NWHI into two zones. The farthest from the Main Hawaiian Islands is the Ho'omalu and the closest is the Mau. The Ho'omalu zone became a limited entry fishery. People who had fished in the NWHI were eligible for a permit, but now with restrictions. There was a time limit to claim the permit and then these permitted fishermen had to either use it or lose it, where minimum numbers of trips and of pounds caught per year were required in order to retain the permit. This measure quickly reduced the field of participants. The most contentious part of this FMP was the non-transferability of the permits. Fishermen with permits were of the opinion that the value of their boats would be reduced, if they could not sell or transfer the permit along with the sale of their boat. But others wanting a permit thought the permit was an unearned windfall. The decision to make the permits non-transferable, ultimately, was not a top down decision, but instead was arrived at after public meetings with active fishermen and potential stakeholders.

President Clinton's Executive Order #13178 of 2000 created the NWHI Coral Reef Ecosystem Reserve. It also created an advisory committee charged with creating a NWHI National Marine Sanctuary. The sanctuary establishment process was to be public and transparent, with stakeholder input from a wide variety of sources. For most working fishermen, this was their first exposure to the concept of marine spatial planning. It was an excruciatingly painful process, and the NWHI fishing community did not fare well. While ostensibly this was a coral reef initiative, where bottomfishing has little ecological impact, it was obvious from the start that most of the committee members believed that a total ban on any fishing would be the only acceptable outcome.

One of the first hurdles that we never did overcome was simply the makeup of the advisory committee. Designated members came from a wide array of interest groups. There were multiple representatives and alternates from environmental non-governmental organizations (NGOs), Native Hawaiian groups, marine tourism industry representatives, and representatives of the general public. The education and outreach seats were filled with folks whose mantra was to look and learn, but not allow any access to the NWHI. An environmental NGO seat was filled by a lawyer who had sued the bottomfish fishermen over killing and harassing endangered Monk seals. The suit was baseless and he lost the case, but this individual continued to assert, when he could, that the NWHI bottomfish fishermen were harming Monk seals. Fishermen were represented through a single seat on the advisory

committee, with one alternate. We asked for at least a second alternate, as the designees were working fishermen and could not always be there without serious financial sacrifice. We were soundly voted down. Many of the other representatives were in paid positions that facilitated their presence or outright paid for them. They suffered no loss of income by participating in the government meetings, unlike the commercial bottomfish fishermen.

Over the next several years, working NWHI and Main Hawaiian Islands fishermen participated in seemingly endless and futile public "visioning" sessions, working groups, policy groups and advisory council sessions. However, 8-14 fishermen didn't make an impact and we were pretty much ignored, and not benignly.

Probably the worst moment came when we still thought we would be allowed to fish, after attending meeting after meeting with contractors representing the NWHI Reserve and government officials to hash out closed fishing areas to meet concerns about seals, essential fish habitat and nursery grounds. We had identified areas important to us and agreed to not fish in others. When proposed regulations were published, however, huge areas of prime bottomfish fishing grounds were closed to fishing. To add insult to injury, these had been identified by scientists as areas of low concern.

These regulations, along with the end of all fishing in 2011, became final rules when President Bush created, by Executive Order, a National Marine Monument under the Antiquities Act. The NWHI fishing community was stunned. And then we became enraged. So many flat-out lies and questionable science had led to this. Our small group of fishermen and supporters never had a chance against huge environmental NGOs, deep pocket foundations, and their sophisticated politicking.

NWHI fishermen, as a group, have always been a proud bunch. We are proud of the quality product that we took such care to bring to market. We are proud to share our catch with family and friends. We are proud that the waters we have fished for years are considered pristine. The concept of a marine sanctuary with input on governance from myriad stakeholders is not without merit. However, I believe the folks of Hawaii really lost out on this one.

## Fishing Industry Experiences with Great Barrier Reef Marine Park Marine Spatial Planning

**Andrew Tobin**
Queensland Seafood Industry Association

The Great Barrier Reef World Heritage Area (GBRWHA) Representative Areas Program (RAP), legislated in June 2004, increased no-take (no fishing) area coverage within the marine park from a previous 4.6% to 33.3%, with understandable consequences on extractive commercial fishing industries with historical activities within the park. Although the RAPs primary objective was to protect the unique biodiversity within the GBRWHA, throughout the consultation process, theoretical benefits to sustainable fisheries production were often claimed by advocates of marine spatial planning as a significant secondary benefit of RAP that the fishing industry should be happy about. Espousing these values in the absence of empirical evidence is nonsensical, and marine spatial planning advocates should practice more caution before pushing these claims that often create undue tensions within fisheries sectors.

The theoretical fishery benefits of marine parks are two-fold: 1) Animals are directly protected from fisheries extraction while harboring within no-take zones; and 2) progeny spill-over occurs from no-take zones. The first claim, protection from fisheries extraction, may well be sound for sedentary species, provided non-extractive area coverage is larger than the species of interest usual home range. However, many species have pelagic and semi-pelagic ecologies that encompass large scale movements often across a wide variety of habitats. In such instances, marine spatial protection benefits may be marginal at best. The second claim of spill-over benefits is also largely restricted to species that may be likely to re-build their populations in the absence of fishing extraction. The resultant net benefit of progeny spill-over, either through larval dispersion or by adult individuals moving out of an area, is limited by carrying capacity.

The focus of this case study is to present some preliminary data from projects investigating the efficacy of the GBRWHA RAP in offering protection to a suite of coastal shark species targeted by a commercial net fishery. Some preliminary data will also be presented on the benefits offered to sedentary reef fishes (population increases), as well as potential benefits from spillover effects.

## Industry Experiences with Atlantic Sea Scallop Area Rotation

**Bill Wells**
Seafood Scallop Company

### ABSTRACT

Area rotation has dramatically changed the yearly harvest of Atlantic sea scallops. Area rotation began in 1998 with three special management areas. The fishery now operates with six special scallop management areas and the harvest within these areas is approximately 50% of the yearly industry harvest.

### PRE-AREA ROTATION

Fleet-wide landings averaged 10-12 million pounds per year. Vessels were in the ocean approximately 240 days per vessel. Every peak in biomass was soon harvested due to an immediate and significant pulse of effort. In 1994, limited entry special management areas, maximum crew size, gear restrictions and a limit on days-at-sea were implemented.

### POST-AREA ROTATION

Fleet-wide landings are averaging 50-55 million pounds per year. The average landed size is 10-20 meats per pound, with an increased opportunity for even larger sizes. A major benefit is reduced bottom time due to high catch-per-unit-of-effort.

### THE FUTURE

There is an overlap with other plans that inhibit effective rotational scallop management. Surveys are critical and expensive. There is a shortage of smaller, less expensive scallops. This causes users of the smaller, less expensive scallops to either buy larger and more expensive scallops, purchase foreign scallops that are generally opened by machine and less tasty, or purchase processed US scallops of a larger size with a lower price point.

The other negative aspect of area rotation is philosophical: Fishermen want to compete against other fishermen. Closed area fishing makes all men and all boats equal, because there is a universal harvest limit of 18,000 pounds per vessel per trip.

On the positive side, biomass is up, bycatch is down, the market is adapting to larger scallops, average landed meat count is up and revenues and profitability are both higher. Area rotation works.

## Taiwan Experiences with Marine Spatial Planning: The Case of Chunghwa County

**Yi-Ping Hung**
Changhua Fishery Association

### ABSTRACT

The coastal area of Chunghwa County, located in the central western portion of Taiwan, has a 50 km-long coastline and the largest mudflat in the nation. A branch of the Kuroshio Current flows from south to north into the Taiwan Strait, together with a current from the South China Sea and a north-south current flowing along Mainland China. These current systems create a highly productive marine environment adjacent to Taiwan, and support productive fishing grounds of commercial fish and shellfish species. However, Taiwan's coastal ecosystems have been degraded from recent high fishing effort, altered coastal morphology from sand mining, and coastal pollution. Wise management and use of Taiwan's coastal resources are critical to ensure sustainable fisheries development. To this end, the Chunghwa Fishermen Association applied for exclusive fishery rights in accordance with the Fisheries Act and obtained a Fishery Right Permit in 2009. An area of 42,071 hectares is included in this permit, which extends seaward from the mean high-tide line. Through these exclusive fishery rights, the Chunghwa Fishermen Association has established time/area management measures for shallow marine aquaculture and offshore fishing operations within the coastal area of Chunghwa.

### MARINE SPATIAL PLANNING

The broad intertidal zone along the Chunghwa coast, with marine and river sand deposits, provides suitable habitat for shallow marine aquaculture. The area between the low tide line and offshore is zoned for shallow marine aquaculture use, and is used primarily to breed oysters and clams. In coastal areas that are not suitable for aquaculture, various coastal fishing gears are permitted and used. The channel entrance is used to collect fish fry. The area from the low-tide line to 25 m depth is zoned for traditional fishing, and is reserved for use by small-scale gillnet and pole-and-line fisheries, as well as some trawl fishing. To conserve fishery resource, trawlers are prohibited from operating within three miles of the coastline, while trawl vessels greater than 50 tons are prohibited from operating within 12 miles of the coastline.

## MANAGEMENT OF COASTAL FISHERIES

- **Shallow marine aquaculture management:** Permits for shallow marine aquaculture are issued for oyster farming and boundaries are demarcated using a global positioning system.
- **Offshore fisheries management:** The Changhua Fishery Association issues licenses for offshore fishing. A list of fishers issued exclusive fishing rights has been established and maintained. The Association also guides and assists fishers to meet catch reporting requirements.
- **Coastal area management measures:**
  - A management structure to issue exclusive fishing rights has been established.
  - Guidelines for marine capture and aquaculture fishing operations and dispute settlement have been established to fulfill the objectives of the management of coastal areas.
  - Volunteers are organized to staff a patrol unit. These volunteer enforcement staff members prevent the entry of tourists or other non-permitted groups into the commercial fishing areas.
  - Fisheries culture tours are organized seasonally to provide an opportunity for the general public to improve their understanding of the fishing industry and fishing culture.
  - Outreach is conducted to improve the knowledge of fishers on their fishing grounds by disseminating information on fishing and aquaculture zones, closed area zones, and rules. Activities include the establishment of a bulletin board with information posted on the extent of exclusive fishing rights.
  - Beach cleanup activities are held annually to provide a clean marine environment and to ensure navigation safety for vessels.
  - Navigational channel markers are deployed and managed. From 2005 to 2009, 7,825 stakes were installed in major navigation waterways of Chunghwa County to guide fishing vessels and rafts entering and leaving port.
  - Roadways to beaches are paved and maintained to enable vehicle access.

## CONSERVATION MEASURES FOR MARINE RESOURCES

- **Marine patrol unit:** The Association established six at-sea patrol units to conduct surveillance and to report illegal fishing activities.
- **Marine pollution warning system:** Marine pollution liaisons have been established in seven branch offices of the Association to quickly communicate with the Authority of Environment Protection when marine pollution incidents occur.
- **Dissemination of information on fisheries conservation measures:** Workshops and tours are held annually to disseminate information on fisheries conservation measures to improve the knowledge of conservation measures and to promote support amongst the fishing sector to comply with the measures.
- **Release of fish fry:** From 2004 to 2008, 1.45 million sea bream fry were released into the marine area adjacent to Chunghwa County.
- **Establishment and management of a mud shrimp conservation area:** To conserve sensitive species of Chunghwa County, a 36-hectare conservation area has been established to protect mud shrimp habitat in Shenkang Township. Conservation groups for mud shrimp have been established to conduct surveillance and management of the conservation area. Employing the assistance of volunteers from community and school groups, an environmental education campaign was initiated in order to raise community support for natural resources conservation activities. In addition, a second mud shrimp conservation area is planned for the Wang Kung area.

# Fishing Industry Experiences with Marine Spatial Planning on the U.S. West Coast

**Marion J. Larkin**
Owner and Manager, Ocean Hunter Enterprises LLC

When I began fishing in 1973, there were few regulations restricting how, when and where fishers could fish. Since then, a plethora of management measures has been implemented that restrict fishing activity. Among these measures are caps on vessel deliveries by species in monthly or bi-monthly periods, and closed and restricted fishing by gear type. This has involved closing most of the shelf inside 125 fathoms to trawl fishing to protect and hasten the rebuilding of overfished species, such as Yellow Eye Rockfish and Canary Rockfish. Forty-one non-bottom trawl areas were also designed, where the use of bottom contact gear by the trawl fleet is prohibited. This overlaid patchwork of regulated areas has created a burdensome, but flexible management system, which has increased enforcement problems, created economic inefficiencies as well as concentrated the fleet into smaller, more intensely fished areas. The closing of a fishing area near shore off the north Washington coast eliminated the 70-year-old trawl fleet operating from Neah Bay, Washington. Fishermen no longer pursue migrating fish year-round throughout their range of depths and habitats, but, instead, must wait for the fish to come to an open area.

Marine spatial planning and implementation have direct impacts on the efficiencies and economies of fisheries and the communities they support. The costs of harvest have gone up, as the fleet fishes more inefficiently in areas of lower abundance and travels greater distances to open areas.

Fishers must be included in marine spatial planning at all levels of discussion, and in particular, when restrictions are placed on where they can fish. Without fishing grounds, there are no fisheries.

**SESSION 3:** MITIGATING BYCATCH OF SENSITIVE SPECIES GROUPS IN MARINE FISHERIES

**Session 3A:** MITIGATING SENSITIVE SPECIES BYCATCH AND MANAGING DISCARDS IN SMALL SCALE FISHERIES, INCLUDING COASTAL ARTISANAL PASSIVE NET FISHERIES


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## Session 3A: Summary

# **Mitigating Bycatch of Sensitive Species Groups in Marine Fisheries:** Mitigating Sensitive Species Bycatch and Managing Discards in Small Scale Fisheries, Including Coastal Artisanal Net Fisheries

**SESSION CHAIR: Dr. Ussif Rashid Sumaila**, Director, Fisheries Centre, University of British Columbia

**TARGET OUTCOMES**: Identify the state of progress and priorities for mitigating bycatch in small scale coastal fisheries.

Assessments of bycatch in small scale fisheries are generally challenging due, in part, to data limitations, including fishing effort, the temporal and spatial distribution of this effort, and associated bycatch rates. The relative degree of threat small scale fisheries pose to sensitive bycatch species groups is also difficult to model due to limited information across mortality sources. A mapping tool to estimate regional fishing effort, methods employing low-cost interview surveys, and employment of onboard observer programs were described and contrasted (see abstract by Rebecca Lewison). Observer selection and training were seen as critical factors in successful observer programs in artisanal fisheries.

Through examples from mitigating sea turtle bycatch in South and Central American small-scale longline fisheries, benefits of direct participation of artisanal fishers were identified in order to achieve successful fishery assessment and bycatch mitigation activities (see abstract by Martin Hall). In some regions, achieving wholesale adoption of gear technology bycatch mitigation measures would require minimal cost to fishermen who operate on very slender profit margins. Conducting commercial demonstrations of bycatch mitigation methods, by trialing these techniques on actual fishing vessels, was identified as a critical part of the process to achieve identification and adoption of effective solutions, based on lessons learned in working with small scale fisheries in the South and Central America regions.

A case study of Taiwan's history of whale shark fishing and transition from exploitation, to annual quotas, to conservation, provided an example of management in a data-rich coastal fishery (see abstract by Shoou-Jeng Joung).

A study in Taiwan collected information on the movements of loggerhead sea turtles, which was combined with oceanographic data on eddy systems (see abstract by Donald Kobayashi and I-Jiunn Cheng). The combined datasets showed the importance of cyclonic eddies to these turtles, and how loggerheads made use of the marine environment in East Asia and Southeast Asia. The study revealed a loggerhead hotspot in the East China Sea, that covered over 400,000 square kilometers and included the continental shelf waters of Taiwan, China, Japan and Korea.

Gear technology approaches to mitigating problematic bycatch were described, including:

- Pingers to reduce interactions with marine mammals in passive net fisheries (see abstract by Geoff McPherson);
- Modified designs of Japanese poundnets to mitigate sea turtle bycatch (see abstract by Osamu Abe); and
- Changing hook types from J-hooks to circle-shaped hooks and use of segments of monofilament in polypropylene longlines to mitigate sea turtle bycatch in small-scale longline fisheries (see abstract by Martin Hall).

Employment of catch-to-bycatch ratios to spatially plan the temporal and spatial distribution of fishing effort so as to balance target species and bycatch species catch rates were also discussed.

## Session 3A:
# Abstracts

## Assessing Bycatch in Small-scale Fisheries and an Estimate of Global Impacts

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Recent evidence points to the potential for artisanal fisheries to have significant negative impacts on marine mammals and sea turtles caught incidentally as bycatch. Because artisanal fisheries are globally ubiquitous and may account for > 95% of the world's fishers and because of the highly migratory nature of bycatch species, the putative impact of bycatch from artisanal fisheries can extend far beyond endemic populations in particular countries and has been linked with population declines of bycatch species at the level of the ocean basin.

One of the central challenges to understanding the impact of artisanal fisheries is the lack of fishing effort data (i.e., the number of boats, the amount of gear deployed, or the frequency of fishing activities), and a lack of knowledge of the spatio-temporal dynamics of coastal fishing fleets. Efforts to describe small-scale fisheries are hindered by lack of resources directed toward data collection, the dispersed nature of the fisheries, disparity among data sources, limited data availability in some areas, a scarcity of spatial information, as well as the high rate of change in both target species and gear types within a short time frame. Here I describe research conducted as part of Project GloBAL (PG) that presents two different approaches to collecting fisheries and bycatch information from artisanal fisheries – spatial mapping of fisheries data and interview-based assessments. These data, paired with existing bycatch information, highlight the larger issue of fisheries sustainability in artisanal fisheries, both in terms of catch and bycatch. We introduce a model for pairing these data with more detailed socioeconomic studies as a way of providing meaningful context and a framework for addressing these challenges.

Using a mapping tool developed for assessing fishing effort in Caribbean fisheries, the PG research team integrated United Nations Food and Agriculture Organization (FAO) data, national fisheries reports and published research to characterize fishing pressure in the coastal waters of six marine regions: West Africa, the West Indian Ocean, Southeast Asia, the Caribbean, the Southwest Atlantic, and the eastern tropical Pacific. Through this process, we were able to map regional-scale patterns of coastal fishing effort and examine the relationship among average fishing effort densities, economic development levels and other demographic parameters within and among countries and regions. We present a novel approach to mapping fishing effort across disparate ocean regions, based on the development of a common fishing effort metric that allows for interregional comparisons. The goal of our analysis was to compare the relative density of coastal fishing effort and to consider potential socioeconomic and physical correlates of fishing density among six different marine regions. Our approach provides a method for quantifying fishing effort and serves as a means to identifying areas where overcapacity may threaten fisheries sustainability and the integrity of coastal ecosystems.

PG also conducted an intensive pilot study to evaluate whether low-cost interview surveys can be effective in assessing fishing effort and bycatch in artisanal fisheries over large areas. Results of this preliminary study suggested that high bycatch of marine mammals and sea turtles are the rule, rather than the exception, in the world's artisanal fisheries. The apparent magnitude of cetacean and sea turtle bycatch in each country surveyed was comparable to the alarming numbers from recent case studies of other artisanal fisheries. However, challenges encountered during this pilot work precluded statistically robust bycatch estimates or comparisons of bycatch levels across study areas and species. The pilot study did provide support for the interview-based methods and has led to additional work to develop a methodology by which local scientists and managers can collect and analyze small-scale fisheries and socioeconomic data. This new phase

of work will serve as a first step in the process of the development and evaluation of management plans that minimize bycatch and ultimately improve fisheries sustainability in small-scale fisheries. While our bycatch data quality is less accurate than direct observation, the survey efforts we describe provide essential information on fishing activity and will also explore the social drivers of bycatch, focusing on the fundamental factors that ultimately lead to bycatch. Our proposed efforts will improve our understanding of the drivers of bycatch and provide a means of evaluating the socio-economic impacts of proposed management actions that could be implemented to reduce bycatch.

## Managing Whale Shark (*Rhincodon typus*) Fishing Mortality in Taiwan

**Hua Hsun Hsu[1], Shoou Jeng Joung[1]*, Kwang Ming Liu[2], and Yi Yia Liao[3]**

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The whale shark (*Rhincodon typus*) is the largest fish in the world, with a circum-global distribution. Due to its life history characteristics and high mortality in fisheries, this species is listed as "vulnerable" by IUCN and is included on CITES Appendix II. From 1996 to 2008, a total of 597 individual whale sharks were caught in Taiwan fisheries. These ranged from 1 to about 13 m in total length (TL), with an average length of 4.6±1.2 m (1SD). Mean TL of whale sharks caught from June to October was smaller than the mean TL of those caught from November to May. Most landed whale sharks were sold to markets in eastern Taiwan. Males comprised the majority of the whale shark catch in Taiwan waters. The mean annual catch of whale sharks in set nets in southwestern Taiwan were the highest of all of the Taiwan fishing areas.

A whale shark catch reporting system was initiated by the Taiwan government in 2001. Since 2002, a total allowable catch (TAC) limit was set at 80 whale sharks per year. In 2005, the TAC was reduced to 65, further lowered to 60 in 2006, then 30 in 2007, and finally the retention of whale sharks was banned in 2008. Total annual catches were dropping annually from 2001 to 2004, but catch levels in the set net fishery increased since 2005; in 2008, 165 individuals were caught in set nets, all of which were released.

Nine individuals (3.8-9.6 m TL) were tagged and released with SPOT or PAT tags. Data from electronic tags was compared to information on sea surface temperatures, the location of thermal fronts, ocean color, bathymetric topography, and typhoon paths. Findings suggest that whale sharks generally stay within 50-150 m below the sea surface, and in waters with temperatures between 15 and 32 °C. Additionally, in the summer and fall, whale sharks were observed to remain in deeper waters during the daytime, and ascend to shallower depths at night, especially from midnight to dawn. In the winter and spring, whale sharks surfaced frequently both during the day and nighttime. Whale sharks were observed to migrate in the open ocean and reached 146.77° E in the summer and fall, and moved to coastal areas of the east Asian continental shelf during the winter and spring.

In order to study whale sharks' age and growth, biannual growth rings in vertebrae of 92 whale sharks were studied. Vertebrae from two full-term embryos, a 61.0 cm TL female and a 54.8 cm TL male, obtained from a pregnant female caught in 1995, were also investigated. Previously published data from a 64-cm-TL embryo was also pooled into the dataset. Data from these 95 vertebrae were fit to a three-parameter von Bertelanffy growth equation (VBGE). The parameters for VBGE were estimated to be $L_\infty$=16.31 m TL, $k$=0.037 year$^{-1}$, and $t_0$=-1.24 years for both sexes. Age at maturity was back-calculated from VBGE and estimated to be 17.2 years for males and 19.2-22.6 years for females. Maximum age was estimated to be more than 79 years, and the average annual growth rate over the whale shark's life span was estimated to be 19.8 cm/year.

Findings from analyses of fisheries data and from additional research conducted on whale sharks indicate that it is a very slow growing species. The northwest Pacific population likely migrates into Taiwan coastal waters when the whales are between 3 and 14 years old. As a result, the sustainability of this whale shark stock is at risk if there is a lack of adequate rules to manage mortality levels in Taiwan fisheries. A larger number of whale sharks occurred in Taiwan waters following the ban on retention, but further study of stock dynamics is needed. Because this is a highly migratory species, international cooperation and management are needed.

# Acoustic Pingers to Mitigate Marine Mammal Gillnet Bycatch – The Biosonar Basis for their Optimum Utilization, and Approaches for Mitigating both Bycatch and Depredation

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Acoustic devices used to mitigate the incidental bycatch of marine mammals by commercial fishing nets (generally called acoustic alarms or pingers) were originally designed to alert these animals at times of inattention, such as a sleep equivalent. Pingers were attached to nets so the acoustic signal warning was associated with an obstruction, hence to be avoided and the behavior was reinforced via associative learning. Providing an effective association between pingers (the warning) and a net (the obstruction) is essential; if there is no obstruction, then is no need for avoidance and, logically, no behavioral reinforcement to the warning. In this case, if a pinger presented without an obstruction, an intelligent marine mammal's behavioral reaction to the "warning" will not be consistent.

A pinger-net association would be established by pinger detection from passive biosonar detection (i.e. simply listening), followed by active biosonar echolocation onto the net material (dolphins). For non-echolocating mammals, pinger detection could be followed by eyesight detection and/or passive biosonar acoustic detection of the net, based on the detection of the acoustic signature of water flowing through a net (particularly for baleen whales and dugong). More complex associations could include behavioral reactions to the relevance or context of the sounds themselves, resulting in the mammals' giving a sufficient berth away from the pingers, thus establishing safe zones around each net.

What constitutes an appropriate alarm or pinger sound should be based on its capability to modify the overall behavior of marine mammals, whether their reactions were detected by human observers or not. The intent is to avoid mammal entanglement when applied in the exact fishery condition in which it is to be used. Fisheries' sociologists, looking at the effectiveness of bycatch reduction technologies, have reinforced the need to incorporate such pinger-net association material in real world fishery situations.

At the most basic level, an effective acoustic device may be expected to evoke cognition in mammals in order to achieve a behavioral response, such as aggression or withdrawal from the immediate or broader region of the pinger-net (often context driven). Yet, it is the change in bycatch rate that is important. Demonstrating this change is often extremely difficult, particularly for species of limited population size and restricted habitat. It has often been concluded by fishery critics that failure to demonstrate an unattainable reduction in bycatch could be seen as failures of pingers *per se*, instead of the more reasonable result that it is failure of the experimental design. Unilateral fishing industry description of any associative positive effects between pingers-nets is gaining relevance.

For bycatch mitigation, several factors are important additional complications for successful deployment. They include the hearing capabilities of the marine mammals, the deployment spacing along the net of acoustic pingers, water clarity and acoustic propagation of pinger sounds in the acoustic environment and consistency of Target Strength and acoustic highlights under biosonar interrogation of the nets. Examples of complications include the following:

- If nets were left for long periods and algae were to grow on the net twine, the target strength of the net under biosonar investigation would decline, and the association between pinger and net could be lost, with a resulting increase in risk of entanglement.
- Pingers set at distances too far for the sound to even reach mid-way between pingers at mammal detectable sound levels due to poor propagation of sound would not generate a consistent net-pinger association.
- While net twine and dimension characteristics may have utility in fishery regulations to protect target species, it may also have bycatch reduction capability, given that target strength is a complex interaction of the net material density and the quantity of mesh within the beam-width of the mammals' biosonar.

For depredation mitigation, factors, such as an as yet-to-be-defined pinger sound "dislike," pinger or mammal biosonar sonar interference, or simply pinger-associated enhancement of the presence of foreign and potentially dangerous fishing gear materials not previously detected by biosonar, would be important.

# Mitigating Sea Turtle Interactions in Pound Nets and Set Nets

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## ABSTRACT

Pound net and set net fisheries are two of the major Japanese coastal fisheries. These types of passive gear are considered to be eco-friendly in that they require a minimum of labor and cause nominal habitat degradation. These fishing gears have high potential to be disseminated and utilized worldwide, especially in the ASEAN region, although the introduction of the gears is at an incipient stage. While information on the interaction between sea turtles and these fishing gears is still limited and fragmentary, several studies report substantial levels of incidental sea turtle captures in pound net fisheries (Gilman et al. 2010).

In general, pound net gear and set net gear consist of leader nets, surrounding nets and fish bags or pocket nets. However, the gear design and operation of set nets are highly variable, where local factors, such as oceanographic and topographic features of local fishing grounds, target fish species and sizes, and labor, influence the fishing gear design and methods. Therefore, the development or selection of marine turtle mitigation measures needs to be fishery-specific.

Sea turtle captures in these gear types occur through entanglement and entrapment. Entanglement of turtles occurs with use of relatively large mesh sizes netting. Turtle entanglement in netting is a major problem in the pound net fishery in the USA. However, in Japanese pound nets, such entanglement is reported to be relatively rare, while turtle entrapment in the bag net and pocket net is problematic. The presence or absence of a fish bag and pocket nets in pound net gear has a large effect on the occurrence of turtle captures. Even though turtles enter the surrounding areas of the pound net, survival is high because they can reach the sea surface to breathe. Conversely, the risk of drowning is high for turtles that enter a fish bag net and become entrapped underwater, as the bag net contains a room that prevents the turtles from reaching the sea surface to breathe. This can be mitigated through four approaches:

- prevent sea turtles from entering the pound;
- prevent sea turtles from entering the bag net;
- allow sea turtles to breathe in the bag net; and
- allow sea turtles to escape from a bag net, while retaining commercial species.

## PREVENT SEA TURTLES FROM ENTERING THE POUND

This is the first step to prevent the entrapment of sea turtles in pound nets. Turtles enter the pound as they swim along the pound net leader. A simple mitigation approach is to incorporate a sorting grid at the mouth of the pound to prevent turtles from entering the pound. The spacing of bars in such a sorting grid would need to be wide enough to allow target fish to still enter the pound. Another approach is to incorporate some sort of sea turtle deterrent to cause sea turtles from entering the mouth of the pound.

## PREVENT SEA TURTLES FROM ENTERING THE BAG NET

A second-stage approach to mitigating sea turtle interactions is to prevent them entering the bag net. Again, a sorting grid could be considered to accomplish this. Interactions between turtles and targeted fish should also be studied to determine whether the presence of fish in the pound net attracts turtles, and vice versa, and also to determine whether the presence of turtles in the pound affects target fish catch levels and quality. Also, methods for handling and safely releasing trapped turtles need to be developed.

## ALLOW TURTLES TO BREATHE IN THE BAG NET

Turtles that enter the fish bag would not drown if they were able to reach the sea surface to breathe, with the bag net design modified to allow them to do so. This would only be feasible for gear deployed in very shallow areas. The gear design would need to be sufficiently durable for use in rough sea conditions and strong tidal currents. The modified gear design would also need to account for practicality of use during the fishing operation. Again, research is needed to better understand the interaction between fish and turtles in the bag net, and to develop best practice handling and release protocols for caught turtles.

## ALLOW SEA TURTLES TO ESCAPE FROM A BAG NET

The bag net could be designed to allow sea turtles to escape, while retaining commercial catch. We have initiated development of a turtle-releasing device (TRD) to do that. The TRD is composed of a vent and a flap on the roof of the fish bag/pocket net. A trapped turtle can open the flap using its body and exit the bag net through the vent. The flap then closes automatically after the turtle escapes due to the tension in the netting. Different TRD designs are required for small- vs. large-scale nets, due to the difference in size and design of their bag/pocket nets.

**1. Small conic-shaped pocket net**
We conducted research on a small pound net with a

cone-shaped bag. The bag was 10m in length and 1.3m in diameter. It was tied to the seafloor, employing sufficient tension to maintain its cone shape. At the top of the cone-shaped bag, we inserted a square vent with a flap (40 x 50 cm) that was hinged to the vent and designed to open outwards when a turtle pushed on the flap from the inside of the bag. This TRD effectively released turtles, with more than 80% of green turtles put into the bag successfully escaping (Abe et al. 2002).

**2. Large box-shaped bag net**

Most large pound nets use an underwater, box-shaped bag net with a roof, which is much bigger relative to the cone-shaped bag net of smaller pound nets. While turtles could effectively escape from small cone-shaped bags through a TRD, there was concern that the concept might be less effective in the larger gear, because turtles might not be able to locate the TRD to exit through the device. To address this concern, a mechanism to guide turtles towards a TRD was considered that would adjust the slope of the roof of the fish bag. We considered locating the TRD at the highest point of the roof, based on the assumption that turtles might swam upward when they are attempting to reach the sea surface to breathe (Takahashi et al. 2010).

Another issue for the huge fish bag is how to keep the net tension consistent and appropriate for the turtle to open the flap, and for the flap to then automatically close after the turtle escapes. To address this problem, we developed a new TRD design, called the '"TRD Unit," which was constructed in the center of plastic netting in order to create stable tension, allowing the TRD to open and close. This TRD design worked well, and all loggerhead and green sea turtles tested successfully escaped; however, about half of the hawksbill turtles failed to escape through the TRD, as they pushed on the flap with less force than the other turtle species (Shiode et al. 2010). These findings suggest that we need to consider behavioral differences by turtle species.

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# Sea turtle Bycatch in Taiwan Coastal Pound Nets and Satellite Tracking of Loggerhead Turtle (*Caretta caretta*) Bycatch


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Marine fisheries are known to have incidental interactions with sea turtles, especially in the coastal waters where they aggregate to search for foods or where there is overlap with migration corridors. The coastal pound net fishery in Taiwan is a stationary coastal fishery that experiences significant sea turtle bycatch. From March 1998 until May 2010 (i.e., 12 years), a total of 90 sea turtles were captured as bycatch from pound nets in Don-Ou and I-Lan counties in the northeast of Taiwan. The highest bycatch occurred in 2008 (28%), followed by 2007 (18%) and 2009 (11%). All sea turtles were alive, unharmed and later released by the fishermen. Among them, 51% were green (46), 48% were loggerhead (43), and 1% was a hawksbill (1) turtle. For the green turtles, 61% were immature (28) and 39% were mature (18). Among the mature greens, 72% were females and 22% were male. The average curved carapace length (CCL) was 73.2±13 (n = 28) cm for immature greens, and 93.1±23.2 (n = 18) cm for mature ones. For the loggerhead turtles, 21% were immature (9) and 79% were mature (34). Among the mature turtles, 94% were females and 6% were male. The average CCL was 72.3±0.6 (n = 9) cm for immature loggerheads, and 80.4±6 (n = 34) cm for mature ones. The hawksbill sea turtle was an immature with a size of 33 cm CCL. Most bycatch green turtles were sub-adults, and most bycatch loggerhead turtles were mature females.

Because the bycatch of mature loggerheads occurred mainly from late fall to winter, it is possible that the pound net fishing grounds overlap with the migratory corridor of adult loggerhead turtles. For this reason, a multinational collaborative tagging project was accomplished. Taiwan is not known to have any loggerhead nesting sites currently, and genetic analysis indicates that these individuals are likely from the Japan nesting stock. This north Pacific stock of loggerheads nesting in Japan is currently thought to be in healthy condition. Hence, this is a vital component of the worldwide loggerhead population and any additional sources of mortality for this stock need to be carefully examined and minimized. The purpose of this study was to analyze the movement patterns of loggerhead turtles taken as pound net fishery bycatch in Taiwan and tagged with satellite transmitting tags. Remotely-sensed satellite data was used to infer patterns of habitat use of these loggerhead turtles with respect to regional oceanographic features, such as large oceanic eddies.

Thirty-four loggerhead turtles were tagged with satellite transmitters, after being captured as bycatch in the coastal pound net fishery off the Pacific coast of Taiwan (Table 1). Captures occurred from 2002-2008, and individuals ranged in size from 64-92 cm SCL (69-95 cm CCL). Several different types of tags were used over the course of this study: Telonics ST-18 (n=10), ST-14 (n=2), ST-20 (n=14), ST-24 (n=3), and Wildlife Computers SPLASH tags (n=6). Tags were affixed to turtle carapaces using polyester resin and fiberglass cloth. Tag transmission failure was very rare in this study. One ST-24 tag deployed in this project malfunctioned and was not used in this analysis. The remaining 34 tags continued to transmit an average of 172 days (range of 6-503 days), providing a grand total of 5,860 individual days tracked. Positional data were downloaded from ARGOS and archived locally for processing. The study was concluded when all 34 tags ceased transmitting. Raw ARGOS positional data from the satellite tags were processed using a Bayesian state-space modeling (SSM). The SSM produced the most likely trajectory through the data points, taking into account the ARGOS data quality codes and temporally adjacent positions. The SSM also recast the tracks into daily streams of points, thereby removing effects due to the variable duty cycles used (Figure 1).

Tracks were merged to a suite of available oceanographic, bathymetric and magnetic data products. These include NOAA Pathfinder sea surface

**Table 1.** Summary of information for 34 satellite-tagged loggerhead turtles (*Caretta caretta*) captured as pound net bycatch in Taiwan

| PTT ID | PTT Type | SCL (cm) | Date deployed | Start latitude (°N) | Start longitude (°E) | Date terminated | End latitude (°N) | End longitude (°E) | Days tracked | Integrated distance (km) | Endpoint distance (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 19693 | ST-14 | 71.8 | 25-Jan-07 | 24.50 | 121.80 | 13-Jul-07 | 33.31 | 123.57 | 170 | 5603.27 | 992.65 |
| 19597 | ST-18 | 64.0 | 02-Apr-03 | 24.49 | 121.90 | 16-Aug-04 | 26.32 | 123.58 | 503 | 7997.52 | 456.62 |
| 19599 | ST-18 | 74.5 | 16-Jan-04 | 24.45 | 121.94 | 28-Aug-04 | 32.28 | 126.98 | 226 | 5809.04 | 997.47 |
| 19608 | ST-18 | 87.7 | 19-Feb-03 | 24.45 | 122.00 | 10-Aug-03 | 22.46 | 117.98 | 173 | 4130.11 | 465.84 |
| 22981 | ST-18 | 74.0 | 22-Mar-04 | 24.47 | 121.89 | 27-Aug-04 | 35.11 | 161.06 | 158 | 8642.19 | 3906.55 |
| 23008 | ST-18 | 72.0 | 30-Nov-04 | 24.47 | 121.84 | 23-May-05 | 34.66 | 145.11 | 175 | 5980.64 | 2522.40 |
| 23513 | ST-18 | 68.7 | 08-Mar-04 | 24.49 | 121.81 | 20-Mar-05 | 22.52 | 117.86 | 377 | 9905.96 | 459.12 |
| 23559 | ST-18 | 72.1 | 10-Apr-04 | 24.50 | 121.80 | 25-Jun-04 | 35.79 | 151.88 | 68 | 4866.79 | 3138.90 |
| 25380 | ST-18 | 75.5 | 05-May-02 | 24.58 | 122.00 | 09-Oct-02 | 32.97 | 128.22 | 158 | 3463.35 | 1112.86 |
| 29066 | ST-18 | 71.3 | 21-Dec-03 | 24.50 | 121.80 | 31-Jan-05 | 29.32 | 149.72 | 408 | 14286.62 | 2824.89 |
| 40470 | ST-24 | 74.5 | 23-Dec-08 | 25.59 | 122.20 | 16-Feb-09 | 21.42 | 115.48 | 52 | 1225.34 | 829.64 |
| 40473 | ST-24 | 68.5 | 04-Dec-07 | 25.38 | 122.66 | 01-Jul-08 | 32.46 | 132.96 | 210 | 2483.98 | 1244.03 |
| 41315 | ST-20 | 74.5 | 17-Oct-06 | 24.50 | 121.80 | 20-Jan-07 | 28.17 | 130.27 | 96 | 3814.74 | 938.55 |
| 41423 | ST-20 | 92.0 | 10-Oct-07 | 24.51 | 122.03 | 05-Apr-08 | 14.47 | 111.16 | 169 | 3707.86 | 1893.81 |
| 41768 | ST-20 | 82.5 | 14-Jan-08 | 26.37 | 125.20 | 02-Aug-08 | 26.45 | 127.64 | 90 | 2151.58 | 243.85 |
| 41789 | ST-20 | 70.0 | 18-May-08 | 25.94 | 122.80 | 09-Nov-08 | 27.32 | 126.04 | 174 | 2254.58 | 357.92 |
| 42714 | SPLASH | 78.0 | 10-Jun-08 | 25.49 | 123.30 | 28-Jun-09 | 25.21 | 126.53 | 382 | 4829.34 | 521.97 |
| 4800 | ST-14 | 69.5 | 09-Feb-07 | 24.33 | 122.10 | 26-Apr-07 | 21.52 | 116.90 | 70 | 2009.11 | 917.56 |
| 50144 | ST-20 | 72.0 | 14-Jan-05 | 25.51 | 123.00 | 08-Jul-05 | 23.09 | 118.10 | 173 | 3258.40 | 565.38 |
| 50145 | ST-20 | 70.0 | 19-May-05 | 24.58 | 121.90 | 11-Mar-06 | 30.08 | 153.28 | 295 | 10960.24 | 3164.93 |
| 5152 | ST-18 | 69.7 | 02-Jun-03 | 24.50 | 121.80 | 07-Jun-03 | 25.80 | 123.13 | 6 | 205.43 | 195.97 |
| 53743 | ST-20 | 74.5 | 26-Jun-06 | 24.49 | 121.87 | 22-Aug-06 | 30.23 | 125.61 | 387 | 5017.65 | 736.52 |
| 53745 | ST-20 | 79.0 | 21-Nov-05 | 24.49 | 121.86 | 16-Jan-06 | 28.58 | 125.73 | 57 | 1115.18 | 885.71 |
| 53746 | ST-20 | 83.0 | 14-Apr-05 | 24.49 | 121.81 | 07-Nov-05 | 27.77 | 123.66 | 208 | 4674.89 | 497.11 |
| 53747 | ST-20 | 87.3 | 15-Mar-05 | 24.50 | 121.80 | 21-Nov-05 | 28.28 | 122.03 | 251 | 5867.75 | 419.13 |
| 53748 | ST-20 | 74.5 | 21-Dec-05 | 25.23 | 122.70 | 07-Mar-06 | 22.46 | 117.88 | 77 | 1755.23 | 579.00 |
| 53750 | ST-20 | 76.0 | 06-Apr-05 | 24.91 | 123.70 | 30-Jun-05 | 28.34 | 121.83 | 87 | 2214.29 | 473.35 |
| 53758 | ST-20 | 80.5 | 01-Feb-05 | 24.44 | 121.90 | 29-May-05 | 5.61 | 114.89 | 118 | 5199.59 | 2216.07 |
| 53768 | SPLASH | 72.5 | 28-Apr-06 | 24.44 | 122.59 | 24-Sep-06 | 37.02 | 141.75 | 52 | 4139.80 | 2304.64 |
| 53769 | SPLASH | 73.0 | 10-Mar-06 | 22.41 | 118.83 | 04-Jun-06 | 26.38 | 120.71 | 73 | 651.39 | 478.52 |
| 53770 | SPLASH | 78.5 | 17-Jan-06 | 24.56 | 121.83 | 17-May-06 | 29.85 | 124.83 | 82 | 1666.06 | 637.86 |
| 53771 | SPLASH | 75.0 | 10-Feb-06 | 24.59 | 121.80 | 14-Jul-06 | 2.36 | 104.41 | 154 | 4968.15 | 3079.59 |
| 53772 | SPLASH | 73.0 | 13-May-06 | 24.64 | 122.00 | 06-Sep-06 | 25.13 | 121.76 | 80 | 1547.36 | 58.75 |
| 67469 | ST-20 | 77.0 | 04-Jan-07 | 25.47 | 122.40 | 29-Apr-07 | 27.00 | 124.50 | 111 | 1469.65 | 270.37 |
| | Mean | 74.0 | 24-Sep-05 | 24.71 | 122.13 | 26-Mar-06 | 26.63 | 126.96 | 172 | 4172.12 | 1159.34 |
| | Median | 73.5 | 08-Sep-05 | 24.50 | 121.90 | 9-Mar-06 | 28.22 | 124.06 | 159 | 3860.36 | 627.71 |
| | Minimum | 64.0 | 05-May-02 | 22.41 | 118.83 | 9-Oct-02 | 2.36 | 104.41 | 6 | 205.43 | 58.75 |
| | Maximum | 92.0 | 23-Dec-08 | 26.37 | 125.20 | 28-Jun-09 | 37.02 | 161.06 | 503 | 14286.62 | 3906.55 |

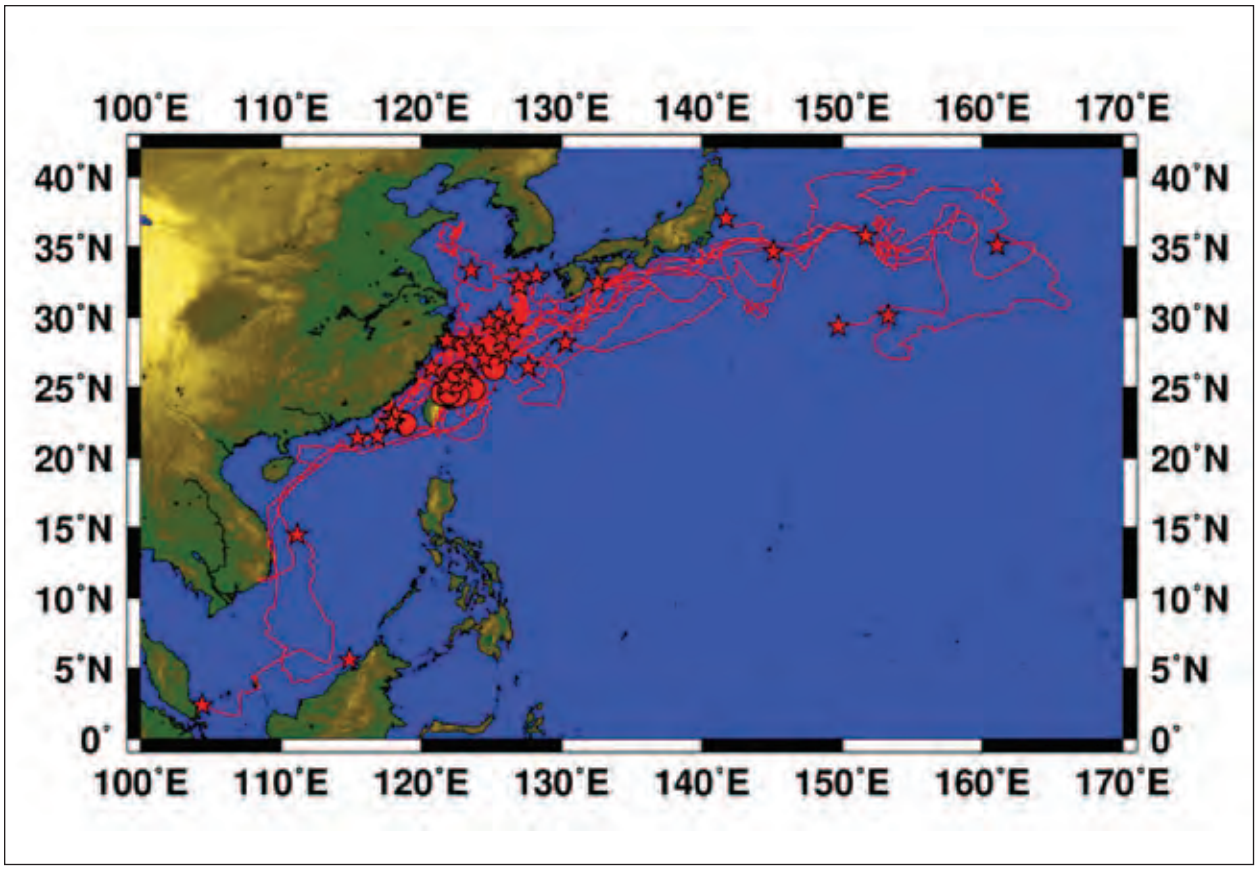


**Figure 1.** Map of loggerhead turtle satellite tracks: "Circles" denote release location, and "stars" denote last transmission position

temperature (SST), AVISO altimetry products (sea surface height (SSH), geostrophic u-component, and geostrophic v-component), SeaWiFS ocean color, Smith and Sandwell bathymetry, and earth magnetic field data from the IGRF-10 model (total force, declination, and inclination). Data were examined both on a daily basis and during integration over the entire track duration by averaging across the daily exposures per individual. The SSM tracks were then merged to a new oceanographic data product that quantifies individual eddies from a time-series of remotely-sensed altimetry fields. After large oceanic currents and gyre circulation, these energetic meso-scale features are one of the primary dynamic features in the ocean. Eddy shapes were reconstructed as "circles," using eddy-specific parameters, and the daily SSM turtle positions were compared to points along the circumference of the eddy. Radii at intervals of 5° of arc originating from the eddy central locations were used for the circle construction and these radii endpoint locations used for comparison to the SSM data. The central locations of all eddies were also compared to the SSM data. Eddies were classified as either cyclonic or anti-cyclonic by the nature of their SSH anomaly (negative SSH anomaly=cyclonic, positive SSH anomaly=anticyclonic), and further classified by eddy strength as indicated by their vertical amplitude. Twelve distant measure metrics were calculated from this merging of datasets, reflecting a nested ordering based on the eddy type (cyclonic or anti-cyclonic), eddy strength (any strength or strong), and the feature of interest (eddy edge or eddy center), respectively.

A novel approach was proposed, called "eddy field randomization (EFR)," which statistically evaluates the match/mismatch of turtle positions with specific eddy features. EFR infers attraction and/or aversion to such features, and was used to demonstrate differential responses by pelagic loggerhead turtles to eddies depending on their orientation (i.e., cyclonic vs. anti-cyclonic eddies), and to specific portions of the eddy (i.e., edges vs. centers). A test of the EFR approach itself was to examine how the approach performs on three sources of non-sentient data in addition to the SSM daily turtle positions. Firstly, EFR was applied to a set of random-walk tracks. Secondly, EFR was applied to a set of simulated passive particle tracks. Thirdly, EFR was applied to subsurface drifter buoys (drogued

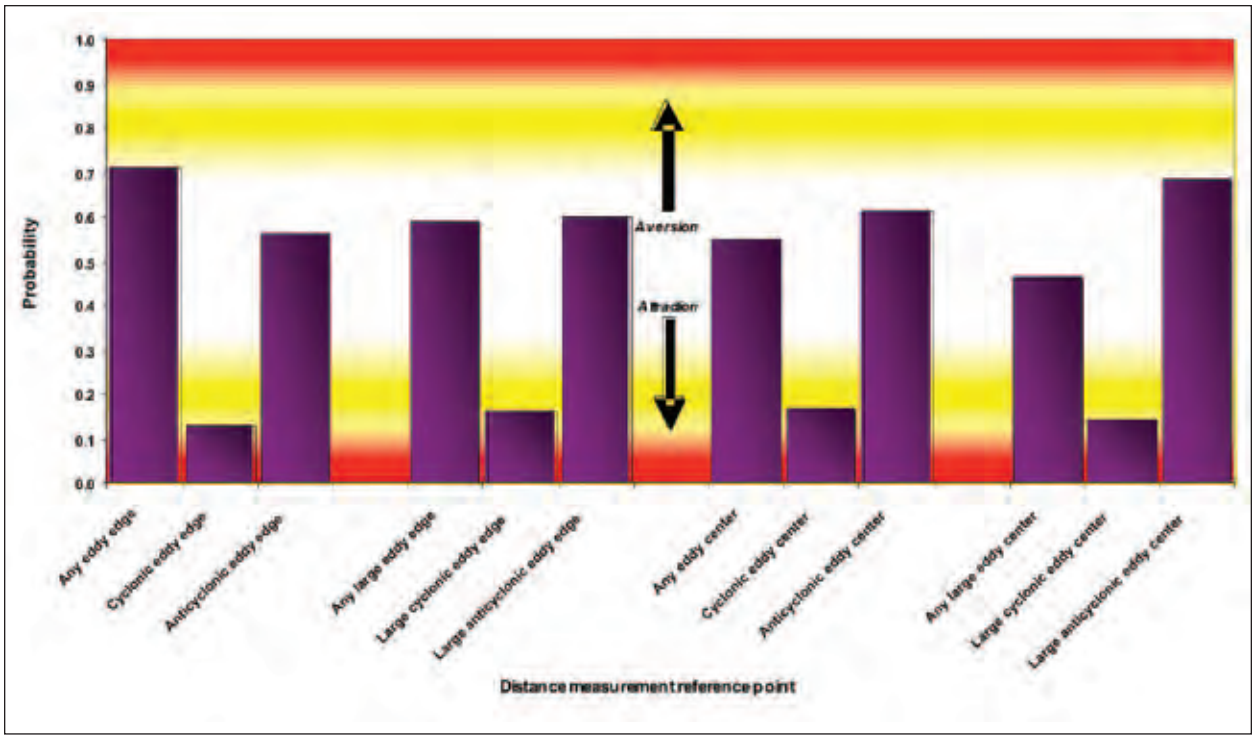


**Figure 2.** EFR results loggerhead turtles tagged in Taiwan

at 15 m depth), which occurred in the spatial and temporal domain of this analysis (n=1291 buoys with 32,963 individual locations). Comparison of the SSM test results and these additional applications yields insights into the underlying mechanism of eddy utilization patterns by loggerhead turtles, and the role of passive versus active orientation. The EFR analysis did not discern any associations between eddy features and the non-sentient objects evaluated, indicating no significant tendency for either attraction or aversion. The EFR analysis applied to the loggerhead turtle tag data indicated that there was an attraction to cyclonic eddy features. This was most pronounced for the edges of any strength cyclonic eddy (Figure 2).

Loggerhead turtles in the Taiwan area also appear to utilize the continental shelf adjacent to the Yangtze River as a foraging area. This region is where the Yangtze River plume meets the Kuroshio Current intrusion. The complex dynamics make this region very productive. The seafloor here is shallow enough for benthic foraging, yet also contains much eddy activity. This area is also intensively fished, primarily by boats from China. The incidental or targeted take of loggerhead turtles by these and other fisheries over the continental shelf is largely unknown and needs further investigation. Loggerhead turtle diet and community structure of both the benthic and pelagic habitat are not well understood in this region and need further study.

# Assessment and Mitigation of Problematic Bycatch in Small Scale Coastal Fisheries of Latin America

**Martin Hall**
Inter-American Tropical Tuna Commission

The two elements to consider when dealing with any bycatch problem are always the same: effort and bycatch-per-unit of effort (BPUE). To assess the bycatch in a fishery requires estimates of both elements. Observer programs appear to be the only way to obtain reliable estimates of BPUE. They are expensive and logistically complex; and in artisanal fisheries, the complexity increases. But they have to be organized. Given the cost and complexity, the sampling design is critical to optimize the use of resources. Observer selection and training are major factors in the success of this type of program.

Experimental work, performed on actual fishing vessels, is recommended to test mitigation options. The cooperation of the fishing community is needed throughout the whole process. The experiences acquired in the Sea Turtle Regional Program in the eastern Pacific will be used to illustrate the challenges encountered and the solutions developed.

**SESSION 3:** MITIGATING BYCATCH OF SENSITIVE SPECIES GROUPS IN MARINE FISHERIES

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## Session 3B: Summary

# **Mitigating Bycatch of Sensitive Species Groups in Marine Fisheries:** Market Based Mechanisms and Fisheries Bycatch

**SESSION CHAIR: Dr. Lida Pet-Soede**, Leader, WWF Coral Triangle Programme

**TARGET OUTCOMES**: Identify how market-based mechanisms have influenced fisheries production practices and governance structures related to mitigating bycatch of sensitive species, and how these approaches can be employed in the future to contribute to sustainable fisheries and to open new and secure existing markets for participating fisheries.

Market-based mechanisms, including eco-labeling and other certification programs for fisheries, and employment of sustainable seafood sourcing policies by grocery retailers and their suppliers, has been an effective approach to achieving sustainable levels of bycatch in marine fisheries. In some regions, environmental non-governmental organizations (ENGOs), and to a lesser degree, consumers are increasingly demanding that seafood sold by retailers and restaurants be sustainably produced. In response, there has been a recent proliferation of programs assessing the sustainability of individual fisheries and species, including in-house programs by retailers, third-party assessment programs such as by the Marine Stewardship Council, and first-party assessment programs where a fishing industry assesses its own sustainability.

The Sustainable Fisheries Partnership described the range of factors that influence the private sector to create tools, including sustainable seafood procurement policies, supply chain agreements, eco-labeling and other initiatives (see abstract by Duncan Leadbitter). Sellers of tuna products may see the advantage of reducing public risk of stigmatization, or a company may seek to position themselves to source sustainable seafood. Catchers need to understand buyer motivations.

Perspectives on sustainable tuna products within Europe and the consumer demand for sustainable tuna products were described (see abstract by Henk Brus). This illustrated how tuna packers and retailers respond to unfavorable publicity, such as shifting labeling of yellowfin to generic tuna meat when this species was described by environmental organizations as being overfished. Consumer interest toward tuna sustainability varied among countries in Europe, with highest interest in the UK and Germany. The complexities of documenting the supply chain in certification programs was also revealed, illustrating a new approach being taken by the Sustunable company, which aims to source fish from sustainable and socially responsible fisheries.

A case study of the actions and influence of the recently formed industry-science-WWF partnership International Seafood Sustainability Foundation elucidated how improvements in governance by the five tuna Regional Fisheries Management Organizations can achieve sustainable tuna fisheries, including sustainable fishing mortality levels of both target tuna stocks and bycatch, and how the collaboration of tuna processors along with WWF can catalyze this (see abstract by Lida Pet-Soede).

A report of the Coral Triangle Fishers Forum was presented describing how market-based solutions to bycatch and technology transfer promise to make substantial bycatch mitigation progress (see abstract by Keith Symington).

The Marine Stewardship Council protocols for assessing bycatch and retained species in data deficient fisheries were described, within its Fisheries Assessment Methodology through the Risk Based Framework (see abstract by Bill Holden).

A case study of the development and employment of Turtle Excluder Devices in three Southeast Asian countries (Thailand, Malaysia and Indonesia), highlighted the role of monitoring control and surveillance or MCS and its linkage to the ability of market based mechanisms to change fishery practices (see abstract by Bundit Chokesanguan).

The Taiwan whale watching industry has grown substantially since it began in 1997. A case study described how some traditional fisheries have undergone transformation into non-consumptive marine industries as traditional fisheries became less profitable due to resource overexploitation (see abstract by Ming-Hua Lee).

Discussion revealed general support for interactions between retailers, their buyers and suppliers, and marine capture fisheries to achieve improvements in fisheries sustainability through mechanisms, such as employment of best practice bycatch mitigation and improved international governance.

## Session 3B:
# Abstracts

## An Introduction to the Taiwanese Whale Watching Industry and its Evolution from Traditional Fisheries

**Ming-Hua Lee**
Secretary General, Taiwan Cetacean Society

Concomitant with increasing overexploitation of fishery resources and fisheries overcapacity in Taiwan's coastal and offshore waters, Taiwanese traditional fisheries have declined. In order to reduce the pressure on fishery resources, the Fisheries Agency of Taiwan actively guides and assists fishers to improve practices of traditional fisheries. Recreational fisheries have gradually gained in popularity, comprised of both full-time and part-time vessels. Whale watching is one such growing recreational industry in Taiwan. The full-time recreational fishery mainly conduct whale-watching, visitation to offshore islands and boating trips. The part-time recreational fishery primarily conducts recreational fishing. There has been a recent increase in the number of people participating in whale watching activities. Since the first whale watching vessel began operations in July 1997 at Shiti Harbor, Hualien, the industry has grown in popularity along the eastern coast of Taiwan. Income generation currently exceeds 1.2 billion New Taiwan Dollars from the whale watching and its supporting industries.

Whale watching activities in Taiwan occur along the east coast, mainly in the areas around Guishan Island, and near Hualien and Taitong. There are currently at least 24 recreational fishing vessels conducting whale watching operations. The industry is most active from May to October, because ocean conditions in Taiwan are too rough at other times due to the northeast monsoon. During the season, there are two to three trips daily, and four trips per day during the peak period of summer vacation. Each trip is about two to three hours long. Each passenger is charged NT$800 to NT$1,000, depending on the total number of customers on a trip. The vessels typically operate within 20 miles of the harbor. Some of them also provide transportation to visit offshore islands, conduct recreational fishing and provide scenic tours. About 70% to 90% of whale watching trips also observe such small dolphin species, such as Risso's, spinner, pantropical spotted and bottlenose. Occasionally, Fraser's dolphins, pygmy killer whales, false killer whales, and short-finned pilot whales are also spotted. Very rarely, whale watchers will encounter larger whales, such as killer and sperm whales.

Since its beginning in 1997, the industry reached a peak in 2002, as the numbers of whale watching vessels increased from 25 to 33. There is variability by area in the number of tourists and vessels. The number of whale watching tourists has steadily increased in Guishan Island, Yilan, while the number in Shiti and Taitong has begun to decline. According to the statistics of the Taiwan Cetacean Society, whale watching activity was concentrated in six harbors in 2009, conducted by 19 companies and 24 ships, and attracted an estimated 259,000 tourists.

Beginning in 2003, the industry encountered several marketing and management challenges, including competition in prices among the companies; variable prices, routes and quality; and possible adverse effects on cetaceans by whale watching vessels. These problems have been studied by scientists and conservation groups. In 2003, the Fisheries Agency of Taiwan developed a Whale Watching Award certification system to initiate improvements in the industry. The award assesses industry companies against 44 criteria, including service, quality, environmental actions, environmental education, performance and pilot standards. Currently, there are eight whale watching vessels that have been certified through receipt of the Whale Watching Award: three in Hualien Harbor, one in Shiti Harbor, three in Wushih Harbor and one in Cheng Kung Harbor. The Whale Watching Award is the only eco-tourism certification process in Taiwan. It is hoped that consumer choices and positive competition among companies serving the whale watching industry will result in improved eco-tourism quality, and sustainable development of Taiwan's whale watching industry.

# The International Seafood Sustainability Foundation and Bycatch Mitigation: Centerpiece of the Global Tuna Sustainability Mission

**Lida Pet-Soede[1]*, Susan Jackson[2]**

[1] WWF Coral Triangle Programme

[2] International Seafood Sustainability Foundation (ISSF)

* Presenter

Of the various factors that bear on the sustainability of the world's tuna stocks – data collection and reporting, Illegal, unregulated, and unreported (IUU) disclosure and compliance; stock assessment; regional fisheries management organization (RFMO) governance and enforcement; net-to-plate traceability; capacity management; operational monitoring, surveillance and control – bycatch mitigation stands as a centerpiece for the role it plays as nexus of all the other elements.

Reducing tuna bycatch to any significant degree will require comparable progress across the range of other sustainability factors. With that awareness, in its first year of operation, the recently formed International Seafood Sustainability Foundation, an industry, science and WWF partnership, acted to intervene directly with industry conservation actions or otherwise lay foundations for driving change across the range of factors. It then convened the first global tuna bycatch reduction workshop. Thus buoyed and as complements to on-going collaboration with the world's tuna RFMOs regarding governance, fisheries management systems, compliance and enforcement, and sustainability stakeholders are poised for at-sea bycatch research and best-practices development. These developments promise to improve the state of tuna bycatch mitigation, now characterized by a patchwork of measures and substantial differences in compliance levels. These include observer coverage in large purse seiners at nearly 100 percent in the Inter-American Tropical Tuna Commission (IATTC) and Western and Central Pacific Fisheries Commission (WCPFC) but widely varying in other RFMOs; discards reporting varying not only by RFMO but also by species and gear/vessel type; moratoria of purse seine and pole-and-line fishing in some areas at some periods (International Commission for the Conservation of Atlantic Tunasw, ICCAT), full time closures in Fish Aggregating Device (FAD)-dominant areas (Indian Ocean Tuna Commission, IOTC), and retention of tuna (IATTC and WCPFC by resolution, IOTC by recommendation); mandated FAD monitoring-management plans (IATTC and WCPFC) and a requirement (IOTC) for purse seiners to report on FAD seedings; and relatively common measures by all four tuna RFMOs to limit or reduce bycatch of non-tuna species, notably sharks, sea turtles and seabirds; and likewise measures to assess the impact of fisheries (particularly longline) on seabirds.

None of the tuna RFMOs has systematically adopted a set of measures that stands as best practices to address bycatch issues, although all four RFMOs have adopted numerous measures to deal with different aspects of bycatch monitoring and mitigation.

Notwithstanding the largely prospective nature of bycatch best practices, at an international level, the 1995 UN Fish Stocks Agreement provides what could be the goals to be achieved by any set of best practices that might be adopted by RFMOs. In particular, these practices – obtaining and evaluating scientific advice, reviewing the status of the stocks and assessing the impact of fishing on non-target and associated or dependent species, and compiling and disseminating accurate and complete statistical data – aim to ensure that the best scientific evidence is available, while maintaining confidentiality where appropriate.

Among the recommendations taking shape for bycatch mitigation best practices are those that are RFMO-specific, related to discard estimates, using observers, and recording of bycatch by gear. Focusing on small tunas and sharks, turtles, seabirds, marine mammals, other non-target species, best practices also involve FAD management, experimental fishing, full retention, gear specifications, bycatch data collection and reporting, and RFMO dissemination of bycatch data. Finally, they encompass fishery impact on bycatch species, ecosystem research, and reduction of discards and bycatch.

While no silver bullet waits to be fired, ample room for improvement waits to be filled with new ideas, practices, technology and attitudes about degree of urgency associated with bycatch mitigation and the full range of sustainability factors. Committed effort is fully warranted in order to preserve marine resources that support one of the single most valuable segments of the global seafood industry. Excluding bluefin stocks, there are 19 principal stocks of tuna that support commercial fishing around the world. Of these 19, 12 are in good condition, meaning they are not overfished. These 12 include all five stocks of skipjack, the most commercially important tuna species by catch that accounts for 85% of world's annual tuna catch. Of that 85%, however, 20% are currently experiencing overfishing, so will become overfished if effort is not limited. ISSF, of course, is striving for all 100% to be healthy.

Joining with founding partner WWF, Bolton Alimentari, Bumble Bee Foods/Clover Leaf Seafoods, MW Brands, Princes Ltd., Sea Value Co., Ltd., StarKist Co.,

Thai Union Mfg./Chicken of the Sea, and Tri Marine International launched ISSF publicly in March 2009. FRINSA and Negocios Industriales Real NIRSA S.A. have since joined ISSF. The foundation's world-caliber science committee is led by Chairman Dr. Victor Restrepo, former assistant executive secretary, ICCAT; and Vice Chair Dr. Meryl Williams, founding coordinator, FishWatch-AsiaPacific, a project of the Asian Fisheries Society.

The ultimate goal of ISSF is to see targeted stocks sustained at or above levels of abundance capable of supporting maximum sustainable yield in a healthy ecosystem. Its chief priorities are to work with RFMOS and their scientists; follow and enforce sound scientific recommendations; strive to eliminate any and all illegal, unregulated and unreported catch of the target stocks; provide for the maintenance and health of the ecosystem to which the target species belong; facilitate the application of the precautionary approach in conserving, managing and utilizing fisheries resources; support implementation of appropriate measures to minimize operational waste, discards, abandoned or lost fishing gear, bycatch and negative impacts of fishing on associated or dependent species; improve the understanding of the status of target fisheries by facilitating the collection of appropriate data and the exchange of information with all relevant groups; support fisheries seeking sustainability certification through programs that meet the 2005 FAO *Guidelines for the ecolabeling of fish and fishery products from marine capture fisheries.*

## The Coral Triangle Fishers Forum: Market-based Partnerships for Managing Bycatch

**Keith Symington, Lida Pet-Soede**
WWF Coral Triangle Programme

### ABSTRACT

Addressing bycatch through the use of bycatch-reducing technologies and adoption of better fishing practices can help seafood businesses immediately reduce some of the negative impacts of fishing, while also setting them on a path towards more sustainable and responsible management. The growing demand in the marketplace for more sustainably- caught seafood, together with new and emerging trade restrictions, provides clear opportunities for expanding the adoption of bycatch reduction gear and techniques in the Coral Triangle. While the eco-certification of fisheries in the Coral Triangle under Marine Stewardship Council (MSC) certification remains a critical objective, in most cases, the meeting of MSC sustainability and management criteria remains a longer-term aim. Thus, bycatch-reducing technology, such as the use of circle hooks in longline fisheries and of excluder devices in trawl nets, can provide the basis of a stepwise and "continual improvement" approach to sustainability. This approach has indeed attracted the interest of several seafood companies and producers, many of whom are currently working to reduce fisheries bycatch in the region. However, in order to optimize success and ensure that supply chain partnerships are of a sufficient scale and scope to create a groundswell of change, a set of strategies for engaging the enlightened self-interest of fisher folks and fishing companies is required. For these individuals and companies, a strong focus must be made to understanding the economic incentives and disincentives that directly influence both the harvesting of bycatch species and the likelihood of mitigating impacts through gear technology. The Coral Triangle Fishers Forum (CTFF), inspired by the International Fishers Forum series of conferences and proposed as an ongoing series of biennial dialogues on fisheries in the Coral Triangle region, promises to provide an opportunity to address these issues head-on among all segments of the seafood supply chain. Results, recommendations, priorities and new concrete projects, stemming from the inaugural CTFF multi-stakeholder meeting in June 2010, will be presented and a strategic agenda forward outlined.

### INTRODUCTION

The incidental capture of untargeted species – bycatch – has become a major political, management, sectoral and environmental focus, bringing its implications to the forefront as conservation, sustainability and food security imperatives. The pervasiveness of fisheries bycatch and unmanaged "multi-species" fisheries are among the most urgent marine conservation and resource management issues in the Coral Triangle today. However, there is great potential for fisheries to reduce bycatch, improve management of multi-species fisheries and tangibly improve fishing practices in the region.

Addressing bycatch through the use of bycatch-reducing technologies and adoption of better fishing practices can help seafood businesses immediately reduce some of the negative impacts of fishing, while also setting them on a path towards more sustainable and responsible management. Already several seafood businesses in the Coral Triangle have made important commitments to work along the supply line to reduce bycatch, leading to more responsible fisheries and a more sustainable long-term forecast for seafood businesses.

Coral Triangle governments are likewise making key pledges on bycatch reduction, as demonstrated

by Philippine President Gloria Macapagal-Arroyo's announcement in January 2010 in support of circle hooks, a technology that can reduce sea turtle bycatch in longline fisheries by up to 80%, as well as various MOUs with seafood businesses aimed at implementing better fishing practices.

However, gear solutions for bycatch are still not adopted in the region at a sufficient scale and scope to create lasting positive conservation impacts and to create a groundswell of change. A wide variety of factors contribute to this low level of adoption, including lack of regulations, low enforcement capacity[1] and poor management capacity. In terms of economic incentives and disincentives, several obstacles have been documented, including:

- few direct economic incentives for local fishermen to adopt appropriate gear or implement best practice;
- high cost of fishing and production (and/or cost of changing operational practices);
- poor product quality and post-harvest losses (i.e. buyer requirements);
- poor access to international markets/ development of new markets;
- limited awareness/concern about market requirements on responsible seafood among key supply chain actors (processors, middlemen etc.);
- lack of collaborative arrangements/contracts with buyers interested in more sustainable seafood;
- poor management capacity at local levels to implement progressive operational practices and regulations; and
- lack of traceability programs to document the details of the fisheries supplying seafood to processors, suppliers and exporters.

## MAKING A MARKET-BASED CASE FOR BYCATCH REDUCTION

Recognizing these practical issues and obstacles, WWF Coral Triangle Programme has developed a strategy for bycatch adoption that is focused foremost on incentivizing the use of appropriate technology and techniques through the enlightened engagement of supply chain actors based primarily on their economic self-interest.

This new approach must primarily address the main economic incentives and disincentives impeding the use of appropriate technology (generally the extra income received from bycatch) and establish new incentives, including:

- combining bycatch gear deployment with new capacity/training for improving post-harvest measures and quality management in the supply chain and for high-value products, increasing income from target species;
- developing direct contracts between major buyer(s) and local producers for the sourcing of bycatch-appropriate seafood and reducing market uncertainties;
- developing niche markets for bycatch-appropriate products by providing higher value for target catch;
- developing and testing directly with fishers new technology that aims to reduce fuel costs by providing higher profits per trip;
- raising awareness on the potential difficult market-access for problematic fisheries with high bycatch levels in the international marketplace that stem from recent EC and other restrictions on seafood trade; and
- exploring the use of "good" subsidies in support of programs aimed at introducing bycatch-reducing technology, and seeking new commitments for long-term private sector and government support of bycatch programs.

## CORAL TRIANGLE FISHERS FORUM

Inspired by the example of information exchange facilitated by the International Fishers Forum series, lessons learned and dialogue between peers and among all segments of the supply chain, the Coral Triangle Fishers Forum (CTFF) is proposed as an ongoing series of biennial dialogues on fisheries in the Coral Triangle region. The inaugural meeting of the CTFF (June 2010, co-hosted by SEAFDEC, WWF and the Indonesian Ministry of Marine Affairs) is adopting a thematic focus on market-based partnerships for bycatch reduction that provides an opportunity to address the above issues head-on and to identify possible solutions and models, as well as to develop new partnerships.

The objectives of the meeting include incentivizing the adoption of bycatch mitigation techniques throughout the supply chain, expanding market-based partnerships for bycatch mitigation and cultivating innovation in the development of new bycatch mitigation technology and techniques.

The presentation will describe the results of the inaugural meeting and progress in meeting the stated objectives and outcomes. Results, recommendations, priorities and new concrete projects resulting from this multi-stakeholder meeting will be presented and a strategic agenda forward outlined.

1 For example, there is little capacity for enforcement of rules for the employment of Turtle Excluder Devices (TEDs) in countries such as Indonesia where their use is required.

# MSC Protocols for Assessing Bycatch in Data Deficient Fisheries

**Bill Holden**
Marine Stewardship Council

This paper discusses how the Risk-Based Framework (RBF) is used to assess bycatch in data deficient fisheries.

At the center of the Marine Stewardship Council (MSC) is a set of "Principles and Criteria for Sustainable Fishing," which is used as a standard in a third party, independent and voluntary certification program. These were developed roughly 10 years ago, by means of an extensive, international consultative process through which the views of stakeholders in fisheries were gathered.

The MSC promotes equal access to its certification program, irrespective of the scale of the fishing operation. The implications of the size, scale, type, location and intensity of the fishery, the uniqueness of the resources and the effects on other ecosystems will be considered in every certification. The three Principles that underlie the MSC program are:

- **Principle 1:** A fishery must be conducted in a manner that does not lead to overfishing or depletion of the exploited populations and, for those populations that are depleted; the fishery must be conducted in a manner that demonstrably leads to their recovery.
- **Principle 2:** Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.
- **Principle 3:** The fishery is subject to an effective management system that respects local, national and international laws and standards, and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

The presentation will focus on Principle 2 and, specifically, the protocols for assessing bycatch and retained species in data deficient fisheries. The intent of this principle is to encourage the management of fisheries from an ecosystem perspective, under a system designed to assess and restrain the impacts of the fishery on the ecosystem.

The system that has been designed to assess all fisheries in the MSC program is the Fisheries Assessment Methodology (FAM). This methodology takes the "MSC's Principles and Criteria for Sustainable Fishing" (the MSC standard) as its foundation and provides a hierarchical, multi-criteria structure for assessing fisheries. This is called the default Assessment Tree, and this structure and the prescribed default set of performance indicators (PI) and scoring guideposts (PISGs) shall be used in all assessments.

The Assessment Tree structure is divided into three levels for the purposes of scoring:

- **Level 1:** Is the MSC Principle as described in the MSC's Principles and Criteria for Sustainable Fishing?
- **Level 2:** Is the Component, which is a high level sub-division of the Principle?
- **Level 3:** Is the performance indicator (PI), which is a further sub-division of the Principle and the point at which scoring of the fishery occurs?

Under Principles 1 and 2, there are PIs evaluating the outcome (status), information and implementation of management to maintain the status for each component.

Principle 2 considerations have been categorized into five Components, which are considered to cover the range of potential ecosystem elements that may be impacted by a fishery. These are:

- **retained species:** species that are retained by the fishery under assessment (usually because they are commercially valuable or because they are required to be retained by management rules);
- **bycatch species:** organisms that have been taken incidentally and are not retained (usually because they have no commercial value);
- **ETP species:** endangered, threatened or protected species are those that are recognized by national legislation and/or binding international agreements (e.g. CITES) to which the jurisdictions controlling the fishery under assessment are party;
- **habitats:** the habitats within which the fishery operates; and
- **ecosystem:** broader ecosystem elements, such as trophic structure and function, community composition, and biodiversity.

The default assessment tree structure is suitable for fisheries where data on such species is sufficient to develop a quantitative score. In data-deficient situations, there is an expanded range of qualitative and semi-quantitative risk-assessment tools available for assessing the outcome status of these components. This set of tools is called the Risk-Based Framework (RBF), which is incorporated into the FAM. In data deficient fisheries, a decision will be made at the beginning of the assessment to use the RBF.

The presentation will consider the rules for assessing the first two components of Principle 2 in data deficient fisheries. Please note the definition for retained and bycatch species used by MSC during the assessment process.

The RBF includes a set of methods for assessing the risk to each of these ecological components from activities associated with the fishery in assessment. The methods range in complexity and data requirements, from a system based on expert judgment (Scale Intensity Consequence Analysis [SICA]) to a semi-quantitative analysis to assess potential risk (Productivity Susceptibility Analysis [PSA]). The RBF is designed to be precautionary in the absence of data.

If sufficient information to allow a performance indicator to be scored does not exist, then the risk-based assessment phase is entered. First, the SICA analysis is undertaken, and if the risk posed to a component is low enough, resulting MSC score is 80 or greater, that score is fed back into the assessment tree and the RBF process for that PI is complete. If the SICA results in an unacceptably high risk, a score of less than 80 is assigned, then a PSA is conducted. The score resulting from the PSA is then fed back into the assessment tree, concluding the RBF for the PI in question.

The steps for applying the risk-based methods for the specific PIs that have been identified as data-deficient are: 1) gathering information relevant to the risk-based assessment (scoping); 2) carrying out a SICA; and 3) carrying out a PSA. The scoping stage provides the background information needed to apply the MSC RBF.

The SICA is a qualitative analysis that aims to identify, through extensive stakeholder input, which activities lead to a significant impact on any species, habitat or ecosystem. The SICA operates as a screening tool – a "worst case" approach that is used to measure the impacts of a range of activities on particular scoring elements.

The PSA approach examines attributes of each species that contribute to or reflect its productivity or susceptibility, in order to provide a relative measure of the risk to the scoring element from fishing activities. Productivity is the average of seven attributes, while susceptibility is the product of four aspects.

The PSA approach is based on the assumption that the risk to a species will depend on two characteristics: (1) the extent of the impact due to the fishing activity, which will be determined by the susceptibility to the fishing activities (Susceptibility); and (2) the productivity of the species (Productivity), which will determine the rate at which recovery can occur after potential depletion or damage by fishing. It is important to note that the PSA analysis essentially measures potential risk.

Three MSC-relevant outcomes can result, based on the PSA score for a species**:**

- where any score is >80, the indicator is passed for that species;
- where any of the species scored in the PSA are at moderate risk (or <80 but higher than 60), a condition is set on that PI. This is similar to the setting of conditions in the "normal" MSC certification process; and
- high risk for any of the species assessed in the PSA (guidepost scores <60) will result in failure for the PI, unless evidence can be presented to suggest that the risk was overestimated.

The level of fishing impact that a species can sustain depends on the inherent productivity of the species. The productivity determines how rapidly a species can recover from depletion or impact due to fishing. The productivity of a species is determined by species attributes, such as longevity, growth rate, fecundity, recruitment and natural mortality.

The level of fishing impact that a species can sustain also depends on its vulnerability or susceptibility to capture or damage by the fishery activities. The susceptibility of a species is determined by attributes, such as the degree of overlap between the distribution of the fishery and the distribution of the species; whether the species occurs at the same depth in the water column as the fishing gear; and whether the species is kept, or released alive.

Use of either the SICA or PSA requires the scoring to be converted back to scores that are meaningful within the default assessment tree. This allows data deficient fisheries to be scored using the same standard as for other fisheries. Each of the methods provides a risk-based estimate of the impact of the fishery on the ecological component addressed within the PI.

PSA can be used to help set conditions in a fishery under assessment. The PSA score is derived from a set of attributes (productivity attributes, such as age at maturity and susceptibility attributes, such as interaction with the fishing gear). Thus, it can be seen which attributes have contributed to a high risk; these can indicate how the risk can be reduced: i.e. the setting of a corrective action or condition.

An example will be given during the presentation that demonstrates the way the RBF works for multiple bycatch species in P2. I will present the PSA attributes to demonstrate what type of data is needed and then show an example of how to score a couple of bycatch species using simple information about the fishery, and also what could be done in the ways of getting information or changing practices to address conditionally passing species.

# Market Influences and Sustainable Tuna: A Diverse and Changing World

**Duncan Leadbitter**
Sustainable Fisheries Partnership

The range of market-related approaches for encouraging good resource stewardship has grown enormously in recent years, with a great deal of overlap and synergy among some of the approaches. An example is the growth of corporate social responsibility in some seafood companies that is driving the creation of tools, such as sustainable procurement policies, supply chain agreements, eco-labeling and other initiatives.

In broad terms, there is a mix of positive and negative measures that provide advice/incentives to source/buy on one hand, or to avoid certain species/gear types or source areas, on the other. Some examples include the buy-and-don't buy species cards for consumers produced by many NGOs, vessel black (and white) lists, and sustainability-oriented labeling, just to name a few. In some cases, there are increasing overlaps with government schemes aimed at targeting the supply of illegal products into the market place, such as catch documentation schemes, vessel black lists and trade restrictions. Indeed, there is often a need for government and private schemes to mutually reinforce each other, as both realms have strengths and weaknesses.

While no stranger to controversy as the tuna dolphin, longlining and "decline of large predator" issues have illustrated, in the past, that the world's tuna industries have found themselves exposed to an increasing number of issues, as some stocks have become seriously depleted, wildlife put at risk and the consequences of inadequate traceability and regulatory control have come to the forefront.

There are many challenges for the tuna industries, which are made more complex by the multinational distribution of the species, as well as by the complexity of global trade. Arguably, many of the issues are solvable, if thought about in a constructive manner. The industry can put in place mechanisms that suit their *modus operandi*. An example is the application of traceability systems for ensuring that product in the supply chain is legal.

This paper will explore the diversity of approaches currently in play that have some "market"-related aspects. It will explore some of the drivers that are motivating the private sector in particular and will also explore some of the dilemmas and potential dangers that the rapidly moving world of sustainable seafood will create, such as "greenwashing." In doing so, it takes a wide view of the term "market" as consumer demand is only a small part of the considerations that companies factor into decisions about sourcing and public positioning.

## TOOLS FOR TILTING THE BALANCE IN FAVOR OF SUSTAINABILITY

Governments act to regulate both catches and markets. Involvement in market regulation remains a contentious area for government involvement under the current climate of global market place deregulation. However, markets are imperfect and tightly targeted interventions may have value for supporting legitimate operators. As documented by the OECD, the production costs for tuna for IUU operators are estimated to be 30% lower than for legitimate operators.

Some examples of government actions that have market implications include: 1) actions to restrict market access to products from fisheries that are not part of an established management regime; and 2) increasing global integration and publication of black vessel lists and port access limitations on such vessels via port state agreements. The most recent example of the former, market access restrictions, is the regulations adopted by the European Union in January of this year that excludes products from IUU fisheries. A second, tuna-focused, example is the ability of ICCAT to require its members to prohibit the imports of relevant species from countries which are undermining ICCAT's conservation and management measures. This ability is restricted to only a few RFMOs.

As for the latter, the global integration efforts to restrict black vessels, this is proving an effective deterrence mechanism. It is further enhanced if a company involved in the receipt of products is an unwitting bystander but is normally committed to a high standard of legitimacy, as was the case when US company Trident inadvertently took possession of pollock supplied by the black listed transshipment vessel, the *Polestar*.

The growth in the use of trade-related measures demonstrates an increasing realization that an integrated approach along the supply chain as far as the market state is vital if the threats to sustainability posed by IUU fishing are to be adequately addressed. As alluded to above, government regulations become part of the portfolio of tools employed by the private sector that go beyond compliance, i.e., a company's interest in these regulations is increasingly driven by public risk management concerns even if the regulation itself is not directly applicable.

## PRIVATE SECTOR INITIATIVES

A wide variety of private sector initiatives for supporting sustainable use has been documented in the past and

the range of options continues to grow. Some examples documented to date include:

- industry initiatives: the fishing industry taking a variety of initiatives aimed at addressing factors that affect sustainability, especially, but not restricted to, IUU fishing and excess capacity;
- catching sector/NGO initiatives: "alliances for good" between NGOs and the catching sector;
- company/NGO (including public aquaria) alliances;
- Codes of Practice and Environmental Management Plans;
- retailer procurement policies; and
- supply chain certification for controlling illegal product.

Some new approaches include the development of control documents that are company-to-company agreements establishing legally binding commitments. These commonly relate to product quality and quantity but have been expanded to include sustainability matters, at least as far as compliance with rules and regulations are concerned. The aim is to ensure that companies that are exposed to public risk, occasioned by the supply of IUU product, can take action against the supplier directly.

This approach was developed on a large scale by the EU Fish Processors Association, which was concerned about the level of IUU fishing of Baltic Sea cod and cod and haddock from the Barents Sea. Control documents, given effect by a Letter of Warranty, set out the obligations of suppliers to be aware of the rules governing the fishery and to not knowingly supply product in contravention of these rules. Supply companies agree to random third party audits and, if found in breach of the agreement (either via these audits or more traditional enforcement means), then the supply contract is null-and-void and the product can be forfeited and sold without benefit to the suppliers.

There is little doubt that this approach has added to the pressure on companies to keep within the law, as the consequences of being blacklisted as a supplier may have greater consequences than a fine.

## CORPORATE SOCIAL RESPONSIBILITY: A MAJOR DRIVER OF PRIVATE ACTION

Corporate social responsibility (CSR) can be described as "the continuing commitment by business to behave ethically and contribute to economic development, while improving the quality of life of the workforce and their families, as well as of the local community and society at large."

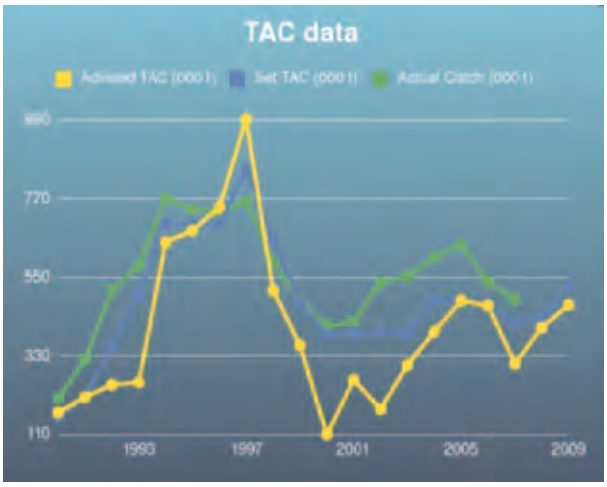


**Figure 1.** Decline in IUU catches of Barents Sea cod following supply chain pressure

While there is much debate over the value of CSR and the underlying reasons behind the adoption of CSR policies, the fact remains that such policies are a mechanism for NGOs to engage with business.

NGO pressure on the retailers of seafood taps into CSR policies and retailers engage in risk management behavior when scrutinized over procurement decisions that may put perceptions about company ethics or reputation at risk. The majority of large European retailers have a generic seafood policy in place and many have specific requirements regarding tunas. Almost all of the top 20 US retailers have partnership agreements with NGOs regarding seafood. In Japan, CSR has been a key component of customer relations for many big retailers.

In addition to procurement policies, CSR has been a key driver of the growth in other areas of seafood business, such as the growth in the availability of eco-labeled products.

## CERTIFICATION AND LABELING

Certification and labeling have grown enormously in the past ten years, primarily due to the growth of the Marine Stewardship Council. In the past, the model for certification to the MSC Standard that was promoted to industry was that consumers would pay more for seafood that was guaranteed sustainable, as determined by the MSC. Although there are many anecdotal reports about price premiums, independent evidence is not available and other factors, such as CSR management and market access, have assumed prominence.

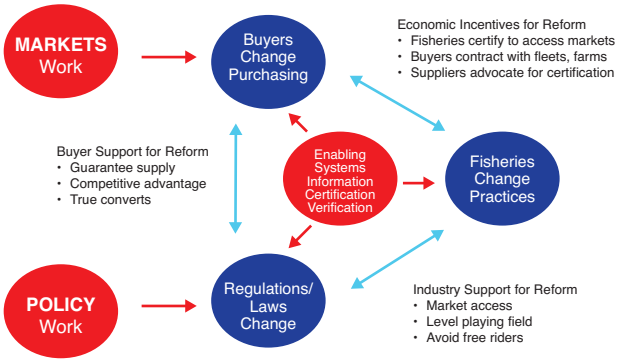


**Figure 2.** Seafood markets strategy: Dynamic model of change (source: Packard Foundation strategic plan for sustainable seafood)

## INTEGRATION OF APPROACHES: THE WAY FORWARD?

The past ten years has been a period of great change and experimentation in the development and implementation of mechanisms for incentivizing sustainable use, with much of it at the market end of the chain. Some approaches have proven more valuable than others and it would appear that many approaches cannot work effectively in isolation. Figure 2 documents the conceptual strategy being implemented by the Packard Foundation, which is not a proprietary strategic approach to that organization, and could be applied to other groups, public and private.

# Monitoring, Control and Surveillance and the Ability of Market-based Mechanisms to Change Fishing Practices: Lessons from US Trade Rules on the Importation of Shrimp and Uptake of TEDs in Tropical Shrimp Trawl Fisheries

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## ABSTRACT

The US shrimp import embargo that went into effect on May 1, 1996 stipulates that fishing methods used in shrimp capture in harvesting countries should inflict no harm on marine turtles. To comply with the condition, Southeast Asian Fisheries Development Center (SEAFDEC), together with its member countries, conducted a series of experiments and trials to develop a suitable Turtle Excluder Devices (TEDs) for use in shrimp trawls in Southeast Asian countries. The design of Thai Turtle Free Device (TTFD) was found to be the most convenient and efficient for use by fishermen due to a low escape rate of the target species, easy operation and low construction cost. TTFD and Super Shooter were selected as suitable TEDs to promote for use in Southeast Asian countries.

Monitoring, Control and Surveillance (MCS) is one set of fisheries management tools that has been promoted in combination with market-based mechanisms in order to implement the use of TEDs by fishermen in trawl fisheries. Thailand, Malaysia and Indonesia are used in this abstract as a case study on MCS and the ability of market-based mechanisms to change fishing practices.

## INTRODUCTION

The US-imposed embargo posed a threat to the livelihood of fishermen of Southeast Asian countries. National governments in the region viewed the threat very seriously and, through the Council of Directors, an agency of a SEAFDEC governing body, approval was given for the urgent consideration of practical designs for additional shrimp trawling gear to lift the US import ban by effecting the release and potential conservation of sea turtles.

The SEAFDEC Training Department (TD) and Marine Fisheries Resources Development and Management Department (MFRDMD) were assigned to study this problem in cooperation with the Departments of Fisheries (DOF) of SEAFDEC member countries. A series of experiments commenced in Thailand; as progress was made, more trials were carried out in other SEAFDEC member countries. Since a large number of fishermen in the region live by catching shrimp, various activities have been conducted to safeguard them and to minimize the impact that could be anticipated by the enactment of the import embargo. Through workshops and seminars, the results of studies were disseminated to fishermen and help them understand the use of the devices to avoid violating the shrimp embargo and also to promote the conservation of sea turtles through the use of such devices.

## TEDS IMPLEMENTATIONS IN SOUTHEAST ASIA

### Thailand

To comply with the conditions set by the US shrimp import embargo, SEADEC/TD in cooperation with DOF, Thailand, conducted a series of experiments to develop a suitable device for use with shrimp trawls in Thailand. Five types of TEDs were imported for testing: Anthony Weedless, Super Shooter, Bent Pipe, Georgia Jumper and Mexican TED.

Based on studies of the design and construction of various types of TEDs, the Super Shooter and Georgia Jumper were modified into what has become known as the TTFD. The results from the experiments suggested that the Super Shooter and TTFD have acceptable escape rates and are convenient to operate. Comparing the two devices, the TTFD was found to be the most suitable due to a lower escape rate of fish, lower fuel consumption and easier construction and installation, because all materials used were available locally.

In October 1996, DOF, Thailand organized a workshop on the use of TEDs for shrimp trawlers, with participants representing fisheries from 22 coastal provinces in Thailand. The fishermen had a positive reaction to the use of TEDs and accepted the reasons for their introduction. The results of the TED fishing trials gave them confidence in the low escape rate levels of the target species and that the shrimp caught also met the conditions of the US embargo. The first 100 TTFDs were contributed for voluntary use. Another 2,900 TTFDs have been distributed to fishermen, resulting in all 3,000 trawlers registered in Thai shrimp fisheries provided with the device. In November 1996, the US shrimp embargo was lifted for Thailand fisheries.

### Malaysia

To comply with the conditions set by the US shrimp import embargo, the SEAFDEC/MFRDMD and TD in cooperation with the DOF, Malaysia, have conducted several experiments to develop TEDs and implement their use by fishermen in Malaysia. MFRDMD also sent its staff to join the first trial carried out in Thailand in September 1996. Following the trial, experiments were conducted in Perak State, Malaysia in February 1997. Results indicated that the shrimp catch rate was not adversely affected by the TEDs.

MFRDMD and TD carried out the first demonstration and workshop in March 1997 in Perak State, in cooperation with DOF, Malaysia. There was also a shore-based exhibition to introduce the TEDs. At-sea demonstrations of the TEDs on shrimp trawlers were then conducted.

Training on the use of TEDs was conducted during July 1997 at MFRDMD for DOF staff from various states. Follow-up training was again conducted for Sabah fisheries officers in December 1997. A questionnaire on the use of TEDs was also given to fishermen.

### Indonesia

The DOF, Indonesia has banned trawl fishing throughout the country since 1980. For various reasons, however, industrial shrimp trawling has been licensed only in the Arafura Sea and its adjacent waters since January 1, 1983. BED is an Indonesian acronym for the Hooped TED, which was introduced by the US National Marine Fisheries Service (NMFS).

When the US shrimp import embargo went into effect in May 1996, Indonesia was not included, because the Hooped TED was already in use. NMFS introduced the Super Shooter TED to Indonesia in October 1996 to replace the Hooped TED. In November 1997, SEAFDEC/TD also introduced the TTFD to Indonesia, based on their experience in Southeast Asian countries.

Indonesia has exported shrimp globally, particularly to Japan and in small quantities to the US. Indonesia has continued to promote selective shrimp trawling by using the Super Shooter and TTFD in Indonesian waters.

## MCS AND MARKET-BASED EFFECT TO THE USE OF TRAWL FISHERIES

Considering the MCS system and mechanism in Southeast Asia, particularly in these three countries, we can conclude, in general, that the implementation of TEDs in each country depends on government policies and governance. For example, in Thailand during the promotion of TEDs, 3,000 sets of TEDs were been distributed among trawlers in the Gulf of Thailand and the Andaman Sea through a workshop held in Southern Thailand. However, there was nominal surveillance to ensure that the TEDs were employed, as enforcement staff had other priorities and enforcement agencies believed that this was a trial period for using TEDs. Lack of personnel and patrol boats to cover all of the area of trawl operations make it impossible to conduct adequate surveillance and enforce trawler use of TEDs. To complement MCS, market-based activities, such as compensating fishermen for the loss of shrimp resulting from using TEDS, should be introduced in order to create an incentive for increased use of TEDs.

In the case of Malaysia, follow-up activities to determine if TEDs were being used were not continued, despite 100 TTFDs having been distributed to fishermen for a trial period. However, MCS activities in Malaysia are very strong in terms of personnel, patrol boats and a zoning system. TEDs are not currently employed in Malaysia, as this country is not currently permitted to export shrimp to the US.

In the case of Indonesia, because the country exports shrimp to US markets, most of the shrimp trawlers that employ TEDs belong to industrial companies, and fishing grounds have been limited to the Arafura Sea and adjacent waters. As a result, MCS has been relatively effective. However, the MCS system in Indonesia is extremely complex with multiple authorities involved.

Currently, Thailand and Malaysia do not rely on exporting shrimp to US markets. As a result, there is limited use of TEDs in these two countries, because its use is not compulsory. Only Indonesia has continued the implementation of TEDs.

### CONCLUSION

The implementation on the use of TEDs needs the strong support of MCS systems. Based on lessons learned from the implementation of TEDs in the region, MCS activities will not be successful if there is an absence of understanding and acceptance by fishers of the rationale for such activities.

The adoption of TEDs by fishermen in the region has been limited and local support has generally been lacking. This is due, in part, to the high cost of fishing, the commercial value of non-target catch, the emergence of multi-species trawling, and ineffective enforcement of regulations requiring the employment of TEDs. As a result, the growing use of market incentives through interactions between buyers/exporters and fishing fleets is critical to achieve broad, effective use of TEDs in shrimp trawl fisheries.

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## Sustainable Tuna Sourcing for the European Market

**Henk Brus**
Atuna

Little progress has been made since the last IFF4, convened two years ago, in getting sustainably-sourced tuna on the shelves of EU supermarkets. Out of 30 supermarkets in six European Union countries checked by Sustunable bv, very little MSC-certified tuna was found, and none certified by other seafood certification programs. The MSC-labeled tuna was all albacore tuna from USA fisheries, and sold at prices too high for most consumers. One reason for this is the limited amount of tuna fisheries that have been MSC-certified (2); but another is also the lack of interest by most players in the entire tuna supply chain to start their own initiatives toward sustainable production and responsible sourcing. Pressure by environmental NGOs, including Greenpeace and WWF, has convinced many retailers that they should start sourcing MSC-certified tuna. The current high prices and limited availability of MSC tuna, however, have been preventing these retailers from doing so.

Sustunable bv's approach aims to create partnerships between fisherman, canners and local government to market the sustainable tuna catch directly to retailers, using an on-line tracking system for consumer use that provides a very high level of transparency.

**SESSION 3:** MITIGATING BYCATCH OF SENSITIVE SPECIES GROUPS IN MARINE FISHERIES

**Session 3C:** MITIGATING BYCATCH IN LONGLINE AND PURSE SEINE FISHERIES


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## Session 3C: Summary

# Mitigating Bycatch of Sensitive Species Groups in Marine Fisheries:
## Mitigating Bycatch in Longline and Purse Seine Fisheries

**Session Chairs: Mr. Tzu-Yaw Tsay**, Fisheries Agency, Taiwan, and **Mr. Peter Ho**, Overseas Fisheries Development Council, Taiwan

**Target Outcomes:** Review progress and identify priorities for mitigating bycatch in pelagic and demersal longline fisheries and purse seine fisheries.

Large longline vessels generally catch older age classes of bigeye tuna and bluefin tunas for the sashimi market. Purse seine vessels catch younger age classes of target skipjack and yellowfin and incidental bigeye tunas for canning. Both of these fisheries have problematic bycatch of seabirds, sea turtles, marine mammals and sharks (see abstract by Eric Gilman) that may severely affect the health of some populations if these fisheries are not adequately regulated. Bycatch of unmarketable species and sizes of finfish (e.g., juvenile and undersized bigeye and yellowfin tunas) in purse seine fisheries, as well as bycatch of undersized swordfish in longline fisheries, may also contribute to overexploitation of some stocks. Furthermore, this bycatch of juvenile and undersized tunas represents a substantive issue for allocation of tuna resources between longline and purse seine fisheries. Concerns over the inconsistent employment of the term "bycatch" were raised during this session, and participants identified other recent international meetings, including the Coral Triangle Fishers Forum, where the issue was also raised. However, reporting and regulating all fishing mortality is critical for effective fisheries governance regardless of the terminology and definition of "bycatch'"employed.

A sequential game theoretical model of the western and central Pacific longline and purse seine tuna fisheries was presented, where maximizing economic yield was set as the goal (see abstract by Ussif Rashid Sumaila). Results of the analyses suggest that it is economically optimal to reduce bycatch of juvenile bigeye and yellowfin by reducing purse seine use of Fish Aggregating Devices. Such an approach would result in an economic loss to countries with domestic purse seine fisheries but the loss would be smaller than the gain to the longline fisheries. The lack of purchasing power and food distribution were raised as complicating measures not addressed in the model. Discussion of the model included how the output would change if the model were designed to optimize the sustainability of tuna stocks or to optimize the production of protein.

A summary was provided of the effects of recent management actions adopted by the Inter-American Tropical Tuna Commission to restore bigeye tuna populations in the Eastern Pacific Ocean (see abstract by Rick Deriso). Longline fleet capacity and hook volume peaked in 2000 and has since been markedly reduced, while purse seine capacity has increased after an initial decline in the 1980s. Management measures have included longline catch limits, progressively increasing purse seine closures, and a purse seine area closure of high bigeye tuna bycatch. Results to date suggest these measures have been successful, and the decline in bigeye tuna stock has been halted.

There has been substantial progress in identifying gear technology solutions to seabird and sea turtle bycatch on longlines and direct mortality of dolphins in purse seines (see abstract by Eric Gilman). Given sufficient investment, gear technology solutions will likely be developed for remaining problems. Fishery-specific assessment is necessary to determine appropriateness of gear technology options, including consideration of efficacy, economic viability, practicality and safety. Insufficient consideration has been made in identifying conflicts as well as mutual benefits amongst species groups from bycatch mitigation methods. The five tuna Regional Fisheries Management Organizations have achieved mixed progress mitigating problematic bycatch. Large gaps remain and current binding measures require improvements.

Participants were challenged to think outside the box to mitigate bycatch in tuna fisheries; instead of "tinkering" with fishing gear and methods to identify minor changes, which results in gradual 'evolution' of bycatch technology, it would be better to have a 'revolution' with potentially dramatic alterations to traditional gear and methods (see abstract by Martin Hall). Such revolutions may include the development of equipment

and onboard processing methods for purse seiners to increase the proportion of the catch that will be discarded alive.

Longline catch depredation by toothed whales, primarily false killer whales and killer whales, cause large economic impacts to the fisheries. Over five decades of experience and research in mitigating interactions between longline fisheries and cetaceans were presented (see abstract by Tom Nishida). A promising pinger device called the dolphin deterrent device (DDD or '"Triple D") was introduced, which reacts to toothed whale clicks and emits a deterrent sound to keep them away from fishing gear.

Seabird bycatch mitigation in demersal and pelagic longline fisheries was also reviewed (see abstract by Charles Cheng and Mayumi Sato). Seabird populations showed consistent declining trends over the last several decades, with fisheries impacts posing the greatest threats. Albatrosses are particularly vulnerable to increased mortality due to their life history characteristics. The efficacy of many techniques for seabird bycatch mitigation (e.g., setting at night, weighting terminal tackle, avoiding offal discharge, setting terminal tackle along the side of the vessel hull) is well documented. Recent gear technology innovations were presented, such as integrated weighted lines, bait capsules, and hook pods.

A comprehensive overview of shark bycatch in the Taiwanese longline fishery was presented (see abstract by Kwang-Ming Liu). Shark bycatch to catch ratios and shark catch composition differed markedly between the Atlantic, Indian and Pacific Oceans. Data were used to generate fleet-wide expansions of the total shark catch by the different Taiwanese longline fleets. While measures restricting shark finning practices (including those of the five tuna RFMOs) do not manage shark fishing mortality and are not likely to address the contribution by longline tuna fisheries to the overexploitation of shark populations, some national measures, including a recent adoption of a shark sanctuary by Palau, are likely to effectively reduce shark fishing mortality.

The outcomes and recommendations from the Kobe II Bycatch Meeting were presented (see abstract by Rebecca Lent). One recommendation was the establishment of a joint tuna-RFMO bycatch technical working group. Follow-up meetings are planned for 2011, including an international workshop on circle hooks and a Kobe III meeting.

Examples of marine spatial planning approaches to mitigate bycatch in marine fisheries were raised in the discussion portion of the session, including the employment of information on bycatch to catch ratios to identify ocean areas where high bycatch ratios have been documented and thus might be avoided in the future.

## Session 3C:
# Abstracts

## Sequential Game Theoretic Models of Western Central Pacific Tuna Stocks

**Ussif Rashid Sumaila*, Megan Bailey**
Fisheries Economics Research Unit, Fisheries Centre, University of British Columbia
* Presenter

The purse seine fleet used by domestic countries of the Western Central Pacific Tuna Stock (WCPT), such as the Philippines and Indonesia, are in a sequential game situation with the longline fleet that is used mainly by distant water fishing nations (DWFNs) to target tuna in the same region. We developed sequential game theoretic models involving these two fleets. Purse seines target mainly skipjack but, in so doing, they also catch a sizable quantity of juvenile bigeye and yellowfin tuna. The longline fleet is split into two groups: the shallow water longline fleet that targets mainly yellowfin and the deeper water longline fleet that targets both bigeye and yellowfin tuna stocks. The purse seine fleet takes juvenile bigeye and yellowfin tuna before the longline fleet gets the chance to target them, thereby creating a sequential game situation. We analyzed joint (cooperative) versus separate (non-cooperative) management of these three stocks of tuna in the WCPT with a view to isolating the net benefit loss due to separate management. Results of the analyses suggest that: (1) It is economically optimal to cut back significantly on the bycatch of bigeye and yellowfin by reducing the use of Fish Aggregating Devices (FADs); and (2) Such a cut in bycatch will result in a loss to the domestic countries that target skipjack. However, this loss is much smaller than the gain in the potential benefit to the longline fleet. For joint management to be implemented, an institutional arrangement is needed to allow domestic countries using purse seines to share in the gains through cooperation, thereby meeting the individual rationality requirement.

## Effects on the Bigeye Tuna Stock in the Eastern Pacific Ocean from the Inter-American Tropical Tuna Commission's Measures for Allocation of Tuna by Gear Type

**Richard Deriso**
Inter-American Tropical Tuna Commission

### ABSTRACT

A simulation study was conducted in 2008 to gain further understanding as to how hypothetical changes in the amount of fishing effort exerted by the tuna fishing fleet might simultaneously affect the stock of bigeye tuna in the eastern Pacific Ocean (EPO) and the catches of bigeye by the various fisheries. Several scenarios were constructed to define how the various fisheries that take bigeye in the EPO would operate in the past and in the future, and also to define the future dynamics of the bigeye stock.

### FISHING EFFORT

Future projection studies were carried out to investigate the influence of different levels of fishing effort (harvest rates) on the stock biomass and catch. The analyses carried out were:

- quarterly harvest rates for each year in the future set equal to the average harvest rates from 2005-2007 to simulate the reduced effort due to the conservation measures of IATTC Resolution C-04-09; and
- an additional analysis that estimates the population status if the resolution was not implemented. (For 2004-2007, purse-seine catch in the third quarter was increased by 86% and the catch in the southern longline fishery was increased by 39% in all quarters. For 2008-2012, the purse-seine harvest rate was increased by 13% for all quarters and the harvest rate in the southern longline fishery was increased by 39% in all quarters).

## SIMULATION RESULTS

IATTC Resolutions C-04-09 and C-06-02 call for the following restrictions on purse-seine effort and longline catches during 2004-2007: 1) a six-week closure during the third or fourth quarter of the year for purse-seine fisheries, and 2) longline catches not to exceed 2001 levels. To assess the utility of these management actions, we projected the population forward five years, assuming that these conservation measures are not implemented in the future.

Comparison of the spawning biomass predicted with and without the restrictions from the resolution show substantial difference (Figure 1). Without the restrictions, the spawning biomass rate (SBR) would increase only slightly and then decline to lower levels.

The reductions in fishing mortality that could occur, as a result of the continuation of IATTC Resolution C-06-02, are insufficient to allow the population to maintain levels above that corresponding to the MSY in the long term. An increase above the MSY level, however, is expected for a few years, due to recent high recruitment.

The conservation resolution that was approved in 2009, IATTC Resolution C-09-01, calls for more restrictive measures than previous resolutions. And by 2011, the purse seine closures (73 days) will approach those (84 days) recommended by IATTC staff.

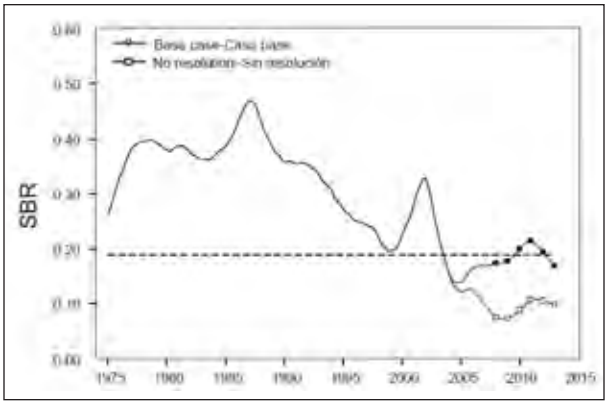


**Figure 1.** Predicted SBR from the base case model and without restriction from IATTC Resolution C-04-09

# Mitigating Unwanted Bycatch in Global Tuna Fisheries

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## ABSTRACT

There has been mixed progress in addressing unwanted bycatch in longline and purse seine tuna fisheries. It is likely that, given sufficient investment in research and development, commercially viable changes in fishing gear and methods are possible to nearly eliminate bycatch. However, even in the gear types where substantial progress has been made and despite the availability of effective bycatch reduction methods that, in some cases, also increase fishing efficiency and provide operational benefits, the majority of fleets do not employ these methods. While Regional Fisheries Management Organizations have made recent progress in addressing bycatch for some bycatch species groups, compromises made during consensus-based decision-making processes have resulted in the adoption of measures that do not employ best practices. Furthermore, because resources for surveillance and enforcement are lacking or weak, compliance is likely low. Due to a lack of mechanisms for performance assessment, including inadequate monitoring (with sparse or no observer coverage and inadequate and inconsistent data collection protocols for non-landed catch), there is insufficient information to guide adaptive management to ensure mitigation of problematic bycatch in tuna fisheries is ecologically and economically sustainable.

## INTRODUCTION

Responsible fisheries' conduct requires the effective governance of all sources of fishing mortality, including from retained target catch, both retained and discarded bycatch, and unobserved mortalities. Bycatch is comprised of the retained catch of non-targeted but commercially valuable species (referred to as "incidental catch"), all discards of unwanted catch, plus all unobserved mortalities (e.g., from catch and bycatch that is depredated or falls from the gear before gear retrieval, and from ghost fishing, including from hooks left in discarded bait) (Alverson et al. 1994; Kelleher 2005; FAO 2009b). Bycatch contains species critical for the maintenance of the structure and functioning of marine ecosystems, and continued provision of ecosystem services. Sensitive species groups subject to bycatch include seabirds, sea turtles, marine mammals, elasmobranchs and other fish species, which are particularly vulnerable to overexploitation and slow to recover from

large population declines (Hall et al. 2000; FAO 1999a; FAO1999b; Gilman et al. 2005; Gilman et al. 2006a; Gilman et al. 2006b; Gilman et al. 2006c; Gilman et al. 2007a; Gilman et al. 2007b; Gilman et al. 2008a; Gilman et al. 2008b; Gilman et al. 2009; FAO 2010; Gilman and Lundin 2010). Discarded catch, offal and bait, all change the foraging behavior and diet of marine species, for instance, by scavenging seabirds, marine mammals, sharks and benthic scavengers, and may also cause localized anoxia of the seabed (Goñi 1998; Gilman et al. 2006a; Furness et al. 2007).

Unsustainable levels of bycatch have negative socioeconomic consequences for fishing communities, as bycatch is an important income source and contribution to food supply in some fisheries and countries (Kelleher 2005; FAO 2008; FAO 2009d). Overexploitation of commercially important non-target bycatch species, including bycatch of juvenile and undersized individuals of a commercial species, can adversely affect future catch levels (Hall et al. 2000), and can result in allocation issues between fisheries (Gilman and Lundin 2010).

This paper reviews bycatch problems in tuna fisheries and gear technology solutions, involving changes in the design of fishing gear and methods. Other bycatch mitigation approaches include input and output controls, compensatory mitigation, time/area closures, fleet communication and industry self-policing (Gilman et al. 2009; FAO 2010; Gilman and Lundin 2010). A combination of mitigation approaches will be effective and commercially viable, depending on the fishery-specific context.

**Table 1.** Bycatch problems in pelagic longline and purse seine fisheries

| Species Group | Pelagic longline | Purse seine |
|---|---|---|
| Seabirds | Problematic primarily in higher latitudes (Brothers et al. 1999). | Not problematic. |
| Sea turtles | Problematic primarily in the tropics and subtropics (FAO 2010). | Sea turtles can become entangled in Fish Aggregating Devices (FADs) and can be caught in the pursed net (Hall et al. 2000). Turtles are typically encountered alive in the net and are released (FAO 2010). Sets on FADs and logs result in higher turtle catch rates than dolphin-associated and unassociated (free-swimming tuna school) sets (Hall 1998; Hall et al. 2000; Molony 2005). |
| Sharks | A large proportion of the total catch in some non-shark fisheries (Gilman et al. 2008a). | Sets on FADs and logs can result in high shark catch rates (Hall 1998; Hall et al. 2000; Molony 2005). |
| Marine Mammals | Cetacean-longline interactions occasionally result in entanglement and hooking, causing injury and mortality (Gilman et al. 2006a). Fishers may harass and kill cetaceans to try to prevent depredation (removal of hooked fish and bait) and gear damage. Resident cetacean populations may be most at risk. | While there has been substantial success in reducing direct dolphin mortality in purse seines in the eastern Pacific (Hall 1998; IATTC 2007a), dolphin populations have not recovered as anticipated. Stress from purse sets on dolphins has been observed to cause miscarriages or separation and loss of calves, hypothesized to be a contributing factor (Archer et al. 2004; Edwards 2006). Purse seining in other areas typically does not involve setting around dolphins.<br>Purse seine sets on whale-associated tuna schools can result in whale injury and mortality (Romanov 2002; Molony 2005). |
| Juvenile/ under-sized tunas | Might be problematic at seamounts (Passfield and Gilman 2010). | Restrictions on setting on dolphin schools resulted in a shift to setting on FADs and logs, where the catch rates of juvenile and under-sized tunas and unmarketable fish species are higher than in unassociated sets (Romanov 2002; Secretariat of the Pacific Community 2006). |

## BYCATCH IN TUNA FISHERIES

Table 1 summarizes bycatch problems in pelagic longline and purse seine fisheries, the primary commercial fishing methods for catching tunas (Majkowski 2007). In pole-and-line fisheries, the third largest contributor to tuna landings, nominal bycatch occurs.

## SOLUTIONS

Of the bycatch problems in pelagic longline and purse seine fisheries, there has been substantive progress only in identifying effective bycatch reduction methods for seabirds and sea turtles on longlines and direct mortality of dolphins in purse seines:

Gear technology methods for mitigating bycatch in pelagic longline fisheries:

- **Seabirds:** A growing number of seabird bycatch avoidance methods have been identified, with varying degree of efficacy. These include: night-setting, *tori* line, underwater setting devices, side setting, branch-line weighting, blue-dyed bait, thawed bait, bait-casting machine, and mainline shooter (Brothers et al. 1999; Gilman et al. 2003; Gilman et al. 2005; Gilman et al. 2007a).
- **Sea turtles:** The best practice for reducing sea turtle bycatch and injury in pelagic longline fisheries is to employ wider, circle-shaped hooks with $< 10^{o}$ offset, in combination with large fish bait (Gilman et al. 2006c; FAO 2010). Deeper setting also holds promise (FAO 2010).
- **Sharks:** Methods to mitigate unwanted shark bycatch include: (1) using fish instead of squid for bait, (2) prohibiting wire leaders, (3) avoiding hotspots, (4) deeper setting, and (5) moving when shark interaction rates are high (Ward et al. 2007; Gilman et al. 2008a). There is a need to invest in research on various shark deterrents (Gilman et al. 2008a; Stoner and Kaimmer In Press).
- **Marine Mammals:** Methods to mitigate marine mammal bycatch include: (1) Avoiding hotspots; (2) fleet communication; and (3) weak hooks (Gilman et al. 2006a; Gilman et al. 2006b). Deterrents and echolocation disruption are potential additional methods.

Gear technology methods for mitigating bycatch in purse seine fisheries:

- **Sea turtles:** Restricting setting on FADs, logs and other debris; avoiding encircling turtles; monitoring FADs and releasing any entangled sea turtles; and recovering FADs when not in use are methods to reduce sea turtle bycatch (FAO 2010). There is a need to invest in research on modified FAD designs to reduce sea turtle interactions (e.g., Molina et al. 2005).
- **Sharks:** Methods to mitigate shark bycatch include: (1) avoiding hotspots; and (2) restricting setting on FADs, logs, other debris and whales. There is a need to invest in research on shark repellents for deployment on FADs (Stoner and Kaimmer In Press).
- **Marine Mammals:** Methods to reduce dolphin bycatch include use of a Medina dolphin safety panel, conducting backdown after dolphins are captured, deploying rescuers during backdown, and using dolphin rescue equipment (Hall 1998; IATTC 2007b). Further restricting setting on marine mammals is another approach.
- **Juvenile and Undersized Tunas:** Restricting setting on FADs avoids catch of small and juvenile tunas. There is a need for investment in research on sorting grids (Nelson 2007).

## PRINCIPLES AND APPROACHES

Bycatch solutions may be fishery-specific. For instance, while fishing with an underwater setting chute has been shown to be effective in avoiding seabirds in the Hawaii longline fleet, trials in Australia have been less promising, likely due to the seabird species complex and behavioral interactions, the weighting design and the use of live bait (Gilman et al. 2005).

Fishers have a large repository of knowledge, which can be tapped to contribute to finding bycatch solutions. Several bycatch reduction methods were developed by fishermen, including the bird-scaring *tori* line for longlining, and methods to reduce dolphin mortality in purse seines.

Given limited resources for monitoring, control and surveillance in most marine fisheries, methods shown to be effective in research experiments at reducing bycatch may not be employed, as prescribed or at all, if they are not convenient, safe and economically viable.

It is critical to identify conflicts as well as mutual benefits among species groups from mitigation approaches. For example, use of wider circle hooks and fish bait to reduce turtle bycatch rates and mortality in pelagic longline fisheries has been found to also cause a reduction in shark and seabird bycatch (Gilman and Lundin 2010). However, in some regions, setting longlines at night to protect diurnal foraging seabirds led to higher bycatch of nocturnal-foragers (Weimerskirch et al. 1999). Restrictions on purse seine dolphin sets resulted in increased FAD setting, which increased bycatch of juvenile and undersized tunas, sharks, dolphin fish, sea turtles and marine mammals (Hall 1998; Molony 2005; Secretariat of the Pacific Community 2006; Gilman and Lundin 2010).

## RFMO GOVERNANCE

Gilman and Lundin (2010) and Gilman et al. (2007c) review measures were adopted by Regional Fishery Bodies, including Regional Fisheries Management Organizations, to address bycatch of sensitive species groups in marine capture fisheries. The legally binding measures that have been adopted do not fully employ best practices for gear technology bycatch mitigation. Some require improvements in the areas where they are required, such as allowing relatively ineffective measures as options, and providing exclusions for classes of vessels with problematic bycatch. Inadequate observer coverage, inadequate and inconsistent data collection protocols for non-landed catch, inadequate resources for surveillance and enforcement, and ineffective or no measures to evaluate performance are additional problems.

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## Creating Incentives for the Development and Uptake of Effective Bycatch Mitigation and Management Methods

**Martin Hall**
Inter-American Tropical Tuna Commission

The mitigation of bycatch in fisheries depends on several stages that go from the identification of the problem, to the testing and implementation of technical or operational solution, the implementation of management programs, and the adoption of the changes proposed. Most of these stages have costs that need to be covered, or impose additional burdens on the fishers. There is a clear need for incentives to drive this process to a successful conclusion. Examples from different fisheries will be used to illustrate that there are practical approaches developed in a variety of settings, which are being implemented without significant negative impacts on the fisheries, and even in some cases, with benefits to them. There is a clear need to promote innovation and creative thinking among those trying to solve bycatch problems, especially the fishing community, whose knowledge of the activity makes them the most likely source of practical ideas. Economic incentives are the most common, and there is a broad range of opportunities to develop or to facilitate the adoption of new technologies.

## Outcomes of the Kobe II Bycatch Meeting

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This presentation summarized the outcomes of the Kobe II Bycatch Workshop (K2B). It was co-hosted by the United States and the Pacific Island Forum Fisheries Agency (FFA), and was held June 23-25, 2010 in Brisbane, Australia. K2B took place through the "Kobe process," a series of joint meetings of the five Tuna Regional Fishery Management Organizations (T-RFMOs). This year, three other Kobe workshops also took place: the Workshop on the best practices on Provision of Scientific Advice; the Workshop on Monitoring, Control and Surveillance; and the Workshop on RFMO Management of Tuna Fisheries.

The objectives for these workshops were adopted by the participants of the second joint meeting of the tuna RFMOs (Kobe II) in San Sebastian, Spain in 2009. The K2B objectives are as follows:

- review available information on incidental catch of non-target species and juveniles of target species;
- provide advice to tuna RFMOs on best practices, methods and techniques to assess and reduce the incidental mortality of non-target species, such as seabirds, turtles, sharks, marine mammals, and juveniles of target species;
- develop and coordinate relevant research programs and observer programs; and
- make recommendations on mechanisms to streamline the work of tuna RFMO Working Groups in this field in order to avoid duplication.

During the workshops, panels of experts presented the current knowledge of bycatch in tuna fisheries by improving: (1) assessment of bycatch within and among T-RFMO, (2) ways to mitigate/reduce bycatch within and among T-RFMOs, and (3) cooperation and coordination across RFMOs. The recommendations made by the participants were forwarded to the five T-RFMOs and will be forwarded to the 2011 Kobe III meeting.

## Seabird Bycatch in Pelagic and Demersal Longline Fisheries: Progress and Obstacles

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* Presenters

The rapid expansion of global fisheries in recent years – due to increasing demand for fish combined with advances in fishing technology and a general failure to effectively integrate sustainable development principles into fisheries policy and management – has resulted in a major decline in marine biodiversity. The primary driver of the continuing decline of albatross and petrel (*Procellariiformes*) populations is their bycatch rates in pelagic longline fisheries. Globally, 17 of the 22 species of albatrosses and petrels are now threatened with extinction under IUCN criteria; in most cases, this is primarily due to mortality in longline and trawl fisheries. For example, the wandering albatross (*Diomedea exulans*) population of South Georgia has undergone a 30% decline since 1984 and has declined at a rate of over 4% annually since 1997.

It has been well documented that in the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) waters, seabird bycatch has been reduced to zero in most demersal Patagonian

toothfish (*Disosstichus eleginoides*) longline fisheries. It has also been demonstrated that a combination of the technologies (mitigation measures) and other management measures that proved so successful in CCAMLR can be exported to achieve dramatic reduction in seabird bycatch in other demersal longline fisheries. The continuing dramatic population declines in many albatross populations are being caused by the overlap between migratory seabirds and fishing effort outside the Convention Area, predominantly in pelagic longline fisheries.

There are a range of political and financial issues that retard progress in the implementation of measures to reduce seabird bycatch to negligible levels in pelagic longline fisheries. But it must be recognized that mitigating seabird bycatch in such fisheries is inherently more difficult than in demersal longline fisheries. This is due to fundamental differences in gear design with demersal gear being configured to sink rapidly to the sea-bed, while pelagic gear is configured to float in the water column. One of the greatest challenges to replicating the success achieved in many demersal longline fisheries is to conduct the scientifically defensible at-sea experimentation to identify a suite of effective mitigation measures for pelagic longline fisheries. These findings then need to be implemented through management measures and regulations in coastal states and on the high seas.

In the last three to four years, significant gains have been made in identifying a suite of best practice mitigation measures for pelagic longline fisheries. This has been achieved through the work of the Agreement on the Conservation of Albatrosses (ACAP), specifically the ACAP Seabird Bycatch Working Group, key fishing states and the BirdLife Albatross Task Force (ATF). The ATF works in seven countries (seabird bycatch 'hotspots') in southern Africa and South America to conduct the at-sea research required to identify fishery specific mitigation measures for target longline fisheries.

There is a rapidly increasing awareness in the fishing industry of the need to improve fisheries sustainability. With considerable action underway to review the performance and reform of Regional Fisheries Management Organizations (RFMOs), there is currently a unique window of opportunity to undertake this at-sea research and have these findings promulgated in both coastal states and RFMOs to realize a dramatic decline in seabird bycatch levels in pelagic longline fisheries.

## Evolution of Mitigation Methods for Depredation by Toothed Whales in Industrial Tuna Longline Fisheries over a Half Century: Who is Smarter and the Winner, Humans or Dolphins?

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* Presenter

In this presentation, we will discuss the evolution of mitigation methods for depredation by toothed whales in tuna longline fisheries over a half century from industrial fisheries operations. Based on our reviews, there are five major *mitigation* approaches in the past some 60 years: (1) self-reliant efforts (boat and line handling and other techniques); (2) chemical methods (use of powders and other materials); (3) population control; (4) physical methods (nets, covers, etc.); and (5) acoustics methods (active and passive approaches). We will discuss the historical progress and evolution of these methods and will evaluate which methods are logistically effective within industrial tuna longline fisheries. Then we will discuss our on-going research on acoustical methods that use depredation mitigation pingers and also special streamers with light alloy balls, developed to strongly disturb echolocation capability and based on longline industry experiences. Lastly, we will discuss the future prospects of the mitigation methods in order for humans to win this long-standing competition between humans and toothed whales to demonstrate (hopefully) that we are smarter.

# Shark Bycatch in the Taiwanese Longline Fishery

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The Taiwanese tuna longline fishery has operated in the three oceans since the late 1960s. However, shark bycatch in the Taiwanese tuna longline fishery has never been reported until 1981 because of the low value of sharks relative to tunas. Prior to 2003, species-specific shark catch data were not available because shark catch had not been recorded to the species level until then. Subsequently, since then, the category "sharks" in logbooks is separated into four species: blue shark, mako shark, silky shark and "other."

three oceans and reported by observers. The averaged proportion of shark catch (both in number) to the total catch of target species reported by these observers (Figure 1) was used to adjust the historical shark catch data on a per-set basis for1991-2008.

According to shark catch rates, the Atlantic Ocean was stratified into the following five areas: (A) 5°N-15°S; (B) 15°S-50°S, west to 20°W; (C) 15°S-50°S, 20°W-20°E; (D) 5°N-20°N; and (E) north of 20°N. Because areas A and D are tropical waters, bigeye tuna (BYT) and yellowfin tuna (YFT) are the major target species, and swordfish (SWO) is the predominant bycatch species (Table 1). In areas B, C and E, the ratio between sharks and albacore (ALB) was used to adjust historical shark catch data on per-set basis. Based on observer records, the seasonal proportion of sharks to the total catch in numbers of BYT, YFT, and SWO in area A were 28.74%, 85.03%, 40.62% and 17.37%, respectively (Table 1). In area B, the proportion of sharks to the total catch of ALB was 22.59% in number (Table 1). In areas C, D, and E, sharks comprised 0.89%, 21.75%, and 5.83% of ALB or (BYT+YFT+SWO) catch and blue shark was the dominant species (Table 1).

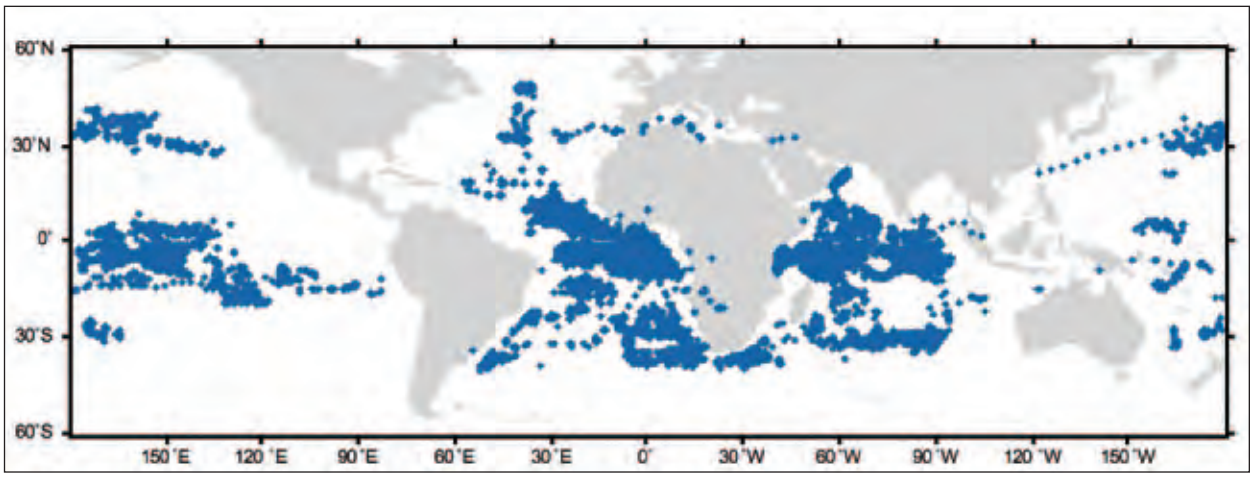


**Figure 1.** Fishing effort of Taiwanese tuna longline vessels operating in the three ocean reported by observers (2002-2008)

With globally widespread fishing grounds across the three oceans, shark bycatch data from the Taiwanese longline fishery can be valuable to determine the stock status of pelagic sharks. This far seas fishery's observer program is one of the ways to obtain detailed data for more comprehensive stock assessments and management studies. To fulfill the obligations of a far seas fishing nation, a pilot observer program was initiated by scientists in 1999 and launched by the Taiwanese Fisheries Agency in 2001. This paper presents a summary of shark bycatch from 2002 -2008 by Taiwanese tuna longline fishing vessels operating in the

In the Pacific Ocean, 4 areas, namely, A (0°-20°S), B (south of 20°S), C (0°-20°N), and D (north of 20°N), were categorized based on the distribution of shark bycatch rates recorded by observers during the period 2002-2008. The major bycatch species was sharks, followed by billfishes, other bony fishes, and "others." The blue shark (*Prionace glauca*), silky shark (*Carcharhinus forcilformis*), bigeye thresher shark (*Alopas superciliosus*), and mako sharks (*Isurus* spp.) are the main shark by-catch species, with the blue shark as the major discarded shark species.

The Indian Ocean was stratified as 3 areas: (A) 10°N-30°N; (B) 15°S-10°N, west to 20°W; and (C) 15°S-50°S, 20°W-150°E. The predominant by-catch is other bony fishes, followed by sharks and billfishes. The blue shark (*Prionace glauca*), sandbar shark (*Carcharhinus plumbeus*), pelagic thresher shark (*Alopias pelagicus*), and mako sharks (*Isurus* spp.) are the dominant shark bycatch species, and blue shark is the major discarded shark species.

The historical shark bycatch in logbooks and the total shark catch by Taiwanese longliners in the three oceans were estimated, based on shark bycatch data reported by observers from 2002-2008. Shark bycatch in weight ranged from 4,689 tons (2007) to 15,117 tons (1996) in the Atlantic Ocean (Table 2), from 2,357 tons (1998) to 12,746 tons (2004) in the Pacific Ocean, and from 730 tons (1991) to 9,957 tons (1995) in the Indian Ocean (Table 2).

**Table 1.** The proportions of shark to target species catch estimated from observers' records of Taiwanese tuna longline fishery in the three oceans, 2002-2008

| Area | | shark ratio | blue shark ratio | mako shark ratio | other sharks ratio | target species |
|---|---|---|---|---|---|---|
| **Atlantic Ocean** | | | | | | |
| A | Quarter 1 | 28.74% | 25.08% | 0.57% | 3.09% | BET_N+YFT_N+SWO_N |
| | Quarter 2 | 85.03% | 78.63% | 3.11% | 3.29% | |
| | Quarter 3 | 40.62% | 35.20% | 2.01% | 3.41% | |
| | Quarter 4 | 17.37% | 14.72% | 0.95% | 1.70% | |
| B | | 22.59% | 20.04% | 1.45% | 1.10% | ALB_N |
| C | | 0.89% | 0.58% | 0.12% | 0.19% | |
| D | | 21.75% | 19.83% | 0.94% | 0.98% | BET_N+YFT_N+SWO_N |
| E | | 5.83% | 3.96% | 0.59% | 1.28% | ALB_N |
| **Pacific Ocean** | | | | | | |
| A | | 5.83% | 4.50% | 0.31% | 1.02% | ALB_N +BET_N+ YFT_N+SWO_N |
| B | | 2.28% | 1.81% | 0.44% | 0.03% | ALB_N |
| C | | 8.41% | 2.71% | 0.22% | 5.48% | ALB_N +BET_N+ YFT_N+SWO_N |
| D | | 4.23% | 1.54% | 0.82% | 1.87% | ALB_N |
| **Indian Ocean** | | | | | | |
| A | | 28.70% | 16.10% | 1.83% | 10.77% | YFT_N |
| B | | 41.53% | 30.23% | 10.13% | 1.17% | BET_N |
| C | | 2.22% | 1.83% | 0.32% | 0.07% | ALB_N +SBT_N |

**Table 2.** Estimated annual shark bycatch by weight (tons) in the Taiwanese tuna longline fishery in the three oceans

| Year | Atlantic Ocean | Pacific Ocean | Indian Ocean |
|---|---|---|---|
| 1991 | 10900 | 2985 | 730 |
| 1992 | 13688 | 4824 | 1988 |
| 1993 | 8073 | 3590 | 2857 |
| 1994 | 12657 | 3086 | 1850 |
| 1995 | 10473 | 7170 | 9957 |
| 1996 | 15117 | 8822 | 4413 |
| 1997 | 12245 | 2943 | 1922 |
| 1998 | 10794 | 2357 | 4126 |
| 1999 | 10626 | 3817 | 2764 |
| 2000 | 11318 | 4367 | 1990 |
| 2001 | 7684 | 10657* | 5532* |
| 2002 | 10564 | 10642* | 4528* |
| 2003 | 9543 | 10242* | 5052* |
| 2004 | 8157 | 12746* | 5398* |
| 2005 | 6516 | 12289* | 3280* |
| 2006 | 5667 | 12482* | 4438* |
| 2007 | 4689 | 12550* | 4391* |
| 2008 | 5300 | 12461* | 5009* |

*Includes small-scale longline fishing vessels

**SESSION 4:** RECOMMENDATIONS FOR IMPLEMENTING COASTAL AND MARINE SPATIAL PLANNING TO ACHIEVE SUSTAINABLE PELAGIC FISHERIES

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## Session 4: Summary

# Recommendations for Implementing Coastal and Marine Spatial Planning to Achieve Sustainable Pelagic Fisheries

**SESSION CHAIR: Dr. Larry B. Crowder**, Duke University

**TARGET OUTCOMES**: Generate recommendations, future actions and industry commitments related to implementing marine spatial planning to contribute to sustainable pelagic fisheries, to be recorded in an IFF5 declaration.

The closing session of the Fishers Forum began with brief statements by each of ten panelists to express their viewpoints on how the pelagic fisheries industry sector can benefit from participation in marine spatial planning and ecosystem-based management in coastal and high-seas areas. Following the panelist statements, questions were solicited from the audience and fielded by the panelists.

Equating marine spatial planning with marine protected areas was a common perspective held by many forum participants, where the presumed end result for the fishing sector from any spatial planning in coastal and marine areas was to designate where fishing can and cannot occur. Through presentations and discussion during the conference, it was learned how the fishing and broader seafood industry can benefit from initiating and improving coordination with other industries that use and affect marine resources, helping to clarify why the perspective that marine spatial planning is just another term for closing areas to fishing is inaccurate.

The fishing industry relies directly on the integrity of marine ecosystems, while other large marine industry sectors do not. If commercial fish stocks crash in the Gulf of Mexico due to the recent oil spill, the oil industry will not be adversely affected as a result. Thus, one example of how marine spatial planning can benefit the fishing sector is to identify areas of commercial importance (e.g., areas with high catch to bycatch ratios, spawning areas, etc.) and, through direct participation in marine spatial planning initiatives, assert this industry sector's interest in protecting these areas from activities that could result in their degradation.

Daniel Dunn, Duke University, expressed how the seafood industry can benefit from formally participating in marine spatial planning processes, and the risks of not participating. He highlighted how the Convention on Biological Diversity's recently adopted scientific criteria for identifying ecologically or biologically significant marine areas (EBSAs) can be applied, first through the in-progress inventory of EBSAs, and then hopefully through their incorporation by organizations with mandates to manage marine resources. IFF5 participants across all sectors were encouraged to contribute in this process.

Paul Holthus, World Ocean Council, explained that across industry sectors there has been limited engagement in multi-stakeholder marine spatial planning processes because industry is engaged in single-sectoral dialogues. There is a need to build constructive relationships among ocean industries and other stakeholders.

Edward Huang, Taiwan Deep Sea Tuna Longline Boat-Owners and Exporters Association, referred to the constructive discussion that occurred during the Fishermen's Lunch. In recent decades, despite initial concerns about how new conservation measures would adversely affect their livelihoods, the tuna fishing industry has adopted new gear technology in order to reduce problematic bycatch of sensitive species groups, including sea turtles and seabirds. Similarly, marine spatial planning and implementation through ecosystem-based management mechanisms will likely elicit gradual support by the fishing industry sector, and their participation in the planning and management processes.

David Hyrenbach, Hawaii Pacific University, expressed how, for pelagic marine ecosystems, the complexity from dynamic processes, multiple stressors, large spatial scale, and multiple interest groups makes marine spatial planning challenging relative to discrete coastal areas, but not insurmountable. The marine spatial planning process must account for these complexities.

Charles Lee, Taiwan Deep Sea Tuna Purse Seine Boat-Owners and Exporters Association, reviewed the status of conservation and management measures applicable to the purse seine tuna fleet operating in the Pacific. Existing time-area closures established by the two Pacific tuna-regional fisheries management organizations are a starting point for marine spatial planning for this industry sector, which promises to contribute to sustainable use of tuna resources.

Hsueh-Jung Lu, National Taiwan Ocean University, described how marine spatial planning is still a relatively new concept and different definitions and perceptions abound. It will be critical to consider socioeconomic effects as a part of marine spatial planning processes, and measures must be designed to flexibly address the three-dimensional, dynamic marine structure and processes.

Sean Martin, Hawaii Longline Association, expressed that it would be optimal for all levels of the seafood industry, from retailers to the capture sector, to participate directly in marine spatial planning processes, both for high-seas and coastal areas. Through the case studies presented during the conference, the importance of consideration of the socioeconomic effects on the fishing industry from alternative spatial planning mechanisms became clear.

Randall Owens, Great Barrier Reef Marine Park Authority, offered that strong governance is critical for effective marine spatial planning and implementation. Spatial management will come at some cost. The management measure outcomes resulting from marine spatial planning requires binding agreements as well as resources to ensure compliance in order to ensure effective implementation.

Robin Warner, University of Wollongong, reminded participants that in the oceans beyond national jurisdiction, there are few examples of marine spatial planning, although there are some single-sector ocean zoning processes, such as fisheries closures, and a few regional examples of protected areas beyond national jurisdiction. At the global level, there are a handful of recent initiatives that may provide a foundation for comprehensive marine spatial planning in waters beyond national jurisdiction. She emphasized the importance of cross-sectoral engagement between fisheries stakeholders and other relevant sectors as spatial planning in international waters evolves.

During the subsequent discussions from the floor, participants made mention of marine protected networks in Palau as another example of the implementation of spatial planning in coastal areas.

In some areas, it is difficult to obtain baseline fundamental information about the social and economic context of coastal and marine human uses, the value of the various uses, and ecological effects. In particular, adequate evaluation of cumulative impacts of marine uses should be a central role of marine spatial planning, which also requires possession of substantial information.

The role of rights-based management measures in fisheries was raised as a potential facet of marine spatial planning to achieve ecologically sustainable fisheries and equitable balance with other ocean activities.

Discussions touched upon the importance of catalyzing effective communication between the fishing industry sector and conservation groups, and how marine spatial planning processes could fulfill this role. Marine spatial planning will have major effects on ocean industry access to marine space and resources; as a result, the seafood industry, which currently is generally not directly involved in planning discussions, needs to become involved with these marine spatial planning processes and develop networks with the other ocean industry stakeholders in order to ensure that the processes are well informed and balanced, to ensure that the seafood industry's interests are equitably considered. It will be critical to clearly present the range of possible benefits to the seafood industry from marine spatial planning, so that there is an incentive for their participation in formal marine spatial planning activities, otherwise these interest groups are not likely to participate if their perception is that the only possible outcomes from spatial planning are further spatial constraints on fisheries.

**PRESENTED BY Kitty M. Simonds**, Executive Director, Western Pacific Regional Fishery Management Council

## AWARD TO GEOFF MCPHERSON AND TOM NISHIDA

It is usual to give awards to people who have made great accomplishments, and not for work in progress. But sometimes work in progress needs to be rewarded, especially when the results may be so far reaching. The goal that our recipients, Geoff McPherson and Tom Nishida, have striven towards is a working deterrent to prevent toothed whales depredating pelagic longlines.

Few of these toothed whales, such as false killer whales or shortfin pilot whales, are ever caught. However, in the United States, the stringencies of the Marine Mammal Protection Act result in small bycatch numbers having a drastic effect on pelagic longline fisheries. The National Marine Fisheries Service has just concluded the drafting of a Take Reduction Plan for the Hawaii longline fishery that will attempt to minimize a handful of serious injuries and mortalities to false killer whales.

The plan uses a combination of gear modifications and spatial management options to achieve a reduction of serious injuries and mortalities. The gear modifications include the mandatory adoption of circle hooks made from a wire diameter strong enough to retain large bigeye tuna, but weak enough to straighten out and release a large animal like a false killer whale. There are great expectations for this plan, and its spatial elements are directly related to many of the topics heard at the Fifth International Fishers Forum. Mitigation of seabirds and sea turtle bycatch was a relatively easy fix. However, solutions for toothed cetaceans, renowned for their intelligence and learning abilities, are proving to be more challenging.

Spatial management of the longline fishery to separate longliners from false killer whales assumes that increasing distances between the locations of known interactions and the waters beyond has any effect. Will false killer whales used to feeding on longline-caught fish and bait simply move to where the longline are fishing? If that is the case, what else can we do?

Fortunately, Geoff McPherson and Tom Nishida have been looking for a solution to this question. They have been investigating the behavior of false killer whales, and, in particular, the echolocation skills employed by these animals as they forage around longlines. Geoff and Tom have worked on a variety of ideas that might be used to deceive false killer whales from taking fish from longlines and how their echolocation skills could be blocked or fooled. Various pieces of equipment, including metal spheres, lengths of wire and glass soda bottles, have been among the range of potential methods considered by Geoff and Tom.

It has been a long journey towards the desired goal of successful toothed whale depredation and bycatch mitigation methodology. Seabirds are easy to scare away with tori lines or prevented from taking baits by other methods such as side-setting. Turtles are organisms with largely by instinctive behavior and mouths unlikely to be caught by large hooks baited with fish. It is worth recalling that the subtext of Geoff and Tom's presentation to IFF5 was, "Who is smarter and the winner: humans or dolphins?" We hope it is the humans, and that Tom and Geoff will achieve their objectives of a safe and humane way to discourage toothed whales from taking longline baits and depredating catches.

Nonetheless, the IFF series acknowledges and applauds the energy and indefatigability of our two colleagues. We know it's been a long journey for them so far. So we present these awards to our two colleagues for their unstinting dedication, and ask them not to be discouraged or despondent. Their work is appreciated, and thousands of longline fishermen will be grateful if find the solution to mitigating marine mammal interactions with longlines.

## AWARD TO THE FISHERY AGENCY OF TAIWAN

The International Fishers Forum would like to present an award to the Fishery Agency of Taiwan for its 2008 decision to ban the hunting of whale sharks. The status of whale shark populations globally continues to be uncertain, and there has been concern about fishing on all sharks for the last two decades. Further, the International Union for the Conservation of Nature (IUCN) considers whale sharks to be vulnerable and in need of protection.

Little is known about this 'gentle giant' of the shark world. But it is to the credit of Taiwan that it has taken advantage of the abundance of whale sharks in its waters to study the biology of this amazing fish. The lifespan of this species exceeds 80 years with sexual maturity between 17 and 22 years. This means that it is vulnerable for a quarter of its lifespan before it is able to reproduce.

The Fishery Agency's decision to ban whale shark fishing meant that this was the end of a tradition in Taiwan, something that is hard for those affected to give up. However other countries in Asia, such as the Philippines and India have also placed a ban on whale shark fishing, despite traditional harvesting activities. Governance and management means making hard choices and taking decisions that may not be universally popular. This International Fishers Forum would, therefore, like to acknowledge the Taiwan Fishery Agency for its actions to conserve whale sharks.

The whale shark is a true highly migratory species, wandering across the vast reaches of the oceans. The award itself, a canoe paddle, is also significant, since it symbolizes not only the great migrations of the whale shark, but also the incredible human voyages that populated the islands of the Pacific.

Taiwan is thought to be the ancestral homeland of many of the peoples of the Pacific Islands. About 5-6000 years ago, Austronesian people from Taiwan are believed to have voyaged through Southeast Asia into New Guinea, where the Lapita culture evolved, marked by a distinct form of red pottery. About 3,000 years ago the Lapita people left New Guinea and spread out into islands of the Central Pacific that became nucleus of Polynesia. The Polynesians spread across the Pacific to temperate New Zealand and the sub-tropical islands of Hawaii and Easter Island.

The IFF series has been convened around the Pacific, in New Zealand, Hawaii, Japan and Costa Rica. It is appropriate, therefore, that we return to the ancestral homeland of so many of the people at this meeting. Symbolic of this voyage is the koa wood paddle that is presented today to Taiwan for their conservation of whale sharks.

It should also be recalled that the circle hook, the basis of so much of success in mitigating longline fisheries interactions with sensitive species, was the product of ancestral Pacific Island cultures. Their ingenuity extends across the centuries to help achieve the goal of environmentally responsible fisheries. In honoring the Fishery Agency of Taiwan, the Fifth International Fisheries Forum applauds actions such as conserving whale sharks and acknowledges the role of ancestral Pacific Islands culture as a source of inspiration for the future.

## Appendix 1:

# IFF5 Program

## Shangri-La Far Eastern Plaza Hotel
## Taipei, August 3-5, 2010

**Western Pacific Regional Fishery Management Council & Fisheries Agency, Taiwan**

IFF5 TAIPEI AUGUST 3-5, 2010
FIFTH INTERNATIONAL FISHERS FORUM

### MONDAY, AUGUST 2, 2010

**13:00 – 17:00**
Registration (Grand Ballroom Foyer, 3rd Floor)

**14:00 –14:30**
Speaker Briefing Meeting (Grand Ballroom, 3rd Floor)

### TUESDAY, AUGUST 3, 2010 (DAY 1)

**7:30 – 17:00**
Registration (Grand Ballroom Foyer, 3rd Floor)

**8:30 – 9:00**
Plenary Opening Ceremonies (Grand Ballroom, 3rd Floor), Hosted by the Fisheries Agency, Taiwan

**9:00 – 9:30**
Opening Addresses

- Dr. Wu-Hsiung Chen, Minister, Council of Agriculture, Executive Yuan, Taiwan

Opening Remarks

- Mr. James Sha, Director General, Fisheries Agency, Council of Agriculture, Executive Yuan
- Mr. Wen-Jung Hsieh, Chairman, Taiwan Deep Sea Tuna Longline Boat-Owners and Exporters Association
- Dr. Rebecca Lent, Director, Office of International Affairs, U.S. National Marine Fisheries Service
- Mr. Sean Martin, President, Hawaii Longline Association

**10:15 – 10:45**
Group Photo (1st Floor Lobby Court Terrace)

**10:45 – 11:15**
Coffee Break

**10:45 – 11:15**
Press Conference[1] (Grand Ballroom, 3rd Floor)

**11:15 – 11:30**
Forum Mission, Structure and Social Events

- Mr. Hong-Yen Huang, Director, Deep Seas Fisheries Division, Fisheries Agency, Taiwan

**11:30 – 12:00**
Reporting on Commitments and Progress since IFF1 and Process for IFF5 Participant Commitments

- Ms. Kitty M. Simonds, Executive Director, Western Pacific Regional Fishery Management Council

**12:00 – 13:30**
Lunch (On Own)

**13:30 – 15:15**
**SESSION 1: APPROACHES TO COASTAL AND MARINE SPATIAL PLANNING AND MANAGEMENT**

Session chair: Dr. Robin Warner, Australian National Centre for Ocean Resources and Security, University of Wollongong

Target Outcomes: What are the various approaches to coastal and marine spatial planning, and how can C&MSP contribute to mitigating fisheries bycatch, managing discards, and achieving sustainable pelagic fish stocks?

Presenters/Panelists: (10-minute presentations followed by panel discussion and audience questions)

- Dr. Larry B. Crowder, Duke University, "The role of marine spatial planning in sustaining pelagic fisheries: Transitioning from managing sectors to comprehensive ecosystem-based management"
- Dr. David Hyrenbach, Hawaii Pacific University, "Oceanographic considerations for marine spatial planning on the high seas"
- Mr. Daniel Dunn, Duke University, "Using the Convention on Biological Diversity's scientific criteria to identify ecologically or biologically significant areas in need of protection to inform fisheries management and marine spatial planning"
- Dr. Hsueh-Jung Lu, Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University, Taiwan, "Marine spatial planning in coastal zones with geographic information system"
- Mr. Randall Owens, Great Barrier Reef Marine Park Authority, "Great Barrier Reef Marine Park Authority – Monitoring, evaluation and adaptive marine spatial planning and management"

1 Press Conference 10:45 – 11:15 with presenters of opening addresses.

- Dr. Robin Warner, Australian National Centre for Ocean Resources and Security, University of Wollongong, "The role of marine spatial planning in governance of climate change mitigation activities in the oceans beyond national jurisdiction"
- Dr. Paul Holthus, Executive Director, World Ocean Council, "Corporate role in marine spatial planning and management"

**14:50 – 15:15**
Panel Discussion

**15:15 – 15:30**
Coffee Break

**15:30 – 17:30**

**SESSION 2A:** CASE STUDIES OF COASTAL AND MARINE SPATIAL PLANNING AND MANAGEMENT– PERSPECTIVES FROM MANAGERS AND PLANNERS

Session Chair: Dr. Milani Chaloupka, Ecological Modeling Services and University of Queensland, and Mr. David Chang, Overseas Fisheries Development Council, Taiwan

Target Outcomes: Identify lessons learned and best practices for effective and ineffective coastal and marine spatial planning, and implications for marine fisheries governance. What lessons can be drawn for the application of marine spatial planning within the Pacific Islands Region?

Presenters/Panelists: (15-minute presentations followed by panel discussion and audience questions)

- Dr. Jo-Ann Leong, Director, Hawaii Institute of Marine Biology, "Coastal and marine spatial planning and the northwestern Hawaiian Islands"
- Mr. Randall Owens, Great Barrier Reef Marine Park Authority, "Great Barrier Reef Marine Park Authority lessons learned in marine spatial planning, including sustainable marine fisheries"
- Ms. Deirdre Boelke, Fishery Analyst, New England Fishery Management Council, "New England area rotation of scallop beds"
- Mr. Mao-Cheng Wang, Fisheries Agency, Taiwan, "Taiwan's experience with marine protected areas"
- Dr. David Fluharty, University of Washington, "Incipient implementation of marine spatial planning in Puget Sound"

**16:45 – 17:30**
Panel Discussion

**19:00**
Aloha Reception (7th Floor Pool Deck), Hosted by Western Pacific Regional Fishery Management Council

## WEDNESDAY, AUGUST 4, 2010 (DAY 2)

**8:00 – 17:00**
Registration (Grand Ballroom Foyer, 3rd Floor)

**8:30 – 8:45**
Announcements (Grand Ballroom, 3rd Floor)

**08:45 - 11:30**
**SESSION 2B:** CASE STUDIES OF COASTAL AND MARINE SPATIAL PLANNING AND MANAGEMENT – PERSPECTIVES FROM THE COMMERCIAL MARINE CAPTURE FISHING INDUSTRY

Session Chair: Mr. Henk Brus, Atuna

Target Outcomes: How can marine spatial planning be adapted to meet specific social, economic, cultural, and environmental contexts of fishing communities?

Presenters: (15-minute presentations followed by discussion)

- Ms. Timm Timoney, Northwestern Hawaiian Islands bottomfish fisher, "Socioeconomic effects on commercial fisheries from spatial planning by the US Papahānaumokuākea Marine National Monument"
- Mr. Andrew Tobin, Queensland Seafood Industry Association, "Fishing industry experiences with Great Barrier Reef Marine Park marine spatial planning"
- Mr. Bill Wells, Wells Scallop Co., "Industry experiences with Atlantic sea scallop area rotation"
- Mr. Yi-Ping Hung, Changhua Fishery Association, "Taiwan experiences with marine spatial planning: The case of Chunghwa county"
- Mr. Marion Larkin, Washington, USA Commercial Fisherman, "Fishing industry experiences with marine spatial planning on the U.S. west coast"

**10:15 – 10:30**
Coffee Break

**10:30 – 11:30**
SESSION 2B (continued): Discussion

**11:30 – 13:00**
Participants Lunch (East Gate Room, Basement), Hosted by the Western Pacific Regional Fishery Management Council

Fishermen's Lunch (North/South Gate Room, Basement), Co-hosted by the Hawaii Longline Association and the Western Pacific Regional Fishery Management Council

Target Outcomes: Informal facilitated discussion of fishermen's experiences and perspective on marine spatial planning.

Co-Chairs: Mr. Edward C.C. Huang, General Secretary, Taiwan Deep Sea Tuna Longline Boat-Owners and Exporters Association and Mr. Sean Martin, President, Hawaii Longline Association

**SESSION 3:** MITIGATING BYCATCH OF SENSITIVE SPECIES GROUPS IN MARINE FISHERIES

**13:00 – 14:45**
**SESSION 3A:** MITIGATING SENSITIVE SPECIES BYCATCH AND MANAGING DISCARDS IN SMALL SCALE FISHERIES, INCLUDING COASTAL ARTISANAL PASSIVE NET FISHERIES

Session Chair: Dr. Ussif Rashid Sumaila, Director, Fisheries Centre, University of British Columbia

Target Outcomes: Identify the state of progress and priorities for mitigating bycatch in small scale coastal fisheries.

Presenters: (12-minute presentations followed by discussion)

- Dr. Rebecca Lewison, San Diego State University, "Assessing bycatch in small-scale fisheries and an estimate of global impacts"
- Dr. Shoou Jeng Joung, National Taiwan Ocean University, "Managing whale shark (*Rhincodon typus*) fishing mortality in Taiwan"
- Mr. Geoff McPherson, James Cook University, "Acoustic pingers to mitigate marine mammal gillnet bycatch - the biosonar basis for their optimum utilization, and approaches for mitigating both bycatch and depredation"
- Dr. Osamu Abe, National Research Institute of Far Seas Fisheries, Japan, "Mitigating sea turtle interactions in pound nets and set nets"
- Dr. Donald Kobayashi, National Marine Fisheries Service Pacific Islands Fisheries Science Center, and Dr. I-Jiunn Cheng, National Taiwan Ocean University, "Sea turtle bycatch in Taiwan coastal poundnets"
- Dr. Martin Hall, Inter-American Tropical Tuna Commission, "Assessment and mitigation of problematic bycatch in small scale coastal fisheries of Latin America"

**14:15 – 14:45**
Discussion

**14:45 – 15:00**
Coffee Break

**15:00 – 17:00**
**SESSION 3B:** MARKET-BASED MECHANISMS AND FISHERIES BYCATCH

Session Chair: Dr. Lida Pet-Soede, Leader, WWF Coral Triangle Programme

Target Outcomes: Identify how market-based mechanisms have influenced fisheries production practices and governance structures related to mitigating bycatch of sensitive species, and how these approaches can be employed in the future to contribute to sustainable fisheries and to open new and secure existing markets for participating fisheries.

Presenters: (10-minute presentations followed by discussion)

- Ms. Ming-Hua Lee, Taiwan Cetacean Society, "An introduction to the Taiwanese whale watching industry and its evolution from traditional fisheries"
- Dr. Lida Pet-Soede, WWF Coral Triangle Programme, "The International Seafood Sustainability Foundation and bycatch mitigation: Centerpiece of the global tuna sustainability mission"
- Mr. Keith Symington, WWF Bycatch Strategy Leader, Coral Triangle and Western Pacific, "The Coral Triangle Fishers Forum: Market-based partnerships for managing bycatch"
- Mr. Bill Holden, Pacific Fisheries Manager, Marine Stewardship Council, "MSC protocols for assessing bycatch in data-deficient fisheries"
- Mr. Duncan Leadbitter, Technical Director, Sustainable Fisheries Partnership, "Market influences and sustainable tuna: a diverse and changing world"
- Mr. Bundit Chokesanguan, Southeast Asian Fisheries Development Center, "monitoring, control and surveillance and the ability of market-based mechanisms to change fishing practices: Lessons from US trade rules on the importation of shrimp and uptake of TEDs in tropical shrimp trawl fisheries"
- Mr. Henk Brus, Atuna, "Sustainable tuna sourcing for the European market"

**16:10 – 17:00**
Discussion

## THURSDAY, AUGUST 5, 2010 (DAY 3)

**8:00 – 17:00**
Registration (Grand Ballroom Foyer, 3rd Floor)

**8:00 – 8:30**
Announcements (Grand Ballroom, 3rd Floor)

**8:30 – 11:00**
**SESSION 3C:** MITIGATING BYCATCH IN LONGLINE AND PURSE SEINE FISHERIES

Session Co-Chairs: Mr. Tzu-Yaw Tsay, Fisheries Agency, Taiwan, and Mr. Peter Ho, Overseas Fisheries Development Council, Taiwan

Target Outcomes: Review progress and identify priorities for mitigating bycatch in pelagic and demersal longline fisheries and purse seine fisheries.

Presenters: (10-minute presentations followed by discussion)

- Dr. Ussif Rashid Sumaila, Director, Fisheries Centre, University of British Columbia, "Sequential game theoretic models of western central Pacific tuna stocks"

- Dr. Rick Deriso, Inter-American Tropical Tuna Commission, "Effects on the bigeye tuna stock in the Eastern Pacific Ocean from the Inter-American Tropical Tuna Commission's measures for allocation of tuna by gear type"
- Dr. Eric Gilman, Hawaii Pacific University, "Mitigating unwanted bycatch in global tuna fisheries"
- Dr. Martin Hall, Inter-American Tropical Tuna Commission, "Creating incentives for the development and uptake of effective bycatch mitigation and management methods"
- Dr. Rebecca Lent, U.S. National Marine Fisheries Service, "Outcomes of the Kobe II Bycatch meeting"
- Dr. Charles Cheng, Chinese Wild Bird Federation and Dr. Mayumi Sato, BirdLife International - Asia, "Seabird bycatch in demersal and pelagic longline fisheries: Progress and obstacles"

**9:30 – 9:45** Coffee break

- Dr. Tom Nishida, National Research Institute of Far Seas Fisheries, Japan, "Evolution of mitigation methods for depredation by toothed whales in industrial tuna longline fisheries over a half century: Who is smarter and the winner, humans or dolphins?"
- Dr. Kwang-Ming Liu, National Taiwan Ocean University, Taiwan, "Shark bycatch in the Taiwanese longline fishery"

**10:05 – 11:00**
Discussion

**11:00 – 11:15**
Coffee Break

**11:15 – 12:45**
**SESSION 4: RECOMMENDATIONS FOR IMPLEMENTING COASTAL AND MARINE SPATIAL PLANNING TO ACHIEVE SUSTAINABLE PELAGIC FISHERIES**

Discussion session (no presentations)

Chair and Panelist: Dr. Larry B. Crowder, Duke University

Target Outcomes: Generate recommendations, future actions and industry commitments related to implementing marine spatial planning to contribute to sustainable pelagic fisheries, to be recorded in an IFF5 declaration.

Panelists:
- Mr. Daniel Dunn, Duke University
- Dr. Paul Holthus, World Ocean Council
- Mr. Edward C.C. Huang, Taiwan Deep Sea Tuna Longline Boat-Owners and Exporters Association
- Dr. David Hyrenbach, Hawaii Pacific University
- Mr. Charles C.P. Lee, Taiwan Deep Sea Tuna Purse Seine Boat-Owners and Exporters Association
- Dr. Hsueh-lung Lu, Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University
- Mr. Sean Martin, Hawaii Longline Association
- Mr. Randall Owens, Great Barrier Reef Marine Park Authority
- Dr. Robin Warner, Australian National Centre for Ocean Resources and Security, University of Wollongong

Group discussion to generate recommendations

**12:45 – 14:15**
Lunch (On Own)

**14:15 – 14:45**
Report of IFF5 Participants' Commitments
Mr. Paul Dalzell, Western Pacific Regional Fishery Management Council

**14:45 – 15:15**
IFF5 Declaration
- Mr. James Sha, Fisheries Agency, Council of Agriculture, Executive Yuan
- Ms. Kitty Simonds, Western Pacific Regional Fishery Management Council

**15:15 – 15:45**
Closing Statements
- Mr. James Sha, Fisheries Agency, Council of Agriculture, Executive Yuan
- Ms. Kitty Simonds, Western Pacific Regional Fishery Management Council

**15:45 – 16:00**
The Fifth International Fishers Forum Award
Presented by Ms. Kitty Simonds, Western Pacific Regional Fishery Management Council

**16:00 – 16:30**
Plenary Closing Ceremony
Hosted by the Western Pacific Regional Fishery Management Council

**17:15 – 17:45**
Press Conference [2]

**19:00**
Farewell Dinner (The Grand Hotel)
Hosted by the Fisheries Agency, Taiwan

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2 Press Conference with a panel comprised of, Mr. James Sha, Director General, Fisheries Agency, Taiwan, Ms. Kitty Simonds, Executive Director, Western Pacific Regional Fishery Management Council; and the panelists of Session 4.

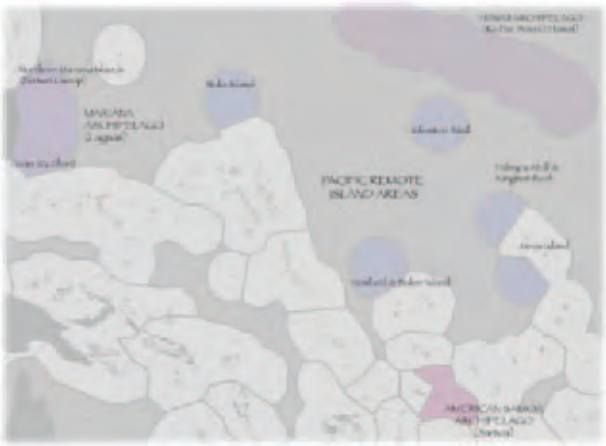
## Appendix 2:
# About the Host Organizations

### ABOUT THE WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

The Western Pacific Regional Fishery Management Council (Council) is the policy-making organization for the management of fisheries in offshore waters around the Territory of American Samoa, the Territory of Guam, the State of Hawaii, the Commonwealth of the Northern Mariana Islands (CNMI) and the US Pacific Remote Island Areas (see map)—an area of nearly 1.5 million square miles. The Council is one of eight regional councils in the United States established under the Magnuson Fishery Conservation and Management Act of 1976. During its first 34 years, the Council's accomplishments have run the gamut from being the first regional fishery management council in the nation to prohibit drift gill-net fishing and to develop an ecosystem-based fishery management plan to being the pioneer of the vessel monitoring system (VMS) for fishing vessels, which is now being implemented in fisheries worldwide.

The main task of the Council is to conserve fishery resources while maintaining opportunities for domestic fishing at sustainable levels of effort and yield. To accomplish this, the Council manages fisheries within its region through place-based Fishery Ecosystem Plans (FEPs) for American Samoa, the Mariana Archipelago (Guam and CNMI), Hawaii, Pacific Remote Island Areas and Pacific Pelagics. Under the FEPs, the Council convenes regional ecosystem advisory committees comprised of Council members and representatives from federal, state, and local government agencies, businesses, and non-governmental organizations that have responsibility or interest in land-based and non-fishing activities that potentially affect the area's marine environment.

The Western Pacific Council is the most internationally focused of the eight US councils. Through membership on US delegations it participates in




various international fishery management conventions in the Pacific, including the Western and Central Pacific Fisheries Commission (WCPFC), North Pacific Regional Fishery Management Arrangement and the Inter-American Tropical Tuna Commission. American Samoa, Guam and the CNMI also participate in their own right in the WCPFC. In addition, the Council has been instrumental in several key conservation initiatives for sea turtles around the Pacific Rim (including Japan, Indonesia, Papua New Guinea and Mexico) and has helped Hawaii to become a world center for sea turtle conservation and management. The Council is also actively engaged in seabird, marine mammal and shark conservation.

The Council has 13 voting and 3 non-voting members. Half of the members are nominated by their governor and appointed by the US Secretary of Commerce to represent fishing and related community interests in the region. The other members of the Council are designated state, territorial and federal officials with fishery management responsibilities.

For more information on the Council, go on to www.wpcouncil.org

## FISHERIES AGENCY OF TAIWAN

The Fisheries Agency which is a statutory independent agency for the administration offisheries and aquaculture affairs operates under the policy guidance of the Council of Agriculture. It was established on 1st August 1998 under the government restructure by combining the then Taiwan Fisheries Bureau and the Department of Fisheries of the Council of Agriculture. The Director-General is the chief administrative officer of the Fisheries Agency who is responsible for the day-to-day business of the agency. He is assisted by two Deputy Director-Generals and a Chief Secretary. Under the Agency, there are Planning Division, Fisheries Regulation Division, Deep Sea Fisheries Division, Aquaculture and Coastal Fisheries Division, Secretariat, Accounting Office, Personnel Office, and Civil Service Ethics Office, for providing governmental services in fisheries. Deep Sea Fishery Research and Development Center and Taiwan Area Fishery Radio Station are also under the supervision of the Agency.

As the highest fisheries administrating authority in Taiwan, the Agency is in charge of and responsible for:

1. Drafting, development, supervision andenforcement of fisheries policy, fisheries laws and regulations, and implementation of theirplans and projects.
2. Research and planning of fisheries science, prevention of public disasters and the restoration of their aftermaths.
3. Management and monitoring of fishing vessels and crewmen.
4. Operation, coordination and supervision of fisheries surveillance.
5. Guidance and assistance to the fishermen associations and fishery organizations.
6. Planning, supervising and training of fishermen and personnel of the fishermen associations and fishery organizations in the fishery extension.
7. Coordination and supervision for the distribution and processing of fish and fish products, fishermen's welfare, and fisheries-related finance.
8. Management and supervision of the foreignports which have been designated as fishingbase.
9. Planning and promoting international fisheries cooperation and coordinating bilateral fisheries affairs.
10. Planning and promoting marine fishery resources conservation, restocking of restoration of habitats, survey and research, fishery stockassessments, and fresh water and marine aquaculture.
11. Planning and supervision of fishing ports and fisheries-related infrastructures.
12. Analysis of statistics on fish productions, and provision and dissemination of fisheries information.
13. Other work as required for the governance of fisheries and fishermen.

## OVERSEAS FISHERIES DEVELOPMENT COUNCIL (TAIWAN)

The Overseas Fisheries Development Council (OFDC) was founded on November30, 1989, as a private, nonprofit organization endowed with funds donated by both the government and private sector.

At early stage, the mission ofthe OFDC was to assist the industry in acquiring opportunities of fisheries cooperation with coastal resources owning countries, and to provide legal assistance to fishermen in cases of fisheries dispute. In recent years,the functions of the OFDC have been greatly diversified to supplement the work of the government in fisheries management in meeting the rapid change in the international fisheries management strategies. As a result, more efforts have been placed on: compilation of fisheries statistics, the maintenance of fisheries database, dissemination of fisheries information and fisheries related publications, provision of the service of a monitoring center for the monitoring of fishing vessels, provision of service to the fishing industry on fleet management, implementation of scientific observer program, as well as participation in international and regional fora on fisheries conservation and management. In carrying out the above functions, currently OFDC has more than 80 staff members.

## Appendix 3:

# The International Fishers Forum Series

The International Fishers Forum (IFF) series has been convened since 2000, bringing together a diverse group of fishers and representatives from other stakeholder groups with an interest in the environmental and socioeconomic sustainability of pelagic marine capture fisheries, mitigating the bycatch of sensitive species groups, the conservation of commercially important pelagic fish stocks, and the protection of marine biodiversity.

The breadth of each forum was expanded to address new and timely conservation and management issues. The first forum, held in 2000, focused on mitigating interactions between demersal and pelagic longline fisheries and seabirds. IFF2, convened in Hawaii in 2002, had an expanded focus on interactions between longline fisheries and sea turtles as well as seabirds. In 2005, IFF3 was convened in Japan jointly with the International Tuna Fishers Conference on Responsible Fisheries. In addition to the incidental bycatch of sea turtles and seabirds in longline fisheries the IFF3 theme had expanded to include sustainable tuna and shark fisheries; fishing capacity; production; marketing; consumption monitoring; illegal, unregulated and unreported fisheries, cetacean depredation, and the employment of market-based mechanisms, including eco-labeling, to influence marine capture fisheries' practices and management. IFF4 was held in Costa Rica in 2007 with an expanded scope that included shark and cetacean interactions with longline fisheries, and also included the state of knowledge for mitigating problematic bycatch in artisanal gillnet fisheries. The information exchange brought about through the IFF series has lead to a more coordinated response to fisheries conservation and management problems and accelerated progress in mitigating these problems globally.

The Western Pacific Regional Fishery Management Council and Fisheries Agency, Taiwan co-hosted the Fifth International Fishers Forum on Marine Spatial Planning and Bycatch Mitigation from August 3-5, 2010 in Taipei.

For more information on the IFF series, including the proceedings from all IFFs, visit: www.fishersforum.net.

## Appendix 4:

# Commitments by IFF5 Participants

| Name | Country/ Territory | Affiliation | Commitments |
|---|---|---|---|
| Stephen Haleck | American Samoa | Western Pacific Regional Fishery Management Council | I commit to participate in marine spatial planning for my island. |
| Guillermo Cañete | Argentina | Fundación Vida Silvestre Argentina | I will promote marine spatial planning in the Southwest Atlantic as a tool for effective implementation of ecosystem-based management. |
| Rashid Sumaila | Canada | Fisheries Centre, University of British Columbia | I will continue to conduct research and compile useful information to support the development of effective marine spatial planning and bycatch mitigation. Specifically, my lab will provide vital economic information for sustainable fisheries, benefiting both current and future generations. |
| Mike Fleming | Commonwealth of the Northern Mariana Islands | Western Pacific Regional Fishery Management Council Advisory Panel Member | I will:<br>1. Actively participate in public fora/scoping affecting fishing grounds of the Commonwealth of the Northern Mariana Islands;<br>2. Continue to participate in non-government organization activities that affect the fishing community; and<br>3. Contribute to fisheries conservation and management activities for inshore marine fishing areas. |
| Jeannette Mateo Perez | Dominican Republic | Dominican Council for Fisheries and Aquaculture (CODOPESCA) | I commit to improve system for the collection of fisheries data related to the bycatch of sensitive species and other discards in fisheries of the Dominican Republic, especially within marine protected areas. |
| Dale Alvarez | Guam | Guam Fishermen's Cooperative Association | I will educate those in the community interested in the environment and the sustainability of pelagic marine capture fisheries. I will share what I learned in this Fishers Forum. |
| Thomas Camacho | Guam | Guam Organization of Saltwater Anglers | I will:<br>1. Educate and promote awareness;<br>2. Assist in the facilitation of future discussion as it relates to my community;<br>3. Influence and demand the need for "REAL DATA";<br>4. Influence and support membership participation;<br>5. Work with legislators and mayors councils; and<br>6. Work with other partners and organizations. |

| Name | Country/ Territory | Affiliation | Commitments |
|---|---|---|---|
| Manuel Duenas | Guam | Fisherman | I will advance the sustainable use of our marine resources through a marine spatial planning process whereby these resources shall be available for future generations. Cognizant that the development of such a program will further advance our role as stewards of the ocean, the development of any marine spatial planning strategy must be developed by active stakeholder involvement and must not be diluted by special groups outside these resource users in order to foster collaboration - hence developing viable and practical solutions. |
| Jesse B. Rosario | Guam | Guam Fishermen's Cooperative Association | I commit to assist stakeholders and practitioners to clearly define marine spatial planning by:<br>1. Creating a global marine spatial planning mission statement;<br>2. Developing global marine spatial planning goals and objectives;<br>3. Identifying global partners to form regional marine spatial planning councils; and<br>4. Developing a sustainable fisheries program, reducing bycatch, reporting harvesting, migration of species, etc. |
| Ebol Rojas | Mexico | Association for Professional Observers/ IFOMC Obsever Professionalism Working Group/ International Observer | Regarding bycatch, I commit to:<br>1. Continue working on the improvement of the techniques in use for bycatch monitoring, through the use of observer programs;<br>2. Work on the mitigation of incidental catch associated with bottom longline through the monitoring and implementation of new reduction devices for sea bird bycatch and marine mammal interactions in the southern oceans with devices like "net sleeves" for Patagonian toothfish longline fishery.<br>3. Continue tackling a new issue with CCAMLR in Indian Ocean waters: the introduction of gillnets targeting toothfish and sharks, yet not having enough data on bycatch due to the illegal nature of these fisheries (IUU). |
| Henk Brus | Netherlands | ATUNA B.V, Sustunable B.V | Within the coming three years, I commit to move our entire supply of canned and frozen tuna to 100% Marine Stewardship Council-labeled products (both for skipjack and yellowfin). |
| Danilo Rosales | Nicaragua | Instituto Nicaraguense de la Pesca y la Acuicultura | I am directed to continue our commitment to develop programs and projects to reduce the incidental catch of seabirds, marine mammals and sea turtles, as well to continue with land management programs that we are developing with fishing communities and regional organizations in Central American and the Caribbean Sea. |

| Name | Country/ Territory | Affiliation | Commitments |
|---|---|---|---|
| David Kellian | New Zealand | Owner, Kellian Fishing | I will take what I have learned and disseminate this information with fellow fishers and my local fishing association. I will continue to work to find new and practical solutions to bycatch of seabirds and turtles, and to use all mitigation tools at my disposal while fishing. I will also encourage others to participate in mitigation activities and will actively work with agencies and fishers in finding solutions to bycatch. |
| Marvin Ngirutang | Palau | Embassy of the Republic of Palau in Taiwan | I will support the creation of a Code of Conduct for captains and crews of fishing vessels. The behavior and conduct of the boat captain and his crew must change. It is common practice for Asian fishing boats to steal fish from the EEZ and territorial seas of the Pacific Islands. They take advantage of the fact that the Pacific Islands, except Hawaii, do not have the means to patrol their maritime zones.<br><br>The captains have to realize that, at the end of the day, the island governments may have to ban all types of fishing methods in an attempt to protect their natural resources, such as a shark sanctuary, whale sanctuary, etc.<br><br>It would help if the Regional Fisheries Management Organizations would pressure their Asian counterparts to conduct themselves in a manner that would benefit fishermen from all over the world.<br><br>Littering and dumping oil into the oceans are also major problems with the Asian fishing vessels. |
| Norman Barnabas | Papua New Guinea | Dologen, LTD | I recognize the importance of marine spatial planning and the need for good interactions/dialogue between different ocean users, including coastal communities at national level, which would contribute to maintaining a healthy ocean environment. I will seek to promote this through the Papua New Guinea fishing industry association. |
| I-Hsun Ni | Taiwan | National Taiwan Ocean University | I commit to promote the use of lower trophic level pelagic fishes, with the following benefits:<br>1. Better use biological resources in the ocean;<br>2. Fewer bycatch problems;<br>3. Reduced effects from organic and inorganic pollutants; and<br>4. Reduced energy utilized for transporting high quality large pelagic fishes. |
| Bundit Chokesanguan | Thailand | Information and Training Division Head, SEAFDEC | I will take the issue on marine spatial planning to our conference, “Fish for the People 2020,” through the process of regional consultation under the theme, “Ecosystem based Fishery Management” (see www.ffp2020.org). I will also continue my work on the promotion and implementation on the reduction of bycatch in shrimp trawling project (REBYC II) and other related activities. |

| Name | Country/ Territory | Affiliation | Commitments |
|---|---|---|---|
| Deidre Boelke | USA | New England Fishery Management Council | As marine spatial planning is more formalized in the United States, I commit to do what I can to ensure that existing fishery councils are actively involved in the process and at the table when possible. The council process has already identified the active/essential players in the fisheries management process, so councils should be used as the first place NOAA goes to identify which fishery issues are important and who needs to be involved.<br>I will try to educate fishers I come in contact with about MSP and what it is and what it is not. Try to encourage them to be involved in whatever process is developed in the US as a result of new executive order. |
| Martin Hall | USA | IATTC | I commit to continue my work to reduce bycatch (defined as discarded dead), while maintaining the fishers' jobs and promoting sustainable fisheries. |
| Rebecca Lewison | USA | San Diego State University | I am committed to working with fishers/industry, resource managers and other scientists to develop innovative management tools and to facilitate bycatch reduction (multi-species) and promote sustainable fisheries. I am also committed to informing marine spatial planning by translating these efforts into an impacts context. |
| Phan Hong Dung | Vietnam | Research Institute for Marine Fisheries (RIMF_MARD) | I commit to implement the declarations resulting from the first four IFFs, and will pursue sustainable fisheries. I commit to pursue specific actions to advance the goals and objectives of marine spatial planning and bycatch mitigation, including the Code of Conduct for Responsible Fisheries, respect international marine dumping regulations, development of circle hook modifications for use in Asian countries, pursue the establishment of more marine protected areas in Southeast Asian countries, initiate coastal and marine spatial planning, train and education fishermen, develop safer seafood products through eco-labeling, share information regionally and support developing countries. |

## Appendix 5:
# Speaker Biographies

**Osamu Abe, Ph.D.,** is Chief of the Planning and Coordination Section, National Research Institute of Far Seas Fisheries, Fisheries Research Agency, Japan. He has a doctorate from the Faculty of Science, University of Tokyo. His career in fisheries science began in 1991 at Shimonoseki Branch, Seikai National Fisheries Research Institute (SNF), conducting stock assessments of pelagic fish in the East China Sea. In 1995, he was assigned to the Ishigaki Tropical Station, SNF, where he studied the conservation of tropical marine species, focusing on sea turtles. He has worked on reducing sea turtle interactions with fishing gear, with a focus on pound net fisheries. From 2007 through April 2010, he served as the Deputy Chief of the Marine Fishery Resources Development and Management Department, Southeast Asian Fisheries Development Center in Malaysia, where he worked on planning and management of Japanese Trust Fund projects, including research on stock enhancement of sea turtles in the Southeast Asia region. His main areas of expertise are in: (i) conservation ecology of sea turtles; (ii) development of fisheries bycatch mitigation measures; and (iii) conservation ecology of coral reefs.

**Deirdre Boelke** has been a staff member of the New England Fishery Management Council in Newburyport, Massachusetts, U.S.A. since 2001 and has been the Scallop Plan Coordinator since 2006. The New England Fishery Management Council is one of eight councils in the United States that are responsible for proposing fishery management measures to the National Marine Fisheries Service. Ms. Boelke has an M.Sc. degree in Marine Affairs from the University of Rhode Island (URI). Her concentration at URI was in fisheries management and her master's thesis evaluated the potential use of individual fishing quotas (IFQs) as a management strategy for Atlantic Sea scallops. Perceptions about IFQs were evaluated by conducting personal interviews with numerous scallop permit holders and managers. Ms. Boelke has a B.S. degree from Georgetown University in Washington, DC. Her bachelor's is in biology with a concentration in ecology. Her undergraduate thesis was on the survivability of visually impaired California sea lions off the northern coast of California. Previous employment includes: SeaWeb in Providence, Rhode Island; Cold Spring Harbor Fish Hatchery in Cold Spring Harbor, New York; Marine Mammal Center in Sausalito, California; and National Geographic in Washington, DC. Specific career interests include: bycatch mitigation; social impacts of fishery regulations on fishing communities; cooperative research; improving communication and cooperation between managers and stakeholders; as well as maintaining unbiased, transparent fisheries management decision-making.

**Henk Brus** was born in the Netherlands in 1957 as the son of a canned foods importer. After he finished his study on psychology, he became a family therapist in 1980. In 1987, he decided to apply his problem-solving and communications background to the commercial sector and accepted a position as a junior salesman with the international canned fish importer MCM Foods in the Netherlands. From 1992 to 1998, he was vice president of the company. During this period, he expanded the company to obtain a European-wide presence, especially in the canned tuna markets. In 1998, he founded his own company, Atuna, a global tuna trading company covering the total vertical supply chain. In 1998, he also started a tuna blog at atuna.com, which has since become the world's leading Internet portal on tuna. He has been a speaker at major tuna conferences and meetings on tuna sustainability over the last 15 years, and was co-chairman of the World Tuna Conferences in Bangkok, Thailand. Atuna Ltd. trades tuna from all oceans and processing areas in the world. Mr. Brus has close to 20 years of trading experiences in most tuna products with the majority of Asian and Pacific nations. These products are mostly shipped to Europe and North Africa. In 1997, he delivered a speech, "*Sustainable Marketing* - necessity or Naïveté?" at World Tuna '97 in Bangkok to promote the sustainable use of tuna resources. In 2000, he was one of the co-founders of the World Tuna Purse Seiner Organization, which aims to halt the further expansion of the global tuna purse seiner fleet capacity. Over the last decade, he has been a frequent speaker at all major tuna conferences and meetings on tuna sustainability. In early 2007, he founded Sustunable, a company that aims to sell "responsibly caught and produced tuna, "at prices accessible to the average consumer. The company is supplying canned

tuna to close to 20 European supermarket chains. Throughout the entire tuna supply chain on responsible tuna fishing and social accountability, Sustunable provides complete transparency for each individual can by making such information directly available to consumers via the Internet.

**Milani Chaloupka, Ph.D.,** is a recognized expert in statistical and mathematical modeling of complex ecological systems, including development of interactive stochastic computer simulations of endangered species population dynamics. He runs an international research consultancy that provides innovative statistical and mathematical solutions to ecological and economic issues for a wide range of industry, government, university and international non-governmental organization clients, such as Chevron, International Union for the Conservation of Nature, Food and Agriculture Organization of the United Nations, and U.S. NOAA Fisheries. Previously, he was Director of the Office of Director-General (Queensland Department of Environment, Australia) and was responsible for strategic policy issues relating to environmental management in Queensland, including the Great Barrier Reef Marine Park, national parks and wildlife conservation. He was also project leader of the ecosystem modeling initiative at the Australian Cooperative Research Centre (Coastal Zone, Estuary & Waterway Management). Dr. Chaloupka is currently the Chair of the Western Pacific Regional Fishery Management Council (WPRFMC) Sea Turtle Advisory Committee, member of the WPRFMC Scientific and Statistical Committee and member of the scientific advisory board of the Caribbean Conservation Council (Florida, Costa Rica). He is a Vice-Chair for the International Union for the Conservation of Nature (IUCN)/SSC/Marine Turtle Specialist Group and responsible for the Pacific Islands region and Chair of the IUCN Marine Turtle Red List Authority. He was also recently appointed to a blue ribbon committee of the National Research Council of the U.S. National Academies to review sea turtle assessment methods for all U.S. marine turtle stocks. He has a substantial list of international peer-reviewed publications in marine science and environmental management fields.

**David Chang** is the Operation Director of Overseas Fisheries Development Council (OFDC) of the Republic of China, a non-profit and non-governmental organization established in 1989 to assist the fisheries industry in reaching fisheries cooperation and reducing the incidence of Taiwanese fishing vessel detentions by foreign authorities. Mr. Chang has more than 20 years of experience working on bilateral fisheries cooperation and managing the detention of Taiwanese fishing vessels. Recently, OFDC's work has focused on assisting the Fisheries Agency of Taiwan to formulate fisheries policies that will ensure sustainable utilization of fisheries resources, urging fishermen and operators to apply fishing practices that are consistent with guidelines stipulated in the Food and Agriculture Organization of the United Nation's Code of Conduct for Responsible Fisheries and comply with conservation and management measures adopted by tuna regional fisheries management organizations. Mr. Chang is also involved in multilateral fisheries issues, including the tuna regional fisheries management organizations and Fisheries Working Group of the Asia Pacific Economic Cooperation.

**Charles C. Cheng, Ph.D.,** was trained in the department of biology, Imperial College, London, England, and was awarded a doctorate with a major in population ecology. Teaching in the department of biomedical science and environmental biology of Kaohsiung Medical University, Taiwan, he is in charge of the course on ecology and conservation biology. Since 2004, Dr. Cheng has served as the moderator of the sea bird conservation group, Chinese Wild Bird Federation (BirdLife in Taiwan), which aims to promote research on sea bird bycatch in fisheries, raise awareness and advocate conservation actions for sea birds, and provide information on the identification of sea birds and information on sea bird bycatch mitigation measures for the Taiwan observer training program. He has been elected President of the Chinese Wild Bird Federation. Since 2005, Dr. Cheng has been a contributing teacher to the Taiwan fisheries observer training program, providing courses on sea bird identification and the application of sea bird bycatch mitigation measure. In 2007- 2008, he was granted a Fulbright Scholarship in U.S.A. His research involved the evolving mechanism of education in the U.S. national observer program, while working at the office of World Wildlife Federation-U.S. At Kaohsiung Medical University, his research teams focus on bird biochemical systematic and ecology, morphometrics and image analysis among other subjects.

**I-Jiunn Cheng, Ph.D.,** was born in Hsinchu City, Taiwan in 1953. In 1998, he received a doctorate from the Marine Science Research Center (renamed the School of Atmospheric and Ocean Sciences), State University of New York at Stony Brook (renamed Stony Brook University), U.S.A. His specialties are benthic ecology, physiological ecology and estuarine ecology. After graduation, he worked as a post-doctoral fellow at the department of ecology and evolution in the same university. Dr. Cheng returned to Taiwan and has taught in the Institute of Marine Biology, National Taiwan Ocean University since 1991. He was elected the Chairperson of the Institute from 2000 to 2003. Currently, he is a full professor at National Taiwan Ocean University. Dr. Cheng was supported by the National Science Council to serve as a visiting scholar at the Banyulus Laboratory, France and Swansea

University, U.K. His current academic interests are sea turtle biology and physiological ecology. His laboratory is the only research unit conducting research on sea turtle ecology and conservation in Taiwan. In 2009, the Council of Agriculture, Executive Yuan of Taiwan awarded Dr. Cheng the "Distinct Contributive Person for Forestry and Nature Conservation."

**Bundit Chokesanguan** works for the training department of the Southeast Asian Fisheries Development Center (SEAFDEC), an intergovernmental organization established in 1976 for the purpose of promoting the fisheries development in the Southeast Asian region. Currently, SEAFDEC has 11 member countries: Brunei Darussalam, Cambodia, Japan, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam. He has a B.S. degree from the Faculty of Fisheries, Kasetsart University, Thailand, and an M.Sc. degree from Tokyo University of Fisheries, Japan. After completing his education, Mr. Chokesanguan started his career as a fishing gear technologist at the training department in Thailand. Since then, he has held various posts at SEAFDEC, including Assistant Instructor, master fisherman, Fishing Technology Section Head, Head of Office of Training Department Chief, Information and Extension Division Head and his current post as head of Information and Training Division. Mr. Chokesanguan brings many years of experience in the development and use of fishing gear that follow the concept of responsible fishing gear and practices based on his extensive knowledge of all forms of capture fisheries technology and gear, ranging from inshore fixed gear and shrimp trawling to the operation of deep-sea purse seines and gear relevant to Southeast Asian waters. His most recent activities are in the development and promotion of selective methodologies in turtle exclusion and trash fish and immature target fish exclusion devices for SEAFDEC member countries through demonstrations and experiments. In addition, he has taken the initiative on an issue of safety at sea for fishers in the region that has long been neglected. From the administrative standpoint, he is involved in the regional implementation of the guidelines on the Food and Agriculture Organization of the United Nation's Code of Conduct for Responsible Fishing.

**Larry Crowder, Ph.D.,** is a Professor of Marine Biology at Duke University. His research centers on predation and food web interactions, mechanisms underlying recruitment variation in fishes, population and food web modeling in conservation biology, and interdisciplinary approaches to marine conservation. He has studied food web processes in both freshwater and marine ecosystems, and has used observational, experimental and modeling approaches to understand these interactions in an effort to improve management. He was Principal Investigator for a number of large interdisciplinary research projects, including the South Atlantic Bight Recruitment Experiment (SABRE), OBIS SEAMAP (Spatial Ecological Analysis of Megavertebrate Animal Populations), and Project GLOBAL (Global Bycatch Assessment of Long-Lived Species). He has also directed and participated in a number of research, analysis and synthesis groups at the National Center for Ecological Analysis and Synthesis (NCEAS) and for the National Research Council's Ocean Studies Board. His recent research has focused on marine conservation, including research on bycatch, spatial ecological analysis, nutrients and low oxygen, sustainable seafood, ecosystem-based management, marine spatial planning, and governance. He is an AAAS Fellow and was awarded Duke University's Scholar/Teacher of the Year award in 2008-2009.

**Richard B. Deriso, Ph.D.,** is Chief Scientist of the Inter-American Tropical Tuna Commission. He received his doctorate in biomathematics from the University of Washington. Dr. Deriso's research interests include population dynamics, quantitative ecology and fishery stock assessment. A former member of the Ocean Studies Board of the National Academies, he has served on four National Research Council committees. He is a member of the Scientific and Statistical Committee of the Western Pacific Regional Fishery Management Council and has served as consultant to numerous organizations, both private and public.

**Daniel C. Dunn** is a Research Associate for the Marine Geospatial Ecology Lab of the Nicholas School of the Environment at Duke University. His work focuses on ecosystem-based management and marine spatial planning, particularly as they apply to fisheries. His current research centers on applying spatio-temporal management measures to dynamic pelagic zones to reduce bycatch and discards, and to increase fishing selectivity. The Marine Geospatial Ecology Lab is the Mapping and Visualization Team for the Census of Marine Life (CoML), and he is a liaison for CoML to the Global Oceans Biodiversity Initiative (GOBI) and the Secretariat to the Convention on Biological Diversity. In this capacity, he edited a group of illustrations depicting methods to identify ecologically or biologically significant areas (EBSAs) in the open on the ocean and deep seas. He also leads the GOBI Dynamic and Pelagic EBSA Working Group. Previously, his work on Project Global Bycatch Assessment of Long-lived Species (GloBAL) involved looking at novel methods to map fishing effort in industrial longline fisheries and artisanal fishing effort in data-poor situations. Other past work includes the management of a fund to support Ecosystem Based Management software tool development, the investigation of the role of tools in EBM workflows, and the spatio-temporal modeling of sea-turtle movement, nesting patterns and overlap with fisheries.

**David Fluharty, Ph.D.,** is an Associate Professor with the School of Marine Affairs and Wakefield Professor of Ocean and Fishery Sciences, University of Washington since 1976. His doctorate is from the University of Michigan, School of Natural Resources, in the interdisciplinary field of natural resource conservation and planning. His research and teaching interests are in natural resource policy and management at national and international levels, ecosystem approaches for management of marine resources, watersheds, coastal zones, fisheries, marine protected areas and regional effects of global climate change. Significant professional activities include: Chair, NOAA Science Advisory Board (2006-current); Chair, External Ecosystem Research Team for NOAA-wide Ecosystem Science and Research (2005–2007); Advisor of National Center for Ecosystem Analysis and Synthesis (NCEAS) study groups on Marine Protected Areas, Models for Fisheries Ecosystems (2002-2005) and Ecosystem Management Feasibility in Tropical Areas (2006-current); Member, North Pacific Fishery Management Council (1994-2003); Acting-Editor-In-Chief, *Coastal Management Journal*; Chair, Editorial Board, *Marine Protected Area News* and *Marine Ecosystems and Management*; Member, National Research Council, Study on Evaluation, Design and Monitoring of Marine Protected Areas and Reserves for the United States (1998-2000); Chair, Ecosystem Principles Advisory Panel (1997-2000) reporting to Congress on Ecosystem-Based Fishery Management. Member; Murray-Metcalf Northwest Straits Citizen Advisory Commission (1997-1999); Co-Chair, Institutional and Regulatory Issues, Sub-Committee and Member, Scientific Advisory Committee for Puget Sound Water Quality Authority (1984-1987); Member, Puget Sound Science Advisory Committee, U.S. Environment Protection Agency (1985-1987); Member, WA Department of Ecology/U.S. Environmental Protection Agency Puget Sound Action Program Implementation Committee (1984-1986); Member, Washington Department of Ecology, Secondary Treatment Committee (1985-1987); Vice-Chair, Puget Sound Water Quality Authority (1983-1985).

**Eric Gilman, Ph.D.**, is a freelance research scientist and Associate Faculty of the College of Natural and Computational Sciences, Hawaii Pacific University. He has served as the technical organizer of the past three International Fishers Forums, in Japan, Costa Rica and Taiwan. He has over 17 years of experience in coastal and marine science and policy at local to international levels. His main disciplines are (i) fisheries science and policy, focusing on mitigating the bycatch of sensitive species groups in marine capture fisheries; (ii) coastal ecosystem responses to climate change and adaptation options; and (iii) large temporal and spatial scale change and loss in marine biodiversity, including designing and applying suites of criteria to identify networks of sites of biodiversity value, and determining availability and quality of open source, primary, species-level data. Dr. Gilman manages project activities of decentralized, multidisciplinary and multicultural teams, and forms coalitions of stakeholders from the private, public and non-profit sectors. His previous employment has included serving as the Marine Science Advisor with the International Union for the Conservation of Nature (IUCN) Global Marine Programme, Visiting Scientist at the Food and Agriculture Organization of the United Nations, Head of Participation of the Global Biodiversity Information Facility, Pacific Representative for the National Audubon Society Oceans Program, Special Assistant for the Environment with the Office of the Governor of the Northern Mariana Islands, and Environmental Advisor to the Pohnpei Port Authority of the Federated States of Micronesia. His publications focus on fisheries bycatch and governance, coastal ecosystem responses to climate change, biodiversity informatics, wetlands ecology and management, site-planning and community-based management. He has a doctorate from the University of Tasmania School of Geography and Environmental Studies, Australia; an M.Sc. from Oregon State University Department of Oceanography, USA; and a B.A. from Wesleyan University, USA.

**Martin Hall, Ph.D.,** has been the Principal Scientist, head of the Tuna-Dolphin Program of the Inter-American Tropical Tuna Commission (IATTC) since 1984. The program succeeded in reducing dolphin mortality to less than 1% of the initial figures, without reducing the productivity of the fishery. Key to the success were the implementation of an observer program to diagnose the causes of mortality, a fishers' education program to disseminate information on the solutions to the problems identified, together with the widespread adoption of improved gear and procedures. Dr. Hall has also been directly involved in developing and implementing the international agreements that address the tuna-dolphin issue. In 2003, IATTC received a request from the government of Ecuador to assist in the development of a program to mitigate sea turtle bycatch by vessels that fish for tunas and mahi-mahis with longline gear. Developed in cooperation with WWF, U.S. NOAA, national fisheries agencies, and local and international conservation groups, this program is currently underway in most countries of the Pacific coast of South and Central Americas, from Peru to Mexico. More recently, he became involved in the coordination of the global efforts to reduce bycatch in the fishery for tunas associated with floating objects. His publications center on bycatch issues in general, and on the strategies and approaches to implement successful mitigation programs. He has presented papers at numerous scientific and management conferences, and organized well over a hundred workshops for fishers on bycatch problems and solutions. Dr. Hall got his first degree from the University of Buenos Aires, Argentina, and his doctorate from the University of Washington.

**Peter S.C. Ho** is the President of the Overseas Fisheries Development Council of Republic of China, a non-profit organization funded mostly by the Taiwan government, with the function of assisting industry in acquiring foreign fishing access, compiling tuna statistics and conducting monitoring, control and surveillance programs, including implementing observer programs and vessel monitoring activities. Mr. Ho has over 20 years of experience in bilateral and multilateral fisheries negotiating, and as an advisor to the Taiwan delegation, has been attending various commission meetings of tuna management organizations since 1997. Notably, he was a member of the Taiwan delegation for the negotiation of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, with subsequent adoption of the convention enabling Taiwan to become a member of the commission, marking the first time that Taiwan became a member of a regional fisheries management organization. His career in fisheries began as the manager of a tuna fishing company, which provided him with an industry perspective for his later role in regional fisheries management.

**Bill Holden** is currently the Pacific Fisheries Manager for the Marine Stewardship Council (MSC) operating from the Sydney, Australia office. He began working with the MSC in February 2009 and his work involves fisheries outreach in the Pacific and Indian Oceans with a focus on tuna fisheries. Another component of his work is with small scale fisheries in Southeast Asia, working towards sustainable fishing practices. Prior to joining MSC, he lived in the Kingdom of Tonga and managed 'Alatini Fisheries Co., which he started in 1989. The company operates tuna longliners and snapper dropliners fishing for the fresh-chilled markets of Japan and the United States. Prior to joining the MSC, he was also President of the Fishing Industry Association of Tonga and a director of the Pacific Islands Tuna Industry Association. He grew up in San Diego, California, where he began commercial fishing. He has a bachelor's degree in political science and communications from the University of California, Santa Barbara.

**Paul Holthus** is the founding Executive Director of the World Ocean Council, which brings together the diverse international ocean business community in a cross-sectoral leadership alliance for ocean stewardship. The World Ocean Council is fostering leadership and collaboration on "corporate ocean responsibility" and catalyzing industry action on specific marine environmental challenges in support of improved business operations. The first "Sustainable Ocean Summit" will take place in 2010 to bring industry leaders together on ocean sustainability, and to develop the programs and working groups to advance solutions on priority shared marine environmental issues. Mr. Holthus works with the private sector and market forces to develop practical solutions for achieving sustainable development and addressing environmental concerns, especially for marine areas and resources. His experience ranges from working with the global industry associations or directors of UN agencies to fishers in small island villages. He has been involved in resource conservation and sustainable use work in over 30 countries in Asia, the Pacific, Central America and West Africa. He has worked with companies, industry associations, UN agencies, international NGOs and foundations on sustainability, especially in the areas of oil and gas, fisheries, aquaculture, and standards and certification as a consultant on sustainable development and environmental management. Past positions include: Deputy Director for the Global Marine and Coastal Program of the International Union for the Conservation of Nature (IUCN); Senior Officer in the Asia-Pacific Program of The Nature Conservancy; Senior Program Officer of the UNEP South Pacific Regional Environment Programme; and founding Executive Director of the Marine Aquarium Council (an international business/environment organization creating standards and certification for the global live fisheries trade). He graduated from the University of California and the University of Hawaii, with advanced degrees in coastal/marine resources and international business.

**Wen-jung Hsieh** is the Chairman of the Taiwan Deep Sea Tuna Longline Boat-owners and Exporters Association (also known as Taiwan Tuna Association or TTA). He graduated from National Kaohsiung Normal University with a bachelor's degree in English, and received his executive master's in business administration (EMBA) degree from National Sun Yat-Sen University in 2004. His master's thesis was entitled, "A Strategic Study on the Operation of Ultra-low Temperature Tuna Longline Fishery under the Pressure of Fishing Quota System in the Indian Ocean." During his 37-year career in the fishing industry, he has demonstrated his expertise in fishing industry management. His main responsibility as a fisher is to ensure compliance with domestic and international management measures, while maintaining his business competitiveness. For his success and leadership in the fishing industry, he was honored with a Kaohsiung Outstanding Fishing Professionals of the Year award in 1990 and a National Ten Outstanding Fishermen award in 2004. Through his leadership of the Taiwan tuna industry, he has actively devoted his time and knowledge to fishery policy-making and other public affairs. From 2002 to 2005, he served as the Director of TTA and Chair of the Indian Ocean Committee of TTA. He has facilitated communication between the government and fishermen, urging his fellow boat owners and fishing operators to ensure compliance with measures of the Indian Ocean Tuna Commission and Commission for the Conservation of Southern Bluefin Tuna by Taiwanese vessels fishing in the Indian Ocean.

After serving as the Standing Director of TTA from 2005 to 2009, he was elected Chairman in 2010. With such trust and recognition from his fellow tuna boat owners, he will continue to lead the Taiwan tuna industry to face the ever growing challenge facing global tuna fisheries working within the scope of Regional Fisheries Management Organizations.

**Edward C. C. Huang** is the General Secretary of the Taiwan Deep Sea Tuna Longline Boat-owners and Exporters Association (TTA). He earned an M.Sc. degree from the department of environmental biology and fisheries science, National Taiwan Ocean University, and a B.S. degree from National Kaoshiung Marine University, Taiwan. He is also the Secretary General of the Taiwan Fisheries Association and President of the Taiwan Deep Sea Tuna Fishery Development Foundation. His involvement in the field of fisheries began from his university days and has continued throughout his career. In his work with TTA over the past thirteen years, he has successfully coordinated Taiwan's tuna fishing industry in this era of turmoil in global fisheries management. Taiwan's tuna fishing industry has undergone substantial reforms in the last decade, following the application of more stringent conservation and management measures by the global tuna regional fisheries management organizations (tuna RFMOs). As the General Secretary of TTA, he helped tuna longline fishing boat owners, as well as the Fisheries Agency of Taiwan, to complete the implementation of a three-year tuna longline vessel reduction program. A total of 183 ultra-low temperature longline fishing vessels were scrapped between 2005 and 2007 under this program. This enabled Taiwan's fishing capacity to comply with the quota allocations set by the tuna RFMOs. One of Mr. Huang's responsibilities is to promote the domestic market of ultra-low temperature sashimi-grade tuna products. Through a subsidy from the Fisheries Agency of Taiwan and Kaohsiung City Marine Bureau, a private company constructed Taiwan's first ultra-low temperature cold storage facility, with the capacity to store 1300-tons. Mr. Huang was assigned to manage the project, which began with securing funding in 2005, followed by issuing a commercial tender, supervision of construction, and concluding with the facility's completion in 2008.

**Hong-Yen Huang** is the Director for Deep Sea Fisheries Division, Fisheries Agency, Council of Agriculture, Executive Yuan. His main duties include: (i) developing deep sea fisheries policies, laws, regulations and plans; (ii) facilitating international cooperation on matters related to deep sea fisheries, including executing multilateral and bilateral access arrangements; (iii) participating in meetings of international fishery bodies; (iv) managing the activities of all of Taiwan's deep sea fishing vessels; and (v) coordinating other matters related to deep sea fisheries, including scientific research. Since graduating from National Taiwan Ocean University, Mr. Huang has worked for the government in deep-sea fisheries for more than 33 years. Over the past decade, he has served as the Head of Delegation for meetings held by the five tuna Regional Fisheries Management Organizations (RFMOs), and for RFMO Commission meetings and subsidiary Committee meetings. He has long committed to implementing the ecosystem-based approach to managing Taiwan's far seas fisheries for the sustainable use of tuna and tuna-like species in three oceans.

**Yi Ping Hung** was born in 1959 at in western Taiwan's Lukang Township, which has a long history and is known for its humanistic spirit. In 1981, he received his B.S. degree from the National Ocean University. After completing military service, Mr. Hung was recruited by the Chunghwa Fishermen Association in 1984. Since 1989, he has served in the post of Chief of the Popularization Section of the Chunghwa Fishermen Association and was promoted to Secretary in 2009. In 2008, he received his M.Sc. degree from Dayeh University, with a thesis entitled, "Research on Oyster Farm Development in the Wang-Kong Area."

**David Hyrenbach, Ph.D.**, is an assistant professor at Hawai'i Pacific University and an adjunct professor at the Duke University Marine Laboratory. His research focuses on mobile marine predators, and the design and effectiveness of protected areas in pelagic systems. Born in Spain, he completed his doctorate at the Scripps Institution of Oceanography. In 2007, he was awarded a Pew Fellowship in Marine Conservation to work on the distributions of marine birds, turtles and mammals in the Alborán Sea in the western Mediterranean. His current research focuses on two main areas: (i) how oceanographic variability in time and space shape the distribution and community structure of pelagic vertebrates, and (ii) how these habitat associations influence the efficacy of spatially-explicit management strategies for their conservation. The applications of this research include identifying potential concentration and foraging areas for the development of spatially-explicit protective measures (e.g., marine protected areas, time-area closures), and monitoring anthropogenic impacts on sea bird populations (e.g., plastic ingestion, bycatch).

**Shoou-Jeng Joung, Ph.D.**, is an Associate Professor in the Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University. He holds a Ph.D., M.Sc. and B.S. degrees from the Faculty of Fisheries, National Taiwan Ocean University.

**Donald R. Kobayashi, Ph.D.,** is a Research Fishery Biologist in the Ecosystems and Oceanography Division at the Pacific Islands Fisheries Science Center, National Marine Fisheries Service, National

Oceanic and Atmospheric Administration located in Honolulu, Hawaii, USA. He has a doctorate in environmental sciences from the University of Technology Sydney, Australia; an M.Sc. in biological oceanography from the University of Hawaii, USA; and a B.S. in ecology and evolutionary biology from the University of Arizona, USA. He is interested in a wide range of subjects, including fishery oceanography, larval transport modeling, population dynamics, computer simulation modeling, marine biology/ecology, ichthyology, plankton ecology, conservation biology, remote sensing, protected species mitigation, fishing gear selectivity and fishery management. In addition to his regular duties, Dr. Kobayashi also serves as a member of the Scientific and Statistical Committee of the Western Pacific Regional Fishery Management Council, is the Chairperson of the NOAA Biological Review Team for the bumphead parrotfish (*Bolbometopon muricatum*), and is Coordinator for the PIFSC Student Intern Program (PSIP). He has numerous peer-reviewed publications and has twice been awarded the NOAA Bronze Medal (in 2005 for research pertaining to sea turtle mitigation in the pelagic longline fishery, and in 2009 for scientific contributions towards understanding of larval transport).

**Marion J. Larkin** began his fishing career in 1971, trying his hand at the crab, salmon gillnet, seine and troll fisheries from Alaska to California. In 1978, he settled into the operation and management of a trawl vessel, and pursued trawl fishery as captain for over 21 years catching groundfish, including Pacific Whiting. Upon reaching the ripe old age 60, Mr. Larkin retired and has since been the owner and manager of Ocean Hunter Enterprises LLC. This company operates trawl vessels in the whiting and traditional groundfish fisheries. Its vessels catch and deliver iced, in-the-round groundfish, which includes Dover sole, ling cod, petrale sole, and whiting. Mr. Larkin received a B.S. in geology from Western Washington University in 1971. He has been actively engaged in the fisheries management process with the state of Washington, where he has served as advisor to the director of fish and wildlife, and as a board member of the Coalition of Ocean Fishers, representing the Washington trawl industry. For the last 26 years, Mr. Larkin has been engrossed with management at the federal level through the Pacific Fisheries Management Council. He has served for the last 24 years on the Groundfish Advisory Committee representing Washington trawlers. During the last eight years, he has been actively involved in the Trawl Rationalization Amendment process as a member of the Trawl Individual Quota Committee. He has also been a member of the Essential Fish Habitat Technical Review Panel, which laid the groundwork for defining the benthic zones and directly resulted in setting aside 41 areas on the Pacific coast in Washington, Oregon and California as “non-trawl zones” to protect critical and essential habitat from the impacts of bottom trawl. For the last eight years, Larkin has served as an advisor to the Washington delegation to the Pacific States Marine Fisheries Commission. For the last 12 years, he has represented Washington trawlers on the board of the Fishermen’s Marketing Association, a trawl advocacy group representing 40% of the groundfish trawl industry.

**Duncan Leadbitter** is the Director of the Australia-based fisheries and natural resource consulting company, Fish Matter, established in March of 2009. Fish Matter provides practical advice to industry, government and NGOs regarding the sustainable use of fish and other aquatic natural resources. Over the past 20 years, Mr. Leadbitter has gained extensive experience in fisheries in Europe, Asia, North America and the Pacific. A major client is Sustainable Fisheries Partnerships, an NGO that works with seafood businesses to assist their moves towards sustainable sourcing and management. As an in-house consultant, Mr. Leadbitter provides advice on a wide range of issues, such as aquaculture feed fish fisheries, tunas and deep water species, and is a liaison with seafood producers, NGOs and multilateral fisheries and aid bodies. Before creating Fish Matter, Mr. Leadbitter was International Fisheries Director for the Marine Stewardship Council from 2000. In 2002, he became responsible for developing and managing the MSC’s Asia Pacific region and, in that role, encouraged fisheries, the post harvest sector and consumers to become involved in the program. Prior to joining the MSC, Mr. Leadbitter was the Executive Director of Ocean Watch Australia, a non-profit organization that aims to protect and improve fish habitats and reduce the impacts of fishing. He has also worked for the fisheries agency in New South Wales, Australia, as a habitat/conservation manager and in the private sector as an environmental consultant. Mr. Leadbitter was the Deputy Director of the Australian Seafood Industry Council and held a number of positions on federal- and state-based natural resource and biodiversity advisory councils. Until recently, he chaired the National Squid Management Advisory Committee for the Australian Fisheries Management Authority. With a background in the management of aquatic habitat and fishing impacts, Mr. Leadbitter has worked on marine protected areas, aquaculture assessments, habitat rehabilitation, pollution assessments, environmental education and bycatch management. He has also worked collaboratively with a variety of fishery stakeholders including industry, environment groups and government. He has written a number of published works on fisheries, coastal zone and habitat matters. He holds a B.S. Honours degree from the University of Sydney and an M.Sc. degree in environmental planning from Macquarie University, Sydney. Mr. Leadbitter is a keen scuba diver and photographer.

**Charles C. P. Lee** is General Secretary of the Taiwan Deep Sea Tuna Purse Seine Boat-owners and Exporters Association (TTPSA), a nonprofit, non-governmental organization established in July 2008. TTSPA was formed to help purse seine boat owners to execute bilateral foreign license access fishing agreements and to participate in the Nauru Agreement, an international agreement providing purse seine access to fish within the Exclusive Economic Zones within eight Pacific Island Country Parties to the Nauru Agreement (Federated States of Micronesia, Papua New Guinea, Solomon Islands, Nauru, Kiribati, Tuvalu and Marshall Islands). The purse seine fishing industry was established in Taiwan in 1984. Before establishing its own association, the purse seine fishery was a part of the Taiwan Tuna Association. Mr. Lee worked at the Taiwan Tuna Association from 1993 through 2008, where he was responsible for meeting the needs of the purse seine fishing sector. Previous to the establishment of TTPSA, Taiwan purse seine fisheries negotiated bilateral agreements with individual Pacific Island countries. Through his extensive career working with the purse seine fisheries, Mr. Lee has had the opportunity to gain direct knowledge of the evolving regional management of tuna fisheries in the western and central Pacific Ocean through working with staff of the Pacific Islands Forum Fisheries Agency and negotiating with officers of various fisheries management authorities of the eight Parties to the Nauru Agreement.

**Ming Hua Lee** is the Secretary General of the Taiwan Cetacean Society, where he has worked in various positions since 1998. He holds an M.Sc. degree from the Institute of Applied Economics, National Taiwan Ocean University, where he conducted research on the performance and improvement of the whale-watching industry in Taiwan. He has published a cost-benefit analysis of whale-watching enterprises in the east coast of Taiwan.

**Rebecca Lent, Ph.D.,** is the Director of the Office of International Affairs, National Marine Fisheries Service, National Oceanic and Atmospheric Administration (NOAA Fisheries Service) in Silver Spring, MD, USA. Her current portfolio includes oversight of the conservation and management of shared stocks of fish and protected species, including multilateral marine management organizations, such as the International Whaling Commission and the five global Tunas Commissions. Dr. Lent received a doctorate in resource economics from Oregon State University in 1984. Following a year of post-doctoral research in France, she served as a professor at Université Laval in Quebec City for eight years. Dr. Lent joined NOAA Fisheries Service in October 1992, first as an economist and then as Division Chief for Atlantic Highly Migratory Species in the Office of Sustainable Fisheries. She served as the Regional Administrator for the Southwest Regional Office in Long Beach, California for a year, overseeing marine stewardship in California as well as Hawaii and the Pacific Territories. In this position, she served as the U.S. Government Commissioner for the Pacific Tunas Commission. Dr. Lent was then selected to serve as the Deputy Assistant Administrator for Regulatory Programs at NOAA Fisheries Service Headquarters in Silver Spring, where she provided leadership and direction for the agency's regulatory programs. Dr. Lent was then selected to serve in her current position. She also currently serves as the U.S. Commissioner to the International Commission for the Conservation of Atlantic Tunas. Dr. Lent served as the Head Delegate from the United States at the Second Joint Meeting of the Tuna Commissions (Kobe II) in San Sebastian, Spain in 2009 and also served as the Head Delegate to the United States at the joint U.S.-FFA hosted Kobe II Bycatch Workshop in Brisbane Australia in June 2010.

**Jo-Ann C. Leong, Ph.D.,** is the Director of the Hawai'i Institute of Marine Biology and professor in the School of Ocean and Earth Science and Technology at the University of Hawaii at Manoa. Dr. Leong is also a distinguished professor emeritus of microbiology and the former chairman of the department of microbiology at Oregon State University, where she held the Emile Pernot Endowed Professorship. She is an elected member of the American Academy of Microbiology. She now serves as the chairman of the board of directors for the Center of Tropical and Subtropical Aquaculture in Hawaii, is president-elect of the National Association of Marine Laboratories, is co-chair of the Ecosystem Science and Management Working Group for the U.S. National Oceanic and Atmospheric Administration (NOAA) Scientific Advisory Board, and is on the National Committee of the Census of Marine Life. She served as the editor of the Viral Diseases Section of Diseases of Aquatic Organisms for more than 10 years and was on the editorial board of *Marine Molecular Biology and Biotechnology* and the *Journal of Marine Biotechnology*. Dr. Leong has published over 100 refereed research papers that resulted from the work of her 18 doctoral students and six M.Sc. students. She holds three patents for the first viral vaccine for fish and the first DNA vaccine for aquacultured species in the U.S. It was in her laboratory that a new genus of *Rhabdoviridae*, the *Novirhabdovirus*, was discovered and the type virus for this new genus, *Infectious Hematopoietic Necrosis Virus*, which kills millions of young trout and salmon each year. She has devoted much of her career to the development of vaccines and control strategies for diseases of aquatic organisms. She retains funding from the National Science Foundation and NOAA.

**Rebecca Lewison, Ph.D.,** is a conservation ecologist and is an assistant professor at San Diego State University (SDSU). She serves as the Director for the Institute for Ecological Management and Monitoring,

a multi-disciplinary research institute at SDSU. Using innovative field, quantitative and lab-based approaches, she studies vulnerable wildlife populations that live in both terrestrial and aquatic environments and face pressing conservation issues (e.g., habitat fragmentation, habitat degradation, harvest and incidental mortality, disease and other disturbances). Over the past decade, Dr. Lewison has been spearheading integrative research in conservation ecology, policy and resource use, with expertise and experience across a wide taxonomic range of organisms. She has been a forerunner in fisheries bycatch research. For the past four years, she has been leading Project GloBAL, a large-scale research initiative, funded by the Gordon and Betty Moore Foundation (bycatch.env.duke.edu/), which is designed to develop new tools and methodological approaches to understand the magnitude and extent, the population-level and the community level effects of fisheries bycatch worldwide. Dr. Lewison serves on the editorial boards of the scientific journals *Conservation Biology*, *Marine Biology* and *Endangered Species Research.*

**Kwang-Ming Liu, Ph.D.,** received B.S. and M.Sc. degrees from the department of fisheries science, National Taiwan Ocean University (NTOU) and received his doctorate from the School of Natural Resource, University of Michigan, USA in 1992. He started his teaching career as an associate professor with the Department of Fisheries Science, NTOU in 1992 and was promoted to be a full professor in 1999. He transferred to the Institute of Marine Affairs and Resource Management in 2002 and served as the director from 2002-2005 and 2008 to present. Dr. Liu's specialty is fisheries biology, fish population dynamics, and marine resource management. He has published more than 40 peer-reviewed scientific papers, including 22 in scientific journals. He has been the principal investigator of more than 50 research projects supported by the National Science Council, Fisheries Agency, Environmental Protection Administration, among others, and has received research grants totaling more than $2 million USD. An active participant in academic societies, he is currently the chief executor of the Marine Taiwan Foundation and a member of the International Union for the Conservation of Nature (IUCN) Shark Specialist Group. He also serves as a director of the Taiwan Fisheries Society, the Taiwan Fisheries Sustainable Development Association, the Taiwan Ocean Conservation Society and the Taiwan International Fisheries Conservation Association. He is on the editorial board of the *Journal of the Taiwan Fisheries Society* and has been a reviewer of many international scientific journals, including the *Canadian Journal of Fisheries and Aquatic Science, Marine and Freshwater Research*, *Journal of Fish Biology, Fish Bulletin, Fisheries Research,* and *Environmental Biology of Fishes*. Dr. Liu's recent research focus is on fisheries biology, stock assessment and the management of elasmobranches. He drafted the *National Plan of Action – Sharks* for the Taiwan government and organized the "Shark Management and Conservation Conference –2002" and the "International Symposium on Whale Shark Ecotourism" to promote shark conservation to academic societies and the general public. He is also interested in ecosystem-based fisheries management. He leads a research team conducting a project from the natural and social sciences prospective, entitled, "Planning of Marine Protection Area in the northeastern Taiwan Waters." In addition, Dr. Liu also contributes to outreach activities, such as promoting marine conservation to fishermen and training observers. Dr. Liu regularly attends APEC Marine Resource Management Working Group meetings and has organized two APEC Private Sector Roundtable Meetings in Taiwan since 2008. In recognition of his long-term career in fisheries resource conservation, he received the National Excellent Agriculturist award from the Council of Agriculture in 2008.

**Hsueh-Jung Lu, Ph.D.,** received his M.Sc. and Ph.D. in fisheries science from the National Taiwan Ocean University in 1988 and 1995, respectively. From 1995 to 1999, he served as a specialist and then as Deputy Director of the Information Division of the Overseas Fishery Development Council, where he was responsible for fisheries statistics of distant-water tuna and squid fisheries. He is currently an associate professor in the Department of Environmental Biology and Fisheries Science at National Taiwan Ocean University. His major research interest is fisheries oceanography. Using hydro-acoustic, geographic information system (GIS), and remote sensing methods, his research focuses on the formation of fishing grounds, particularly under the influence of climate changes. For many years, he has worked to establish and maintain a Web-based GIS for Taiwan coastal fisheries, with the aim to make integrated information available. In recent years, through studies that have assessed the impact of climate change on fisheries and his role as General Secretary of the Taiwan Ocean Conservation Association, he has focused on addressing marine environmental issues.

**Sean Martin** is currently President and a director of the Hawaii Longline Association (HLA), and has participated in that capacity in all forums in the IFF series. In addition to activities associated with HLA, Mr. Martin has also participated in a number of international and domestic commissions and workshops, including the Western and Central Pacific Fisheries Commission, where he currently serves as an alternate commissioner on the United States delegation. As a current member and former chair of the Western Pacific Regional Fishery Management Council, he has an extensive background in USA fisheries policy and management development throughout the central

Pacific region. He has worked on several collaborative research and gear technology projects throughout the region, primarily focused on stock assessment and bycatch mitigation. Mr. Martin is the owner and operator of a fleet of pelagic longline fishing vessels engaged in the Hawaii longline fishery for tuna and swordfish. Additionally, he has been involved in the development, introduction and advancements in modern pelagic longline systems, both domestically and internationally, through a major supply facility based in Honolulu. Mr. Martin has been an active participant in pelagic fisheries for 35 years.

**Geoff McPherson** is an Adjunct Principal Research Fellow of the School of Engineering and Physical Sciences, James Cook University, Australia. He was originally a fisheries biologist with inshore net fishery experience with Australian barramundi fisheries and offshore tuna fishery experience in Coral Sea waters since the mid-1970s. His involvement with marine mammal bycatch mitigation began with driftnet fisheries in the mid-1980s with passive acoustic systems. From the early 1990s, he incorporated active acoustic alarms/pingers developed in association with Professor Jon Lien of Memorial University Canada. His interest in the physical sciences resulted in the designs of low frequency Constant Frequency alarms in northern Australian waters, currently used for inshore non-echolocating whales and dugong, and of higher-frequency 'Frequency Modulated' pingers for echolocating dolphins in northern Australian waters. He is closely associated with the utilization of acoustic devices to mitigate bycatch with two commercial fishing organizations. He is also involved with utilization of alternate pinger types to mitigate depredation on longlines with Japanese and Hawaiian fisheries and on encirclement in purse seines in Australian fisheries. His particular interest is the matching of acoustic devices to the acoustic capability of marine mammal bycatch species. Also of particular interest are the physics of pinger sounds in different ecosystems, and the acoustic reflectivity of nets and fishing gear components to mammal biosonar. He has assisted a number of pinger manufacturers to enhance the suitability of their products for specific applications on a non-commercial basis. He has been a member of the Western Pacific Regional Fishery Management Council's Marine Mammal Advisory Committee for toothed whales and has worked with members of the Hawaii Longline Association since 2004.

**Tom Nishida, Ph.D.,** is a research scientist with the National Research Institute of Far Seas Fisheries (NRIFSF), Fisheries Research Agency (FRA) of Japan. He graduated from the University of Hokkaido (Japan) and the University of Washington (USA) where he earned his B.S. and M.Sc. degrees, respectively. He later obtained his doctorate in fish stock assessment from the University of Tokyo. He served as the fisheries statistician in two field projects of the Food and Agriculture Organization of the United Nations (BOBP and IPTP in Sri Lanka) from 1986 to 1991. His research areas include tuna resources research, fisheries oceanography and the use of geographic information systems (GIS) for spatial analyses of fisheries and ecosystem data (for details refer to http://www.esl.co.jp/Sympo/index.htm/). Dr. Nishida has a continuing interest in the issues facing longline fisheries from depredation of catches by toothed whales and convened a workshop on this topic for the Indian Ocean Tuna Commission (IOTC) in the Seychelles (July, 2007). Currently, Dr. Nishida has a project with Adjunct Principal Research Fellow Geoff McPherson of James Cook University, Australia to mitigate depredation in the tuna longline fisheries by applying different types of devices, including newly developed pingers.

**Randall Owens** is certainly not an academic. He started his working life as a commercial fisherman and diver, mixed with income from surfing. This generated his ever-growing interest in how fisheries and the marine environment interface. He went on to work with Fisheries Western Australia as a patrol boat skipper. Later, in the newly created position of the "on ground" manager, he worked in the Houtman Abrolhos Islands, a rich and highly productive coral reef archipelago that supports the largest single species intensive fishery for the western rock lobster on a coral reef system. He worked there for 10 years, establishing an Marine Protected Area (MPA) under fisheries legislation and working, with marine and conservation scientists, to improve the environmental management at the seasonally inhabited islands. At the Abrolhos, he learned about the politics of creating MPAs and threatened species management in a fisheries world. In 2000, he joined Great Barrier Reef Marine Park Authority to '"earn how they did things," with the initial intent to stay a year or two. Ten years later, Owens is still there, enjoying the challenge as Manager, Sustainable Fishing, for the Ecosystem Conservation and Sustainable Use Group. He has an M.B.A. in marine resource management and remains an avid fisher and waterman. He has some experience in the Baltic and North Seas marine spatial planning issues while in Germany in 2008 and following a WPRFMC invitation to speak at a 2005 fishers forum in Honolulu. His master's thesis is on the comparison of the scope of processes that were used to rezone the Great Barrier Reef under the Representative Area Program, with the processes that were in place to establish the Northwestern Hawaiian Islands National Marine Monument.

**Lida Pet-Soede, Ph.D.,** holds B.Sc., M.Sc. and a doctorate in tropical fisheries biology and management from Wageningen Agricultural University, The Netherlands. Her major disciplines were fisheries biology and management, socio-economics of developing countries, and fish culture. She is also

an avid diver. She conducted her doctoral research in Indonesia, supervising more than 100 students, many of whom now have jobs in conservation and fisheries management. She has co-authored more than 40 papers and publications. Before joining WWF-Indonesia full time in 2003 and becoming the Marine Program Director in 2004, Dr. Pet-Soede worked as a consultant in Southeast Asia. Born in the Netherlands, she enjoys living in Indonesia with her family and showing her two daughters the beauty of the Coral Triangle.

**Mayumi Sato, Ph.D.,** received a doctorate in conservation/landscape ecology in 2008. She has conducted research on various organisms, including dragonflies, damselflies, waterfowls and freshwater fish during and after her postgraduate study. Since November 2009, Dr. Sato has worked as the BirdLife Global Seabird Programme (GSP) Regional Coordinator for Asia, based at the BirdLife International Asian regional headquarters in Tokyo (BirdLife Asia). She facilitates regional sea bird/marine conservation activities with a focus on the identification of Marine Important Bird Areas (Marine IBAs) and the mitigation of seabird interactions in fisheries. The Convention of Biological Diversity (CBD) aims to include 10% of marine areas as protected area by 2012 and requires its member countries to submit conservation plans for their waters. The Marine IBAs are expected to provide good baseline information for the identification of MPAs, because sea bird species' richness is an indicator of overall marine biodiversity. The greatest threat to sea birds is bycatch in marine fisheries, with an estimated 300,000 sea birds caught annually. However, because fish are a vital source of food for people in Asia, imposing restrictions on fishing activities is not a viable solution. Cross-sectoral cooperation between the fishing industry, government agencies, academia and NGOs will be key to solving regional bycatch problems.

**James Sha,** Director-General of Fisheries Agency, Council of Agriculture, Executive Yuan, has two M.Sc. degrees in marine food science from National Taiwan Ocean University, and in marine affairs from the University of Rhode Island, USA. He has served as Deputy Director-General, Fisheries Agency, Council of Agriculture (1999 – 2008); Director-General, Taiwan Fisheries Bureau (1996 – 1999); Deputy Director, Fisheries Department, Council of Agriculture (1996); Chief, Marine Fisheries Division, Fisheries Department, Council of Agriculture (1991 – 1996); specialist, Agriculture Bureau, Ministry of Economic Affairs (1982 – 1991); and specialist of Taiwan Fisheries Bureau to Cape Town, South Africa (1981 – 1982). For the past decade, Mr. Sha has been involved in international affairs, including participation in meetings of tuna Regional Fisheries Management Organizations and bilateral and multilateral meetings. He was appointed the Chair of the Extended Commission for the Conservation of Southern Bluefin Tuna (CCSBT) in 2005 and selected as the Lead Shepherd for Fisheries Working Group of Asia-Pacific Economic Cooperation (APEC) from 2005-2007. In 2002, Mr. Sha was awarded the Outstanding Diplomat Award, presented by the Ministry of Foreign Affairs.

**Kitty M. Simonds** has served more than 30 years as the executive director of the Western Pacific Regional Fishery Management Council, following a 13-year career as an aide to U.S. Senator Hiram L. Fong. Under her leadership, the council has established the benchmark for environmentally responsible pelagic and demersal fisheries through the prohibition of non-selective fishing gear, electronic logbooks, observer programs, vessel monitoring systems and spatial zoning for fishery management. In the realm of bycatch mitigation, measures adopted by the council under Ms. Simonds' leadership have not only demonstrated major reductions in sea turtle and sea bird interactions with pelagic longline fishing, but have also been adopted as standards for responsible longline fishing by regional fishery management organizations. Through Ms. Simonds vision, the council drafted the nation's first ecosystem-based management plan, and has pioneered an ecosystem-based approach to fisheries management, with an emphasis on the role of indigenous traditional and local ecological knowledge as a means to inform decision-making. On a broader scale, Ms. Simonds has ensured that the council continues to play a major role in the international management of tunas, and of vulnerable species, such as sea birds, turtles and sharks, through the dissemination of mitigation technologies and through direct support for conservation initiatives.

**Ussif Rashid Sumaila, Ph.D.,** is Director of the Fisheries Centre at the University of British Columbia, Vancouver, Canada. He also directs the Economics Research Unit (FERU) at the Centre. Dr. Sumaila's research is in the area of natural resource and environmental economics, with particular emphasis on fisheries. He is deeply interested in how economics, through integration with ecology and other disciplines, can be used to help ensure that environmental resources are sustainably used and managed for the benefit of both current and future generations. Dr. Sumaila has won a number of awards, including the Aldo Leopold Fellowship, Pew Fellowship for Marine Conservation; Craigdarroch Award for Societal Contribution; the Zayed International Prize for the Environment, and the Peter Wall Centre Senior Early Career Scholar Award. He has authored/co-authored numerous journal articles, edited books/volumes, book chapters and other publications. He selects a wide range of journals and outlets for the publication of his work to reach (i) mainstream economists by publishing in outlets, such as the *Journal of Environmental Economics and Management, Land Economics*, and

*Marine Resource Economics*; (ii) interdisciplinary scholars by publishing in journals such as *Nature, Natural Resource Modeling, Canadian Journal of Fisheries and Aquatic Sciences*, and the *ICES Journal of Marine Science*; and (iii) policy makers and other stakeholders by publishing in *Marine Policy and Natural Resources Forum*. Dr. Sumaila's work is taken seriously by policy makers at the highest levels, resulting in invitations to give talks at the United Nations, the White House, the U.S. Congress, the Canadian Parliament, the Woodrow Wilson International Center for Scholars, and the World Trade Organization. His work has generated significant international interest, and has been cited by The *Economist*, *Boston Globe, International Herald Tribune, Maine Sunday Telegram, Financial Times,* The Globe and Mail, Voice of America, CBC News and *Vancouver Sun,* among others.

**Keith Symington** is the Bycatch Strategy Leader for the WWF Coral Triangle Program. He began working on marine conservation and sustainable fisheries in Pacific Canada in 1995, after earning an M.Sc. (geography) at the University of British Columbia and a B.S. (specialists in geography and minor in international development studies) at the University of Toronto. In Pacific Canada, he worked with the Canadian Parks and Wilderness Society and WWF Canada in developing their joint Pacific marine conservation programs. He subsequently served as Marine Program Coordinator for the Sierra Club of Canada – BC Chapter, and as a consultant to David Suzuki Foundation, BC Land Use Coordination Office and Parks Canada. In 2004, Mr. Symington began serving as Marine Program Coordinator for WWF Vietnam, and in 2008, joined WWF's regional Coral Triangle Program. His main areas of interest are: (i) fisheries bycatch reduction, management and policy, focused on Southeast Asia and Pacific regional fisheries; (ii) market-based reforms and approaches for advancing fisheries Best Practices; (iii) small-scale fisheries management, including co-management, poverty and sustainability, and fisheries reconstruction strategies; and (iv) MPAs and fisheries harvest refugia, particularly for mainstreaming of marine biodiversity conservation into fisheries management.

**Timm Timoney** is a commercial fisherman from Hawaii. She has been working and playing on and in the ocean for over 40 years.

**Andrew Tobin, Ph.D.,** is a wild catch commercial fisher, board member of the Queensland Seafood Industry Association, and Senior Research Fellow with the Fishing and Fisheries Research Centre, James Cook University, Australia. Since 1997, Dr. Tobin has participated in the commercial wild catch fishery within the Great Barrier Reef World Heritage Area, targeting a diverse array of finfish (Spanish mackerel – *Scomberomorus commerson*, grey mackerel – *Scomberomorus semifasciatus*, coral trout – *Plectropomus leopardus*, barramundi – *Lates calcarifer* and threadfins - Polydactylids) as well as mud crab (*Scylla serrata*). His fishing business experienced the roll-out of the Great Barrier Reef Marine Park Authority Representative Areas Program (RAP) legislated in June 2004, the world's largest marine park at the time covering more than 345,400 km$^2$. The RAP increased the spatial coverage of protected areas in the park (no extractive activity) from 4.6% to 33.3%. The immediate impacts on his business were the loss of historically important fishing grounds, the need to shift effort into other areas and fisheries, and the need to cope with displaced effort. His business received a "restructure grant" from the government that aided his business through this transitional period.

Graduating from James Cook University in 1997, and currently a fulltime research scientist and part-time commercial fisher, Dr. Tobin has focused his research on measuring the efficacy of marine parks in offering protection to fishery exploited species. This is a passionate area of interest for him, as much of the advertising rhetoric promoting marine parks as protectors of biodiversity also claim significant benefits to fisheries' exploited species. This claim is largely untested, and should be treated with caution and used less liberally than is often the case, at least until empirical evidence is available to support it.

**Tzu-Yaw Tsay** is the Deputy Director-General of the Fisheries Agency, Council of Agriculture, Executive Yuan. He has an M.Sc. degree from the Institute of Applied Economics, National Taiwan Ocean University. Mr. Tsay has served as a specialist at the Taiwan Fisheries Research Institute; specialist and Division Chief of the Fisheries Department of Kaohsiung City; senior specialist of the Fisheries Department of the Council of Agriculture, Executive Yuan; Deputy Director of the Taiwan Fisheries Bureau; Director of the Deep Sea Fishery Research and Development Center, Fisheries Agency; and Director of the Deep Sea Fisheries Division, Fisheries Agency. He was appointed Deputy Chair (2009) and Chair (2010) of the Extended Commission of the Commission for the Conservation of Southern Bluefin Tuna. His main disciplines are fisheries management and international cooperation for fisheries governance. Mr. Tsay's recent publication is entitled, "A Study on Setting up a Mechanism for the Management of Foreign-flagged Longliners Run by Taiwan Nationals in Response to the Global Trend of Deterring IUU Fishing."

**Mao-Cheng Wang** is the Director of the Fisheries Regulation Division, Fisheries Agency, Council of Agriculture, Executive Yuan. He has an M.Sc. degree in oceanography from National Taiwan Ocean University. Mr. Wang's previous employment included serving as a specialist for the Fisheries Station. Transferred to the Keelung City Government and Fisheries Bureau,

Fisheries Agency, he was responsible for: (i) conservation and management of coastal fishery resources; (ii) rehabilitation and conservation of coastal ecosystems; and (iii) promotion and management of marine ranching and aquaculture industries.

**Robin Warner, Ph.D.,** is a Senior Research Fellow at the Australian National Centre for Ocean Resources and Security and the recipient of an Australian Research Council Postdoctoral Fellowship for 2010-2012. Her research interests include Law of the Sea, oceans governance, marine environmental law, climate law, transnational crime and international criminal law. She was formerly the Assistant Secretary of the International Crime Branch of the Criminal Justice Division in the Commonwealth Attorney General's Department from 2002 to 2006. Prior to that, she was a legal officer in the Australian Defence Force (ADF) where she held a wide range of positions, including Director of International Law for the ADF. She has recently published a book, *Protecting the Oceans Beyond National Jurisdiction: Strengthening the International Law Framework* (Martinus Nijhoff, Leiden, 2009) and has also published a wide range of book chapters and journal articles on oceans law and policy.

**Bill Wells** is the Manager of Seafood Scallop Company and Wells Scallop Company in Seaford, Virginia, USA. Seafood Scallop Company purchases scallops, flounder and monkfish and sells fuel and supplies to fourteen scallop vessels. Wells Scallop Company is the fleet of seven scallop vessels owned by Mr. Wells and the Wells family, which has been in the seafood business for four generations beginning in 1915, initially fishing for shrimp. The family fished in six different states until leaving the Gulf of Mexico in 1979 to begin scalloping. In the last 30 years, the family has scalloped from the state of Virginia to the state of Massachusetts for Atlantic Sea scallops and for nine years in Alaska for weathervane scallops. During this time, Wells Scallop Company has worked with and been governed by the New England Fisheries Management Council, Mid-Atlantic Fisheries Management Council, North Pacific Fisheries Management Council, and the Gulf Fisheries Management Council. Educated at the University of Florida, Mr. Wells has served on the Mid-Atlantic Fisheries Management Council for nine years, concluding in 2001.He is currently chairman of the Scallop Advisory Panel. During the last twenty years, he has continually served either as a council member or an advisor, while the American scallop fishery has adopted all of its current fisheries management tools. These include limited entry, gear size restrictions, crew limits, marine mammal avoidance technology, bycatch reduction and the opening and closing of special management areas to promote an increased harvest of larger scallops.

# 海洋空間規劃與漁業混獲管理之
# 第五屆國際漁業人論壇
# 實錄集

香格里拉遠東國際大飯店
2010年8月3日至5日於台北

西太平洋區域漁業管理理事會(美國)暨
行政院農業委員會漁業署(臺灣)共同主辦

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# 主辦單位序言

海洋空間規劃與漁業混獲管理之第五屆國際漁業人論壇於本2010年8月3日至5日在台北召開並圓滿閉幕，很高興出版本屆論壇實錄集供大眾參閱。

過去十年，國際漁業人論壇系列已橫跨太平洋，從紐西蘭到夏威夷、日本、哥斯大黎加與臺灣。本論壇始自探討表層延繩釣漁業之海鳥混獲減緩措施，其後擴大到包括一些其他表層漁業混獲，以及有關永續漁業之各種不同主題。

國際漁業人論壇系列是結合不同漁民團體及來自各種環保團體與學術界之代表。所有國際漁業人論壇與會者之共同利益，係永續發展表層海洋捕撈漁業、養護表層魚種及保護海洋生物多樣性。

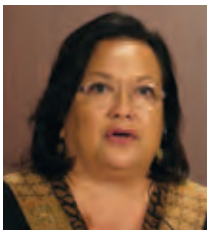
海洋空間規劃係一正迅速成為海洋管理最重要部分的概念。第五屆論壇提供漁民、業界代表、科學家及管理者參與討論海洋環境三度空間區劃，特別是海洋空間規劃如何影響使用者團體及其於養護上所扮演的角色。

與會者體認到海洋產業跨領域協調日益重要，是處理海洋活動所累積生態影響的機制。目前從墨西哥灣石油探勘所引發的問題，已對不同資源之使用者造成影響，並突顯海洋空間規劃之重要需求。

與會者亦延續歷屆論壇減緩混獲之討論與主題。過去十年，透過不同漁具技術改良，海鳥與海龜混獲減緩措施已獲得重大進展，與會者也在本屆論壇回顧該等進展。本屆論壇與會者確認機制，以達成廣泛執行混獲減緩措施之最佳實踐，並作出承諾善盡其職責，以確保履行相關行動。

第五屆國際漁業人論壇與會者通過台北宣言，建議漁業部門涉入海洋空間規劃，並確認應用此規劃方法的考量，這代表重要且積極的一步，使全球漁業朝向達成對環境負責任之路。感謝所有第五屆國際漁業人論壇之與會者及贊助商的參與和對本屆論壇的貢獻。

行政院農業委員會漁業署
署長 沙志一



西太平洋區域漁業管理理事會
執行長 Kitty M. Simonds

# 論壇摘要

## 海洋空間規劃與漁業混獲管理之第五屆國際漁業人論壇實錄集

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海洋空間規劃與漁業混獲管理之第五屆國際漁業人論壇於2010年8月3日至5日舉辦，結合300位來自漁業產、官、學界及保育組織代表。第五屆國際漁業人論壇係處理海洋捕撈漁業及更廣泛水產業所面臨之非常及時議題，即漁業和更廣泛水產業如何自提倡或擴大與利用和影響海洋資源之其他產業合作中獲取利益？第五屆國際漁業人論壇與會者也評估過去十年間本論壇系列在解決海洋捕撈漁業混獲議題所獲得之進展。

第五屆國際漁業人論壇係由以夏威夷為總部之美國西太平洋區域漁業管理事會與臺灣行政院農業委員會漁業署共同主辦，首屆論壇是在10年前於紐西蘭舉行，隨後於夏威夷、日本及哥斯大黎加召開。

閉幕前第五屆國際漁業人論壇與會者通過台北宣言，支持12項行動，首要行動為確保捕撈產業在海洋空間規劃和生態系統管理上有衡平的聲音，其他重要的行動包括在海洋空間規劃行動時，充分考量對漁村的社會經濟影響、結合效能檢視及因應情況變動之機制。該宣言也鼓勵區域性漁業管理組織，指認公海及國家管轄水域外之海床對海洋生物多樣性相對高重要性的區域，與會者亦表達支持透過市場機制和治理措施，促進使用減緩混獲方法之最佳實踐。

在論壇結束前，西太平洋區域漁業管理事會進行兩項頒獎活動，此為自第二屆論壇開始的傳統。首先頒獎予詹姆士庫克大學Geoff McPherson先生及日本水產綜合研究中心Tom Nishida博士，獎勵渠等不斷地研究偽虎鯨行為，特別是該等動物在延繩釣附近搜索糧食所使用之回波定位技術。另一獎項表彰臺灣行政院農業委員會漁業署於2008年禁止捕撈鯨鯊之決策。

### 海洋捕撈漁業參與海洋空間規劃之誘因

隨著因種種商業利益而使用海洋水域之大幅增加，致與利用海洋空間與資源之衝突中所衍生的錯綜複雜風險漸增。單一公司或產業部門可盡之最大努力，將無法有效處理廣泛的海洋產業所累積之環境影響，協調海洋產業間跨領域部門之互動有增加的必要。

第五屆國際漁業人論壇的成果之一，是消除許多與會者，以為海洋空間規劃即是海洋保護區的誤解。對漁業而言，沿岸與海洋任一空間規劃之最終結果就是指明哪些區域可捕魚、哪些區域不可捕魚。實際上，海洋空間規劃是從單一領域管理到完整的以生態系統為基礎之管理所需變革之過程。

在海洋空間規劃過程中，所有海洋活動均受到整合性的管理，並著重於包括人類活動在內的整體生態系統。海洋空間規劃的目標在於維護人類所依賴的沿岸和海洋生態系統結構、功能與服務，並滿足所有利益相關者之社會、經濟、文化和政治目標。與多數海洋產業不同，漁業直接依賴沿岸和海洋生態系統的完整性，因此相對更具利害關係及更有強勁誘因，以確保海洋空間規劃及其後續以生態系統為基礎管理之成功。

第五屆國際漁業人論壇講者點出漁業部門正式參與海洋空間規劃之誘因，並從不同的個案研究學習到有效及無效的海洋空間規劃方法。管理機關及漁業界代表分別報告其個案研究，對該等空間規劃活動之影響表達不同的觀點。這些個案研究強調有效的海洋空間規劃考量包括：

- 確保衡平考量所有利益團體需求之機制；
- 漁業界直接涉入（海洋空間規劃）過程與接受最終措施之最適條件，在有些案例中，實體的產業經濟艱困，需要有效處理漁撈能力過剩和過度利用；及
- 監控、巡邏及執法資源之充足是不可或缺的。

在公海專門捕撈高度洄游物種的海洋捕撈漁業代表，表達難以確認參與包含所有跨部門單位規劃及管理海洋活動的短期與直接價值之困難，並解釋他們無法從參與規劃石油及天然氣、航運、近岸之風力發電、波浪及潮汐能源及其他海洋產業部門之海洋活動過程中察覺到強烈的誘因或好處。目前公海主要的問題是表層漁業已過度開發、混獲敏感性物種、漁具別之間的分配、遵從國際措施和非法、無報告及未受規範捕魚。然而，海洋空間規劃是基於生態系統管理之前導，具有處理前述問題使公海漁業受益的能力。

舉例來說，空間規劃可保護重要的產卵場、攝食棲地和其他商業性重要海洋資源因其他海洋產業(如污染及棲地變遷)而退化之預期高度密集時空區域。生物多樣性公約所發展之指認公海及國家管轄水域外之海床具海洋生物多樣性相對高重要性區域的標準，可作為指引公海海洋空間規劃之有力工具，且意含可用以區劃海洋產業活動，包括海洋捕撈漁業。

以區域為基礎之規劃也可解決漁業部門間衝突，例如透過以區域為基礎之規劃，建立不同漁具之漁區、及對漁具設計及漁法進行以區域為基礎之限制。此類以場所為基礎的規劃和管理方法，可對達成漁具間和小規模漁業與商業漁業間衡平及可持續之漁業資源分配作出貢獻。

建立時空限制是一分區工具，也是一空間規劃方法，可處理許多魚類系群之過度開發、保護目標魚種之產卵區、及迴避生物多樣性相對高重要性的區域，如混獲熱點。再者，需要多種產業部門實際合作，以成功減緩其他造成海洋生物多樣性變動及喪失的全球驅動因子，包括對漁業造成影響的海洋污染、氣候變遷及外來入侵物種的擴散。

有必要發起和增進捕撈漁業參與海洋空間規劃和以生態系統為基礎之管理的過程，使其在不同人類活動之海洋區域及資源時空分配之決策上有衡平的聲音。在國家管轄水域內有許多海洋空間規劃的範例，已建立相當完善的跨部會參與治理，然國家管轄水域外之海洋空間規劃和以生態系統為基礎之管理的跨部門治理架構仍在發展中，目前僅有少量正式的規劃與管理機制。在國家管轄水域外存有多種跨部門空間規劃機制，漁業部門應直接涉入其中，包括執行在開放的海洋水域及深海棲地指認生態或生物學上需受保護重要海洋區域之科學標準的生物多樣性公約、研究在國家管轄水域外養護和永續利用海洋生物多樣性相關議題之聯合國非正式特別工作小組，及世界海洋理事會所推動的同等倡議。

## 混獲減緩措施

召開第五屆國際漁業人論壇之第二個目標是評估過去十年間本論壇系列在減緩敏感性物種混獲議題所獲得之進展，包括海龜、海鳥、鯊魚、海洋哺乳類及體型不適市場出售之鰭魚類，及指認需要增加關注之優先養護管理領域，以確保長期環境及社會經濟之永續性。

處理延繩釣及圍網漁業和沿岸消極性網具及定置網混獲之過程繁雜，但在確認延繩釣漁業之海鳥及海龜混獲與圍網漁業之海豚直接死亡率的漁具技術解決方案已有堅實的進展。然而，仍需進一步投入研究及發展減緩混獲之措施及漁法技術，以處理延繩釣及圍網漁業混獲鯊魚、圍網漁業混獲海龜、延繩釣漁業混獲鯨魚、投放集魚器之圍網漁業混獲幼小及體型過小的鮪類，以及延繩釣漁業混獲旗魚類。目前有關減少延繩釣漁業和鯨魚間互動之研究顯示此途大有可為。第五屆國際漁業人論壇與會者已運用名為「Triple D」之消極性聲納發射器影響齒鯨類，並防止渠等和漁具互動。

區域性漁業管理組織已著手通過漁具技術方法之最佳實踐，以減緩混獲問題。然用於監控、巡邏和執法之船上觀察員資源不足，致有效執行具法律約束力之養護與管理措施的可能性並不高。儘管為有效減緩海鳥混獲，眾多且相關區域性組織對延繩釣漁業通過具法律約束力之措施，但與延繩釣漁業互動而受影響之海鳥族群仍呈下滑趨勢，從中可窺見前述治理之不足。此外缺乏評估區域性漁業管理組織養護管理措施之績效標準，致無法進行混獲減緩措施之成效評估，而此為引導有效合適管理所需之基礎資訊。

本屆論壇講者亦論及對小規模漁業進行混獲評估之挑戰，小規模漁業通常缺乏主要的基礎資訊，包括漁獲努力量水準、漁獲努力量之時空分佈及混獲率等資料。估算區域漁獲努力量之繪圖工具、利用低成本訪查之方法及聘用船上觀察員計畫已被採用。家計型漁民直接參與混獲評估和減緩措施的好處已被強調，包括商業化展示大有可為的減緩混獲漁具技術。

以市場為基礎的機制，包括生態標籤和其他海洋捕撈漁業認證計畫，以及食品雜貨零售商與其供應商運用永續水產品來源策略，可能是海洋漁業混獲達到可承受水平的有效途徑之一。改進零售商與其買主和供應商之間的交流與互動，及被點名優先改善其漁業永續性之捕撈漁業，包括透過運用混獲減緩措施之最佳實踐及有效解決國際治理之不足。

## 第五屆國際漁業人論壇與會者之承諾

每一屆國際漁業人論壇均邀請與會者作出承諾，採取行動以推動國際漁業人論壇目標。第五屆國際漁業人論壇與會者中，有22位來自15個國家或領地對海洋空間規劃及混獲減緩措施作出個別承諾。該等承諾摘要如表一並分為19類。個別承諾詳見附錄4。

**表一、第五屆國際漁業人論壇與會者承諾摘要**

| 類別 | 承諾之百分比 |
|---|---|
| 發展及履行混獲減緩方案及工具 | 16% |
| 透過參與、合作和教育對海洋空間規劃作出貢獻 | 14% |
| 推動海洋空間規劃和鼓勵漁民及漁業組織涉入 | 9% |
| 參與未來之論壇、組織和討論 | 9% |
| 改善資料蒐集和有關混獲及海洋空間規劃議題之資訊分享 | 9% |
| 為漁民製作教育及延伸教材 | 7% |
| 與合作夥伴、相關組織及立法者合作 | 5% |
| 繼續進行水產品生態標籤及其他認證方法 | 5% |
| 鼓勵他人減少混獲 | 2% |
| 透過觀察員計畫改善混獲監控技術 | 2% |
| 支持制訂船長及船員行為規約 | 2% |
| 為永續漁業進行經濟分析 | 2% |
| 改善漁村及組織的區域管理 | 2% |
| 促進利用低營養層級之表層魚類 | 2% |
| 承擔漁業養護及管理之義務 | 2% |
| 發展海洋保護區 | 2% |
| 支持開發中國家之技術研發 | 2% |
| 教育他人有關漁業之永續性 | 2% |
| 處理非法、無報告及未受規範捕撈之議題 | 2% |

# 第五屆國際漁業人論壇任務與目標

## 任務

第五屆國際漁業人論壇之任務為廣集漁業人、管理者、水產品零售及批發商、漁撈技術專家、海洋生態與漁業科學學者專家及其他相關團體或個人，召開國際會議以探討：

- 促進各界就海洋空間規劃議題資訊及經驗之交流，以達包括減緩敏感性物種之混獲及混獲丟棄管理之可持續漁業實踐；及
- 檢視自2000年首屆漁業人論壇後，至此最後一屆十年間所達成的各項進展，並透過確認日益關注需優先養護之區域，並提供前瞻看法，以確保延繩釣漁業、沿岸消極性網具漁業及其他對敏感物種混獲有問題的小規模漁業，在環境與社會經濟層面之永續性。

## 目標

本屆論壇將追求下列目標以達成任務：

### 回顧

- 檢視前屆論壇迄今所做出的承諾及其進展；
- 檢視大洋性及全球延繩釣漁業之現況與趨勢；
- 檢視並評估跨政府間組織倡議達成永續及負責任延繩釣漁業之成效，包括混獲及丟棄之養護與管理措施，和海洋空間規劃之採用；
- 分享在減緩海鳥和海龜混獲、減緩鯊魚混獲、減少鯊魚和鯨豚混獲，及管理表層及底延繩釣漁業和沿岸消極性網具漁業丟棄，發展與使用替代方法之經驗；
- 分享在應用海洋空間規劃，所學到的經驗教訓以對管理沿岸和公海漁業作出貢獻，包括混獲和丟棄；及
- 分享漁業永續性評估活動對捕撈實踐影響之證據，包括由第三方認證的生態標籤和消費者指南、零售商計畫及第一方評估計畫；

### 展望

- 確認有效與協調合作之途徑，以減少海鳥、海龜、鯊魚及鯨豚與延繩釣和沿岸消極性網具漁業間可能造成問題的互動。
- 指出減緩延繩釣漁業和沿岸消極性網具漁業混獲和管理丟棄之新進展或持續進展及其優先順序；
- 建議海洋空間規劃如何實施，以對沿岸和公海漁業之永續管理做出有效貢獻，包括減緩混獲和管理丟棄。
- 考量趨重要的市場機制對捕撈漁業實踐和長期永續性之影響，包括減緩混獲，及建議漁業界之最佳主動回應；及
- 確認家計型和商業型漁業人、政府間組織(包括區域性漁業管理組織和其他區域性漁業團體)及非政府間環境組織，在減少漁業混獲及管理丟棄方面所扮演的建設性角色，並建議如何將此類建設性角色納入未來利用之主流。

# 第五屆國際漁業人論壇台北宣言

**海洋空間規劃及減緩混獲管理**
2010年8月3日至5日
**台灣，台北**

**憶及**舉辦第五屆國際漁業人論壇之核心目標，係使漁業界參與近期興起有關採用海洋空間規劃與管理途徑之討論；

**進一步憶及**舉辦第五屆國際漁業人論壇之第二個核心目標，係評估舉辦本論壇系列會議迄今在減緩與海龜、海鳥、鯊魚及海洋哺乳類動物交互影響之進展，並指認需要增加關注之優先養護管理領域，以確保長期環境及社會經濟之永續性；

**承認到**聯合國教育、科學暨文化組織將海洋空間規劃定義為「分析及分配在海洋區域之人類活動之時空分布之公開過程，以達成通常透過政治過程所指認之生態、經濟及社會目標」；

**進一步承認到**海洋空間規劃可以被當作其中一種工具，以避免、最小化衝突，並支持與陸上土地利用規劃相稱之之海洋生態系統運作及服務；

**考量到**漁撈業及更廣泛的水產業在發起或改進與其他使用及影響海洋資源產業間協調所做的努力，將有助於成功的減緩某些造成海洋生物多樣性變動或喪失的主要全球驅動因子，包括對漁業界造成負面影響的海洋污染、侵入外來物種之擴散及氣候變遷；

**承認到**生物多樣性公約用作指認生態或生物學上需受保護重要海洋區域之科學標準，具有作為指引海洋空間規劃工具的潛力，且意含可用以區劃海洋捕撈漁業；

**承認到**某些物種，包括海鳥、海龜、海洋哺乳類動物及鯊魚，其混獲情形已成為生態上關切事項，由於其高年級群特別易於受到過度捕撈的傷害，可以在短期間內大幅減少，但恢復的速度卻很緩慢；

**進一步承認到**混獲稚魚或體型不足的目標魚種，將惡化某些魚群過度捕撈的情形，且在不同漁具間、小規模漁業與商業漁業間、沿海漁業與公海漁業間成為分配上的問題；

**考量到**漁業正如聯合國糧農組織的負責任漁業行為準則及有關永續漁業對糧食安全之京都宣言所述，為全球人類目前及未來世代之糧食、就業、娛樂、貿易及經濟繁榮的重要來源；

**認知到**自從第一屆國際漁業人論壇在十年前召開以來，在發展及分享減緩表層及底層延繩釣漁業中有問題的混獲有效方法之知識方面，系列漁業人論壇已催化了相當程度的進展；

我等身為海洋空間規劃及減緩混獲之第五屆國際漁業人論壇參與者，包括漁業者、漁業管理當局、海洋空間規劃專家、漁撈技術專家、漁產品零售商代表、海洋生態學家及漁業科學家，茲聲明我等將執行及支持下列行動：

1. 承認海洋空間規劃及管理在海洋資源養護上所扮演的重要角色，並認知在公海所進行的相關規劃及管理應當由主管區域性漁業管理組織因應；
2. 發起及增進海洋漁業界參與廣泛及跨部門海洋空間規劃及管理，以確保海洋漁業業者，在不同人類活動之海洋區域空間及時間分配決策中，有衡平的聲音；
3. 確保在未來海洋空間規劃行動時，充分考量對漁村的社會經濟影響；
4. 支持使用有關之海洋空間規劃工具，以對不同漁具間、小型漁業與商業漁業間

及沿岸漁業與公海漁業間衡平及可持續之漁業資源分配有所貢獻，如透過以區域為基礎之規劃建立不同漁具之漁區、及對漁具設計及漁法進行區域為基礎之限制；

5. 進行研究以進一步闡明海洋空間規劃，在嘉惠漁業方面所扮演的角色；
6. 認識到海洋生態系統是動態系統，為此應確保海洋空間規劃倡議，能結合效能檢視及因應情況變動之機制；
7. 考量海洋空間規劃為盡可能減低漁業與受保護物種及敏感物種交互影響之附加工具；
8. 鼓勵主管區域性漁業管理組織採取措施，適用生物多樣性公約配套標準，以指認公海及海床上對海洋生物多樣性相對高重要性的區域；
9. 增進對過去10年間全球表層漁業界、漁業經理人、漁業科學家及漁業工程人員以及保育界，在研究及實踐混獲減緩措施所達成就之瞭解；
10. 支持對表層漁業漁具的持續研究，以發展對環境負責任的鮪魚及相關魚種之漁業，使對稚魚、體型不足的目標魚種、海龜、海鳥、海洋哺乳類動物及被指認資源狀態為已過漁鯊魚的影響減到最小；
11. 鼓勵零售商、漁產品採購商、供應商和海洋捕撈漁業間的互動，以改善漁業永續性，包括透過採用最佳的混獲減緩實踐及改進的國際治理；
12. 加強宣傳及擴大業界對鮪延繩釣及圍網漁業、小規模沿海漁業之非目標物種混獲減緩措施最佳實踐的理解；

我等會將此宣言送交聯合國教育、科學暨文化組織秘書長、生物多樣性公約執行秘書、世界海洋理事會執行長、聯合國秘書長、聯合國糧農組織秘書長及五個區域性鮪漁業管理組織，供其考量。我等亦將要求各國政府，包括台灣政府及美國政府，支持全世界的漁業界落實此宣言。

# 開幕致詞及來賓致詞

## 開幕致詞

**陳武雄博士**

行政院農業委員會主任委員

美國西太平洋漁業管理委員會執行長也是本次IFF5共同主辦人Kitty Simonds女士、各位親愛的部長、漁業署沙署長、以及各位來賓朋友們，大家早安：

首先，對於各位貴賓來到台北，在此向大家表示竭誠歡迎之意。很榮幸能在這裡與大家一起關注與探討「如何應用海洋空間規劃以保護海洋資源，並確保其永續發展」的議題。

漁業係目前少數利用海洋野生資源來維護人類糧食安全的產業之一。為了確保資源的永續利用與維護生物多樣性，全球通過並實施各種漁業資源養護及管理措施。

聯合國教科文組織與全球科學家們皆試圖提出透過海洋空間規劃與管理的方式，減緩捕獲非目標魚種與意外混獲魚種的情形，以確保海洋資源之有效管理。

本次「第五屆國際漁業人論壇」會議有超過28個國家參與，主題就是要探討海洋空間規劃與漁業混獲管理之議題。其目的就是，為尋求改善魚類系群之永續性及受保護物種與漁業之交互影響，來進行意見交換與討論，以實現永續漁業的目標。

台灣政府亦十分關心海洋空間規劃問題，目前，我國執行海洋事務之權限分屬不同的行政部門，政府正進行改造將解決此一現狀，訂於2011年成立一個新的部級組織－海洋委員會，未來包括海洋空間規劃在內的海洋相關政策，將由該機構負責制訂。

另外，漁業捕獲非目標魚種之問題已逐漸被大家所關注，尤其是意外捕獲海鳥、海龜、海洋哺乳動物以及部分鯊魚魚種的情形。故，如何有效減緩混獲問題已被國際漁業管理組織所重視，也促使了聯合國糧農組織制訂海鳥與鯊類之國際行動計畫。

而台灣做為一個從事公海捕魚的主要國家，在此問題上也充分展現負責任的態度，積極參與各區域性之漁業管理組織，以制訂混獲減緩標準與措施。

漁業一直與人類糧食安全息息相關，尤其在某些國家它又具有收入、財富與就業等社會安全的重要功能。所以生態系統為基礎的漁業資源養護與管理工作固然需要提倡，但也不能忽視漁業對確保糧食與社會安全的重要性。

希望藉由本次論壇的意見交換與討論，使漁業業者、管理當局、相關學者專家更能瞭解維持海洋漁業資源永續利用與養護的重要性。

最後，希望各位貴賓利用這個機會多看看台灣，瞭解與享受我們台灣特有的風土民情。也希望各位在本次的短暫停留期間，能夠有個美好的回憶。祝大會圓滿成功

# 來賓致詞

**沙志一先生**
行政院農業委員會漁業署署長

各位部長、嘉賓以及朋友們，早安。

首先，我要感謝美國西太平洋區域漁業管理理事會與本署共同主辦本次會議。

此刻，我也要對所有來自不同地區及國家的嘉賓們表示最熱烈的歡迎，感謝各位能出席這項有意義的國際盛會。

過去幾十年來，經由政府、學者跟業界的共同努力，台灣的漁業得以快速成長。漁業對於周邊產業的發展、經濟的穩定與確保糧食供應有諾大的貢獻，而台灣的遠洋漁業也甚至晉身世界六大強。

我們應該注意到，捕撈漁業的全球產量已達到顛峰，而且從2001年起，便一直維持在同樣的水準。根據聯合國糧農組織的估計，全球超過一半的魚類資源已達充分利用，大約百分之二十八的魚類資源不是遭過度捕撈，就是資源耗盡。

毫無疑問地，許多具有商業價值的魚類資源處於過漁中，或者已經過漁，我們必須採取負責任的行動來處理這些問題。正如人們所說，能力越強，責任越重。作為主要遠洋漁業國家之一，台灣政府已制訂並修改相關國內規則與規定，以符合國際漁業組織通過的措施，目標是確保台灣遠洋漁業的永續發展。心繫此一目標，台灣將繼續積極參與各區域性漁業管理組織（RFMOs），並與其他各國合作，以建立包括混獲減緩措施在內的國際性漁業管理措施。

海洋覆蓋了地球表面百分之七十以上的面積。從古到今，對人類生活的各個領域來說，海洋一直扮演著非常重要的角色。海洋資源是人類的共同財產，我們應該予以永續利用和管理。身為站在海洋相關產業最前線的漁業人，我們有責任為了今世後代維護海洋資源。

本次論壇針對海洋空間規劃與減緩混獲，準備了許多傑出的簡報。藉由論壇期間的這些簡報與討論，希望所有漁業利害關係者能更加瞭解海洋空間規劃議題與混獲減緩措施之實踐，我們將在會議閉幕之前，於IFF5宣言中做出堅定的承諾，以達成預定目標。

最後，藉由所有與會者的參與，希望本次論壇能順利、成功，並敬祝各位嘉賓能在逗留台灣期間有個愉快的體驗。

謝謝。

**謝文榮先生**
臺灣區遠洋鮪釣船魚類輸出業同業公會理事長

陳主任委員、大會共同主持人Ms. Simonds及漁業署沙署長，各位與會貴賓，各位女士、先生們大家好。

謹代表台灣區鮪魚公會誠摯的歡迎來自世界各地的外國朋友們，來到台灣參加第五屆國際漁業人論壇。

如同我們所知，這個論壇是為了漁業人與政府之間對話所創立的平台，為了建立更緊密的合作與溝通在我們所關心的國際議題上，並且在海洋保育及商業漁撈間取得適當的平衡。我衷心希望未來幾天的會議不僅是成功的會議，更是一個能喚起大家對於攸關業者生存的資源議題的重視，而具有相當重要意義的會議。

第一屆的國際漁業人論壇於2000年在紐西蘭召開。今年2010年，IFF5在台灣舉行，大會以海洋空間規劃與降低混獲為議題。從第一屆的論壇一系列至今已經十年。在過去的十數年間，台灣區鮪魚公會體認全球發展的趨勢並從國際社會中學習到許多的經驗與教訓。在混獲的議題上，透過實際的參與及觀察，台灣漁業界充份瞭解我們所必需履行的

責任。台灣的鮪漁業界，尤其是遠洋漁業，我們十分樂意把過去我們配合國際間對於 降低混獲議題所做的努力與成果跟各位分享。

海洋空間規畫對我而言是一項新的議題，我期待透過與會貴賓熱烈的溝通與討論，在此議題上能夠達成具有深切意義的結論。而我認為關於海洋空間規劃的結論，一定要把漁業社群的存續與和生計一起考慮。

過去的十年間，漁業經營環境有著相當大的變化，決大部份來自於燃油價格的高漲以及政府為了管理所附加的各種不同類型的管理費用。與過去十年相較，燃油的成本提高了二至三倍。油價持續的波動，造成了經營上極為不可預期的風險。油價似乎在我們的掌握之外，但是經營的費用卻掌握在我們手上。我相信為了海洋資源的永續利用，漁業產業界是相當樂於與管理者合作。沒有豐富的海洋資源，漁業也無法存活。無論如何，我們十分堅信，無論是使用任何的方法，只有兼顧考量其適用性以及商業利益，如此漁業才得以存活下去。

我們的目標是魚，而非其它意外混獲的物種。如何降低混獲及保育海洋資源，對我們而言永遠是最重要而且長程的目標。

除此之外，當我們在處理混獲的保育議題時，我們認為收集可靠的科學數據更顯重要，任何在資料收集時的疏忽都將把評估的結果引導至錯誤的方向。過度而不生當的保護特定的物種，將導致另一種型態的生態失衡。

我衷心希望今年IFF5會議圓滿成功，也希望各位在台北的這段時間能有非常愉快而值得回憶的經驗，謝謝大家。

**Rebecca Lent博士**

美國國家海洋漁業局國際事務處處長

首先感謝臺灣行政院農業委員會漁業署及美國西太平洋區域漁業管理理事會共同籌辦第五屆國際漁業人論壇，並宣告美國新的國家海洋政策，為確保管理海洋及其天然資源之生態系統方法是基於科學且健全有效，新政策體認到機構間合作之重要性，故新政策將花費更多心力在區域層級諮商上，更重視利益相關者在區域層級上參與討論。L博士最後總結，希望聆聽未來幾天之海洋空間規劃及混獲管理的討論。

**Sean Martin先生**

夏威夷延繩釣協會理事長

首先感謝美國西太平洋區域漁業管理理事會及台灣行政院農業委員會漁業署共同舉辦本屆國際漁業人論壇，並給我機會在開幕致辭。這次是國際漁業人系列論壇最後一屆。

未來幾天本論壇將探討兩項即時且重要的議題，這些問題並非僅鮪漁業需面對，亦牽涉廣泛的水產品產業及其他海洋產業部門。

我想提出的第一問題是，廣泛的漁業及水產業，特別是夏威夷延繩釣協會，如何與其他利用及影響海洋資源之產業合作或改善合作並從中獲得好處？

對許多本論壇的參與者而言，海洋空間規劃是一項相當新的倡議。簡單地說，海洋空間規劃不只規劃娛樂漁業及商業漁業對海洋區域之利用，亦對廣泛的使用者進行規劃，包括運輸、海洋採礦、海洋娛樂、海洋發電，及其他增加環境衝擊之複雜風險和可能在海洋空間和資源利用中發生衝突之更多使用者。單一公司或整個產業盡其最大努力，都無法解決廣泛海洋產業蓄積的環境衝擊，而協調海洋產業間互動的需求日益增加。

最近成立之世界海洋理事會提供建立一跨部門協調機制，該會創會執行長將在本論壇研討主題中作簡報。許多水產業發現，在所有作法中，難以辨識跨部門協調之短期直接或長期間接的價值。很多海洋捕撈漁業重要議題之提出，不易讓跨部門介入。處置最具成效的漁業遵從問題包括過度利用、混獲、分配配額和非法、無報告及不受規範（IUU）等，然海洋生物多樣性之改變、海洋污染、外來種的傳播及氣候變遷等議題也衝擊漁業，漁業需加入跨部門協調之行列。

第二個問題是透過本論壇，應考量如何併入鮪漁業，使其成為海洋空間規劃及管理之一部份？

透過以區域規劃為基礎可達成以漁具類型間、小規模漁業與商業性漁業間之鮪資源分配，如建立不同漁具類型之使用區域和限制漁具及漁法區域。舉例來說，諾魯協定會員國已建立圍網漁業集魚器之季節限制，有助於降低小鮪類及幼鮪之混獲率。另一實例是禁止延繩釣在夏威夷大島鄰接水域作業，不僅避免與沿岸漁業發生衝突，也增加小型漁船取得資源的機會。

我們將在本論壇聆聽到資源分配之不同觀點。有些區域性鮪漁業管理組織及國內漁業管理者採用時間或空間之禁漁措施，如夏威夷群群島西北方之鄰接水域，因關切衝擊瀕危之夏威夷僧海豹棲地而禁止延繩釣漁業。

本論壇也將回顧表層延繩釣及圍網漁業和沿岸家計型漁業對減少混獲之進展。針對夏威夷延繩釣漁業，Eric Gilman博士將說明延繩釣漁業解決海鳥、海龜、鯊魚及海洋哺乳類混獲之漁具技術進展。我們也將聽到鮪類圍網漁業漁具技術解決方案之發展及持續努力，以降低圍網漁業對非目標物種的衝擊。另我們也將聽到成功的合作研究，如確認夏威夷延繩釣船隊之海鳥及海龜解決方案。

國際間普遍有改進的需要，五大區域性鮪漁業管理組織應通過養護及管理措施，利用最佳實踐之漁具技術，提供適當的監督與執法資源、充足的船上觀察員涵蓋率，確保遵從該等措施使其具有效力。目前管理夏威夷漁業的制度已符合該等要求，受保護物種之意外捕獲量減少，證明管理制度無須降低目標魚種之捕獲量。夏威夷延繩釣漁業已經歷兩次聯合國負責任漁業行為準則評估，達成率均超過90%。截至目前為止，夏威夷漁業是在一極嚴格的管理環境中運作，未來將繼續使其經濟可行。

過去十年，混獲減緩技術已有許多進展，當時本論壇已開始進行討論。我們確信已作充分的投資，確認幾乎可消除混獲問題的方法，期望增強採取該等有效減緩措施之政治意願。本人代表夏威夷延繩釣協會，非常樂意參與本論壇，促進鮪漁業應用海洋空間規劃，並審視及建立減緩混獲之優先考量。

# 簡介第一屆國際漁業人論壇迄今之承諾與進展及本屆與會者承諾之程序

**Kitty M. Simonds女士**
西太平洋區域漁業管理理事會執行長

很高興能在台灣致詞，與各位一同慶祝從2000年第一屆國際漁業人論壇至今十年間所達成的進展與成就。首先感謝台灣共同主辦單位漁業署及中華民國對外漁業合作發展協會，讓第五屆國際漁業人論壇有機會在台北舉辦，並感謝他們盡心盡力籌備本屆論壇。

自第一屆國際漁業人壇論開始，國際漁業人論壇系列已橫跨太平洋，從紐西蘭到夏威夷、夏威夷到日本、日本到哥斯大黎加。這次是歷來距離最遠的一次，從哥斯大黎加跨越整個太平洋到台灣。

身為玻里尼西亞原住民，我認為我們在浩瀚的太平洋上展開追求負責任漁業的旅程係合適的。更重要的是，我們有許多與會者來自太平洋島國，現在我們來到了他們的起源地。考古學、遺傳學和語言學研究顯示，我的玻里尼西亞人祖先，和來自太平洋島國的同胞兄弟姐妹的祖先，皆是在五千年前發源於台灣，然後他們在一千年內經由廣闊的海洋迅速向外擴展，從台灣到玻里尼西亞。

誠如我之前多位講者所說，自2000年在奧克蘭舉辦第一屆國際漁業人論壇後，我們歷經漫漫長路。當時，國際漁業人論壇只關切海鳥與延繩釣漁業間之互動，和如何避免這些問題。後續的國際漁業人論壇則擴大角色和範圍，關注重點擴及海龜、鯊魚、海洋哺乳類、負責任漁業和其他漁具，特別是沿岸消極性網具等。

在此毫無傲慢之意，我想我們可以說，國際漁業人論壇系列獲得空前的成功，特別是在朝向對環境負責任漁業之進展更是有目共睹。在21世紀的一開始，漁民、科學家、管理者及保育人士就面臨艱鉅的任務。數以千計的海鳥和海龜因延繩釣漁業而死亡，然而當時解決方法才剛開始進行測試和被採用。對某些國家而言，海鳥混獲解決方法來得相對簡單，例如夏威夷延繩釣漁業，因為與該漁業發生互動的海鳥主要只有兩種信天翁。在緯度較高地區，物種多樣性和數量龐大的海鳥，加深問題的難度，但是現在表層及底延繩釣漁業都已找到解決方法並實行之。

與海龜互動的問題曾讓夏威夷延繩釣漁業被關閉，然後又受到嚴格限制，但解決方法其實既簡單又簡潔。採用大的圓形鉤和魚餌讓我們的漁業與海龜間之互動減少90%以上，這個方法凸顯持續研究和瞭解漁具如何運作，或術語上所說「釣獲率」(catchability)之必要。

在為解決漁業與敏感性物種間之互動，發展可行的解決方法所達成的進展，亦反映於區域性漁業管理組織或稱為RFMOs之回應，特別是區域性鮪漁業管理組織。以不同漁業成功案例為基礎之海鳥及海龜混獲減緩措施已被不同的區域性鮪漁業管理組織採用。夏威夷劍旗魚表層延繩釣漁業現在與海龜平均互動率已被中西太平洋漁業委員會採用為最低標準，中西太平洋漁業委員會會員國必須採取該標準作為延繩釣漁業之海龜混獲減緩措施。

夏威夷延繩釣漁業持續扮演積極角色，尋找方法解決延繩釣與受保護及敏感性物種間之互動。該漁業持續積極配合研究，讓所屬漁船參與技術解決方法測試和新倡議，如視訊監控。夏威

夷延繩釣漁業亦參與三國漁民交流計畫（Tri-National Fishermen's Exchange）。該計畫促進日本、墨西哥及夏威夷漁民拜訪彼此的國家，瞭解渠等之漁業如何對赤蠵龜造成衝擊，及哪些潛在後果可能會促成漁業法規之推動。

上述進展和有關混獲的其他進展，係區域性鮪漁業管理組織聯席會議或神戶程序（Kobe process）之焦點，2010年已召開數次研討會，其中之一於7月在澳洲布里斯本舉行，該研討會之目標為：

- 檢視可取得之非目標魚種意外混獲及目標魚種幼魚的資料；
- 提供有關最佳實踐、方法與技術之建言予區域性鮪漁業管理組織，以評估及降低非目標物種之意外死亡率，如海鳥、海龜、鯊魚、海洋哺乳類及目標魚種之幼魚；
- 發展及協調相關研究計畫及觀察員計畫；
- 為避免工作重複，提出有關機制之建議，以流暢調整區域性鮪漁業管理組織工作小組在該領域之工作。

有一點值得提醒本屆與會者的是，因有國際漁業人論壇等倡議，布里斯本研討會內容和混獲減緩之進展才大幅展開。

在上屆論壇，計有60位來自21個國家和機關的與會者做出承諾。這些承諾大致可分為兩類：(1)提倡對環境負責任漁業意識，(2)進行漁具試驗，如圓形鉤或經過調整的刺網，以減少混獲。上屆論壇約有三分之二的承諾屬於這兩類。

其餘三分之一承諾所涵蓋的議題包括考慮環境負責任漁業之生態標籤及採購、落實海龜、鯊魚和其他物種之保育、加強區域性合作與立法，及改善漁業資料蒐集和觀察員計畫等。

自第四屆論壇後，我們開始請求提供書面承諾者給予報告。在提倡負責任漁業意識之承諾類別下，我們收到數個區域性組織的報告，例如服務所有太平洋島國和領地之太平洋共同體秘書處。太平洋共同體秘書處漁業計畫訓練太平洋島國人民，使他們得以在自已的國家內舉辦受保護物種研討會。太平洋共同體秘書處給予這項努力協助，準備並免費提供研討會材料，例如延繩釣尾端漁具（longline terminal gears）指南、延繩釣船所捕漁獲（包括混獲）指南等，並修改處理準則，以與中西太平洋漁業委員會所採用之處理準則一致。

捕撈組織，如太平洋島國鮪漁業協會，持續提倡漁業永續性和混獲減緩。太平洋島國鮪漁業協會擔任太平洋地區國家商業漁民和組織之資訊管道，並持續按照其章程提倡安全的環境實踐。其他區域性組織，如生物多樣性中美洲市場，已進行一系列的活動，包括貸款計畫及技術協助，以在中美洲建立對環境負責任之漁業。

全球各地已開始進行混獲減緩技術試驗，如使用圓形鉤，而且有關這些技術之有效性報告亦在各種不同的會議發表，包括區域性鮪漁業管理組織會議和研討會，及海龜保育相關研討會等。太平洋共同體秘書處已在庫克群島、美屬薩摩亞及新喀里多西亞進行減少海龜混獲之圓形鉤試驗，該組織亦於斐濟觀察延繩釣與鯨豚間之互動，夏威夷亦進行相同的活動。夏威夷未來可能採用圓形鉤和「較不銳利」的魚鉤（weak hooks），以最小化對偽虎鯨所造成之嚴重傷害和死亡率。全球各地已通過實施經證明安全的海龜處理與釋放方法，該方法亦被強制實施於太平洋島國鮪漁業協會會員之太平洋島國船隊。

南美洲的漁業研究組織已發展多項國家行動計畫，以保育鯊魚及減少捕撈巴塔哥尼亞美露鱈的底延繩釣船與海鳥之互動。海鳥計畫所採取的減緩措施，如使用避鳥繩，類似南極海洋生物資源保育委員會所建立之減緩措施。此外，巴塔哥尼亞美露鱈漁業已開發一種稱之為cachalotera或「hood」的裝置，以最小化與齒鯨間之互動。

最後，為減少延繩釣漁業與敏感性物種間之互動，目前有一股強大的力量推動加強區域合作和實施立法，包括中西太平洋漁業委員會對海鳥、海龜、鯊魚鰭所通過的養護與管理措施，及捕撈組織如太平洋島國鮪漁業協會所採用之鯊魚鰭規定。

南太平洋論壇漁業局之16個會員國已對目標魚種和混獲物種採取措施，以減緩漁業與海龜、海鳥、和海洋哺乳類間可能造成問題的互動，和其他優先措施，如空間/時間區及禁用集魚器之區域。南太平洋論壇漁業局在發展圍網漁業努力量管控方面一直有重要作用，南太平洋論壇漁業局未來可能對延繩釣漁業採取類似的計畫。南太平洋論壇漁業局的南方會員國已快完成南太平洋長鰭鮪及劍旗魚計畫之簽定，而且玻里尼西亞南方的南太平洋論壇漁業局會員國最近簽定一合作安排，以在漁業監控、管制及監督方面更緊密合作與協調。

在這一週，如同前幾屆的國際漁業人論壇，本屆持續關注透過主流化有效的、商業上可行的和公平的混獲避免策略之途徑，解決延繩釣漁業意外捕獲海鳥、海龜和海洋哺乳類的問題。然而，與前幾屆相比，本屆的範圍更廣泛，擴大考慮漁業作業之海洋空間。許多人對海洋保育區的概念，及海洋保育區加強和復育已枯竭漁業資源的能力寄予厚望。海洋保育區被提倡用於敏感性物種保育，亦係夏威夷最近一次海洋哺乳類研討會之焦點。

此外，隨著全球人口快速成長，越來越多人認識到競爭的資源使用者讓海洋越來越擁擠。墨西哥灣最近發生的事件讓衝擊和災難顯得格外突出。這些事件不只對未來的石油探勘有重大影響，對漁業、觀光業和受保護物種保育亦然。因此海洋空間規劃的概念成為美國歐巴馬政府的主要政策措施確實不足為奇。因此，我們期待在這一週聽到本屆與會者如何利用海洋空間規劃，緩和重疊的海洋使用者所造成的衝擊和提倡保育的經驗。

國際漁業人論壇系列正創造一個全球社區，或夏威夷語所稱之「ohana」（家族），我們希望這個社區能夠共同迎接這個挑戰。跟上屆論壇一樣，我們再次請求您寫下承諾，寫下直到下次國際漁業人論壇聚會您將採取的具體行動，承諾書附在您從報到處領到的大會手冊最後面。請在表格上寫下您的承諾並於明天論壇結束前交回報到處。我們將於星期四下午的閉幕乙節報告本屆與會者之承諾摘要。Mahalo（謝謝）!

TAIPEI

AUGUST 3-5, 2010

FIFTH INTERNATIONAL FISHERS FORUM

# 研討主題摘要
# 及專題簡報摘要

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## 研討主題1摘要

# 沿岸及海洋空間規劃與管理之途徑

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**預期結果**：沿岸及海洋空間規劃之途徑有哪些？其對減少漁業混獲、管理丟棄及達成永續的表層魚類資源之貢獻為何？

海洋空間規劃是一跨領域過程，用以決定沿岸及開放海域人類活動的時空分佈（詳見Larry Crowder博士之專題簡報摘要）。海洋空間規劃不是在創造海洋保護區，而是將海洋活動合理化之過程。海洋空間規劃也是執行基於生態系統管理的方法，永續漁業依賴健全的海洋生態系統。

大部分海洋空間規劃發生在國家管轄水域內（領海及專屬經濟海域），並已建立跨部門治理架構。然公海及國家管轄水域外海床的跨部門治理架構仍在發展且相當不全，得加速專責公海及國家管轄水域外海床之全球和區域性組織間的更多聯繫。公海使用者必須接受公海自由係附隨永續利用其資源及養護其生物多樣性之責任。

生物多樣性公約及聯合國有關國家管轄水域外生物多樣性工作小組提出許多倡議，即最終將強化公海及國家管轄水域外海床之海洋空間規劃治理架構。在此部分，生物多樣性公約已發展認定生態上及生物學具敏感性區域(ecologically and biologically sensitive areas；EBSAs)的概念和標準，旨在幫助生物多樣性之養護及永續利用(詳見Daniel Dunn博士之專題簡報摘要)。

EBSAs之認定可用於漁業管理及養護。舉例來說，太平洋黑鮪高度利用的區域可被認定為一EBSA，及可應用海洋空間規劃制止該區可能對鮪類系群和捕魚有影響之其他活動。藉由限制人為活動對海洋環境之壓力和保護可持續的漁業，EBSAs可減少對漁業具重要性區域之混獲。

在公海應用海洋空間規劃管理及養護高度洄游魚種有兩種方式。第一是專用於養護高度洄游魚種之海洋保護區，以渠等瀕危之棲地為目標，如繁殖區和攝食區或渠等聚集的場所。第二是設計為專捕具商業價值魚類同時最小化敏感性魚種混獲的漁區，如對減少開放海域專捕表層魚類之延繩釣漁業混獲有貢獻之空間管理技術。

儘管許多高度洄游魚種之範圍過於廣闊，無法圍成一空間區域，保護渠等生存之部分範圍仍有重要的養護利益。就此而言，技術可協助定義動物所使用之空間和聚集的規模，考量生態系統為動態系統也很重要，特別是在開放的海域。

研究及繪製動態特性的能力已被發展，但不完美(詳見David Hyrenbach博士之專題簡報摘要)，需有更多的資訊及改善對分佈之認知與威脅之跡象。再者，需預期氣候變遷對沿岸及開放海洋環境之影響，因其將導致環境及魚種分佈之長期改變(詳見Robin Warner博士之專題簡報摘要)。

海洋空間規劃決策可由多向度地理空間或地理資訊系統支援，以繪製區域及讓使用者察看陸地及海洋之重疊空間(詳見呂學榮博士之專題簡報摘要)。以地理資訊系統資料為基礎之海洋空間規劃決策，涉及科學與政策交換，並使利益相關者之利益極大化。

澳洲昆士蘭外海之大堡礁是一成功的沿岸海洋空間規劃示範，整合多用途海洋保護區之

管理(詳見Randall Owens博士之專題簡報摘要)。大堡礁之潛在價值包括養護其生物多樣性、生態系統健康及評估商業與非商業利用。成功的海洋空間規劃需有長期的政策和利益相關者支持，並結合有效的監控及預報。

世界海洋理事會是一跨領域之商業聯盟，聯合漁業、養殖漁業、石油及天然氣、航運及觀光等海洋產業(詳見Paul Holthus先生之專題簡報摘要)，包括海洋之直接利用者、支持海洋利用者之產業及使用海洋設施之提供者。世界海洋理事會會員之共同目標是健康的生態系統及為負責任經營者創造商業價值。

海洋利用者及其複雜性漸增，海洋產業尚未妥適參與海洋治理過程。進入海洋空間是漁業繼續性的基礎，為確保持續進入海洋空間，在當地、區域及全球層級上，漁業與其他海洋產業之交往溝通是至關重要的。

研討主題1：

# 簡報摘要

## 海洋空間規劃在可持續表層漁業所扮演的角色：從多管理部門過渡到綜合性以生態系統為基礎之管理

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### 摘要

漁業的管理正從管理單一魚種作法轉變為朝向充分考量這些漁業所在之生態系統。此趨勢通常稱為以生態系統為基礎之漁業管理。對海洋以生態系統為基礎之管理的更寬廣的作法，不僅考量漁業部門，也要考量以某種程度利用海洋資源的其他部門。過去五年來，國家和國際的許多評估力促採取以生態系統為基礎之管理。美國歐巴馬總統於2009年6月成立機構間海洋政策任務小組，整合充實國家海洋政策及海洋空間規劃(Marine Spatial Planning；MSP)架構，以跨海洋部會執行以生態系統為基礎之管理。

本次簡報將回顧全球漁業及跨部會使用MSP之模式，並提出MSP從底棲及沿岸漁業拓展至近海表層漁業的想法。MSP係承諾支持經濟、環境、社會及安全等目標，具促進恢復、健康、具功能的之生態系統潛力，也容許永續利用海洋空間及資源。但從「平時作為」變革至此一新作法需利用海洋者及擬定符合多元目標計畫的環保團體主動參與。礙於管理機構之限制，在表層漁業推動此作法相當具挑戰性。

### 簡介

當海洋漁業之傳統管理聚焦於資源量普遍下滑的目標魚種時，海洋食物網絡已因過漁而有重大改變(Jackson et al. 2001)。捕魚對海洋生態系統之互動網絡有各種直接和間接的影響，該等影響複雜且可能有串級效應(圖1)。許多漁業的目標是捕撈食物網之頂級掠食者，且以無法持續的速度進行捕撈，然而其他的漁業捕撈網之中階者，使得頂級掠食者所需的食物來源(位於食物網絡中層的物種)遭大量移除(生物量下降)，包括魚類、海洋哺乳類及海鳥。捕魚不僅消除食物網特別區位的生物量(如同進行一個生態性的控制試驗)，也產生間接影響，如殺害非目標物種、改變棲地及提供食腐動物額外食物。

研究人員指出，捕魚是改變海洋生態系統最久遠及最大的因素之一。捕魚並與其他人為影響一同造成生物多樣性的驚人損失(Worm et al. 2006)，以及可能有不能預見的效應在生態系統中傳遞。Friedlander和DeMartini(2002)發現，在沒有捕魚的西北夏威夷島其頂端掠食者平均生物量超過已重度開發的主要的夏威夷島之260%。其他研究也察覺沿岸和大洋的鯊魚族群正快速、且大幅下降，有些魚種的下滑幅度高達99%(Baum et al. 2003)。在認知上確認及管理捕撈漁業的直接影響有困難，更不用說間接影響及可能的生態系統影響，我們建議將食物網絡作為互動的主要核心(Mangel and Levin 2005)。

為瞭解捕魚對生態系統的影響，有必要檢視四周的食物網絡及影響海洋系統之非生物性分解過程。透過生態性分解過程，強健的交互行為導引食物網絡的結果，如被掠食或成

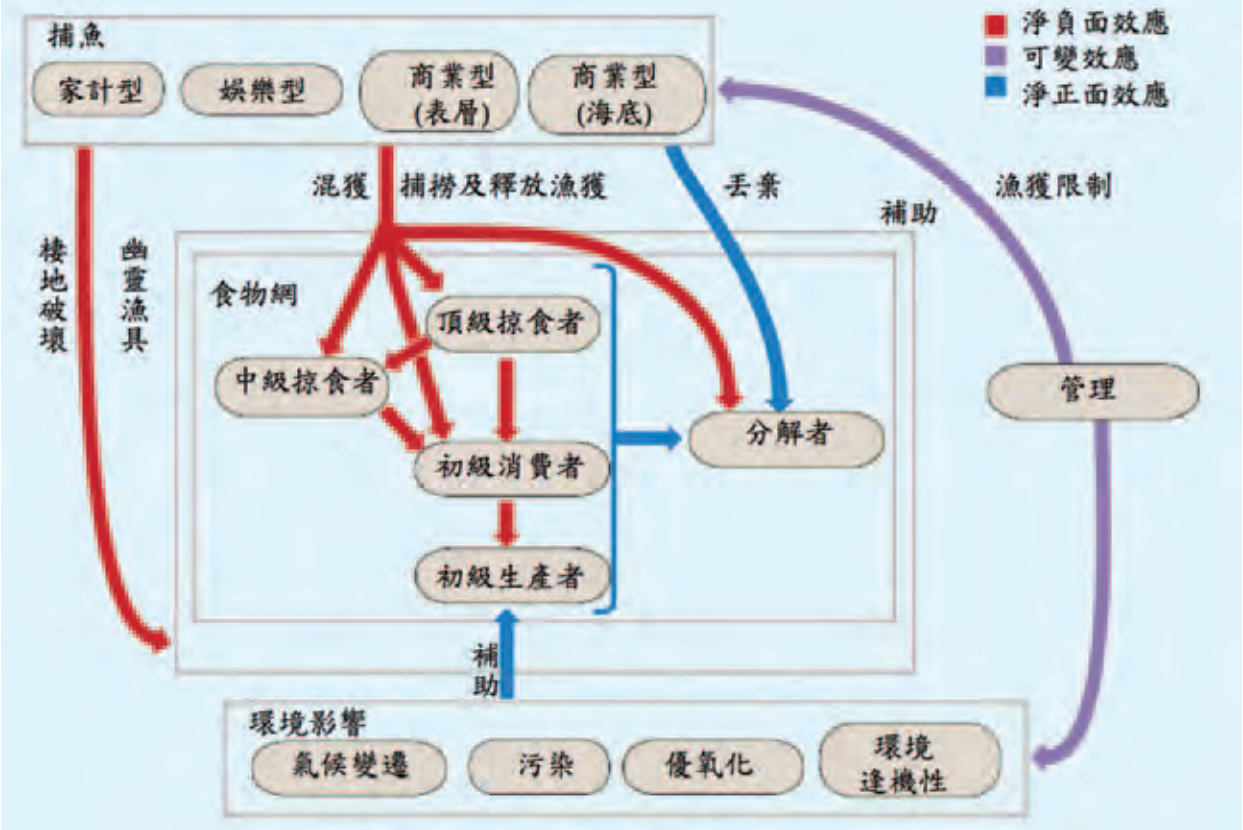


**圖1** 捕魚對海洋生態系統之直接與間接影響，該等影響複雜且可能有串級效應(Crowder et al., 2008)

為競爭對手。倘受漁業衝擊，該等強健交互行為的特性可透過食物網絡增強其影響。研究顯示，具強健交互行為及高度專殊性之食物網絡(e.g. low omnivory)是最容易受漁業影響而崩潰(Bascompte et al. 2005)。

## 捕魚、海洋生態系統及變革至以生態系統為基礎之管理

我們該如何解決海洋生態系統因不同漁業所累積之衝擊和自然驅使的變化？要求海洋政策自管理個別部門活動(如漁業)，戲劇性轉變為以生態系統為基礎之管理(Crowder et al. 2006)。以生態系統為基礎之管理是一整合性作法，管理納入整個生態系統考量，包括人類(McLeod et al. 2005)。生態系統固然以場所為基礎(McLeod et al. 2005, Crowder et al. 2006, Young et al. 2007)，但生物物理環境所定義之場所，涵蓋社會、文化、經濟與政治等層面。因此該作法需整合有關海中場所之定義及管理的自然與社會科學觀點，以克服漁業無法控制、累積的衝擊，和其他人為影響(Shackeroff et al. 2008)。

分析家開始認同管理不善是海洋生態系統逐步瀕危的主因(Crowder et al. 2006)，最近的評估結果要求自管理部門活動(包括漁業)朝向以生態系統為基礎之管理。環保部門期實施海洋保護區，以維護海洋生態系統之結構和功能，但此也是一部門之作法。傳統之單一魚種管理有明確的復育目標，具體化為支持未來漁獲努力量之特定產卵群生物量。然在生態系統架構下，較難定義復育目標。

為執行以生態系統為基礎之管理，以場所為基礎之管理和海洋空間規劃(MSP、圖2)是很有希望的作法(Young et al. 2007)。所有負責之部門單位應合作，管理某一場所之所有人類活動，而不是個別部門機構管理任一場所其所負責之活動。上述場所可能與生態系統疆界、社經疆界及/或管轄疆界並列。實際上，管理通常是於限定空間內橫跨管理疆界的過程。

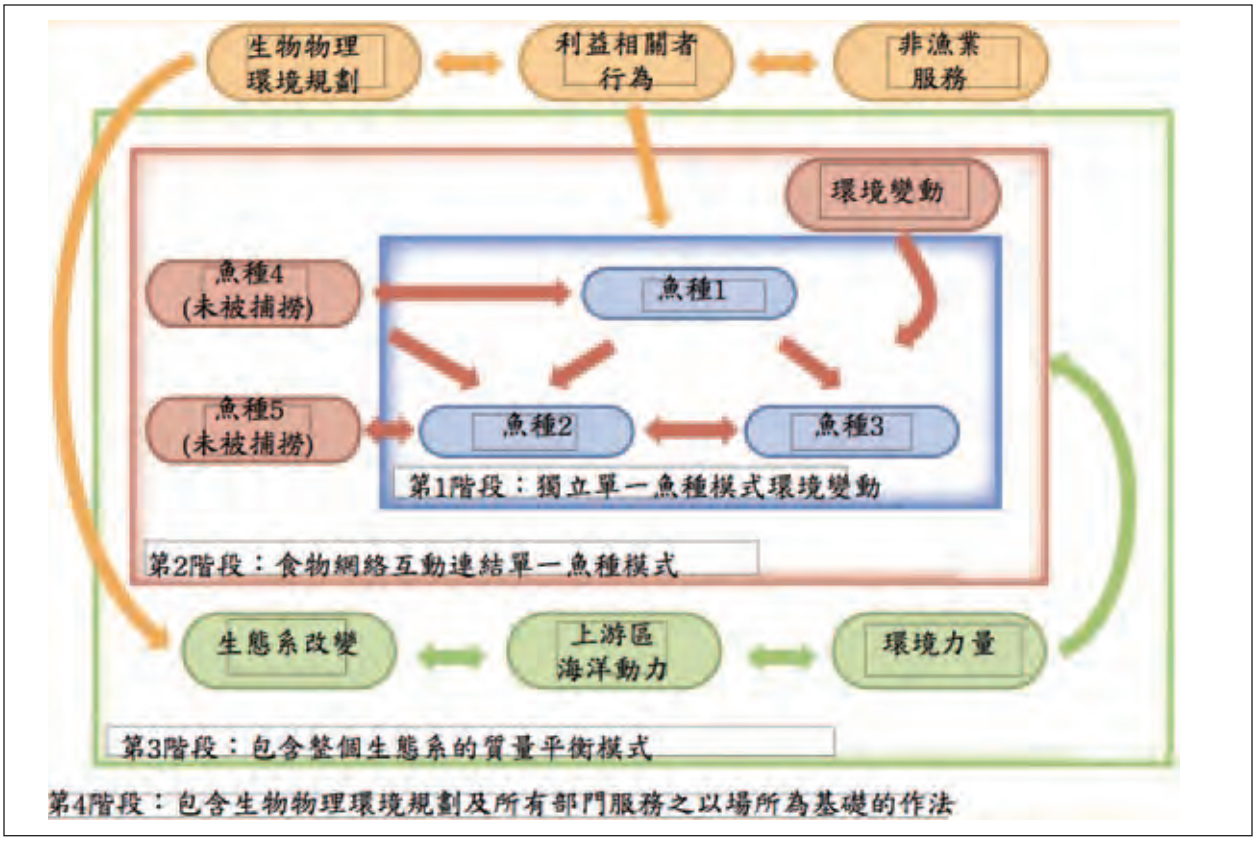


**圖2** 海洋空間規劃(Crowder et al., 2008).

海洋生態系統之生物物理組成為所有人類活動提供一基礎樣板，包括漁業、管理規範之生成及各式型態。MSP及海洋分區等作法考量基礎生態概念，使人類活動可以維護生態系統功能、提供人類依賴之可持續生態系統服務及擁有對環境變遷反應迅速的生態系統等方式進行。

以場所為基礎之海洋生態系統管理需有管理實踐之階系制度，始於符合以生態系統為基礎之管理概念最普遍的階層，朝向發展一整合措施，優先調和維護生態系統之健康、生物多樣性、多產及迅速恢復產能等項。該管理作法之成功要件是設計一管理系統，激勵利益相關者(此指漁民)與其管理目標合作。充分包含生態系統樣板下所有組成及明確併入社經管理所涵蓋層面之MSP，可作為妥適保護海洋生態系統及海洋資源利用之基礎，包括漁業。

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## 有關公海海洋空間規劃之海洋學考量

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海洋空間規劃追求最小化有害的生態與社經衝擊，將不相容的活動以時間與空間將之分隔開來。此種作法需整合範圍內下列以空間顯示的資訊--人類活動的內涵和強度，有價值和受保護之海洋資源的分布、以及人類活動與資源時空互動之程度。本簡報闡明應用海洋空間規劃於管理會和受保護魚種與其棲地相互影響的漁業；特別強調為高度移動性表層脊椎動物(海鳥、海洋哺乳類及海龜)而設計之海洋保護區。

海洋養護正快速地進展，因受監控生物多樣性之技術發展(如野生生物追蹤，遙測)所激勵，而且海洋養護是概念的進展(如族群結構，統計)，以決定何地/何時進行最有效之養護投資。這些增強的瞭解正協助資源管理者確認何時/何地/如何保護海洋物種及棲地。於是海洋保護受到漸增的擁護，並使用於保護表層物種及渠等關鍵性的攝食及繁殖之棲息地。

野生動物的保護，首先在陸地及水底生態系統實施，這些系統在尺度上及預測上會各不相同，更不用說高度動態的海洋表層系統更不相同。然而若當作一個靜態系統，許多表層物種利用可預期的棲地以繁殖與攝食。原則上，海洋保護可被設計成保護渠等之攝食與繁殖聚集。遠洋棲地依其動態可歸納為三大類：靜態的、持續的和短暫的(Hyrenbach et al. 2000)。儘管傳統的保護設計對靜態的棲地有效，但許多重要的海洋表層棲地既非固定的，也非可預測的。因此，海洋表層的保護需要新穎的概念與設計，如動態界線和大規模緩衝區，此區係依特定海洋學特徵之內含及位置所定義。本文將說明海洋學的一些特性，並提供一些有潛能成為保護設計概念的淺見。

因海洋生態系統為一空間顯著的環境，故海洋空間規劃必須強調自然與生物在時空之基本異質性，以及主要生活史過程與人類影響之動態特性，因此發展顯著空間之養護對象即成為一主要目標。為達此目的，乃重述發展該等養護對象之五大準則(Crowder & Norse 2008)，並說明該等概念基礎及養護表層脊椎動物之實際應用：(1)評估管理及生態過程之不協調、(2)考量時空之易變性、(3)保護生態互動網絡、(4)瞭解人類活動之異質性、及(5)納入以地點為基礎的管理。

對重要棲地和人類影響之進一步認知，將促使養護需求整合發展領海及公海之整體海洋空間規劃。就此而言，瞭解影響具商業價值且受保護物種分佈之機制及動態海洋棲地之形成與持續，將是設計與執行空間保護措施所不可或缺的。

當目前概念與技術之進步促進遠洋保護區之實施和監控時，有效之保護區應包括執法、研究與管控計畫以評估其成效。更進一步，該等措施應設置於包含較廣漁業管理和生態系統監控工具之大型管理計畫內。海洋空間規劃將提供一重要架構，以整合前述多樣作法成為條理分明且具整體遠景的動態海洋管理。

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# 運用生物多樣性公約之生物多樣性科學標準，以認定在生態上或生物上具重要性之需要保護的公海及深海棲地區域

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## 摘要

2008年生物多樣性公約會議通過有關認定需要保護、在生態上或生物上具重要性之海洋地區(ecologically or biologically significant marine areas；EBSAs)的科學標準，目前更進一步朝向建立EBSAs清單發展。雖然劃設EBSAs純粹為科學工作，然而其重要性主要在於EBSAs對海洋資源管理組織所能提供之功效，和使EBSAs納入該等組織之管理範圍。藉由劃設EBSAs，我們可以提供管理者和規劃者有關渠等工作內之系統生態性狀的重要資訊。因此，劃設EBSAs對於確保海洋環境之使用與管理是以與生態相關和永續方式進行而言十分重要。本文將檢視在管理對海洋環境造成嚴重壓力的人為活動(如漁業)，和在海洋空間規劃上，EBSAs所能提供之功效，另從反面檢視漁業管理組織在EBSAs之劃設過程中能夠如何做出貢獻和如何參與。

## 序言

生物多樣性公約(CBD)專家工作小組於2007年在葡萄牙亞速爾群島(Azores)召開，會中擬定、修改和整併有關認定需要保護地區之科學與生態標準。隔年，CBD締約方大會通過該等有關認定需要保護的EBSAs之科學標準(CBD 2008; fig. 1)，亦決定呼籲締約方並邀請其他政府和相關組織視適當應用亞速爾群島科學標準。此事目前朝向建立EBSAs清單前進，在建立清單的過程中，將有更多政府、機關和組織注意到此事，並嘗試了解EBSAs之角色與功效。

雖然EBSAs之認定純粹為科學工作，然而其重要性在於EBSAs對海洋資源管理組織所能提供之功效，和使EBSAs納入該等組織之管理範圍。至今，有關如何執行CBD EBSA標準之說明主要以檢視特定棲息地或物種之相關資料為基礎。倘採用這種方式，將有無數地區可被認定為EBSAs。因此，為管理目的，以與特定人類活動重疊之地區，和該地區面臨人類活動之脆弱性為基礎，進行EBSAs劃設將更適合和有效率。

事實上，這樣的觀點本就存在於CBD所採用之用語，「在生態上或生物上具重要性之地區」總是加上「需要保護」，此用法意味著此類地區為免受到「某事」傷害而需要保護。人為活動是對海洋環境造成壓力的主要來源，亦是任何管理措施之特殊焦點，因此可合理推論，「需要保護」的EBSAs需要的是不受人類影響之保護。因此，EBSAs之劃設應與其面對人類影響時的脆弱性(EBSA標準之一)有關。如前所述，要有效率地進行EBSAs劃設，可從有人為活動發生的地區開始。雖然以此方式進行之EBSAs劃設依然只是以生物和生態標準為基礎之科學過程，但是經此方式認定之EBSAs對管理者更具有直接的用處。接下來將檢視EBSAs在管理對海洋環境造成嚴重壓力的人為活動(如漁業)，和海洋空間規劃上所能提供之功效，另從反面檢視漁業管理組織在EBSAs劃設過程中能夠如何做出貢獻和如何參與。

## EBSAs在漁業管理上的角色

劃設EBSAs對於確保海洋環境之使用和管理是以與生態相關和永續方式進行而言十分重要。海洋環境受到各種不同的人為使用影響(Halpern et al. 2008)。農業、工業生產、能源探勘/生產、沿岸開發、航運及運輸等人類活動污染、毒害、增加海洋中的營養物和酸度、破壞重要的海洋生物棲地(Bryant 1995, Smith et al. 1999, Islam & Tanaka 2004, Orr et al. 2005)。漁業為另一種對海洋生態系統造成壓力的一種人為活動(Dayton et al. 1995; Goñi 1998; Jackson et al. 2001)，而且在許多地區如果不是最嚴重，就是最嚴重之一的人為活動。在捕撈對生態系統所造成的影響當中，近年來，混獲造成的有害衝擊在紀錄上不斷增加(Crowder and Murawski 1998; Hall et al. 2000; Lewison et al. 2004; Gilman et al. 2005)。漁業造成受保護物種

表一　生物多樣性公約所通過之認定需要保護的EBSAs之科學標準(CBD 2008)

| 標準 | 定義 | 基本原理 |
|---|---|---|
| 獨特性或稀有性 | 具有(i)獨特(僅此一種)、稀有(只出現在極少數地點)或原生的物種、族群或群集，和/或(ii)獨特、稀有或特有的棲息地或生態系統；和/或(iii)獨特的或不同尋常的地形或海洋特徵之地區 | 不可替代。<br>此類地區之損失意味著多樣性和其一種特徵很可能永遠消失，或多樣性出現任何程度的減少 |
| 對物種生活史中各階段具有特殊重要性 | 族群存活和繁衍所需之地區 | 各種不同的生物和非生物條件，加上特定物種的生理限制和偏好使得海洋區域的某些地方比其他地方更適合特殊的生命階段和功能。 |
| 對受威脅、瀕危或正在衰退的物種具有重要性 | 含有受威脅、瀕危或正在衰退的物種存活或復育所需之棲息地的地區 | 確保此類物種和棲息地之復育 |
| 脆弱性、敏感或復育緩慢 | 有功能脆弱或復育緩慢的敏感棲息地、生態棲地或物種的比例較高之地區(極易因人類活動或自然事件影響而退化或耗竭) | 本項之標準指出在一個地區或該地區其中一部分，人類活動或自然事件倘不能受到有效管理或以不符永續的速度進行的情況下，可能產生之危險程度 |
| 生物生產力 | 含有具有相對較高的生物自然生產力之物種、族群或群集 | 在加強生態系統和提高生物成長率及繁殖力上扮演重要角色 |
| 生物多樣性 | 含有具有相對較高的多樣性之生態系統、棲息地、群集或物種，或有較高的遺傳多樣性 | 對維護海洋物種和生態系統之進化與恢復力具有重要性。維護此類地區，以作為參考地點 |
| 自然性 | 由於未遭受或受到低度的人類活動所引起之干擾或退化，而自然性相對較高的地區 | 保護具有接近自然之結構、過程或功能的地區。保護並加強生態系統的恢復力 |

的數量下降(Spotila et al. 1996; Brothers et al.1999; Read et al. 2006)，因而產生保育政策(Moore et al. 2009)和需要龐大成本的管理措施。為減緩混獲的漁具改良亦增加漁民和漁業國的經濟負擔(Gilman et al. 2006)。

由於這些經濟和生態衝擊，漁業在混獲和空間範圍上開始有更明確的規範。隨著年度捕撈限額之實施，商業和受保護物種混獲與利用以生態系統為基礎之途徑管理漁業之管理者更加相關，提高漁獲選擇性(例如提高漁獲/混獲比例)的需求日益增高。在更多產業(如採礦、航運、能源)宣稱具有海洋資源與空間的所有權的情況下，漁業管理途徑必須在海洋空間規劃的範圍內實施，藉此保留核心區，僅供捕撈活動和相容活動之用。藉由劃設EBSAs，我們可以提供管理者和規劃者有關渠等工作內之系統生態性狀的重要資訊。

有數項標準可用於劃設與一般漁業管理，特別是減少混獲相關之EBSAs。例如「對受威脅、瀕危或正在衰退的物種和/或棲息地具有重要性」(受威脅/瀕危標準)，「對物種生活史各階段具有特殊重要性」(生活史標準)、「脆弱性、敏感或復育緩慢」(脆弱性標準)等標準，這些標準有助於了解造成混獲之動態。受威脅/瀕危標準所指之EBSAs為對瀕危物種(如太平洋革龜)具有重要性之棲息地，漁民可避免在此類地區作業，以減少混獲。生活史標準可用於辨識商業物種重要的產卵群集或孵育地。漁業管理組織之混獲資料可直接用於脆弱性標準所指之EBSAs之劃設。脆弱性標準之基本原理依要求特別考慮到「在一個地區或該地區其中一部分，人類活動或自然事件倘不能受到有效管理或以不符永續的速度進行的情況下，可能產生之危險程度」。在許多情況下，混獲或丟棄倘不能受到「有效管理」，受保護物種和魚群所面臨之「危險程度」將非常高(e.g. Spotila et al. 1996; Brothers et al. 1999; Read et al. 2006)。Dunn和其他學者提供一個辨識混獲資料之時空格局的綜合方法，在假設混獲動物需要保護的情況下，可利用時空格局描繪混獲率高或漁獲選擇性低的EBSAs。需要注意的是，在某些情況下，可用於劃設EBSAs之資料已被納入漁業管理(例如夏威夷表層延繩釣漁業在北太平洋葉綠素鋒面過渡區自願性禁漁；Howell 2008)。劃設EBSAs與EBSAs清單應對其他漁業之管理同樣有效。

## EBSAs在海洋空間規劃上之角色

海洋空間規劃提供一整合性架構，在此架構內，可透明地衡量和公平處理所有影響海洋環境之人為活動，並提供方法，以合併多重目標並處理複雜的衝突、整合評估與治理、為海洋資源使用者和發展者提高投資安全(Douvere 2008)。倘海洋空間規劃之角色為協助達成永續目標，海洋環境特點必須被客觀地併入過程之中。在海洋空間規劃中利用EBSAs可幫助管理者了解，哪些人類使用可能與特定地區之生態相容或不相容，並避免使用者與環境間之衝突。由先前經其他計畫所採用之標準認定、在海洋空間計畫中具有生態或生物重要性之地區(例如拉姆薩公約或國際鳥盟之重要鳥類保護區計畫)之整合可得知，EBSA在此過程中亦會有所助益(Douvere 2007, Ekebom 2008)。

前述有關使用受威脅/瀕危標準將瀕危物種之核心使用地區劃設為EBSAs的例子，即為如何在海洋空間規劃中運用EBSAs之示範。很明顯地，根據對此類EBSA的認識，某些人類使用(如干擾瀕危物種之漁業、產生之噪音達到對瀕危物種有害程度之能源生產活動)在此類地區應減至最低。相反地，具有高度生產力之EBSAs(根據生物生產力標準所認定)則應受到保留，僅供漁民使用，以最小化其他人類活動(如污染、某些形式之能源生產)所造成的風險和影響。因此，不論是在國家管轄區域內或國家管轄區域內外，將EBSAs併入海洋空間規劃之實施對於環境永續性和個別產業部門之經濟可行性(economic viability)極為重要。

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# 運用地理資訊系統之海岸地區海洋空間規劃

**呂學榮**
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海岸地區環境通常具備以下重要特徵：豐富的漁業資源、美麗景觀，以及豐富的生態系統，該地區亦吸引人們前往從事漁業、養殖、觀光與商業利用等活動。然而，人類活動和自然資源的共存，經常導致優先順序之衝突發生。海岸地區的海洋空間規劃(MSP)提供執行一項包括養護、永續發展與管理之全方位策略的機會，以達到未來的經濟利潤最大化。不過，有別於陸地的空間利用，海岸地區的MSP在空間範圍上遭遇到許多具變異性之問題。

地理資訊系統(GIS)係一電腦系統，該系統可蒐集、儲存、檢查、整合、操作、分析與顯示地球表面上之相關定位資料。GIS係目前呈現與分析空間資料的主要工具，使用GIS能提供MSP切實可行的解決方案，特別在海岸利用上。許多空間的組成份子(例如：資源的流動與遷移、漁場的定義與運輸網絡)和棲息地流失與環境惡化等重大議題，皆具有空間特徵(spatial dimensions)，因此漁業利益關係者、水產資源經營者及政府決策者，必須處理這些極其複雜之議題。GIS科技能協助闡明這些議題，並同時透過各種空間特徵以獲取解決方案。

相較於長期的陸地利用規劃，海岸地區的MSP則缺乏資訊與全面性架構。蒐集足夠資訊當然相當重要，然而，要把獲自不同系統的資訊予以整合，又是另一問題。海岸地區包含被稱為潮間帶(tidal zone)的動態區域，該區域係位於陸地與海水之前沿，在地形圖與海圖中皆處於同等重要之地位。由於陸地係指高於水位之區域，因此地形圖中的高度是以最高潮位來計算。與此同時，由於考慮到地圖使用者的航行安全，海圖中的水深通常是以最低潮位來計算。如此一來，潮間帶便成為地形圖和海圖間的灰色地帶。GIS能輕易地將此兩種地圖系統予以結合，且能整合該兩套系統中的所有相關資料，以供海岸地區MSP之用。

蒐集空間資料並予以數位化後代入GIS，係首要且為最困難之階段，包括要從不同表格與數據，彙整數量龐大的原始資料。俟資料整入GIS後，空間資訊可進一步彙整成一表格，以利MSP製程之用。詳細的海岸與海洋地區相關地圖資訊，讓我們有機會辨識該等風險或衝突區域，並可詳細審視活動發生次數。審視個別活動所造成的環境衝擊極其重要，而研究一區域內多種活動的累積效應亦是如此。例如：透過不同活動地圖的重疊，可以很輕易地指出漁業活動和非漁業活動間的空間衝突，這將有助於MSP與海岸管理。除主觀且由上而下(subjective/top-down)的決策方式外，客觀且由下而上(objective/bottom-top)的決策過程，亦有運用GIS之資料分析，例如多標準分析、空間分析、生物多樣性分析、景觀分析、拓樸分析(topology analysis)與電腦輔助設計製圖等。

臺灣四面環海、地貌多變，且由於多樣的洋流系統在此交會，而有豐富的海洋資源。近幾年因快速經濟發展與海岸管制的放寬，造成海洋利用的增加。然而，缺乏全面性海洋與海岸計畫，已導致海洋環境及陸地的破壞、威脅到公共安全並危害社會安全。漁業係臺灣海岸地區的主要使用者，其活動幾乎涵蓋所有水域。為達成漁業之相互發展與海岸之多目的利用，當務之急係有效利用漁業資訊，例如目標魚種、數量、漁期、漁場、保護區與管理計畫等，以及其與相同空間範圍內非漁業資訊的相互關係。

漁業署於2001年補助「臺灣沿岸水域之漁業多用途規劃」之研究，係運用地理資訊系統之海岸地區海洋空間規劃的成功案例。該研究草擬10項漁業利用的界線，包括漁業法授權的3種漁業權，即定置網漁業權、區劃漁業權與專用漁業權區域，及7種其他特定漁業區域，包括箱網養殖區域、娛樂漁業、海洋牧場、固定式集魚礁(anchored fish aggregating reefs)、漁業資源保育、海洋保護區與沿岸捕撈。GIS不僅在規劃階段提供莫大幫助，亦對MSP資訊服務有所貢獻。依據該研究所建立的網路GIS(http://fgis.ntou.edu.tw)，則提供臺灣海岸地區漁業與非漁業利用之整合性資訊給經授權的使用者。

如前所述，對臺灣人民來說，海岸地區係最重要的共同財產，而缺乏全面性MSP會導致海洋環境與陸地遭到破壞。最近，政府正在草擬國土法、國土復育條例、海岸法及行政區劃法。除漁業部門外，政府高層將涉入海岸地區的MSP，預計將來會有更多更全面性的政府單位會投入到這項工作。海岸地區的MSP不應該僅是利害關係者間的政治取捨，例如只考量漁業與非漁業之間的利益問題。今後應發展更多可靠的科學資訊與客觀分析，在環境永續發展的前提下，尋求經濟效益的最大化，而GIS將是協助推動MSP的一項重要工具與方法。

## 管控、評估及調適性的海洋空間規劃及管理[1]

**Randall Owens**
大堡礁海洋公園署

海洋空間規劃(Marine spatial planning, MSP)不像是會成功的，也不像可以獲致利益相關者與政治上之長期支持，除非先執行一個已具策略性的計畫和已協調過的過程，以確保管理系統之有效管控與評估已到位；同樣地，當評估證明MSP有調整需要時，也應有明確的接受力，俾做出調適。管控及評估目標之一，應是嘗試及預測或預防，以為變更預作準備及調整管理設定至較佳考量。當元件中的一個因子改變，如氣候，適應性的調整接受力將是MSP的主要元素。在單一機構管理的一個理想世界裡，這情形可能相對直截了當，但在多方管轄及多重管理機構的MSP世界裡，管控及評估(尤其係評估)之元素係複雜且會有爭議。在2007年，大堡礁海洋公園法1975(Great Barrier Reef Marine Park Act 1975)被修訂，要求大堡礁海洋公園署(Great Barrier Reef Marine Park Authority, GBRMPA)每五年準備一個大堡礁區域展望報告。

首份展望報告在2009出版[2]；圖1為此報告的一個摘錄。

1 本摘要係作者之個人觀點，並非反應官方看法或大堡礁海洋公園署之政策。

2 展望報告可於http://www.gbrmpa.gov.au/corp_site/about_us/great_barrier_reef_outlook_report取得。

*2009年大堡礁展望報告係依1975年大堡礁海洋公園法第54節所要求之8項評估編撰*

**圖1** GBRMP法要求之展望評估

上圖顯示須被監控及評估的層面廣泛，特別是第6部分：管理成效之評估。此不僅評估GBRMPA之成效，亦要求評估負責發生於大堡礁海洋公園(GBRMP)或影響GBRMP之活動(如捕魚活動)的其他管理機構成效，彙整成最終評估結果，對GBR生態系統之長期展望作出評估。展望報告是一份公開文件，綜合可取得之證據並作出結論，雖未提出管理建議，但指出GBR生態系統之威脅、缺陷和現存關口所在。此展望文件可從網路取得，其背後雖有大量資訊支持，但展望報告僅提供該等資訊所傳達之訊息，而不提供新資訊。其價值為指出需解決的問題、明確的管理優先事項及為GBRMP管控所需之科學資訊項目[3]。

3 相關網站資訊：（網址：http://www.gbrmpa.gov.au/corp_site/info_services/science_management/science_information_needs)

GBRMPA署長Russell Reichelt在GBR展望報告之序言，簡短[4]概述「展望報告，係總結我們已知的生態系統，包括其利用程度、管理概況、其面臨的壓力及通往未來的管道。該報告認為氣候變遷、集水徑流的水質持續惡化、沿岸發展導致沿岸棲地損失和捕魚造成之少數衝擊，是降低大堡礁恢復力之主要問題。」

展望報告中闡述之問題層面與範圍，強化GBRMP係面積達344,400平方公里的MSP，包括世界遺產地區內多元利用的管理區及GBRMPA直屬管轄外的區域，該等區域影響GBRMP之價值需予以管理。水質、沿岸規劃、航運、疏浚、捕魚和養殖等產業，均衝擊或發生於GBRMP，顯見政府不同階層間需通力合作與協調，如同展望報告所強調，需套用和整合以生態系統為基礎之管理(ecosystem based management, EBM)至各類管理系統。

展望報告係作為瀏覽整體及其組成部分的一種方式，提供明確的目標(有所作為的理由)及指標，俾整體和嚴苛地評估其成效，為達成以生態系統為基礎之成果進行管理績效之透明評估。

GBRMPA係一資源完善的組織，與研究團體關係密切，包括澳洲海洋科學研究所(Australia Institute of Marine Science, AIMS)。目前已有各類長期監控調查報告，包括自1993年起遍佈於大堡礁之47處礁體健康報告。我們亦有長期之珊瑚礁有關物種生物量資訊，且由Geoff Jones、Gary Russ及其他單位進行中之珊瑚幼蟲運輸工作亦證實，GBRMPA建立之禁漁區使GBRMP以外的資源補充群也有增加，這是關鍵所在。但對表層及洄游物種之分區效果尚未確定，我們支持這個方向的工作，及決定刺網漁業捕撈熱帶鯊魚之魚種組成的重要工作，如同我們試圖瞭解分區對頂級掠食者之功效。展望報告可提供管理價值的整合評估，且是目前在GBRMP鄰接水域著重於生態及關連性之各類監控計畫所需。

基本上，海洋管理區僅在其周遭水域是健康時才被視為健康，且關連性是EBM之重要概念，故需與鄰近區域之管轄政府諮商達成協議係十分

4 同註釋2。

重要。展望報告指出，GBR之主要威脅是水質，驅使諮商管理因應對策及水質指標，目前的改進目標係適當。解決蓄積的衝擊和沿岸發展之範圍與領域可能更具挑戰，因其已明確被認定為一主要威脅，需有管理因應之道並指出需重視的環節。對漁業而言，主要的威脅確定與頂級掠食者之捕獲量、養護物種之意外捕獲、非法捕魚和丟棄、以及在未受保護之產卵區作業有關。

展望報告亦評估先前認為高風險、但因管理協議有成效、目前評估顯示為低風險區域之捕魚的積極改變，如受空間管理之蝦拖網漁業，可在廣大的海洋區域以透明的方式認定及評估風險程度，明確指出何處需優先採取行動、何處需進行投資，如同GBRMP模式。利益相關者也清楚瞭解，運用EBM是極重要的關鍵。漁業管理成效之評估發現：「漁業管理成效受限於資料闕如和欠缺協調，以及採用最佳實踐管理之差異。」展望報告提供我們應如何合作及何領域應投入努力並進行投資的明確方向，未來我們需改進事項肯定是需朝氣候變遷調適策略共同合作，作為產官合作之方向基礎，俾發展及投資一真正的夥伴關係。

表一係圖解廣泛的評估標準及評估等級，對MSP相關議題作出結論十分有用。

表一、管理成效之廣泛評估

| 評估標準 | 摘要 | 評估等級：非常好 | 好 | 差 | 非常差 |
|---|---|---|---|---|---|
| 瞭解內涵 | 瞭解價值、威脅、國家和國際影響、以及利益相關者，有助於評估所有管理議題。此反映出需有穩固的資訊和研究基礎，國家和國際均對大堡礁之主要價值有純熟的認知、以及瞭解前述價值的真正威脅與潛在威脅。利益相關者之認知一貫涵蓋所有問題(事實上，其涵蓋整體評估標準)。 | ◎ | | | |
| 規劃 | 倘少數組織或管理階層涉入規劃過程時，規劃績效傾向於最佳。對所有議題均有妥適的發展規劃系統，除沿岸發展外，因此節規劃機制破壞自然產生問題。相關管轄政府缺乏一致性是此節最薄弱之處。 | | ◎ | | |
| 資金、人員及資訊的投入 | 適當的投入對眾多管理議題而言是相當多變，特別是強調為防衛、氣候變遷和研究、以及疲軟的沿岸發展等項。充足的社經支持及取得相關傳統業者的認知是大多數議題的困難，也是整體評估最糟的執行標準之一。 | | | ◎ | |
| 管理系統及過程 | 管理過程特別強調為防衛、觀光和研究、疲軟的沿岸發展和水質等項。大部分議題之問題為監控績效、解決蓄積的衝擊、以及運用社經和傳統業者之認知。蓄積衝擊之處理程度是整體評估最欠缺的部分，而利益相關者之參與及運用生物物理資訊則是最強的部分。 | | ◎ | | |
| 產出之傳遞 | 關於產出的傳遞，在沿岸發展和水質等節最差，有關防衛、觀光和研究等節最強。管理機構和社區的知識庫均需改善。當多數管理計畫滿意地進行時(除沿岸管理和水質外)，經常遺忘計畫時程，且不清楚計畫是否達成其所預期之目標。 | | ◎ | | |
| 結果之達成 | 各議題達成其所預期成果的程度不等，如保護價值、減少威脅、環境和經濟之長期永續性。有關社區認知議題和發展有效夥伴關係之目標已達到。整體來說，有關預期達成之最大關切與氣候變遷有關。 | | | ◎ | |

展望報告具前瞻性，提出何處應投入努力和資源的理由及實質意義，GBRMP和世界遺產地區係多重管轄區域，該報告闡述衝擊該等區域健康及恢復力之所有領域的因素及管理成效。

GBRMP處境複雜，但不如以漁業觀感在多國管轄海域為表層或高度洄游物種應用MSP般複雜。儘管如此，GBRMPA之經驗和我們習得之課程可供各界參考，俾以貼近以生態系統為基礎之管理評估。

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## 海洋空間規劃在治理國家管轄水域外的氣候變遷減緩活動之角色

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人類活動所引起的氣候變遷對陸地和海洋環境造成負面衝擊，已被全球性和國家組織委託專家所提出之報告所承認[5]。這樣的認知促使各種不同的地球工程計畫出現，以減緩氣候變遷對環境的有害影響，包括利用海洋消除大氣中二氧化碳之增強機制。海洋本身即為一個大型的碳匯，有能力吸收大氣中過多的二氧化碳，並將其轉化成可溶的形式。科學家估計目前每年因燃燒石化燃料而排放至大氣的二氧化碳約55億噸，其中約1/3由海洋吸收[6]。

多項與海洋有關的氣候變遷減緩活動，如碳捕捉，很可能會在國家管轄水域內進行，國家將依其國內法制定環保措施，而在國家管轄水域外[7]，至少已有一項氣候變遷減緩活動進行過實驗，例如一種被稱為海洋施肥的方法。提高海洋的二氧化碳吸收率為海洋施肥之基本目標，此方法被提議用於含鐵量或營養物匱乏的水域，此類水域大部分位於國家管轄水域外。海洋施肥目的在於增加海洋表層的有機物生成量，由海洋上層下沉至深海的「海洋雪」(marine snow)或有機物碎屑會隨之等量增加。被海洋雪吸收的碳會下沉到深海，最後被分解成無機營養物質。溶解於深海中的二氧化碳將因洋流循環週期甚長，而長時間被隔絕於海洋表層和大氣之外[8]。

海洋施肥對環境的長期影響尚不明確，規範此方法之法規架構亦尚在發展階段。海洋施肥等氣候變遷減緩活動，倘在國家管轄水域內進行，可能受到沿海國法規與環境影響評估政策、策略性環境評估，及其他環保措施規範。然在國家管轄區域外，規範此類活動之法規架構尚未完善且定義較不明確。雖然聯合國海洋法公約(1982 LOSC)[9]第12部分訂有保護國家管轄水域外的海洋環境之一般義務，然對船旗國、其國人和公司在國家管轄水域外所進行之海洋施肥等

5 Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report (2007) ('IPCC Fourth Report') <http:www.ipcc.ch/ipccreports/ar4-syr.htm> 2010年5月13日讀取; Nicholas Stern et al, Stern Review: The Economics of Climate Change (HM Treasury, London, 2006); BL Preston & RN Jones, Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions. A consultancy report for the Australian Business Roundtable on Climate Change (CSIRO Canberra, Canberra ACT, 2006).

6 Tony Koslow, The Silent Deep (UNSW Press, University of New South Wales, Sydney, Australia, 2007)，頁156。

7 Karen N Scott, The Day After Tomorrow: Ocean CO2 Sequestration and the Future of Climate Change' (2005) 18 Georgetown International Environmental Law Review，頁57。

8 John L. Cullen and Philip W. Boyd, "Predicting and verifying the intended and unintended consequences of large-scale ocean iron fertilization" (2008) 364 Marine Ecology Progress Series，頁296。

9 聯合國海洋法公約於1982年12月10日開放簽署，聯合國條約編號第1833號（於1994年11月16日生效）（簡稱為1982 LOSC）。「國家管轄外之海域」，於本文中意指：所有非屬於任一國家經濟海域、領海、內水或某一群島國之群島水域之海域，以及位於任一國家大陸棚外界線以外之海床及底土。

新出現的活動，該部分目前尚未以國際法律文書加以補充適用於該等活動之現代環保原則。在欠缺制度監測和減緩此類活動對國家管轄區域外的水域所造成之負面衝擊情況下，存在著對該等水域之海洋環境和生物多樣性造成不可逆轉的損害之實質風險[10]。

海洋空間規劃在促進和減緩如海洋施肥等氣候變遷減緩活動之負面衝擊，有其扮演的角色。國際海洋學委員會對海洋空間規劃之定義為：「分析和分配人類活動在海洋地區時空分佈之公開過程，以達成通常經由政治過程指明之生態、經濟與社會目標[11]。」海洋空間規劃的概念，不侷限於劃設海洋保護區或海洋區劃，而是在本質上更接近包括保育、社會與經濟發展等各種不同目標的全面性海洋區域願景或計畫。澳洲聯邦政府環境、水資源、文化遺產與藝術部目前於該國管轄水域內進行之海洋生物區域規劃即為海洋空間規劃之一例。

在國家管轄水域外，全面性海洋空間規劃的例子少之又少，儘管有一些單一層面的海洋區劃過程，如禁漁。而在國家管轄水域外，區域性的例子有限，目前有奧斯陸-巴黎委員會(OSPAR)成員在東北大西洋所劃設之海洋保護區，和海洋生物保護區協定(Pelagos sanctuary agreement)在地中海所劃設之海洋保護區。在全球層面上，目前有數項計畫正在進行，這些計畫最後或許能為國家管轄水域外之全面性海洋空間規劃提供一個更穩固的基礎。2008年第9屆生物多樣性公約締約方會議(COP 9)第IX/20號決定通過，在生態上或生物上具重要性海洋地區(ecologically or biologically significant marine areas；EBSAs)之科學標準，和設計海洋保護區代表性網絡之科學準則。COP 9亦決定於2009年9月在加拿大渥太華召集專家工作小組，提供有關利用和進一步發展生物地理分類系統之科學準則，和位於國家管轄區域外，符合EBSAs科學標準的水域之準則。針對國家管轄水域外之海洋生物多樣性養護與永續利用相關研究議題所成立之聯合國開放性工作小組於2010年2月召開第3次會議，肯定主管國際組織之工作成果，例如有關利用以區域為基礎之管理工具的生物多樣性公約，和建立符合國際法並以科學資訊為基礎的海洋保護區之重要性，包括於2012年前建立永續發展世界高峰會之約翰尼斯堡執行計畫所要求之代表性網絡。該次會議並呼籲各國透過主管國際組織互相合作，以發展用於認定和選擇可能因受到保護而獲益之海洋地區的共同方法。本文將檢視這些計畫的成果、在國際法下於國家管轄水域外實施海洋空間規劃之潛在選項，和海洋空間規劃對擬於國家管轄水域外進行之氣候變遷減緩活動的影響。

10 Koslow，見註釋2，頁159-160；Scott，見註釋3，頁58。

11 UNESCO-International Oceanographic Commission, Marine Spatial Planning, http://www.unesco-ioc-marinesp.be/marine_spatial_planning_msp 2010年5月13日讀取。

## 法人組織在海洋空間規劃與管理所扮演之角色

**Paul Holthus**
世界海洋理事會

在海洋生態系統管理上，海洋空間規劃與空間管理日漸成為主要之進展。此進展之追求達成，係經由各式程序和機構，特別顯著的是來自非政府組織。海洋空間規劃將對使用海洋空間和資源的海洋產業產生主要的影響，如沿岸之風力發電、波浪及潮汐能源、石油及天然氣、航運、漁業、水產養殖等。各產業一定要建設性地對海洋空間管理付諸努力，並參加其他海洋產業利益相關者，以確保此制定過程被告知及被平衡對待。這樣將增加此新興海洋管理的潛力，以反映相關產業人員之需要。遺憾的是，產業界通常不被包括於海洋空間規劃的發展上。

產業參與海洋空間規劃與管理之障礙，包括：(i)對參與的程序和角色，缺乏認識；(ii)對多重產業過程之參與程度有限，宥於產業參與多個部門過程，及(iii)欠缺方法，以參與更廣的海洋管理及永續性之事務性社群。在海洋空間規劃及管理上，有一些需求及機會給具建設性的產業領導階層及其合作者，包括：(i)逐漸產生對議題、利益相關者和過程的瞭解；(ii)積極參與重要的多重產業利益相關者之程序；(iii)在海洋產業和其他利益相關者間打造建設性關係；及(iv)透過建設性地參與特定地點之海洋空間規劃及管理發展，以取得實際的經驗。

**研討主題2：**沿岸與海洋空間規劃及管理之個案研究

**研討主題2A：**管理者及規劃者之觀點

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研討主題2A摘要

# 沿岸與海洋空間規劃及管理之個案研究：管理者及規劃者之觀點

**主持人：Milani Chaloupka博士**，生態模型分析中心與昆士蘭大學及**張正昇先生**，中華民國對外漁業合作發展協會組長

**預期結果：**確認有效及無效的海洋空間規劃之經驗、最佳實踐及海洋漁業治理之涵意。

五項專題簡報著重於引入海洋空間規劃概念至實踐。確認兩個主要概念如次：

- 空間本質結構及複合族群動態間之連結可適用於暴露在各種人為危害之系群的長期生存能力；及
- 海洋空間規劃工具之成效，如海洋保護區及區域輪作，以支持天然資源之養護及改善漁業治理。

Papahanaumokuakea國家海洋紀念區(美國西北夏威夷群島；詳見Jo-Ann Leong博士之專題簡報摘要)及大堡礁國家海洋公園(澳洲；詳見Randall Owens博士之專題簡報摘要)之個案研究，展現以海洋空間規劃技術為基礎，指定大規模海洋保護區，限制多用途使用可能發生的衝突，達成較大的生態系統恢復力。體認到海洋保護區對海洋生態系統及漁業資源的優勢，臺灣政府努力在2020年前達成其20%以上的領海為保護區之目標(詳見王茂城先生之專題簡報摘要)。新英格蘭扇貝漁業成功利用區域輪作制度，提升生物量及改善整體漁業資源管理，也展現海洋空間規劃工具可適用於特定漁業(詳見Deirdre Boelke女士之專題簡報摘要)。普吉灣夥伴協會(美國)則展示承諾科學政策治理架構，以推動廣泛之生態系統復育工作，包含陸地及海洋部分(詳見David Fluharty博士之專題簡報摘要)。

本節獲致海洋空間規劃及管理工具之有效運用，依賴但不侷限於下列各項：

- 發展對複合族群動態(metapopulation dynamics)更佳的認知；
- 即時的時空監控係昂貴的；
- 發展社區及產業之夥伴關係；
- 發展對資源公平分配之共識；及
- 資源治理獲得政治的支持。

體認到應用海洋空間規劃工具以養護高度洄游魚種之主要即時的挑戰，但未提出有效的解決方案。

研討主題2A：

# 簡報摘要

## 沿岸及海洋空間規劃與西北夏威夷群島

**Jo-Ann Leong**[1]及**T. ‘Aulani Wihelm**[2]

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### 摘要

Papahanaumokuakea國家海洋紀念區係美國總統於2006年6月15日建立，繞過了指定為西北夏威夷群島珊瑚礁生態系統保留區的過程，成為一國家級的海洋避難所。管理紀念區條例規定，特定活動的區域及所有商業性捕魚應於2011年6月15日逐步淘汰。紀念區管理計畫和紀念區科學計畫確實做出必要的工作以瞭解該區域的生態系統，及整併資訊至紀念區之調適性管理策略。這些資訊將化為管理行動以規範容許在不同區域所從事的活動。

### 簡介

美國布希(George W. Bush)總統於2006年6月15日發佈第8031號總統令，宣布依1906年聯邦古物法(Antiquities Act, 16 U.S.C. 431)，建立西北夏威夷群島(Northwestern Hawaiian Islands, NWHI)國家海洋紀念區，該區於2007年3月6日更名為Papahanaumokuakea國家海洋紀念區(Papahanaumokuakea Marine National Monument, PMNM)，成為美國最大且完整的海洋保留區。

該紀念區包括許多現存的聯邦保育區，如美國商業部透過國家海洋暨大氣總署管理之夏威夷群島西北部珊瑚礁生態保留區、及美國內政部透過美國漁業暨野生動物局管理(Fish and Wildlife Service, WS)之中途島環礁國家野生動物庇護區、夏威夷群島國家野生動物庇護區和中途島戰役國家紀念碑。另包括夏威夷州透過國土及天然資源部管理之夏威夷州陸地和水域，如同西北夏威夷群島庇護區和在庫耳環礁的州立海鳥保護區。該等區域目前全數保留，除該宣布涵蓋項目外，亦受渠等適用法規管制。

PMNM圍繞太平洋水域139,797平方英里，涵蓋夏威夷群島北方1200英里的水域，超過7千種物種棲息於該區廣大的珊瑚礁(24-35%尚未在世界其他地方被發現)水域。自公元500年起，該區為夏威夷原住民提供漁業資源，並遭外國漁民大量捕撈僧海豹、鯨魚、魚類、龍蝦及黑唇珍珠。為防止與瀕危物種互動，於1991年指定延繩釣保護物種區，不准表層延繩釣在NWHI 50海浬內作業，另自2000年起無甲殼類漁業在NWHI內運作。儘管底魚漁業仍開放予授權核准的8艘漁船作業，但預定於2011年6月15日禁止該漁業，該等漁民至2009年12月已全數自願接受政府對渠等預期損失的補償，並放棄漁業執照。終止PMNM內之所有商業性捕魚，並完成與漁業資源有關之沿岸及海洋空間計畫(coastal and marine spatial planning, CMSP)。未來將繼續CMSP對保護區之其他運用，另對NWHI生態系統之規劃、管控及模擬等研究將引導PMNM之MSP合適管理。

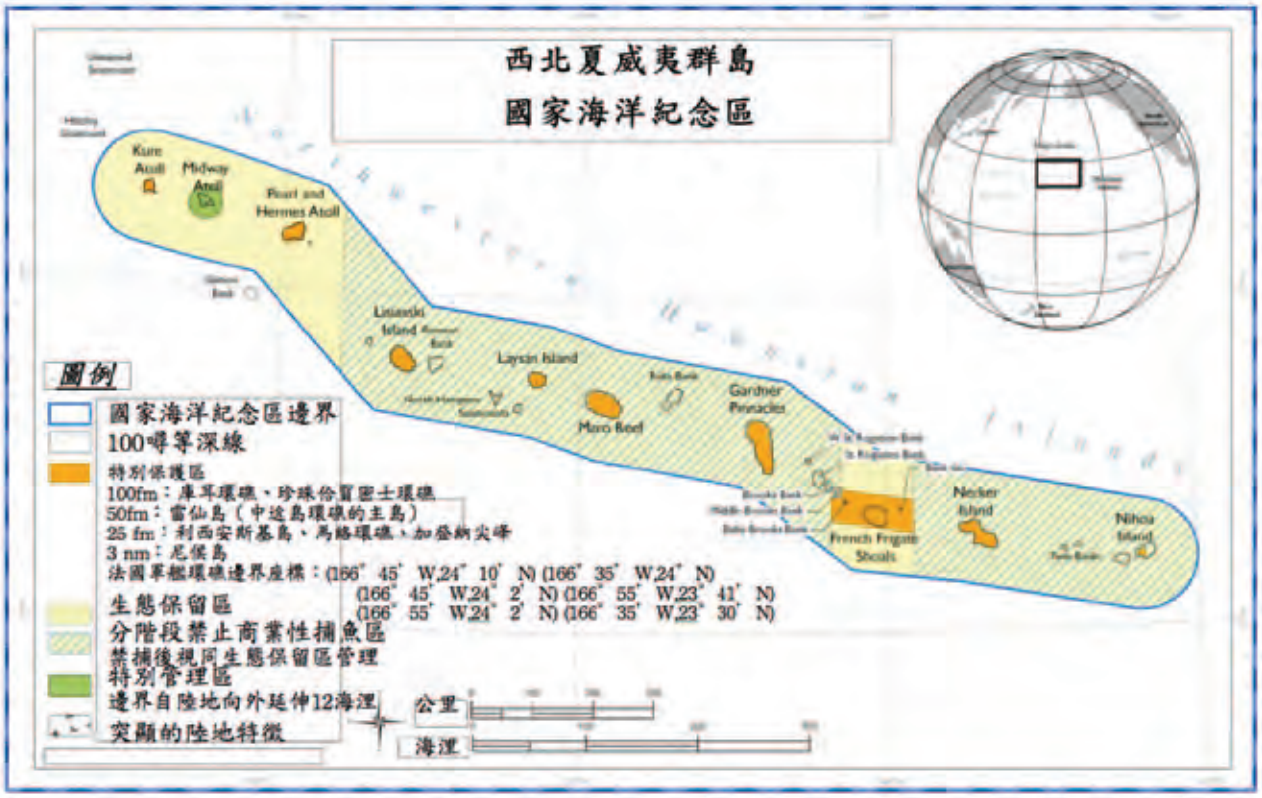


**圖1.** 西北夏威夷群島國家海洋紀念區(2006) (71 FR 51134)

## PMNM之沿岸及海洋空間規劃

依FWS及NOAA於2006年8月29日共同完成之71 FR 51134決定，指定PMNM之範圍，而50 CFR Part 404則制訂紀念區之範圍和目的、邊界、定義、禁止事項、海洋區域及受規範活動(圖1)。除為運輸、緊急狀況和執法目的、武裝活動外，嚴格禁止進入PMNM。2011年6月15日後禁止所有商業性捕魚，許可的活動包括研究、教育、夏威夷原住民文化實踐、為生計在中途島環礁特別管理區內捕魚，及已知為「特殊海洋利用」之活動。管理區如圖1所示，包括特別保護區、生態保留區及中途島環礁特別管理區。每一分區係為保護受威脅和瀕危物種之棲地與覓食區，包含代表範圍內多樣的海洋棲地，包括淺灘的珊瑚礁、深海的斜坡、沙洲及海山。該等區域係透過2003年國家海洋保護區計畫(National Marine Sanctuary Program；NMSP)倡議之規劃階段及EIS過程所建議，並納入71 FR 51134以保護棲地間之生態關連，並將與相關活動(如捕魚及娛樂活動)之風險降到最低。NMSP過程包括6個漁業主題之研討小組，每組集會2～3次，總會議次數為18次(Kittinger et al., 2010)。每個團隊包括各種學科之研究人員，亦負責提供NWHI水域內有關商業性捕魚之背景研究，並提出報告予漁業研討小組尋求改進意見(Wilcox et al., 2004)。

管理該等區域之基本原則是瞭解NWHI生態系統。PMNM紀念區管理計畫指出，在研擬合適的管理過程中，需通報紀念區之生物多樣性、珊瑚礁、生態系統動態、氣候變遷之潛在效應和社經驅動的知識，並昇華為管理策略。該過程之內涵可能重新定義海洋區域，倘科學資料支持該變更符合紀念區目標和渴望成果。定義引導任一改變之標準是合適管理的要素。

## PMNM之CMSP原則與作法

目前基於生態系統作法之空間管理廣泛被接受，藉由分隔互不相容的利用方式，作為保護生態系統服務的方法(Crowder and Norse, 2008)，其核心為透徹瞭解考慮中系統的生態屬性，詳如表一(Foley et al., 2010)。提出四項生態原則，

**表1.** 以生態系統為基礎之沿岸與海洋空間規劃的生態原則（依Foley et al., 2010.修正）

| 原則 | 重要特徵 | 支持的生態系統功能 |
|---|---|---|
| 維護原生種多樣性 | 物種多樣性及組成<br>基因多樣性<br>功能重疊性 | 生產力<br>恢復力(抵抗力及復原力) |
| 維護棲地多樣性及變異性 | 棲地代表 | 維護物種多樣性 |
| 維護主要物種族群量 | 生產者<br>一級消費者<br>二級以上消費者<br>上層掠食者 | 物種多樣性<br>食物網絡的穩定性<br>恢復力<br>生態系統工程 |
| 維護關連多樣性 | 族群量及物種持久<br>補貼流量 | 物種多樣性<br>變異族群及變異社群變動 |

引導以生態系統為基礎之CMSP的維護或修復，包括(1)原生種之多樣性、(2)棲地多樣性和變異度、(3)主要物種及(4)關連性。在PMNM中，科學資料並不完全支援上述原則，未來將繼續進行科學研析增加資料來源。

## 為太平洋群島之沿岸與海洋空間規劃而產生的海洋政策任務小組

美國歐巴馬總統之海洋政策任務小組對沿岸與海洋資源國家政策之建議，是以生態系統作法達成CMSP(2009年6月12日總統備忘錄)。為有效進行CMSP，2009年12月9日發佈機構間海洋任務小組之臨時架構，該文件並提供以生態系統為基礎之PMNM管理原則與作法(機構間海洋政策任務小組，2009年12月9日，為有效進行CMSP之臨時架構)。

CMSP被定義為一完整、合適、整合、以生態系統為基礎和透明的空間規劃過程，基於科學分析海洋、沿岸及大湖區目前與未來的利用。為降低各種利用之衝突、減少環境之衝擊、便利相容的利用及保護重要的生態系統服務，以符合經濟、環保、安全及社會目標，CMSP認定最適合不同類型或等級活動的區域。最終政策概略CMSP過程之要素：

- 確認區域目標
- 確認現存的努力，透過此程序有助於塑造合適的計畫
- 利益相關者及大眾透過此程序在重要時間點參與之
- 與科學家及技術性與其他專家諮商
- 分析資料、使用程度、服務和衝擊
- 發展及評估未來利用與交易之替代方案
- 為支持環境衝擊之分析，準備及發表CMS草案
- 確認區域規劃團體的成員：有管轄責任或其他利益之聯邦、州、部落當局及本地社區代表。

雖然這些CMSP過程之要素當時尚無定義，然該等要素在不同程度上被用於發展國家海洋紀念區管理計畫、環境影響說明書草案及法規草案，除未用於發展區域目標外。類似的原則很可能每隔5年被運用於檢視和評估現行的管理計畫。管理計畫之任何修訂將以行政命令為之，隨後納入先前為使紀念區生效而頒布之法規。

為達CMSP目的，最初CMSP之規劃係以大型海洋生態系統(large marine ecosystem；LME)規模為之。就太平洋群島而言，即包括整個夏威夷群島、北馬里亞納群島聯邦、美屬薩摩亞及關島。過程涉及下述內容：

1. 履行CMSP發展協定之夥伴，以提供解決衝突之程序和制訂正式區域工作計畫之程序。
2. 建立最終CMS計畫並提交國家海洋理事會(National Ocean Council, NOC)審核。(NOC之功能及責任詳見海洋政策任務小組之臨時報告)
3. 發展區域工作計畫之夥伴，建立主要的里程碑、確認資源、特定的時間時程、及解決規劃過程之必要因子：

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# 大堡礁海洋公園署海洋空間規劃包括永續海洋漁業的心得[1]


**Randall Owens**

大堡礁海洋公園署


大堡礁海洋公園(Great Barrier Reef Marine Park；簡稱GBRMP)為多用途使用之海洋公園，總面積達34萬4千4百平方公里(圖1)，於2004年進行區域重劃，禁取(no take)保護區比例自4.5%增加到34%。很明顯地，在日益複雜的海洋與社會政治環境中，漁業資源之利用與養護正在進行。透過使用海洋保護區(Marine Protected Areas；簡稱 MPAs)，使以生態系統為基礎之養護及利用開發間之分配更為複雜。

漁業及海洋空間規劃之倡議正被許多國家更廣泛地實施及升級，此為生物多樣性養護之重要成就，顯示漁業資源之分配及養護，正在日趨複雜的海洋及社會政治環境中發生。或許在此環境中分配最大的挑戰，為在生態系統養護及資源攫取之間，達成在生態意義方面有效及在社會意義方面合理之平衡。以保護生物多樣性為目標，海洋保護區（MPAs）為分配難題中重要的一部份。然而，由於海洋空間規劃過程中在可察覺分配及社會文化之缺乏，以及明顯缺乏對漁業管理過程及目標之相互重視，目前仍有許多問題。

自大堡礁海洋公園署習得的教訓與前一段有關。我們發現GBRMP的面積夠大且有足夠的代表性，讓大堡礁海洋公園署(GBRMPA)，雖然並不完全靠其本身，但可達成（或至少接近）以生態系統為基礎之管理(ecosystem based management；簡稱EBM)。與許多小型海洋保護區主要的不同之處，在於GNRMPA採用之EBM係基於多用途的架構，旨在管理利用資源之影響，而非簡單的排除利用資源之問題。

1 本摘要係作者之個人觀點，並非反應官方看法或大堡礁海洋公園署之政策。

**圖1** GBRMP從南緯10度41分延伸至南緯24度30分，面積大約等同波羅的海或美國西海岸。

自GBRMPA經驗習得之要點有[2]：

- 一健全的管理架構，包括特別為GBRMP及世界遺產地區(World Heritage Area)立法，並與聯邦環境法規及鄰近各州水域之互補法規相結合。
- 強化法律授權，俾與以生態系統為基礎之管理[3]及生態上永續利用原則一致。
- 儘量以生態系統可能的最廣觀點考量，俾使其管理影響力，較之原有：包括鄰近區域之可捕分配、水域及群島使用，等聯邦較GBRMP議題來得廣。
- 建構綜合性管理系統，包括區域劃分計畫，該計畫提供多用途區域劃分網絡、法定管理計畫、特定點管理計畫、許可制及全區策略計畫等。
- 妥善發展/整合與所有相關聯邦及州機構之管理體系，包括對管轄鄰近受潮汐影響水域及大多數島嶼負有責任之昆士蘭州政府進行正式及非正式之協商。
- 利益相關者透過多樣化的諮詢委員會及在規劃與管理期間之社區參與程序而廣泛參與。
- 穩固的合作夥伴及/或與其他機構、商業及娛樂漁業、傳統漁民、研究所及大學之正式協議。
- 在聯邦、州及地方政府層級給予政策上強力的支持。
- 基於監控和一系列評估(包括管理成效)之適當管理作法並持續改進。
- 國家有共識且國際承認大堡礁是一標誌，有保護養護之必要。
- 有效的研究與監控計畫，優先提供修正資訊，以促進管理。

在此背景下，伴隨著其基礎法規-大堡礁海洋公園署法，授予GBRMPA權力及所應從事的目的。

同樣值得注意的是，包括高度保護區在內的區域劃分，為達成包括大堡礁EBM在內之目標的重要管理工具，然區域劃分必須由其他空間及時間管理工具支持。這些其他工具是必須的，以控制及減緩人類使用大堡礁相關的廣泛衝擊和發生在GBRMP以外活動所引發的衝擊。在GBRMP，這些其他管理工具包括：捕魚許可（一般而言限制在明確範圍或特定區域）、管理計畫（特別發展以管理旅遊或高度使用區）、遺跡管理計畫、特殊管理區域（如Dugong保護區）及其他法定空間限制（如國防訓練區、指定裝運區、及原住民管理協議等）、最佳環境實踐、及產業營業守則及合夥關係等。這些形形色色的管理工具涵

2 摘自Jon Day及Peter McGinnity於2010所進行的GBRMPA內部評估。

3 大堡礁海洋公園法將EBM定義為「...管理一生態系統及影響該系統事務之整合性途徑，主要目標為維持生態學上的近程、生物多樣性及使生物社群運行。」

蓋了區域劃分，且可能擁有其自身的目標或法律授權。

維持大堡礁健康作為重要全球資源之要素，尚包括其他許多形形色色的管理計畫，包括群礁水質保護計畫（一項與昆士蘭省針對流域管理之協議伙伴關係）、漁業管理安排（GBRMPA影響但不負責及管理漁業）、一項氣候變遷行動計畫、戰略規劃合作遵從及執法計畫、及綜合性監控計畫。

前一段摘要內容似乎相當妥善，但如西諺所言「惡魔（困難的部分）都在細節裡」。在本篇摘要的範圍內，僅能簡要敍述其概要，但無法闡明細節。因此，身為密切涉入典型區域計畫(Representative Areas Program；簡稱RAP)及其結果的人，我將僅強調重要困難之處，特別是與漁業相關的部分。我們的經驗無法直接解釋公海及開放海域遠洋治理和環境議題。但仍有許多可以借鏡之處，尤其在考慮可達成何種空間規劃（及可能成本），以確保海洋生態系統之恢復力及長期生產力時，會有許多共通之處。

GBRMP之區域重劃係由RAP所推動。RAP係基於最佳可得之科學知識及應達成目標之建議，設定明確目標之過程，以透過禁捕保護區網絡，使對 GBRMP之生物多樣性保護達到令人滿意的水準。區域重劃是為了盡可能確保大堡礁生態系統之健康與恢復力，在未來能被適當地保護。

經由科學及利益相關企業（包括漁業人）之合作，RAP運用大堡礁生態系統最佳的當代綜合科學知識，劃分了生態系統中30個群礁及40個非群礁生物區。在RAP過程之始，已認知到其不僅只是科學決定。為使RAP在政治及社會層面能被接受，關於社會經濟之因素及意涵必須被考量，並建立相關原則。

## 典型區域計畫之基礎

設定生物區(bioregions)[4]是達成RAP之首要基礎，該作法由Lubchenko等人於1991年在「可持續的生物圈倡議」中坦承，目前之研究成果對處理牽涉多種資源、多種生態系統和空間規模大之系統的永續性並不適當。他們強調需要瞭解及敍述「影響自然及管理系統永續之基本生態過程」。

推動RAP之第2項基礎，依據科學執委會之建議，為發展11項之生物物理操作原則(Biophysical Operational Principles；簡稱BOPs)。支持科學性BOPs者為支持包括社會、經濟、文化及管理可行性等四方面之操作原則(SecBOPs)。

表一、操作原則(摘要版)：

| **生物物理操作原則** |
|---|
| 1. 倘可能，範圍大小至少橫跨20公里； |
| 2. 範圍越廣越好； |
| 3. 在生物區內設置禁漁區，以降低風險； |
| 4. 群礁儘可能不要分區； |
| 5/6.(*群礁)&(非群礁)*每個生物區至少佔20%； |
| 7. 考量陸棚邊緣及緯度之差異； |
| 8. 包括所有群聚類型及自然環境之範例； |
| 9. 考量互聯性； |
| 10. 考量特別及獨一的地點/位置； |
| 11. 考量鄰近的使用情況； |
| **社會、經濟、文化及管理可行性之操作原則** |
| 1. 最大化與鄰近區域之互補性； |
| 2. 認清社會利益/成本； |
| 3. 現行及未來管理相稱； |
| 4. 最大化大眾認知及執行力。 |

達成BOPs促成了禁取區之設立。BOPs係互相依存，須以整體考量，而非單獨隔離(Day et al 2003)。當社會經濟原則受到科學BOPs的支配，這樣的考量並不容易。試圖兼顧兩者目標以在設立基本禁取區時耗費最少的社會經濟成本為其主要挑戰，並揭露其在獲取所有相關資料之能力方面的缺點。RAP過程的誠實及公開透明，以及在最後回顧區域劃分基礎之政治及社會正當性，均有賴於成功兼顧兩者原則之能力。

BOPs之應用提供了起點，並為須達成之目標提供參考。考量到GBRMP的規模，候選區域選項實際上有成千上萬。因此，在利益相關者的參

4 生物區疆界鮮少明確清晰，通常僅是象徵性或模糊的概念，但對有必要受保護之生物多樣性分類有極大的幫助(Day et al 2003)。

與（包括對自二階段正式公開參與中所收到的31,500份意見之綜合分析）下，經過了多次的反覆討論，產生了多樣的解決方案。

透過我們在海洋空間規劃的經驗，很明顯的，目標及操作性原則需要事先公開建立。它需基於最佳可使用的科學，並連同期所設定之目標及原因，適當記錄並公開。完整過程必須透明公開，並邀請公共參與。其中的問題應被清楚定義及澄清，並視情況調整所提出解決方案之規模。此外讓職員與瞭解所提出方案之相關社區代表進行個人互動，是相當重要的。

基本上，具體的操作步驟為（摘自Fernandes et al. 2004）：

- 討論及澄清問題；
- 決定目標；
- 適當且獨立專家之涉入；
- 敍述生物多樣性，如透過生物區；
- 定義為達成目標之操作性原則；
- 社區對前述所有項目之實質參與
- 於圓桌討論蒐集及分類資料（並確保適當平衡，以使瞭解該區域使用的人員參與）；
- 對於禁取區或限取區的替代劃分，報告其原則之達成狀況；
- 組織適當的策略以有效的處理負面的社會經濟衝擊。

其餘的困難則為個別案件的政治及法律獨特性。

在任一階段，不太可能對所有論點及科學之確定性取得共識，保護程度須於政治和區域內辯護。倘多功能使用觀念係MSP之意圖，那保護需求在係爭之明智合理使用區域的構成要素間需取得平衡。最後，倘若僅是紙上作業的話，結果是一點價值也沒有的。為達成令人滿意的紀律水平，充分的執行資源及有效地管理是成功的要素。若基礎工作有做好，夠獲得並維持廣泛「區域使用者」的支持，這些要素將被相當程度的增強。基本上，這些工作必須事先完成以使自願性的遵從達到最大化。

## 漁業議題

區域劃分計畫之最終發展階段是一反覆的任務引導過程。候選區域依照公共提交的意見及其他可得的資訊及數據反覆的審查。為使該過程有效率，在圓桌決策過程中，熟知形形色色利益相關者立場之職員，其在場顯得相當重要。該過程相當艱辛。倘為符合適法性考量而修改一處，將打亂另一處BOPs之達成程度。從漁業觀點觀之，尤其是對瞭解這些為特定漁業人或漁業團體此帶來衝擊的人而言，區域劃分計畫經常是困難的，因為有些候選區域之劃分，確對漁民造成影響並對渠等之經濟造成衝擊。

在所需符合之兩組原則中，社經原則較難達成，其易引發內部與外部之爭議。倘以殘缺不全的資料進行分析，評估社會成本及利益，包括社會接受程度時，困難就此衍生。且此困難會因對人類、經濟和生態系統服務之內涵價值及社會使用方式等看法分歧時而加重（Lubchenko et al. 1991; Costanza and Daly 1992; McManus 1996）。儘管如此，倘資源已被分配到私部門利益者(如捕魚)及更寬廣的公共部門(如養護生物多樣性)，那就必須進行評估。評估結果會影響民眾的生計，儘管有可能的補償或其他改善行動，評估之結果會影響民眾對所處社會的認知，因而影響一社區的社會結構。這種影響「民眾認知」的情形對距離被考量區域較遠的社區而言，可能並非重大問題，但對於生活在該區域附近或緊鄰區域的人們而言，其社會層面的影響相當確實且深遠，亦會造成政治上的痛苦並可能使社區分裂。

在GBRMP，在進行各項漁業活動以空間為基礎之總生產值具體預測時，其資料來源範圍及闡釋尤其困難。而職員及漁業企業瞭解漁獲記錄資料之不可靠程度，進一步將其困難複雜化。透過他們對個別漁業的整體瞭解，加上在州級漁業管理中參與管理諮商委員會及工作小組的過程，職員們瞭解到許多漁業的漁獲記錄資料相當的不準確，進而將扭曲以空間為基礎之總生產值預測。雖然有些漁業有提供6分方格（1度＝60分）的資料，但大多數資料為較粗糙的30分方格水準。漁獲努力量並非平均分佈，有些區域的生產力遠較其他區域好，漁民係應用其特殊的知識及捕撈策略，以使各個區域中的生產力最大化。而有些漁民會遠離其他漁民，集體在同一個區域作業，更增添其複雜度。在進行以空間

為基礎之總生產值預測時，該等漁民之漁獲並不顯著。但以單船水準視之，某個特定區域可能代表他們相當程度的預期收入。

在與於漁業管理者及漁民的交涉過程中產生了許多問題，儘管由於諮商或談判的目標為尋找適當且接近精華活動之區域明顯造成困難，但並非是唯一的原因。首先，因有法律和管轄權政策之障礙，故難以取得所有資料，以支持其空間規劃決策，以儘量降低設置禁漁區所需之社經成本。其次，為達到RAP之生物多樣性保護目標，所需的決策將導致資源重新分配，及在某些情況下，可能產生嚴重和無法替換之努力，而此對魚類種群之可持續性將是一威脅。

考量補償對象之因素，包括政治上及問題仍存在之不確定因素。許多漁業關切之潛在因素也是主要議題。以區域劃分案例而言，倘在空間層次上，重新分配漁業資源至另一部門，且倘補償事宜已被考量，那必須移除考慮中可實際應用於該區域之努力。就達成公平之結果而言，重要的是，補償應給予可證明渠等努力係真實依賴漁業具係值得給予之業者。

在漁業管理中，以生態系統為基礎之管理途徑的應用，為了保存恢復力及基本的生態特色以及海洋生態系統之關連性，需要對支撐漁業管理的某些推論做出可詮釋的改變。當多目標或非目標資源架構及掠食者與被掠食者和其他生態及棲地間的關係，需要被檢驗並進行整體的考量，主要的焦點將被放在漁業資源的分配上。當認知到生態系統本身亦需要分配，這改變了對資源分配目的的看法。這從根本上改變了資源可能被如何分配。分配的改變同時對經濟及生態造成影響，並改變了最理想及有效率資源使用的可能思考方法。

儘管有捕撈部門各產業之爭論及擔憂，漁業管理機關策略上應規劃最有效利用之生物多樣性保護程序及包含MPAs在內之對策，以確保資源重新分配係公平的。

海洋環境管理機關，如同漁業管理機關，擁有及累積了可觀的資料、知識及技巧。在沒有人為界線的海洋環境中，其各自的技巧原則上在以生態系統為基礎管理永續生態發展都是必須的。漁政機關就其管轄範圍蒐集儲藏了各項漁業活動的資料，需發展政策立場以積極協助MPAs的設計，以保護生物多樣性。在此過程中，其應致力於掌握有關資源使用的資訊及良好品質的資料，使能在資訊充分下做出適當的決定，以將選定禁取區或限取區之社會經濟成本降到最低。有關漁業資料分享及機密保護的法律問題及管轄協定需要被重新檢視，唯有如此，資源重新分配從私人利益（如漁撈）移轉成公共財（如生物多樣性的保護），才能毋須一再地進行爭論。

漁業和海洋環境管理機關之目標雖有不同，但非彼此獨立。兩者之管理目標須以較具凝聚力的方式而結合，及有必要在最適利用資料和資源上協調一致。捕撈自然資源之活動是海洋環境不爭的事實，沒有一道方便的柵欄或自然邊界可將該等活動及影響予以分開，但其是可被管理的。目前的行政和管轄疆界與意識形態或政治上操弄之哲學心態，正在削弱可改變海洋資源管理及資源最適利用以實踐專屬經濟區生態上永續發展之知識。重要的是，就社區而言，激化討論並造成沿海社區不安之區劃界線必須同時進行，俾可全部執行運作及符合生態上之永續發展。簡單地說，就是統合各陣營。

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## 新英格蘭扇貝床之區域輪作

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### 摘要

自1998年起，新英格蘭便將區域輪作，此一海洋空間規劃方法，運用在扇貝管理上。雖然一開始有點像是一場意外，然現在卻是運用海洋空間規劃以增加生物量與改善漁業資源全面管理的最佳範例之一。扇貝漁業在1990年代經歷了過漁及卸魚量相對低落的時期。在1998年時，富含小扇貝之區域實施三年的禁漁期。在這些區域重新開放後，生物量與捕獲率增加，且扇貝的體型亦大於以往，這讓漁船能賣出較高的價格並降低其捕撈成本，此等情事轉而為捕撈船隊帶來較高的獲利。該計畫於2004年時，因扇貝漁業管理計畫(FMP)第10修正案的制訂而擴大進行。持續不斷的細部調整，則使該計畫能獲得進一步改善，並越來越有效率。區域輪作的主要益處係減少捕撈時間，這對資源、混獲、海床以及降低捕撈成本有正面效應。此外，禁漁區使扇貝得以成長，並使單位加入漁獲量(yield per recruit)增至最大限度。由於體型較大的扇貝能在市場以較高的價錢售出，因此該計畫有益於扇貝漁業。關閉主要扇貝漁場將造成重大爭議，因此區域輪作最需要的是高度的品質、該系統規模與地點的即時資料、有效執行禁漁區、相對快速且具彈性的管理系統，以及產業的大力支持。因有助於扇貝漁業優化產量並防止過漁，全面性區域輪作已成為新英格蘭地區海洋空間規劃的成功範例。

### 背景

大西洋海扇貝(Placopecten magellanicus (Gmelin))係可在西北大西洋北卡羅萊納州至聖羅倫斯灣水域發現之軟體動物門雙殼綱物種，通常分佈於沙地與礫石棲地(Hart and Chute, 2004)。適合漁業捕撈之扇貝殼高約90至105mm，然過去亦曾捕撈體型較小之扇貝(NEFSC, 2007)。目前能採捕扇貝的入漁限制許可約350張，作業漁船主要以新貝德福式(New Bedford style)漁法捕撈扇貝，船長通常在70至90英尺間。為控制該等船隊之漁獲死亡率所實施的主要規範如下：限制每艘漁船的捕撈天數、每艘船得進入輪作區域的最大航次數、限制船員人數，以及漁具限制。由較小型之漁船所組成的一支「普通類別(general category)」船隊亦從事扇貝捕撈作業，然其卸魚量未達總漁獲量的10%(NEFMC, 2007)。直到最近為止，許可類別(permit category)係採開放入漁之方式，然一般類別漁船則須以從事該漁業之歷年漁獲歷史與漁獲量為基礎，算出其個別捕撈配額(IFQ)，來進行捕撈作業。

美國的扇貝漁業始於1900年代初期，卸魚量的顛峰期為1960年、1978年、1990年與2004年(NEFMC,2007)，1990年代則因該資源的過漁(overfished)而出現較低之卸魚量。1994年時，Georges Bank的大部分區域遭關閉，以減少對已過漁底棲魚種的衝擊。由於這些區域剛好與部分扇貝漁場重疊，因此在關閉期間內，扇貝資源戲劇性地大量繁殖。這些區域的一部分於1990年與2000年實施限制入漁，以期能獲致扇貝的高捕獲率與底棲魚類的低混獲率。在同一時間，中大西洋的兩個區域則禁止捕撈扇貝，以保護高度集中在該等區域之小型扇貝(Hart, 2003)。

自1990年代後期起，由於實施禁漁區、漁獲努力量的降低、漁業選擇的改變與高度的資源加入量，導致扇貝生物量大幅增加。該資源不再處於過漁狀態，且不再發生過漁的情形。自2003年起，年度漁獲量約為5千5百萬至6千萬磅。扇貝漁業的獲利亦有急遽之增加，相較於1990年代每年總金額低於1億美元，2005年起每年總金額高達3億5千萬至4億美元，這主要是因為所卸的扇貝平均肉質含量多於以往。圖1所述為1998年至2006年商業卸魚之肉質重量構成，相較於1998年大型扇貝(<u20)僅佔總漁獲之一小部分，2006年所捕獲的大型扇貝則佔總漁獲之大部分。

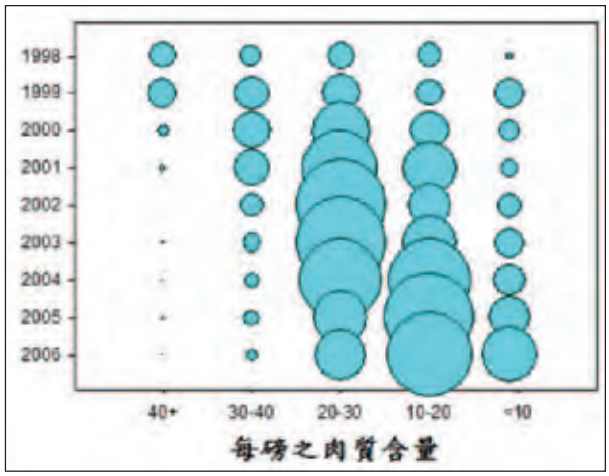


**圖1** 商業卸魚之肉質含量構成，1998年至2006年(資料來源：NEFSC, 2007)

## 今日的區域輪作

現在美國東岸有六個扇貝輪作區：其中三處位於Georges Bank既有的底棲魚禁漁區內，另三處則位於中大西洋區域(圖2)，並專門用來保護小扇貝。通常多個區域將以每年輪作的方式予以開放。雖然每年開放的區域數不定，但管理計畫力求維持在能持續捕撈之水準。區域輪作有助於維持穩定之卸魚量，並防止1990年代常有之「興衰週期(boom and bust cycles)」現象發生。入漁區的增加，使得區域輪作計畫擴大了該等區域佔總漁獲量之百分比。例如，1998年時僅有一個區域開放捕撈，該區域的漁獲量僅侷限於5,000公噸，約佔總漁獲量的20%。另一方面，2007年

**圖2** 扇貝入漁區與分區地圖(深色區域係NEFSC捕撈調查所得之地層)(資料來源：NEFSC, 2007)

與2008年時，入漁區的漁獲量則佔總漁獲量的60%以上(NEFMC, 2007)。

## 益處

區域輪作的主要益處係減少捕撈時間，這有益於資源、混獲、海床以及降低捕撈成本。扇貝漁具在水中待的時間越短，混獲比目魚與鰩魚的機會就越小。再者，較短的捕撈時間意味著，與海龜等保育類資源會有較少的潛在相互作用。其次，倘漁具越少接觸海床，則將對海底生態系統與棲地有所助益，而縮短捕撈時間亦有助於降低漁船的作業成本。在過去，卸18,000磅的扇貝要花費兩個禮拜的時間，相當於一個入漁區航次。在某些場合，現在要捕撈同樣1,8000磅的漁獲量，其出航只需5或6天即可。這意味著漁船能節省相當多的成本。再者，禁漁區使扇貝得以成長，並使單位加入漁獲量(yield per recruit)增至最大限度，這將為資源與漁業帶來收益影響，因為較大型的扇貝具較強之繁殖力，且在市場能獲取較高價格。美國的漁場現在能穩定供應大型扇貝，該產業已具備在全球新市場競爭之能力。最後，有證據顯示，禁漁區的扇貝可能因加入量的增加，而有「外溢(spillover)」至鄰近區域之現象。

## 挑戰

區域輪作伴隨著幾項挑戰。由於需要詳細的區域調查，因此區域輪作成本高昂。自1979年起，美國聯邦政府資助一項捕撈調查，每年以同樣方法來估算扇貝資源。該管理計畫已解決部分區域輪作之相關成本問題，該計畫透過每年撥出2%的漁獲收入，來資助扇貝研究。部分的漁獲則用於評估資源，以制訂可捕量與認定新的入漁區。除了調查成本外，調整扇貝區域輪作計畫需要相當可觀的資源，以供資料加工、分析與監控之用。確實執行，係區域輪作成功的重要關鍵。漁船需搭載漁船監控系統(VMS)，提供其一天24小時的船位給NMFS，以協助渠強制關閉入漁區。整個計畫的調整，係基於管理理事會所接獲之關切事項，例如，有關所分配到的航次遠離特定港口時之安全與公平性問題。很幸運地，該系統相當具彈性，能簡單且迅速地予以修改。最後，區域輪作並非唯一用以控制漁獲死亡率之工具，我們需要其他規範，來降低對扇貝的衝

擊，並防止過漁發生，例如限制船員人數、將漁具大小予以最小化，以及DAS限制以控制開放區域之漁獲努力量。

對新英格蘭的區域輪作來說，最大的挑戰或許在於扇貝管理並非管理委員會所面對之唯一問題。其他如底棲魚計畫與重要魚類棲地計畫等管理計畫，正對扇貝漁業施加限制，以防止區域輪作越來越有效率。例如，可能在扇貝計畫的規劃外增加額外的禁漁區，這將與未來的扇貝入漁區有所重疊。然而，最大的挑戰係「Magnuson Stevens漁業保育及管理法」—管理理事會必須持續衡量每個行動的成本與益處，且確定戰略以把對整體生態系統的衝擊減至最小，並將益處增至最大。

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# 臺灣劃設海洋保護區之經驗


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1992年在委內瑞拉所舉行之第四屆世界公園大會中，明白將保護區(Protected Area)定義為：「一處特定作為保護及維持生物多樣化、具有自然及與其關聯的文化資源，並藉由法律或其他有效方式，進行管理的陸地及(或)海洋」(IUCN，1994)。因此自然保育聯盟(IUCN)為方便管理保護區，特別將保護區分為六大類型，並個別為其訂定管理目標與方針。六大類型分別為：

1. 嚴格自然保留區(Strict Nature Reserve)/荒野區(Wilderness Area)
2. 國家公園(National Park)
3. 自然紀念區(Natural Monument)
4. 棲地/物種管理區(Habitat/Species Management Area)
5. 地景保護區/海景保護區(Protected Landscape/Seascape)
6. 資源管理保護區(Managed Resource Protected Area)

其中「資源管理保護區」是最具彈性之保護區域，其管理目標以永續利用自然生態系統為宗旨。其保護區域內包括明顯未改變的自然系統，藉管理以確保對生物歧異度的長期保護及維持，同時提供滿足當地社區需求的、持續的自然產品供應。海洋保護區(Marine Protected Area, MPA)之劃設概念因而崛起，並且獲得全球許多的國家採納和施行，期待通過上述管理目標在兼顧海洋物種保存與環境保護下，確保海洋區域自然資源的永續利用。

臺灣為一個四面環海之島國，位於東經120度到122度，北緯22度到25度，處於亞熱帶氣候的區域，西部海洋環境多平緩之沙岸，海底大陸棚廣大，沙洲、沼澤，潮汐灘地發育良好；東部則為多變化之陡峻岩崖，坡降極大，海底大陸棚狹小，海蝕地形十分發達，多海崖、海蝕洞、岬灣及礁岩；以北海域和大陸東海相接；以南則與巴士海峽相鄰。且周邊海域有多樣的水文環境及水團交會，使其富含營養鹽；在各項生態環境條件俱佳之狀況下，使得臺灣海域擁有高度多樣化

之生態系統，舉凡：岩礁生態系統、河口溼地、灘地生態系統、珊瑚礁生態系統及大洋生態系統等，海洋生物種類多樣而豐富，擁有得天獨厚的海洋生態環境。

近幾十年來，全球漁業逐漸大型化與工業化後，大型魚類族群有90%屬過漁狀態，75%商業漁獲族群已瀕臨崩潰，加上沿海環境之棲地破壞、污染等，不少海洋生物多樣性及漁業資源正在快速滅絕之警訊已出現，根據國外之研究與經驗，劃設海洋保護區是目前最為簡單、經濟且有效的資源保育方式，同時也逐漸成為必要的管理手段。海洋保護區的理念，獲得全球許多的國家採納和施行，劃設海洋保護區已成為全球各國政府共同努力的目標。

臺灣政府就海洋管理的權責，係分散於漁業、野生動物保育、觀光、環境保護、國家公園、文化等部門；為維護海洋生態多樣性，各機關會依其功能需要，劃設具有海洋保護區功能之限制區位，包括有漁業資源保育區、野生動物保護區、野生動物重要棲息環境、自然保留區、國家風景特定公園、海岸保護區及國家公園等；另外，行政院國家永續發展委員會亦於2009年12月31日修正國家永續發展指標系統，將海洋保護區(Marine Protected Area, MPA)納為永續指標之一。迄目前為止，各部門所劃設各類型海洋保護區之總面積計約為23萬3000公頃(不含東沙國家公園)，約為臺灣本島距岸12浬海域面積(251萬1000公頃)之9.28%；未來亦規劃在綠島、北方三島、澎湖群島等週邊島嶼及海域，劃設海洋型國家公園。

海洋保護區之劃設，通常會與重要經濟漁場、遊憩區域或傳統漁業活動範圍等重疊，加以區位內會針對漁業、遊憩活動，甚至開發行為作一定程度之限制。因此在劃設前，常常面臨當地漁民或設區居民的反對，造成推動的困難。再者，部分區域之主管權責為地方政府，常因經費、人力及巡護船艦的不足，而無法落實執行。

臺灣四面環海，海洋對於我們，無論在過去或未來，都是發展的命脈，保護海洋環境，確保漁業資源永續利用，是目前政府必須正視的課題。推動海洋保護區劃設工作，確實會有一定程度的阻力，但在當前海洋環境及漁業資源水準持續惡化之狀況下，該項工作仍需持續推動。未來除了會擴建海上巡護船艦，加強現有保護區之維護管理外，亦會持續與地方居民及漁民之溝通協調，加強宣導海洋保育區之功能，並擴大劃設海洋保護區，期在2012年海洋保護區面積能達到臺灣本島距岸12浬海域範圍20%的目標。

## 普吉灣海洋空間規劃之初期實施成果

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普吉灣(包括胡安·德·富卡海峽)係位於美國西北部之大型海灣，為當地居民與觀光客帶來諸多益處(圖1)。不論是商業與娛樂漁業、海洋運輸、貝類養殖，作為海洋生物、海鳥與其他海洋生物資源的棲地，以及其他各種藝術價值，該海灣對該區域之生活品質可謂貢獻良多。隨著時間推移，由於過漁、海洋污染與棲地變動等複雜作用之影響，該區域之品質已遭到削弱。為減少對普吉灣社群之衝擊而採取的努力，並無法成功地扭轉諸多負面趨勢。近期則又開始進行多項嘗試，欲復育普吉灣至健康狀態。

**圖1** 普吉灣及鄰近流域

1970年代與1980年代，華盛頓州立法機關創設「普吉灣夥伴協會(Puget Sound Partnership)」以作為科學政策治理機構，該機構負責發展行動計畫，以推動廣泛之生態系統復育工作。該協會結合多方力量，來控制海洋污染與棲地環境惡

化，及發展共同鮭魚策略，用以解決遭列入「美國瀕危物種法(U.S. Endangered Species Act)」中瀕危或受威脅(threatened)的鮭魚與其他普吉灣物種之相關問題，其中鮭魚是各流域、普吉灣口與海洋間生命循環(life cycle)的象徵。

該協會的特點，係規劃並執行一項以科學為基礎之整合性生態評估，而該評估適用於整個流域範圍。該行動計畫為初期執行步驟，其階段性分工說明如下：一、明確表達該協會之管理目標與規模；二、該協會負責居間發展生態指標與臨界值；三、透過正在執行的生態系統規模風險分析模組與情境建構，以識別優先順序；四、倘管理方式有所變動，則合併監控與管理策略評估，以瞭解管理策略在修改後之選擇與採納方式；最後，這些步驟的累積效應，便是執行所選定之管理策略。

在權衡各管理策略之際，必須選出嚴厲的管理選項，而以生態系統為基礎的目標，則用以嚴格要求該等政策選項並予以明確化。此一全面性管理途徑正於當地實施中，透過在流域與生態系統等方面的努力，以瞭解並創造復育普吉灣之誘因。目前看來，普吉灣之復育似乎已出現一道曙光。然而，不論是在維護或復育普吉灣上，都還有一段漫漫長路得走。

**研討主題2:** 沿岸與海洋空間規劃及管理之個案研究

**研討主題2B：** 商業海洋捕撈漁業之觀點


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**Bill Wells先生**，Wells扇貝公司
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## 研討主題2B摘要

# 沿岸及海洋空間規劃之個案研究：商業海洋捕撈漁業之觀點

**主持人：Henk Brus先生**，Atuna

**預期結果：**海洋空間規劃應如何調整，以符合個別漁業社區之社會、經濟、文化及環境背景？

本節有五項個案研究專題報告，提出商業捕撈漁業之觀點，每一案例報告之管理觀點與2A所述觀點呈現對比。個案研究並未包括國際水域之空間規劃案例，其牽涉更複雜的法律架構及監督與執法機制。

西北夏威夷群島(詳見Timm Timoney女士之專題簡報摘要)及大堡礁(詳見Andrew Tobin先生之專題簡報摘要)個案簡報強調，捕撈漁業的聲音在規劃及建立該等區域期間未獲得衡平的考量。該等過程直接以消除榨取自然資源活動為目標而進行，未以經驗法則推敲此舉是否對生態系統之維護作出貢獻。西北夏威夷群島之個案研究亦揭示，當小型漁業的資源有限時，其政治上的談判影響力如何與其他利益團體成比例的減少。

對照之下，美國新英格蘭扇貝漁業從開放式加入、過漁及漁撈能力過剩之漁業，轉變成一嚴格管理空間架構的漁業，顯示成功應用海洋保護區之例。此個案研究強調產業接受及承諾履行新的管理計畫具絕對重要性，以達成功的變革。復育扇貝生物量及扇貝收成量之成果令人震驚(詳見Bill Wells先生之專題簡報摘要)。同樣的，在美國西海岸為恢復平鮋類族群所採取的行動也是成功的，該行動涉及對拖網漁業及手釣漁業建立禁漁區(詳見Marion Larkin先生之專題簡報摘要)。然而前述兩個案研究之成功減輕過漁及漁撈能力過剩，係經由產業及廣泛社區承受大量困苦而得以實現。

臺灣彰化地區海洋空間規劃之經驗，亦呈現另一成功的案例(詳見洪一平先生之專題簡報摘要)，臺灣漁政單位已均衡沿岸活動，包括水產養殖、定置網漁業、捕獲蝼蛄蝦及設置人工魚礁。

本節也提出消除漁撈能力之成功及不成功案例，政府透過收購及再訓練轉型等協助可能會成功。

在監督與執法資源相對有限之開發中國家，要求產業接受執行海洋空間規劃，倘捕撈業者相信透過限制努力量和漁撈能力可使他們長期獲益，可有較大機會使他們願承受所帶來的困苦。

在有些區域，漁民所付出的努力超越海洋保護區，海洋保護區僅是海洋空間規劃的一個面向，海洋空間規劃係為處理如何與其他產業分享海洋空間，如能源產業及賞鯨業。墨西哥灣漏油是一為何需增加海洋空間規劃活動之即時範例，就此案例而言，捕撈漁業因其他海洋產業之治理不足而遭受嚴重衝擊。

從漁民的觀點及本節之討論，確認進行海洋空間規劃時應考量下列事項：

- 讓漁民及漁業成員涉入整個過程並充分表述至關重要，以取得渠等的支持；
- 讓漁民及漁業成員接受過程及規劃結果，將提升渠等對可能發生之暫時性困苦的接受度；及
- 以平衡商業及養護活動取代排除商業性活動，可引導成功的海洋空間規劃。

研討主題2B：

# 簡報摘要

## 美國Papahanaumokuakea國家海洋紀念區空間規劃對商業漁業之社會經濟效應

**Timm Timoney**
西北夏威夷群島底魚漁民

2009年秋天，底魚捕撈漁民前往西北夏威夷群島(NWHI)展開最後一個作業航次，長久以來在這些島嶼的漁業歷史，就此劃下一個令人難過的句點。多年來，不同種類的漁業曾在這個區域成功、衰退。最早來採收NWHI的恩惠以餵養家庭與村落係夏威夷人。幾個世紀後，則有大型與商業捕撈開始進行嘗試，其中包括潛水採收珍珠貝；鮪旗魚延繩釣；籠具捕捉龍蝦、對蝦與科納蟹；專業鯊釣；竹筴魚圍網船；以及非法珊瑚拖曳漁業。當然在NWHI還有歷史悠久的捕撈鯛魚與石斑底魚捕撈業。

當1983年，我先生Tim和我在NWHI開始從事捕撈作業時，我們幾乎可以從尼侯阿島(Nihoa)一路捕到庫爾環礁(Kure Atoll)。三項授權令則改變了捕撈作業規定：西太平洋區域漁業管理理事會(WPRFMC)底魚漁業管理計畫(FMP)、2000年柯林頓總統簽署之行政命令及布希總統之行政命令(創設了NWHI國家海洋紀念區)。這三個管理措施，係以非常不同的程序發展。

俟漁民、科學家與經濟學家等眾多民眾投入其中後，WPRFMC執行一項FMP，該計畫一開始便將NWHI區域一分為二。離夏威夷本島最遠的是檀香山區，最近的是茂宜島區。其中檀香山區成了限制進入漁業(limited entry fishery)。曾在NWHI從事漁業，享有捕魚許可資格的人們，現在遭到限制。首先須在時間限制內申請捕魚許可，獲得許可的漁民不是使用它就是失去它，而為保有許可，每年須達到最少航次與最低漁獲量。很快地，這項措施導致該領域參與者的減少。該FMP最具爭議之處在於不得轉讓許可(non-transferability)。握有許可的漁民認為，倘無法在賣掉船隻的同時，將許可予以售出或轉讓的話，漁船價值將會降低。然其他希望獲得許可的人們則認為，許可係不勞而獲的意外之財。不得轉讓許可此一決策，基本上並非透過由上而下(top down)之決策方式所定，反係由現役漁民與潛在的利害關係者，在進行公開會議後達成之協議。

2000年，柯林頓總統發佈13178號行政命令，創建NWHI珊瑚礁生態紀念區。該行政命令亦設立一諮詢委員會，以處理NWHI國家海洋紀念區的設置問題。該紀念區的設置過程公正透明，利害關係者得經由多方管道投入其中。對大部分漁民來說，這是他們首度面臨海洋空間規劃這個概念。該過程極為痛苦，而NWHI漁業社群並未獲得良好的進展。表面上這個計畫為一項珊瑚礁倡議(coral reef initiative)，捕撈底魚對該生態之衝擊極小，然顯而易見地，打從一開始委員會大多數成員都認為全面禁止所有捕撈活動，將是唯一能接受的結果。

我們從未克服的障礙之一，就是簡化諮詢委員會的組織架構。委員會的選定成員來自四面八方不同的利益團體，包括環保非政府組織(NGOs)、夏威夷原住民團體、海洋觀光產業代表，以及一般大眾代表等各式各樣代表與代理人。教育和推廣席位坐滿了想前來觀摩與學習的民眾，然渠等並未享有任何NWHI入漁權。環保團體席位則坐了一位律師，他控告底魚漁民殺害並騷擾瀕危的夏威夷僧海豹(Monk seal)。該項控訴並無事實根據，而他亦輸掉該場辯論，但他

依舊宣稱NWHI的底魚漁民正在傷害夏威夷僧海豹。漁民們在諮詢委員會享有一席，並得指派一名代理人。我們認為被指派人係現役漁民而無法隨時在場，因此希望能有第二個代理人名額，該項提案經投票後，遭到徹底否決。許多其他團體代表係擔任有給職，這使渠等能出席會議，或由該團體獲得費用出席會議，因此這些人在參與政府舉辦的會議時，並未蒙受任何收入損失，然底魚漁民則會有所損失。

在接下來數年內，在NWHI與夏威夷島嶼水域從事漁業活動的漁民，參與了虛有其表、永無止盡且不重要的遠景會議、工作團體、政策團體與諮詢委員會會議。然而這8至14位漁民並未發揮任何影響力，且似乎經常遭到忽略，並處於不利的地位。

當我們在和代表NWHI紀念區的承包商與政府官員開會敲定禁漁區，以滿足對海豹、重要魚類棲地與孕育場後，我們仍然參加會議思考我們應享有的捕魚權利時，或許最糟的時刻已經到來。我們確認這些區域對我們而言極為重要，並同意不到其他區域從事捕撈活動。當政府規定公布後，主要底魚漁場的大半區域將禁止捕撈。更令人感到羞辱的是，這些區域曾被科學家認定為低度關注區域。

當喬治布希總統依據古蹟法(Antiquities Act)，以行政命令制訂國家海洋紀念區後，這些規定－2011年結束所有漁撈活動－即為最終定案。NWHI的漁業社群對此感到震驚且忿忿不平。許多漫天謊言與令人質疑的科學證據導致此一結果。我們這些小小漁民團體與支持者，無法對抗龐大的環保NGO、資金雄厚的財團以及複雜的政治活動。

NWHI的漁民團體永遠都是高貴可敬的，我們對於自己小心翼翼運至市場的高品質產品感到自豪。我們對於與家人和朋友分享漁獲物感到自豪。我們對於數年來從事捕撈的水域仍未遭到污染感到自豪。由無數利害關係者介入管理的海洋紀念區概念，並非毫無益處。然而，我確信夏威夷人的確將因此而有所失。

## 澳洲大堡礁海洋公園海洋空間規劃之漁業界經驗

**Andrew Tobin**
昆士蘭水產協會

名列世界遺產的大堡礁海洋公園於2004年6月通過代表性分區計畫(Representative Areas Program)，將園區內禁漁區面積比例由4.6%增加到33.3%，想當然爾，此舉必然對園區內有歷史活動之商業性漁業造成影響。代表性分區計畫主要目標為保護大堡礁海洋公園內獨特的生物多樣性，但是在整個協商過程中，海洋空間規劃提倡者卻時常主張，代表性分區計畫理論上有助於漁業資源永續，為其次要重大效益，漁業界應為此感到欣喜。然而，擁護這些欠缺實際證據證明的價值可謂毫無意義。此外，海洋空間規劃提倡者之主張，時常對漁業界造成不當的緊張，因此渠等在推動此類主張時應更加謹慎。

理論上，海洋空間規劃對漁業的效益可分為兩個層面：直接保護棲息於禁漁區內之生物，使渠等不遭受捕撈；禁漁區內的生物繁殖的後代將溢出(spill-over)。海洋空間規劃提倡者所提出的第一個主張為：假如禁漁區面積大於受關切魚種平常的活動範圍，渠等便能不遭受捕撈，受到健全的保護。然而許多大洋性中上層洄游魚種移動範圍廣大，時常跨越各式各樣的棲地。在這種情況下，海洋空間規劃所能產生的效益極為有限。第二個主張為溢出效益(spill-over benefits)：在未受捕撈的情況下，資源量將恢復，當資源量超過禁漁區之承載量時，將透過幼體擴散或成體遷移至區外而產生溢出的淨效益(net benefit)。然而溢出效應亦僅及於保護區內之某些魚種，且其效應尚有待證明。

本個案研究之重點為提出自研究計畫得到的一些初步資料，包括大堡礁海洋公園代表性分區計畫對遭受商業性捕撈作業之沿海鯊魚魚種提供保護之成效，對珊瑚礁魚類提供之效益(數量增加)，及溢出效應之潛在效益。

## 大西洋扇貝區域輪作之產業經驗

**Bill Wells**
扇貝水產品公司

### 摘要

大西洋扇貝之年收成量因區域輪作而有戲劇性的轉變。區域輪作始於1998年，最初有三個特別管理區，目前已有六個特別扇貝管理區，該等區域之收成量將近該產業年收成量之50%。

### 區域輪作前

平均每年整體收成量為1,000-1,200萬磅，每船在海中的天數約240天。1994年實施諸多限制，包括特別管理區加入量、最多船員數、漁具及海上作業天數等。

### 區域輪作後

平均每年整體收成量為5,000-5,500萬磅，且有較高機會取得較大尺寸之扇貝，致平均收成尺寸為每磅/10-20顆扇貝肉身。再則因單位漁獲努力量高，扇貝養成之時間亦有所縮短。

### 未來

區域輪作計畫與其他計畫有重疊，但該等計畫抑制扇貝輪作管理計畫之有效性。進行調查是重要的但很昂貴。目前市場上，較小且較便宜的扇貝有短缺，使買主不是改買較大、較貴的扇貝、使用機器剝殼的外國扇貝，就是購買尺寸較大卻較低價的美國加工扇貝。

區域輪作之其他負面觀點則是哲學的：漁民想與其他漁民競爭之想法態度。關閉捕撈區域使所有漁民和漁船的權益變得等同，因為每船每航次的收成量均限制為18,000磅。

然以有利的觀點觀之，區域輪作提升生物量且減少混獲，市場亦接受更大的扇貝，扇貝肉身之平均卸售量亦有增加，漁民收入及獲利均有所提高。

## 台灣海岸空間規劃利用---以彰化地區為例

**洪一平**
彰化區漁會秘書

### 摘要

彰化海岸位於台灣中西部，海岸線長50公里，潮間帶寬達5公里，是台灣最大的黑色泥質灘地。由於黑潮分支由南往北流入台灣海峽，加上從南中國海北上的水團和沿著中國大陸南下的沿岸流的交會，造就台灣周圍海域基礎生產力豐富，是魚貝介類良好的繁殖、棲息場所，形成良好漁場。但是近年來高度漁獲努力量及沿岸經濟開發抽砂造地，使得海岸地貌的變動，加上沿岸汙染影響，破壞海岸棲地生態環境。因此，必須妥適海岸的管理與利用，以維持漁業永續經營。彰化區漁會(以下簡稱本會)依據我國漁業法申請專用漁業權，於西元2009年經中央主管機關核准並取得專用漁業權證照。本會專用漁業權範圍，自沿岸平均高潮線起向外延伸，面積共42071.33公頃。依淺海養殖、沿近海漁撈作業，分時、分區辦理專用漁業權入漁申請，並進行彰化海岸的管理與利用。

### 海岸空間的規劃

彰化海岸潮間帶遼闊，由海沙及河砂沖積形成的淺灘是良好的淺海養殖場所。因此規劃自離岸至低潮線為淺海養殖區，分佈於沿海6鄉鎮，大部分面積養殖牡蠣和文蛤，在不適合養殖區漁民從事立竿網及雜漁業之採捕，水道則適合捕魚苗業。低潮線以降至水深25米處規劃為傳統漁撈區，以小型刺網及一隻釣為主，部份從事拖網漁業。為維護漁業資源，沿岸3浬內禁止拖網，在12海浬內禁止50噸以上拖網漁船作業。

### 海岸漁業的管理

- **淺海養殖管理**：自2010年7月全面開放淺海養殖申請入漁，透過GPS定位系統，實地辦理蚵田範圍測量以核發專用漁業權入漁權執照。
- **沿岸漁撈管理**：受理有合法漁業執照之漁民辦理入漁申請及核發執照。並登錄

專用漁業權入漁名冊資料，完善入漁檔案管理。並輔導漁船進行漁獲量通報，建立相關漁獲量資料。

- **海域管理機制**：
  1. 制定專用漁業權入漁規章為入漁漁民共同遵守規定。
  2. 訂定漁船筏海上作業公約，落實專用漁業權海域管理，建立漁船筏海上互助、作業秩序，糾紛調解。
  3. 配合志工及巡護隊，防止遊客或其他干擾活動進入。
  4. 依季節辦理體驗活動及漁業產業介紹等文化導覽，使漁業產業文化深耕國人心中。
  5. 設立專用漁業權範圍告示牌，加強宣導漁場作業區、養殖區、禁漁區，促進入漁權人對漁場之認知與了解。
  6. 每年辦理海域淨灘及廢棄物清除，提供海域環境清潔及船筏航行安全。
  7. 辦理水上標設及航道標設，於2005年至2009年在本縣海域主要水道設立航道標識桿共7825支，指引漁船筏進出港，維護海上漁航作業安全。
  8. 辦理出海道路鋪設與維護，便利漁民運載車輛進出海灘，提高作業效率。

### 水產資源保育措施

- **成立海上巡守隊**：本會分別於沿海鄉鎮，成立6支海上巡守隊，負責海域巡護、糾舉非法捕魚通報工作，以保障水產資源永續經營管理。
- **建立海域防污機制**：於本會7個辦事處，配置海域污染通報員，聯絡環保單位處理海域遭受污染，避免漁場破壞。
- **漁業資源保育宣導**：每年辦理漁業資源保育宣導與導覽至少1場次，藉此宣導活動推廣資源保育觀念，加強漁民共識，促進漁業永續經營。
- **辦理魚苗放流**：2004年至2008年於本縣海域放流鯛魚苗共145萬尾。
- **美食蝼蛄蝦保育區設立與管理**：辦理本縣特有水產資源--台灣美食蝼蛄蝦保育計畫，設立伸港蝼蛄蝦保育區，面積共36公頃。其中16公頃為保護區，外圍20公頃為養護區。組成蝼蛄蝦資源保育班，平日維護保育區巡護與管理工作。並結合社區與學校志工，辦理生態教育及校外研習。達成全民資源保育教育之目的。近期擬增設王功區蝼蛄蝦資源保育區，有效保護稀有海洋生物棲地，延續物種繁殖。

## 美國西海岸海洋空間規劃之漁業產業經驗

**Marion J. Larkin**
海洋獵人企業有限責任公司負責人

Larkin先生於1973年開始捕魚，當時鮮少規範限制漁民如何捕魚及捕魚的時間與地點。之後捕魚活動開始受到管理措施的限制，包括漁船每月或每兩個月傳送魚種別漁獲量、限制使用漁具及禁用某些漁具，包括關閉作業深度達125噚且海域內大部分為暗礁之拖網漁業漁場，以保護及加速復育過漁的魚種，如銼頭平鮋(Yellow Eye Rockfish)及網翼平鮋(Canary Rockfish)。前述措施亦納入41處非底拖漁區，禁止拖網船隊使用接觸海底之漁具作業。前述管理措施形成一繁重但可變通的管理系統，並增加執法、引發經濟無效益和漁船聚集在較小漁區內捕魚等問題。關閉華盛頓州北海岸外海之漁場，淘汰在尼灣(Neah Bay)作業之船齡達70歲的拖網船。漁民不在洄游魚類所處深度和棲息地水域內從事捕撈，取而代之的是等待魚群游入開放區水域。

海洋空間規劃及執行直接衝擊漁民的收益和其所支持的漁業社區，倘漁船在豐度較低的區域從事較無效率的捕魚，漁民的捕撈成本增加。

在海洋空間規劃之所有討論層面上均需納入漁民的參與，特別是對渠等可捕魚區域設限時。倘無漁場，漁民無以生存。

TAIPEI

AUGUST 3-5, 2010

FIFTH INTERNATIONAL FISHERS FORUM

**研討主題3：**減少海洋漁業對敏感性物種之混獲

**研討主題3A：**減緩小規模漁業(包括沿岸消極性網具之家計型漁業)對敏感性物種之混獲及混獲丟棄之管理

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研討主題3A摘要

# 減緩小規模漁業對敏感性物種之混獲及混獲丟棄之管理包括沿岸消極性網具之家計型漁業

**主持人：Ussif Rashid Sumaila博士**，英屬哥倫比亞大學漁業中心主任

**預期結果：**認定減緩小規模沿岸漁業混獲之進展及其優先順序。

就某種程度而言，對小規模漁業進行混獲評估之挑戰，通常是資料有限，包括漁獲努力量水準、漁獲努力量之時空分佈及有關聯的混獲率。小規模漁業威脅敏感性混獲物種之相對程度也難以估算，因各種死亡率資料來源有限。本節亦闡述及對照估算區域漁獲努力量之繪圖工具、利用低成本訪查之方法及聘用船上觀察員計畫(詳見Rebecca Lewison博士之專題簡報摘要)。觀察員之遴選及訓練似乎是家計型漁業觀察員計畫成功與否的重要因素。

減緩中南美洲小規模延繩釣漁業混獲海龜之成功案例，說明家計型漁業直接參與的好處(詳見Martin Hall博士之專題簡報摘要)。在有些區域，要求達成全魚利用之減緩混獲措施的漁具技術，需使漁民負擔極小成本，因渠等作業之邊際利潤相當微薄。基於與中南美洲小規模漁業共事之經驗，進行混獲減緩方式之商業性展示，並實際在漁船上試驗該等技術，是確認及導入有效解決方案之重要過程。

走入歷史之臺灣鯨鯊漁業，從採捕到每年設定配額至全面保育，提供資料豐富之沿岸漁業管理示範(詳見莊守正博士之專題簡報摘要)。

臺灣進行研究蒐集赤蠵龜之遷移資訊，該資訊結合渦流系統之海洋資料(詳見Donald Kobayashi博士及程一駿博士之專題簡報摘要)，顯示氣旋渦流對赤蠵龜之重要性，及赤蠵龜如何利用東亞及南亞之海洋環境。該研究揭露赤蠵龜在東中國海之熱點，涵蓋面積超過40萬平方公里，包括臺灣、中國、日本及韓國之大陸棚水域。

本節亦述及降低混獲問題之漁具技術方法，包括：

- 減少海洋哺乳類與消極性網具互動之聲納發射器(詳見Geoff McPherson先生之專題簡報摘要)；
- 減緩海龜混獲之日本待袋網改良設計(詳見Osamu Abe博士之專題簡報摘要)；及
- 改變魚鈎類型（從J型鈎變成圓形鈎）及在尼龍絲延繩上使用片段的單絲纖維，以減緩小規模延繩釣漁業之海龜混獲(詳見Martin Hall博士之專題簡報摘要)

本節也論及使用漁獲物對混獲物之比率至漁獲努力量時空分佈之空間規劃，以平衡目標魚種及混獲物種之漁獲比例。

研討主題3A：

# 簡報摘要

## 評估小規模漁業混獲及預估全球的影響

**Rebecca Lewison**
聖地牙哥州立大學

最近的證據顯示，家計型漁業可能對海洋哺乳動物與海龜遭意外混獲，有顯著之負面影響。由於家計型漁業遍佈全球，其人口可能佔全世界漁民的95%以上，再加上高度洄性魚種之混獲等因素，推算某些國家的家計型漁業混獲影響遠不止於特定資源，同時影響全洋區混獲魚種資源的減少。

瞭解家計型漁業之影響的主要挑戰之一，係缺乏漁獲努力量資料(例如：船舶數、使用的漁具數量，或漁撈活動的次數)及對沿岸漁船時空動態知之甚少。描述小規模漁業所做的努力，會因資料蒐集、漁業的分散性、資料來源間之差異、某些區域可得資料有限、空間資訊短缺及目標魚種與漁具種類於短時間內的高變換率等問題而受到阻礙。本研究係全球計畫(Project GloBAL；PG)之一部分，採用下列兩種途徑以蒐集家計型漁業之漁業與混獲資訊：(1)漁業資料之空間解析(spatial mapping)；(2)以訪談為基礎之評估(interview-based assessments)。這些資料結合現有的混獲資訊，以強調家計型漁業之永續發展議題。本文介紹的模型，係結合上述資料與詳盡之社會經濟學研究，以提供處理該等挑戰之有意義的架構與內容。

PG研究團隊採取原先用於評估加勒比海漁業之空間解析工具，整合聯合國糧農組織的資料、各國漁業報告與已發表的研究，以說明西非、印度洋、東南亞、加勒比海、西南大西洋及東南太平洋等六個海域之沿岸漁獲壓力。透過該過程，我們得以繪製沿岸漁獲努力量之區域規模類別，並審視平均漁獲努力量密度、經濟發展程度，及各國與區域人口參數間之相互關係。本文提出一項用以繪製各不同海域漁獲努力量之新途徑，該途徑係改良常見的漁獲努力度量，使其能顧及區域間之比較。分析目標係比較六個不同海域間沿岸漁獲努力量之相對密度，並考慮該海域間漁獲密度之潛在社會經濟與物理關連性。該途徑提供量化漁獲努力量之方法，並可用以界定某區域可能因漁撈能力過剩而威脅到漁業永續發展與沿岸生態系統的完整性。

PG亦實施一項密集的試驗性研究，以估算低成本的訪談調查，能否在大範圍區域內，有效評估家計型漁業之漁獲努力量與混獲問題。該先行研究之結果顯示，高度混獲海洋哺乳動物與海龜係全世界之通則，家計型漁業亦不例外。根據調查，各國混獲鯨豚與海龜的數量，和最近其他家計型漁業研究之驚人數量極為類似。儘管本試驗性研究在統計混獲估算之準確性或研究區域與物種間混獲程度之比較上面臨挑戰，但卻印證了以訪談為基礎之評估的可行性，並促使當地科學家與管理者發展新的研究方法，蒐集與分析小規模漁業及社會經濟資料，並使得此一工作，成為管理計畫發展與評估過程的第一步，以降低小規模漁業混獲並達成永續發展的目的。雖然本文的混獲資料品質不如直接觀測來得精確，然本文的調查成果可提供漁撈活動的基本資訊，並探討混獲之社會驅力，使最終導致混獲之基本要素。本文之研究將提升我們對混獲社會驅力之瞭解，評估其所造成之社會經濟衝擊，以減少混獲的管理行動。

## 臺灣鯨鯊*(Rhincodon typus)*的利用、管理及研究

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鯨鯊*(Rhincodon typus)*為泛世界性魚種，是世界上最大的魚類，但是其生物特性及高度的漁業開發，致使本種在這個世紀初即分別被自然保育聯盟(IUCN)與華盛頓公約組織(CITES)列入瀕危物種的名錄中。臺灣鯨鯊的漁獲調查紀錄顯示，1996～2008年間所捕獲的597尾個體，全長(total length, TL)範圍為1～13公尺，平均體長4.6±1.2公尺(1SD)。根據2001至2008年的漁業調查資料，在臺灣周邊海域被捕獲的鯨鯊，主要卸魚的地區以東部為主；從平均體長的變化中，可以看出每年6～10月來游的個體小於11～5月間來游者；性比分析顯示各地區皆呈現雄魚較多；而各地區定置網漁業的平均年漁獲量以西南部的為最高。

臺灣政府自2001年起進行鯨鯊漁獲通報制度，隔年限定每年鯨鯊的漁獲上限為80尾，到了2005年則降為65尾，2006年60尾，2007年減少至30尾，2008起則全面禁捕。2001～2004年的漁獲量逐年遞減，從2005年起定置網漁獲鯨鯊的數量則逐漸增加，2008年共捕獲165尾個體並全數予以放流。

本研究以衛星定位標識籤，以及自浮型可記錄式衛星標識籤，自2002年至2009年間於臺灣沿近海域成功標識放流了9尾體長介於3.8～9.6公尺間的鯨鯊個體，藉由電子標識籤所記錄的資訊，搭配海表面溫度、鋒面、海洋水色、海底地形以及颱風路徑等環境資料，發現鯨鯊的洄游與移動模式以攝食為主要導向，棲息溫度介於15～32° C之間，深度則多在近水表以及50～150公尺深的水層，春夏的日間鯨鯊在深水處的比例較高，夜間尤其午夜到清晨時段則會明顯上浮，冬春則上浮的時間不固定，且不論日夜，多在水面附近區域活動；洄游路徑資料則顯示夏秋常會移動至外洋水域，最遠可達146.77° E，而冬春主要進行沿岸洄游，洄游水域以東亞陸棚區為主，進行南北方向的移動。

此外，在年齡與成長的研究中，於2001～2006年，共採得92尾鯨鯊的脊椎骨樣本，另有2尾發育完全即將產出的胎仔標本，分別是全長61.0公分的雌魚以及54.8公分的雄魚，係來自1995年被捕獲的懷孕雌魚；從邊緣成長率及邊緣成長帶形成月別變化的分析結果，發現成長輪紋為一年形成兩輪；94尾脊椎骨樣本年齡加上一來自過去文獻的最大胎仔資料(全長64公分)，套適於三個參數的范氏成長方程式(VBGE)來描述鯨鯊的成長模式，求得VBGE各項參數分別為$L\infty$=16.31公尺TL，k=0.037年-1，t0=-1.24年；雄魚的性成熟年齡估計為17.2歲，而雌魚則約為19.2～22.6歲；估計本種的理論最大年齡(壽命)應大於79歲，終其一生，鯨鯊之平均年成長率為19.8公分/年。

從鯨鯊漁業調查及其他研究的結果顯示，西北太平洋的鯨鯊為成長相當緩慢的種類，其族群生活史中，於4～13歲之時，有很高的機會洄游至臺灣周邊海域，若漁業開發未加以管理便會造成其資源傷害；臺灣海域禁捕鯨鯊之後其來游量明顯增加，但資源量的變動則還需要進一步的研究，然而從洄游資料來看，國際間的合作及管理則是必須的。

## 減少刺網混獲海洋哺乳類之聲納發射器—生物聲納基礎之最適利用及減輕混獲與咬食之作法

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最初利用聲納設備減緩商業性網具漁業意外混獲海洋哺乳類之設計(一般稱為聲納警報器或發射器)，係用於警告動物在不注意時，如睡眠。發射器繫在網上，使得聲納警報信號與障礙物連結進而避免，並透過聯想學習刺激行為。在發射器(警報)與網具(障礙物)間作出一有效的聯想是必須的，倘若無障礙物則無須避免，邏輯上哺乳類對警報不會有行為上的刺激。在發射器未與一障礙物連結下，聰明的海洋哺乳類對警報之行為反應不一致。

一發射器與網具之連結需先由消極生物聲納(如簡單地聽)之發射器偵查，再以主動式生物聲納對網內的生物(海豚)進行回聲定位。對非回聲定位哺乳類之發射器偵查則可隨後以視力偵查及或基於水流過網具之聲納特性的消極生物聲納偵查，特別是對鬚鯨和海牛。較複雜的連結可包括對渠等相關聲響之行為反應，使哺乳類有充足的通道自發射器對每一網具所建立之安全區游走。

不管哺乳類之反應是否為人類所觀察，合適的警報或聲響發射器組成的工具，應基於其性能修改對於海洋哺乳類之整體反應，以避免哺乳類在實際漁業條件下被纏繞。漁業社會學家認為此減少混獲之技術成效，已鞏固在全球漁業實際情形下，引入此種發射器與網具連結工具的需要。

一個有效的聲納設備可預期能喚起哺乳類的認知，以引發如侵略或立即撤退或與發射器連結之網具保持較遠距離(通常為事件背景所引起)等行為反應，然重要的是混獲率的改變，但證明此改變通常極度困難，特別是對族群量有限且棲地受限之物種。漁業評論家對此表示，無法證明達不到混獲之降幅，可視為發射器本身之不足，應以較合理的結果取代，而不是失敗的試驗設計。漁業界單方面所敍述發射器與網具間任何相關的正面效益已獲得證實。

為減輕混獲，下列因素均對成功部署聲納發射器有所影響，如海洋哺乳類之聽力、聲納發射器沿著網具部署的距離、海域清澈度、發射器聲響在聲音環境之傳播、目標對象之硬度、屬於網具生物聲納疑問之強度。舉例來說：

- 倘網具長時間留置在水中，海藻生長附著在網繩上，在生物聲納研究下之網具目標對象強度將衰退，失去發射器和網具之連結，因而提高纏繞風險。
- 發射器為聲響設置的距離過遠，甚至在哺乳類可察覺之聲音水平下，只可到達發射器間的中途，因聲音傳播不良而無法產生一致的網具與發射器連結。
- 漁業法規所用的網繩和尺寸特性可以保護目標物種，然而哺乳類生物聲納之射束寬度的複雜互動，使得假設目標對象強度係網具材料密度及網眼數量也具有減少混獲的能力。

為減輕掠奪，下列因素很重要，如尚待被定義為「不喜歡」的發射器聲響、發射器或哺乳類生物聲納干擾、或簡單強化生物聲納未能事先偵查到的不適合及可能有害之漁具的發射器連結。

## 減緩待袋網/定置網與海龜之相互影響

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### 摘要

待袋網(poundnet)與定置網(set net)係日本沿岸漁業之主要漁法，此等被動性漁具由於僅需最小限度的勞力，且其所造成的棲地破壞微乎其微，因此被稱為生態友善型漁具。儘管尚處於引進的初期階段，該等漁具有推廣與運用至全世界的高度潛力，尤其是在東南亞國協(ASEAN)區域。雖然海龜與此漁具互相影響的資訊有限且未臻完整，但有許多研究報告顯示待袋網漁業意外捕獲相當程度的海龜(Gilman et al., 2010)。

大致上，待袋網與定置網具包括引網、外網及囊網。然而，漁具的設計與操作具高度多樣性，當地的各種要素，例如當地漁場的海洋學與地形學特徵、目標魚種與魚種體型，以及勞工等，將影響漁具設計和使用方法。因此，海龜減緩措施的開發與選擇，必須因個別漁業之不同而有所改變。

海龜因遭此等漁具纏住與受困而遭捕獲。例如美國待袋網漁業之主要問題，當使用網具之網目較大時，將使網具纏住海龜。然在日本，較少有待袋網網具纏住海龜的情形，日本主要的問題是海龜受困於袋網與口袋網內，待袋網漁具是否有袋網與口袋網，係海龜捕獲發生率之重要因素。然即使海龜進入待袋網周遭區域，由於牠們還可於海水表面進行呼吸，因此存活率仍高。相反地，海龜進入袋網與口袋網中，且受困於水面下時，由於袋網設有一空間，該空間會阻

止海龜浮上海面呼吸，因此海龜溺斃的機率高。這可經由下列四種減緩措施予以解決：

- 避免海龜進入待袋網；
- 避免海龜進入袋網；
- 讓海龜能在袋網中呼吸；
- 在繼續保有商業性魚種的情況下，讓海龜逃離袋網。

### 1. 避免海龜進入待袋網

此係避免海龜受困於待袋網的第一步驟。海龜會沿著待袋網的垣網游進網內，簡單的減緩方法便是在網口處併入一篩選柵欄(sorting grid)，以避免海龜進入網中。篩選柵欄之間的欄杆間距必須夠寬，以讓目標魚種能進入網內。另一個方法係合併某些海龜阻礙物，以避免海龜進入網口。

### 2. 避免海龜進入袋網

第二階段的海龜減緩措施，係在海龜進入待袋網後，避免其進入袋網中。相同的，使用篩選柵欄即可達到本目的。吾人應研究海龜與目標魚種之相互影響，以查明待袋網中既存的魚隻是否會吸引網外的魚隻，反之亦然，以及查明是否待袋網中的海龜會影響目標魚種的漁獲水準與品質。再者，處理進入待袋網中的海龜以及安全的釋放方法仍尚待研究。

### 3. 讓海龜能在袋網中呼吸

倘進入袋網的海龜能浮出海水表面呼吸，便不會溺斃。袋網之設計必須加以改良，以讓海龜能浮出海水表面。此方法僅限用部署在淺水區的漁具。該漁具之設計必須十分耐用，以應付嚴峻的海上條件及強烈的海流。改良漁具之設計圖亦必須說明其於捕撈作業期間之實用性。同樣地，必須有充分的研究以瞭解魚群與海龜在袋網內的相互影響，並針對遭待袋網捕獲之海龜，設計實際上最好的處理與釋放方案。

### 4. 讓海龜逃離袋網

袋網要設計成能讓海龜逃脱，並同時保住商業漁獲。我們嘗試開發海龜釋放器(turtle releasing devices；TRD)，以讓海龜能逃離袋網。TRD係由袋網/口袋網頂端的逃脱口與封蓋所構成。海龜能藉由身體推動封蓋，並從逃脱口離開袋網。在海龜逃離後，封蓋由於受到網具拉力的影響，將會自動關閉。由於小型與大型之袋網/口袋網的大小與設計有異，因此必須針對兩者分別設計不同的TRD。

### 4.1 小型圓錐形口袋網

我們進行一項設有錐形袋之小型待袋網研究，錐形袋長10公尺，直徑1.3公尺。袋子緊繫於海底，用以獲取保持圓錐狀之足夠張力。我們在錐形袋的頂端附上一個有蓋的正方型逃脱口(40x50公分)，該封蓋以絞鏈和逃脱口相連結，該逃脱口之設計係用於當海龜從袋網內部推動頂蓋時，頂蓋能向外開啟。該TRD能有效釋放海龜。80%以上放入袋中的綠蠵龜能藉由TRD順利逃脱(Abe et al., 2002)。

### 4.2 大型箱形袋網

大部分大型待袋網使用一置於水下且附有頂蓋之箱形袋網，尺寸大於小型待袋網的圓錐形口袋網。儘管海龜能經由TRD有效逃離小型圓錐形袋網，然我們擔心的是，因為海龜無法找出TRD的準確位置，並經由該裝置逃出網袋，使得該裝置運用在大型漁具之效率將有所降落。為處理這個問題，需考慮一項引導海龜前往TRD之裝置。為將海龜引導至TRD，我們思考如何調整袋網頂部傾斜度，並把TRD放置在頂部最高點，此係基於假設倘海龜欲浮上海平面呼吸，應該會往高處游之故(Takahashi et al., 2010)。

大型袋網的另一項問題是，該如何維持網具張力的持續性，且該網具須適合海龜開啟封蓋，並能在海龜逃離網具後自動關閉。為解決這個問題，我們發展新的TRD設計，稱為「TRD Unit」。TRD Unit設置於塑膠網具的中央部位，藉此產生穩定的張力，以讓TRD得以開合。此一新設計運作良好，所有的赤蠵龜與綠蠵龜在測試時都能順利透過TRD逃離網具，不過，有半數的玳瑁無法經由TRD逃離網具，因為牠們在推開頂蓋時的施力小於其他海龜物種(Shiode et al., 2010)。這些發現告訴我們必須考慮到不同海龜物種之間的行為模式。

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# 臺灣沿岸定置網海龜混獲及衛星追蹤混獲之赤蠵龜


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如吾人所知，海洋漁業會意外捕獲海龜，尤其沿岸水域係海龜聚集覓食之處，抑或與其洄游路線部分重疊。臺灣沿岸定置網漁業為固定式沿岸漁業，經常有混獲海龜的情形發生。自1998年3月至2010年5月止(共計12年)，位於臺灣東北角的宜蘭縣東澳村之定置網共捕獲90隻海龜。2008年混獲率最高(28%)，次為2007年(18%)與2009年(11%)。所有海龜皆未遭傷害，且由漁民予以活體釋放。就海龜種類觀之，其中綠蠵龜佔51%(46隻)、赤蠵龜佔48%(43隻)，以及玳瑁佔1%(1隻)。在綠蠵龜中，61%為幼龜(28隻)，39%為成龜(18隻)；成龜中母龜佔72%，公龜佔22%。幼龜平均背甲曲線長(CCL)為73.2±13公分(n=28)；成龜為80.4±6公分(n=34)。玳瑁為幼龜，背甲曲線長33公分。大部分的混獲綠蠵龜為亞成龜，赤蠵龜則多為母成龜。

赤蠵龜幼龜混獲主要發生於晚秋至冬季，因此該定置網漁場可能與赤蠵龜成龜之洄游路線重疊。為此，我們開始執行一項跨國合作標識計畫。臺灣並沒有赤蠵龜之產卵場，而據基因分析指出，這些個體可能來自日本的產卵群。該種群係屬在日本產卵的北太平洋赤蠵龜，目前資源狀況良好。因此對全球赤蠵龜資源量而言，該種群係重要之成員，而對於其他造成該種群死亡之任何原因，皆須予以詳細驗證並將其降至最低。本研究之目的，係將臺灣定置網漁業混獲之赤蠵龜繫於衛星發報標籤，以分析其遷移模式，並透過遙測衛星資料，以推斷該赤蠵龜族群棲地利用模式和大型海洋渦流等區域性海洋學特性之關係。

臺灣太平洋沿岸定置網所捕獲之34隻混獲赤蠵龜，均已附上衛星發送標籤(表1)。捕獲期間為2002年至2008年，就體長來看，背甲直線長(SCL)約為64公分至92公分(CCL則為69公分至95公分)。本研究過程中使用多種不同的標籤，包括Telonics ST-18(10個)、ST-14(2個)、ST-20(14個)、ST-24(3個)，以及Wildlife Computers SPLASH標籤(6個)，並用聚酯樹脂與玻璃纖維布將標籤黏貼於海龜背甲上。本研究中之標籤少有訊號發送失敗情形。由於本研究配置的一個ST-24標籤發生故障，因此其並未用於本分析中，剩餘的34個標籤則持續發送資料，平均傳送天數為172天(傳送範圍從6至503天)，追蹤訊號之個別發送天數共計5,860天。定位資料下載自ARGOS，並予以歸檔以供運算之用。當34個標籤皆停止傳送資料時，本研究即宣告終止。自衛星標籤蒐集之原始ARGOS定位資料，則運用貝氏狀態空間模型(Bayesian state-space modeling；SSM)予以處理。SSM模型透過ARGOS數據質量碼(data quality codes)與時間上相鄰位置(temporally adjacent positions)計算出最有可能的軌跡，亦將所有軌跡重組為每日動線，從而消除受到變動工作週期之影響(圖1)。

| PTT ID | PTT種類 | SCL(公分) | 部屬日期 | 開始緯度 (°N) | 開始經度 (°E) | 終止日期 | 結束緯度 (°N) | 結束經度 (°E) | 追蹤日數 | 綜合距離 (公里) | 終點距離 (公里) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 19593 | ST-14 | 71.8 | 25-Jan-07 | 24.50 | 121.80 | 13-Jul-07 | 33.31 | 123.57 | 170 | 5603.27 | 992.66 |
| 19597 | ST-18 | 64.0 | 02-Apr-03 | 24.49 | 121.90 | 16-Aug-04 | 28.32 | 123.58 | 503 | 7097.52 | 458.62 |
| 19599 | ST-18 | 74.5 | 16-Jan-04 | 24.45 | 121.94 | 28-Aug-04 | 32.28 | 126.98 | 226 | 5609.04 | 897.47 |
| 19606 | ST-18 | 67.7 | 19-Feb-03 | 24.45 | 122.00 | 10-Aug-03 | 22.46 | 117.98 | 173 | 4130.11 | 465.84 |
| 22981 | ST-18 | 74.0 | 22-Mar-04 | 24.47 | 121.89 | 27-Aug-04 | 35.11 | 161.06 | 158 | 8642.19 | 3966.55 |
| 23068 | ST-18 | 72.0 | 30-Nov-04 | 24.47 | 121.84 | 23-May-05 | 34.66 | 145.11 | 175 | 5980.64 | 2522.40 |
| 23513 | ST-18 | 68.7 | 08-Mar-04 | 24.49 | 121.81 | 20-Mar-05 | 22.52 | 117.86 | 377 | 3905.96 | 459.12 |
| 23559 | ST-18 | 72.1 | 19-Apr-04 | 24.50 | 121.80 | 25-Jun-04 | 36.79 | 151.66 | 68 | 4666.79 | 3138.90 |
| 25360 | ST-18 | 76.5 | 05-May-02 | 24.56 | 122.00 | 09-Oct-02 | 32.97 | 128.22 | 158 | 3453.35 | 1112.86 |
| 29066 | ST-18 | 71.3 | 21-Dec-03 | 24.50 | 121.80 | 31-Jan-05 | 29.32 | 149.72 | 408 | 14285.62 | 2824.89 |
| 40470 | ST-24 | 74.5 | 23-Dec-08 | 25.59 | 122.20 | 16-Feb-09 | 21.42 | 115.46 | 52 | 1225.34 | 829.84 |
| 40473 | ST-24 | 66.5 | 04-Dec-07 | 25.38 | 122.66 | 01-Jul-08 | 32.46 | 132.56 | 210 | 2483.99 | 1244.03 |
| 41315 | ST-20 | 74.5 | 17-Oct-06 | 24.50 | 121.80 | 20-Jan-07 | 28.17 | 130.27 | 95 | 3814.74 | 936.55 |
| 41423 | ST-20 | 92.0 | 19-Oct-07 | 24.51 | 122.03 | 05-Apr-08 | 14.47 | 111.16 | 169 | 3707.65 | 1593.81 |
| 41788 | ST-20 | 82.5 | 14-Jan-08 | 26.37 | 125.20 | 02-Aug-08 | 26.45 | 127.64 | 90 | 2151.86 | 243.85 |
| 41789 | ST-20 | 70.0 | 13-May-08 | 25.94 | 122.80 | 09-Nov-08 | 27.32 | 126.04 | 174 | 2254.59 | 357.92 |
| 42714 | SPLASH | 78.0 | 10-Jun-09 | 25.49 | 123.30 | 28-Jun-09 | 29.21 | 126.53 | 382 | 4029.34 | 521.97 |
| 4800 | ST-14 | 69.5 | 09-Feb-07 | 24.33 | 122.10 | 20-Apr-07 | 21.52 | 116.90 | 70 | 2009.11 | 617.56 |
| 50144 | ST-20 | 72.0 | 14-Jan-05 | 25.51 | 123.00 | 08-Jul-05 | 23.09 | 118.10 | 173 | 3258.40 | 566.38 |
| 50145 | ST-20 | 70.0 | 19-May-05 | 24.58 | 121.90 | 11-Mar-06 | 30.08 | 153.28 | 295 | 10960.24 | 3184.93 |
| 5152 | ST-18 | 69.7 | 02-Jun-03 | 24.50 | 121.80 | 07-Jun-03 | 25.80 | 123.13 | 6 | 205.43 | 195.97 |
| 53743 | ST-20 | 74.5 | 26-Jun-05 | 24.49 | 121.87 | 22-Aug-06 | 30.23 | 125.61 | 387 | 5017.65 | 736.52 |
| 53745 | ST-20 | 79.0 | 21-Nov-05 | 24.49 | 121.88 | 16-Jan-06 | 28.59 | 125.73 | 57 | 1115.18 | 596.71 |
| 53746 | ST-20 | 83.0 | 14-Apr-05 | 24.49 | 121.81 | 07-Nov-05 | 27.77 | 123.66 | 208 | 4674.89 | 407.11 |
| 53747 | ST-20 | 67.3 | 15-Mar-05 | 24.50 | 121.80 | 21-Nov-05 | 26.28 | 122.03 | 251 | 5957.75 | 419.13 |
| 53748 | ST-20 | 74.5 | 21-Dec-05 | 25.23 | 122.70 | 07-Mar-06 | 22.46 | 117.88 | 77 | 1755.23 | 579.00 |
| 53750 | ST-20 | 76.0 | 04-Apr-05 | 24.91 | 123.70 | 30-Jun-05 | 28.34 | 121.83 | 87 | 2214.29 | 423.35 |
| 53758 | ST-20 | 80.5 | 01-Feb-05 | 24.44 | 121.90 | 29-May-05 | 5.61 | 114.89 | 118 | 5199.59 | 2216.07 |
| 53768 | SPLASH | 72.5 | 28-Apr-06 | 24.44 | 122.59 | 24-Sep-06 | 37.02 | 141.75 | 82 | 4139.80 | 2304.84 |
| 53769 | SPLASH | 73.0 | 10-Mar-06 | 22.41 | 118.83 | 04-Jun-06 | 26.38 | 120.71 | 73 | 661.39 | 475.52 |
| 53770 | SPLASH | 78.5 | 17-Jan-06 | 24.56 | 121.89 | 17-May-06 | 29.68 | 124.83 | 62 | 1666.05 | 637.86 |
| 53771 | SPLASH | 76.0 | 10-Feb-06 | 24.59 | 121.50 | 14-Jul-06 | 2.36 | 104.41 | 154 | 4968.15 | 3079.59 |
| 53772 | SPLASH | 73.0 | 13-May-06 | 24.64 | 122.00 | 08-Sep-06 | 26.13 | 121.76 | 60 | 1547.38 | 58.75 |
| 67469 | ST-20 | 77.0 | 04-Jan-07 | 25.47 | 122.40 | 29-Apr-07 | 27.00 | 124.50 | 111 | 1459.65 | 270.37 |
| | 平均值 | 74.0 | 24-Sep-05 | 24.71 | 122.13 | 26-Mar-06 | 26.63 | 126.95 | 172 | 4172.12 | 1159.34 |
| | 中位數 | 73.5 | 09-Sep-05 | 24.50 | 121.90 | 9-Mar-06 | 28.22 | 124.06 | 158 | 3860.36 | 627.71 |
| | 最小值 | 64.0 | 05-May-02 | 22.41 | 118.83 | 9-Oct-02 | 2.36 | 104.41 | 6 | 205.43 | 58.75 |
| | 最大值 | 92.0 | 23-Dec-08 | 26.37 | 125.20 | 28-Jun-09 | 37.02 | 161.06 | 503 | 14285.62 | 3966.55 |

**表1** 臺灣定置網捕獲34隻附有衛星標識之赤蠵龜(Caretta caretta)資訊摘要

註：PTT係指「發報器終端機平台(platform terminal transmitter)」。

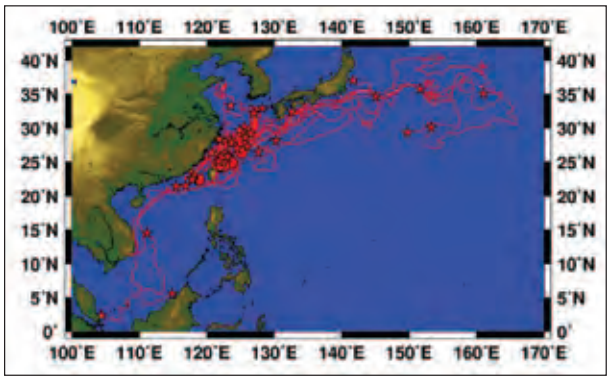


**圖1** 赤蠵龜衛星軌跡地圖
備註：圓圈代表野放地點；星號代表訊號最終發送地點。

洄游軌跡並併入一套可行的海洋、水深與磁力資料系統中，這些資料包括NOAA Pathfinder之海水表面溫度(SST)、AVISO測高衛星(海表面高度(SSH)、地轉u分量與v分量)、SeaWiFS海洋水色、Smith and Sandwell地形檔，以及自IGRF-10模型(總力、偏角、傾角)所得之地球磁場資料。除每日檢驗該等資料外，亦算出每隻海龜的每日平均暴露量，並將該數據套入所有軌跡追蹤期間。其後則將SSM軌跡整合至一新的海洋資料系統，該系統透過遙測測高地點之時間序列，以量化個別的渦流。這些高能量中尺度特性(energetic mesoscale eatures)，係大型洋流與海洋暖流流經海洋後之主要動態特性。

我們提出一項名為渦流場隨機採樣(eddy field randomization；EFR)之新研究途徑，該途徑統計評估海龜定位與特定渦流之特性是否一

致。EFR推斷出海龜是否被此等特性吸引(或趨避)，且可藉由渦流之取向(例如氣旋渦流或反氣旋式渦流)，以論證表層赤蠵龜對渦流與渦流特定部分(例如邊緣處或中心部)的不同反應。除SSM之每日海龜定位外，則透過EFR途徑本身的一項測試來檢驗該途徑所執行之三種無感資料(non-sentient data)。第一，將EFR應用於一組隨機游動軌跡(random-walk tracks)。第二，將EFR應用於一組模擬被動粒子軌跡(simulated passive particle tracks)。第三，將EFR應用於本分析中，空間與時間範疇(1,291個浮標之32,963個個別位置)之水下漂流浮標(懸掛於水深15公尺處)。藉由比較SSM測試結果與此等額外應用程序，以瞭解赤蠵龜利用渦流模式的潛在機制，以及被動與主動取向(passive versus active orientation)所扮演之角色。EFR分析途徑並未分辨出渦流特性與評估過的無感資料之間有任何因果關係，並指出無顯著之吸引或趨避傾向。而對於赤蠵龜之標籤資料，該分析途徑則指出，氣旋式渦流特性對赤蠵龜具吸引力，這點顯見於任何強度的氣旋式渦流邊緣處(圖2)。

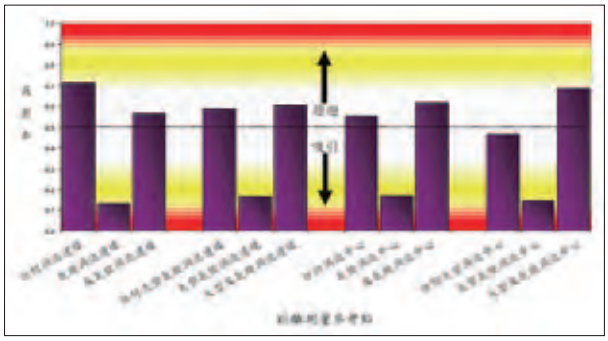

**圖2** 臺灣標識赤蠵龜之EFR分析結果

臺灣地區的赤蠵龜似乎亦利用鄰近長江的大陸架作為覓食區，該區域係長江淡水遭黑潮入侵之處，且因複雜動態而非常富饒。該處海床夠淺且適合海底覓食，然亦多有渦流活動。該區域捕撈活動密集，漁船主要來自中國。赤蠵龜是否為這些漁船或大陸架的其他漁業活動之目標漁獲或意外捕獲，尚屬未知且需進一步調查。赤蠵龜於該區域海底及表層棲地之飲食習性與群體結構，未解之處仍多，有待進一步研究。

## 評估與減緩拉丁美洲小規模沿岸漁業可能造成問題之混獲

**Martin Hall**
美洲熱帶鮪類委員會

處理任何混獲問題之基本考量不外乎：努力量與單位混獲努力量(bycatch-per-unit of effort；BPUE)。評估漁業混獲須同時估算此兩項目。觀察員計畫似乎是獲取可靠BPUE的唯一途徑。觀察員計畫成本高且組織工作複雜，尤其家計型漁業觀察員計畫更為複雜。然確有設立觀察員之必要，在考量成本與複雜度情況下，抽樣設計(sampling design)是合理化使用資源的主要關鍵。而遴選觀察員並予以訓練，係促使此類計畫成功之重要因素。

在實際作業漁船上執行科學性實驗可以測試減緩措施。在整個過程中，需要漁業界的合作。本文將運用在東太平洋區域性海龜計畫中獲得的經驗，以闡明所遭遇到的挑戰及研發出的解決方案。

**研討主題3：**減少海洋漁業對敏感性物種之混獲

**研討主題3B：**市場機制和漁業混獲

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## 研討主題3B摘要

# 市場機制和漁業混獲

**主持人：Lida Pet-Soede博士**，世界自然基金會珊瑚三角區計畫主持人

**預期結果：**指出市場機制如何影響漁業生產實務及有關減緩敏感性物種混獲之治理架構，以及未來如何應用這些方法對永續漁業作出貢獻，並為參與的漁業開創新市場及鞏固既有市場。

包括生態標籤和其他漁業認證計畫之市場機制，以及食品雜貨零售商與其供應商運用永續水產品來源策略，已是海洋漁業混獲達到可承受水平之一有效方法。在有些區域，非政府環保組織及消費者，對零售商和餐廳販售之水產品應為永續食品之需求漸增。鑒此，近來評估個別漁業及魚種之永續性的計畫激增，包括零售商之內部計畫、經海洋管理理事會等第三方之評估計畫和捕撈漁業評估其自身永續性之內部評估計畫。

永續漁業夥伴說明，影響私部門創造包括永續水產品採購政策、供應鏈契約、生態標籤及其他計畫等工具之因素範圍(詳見Duncan Leadbitter先生之專題簡報摘要)。鮪類產品之銷售者可察覺降低產品遭污名化之公共風險的優勢，或一企業可試圖將該等產品打入市場，以供應永續水產品。捕撈業者需瞭解買主的行動方式。

本節亦提及歐洲對永續鮪類產品之觀點及消費者對此類產品之需求(詳見Henk Brus先生之專題簡報摘要)，描述鮪類包裝業者及零售商如何因應不利名聲之策，如當黃鰭鮪遭環保組織描繪為過漁時，轉標示為基因鮪魚肉。歐洲各國消費者對鮪類永續性之興趣不一，以英國及德國消費者之興趣最高。此外，供應鏈在認證計畫中所提供文件證明之複雜性亦遭披露，亦說明Sustunable公司所採之新法，旨在從可持續及具社會責任之漁業取得永續魚類。

甫由水產業、科學家和世界自然基金會共同成立之國際水產永續基金會所採行動和影響之個案研究，闡明五個區域性鮪漁業管理組織如何改善其治理，以達成鮪漁業之永續，包括可持續的目標鮪類系群和混獲物種之漁獲死亡率水準、及如何催化鮪類加工業者與世界自然基金會合作(詳見Lida Pet-Soede博士之專題簡報摘要)。

珊瑚三角區漁人論壇所提之報告，說明混獲和技術轉移之市場機制解決方案如何對持續減緩混獲過程作出承諾(詳見Keith Symington博士之專題簡報摘要)。

本節亦說明用於評估資料不足漁業之混獲及留置漁獲的海洋管理理事會之協議，並述及在漁業評估方法論中運用風險基礎架構(詳見Bill Holden先生之專題簡報摘要)。

在三個東南亞國家(泰國、馬來西亞及印尼)發展和運用海龜脫逃器之個案研究，強調監測、管控與偵察之角色及其與改變漁業實務之市場機制能力的關連性(詳見Bundit Chokesanguan先生之專題簡報摘要)。

臺灣賞鯨業自1997年開始蓬勃發展，該個案研究敘述傳統漁業轉型為非消費型海洋產業，因傳統漁業受資源過度利用而變得獲利較差(詳見李明華女士之專題簡報摘要)。

本節討論之結果顯示，原則上支持零售商與其買主和供應商之間的互動，及海洋捕撈漁業應透過機制改善其漁業永續性，如運用混獲減緩措施之最佳實踐及改善國際治理之不足。

研討主題3B：

# 簡報摘要

## 臺灣傳統漁業轉型經營賞鯨業之概況

**李明華**
中華鯨豚協會

隨著沿近海漁業資源之日益枯竭以及漁船數量過多，臺灣傳統漁業活動逐漸沒落，為減少作業漁船數，以紓解漁業資源的壓力，漁業署積極輔導漁民將傳統生產型漁業轉型為資源管理型漁業，娛樂漁業乃因此應運而生。娛樂漁業所稱之漁業範圍，包括觀賞漁撈作業或海洋生物及生態之休閒活動，賞鯨活動也是娛樂漁業之經營範疇。其經營方式分專營與兼營娛樂漁船兩種。專營娛樂漁船主要從事載客賞鯨、登島、遊海等活動，兼營娛樂漁船可經營海釣、捕魚、登島、遊海及載客賞鯨等活動。從近年來搭乘娛樂漁船出海賞鯨活動的人數來看，可知賞鯨活動蓬勃發展迄今已成為國內娛樂漁業產業中重要的一環。尤其是當第一艘賞鯨船於1997年7月在花蓮的石梯港開航之後，臺灣的賞鯨活動迅速的在東海岸擴展開來。帶動了國內生態旅遊的市場商機，也為賞鯨業者與相關產業帶來高達12億以上的整體效益。

臺灣賞鯨活動主要分佈在東海岸一帶，依觀賞鯨豚的海域可區分為龜山島周邊、花蓮、台東等區域，目前經營賞鯨的娛樂漁船至少有24艘以上。每年的5月~10月是賞鯨活動的旺季，其餘時間因為東北季風吹拂，海上風浪強勁，較不適宜一般遊客出海。賞鯨業者訂有固定的航班，每日提供2-3個航班，暑假旺季則會增加到4個航班，每趟航班約需2-3個小時，費用通常介於800-1000元間，視報名人數而定。賞鯨的範圍主要在港口周圍20海哩內的海域，除了尋找鯨豚、觀賞鯨豚外，部分賞鯨船也有自然景觀、登島、海釣、漁撈作業及其他海洋生態的介紹，增加遊憩活動的深度與多樣性。目前在東海岸鯨豚的發現率約在7-9成，瑞氏海豚、長吻飛旋海豚、熱帶斑海豚、瓶鼻海豚等小型海豚為最常見，弗氏海豚、小虎鯨、偽虎鯨、短肢領航鯨等次之，偶爾幸運也有機會發現虎鯨、抹香鯨等大型鯨類，鯨豚種類相當豐富。

臺灣的賞鯨活動發展從1997年7月啟航之後，開始急速的成長，發展至2002年以後，賞鯨船數從25艘，增加至高達33艘以上，參與賞鯨的人數估計每年超過22萬5千人次以上，可說是賞鯨活動的高峰期。雖然賞鯨業發展十分快速，其中賞鯨船進出市場也經常變動，目前除了宜蘭龜山島海域持續成長外，石梯、台東賞鯨人數都開始下滑。根據中華鯨豚協會長期的資料顯示，2009年賞鯨活動集中分佈於6個港口，業者估計達19家，船數達24艘，參與賞鯨人數估計達25萬9千人次以上。

但是從2003年開始，蓬勃發展的賞鯨產業，在市場營運與經營管理上，卻也面臨了許多的問題及挑戰，諸如賞鯨船業者間出現相互削價競爭之現象，賞鯨票價、行程與品質的參差不齊，及成長迅速的賞鯨船數可能帶來對鯨豚生態的衝擊等，這些隱憂已成為國內學者專家保育團體所關注。為了要永續發展臺灣的賞鯨活動，2003年漁業署開始推動「賞鯨標章」評鑑制度，希望能夠透過「賞鯨標章」認證制度的建立，讓消費者選擇有品質的賞鯨遊程，同時希望透過消費者選擇的機制，讓業者能有自我提升的意願，因此如何有效規劃及管理賞鯨產業的健全發展，是現階段的重要課題。「賞鯨標章」針對服務品質、環保動作、環境教育功能、解說表現、駕駛規範等超過44項的指標作評鑑，除了實地上船評鑑外，每年還會實施暗評追蹤以確保品質，目前通過「賞鯨標章」

認證的賞鯨船共有8艘，分別在花蓮港有3艘，石梯港有1艘，烏石港有3艘，成功港有1艘。賞鯨標章也是臺灣目前唯一與生態旅遊有關的標章，希望透過消費者自發性選擇，與業者良性的競爭，提高賞鯨生態旅遊的品質，以達賞鯨永續發展之目標。

## 減緩混獲：全球鮪類資源永續任務之核心因素

**Lida Pet-Soede[1*], Susan Jackson[2]**

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在諸多支持全球鮪類資源永續的因素當中一資料蒐集與通報；非法、無報告、不受規範(IUU)漁撈揭露與法規遵守；資源評估；區域性漁業管理組織之管理與執法；從漁網到餐盤的可追溯性；漁撈能力管理；作業監測、檢查和管控等一減緩混獲扮演連結其他所有要素之角色，為最重要的核心因素。

鮪魚混獲要大程度地減少，需要其他永續性因素整體同步跟進。抱持這樣的觀念，甫由水產業、科學家和世界自然基金會(WWF)共同成立之國際水產永續基金會(ISSF)，在運作的第一年即直接以採取保育行動的方式介入水產業，或奠定促使其他永續因素整體改變之基礎，ISSF隨後召開第1屆減少全球鮪魚混獲工作小組。受到ISSF的支持，與資源永續相關的利害關係人已準備進行海上混獲研究，發展最佳實踐，並與鮪類區域性漁業管理組織就治理、漁業管理系統、紀律與執法等方面持續合作。可預見這些發展將有助於減緩鮪魚混獲，目前各式各樣的相關措施未作整合，且在遵守程度上有極大差異：大型圍網船觀察員涵蓋率在美洲熱帶鮪類委員會(IATTC)和中西太平洋漁業委員會(WCPFC)管轄水域幾達100%，但在其他區域性漁業管理組織管轄水域卻有很大的差異：例如區域性漁業管理組織的丟棄量通報規定各有不同，此類規定亦因依物種、漁具/船舶類型不同而有所差異；ICCAT之圍網漁業和一支釣漁業禁漁期和禁漁區規定；印度洋鮪類委員會(IOTC)全年限制集魚器主要使用之地區；鮪漁獲留置，IATTC和WCPFC以決議案規定之，IOTC以建議案規定之；IATTC和WCPFC之集魚器監測管理計畫、IOTC要求圍網漁業提出使用集魚器之成效報告；四個鮪類區域性漁業管理組織為限制或減少混獲所採取之共同措施，特別是鯊魚、海龜和海鳥混獲；評估漁業(特別是延繩釣漁業)對海鳥之衝擊的措施。

雖然前述四個區域性漁業管理組織已採取無數措施，從不同層面監測和減緩混獲。但目前尚無任何鮪區域性漁業管理組織係有系統地採取一套措施，以作為處理混獲問題之最佳實踐。

不論混獲減緩最佳實踐未來可能的種類為何，1995年聯合國魚類資源協定(Fish Stocks Agreement)已在國際層級上提供可能的目標，這些目標可由區域性漁業管理組織採取最佳實踐達成，特別是獲得並評估科學建議、檢視資源狀況和評估漁業對非目標魚種及相關或依存物種之衝擊，彙整發布正確且完整的統計資料，以確保獲得最佳科學支持，並在適當時維持資料的保密性。

有關混獲減緩最佳實踐，目前成形之建議為以區域性漁業管理組織為主之相關建議包括：丟棄量估計；觀察員；依漁具作混獲紀錄；集魚器管理；試驗性捕撈；漁獲完全留置；漁具規格；小型鮪類、鯊魚、海龜、海鳥、海洋哺乳類、和其他非目標魚種之混獲資料蒐集與通報；由區域性漁業管理組織分發混獲資料；漁業對混獲物種之衝擊；生態系統研究；減少丟棄與混獲。

目前尚無任何解決混獲問題的法寶，因此還有很大的進步空間留待與減緩混獲和其他永續因素有關的新想法、實踐、技術來填滿。ISSF保證將盡心盡力保護海洋資源以支持全球水產業中最具價值之一的鮪漁業。除黑鮪資源外，另有19種鮪類支持著全球商業性漁業活動。19種中有12種資源狀況良好，無過漁現象，其中有5種為最具商業價值之正鰹種群。這12種魚種佔全球鮪漁獲量85%，然而其中20%目前出現過漁現象，倘不限制漁獲努力量，這些資源將遭受過漁。當然，ISSF將竭力確保全部資源的健康。

ISSF於2009年3月正式成立，其創始會員包括世界自然基金會、Bolton Alimentari、Bumble Bee Foods/Clover Leaf Seafoods、MW Brands、

Princes Ltd.、Sea Value Co., Ltd.、StarKist Co.、Thai Union Mfg./Chicken of the Sea及Tri Marine International，之後加入的會員包括FRINSA和Negocios Industriales Real NIRSA S.A。ISSF世界級科學委員會由主席Victor Restrepo博士(前ICCAT助理秘書長)和副主席Meryl Williams博士(亞洲水產協會Fish Watch-Asia Pacific計畫創始協調者)領導。

ISSF之最終目標為支持鮪魚資源在健康的生態系統中維持或高於最大可持續生產量所需的資源量，ISSF首要之務為與區域性漁業管理組織及其所屬科學家共同合作；跟進並執行健全的科學建議；竭力消除任何捕撈目標魚群之IUU活動；支持目標魚種所在之生態系統之維護與健康；促進預警措施之應用，以養護、管理和利用漁業資源；支持實施合適的措施，以極小化捕撈作業之廢棄物、丟棄、漁具拋棄或流失、混獲、及捕魚對相關或依存物種之負面衝擊；藉由促進蒐集適當資料和與相關團體交換資訊，增進對於主要漁業狀況之了解；透過符合2005年聯合國糧農組織(FAO)海洋捕撈漁業水產品生態標籤準則(Guidelines for the ecolabeling of fish and fishery products from marine capture fisheries)之計畫，支持追求永續認證之漁業。

## 珊瑚三角區漁人論壇：管理混獲之市場機制夥伴關係

**Keith Symington，Lida Pet-Soede**
世界自然基金會珊瑚三角區計畫

### 摘要

利用減少混獲的技術及採取較佳捕魚方式解決混獲問題，可幫助水產業立即降低捕魚之負面衝擊，邁向更永續和責任型之漁業管理。永續捕撈水產品市場需求日益增加，加上新興的貿易限制，無疑是拓展珊瑚三角區內使用減少混獲之漁具和技術的機會。海洋管理理事會(Marine Stewardship Council, MSC)之生態認證下的珊瑚三角區漁業仍是重要的目標，在大多數情況下以符合MSC永續和管理標準為長期目標。因此，減少混獲技術可作為逐步及持續改善的基礎以達永續，如延繩釣漁業使用圓形鉤、拖網漁業使用脫逃器。該作法確實引起許多水產品公司和生產者的興趣，許多業者目前致力於降低該區的混獲。為優化成功及確保供應鏈夥伴廣泛運用創造重大的改變，需有一套策略教導自我營利之漁民和漁業公司，重點在於透過了解漁具改良技術，將直接影響混獲物種捕撈量及可能減少衝擊的經濟誘因和限制因素。珊瑚三角區漁人論壇(The Coral Triangle Fishers Forum, CTFF)係受國際漁業人論壇一系列會議所啟發，為珊瑚三角區漁業每兩年之一系列會議，提供機會以解決水產品供應鏈所有環節面臨的問題。茲提供2010年6月首次CTFF會議所通過之結論、建議、優先性和新具體計畫，並略述未來之策略。

### 簡介

混獲是意外捕撈非目標物種，已成為政治、管理、產業和環保團體的主要關注焦點，是達成保育、永續和糧食安全的前置議題。漁業混獲之普遍性及未受管理之「多魚種」漁業是珊瑚三角區目前面臨最急迫的海洋保育與資源管理問題。然此區域漁業有極大潛力減少混獲、改善多魚種漁業管理和實際改進捕魚方式。

利用減少混獲技術及採取較佳的捕魚方式解決混獲問題，可幫助水產業立即降低捕魚之負面衝擊，邁向更永續和責任型的漁業管理。許多珊瑚三角區內之水產品業者已作出重大承諾，將致力於降低混獲，創造責任型漁業，並許下水產業更永續的未來。

珊瑚三角區的政府也對減少混獲作出宣誓，如菲律賓總統艾羅育(Gloria Arroyo)於2010年1月宣告支持圓形鉤，因該項技術可降低延繩釣漁業之80%海龜混獲量，並與水產業者簽署多項備忘錄，旨在履行較佳的捕魚方式。

儘管具有持續性正面保育效益及重大轉變，珊瑚三角區仍未充分採用減少混獲漁具之解決方案，許多因素中像是：缺乏規範、執法能力低及管理能力差，使得使用率低。在經濟誘因和限制因素方面之障礙包括：

- 對當地漁民採用適當漁具或實行最佳捕魚方式之直接經濟誘因少之又少；
- 高捕魚及生產成本(包括改變作業方式之成本)；
- 漁獲品質差及其他販賣損失(如買主之要求)；
- 鮮少進入國際市場或開發新市場；
- 主要供應鏈參與者(加工業者、中盤商等)對於責任型水產品市場要求之體認與關切有限；
- 對採買永續水產品之買主缺乏合作協定與契約；
- 當地執行先進的作業方式與規範之管理能力差；及
- 欠缺追蹤方案，將水產品供應至加工業者、供應商和出口商等細節文件化。

**為減少混獲建立市場機制**

體認前述實際困難與障礙，世界自然基金會(WWF)珊瑚三角區計畫已研擬策略，最初著重於透過自我營利的供應鏈參與者之教育推廣，獎勵使用合適的技術和方法。

此新作法需先解決限制使用合適技術的主要經濟誘因和限制因素(一般多是混獲之額外收入)，並建立新的誘因，包括：

- 對高價水產品而言，結合減少混獲漁具之發展及改善供應鏈之捕獲後措施和品管能力建置/訓練，以提升目標魚種所取得之收入；
- 發展買主和當地生產者之直接合同契約，供應適當混獲量之水產品，以降低市場之不確定性；
- 為混獲量適當之產品開發利基市場，並為目標漁獲創造較高價值；
- 開發並由漁民直接測試降低燃油成本之新技術，使其單航次獲益較高；
- 增加漁民體認混獲量高之問題漁業，其漁獲進入市場可能之困難，以及目前歐盟有關國際水產品之規定及水產品貿易之其他限制；及
- 嘗試利用優渥補貼，支持引入減少混獲技術的方案，並尋求私部門及政府長期支持減少混獲方案之承諾。

**珊瑚三角區漁人論壇**

受國際漁業人系列論壇之便利資訊交流示範所啟發，為同業及供應鏈所有環節參與者間之學習及對話，提議召開珊瑚三角區漁人論壇(The Coral Triangle Fishers Forum, CTFF)，成為珊瑚三角區漁業每兩年對話之一系列會議。CTFF首次會議於2010年6月由東南亞漁業開發中心、WWF及印尼海洋事務部共同召開，主題著重於減少混獲之市場機制夥伴關係，提供解決前述面臨問題的及確認可行方案的機會，並發展新夥伴關係。

該會議目的包括獎勵全部供應鏈採用減少混獲技術、為減少混獲擴展市場機制及加強發展新式減少混獲技術與方法之創新。

本次簡報將概述CTFF首次會議之結果及會議對目標與具體結果的進展，並提出會議結論、建議、優先性和通過之新具體計畫，及略述未來之策略。

## 用於評估資料不足漁業混獲之海洋管理理事會(MSC)協議

**Bill Holden**
海洋管理理事會

本文討論如何用風險基礎架構(Risk Based Framework；RBF)，以評估資料不足漁業(data deficient fisheries)之混獲。

海洋管理理事會(Marine Stewardship Council；MSC)的核心，係「永續漁業之原則與標準(Principles and Criteria for Sustainable Fishing)」，其係藉由第三者判斷，並以具獨立性與得任意申請之認證機制為運用基準。這些規範約10年前開始發展，並透過廣泛且國際性之諮詢過程，蒐集漁業利益關係者的觀點而訂定。

不論捕撈作業規模大小，MSC皆賦予其接受認證機制之均等機會。每次認證將檢討漁業的範圍、規模、種類、地點與強度之可能影響，以及資

源的獨特性與對其他生態系統所造成的影響。構成認證機制的三項原則如下:

**原則1** 漁業必須以不會導致過漁或利用資源枯竭之方式進行,而對枯竭的資源,則必須實施能明確促進其復育之漁法;

**原則2** 捕撈作業應慮及維持漁業所仰賴之生態系統(包括棲地、相關附屬物種與生態相關物種)的構造、生產能力、功能與多樣性;以及

**原則3** 漁業受有效管理系統之約束,該系統須尊重地區、國內與國際之法律及基準,並納入制度化之可行架構,以負責任且永續利用資源。

本發表將著重於原則2部分,以及供評估資料不足漁業混獲之具體協定。該原則的意圖,係在於鼓勵漁業自生態系統觀點來設計一管理系統,以評估與抑制漁業對生態系統之影響。

在MSC計畫中,設計用來評估所有漁業之系統為「漁業評估方法論(Fisheries Assessment Methodology;FAM)」。該方法係以MSC「永續漁業之原則與標準」(MSC基準)為基礎,而提供一項分層且多元化的標準結構,以用來評估漁業。該結構稱之為評估樹狀圖(default Assessment Tree),在所有評估中,應運用此結構與所規定之績效指標(performance indicators;PI)與評分指標(scoring guideposts;PISGs)。

評估樹狀結構分成三個層級,以供評分之用:

- **第1級**:係MSC「永續漁業之原則與標準」中所述之MSC原則。
- **第2級**:構成要件(Component),係原則中較高層級的分支部分。
- **第3級**:績效指標(PI),其為原則中進一步細分之分支部分,說明漁業之評分要點。

在原則1與2之下有多項績效指標,用以估算結果(狀態)、資訊,並執行管理,以維持每一構成要件狀態。

原則2所考量者,可分為五項構成要件,其涵蓋範圍包含可能遭受漁業影響之潛在生態系統要件。

- **保留物種**:根據評估後,漁業欲保留之物種(通常因其具商業價值,或因管理規定要求而予以保留)。
- **混獲物種**:遭意外捕獲並未被保留之生物(通常因其不具商業價值)。
- **ETP物種**:係經國家立法機關,以及/或具拘束性之國際協議認定(例如華盛頓公約[CITES])之瀕危(endangered)、受威脅(threatened)或受保護(protected)物種,會員國將依據評估,運用管轄權以管理漁業。
- **棲地**:漁業作業棲地。
- **生態系統**:例如營養結構與功能、群落組成,以及生物多樣性等廣泛之生態系統要件。

評估樹狀結構適用於,當此等物種資料足以發展定量性評分(quantitative score)之漁業上。在資料不足的情況下,則需一擴大範圍之定量性與半定量性風險評估工具,以評估該等構成要件之結果狀態。該套工具稱為風險基礎架構(Risk-Based Framework;RBF)。在資料不足漁業之場合,將運用RBF來進行評估。

本發表將構思多項規則,以用來評估原則2中,資料不足漁業之前兩項構成要件。請注意MSC在評估過程中,對保留與混獲物種所下之定義。

RBF包含一套方法,得用以評估漁業相關活動,對生態系統構成要件所造成之風險。這些方法相當複雜,而所需資料則得自於以專業判斷為基礎之系統(規模強度結果分析—Scale Consequence Analysis;SICA),以及用以評估潛在風險之半定量分析(生產能力暨敏感性分析—Productivity Susceptibility Analysis;PSA)。RBF係專為預防欠缺資料而設計者。

倘資訊不足,無法為績效指標(PI)評分,則將進入風險基礎評估階段。首先,將實施SICA分析,倘威脅某一構成要件之風險夠低,而其MSC評分為80分或更高,則該分數將反饋至評估樹狀圖中,而該PI之RBF程序即告完成。倘SICA之分析結果為一令人無法接受之高風險,其所得分數

低於80分，則隨即對其進行PSA分析。PSA分析所得之評分結果將反饋至評估樹狀圖中，以總結該PI之RBF。

將風險基礎評估方法應用於資料不足之特定績效指標(PI)時，其步驟如下：蒐集和風險基礎評估有關之資訊(劃定範圍)；實施SICA分析；以及實施PSA分析。「劃定範圍」此一步驟，係提供必要的背景資訊，以運用在MSC之RBF上。

SICA為一定量性分析，其目標是藉由投入廣泛之利益關係者，來認定哪些活動將對任何物種、棲地或生態系統造成重大影響。SICA就像是一種篩選工具；其「最糟之情況」，便是用來衡量對特定評分構成要件造成影響之活動範圍。

PSA途徑檢驗有助於或影響每一物種之生產能力或敏感度的屬性特徵，以提供相對的風險評估標準，來對漁業活動中之構成要件予以評分。生產能力係七項屬性特徵之平均值，而敏感性係四個層面之產物。

PSA途徑係以一項假設為基礎，該假設認為對一物種所造成之風險，將取決於兩個特性：(1)漁業活動之影響程度，其係取決於漁業活動之敏感性及(2)該種群之生產能力，其決定遭漁業活動之潛在耗損或傷害後之復育進度。須注意的是，PSA分析基本上係用於衡量潛在風險。

基於PSA對於一物種之評分，可導出三項MSC相關結果：

- 倘任何評分高於80分，則表示該物種通過該項指標；
- 倘該物種之任何PSA評分係中度風險(低於80分，但高於60分)，績效指標中將設定一條件，其等同於一般MSC認證過程中所設定之條件；以及
- PSA所評估之任何高風險物種(低於60分)，其結果便是未通過該項績效指標，除非有辦法提出證據，證明該風險係過度評價。

一物種能承受之漁業活動影響程度，取決於該物種固有的生產能力。生產能力決定一物種自漁業活動之耗損或影響之復育速度。一物種的生產能力則依該物種之屬性特徵而定，如壽命、生長速度、繁殖能力、加入量及自然死亡率。

一物種能承受之漁業活動影響程度，亦取決於遭漁業活動捕獲或傷害之脆弱性(vulnerability)或敏感性。物種敏感性係依漁業分佈與種群分佈之重疊程度等特徵而定，不論該物種是否與漁具位於同樣水深，以及不論該物種被留下或者活體釋放。

不論使用SICA或PSA，皆須將評分轉換為評估樹狀圖中有意義之分數。這讓資料不足漁業，得使用同於其他漁業之相同評分標準。這兩種方法係透過績效指標之處理，以提供一分析漁業對生態系統構成要件影響之風險基礎評估。

PSA能協助設定用來評估漁業之各種條件。PSA評分係得自一整套之屬性特徵(生產能力特徵，例如成熟年齡，以及敏感性特徵，例如與漁具之互動)。因此，可看出哪些特徵會造成高風險，且能顯示如何降低風險，例如：用以設定經修正之行動或條件。

本發表將提供一項例證，以論證原則2中，用於評估各種混獲魚種之RBF方法。並提出各種PSA特徵，以示範所需資料為何，且展示如何使用簡單的漁業資訊，以評分一組混獲物種。另亦將展示如何用蒐集資訊或改變實際作為，來附帶處理通過審核之物種。

## 市場影響與鮪類資源永續：多樣且多變的世界

**Duncan Leadbitter**
永續漁業夥伴

近年來，鼓勵良好資源管理之與市場相關途徑範圍大幅擴大，某些途徑有許多重疊之處，並產生協力作用。舉例來說，某些水產公司更加重視企業的社會責任，因而產生永續採購政策、供應鏈契約、生態標籤和其他計畫等工具。

大致上，目前積極和消極措施互相配合，一方面向供應者和買方提供忠告和獎勵，另一方面防

範某種物種、漁具或來源地區。例如許多非政府組織(NGOs)為消費者製作的可買與拒買(buy and don´t buy)卡片、船舶黑名單和白名單、永續導向的標籤等。在某些情況下，越來越多措施與政府計畫有所重疊，這些措施亦以鎖定非法產品之供應，阻止其進入市場為目標，例如漁獲文件計畫、船舶黑名單及貿易限制。其實，政府計畫和非政府計畫各有其優缺點，需時常互相合作，截長補短。

全球鮪魚業者對過去的美國鮪魚海豚案、延繩釣及大型掠食者數量下降等問題所引起的爭議並不陌生，然而隨著某些魚群嚴重枯竭、野生動物受到危害、不適當的可追溯性規定和法規管制所造成的影響紛紛浮現，鮪魚業者發現其面臨的問題不斷增加。

鮪漁業正面臨著許多挑戰，這些挑戰因為魚類資源分佈於許多國家，以及全球貿易之複雜性而更形複雜。其實，倘能以建設性的方式思考，許多問題是可以解決的，因為業者可採用適合其工作方法的機制，像是應用可追溯性系統，確保供應鏈中的產品為合法產品。

本文將從市場相關層面探討現在與市場相關途徑之差異，特別是一些鼓勵民間之驅力因素，及發展迅速的永續水產品，將產生的一些難題和潛在危險，如漂綠(greenwashing)。藉由這樣的探討，本文從廣闊的角度看待「市場」一詞，因為公司在做採購和公共定位決定時，消費者需求僅佔考量因素的一小部分。

## 使平衡偏向永續性之工具：

在目前全球市場解除管制的環境下，政府涉入市場管制依然是具爭議性的領域。然而市場並不完善，目標確定的干預可能有利於支持合法業者。根據經濟合作暨發展組織(OEDC)的文件紀錄，合法業者生產鮪魚的成本估計比從事非法、無報告、未受規範(IUU)漁撈的業者高出30%。

對市場產生影響的一些政府行動包括：

1. 限制未加入現有管理制度之漁業所生產的產品進入市場之行動。最近的例子為歐盟自2010年1月開始實施排除任何IUU水產品之規定。第二個例子為大西洋鮪類國際保育委員會(ICCAT)要求其會員禁止從損害ICCAT養護與管理措施之國家進口相關物種，以鮪魚為主。僅有少數區域性漁業管理組織像ICCAT具有此種能力。
2. 公佈並持續整合全球船舶黑名單，透過港口國協定，對黑名單上之船舶採取進港限制。此方法證明為有效的嚇阻機制，例如美國公司Trident無意取得列於黑名單之轉載船Polestar所供應之鱈魚一案。

貿易相關措施之使用增加，證明有越來越多人了解，倘要適當解決IUU漁撈對永續性所引發的威脅，從供應鏈到市場國建立整合性方法十分重要。如前所述，政府法規成為民間使用的工具之一，民間不再停留於被動的守法階段，例如公共風險管理之關切，不斷促使公司關注法規，即使法規本身非直接適用。

## 民間計畫

各種支持永續利用的民間計畫從過去一直有紀錄，而且選擇的範圍持續擴大，列於紀錄之例子包括：

- 產業計畫—捕撈業所採取之各種不同的計畫，旨在解決影響永續之因素，特別是但不限於IUU漁撈和漁撈能力過剩。
- 捕撈業者/非政府組織之計畫—永久聯盟(alliances for good)
- 公司/非政府組織(包括公共水族館)聯盟
- 行為守則和環境管理計畫
- 零售業者採購政策
- 管制非法產品之供應鏈認證

一些新的作法包括發展管控文件，管控文件為公司與公司間之契約，用以建立具有法律約束力之承諾。該等文件通常與產品品質或數量有關，但已擴大至包括永續事項，至少就遵守規定與法規而言。管控文件之目標為確保公司因供應商提供IUU產品而面臨公共風險時，可直接對供應商採取行動。

歐盟水產加工業者協會(EU Fish Processors Association)十分關切波羅的海(Baltic Sea)鱈魚、巴倫支海(Barents Sea)鱈魚和黑線鱈遭受IUU漁撈的程度，因而大規模發展管控文件的作法。管控文件經由保證書(Letter of Warrant)生效，保證書上明訂供應商有注意漁業管理規定，及不在知情情況下，供應違反規定之產品。供應商同意由第三方隨機稽查，倘發現有違反契約之情事(不論是透過稽核或傳統的執法方式)，供應契約即失效，產品將予以沒收或賣出，獲取之利益供應商不得享有。

毫無疑問，這樣的作法增加了業者守法的壓力(圖1)，因為被列入供應商黑名單的後果遠比罰款來得嚴重。

**圖1** 在供應商受到壓力後下降之巴倫支海鱈魚IUU漁獲量

## 企業的社會責任—促使民間採取行動之主要驅動因素

企業的社會責任可解釋為「企業持續承諾遵守道德規範並對經濟發展作出貢獻，並改善員工及其家庭、當地社區和社會整體的生活品質。」

對於企業社會責任的價值，及採取企業社會責任政策背後的潛在原因仍有許多爭論，但企業社會責任政策成為非政府組織(NGOs)與企業間建立關係的機制，是不變的事實。

非政府組織對零售業者所造成的壓力而導出企業社會責任政策，在公司倫理或名譽可能因採購政策被詳細檢視而受到危害的情況下，零售業者參與風險管理。大多數歐洲大型零售業者有通用的水產品政策，而且許多零售業者對鮪魚有特定要求。美國排名前20名的零售業者幾乎全部與非政府組織就水產品訂有夥伴協議(partnership agreement)，在日本，許多大型零售業者將企業的社會責任視為客戶關係的關鍵之一。

企業的社會責任是促使水產業其他領域成長的主要因素，例如貼有生態標籤的產品更容易取得。

## 認證和標籤

過去10年來，認證和標籤隨著海洋管理理事會(MSC)持續成長而蓬勃發展。過去MSC以消費者對有保證的永續水產品—獲MSC認證之水產品—更感興趣的促銷模式，向水產業提倡MSC認證。儘管許多報告提出價格溢價、無法取得獨立證據，和企業社會責任管理和市場進入最受重視等其他因素。

## 途徑整合—未來之路？

過去10年來，永續利用激勵機制之發展與實施，經過很大的變化與實驗，而大部分發生在供應鏈尾端的市場。經證明，其中一些方法比其他方法有用，而許多方法單獨使用似乎成效不佳。圖2為Packard基金會所實施之概念性策略，此策略非該基金會專有，其他公共或私人團體亦可使用。

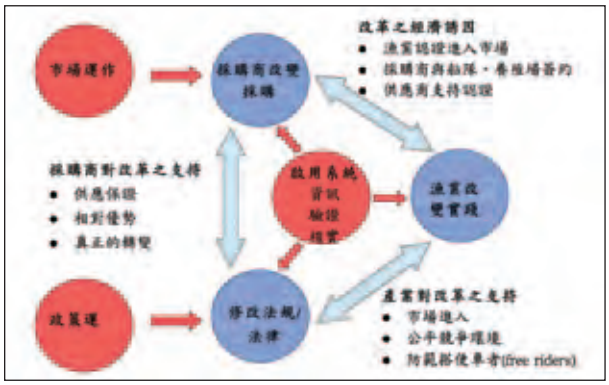


**圖2** 水產品市場策略：動態變化模型(取材自Packard基金會永續水產品策略計畫)

# 監測、管控與偵察(MCS)和改變捕魚方法之市場機制能力～美國進口蝦類貿易規則及熱帶蝦類拖網漁業使用海龜脫逃器措施之啟示

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## 摘要

美國進口蝦類禁令自1996年5月1日生效，規定捕撈國使用於捕撈蝦類之漁法不應傷害海龜。為遵守此規範，東南亞漁業發展中心(SEAFDEC)與其會員國合作，進行一系列試驗，努力研發東南亞國家蝦類拖網漁業適用之海龜脫逃器(Turtle Excluder Devices; TEDs)。泰國海龜解脫設備(Thai Turtle Free Device; TTFD)係目前漁民使用最為方便且成效最高的設計，因TTFD之目標魚種脫逃率低、操作簡單且建置成本低。TTFD及Supper Shooter(TEDs之一種)被選為推廣至東南亞國家使用最合適之TEDs。

監測、管控與偵察(Monitoring, Control and Surveillance; MCS)是一套漁業管理工具，為推動拖網漁業漁民使用TEDs，已將其與市場機制結合。本文是泰國、馬來西亞及印尼之MCS及改變捕魚方式之市場機制能力的案例報告。

## 簡介

禁運令對東南亞國家漁民之生計造成威脅，該區國家政府認真看待此威脅，並透過管理SEAFDEC之理事會核准緊急考量可行的蝦拖網漁具設計，以有效釋放及保育海龜，俾美國解除進口禁令。

為研析此問題，指定SEAFDEC訓練組(TD)和海洋漁業資源暨管理組(MFRDMD)與SEAFDEC會員國漁業局(DOF)合作，在泰國開始一系列試驗，有所進展後於其他SEAFDEC會員國進行更多的測試。因該區大部分漁民均依賴捕蝦維生，故實行多項測試以保護其生計，及減少預期之進口禁令的衝擊。研究成果透過研討會及研習班傳達給漁民，並使他們瞭解該項設備之使用方式，以避免蝦類禁令，並經由使用該設備促進海龜之保育。

## 東南亞執行TEDs之概況

### 1. 泰國

為遵守美國進口蝦類禁令所設規範，SEAFDEC/TD與泰國DOF合作進行一系列之試驗，研發泰國蝦拖網漁業使用之合適設備。為進行測試，進口5種TEDs，即Anthony Weedless、 Super Shooter、Bent Pipe、Georgia Jumper和Mexican TED。

基於不同類型TEDs之設計與建置的研究，改良Super Shooter及Georgia Jumper成為大家所熟知的TTFD。試驗結果顯示，Super Shooter及TTFD之脫逃率令人滿意且便於操作。兩者相較，TTFD較適用，因目標魚類脫逃率低、燃油消耗量低且較易建造和安裝，且所有材料可自當地取得。

泰國DOF於1996年10月籌辦一有關蝦拖網漁業使用TEDs研討會，參與人員包括泰國沿岸22個省之漁業代表，漁民對使用TEDs之反應相當正面並接受引用該設備之理由，漁撈試驗結果使他們相信僅有蝦類被捕撈且脫逃率低。前100組TTFDs係採自願性使用，另2,900組則分發給漁民使用，故泰國登記有案之3,000位蝦漁業拖網業者均有該項設備，因此美國於1996年10月對泰國解除蝦類禁運令。

### 2. 馬來西亞

為遵守美國進口蝦類禁令所設規範，SEAFDEC/MFRDMD及TD與馬來西亞DOF合作進行許多試驗，研發馬國漁民使用之TEDs。1996年9月MFRDMD首次派遣其職員赴泰國進行聯合測試，爾後於1997年2月在馬國霹靂州(Perak State)進行多次試驗，結果顯示使用TEDs對蝦捕獲率無不利的影響。

MFRDMD及TD於1997年3月與馬國DOF合作，舉辦一研討會進行初次示範，也在陸上展覽介紹TEDs，之後則在蝦拖網船進行TEDs之海上示範。

MFRDMD於1997年7月對各州之DOF職員進行使用TEDs之訓練，之後又在同年12月對沙巴漁業辦事處人員進行訓練，同時也進行漁民使用TEDs之問卷調查。

### 3. 印尼

印尼DOF自1980年起禁止拖網漁業作業。基於各項理由，1983年1月1日起允許蝦拖網漁船可在阿拉富拉海(Arafura Sea)及其鄰近水域作業，BED是印尼對Hooped TED的簡稱，該設備係由美國國家海洋漁業局(NMFS)引進。

當美國進口蝦類禁令於1996年5月1日開始生效，印尼因已使用Hooped TED而未被納入禁令適用國家。NMFS於1996年10月引進Super Shooter TED取代Hooped TED，而SEAFDEC/TD基於其在東南亞國家之經驗，也於1997年11月引進TTFD至印尼。

印尼出口蝦類至全球，特別是日本，並出口少量蝦類至美國。印尼持續在其水域使用Super Shooter及TTFD，以推廣選擇性蝦拖網作業。

## 對拖網漁業使用之MCS及市場機制效益

以東南亞地區特別是前述三國之MCS系統和機制而言，每個國家實施TEDs措施，大多視政府政策及管理而定。舉例來說，泰國在推廣TEDs期間，3,000組TEDs透過在泰國南部舉行之研討會，分發予在泰國灣及安達曼海(Andaman Sea)作業之拖網業者。然而，因執法人員另有要務，且執法單位認為此係TEDs之試驗期間，因此確保使用TEDs之巡邏措施係微不足道的。因執法人員及巡邏船之缺乏，致無法對蝦拖網船之全部作業水域進行使用TEDs之充分巡邏與執法。為補足MCS之不足，以市場為基礎之活動應引入補償漁民因使用TEDs所造成蝦類損失等措施，以增加使用TEDs之誘因。

就馬來西亞而言，儘管在試驗期間曾分發100組TTFDs給漁民，但未有決定是否使用TEDs之後續活動，馬國之MCS活動，在人員、巡邏船及區域劃分上相對較強勢。因馬國尚未允許出口蝦類至美國，目前並未使用TEDs。

就印尼而言，因為有出口蝦類至美國市場，大部分蝦拖網船使用TEDs，該等蝦拖網船屬於漁業公司，且漁場限制在阿拉富拉海及其鄰近水域，MCS措施亦有成效，但印尼之MCS系統相當複雜，牽涉多個管理機構。

目前泰國和馬國未仰賴出口蝦類至美國市場，導致兩國使用TEDs有限，因使用TEDs非強迫性。僅有印尼持續執行使用TEDs。

## 結論

使用TEDs之執行需有強健之MCS系統支援。基於該區執行TEDs之經驗，倘漁民對MCS活動之基本認知和接受度不足，MCS活動將無法成功。

該區漁民採用TEDs有限且當地支援通常不足，部分因捕魚成本高、非目標魚種具商業價值、多魚種拖網的出現、要求使用TEDs規範之執法不彰。因此透過買主/出口商及漁船間互動之市場獎勵措施，是達成蝦拖網漁業有效使用TEDs目標之關鍵。

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# 為歐洲市場供應永續鮪類

**Henk Brus**
Atuna

在歐盟超級市場架上取得永續來源之鮪類，自兩年前召開第四屆國際漁業人論壇後已有些微進展。Sustunable公司抽查6個歐盟國家之30家超級市場，發現經海洋管理理事會認證之鮪類產品極少，且未發現經其他水產品認證計畫認證的產品。附有海洋管理理事會標籤的鮪類產品皆是源自美國漁業的長鰭鮪，販售價格對大部分消費者而言過高，此為經海洋管理理事會認證的鮪漁業產品數量有限的原因之一。另一原因是缺乏誘因而讓鮪類供應鏈之大部分操作者開始提倡永續產品及負責任來源。包括綠色和平組織及世界自然基金會等非政府環保組織壓力，已說服許多零售商願意開始販售經海洋管理理事會認證之鮪類產品，但目前的高價位及取得海洋管理理事會認證鮪類有限等原因，阻撓零售商販售永續來源之鮪類產品。

Sustunable公司之方法旨在創造漁民、罐頭業者及地方政府間之夥伴關係，直接販售永續來源之鮪類漁獲予零售商，消費者可利用線上追蹤系統查詢，並獲得極高水平的透明度。

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## 研討主題3C摘要

# 減緩延繩釣及圍網漁業之混獲

**主持人：蔡日耀先生**，行政院農業委員會漁業署副署長及**何勝初先生**，中華民國對外漁業合作發展協會執行長

**預期結果：**檢視表層及底延繩釣漁業暨圍網漁業減緩混獲之進展，並界定優先順序。

大型延繩釣漁船通常捕撈年齡層較大的大目鮪及黑鮪，供應生魚片市場；圍網漁船之目標魚種則為年齡層較輕的正鰹及黃鰭鮪，意外混獲之大目鮪則製成罐頭。該兩種漁業均有海鳥、海龜、海洋哺乳類及鯊魚的混獲問題(詳見Eric Gilman博士之專題簡報摘要)，倘未妥適規範該等漁業，可能嚴重影響許多資源的健康。圍網漁業的非市場販售魚種和體型（如體長過小之大目鮪和長鰭鮪）及延繩釣漁業混獲體長過小之劍旗魚，可能促成許多系群遭過度利用。再者，混獲幼小及小體型鮪類，意味著兩漁業間鮪類資源分配之實質問題。此節提及運用不一致混獲條款的關切，與會者指出近來其他國際會議也述及此問題，包括珊瑚三角區漁業人論壇。但回報及規範所有漁獲死亡率對有效的漁業治理相當重要，不論「混獲」之術語及定義為何。

中西太平洋鮪延繩釣及圍網漁業之序列賽局理論模式，以最大經濟產量為目標(詳見Ussif Rashid Sumaila博士之專題簡報摘要)。分析結果建議減少圍網漁業使用集魚器，以降低大目鮪及黃鰭鮪幼魚混獲量，是經濟上最理想的方式。此法將導致圍網漁業國家之經濟損失，但該損失遠小於延繩釣漁業所獲得之利益。另該模式並未處理以缺乏購買力和食品配銷為主要情境乙節。對該模式之討論尚包括，倘該模式係以鮪類系群之最適永續性或最適蛋白質產量來設計，產出將如何變化？

美洲熱帶鮪類委員會為復育東太平洋大目鮪資源所採管理行動之影響報告亦被提出(詳見Rick Deriso博士之專題簡報摘要)。延繩釣船隊之漁撈能力和投鈎數在2000年達高峰，爾後顯著下降，而圍網漁業之漁撈能力則繼80年代初次滑落後攀升。管理措施包括延繩釣漁業之漁獲限制、逐漸增加圍網漁業之禁漁期和關閉大目鮪混獲量高的圍網漁區。至今的結果建議該等措施係成功，且大目鮪資源量已停止下滑。

在確認延繩釣漁業之海鳥與海龜混獲問題及圍網漁業之海豚直接死亡率的漁具技術解決方案上已有堅實的進展(詳見Eric Gilman博士之專題簡報摘要)，給予充足的資金，將有可能發展其餘問題之漁具技術解決方案。決定合適的漁具技術選項需進行特定的漁業評估，包括考量其功效、經濟可行性、實用性及安全性。目前未充分考量已確認各物種混獲減緩方法的衝突及共同利益，五個區域性鮪漁業管理組織對減緩混獲問題雖有進展，但仍存在廣大差距，及須改善目前具約束力之措施。

與會者質疑鮪漁業減緩混獲技術進行革命性變革，以取代目前所進行之傳統漁具和漁法之小幅度改革(詳見Martin Hall博士之專題簡報摘要)。此類改革得包括發展圍網船上之設備和加工方法，以增加活體漁獲丟棄之比例。

齒鯨（主要是偽虎鯨和虎鯨）咬食延繩釣漁獲對漁業產生大量的經濟衝擊，本報告提出過去半世紀對減少延繩釣漁業和鯨魚間互動的經驗與研究(詳見Tom Nishida博士之專題簡報摘要)，介紹大有可為的聲納發射器，稱為海豚威懾器(dolphin deterrent device；簡稱DDD或“Triple D”)，對齒鯨之吸氣聲作出反應，發出威懾的聲響，使渠等遠離漁具。

本節亦檢視表層及底延繩釣漁業之海鳥混獲減緩措施(詳見程建中博士之專題簡報摘要)。過去數十年漁業帶來極大的威脅，使海鳥資源一直呈現下滑的趨勢，信天翁因其生活史特性而特別脆弱，死亡率增加。已證實許多減緩海鳥混獲技術的功效，如夜間投繩、支繩加重、避免排放內臟、側邊投繩等。另近期亦提出創新的漁具技術，如整合型支繩加重、餌料膠囊及餌鈎膠囊。

臺灣延繩釣漁業之鯊魚混獲報告亦提出討論(詳見劉光明博士之專題簡報摘要)。三大洋之鯊魚混獲與漁獲之比率，及鯊漁獲組成顯著不同。該報告放大不同延繩釣船隊的資料，以產生整體船隊之鯊魚總漁獲量。限制鯊魚割鰭之措施(包括五個區域性鮪漁業管理組織所採措施)無法管理鯊魚的漁獲死亡率，且不可能解決鮪延繩釣漁業對過度利用鯊魚資源之危害。有些國家已採取措施，包括帛琉近期通過之鯊魚禁捕區，可有效降低鯊魚漁獲死亡率。

本節亦提及第二屆區域性鮪漁業管理組織聯席會議之混獲研討會成果與建議(詳見Rebecca Lent博士之專題簡報摘要)，其中建議之一為建立區域性鮪漁業管理組織混獲技術性聯合工作小組，預定於2011年召開後續會議，包括有關圓形鈎之國際研討會及第三屆區域性鮪漁業管理組織聯席會議。

本節綜合討論述及減緩海洋漁業混獲之海洋空間規劃方法的範例，包括運用經證實的混獲對漁獲之比率資訊，以確認混獲率高的海域，因此可於未來避開此區域。

研討主題3C：

# 簡報摘要

## 中西太平洋鮪類系群之序列賽局理論模式

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利用圍網船隊捕撈中西太平洋鮪類系群的捕撈國家，如菲律賓及印尼，正與本區利用延繩釣漁船捕撈鮪類之主要遠洋漁業國處於連續的賽局局勢。本文研擬牽涉上述兩種船隊之序列賽局理論模式。圍網船隊的主要目標魚種是正鰹，但也捕撈相當大量的大目鮪及黃鰭鮪幼魚；延繩釣船隊則分為兩類，一為表層延繩釣船隊，主要目標魚種為黃鰭鮪，另一為深層延繩釣船隊，主要捕撈大目鮪及黃鰭鮪。圍網船在延繩釣船隊未有機會捕撈該等魚類前，先捕撈大目鮪及黃鰭鮪幼魚，因此產生序列賽局形勢。本文在個別管理所產生之分離淨損益觀點下，分析中西太平洋三種鮪類系群聯合管理(合作)及個別管理(不合作)之成效。分析結果建議如下：(i)減少使用集魚器(FADs)可大幅降低大目鮪及黃鰭鮪混獲量，且是經濟上最理想的方式；和(ii)此混獲之減少將導致捕撈正鰹船隊之損失，但該損失遠小於延繩釣船隊可獲得之潛在性利益。為執行聯合管理，需有制度安排，允許使用圍網的國家分享自合作中獲得之利益，因此滿足個別合理的需求。

## 美洲熱帶鮪類委員會漁具別鮪漁獲分配措施對東太平洋大目鮪資源之影響

**Richard Deriso**
美洲熱帶鮪類委員會

### 摘要

2008年執行的一項模擬研究，用以獲得進一步瞭解假設的鮪漁船隊所施加之漁獲努力量的變動，如何同時影響東太平洋大目鮪資源及不同漁業的大目鮪漁獲量。數種模擬情境被建構，來闡明在東太平洋捕撈大目鮪的不同漁業，在過去與未來如何運作的可能情形，以及闡明大目鮪資源的未來動態。

### 漁獲努力量

未來投射研究被執行，用來探討在不同水準的漁獲努力量下(捕獲率)對系群生物量和漁獲量之影響。所進行之分析如下：

1. 未來每年每季捕獲率均設為與2005-2007年之平均捕獲率相等，以模擬執行由於IATTC第C-04-09號決議的保育措施而減少的漁獲努力量。
2. 在前述之保育措施決議尚未實施前，一項附加的分析被執行以估計資群狀態。就2004～2007年而言，圍網漁業漁獲量在第3季增加86%，在南部的延繩釣漁業漁獲量則每季增加39%。就2008～2012年而言，圍網漁業捕獲率每季增加13%，南部的延繩釣漁業捕獲率每季則增加39%。

## 模擬結果

IATTC第C-04-09號和第C-06-02決議要求限制2004～2007年圍網漁業漁獲努力量和延繩釣漁業漁獲量：圍網漁業在每一年度第3或第4季設定6週的禁漁期；延繩釣漁業漁獲量則不超過2001年的水準。為評估該等決議措施之執行成效，在假定該等養護措施並未實施情況下，本研究投射未來5年的族群數量。

經比較受決議限制與未受決議限制之產卵群生物量，有實質的差異(圖1)。在未受決議限制的情況下，產卵群生物量比(SBR)僅微幅增加，然後下降至更低的水準。

由於近期有高補充群加入，雖然預期有幾年資源將增加至MSY水準之上，漁獲死亡率雖會因IATTC第C-06-02號決議持續實施而減少，卻不足以使資源長期維持在最大可持續生產量(MSY)水準之上。

2009年通過IATTC第C-09-01號決議要求制定比以往的決議更嚴格的措施，且在2011年前，圍網漁業之禁漁期(73天)將接近IATTC工作人員所建議之天數(84天)。

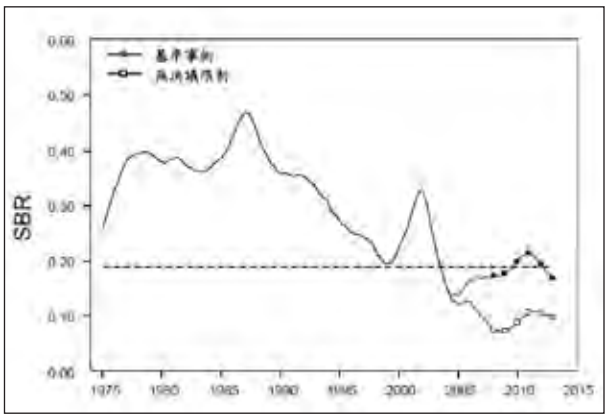


**圖1** 從基準事例模式和無IATTC第C-04-09決議限制時所預測之產卵群生物量比(SBR)

# 全球鮪漁業減緩不要的混獲

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## 摘要

處理延繩釣及圍網漁業多餘之混獲已有進展。在足夠的研發投資下，商業性漁具和漁法可行的變更，才有可能幾近消除混獲。然而，即使漁具類型已有重大進展，該等有效的減少混獲方法亦可利用，在許多情況下，並可提高捕魚效率和提供營運獲利，但大部分的船隊仍不採用該等方法。區域性漁業管理組織(RFMOs)最近已對處理某些混獲物種之混獲議題有所進展，但因共識決的決策過程中有所妥協，導致通過的措施並未作最佳的實踐。而且，因為偵察監控和執法資源之不足或薄弱，致遵從守法度可能很低。由於缺少績效評估機制，包括不適當的監控、觀察員涵蓋率低或無、非卸載漁獲之資料蒐集準則的不適當和不一致，因此引導調適性的管理，以減緩鮪漁業混獲問題的資訊係不夠充足。

## 緒言

從事負責任漁業需有效管理漁獲死亡率之所有來源，包括被保留的目標漁獲、被保留和丟棄的混獲及未被注意到的死亡率。混獲包括被保留的非目標漁獲但具經濟價值之物種(稱為「意外漁獲」)、所有丟棄的不要的漁獲、加上所有未被注意到的死亡率，如遭破壞或在漁具取回前自漁具及幽靈漁具捕獲之漁獲和混獲物(Alverson et al., 1994; Kelleher, 2005; FAO, 2009b)。混獲包含對海洋生態系統結構維護和功能的重要物種，並繼續為生態系統服務。受混獲影響之敏感物種包括海鳥、海龜、海洋哺乳類、板鰓亞綱魚類(軟骨魚類)和其他魚類，該等因過度開發而特別脆弱，且族群量之復甦相當緩慢(Hall et al., 2000; FAO 1999a, 1999b, 2010; Gilman et al., 2005, 2006a,b,c, 2007a,b, 2008a,b, 2009; Gilman and Lundin, 2010)。丟棄的漁獲、內臟及餌料改變海洋物

種的覓食行為和飲食，如由海鳥、海洋哺乳類、鯊魚及固著性食腐動物清除這些污物，也可能導致海床缺氧(Goñi, 1998; Gilman et al., 2006a; Furness et al., 2007)。

當混獲是某些漁業和某些國家之重要收入及食物供應來源時，無法持續的混獲水平對漁業社區有不利的社經影響(Kelleher, 2005; FAO, 2008, 2009d)。過度開發商業上重要的非目標混獲物種，包括幼小及體型過小之商業混獲物種，將嚴重影響未來的漁獲水平(Hall et al., 2000)及反映在漁業間之分配問題(Gilman and Lundin, 2010)。

本文檢視鮪漁業之混獲問題及漁具技術解決方案，包括改變漁具設計及漁法。其他之混獲減緩措施包括投入及產出管控、補償性減緩、禁漁期／區、船隊通訊及產業自我監督(Gilman et al., 2009; FAO, 2010; Gilman and Lundin, 2010)。組合式減緩措施將是有效且在商業上可行，惟端視漁業之特性而定。

## 鮪漁業之混獲

表一總結捕撈鮪魚之主要商業性漁法--表層延繩釣及圍網之混獲問題(Majkowski, 2007)。一支釣漁業之鮪卸魚量位居第三.，但其混獲發生率極低。

表一、表層延繩釣及圍網漁業之混獲問題

| 物種 | 表層延繩釣 | 圍網 |
|---|---|---|
| 海鳥 | 問題主要發生在高緯度水域(Brothers et al. 1999) | 無此問題 |
| 海龜 | 問題主要發生在熱帶及亞熱帶水域(FAO, 2010) | 海龜可能被集魚器纏住及遭圍網捕撈(Hall et al. 2000)。通常在網中的海龜係活的，並被釋回海中(FAO, 2010)。集魚器及流木群漁法所造成之海龜捕獲率較海豚隨附群及素群高(Hall 998, Hall et al. 2000, Molony 2005) |
| 鯊魚 | 有些非鯊魚漁業之鯊魚混獲量在總漁獲量中佔有很大的比例(Gilman et al. 2008a) | 集魚器及流木群漁法導致鯊魚漁獲率較高(Hall 1998, Hall et al. 2000, Molony 2005) |
| 海洋哺乳類 | 鯨豚和延繩釣間之互動偶爾造成鯨豚被延繩纏住及遭魚鈎鈎住，導致鯨豚受傷及死亡(Gilman et al., 2006a)。漁民可能殺害鯨豚，以避免漁獲被咬食(上鉤魚類和釣餌被掠奪)和漁具損壞。無遷移習性的鯨豚族群大部分處於危險中。 | 儘管已實質成功降低東太平洋圍網漁業所造成之直接海豚死亡率(Hall 1998, IATTC 2007a)，但海豚族群量之回復尚不如預期。已觀察到圍網網次對海豚之壓力，導致海豚流產或分離和小海豚走失(Archer et al. 2004, Edwards 2006)。其他區域之圍網漁業通常不會在海豚附近投網。<br><br>鯨魚隨附群漁法可導致鯨魚受傷和死亡(Romanov 2002, Molony 2005)。 |
| 鮪類之幼魚及小體型者 | 在海山可能有此問題(Passfield and Gilman, 2010) | 限制在海豚群投網，導致漁民轉向投放集魚器及流木，使得鮪類幼魚及小體型者和無法販售之魚類捕獲率較素群高(Romanov 2002, Secretariat of the Pacific Community 2006)。 |

## 解決方案

表層延繩釣漁業及圍網漁業之混獲問題已有堅實的進展，但僅限於確認延繩釣漁業有效降低海鳥及海龜的方法，及圍網漁業之海豚直接死亡率：

表層延繩釣漁業減緩措施的漁具技術方法：

- **海鳥**：已被確認的避免混獲海鳥方法漸增，但效益不同，包括夜間投繩、避鳥繩、水下投繩設備、船舷、支繩加重、染色餌、解凍餌、投餌機和投繩機(Brothers et al. 1999, Gilman et al. 2003, Gilman et al. 2005, Gilman et al. 2007a).
- **海龜**：減少表層延繩釣漁業混獲及損傷海龜的最佳實踐方法為使用較寬且偏離角度小於10o的圓形鈎，並以較大的魚類為餌 (Gilman et al. 2006c, FAO, 2010)。投繩在較深水域亦有成效(FAO, 2010)。
- **鯊魚**：減少不要的鯊魚混獲量之策略包括(i)餌料以魚類取代魷魚；(ii)禁用短鋼絲；(iii)避開鯊魚常出沒的水域；(iv)在較深水域投繩；及(v)當與鯊魚互動機率高時，遠離該區水域(Ward et al. 2007, Gilman et al. 2008a)。有必要投入各式威嚇鯊魚的研究 (Gilman et al., 2008a; Stoner and Kaimmer, In Press)。
- **海洋哺乳類**：減緩海洋哺乳類混獲的方法，包括(i)避開海洋哺乳類常出沒的水域；(ii)船隊間通報；及(iii)減弱魚鈎的承受力(Gilman et al. 2006a,b)。其他可能的方法尚有威嚇及瓦解其回聲定位能力。

圍網漁業減緩措施的技術方法：

- **海龜**：減少混獲海龜的方法有限制投放集魚器、流木及其他廢棄物；避免纏繞海龜；監控集魚器及釋放任一被纏住的海龜；及集魚器不使用時予以回收(FAO, 2010)。有必要投入改善集魚器設計的研究，以減少與海龜之互動。(e.g., Molina et al. 2005).
- **鯊魚**：減少混獲鯊魚的方法，包括(i)避開鯊魚常出沒的熱點區域；及(ii) 限制集魚器、流木及其他廢棄物及鯨魚群漁法之使用。有必要投入在集魚器上投放驅鯊劑的研究(Stoner and Kaimmer, In Press)。
- **海洋哺乳類**：減少混獲海豚的方法，包括使用梅迪納(Medina)海豚安全操控盤，在海豚被捕時進行棄魚，棄魚期間展開救援，並使用海豚逃生設備(Hall, 1998; IATTC, 2007b)。此外，限制海洋哺乳類群漁法之使用也是另一方法。
- **小鮪類**：限制集魚器漁法之使用，可避免捕獲小鮪類，有必要投入格網(sorting grids)的研究。

## 原則和方法

混獲的解決方案視漁業特定而有所不同。舉例來說，夏威夷延繩釣船隊已證明水下投繩坡道可有效避免混獲海鳥，但澳洲的試驗結果則不盡理想，而其原因可能是海鳥種類複雜及互動方式不一、加重的設計和使用之活餌(Gilman et al., 2005)。

漁民擁有廣泛的知識，可輕易對尋找混獲解決方案做出貢獻。許多減少混獲的方法是由漁夫所研發，包括延繩釣漁業所使用驅趕鳥類的避鳥繩，及降低圍網海豚死亡率之方法。

大部分海洋漁業的監測、管控及偵察資源有限，經研究試驗顯示，可有效減少混獲的方法，倘非便利、安全和經濟可行，可能無法援引。

確認各物種減緩方法之衝突及共同利益乃十分重要。舉例來說，在表層延繩釣漁業使用較寬的圓形鈎和魚餌以降低海龜捕獲率及死亡率，此舉亦可減少鯊魚及海鳥的混獲(Gilman and Lundin, 2010)。然為保護日間搜尋糧食的海鳥，在某些區域之晚上投放延繩漁具則提高夜間覓食物種之混獲率。限制圍網漁業使用以海豚群漁法，反而提高集魚器漁法之使用次數，增加小鮪類、鯊魚、海豚、海龜及海洋哺乳類的混獲(Weimerskirch et al., 1999). (Hall, 1998; Molony, 2005; Secretariat of the Pacific Community, 2006; Gilman and Lundin, 2010)。

## RFMO之管理

Gilman及Lundin(2010)，以及Gilman(2007c)曾檢視區域性漁業團體，包括RFMOs所採行的措施，以說明海洋捕撈漁業之敏感性物種混獲議題。在該等組織所通過之具法律約束力措施並未完全採用減少混獲的漁具技術之最佳實踐，有些措施僅是改善該區所需改善事宜，允許選擇相對上效率較差的措施，並讓有混獲問題之漁船可被排除適用。而觀察員涵蓋率不足、非卸載漁獲之資料蒐集不充分和不一致、監測和執法資源之不足及無績效評估體制或效率不彰，則是另外的問題。

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## 創造誘因以發展引進有效的減緩混獲與管理措施

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減緩漁業混獲措施取決於幾個階段：從辨識問題到測試與執行技術或作業解決方案、執行管理計畫，及採行所提議之修改。這些步驟大都需花費成本，或者增加漁民的額外負擔。為促使減緩措施之執行能順利成功，須有明確之誘因。本文將從不同漁業的例證，說明減緩措施之執行，其執行並不會對漁業帶來顯著的負面影響，在某些場合，甚至對漁業有所助益。在嘗試解決混獲問題之參與者中，有必要推動革新與創造性思維，尤其是漁業社群具混獲行為之相關知識，係提供實際想法之最可能來源。經濟誘因係最常見的，且有較大的機會發展或促進新技術之採用。

## 第二屆鮪類區域性漁業管理組織會議之混獲研討會成果

**Rebecca Lent**
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本項簡報將概述第二屆鮪類區域性漁業管理組織(T-RFMOs)聯席會議之混獲研討會(K2B)成果。該研討會係由美國和太平洋島國漁業論壇(FFA)合辦，於本(99)年6月23～25日在澳洲布里斯本舉行。K2B係經由”神戶程序”(Kobe process)所產生，為5個T-RFMOs聯席會議之系列會議。今年也舉行其他3個經由神戶程序所產生的研討會，包括有關科學建議條款之最佳實踐研討會、監測、管控和偵察措施研討會及鮪漁業區域性漁業管理組織管理研討會。

上述研討會之目標係由2009年西班牙聖塞巴斯坦之第二屆T-RFMOs聯席會議參與者通過，K2B之目標如下：

- 檢視可取得之非目標魚種意外混獲及目標魚種幼魚的資料；
- 提供有關最佳實踐、方法與技術之建言予T-RFMOs，以評估及降低非目標物種之意外死亡率，如海鳥、海龜、鯊魚、海洋哺乳類及目標魚種之仔魚；
- 發展及協調相關研究計畫及觀察員計畫；及
- 為避免工作重複，提出有關機制之建議，以流暢調整T-RFMOs工作小組在該領域之工作。

研討會期間，專家小組將提出目前鮪漁業混獲之知識、改善T-RFMO內和T-RFMO間的混獲評估、減輕/降低混獲之改善對策及改善RFMOs之橫向合作與協調。與會者之建議將提供給5個T-RFMOs及2011年之第三屆T-RFMOs聯席會議(Kobe III)參酌。

## 表層及底延繩釣漁業海鳥混獲：進展與阻礙

**程建中[1*]、Mayumi Sato[2]、John Croxall[3]、Ben Sullivan[3]**

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由於魚類需求上升併同捕撈技術進步和未能成功地將永續發展原則有效地納入漁業政策與管理等因素，近年來全球漁業迅速擴展，已經導致海洋生物多樣性大為下降。表層延繩釣漁業混獲為造成信天翁和海燕數量持續下降的主要推手。按照自然保育聯盟(IUCN)的準則，全球性的22種信天翁和海燕中有17種面臨滅絕之威脅，主要是因被延繩釣和拖網漁業混獲而死亡。例如自1984年以來，南喬治亞的漂泊信天翁數量已減少30%，且自1997年開始以每年4%的速度下降。

已有充份證據證明，在南極海洋生物資源保育委員會(CCAMLR)管轄水域內，技術(減緩措施)結合其他管理措施的作法，極為成功地將大部分美露鱈底延繩釣漁業之海鳥混獲量降至0。經證明，前述作法亦可轉用於大幅減少其他底

延繩釣漁業混獲海鳥。遷移路徑與公約區域外捕撈作業水域重疊，特別是表層延繩釣漁業，是造成許多信天翁族群數量持續劇烈下降之原因。

諸多政治與財務問題阻礙降低表層延繩釣漁業混獲海鳥至不顯著水準措施之實施進展。然而，須注意的是，減緩表層延繩釣漁業混獲海鳥，基本上比底延繩釣漁業來得困難，原因在於這兩種漁業之漁具在設計上的基本差異。底延繩釣漁業之漁具是為快速沉降至海床而設計，表層延繩釣漁業之漁具則為飄浮於水層中而設計。要使表層延繩釣漁業如許多底延繩釣漁業一樣，能成功減少海鳥混獲，最大的挑戰之一為進行可信的海上科學實驗研究，以確認有效的減緩表層延繩釣漁業混獲措施。然後透過管理措施和法規方式，在沿海國和公海上實行。

過去3-4年來，透過信天翁保育協定(ACAP)，特別是ACAP海鳥混獲工作小組、主要漁業國，及國際鳥盟信天翁任務小組(ATF)之努力，在確認有效的表層延繩釣漁業混獲減緩措施與最佳實踐上有重大斬獲。ATF在南部非洲和南美的7個國家(混獲海鳥熱點)進行海上研究，針對列為目標之延繩釣漁業，確認所需的混獲減緩措施。

必須增進漁業可持續性的意識在漁業界正迅速提高，檢視區域性漁業管理組織之績效與改革的行動亦正在進行。目前正是進行前述海上研究並將研究結果公布於沿海國和區域性漁業管理組織的時機，以實現大幅減少表層延繩釣漁業混獲海鳥之目標。

## 半世紀以來鮪延繩釣漁業減緩齒鯨咬食措施之演進：誰比較聰明和贏家？人類或海豚？

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本文將從商業性捕撈作業的觀點，討論半世紀以來鮪延繩釣漁業減緩齒鯨咬食措施之演進。根據過去60年來資訊的回顧，有五種主要的減緩途徑：(1)自主性努力(船舶和延繩操作與其他技術)；(2)化學方法(使用粉末與其他物質)；(3)資源族群控制；(4)物理方法(網具、遮蓋物等)；(5)聲波方法(消極與積極途徑)。本文將討論前述減緩途徑之歷史演進及進展，及評估那一種措施途徑在鮪延繩釣漁業較具效率。本文亦將討論正進行的聲學方法，該方法係以延繩釣業之經驗為基礎，運用在減緩咬食之聲波發射器，及強力干擾回波定位能力附有輕合金球的特殊飄帶。最後將討論減緩措施的未來展望，以讓人類在和齒鯨的長期對抗中獲勝，希望能藉此證明我們比較聰明。

## 臺灣鮪延繩釣漁業之鯊魚混獲

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臺灣鮪延繩釣漁業自1960年代晚期開始於三大洋作業，然而由於鯊魚價值相對低於鮪魚，因此鯊魚混獲遲至1981年才開始通報。2003年始能取得特定鯊魚魚種的漁獲量資料，因為在此之前，鯊魚漁獲量未依魚種別作紀錄。作業報表之鯊魚欄位自2003年起依魚種別分為四欄位，分別為鋸峰齒鮫、灰鯖鮫、平滑白眼鮫和其他種類。

臺灣鮪延繩釣船作業漁場遍佈三大洋，鯊魚混獲資料可用於判斷遠洋鯊魚資源狀況，具有寶貴價值。遠洋觀察員計畫即為取得相關詳細資料的方法之一，以供更全面的資源評估與管理研究之用。為履行遠洋漁業國之義務，科學家於1999年發起實驗性觀察員計畫，漁業署於2001年實行此計畫。本文概述觀察員回報之2002～2008年臺灣鮪延繩釣船於各洋區混獲鯊魚情形。利用觀察員回報之2002～2008年鯊魚漁獲量(尾數)相對於目標魚種總漁獲量(尾數)的平均比例(圖1)，調整1991～2008年每一次作業之歷史鯊魚漁獲量資料。

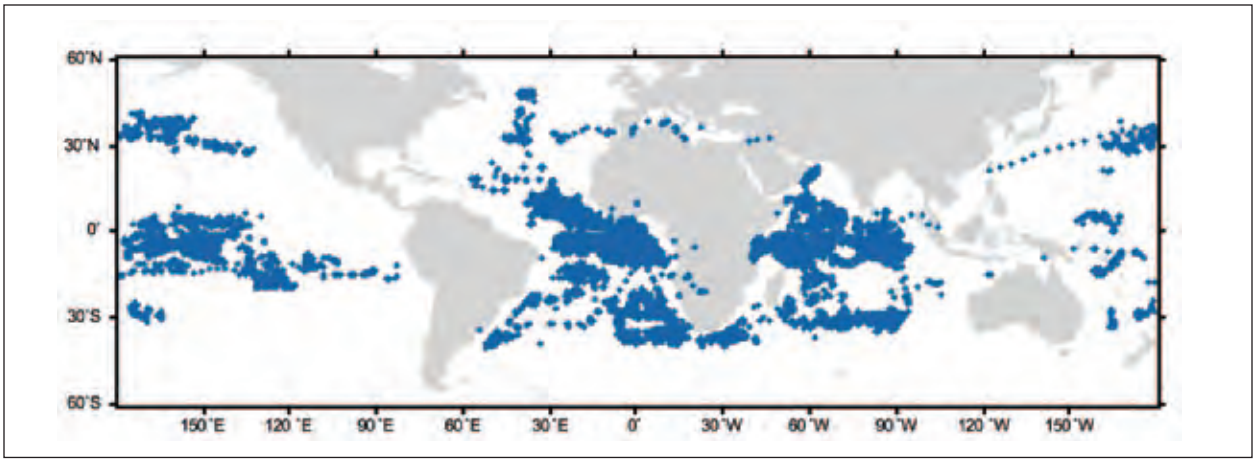


**圖1** 觀察員回報之2002～2008年臺灣鮪延繩釣船於三大洋之漁獲努力量分佈圖

大西洋依鯊魚捕獲率分為5區：A區為北緯5度～南緯10度；B區為南緯15度～50度，西經20度以西；C區為南緯15度～50度，西經20度～東經20度；D區為北緯5度～20度；E區為北緯20度以北。A區和D區為熱帶水域，因此主要目標魚種為大目鮪、黃鰭鮪，主要混獲魚種為劍旗魚。利用B區、C區和E區之鯊魚與長鰭鮪之比例，調整過去每一次作業之歷史鯊魚漁獲量資料。根據觀察員紀錄，在目標魚種為大目鮪、黃鰭鮪、劍旗魚之A區，每季鯊魚漁獲量與目標魚種漁獲量之比例依序為28.74%、85.03%、40.62%、17.37%(如表一所示)。在目標魚種為長鰭鮪之B區，鯊魚漁獲量與目標魚種漁獲量之比例為22.59%(如表一所示)。在目標魚種為長鰭鮪(或大目鮪+黃鰭鮪+劍旗魚)之C區、D區和E區，鯊魚漁獲量在各區目標魚種漁獲量所佔比例分別為0.89%、21.75%、5.83%(如表一所示)，其中，鋸峰齒鮫佔最高比例(如表一所示)。

**表一：**根據觀察員紀錄推估2002～2008年臺灣鮪延繩釣船於各洋區之鯊魚漁獲量與目標魚種漁獲量之比例

| 區域 | | 鯊魚比例 | 鋸峰齒鮫比例 | 灰鯖鯊比例 | 其他種類比例 | 目標魚種 |
|---|---|---|---|---|---|---|
| **大西洋** | | | | | | |
| A區 | 第1季 | 28.74% | 25.08% | 0.57% | 3.09% | 北大目鮪+北黃鰭鮪+南劍旗魚 |
| | 第2季 | 85.03% | 78.63% | 3.11% | 3.29% | |
| | 第3季 | 40.62% | 35.20% | 2.01% | 3.41% | |
| | 第4季 | 17.37% | 14.72% | 0.95% | 1.70% | |
| B區 | | 22.59% | 20.04% | 1.45% | 1.10% | 北長鰭鮪 |
| C區 | | 0.89% | 0.58% | 0.12% | 0.19% | |
| D區 | | 21.75% | 19.83% | 0.94% | 0.98% | 北大目鮪+北黃鰭鮪+北劍旗魚 |
| E區 | | 5.83% | 3.96% | 0.59% | 1.28% | 北長鰭鮪 |
| **太平洋** | | | | | | |
| A區 | | 5.83% | 4.50% | 0.31% | 1.02% | 北長鰭鮪+北大目鮪+北黃鰭鮪+北劍旗魚 |
| B區 | | 2.28% | 1.81% | 0.44% | 0.03% | 北長鰭鮪 |
| C區 | | 8.41% | 2.71% | 0.22% | 5.48% | 北長鰭鮪+北大目鮪+北黃鰭鮪+北劍旗魚 |
| D區 | | 4.23% | 1.54% | 0.82% | 1.87% | 北長鰭鮪 |
| **印度洋** | | | | | | |
| A區 | | 28.70% | 16.10% | 1.83% | 10.77% | 北黃鰭鮪 |
| B區 | | 41.53% | 30.23% | 10.13% | 1.17% | 北大目鮪 |
| C區 | | 2.22% | 1.83% | 0.32% | 0.07% | 北長鰭鮪 + 北方黑鮪 |

太平洋依觀察員記錄之2002～2008年鯊魚混獲率分佈情形分為4區：A區為南緯0度～20度；B區為南緯20度以南；C區為北緯0度～20度；D區為北緯20度以北。主要混獲魚種依序為鯊魚、旗魚、其他硬骨魚類和其他魚種。主要混獲鯊魚包括鋸峰齒鮫、平滑白眼鮫、深海狐鮫和灰鯖鮫，其中鋸峰齒鮫為主要丟棄之鯊魚魚種。

印度洋分為3區：A區為北緯10度～30度；B區為南緯15度～北緯10度，西經20以西；C區為南緯15度～50度，東經150度～西經20度。主要混獲魚種依序為其他硬骨魚類、鯊魚和旗魚。主要混獲鯊魚魚種包括鋸峰齒鮫、淺海狐鮫和灰鯖鮫，其中鋸峰齒鮫為主要丟棄之鯊魚魚種。

根據觀察員回報之2002～2008年鯊魚混獲資料，對作業報表之歷史鯊魚漁獲量，和臺灣鮪延繩釣船於三大洋之鯊魚總漁獲量進行推估，大西洋之鯊魚混獲量介於468,9公噸(2007年)至15,117公噸(1996年)不等，太平洋為2,357公噸(1998年)至12,746公噸(2004年)不等，印度洋為730公噸(1991年)至9,957公噸(1995年)不等(如表二所示)。

**表二：**臺灣鮪延繩釣船於各洋區之年度鯊魚混獲估計量(公噸)

| 年度 | 大西洋 | 太平洋 | 印度洋 |
|---|---|---|---|
| 1991 | 10900 | 2985 | 730 |
| 1992 | 13688 | 4824 | 1988 |
| 1993 | 8073 | 3590 | 2857 |
| 1994 | 12657 | 3086 | 1850 |
| 1995 | 10473 | 7170 | 9957 |
| 1996 | 15117 | 8822 | 4413 |
| 1997 | 12245 | 2943 | 1922 |
| 1998 | 10794 | 2357 | 4126 |
| 1999 | 10626 | 3817 | 2764 |
| 2000 | 11318 | 4367 | 1990 |
| 2001 | 7684 | 10657* | 5532* |
| 2002 | 10564 | 10642* | 4528* |
| 2003 | 9543 | 10242* | 5052* |
| 2004 | 8157 | 12746* | 5398* |
| 2005 | 6516 | 12289* | 3280* |
| 2006 | 5667 | 12482* | 4438* |
| 2007 | 4689 | 12550* | 4391* |
| 2008 | 5300 | 12461* | 5009* |

備註：包括小型鮪延繩釣船混獲量

TAIPEI

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FIFTH INTERNATIONAL FISHERS FORUM

**研討主題4：**實踐沿岸及海洋空間規劃以達成永續表層漁業之建議

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## 研討主題4摘要

# 實踐沿岸及海洋空間規劃以達成永續表層漁業之建議

**主持人：Larry B. Crowder博士**，杜克大學

**預期結果：**為對永續表層漁業有所貢獻，對實踐海洋空間規劃提出建議，未來行動及產業承諾，並擬列入第五屆國際漁業人論壇宣言。

本節由10位討論小組成員個別發表簡短聲明，就表層漁業界如何自參與沿岸及公海之海洋空間規劃與生態系統管理中獲益表達看法。發表結束後即由觀眾發問，由討論小組成員回答。

許多與會者普遍認為海洋空間規劃等於海洋保護區，其中捕撈漁業對沿岸及海洋空間規劃所假定的最終結果，係劃設可捕撈和不可捕撈的區域。透過本次會議的簡報及討論，已瞭解捕撈漁業及較廣泛水產業，如何藉由發起及改善與其他使用及影響海洋資源產業間之協調而獲益，協助澄清海洋空間規劃僅是禁漁區的另一種用語看法，是不正確的。

捕撈漁業直接仰賴海洋生態系統的完整性，然而其他大型海洋產業並非如此。即使墨西哥灣的商業魚群因近期漏油事件而崩潰，石油產業卻不會受到影響。因此，指出具商業重要性區域（如與混獲比例相比漁獲比例高的區域、產卵區等）係海洋空間規劃如何有益於捕撈漁業的一個例子，且透過直接參與海洋空間規劃倡儀，保護該等區域免於遭受導致渠等退化之活動，以維護捕撈漁業之利益。

杜克大學Daniel Dunn博士說明水產業如何從正式參與海洋空間規劃的過程中獲益，及未參與之風險。渠強調如何應用生物多樣性公約最近通過的生態或生物學上重要海洋區域（EBSAs）認定之科學標準。首先透過研擬的EBSAs清單，再透過受命管理漁業資源的組織將EBSAs納入管理。Dunn博士鼓勵來自各界的第五屆國際漁業人論壇與會者對此過程作出貢獻。

世界海洋理事會Paul Holthus博士解釋各產業部門對多重利益相關者之海洋空間規劃過程的參與有限，因為各產業忙於單一部門之對話。所以實有必要在海洋產業與其他利益相關者間建立建設性的關係。

臺灣區遠洋鮪釣船魚類輸出同業公會黃昭欽總幹事提及漁業從業人員聚餐時所做的建設性討論。近幾十年來，儘管一開始鮪漁業擔憂新的養護措施可能影響其生計，然為減少有問題的敏感性物種混獲，包括海龜和海鳥等，鮪漁業已採用新的漁具技術。同樣地，海洋空間規劃和以生態系統為基礎之管理機制的實施亦將逐漸贏得捕撈漁業之支持，並吸引渠等參與規劃與管理過程。

夏威夷太平洋大學David Hyrenbach博士就表層海洋生態系統，說明相對於分散的沿岸地區，動態過程的複雜性、多重壓力源、廣大的空間規模和多重利益團體如何使海洋空間規劃更具挑戰性，但這並非無法克服。海洋空間規劃過程必須考慮到這些複雜性。

臺灣區遠洋鰹鮪圍網漁船魚類輸出同業公會李嘉寶總幹事回顧太平洋作業鰹鮪圍網船所適用之養護與管理措施狀況。對鮪漁業而言，現行兩個太平洋區域性鮪漁業管理組織建立之禁漁期與禁漁區，係海洋空間規劃的起點，對鮪類資源之永續利用將有所貢獻。

國立臺灣海洋大學環境生物與漁業科學系呂學榮博士說明為何海洋空間規劃仍然是一個相當新的概念，以及不同定義和看法存在的原因。將社會經濟影響視為海洋空間規劃過程的一部份係極為重要，而且必須設計措施，以靈活處理立體的動態海洋結構與過程。

夏威夷延繩釣協會Sean Martin理事長表示倘水產業各階層，從零銷售到捕撈業，能直接參與公海和沿岸海洋空間規劃過程係最理想。透過本次會議所發表的個案研究，替代的空間規劃機制對捕撈漁業所造成之社會經濟影響的重要性更加清楚。

大堡礁海洋公園署Randall Owens博士主張強而有力的管理，對有效的海洋空間規劃與實施極為重要。空間管理需要一定的成本，為確保有效實施，海洋空間規劃所產生的管理措施結果需要具拘束力的協定，及確保遵循的資源。

澳洲臥龍崗大學國家海洋資源與安全研究中心Robin Warner博士提醒與會者，在國家管轄水域外，極少有海洋空間規劃的例子。雖然有一些單一層面的海洋區劃過程，如禁漁區，和一些國家管轄水域外保護區的案例。在全球層級上，近期有一些倡儀可能為國家管轄水域外之全面性海洋空間規劃提供基礎。隨著國際水域空間規劃的發展，Warner博士強調漁業利益相關者與其他相關部門間跨部門參與的重要性。

在接下來的全體討論中，與會者提到帛琉的海洋保護網絡，係沿岸地區實施海洋空間規劃之另一案例。

在某些地區，不易獲得有關沿岸及海洋人為使用之社會與經濟背景、各式各樣使用之價值及生態影響等基礎資訊。充分評估海洋利用所造成之累積衝擊，應係海洋空間規劃的中心角色，此亦需要掌握大量資訊。

與會者提出以權利為基礎（rights-based）之管理措施在漁業中之角色，該角色可作為海洋空間規劃的一個可能面向，以達成生態上永續之漁業及與其他海洋活動取得公平的衡平。

討論中談到促進捕撈漁業與保育團體間有效溝通的重要性，以及海洋空間規劃如何實現這個角色。海洋空間規劃將對使用海洋空間及資源的海洋產業產生主要的影響，因此現在普遍尚未直接參與規劃討論的水產業必須逐漸參與這些海洋空間規劃過程，並與其他海洋產業利益相關者發展網絡，以確保這些過程被告知及被平衡，並確保水產業的利益獲得公平的考慮。重要的是，清楚呈現海洋空間規劃對水產業之可能利益範圍，創造誘因吸引水產業參與正式的海洋空間規劃活動，否則這些利益團體不太可能參與，倘渠等對海洋空間規劃可能產生之結果看法僅止於漁業將受到進一步的空間限制。

# 第五屆國際漁業人論壇頒獎

**由西太平洋區域漁業管理理事會執行長Kitty M. Simonds頒發**

**頒予Geoff McPherson先生及Tom Nishida博士**

通常頒發獎項給人們，係由於其達成偉大成就，而非對其工作進展之讚揚。但有些時候，尤其是當成果可能影響深遠時，便需要對其工作進展予以表揚。我們的獲獎者Geoff McPherson先生及Tom Nishida博士所努力追尋的目標，就像是神話中的賢者之石或長生不老藥一般【嚇阻齒鯨以避免其咬食表層延繩釣漁獲】。

偽虎鯨或短肢領航鯨等少數齒鯨類曾遭到捕獲，但在美國，嚴謹的海洋哺乳動物保護法則認為，即使遭捕獲的數量不多，卻能對表層延繩釣漁業帶來重大影響。國家海洋漁業局（NMFS）剛完成一項行動計畫之起草工作，企圖將夏威夷延繩釣漁業每年混獲偽虎鯨所造成嚴重傷害及死亡數量降至最低。

該項計畫結合漁具改良及空間管理選項，以減少嚴重傷害及死亡率。漁具改良包括強制採用圓形鉤，其線徑之強度足以留住大型大目鮪，但亦能釋放如偽虎鯨之類的大型生物。該計畫的協調工作正順利進行中，而其空間要素則直接與本論壇所聽到的許多主題息息相關。然而，不像海鳥及海龜減緩計畫般相對容易解決，齒鯨類素以智能及學習能力聞名，較具挑戰性。

延繩釣漁業空間管理假設，增加發生相互作用的地點和外圍水域間的距離，能使延繩釣漁船有效遠離偽虎鯨。但如果我們欲實施禁漁區以減少相互影響，則原本習於咬食延繩釣漁獲及魚餌的偽虎鯨，是否會輕易地轉移

到正在作業的漁船？如果是遇到這種情形，我們還能做些什麼？

很幸運的，Geoff先生及Tom博士一直在尋找解決這個問題的方法。他們一直在調查偽虎鯨的習性，特別是該等動物在延繩釣周遭覓食時所運用的回聲測距能力。Geoff先生及Tom博士已嘗試過許多方法，包括能將偽虎鯨騙離延繩釣線，避免其咬食漁獲，以及妨礙或欺騙其回聲測距能力等。包括金屬球、金屬線以及玻璃飲料瓶等許多工具設備，都是Geoff先生及Tom博士所考量過的方案。

要達到減緩偽虎鯨咬食及混獲的預期目標，是一段漫長的旅程。海鳥相對較易受到避鳥繩之嚇阻，或不敢飛到漁船的旁邊。而相較於鯨豚，海龜是受本能制約進行活動的生物，而且很幸運的，海龜的嘴巴不會被掛著沙丁魚及鯖魚等餌料的大型魚鉤鉤住。讓我們回顧一下Geoff先生及Tom博士在本屆論壇發表報告的副標題，「誰比較聰明＆誰才是贏家？：是人類嗎？還是海豚？」，我們希望人類是贏家，而Tom博士及Geoff先生亦能完成他們的夢想，並在延繩釣對海龜、海鳥及齒鯨類混獲減緩上獲得完美的三連勝。

儘管如此，國際漁業人論壇系列感謝並讚許我們兩位同仁的幹勁及努力不懈。我們知道，對他們來說還有很長一段旅途要走，而在他們成功靠岸前，可能還會遇到許多波折。據此，我們頒獎給兩位同仁，以感謝他們的慷慨奉獻，並要求他們不要灰心喪志。先生們，你們的工作表現值得讚許，且全世界都在睜大眼睛期盼著，當你們找出解決減緩海洋哺乳動物與延繩釣相互影響的方法時，數以千計的延繩釣漁民將報以嘉許。

## 頒予臺灣漁業署

國際漁業人論壇頒獎予台灣漁業署，以表揚其於2008年做出禁捕鯨鯊之決定。全球鯨鯊資源狀況依舊不明確，但所有鯊類的捕撈問題在過去二十年來一直受到關注。此外，世界自然保育聯盟認為鯨鯊係易受傷害且需受到保護。很少人知道鯨鯊是鯊魚世界中「溫柔的巨人」。值得讚揚台灣的是，該國利用其水域內豐富的鯨鯊資源，研究這一驚人魚種的相關生物學知識。該物種的壽命超過80歲，性成熟期約為17至22歲間。這意味著，鯨鯊在能生育前，其壽命中有四分之一的期間是易受傷害的。

臺灣漁業署決定禁捕鯨鯊，意味著傳統漁業的結束，這對那些受影響的人而言是很難放棄的。然而諸如菲律賓及印度等亞洲國家，儘管仍存在傳統鯨鯊捕撈活動，亦實施禁捕。選擇並決定嚴厲的治理與管理方式可能無法受到普遍的歡迎，本論壇在此對臺灣漁業署所採取的鯨鯊保育行動表示敬意。

鯨鯊係真正徜徉於各大洋的高度洄游性魚種。一支獨木舟划槳之獎座具有雙重意義，既象徵鯨鯊所進行的大洄游，亦代表著居住在太平洋島嶼的人們所進行的驚人旅程。台灣被認為是許多太平洋島嶼人們祖先的故鄉。據信南島民族約在五千到六千年前，自台灣展開旅程，並經由東南亞來到新幾內亞，在此形成拉匹達文化（Lapita culture），並保有獨特的陶器形式。三千年前，拉匹達文化離開新幾內亞群島，並散播至中太平洋島嶼並造就了波利尼西亞。波利尼西亞人遍佈於溫帶的紐西蘭、亞熱帶的夏威夷群島及復活島等太平洋區域。南島民族聚居於菲律賓及西密克羅尼西亞，而來自新幾內亞群島的旅人則居住在東密克羅尼西亞。

因此，這就如同國際漁業人論壇系列在太平洋所進行的旅程，我們從紐西蘭到夏威夷、日本及哥斯大黎加，而在本屆論壇中，許多的與會者回到了我們祖先的故鄉。今天我們致贈本次旅程的象徵－夏威夷相思木划槳予台灣，以表揚其對鯨鯊保育所做的貢獻。不要忘了還有圓形鈎，我們之所以能成功減緩延繩釣漁業和敏感性物種間的相互影響，是因為我們的祖先跨越了時空，協助我們達成對環境負責任漁業的目標。為感謝主辦本次論壇活動之臺灣漁業署，同時對於其保育鯨鯊之行動與我們的祖先文化表示敬意，並希望於未來持續傳遞我們所採取的行動。

附錄1

# 第5屆國際漁業人論壇(IFF5) 議 程

**海洋空間規劃與漁業混獲管理**
**2010年8月3日至5日於台北**
**西太平洋區域漁業管理理事會(美國)暨行政院農業委員會漁業署(臺灣) 共同主辦**

## 2010年8月2日星期一

**13:00 – 17:00**
報到註冊(3樓遠東宴會廳入口處)

**14:00 –14:30**
向講者簡報會議流程(3樓遠東宴會廳)

## 2010年8月3日星期二 (會議第一天)

**7:30 – 8:30**
報到註冊(3樓遠東宴會廳入口處)

**8:30 – 9:00**
開幕典禮(3樓遠東宴會廳)
行政院農業委員會漁業署主辦

**9:00 – 9:30**
開幕致詞
陳武雄博士,行政院農業委員會主任委員
"來賓致詞"
沙志一先生,行政院農業委員會漁業署署長
謝文榮先生,臺灣區遠洋鮪釣船魚類輸出業同業公會理事長
Rebbeca Lent博士,美國國家海洋漁業局國際事務處處長
Sean Martin先生,夏威夷延繩釣協會理事長

**10:15 – 10:45**
團體照(1樓大廳)

**10:45 – 11:15**
茶點時間

**10:45 – 11:15**
記者會[1](3樓遠東宴會廳)

**11:15 – 11:30**
論壇架構、宗旨、目標及活動簡介
黃鴻燕先生,行政院農業委員會漁業署遠洋漁業組組長

**11:30 – 12:00**
簡報第1屆國際漁業人論壇迄今之承諾與進展及本屆與會者承諾之程序
Kitty M. Simonds女士,西太平洋區域漁業管理理事會執行長

**12:00 – 13:30**
午餐 (自理)

**13:30 – 15:15**
**研討主題1:**沿岸及海洋空間規劃與管理之途徑

主持人:Robin Warner博士,澳洲臥龍崗大學國家海洋資源與安全研究中心

預期結果:沿岸及海洋空間規劃之途徑有哪些?其對減少漁業混獲、管理丟棄及達成永續的表層魚類資源之貢獻為何?

講者/小組成員:(每位簡報10分鐘,之後進行綜合討論)
Larry B. Crowder博士,杜克大學
"海洋空間規劃在可持續表層漁業所扮演的角色:從以漁業部門為基礎之途徑轉至以生態系統為基礎之途徑"
David Hyrenbach博士,夏威夷太平洋大學
"公海海洋空間規劃之海洋學考量"
Daniel Dunn博士,杜克大學
"運用生物多樣性公約之生物多樣性科學標準,以認定在生態上或生物上具重要性之需要保護的公海及深海棲地區域"
呂學榮博士,國立臺灣海洋大學環境生物與漁業科學系
"運用地理資訊系統之海岸地區海洋空間規劃

[1] 開幕致詞代表偕同參加10:45 - 11:15召開之記者會。

Randall Owens先生，大堡礁海洋公園署
“管控、評估及調適的海洋空間規劃及管理”
Robin Warner博士, 澳洲臥龍崗大學國家海洋資源與安全研究中心
“海洋空間規劃在治理國家管轄水域外的氣候變遷減緩活動之角色”
Paul Holthus博士，世界海洋理事會執行長
“法人組織在海洋空間規劃與管理所扮演之角色”

**14:50 – 15:15**
綜合討論

**15:15 – 15:30**
茶點時間

**15:30 – 17:30**
**研討主題2A：**沿岸與海洋空間規劃及管理之個案研究-管理者及規劃者之觀點

主持人：Milani Chaloupka博士，生態模型分析中心與昆士蘭大學及張正昇先生，中華民國對外漁業合作發展協會

預期結果：確認有效與無效的海洋空間規劃之經驗、最佳實踐及海洋漁業治理之涵意，其中何者能作為太平洋島嶼區域應用海洋空間規劃之參考？

講者/小組成員：(每位簡報15分鐘，之後進行綜合討論)
Jo-Ann Leong博士，美國夏威夷海洋生物研究院院長
“沿岸及海洋空間規劃與西北夏威夷群島”
Randall Owens先生，大堡礁海洋公園署
“大堡礁海洋公園署海洋空間規劃包括永續海洋漁業的心得”
Deirdre Boelke女士，新英格蘭漁業管理理事會漁業分析員
“新英格蘭扇貝床之區域輪作”
王茂城先生，行政院農業委員會漁業署
“臺灣劃設海洋保護區之經驗”
David Fluharty博士，華盛頓大學
“普吉灣海洋空間規劃之初期實施成果”

**16:45 – 17:30**
綜合討論

**19:00**
歡迎酒會（7樓游泳池畔）
西太平洋區域漁業管理理事會主辦

---會議第一天結束 ---

## 2010年8月4日星期三(會議第二天)

**8:00 – 17:00**
註冊報到（3樓遠東宴會廳入口處）

**8:30 – 8:45**
說明本日會議安排（3樓遠東宴會廳）

**08:45 – 11:30**
**研討主題2B：**沿岸及海洋空間規劃之個案研究-商業海洋捕撈漁業之觀點

主持人：Henk Brus先生，Atuna

預期結果：海洋空間規劃應如何調整，以符合個別漁業社區之社會、經濟、文化及環境背景？

講者：(每位簡報15分鐘，之後進行綜合討論)
Timm Timoney女士，夏威夷西北部之底魚漁民
“美國Papahanaumokukea國家海洋紀念區空間規劃對商業漁業之社會經濟效應”
Andrew Tobin先生，昆士蘭水產協會
“澳洲大堡礁海洋公園海洋空間規劃之漁業界經驗”
Bill Wells先生，Wells扇貝公司
” 大西洋扇貝區域輪作之產業經驗”
洪一平先生，彰化區漁會
“臺灣海岸空間規劃利用---以彰化地區為例”
Marion Larkin先生，美國華盛頓州商業漁民
“美國西海岸海洋空間規劃之漁業界經驗”

**10:15 – 10:30**
茶點時間

**10:30 – 11:30**
研討主題2B (續)：綜合討論

**11:30 – 13:00**
與會者聚餐
西太平洋區域漁業管理理事會主辦

漁業從業人員聚餐
夏威夷延繩釣協會暨西太平洋區域漁業管理理事會共同主辦

預期結果：漁業人在海洋空間規劃之經驗與觀點進行非正式討論

主持人:
黃昭欽先生，臺灣區遠洋鮪釣船魚類輸出業同業公會總幹事
Sean Martin先生，夏威夷延繩釣協會理事長

**研討主題3：**減少海洋漁業對敏感性物種之混獲

**13:00 – 14:45**
**研討主題3A：**減緩小規模漁業(包括沿岸消極性網具之家計型漁業)對敏感性物種之混獲及混獲丟棄之管理

主持人：Ussif Rashid Sumaila博士，英屬哥倫比亞大學漁業中心主任

預期結果：認定減緩小規模沿岸漁業混獲之進展及其優先順序

講者：(每位簡報12分鐘，之後進行綜合討論)
Rebecca Lewison博士，聖地牙哥州立大學
“評估小規模漁業混獲及預估全球的影響”
莊守正博士，國立臺灣海洋大學
“臺灣鯨鯊的利用、管理及研究”
Geoff McPherson先生，詹姆士庫克大學
“減少刺網混獲海洋哺乳類之聲納發射器—生物聲納基礎之最適利用及減輕混獲與咬食之作法”
Osamu Abe博士，日本遠洋水產研究所
“減緩待袋網/定置網與海龜之相互影響”
Donald Kobayashi博士，美國NMFS太平洋島嶼科學中心、以及
程一駿博士，國立臺灣海洋大學
“臺灣沿岸定置網海龜混獲及衛星追蹤混獲之赤蠵龜”
Martin Hall博士，美洲熱帶鮪類委員會
“評估與減緩拉丁美洲小規模沿岸漁業可能造成問題之混獲”

**14:15 – 14:45**
綜合討論

**14:45 – 15:00**
茶點時間

**15:00 – 17:00**
**研討主題3B：**市場機制和漁業混獲

主持人：Lida Pet-Soede博士，世界自然基金會(WWF)珊瑚三角區計畫主持人

預期結果：指出市場機制如何影響漁業生產實務及有關減緩敏感性物種混獲之治理架構，以及未來如何應用這些方法對永續漁業做出貢獻，並為參與的漁業開創新市場及鞏固既有市場

講者：(每位簡報10分鐘，之後進行綜合討論)
李明華女士，中華鯨豚協會
“臺灣傳統漁業轉型經營賞鯨業之概況”
Lida Pet-Soede博士，WWF全球珊瑚三角區計畫
“國際水產永續基金會及減緩混獲：全球鮪類資源永續任務之核心因素”
Keith Symington先生，WWF珊瑚三角區及西太平洋計畫之混獲策略主持人
“珊瑚三角區漁人論壇：管理混獲之市場機制夥伴關係"
Bill Holden先生，海洋管理理事會(MSC)太平洋漁業經理
“用於評估資料不足漁業混獲之MSC協定”
Duncan Leadbitter先生，永續漁業夥伴技術經理人
“市場影響與鮪類資源永續：多樣且多變的世界”
Bundit Chokesanguan先生，東南亞漁業發展中心
“監測、管控與偵察（MCS）和改變捕魚方法之市場機制能力～美國進口蝦類貿易規則及熱帶蝦類拖網漁業使用海龜脫逃器措施之啟示”
Henk Brus先生，Atuna
“為歐洲市場供應永續鮪類”

**16:10 – 17:00**
綜合討論

--- 會議第二天結束 ---

## 2010年8月5日星期四(會議第三天)

**8:00 – 17:00**
註冊報到(3樓遠東宴會廳入口處)

**8:00 – 8:30**
說明本日會議安排(3樓遠東宴會廳)

**8:30 – 11:00**
**研討主題3C:**減緩延繩釣及圍網漁業之混獲

主持人:蔡日耀先生,行政院農業委員會漁業署副署長及何勝初先生,中華民國對外漁業合作發展協會執行長

預期結果:檢視表層及底延繩釣漁業暨圍網漁業減緩混獲之進展並界定優先順序

講者:(每位簡報10分鐘,之後進行綜合討論)
Ussif Rashid Sumaila博士,英屬哥倫比亞大學漁業中心主任
"中西太平洋鮪類系群之序列賽局理論模式"
Rick Deriso博士,美洲熱帶鮪類委員會
"美洲熱帶鮪類委員會漁具別鮪漁獲分配措施對東太平洋大目鮪資源之影響"
Eric Gilman博士,夏威夷太平洋大學
"全球鮪漁業減緩不要的混獲"
Martin Hall博士,美洲熱帶鮪類委員會
"創造誘因以發展引進有效的減緩混獲與管理措施"
Rebecca Lent博士,美國國家海洋漁業局
"第二屆鮪類區域性漁業管理組織會議之混獲研討會成果"
程建中博士,中華民國野鳥學會
Mayumi Sato博士,亞洲鳥盟
"表層及底延繩釣漁業海鳥混獲:進展與阻礙"

**9:30 – 9:45**
茶點時間

Tom Nishida博士,日本遠洋水產研究所
"半世紀以來鮪延繩釣漁業減緩齒鯨咬食措施之演進:誰比較聰明和贏家?人類或海豚?"
劉光明教授,國立臺灣海洋大學
"臺灣鮪延繩釣漁業之鯊魚混獲"

**10:05 – 11:00**
綜合討論

**11:00 – 11:15**
茶點時間

**11:15 – 12:45**
**研討主題4:**實踐沿岸及海洋空間規劃以達成永續表層漁業之建議
<團體討論(無簡報)>

主持人:Larry B. Crowder博士,杜克大學

預期結果:為對永續表層漁業有所貢獻,對實踐海洋空間規劃提出建議、未來行動及產業承諾,並擬列入IFF5宣言

討論小組成員:
Daniel Dunn博士,杜克大學
Paul Holthus博士,世界海洋理事會
黃昭欽先生,臺灣區遠洋鮪釣船魚類輸出業同業公會
David Hyrenbach博士,夏威夷太平洋大學
李嘉寶先生,臺灣區遠洋鰹鮪圍網漁船魚類輸出業同業公會
呂學榮博士,國立臺灣海洋大學環境生物與漁業科學系
Sean Martin先生,夏威夷延繩釣協會
Randall Owens先生,大堡礁海洋公園署
Robin Warner博士,澳洲臥龍崗大學國家海洋資源與安全研究中心

分組討論以擬定建議

**12:45 – 14:15**
午餐(自理)

**14:15 – 14:45**
報告IFF5與會者之承諾
Kitty M. Simonds女士,西太平洋區域漁業管理理事會執行長

**14:45 – 15:15**
IFF5宣言
沙志一先生,行政院農業委員會漁業署署長
Kitty M. Simonds女士,西太平洋區域漁業管理理事會執行長

**15:15 – 15:45**
閉幕聲明
沙志一先生，行政院農業委員會漁業署署長
Kitty M. Simonds女士，西太平洋區域漁業管理理事會執行長

**15:45 – 16:00**
第五屆國際漁業人論壇頒獎
Kitty M. Simonds女士頒發

**16:00 – 16:30**
閉幕典禮
西太平洋區域漁業管理理事會主辦

**17:15 – 17:45**
記者會[2]

**19:00**
惜別晚會（台北圓山大飯店）
行政院農業委員會漁業署主辦

--- 會議第三天結束---

[2] 記者會之參加人員包括沙志一先生（行政院農業委員會署長）、Kitty M. Simonds女士（西太平洋區域漁業管理理事會執行長）及研討主題4之小組成員。

附錄2

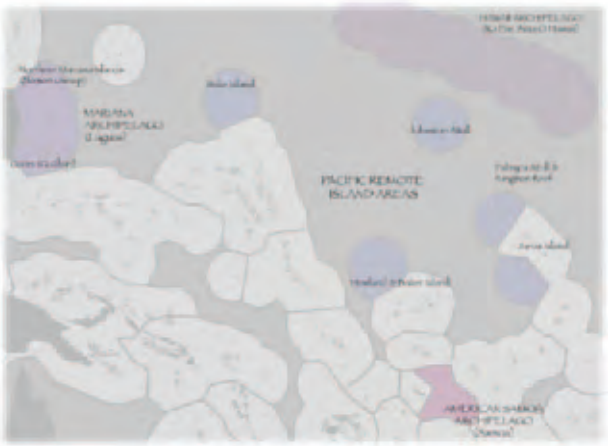
# 主辦單位介紹

## 美國西太平洋區域漁業管理理事會

美國西太平洋區域漁業管理理事會（以下簡稱理事會）為一漁業管理政策制訂組織，管轄範圍包括美屬薩摩亞、關島、夏威夷州、北馬里亞納群島等地及美國在太平洋其他島嶼區域鄰近水域（如附圖），管轄海域面積近150萬平方英里。該理事會為美國依據1976年麥格那森漁業養護與管理法（Magnuson Fishery Conservation and Management Act of 1976），所建立的八個區域性理事會之一。該理事會成立34年迄今，在各方面取得良好的成績，包括成為全國第一個禁止流刺網漁業的區域漁業管理理事會，並發展以生態系統為基礎的漁業管理計畫，倡導的漁業漁船監控系統為世界各地漁業所採用。

該理事會主要任務為養護漁業資源，並使國內漁業努力量及產量維持在可持續性水準。為此，該理事會在轄區內分區施行漁業生態系統計畫（FEPs），進行美屬薩摩亞、馬里亞納群島（關島及北馬里亞納群島）、夏威夷、太平洋離島水域等地漁業及太平洋遠洋漁業之管理。在漁業生態系統計畫架構下，該理事會成立區域性生態系統顧問委員會，成員包括理事會成員、聯邦政府、州政府及地方政府代表、業者代表及關注可能影響區域海洋環境之陸上或非漁業活動的非政府組織。

在美國八個理事會中，該理事會最關注國際漁業之管理。身為美國代表團的成員之一，該理事會參加在太平洋的各項國際漁業管理公約組織，包括中西太平洋漁業管理委員會（WCPFC）、北太平洋區域漁業管理安排及美洲熱帶鮪類委員會(IATTC)等活動。美屬薩摩亞、關島及北馬里亞納群島同時亦分別派




員參加WCPFC。此外，該理事會亦贊助幾個太平洋周邊（包括日本、印尼、巴布亞紐幾內亞及墨西哥）主要的海龜保育倡議，並協助夏威夷成為世界海龜養護及管理的中心。該理事會並積極從事海鳥、海洋哺乳動物及鯊魚的養護工作。

該理事會有13名具投票權的成員及3名不具投票權的成員。一半的理事會成員是由所屬州長提名並由美國商務部長指派，以代表區域內漁業及相關社區之利益。其他理事會成員則由指定州政府、領地政府及聯邦政府之漁政官員擔任。

## 行政院農業委員會漁業署

漁業署為主司全國漁業及養殖行政事務之法定獨立行政機關，隸屬於行政院農業委員會。該署於1998年8月1日由行政院農業委員會漁業處升格，並納編前省政府農林廳漁業局而成。該署設置署長1人，平日負責綜理漁業署各項事務。該署另設置副署長2人，主任秘書1人，並下設企劃組、漁政組、遠洋漁業組、漁業設施及養殖組、秘書室、會計室、人事室及政風室，處理各項漁業行政事務。另該署亦設置遠洋漁業開發中心及漁業廣播電台。

身為台灣最高漁業主管機關，漁業署主管事務包括：

1. 漁業政策、法規、方案、計畫之擬訂及督導。
2. 漁業科學、漁業公害防治之研究及規劃。
3. 漁船與船員之管理督導。
4. 漁業巡護之執行、協調及督導。
5. 漁民團體與漁業團體之輔導及督導。
6. 漁業從業人員、漁民團體與漁業團體推廣人員之訓練、策劃及督導。
7. 漁產運銷與加工、漁民福利、漁業金融之督導及配合。
8. 國外漁業基地業務之督導。
9. 國際漁業合作策劃、推動及漁業涉外事務之協調。
10. 漁業資源保育、栽培、管理、調查研究、評估及養殖漁業之策劃、推動、督導與協調。
11. 漁港與其附屬公共設施之規劃及督導。
12. 漁獲統計及資訊之綜理分析。
13. 其他有關漁業及漁民之輔導。

## 中華民國對外漁業合作發展協會

對外漁業合作發展協會（以下簡稱協會）成立於1989年11月30日，為一非營利之財團法人組織，由政府部門及民間共同捐助基金。

早期協會的任務為協助業者與沿岸國洽談對外漁業合作，協助業者與沿岸國簽署漁業合作協議，並在發生漁業糾紛時提供業者法律上的協助。近年來，協會功能已朝多方面發展，協助補充政府在漁業管理方面的工作，以符合快速變遷的國際漁業管理。因此主要的工作內容集中在：漁業統計資料之蒐集與彙整、漁業統計資料庫之維護、設置漁船監控中心並提供相關服務、執行科學觀察員計畫及參加國際性及區域性漁業養護及管理會議及論壇、向業者提供有關國際漁業訊息資料並向業者提出因應建議。目前協會職員已超過80人。

附錄3

# 國際漁業人論壇系列沿革及最終屆論壇之規劃

國際漁業人論壇系列自2000年開始舉辦，邀請來自不同種類的漁業從業人員，及其他關切表層海洋捕撈漁業在環境及社會經濟之可持續性、減緩敏感物種混獲、商業上重要表層魚種之養護，及保護海洋生物多樣性等議題之利益相關團體，共同參加。

每屆論壇的範圍均逐次擴大，以應付新的及即時的養護管理議題。2000年舉辦的首屆論壇聚焦於減緩底層及表層延繩釣漁業與海鳥的互動。2002年在夏威夷舉辦的第2屆論壇，則將關注重點擴展到延繩釣漁業與海鳥及海龜之互動。2005年第3屆論壇於日本與國際負責任鮪漁業研討會共同舉辦，除延繩釣漁業混獲海龜及海鳥外，第3屆論壇的主題還包括可持續性鮪漁業及鯊漁業；漁撈能力；生產、行銷及消費之監控；非法、無報告、不受規範漁業；減少鯨豚混獲；及使用以市場為基礎之機制（包括生態標籤）以影響海洋捕撈漁業的實踐與管理。第4屆論壇2007年於哥斯大黎加舉辦，關注範圍擴展到鯊魚及鯨豚與延繩釣漁業之互動及減緩家計型流刺網漁業混獲之知識現況。透過國際漁業人論壇系列的意見交換，使對漁業養護及管理的問題能有更綜合性的回應，並加速全球減緩該等問題之進展。

以海洋空間規劃及漁業混獲管理為重點之第5屆國際漁業人論壇，將由美國西太平洋區域漁業管理理事會及行政院農業委員會漁業署於2010年8月3日至5日在台北共同舉辦。第5屆論壇為本系列論壇的最終屆。本次論壇主題為海洋空間規劃，同時並將回顧歷屆論壇迄今的進展。

欲取得國際漁業人論壇系列相關資訊，包括所有屆別實錄集，請瀏覽國際漁業人論壇網站（www.fishersforum.net）

## 附錄4
# 第五屆國際漁業人論壇與會者之承諾

| 姓名 | 國家/領地 | 所屬單位 | 承諾 |
|---|---|---|---|
| Stephen Haleck | 美屬薩摩亞 | 西太平洋區域漁業管理理事會 | 我承諾參與我們島嶼之海洋空間規劃。 |
| Guillermo Cañete | 阿根廷 | 阿根廷野生動物基金會 | 我將推動西南大西洋之海洋空間規劃，以作為有效執行生態系統管理之工具。 |
| Rashid Sumaila | 加拿大 | 英屬哥倫比亞大學漁業中心 | 我將持續進行研究並彙編有用資訊，以支持有效的海洋空間規劃及混獲減緩措施之發展。具體而言，我的研究室將提供重要經濟資訊，以促進永續漁業，並對當代與未來世代有所助益。 |
| Mike Fleming | 美國北馬里亞納群島 | 西太平洋區域漁業管理理事會諮詢小組成員 | 我將：<br>1. 積極參與會影響北馬里亞納群島漁場之公共論壇與架構；<br>2. 持續參與對漁村有所影響之非政府組織活動；及<br>3. 對沿岸漁區之漁業養護與管理活動有所貢獻。 |
| Jeannette Mateo Perez | 多明尼加共和國 | 多明尼加漁業及養殖協會 | 我承諾改善多明尼加共和國有關敏感物種混獲及其他丟棄漁獲之漁業資料收集系統，尤其是海洋保護區。 |
| Dale Alvarez | 關島 | 關島漁民合作協會 | 我將教導社區中對表層海洋捕撈漁業環境及永續性有興趣的人們。我將與渠等分享我在本漁業論壇之所學。 |
| Thomas Camacho | 關島 | 關島海釣協會 | 我將：<br>1. 教育並推動瞭解；<br>2. 協助以促進未來之討論，因其與我的社區息息相關；<br>3. 影響並要求對「實際數據」之需求；<br>4. 影響並支持會員參與；<br>5. 和立法議員與市長一同努力；及<br>6. 和其他伙伴與組織一同努力。 |
| Manuel Duenas | 關島 | 漁民 | 我將透過海洋空間規劃的進程，推動海洋資源供後代子孫永續利用。認知到發展此一計畫將使我們進一步提升為海洋管理員之角色，為促進合作，任何海洋空間規劃策略必須由利害關係人積極參與其發展，而不應由資源利用者以外的特殊團體為之，並據此制定可行且實際之解決方法。 |

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|---|---|---|---|
| Jesse B. Rosario | 關島 | 關島漁民合作協會 | 我承諾要協助利害關係人及從業人員，明確界定海洋空間規劃，藉由<br><br>1. 創建全球性的海洋空間規劃任務聲明；<br>2. 發展全球性海洋空間規劃目標及目的；<br>3. 指認全球合作伙伴，以組成區域性海洋空間規劃理事會；及<br>4. 發展永續漁業計畫及減少混獲、報告捕獲及物種洄游情形等。 |
| Ebol Rojas | 墨西哥 | 專業觀察員協會/IFOMC觀察員<br><br>專業工作小組/ 國際觀察員 | 關於混獲，我承諾 ：<br><br>1. 藉由運用觀察員計畫，以持續改善混獲之監測技術；<br>2. 籍由監測與實施新的海鳥混獲減緩裝置，致力於減緩底層延繩釣之意外捕獲，並透過諸如美露鱈延繩釣漁業所使用的網套裝置，以減緩和海洋哺乳動物之交互影響。<br>3. 持續和南極海洋生物資源保育委員會處理印度洋域之新議題：以美露鱈及鯊魚為目標漁獲之漁業使用流網漁具，此一非法漁業導致混獲資料不足。 |
| Henk Brus | 荷蘭 | ATUNA B.V, Sustunable B.V | 在接下來三年內，我承諾全面供應獲得海洋管理理事會生態標籤之鮪罐及冷凍鮪類商品（包括正鰹及黃鰭鮪產品）。 |
| Danilo Rosales | 尼加拉瓜 | 尼加拉瓜漁業及水產養殖研究所 | 我將持續承諾，制定計畫及方案以減少海鳥、海洋哺乳動物與海龜之意外捕獲，以及持續進行我們和漁村及中美洲與加勒比海區域組織共同發展之土地管理計畫。 |
| David Kellian | 紐西蘭 | Kellian漁業公司負責人 | 我將帶回在本次論壇中所學，並將此等資訊傳遞給漁民伙伴及當地的漁業協會。我將持續致力於尋找新的且實際的解決海鳥與海龜混獲方法，並在進行捕撈作業時，使用我所能使用的減緩工具。我亦將鼓勵其他人來參與減緩混獲活動，並將積極和有關當局與漁民共同合作，以尋求解決混獲之道。 |
| Marvin Ngirutang | 帛琉 | 帛琉共和國駐台灣大使館 | 我將支持建立一漁船船長及船員之行為準則。船長及船員必須改變其習慣與行為。自太平洋島國專屬經濟水域及領海偷抓魚，係亞洲漁船常見的做法。他們利用島國(除夏威夷外)無法在其海域內落實海上巡邏之能力。船長們必須瞭解到，最終島國政府恐須禁止所有類型的捕魚方式，以試圖保護他們的天然資源，例如設置鯊魚保護區或鯨魚保護區等。<br><br>倘各區域漁業管理組織能對該等亞洲國家施壓，將有助於促使該等國家實施對全球漁民有所助益之行動。<br><br>將石油丟棄及傾倒至海洋亦為亞洲漁船之主要問題。 |

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|---|---|---|---|
| Norman Barnabas | 巴布亞紐幾內亞 | Dologen公司 | 我承認海洋空間規劃的重要性及不同海洋利用者－包括國家層級的沿海社群在內－間有良善互動與對話之需求，這將有助於維持健康的海洋環境。我將透過巴布亞紐幾內亞漁業協會，努力推動此一活動。 |
| 倪怡訓 | 台灣 | 國立臺灣海洋大學 | 我承諾要推廣營養層級較低之表層魚類利用，其具下列優點：<br>1. 海洋生物資源之較適利用；<br>2. 較少混獲問題；<br>3. 減少有機與無機污染物之影響；及<br>4. 減少用於運送高品質大型表層魚類之能源消耗。 |
| Rita Zeng | 台灣 | 竹門國際有限公司 | 我同意第五屆國際漁業人論壇所通過之台北宣言，並承諾支持海洋空間規劃之執行及減緩混獲。 |
| Bundit Chokesanguan | 泰國 | 東南亞漁業發展中心 | 我將透過區域諮商會議討論「生態系統漁業管理」（參照www.ffp2020.org）主題之過程，將海洋空間規劃議題提至「Fish for the People 2020」大會上。我亦將持續推動及執行蝦拖網計畫(REBYC II)與其他相關活動，以減少混獲。 |
| Deidre Boelke | 美國 | 新英格蘭漁業管理理事會 | 由於美國的海洋空間規劃日益具體成形，我承諾將盡己所能，以確保現有的漁業理事會能積極參與其過程及討論。本理事會已指認漁業管理程序中之實際/主要參與者，因此美國國家大氣暨海洋總署在指認哪一漁業議題係重要及何者應參與時，應交由各個理事會先行為之。<br><br>我將嘗試教導我所接觸到的漁民有關海洋空間規劃之具體內容。並盡量鼓勵他們參與美國正在發展的行政命令之過程。 |
| Martin Hall | 美國 | 美洲熱帶鮪類委員會 | 我承諾持續進行減少混獲（定義為拋棄屍體）之工作，同時維持漁民的工作機會並推動永續漁業。 |
| Rebecca Lewison | 美國 | 聖地牙哥州立大學 | 我承諾和漁民/業者、資源管理者及其他科學家，致力於開發創新的管理工具、促進混獲之削減（多物種），以及推動永續漁業。我亦承諾，將把此等努力轉化為具影響力的文章，以傳遞海洋空間規劃資訊。 |
| Phan Hong Dung | 越南 | 海洋漁業研究所 | 我承諾執行前四屆國際漁業人論壇會議所通過之宣言，並將持續進行永續漁業。我承諾採取具體行動，包括負責任漁業行為準則、遵守國際海洋海拋規定、改良圓形鉤以供亞洲國家使用、在東南亞國家設置更多的海洋保護區、倡議沿海及海洋空間規劃、訓練及教育漁民、透過生態標籤開發更安全的水產食品、定期分享資訊及援助開發中國家，以達成海洋空間規劃及減緩混獲之目標與目的。 |

附錄5

# 專題講者簡歷

**Osamu Abe博士**係日本水產綜合研究中心遠洋水產研究所規劃及協調科科長，他自東京大學科學學院取得博士學位，並從1991年進入漁業科學職場，首先在西海區水產研究所(Seikai National Fisheries Research Institute, SNF)下關支所進行東中國海表層魚類資源評估。1995年被分配到SNF石垣分所，研究熱帶海洋物種的養護，特別是海龜，尤其致力於研究減少與海龜互動的漁網具。2007年至2010年4月間，他在馬來西亞擔任東南亞漁業發展中心海洋漁業資源發展與管理處副處長，從事日本信託基金計畫之規劃與管理，包括有關東南亞地區之海龜族群增生研究。Abe博士主要專長領域在：1)海龜生態之養護；2)發展減緩漁業混獲之措施；及3)珊瑚礁生態之養護。

**Deirdre Boelke女士**自2001年開始任職於美國麻州紐伯瑞波特市的新英格蘭漁業管理理事會，自2006年開始擔任該理事會之扇貝計畫協調人。新英格蘭漁業管理理事會為負責向美國國家海洋暨大氣總署國家海洋漁業局提出漁業管理措施的8個理事會之一。她在華盛頓特區喬治城大學取得理科學士學位，專攻生物學和生態學，其學士論文探討加州北部海岸視力受損海獅之存活。之後在羅德島大學取得海洋事務碩士學位，專攻漁業管理，其碩士論文係評估利用個別捕撈配額(IFQs)作為大西洋扇貝管理策略之潛力，並藉由與扇貝漁業執照持有人和管理者進行個別訪談，評估IFQs之執行。她以往的工作經歷包括：美國羅德島普羅敦斯(Providence)之海洋保育組織Seaweb；美國紐約冷泉港之水產種苗繁殖場；美國加州索塞里多(Sausalito)之海洋哺乳類中心；美國華盛頓特區之國家地理雜誌社。其工作領域尚包括：減緩混獲；漁業法規對漁業界之社會影響；共同合作研究；改善管理者與利害關係人間之溝通與合作；及維持公正透明的漁業管理決策。

**Henk Brus先生**於1957年在荷蘭出生，是罐頭食品進口商的兒子。在完成心理學學業後，他在1980年成為家族的心理治療師。1987年時，他決定在商業領域運用所學背景－解決問題與溝通能力，擔任國際魚罐進口商MCM Foods的低階銷售員。在這段期間，他將公司業務擴展至全歐洲，尤其是在鮪罐市場方面。1998年時，他創辦屬於自己的公司Atuna，該公司以垂直整合型供應鏈之方式，經營全球鮪類貿易。該年他亦設立atuna.com此一鮪類部落格，目前已成為全球性領導地位之鮪類入口網站。在近15年來，他曾在各主要鮪類會議發表演講，並曾於曼谷召開的世界鮪類大會擔任共同主席。Brus先生有將近20年的經驗，和大多數亞洲與太平洋國家進行鮪類產品貿易，這些產品大多銷往歐洲與北非。他曾於1997年世界鮪類會議上發表題為「永續性行銷－是必然或天真？」之演講，提倡鮪類資源之永續利用。2000年他為世界圍網漁業組織(World Tuna Purse Seiner Organization；WTPO)的共同創辦人，該組織之目的，在於防止未來全球圍網船漁撈能力之擴大。在過去10年間，他頻繁出席所有主要的鮪類會議，並發表鮪類永續發展之文章。2007年初期，他創辦Sustunable公司，該公司的目標係以一般大眾可接受的價格，販售負責任捕撈與製造之鮪類產品。該公司供應鮪罐產品給歐洲近20家連鎖超市，並以負責任捕撈鮪魚與具社會責任的態度，將所有鮪罐供應鏈透明化，且透過網路技術，直接提供該等資訊給消費者。

**Milani Chaloupka博士**為公認的複雜生態系統之統計和數學模型方面的專家，研究領域包括發展互動式隨機性電腦模擬瀕危物種之族群動態。Chaloupka博士目前經營一家國際研究顧問公司，就生態和經濟議題，提供客戶創新的統計和數學解決方案。公司客戶層廣泛，包括企業、政府、大學和政府間暨非政府間國際組織(INGO)等，例如雪孚龍(Chevron)公司、自然保

育聯盟(IUCN)、聯合國糧農組織(FAO)和美國國家海洋暨大氣總署(NOAA)國家海洋漁業局(NMFS)。Chaloupka博士曾擔任澳洲昆士蘭環境局局長辦公室主任，負責有關昆士蘭環境管理之策略性政策議題，包括大堡礁海洋公園、國家公園和野生動物保育，亦曾擔任澳洲合作研究中心之生態系模型計畫(海岸帶，河口與水道管理)主持人。Chaloupka博士目前擔任美國NOAA NMFS所屬之西太平洋區域漁業管理理事會之海龜諮詢小組主席和漁業科學與統計小組成員、加勒比海保育委員會之科學諮詢委員會成員，其亦為IUCN物種存續委員會之海龜專家小組副主席，負責太平洋島國區域，及IUCN海龜紅皮書管理局主席。Chaloupka博士最近受任為美國國家科學院所屬國家研究委員會之藍帶委員會成員，檢視美國海龜資源之所有評估方法。渠在國際期刊上發表多篇論文，著作甚豐。

**David Chang張正昇先生**目前係擔任中華民國對外漁業合作發展協會業務組組長，該協會創立於1989年，係一非營利之非政府間組織，以協助業者達成漁業合作及處理漁船被扣事宜。張正昇組長處理雙邊漁業合作及漁船被扣事宜，已有20年之經驗。近年來該協會工作重點在於協助漁業署釐訂永續利用漁業資源之政策，並鼓勵要求漁民業者遵守負責任漁業行為準則及區域性鮪漁業管理組織所通過之管理及保育措施，因此張組長近來亦涉及有關多邊漁業合作等事宜，如各區域性鮪漁業管理組織及亞太經濟合作之漁業工作小組等事宜。

**Charles Cheng程建中博士**獲有英國倫敦帝國學院生物學系博士學位，其主修族群生態學，目前任教於高雄醫學大學生物醫學暨環境生物學系，開授生物學和保育生物學等課程。程博士自2004年開始擔任中華民國野鳥學會海鳥工作小組召集人，該小組之目標為促進漁業混獲海鳥之研究、提高海鳥保育意識並提倡海鳥保育行動，為臺灣觀察員訓練計畫提供海鳥辨識和海鳥混獲減緩措施等資料，渠之後獲選為中華民國野鳥學會(國際鳥盟會員)理事長。程博士自2005年開始投入臺灣漁業觀察員訓練計畫之教學工作，開授海鳥辨識和海鳥混獲減緩措施之應用等課程。程博士曾獲得2007～2008年度美國傅爾布萊特獎助學金，其研究包括美國國家觀察員計畫之教育演進機制，和世界自然基金會美國分會之相關工作。其大學研究團隊之研究領域包括鳥類生化系統與生態學、形態測定學，及影像分析。

**I-Jiunn Cheng程一駿博士**於1998年自美國紐約州立大學海洋研究中心取得博士學位，其專長包括底棲生態、生理生態及河口生態等。程博士畢業後於該校生態及演化學系擔任博士後研究員，渠自1991年返台後在國立台灣海洋大學海洋生物研究所任職至今，曾於2000至2003年獲選該所所長，現為該所教授。另程博士曾獲行政院國家科學委員會贊助，至法國CNRS, Banyulus Marine Laboratory及英國史旺西大學擔任訪問學者。程博士目前專門研究海龜生物學及生理生態，渠主持之實驗室現為全台唯一研究海龜生態及保育之研究單位。程博士於2009年獲行政院農業委員會頒發林業及自然保育有功人士獎。

**Bundit Chokesanguan先生**任職於東南亞漁業發展中心(SEAFDEC)訓練組，SEAFDEC係一政府間組織，創立於1976年，旨在促進東南亞區域之漁業發展。目前SEAFDEC有11個會員國，包括汶萊、柬埔寨、日本、印尼、寮國、馬來西亞、緬甸、菲律賓、新加坡、泰國和越南。Bundit自泰國農業大學漁業系取得學士學位，並於日本東京大學漁業所取得碩士學位。學成歸國後，其在SEAFDEC訓練組擔任漁具技術專家，至今他曾在SEAFDEC擔任過助理講師、船長、捕撈技術科科長、訓練組組長、資訊及技術推廣處處長等職務，目前他擔任資訊及訓練處處長。其有多年發展及利用負責任漁具的經驗，且以他對所有類型之捕撈漁業技術和漁具(從近海之固著性漁具和蝦拖網)之博學經驗，操作遠洋圍網和東南亞水域相關之漁具。他最近的活動是透過示範和實驗，為SEAFDEC會員國研發及推廣選擇性漁法，包括海龜、下雜魚和尚未成熟之目標魚類的脫逃設備。此外他主動研究該區長久以來忽視漁民海上安全之議題。以管理立場觀之，Bundit已在該區從事涉及履行聯合國糧農組織負責任漁業行為準則之活動。

**Larry Crowder博士**為美國杜克大學海洋生物學教授，其研究重心為掠食與食物網之相互作用、資源加入量變動機制、保育生物學之族群與食物網模型，及以跨領域方式進行海洋保育。渠研究淡水及海洋生態系統之食物網過程、並利用

觀察法、實驗方法、及模型建構方法瞭解其中的相互作用，以改善管理。Larry Crowder博士曾擔任數項大型跨領域研究計畫之主持人，包括大西洋南方海灣資源加入量實驗、OBIS SEAMAP(對大脊椎動物族群數量進行空間生態分析)，及全球計畫(對全球長壽型物種混獲情況進行評估)，另曾指導並參與數項研究、分析、美國國家生態分析綜合中心之綜合小組，及國家研究理事會之海洋研究小組。其近期研究著重於海洋保育，包括混獲、空間生態分析、營養物與低氧、永續水產品、以生態系為基礎之管理、海洋空間規劃、治理等研究。Larry Crowder博士為美國科學促進學會會士(AAAS Fellow)，並獲杜克大學頒授2008～2009年年度學者/教師獎。

**Richard B. Deriso博士**為美洲熱帶鮪類委員會(IATTC)之首席科學家，並於華盛頓大學取得生物數學博士學位。Deriso博士的研究領域包括資源動態、計量生態學與漁業資源評估。他曾為美國國家科學院海洋研究委員會之院士，亦曾任職於美國國家研究委員會轄下的四個次委員會。他現為美國西太平洋區域漁業管理理事會(WPRFMC)科學暨統計次委員會之成員，並擔任過許多組織包括公私部門之顧問。

**Daniel C. Dunn先生**目前擔任美國杜克大學尼可拉斯環境學院海洋地理空間生態學實驗室副研究員，其研究工作著重於以生態系統為基礎之管理(EBM)和海洋空間規劃，特別是在漁業上的應用，目前研究重心為在動態的表層漂泳區應用時空管理措施，以減少混獲和丟棄，並提高漁獲選擇性。海洋地理空間生態學實驗室為海洋生物普查計畫之構圖與視覺化小組，而Daniel C. Dunn先生為海洋生物普查計畫與全球海洋生物多樣性計畫(GOBI)和生物多樣性公約秘書處之聯絡人，在擔任此職期間，渠編輯了一組示意圖，用以說明位於公海和深海、在生態上或生物上具重要性之地區(EBSAs)的認定方法。Daniel C. Dunn先生亦領導GOBI動態與遠洋EBSA工作小組。渠曾參與全球計畫(Project GloBAL)，檢視繪製商業性延繩釣漁業漁獲努力量分佈圖，及在資料匱乏的情況下，繪製家計型漁業漁獲努力量分佈圖之新方法。Daniel C. Dunn先生過去的工作內容包括：管理EBM軟體工具研發支持基金；研究工具在EBM工作流程中之角色；建構海龜移動、築巢模式、與漁業的重疊範圍之時空模型。

**David Fluharty博士**自1976年開始任職於美國華盛頓大學，擔任海洋事務學院副教授。渠在美國密西根大學自然科學學院取得跨領域自然資源保育與規劃博士學位，其研究與教學領域包括國家層級和國際層級之自然資源政策與管理；管理海洋資源；以生態系統作法管理海洋資源、分水嶺、海岸帶、漁業、海洋保護區，全球氣候變遷之區域效應。David Fluharty博士之榮譽事蹟包括：美國國家海洋暨大氣總署(NOAA)科學諮詢委員會主席(2006至今)；NOAA範圍內生態系統科學與研究之外部生態系統研究小組主席(2005-2007)；國家生態分析綜合中心之讀書小組顧問，該等小組包括海洋保護區、漁業生態系統模型(2002-2005)、在熱帶地區進行生態系統管理之可行性(2006至今)；北太平洋漁業管理委員會成員(1994-2003)；海岸管理期刊代總編輯；海洋保護區新聞和海洋生態系統與管理編輯委員會主席；國家研究理事會成員，研究美國海洋保護區和保留區之評估、設計及監測(1998-2000)；生態系統原則諮詢小組主席(1997-2000)，向美國國會報告有關以生態系統為基礎之漁業管理事宜；Murray-Metcalf西北海峽公民諮詢委員會會員(1997-1999)；普吉灣水質管理局所屬次委員會共同主席，處理體制與法規問題、普吉灣水質管理局所屬科學諮詢委員會會員(1984-1987)；美國環保署所屬普吉灣科學諮詢委員會會員(1985-1997)；華盛頓生態部/美國環保署普吉灣行動計畫執行委員會會員(1984-1986)；華盛頓生態部二級處理委員會會員(1985-1987)；普吉灣水質管理局副主席(1983-1985)。

**Eric Gilman博士**為夏威夷太平洋大學自然與計算科學學院教職成員之一，也是美國藍色海洋研究所的資深科學家。渠在澳洲塔斯馬尼亞大學地理與環境研究學院取得博士學位；在美國俄勒岡州州立大學海洋學系取得碩士學位；自美國韋斯利大學取得學士學位。Eric Gilman博士從事沿岸及海洋科學與政策工作17年，研究層面從本地拓展至開發中國家和已開發國家之國際水平，主要專長在(i)漁業科學與政策，聚焦於減緩海洋捕撈漁業之敏感物種混獲量及目標物種的過度利用；(ii)沿岸生態系統對氣候變遷之反應和調適選項；及(iii)生物多樣性資訊學，利用經整合的物種發生原始資料，瞭解該物種在全球生物多樣性中的狀態、變化和損失。Eric Gilman博士曾擔任自然保育聯盟(IUCN)全球海洋計畫之海洋科學顧問、聯合

國糧農組織客座科學家、全球生物多樣性資訊機構之美國團長、美國奧杜邦學會海洋計畫之太平洋代表、北馬里亞納群島總督辦公室環境特助及密克羅尼西亞波納佩港務局環境顧問。Eric Gilman博士的著作包括評鑑性期刊論文逾25篇，該等係有關減緩漁業之混獲、沿岸生態系統對氣候變遷之反應、利用標準鑑定高度生物多樣性價值海域、生物多樣性資訊學和海域規劃。

**Martin Hall博士**自1984年起擔任美洲熱帶鮪類委員會(IATTC)鮪魚暨海豚計畫之首席科學家。該計畫在未削減漁業生產力情況下，成功將海豚死亡率降至初步統計數字的1%以下。執行觀察員計畫以判斷死亡原因、實施漁業人教育計畫以傳遞解決該等問題之資訊，再加上廣泛採用改良漁具與漁法，係該計畫成功之關鍵。Hall博士亦曾直接參與國際協議的發展與執行，以處理鮪魚與海豚議題。2003年IATTC受厄瓜多政府之託，協助該國發展一項計畫，以減緩捕撈鮪魚及鬼頭刀之延繩釣船混獲海龜。該計畫係和世界自然基金會、美國國家海洋暨大氣總署、各國漁業當局，以及當地與國際保育團體共同合作發展，目前自秘魯到墨西哥等大部分太平洋沿岸美洲國家，皆正在進行該項計畫。最近他則致力於協調全球力量，以降低與漂浮物有關的鮪魚捕撈業之混獲。他的著作大都集中在有關混獲議題及成功實施減緩措施的策略與方法。他曾於眾多科學與管理會議發表論文，並統籌過100個以上有關混獲議題的漁業工作小組。Hall博士畢業於阿根廷布宜諾艾利斯大學，並自美國華盛頓大學取得博士學位。

**Peter Ho何勝初先生**是中華民國對外漁業合作發展協會之執行長，該協會是政府資助為協助業者達成與外國漁業合作而成立之財團法人不牟利之機構，除促進漁業合作外，目前該協會之業務涵蓋鮪漁業統計資料之蒐集、執行船位之監控、漁船觀察員之訓練及遣派、國內外港口魚類生物資料之採樣等。何勝初在雙邊與多邊漁業談判交涉有20多年的經驗，自1997年起即以台灣代表團顧問身分參加無數之鮪漁業管理組織之會議。特別一提是，他是中西太平洋高度洄游魚群養護管公約磋商會議台灣談判團成員，該會議隨後通過之公約使台灣首次成為漁業管理組織委員會成員。他從經營鮪漁業公司開始進入漁業行業，使其在區域性漁業管理之業務方面或在漁業管理條約之磋商方面有更廣之視野。

**Bill Holden先生**目前擔任海洋管理理事會(MSC)駐澳洲雪梨辦事處太平洋漁業之經理一職，他自2009年2月開始任職於MSC，主要的工作重點在於太平洋與印度洋之鮪漁業，另外他亦致力於推動東南亞小規模漁業之持續性漁撈實踐。在進入MSC前，1989年他在東加王國設立並管理Alatini漁業公司，該公司經營鮪釣船與笛鯛深海一支釣船，所捕漁獲物出口至日本與美國生鮮冷凍市場銷售。此外他亦曾擔任過東加捕撈漁業協會(FIAT)會長及太平洋島嶼鮪魚產業公會之理事。他生於美國加州聖地牙哥，並於加州大學聖塔芭芭拉分校取得政治科學與通訊學士學位。

**Paul Holthus先生**為世界海洋理事會(WOC)創辦執行長，該組織為聯合國際上各種海洋產業業者成立跨領域領導聯盟以推動海洋管理。該理事會鼓勵在「企業海洋責任」議題上發揮企業之領導力與相互合作，並呼籲產業在特定海洋環境挑戰上付諸行動，因為這將有助於企業經營之改善。第一屆「永續海洋高峰會」將於2010年召開，屆時產業領導者們將共同討論海洋永續性之問題，並進一步發展各式方案與工作小組，以解決共同關心之海洋環境優先課題。Holthus執行長結合私部門與市場的力量，針對海域與海洋資源議題研擬可達成的永續發展，並解決環境問題之有效方案。他工作的合作對象從全球性產業組織、聯合國機構的主管，乃至於小島漁村的漁民。他曾參與亞洲、太平洋、中美洲及西非等30多國家的資源養護與永續利用事務，亦曾擔任過許多企業、產業公會、聯合國組織、國際非政府組織與基金會顧問，協助渠等處理有關石油、天然氣、漁業、養殖、標準與認證之永續發展及環境管理問題。他過去的職務包括：自然保育聯盟(IUCN)全球海洋暨沿海計畫副執行長、美國自然保育協會(TNC)亞太計畫資深官員、聯合國環境規劃署(UNEP)南太平洋區域環境方案(SPREP)資深官員，以及海洋水族委員會(MAC，為一國際性商業暨環保組織，制訂全球海水魚貿易之標準與認證)創辦執行長。Holthus畢業於加州大學與夏威夷大學，並分別自兩校取得沿海暨海洋資源學位及國際貿易學位。

**Wen Jung Hsieh謝文榮先生**為臺灣區遠洋鮪釣船魚類輸出業同業公會(簡稱臺灣區鮪魚公會)之理事長，國立高雄師範大學英語系畢業，於2004取得國立中山大學管理學院高階經營碩士班之學位，並發表了其碩士論文「國際配額壓力下印度洋超低溫鮪延繩釣漁船經營策略之探討」。謝文榮先生從事漁業經營已有37年的經歷，憑藉著熟稔的經營技巧與管理專長，公司所屬漁船在其領導與管理下，配合政府法令、遵守國際規範，並有十分良好之作業成績。因此謝文榮先生於1990年獲得高雄市政府所頒發之優良漁業從業人員之獎勵，更於2004年獲得全國十大傑出漁民之殊榮。謝文榮先生為漁業界之領導者，長期以來熱心投入參與漁業政策及公共事務之推動。2002~2005年期間，擔任臺灣區鮪魚公會理事及該公會印度洋營運委員會之主任委員。謝文榮先生以最大的熱忱、專業的判斷、在漁政管理機關與漁民之間扮演協調與溝通的角色。讓印度洋作業漁船在IOTC及CCSBT二個國際鮪類組織的管理，能遵守規範、落實資源管理與保育之決議。2005至2009年期間，擔任臺灣區鮪魚公會常務理事，並於2010年擔任臺灣區鮪魚公會理事長，推動漁業公共事務的領域也由印度洋擴大到三大洋區及RFMOs之範疇。足見臺灣鮪漁業之業者高度重視及信任謝文榮先生之領導。

**Edward Huang黃昭欽先生**為臺灣區遠洋鮪釣船魚類輸出業同業公會(簡稱台灣區鮪魚公會)總幹事，國立高雄海洋科技大學畢業，並取得國立海洋大學環境生物與漁業科學研究所碩士。黃昭欽先生除擔任台灣區鮪魚公會總幹事外，目前也是臺灣水產協會以及臺灣區遠洋鮪魚產銷發展基金會的秘書長。黃昭欽先生從求學時期至目前工作生涯，均以漁業為主軸。特別是他在鮪魚公會服務已超過13年，因此對鮪漁業十分熟稔。由於鮪漁業經營與發展以及國際鮪類保育管理組織在近十年來有相當大的變革，為了配合國際組織對於鮪資源保育所採取之配額管理措施，黃昭欽先生協助行政院農業委員會漁業署及鮪延繩釣業者執行三年減船計畫(2005~2007)，一共減少了183艘超低溫鮪延繩釣漁船，讓臺灣在三大洋漁船數能與管理措施所分配之配額相稱。黃昭欽先生也負責臺灣鮪魚消費市場的推廣。為了推廣超低溫鮪魚生魚片之國內市場，由行政院農業委員會漁業署及高雄市政府補助一部份的經費，以興建、營運、移轉計畫(BOT)的方式招商興建超低溫冷凍廠。黃昭欽先生負責本案之推動，從2005年開始爭取經費，一直到招商、工程進行間之督導，終於在2008年7月建立了臺灣第一家1300噸級的超低溫冷凍廠。

**Hong-Yen Huang黃鴻燕先生**目前擔任行政院農業委員會漁業署遠洋漁業組組長。黃先生在漁業署的主要職責包括：(1)制訂遠洋漁業政策、法規、規範、計畫等；(2)推動遠洋漁業之國際合作事務，包括多邊和雙邊安排；(3)參與國際漁業組織相關會議；(4)管理臺灣遠洋漁船之所有活動；及(5)其他與遠洋漁業有關事項，包括科學研究。黃先生自國立臺灣海洋大學畢業後，即進入政府機關從事遠洋漁業相關事務逾33年。過去十年，黃先生曾代表臺灣出席南方黑鮪保育委員會、大西洋鮪類國際保育委員會、美洲熱帶鮪類委員會、中西太平洋漁業委員會等組織年會及旗下次委員會會議，並擔任團長。為三大洋鮪類及類鮪類之永續利用，黃先生長期致力於以生態系為基礎之臺灣遠洋漁業管理。

**Yi-Ping Hung洪一平先生**於西元1959年出生在素有海濱鄒魯之稱的文化小鎮—鹿港。自幼耳濡目染鹿港詩書文化的啟禮，自許秉承儒家忠恕之道以為人生的準則。1981年自國立海洋學院畢業，考取預備軍官海軍航海官，擔任航海學校大隊行政官兼勤務隊長，負責學校的行政業務，1983年8月退役。1984年通過漁會考試，成為彰化區漁會的一員，一直至今已25年。1989年底奉命擔任推廣課長，至民國2009年擔任漁會秘書一職。2006年為充實知能，就近考入彰化大葉大學就讀設計研究所，研究主題以文化產業設計為主，論文題目王功蚵田文化景觀產業發展與研究，並於2008年6月畢業。

**David Hyrenbach博士**係夏威夷太平洋大學助理教授及杜克大學海洋實驗室副教授，專注於研究海洋掠食者及保護區之設計與成效。Hyrenbach博士出生於西班牙，在美國聖地牙哥斯克里普斯海洋研究所取得博士學位。2007年獲得皮優海洋保育夥伴獎(Pew Fellowship in Marine Conservation)，研究亞伯蘭海(地中海西部)之海鳥、海龜及海洋哺乳類分佈。Hyrenbach博士目前之研究集中於兩大區塊，一為海洋時空變化如何

塑造表層脊椎動物之分佈和群聚結構，另一為脊椎動物棲地群如何影響養護該等物種空間管理策略之成效。該項研究之應用包括鑑定可能之集中區及搜尋可發展空間保護措施的區域(如海洋保護區、禁漁區／期)，並監控人類作為對海鳥族群之影響(如誤食塑膠、混獲)。

**Shoou-Jeng Joung莊守正博士**現為國立台灣海洋大學環境生物與漁業科學學系副教授，渠自該校漁業科學研究系取得學士學位後，續取得該校漁業科學研究所碩士及博士學位。

**Donald R. Kobayashi博士**現任職於美國國家海洋漁業局(NMFS)太平洋島嶼漁業科學中心(PIFSC)生態系統與環境組，擔任漁業生物研究員一職。他畢業於美國亞利桑那大學生態暨演化生物學系，並先後自夏威夷大學及澳洲雪梨科技大學取得生物海洋學碩士與環境科學博士學位。他的研究領域相當廣泛，包括漁業海洋學、幼魚運送模型建構、種群動態、電腦模擬模型建構、海洋生物與生態學、魚類學、浮游生物生態學、保育生物學、遙測、保育類物種減緩措施、漁具選擇性及漁業管理。此外其亦為美國西太平洋區域漁業管理理事會所轄科學暨統計次委員會之成員、美國國家海洋暨大氣總署(NOAA)隆頭鸚哥魚(Bolbometopon mrricatum)生物審查小組組長，以及PIFSC學生實習計畫(PSIP)之協調人。他獲經同儕評審之著作甚豐，並曾於2005年及2009年分別因研究表層延繩釣漁業之海龜減緩措施與解析幼魚運送之科學貢獻，而二度獲得NOAA銅質獎章。

**Marion J. Larkin**先生的漁民生涯始於1971年，當時從事捕撈螃蟹、鮭魚和進行曳繩釣作業，作業漁場遍及阿拉斯加到加州外海。1978年其經營與管理一艘專門捕撈底棲魚類如太平洋牙鱈(Pacific Whiting)之拖網船，並擔任船長達21年之久，60歲時其不再從事捕撈活動並卸下船長一職。爾後成立海洋獵人企業有限責任公司，該公司經營之拖網船主要捕撈牙鱈和傳統底棲魚類，包括多佛比目魚(Dover Sole)、蛇鱈(Ling Cod)、鰈魚(Petrale Sole)及牙鱈等魚種，並以冰鮮方式運送漁獲。1971年Larkin先生取得西華盛頓大學地質學學士學位。渠擔任華盛頓州政府魚類及野生動物局局長之顧問，積極參與漁業管理過程，亦代表華盛頓州拖網業者擔任海洋漁民聯盟之理事。過去26年來，渠透過太平洋漁業管理理事會，專注於聯邦層級之漁業管理，並代表華盛頓州拖網業者服務於底棲漁業諮詢次委員會達24年。近8年其以拖網漁業個別配額次委員會會員身份，積極參與拖網經濟合理化之修正，並成為重要魚類棲地技術性審查小組之成員，該小組為保護關鍵且重要的棲地遠離底拖漁業之影響，提出底棲區域劃定之基礎，直接影響華盛頓州、奧勒崗州及加州太平洋沿岸41個禁止拖網漁區之設置。Larkin先生擔任美國太平洋沿岸各州漁業委員會之華盛頓州代表團顧問8年，其也代表華盛頓州拖網業者擔任漁民行銷協會董事達12年之久，該協會是代表40%底拖業者之漁業團體。

**Duncan Leadbitter先生**目前擔任Fish Matter公司之經理，Fish Matter於2009年3月在澳洲成立，主要針對魚類及其他水生天然資源之永續利用，提供實際建議予產業、政府及非政府組織(NGO)參酌。過去20年Leadbitter先生對歐洲、亞洲、北美洲及太平洋之漁業有廣泛的經驗，其主要客戶是屬非政府組織之永續漁業夥伴，該組織與水產品業界攜手合作，協助該等朝向可持續的取得資源及管理。L先生是一可獨立作業之顧問，對廣泛層面的議題如水產養殖飼料魚漁業、鮪類和深海魚種、及與水產品製造商、非政府組織和多邊漁業與援助團體聯繫等提供建議。在Fish Matter成立前，L先生於2000年進入海洋管理理事會(Marine Stewardship Council, MSC)，擔任國際漁業部門之主管，並在2002年負責MSC亞太地區之發展及管理，鼓勵捕撈漁業、捕獲後加工部門及消費者參與MSC計畫。在進入MSC任職前，其是Ocean Watch Australia之執行秘書，Ocean Watch Australia為一非營利組織，旨在保護及改善魚類棲地，並降低漁業衝擊。其亦為澳洲新南威爾斯漁業局效勞，負責棲地/養護管理，亦曾在私部門擔任環境顧問。L先生曾為澳洲水產協會之副秘書長，並在澳洲聯邦及州立之天然資源與生物多樣性諮詢理事會擔任不同職銜之職位，最近他是澳洲漁業管理局魷魚管理諮詢委員會之主席。L先生以其管理水生棲地和漁

業衝擊之背景，致力於海洋保護區、水產養殖評估、棲地修復、污染評估、環保教育推廣及混獲管理，其亦與不同漁業利益相關者合作，包括產業、環保團體及政府。其已發表許多與漁業、沿海區域及棲地有關的出版品。其自雪梨大學取得科學榮譽學士學位，並自雪梨麥考瑞大學取得環境規劃碩士學位，平時熱衷浮潛及攝影。

**Charles C. P. Lee李嘉寶先生**為臺灣區遠洋鰹鮪圍網漁船魚類輸出業同業公會(簡稱臺灣區圍網公會)總幹事，該公會創立於2008年7月，係一非營利之非政府間組織，以協助圍網業者取得諾魯協定會員國之入漁執照，使圍網船得以進入該協定之8個太平洋島國專屬經濟水域作業，包括密克羅尼西亞聯邦、巴布亞紐幾內亞、索羅門群島、諾魯、吉里巴斯、吐瓦魯和馬紹爾群島。臺灣圍網漁業始於1984年，在臺灣區圍網公會成立前，圍網漁業附屬在臺灣區遠洋鮪釣船魚類輸出業同業公會之下。李嘉寶先生於1993～2008年任職於臺灣區鮪魚公會，負責圍網漁業相關事務。在臺灣區圍網公會成立之前，臺灣圍網業者需與個別的太平洋島國進行雙邊諮商。因經驗豐富，使李嘉寶先生有機會與南太平洋論壇漁業局同仁接觸溝通，取得中西太平洋鮪漁業管理之訊息，並與諾魯協定8個會員國之漁業管理當局進行諮商。

**Ming-Hua Lee李明華女士**現任中華鯨豚協會秘書長，渠自1998年加入該協會至今，曾擔任不同職位。李秘書長獲有臺灣海洋大學應用經濟研究所碩士學位，渠就讀研究所時研究臺灣賞鯨業之營運及改善。李秘書長之著作包括臺灣東海岸賞鯨業之成本效益分析等。

**Rebecca Lent博士**為美國國家海洋暨大氣總署(NOAA)國家海洋漁業局(NMFS)之國際事務處處長，其職責包括監督共享之魚種資源和受保護物種之養護與管理、參與多邊海洋管理組織，如國際捕鯨委員會和5個國際鮪類委員會。Lent博士於1984年在美國奧勒岡州立大學取得資源經濟學博士學位後，赴法進行一年博士後研究，之後8年在加拿大拉瓦爾大學擔任教授。Lent博士於1992年10月進入NOAA NMFS，從經濟分析人員升任大西洋高度洄游性物種永續漁業辦公室主任，後再升任位於長島之西南區辦公室主任，負責監督加州、夏威夷和太平洋領地之海洋管理，同時擔任中西太平洋漁業委員會之美國代表。稍後渠升任為NOAA NMFS助理副署長，掌管該局管考計畫。之後Lent博士即擔任現職，除負責領導國際事務處外，其另擔任大西洋鮪類國際保育委員會(ICCAT)之美國代表。Lent博士於2009年在西班牙聖塞巴斯坦舉行之第二屆區域性鮪漁業管理組織聯合會議，擔任美國代表團團長，並將於2010年6月由美國和南太平洋論壇漁業局(FFA)在澳洲布里斯本共同主辦之Kobe II混獲工作小組會議再次擔任美國代表團團長。

**Jo-Ann C. Leong博士**為美國夏威夷海洋生物研究所所長，以及夏威夷大學馬諾分校海洋與地球科學技術學院(SOEST)教授。她亦為奧瑞岡州立大學微生物學傑出榮譽教授，曾擔任該校微生物系主任，並於該校設置Emile Pernot講座教授。此外，她亦獲選為美國微生物學院院士。現在她擔任夏威夷熱帶及亞熱帶水產養殖中心(CTSA)董事長、全國海洋實驗室協會選任理事長、美國國家海洋暨大氣總署(NOAA)科學諮詢委員會生態系統科學與管理工作小組聯合主席，以及國家海洋生物普查委員會(CoML)成員。她曾任『水生生物疾病期刊』病毒性疾病組編輯達10年以上，並曾為『海洋分子生物科技』雜誌與『海洋生物科技期刊』編輯委員。Leong博士和她門下的18名博士生與6名碩士生發表共計100篇以上經審查之學術期刊論文。她擁有魚類病毒性疫苗與水產養殖物種之DNA疫苗等三項美國專利；她的實驗室發現名為「傳染性造血組織壞死病(Infectious Hematopoietic Necrosis Virus)」的新型桿狀病毒(Rhabdoviridae/Novirhabdovirus)，每年有上百萬尾鱒鮭幼魚死於該疾病。目前她持續接受美國國家衛生基金會(NSF)與NOAA之贊助。

**Rebecca Lewison博士**是一位生態保育學家，也是加州聖地牙哥州立大學助理教授，擔任該大學多元化研究之生態管理暨監控研究所所長。她利用創新、定量和實驗方法，研究同時居住在陸地和水生環境且面臨保育壓力的脆弱野生族群，如棲地破碎化、棲地劣化、捕獲及意外死亡率、疾病和其他干擾。過去10年Lewison博士率先以專門技術和經驗整合廣泛生物界的生態保育、政策和資源利用等研究，渠亦為漁業混獲研究的

先驅者，過去4年擔任GloBAL計畫主持人，該項大型研究計畫由戈登和貝蒂摩爾基金會(bycatch.env.duke.edu/)資助，研發新工具和方法理論，以了解全球漁業混獲影響族群和群聚水平之強度和廣度。Lewison博士也擔任生物保育、海洋生物及瀕危物種研究的編輯委員。

**Kwang-Ming Liu劉光明博士**在國立臺灣海洋大學取得學士和碩士學位，1992年在美國密西根大學自然資源學院取得博士學位，同年成為國立臺灣海洋大學漁業科學系副教授，1999年升任教授，2002年轉任海洋事務與資源管理研究所，並兼任該所所長至2005年，2008年再兼任該職至今。其專長為漁業生物學、魚類族群動力學和海洋資源管理。劉博士已發表40多篇經同儕審核之科學論文，其中有22篇發表於科學引用索引(SCI)期刊，另擔任50多個由行政院國家科學委員會、漁業署和環保署補助之研究計畫主持人，其獲得之研究經費總計超過200萬美元。劉博士亦為多個學術團體成員，目前擔任海洋臺灣文教基金會執行長、自然保育聯盟鯊魚專家小組成員、臺灣水產學會理事、臺灣永續漁業發展協會常務理事、臺灣海洋保育協會理事、臺灣國際漁業發展保育協會理事、臺灣水產學會刊編輯委員，和許多國際科學期刊審稿人，包括加拿大漁業和水產科學期刊、海洋與淡水研究、魚類生物學期刊、Fish Bulletin、漁業研究，和環境魚類生物學等期刊。劉博士近期研究重點為漁業生物學、資源評估，及板鰓類管理。渠曾草擬臺灣鯊魚保育與管理國家行動計畫，籌辦「2002年鯊魚管理與保育會議」和「國際鯨鯊生態旅遊研討會」，向學術團體和社會大眾宣導鯊魚保育。其研究興趣包括以生態系統為基礎之漁業管理，率領研究團隊從自然和社會科學的角度進行「臺灣東北部水域海洋保護區之規劃」研究計畫。此外，劉博士亦參與其他推廣活動，例如向漁民宣導海洋保育的觀念，訓練觀察員等，並固定參加亞太經濟合作(APEC)海洋資源保育工作小組會議，渠自2008年起在臺灣籌辦兩次APEC私人部門/企業參與海洋永續性圓桌會議。劉博士長期致力於漁業資源保育，曾於2008年獲得行政院農業委員會全國優秀農業人員獎之肯定。

**Hsueh-Jung Lu呂學榮博士**於1988年與1995年自國立臺灣海洋大學分別取得碩士及博士學位。畢業後，於1995至1999年間任職中華民國對外漁業合作發展協會，先後擔任專員及資訊組副組長，並負責遠洋鮪釣及魷釣之漁業統計業務。現任職於國立臺灣海洋大學環境生物與漁業科學系，擔任副教授一職。主要研究領域為漁業海洋學，尤其是以聲波、地理資訊系統(GIS)與遙測等方法，探討在氣候變遷影響下之漁場形成機制。多年來，致力於建立與維護臺灣沿近海漁業之網際網路地理資訊系統，以提供合作客戶相關綜合資訊。近年來，更進而關注有關海洋環境問題，除針對氣候變遷對漁業造成之衝擊進行研究外，並擔任臺灣海洋保育協會秘書長一職。

**Sean Martin先生**現為夏威夷延繩釣協會(HLA)理事長及理事會成員。HLA曾全程參與國際漁業人論壇(IFF)，而Martin亦曾參加IFF所有的論壇。除HLA活動外，Martin先生亦曾參與許多國內外之委員會及工作小組，包括以美國代表團代理全權代表(Alternate Commissioner)身份出席中西太平洋漁業委員會(WCPFC)。他亦曾以西太平洋區域漁業管理理事會(WPRFMC)現任成員與前任主席的身份，廣泛參與中太平洋區域之美國漁業政策及管理發展。他在該區域進行多項合作研究與引擎技術計畫，主要關注焦點為資源評估與混獲減緩措施。除漁業管理之相關活動外，他亦為表層延繩釣漁船船隊之所有者與經營者，該船隊係於夏威夷從事鮪魚及劍旗魚之延繩釣漁業。他以檀香山作為主要據點，從事國內外現代化表層延繩釣系統之發展、介紹與推動。他積極從事表層漁業已達35年之久。

**Geoff McPherson先生**是澳洲詹姆士庫克大學自然科學暨工程學院之兼任首席研究員。其為漁業生物學家，自70年代中期研析澳洲珊瑚海域之金目鱸漁業和鮪漁業，80年代中期開始以消極聲學系統研究流網漁業混獲海洋哺乳類之減緩措施，90年代初期與加拿大紀念大學Jon Lien教授合作發展積極主動式聲納系統/發射器。其設計出澳洲北部海域所使用低頻之恆定頻率系統(供近海非回聲定位鯨魚和海牛)及較高頻之調頻聲納發射器(供回聲定位海豚)。他密切與兩個商業捕魚組織合作利用聲波設備以減輕混獲，及利用交替式發射器減緩日本和夏威夷

延繩釣漁業之混獲及處理澳洲圍網漁業之網具纏繞。其對下述領域亦有研究，包括海洋哺乳類混獲物種之聲波性能與聲波設備比對、發射器在不同生態系統所發出聲響之物性、漁網及漁具組成對哺乳類生物聲納之聲波反射。其以非商業性之具體應用，協助許多發射器製造商提升渠等生產產品的適用性。其自2004年起與夏威夷延繩釣協會會員合作，並為美國西太平洋區域漁業管理理事會之齒鯨海洋哺乳類諮詢小組成員。

**Tom Nishida博士**現在擔任於日本水產綜合研究中心遠洋水產研究所(NRIFSF)擔任科學研究員一職，其分別於日本北海道大學及美國華盛頓大學取得學士及碩士學位，並自日本東京大學獲得魚類資源評估博士學位。1986年至1991年間，他在斯里蘭卡參與並擔任聯合國糧農組織所轄兩項計畫「(孟加拉灣計畫(BOBP)與印太鮪類發展與管理計畫(IPTP)」之漁業統計員。研究領域包括鮪類資源研究、漁業海洋學，及應用於漁業與生態系統資料空間分析之地理資訊系統(GIS)(詳細內容請參酌http://www.esl.co.jp/Sympo/)。Nishida博士持續關心延繩釣漁獲遭鯨豚咬食之問題，並於2007年7月間在塞昔爾召開印度洋鮪類委員會(IOTC)工作小組會議討論此一議題。最近他與澳洲詹姆士庫克大學的兼職首席研究員Geoff McPherson共同執行一項計畫，研究如何運用聲納發射器等各式裝置，以減緩鮪延繩釣漁業漁獲遭咬食。

**Randall Owens先生**並非係學術界人員，他的職涯開端是一位商業漁民和潛水夫，有時從事衝浪賺取外快，因此渠對漁業及海洋環境漸生興趣。稍後轉任職於西澳漁業局，擔任巡邏船船長，之後在豪特曼群礁(Houtman Abrolhos Islands)擔任地勤經理，豪特曼群礁係一生態豐富具高度生產力的珊瑚礁群島，支持珊瑚礁系統內最大的單一物種密集漁業(西岩龍蝦)。渠在此工作10年，依漁業法規建立一海洋保護區(Marine Protected Area; MPA)，並與海洋及養護科學家合作，改善季節性棲息島嶼之環境管理，渠在此學習到創建MPAs之政治手腕及管理受漁業威脅之物種。Owens先生於2000年進入大堡礁海洋公園署(GBRMPA)學習該署事務，最初他僅打算任職1至2年，但目前他仍任職於GBRMPA，並樂於接受擔任生態系統養護及永續利用小組永續捕魚經理人所面臨之挑戰。Owens先生擁有海洋資源管理之工商管理碩士學位，2005接受西太平洋區域漁業管理理事會邀請在夏威夷召開的國際漁業人論壇進行演說，2008年於德國參與波羅的海及北海海洋空間規劃。他的碩士論文題目係在典型區域計畫下，比較使用大堡礁區域劃分及建立西北夏威夷群島國家海洋紀念區之程序。

**Lida Pet-Soede博士**在荷蘭瓦郝尼罕農業大學取得熱帶漁業生物學與管理之學士、碩士和博士學位，其主修漁業生物學與管理、發展中國家之社會經濟學，及魚類養殖。多年來，她在印尼進行博士研究，並指導過100多位學生，其中有多人現從事保育與漁業管理之工作，並與人合作完成40多篇之論文及著作。Pet-Soede博士於2003年成為世界自然基金會(WWF)印尼分部之專職人員，並於2004年成為該分部海洋計畫主持人。在此之前，她在東南亞地區擔任顧問。Pet-Soeda博士熱愛潛水，在荷蘭出生的她非常享受和家人住在印尼的生活，也喜愛向兩個女兒展現珊瑚三角區之美。

**Mayumi Sato博士**於2008年取得保育及景觀生態學博士學位。她的研究對象包括蜻蜓、豆娘、水鳥與淡水魚等多種物種。2009年11月起，她擔任國際鳥盟(BirdLife International)亞洲區總部(位於東京)全球海鳥計畫(GSP)亞洲區協調人一職，並將工作重點放在重要海上野鳥棲地(Marine Important Bird Areas)之認定及減緩海鳥和漁業之衝突。生物多樣性公約(CBD)之目標是在2012年將10%的海域設為保護區，並要求各會員國提交該國水域內之保育計畫。由於海鳥物種豐度係判斷海洋生物多樣性之指標，因此重要海上野鳥棲地將有助於海洋保護區(MPAs)之認定。海洋漁業混獲係對海鳥之最大威脅，據估計每年有30萬隻海鳥遭到捕獲。然對亞洲人而言，魚類係重要的食物來源，強加限制漁業活動並非係可行的解決之道。水產業、政府機關、學術界與非政府組織的跨部門合作，將是解決區域性混獲問題的關鍵。

**James Sha沙志一先生**目前擔任行政院農業委員會漁業署署長，其擁有國立臺灣海洋大學海洋食品科學碩士學位及美國羅德島大學海洋事務碩士學位。

沙先生的資歷如下：

1999-2008：行政院農業委員會漁業署副署長
1996-1999：臺灣省漁業局局長
1996：行政院農業委員會漁業處副處長
1991-1996：行政院農業委員會漁業處海洋漁業科科長
1982-1991：經濟部農業局專員
1981-1982：臺灣省漁業局駐南非開普敦專員

過去十年，沙先生積極參與國際事務，如鮪類區域性管理組織及雙邊/多邊會議。沙先生曾於2005年擔任南方黑鮪保育委員會延伸委員會會議主席，並獲推舉於2005年至2007年擔任亞太經濟合作漁業工作小組主事國。沙先生於2002年獲得中華民國外交部傑出外交人員之殊榮。

**Kitty M. Simonds女士**擔任美國西太平洋區域漁業管理理事會(WPRFMC)執行長職務已超過30年以上。在此之前，渠擔任美國參議員Hiram L. Fong助理達13年。在Simonds女士領導下，WPFRMC透過禁止不具選擇性的漁具、電子漁獲日誌、觀察員計畫、漁船監控系統及漁業管理空間區劃等措施，已對環境負責任表層及底延繩釣漁業建立基準。在減緩混獲方面，WPRFMC所採取的措施不僅可大幅降低海龜及海鳥與表層延繩釣間之互動，亦受到區域性漁業管理組織採用為負責任延繩釣漁業之標準。在Simonds女士具前瞻性的領導下，WPRFMC草擬了美國第一個以生態系統為基礎之管理計畫，並在漁業管理上率先應用以生態系統為基礎之途徑，重視原住民傳統和當地生態知識在決策過程中所扮演之角色。此外，Simonds女士更確保WPRFMC在鮪魚和脆弱物種(包括海鳥、海龜和鯊魚)之國際管理上持續扮演重要的角色，具體作為包括推廣混獲減緩技術和支持養護之倡議。

**Ussif Rashid Sumaila博士**係加拿大溫哥華英屬哥倫比亞大學漁業中心主任，也指導該校經濟研究中心。S博士的研究領域為自然資源與環境經濟，特別是在漁業範疇，其對如何利用經濟，透過整合生態及其他學科，以確保可持續利用環境資源及管理目前與未來世代的利益，相當有興趣。S博士已獲得許多獎項，包括李奧波(Aldo Leopold)講學基金、皮優(Pew)海洋保育講學基金、Craigdarroch社會貢獻獎、伊德(Zayed)國際環境獎、Peter Wall中心高等早期職業研究獎。S博士編寫或與他人合著許多學術文章、書籍或套書、課程章節及其他出版品，使其得以(i)透過如環境經濟與管理、土地經濟及海洋資源經濟等期刊通路發行，成為主流經濟學者；(ii)透過在許多期刊發表文章，成為學科間的學者，如自然、自然資源模式、加拿大漁業和水生科學期刊及海洋調查國際理事會(ICES)之海洋科學期刊；及(iii)在海洋政策與自然資源論壇刊載，使其成為決策者及其他利益相關者。S博士的研究受到決策高層的高度重視，使其曾受邀在聯合國、美國白宮及國會、加拿大國會、伍德羅威爾遜(Woodrow Wilson)國際學者中心及世界貿易組織進行演說。其研究引發國際關注，並為各方引用，如經濟人雜誌(Economist)、波士頓全球雜誌(Boston Globe)、國際先驅論壇報(International Herald Tribune)、緬因週日電訊報(Maine Sunday Telegram)、金融時報(Financial Times)、環球郵報(Globe nd Mail)、美國之聲(Voice of America)、CBC新聞及溫哥華太陽日報(Vancouver Sun)。

**Keith Symington**先生為世界自然基金會珊瑚三角區計畫之混獲策略主持人。渠就讀加拿大多倫多大學時主修地理，輔修國際發展研究，獲地理學士學位後在英屬哥倫比亞大學取得地理碩士學位。其後Symington先生於1995年開始致力於加拿大太平洋地區海洋保育和永續漁業之工作，並與加拿大環保組織Canadian Parks and Wilderness Society，和世界自然基金會加拿大分會合作，發展太平洋海洋保育共同計畫。隨後亦擔任加拿大保育團體Sierra Club of Canada BC Chapter海洋計畫協調者，同時擔任大衛鈴木基金會、加拿大英屬哥倫比亞省土地利用協調處和加拿大國家公園管理局之顧問。Symington先生自2004年開始擔任世界自然基金會越南分會海洋計畫協調者，並於2008年參與世界自然基金會區域性珊瑚三角區計畫。其主要研究領域包括：(1)減少漁業混獲、管理與政策，側重於東南亞地區和太平洋地區漁業；(2)以市場為基礎之改革和作法，以促進漁業最佳實踐；(3)小規模漁業管理，包括共同管理、貧窮與可持續性和漁業重建策略；(4)海洋保護區和禁漁區，特別是將海洋生物多樣性保育納入漁業管理之主流。

**Timm Timoney**女士係美國夏威夷之商業漁民，已從事海洋相關產業逾40年。

**Andrew Tobin博士**為野生捕撈業漁民、昆士蘭水產協會理事以及澳洲詹姆士庫克大學捕撈暨漁業研究中心資深研究員。他從1997年起便於大堡礁世界遺產地區從事商業性野生捕撈漁業，以有鰭魚類(鰆－Scomberomorus commerson、半線馬鮫－Scomberomorus semifasciatus、花斑刺鰓鮨－Plectropomus leopardus、尖吻鱸－Lates calcarifer與馬鮫科魚類－Polydactylids)以及鋸緣青蟳(Scylla serratea)為捕獲目標。他的捕撈事業因2004年立法通過的大堡礁海洋公園署(GBRMPA)代表性區域計畫(RAP)而受到影響，該地區成為全球最大的海洋公園，涵蓋面積超過345,400平方公里，保護區(不得進行捕撈自然資源之活動)空間涵蓋率從4.6%提升到33.3%。對他而言，最立即的衝擊便是失去傳統重要漁場，他必須將漁獲努力量移轉到其他區域與漁業，並處理多出來的努力量。他的事業獲得政府的「重建補助」，該援助使他的事業得以度過過渡期。1997年Tobin博士自詹姆士庫克大學畢業，目前為全職的研究科學家與兼職的捕撈漁民，他的研究焦點在於衡量海洋公園在保護捕撈魚種之效能。由於以生態多樣性守護者自居的人們，經常利用廣告手法宣傳海洋公園，並主張保護區對捕撈魚種有顯著益處，Tobin博士對於這個領域有高度興趣，他認為該主張大都未經過驗證，至少在有實證可支持前述說法前，應謹慎對待且不得予以濫用。

**Tzu-Yaw Tsay蔡日耀先生**目前擔任行政院農業委員會漁業署副署長，渠畢業於國立臺灣海洋大學應用經濟研究所，獲有碩士學位。以往的工作經歷包括：水產試驗所技士；高雄市漁業處技士、組長；行政院農業委員會漁業處技正；臺灣省漁業局副局長；行政院農業委員會漁業署遠洋漁業開發中心主任；行政院農業委員會漁業署遠洋漁業組組長。渠曾受任為2009年南方黑鮪保育委員會(CCSBT)延伸委員會年會副主席，2010年擔任主席。蔡日耀先生之主要專長領域包括：(1)漁業管理；(2)國際漁業合作。其近期著作為「回應國際遏止非法、無報告和未受規範捕撈之發展趨勢，建構管理國人經營外籍延繩釣漁船機制之研究」。

**Mao-Cheng Wang王茂城先生**現為行政院農業委員會漁業署漁政組資源管理科科長，渠畢業於國立海洋大學漁業研究所，擁有碩士學位。在進入漁業署前，王科長曾於基隆市政府及臺灣省漁業局服務。王科長負責之業務主要包括：沿近海漁業資源之養護與管理、種苗放流與增殖利用之策劃及推動、沿近海漁場環境之改造及保護、海洋牧場及栽培漁業之推動與管理等。

**Robin Warner博士**為澳洲國家海洋資源與安全研究中心(ANCORS)資深研究員，並為澳洲研究委員會(ARC)博士後研究獎學金受獎人(2010-2012年)，其主要研究領域為海洋法、海洋管理、海洋環境法、氣候法、跨國犯罪及國際刑法。她曾於2002年至2006年間擔任澳洲聯邦檢察總署(AGD)刑事司法司國際犯罪處助理秘書，在此之前則曾為澳洲國防部(ADF)軍法官，主管國際法業務，並歷任其他多項職務。她最近發表的書籍名稱為『強化國際法架構：保護國家管轄範圍外之海洋』(Martinus Nijhoff, Leiden, 2009)，並曾於諸多書籍與期刊發表有關海洋法與海洋政策之文章。

**Bill Wells先生**為Seafood扇貝公司和位於美國維吉尼亞州西福德的Wells扇貝公司經理。Seafood扇貝公司收購扇貝、比目魚和鮟鱇魚，並向14艘扇貝船銷售燃油和補給品。Wells扇貝公司由Bill Wells先生和其家族所擁有之7艘扇貝船組成。Wells家族自1915年開始從事水產業，以捕蝦業起家，目前已傳承至第四代。該家族原先在6個不同的州捕蝦，1979年離開墨西哥灣後結束捕蝦業，轉而發展扇貝漁業。過去30年來，Wells家族的大西洋扇貝漁業從維吉尼亞州拓展到麻州，該家族亦於阿拉斯加捕撈阿拉斯加海扇蛤，至今已達9年之久。Wells扇貝公司目前與新英格蘭漁業管理理事會、中大西洋漁業管理理事會、北太平洋漁業管理理事會和海灣管理理事會合作，並受渠等管理。Bill Wells先生畢業於佛羅里達大學，曾於中大西洋漁業管理理事會服務9年，於2001年離開該理事會，目前擔任扇貝諮詢小組主席。過去20年來，在美國扇貝漁業採取所有現行漁業管理工具之期間，Bill Wells先生持續擔任理事會之委員或顧問。前述漁業管理工具包括：船數限制、漁具大小限制、船員限制、避免捕獲海洋哺乳類之技術、減少混獲、開放或關閉特別管理區域，以提高較大型扇貝捕撈量。

TAIPEI
AUGUST 3-5, 2010
FIFTH INTERNATIONAL FISHERS FORUM

# Appendix 6: Participant List
# 附錄6: 與會名單

## ARGENTINA

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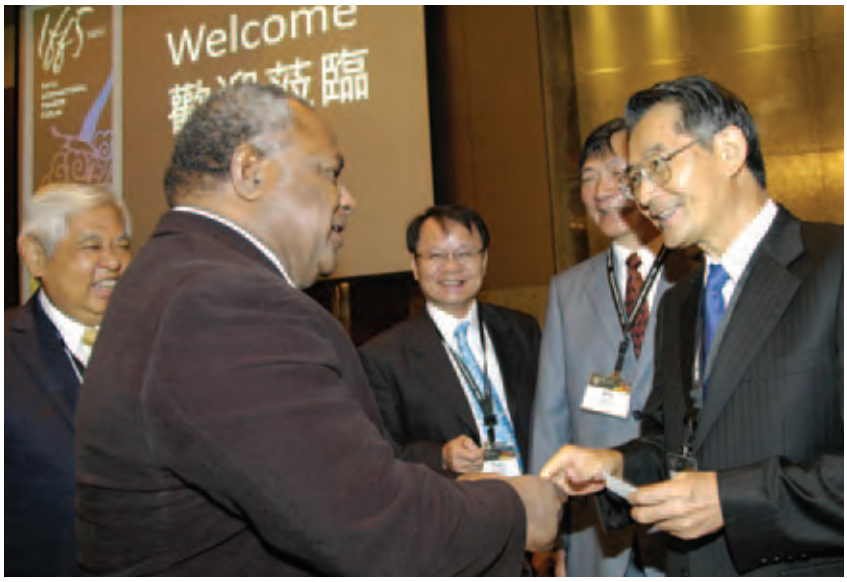
IFF5 TAIPEI
AUGUST 3-5, 2010

FIFTH INTERNATIONAL FISHERS FORUM

# Participants

Nearly 300 participants from fishing industries, governments, academia and conservation organizations representing 28 countries gathered in Taipei for the Fifth International Fishers Forum.




IFF5 TAIPEI
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FIFTH INTERNATIONAL FISHERS FORUM

Archipelagic-based Fishery Ecosystem Plans:
Looking to the Past in Managing the Future

Help Yourself
current

Press conference (L-R): Wen-Jung Hsieh, Kitty Simonds, James Sha, Rebecca Lent, and Sean Martin

Traditional Taiwanese performers welcome IFF5 participants during the Opening Ceremony

Western Pacific Regional Fishery Management Council Secretariat and participants

Fishery Agency and Overseas Fisheries Development Council of Taiwan Secretariat and participants

# Aloha Reception

Kitty Simonds (Executive Director, WPRFMC) and James Sha (Director General, FA-COA) welcome participants at the Aloha Reception.

David Chang (at center; Operational Director, OFDC) and his OFDC Secretariat staff.

Participants gather for a photo opportunity during the Aloha Reception.

# Fishermen's Lunch

Fishermen gathered for an informal discussion of their experiences and perspectives on marine spatial planning.

Edward C.C. Huang, Taiwan Deep Sea Tuna Longline Boat-owners and Exporters Association (Co-chair)

Sean Martin, Hawaii Longline Association (Co-chair)

Chu-Lung Chen, Tuna Fishing, Ltd.

Roy Morioka, Hawaii fisherman

Yueh-Ying Lin, Su-ao Fishermen's Association

Fan-Tung Hsieh, Keelung Fisherman's Association

# Farewell Dinner

Kitty M. Simonds (Executive Director, WPRFMC) and Minister Wu-Hsiung Chen (Council of Agriculture) contgratulate participants for a successful 3-day meeting

TAIPEI
AUGUST 3-5, 2010
FIFTH INTERNATIONAL FISHERS FORUM

FIFTH INTERNATIONAL FISHERS F

# Field Trip

Indoor shrimp pond at Da-wen Aquaculture Farm

Auction at Su-ao Harbor

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