ALBATROSS AND PETREL MORTALITY FROM LONGLINE FISHING INTERNATIONAL WORKSHOP, HONOLULU, HAWAII, USA, 11–12 MAY 2000. REPORT AND PRESENTED PAPERS

Edited by JOHN COOPER

Coordinator, BirdLife International Seabird Conservation Programme, Avian Demography Unit, Department of Statistical Sciences, University of Cape Town, Rondebosch 7701, South Africa (jcooper@botzoo.uct.ac.za)

Received 30 August 2000

SUMMARY

COOPER, J. (Ed.). 2000. Albatross and Petrel Mortality from Longline Fishing International Workshop, Honolulu, Hawaii, USA, 11–12 May 2000. Report and presented papers. *Marine Ornithology* 28: 153–190.

The Workshop on Albatross and Petrel Mortality from Longline Fishing, held in Honolulu, Hawaii, USA May 2000, and attended by approximately 75 biologists, resource managers and conservationists from many countries, reviewed the effects of longlining on albatrosses and petrels on a global scale. The workshop recognised that effective progress required a range of complementary and interlinked actions to:

A. Develop and use appropriate multilateral, inter-governmental instruments, mechanisms and fora;
B. Develop and improve practical means to reduce seabird bycatch and promote their wide and effective use; and
C. Enhance science-based monitoring of seabird bycatch and population trends, complemented by relevant research into population structure, dynamics and foraging ecology.

To these ends, the workshop recommended that:

International agreements and initiatives

1. States proceed as a matter of urgency to conduct assessments of seabird bycatch in their longline fisheries and develop National Plans of Action in accordance with the International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA – Seabirds) of the Food and Agriculture Organization of the United Nations;
2. Range states for the three North Pacific albatross species collaborate by way of relevant existing and new international and regional instruments, to reduce mortality of these birds in their longline fisheries;
3. Range states support the development of and become parties to a Southern Hemisphere Albatross and Petrel Agreement, in accordance with the Convention on the Conservation of Migratory Species of Wild Animals;
4. States, entities and international bodies and fora develop and implement appropriate diplomatic and legal means to regulate illegal, unregulated and unreported (IUU) fishing so that seabird bycatch is minimised;

Practical action

5. It was important to stimulate technological development of new and improved mitigation measures to reduce and, if possible, eliminate seabird bycatch;
6. It was essential to encourage effective use of these measures, particularly amongst developing states and high seas fleets;
7. It was important to promote awareness of problems and their solutions in all states operating or licensing longline fishing;

Research and monitoring

8. Priorities for sustaining existing research and monitoring work, and developing new studies were:
   i. Monitoring of status and trends of albatross populations, complemented by demographic research;
   ii. Undertaking genetic studies to understand structure and stock identity within albatross species and populations;

iii. Collecting comprehensive data on bycatch rates and fishing effort; and
iv. Defining foraging ranges by age, sex and season, using new technologies, devices and analytical approaches.

In addition to the above suggested actions, in order to facilitate co-operation and information exchange throughout the international seabird research and conservation communities, it was concluded that the issue of seabird mortality in longline fisheries be addressed by means of further national and international workshops and conferences. BirdLife International was invited, in the context of its 'Save the Albatross Campaign', to sponsor a workshop in 2001 among Latin-American states to address the issue of seabird bycatch in longline fisheries in that region.

INTRODUCTION

In September 1995 a workshop on the incidental mortality of albatrosses in longline fisheries was held in Hobart, Australia, as part of the First International Conference on the Biology and Conservation of Albatrosses (Alexander *et al*. 1997, Robertson & Gales 1998). The workshop reviewed the effects of longlining on albatrosses and drew important conclusions and recommendations for action. Since then, much has happened to address the problem, but seabirds are still substantially at risk of drowning on hooks in many parts of the world's oceans (Brothers *et al*. 1999). Initiatives at the inter-governmental level by the Food and Agriculture Organization of the United Nations (FAO) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention or CMS), by regional bodies such as the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), by individual nations and by non-governmental organizations such as BirdLife International, hold promise to reduce considerably, if not to solve, the problem (Cooper *et al*. 2001).

With such initiatives underway, it seemed timely to hold a second international workshop on the issue, again linked to an international conference on albatrosses and (this time) petrels, to review the effects of longlining, what is currently being done or planned to be done about it, and to make suggestions and recommendations for action. Following the findings of a workshop on Black-footed Albatrosses *Phoebastria nigripes* held in Honolulu, Hawaii, USA in October 1998 (Cousins & Cooper 2000), it was decided that the effects of longlining on all the albatross species of the North Pacific was in particular need of review. Further, progress with international initiatives needed to be reviewed as did research on mitigation measures. Accordingly, four presentations covering these subjects were solicited from experts in their fields to 'set the scene' for the workshop. The written texts of these presentations, appended to this report, and ensuing discussions, coupled with a detailed discussion on research needs led by J.P. Croxall and H. Weimerskirch, form the basis of the conclusions and recommendations of this workshop report.

The workshop was attended by approximately 75 biologists, resource managers and conservationists working with albatrosses and petrels from many countries, allowing for a global perspective to be developed. A number of papers and posters addressing seabird mortality in longline fisheries presented at the conference immediately before the workshop helped set the scene for the workshop deliberations.

FAO INTERNATIONAL PLAN OF ACTION

All longlining states were strongly encouraged to conduct assessments of bird bycatch, and, where warranted, proceed towards the production and adoption of National Plans of Action (NPOA – Seabirds) in accordance with the International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA – Seabirds) of the Food and Agriculture Organization of the United Nations by the next (24th) Session of FAO's Committee on Fisheries (COFI) in February–March 2001.

The lack of progress by most states in developing NPOA – Seabirds, including but not restricted to those within the European Union and in the developing world, was noted with concern. The workshop participants hoped that some states would be able to report significant progress with their NPOA – Seabirds at the 24th Session of COFI. In this regard it was noted that Paragraphs 22 and 23 of the IPOA – Seabirds allowed for technical and financial support to States. This opportunity should be taken up, especially by developing countries in the southern hemisphere. It was also noted that developing states could seek funding to produce their NPOA – Seabirds from the Global Environment Facility (GEF). Progress reported to the workshop towards the production and adoption of NPOA – Seabirds by Australia, Canada, Japan, New Zealand, Norway and the USA was welcomed.

Lastly, the workshop participants took note of the Seabird Conservation Programme of BirdLife International and its initiation in 2000 of a global 'Save the Albatross Campaign' designed to reduce the mortality of seabirds in longline fisheries. The workshop suggested that BirdLife International, working through its global partnership and with other concerned non-governmental organizations, could produce 'shadow plans' that would assist countries to produce their NPOA – Seabirds. BirdLife International should also endeavour to obtain and circulate copies of existing NPOA – Seabirds as examples of 'best practice' to help countries prepare their own.

NORTH PACIFIC ALBATROSSES AND PETRELS

All states with breeding and non-breeding populations of North Pacific Albatrosses (Short-tailed *Phoebastria albatrus*, Laysan *P. immutabilis* and Black-footed) should collaborate by way of relevant existing and new international and regional instruments, including those managing fisheries, to reduce bycatch of these species by their longlining activities, consistent with Paragraphs 19 and 20 of the IPOA – Seabirds.

The proposed Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean was recognized as a potential instrument to address albatross and petrel bycatch by longline fisheries in the western part of the North Pacific. The April 2000 draft of the Convention makes reference to assessing the impacts of and adopting measures to minimize 'catch of non-target

species, both fish and non-fish species . . . in particular endangered species and promote the development and use of selective, environmentally safe and cost-effective fishing gear and techniques' (Article 5(e), Multilateral High Level Conference 2000). However, the proposed area to be covered by this convention does not extend east of 150°W north of the Equator, and thus does not cover longline fisheries in the Gulf of Alaska and Bering Sea where seabird mortality of North Pacific albatrosses also occurs (Brothers *et al*. 1999). The Seventh and Final Session of the Convention is due to be held in August–September 2000.

Another potential instrument to address albatross and petrel bycatch in longline fisheries in the North Pacific is the Fisheries Working Group (FWG) of the Asian–Pacific Economic Cooperation (APEC), a group of 21 member economies in the Pacific region. The FWG aims to promote the conservation and sustainable use of fisheries resources and it is in this capacity that seabird mortality could be raised. The FWG is currently addressing a project that would encourage all member economies to implement the FAO's International Plan of Action for the Conservation and Management of Sharks, so could presumably undertake a similar initiative for IPOA – Seabirds.

Consideration could also be given to a North Pacific Albatross range-state Agreement under the terms of the Bonn Convention, since all three North Pacific albatrosses are listed in its appendices. It was noted that at least one state in the region would need to be a party to the CMS before such an Agreement could be advanced.

Publicly-available information on levels of albatross and petrel bycatch by North Pacific fishing nations was currently only available for the USA, from Alaskan and Hawaiian waters. There is a pressing need for such information to be collected and made available by the other nations undertaking longline fishing in the region.

SOUTHERN HEMISPHERE ALBATROSS AND PETREL AGREEMENT

The workshop participants commended South Africa for its successful nomination of seven *Procellaria* and *Macronectes* petrels to Appendix II of the Bonn Convention at its 6th Conference of Parties held in South Africa in 1999. It was noted that this meant that all procellariiform seabirds considered to be seriously at risk from longlining in the southern hemisphere were now listed in Appendices of the CMS, since all albatross species had been previously listed.

The 6th COP adopted a resolution on by-catch emphasizing the 'significant and continuing mortality of albatrosses and other species' in longline fisheries. The 6th COP also recommended that all range states for southern hemisphere albatrosses actively participate in the development and successful conclusion of an Agreement. Australia offered to facilitate further discussions and it was noted that Australia was hosting a meeting, involving all range states, to develop agreed text for an Agreement in Hobart, in July 2000. This initiative was strongly supported and it was recommended that the seven petrel species included in Appendix II of the CMS be included within the Agreement from the outset.

It was noted with approval that a Southern Hemisphere Albatross and Petrel Agreement would address conservation concerns broader than just longlining, and was intended, *inter alia*, to address habitat protection and management, both at sea and on land; human-bird interactions, such as those resulting from scientific research and eco-tourism; collaborative research and monitoring requirements; information dissemination to both the technical and wider global community; and collaboration with other international and regional instruments, including fishery organizations.

The workshop encouraged the prioritization of on-ground conservation actions under the terms of the proposed Agreement and further noted the importance of the collection, analysis and public dissemination of findings. Duplication of work already undertaken and available (e.g. reviews of albatross and petrel status and of mortality rates in longline fisheries) should be avoided, so as to concentrate efforts on achieving effective action, both politically and on-the-ground, to address the two most pressing problems: longline mortality at sea and predation by introduced species at breeding grounds.

All range states, including high-seas nations fishing in the southern hemisphere, as well as breeding and non-breeding range states, were strongly encouraged to attend the July intergovernmental meeting and contribute to the early completion of an Agreement. Further, such states were encouraged to join the Agreement as soon as it was open for signature. In this regard, the intention of New Zealand to accede to the CMS during 2000 was welcomed.

It was considered that the Agreement should include recommendations for the transfer of technical knowledge and financial support between parties, to facilitate especially the enhanced protection of the listed albatrosses and petrels by developing countries.

ILLEGAL, UNREPORTED AND UNREGULATED FISHING

Workshop participants were extremely concerned by the likely high levels of albatross and petrel mortality caused by illegal, unreported and unregulated (IUU) longline fishing, especially for Patagonian Toothfish *Dissostichus eleginoides* in the Southern Ocean. The workshop urged states, entities and international bodies and fora to implement (and where necessary develop) appropriate diplomatic and legal means to regulate these fishing activities so that seabird bycatch is minimized.

The efforts of CCAMLR both to assess and control IUU fishing in the Southern Ocean and its adoption of a catch-documentation scheme for toothfish from 1 May 2000 that should lead to the halting of international trade in IUU-caught toothfish by CCAMLR nations was noted. Whether such a scheme can reduce trade involving non-parties to CCAMLR or whether other mechanisms will be necessary to address the issue was unclear.

The holding of an Expert Consultation on Illegal, Unreported and Unregulated Fishing Organized by the Government of Australia in Cooperation with the FAO from 15–19 May 2000 soon after this workshop was noted with approval. It was noted that the consultation aimed to produce an International Plan of Action (IPOA) to combat IUU fishing that would be adopted at the 24th Session of COFI in 2001. It was hoped that bycatch in longline fisheries, including of albatrosses and petrels, would be reduced by this development. Nations are urged to adopt the provisions of the IPOA once it is finalized.

MITIGATION OF SEABIRD MORTALITY IN LONG-LINE FISHERIES

Recent and ongoing research, including by way of controlled experiments, into reducing seabird mortality from longlines was noted with approval. It was agreed that further research and outreach was required on two broad fronts:

1. in the area of technological development and refinement of mitigation measures, including their applicability to individual fisheries and to the species at risk; and

2. in the non-technical area, addressing the continuing lack of awareness of seabird conservation issues and the reluctance to change practices to reduce seabird mortality, in both developed and developing countries.

A holistic approach was considered desirable, with a 'top-down' approach via governments and international and regional agreements and other instruments and a 'bottom-up' approach via fishers and fishing gear companies. For the former approach, consumer markets demanding fish products captured using techniques which significantly reduce or avoid seabird mortality was recognized as an additional tool to encourage fishers to adopt mitigation measures, with the consequence that observer programmes will be needed to check for compliance. For the latter, direct links should be made and fostered between concerned scientists and conservationists and with fishers. In this regard the several mitigation measures that had been first developed and voluntarily adopted by fishers (e.g. use of bird-scaring 'tori' lines, blue-dyed bait and towed 'buoy bags') showed the value of such an approach.

It was noted that many longline fisheries did not currently have on-board observer programmes to collect information on seabird mortality and use and effectiveness of mitigation measures. Although it was noted that running such schemes was expensive, and might thus be beyond the ability of some developing countries, in some fisheries the 'user-pays' principle had been adopted so that the fishery itself paid for the observer scheme.

The benefits of maintaining teams of well-trained observers was noted. The development of scientific observer programmes has led not only to improved collaboration between fishery organizations and scientists in reducing seabird mortality by longline fisheries, but also to the improved management of the fisheries themselves. The absence of observer programmes in some developing countries, including in South America, was noted with concern. Countries with established observer programmes, such as Australia and New Zealand, could help in this regard by providing training. For a number of southern hemisphere nations, the Valdivia Group of Temperate Southern Hemisphere Countries on the Environment could provide a framework for such cooperation. A similar approach would be of value elsewhere, including in the North Atlantic and North Pacific Oceans.

It was noted that independent observer programmes were the only reliable way to collect data on bycatch rates. In order to obtain statistically rigorous results, such programmes needed to cover an adequate sample of vessels and allow for the collection of accurate data on the fine-scale distribution of both fishing effort and bird mortality. In this regard, it was noted with regret that local media reports at the time of the workshop stated that the mandatory observer programme operating within the Hawaiian-based pelagic longline fishery since 1994 was to be reduced in size (by the elimination of 12 of 14 posts) due to a lack of funding.

Lastly, it was agreed that observer programmes should return representative samples of seabird corpses to port, both for validation of specific identifications and to collect data on such characteristics as gender and age-class ratios, body condition, moult and for genetic studies. To this purpose, concerned scientists and institutions needed to ensure that there was an efficient and effective means of collecting specimens from ports of landing and processing and/or storing them as necessary.

RESEARCH ISSUES AND PRIORITIES

Population studies

It was considered vital to maintain and sustain existing long-term population studies since these are unique as sources from which to identify problems, disentangle potentially confounding causal effects and monitor progress towards management targets, including success of remedial measures. Those conducting and/or commissioning these studies should ensure that results are made available as promptly and as widely as possible.

Whenever possible these studies should be designed so as to accompany estimates of population size and trends with other demographic data, especially annual adult survival and recruitment rates.

For many purposes, including population models and assessment of threatened status under IUCN criteria, population trends and generation time are essential data. For calculating the latter, estimates of mean age of first breeding and adult annual survival are required. These data should be a high priority for acquisition and publication.

There is a need to explore more rigorously and state more explicitly the objectives of management action, taking account of:

1. current best practices with precautionary management approaches in marine and terrestrial systems; and

2. the need to restore the populations of the many seabird species which have globally or regionally threatened status under the IUCN criteria.

The utility of population models in expressing many of the most urgent problems relevant to conservation and management of seabirds was emphasized, particularly including seabird bycatch. One topic considered of potential interest was to evaluate the relevance of approaches to fisheries bycatch management involving bycatch limitation based on precautionary population models.

The proposal to hold a workshop to explore the issue of matrix population models, using long-term data for studies of albatrosses and petrels was endorsed and commended, especially for those species actually or potentially affected by seabird bycatch.

The importance was recognized, including amongst threatened species, of review and prioritization of management options, including (but not limited to) commencing new population

studies, developing models using analogue (e.g. congener) data and taking direct action to address the major perceived threats.

The importance of maintaining and developing national and regional systems for retention, analyses (and archiving where appropriate) of specimens, material and data from seabird bycatch was recognized. Data on age and sex were considered to be of particular interest. Special note was taken of the importance of recording the details of banded birds caught as bycatch. In some circumstances it might be appropriate to make recording these data a condition of permits issued within licensed fisheries.

Genetics

The importance of recent and current genetic studies in illuminating species limits and defining population structure within species for conservation and management was recognized. For seabird bycatch the potential for determining the provenance (e.g. to island group, island population, colony) of individual seabirds is considerable. However, the currently detectable levels of genetic variation differ greatly amongst species and it would be optimistic to expect that allocation to island 'population' would be possible for some species.

Careful evaluation of genetic data, in conjunction with morphometric, ecological and behavioural data, combined with a pragmatic approach, would be prudent in any redefinition of species limits.

Notwithstanding whatever species limits are recognized, there is a need for enhanced focus on the management and conservation of albatrosses and petrels at the most appropriate levels (e.g. management stock or unit). For some species at least this will be on an infra-specific basis (e.g. island or colony).

It was agreed that the following practical steps were needed:

1. formulate and circulate recommended sampling and storage protocols for genetic material for seabirds;

2. establish and manage an electronic and open-access database inventory of the nature and location of relevant samples for albatrosses and petrels; and

3. consider the feasibility and desirability of establishing international, national and regional repositories for samples of genetic material of albatrosses and petrels.

At-sea studies of foraging and diet

In order effectively to study interactions between longline fisheries and seabirds it is essential to have available data on:

1. species-specific seabird bycatch rates (i.e. from scientific observer programmes) from a reasonable sample of (ideally all) vessels in all relevant longline fisheries; and

2. data on fishing effort at as fine a scale as possible for a reasonable sample of (ideally all) vessels in all relevant longline fisheries.

The importance of collecting data by both shipboard observational and remote-sensing techniques was recognized for delimiting ranges and foraging areas of seabirds at sea.

It was recommended that practitioners of both types of data collection should collaborate at regional and global levels to define ranges of seabirds at sea (including by age, sex and season) and to identify areas of intensive use and migration pathways within these.

The urgent need for review and elaboration of statistical methods for use in analyses of satellite tracking was recognized, especially in relation to generating range, density-distribution and trip-specific phenomena. A workshop should be held to facilitate this.

Development and use of miniaturized devices and improved attachment methods should be promoted to facilitate the long-term, relatively inexpensive collection of data on at-sea range and movements of seabirds outside their breeding seasons and of age-groups other than adults.

Research, particularly into feeding methods, especially diving depth, bait attractiveness, etc. should be encouraged, with respect to:

1. susceptibility of species to being caught; and

2. developing methods of avoiding seabird bycatch.

The effects of enhanced availability of offal to seabird demography as a result of fishing needs to be studied.

THE FUTURE

It was considered that there was a need for future meetings on the subject of albatross and petrel mortality by longline fisheries, especially in developing countries such as on the South American continent. However, it was noted that, at present, no formal structure existed to convene them. Such a structure would allow for a wide group of biologists and conservationists working with albatrosses and petrels to provide advice, for example, to a Southern Hemisphere Albatross and Petrel Agreement. Several options were noted as how this could best be achieved. These included the resuscitation of an international Seabird Specialist Group, as previously run by BirdLife International; a formal collaboration between existing regional seabird groups; or the formation of a new body. Because many attendees at the workshop hold influential positions in their respective organizations, all were asked to consider the way forward with their colleagues and circulate their suggestions. The Seabird Conservation Programme of Birdlife International and the internet Seabird Listserver could act as enabling mechanisms in this regard.

It was recommended that seabird mortality from longlining should be discussed again at the Third International Conference on the Biology and Conservation of Albatrosses and Petrels. Lastly, BirdLife International was encouraged to sponsor a workshop among Latin-American states undertaking longlining during 2001, both to assess the levels of mortality of albatrosses and petrels in that region and to encourage the production of NPOA – Seabirds and the development and adoption of a Southern Hemisphere Albatross and Petrel Agreement.

ACKNOWLEDGEMENTS

Thanks are due to all the workshop participants for their valued contributions, especially those that prepared presentations in advance, led discussions and commented on drafts of this report, and to the organizers of the Second International Conference on the Biology and Conservation of Albatrosses and other Petrels, especially Beth Flint and Katie Swift, for their efficient arrangements. JC gratefully acknowledges financial and logistic support received from the African Seabird Group, the Fish and Wildlife Service, Department of Interior and the Western Pacific Regional Fishery Management Council, Department of Commerce of the United States Government, the Royal Society for the Protection of Birds through BirdLife South Africa and the University of Cape Town for enabling his attendance at the conference and workshop in Hawaii and the production and publication of this report.

REFERENCES

ALEXANDER, K., ROBERTSON, G. & GALES, R. 1997. The incidental mortality of albatrosses in longline fisheries. A report on the Workshop from the First International Conference on the Biology and Conservation of Albatrosses, Hobart Australia – September 1995. Kingston: Australian Antarctic Division.

BROTHERS, N.P., COOPER, J. & LØKKEBORG, S. 1999. The incidental catch of seabirds by longline fisheries: worldwide review and technical guidelines for mitigation. *FAO Fisheries Circular* No. 937. 100 pp.

COOPER, J., CROXALL, J.P. & RIVERA, K.S. 2001. Off the hook? Initiatives to reduce seabird bycatch in longline fisheries. In: Melvin, E.F. & Parrish, J.K. (Eds). Seabird bycatch: trends, roadblocks and solutions. Fairbanks: Alaska Sea Grant Program. pp. 9–32.

COUSINS, K. & COOPER, J. (Eds). 2000. The population biology of the Black-footed Albatross in relation to mortality caused by longline fishing. Honolulu: Western Pacific Regional Fishery Management Council.

MULTILATERAL HIGH LEVEL CONFERENCE. 2000. Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Proposal by the Chairman, 19 April 2000, Honolulu, Hawaii. MHLC/Draft Convention Rev. 1.

ROBERTSON, G. & GALES, R. (Eds). 1998. Albatross biology and conservation. Chipping Norton: Surrey Beatty & Sons.

APPENDED

Appendix 1: Katherine L. Cousins, Paul Dalzell & Eric Gilman: Managing pelagic longline-albatross interactions in the North Pacific Ocean.
Appendix 2: K.S. Rivera: The FAO International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries: what are countries doing?
Appendix 3: Edward F. Melvin & Graham Robertson: Seabird mitigation research in longline fisheries: status and priorities for future research and actions.
Appendix 4: R. Hall & M. Haward: International legislation and agreements affecting seabird mortality on longlines.

APPENDIX 1

MANAGING PELAGIC LONGLINE–ALBATROSS INTERACTIONS IN THE NORTH PACIFIC OCEAN

KATHERINE L. COUSINS[1], PAUL DALZELL[2] & ERIC GILMAN[3]

[1]*Pacific Islands Area Office, National Marine Fisheries Service, 1601 Kapiolani Blvd., Suite 1110, Honolulu, Hawaii 96814, USA*
(Kathy.Cousins@noaa.gov)
[2]*Western Pacific Regional Fishery Management Council, 1400-1164 Bishop Street, Honolulu, Hawaii 96813, USA*
[3]*Living Ocean Program, National Audubon Society, 2718 Napuaa Place, Honolulu, Hawaii 96822, USA*

SUMMARY

COUSINS, K.L., DALZELL, P. & GILMAN, E. 2000. Appendix 1. Managing pelagic longline–albatross interactions in the North Pacific Ocean. In: Cooper, J. (Ed.). Albatross and Petrel Mortality from Longline Fishing International Workshop, Honolulu, Hawaii, USA, 11–12 May 2000. Report and presented papers. *Marine Ornithology* 28: 159–174.

The Short-tailed *Phoebastria albatrus*, Black-footed *P. nigripes* and Laysan *P. immutabilis* Albatrosses, all native to the North Pacific, interact with demersal and pelagic longline vessels and may on occasion be caught by a baited hook and drown. This problem has been studied in detail for 105–115 pelagic longline vessels home-ported in Hawaii, which kill between 1000–2000 each of both Black-footed and Laysan Albatrosses each year. No takes of Short-tailed Albatrosses have been reported for the Hawaii longline fishery, but between 1987 and 1999 a total of six birds has been reported incidentally caught in the Alaska longline fisheries. The Black-footed and Laysan Albatrosses are most vulnerable to longline fishing for Broadbill Swordfish *Xiphias gladius*, where longlines are set near the surface providing ample opportunity for albatrosses to intercept baited hooks. Studies of the rarer Black-footed Albatross population revealed fishery-induced mortality to be a chronic rather than a catastrophic source of mortality. Some simple mitigation methods implemented in the fishery should reduce the incidental catch of albatross by an order of magnitude and eventually lead to negligible take levels. However, the Hawaii-based longline vessels targeting swordfish represent only a small fraction of pelagic longline effort in the North Pacific and albatrosses will continue to be taken by Japanese, Taiwanese and Korean longliners operating in the same vicinity. Asian longline vessels fish primarily for tuna *Thunnus* spp. and are likely to have much lower albatross take rates than the Hawaii-based fleet, but collectively these 3000+ vessels still represent a significant threat to North Pacific albatrosses. Although several multilateral fishery bodies and agreements identify cost-effective methods to reduce significantly the incidental catch of seabirds in longline fisheries, very few international or national fishery management organizations require longline fishers to employ these mitigation measures. There is a need to strengthen international efforts to reduce seabird mortality on longlines, and effective monitoring of albatross populations in the North Pacific to gauge the success of mitigation measures.

INTRODUCTION

In this paper, we present maps showing the crude distribution of three North Pacific albatross species and of pelagic longline fishing activity, in order to understand where interactions could occur between these seabirds and various longline fleets in the North Pacific Ocean. We also describe the pelagic longline fishing techniques used by different fishing nations, and review the actions by several international agencies and fishery bodies to reduce seabird mortality in the North and Central Pacific longline fisheries. Lastly, we review the international agreements and initiatives that can or could address seabird mortality in North and Central Pacific longline fisheries.

AT-SEA DISTRIBUTIONS AND FORAGING BEHAVIOURS OF NORTH PACIFIC ALBATROSSES

Maps showing the breeding locations, plus crude approximations of the range and regions most frequented by the three North Pacific albatross species (Fig. 1) were generated using information gathered from several studies (Rice & Kenyon 1962, Sanger 1972, Robbins & Rice 1974, Sanger 1974, Hasegawa & DeGange 1982, McDermond & Morgan 1993, Sherburne 1993, Anderson & Fernandez 1998). Our objective is to show the regions where the species are known to converge and then to compare these findings with the distribution of pelagic longline fishing activity.

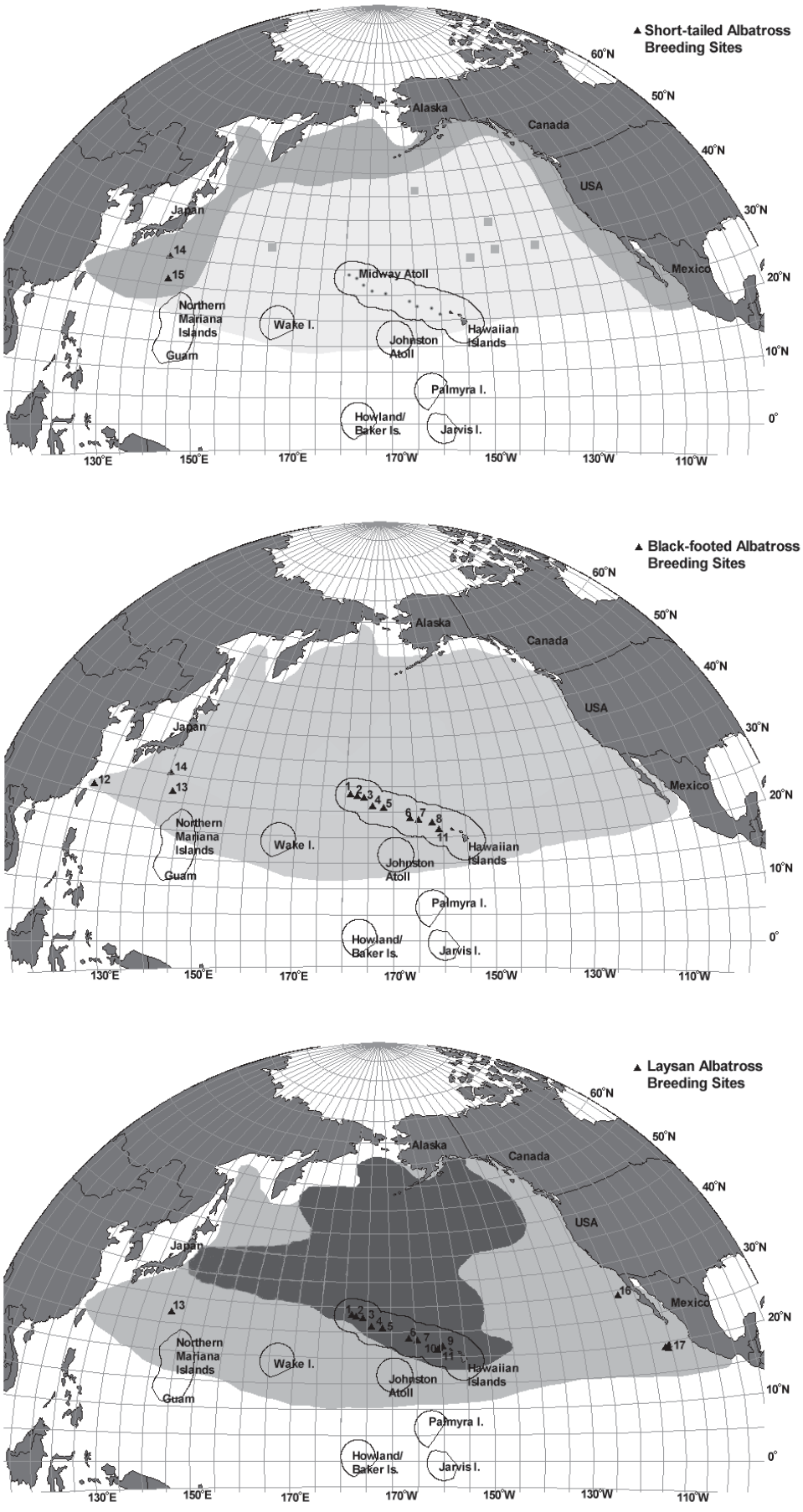

Fig. 1. *Breeding sites plus crude approximations of the range and regions most frequented by Short-tailed, Black-footed and Laysan Albatrosses in the North and Central Pacific. The entire North Pacific Ocean is the range for all three species, and darker areas indicate regions where sightings have been most prevalent. Short-tailed Albatrosses breed only in the western*

Pacific and are known to visit the NWHI with one or two birds routinely visiting Midway Atoll (top figure). The majority of Short-tailed Albatross sightings occurs along the coastlines of Asia, Japan, Russia, the Aleutian Islands, the Gulf of Alaska and the west coast of North America. A few sightings recorded at sea occur in the NPTZ. Black-footed Albatross breed on the Northwestern Hawaiian Islands (NWHI) and in the Western Pacific (centre figure). The majority of Black-footed sightings at sea occur in the NPTZ and along the west coast of North America and the east coast of Japan. Black-footed Albatrosses are known to forage in the Bering Sea and the Gulf of Alaska, but the results of Anderson &Fernandez' (1998) satellite-tagging study suggests that this species prefers to forage off the west coast of North America whereas the Laysan Albatross migrates north to Alaska. The Laysan Albatross also breeds on the NWHI and Bonin Island in the western Pacific and the species has established two colonies in the eastern Pacific on islands off of the Mexican coast (bottom figure). Breeding sites: (1) Kure Atoll; (2) Midway Atoll; (3) Pearl and Hermes Reef; (4) Lisianski Island; (5) Laysan Island; (6) French Frigate Shoals; (7) Necker Island; (8) Nihoa Island; (9) Kauai Island; (10) Niihau Island; (11) Kaula Island; (12) Senkaku Islands (Kita-Kojima); (13) Bonin Island (Chichijima); (14) Izu Island (Torishima); (15) Minami-Kojima Island; (16) Guadelupe Island; (17) Mexican Island.

To date, only Anderson & Fernandez (1998) have completed satellite telemetry studies of breeding Laysan *Phoebastria immutabilis* and Black-footed *P. nigripes* Albatrosses. No telemetry studies have been completed for Short-tailed Albatrosses *P. albatrus*. Without the aid of telemetry studies, information on albatross distribution at sea can be estimated from a variety of sources including: 1) sighting records; 2) fishery observer programmes; 3) breeding locations; 4) at-sea behaviour and feeding ecology; and 5) empirically from the location of oceanographic fronts in the North Pacific. A large volume of literature has been published on the population biology of Laysan and Black-footed Albatrosses, however, only recent work primarily by H. Hasegawa (Toho University) supplies population information for the Short-tailed Albatross.

The Short-tailed, Black-footed and Laysan Albatrosses range over the entire North Pacific Ocean, however, there are regions where albatrosses are more commonly observed (Fig. 1). These regions are associated with breeding colonies and highly productive waters of the Bering Sea and Gulf of Alaska, as well as the waters in the region of the North Pacific Transition Zone (NPTZ) and along the west coast of North America. The NPTZ (Fig. 2) is a broad, weak, eastward flowing surface current composed of a series of fronts situated between the Subtropical Gyre to the south and the Subarctic Gyre to the north (Roden 1980).

Differences in at-sea distribution of the three North Pacific albatross species might be explained, in part, by variations in foraging behaviours and preferred prey. Even though there are biases associated with sighting records, such that the majority of sightings are from land-based or fishery derived sources, it is reasonable to assume that the seabirds are migrating to regions of high productivity to forage regardless of their preferred food. Unfortunately, these same areas of high productivity also attract longline fishing operations (Seki *et al.* 1999).

PELAGIC LONGLINE FISHERIES OF THE NORTH PACIFIC

Seabirds are vulnerable in the North Pacific to demersal longline fishing off the coast of Alaska and Bering Sea, and the pelagic longline fisheries farther south in the North and Central Pacific, especially between 20° and 40° N (Figs 3 & 4). Pelagic longline fishing in the Pacific went through a period of great expansion in the latter half of the 20th Century,

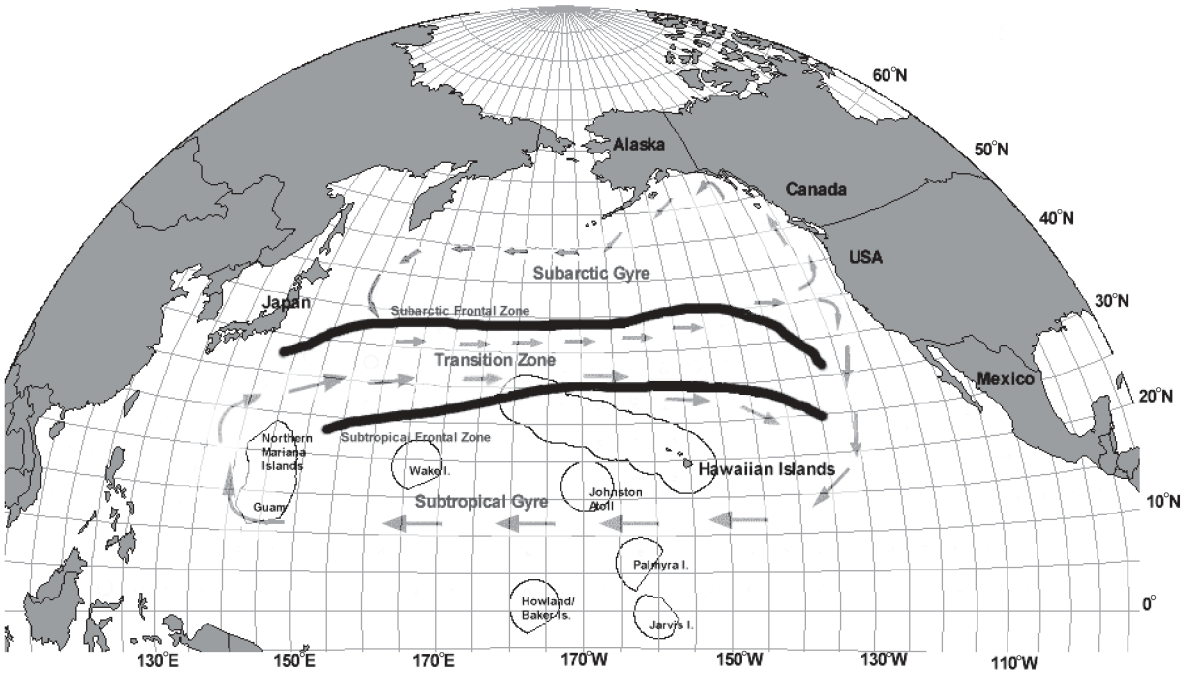

Fig. 2. *The North Pacific transition zone (NPTZ) is the region between the subarctic and subtropical frontal zones (figure was adapted from Roden 1991 by D. Foley of Hawaii Coastwatch).*

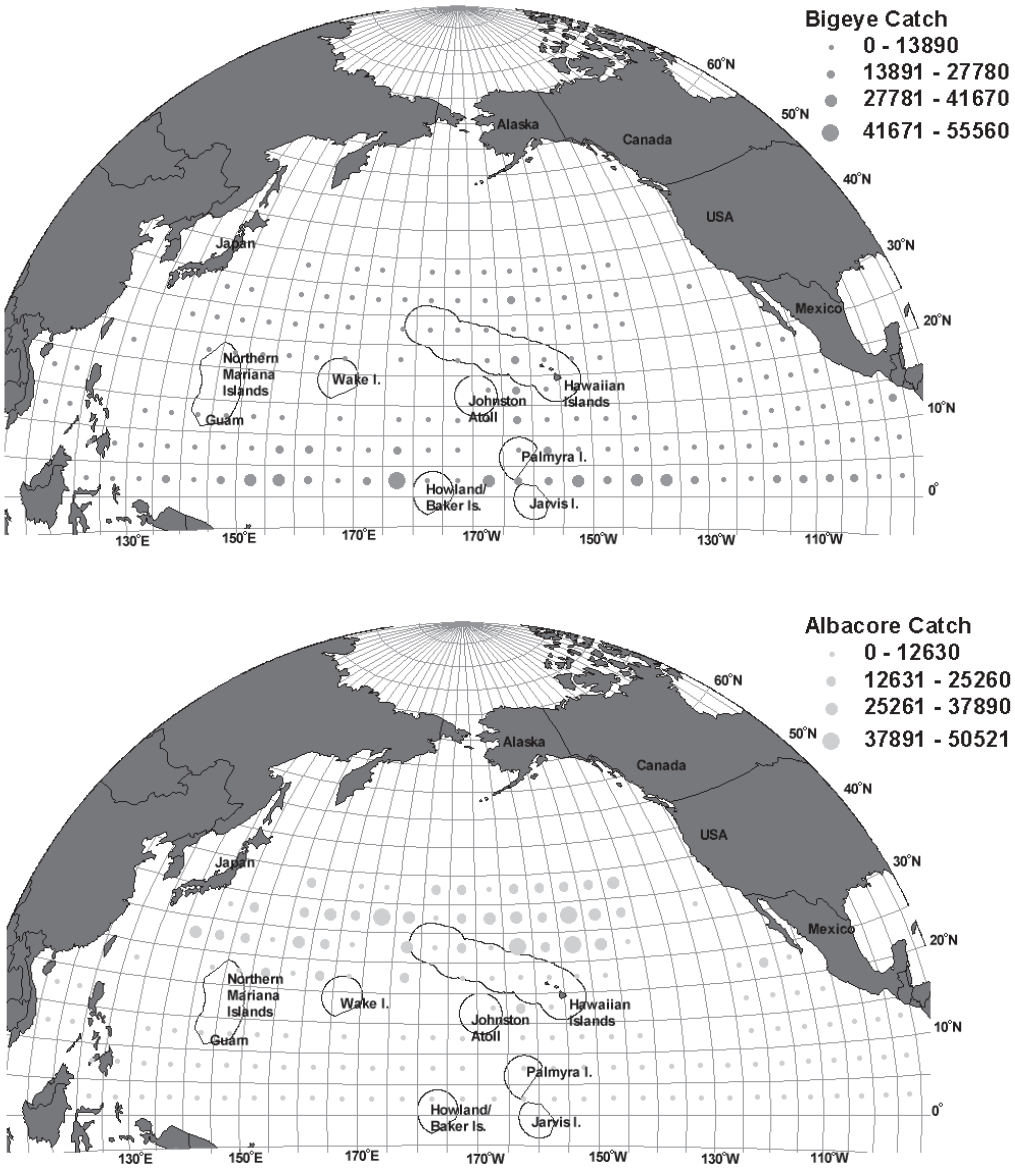

Fig. 3. *Pelagic longline fishing catch (in tonnes) for Bigeye and Albacore Tuna in the North and Central Pacific Ocean for 1997. Sources: NMFS, Southwest Fisheries Science Center, Honolulu Laboratory and Secretariat of the Pacific Community Oceanic Fishery Program web site.*

initially from Japan as it rebuilt its economy after Word War II, and then later by Taiwan and Korea (Lawson 1999a). The total Japanese fleet had peaked by the mid-1960s, and was comprised of coastal, offshore and distant water vessels. The Taiwanese longline fleet peaked in the late 1980s, and like the Japanese fleet has distant water and offshore components. The Korean fleet is much smaller, with the fleet size peaking in the mid-1970s. Other Asian fleets that have contributed to the overall increase in pelagic longline fishing in the North Pacific are the Chinese, Philippine and Indonesian, while the revitalization and expansion of the Hawaii longline fishery also added further to the total number of Pacific longline vessels and volume of hooks deployed.

On average about 570 million longline hooks are deployed each year in the Pacific (Secretariat of the Pacific Community Oceanic Fishery Program web site) but only a fraction of these represent a threat to North Pacific albatrosses. Albatross bycatch appears to be a function of the density of birds in the vicinity of the fishing vessels and the type of longline fishing, particularly where shallow sets are made, with slow sink rates of baited hooks deployed at the same time birds are feeding most actively. This combination of factors tends to be a characteristic of swordfish-directed fishing rather than longline fishing focused on tuna (Table 1). For this reason, this paper focuses on swordfish pelagic longline fisheries in the North Pacific and attempts to assess their threat potential to albatrosses in the absence of quantitative information for any other North Pacific pelagic longline fisheries.

HAWAII AND OTHER USA LONGLINE SWORDFISH CATCH

The revitalization of the Hawaii longline fishery was due to the development of local and export markets for fresh tuna to the mainland and Japan, and the discovery of swordfish stocks around Hawaii (Boggs & Ito 1997, Dalzell 1997). Participa-

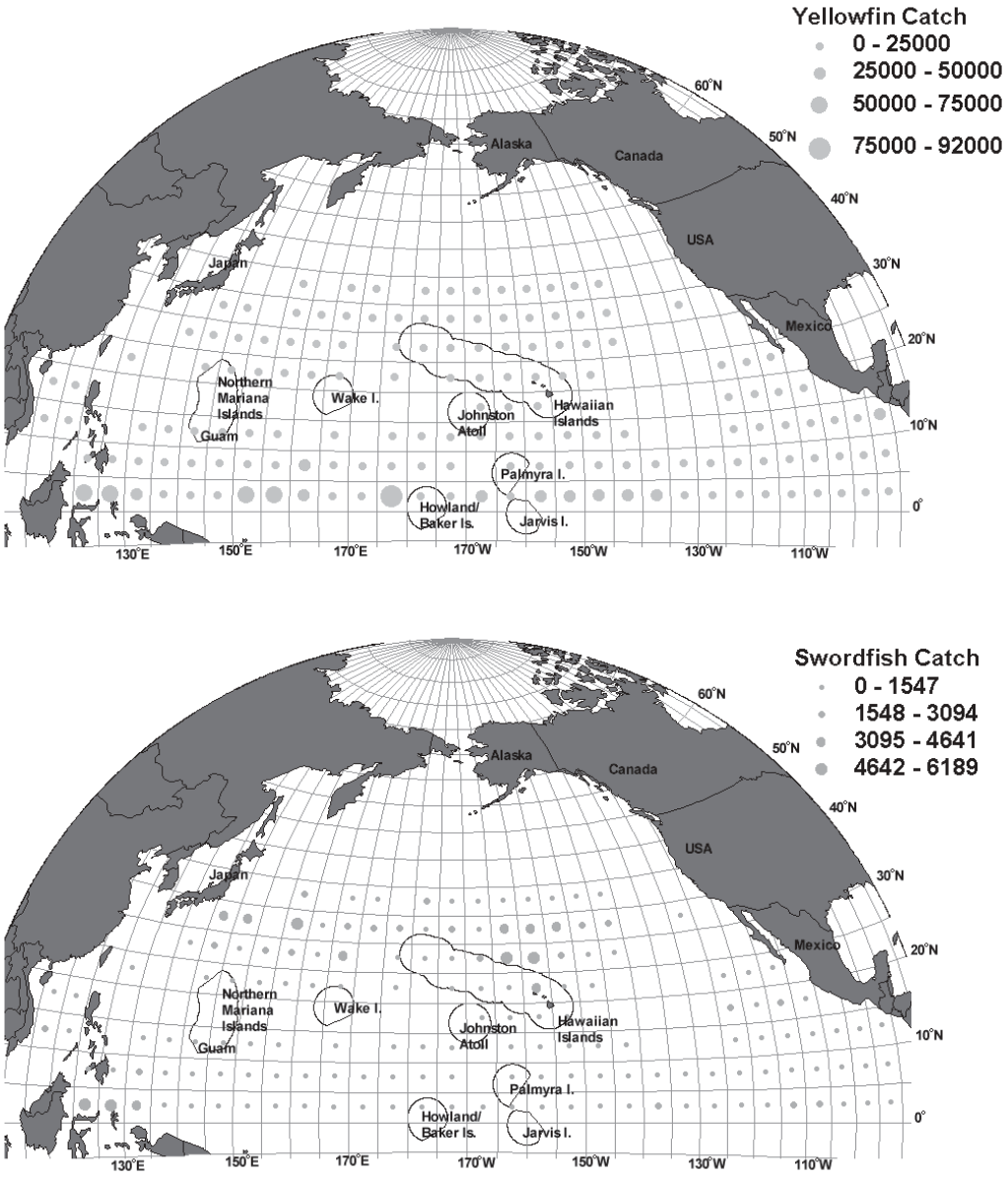

Fig. 4. *Pelagic longline fishing catch (in tonnes) for Yellowfin Tuna and swordfish in the North and Central Pacific Ocean for 1997. Sources: NMFS, Southwest Fisheries Center, Honolulu Laboratory and Secretariat of the Pacific Community Oceanic Fishery Program web site.*

TABLE 1

Incidental catches of albatrosses in the Hawaii pelagic longline fishery by set type based on NMFS observer records from 1994–1998

Targeted fish during set	Observed bird catch	Number of observed sets	Bird catch/set
Swordfish	370	488	0.758
Mixed (swordfish and tuna)	472	946	0.499
Tuna	16	1250	0.013

Source: NMFS, Southwest Fisheries Science Center, Honolulu Laboratory, unpubl. data.

tion in the Hawaii longline fishery increased from 37 vessels in 1987 to 75 and then doubled again to 156 vessels in 1991. Further entry to the fishery was halted by a moratorium in 1991, later formalized as a limited entry programme with a cap of 164 vessels. Landings increased rapidly and by 1991 had reached 8165 tonnes, of which 3992 tonnes was swordfish. The newer vessels in the fishery were characterized by a greater reliance on sophisticated electronic gear for navigation and finding fish. These newer vessels also tended to be larger in size. The majority of vessels operating in the Hawaii longline fishery range between 56 to 74 ft (17–22 m) in length, with the larger vessels fishing to the north-east of the Hawaiian Islands and targeting a mixture of swordfish and Bigeye Tuna *Thunnus obesus*. The revitalized fleet also adopted more modern longline gear, using continuous nylon monofilament main lines stored on spools, with snap-on monofilament gear. Monofilament longline gear is more flexible in configuration and can be used to target various depths more easily than can traditional tar-coated rope longlines. Both daytime and night-time fishing are practiced using the same monofilament system. Depth of a longline set irrespective of mainline material is principally a function of the length of mainline between adjacent floats and the number of hooks between floats (HBF). In targeting deep dwelling Bigeye Tuna, 12–25 HBF are deployed with lots of sag to reach as deep as 400 m. Only four to six HBF are deployed when targeting swordfish and the line is kept relatively taut so that it stays within the first 30–90 m of the water column. Night-time fishing employs luminescent light sticks to attract swordfish and their prey to the baited hooks. Longlines deployed for swordfish are baited with large squid *Illex* spp. Tuna-targeting longlines tend to be set during the day and use Saury *Cololabis saira* as bait. Saury bait tends to sink faster than squid, which often has pockets of air trapped within the mantle. Currently, the Hawaii fishery represents about 2.7% of the longline hooks deployed in the entire Pacific each year.

The Hawaii-based fishery is monitored through a number of different instruments. Among the federal permit obligations is a mandatory National Marine Fisheries Service (NMFS) log book detailing the catch and characteristics of each longline set. NMFS also deploys observers, primarily to record protected species interactions on the Hawaii longline vessels, with coverage ranging between four and five percent annually. The observer data on albatross catch is used to generate fleet-wide estimates of the annual take (Table 2). US longline vessels must also carry a vessel monitoring system (VMS) so that closed areas around the Hawaii Islands, and more latterly on the high seas, are monitored. Lastly, about 30% of the longline fleet is boarded for inspection by the US Coast Guard (USCG) each year as part of routine fishery patrols.

A smaller fleet of US longliners also fishes for swordfish from ports in southern California, with fleet size ranging from 15–30-m vessels. The California fleet is augmented annually by Hawaii-based vessels that fish from California during mid-winter, and fish progressively to the west, until it becomes more practical to be based in Hawaii. Hawaii longline vessels operating from California complete log books, but do not carry observers.

JAPANESE SWORDFISH FISHERIES

Japanese longline fisheries are classified into three categories, namely coastal, offshore and distant vessels (Takahashi & Yokawa 1999). The sizes of the boats range 10–20 gt, 20–120 gt and 120–500 gt, respectively. The annual catch of swordfish by offshore and distant water longlines has been stable at around 11 000 tonnes. In the North Pacific the catch reached over 9000 tonnes in 1985 and 1987, then decreased to 4800 tonnes during 1988 and 1991, and since 1992, has fluctuated between 6000 and 8000 tonnes. The catch of coastal longliners, also in the North Pacific, fluctuated between 600 and 1000 tonnes in the 1980s, but increased to 1300 tonnes since 1993.

The Japanese North Pacific catch amounts to about 55% of the total swordfish catch of all vessels active in the North Pacific (Takahashi & Yokawa 1999, Table 3). There is a directed longline fishery for swordfish in the coastal and offshore waters of Japan which takes about 40% of the total Japanese swordfish catch, and 60% North Pacific catch. Swordfish-directed longline fishing uses only 3–4 branch lines and mackerel *Scomber* sp. as bait. The branch lines used for directed fishing are shorter than those used for tuna, and fishing is conducted at night. Monofilament line has been introduced to Japanese longliners in favour of the tar-coated kuralon, but this type of gear is not commonly used in the North Pacific swordfish-directed fishery. Since the mid-1970s, Japanese tuna longliners have been fishing deeper to target Bigeye Tuna. Uozumi & Okamoto (1997) monitored the depth of Japanese longline sets with time-depth recorders. They found that the deepest hook depths with 5, 7, 9, 11, 13 and 15 HBF were 90, 120, 150, 180, 210 and 240 m, respectively. Suzuki & Kume (1982) consider conventional (i.e. shallow) and deep longlining to be those with four to six HBF and ten or more HBF. Hampton *et al.* (1998) summarized data on Asian longline fleets over time to develop standardized indices of fishing effort. In the North Pacific, between 150°E and 150°W and 0–40°N, nearly 40% of longliners were using four to six HBF and fished at relative shallow depths prior to 1981. After 1981, the Japanese fleets on average fished deeper tending to use 10–11 and 12–15 HBF to the mid-1980s, with a steadily increasing proportion of sets using 16–20 hooks, until the 1990s, when this was the commonest gear configuration.

TAIWANESE SWORDFISH FISHERIES

Swordfish catches are an incidental catch of the distant-water tuna longline fishery and the offshore tuna longline fishery in Taiwan (Sun *et al.* 1999). Taiwan also has a small coastal harpoon fishery for swordfish. The offshore tuna longline fishery catches the majority of the swordfish, ranging from 53 to 91% by number with an average of 87%. Most of this catch (75–97%, mean = 88%) comes from fishing in the North Pacific (Table 3). The distant water longline fishery comprise vessels >100 gt, usually 150–250 gt, and has been operating in the Pacific Ocean since 1963. The main fishing ground for this fishery varies considerably throughout the central and southwest Pacific Ocean where Albacore *T. alalunga* and sometimes Bigeye Tuna are the target species and swordfish a bycatch. Few swordfish are caught by this fishery in the Northern Pacific due to its southern Pacific focus. Like the Japanese longline vessels, Taiwanese longliners have traditionally used mainly tar-covered kuralon, although newer vessels are equipped with monofilament.

The offshore fishery longline fleet consists of two classes of vessels of <100 gt. The first group comprises vessels of 20–50 gt, home-ported in Tung-Kang and Kaushiung, which make short trips of seven to ten days landing their catch to their home port. The second group is composed of larger vessels of

TABLE 2

Estimated annual total incidental catches of albatrosses in the Hawaii pelagic longline fishery based on catches recorded by NMFS observers on monitored fishing trips. Values in parentheses are 95% confidence bounds

		Black-footed Albatross			Laysan Albatross		
Year	**Hooks set**	**Estimated total catch**		**Birds/1000 hooks**	**Estimated total catch**		**Birds/1000 hooks**
1994	11 996 072	1994	(1508–2578)	0.166	1828	(933–2984)	0.152
1995	14 190 219	1979	(1439–2497)	0.139	1457	(767–2308)	0.103
1996	14 400 031	1568	(1158–1976)	0.109	1047	(569–1610)	0.072
1997	15 564 321	1653	(1243–2101)	0.106	1150	(599–1875)	0.074
1998	17 365 852	1963	(1479–2470)	0.113	1479	(822–2336)	0.085

Source: NMFS, Southwest Fisheries Science Center, Honolulu Laboratory, unpubl. data.

TABLE 3

Annual North Pacific pelagic longline catches of Broadbill Swordfish, Albacore, Bigeye and Yellowfin Tunas (in tonnes)

Year	**Swordfish catch**	**Albacore catch**	**Bigeye Tuna catch**	**Yellowfin Tuna catch**
1990	12 203	9999	65 503	46 629
1991	13 225	12 386	56 529	43 022
1992	1460	13 401	62 609	46 187
1993	16 055	18 525	57 822	44 103
1994	12 582	18 589	54 875	38 731
1995	11 199	24 156	49 723	46 741
1996	10 889	24 776	37 972	38 247
1997	11 118	18 271	42 986	37 821
Average	12 729	17 516	53 502	42 685
Average for the Hawaii Longline Fishery (1990–1997)*	3078 (24.2%)	1409 (8.0%)	2793 (5.2%)	777 (1.8%)

Sources: The public domain database on Secretariat of the Pacific Community Oceanic Fishery Program web site.
*Ito & Machado 1999.

50–70 gt based in fishing ports of the western Pacific islands countries. Both types of vessel target primarily Yellowfin *T. albacares* and Bigeye Tuna for the Japanese sashimi market, taking swordfish as a bycatch. These fleets, however, fish predominantly in the North Pacific. Most of these vessels use monofilament main lines and branch lines. In the North Pacific (150–180°E and 0–40°N) between 1981 and 1996, nearly 60% of the Taiwanese vessels fished very deep using more than 20 HBF, and a further 21% using 16–20 HBF (Hampton *et al*. 1998). The total North Pacific catch of swordfish by Taiwanese longline vessels currently amounts to about 1100 tonnes annually.

KOREAN LONGLINE FISHERY

The Korean longline fleet comprises about 150 vessels of about 370 gt which fish primarily in the tropical Pacific for Bigeye and Yellowfin Tuna for the Japanese frozen sashimi market (Lee *et al.* 1997). As with the Taiwanese fleets, the small volume of swordfish caught by this fleet is taken as bycatch. The Korean fleet operates almost exclusively in the equatorial belt between 10°N and 10°S, and as such may not interact with North Pacific albatrosses. Further, like the Japanese vessels, there has been a shift in longline gear deployment from shallow sets to deep sets. Prior to 1981, Korean vessels used predominantly four to six HBF on their longlines. From 1981 onwards, an increasing proportion of vessels switched to deeper sets using more hooks, such that by 1996, 47% of vessels employed 10–11 HBF. Like the Japanese and other Asian fleets the longlines tend be constructed predominantly from tar-covered Kuralon.

However, according to Moon *et al*. (1999) there has been an increasing trend towards using monofilament leaders on the branch lines. In 1990, only nine percent of vessels were using monofilament leaders, but by 1995, this had risen to 93%. Branch lines with monofilament leaders appear to be much more effective at catching Bigeye and Yellowfin Tuna than wire leader-equipped branch lines. Korean longliners land

about 270 tonnes of swordfish annually, mainly from equatorial latitudes either side of the equator.

OTHER ASIAN FLEETS

Relative newcomers to longline fishing are the Chinese, Philippine and Indonesian longliners (Lawson 1999b). Fishing companies in China have based several fleets in ports of Palau, the Federated States of Micronesia and Marshall Islands under bilateral access arrangements. The Chinese longline fleet operating in central Micronesia numbered as high as 456 vessels in 1994, but has been greatly reduced since then to less than 75 vessels operating from Pohnpei and Palau. These vessels use monofilament main lines as well as branch lines, but fishing where they do in Micronesia, they are too far south to be of any real threat to North Pacific albatrosses. The same applies to Philippine and Indonesian longliners that tend to operate within their Exclusive Economic Zones and sufficiently far south to present no threat to North Pacific albatrosses.

MULTILATERAL AGENCIES, FISHERY BODIES AND INTERNATIONAL AGREEMENTS

There are numerous regional and international fishery bodies that manage fishing in the North and Central Pacific Ocean that have the authority to address the problem of incidental mortality of seabirds in longline fisheries (Table 4). There are also several multilateral agreements and initiatives that address or could address seabird mortality on longlines in this region (Table 5).

A review of international and regional activities reveals that three multilateral agencies and fishery bodies, the Food and Agriculture Organization of the United Nations (FAO), the World Conservation Union (IUCN) and the International Pacific Halibut Commission (IPHC), have taken steps to address specifically the problem of seabird mortality in Northern Hemisphere longline fisheries (Table 4). Only the FAO has taken substantive steps with the endorsement of a non-binding International Plan of Action (IPOA) for Reducing the Incidental Catch of Seabirds in Longline Fisheries in July 1999. However, no actions have been taken to coordinate policies, research, monitoring or enforcement by national-level fishery managers, and the majority of North and Central Pacific longline vessels continues to operate without employment of seabird deterrent measures.

Whereas there has been some progress with international agreements and initiatives to address seabird mortality in North and Central Pacific longline fisheries, only the Convention on the Conservation of Migratory Species of Wild Animals (CMS) currently can obligate a contracting party to execute a legally binding agreement to address seabird mortality in longline fisheries (Table 5). The CMS Secretariat could, therefore, develop a legally binding, multilateral, range state agreement for the three North Pacific species of albatrosses that interact with longline fisheries, providing that at least one range state is a member of the CMS.

The other multilateral agreements and initiatives listed in Table 5 do not contain enforceable regulations that, when violated, result in sanctions on a contracting party or fishing vessel. As is the case with most 'soft law' international conventions, contracting parties are obligated to act in accordance with Convention guidelines, and international politics or fear of losing credibility influences some nations to meet Convention guidelines. Nonetheless, there may be additional legally binding conventions, since the United Nations Implementing Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (UNIA) will be legally binding once it comes into effect. The Agreement obligates signatory States to 1) consider the effects of fishing on associated and dependent species, 2) provides guidance on applying the precautionary approach, 3) defines how coastal states and distant water fishing nations will cooperate to conserve and manage tuna and other fish stocks, and 4) requires regional fisheries bodies to develop management strategies along with enforcement and monitoring control and surveillance systems to ensure compliance with fisheries regulations for highly migratory species. The Agreement to Promote Compliance with International Conservation and Management Measures by Vessels Fishing the High Seas could also be used to enforce legally other international agreements once it comes into effect. The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Central and Western Pacific Region (MHLC), however, would have to be amended after it comes into effect to address seabird mortality on longlines.

DISCUSSION

Pelagic longline fishing fleets may pose a serious threat to North Pacific albatrosses, but combinations of different factors are required before that threat is realized. When monofilament longlines are set shallow, with floatation aided by light sticks and bait, in proximity to a large population of albatrosses, then, without mitigation measures, bird takes are likely to be extensive. Fortunately we know how extensive this is for the Alaska and Hawaii US longline vessels through observer programmes. Without observer data we may only guess at the impact of the other fishing fleets. Empirically, there may be fewer birds killed per boat due to fishing locations and method of fishing, but due to sheer fleet size the mortality may still be significant. Clearly, similar observer information with gear descriptions and seabird interaction rates is urgently required for other longline fleets to achieve a more balanced picture of fishery-induced mortality in the North Pacific.

We have made some crude calculations on the potential numbers of albatrosses killed in the North and Central Pacific pelagic longline fisheries, based on the ratio of swordfish and seabirds caught in the Hawaii pelagic longline fishery. Recent analysis of the Hawaii-based longline bird catches suggest that fisheries operating close to breeding colonies have higher bird catch rates (Kleiber 1998a,b, Laurs *et al*. 1999). The Hawaii-based longline fishery fishes near the NWHI breeding colonies in the US EEZ 50 nautical miles from the shore, as well as on the high seas. We used data generated from mixed sets, where vessels target a mix of swordfish and tuna, as this is thought to approximate best the fishing technique for swordfish used by other longliners in the North Pacific. We only used swordfish catch data for Japanese (9360 tonnes) and Taiwanese (1100 tonnes) fleets, since they comprise most of the other pelagic longline effort in the North Pacific. We also used the average catch rate of Laysan and Black-footed Albatrosses (0.43 and 0.57 birds/tonne fish caught with swordfish gear). Based on these assumptions we roughly estimate that pelagic longline vessels targeting swordfish, other than the Hawaiian longline fishery, annually catch a total of 10 500 albatrosses in the North Pacific. We applied similar methods to North Pacific pelagic longline vessels targeting tuna (using 0.24 and 0.31 birds/tonne

TABLE 4

Actions by multilateral agencies and fishery bodies to reduce seabird mortality in North and Central Pacific longline fisheries

Name of multilateral agency or fishery body	Member states, territories, and organizations	Area of interest; advisory or regulatory	Actions to reduce seabird mortality in longline fisheries
Food and Agriculture Organization of the United Nations (FAO)	175 member nations	All oceans. Advisory body	a) The non-binding FAO Code of Conduct for Responsible Fisheries, Article 7.6.9, promotes the minimization of catch of both non-target fish and non-fish species. b) The non-binding FAO International Plan of Action for Reducing Indicental Catch of Seabirds in Longline Fisheries was endorsed by the 23rd Session of the Committee on Fisheries, and adopted by the FAO Council and FAO Conference in 1999. The voluntary plan calls on all States to implement the plan, which provides guidance for the development of National Plans of Action (FAO Fisheries Department 1998, FAO 1999).
Asia-Pacific Fishery Commission (APFIC)	20 nations[1]	Asia Pacific Region. Advisory body	APFIC, an FAO regional fishery body, has not taken actions to address seabird mortality in longline fisheries (FAO 1997b).
Group of Temperate Southern Hemisphere Countries on Environment (Valdivia Group)	Argentina, Australia, Brazil, Chile, New Zealand, South Africa and Uruguay	Southern Hemisphere (marine and terrestrial). Advisory body	The Valdivia Group's Biodiversity working group formed an Ad Hoc working group on albatross to develop a framework for regional collaboration to conserve all Southern Hemisphere albatross species. The Ad Hoc working group has developed a document that outlines proposed elements of a cooperative instrument to restore and maintain albatross populations, which is hoped to result in a regional instrument (Ad Hoc Working Group on Albatross 1999, Bomford 1999).
South Pacific Forum Fisheries Agency (FFA)	Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, Vanuatu and Samoa	EEZs of the 16 listed Member Nations, located in the South Pacific. Advisory body	FFA does not address seabird mortality in longline fisheries. Through its role in facilitating the establishment of access arrangements, drafting and reviewing fisheries legislation, coordinating regional surveillance, and collecting and disseminating data, FFA is in a position to address effectively seabird mortality of longline fisheries occurring in the EEZs of its member nations (Alexander *et al*. 1997).
World Conservation Union (IUCN)	76 member nations, 111 member government agencies, 732 member non-governmental organizations and 36 affiliates	Global. Advisory body	a) IUCN's advisory resolution adopted in 1996 entitled *Incidental Mortality of Seabirds in Longline Fisheries*, calls upon States to adopt the goal of reducing seabird bycatch in longline fisheries to insignificant levels, and immediately implement seabird bycatch reduction measures by longline fisheries. b) IUCN has criteria for the identification of threatened species, and has categorized the Black-footed Albatross as Vulnerable, the Laysan Albatross 'lower-risk–least concern', and the Short-tailed Albatross as Vulnerable (IUCN 1996).

TABLE 4 (continued)

Name of multilateral agency or fishery body	Member states, territories, and organizations	Area of interest; advisory or regulatory	Actions to reduce seabird mortality in longline fisheries
Inter-American Tropical Tuna Commission (IATTC)	Costa Rica, France, Japan, Nicaragua, Panama, USA, Vanuatu and Venezuela	Eastern Pacific Ocean (FAO Area 87). Regulatory body	IATTC does not address seabird mortality in longline fisheries. The Convention of the IATTC may be flexible enough to provide the Commission with the ability to address seabird impacts by longline fisheries (Brothers *et al*. 1998, Sakagawa 1999).
Pacific Island Roundtable for Nature Conservation	All 26 SPREP member countries and territories[2]	Pacific Islands region. Advisory body	The Roundtable does not address seabird mortality in longline fisheries. However, the goals of the action strategy for Nature Conservation in the Pacific islands region 1999–2002 are broad enough to allow the Roundtable to address this problem (Pacific Island Roundtable for Nature Conservation 1999, South Pacific Regional Environment Programme 1999) .
International Pacific Halibut Commission (IPHC)	Canada and USA	Territorial waters off the west coasts of Canada and the USA	The IPHC introduced legislation to ensure that seabird mortality levels remain low (International Pacific Halibut Commission 1998). (FAO Areas 18, 61, and 67)
Secretariat of the Pacific Community (SPC)	SPC has 26 member countries and territories of which 22 are in Melanesia, Micronesia and Polynesia	Between 25°N–45°S latitude, and 125°E–120°W longitude. Advisory body	SPC does not collect observer data north of 25°N latitude, where seabirds are known to interact with longline vessels. SPC does not address seabird mortality in longline fisheries (Bailey *et al*. 1996, Alexander *et al*. 1997).
North Pacific Interim Scientific Committee for Tuna and Tuna-Like Species (ISC)	No information	North Pacific Ocean. Advisory body	ISC does not address seabird mortality in longline fisheries (http://www.nmfs.gov/oneagree.html).
Organization for Economic Cooperation and Development (OECD)	29 Member countries[3]	Global. Advisory body	OECD does not address seabird mortality in longline fisheries. OECD has an *ad hoc* expert group on fisheries studying the economics of fisheries management, with a sub-group of Iceland, Canada, Australia, and the USA, formed in 1994, to examine bycatch issues (Haward *et al*. 1998).

TABLE 4 (continued)

Name of multi-lateral agency or fishery body	Member states, territories and organization	Area of interest; advisory or regulatory	Actions to reduce seabird mortality in longline fisheries
North Pacific Marine Science Organization (PICES)	Canada, China, Japan, Republic of Korea, Russian Federation and USA	Northern North Pacific Ocean. Advisory body	PICES does not address seabird mortality in longline fisheries (http://pices.ios.bc.ca).

[1] Australia, Bangladesh, Cambodia, China, France, India, Indonesia, Japan, Korea, Malaysia, Myanmar, Nepal, New Zealand, Pakistan, Philippines, Sri Lanka, Thailand, United Kingdom, USA and Vietnam.
[2] Plus, World Heritage Center of UNESCO, Foundation for Peoples of the South Pacific International, IUCN, New Zealand Ministry of Foreign Affairs and Trade, The Nature Conservancy Asia/Pacific Region office, University of the South Pacific and World Wide Fund for Nature.
[3] Japan, Australia, New Zealand, Finland, Mexico, the Czech Republic, Hungary, Poland and Korea, USA, Canada and European countries

TABLE 5

International agreements and initiatives that address seabird mortality in North and Central Pacific longline fisheries

Name of agreement or initiative	Contracting parties or adopters	Area of coverage; and legally binding or advisory	How agreement or initiative addresses seabird mortality in North and Central Pacific longline fisheries
Kyoto Declaration and Kyoto Plan of Action	95 nations that met at the International Conference on the Sustainable Contribution of Fisheries to Food Security	Global. Advisory	The Kyoto Declaration states policies towards better fisheries management. The Kyoto Plan of Action lists areas requiring urgent attention (Haward *et al*. 1998).
Rome Consensus on World Fisheries	FAO's 175 member nations	Global. Advisory	The Rome Consensus urges governments and international organizations to minimize wasteful fishing practices (http://www.fao.org).

TABLE 5 (continued)

Name of agreement or initiative	Contracting parties or adopters	Area of coverage, and legally binding or advisory	How agreement or initiative addresses seabird mortality in North and Central Pacific longline fisheries
United Nations Implementing Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (High Seas Agreement or UNIA)	The Agreement will come into effect once ratified by 30 nations.	Global. Legally binding (once comes into effect)	Several articles in the Agreement include measures to conserve associated or dependent non-target species including seabirds, providing a strong vehicle to direct international action to address the problem of seabird mortality in commercial fisheries (Haward *et al*. 1998).
Convention on Biological Diversity (CBD)	174 nations and the European Community	Global. Advisory	The Convention obligates contracting parties to conserve biodiversity, including marine biodiversity, and parties are to cooperate to implement the treaty outside of national boundaries. The CBD has not been used to address seabird mortality in longline fisheries (http://www.biodiv.org).
Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention or CMS)	55 nations	Global. Advisory and legally binding	CMS requires range states to execute formal multilateral agreements and less formal Memoranda of Understanding to manage taking of species listed in the Appendices of the Convention. A draft agreement has been developed to protect albatross and other petrel species (Bergin 1997, Brothers *et al*. 1998, CMS 1998, Haward *et al*. 1998, Cooper in press).
United Nations Convention on the Law of the Sea (UNCLOS)	132 nations	Global. Legally binding	The treaty has a provision that deals with bycatch within national jurisdictions. This provision directs coastal states to maintain or restore sustainable populations of associated or dependent species. The Convention does not contain enforceable regulations. Countries that do not want to comply with restrictions imposed by an agreement can refuse to do so or withdraw from the Convention. Furthermore, if a home nation enters into an agreement that might restrict fishing, fishing vessels from that nation can adopt a flag of another nation that has not signed the agreement (Alexander *et al*. 1997, Haward *et al*. 1998).
Rio Earth Summit Agenda 21	Adopted by participants of the 1992 United Nations Conference on Environment and Development	Global. Advisory	Agenda 21 promotes the development and use of selective fishing gears and practices to minimize bycatch of non-target species (Haward *et al*. 1998).
Cancun Declaration	Adopted by the participants of the 1992 Cancun Conference on Responsible Fishing	Global. Advisory	The Declaration calls for coastal states to promote the use of selective fishing gears and practices to minimize waste of catch of target species and bycatch of non-target species (Haward *et al*. 1998).

TABLE 5 (continued)

Name of agreement or initiative	Contracting parties or adopters	Area of coverage, and legally binding or advisory	How agreement or initiative addresses seabird mortality in North and Central Pacific longline fisheries
Agreement to Promote Compliance with International Conservation and Management Measures by Vessels Fishing the High Seas	Agreement will come into effect when ratified by 25 states	Global. Legally binding (once comes into effect)	Contracting Parties are obligated to ensure fishing vessels flying their flags do not violate international management measures (Haward *et al*. 1998).
Migratory Bird Treaty Act (MBTA)	Bilateral agreements between the USA and Canada, Mexico, Japan and the former Soviet Union	Land and seas of the signatory nations. Legally binding	The MBTA is the USA's domestic enabling legislation to implement bilateral treaties between the USA and Canada, Mexico, Japan and the former Soviet Union to protect and conserve migratory birds. There is controversy within the USA concerning to what degree the MBTA restricts the take of migratory birds, including seabirds.
Multilateral High Level Conference to develop a Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Central and Western Pacific Region (MHLC)	Negotiated by 28 nations	Central and Western Pacific. Legally binding (once comes into effect)	The Convention text does not contain specific language to take steps to minimize seabird mortality in longline fisheries (MHLC 2000).
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	125 nations	Global. Legally binding	CITES protects endangered species from over-exploitation by controlling trade in live or dead animals and animal parts through a system of permits. The Short-tailed Albatross is listed in Appendix I of the Convention, which prohibits international trade in wild specimens of this species. CITES does not address the incidental mortality of seabirds in longline fisheries (Alexander *et al*. 1997, Haward *et al*. 1998).

fish caught with tuna gear in the Hawaii longline fishery for Laysan and Black-footed Albatrosses and the average catches for the North Pacific shown in Table 3) and found the estimated annual catch of albatrosses was about 21 000. Clearly, these figures are speculative and should not be cited as anything other than a rough guess using the data most readily to hand.

However, until we have good direct observational material on the temporal and spatial distributions of albatross takes for pelagic longline fleets in the North Pacific other than the Hawaii longline fishery then the only avenue left will be to generate empirical estimates such as this. Moreover, knowing the numbers of birds taken will not solve the albatross bycatch problem, but if numbers are available the process of managing the problem at the regional level can be addressed through national policy and/or international fora and agreements. Pelagic longline operations are not equal when managers attempt to estimate seabird mortality resulting from incidental catch. Differences in gear configurations used to target swordfish or tunas result in different seabird catch rates. There is a need to collect gear descriptions, as well as seabird catch rates (expressed as birds/1000 hooks) for each fishery in the North and Central Pacific Ocean. There is also a need to conduct satellite tag studies of all three North Pacific albatross species, especially for the endangered Short-tailed Albatross. Juvenile birds are more susceptible to being caught on longline gear (Brothers 1991, Boggs 2001), and satellite telemetry studies would show the distributions of these birds with respect to current longline fishing effort. Fishing effort and seabird catch data may be achievable through the existing Interim Scientific Committee for the Management of Tunas and Tuna-like Species in the North Pacific, or the management commission developed by the Central and Western Pacific by a series of ministerial-level meetings known as the Multi-Lateral High Level Conference (Table 5).

To address seabird mortality in the North and Central Pacific longline fisheries, only the CMS currently can obligate a contracting party to execute a legally binding agreement. Once the United Nations Implementing Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (High Seas Agreement or UNIA) comes into effect, then this agreement would also be legally binding to contracting parties. Without a coordinated effort, the efforts of agencies like the US Western Pacific Regional Management Council to reduce albatross mortality on pelagic longline vessels will be less effective. However, efforts must be made, even if the efforts are restricted to a sub-national level, to provide support toward solving the problem.

Therefore, there is a need for regional, centralized coordination of research and management activities by regional and national-level fishery bodies to coordinate management of longline fisheries for the North and Central Pacific. There is a need for improved coordination of the numerous regional multilateral agencies and fishery bodies whose purview includes the North and Central Pacific Ocean. The geographical coverage of the agencies and bodies are patchwork in nature, meaning that no single organization covers the entire range of the North Pacific albatrosses. For instance, organizations that could collect and distribute data on incidental seabird catch, such as the SPC, FFA, and IATTC, likely have different structures for their data collection and dissemination. A first step that a regional coordinating body could perform could be to make these data collection and distribution processes consistent, as accurate region-wide scientific data to help achieve effective management.

Through collaboration via a centralized coordinating body, each nation could tailor seabird deterrent measures to the context of their pelagic longline fisheries to maximize a reduction in seabird mortality on longlines as there is a need for fishery-specific adaptation of seabird mitigation measures. Because longline fishers are likely the most qualified to develop seabird mitigation tools, and because it would potentially allow fishers to develop a sense of ownership and support for the required implementation of these tools, a centralized coordination body could encourage and support national efforts to allow longline fishers to develop and test current or new seabird deterrent methods. Longline fishers will be much more likely to employ seabird measures that are economically and operationally suitable to their fishery, regardless of whether these measures are legally mandated or voluntary. Thus, it behoves fisheries managers to involve directly and make allies of the longline industry in the process to develop and require seabird mitigation measures (Croxall 1998, Brothers *et al*. 1999).

There is also a need for managers to develop outreach programmes to inform North Pacific pelagic longline fishers concerning the economic benefits they can derive from avoiding seabirds, and to develop and augment a seabird conservation ethic among them. A centralized coordinating body could also assist the development of national-level outreach and capacity-building workshops, providing fishery managers the opportunity to learn from industry's experiences with mandatory seabird deterrent measures and the development of new innovative seabird avoidance methods. Thus, through these national-level outreach and capacity building efforts, a centralized coordinating body can disseminate the results of ongoing research and development, results of efforts to monitor the effectiveness of mitigation measures, and conduct outreach to instruct how measures can be effectively used.

It is not our intention to vilify longline fishing or longline fleets that target swordfish or a mixture of swordfish and tuna, but simply to address the management of the interaction problem associated with seabirds and pelagic longlines in the North Pacific. Global demand for high-quality longline-caught fish, especially swordfish, is unlikely to diminish and the problems associated with the incidental catch of seabirds by pelagic longline vessels are manageable. Studies have shown that several different technical and operational methods are extremely effective in reducing albatross mortality by longline gear (Brothers *et al*. 1999, Grabowsky-Kaaialii *et al*. 2000, Boggs 2001). Indeed, the interaction problems in the North and Central Pacific are mild compared with those of demersal longliners in Alaska and pelagic longlining in the South Pacific and Southern Ocean, where the species and sheer number of birds involved are much greater. We have an opportunity for developed and less developed countries to collaborate via an integrated management approach to share more equitably the costs to protect seabirds from being incidentally caught by pelagic longline gear. This could be achieved by making use of international conventions and agreements to protect seabirds, and to induce States that are not parties to these conventions and agreements to comply with their provisions. This will require outreach and capacity building efforts to develop a sense of ownership and perhaps even a conservation ethic by the longline industry for using seabird avoidance measures.

ACKNOWLEDGEMENTS

We thank M. Laurs, C. Boggs, P. Kleiber, S. Pooley, R. Ito and M. Parke of the Southwest Fisheries Science Center, Honolulu Laboratory. We also thank Peter Williams for reviewing our interpretation of the SPC data set.

REFERENCES

AD HOC WORKING GROUP ON ALBATROSS. 1999. Final statement of the First Meeting of the Valdivia Group's Ad Hoc Working Group on Albatross. The Group of Temperate Southern Hemisphere Countries on Environment (Valdivia Group). Canberra, Australia, 15–18 June. 5 pp.

ALEXANDER, K., ROBERTSON, G. & GALES, R. 1997. The incidental mortality of albatrosses in longline fisheries. Hobart: Australian Antarctic Division. 44 pp.

ANDERSON, D. & FERNANDEZ, P. 1998. Movements of Laysan and Black-footed Albatrosses at sea, Jan–August 1998. Abstract to the Black-footed Albatross Population Biology Workshop, Honolulu, Hawaii, 8–10 October 1998.

BAILEY, K., WILLIAMS, P.G. & ITANO, D. 1996. By-catch and discards in Western Pacific Tuna Fisheries: A review of SPC Data Holdings and Literature. *South Pacific Commission, Oceanic Fisheries Program Technical Report* No. 34. Noumea, New Caledonia. 149 pp.

BERGIN, A. 1997. Albatross and longlining – managing seabird bycatch. *Mar. Policy* 21: 63–72.

BOGGS, C.H. 2001. Deterring albatrosses from contacting baits during swordfish longline sets. In: Melvin, E.F. & Parrish, J.K. (Eds). Seabird bycatch: trends, roadblocks and solutions. Fairbanks: University of Alaska Sea Grant. pp. 79–94.

BOGGS, C.H. & ITO, R.Y. 1993. Hawaii's pelagic fisheries. *Mar. Fish. Rev.* 55: 69–82.

BOMFORD, R. 1999. Letter to Eric Gilman, National Audubon Society's Living Oceans Program, 20 December. Environment Australia, Department of the Environment and Heritage, International and Intergovernmental Branch. 2 pp.

BROTHERS, N. 1991. Albatross mortality and associated bait loss in the Japanese longline fishery in the Southern Ocean. *Biol. Conserv.* 55: 255–268.

BROTHERS, N.P., COOPER, J. & LØKKEBORG, S. 1999. The incidental catch of seabirds by longline fisheries: worldwide review and technical guidelines for mitigation. *FAO Fisheries Circular* No. 937. 99 pp.

CMS. 1998. Update on other conservation activities: albatrosses (Southern Hemisphere). *CMS Bulletin* 8: 7.

COOPER, J. in press. Getting seabirds off the hook in the world's longline fisheries. BirdLife International Seabird Conservation Programme, Rondebosch, South Africa.

CROXALL, J.P. 1998. Research and conservation: a future for albatrosses? In: Robertson, G. & Gales, R. (Eds). Albatross biology and conservation. Chipping Norton: Surrey Beatty & Sons. pp. 269–290.

DALZELL, P. 1997. The influence of incidental catch and protected species interactions on the management of the Hawaii-based longline fishery. Presented at the 48th Lake Arrowhead Tuna Conference, 19–22 May 1997. 12 pp.

FAO. 1997a. FAO Consultation on Reduction of Incidental Bycatch of Seabirds in Longline Fisheries. Food and Agriculture Organization. Unpublished document. 2 pp.

FAO. 1997b. Asia-Pacific Fishery Commission: Structure, Functions and Directory of its Subsidiary Bodies. FAO RAP Publication. 28 pp.

FAO. 1998. Report of the Technical Working Group on Reduction of Incidental Catch of Seabirds in Longline Fisheries, Tokyo, Japan, 25–27 March 1998. *FAO Fisheries Report* No. 585.

GRABOWSKY-KAAIALII, G., McNAMARA, B., TORRE, L., KLEIBER, P. & COUSINS, K.L. 2000. Investigating methods to reduce the incidental catch of albatrosses in the Hawaii longline fishery. In: Flint, E. & Swift, K. (Eds). Second International Conference on the Biology and Conservation of Albatrosses and other Petrels, Honolulu, Hawaii, 8–12 May 2000. Abstracts of oral and poster presentations. *Mar. Orn.* 28: 131.

HAMPTON, J., BIGELOW, K. & LABELLE, M. 1998. A summary of the current information on the biology, fisheries and stock assessment of Bigeye Tuna (*Thunnus obesus*) in the Pacific Ocean, with recommendations for data requirements and future research. *Secretariat of the Pacific Community, Oceanic Fisheries Program, Technical Report* No. 36, Noumea, New Caledonia, 46 pp.

HASEGAWA, H. & DEGANGE, A. 1982. The Short-tailed Albatross *Diomedea albatrus*, its status, distribution and natural history. *Amer. Birds* 6: 806–814.

HAWARD, M., BERGIN, A. & HALL, H.R. 1998. International legal and political bases to the management of the incidental catch of seabirds. In: Robertson, G. & Gales, R. (Eds). Albatross biology and conservation. Chipping Norton: Surrey Beatty & Sons. pp. 255–266.

INTERNATIONAL PACIFIC HALIBUT COMMISSION. 1998. The Pacific Halibut: biology, fishery, and management. *Technical Report* No. 40. 68 pp.

ITO, R.Y. & MACHADO, W.A. 1999. Annual Report of the Hawaii based longline fishery for 1998. National Marine Fisheries Service, SWSFC Honolulu Laboratory Admin. RE. H-99-06. 62 pp.

IUCN. 1996. Incidental mortality of seabirds in longline fisheries. In: Resolutions and recommendations, World Conservation Congress, Montreal, Canada, 13–23 October 1996. Gland: World Conservation Union. pp. 16–17.

KLEIBER, P. 1998a. Estimating annual takes and kills of sea turtles by the Hawaii longline fishery, 1994–1997, from observer program and logbook data. NMFS Honolulu Laboratory Admin. Report H-98-08. 15 pp.

KLEIBER, P. 1998b. Estimation of sea turtle take and mortality in the Hawaii-based longline fishery, 1994–1996. NOAA Tech. Memo, NMFS-SWFSC-257. 8 pp.

LAURS, R.M. & Associates. 1999. 1999 Program Review Honolulu Laboratory. Southwest Fisheries Science Center Administrative Report H-99-05. 110 pp.

LAWSON, T. 1999a. Estimates of annual catches of target species in tuna fisheries of the Western and Central Pacific Ocean. Working Paper SWG-2, 12th SPC Standing Committee on Tuna and Billfish, July 16–23, 1999, Tahiti, 71 pp.

LAWSON, T.A. 1999b. Tuna Yearbook 1998. Secretariat of the Pacific Community, Oceanic Fisheries Program, Noumea, New Caledonia. 149 pp.

LEE, J-U., MOON, D-Y. & HWANG, S-J. 1997a. Changes in gear construction of Korean tuna longline. Working Paper 10, 10th SPC Standing Committee on Tuna and Billfish, Nadi, Fiji, June 18–20 1997. 6 pp.

LEE, J-U., MOON, D-Y. & HWANG, S-J. 1997b. Korean tuna fisheries in the Western Pacific Ocean. 10th SPC Standing Committee on Tuna and Billfish, Nadi, Fiji, June 18–20 1997. 9 pp.

McDERMOND, D.K., & MORGAN, K.H. 1993. Status and conservation of North Pacific albatrosses. In: Vermeer, K., Briggs, K.T., Morgan, K.H. & Siegel-Causey, D. (Eds). The status, ecology, and conservation of marine birds of the North Pacific. *Special Publication Canadian Wildlife Serv-*

ice. pp. 70–81.

MHLC. 2000. Draft Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Proposal by the Chairman, 19 April, 2000. Honolulu, Hawaii, USA. 27 pp.

MOON, D-Y., PARK, Y-C. & HWANG, S-J. 1999. Effects of different longline materials on catch rates of the species caught by Korean tuna longliners in the Pacific Ocean. Working Paper RG-6, 12th SPC Standing Committee on Tuna and Billfish, July 16–23, 1999, Tahiti. 4 pp.

PACIFIC ISLAND ROUNDTABLE FOR NATURE CONSERVATION. 1999. The Fourth Pacific Island Roundtable for Nature Conservation, November 2–4, 1999, Draft Meeting Report of 2 December 1999. Honolulu, Hawaii, USA. 54 pp.

RICE, D.W. & KENYON, K.W. 1962. Breeding distribution, history, and populations of North Pacific albatrosses. *Auk* 79: 365–386.

ROBBINS, C.S. & RICE, D.W. 1974. Recoveries of banded Laysan Albatrosses (*Diomedea immutabilis*) and Black-footed Albatrosses (*D. nigripes*). In: King, W.B. (Ed.). Pelagic studies of seabirds in the central and eastern Pacific Ocean. *Smithsonian Contrib. Zool*. No. 158. pp. 232–277.

RODEN, G.R. 1980. On the Subtropical Frontal Zone north of Hawaii during winter. *J. Phys. Oceanogr*. 10: 342–362.

RODEN, G.I. 1991. Subarctic-subtropical transition zone of the North Pacific: large scale aspects and mesoscale structure. In: Wetherall, J. (Ed.). NOAA Tech. Report NMFS 105. 38 pp.

SAKAGAWA, G.T. 1999. Background information on List of Highly Migratory Species for the MHLC Process. MHLC-3 Working Paper for the 12th Standing Committee on Tuna and Billfish, Papeete, French Polynesia, June 16–23, 1999. National Marine Fisheries Service, La Jolla, CA, USA. 33 pp.

SANGER, G.A. 1972. The recent pelagic status of the Short-tailed Albatross (*Diomedea albatrus*). *Biol. Conserv*. 4: 189–193.

SANGER, G.A. 1974. Black-footed Albatross (*Diomedea nigripes*). In: King, W.B. (Ed.). Pelagic studies of seabirds in the central and eastern Pacific Ocean. *Smithsonian Contrib. Zool*. No. 158. pp. 96–128.

SEKI, M.P., POLOVINA, J.J., KOBAYASHI, D.R. & MUNDY, B.C. 1999. The oceanography of the subtropical convergence zone in the central west North Pacific and its relevancy to the Hawaii-based swordfish fishery. Second meeting of the Interim Scientific Committee for Tuna and Tuna-like species in the North Pacific Ocean, Honolulu, January 15–23, 1999.

SHERBURNE, J. 1993. Status report on the Short-tailed Albatross *Diomedea albatrus*. Unpublished Report for FWS, Alaska Natural Heritage Program. 33 pp.

SOUTH PACIFIC REGIONAL ENVIRONMENT PROGRAMME. 1999. Action strategy for nature conservation in the Pacific Islands Region 1999–2002. Apia, Samoa. 44 pp.

SUN, C.L., YEH, S.Z., WANG, S.P. & CHANG, S.K. 1999. A review of Taiwan's swordfish fishery in the Pacific Ocean. Working Paper 1.4, Second meeting of the Interim Scientific Committee for Tuna and Tuna-like species in the North Pacific Ocean, January 15–23, 1999, Honolulu. 12 pp.

TAKAHASHI, M. & YOKAWA, K. 1999. Brief description of Japanese swordfish fisheries and statistics in the Pacific Ocean. Working Paper 1.1, 12th SPC Standing Committee on Tuna & Billfish, July 16–23, 1999, Tahiti. 6 pp.

UOZUMI, Y. & OKAMOTO, H. 1997. Research on hook depth of longline gear in the 1995 research cruise of the R/V Shoyo Maru. Working Paper 3, 7th Meeting of the Western Pacific Yellowfin Research Group, Nadi, Fiji, June 18–20 1997. 20 pp.

WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL. 1998. Reducing seabird-longline interaction. *Pacific Fishery News* Fall, 1: 6.

APPENDIX 2

THE FAO INTERNATIONAL PLAN OF ACTION FOR REDUCING INCIDENTAL CATCH OF SEABIRDS IN LONGLINE FISHERIES – SEABIRDS: WHAT ARE COUNTRIES DOING?

KIM S. RIVERA

National Marine Fisheries Service, Alaska Region, Protected Resources Division, PO Box 21668, Juneau, Alaska 99802, USA
(Kim.Rivera@noaa.gov)

SUMMARY

RIVERA, K.S. 2000. Appendix 2. The FAO International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries: what are countries doing? In: Cooper, J. (Ed.). Albatross and Petrel Mortality from Longline Fishing International Workshop, Honolulu, Hawaii, USA, 11–12 May 2000. Report and presented papers. *Marine Ornithology* 28: 175–178.

The Committee on Fisheries (COFI) of the Food and Agriculture Organization of the United Nations (FAO) adopted a voluntary International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-Seabirds) in 1999. FAO Member States are requested to report at biennial sessions of COFI on the implementation of their National Plan of Actions (NPOA-Seabirds) through reporting procedures established for the FAO's Code of Conduct of Responsible Fisheries. In anticipation of the Workshop on Albatross and Petrel Mortality from Longline Fishing held in conjunction with the Second International Conference on the Biology and Conservation of Albatrosses and Other Petrels in Honolulu, Hawaii, USA in May 2000, individuals were informally queried as to the status of the implementation of NPOA-Seabirds in their countries. A summary of responses is provided.

INTRODUCTION

The Code of Conduct for Responsible Fisheries was adopted by the Twenty-eighth Session of the Food and Agriculture Organization of the United Nations (FAO) Conference in October 1995. It sets out principles and standards for responsible fishery practices to ensure effective conservation, management and development of living aquatic resources (FAO 1995). Article 7.6.9 promotes management measures to minimize the catch of non-target, non-fish species and promotes the development and use of selective, environmentally safe and cost-effective gear and techniques.

Pursuant to a proposal at the Twenty-second Session of the FAO's Committee on Fisheries (COFI) in March 1997 that FAO organizes an expert consultation on the issue of seabird mortality from longline fishing (FAO 1997), representatives of the FAO and the Governments of Japan and the United States agreed to organize an FAO Consultation in October 1998. The objective of this consultation was to produce an International Plan of Action (IPOA-Seabirds) for implementing mitigation guidelines to reduce incidental catches of seabirds in longline fisheries.

In preparation of the FAO Consultation a group of 16 experts from major regions which have problems with incidental catch of seabirds was established. This group was known as the Seabird Technical Working Group (STWG). The members of the STWG were involved in the preparation and review of three background papers on:

1) a description of pelagic and demersal longline fisheries (areas, catches, technology and fishing effort);
2) review of the incidental catch of seabird in specific longline fisheries; and
3) a review of seabird bycatch mitigation measures and their effect on other marine species.

The STWG was also involved in the preparation and review of two draft documents on:

1) Guidelines for measures to reduce seabird bycatch; and
2) a Plan of Action for implementation of the proposed guidelines.

The STWG met in Tokyo, Japan in March 1998. A final version of the compiled background papers, *The Incidental Catch of Seabirds by Longline Fisheries: Worldwide Review and Technical Guidelines for Mitigation*, has been published in the *FAO Fisheries Circular* series (Brothers *et al.* 1999).

The consultation on the Management of Fishing Capacity, Shark Fisheries and the Incidental Catch of Seabirds in Longline Fisheries occurred in plenary session in Rome, Italy, 26–30 October 1998, following a preparatory meeting held in July 1998 (FAO 1998, 1999a). It was attended by 81 members of FAO and by observers from a non-member nation of FAO, a specialized agency of the United Nations, as well as 10 intergovernmental organizations and eight international non-governmental organizations. The draft International Plan of Action for Reducing Incidental Catch of Seabirds in Longline

Fisheries (IPOA-Seabirds) was approved and is summarized below The IPOA-Seabirds was endorsed by the FAO's COFI at its 23rd Session in February 1999 (FAO 1999b), commended by the March 1999 FAO Fisheries Ministerial, and adopted by the June 1999 FAO Council and the November 1999 FAO Conference (FAO 1999c).

SUMMARY OF THE IPOA-SEABIRDS

The IPOA-Seabirds describes concrete and specific steps for reducing the incidental catch of seabirds in longline fisheries at the national, regional, and global levels, calling for National Plans of Action (NPOA-Seabirds) to be developed by 2001. Countries are requested to conduct assessments of seabird bycatch in their waters and by their vessels (including on the high seas) and, if considered warranted, develop NPOA-Seabirds. Suggested elements of an NPOA-Seabirds include: prescription of mitigation measures; plans for research and development of improved measures or practices and evaluation of the effectiveness of such measures and practices; plans for outreach programmes to raise awareness of and to educate about the need to reduce seabird bycatch; and data collection programmes, including observer programmes, to determine the incidental catch of seabirds in longline fisheries and the effectiveness of mitigation measures. Attached to the IPOA-Seabirds are technical notes to provide assistance to countries in developing their NPOA-Seabirds and in identifying appropriate technical and operational mitigation measures to reduce seabird bycatch (FAO 1999b).

REPORTING ON IMPLEMENTATION OF NPOA-SEABIRDS

Article 4 of the Code of Conduct for Responsible Fisheries requires the FAO's COFI to monitor the application and implementation of the Code. At its Twenty-second Session in 1997, COFI agreed that progress on the implementation of the Code would be reported to COFI biennially and would include information on both FAO and Member State activities. Information from Member States is to be gathered through a questionnaire designed by the Secretariat.

Reporting requirements associated with the Code of Conduct are multiplying, especially with the adoption of the three IPOAs for the Management of Fishing Capacity, the Conservation and Management of Sharks, and Reducing the Incidental Catch of Seabirds in Longline Fisheries. Each of these IPOAs contain a reporting requirement that States should report on the progress of the assessment, development, and implementation of their NPOAs for seabirds and for the management of capacity and sharks. The IPOA on Capacity also reaffirms a previously negotiated reporting requirement regarding vessels licensed to operate on the high seas. Additionally, the FAO will hold a technical consultation to develop an International Plan of Action to Combat Illegal, Unreported or Unregulated Fishing. It is most likely that there will be reporting requirements associated with that plan of action as well.

At its Twenty-third Session in 1999, COFI in considering the progress report on the implementation of the Code stressed the following:

- The need to clarify and simplify the national questionnaires to facilitate reporting on actions to implement the Code;
- The need to provide specific reporting on the development of national plans and other plan and other actions called for in the three IPOAs on Capacity, Seabirds and Sharks;
- Monitoring of the implementation of the Code needed to be results oriented;
- The need to report on problems being encountered in the implementation of the Code; and
- The need to involve non-governmental organizations in the implementation of the Code.

Per the COFI recommendations above, the FAO developed a new questionnaire which was distributed to Members in May 2000. FAO Members were asked if they had longline fisheries, if a seabird longline bycatch assessment had been carried out, if a plan of action was warranted, and if mitigation measures were in place. Questionnaires to non-governmental organizations and regional fishery management organizations were also developed to inquire about efforts to assist in the implementation of NPOAs.

INQUIRY ON STATUS OF NPOA-SEABIRDS IMPLEMENTATION AND DEVELOPMENT

In February 2000, individuals from 14 countries thought to be involved with seabird/longline fishery interactions and/or NPOA-Seabirds development were queried by e-mail regarding their country's activities. A general query was also posted on the Seabird Listserver in March 2000. Queries were also made about NPOA-Seabirds implementation by Arctic countries at the 'Workshop on Seabird Incidental Catch in the Waters of Arctic Countries', held under the auspices of the Program for the Conservation of Arctic Flora and Fauna (CAFF) of the Arctic Council, in April 2000 (Cooper *et al*. 2000).

NPOA-SEABIRDS STATUS AS AT MAY 2000

Responses received from individuals in 14 of the 19 countries are summarized in Table 1. More details for several countries are given below.

Australia

Although developed prior to the adoption of the IPOA-Seabirds, Australia's 'Threat Abatement Plan for the incidental catch (or by-catch) of seabirds during oceanic longline fishing operations' (n.d.) covers most of the requirements of a NPOA-Seabirds. It may be found at Environment Australia's web site http://www.biodiversity.environment.gov.au/threaten/plans/tap/index.htm. However, Australia still intends to produce a NPOA-Seabirds.

New Zealand

The Ministry of Fisheries and Department of Conservation of New Zealand are currently developing a NPOA-Seabirds that sets out how the incidental capture of seabirds by both longline and trawl fisheries will be addressed over the next five years. The draft document addresses topics such as level of observer coverage, population monitoring, measures to reduce seabird bycatch, and catch limits for seabirds.

United States of America

The USA's NPOA-Seabirds can be found at the National Marine Fisheries Service web site for the Alaska Region at http://www.fakr.noaa.gov/protectedresources/seabirds.html.

European Community

Given that several of the countries listed in Table 1 belong to the European Community and that the EC has competence for fisheries issues, it is believed that the EC would be responsible for production of an NPOA-Seabirds rather than the individual member countries.

WHERE TO FROM HERE?

Paragraphs 19 and 20 of the IPOA-Seabirds state, '19. States, within the framework of their respective competencies and consistent with international law, should strive to cooperate through regional and subregional fisheries organizations or arrangements, and other forms of cooperation, to reduce the incidental catch of seabirds in longline fisheries. 20. In implementing the IPOA-SEABIRDS States recognize that cooperation among States which have important longline fisheries is essential to reduce the incidental catch of seabirds given the global nature of the issue. States should strive to collaborate through FAO and through bilateral and multilateral arrangements in research, training and the production of information and promotional material.'

In this context, it is appropriate to pursue implementation of the IPOA-Seabirds through various international avenues, such as CAFF (Cooper *et al*. 2000), the Fishery Working Group of the Asia-Pacific Economic Cooperation (APEC) and the Agreement for the Conservation of Albatrosses and Petrels (ACAP) being developed under the auspices of the Convention for the Conservation of Migratory Species of Wild Animals (CMS).

ACKNOWLEDGEMENTS

I thank the various correspondents who supplied information.

REFERENCES

BROTHERS, N., COOPER, J. & LØKKEBORG, S. 1999. The incidental catch of seabirds by longline fisheries: worldwide review and technical guidelines for mitigation. *FAO Fisheries Circular* No. 937. 100 pp.

COOPER, J. 2000. Conservation of South African albatrosses and petrels at risk from longlining. A BirdLife South Africa and South African National Antarctic Programme Workshop, Cape Town, 7 June 2000. *Avian Demography Unit Research Report* No. 39. 27 pp.

COOPER, J., DUNN, E., KULKA, D.W., MORGAN, K.H. & RIVERA, K.S. 2000. Addressing the problem: seabird mortality from longline fisheries in the waters of Arctic countries. In: Chardine, J.W., Porter, J.M. & Wohl, K.D. (Eds). Workshop on Seabird Incidental Catch in the Waters of Arctic Countries. Report and Recommendations. *Conservation of Arctic Flora and Fauna Tech. Rep*. 7: 9, 33, 35–42, 61–65.

ENVIRONMENT AUSTRALIA. n.d. Threat Abatement Plan for the incidental catch (or by-catch) of seabirds during oceanic longline fishing operations. Canberra: Environment Australia.

FAO. 1995. Code of Conduct for Responsible Fisheries. Rome: Food and Agriculture Organization.

TABLE 1

Response to queries on progress with developing NPOA-Seabirds as at May 2000

Country	Response	Comments
Argentina	No	
Australia	Yes	Threat Abatement Plan currently being implemented (see text)
Brazil	Yes	Not aware of forthcoming NPOA
Canada	Yes	DFO & CWS formed a national working group to produce an NPOA-Seabirds, following assessment of fisheries in 2000
Chile	Yes	No details given
Faeroe Islands	Yes*	Not known if NPOA is planned
Falklands/Islas Malvinas	Yes	Considering need for NPOA
Finland	Yes*	Longline fishery has declined and seabird mortality considered to be 'very small or nil'
Greenland	Yes*	No formal assessment as yet if NPOA needed
Iceland	Yes	No current plans to develop NPOA
Japan	Yes	NPOA under development and will be implemented in early 2001
Mexico	No	
New Zealand	Yes	NPOA under development (see text)
Norway	Yes	NPOA under development
Russia	No*	
South Africa	Yes	Workshop planned to decide on NPOA process (see Cooper 2000)
Sweden	No*	Very little longlining in Baltic Sea
Taiwan	No	Initial contact made, no further response
United States	Yes	NPOA-Seabirds developed (see text)

* Countries responding solely at CAFF Workshop, April 2000.

FAO. 1997. Report of the twenty-second Session of the Committee on Fisheries, Rome, 17–20 March 1997. *FAO Fisheries Report* No. 562. 32 pp.

FAO. 1998. Report of the Preparatory Meeting for the Consultation on the Management of Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries. Rome, Italy, 22–24 July 1998. *FAO Fisheries Report* No. 584. 48 pp.

FAO. 1999a. Report of the Consultation on the Management of Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries. Rome, Italy, 26–30 October 1998. *FAO Fisheries Report* No. 593. 122 pp.

FAO. 1999b. Report of the twenty-third Session of the Committee on Fisheries, Rome, Italy, 15–19 February 1999. *FAO Fisheries Report* No. 595. 70 pp.

FAO. 1999c. International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries. International Plan of Action for the Conservation and Management of Sharks. International Plan of Action for the Management of Fishing Capacity. Rome: Food and Agriculture Organization. 26 pp.

FOOTNOTE

Based on reports at the FAO's COFI meeting in February 2001 and responses to an FAO questionaire on IPOA-Seabirds implementation, the following countries/entities indicated they either have an NPOA, are developing one, are in need of one, or are in the process of making a decision on whether one is needed: Australia, Brazil, Canada, China, European Community, Japan, New Zealand, Norway, Philippines, South Africa, United States, Uruguay, and Vietnam.

APPENDIX 3

SEABIRD MITIGATION RESEARCH IN LONGLINE FISHERIES: STATUS AND PRIORITIES FOR FUTURE RESEARCH AND ACTIONS

EDWARD F. MELVIN[1] & GRAHAM ROBERTSON[2]

[1]*Washington Sea Grant Program, University of Washington, PO Box 55020, Seattle, Washington 98195, USA (emelvin@u.washington.edu)*
[2]*Australian Antarctic Division, Channel Highway, Kingston, Tasmania 7050, Australia*

SUMMARY

MELVIN, E.F. & ROBERTSON, G. 2000. Appendix 3. Seabird mitigation research in longline fisheries: status and priorities for future research and actions. In: Cooper, J. (Ed.). Albatross and Petrel Mortality from Longline Fishing International Workshop, Honolulu, Hawaii, USA, 11–12 May 2000. Report and presented papers. *Marine Ornithology* 28: 179–182.

We review the current status of mitigation research to reduce seabird mortality by longline fisheries. Future research and actions need to be directed at further development of mitigation technologies, increasing awareness of seabird conservation in these fisheries, and engendering political action.

INTRODUCTION

Efforts to develop mitigation strategies to reduce the incidental hooking of seabirds in longline fisheries began in the Southern Ocean with the work of Nigel Brothers (Brothers 1991). Since that time strategies have been developed and tested in both pelagic and demersal fisheries and in the northern and southern hemispheres. These technologies are summarized by Alexander *et al.* (1997) and Brothers *et al.* (1999). The convenors of the International Workshop on Albatross and Petrel Mortality from Longline Fishing held in conjunction with the Second International Conference on the Biology and Conservation of Albatrosses and other Petrels, Honolulu, Hawaii, USA in May 2000 requested that we update the status of seabird mitigation research, and propose priorities for future mitigation research and action to minimize seabird mortality in longline fisheries. This was one of four papers that served as the foundation for discussion at the workshop.

In order to gauge the status and trends of seabird mitigation research, we solicited insights and ideas from colleagues working in longlining nations throughout the world. The resulting summary is based on input from 18 colleagues in 12 countries (see Acknowledgements), as well as our experiences. This paper briefly reviews current mitigation measures being tested for both pelagic and demersal fisheries, but then focuses primarily on priorities for future research or action. Priorities for future research are categorized as technical and non-technical. Technical issues are divided into three categories: general issues common to all mitigation research; existing technologies; and new technologies. Non-technical issues are those that address cultural, social and political realities. It is our hope that the issues raised here will guide discussion at the scheduled mitigation research workshop and expedite progress toward seabird conservation in longline fisheries worldwide.

CURRENT RESEARCH

Current research is defined as formal government or university research underway as of 2000. Research completed prior to that is not presented – our interest was to determine the players conducting research now and in the near future. In pelagic longline fisheries, only three countries, Australia, Japan and New Zealand, have active research programmes to develop and test seabird deterrents (Table 1). Technologies currently being tested include underwater setting using chutes and capsules (Australia and New Zealand), adding weight to enhance sink rates (Australia, Japan and New Zealand), optimizing performance design and performance standards for bird-scaring lines (Japan), and assessing the effect of night setting on target catch (Japan).

In demersal longline fisheries, only five countries, Australia, Japan, New Zealand, United Kingdom, and the USA, have active research programmes testing seabird bycatch mitigation strategies (Table 1). Technologies currently being tested include: adding weight to enhance sink rates of longlines (Australia, New Zealand and USA), developing performance standards and optimal materials for bird-scaring lines (Japan and USA), effects of night setting (Japan and USA) and using pot fishing as an alternative to longline gear (United Kingdom). Norway is the only country to have developed mitigation practices proven to be effective at reducing seabird bycatch to acceptable levels in a demersal fishery.

Of these five countries, only the USA is new to this field of research. A large controlled study testing deterrent strategies in two Alaska demersal fisheries is scheduled to be completed in 2001. In Hawaii, The National Marine Fisheries Service and the Western Pacific Fisheries Management Council recently

TABLE 1

Active research programmes (2000) in pelagic and demersal longline fisheries

Nation	Underwater setting		Line weighting sink rate	Bird-scaring lines	Night setting	Pot fishing
	Chutes	Capsules				
Pelagic						
New Zealand	X	X	X			
Australia	X	X	X			
Japan*			X	X	X	
Demersal						
New Zealand			X			
Australia			X			
United Kingdom						X
Japan				X	X	
USA			X	X	X	

* Light, sound and electricity

completed two research activities in its pelagic fisheries and new regulations are proposed based on that work. Australia and New Zealand remain the leaders in developing and fine tuning seabird deterrent strategies for both demersal and pelagic fisheries. Globally, the primary trend is to develop and test technologies that remove baited lines from the surface either through underwater setting or by adding weight.

THE WAY FORWARD: PRIORITIES FOR FUTURE ACTION

Action is needed on at least two fronts to reduce significantly the incidental mortality of seabirds in longline fisheries. One is in the area of technological development and refinement of mitigation strategies. A variety of tools or strategies has been developed and proven effective in multiple fisheries. These tools and strategies now require further refinement and local innovation and adaptation based on the unique characteristics of the fishery, and the seabird species with which they interact. However, perhaps surprisingly, the greatest needs toward reducing seabird bycatch in longline fisheries are non-technical. The lack of awareness of seabird conservation issues and will to change practices to conserve seabirds are serious and pervasive obstacles. In many countries, the extent of seabird interactions with longline fisheries is ignored and remains uncharacterized. Longline-seabird interactions are not a priority for governments, resource management agencies or the fishers themselves. As long as these attitudes persist, seabird mitigation strategies, no matter how effective or refined, will not achieve conservation goals unless they are applied at a global level.

TECHNICAL ISSUES: MITIGATION RESEARCH AND DEVELOPMENT

General

We found that mitigation research is often difficult to evaluate or compare from study to study. Goals, methodologies and sampling protocols are rarely similar across studies, sample sizes are rarely adequate to make robust comparisons, and controlled studies conducted aboard fishing vessels are few. Although regulations requiring the use of mitigation devices are in place in seven countries and in waters managed by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), research through controlled studies on fishing vessels is rare (Løkkeborg & Bjordal 1992, Cherel *et. al*. 1995, Løkkeborg 1996, 1998, 2001). Research done without controls or where research questions are imposed on observer programme data after it is collected is of limited use and is not definitive. We suspect controlled studies are lacking because resources are scarce and/or incentives for fishers to participate in the research are few. We suggest that, where possible, research programmes testing seabird bycatch deterrents in longline fisheries:

- Have a single, common goal: to reduce seabird bycatch significantly without reducing the catch rate of the target species or increasing the bycatch of other non-target species.
- Compare deterrent strategies to a standard: either a control of no deterrent or some other rational measure.
- Collaborate with fishers and conduct research on active fishing vessels.
- Use consistent measures of bird interactions (such as abundance and attacks) and bird catch per unit effort and explore the relationship among them.

As seabird mitigation research becomes more global, the need to share information and expertise will increase. Given this trend, the need exists to encourage collaboration among scientists doing mitigation research with the goal of refining and standardizing experimental designs, as well as data collection and analysis techniques.

WORKING WITH EXISTING TECHNOLOGIES

Weighting studies

Adding weight to groundline to quickly sink gear beyond the range of seabirds is a focal theme worldwide in both pelagic and demersal longline fisheries. As a primary course of action, there is a critical need to determine a minimum sink rate that eliminates seabird interaction with longline gear. This standard should also be developed for use with bird-scaring lines and other deterrent strategies. These standards would serve as a benchmark and a motivation for rope and gear manufacturers to develop line with enhanced sink-capability while meeting efficiency and safety standards for the fishing industry.

Related and subsidiary issues include:

1) Developing techniques that accurately measure the sink rate of fishing gear in the upper two to three metres of the water column. Ideally, these techniques should be accurate, inexpensive, and easy to use.

2) Characterizing the profile of sinking lines deployed under a variety of conditions with a view towards understanding the forces that create that profile. Conditions likely to affect sink rates include vessel speed, sea conditions and propeller turbulence (wake characteristics). Innovative approaches, such as the use of flume tank technology and/or direct observations at sea, will be critical to success.

3) Determining the effects of added weight on groundlines to catch rates of target fish species and bycatch of all taxa. Practicalities such as attachment and retrieval of added weights on operations and crew safety must also be evaluated.

4) Eliminating hook-fouling events that force the groundline to go taut and pull baits to the surface during deployment. Fouled hooks are most associated with auto-baiting systems that shoot hooks along racks into a baiting machine at several hooks per second. If hooks become fouled, line deployment stops abruptly and extreme tension is put on the groundline as the vessel steams at seven to ten knots. As the line deployment stops and the line goes taught, baited hooks remain on the surface within easy reach of seabirds potentially causing an episode where many seabirds are hooked and killed. Fouled hooks also seriously jeopardize crew and vessel safety. Autoline system manufacturers must be encouraged to develop auto-baiting systems that minimize hook fouling. Development of automated technologies that set the line slack as opposed to under tension (line shooters) under a broad range of weather conditions might help minimize hook fouling and related problems.

Bird-scaring lines

Bird-scaring (streamer or tori) lines are the most commonly used mitigation measure in longline fisheries, but effectiveness varies tremendously with design and deployment. Improper use can lead to fouling the groundline with the scaring line resulting in lost fishing time, hazardous conditions for the crew, and exacerbated risks to birds. Non-automated scaring-line retrieval systems are unpopular with crew and can pose safety problems. There is a critical need to develop minimum design and performance standards for bird-scaring lines. Performance standards would vary with the sink rate of the groundline used and perhaps with other mitigation measures. The need exists to:

1) In demersal fisheries, test the efficacy of paired (versus single) bird-scaring lines. (Paired streamer lines are impractical in most pelagic longline fishery operations.)

2) Develop vessel attachment and automated retrieval and adjustment systems that optimize the performance of bird-scaring lines and minimize negative effects (such as tangles with groundlines) on fishing operations.

3) Experiment with a variety of materials to optimize scaring line performance and minimize cost.

Specialized bait

Preliminary work done in Hawaii's pelagic fisheries suggests that dying bait blue can reduce seabird attacks on baits (Boggs 2001). Given this potential, the need exists to develop and test artificial and coloured baits and artificial lures that might reduce or eliminate seabird bycatch with little or no effect on target catch.

Night setting

Night setting is a common strategy employed and recommended to reduce seabird bycatch. This approach has proved successful with albatross species, but is less effective with other petrels (White-chinned Petrels *Procellaria aequinoctialis*) and might actually increase bycatch of some seabirds (Northern Fulmars *Fulmarus glacialis* in Alaska). Effectiveness of night fishing as a seabird bycatch deterrent is also limited by moonlight and bioluminescence. Accordingly, there is a need to determine the effect of night setting on all species of affected seabirds and on catch rates of target fish and other bycatch species. Where night setting is found to increase the bycatch of some seabird species, there is a need to determine the efficacy of using bird-scaring lines at night, with and without lights.

DEVELOPING NEW TECHNOLOGIES

Underwater setting

Effectively setting longlines below the surface of the sea (sub-surface) is likely to eliminate all interaction with seabirds as the lines are deployed. This could be accomplished by setting longlines through the hull or through chutes or with capsules. If successful, it would render other mitigation strategies obsolete and require no enforcement. The highest priority should be to:

1) Stimulate innovation among ship builders to develop designs and systems for new vessels that set and retrieve fishing gear sub-surface through the hull. Innovations in naval architecture will require computer modelling and flume-tank testing to determine optimal line-setting locations, depth underwater (in relation to seabird diving potential and effects of wave action on maintenance of line-sinking rates) and distance from propeller turbulence.

2) Encourage co-operation between ship builders and autoline system and rope manufacturers to ensure that through-hull line setting is achievable and that optimal line sink rates are attained the instant lines enter the water.

3) Where possible, retrofit existing vessels with through-hull and sub-surface line deployment innovations.

4) Continue to develop, refine and test sub-surface-setting technologies that are applied outside the hull (e.g. New Zealand/Australia slotted chute and retrievable capsule and Mustad lining tube) for both hand-bait and auto-bait systems in pelagic and demersal longline fisheries.

NON-TECHNICAL: POLITICAL ACTION AND EDUCATION

Responses from colleagues were striking in two respects. Most countries have failed to initiate a characterization of seabird bycatch in longline fisheries within their Exclusive Economic Zones (EEZs). Where seabird bycatch has been characterized and regulations do exist, they are poorly enforced. We heard an overwhelming cry for international support and assistance. Clearly, many countries need help to raise awareness of seabird conservation issues at all levels. This will not happen solely by holding workshops and conferences but, rather, by aggressive efforts within these countries and within fishing fleets. Development and refinement of mitigation measures are secondary to building this awareness. Further, despite regulations that require the use of mitigation devices in several countries (see Brothers *et al*. 1999; Table 11, p. 85) enforcement is rare to absent. Observer programmes, if present, rarely exceed 5% of fishing effort. Given this grim situation, we suggest priority be given to the following:

1) Engage in political action to bring seabird conservation in longline fisheries to the forefront in all longlining nations. This political action should be approached from the top down through international pressure and from the bottom up by establishing education and awareness programmes with fishers and resource management agencies.

2) Encourage longline nations to include provisions within their fisheries management plans to protect seabirds from incidental mortality within their EEZs.

3) Develop funding sources for observer programmes to characterize seabird–longline fishery interactions in countries that lack the will or the resources.

4) Develop funding sources for mitigation research, especially in these countries.

5) In countries where mitigation measures are required, develop methods to educate fishers on the need for seabird conservation and encourage and empower them with proper use of mitigation strategies and continued refinement and innovation; make funds available to install and optimize seabird mitigation strategies; and develop industry-based seabird bycatch quota systems that encourage 'clean fishing'and discourage 'dirty fishing' within the fleet.

6) Develop non-regulatory communication channels with the fishing industry through individuals specifically trained and dedicated to working with fishers on seabird mitigation issues.

ACKNOWLEDGEMENTS

We thank the following who contributed to this review: Rosemary Gales, Australia; Fabio Olmos, Pero Lima and Tatiana Neves, Brazil; Carlos Moreno, Chile; John Barton, Martin Cox and Becky Ingham, Falkland Islands; Masashi Kiyota, Japan; Janice Molloy, New Zealand; Svein Løkkeborg, Norway; Jaime Jahncke and Carlos Zavalaga, Peru; John Cooper, South Africa; John Croxall, United Kingdom; Adrian Stagi, Uruguay; and Christopher Boggs, USA.

REFERENCES

ALEXANDER, K., ROBERTSON, G. & GALES, R. 1997. The incidental mortality of albatrosses in longline fisheries: a report on the workshop from the First International Conference on the Biology and Conservation of Albatrosses, Hobart Australia, September 1995. Kingston: Australian Antarctic Division.

BOGGS, C.H. 2001. Deterring albatrosses from contacting baits during swordfish longline sets. In: Melvin, E.F. & Parrish, J.K. (Eds). Seabird bycatch: trends, roadblocks and solutions. Fairbanks: Alaska Sea Grant. pp. 79–94.

BROTHERS, N. 1991. Albatross mortality and associated bait loss in the Japanese longline fishery in the Southern Ocean. *Biol. Conserv*. 55: 255–268.

BROTHERS, N.P., COOPER, J. & LØKKEBORG, S. 1999. The incidental catch of seabirds by longline fisheries: worldwide review and technical guidelines for mitigation. *FAO Fisheries Circular* No. 937. 100 pp.

CHEREL, Y., WEIMERSKIRCH, H. & DUHAMEL, G. 1996. Interactions between longline vessels and seabirds in Kerguelen waters and a method to reduce seabird mortality. *Biol. Conserv*. 75: 63–70.

COOPER, J. (Ed.). 2000. Albatross and Petrel Mortality from Longline Fishing International Workshop, Honolulu, Hawaii, USA, 11–12 May 2000. Report and presented papers. *Marine Ornithology* 28: 153–190.

LØKKEBORG, S. 1998. Seabird bycatch and bait loss in long-lining using different setting methods. *ICES J. Mar. Sci*. 55: 145–149.

LØKKEBORG, S. 2001. Reducing seabird bycatch in longline fisheries by means of bird-scaring lines and underwater setting. In: Melvin, E.F. & Parrish, J.K. (Eds). Seabird bycatch: trends, roadblocks and solutions. Fairbanks: Alaska Sea Grant. pp. 33–41.

LØKKEBORG, S. & BJORDAL, A. 1992. Reduced bait loss and bycatch of seabirds in longlining by using a seabird scarer. ICES Fishing Technology and Fish Behaviour Working Group. Bergen, Norway. Tech. Report. May 1992.

APPENDIX 4

ENHANCING COMPLIANCE WITH INTERNATIONAL LEGISLATION AND AGREEMENTS MITIGATING SEABIRD MORTALITY ON LONGLINES

H. ROBERT HALL[1] & MARCUS HAWARD[2]

[1]School of Government, University of Tasmania, Hobart, Tasmania 7001, Australia
(h.r.hall@utas.edu.au)
[2]Institute of Antarctic and Southern Ocean Studies, University of Tasmania, Hobart, Tasmania 7001, Australia

SUMMARY

HALL, H.R. & HAWARD, M. 2000. Appendix 4. International legislation and agreements affecting seabird mortality on longlines. In: Cooper, J. (Ed.). Albatross and Petrel Mortality from Longline Fishing International Workshop, Honolulu, Hawaii, USA, 11–12 May 2000. Report and presented papers. *Marine Ornithology* 28: 183–190.

Since 1995 a number of international measures have been developed to address the problems of albatross and petrel mortality from longline fishing. This paper provides a brief survey of these measures and identifies, too, the importance of non-government initiatives. The paper examines the options to engender implementation of and compliance with international measures/agreements/accords that might usefully be employed by those engaged in the seabird conservation effort.

INTRODUCTION

Over the past decade, numerous international measures to mitigate seabird mortality from longline fishing have been developed. Most of these have taken the form of 'soft law' in the sense that they are hortatory declarations and recommendations rather than binding duties. Recent preliminary discussions to formulate a binding 'hard law' albatrosses and petrels agreement under the terms of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) have, however, also taken place. This initiative appears very promising.

Notwithstanding that real progress has been made, it is critical to recognize and understand that the formulation and acceptance of such measures is only part of the international policy process. Implementation of, and compliance with international legislation and agreements is also required yet, as recent analyses show, it is often random and incomplete.

The purpose of this paper is to highlight this point and direct attention to strategies about enhancing compliance with international environmental measures that could be used to advance the seabird conservation effort.

INTERNATIONAL DEVELOPMENTS

Since 1995, there have been a number of international developments which indicate that our prognosis (made at the First International Conference on the Biology and Conservation of Albatrosses) about an emerging patchwork regime of rules and recommendations was fairly accurate (Haward *et al.* 1998). Some of the most significant of these are listed below.

Inter-governmental instruments

1. The International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-Seabirds) adopted in 1999 within the framework of the Code of Conduct for Responsible Fisheries of the Food and Agriculture Organization of the United Nations (FAO);

2. The further development by the Convention for the Conservation of Southern Bluefin Tuna (CCSBT) of its Working Group on Ecologically Related Species (ERS) to monitor seabird bycatch issue within its area of application;

3. The listing of additional albatross and petrel species in Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) thereby bringing, by the end of 1999, the overall number of albatross species listed in Appendix I to four and in Appendix II to 12 and the number of petrels listed in Appendix II to seven;

4. The CMS Resolution on Bycatch (November 1999);

5. The CMS Resolution on Southern Hemisphere Albatross Conservation (November 1999) which, *inter alia*, accepts Australia's offer to initiate further discussions in early 2000 with all parties which are range states, with a view to the development of an Albatross Agreement. This aspect of the resolution builds on previous discussions conducted during the late 1990s by the Valdivia Group of countries, again under the leadership of Australia;

6. The introduction of legislation by the International Pacific Halibut Commission, the aim of which is to ensure that seabird mortality remains at a low level;

7. The 1998 Honolulu Declaration of Representatives at the Asia-Pacific Economic Cooperation (APEC) Oceans Conference: Realizing the Opportunities for APEC Economies which recommended, *inter alia*, that their economies agree to participate in and support implementation of the FAO's IPOA-Seabirds;

8. The 1999 Rome Declaration on Responsible Fisheries adopted by the FAO Ministerial Meeting on Fisheries which, *inter alia*, attached high priority to the implementation of the IPOA-Seabirds.

Non-governmental organization initiatives

1. The continuing commitment of Birdlife International to the sponsorship of its Seabird Conservation Programme via its *Save the Albatross: Keep the World's Seabirds off the Hook* campaign;

2. The 1996 and 2000 IUCN Seabird bycatch resolutions calling upon member states to reduce the incidental mortalities in longline fisheries to insignificant levels;

3. The establishment in 1998 of the International Southern Oceans Longline Fisheries Information Clearing House (ISOFISH) in Hobart, Australia as a centre to collect, collate, analyse, verify and disseminate data, information and reports on longline fisheries in the Southern Ocean to assist governments in preventing illegal, unregulated and unreported fishing and the incidental mortality of seabirds in these fisheries.

THE SIGNIFICANCE OF SOFT LAW

We do not intend to assess the merits of the substance of these developments. Several considerations do, however, need to be acknowledged. The IPOA-Seabirds and the CMS resolutions are non-binding and hortatory in nature. They, together with the declarations, can be placed within the legal category known as 'soft law'. This does not mean that they are lacking in significance or that they should be considered only as 'second best'. As Birnie & Boyle (1992) point out, '[s]tates expect that they will command respect and there is a strong expectation that they will be adhered to in the longer as well as the short-term.' Lyster (1985) agrees, recognizing that while they do not have the same legal standing as the text of a treaty, they are regarded as rules with which parties should comply. They have, therefore, Lyster argues 'a considerable practical significance'. One great advantage of 'soft law' over 'hard law' is that the former may allow states to formulate obligations in a precise and restrictive form that would not be acceptable in a binding treaty. We shall see below that this consideration is an important factor in promoting compliance. Birnie & Boyle (1992) also note that despite the fact that states retain control over the degree of commitment to 'soft law', some elements of it may rapidly become part of customary law or even become hardened in treaties. They conclude that this soft type of law has an important contribution to make in establishing a new legal order – especially in such a fast-growing and unsettled field as international environmental law.

The CCSBT-ERS Working Group has continued to meet, thereby providing the opportunity for the exchange of relevant information between the parties – Australia, New Zealand and Japan. Observers to most recent meetings have included the Republic of Korea, Taiwan and South Africa, countries conducting significant fishing activities within the range of Southern Ocean albatross species. ERS Working Group initiatives include (a) the requirement of the parties to lodge annual reports on incidental take, mitigation measures employed and education programmes delivered; (b) ongoing discussions on research priorities and data exchange; (c) the establishment of guidelines for the design and deployment of bird-scaring lines on fishing vessels; and (d) discussion about how the CCSBT might fulfil FAO rules to cooperate on the implementation of IPOAs on seabirds and sharks (CCSBT 1999).

ENHANCING COMPLIANCE

Whether these and the other international developments listed above represent progress or advancement toward the goal of reducing the seabird bycatch problem is difficult to say. It may also be premature to make any assessment at this time. Graham Robertson has demonstrated, however, that the seabird conservation effort is currently in 'considerable trouble' and that 'a panacea to the problem has not yet emerged and until it does we are left with the promotion of existing measures and pressure on tuna fishermen via the administrative, legislative and diplomatic processes to use best practice' (Robertson 1998).

Given that there are a number of international measures that have been formulated together with the prospect of a multilateral agreement involving, hopefully, all range states in the Southern Hemisphere, this paper focuses on ways to engender the implementation of, and compliance with, such initiatives. Before embarking on this task, however, a brief classification about the possible options available to actors wishing to affect significantly the seabird conservation effort (be they individuals, countries, non-governmental organizations or international organizations) is useful.

In the discipline of political science, the terms power and influence are what are known as essentially contested concepts. In other words, they are inherently a matter of contestation involving 'endless dispute about their proper uses on the part of their users.' (Gallie 1955–6) They can, however, also be viewed as forms of 'significant affecting' – and they might all be used by actors aiming to advance the seabird conservation effort.

A conceptual map of 'significant affecting' (based on the work of Lukes 1974) sets out meanings of terms that we use in this paper and we hope that this preliminary diversion allows for greater clarity in understanding the options available. The terms we have chosen to constitute this conceptual map are: power, influence, coercion, force, manipulation, inducement, persuasion and encouragement.

Power refers to a form of significant affecting when A affects B in a manner contrary to B's interests. Three main types of power are (i) coercion (when A secures B's compliance by the threat to impose sanctions); (ii) force (when A secures B's compliance by the imposition of sanctions); and (iii) manipulation (where A secures B's compliance in the absence of recognition on B's part either of the source or the exact nature of A's demand upon it – that is, by A shaping B's wants, desires and preferences).

Influence refers to a form of significant affecting when A affects B without the threat or use of sanctions. Four main types of influence are (i) inducement (where there is no conflict of interest between the parties and A offers something to B in

exchange for B agreeing to follow a course of action that A desires); (ii) persuasion (where there is no conflict of interest between the parties and B agrees to follow A's desired course of action because B recognizes that A's request for B to do so is reasonable, impelled by argument); (iii) encouragement (where there is no conflict of interest between the parties and A entreats, urges, inspires B to follow a course of action that A desires); and (iv) manipulation, as defined above).

With the terms defined in these ways, it can be seen that power may or may not be a form of influence – depending on whether threats of, or use of, sanctions – depending upon whether a conflict of interest is involved.

We define the term 'leadership' to refer to the actions of actors (individuals, countries, NGOs and IGOs) who/which endeavour to solve or circumvent the collective action problems that plague the efforts of parties involved in processes of international governance (Young 1989, 1994). At the core of leadership, we contend, is the exercise of power and influence to overcome these problems. It may involve (i) structural leadership (typically used by so-called 'powerful' states) – which is based on the possession and use of material resources to coerce, enforce and/or induce compliance; (ii) entrepreneurial leadership – which relies on negotiating skills associated with such activities as shaping agendas, popularizing positions, inventing innovatory procedural options, brokering deals, supporting and persuading; and (iii) intellectual leadership – which generates and proposes ideas or systems of though that 'cut through' and provide solutions to problems.

With these brief definitional matters outlined, we can now turn to the central focus of this paper: ways to engender the implementation of, and compliance with, international measures/agreements/accords that might usefully be employed by those engaged in the effort to reduce seabird mortality from longline fishing.

The publication of *Engaging countries: strengthening compliance with international environmental accords* by Brown Weiss & Jacobson (1998) provides a comprehensive model of factors that affect implementation and compliance together with a set of broad legal and institutional prescriptive strategies. The starting point of the study is the portrayal of the traditional, stylized view of international law that (i) countries accept an international accord when their governments have concluded that it is in their interest; (ii) because of this, countries generally comply with the accord; and (iii) when countries do not comply, sanctions are employed to punish the non-compliers, and thereby deter other countries and encourage their compliance.

Jacobson & Brown Weiss (1998) contend that in practice this view is deficient and that scattered evidence indicates that implementation of, and compliance with, international environmental accords is 'often haphazard and ragged'. Governments may choose to accept an accord just to 'climb onto an international bandwagon' or because of pressures from other governments with leverage over them (through coercion and inducement). Moreover, some countries, even if they intend to comply, may find this difficult because they lack the capacity to do so.

By implementation, Jacobson & Brown Weiss (1988) mean measures that governments take to make international accords effective in their domestic (or national) law, and by compliance they mean the adherence by governments to the provisions of the accord and to the implementing measures that they have instituted. Recognizing that compliance is probably never perfect, Jacobson & Brown Weiss (1988) maintain that substantial compliance is what is generally sought and this involves compliance to the specific obligations of the accord (substantive and procedural) and to the spirit of the treaty (which is often enunciated in a preamble).

Jacobson & Brown Weiss's model is depicted in Figure 1. The interrelated factors identified in it are adumbrated below. We suggest that this model provides a useful organizing framework upon which to develop strategies to (i) enhance the continued development of international mitigation agreements; and (ii) strengthen implementation and compliance. Where appropriate, we have added further considerations derived from the works of Peterson (1997) and Sand (1996) on implementation and compliance, and the works of Frank (1990) and Stokke & Vidas (1996) on regime legitimacy.

As shown in the model, the factors affecting implementation and compliance are grouped into four broad categories: (i) characteristics of the activity involved; (ii) characteristics of the accord/agreement; (iii) the international environment; and (iv) factors involving the country.

Characteristics of the activity involved

This category of factors includes:

1. The number of actors involved in the activity – with Jacobson & Brown Weiss's (1998) study confirming the conventional wisdom that the smaller the number of actors involved, the easier (and less expensive) it is to regulate the activity;

2. The effect of economic incentives varies with compliance being favoured when there is complementary or non-competing economic interests of the actors whereas conflicting economic interests tend to work against compliance;

3. The involvement of multinational corporations (MNCs) is a factor which Jacobson & Weiss suggest tends to facilitate compliance as they (a) are generally concerned about their reputations globally; (b) are much more subject to the pressure of public opinion; (c) have bureaucratic structures that engender control; and (d) prefer to conduct their business in stable, uniform regulatory environments;

4. The location of the activity in major countries tends to strengthen compliance by those countries although it is important to recognize (a) that the compliance of smaller countries can contribute to international momentum; and (b) 'free-riding' on the part of a large number of small countries can sap the will of larger countries to comply.

Characteristics of the accord

Jacobson & Brown Weiss (1998) emphasize that these characteristics also make a difference. Their research suggests:

1. For parties to implement and comply with accords, they must feel that the obligations (or recommendations) articulated are equitable;

2. That the more precise the obligations, the easier it is to assess and promote compliance;

3. That the accord needs to include provisions for gaining and utilizing scientific and technical advice and for ensuring that there is a broad consensus among the parties on the scientific and technical issues;

4. A requirement to file regular reports containing information on the nature of policies countries have adopted and on the extent and form of regulated activities is very useful in monitoring implementation and compliance and, furthermore, engenders discipline;

5. NGOs and MNCs can also play important roles in providing information and knowledge and that such organizations may publicize activities which can prompt governments to report more accurately;

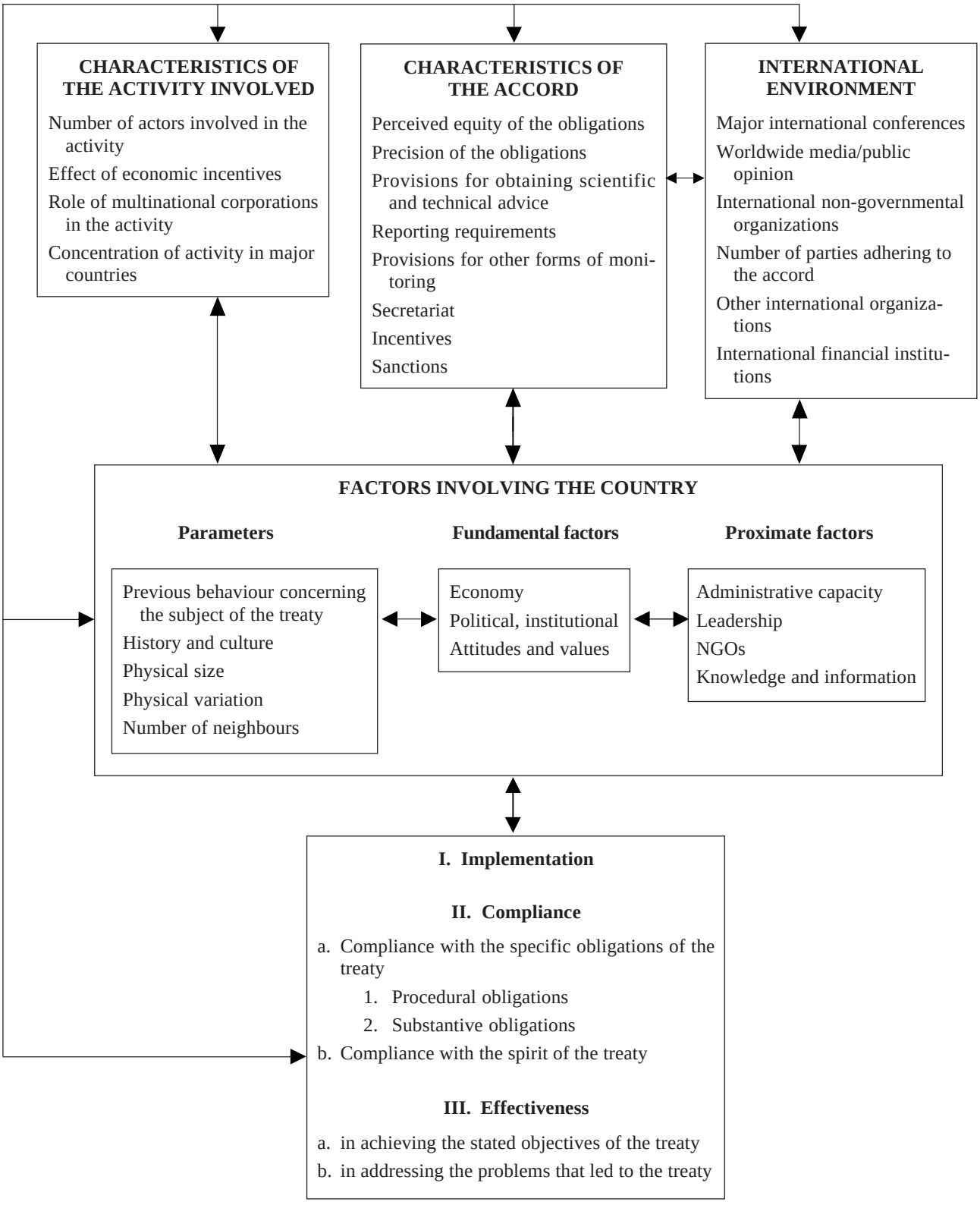

Fig. 1. *A comprehensive model of factors that affect implementation, compliance, and effectiveness.*

6. On-site inspections play a similar role in monitoring;

7. The importance of having an effective and efficient secretariat facilitates implementation and compliance by, for example, clarifying obligations and the variety of techniques that might be used to meet them;

8. Providing countries with financial or other assistance (inducements) to help them comply with their obligations can advance compliance; and

9. There is a role for the use of sanctions (through coercion and force) to strengthen compliance although it is recognized that, in the cases studied, they have been used sparingly.

Sand (1996) offers several additional considerations concerning the characteristics of an accord that are also relevant:

1. If differential obligations or selective incentives are required to meet the special circumstances of some parties they should, if possible, be built into agreements at the start rather than be added on to an agreement during last-minute or later negotiations – skewing an agreement later can seriously undermine its credibility;

2. The degree of institutional cooperation accomplished under regional environmental agreements has consistently been higher than under comparable global accords;

3. A number of environmental agreements expressly confirm the right of parties to take more stringent measures individually or collectively. This can promote over-achievement with the progressive 'club within the club' playing a pilot role in target setting and producing a 'bandwagon effect' with other parties climbing aboard as political momentum gathers;

4. Pending the formal entry into force of a 'hard-law' international agreement, parties may agree to bring it into operation on an interim basis. This provisional application mechanism is a way to circumvent the signatories' concern to avoid a potential 'anarchic hiatus' which may be created by ratification delays; and

5. Another way to by-pass the ratification process is to delegate powers to adopt and regularly amend 'technical' standards to a specialized intergovernmental organization.

Peterson's (1997) extensive study of the implementation of environmental regimes also provides some useful considerations that might be built into an accord to enhance compliance. In regard to monitoring, Peterson notes that almost all environmental self-reporting systems are ineffective because few governments bother to file reports. She suggests that a number of simple steps taken by the relevant intergovernmental organization may enhance the usefulness of reports in assessing noncompliance. These include:

1. Designing and supplying standard forms for reporting;

2. Aggregating and using the information in general or in a country-by-country compliance review (rather than just simply filing the information away);

3. The information might be made directly useful to participating governments or other actors; and

4. Governmental sources of information could be cross-checked against external sources.

Peterson (1997) also suggests that a periodic review of performance under environmental regimes provided by recurrent meetings of the parties (the requirement for which can again be built into an accord) can create opportunities for identifying unintended consequences and for addressing whether prescriptions require modification. Intergovernmental organizations involved in the regime can contribute to the effectiveness of these reviews by ensuring that analyses of monitoring data point out any unintended consequences and schedule time at the meetings for the assessment of these consequences and their implications.

Another consideration raised by Peterson (1997) relates to the nature of dispute resolution mechanisms. She points out that implementation of any accord is likely to trigger disputes about noncompliance by particular parties and the actions of other parties in the light of this noncompliance. The non-resolution of such disputes reduces the sense of mutual trust and common purpose that is needed to sustain compliance so building into an accord effective dispute-resolution mechanisms is clearly useful. While governments have tended to avoid most formal methods of resolution through adjudication and arbitration, new informal, less confrontational methods based on mediation and conciliation have been developed. Under the Montreal Protocol, for example, the parties established an informal and formal dispute resolution mechanism that operates through a small intergovernmental implementation committee. The effectiveness in building compliance of this model has led to similar measures being incorporated into the 1996 Protocol to the London Convention of 1972 on ocean dumping (Brown Weiss 1998).

The international environment

Major international conferences, the mobilization of the media, the arousal of public opinion, the advocacy of NGOs, the increased attention paid to environmental issues by international governmental organizations, the role of international financial institutions and particularly the inducements they offer, and the number of parties adhering to the accord are all important factors which contribute to the (i) development of international momentum concerning the increased salience of environmental issues; and (ii) enhancement of implementation and compliance with international accords. Most, if not all of these elements are subject to policy intervention.

The development of international momentum is linked to the legitimacy of the accord (or an international regime) and this, in turn, is related to compliance. Legitimacy, until recently, has been a neglected subject in the literature on international relations and international law (Stokke & Vidas 1996). This is certainly not the place to divert into an extended treatment of the subject. Suffice to say that the legitimacy comprises, first, 'a property of a rule or rule-making institution which itself exerts a pull towards compliance on those addressed normatively'; and, second, a 'perception of those addressed by a rule or rule-making institution that the rule or institution has come into being and operates in accordance with generally accepted principles of right process' (Frank 1999).

Extending Frank's discussion, Stokke & Vidas (1996), have constructed two categories of criteria to assess the legitimacy of international regimes: (i) the extent of applicability of the rules; and (ii) the level of acceptance of them by relevant subjects.

In regard to the applicability criteria there are two aspects: an internal aspect and an external aspect. The internal applicability aspect concerns the extent to which the rules are conducive to the solution of the problem addressed and whether they are internally consistent. Of importance here is the 'determinacy' of the rule (which Frank 1992 explains is the 'literary property of a rule: that which makes its message clear'). Frank argues that the 'determinacy of a rule directly affects its legitimacy because it increases the rule's transparency and thus its capacity to pull members of the international community toward voluntary compliance . . . the more opaque and elastic the rule text, the less compliance pull it is likely to exert.' This argument lends support to the previous section on characteristics of the accord – i.e. the more precise the obligations, the easier it is to assess and promote compliance.

The external aspect of applicability refers to the normative and structural components of a regime (or accord) which must to be consistent with major developments in the international community. As Stokke & Vidas (1996) stress, '[t]his involves placing a particular regime [or accord] in the wider normative order of the international community and assessing the extent to which there is discord or harmony in their relationship.'

The second category of criteria concerning acceptance has two aspects, too – again an internal aspect and an external one. The internal acceptance aspect concerns the extent to which the parties to a regime (or accord) accept it by acknowledging, implementing and adhering to its provisions (Stokke & Vidas 1996). It may also be demonstrated by the parties' support of the regime (or accord) in wider in international fora or in interaction with other actors.

The external acceptance aspect concerns the level of acceptance by third parties and is manifested through the strength and persistence of their attitudes to the regime (or accord) on a scale ranging from open criticism, implied opposition, indifference, acquiescence, acknowledgement and, finally, accession to it (Stokke & Vidas 1996).

In sum, then, an accord with a high degree of internal and external applicability and a high degree of internal and external acceptance has a very high degree of legitimacy, which exerts a strong pull towards compliance. Clearly, legitimacy-building is an important factor in strengthening compliance.

These three sets of factors – characteristics of the activity, characteristics of the accord and the international environment – are related to each other and with a cluster of factors involving individual countries. As Jacobson & Brown Weiss (1998) recognize, whereas the first three sets of factors are important, it is countries that are at the centre of the compliance process because it is countries that must take actions that are required to fulfill their obligations under accords.

Factors involving the country

Jacobson & Brown Weiss (1998) have divided this set of factors into three sub-categories. They suggest that a country's physical characteristics, its history, its culture and its previous behaviour concerning the subject of an accord establish basic parameters that affect implementation and compliance. Furthermore, a country's economy, its political institutions and its social attitudes and behaviour (fundamental factors) also have an effect, but this is more likely to be generally indirect. They go on to suggest that these two sub-categories of factors operate through proximate factors, the most important of which are:

1. administrative capacity;
2. leadership;
3. NGOs; and
4. knowledge and information.

Taking proximate factors first, it is clear that administrative capacity is a crucial factor and that countries that have stronger administrative capacity (knowledge, educated and trained personnel, financial support, legal mandates) tend to enhance implementation and compliance. So, too, is leadership (individual political, administrative and technical) and group (through, for example, epistemic communities). The importance of NGOs in enhancing international momentum and performing important monitoring roles has already been discussed. Within countries, too, NGOs can also mobilize public opinion, help shape political agendas and make knowledge and information available.

Whereas these proximate factors appear to be of critical significance, especially in the short-run, it is important to understand that they operate within the context of fundamental factors and basic parameters. And while democratic governments have been found to be more likely to implement and comply with international environmental accords than undemocratic governments, cultural and historical considerations at odds with an accord may make implementation and compliance problematic.

Dynamic processes concerning accord formation and compliance

Jacobson & Brown Weiss (1998) argue that whereas their comprehensive model is useful for analysing differences among countries and accords, it has a static quality. It does not show how dynamic processes occur such as the interactions among countries and how country positions regarding compliance can change over time.

Of relevance here is the conclusion drawn that 'leader countries' are crucial to the negotiation of environmental accords (Jacobson & Brown Weiss 1998). This finding complements extensive research by Young (1989, 1994) and by Young & Osherenko (1993) on the significant role played by entrepreneurial and intellectual leaders in international regime formation. Jacobson & Brown Weiss (1998) also concluded that as the five conventions it focused upon came into force, 'leader countries' continued to play leadership roles to promote compliance with them.

In regard to changing positions concerning compliance within countries, Jacobson & Brown Weiss indicate that two dimensions are significant: the intention and the capacity to comply (both of which are related to the proximate factors involving the country). A country's position in respect to compliance can be plotted by using these two dimensions (see Fig. 2).

While a country's position can change over time on both dimensions due to endogenous factors (such as changes in leadership and public support) and to exogenous factors (such as changes in external financial or technical assistance), the value of plotting compliance along these dimensions helps to specify factors which could change a position from weak to strong on both dimensions.

Strategies for strengthening compliance

Having identified important factors involved in enhancing

implementation of and compliance with international environmental accords and having identified considerations important in understanding the dynamics of compliance behaviour, Jacobson & Brown Weiss (1998) discuss three categories of prescriptive strategies to strengthen compliance. These are:

1. Sunshine methods which are intended to show the behaviour of parties and targeted actors in the open for scrutiny and, through what Peterson (1997) calls 'peer pressure', strengthen compliance. These methods include such activities as monitoring, reporting, on-site inspections, persuasion, access to information and NGO participation. Most of them serve as mild forms of coercion or force when they are used to threaten, or actually, shame violators to conform to the obligations of an agreement;

2. Positive incentives (or, in our terms, inducements) such as funds for financial and/or technical assistance, training programmes and access to technology; and

3. Stronger forms of coercive and enforcement measures – such as penalties, sanctions or the withdrawal of membership privileges. It must be noted, however, that Jacobson & Brown Weiss (1998) point out that some have suggested that these particular measures are largely irrelevant to and ineffective for environmental agreements. Peterson (1997) concurs, also noting that the sanction of excluding a non-compliant party from participation in an intergovernmental organization would insulate it from processes of information dissemination and peer pressure.

By linking their schema on compliance with these categories of strategies, Jacobson & Brown Weiss (1998) show how it is possible to target countries with the appropriate mix of strategies (see Fig. 3 which designates strategies that are useful primarily in supporting compliance. Back-up roles are placed in parentheses).

Jacobson & Brown Weiss (1998) conclude the study with a list of prescriptions concerning negotiating accords, institutional arrangements and measures directed at countries (see Appendix 1) and emphasize that engaging countries and all relevant actors from the early stages of negotiating an accord and then keeping them engaged are the essential steps that must be taken to enhance national compliance with international environmental agreements. Their model and schemas offer, we believe, a very useful way of advancing the seabird conservation effort by providing (i) a checklist of factors that needs to be analyzed and assessed to identify current problems and windows of opportunity; and (ii) a mechanism for designing appropriate compliance strengthening strategies to target countries with specific (i.e. strong or weak) intentions and capacities to comply.

INTENTION	CAPACITY: Strong	CAPACITY: Weak
Strong	Country A	Country B
Weak	Country C	Country D

Fig. 2. *Intent and capacity to comply.*

INTENTION	CAPACITY: Strong	CAPACITY: Weak
Strong	Sunshine (Sanctions)	Incentives (Sunshine)
Weak	Sunshine Sanctions (Incentives)	Incentives Sanctions (Sunshine)

Fig. 3. *Strategies to strengthen compliance, taking account of intention and capacity to comply, after Jacobson & Brown Weiss (1998).*

CONCLUSION

It is in connection with this latter point that our earlier discussion about power and influence as forms of 'significant affecting' dovetails. We suggest that it is important to assess the extent to which conflicts of interest exist between all relevant actors and recognize that if the situation contains a mix of conflicting and compatible interests held by these actors then a mix of power and influence needs to be exercised by those wishing to play leadership roles (especially the entrepreneurial and structural styles) to enhance compliance – be they concerned conservationists or committed governments. In such situations, reliance on types of influence while neglecting power (and *vice versa*) is likely to be a deficient recipe. Because we feel that this mixed-interest situation characterizes the seabird bycatch issue (with fishing industry interests often in conflict with conservation interests), we emphasize the need for the availability of sunshine methods, positive incentives (inducements) and, if possible, stronger forms of coercive and enforcement measures (sanctions).

To conclude, the proof of the utility of Jacobson & Brown Weiss's approach to strengthening compliance with international environmental accords is in its application. The nature of this introductory paper has not permitted us to offer an analysis (comprehensive or illustrative) of the seabird conservation issue based on this framework or on the construction and advocacy of specific, targeted prescriptions. That is the task that will begin at this workshop. If we are to avoid Robertson's (1998) dire-case scenario of desolate oceans with fewer albatrosses and petrels plying the waves we hope for their sake, and for ours, that this approach fulfills its promise.

REFERENCES

BIRNIE, P. W. & BOYLE, A.E. 1992. International law and the environment. Oxford: Clarendon Press.

BROWN WEISS, E. 1998. The five international treaties: a living history. Brown Weiss, E. & Jacobson, H.K. (Eds).

Engaging countries: strengthening compliance with international environmental accords. Cambridge, Mass: MIT Press. pp. 89–172.
BROWN WEISS, E. & JACOBSON, H.K. (Eds). Engaging countries: strengthening compliance with international environmental accords. Cambridge, Mass: MIT Press.
CCSBT. 1999. Report on the 5th Annual Meeting of the Commission for the Conservation of Southern Bluefin Tuna, Tokyo, Japan, 22–26 February, 1999.
FRANK, T.M. 1990. The power of legitimacy among nations. Oxford: Oxford University Press.
FRANK, T.M. 1992. The emerging right to democratic governance. *Amer. J. Int. Law* 86: 46–91.
GALLIE, W.B. 1955–6. Essentially contested concepts. *Proc. Aristotelian Soc.* 56: 167–198.
HAWARD, M., BERGIN, A. & HALL, H.R. 1998. International legal and political bases to the management of the incidental catch of seabirds. In: Gales, R. & Robertson, G. (Eds). Albatross biology and conservation. Chipping Norton: Surrey Beatty and Sons. pp. 255–266.
JACOBSON, H.K. & BROWN WEISS, E. 1998. Assessing the record and designing strategies to engage countries. In: Brown Weiss, E. & Jacobson, H.K. (Eds). Engaging countries: strengthening compliance with international environmental accords. Cambridge, Mass: MIT Press. pp. 511–554.
LUKES, S. 1974. Power: a radical view. London: Macmillan.
LYSTER, S. 1985. International wildlife law. Cambridge: Grotius Publications.
PETERSON, M.J. 1997. International organizations and the implementation of environmental regimes. In: Young, O.R. (Ed.). Global governance: drawing insights from the environmental experience. Cambridge, Mass: MIT Press. pp. 115–151.
ROBERTSON, G. 1998. The culture and practice of longline tuna fishing: implications for seabird by-catch mitigation. *Bird Conserv. Int.* 8: 211–221.
SAND, P.H. 1996. International cooperation: the environmental experience. In: Young, O.R. (Ed.). The political economy and international institutions, Vol. II. Cheltenham: Edward Elgar. pp. 421–463.
STOKKE, O.S. & VIDAS, D. 1996. The effectiveness and legitimacy of the Antarctic Treaty System. Cambridge: Cambridge University Press.
YOUNG, O.R. 1989. International cooperation: building regimes for natural resources and the environment. Ithaca: Cornell University Press.
YOUNG, O.R. 1994. International governance: protecting the environment in a stateless society. Ithaca: Cornell University Press.
YOUNG, O.R. & OSHERENKO, G. (Eds). 1993. Polar politics: creating international environmental regimes. Ithaca: Cornell University Press.

APPENDIX 1

PRESCRIPTIONS FOR ENGAGING COUNTRIES

(after Jacobson & Brown Weiss 1998)

NEGOTIATING THE ACCORD

A. Ensure that the obligations of the accord are perceived as equitable by parties and potential parties.
B. If clearly assessing compliance is a primary concern, make the obligations as precise as possible.
C. Try to ensure that the obligations are reinforced rather than contradicted by economic forces.
D. Craft treaty so that the burden of compliance is placed on a manageable number of actors. Target the major actors.
E. Ensure that there are leader countries in the negotiations and that early on, they take measures to implement and comply with the agreement.

INSTITUTIONAL ARRANGEMENTS ASSOCIATED WITH THE ACCORD

F. Provide for regular meetings of parties, so that national and international bureaucracies will be mobilized regularly.
G. Ensure that secretariats are strong enough to identify cases of noncompliance, advise various actors on how to comply, propose measures (through governments) to address issues of noncompliance, and seek support from various institutions, and other actors in which parties have confidence, to help countries.
H. Include means, in which parties have confidence, for ongoing scientific assessments of problems targeted by the accord.
I. Involve the international financial institutions, including the Global Environment Facility, in building local capacity to comply with the accords.
J. Develop standardized forms for reporting data, which should contribute to the effectiveness of reporting. Data required should be frugal, and perceived as equitable and essential.
K. Inform the public about the agreement through the media and new information technology. This can build support for implementation and compliance.

MEASURES DIRECTED AT COUNTRIES

L. Focus strategies for strengthening compliance on individual countries, and differentiate them according to their intention and capacity to comply.
M. Make it possible for low- and middle-income countries to participate meaningfully in all agreements they may be expected to join.
N. Assist countries, when necessary, in drafting implementing legislation and in initiating the steps required by the agreement for compliance.
O. Make available technical assistance and capacity-building programmes at the national and local levels. Regional networks of relevant national officers who have responsibility for implementation and compliance may encourage learning how to address shared compliance problems.
P. Strengthen coordination among relevant ministries and departments, and between national and provincial or municipal units of government. Strengthen domestic institutions concerned with compliance.
Q. Build a culture of compliance by engaging both the public sector and the private sector in determining domestic needs and setting priorities.