CONSERVATION OF ARCTIC FLORA AND FAUNA

Workshop On Seabird Incidental Catch In The Waters Of Arctic Countries

26-28 April 2000

REPORT AND RECOMMENDATIONS

Editors (in alphabetical order)

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FOREWORD

On behalf of Canada and the United States, co-sponsors of the Workshop On Seabird Incidental Catch in Waters of Arctic Countries, we are pleased to present this Report and Recommendations to member countries of the Conservation of Arctic Flora and Fauna (CAFF) Program of the Arctic Council. The Workshop was instrumental in furthering and focusing the discussion on seabird incidental catch in fisheries of the Arctic among scientists, managers, and fishers. Although the Workshop was an important step in developing practical recommendations concerning outreach and education, monitoring and assessment, mitigation measures, and mechanisms for implementing these recommendations, this is only a first step in the long-term process of actually implementing these recommendations. The Report and Recommendations should be widely distributed and its recommendations communicated to Arctic and marine resource policy and management people.

EXECUTIVE SUMMARY

Incidental catch of seabirds in fisheries is an issue common to nations fishing in the waters of Arctic Countries. This Workshop brought together a variety of experts from Conservation of Arctic Flora and Fauna (CAFF) countries, and others, to exchange information on the magnitude of the problem and to develop solutions to reduce the incidental catch of seabirds in fisheries. Participants included seabird and fisheries scientists, fisheries managers, fishers, and conservationists.

The CAFF Working Group of the Arctic Council hosted this workshop on the incidental catch of seabirds in the waters of Arctic countries in response to recommendations put forth in the recent CAFF Technical Report No. 1 entitled *Incidental Take of Seabirds in Commercial Fisheries in the Arctic Countries* (Bakken and Falk 1998). This report identified seabird mortality in gillnet fisheries to be a particular concern, and one that was not being addressed within the Arctic or in international fora. Accordingly, one important focus of the workshop was on seabird incidental catch in fixed gear such as gillnets. A second focus of the workshop was longline incidental catch, in response to *The International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries* (IPOA- Seabirds, FAO 1999), a voluntary instrument of the FAO. This workshop was the first formal opportunity for the stakeholders to gather and discuss the issue of incidental catch of seabirds since FAO´s approval of the IPOA-Seabirds in 1999.

The workshop goals were fourfold as listed below.

- Exchange the latest information on the problem of seabird incidental catch in waters of Arctic countries, the seabird species and fisheries involved and temporal, spatial, and other patterns of incidental catch;
- Identify the needs associated with the development of an effective system for monitoring seabird incidental catch in Arctic countries;
- To identify methods of reducing seabird incidental catch and the attributes of effective communication and outreach programs;
- To explore the approaches that Arctic countries are taking to the development of National Plans of Action to deal with seabird incidental catch in longline fisheries, as agreed to in recent FAO meetings.

Cooperation, collaboration and communication among scientists, managers, fishers and conservationists were considered to be essential and were encompassed in the spirit of the workshop.

The group identified needs associated with the development of effective monitoring programs for assessing seabird incidental take. The group recognised that the level and significance of seabird mortality varied with the type of fishery and geographically within fisheries. Although there was much in common among fisheries, there was a need to develop monitoring programs on a fishery-by-fishery basis. The importance of long-term seabird population monitoring and bycatch assessment was emphasised to document species composition and mortality, assess population level impacts and evaluate improvements in mitigation methods. States should report periodically on seabird incidental catch at appropriate fora.

The group identified methods of reducing incidental seabird mortality in fisheries. The ultimate goal is to reduce seabird mortality substantially, although the group recognised that mortality is unlikely to be completely eliminated in most fisheries. Mitigation measures should be tailored to the specific characteristics of fisheries and gear types. Further research and development on seabird incidental

catch mitigation methods are required, particularly for fixed gear fisheries.

The group recognised that there are some excellent instruments and processes in place to help reduce seabird incidental catch in fisheries, including the FAO *Code of Conduct for Responsible Fisheries* (FAO 1995), and the FAO *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries* (FAO 1999), including the National Plans of Action required by 2001. The group explored the approaches that Arctic countries are currently taking in the development of National Plans of Action to deal with seabird incidental catch in longline fisheries, in response to the FAO IPOA-Seabirds.

The group recognized both the need to apply adaptive management, and the importance of employing precautionary approaches, in addressing the issue of seabird mortality in fisheries. The group developed a series of recommendations on the topics listed below.

- Outreach and education
- Monitoring and assessment
- Mitigation measures
- Mechanisms for implementation

The individual recommendations are contained in the body of this report.

This report will be presented to CAFF for approval, and will ultimately be presented to the Arctic Council for approval and implementation. National participants should encourage their national governments to support and implement appropriate recommendations immediately.

ACKNOWLEDGEMENTS

Canada and the United States, co-sponsors of the Workshop on Seabird Incidental Catch in Waters of the Arctic Countries, and the Conservation of Arctic Flora and Fauna Program of the Arctic Council would like to thank Fisheries and Oceans Canada, Canadian Wildlife Service, and the U.S. Fish and Wildlife Service for their generous funding support of the Workshop; and Fisheries and Oceans Canada (Bedford Institute of Oceanography) for hosting the meeting.

The co-sponsors would also like to thank J.W. Chardine, the Program Chair, J.M. Porter, the Meeting Chair, all of the Session Chairs (J.M. Porter, A. Manville, R.D. Elliot, A. Bielak, J. Lein and K. Wohl) and their rapporteurs (D. Cairns, M. Massaro,A. Bielak, M. Showell, C. Hood, J. Cooper and A. Lock), and R.D. Elliott for reviewing the draft manuscript. Finally, the success of the meeting was due in large part to the excellent and diverse participation of stakeholders including fishery and seabird scientists, fishery managers, fishers, and conservationists.

PART ONE: SUMMARY REPORT AND RECOMMENDATIONS

1.1 Introduction

Workshop participants were welcomed to the Bedford Institute of Oceanography in Halifax, Nova Scotia. The Meeting Chairman (J.M. Porter, Canada) reiterated that the meeting mandate was an especially important one as nations move forward in the national assessment phase of responding to the FAO IPOA-Seabirds.

It is important to view seabird incidental catch in terms of responsible fishing, and reference was made to the FAO *Code of Conduct for Responsible Fisheries* (FAO 1995). In particular, Article 6.1 refers to the obligation to ensure the conservation of both the target species and species belonging to the same ecosystem, or associated with or dependent upon target species. Article 8.5 refers to the requirement to minimise the incidental take of non-target species.

The Chairman noted the participation of both seabird and fisheries scientists and managers, and members of the fishing industry and environmental groups. In particular, this meeting provided a broad perspective on the seabird incidental catch issue. Not only were areas of particular concern identified, but also the global comparison allowed application of a balanced perspective, as data from various CAFF countries were examined. The Chairman emphasised the need to attempt to define what level of incidental catch should be considered a problem, and that sound scientific rationales be used to make that decision. It is important for fishers, scientists, and resource managers to highlight seabird incidental catch problems where they occur. It is also important to avoid creating issues where they do not exist. It becomes a matter of perspective and defining limits.

Fishery and seabird scientists generally have different approaches and philosophies. In a fisheries context mortality in fishing gear is assumed to be a part of the total mortality, and the aim is to maximise economic gain from fishing while keeping populations at a healthy level. For most seabirds such as those in Canada and the U.S. there is no commercial harvest of seabirds. Seabird biologists and managers are primarily concerned with maintaining healthy populations and conserving quality habitats. So those different philosophies must be merged to manage these wild populations of animals. The Chairman noted marked discrepancies in the levels of research funding, with much lower levels of funding for non-commercial species including seabirds. Further, it was noted that seabirds and fish have very different life history strategies.

It is essential to define which seabird populations are being considered in getting management objectives, and what level of mortality constitutes a problem to these populations. It is important, therefore, for fishers to recognise their responsibility to understand how to reduce incidental catch of all species which will result in more efficient fishing, and clearly benefit the non-target species. There has been tremendous work done

on that and it is exciting to have those experts in the same workshop as the fishing industry.

1.2 Workshop Goals

The Conservation of Arctic Flora and Fauna (CAFF) Program of the Arctic Council hosted this workshop on seabird incidental catch in the waters of Arctic countries in response to recommendations put forth in the recent CAFF Technical Report No. 1 entitled *Incidental Take of Seabirds in Commercial Fisheries in the Arctic Countries* (Bakken and Falk 1998). This report identified seabird mortality in gillnets to be a particular concern; accordingly, one focus of the workshop was on seabird incidental catch in fixed gear such as gill-nets. A second focus was longline incidental catch, in response to *The International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries* (FAO 1999), a voluntary instrument of the FAO.

The workshop was designed around several themes: the incidental catch problem - the species and fisheries involved, monitoring and mitigation, outreach and communications, and FAO National Plans of Action for reduction of seabird incidental catch in longline fisheries.

Workshop Goals

1. To exchange the latest information on the problem of seabird incidental catch in waters of Arctic countries, the seabird species and fisheries involved and temporal, spatial, and other patterns of incidental catch.

2. To identify the needs associated with the development of an effective monitoring system for seabird incidental catch in Arctic countries.

3. To identify methods of reducing seabird incidental catch and the attributes of effective communication and outreach programs.

4. To explore the approaches that Arctic countries are taking in the development of National Plans of Action to deal with seabird incidental catch in longline fisheries, as agreed to in recent FAO meetings.

1.3 Workshop Conclusions and Recommendations

1. The group exchanged the latest information on seabird mortality in commercial fisheries in the waters of Arctic countries, the seabird species and fisheries involved and temporal, spatial and other patterns of seabird mortality. Cooperation, collaboration and communication among scientists, managers, fishers and conservationists were considered to be essential and were encompassed in the spirit of

the workshop.

2. The group recognized that the level and significance of seabird mortality varied with the type of fishery and geographically within fishery types, and that although there was much in common among fishery types, there was a need to develop monitoring programs on a fishery-by-fishery basis. The importance of long-term seabird monitoring and assessment was emphasized to document species composition and mortality, and assess population level impacts, and evaluate improvements in mitigation methods. Annual reporting of seabird incidental catch should be required at appropriate fora.

3. The group identified methods of reducing incidental seabird mortality in fisheries. The ultimate goal is to reduce seabird mortality substantially, although the group recognized that mortality is unlikely to be completely eliminated in most fisheries. Mitigation measures should be tailored to the specific characteristics of fisheries and gear types. Further research and development of seabird mitigation methods are required, particularly for fixed gear fisheries.

4. The group recognized that there are some excellent instruments and processes in place to help reduce seabird incidental catch in fisheries, including the FAO *Code of Conduct for Responsible Fisheries* (FAO 1995), and the FAO *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries* (FAO 1999). The group explored the approaches that Arctic countries are currently taking in the development of National Plans of Action to address seabird incidental catch in longline fisheries, in response to the FAO IPOA-Seabirds.

5. The group recognized the need to apply adaptive management in addressing the issue of seabird incidental catch in fisheries. This entails evaluating the effectiveness of all methods chosen for outreach and education, monitoring and assessment of incidental catch, mitigation methods, and methods for implementation, and continuing to modify them when required.

6. The group encouraged all countries to employ precautionary approaches in addressing the issue of seabird incidental catch in fisheries.

Seabird Incidental Catch Recommendations

Outreach and Education

1. Educate seabird and fishery researchers and managers, fishers and non-governmental organizations in fisheries and fishery gear techniques, seabird conservation, and the full spectrum of economic, cultural, and ecological values of fisheries and seabirds to society.

2. Distribute identification guides, fact sheets, posters and videos to fishers in local

languages of fishers.

3. Develop a comprehensive list of experts and organizations that have an interest in seabird incidental catch and have information to contribute to resolving this seabird mortality.

4. Train observers in the political, economic and biological aspects of the issue of seabird incidental catch, so they can play a useful role as direct ambassadors with vessel captains and the fisheries industry.

5. Increase communication among experts in seabird incidental catch in the circumpolar regions to improve the dissemination of regional information and different approaches, processes and experiences in resolving this issue.

6. Improve the availability and use of seabird incidental catch information (geographical and temporal distribution of mortality, mitigation methods, measures and devices, and biological and socio-economic concerns).

7. Create a seabird incidental catch focus group that includes a range of government and non-governmental organizations, or otherwise improve the communication, coordination, and cooperative approaches needed to resolve the seabird incidental catch issue.

8. Develop a website and list server to distribute seabird incidental catch information and encourage discussion of appropriate mitigation methods, linked to existing government and non-government websites.

Monitoring and Assessment

1. Improve efforts to determine the magnitude of seabird mortality and effective mitigation measures and devices for gill-net fisheries, to match the level of information available on longline fisheries.

2. Establish new incidental catch observer programs, and improve the fisheries and geographical coverage, sampling design, and data collection efforts of existing observer programs.

3. Improve information on seabird distribution and abundance in longline and gill-net fishing areas, to avoid seabird breeding and foraging concentration areas and to determine impacts to populations of seabirds in the area.

4. Salvage dead birds from fishing gear to confirm their identification and conduct further analyses of sex, age class, fat condition, diets, etc to better assess population impacts.

5. Seabird incidental catch information should be acquired by several methods, including independent non-government observer programs, logbooks, video cameras, dockside interviews, questionnaires, and randomized at-sea boarding of fishing boats.

6. Assess and prioritise seabird incidental catch by specific fishery gear types, fisheries and locations.

7. Evaluate and standardise seabird incidental catch observer data collection, reporting, and training among observer programs within and among countries.

8. Ensure that seabird incidental catch information is collected to determine the magnitude of the incidental catch and its impact on seabird populations, rather than for the need for enforcement information.

9. Monitor seabird mortality and populations at different geographical scales to be most responsive to specific fisheries.

Mitigation Measures, Methods, and Devices

1. Complete a world-wide review and handbook on gill-net/seabird mitigation measures and devices, including a cost-effectiveness assessment of each, similar to that which has been done for longline fisheries.

2. Include incidental catch mortality in determining the overall allocation of sport and subsistence harvests of waterbirds.

3. Avoid areas of seabird concentrations (e.g., near seabird colonies and foraging areas), using time (seasonal and time of day) and area closures.

4. Consider the use of modified upper net panels, audio alarms and pingers, alternative mesh colours, modified corklines, and fishing surface nets deeper in the water column, to reduce the incidental seabird catch in gill-net fisheries.

5. Determine the underwater behaviour of selected species of seabirds in relation to gill-net and longline fishing operations and specific gear types.

6. Increase research on mitigation measures and methods to reduce seabird incidental catch in fisheries, and test methods regionally, and by specific gear type, in collaboration with the fishing industry and others involved in incidental catch.

7. Conduct regular reviews of mitigation measures and deterrent devices, and distribute

the information to all interested parties.

8. Use a suite of mitigation measures and deterrent devices in combination appropriate to the specific fisheries bycatch situation being addressed.

Mechanisms and Processes to Implement Workshop Recommendations

1. Complete the seabird incidental catch workshop summary report for CAFF and the Arctic Council, and distribute the report to governments, the fishing industry and environmental organizations. Governments should use the recommendations to develop voluntary and regulatory methods to reduce seabird incidental catch in gill-net fisheries.

2. Use inducements such as tax incentives, extra fishing days, additional fishing areas, license fee reductions, preferred access to fisheries, or qualification in a "green ship" program for vessels using approved mitigation methods and devices.

3. Create a fishing grounds advisory service to alert fishers of seabird breeding and foraging concentration areas during the fishing season.

4. Improve information on opportunities for funding seabird incidental catch mortality, mitigation, and gear modification studies and outreach activities.

PART TWO: SESSION SUMMARIES

2.1 General Session: Seabird Incidental Catch: A Conservation Issue for CAFF Countries

2.1.1 Summary

This workshop was the first formal opportunity for different stakeholders to gather and discuss the incidental catch of seabird issue. Participants included seabird and fisheries scientists, fisheries managers, fishers, and conservationists. Given the diversity of backgrounds of the participants, a range of perspectives, opinions and approaches was presented. In spite of these divergent views, the group agreed on a comprehensive set of recommendations.

This session provided the workshop with an excellent foundation on the topic of seabird incidental catch in commercial fisheries. There was a general overview of the topic by Mac Mercer, followed by the current status of efforts to address the problem and its mitigation presented by John Cooper, and finally the work to date of the CAFF Circumpolar Seabird Working Group, presented by John Chardine. The papers by Mercer and Cooper et al. are presented in their entirety in this report, and the CAFF Technical Report No. 1 is available from the CAFF Secretariat.

An important conclusion of Dr. Mercer´s presentation was that there is a good list of instruments and processes in place to address of seabird incidental catch where it exists. There has also been considerable review of mitigation measures that have been shown to be effective in certain situations. However, he expressed concern that Agood will" and commitment must be maintained to ensure that effective mitigation measures were implemented or adopted. Much of the general discussion centred around the question, "How do we maintain momentum and actually reduce the seabird mortality in fisheries?" Given that the FAO IPOA-Seabirds requests that countries report biennially on the state of progress in the implementation of their National Plans of Action (NPOA), there is a good foundation for momentum. Participants were encouraged to communicate the recommendations of this Workshop to their national governments, making sure it was understood that additional resources may be required to implement many of the recommendations.

The presentation by Dr. Cooper and others highlighted the need for better information on seabird populations and incidental catch in commercial fisheries (including data to describe the impacts of incidental catch on seabird populations), a need for taking new approaches (including ecosystem management), and a general need for collaboration, communication and coordination among the stakeholders. Not only is it important to improve data on seabird populations and their mortality in fisheries and other sources, but there is also a need to educate the fishing industry to "fish smarter" to reduce seabird mortality. Therefore the general discussion considered the question, "How do we improve our data

on populations, and at the same time encourage fisheries managers and fishers to fish smarter?" A related question raised was, "Are the data representative?" There was concern that data on both seabird incidental bycatch in fisheries and the status of seabird populations are required. Fishery representatives made the point that fishers are more apt to be responsive if they understand the impacts on populations, which requires that seabird mortality rates be made available. The point was strongly made that a lack of information is not a reason to avoid action on this issue. FAO, through their *Code of Conduct for Responsible Fisheries* (especially Article 8.5), has already concluded that incidental catch must be minimised, regardless of its impact on individual species. All countries are encouraged to employ precautionary approaches in addressing the issue of seabird mortality in fisheries (FAO 1996). It was noted that the longline incidental catch issue may be more easily solved than the gill-net issue; we are starting with the easier problem (longlines) in the NPOAs. It was emphasised that both management action and data collection should be initiated immediately and conducted concurrently.

A final conclusion from this important overview was that the group wished to prepare a formal statement from the meeting. This has taken the form of the Recommendations Section (Section 1.3), as a consensus document. Following approval by CAFF, some or all of these recommendations should be presented to the Arctic Council. National participants should encourage their national governments to implement these recommendations immediately, and to ensure that sufficient funding is provided for their implementation.

2.1.2 Abstracts

A Perspective On The Bycatch Problem. M.C. Mercer, Director, IUCN Canada Office, IUCN, 380 St. Antoine Street, Suite 3200, Montreal, QC H2Y 3X7, Canada.

This presentation addresses some general aspects of the bycatch problem and the evolving institutional context in which this problem is being addressed. It then looks briefly at some of the initiatives and involvement of IUCN in addressing the issue. Bycatch and subsequent discarding was tolerated traditionally as a normal part of fishing operations, except where it caused problems interfering with the fishing operations itself. It is only more recently that substantive attention has turned to other biological impacts. Through the 1970s and 1980s, the extent and seriousness of the bycatch problem began to attract international attention, which was subsequently galvanised by the Alverson Report in 1994. International attention was brought to bear on the problem in the 1990s through the *United Nations Convention on the Law of the Sea, United Nations Conference on Environment and Development, Convention on Biological Diversity,* the 1995 *Agreement on Highly Migratory Fish Stocks and Straddling Fish Stocks, the FAO Code of Conduct on Responsible Fisheries* (1995), and the FAO *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries* (FAO 1999). Solutions to the bycatch problem fall into three general categories: policy and regulatory changes; technological innovations; and co-operative dialogue and capacity building. IUCN is positioned to play a

contributing role in resolving the bycatch problem because of its membership, comprised of governments and non-governmental organisations, its long experience in training and capacity building, and its broad network of experts. Relevant IUCN Resolutions and current activities are outlined.

Addressing the Problem: Seabird Mortality from Longline Fisheries in the Waters of Arctic Countries. J. Cooper,[1] E. Dunn,[2] D. W. Kulka,[3] K. H. Morgan,[4] and K. S. Rivera,[5] [1]BirdLife International Seabird Conservation Programme, Avian Demography Unit, University of Cape Town, Rondebosch 7701, South Africa; [2]Royal Society for the Protection of Birds, The Lodge, Sandy, Beds SG19 2DL, UK; [3]Department of Fisheries and Oceans, P. O. Box 5667, White Hills, St John´s, Newfoundland A1C 5X1, Canada; [4]Canadian Wildlife Service, Institute of Ocean Sciences, P. O. Box 6000, Sydney, British Columbia V8L 4B2, Canada; [5]Protected Resources Division, National Marine Fisheries Service, P. O. Box 21668, Juneau, Alaska 99802, USA.

Because only a few longline fisheries in Arctic countries have onboard observer programs, the exceptions being Canada and the USA, few estimates are available for the numbers of seabirds killed by these fisheries. In addition, because many of the affected species occur over broad ranges, the available estimates do not account for all sources of longline mortality. In Alaskan (USA) and the combined Icelandic, Faeroese and Norwegian longline fisheries, the Northern Fulmar *Fulmarus glacialis* accounts for the greatest numbers of birds killed (annual estimates 9,000 and 50,000 B 100,000, respectively). However, its large global population (10-12 million birds) does not place it at risk. Conservation concern is required for the three albatrosses *Phoebastria* spp. that are killed by longlines in Alaskan and Canadian Pacific waters. Three percent of the Alaskan Glaucous Gull *Larus hyperboreus* breeding population might be caught annually. Few countries have adopted mitigation measures for their longline fisheries, and only two (USA and Norway) have conducted mitigation research. Some Arctic nations have progressed towards adopting FAO National Plans of Action (NPOA-Seabirds) to reduce seabird mortality in longline fisheries. The USA draft plan is being revised in 2000 following public comment. Canada has established a National Seabird Bycatch Working Group to produce an NPOA-Seabirds. Norway intends to produce its draft plan in 2000. Greenland, the Faeroe Islands and Iceland have not as yet made decisions to produce plans, and Finland and Sweden apparently do not have seabird bycatch problems that warrant plans. For Russia no information is available, but seabird mortality most probably occurs, given the existence of domestic longline fisheries in Arctic waters. It is suggested that Arctic countries that are members of the CAFF Program of the Arctic Council consider the desirability of adopting a regional inter-governmental agreement to reduce seabird mortality from longlining, by way of sharing biological knowledge and technical expertise and by adopting obligatory mitigation measures. Such regional agreements are encouraged by the FAO.

Seabird Bycatch in Net Fisheries in Arctic Countries: A Summary of the CAFF

Report. John W. Chardine[1], Vidar Bakken[2], and Knud Falk[3], [1]Canadian Wildlife Service, P.O. Box 6227, Sackville, NB E4L 1G6, Canada; [2]University of Oslo, Zoological Museum, Sarsgt. 1, N-0562 Oslo, Norway; and [3]Ornis Consult, Vesterbrogade 140 A, 2, DK-1620 Copenhagen, Denmark.

The Circumpolar Seabird Working Group of the Conservation of Arctic Flora and Fauna (CAFF) program recently coordinated a review of the incidental bycatch of seabirds in fisheries of Arctic countries. This paper summarises the results as published in the CAFF report, but focuses on net rather than longline bycatch. Arctic countries are among the most active fishing nations in the world, and their seabird populations are large and diverse. It is well known that seabirds are routinely drowned in fishing gear in Arctic countries, however, seabird bycatch is not currently monitored routinely in any except some of the U.S. fisheries. Information is therefore very patchy and incomplete. We do know that a wide variety of seabird species is drowned in net fisheries, and that diving species are certainly the most commonly killed. Important bycatches of murres, Black Guillemots, Razorbills, and Common Eiders are mentioned in the report by four or more nations, and salmon, lumpfish, and groundfish gill-nets were mentioned by three or more nations as the fisheries responsible for this. Very large losses of seabirds have been recorded in Arctic countries historically. Most of these reports involve murres. Examples of 100,000s of murres being taken in net fisheries come from Greenland, Norway and, most recently, in a Japanese salmon driftnet fishery in eastern Russia. Some fisheries that have historically taken many seabirds have ceased, with associated seabird bycatch declining to negligible levels. It is generally recognised that a major impediment to managing the seabird bycatch problem in Arctic countries is the fragmentary information currently available, and most countries recommended improved monitoring and assessment. Close cooperation among fishers, industry and marine resource managers will be needed to reduce seabird bycatch. The development of nets that catch birds less frequently, while maintaining fish catches, is needed. Modifications to fishing practices are required in areas where seabird bycatch is a serious problem.

2.2 Seabird Incidental Catch on Longlines, and Alternative Approaches to Completing National Plans of Action (NPOAs) for Seabird Incidental Catch in ongline Fisheries

2.2.1 Summary

The past problem with large-scale, high-seas driftnets, including incidental catch of seabirds such as Laysan Albatrosses in active driftnets and bird incidental catch in Aghost driftnets", is well known. The United Nations banned large-scale high-seas driftnetting in 1992. This session reviewed longline fisheries in Hawaii (including continuing concern over albatross take), in Alaska (with special concern over the take of the endangered Short-tailed Albatross), in Canadian waters, and in New Zealand (potential impacts on aboriginal take of Sooty Shearwaters). The presenters also reviewed the development of the FAO *International Plan of Action for Reducing Incidental Catch of Seabirds in*

Longline Fisheries (IPOA-Seabirds), and the evolution of the National Plans of Action (NPOA-Seabirds) for Reducing Seabird Incidental Catch in both Canada and the United States.

A number of common themes emerged from the presentations: there is a need for enhanced data collection; observer programs are an extremely important source of data and should be enhanced and encouraged; and there is a need for more collaboration between fisheries and seabird scientists to assess impacts on populations. A further point, which was also addressed in Sessions 3 and 4, was that it is especially important to encourage coordination between those familiar with fisheries and incidental catch issues (a bottom-up approach), rather than by administrators lacking a full understanding of these issues. This should, of course, include the fishing industry. In fact, voluntary mitigation has been initiated by fishers for many years, with benefits both for the seabirds and for the efficiency of fishing operations. Classic examples are the Japanese fishing industry's development of the paired tori line, and use of towed devices and offal discharge techniques to protect bait on baited hooks and reduce seabird mortality by Alaskan fishers. A new example was presented of the Norwegian longline fishers developing and using a seabird scaring device and a setting funnel.

The overview on the IPOA-Seabirds by John Valdemarsen was especially informative in clarifying this initiative, and the workshop benefited from several participants who had been involved with the development of the IPOA-Seabirds. There were three important messages from this discussion: the longline incidental take issue is easier to address than effects of gill-nets, so we are starting with a problem with a high likelihood of success; the NPOAs are to be put in place immediately, rather than waiting for more study; and the goal is to reduce seabird incidental catch, not necessarily eliminate it. The need for outreach and communication was emphasised, as was the need to provide technical information to concerned parties in a timely basis. FAO member states are now in various stages of meeting the requirement for a NPOA, from having a draft plan (e.g., USA), to having committees in place and conducting assessments (e.g., Canada), to basic data collection. Although it was clear from the discussions that most Arctic countries had not initiated their NPOAs, there was considerable commitment to develop a NPOA-Seabirds, and it is hoped that recommendations from this meeting will both clarify and encourage those efforts.

2.2.2 Abstracts

The Distribution of Fishing Effort and Seabird Bycatch in the Rockfish Longline Fishery off the West Coast of Canada in 1998 and 1999. Jeff Fargo and K. Lynne Yamanaka, Department of Fisheries and Oceans, Pacific Biological Station, 3190 Hammond Bay Road, Nanaimo, BC V9R 5K6, Canada.

The longline fishery on the Pacific coast of Canada targets rockfish, blackcod, halibut and lingcod. In the halibut fishery, approximately 10% of the trips are monitored by observers.

The longline fishery for rockfish receives about 5% observer coverage. The longline fisheries for blackcod, dogfish and lingcod are not monitored. We examined fishery logbook records and observer reports for the ZN rockfish longline fishery for 1998 and 1999, to summarise the distribution of fishing effort and the bycatch of seabirds. Seasonal fishing patterns for this fishery are a direct result of management. Area openings in this fishery are controlled by managers. The year-around rockfish longline fishery consists of demersal longlines, and involves about 160 vessels and 2500 sets annually. We examined logbook data from 4295 sets, 3397 in summer (April-September) and 1211 in winter (October-March). Data for the summer fishery included 2080 sets in 1998 and 1317 sets in 1999. Data for the winter fishery included 585 sets in 1998 and 626 sets in 1999. In the inshore, fishery observers were present on 12 fishing trips (100 sea days) in 1999 and no seabirds were reported caught. Over the same period observers made 5 trips (42 sea days) to offshore seamounts and reported three Black-footed Albatrosses caught. Monitoring of the longline fishery for rockfish will continue, and coverage will be expanded to include more areas and fishing trips. In the future, these data will be used by Canadian Wildlife Service and Department of Fisheries and Oceans to estimate the total bycatch of seabirds in this fishery.

Seabird Bycatch on Longline Fisheries in Atlantic Canada. David Kulka[1] and Mark Showell[2], [1]Department of Fisheries and Oceans, P.O. Box 5667, White Hills, St. John´s, NF A1C 5X1, Canada; [2]Marine Fish Division, Bedford Institute of Oceanography, 1 Challenger Drive, Dartmouth, Nova Scotia, Canada B2Y 4A2.

Data on seabird bycatch was obtained through the Canadian fisheries observer programs, records of weight were kept on a set-by-set basis from 1988 to date, from Arctic waters to the most southerly of Canadian waters on the Scotian Shelf (no records are available from the Gulf of St. Lawrence). Not all seabirds were speciated prior to 1997. Ten species were observed as bycatch, with shearwaters and fulmars dominating the bird bycatch records. Sea ducks, jaegers, terns, petrels, Cory´s Shearwaters and gulls were not observed in fishing gear. Ninety percent of individual sets contained less than 11 birds. Shearwaters, fulmars and puffins were observed in greatest numbers. Shearwaters, fulmars and murres occurred in more sets observed with birds. Shearwaters and fulmars dominated the bird bycatch records. Longlines and gill-nets were the primary gears capturing birds. Trawls, the dominant gear fished in these areas were almost devoid of bird bycatch. As a preliminary estimate, longlines are estimated to have taken on average about 700-800 birds per year, fewer in recent years, with gill-nets taking about 500 birds annually. These estimates need to be refined by fishery and by year. Other gears take insignificant numbers of birds. The distribution of seabird bycatch records was a function of seabird and fishery distribution. As such, seabirds were recorded in fishing gear along the outer edge of the Scotian Shelf and Grand Banks throughout the entire study period. Newfoundland coastal records are more recent, corresponding with inshore observations commencing in 1992. Most sets with seabird bycatch north of 51° (Northeast Newfoundland and Labrador Shelf) occurred during the late 1980s and the early 1990s corresponding to coverage of longline fisheries during that period. Longline fisheries for

large pelagic fish and turbot, and trawl fisheries for white hake, cod and silver hake comprise the main directed fisheries where seabirds are taken as bycatch. Seasonally, 97% of bird records occurred between March and November (67% between March and October), again a function of the timing of fisheries and bird movements. Observer data has proved to be an excellent source of information. To date, observers have been required to gather bird data for certain regions only. More structured training and data collection requirements and broader observer coverage are required.

Fisheries Bycatch: Does it Threaten the Long-Term Sustainability of Sooty Shearwater (*Puffinus griseus*) Harvests by Rakiura Maori? Sebastian Uhlmann, and Henrich Moller, Department of Zoology, University of Otago, P.O. Box 56, Dunedin, New Zealand.

Incidental bycatch of pelagic seabirds in fishing gear (e.g., longlines and drift and trawl nets) is a well-known and widespread problem that may threaten populations of rare albatrosses and petrels. Sooty Shearwaters, or titi ("muttonbirds"), remain abundant but are also caught in fisheries. Their chicks are harvested by Rakiura Maori from their breeding grounds on the Titi Islands around Rakiura (Stewart Island). The muttonbird harvest is a culturally defining tradition of great economic and social importance for Rakiura Maori. High rates of adult mortality from fisheries bycatch may lead their customary harvest into unsustainability. Any changes in the abundance of titi will also have profound effects on breeding island ecology as titi are a "keystone species" because of their impact on soil aeration, nutrification and plant regeneration. The bycatch dilemma has been examined for endangered species, but only for a few common species. Characterising the problem for a species that is still relatively common has statistical advantages. The spatial and temporal patterns in bycatch of a common and widespread species like titi may help identify general patterns that may indicate risk factors from different fisheries or ecological conditions for the rarer ones. A literature review and a meta-analysis will describe the temporal and spatial patterns of fishing effort in relation to the distribution and density of titi in the Southern hemisphere (breeding season) and northern hemisphere (Sooty Shearwaters migrate to Arctic waters during the austral winter). It will be important to determine whether bycatch mortality varies with sex, age, or breeding status. Information will be gathered by networking with the Ministry of Fisheries (MAF), Department of Conservation (DOC) and information will be exchanged in conferences and by e-mail with experts worldwide. This review and meta-analysis will conclude that there is a gender bias in catch rates. The sex ratio among non-breeding titi adults will be measured by analysing feather samples. This will indirectly test whether fisheries bycatch has a significant impact on titi abundance. An estimate of the total number of titi dying in fisheries will be scaled against estimates of the overall number of titi and their annual survival. This will refine a population model which assesses the overall threat from fisheries bycatch on the long-term sustainability of muttonbirding by Rakiura Maori.

The Process of Developing An International Plan of Action for Reducing Incidental

Catch of Seabirds in Longline Fisheries (IPOA-Seabirds). John Willy Valdemarsen, Fishing Technology Service, Fishery Industries Division, UN Food and Agriculture Organisation, Viale Delle Terme di Caracalla, Rome 00100, Italy.

FAO´s Committee on Fisheries (COFI), at its 22nd session in 1997, proposed that FAO should organise an expert consultation to develop guidelines leading to a plan of action aimed at reducing the incidental catch of seabirds in longline fisheries. The process which followed included preparation of background documents about the longline fisheries, the bycatch of seabirds issue and a review of possible mitigation measures, the content of which was reviewed by a group of experts. A draft proposal of a Plan of Action was prepared by FAO and its text was further developed in the course of two intergovernmental meetings, open to all FAO members, held in 1998. The IPOA-Seabirds was adopted by the 23rd session of COFI in February 1999 and endorsed by the FAO Council at its session in June 1999. The IPOA-Seabirds is a voluntary instrument that applies to all member States whose fishers engage in longline fisheries. The text sets out a set of activities which member States are expected to implement, including assessment of whether a problem exists with respect to the incidental catch of seabirds in longline fisheries, and procedures for national reviews and reporting requirements.

U.S. National Plan of Action for the Reduction of Incidental Catch of Seabirds in Longline Fisheries. Albert M. Manville II, Office of Migratory Bird Management, U.S. Fish and Wildlife Service, 4401 N. Fairfax Drive, Suite 634, Arlington, VA 22203, USA.

This presentation reviews steps in the development of the U.S. NPOA-Seabirds, since the 22nd meeting of the FAO Committee on Fisheries (COFI) in March 1997 in Rome. In preparation for an October 1998 FAO Technical Consultation on, among other issues, seabird bycatch reduction, a Seabird Technical Working Group (STWG), consisting of a panel of experts, met in Tokyo in March 1998 to develop a preliminary draft of the FAO *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries* (IPOA-Seabirds). Prior to the STWG meeting, the U.S. created a 5-member U.S. Seabird Bycatch Steering Committee in February 1998. The Committee's roles included expediting the outreach process, anticipating the likelihood of an NPOA-Seabirds; briefing Congressional staff, industry and NGO representatives on development of the IPOA-Seabirds; and seeking, reviewing, and incorporating constituent feedback and comments on the STGW report and later on the draft NPOA-Seabirds. The Steering Committee conducted eight briefings. With the approval of the IPOA-Seabirds at the FAO Technical Consultation in 1998, approval by the COFI in February 1999, and adoption by the FAO Council the following June, the U.S. created the Inter-Agency Seabird Working Group (IASWG), represented by the National Marine Fisheries Service (NMFS; co-chairing), U.S. Department of State, and the U.S. Fish and Wildlife Service (FWS; co-chairing). In September 1999, a public notice was published in the *Federal Register* announcing a rough schedule for development of the NPOA-Seabirds, an outline of the document, and a call for public comment and suggestions -- to which a number of fishers and nongovernmental organisations (NGO) responded. The NPOA-Seabirds is a

shared conservation initiative. The FWS is the trust resource agency responsible for migratory birds protected under several Federal statutes, while NMFS is the agency responsible for most commercial fisheries including longline fishing under the Magnuson-Stevens Fishery Conservation and Management Act. In October 1999, a letter of cooperation between NMFS and FWS was signed, outlining the need for continued collaboration and shared conservation mandates. In December 1999, a draft NPOA-Seabirds was published in the *Federal Register*, resulting in many comments from the fishing industry and conservation NGO community. It is anticipated that the IASWG will next finalise the document which must then be approved by NMFS and the FWS. The final NPOA-Seabirds will be published in the *Federal Register,* later in 2000.

In the United States, eight Regional Fishery Management Councils manage virtually all regional fisheries. The Councils are advisory to NMFS, have FWS staff represented on them as non-voting members, are Federally recognised under the Magnuson-Stevens Act, and are Federally funded by NMFS. Where seabird bycatch has been shown to be a problem, predominantly in the Pacific Ocean, longline fishery management has been accomplished by implementing Fishery Management Plans and by regulations. For example, in 1997 in Alaska's groundfish longline fishery, and in 1998 in Alaska's longline halibut fishery, rules and regulations were implemented to reduce the incidental capture of the endangered Short-tailed Albatross and other seabird species. This presentation reviews some of these technical and operational requirements and options. In Hawaii's longline fisheries, regulations are being drafted by the Western Pacific Regional Fishery Management Council for implementation by NMFS later in 2000. The U.S. Coast Guard generally enforces U.S. fishery regulations. Where other longline fisheries take seabirds, the NPOA-Seabirds will require an assessment with possible development of a regional seabird bycatch plan of action. Where mitigation measures are being used, the NPOA-Seabirds will likely recommend that these measures be incorporated within amended Fishery Management Plans and as regulations. The NPOA-Seabirds and its implementation will allow for adaptive management, especially as new technologies are developed and tested. We also recognise that no one "magic bullet" exists that will reduce seabird bycatch in all fisheries. Each fishery is unique. Lastly, challenges also exist, such as funding, coordination, and timing, which are briefly reviewed.

Canada's National Plan of Action for Reducing Incidental Bycatch of Seabirds in Longline Fisheries. Julie M. Porter[1] and Howard Powles[2], [1]Department of Fisheries and Oceans, 531 Brandy Cove Road, St. Andrews, NB E5B 2L9 Canada; [2]Department of Fisheries and Oceans, 200 Kent Street, Ottawa, ON K1A 0E6 Canada.

Canada is in the assessment phase of responding to the FAO *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries*. Canada has established a National Working Group on Seabird Incidental Catch with both fisheries and seabird biology experts, to oversee development of the NPOA and identification and implementation of any related seabird bycatch activities. Incidental catch data from

national observer programs have been examined for this workshop to determine the nature and extent of any incidental seabird catch by longline. In 2000, there will be enhanced observer monitoring, further analyses, and consultation to complete the assessment phase. Canada is well placed to implement a National Plan of Action in 2001, should one be deemed necessary. Canada has a well-established observer program, a *Canadian Code of Conduct for Responsible Fishing Operations*, and a network of fishing industry associations, which could support implementation of an NPOA-Seabirds or other actions. Once longline incidental catch has been considered and appropriately dealt with, the National Working Group will consider incidental catch of seabirds in other kinds of fishing gear.

2.3 Seabird Incidental Catch in Gill-net Fisheries B The Problem and Solutions

2.3.1 Summary

Presentations and discussions on the effects of gillnets on seabirds were wide-ranging, describing specific case studies in different parts of the world, and considering the suite of approaches available to document the extent of the problem and to reduce it to acceptable levels. The impacts of gill-net fisheries raise different challenges for seabird conservation in comparison to longline fisheries, as most occur in inshore or coastal waters, often prosecuted by relatively small-boat fisheries, and in many cases our assessments of both the extent and the effects of the problem are much less-developed.
From the presentations it is clear that no single solution will be effective in all situations. The best suite of solutions can be found by involving all stakeholders and by using science to define problems and assess a range of possible solutions. Most appropriate and effective solutions are likely to come from the fishers themselves because they understand and accept the need, by developing answers through trial and error and innovation that reflect their wealth of experience with fishing gear and methods. By presenting fishers with conservation targets, and describing the problem in non-threatening terms, they are most likely to accept the challenge of finding ways to reduce incidental catch to target levels in practical ways that reflect the characteristics of their specific situations, without the need for burdensome regulatory controls.

Many of the ideas presented by the speakers were explored and reinforced in the open discussion with those people with working experience in fisheries. Additional remedies such as changing net characteristics (colour, mesh size and material) were considered, as were the pros and cons of acoustic and pinger devices specifically designed to deter seabirds from approaching nets. The fishers pointed out the need to clearly document the extent and impact of the problem in an unbiased way, without exaggeration, and explain it in non-scientific terms to those in the industry before attempting to implement solutions. Once convinced of the need to take steps to reduce seabird incidental catch, fishers would be prepared to work to alter the fishery to improve bird populations. A consensus emerged: that documentation of the problem by biologists and fishers together, and agreement on acceptable and practical target levels, was needed first, and that these would

vary from fishery to fishery. The development of solutions with fishers would then follow and build on the support and experience of scientists in similar situations in other areas.

2.3.2 Abstracts

Bycatch of Waterbirds in Mid-Atlantic Coastal Anchored Gill-nets During Spring, 1998. Doug Forsell, U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, 177 Admiral Cochrane Dr., Annapolis, MD, 21401, USA.

The U.S. Fish and Wildlife Service conducted a study of bird mortality in anchored gill-nets in the near-shore ocean waters of New Jersey, Delaware, Maryland, and Virginia. Twenty five dead birds were observed being removed during 161 net retrievals. This equates to a minimum mortality of 0.16 birds per 300 feet of net per set. Based on approximately 14,900 net sets, we estimated at least 2,387 diving birds were killed, mostly Red-throated and Common Loons. Beached bird surveys were conducted repeatedly at 20 locations along the 565 km shoreline. Two hundred and ten (210) dead diving birds were found on 1,732 km of surveyed beach or 0.12 birds/km. Approximately ten times more dead birds were found on beaches within two km of a gill-net than on beaches without nets. A minimum mortality estimate based on the beached bird surveys is 1,265 diving birds per season. Birds were counted to 400m offshore on 590 km of shoreline with nets deployed within one km, and on 953 km of shoreline with no nets deployed. For all diving birds, 10.3 birds/km were counted in waters without nets, and 4.6 birds/km were counted in areas with nets. A vulnerability index was developed.

Seabird Mortality Caused By Nearshore Gill-net Fishery in Lithuania, Eastern Baltic. Ramunas Zydelis, Institute of Ecology, Akademijos 2, LT-2600 Vilnius, Lithuania.

Near-shore gill-net fisheries are a new phenomena in the Eastern Baltic region that started in the decade after the collapse of the Soviet Union. Fishing effort rapidly increased during that period. Beached bird surveys and direct communication with fisherman were used to evaluate seabird mortality in fishing gear. Bird spatial distribution patterns were compared with allocation of main fishery areas. Results of beached bird surveys revealed that the number of birds drowning in gill-nets was increasing. At least 50% of birds that washed ashore on beaches could be classified as victims of gill-net fisheries. Preliminary estimates suggest that 5,000-10,000 birds die in gill-nets each year in Lithuanian coastal waters. Sea ducks were most commonly observed entangled in gill-nets. Divers (loons), grebes and alcids are also drowned in nets. Analysis of bird spatial distribution revealed that the main fishery areas significantly overlapped with important bird wintering sites. Unfortunately, seabird bycatch in fishing gear is currently not recognised as an important environmental issue at the regional decision-making level.

Incidental Mortality of Seabirds in the Salmon Gill-net Fishery in the Russian Far East EEZ, 1993-98. Y.B. Artukhin[1], V.N. Burkanov[1,2], and P.S. Vyatkin[1], [1]Kamchatka

Institute of Ecology and Nature Management, Far East Branch of Russian Academy of Sciences, 683024 Petropopavlovsk-Kamchatskiy, Prospect Rybakov 19A, Russia; [2]Alaska Sea Life Center, P.O. Box 1329, Seward, AK 99664.

The Japanese salmon drift gill-net fishery has increased within the Russian Exclusive Economic Zone in the north-west Pacific since 1989. Fishery areas included south-western Bering Sea, the Pacific side of the Kuril Islands chain, and the southern and eastern parts of the Sea of Okhotsk. During 1993-98, fishing effort was between 54,000 and 147,000 km of nets set during May-July annually. The analysis used data collected by observers on 16% of total nets set. Twenty-eight species of seabirds were observed dead in gill-nets of which the majority were either Alcidae (62%), or Procellariidae (38%); Hydrobatidae, Diomedeidae, Gaviidae, Phalacrocoracidae, Stercorariidae, and Laridae were also represented. Total estimated mortality of all species during the period was around 1.1 million individuals. Bycatch of seabirds varied by area and by year. Indications are that bycatch in this driftnet fishery may affect populations of Red-legged Kittiwakes on the Commander Islands and Thick-billed Murres in the western Bering Sea.

Seabird Bycatch in Salmon Gill-net Fisheries in Puget Sound, Washington - A Case Study. J. Grettenberger[1], E. Melvin[2], and J. Parrish[3], [1]U.S. Fish and Wildlife Service, 510 Desmond Dr. SE, Suite 102, Lacey, WA 98503, USA; [2]Washington Sea Grant, University of Washington, Box 351800, Seattle, WA 98195-1800, USA; and [3] School of Fisheries, University of Washington, Box 355020, Seattle, WA 98195-5020, USA.

Seabird mortality in the salmon gill-net fishery in the state of Washington was elevated as an issue in 1992 with the listing of the Marbled Murrelet as a threatened species under the Endangered Species Act. State and Federal agencies, working with the tribes and the fishing industry, initiated an observer program. In 1994, it was estimated that 3,500 seabirds, mostly Common Murres and Rhinoceros Auklets, were killed in the non-tribal sockeye fishery in north Puget Sound. An estimated 15 murrelets were killed in tribal and non-tribal fisheries. As a result, closures of areas with high Marbled Murrelet densities were implemented. In addition, working closely with the fishing industry, testing of modified gill-nets designed to reduce seabird mortality was conducted by the Washington Sea Grant Program from 1994 to 1996. Measures which could reduce seabird bycatch were identified, including: visible barrier of white twine in the upper part of the gill-net, prohibition of sunrise fishing, and scheduling of open seasons to maximise fishing efficiency and avoid periods of high bird abundance. The first two measures were adopted as regulations by the Washington Department of Fisheries and Wildlife in 1997 for non-tribal fisheries. Puget Sound can serve as a model for addressing seabird bycatch, but further action to reduce seabird bycatch by the tribes and Canada is needed to significantly reduce seabird bycatch in the region.

Thoughts of Reduction of Seabird Bycatch in Fishing Gear Based on Experiences in Mitigation of Cetacean Bycatch by Fisheries: Understanding Both Animals and Fishermen. Jon Lien and Catherine Hood, Biopsychology Program and Whale Research

Group, Memorial University of Newfoundland, St. John´s, Newfoundland A1C 5S7 Canada.

Fishing technology has generally been well designed for catching effectiveness. Selectivity and incidental mortality caused by fishing has been of secondary interest. The solution to bycatch problems in fisheries requires an understanding of target and non-target animals involved, and an understanding of fishers and fishing. Other than for target species of fish, little is known of how animals, captured by fishing, function underwater. Sensory function, barrier detection and typical detour behaviours underwater are usually unknown. Underwater studies of the behaviour of captive seabirds should be a productive area for investigation. Efforts at mitigation of bycatch have typically involved enhancing detectability of fishing gear, better defining the nature of the barrier for the animal, or by scaring non-target animals out of the vicinity of fishing activity. Efforts at scaring birds typically result in habituation if threatening stimuli can be checked by context. Adequate mitigation by net enhancement depends on how well one understands the behaviour of the animal underwater. Fishing technology has evolved by a trial-and-error process with rigorous peer review. Acceptance of responsibility for bycatch by the fishing industry and cooperative involvement of fishermen in the process of developing solutions are necessary components in achieving solutions to bycatch. The nature of the relationship between responsible fishermen and their technical helpers generally determines if mitigation is successfully implemented.

2.4 Monitoring Seabird Incidental Catch Effectively: How Do We Do It?

2.4.1 Summary

This session was characterised by four excellent presentations that provided a range of contrasts - both in scale and geographically. The data presented illustrated both the difficulty of addressing the whole subject of seabird incidental catch, and the necessity of improving the baseline data. The issue of seabird incidental catch has been described as a problem, but there are few data beyond anecdotal accounts and strong suspicion to actually support this resource issue. In most cases, if there is some indication of the extent of the mortality there are no bird population data to assess the impact of the fisheries-related mortality on population viability. Are we dealing with a "manageable" or a sustainable mortality, one well below any other factors, and thus unlikely to have significant effects? Or are we dealing with seabird kills of a magnitude that might be seriously affecting or ultimately endangering populations or even species?

Clearly, observer programs are important monitoring tools. The presentations contrasted the observer programs in the U.S. and in eastern Canada. In both presentations on the U.S. situation, it was stressed that the seabird work was highly dependent on marine mammal incidental catch concerns, and would not likely be expanded beyond the needs of those programs. They are not optimally designed to provide a comprehensive account of

the seabird issue. Similarly, the Canadian programs are generally driven by fishery management concerns, and the collection of seabird data is incidental to those concerns. There is a need for improving data collection, training and communication, and increased partnering and education.

Overviews of monitoring programs in several other fisheries were provided during the discussion. In Greenland, for example, there are 50 observers on offshore vessels who could monitor incidental catch if requested. However, these fisheries are not monitored and the authorities are not concerned with incidental catch *per se*, but rather the actual numbers of birds taken and whether these are sustainable. In that jurisdiction where the inshore fishery is comprised of small commercial vessels or subsistence fishers, incidental catch is considered a bonus rather than a problem, as the incidental seabird catch can be sold and consumed. John Cooper gave an overview of the internationally managed and 100% monitored Patagonian toothfish fishery in the southern ocean. Certain vessels carry two observers, one for fish and one for birds. All birds are collected, labeled and maintained for study. This provides the opportunity for the collection of valuable data related to age class and sex ratios of birds killed.

The critical need was raised for obtaining estimates of bird populations to put incidental catch numbers in perspective with other threats or impacts, such as illegal dumping of oil by ships. However, it was noted that in certain instances the response to the question of "how many is too many?" might be a legal one related to the legislation of certain countries to protect migratory birds. Thus the political, social, legal or economic aspects also enter into the equation.

There is a need to identify potential problem areas or "hot spots" for seabird incidental catch. The potential to capitalise on the accumulated knowledge of past and present observers was identified, and could perhaps be accomplished via questionnaires or during training sessions. While there is a need to focus attention on obvious areas of bird abundance (e.g. breeding colonies, migration routes and staging areas, and wintering grounds), caution should be exercised in this approach as there is the potential to overestimate the magnitude of the issue. There is a need to assess the incidental seabird catch associated with all fisheries, including recreational fisheries. Furthermore, there is also a need to design and implement incidental catch monitoring programs prior to re-opening fisheries which have been closed (e.g., the inshore gill-net fisheries in Newfoundland). Since many fishery management plans are reassessed annually, the possibility to institute such monitoring exists.

There is a need for mechanisms, similar to those developed for the Marine Mammal Protection Act in the U.S., to identify incidental catch thresholds at which reductions in fisheries should be effected to protect the resource. In the case of marine mammals, where it is assumed that population sizes are known, the definition of thresholds relates to a mortality which does not extend the recovery of the population in question beyond 10% of the total anticipated time to recovery.

Use of observer programs is an excellent potential tool to collect data, although most programs are not tailored to the collection of seabird incidental catch data. There was general agreement that, while seabird incidental catch was certainly an issue, there is still insufficient data in most Arctic countries to determine the fine-scale significance of incidental catch on seabird populations. However, broad conclusions can be made in many situations (see section 3.1.3). There is a need to collect sufficient data on both incidental catch itself, and the population numbers and distribution of the bird species affected.

2.4.2 Abstracts

The Collection of Seabirds and Seabird Bycatch Data by U.S. Fishery Observer Programs: An Overview. Victoria R. Cornish, National Marine Fisheries Service (NMFS), Office of Science and Technology, 1315 East-West Highway, Room 12342, Silver Spring, MD 20910 USA.

The NMFS currently deploys fishery observers on commercial fishing vessels in 18 different fisheries throughout the U.S. The primary role of fishery observers is to collect scientific catch and bycatch data in commercial fishing activities. To a lesser degree, fishery observers also monitor compliance with Magnuson-Stevens Fishery Conservation and Management Act regulations, Marine Mammal Protection Act and Endangered Species Act requirements, and catch quotas. Fishery observers collect information on all aspects of fishing activity, including vessel and gear characteristics, gear deployment methods, fishing locations, environmental parameters, and species composition of catch and bycatch. For bycatch of protected species, such as marine mammals, sea turtles, and seabirds, observers may collect skin biopsies or take photographs but are directed to release animals alive with minimal injury. For dead bycatch, animals are extensively sampled or the entire carcass may be salvaged. Salvage of seabirds by observers is done only under special request from U.S. Fish and Wildlife Service scientists or scientists holding a Migratory Bird Treaty Act permit issued by the Service. Currently, seven of the 18 observed U.S. fisheries have significant or occasional seabird bycatch. Summary data on bycatch of seabirds are available upon request from NMFS regional observer program managers and the U.S. Fish and Wildlife Service.

An Overview of Observer Programs in Atlantic Canada. Mark A. Showell, Marine Fish Division, Bedford Institute of Oceanography, 1 Challenger Drive, Dartmouth, Nova Scotia, Canada B2Y 4A2.

A Department of Fisheries and Oceans (DFO) fisheries observer program was established in 1977, in conjunction with the establishment of Canada´s 200 mile Exclusive Economic Zone. While initially conceived as a scientific program collecting data from the foreign groundfish fleets, the role of the observers changed subsequently to include both science

and enforcement responsibilities. The objective of the program is therefore twofold: to provide scientific and management advice for the conservation of Canada´s fisheries resources, and to ensure compliance with Canadian fishing regulations. Fishery observers report on catch, bycatch, discarding, and fishing effort, and characteristics of fishing gear and length-frequency distribution of the catch. Observers also report details on fishing strategies and document possible regulatory violations. Recording of seabird bycatch by observers in Atlantic Canada has been variable; for many years codes for all species were not available. More detailed records exist from the mid-80s for the Newfoundland program, and since 1998 for Scotia-Fundy. Education of the observer corps as to the value of seabird observations is critical, and clear policies on recording practices is required to ensure all seabird incidental catches are consistently recorded. Fisheries observers are currently deployed from four regional sites in Atlantic Canada, by companies under contract with DFO who hold exclusive rights for observer services in their region. A total of 175 DFO-certified observers are employed between the four regions. Coverage has expanded since early years of the program, where deployments were limited to foreign groundfish fleets. Observers are currently deployed in most domestic fixed and mobile gear fisheries in Atlantic Canada, at industry expense. Coverage levels vary by fleet and region. Foreign vessels and the northern shrimp vessels require 100% coverage, and the coverage of the snow crab fleet is 20B30%. Many other Canadian fleets such as the longline fishery by ships over 45 feet in length, gill-net, swordfish and tuna fisheries, are covered at relatively low levels (<5%). The usefulness of observers as a monitoring tool at these low coverage levels is questionable, as observed vessels are likely behaving differently than those without observers. Deployment strategies to ensure that data collected are representative of each fishery as a whole is a major challenge under these circumstances.

Incidental Observation of Seabirds Taken Incidentally by Alaskan Near-shore Commercial Net Fisheries: Is It Good Enough? Brian Fadely, National Marine Fisheries Service, Protected Resources Division, PO Box 21668 W. 9th St., Juneau, AK 99801, USA.

All near-shore net fisheries in Alaska are state-managed, though many can be directed to carry National Marine Fisheries Service (NMFS) observers under the Marine Mammal Protection Act (MMPA). The MMPA also provides authority to collect bycatch data on other non-target species, and that authority was used to collect seabird bycatch data during marine mammal observer programs of three salmon gill-net fisheries in Prince William Sound and South Unimak Island (Aleutian Islands) during 1990-91, and two Cook Inlet salmon gill-net fisheries during 1999-2000. Interactions occurred in up to 10% of observed sets, and up to 6% of the birds interacting with nets became entangled and died. There was considerable variation in the numbers and species of birds interacting with, and entangling in, gill-nets, depending upon fishery location and timing. However, because these programs are driven by marine mammal concerns, coverage of seabird bycatch among Alaska's net fisheries has been temporally and spatially sporadic. Additionally, the program design has neither been optimised to detect seabird interactions

nor has it been integrated with seabird abundance surveys. Thus, marine mammal observer programs in Alaska may be less than ideal for accurate estimation of the magnitude and variability of seabird bycatch mortality.

Off The Hook: Monitoring The Incidental Catch Of Seabirds In British Columbia, Canada. K.Morgan[1] and Joanna Smith[2], [1] Canadian Wildlife Service, P.O. Box 6000, Sidney, BC, V8L 4B2, Canada; [2] 101-1001 West Broadway, Box 623, Vancouver, BC V6H 4E4, Canada.

Since 1998, the Canadian Wildlife Service of Environment Canada has been working with the Canadian Department of Fisheries and Oceans and fisheries observer companies to develop a program to assess the incidental catch of seabirds in commercial fisheries. We describe efforts to integrate seabird monitoring into existing fisheries observer programs in British Columbia, develop standardised observer training using a seabird identification manual and course curriculum, and pitfalls which have been encountered. To date, a considerable amount of effort has been expended on the process of establishing an appropriate monitoring program. However, very few seabird bycatch data have actually been gathered. What has been collected is summarised in the presentation.

2.5 Fisher Outreach and Communication: Approaches and Needs

2.5.1 Summary

Cooperation, collaboration and communication among scientists, managers, fishers and conservationists are considered to be essential and were encompassed in the spirit of the entire workshop. There were no papers presented in this session, and discussions relied upon the themes and presentations of the previous two days. In addition, the experience of the session moderator (J. Lien) in Newfoundland (see also sections 2.3.2 and 3.2.2) provided valuable lessons. This session enjoyed particularly active and valuable participation from the fishing industry participants and scientists.

There is a basic responsibility that comes with fishing in the ocean, and this is well encompassed by the FAO *Code of Conduct for Responsible Fisheries*. Seabirds are a natural resource and should not be thought of separately from fisheries harvesting. Given that their life history strategy (long-lived, low rate of reproduction), is so sensitive to mortality of individuals, incidental bycatch of seabirds should not be down-played. It is therefore essential to follow the precautionary principle when addressing these issues. It is essential to communicate the issues clearly and to have strong supporting data upon which statements are based. Fisheries management can quickly become dysfunctional if the motives for rules are not understood. Both fishers and scientists agreed that to take this conservation issue seriously, information presented must be comprehensive and well-prepared. Perhaps most importantly, it is essential that fishers be included in discussions and decision-making from the very beginning of the issue/management process.

Considerable time was spent discussing ways that fishers and scientists can communicate effectively. Essentially, one-on-one contact should be made, in a familiar setting, such as at the dock. Scientists need to understand and listen to fishers, and to recognise that they too have something to offer. In the words of the moderator, "If you go down to the wharf and tell fishermen that you want to learn about fishing, you are a scholar right away." In the same way, fishers must recognise and respect the responsibility that comes with the privilege of fishing, and the kinds of information and insights that scientists can provide. Mutual respect, and taking the time to listen and learn, can go a long way to understanding implications of the seabird incidental catch issue. Fishers can be ambassadors and teachers in their own communities, as they educate colleagues on this seabird issue.

It was also emphasised that other, less direct levels of communication are important. Fishery observers can serve as the "eyes and ears" of scientists, and can also help to disseminate information to the fishing industry. Many fishers have computers and access to the world wide web. It was therefore recommended that a website and list server be developed to disseminate seabird incidental catch information and to elicit discussion of possible mitigation methods. Linkage with existing government and non-government websites was also suggested.

At the conclusion of this session, the group broke into concurrent focus groups to identify recommendations, and a number of these relate to outreach and education (see section 1.3).

PART THREE - OVERVIEWS

3.1 Keynote Presentations

3.1.1 Welcome Address. A. T. Bielak, Canadian Wildlife Service, Environment Canada, Dartmouth, Nova Scotia, Canada

It is my great pleasure to join Dr. Michael Sinclair, Director of Science for Fisheries and Oceans Canada, Maritimes Region, here at the Bedford Institute of Oceanography, in welcoming you here today to this important workshop, sponsored jointly under the aegis of CAFF, by DFO, the US Fish and Wildlife Service and Environment Canada's Canadian Wildlife Service. I feel particularly fortunate to be here with you today, in the guise of someone who, as you have heard in the kind introduction by Dr. Julie Porter, having worked for both DFO and CWS, has had the opportunity of sampling both fish and fowl so to speak (as indeed has Dr. Porter).

There are a couple of things that are germane in this regard. Several years ago Dr. John Chardine took me out to Witless Bay in Newfoundland to look at the seabird colonies there, and to see at first hand the burgeoning eco-tourism industry which had developed around those colonies. In fact, Mr. Joe O'Brien, who is here with us today, was our skipper that day and it was one of my first practical immersions into seabird ecology and some of the related conservation issues. In particular Joe and John sensitised me during that trip to the fact that during the cod moratorium the birds were getting a break from being taken incidentally in gill-nets, and what that could mean.

I'm sure that there is no doubt in any of our minds that fisheries impact the marine ecosystems in which they are prosecuted, and that these effects range from direct impacts on fish populations to collateral damage to marine habitats and other non-target species. It is fair to say that these collateral impacts have not been given the emphasis they deserve, partly because, frankly and with apologies to my seabird-loving colleagues, some of the birds aren't as cute as otters, or even turtles and whales. Also, out of sight is out of mind. And what is happening is out of sight because the ocean is a big place and these impacts are difficult to monitor, but also because humans are terrestrial animals not marine animals; i.e., it is not in our back yard.

The second experience that I would like to share with you is that, as part of my training as a relatively new member of the Canadian Wildlife Service, I participated, during the fall of 1998, in the Seabird Working Group of CAFF in northern Iceland. Kent Wohl chaired that meeting. While seabird incidental take in fishing gear has long been understood by seabird biologists to be a conservation issue worth more than a passing glance, it has taken a long time for the problem to be addressed.

Recently, several international agencies, including the IUCN (The World Conservation Union), Birdlife International, and FAO, have taken up the issue of seabird bycatch in

longline fisheries around the world. At the CAFF meeting in Iceland, a group of seabird experts reviewed an excellent report on the bycatch issue in Arctic countries. We'll be getting an overview of that report by John Chardine, Vidar Bakken and Knud Falk later this morning.

It is as a direct result of our discussions at that CAFF seabird meeting that we are meeting here at Bedford Institute over the next three days. I'm pleased to recognise that Kent Wohl was one of the key players in getting this meeting going and, together with John Chardine and Julie Porter, in putting together the excellent and balanced program we have for the next few days.

You might ask why are we worrying about seabird incidental catch, when fisheries themselves are in jeopardy in so many places? I don't want anyone to have the impression that people interested in resolving the issue of seabird incidental catch are insensitive to the downturn in fisheries in Atlantic Canada and elsewhere. The point is that, as in the case of the Witless Bay example, with this downturn in the fisheries, we have an opportunity to discuss and perhaps solve some problems - such as seabird incidental catch, that would be much harder to solve with an active fishery fully underway.

Ultimately the sustainability of fisheries will depend not just on the sustainability of fish stocks, but on the sustainability of the whole ecosystem that supports those stocks, an important component of which is seabirds. Fishers, and I am glad to see several of you among us today, do not want to catch seabirds as much as the agencies responsible for the conservation of seabirds do not want them to.

Resolution of the seabird catch problem is a win-win situation for fishers, the fishing industry and for sectors that are concerned with the conservation of seabirds themselves, including the tourism industry and government and non-government conservation agencies. Fishers, and fisheries and seabird biologists, know this and it is up to us to convince our elected representatives and our masters at various levels of our agencies or ministries that this is so.

This workshop is an important part of that process.

3.1.2 **A Perspective On The Bycatch Problem.** M.C. Mercer, Director, Canada Office IUCN (The World Conservation Union).

Introduction

I was very pleased to receive the invitation to give an opening presentation at this CAFF Workshop. As a former fisheries scientist and manager, I have spent much time in this very building discussing, among other things, bycatch problems in fisheries and management approaches to dealing with these. Of course in those days, while we were

aware of the dangers posed to birds, reptiles and mammals by fishing gear, it was not these bycatch issues that concerned fisheries managers most greatly; it was rather the bycatch of non-target fish species, most particularly where these were also commercially harvested species. Only in recent years has attention focused more clearly on some of the potentially more serious consequences of fisheries bycatch for biodiversity and the survival of non-fish species.

In my brief presentation today, I would like to address some general aspects of the bycatch problem and the evolving institutional context in which this problem is being addressed. I will then look briefly at general approaches to finding solutions and at some of the initiatives and involvement of IUCN in addressing the issue.

Bycatch has been defined in many ways, but the fundamental element is that such catch is not the primary species sought; while bycatch may be a very important component of a fisheries catch because of the market value of the particular species, the more usual situation is that the bycatch cannot be used and is thus discarded. Generally the discarded animals are dead because only seldom is it possible to release them alive. When dealing with non-fish species such as birds, whales, and sea turtles, quite apart from there being no economic advantage in the bycatch of these species, the accidental capture and death of some endangered species may even pose risks to species survival and thus to biodiversity in general.

A related problem in fisheries management is one of discards. These are quantities of target species that are too small or too damaged to be sold, or they may not be compatible with the particular fishing operation (e.g., due to specialised processing equipment, limited storage, etc.). Another reason for discarding may relate to the fisheries management regime in place, particularly if there is a price differential among various sizes of the target species. Fishermen may try to maximise their economic return from the allowed catch by discarding all but the sizes commanding the best price, while trying to stay within catch or bycatch allocations. Discarding may also occur because it is illegal to land a particular species, even though its capture may be unavoidable (for example some Atlantic salmon are taken in codtraps, even though every precaution may be exercised to avoid their capture, such as sinking the traps below the surface of the water).

Bycatch issues vary considerably from fishery to fishery. Some fisheries may be relatively "clean", such as the purse seining of herring. However, many other fishing gears are far less selective. Bottom trawls usually capture a wide range of species. This is particularly the case in tropical shrimp fisheries where a single trawl catch may contain many tens or even hundreds of species and the finfish bycatch may be ten times as large as the shrimp catch.

Bycatch and subsequent discarding were tolerated traditionally as a normal part of fishing operations, except where bycatch interfered with the fishing operations (such as plugging meshes or damaging gear). It is only more recently that substantive attention has turned to other biological impacts. Until recently, for example, no one imagined that a species such as the barndoor skate could actually be threatened with extinction by virtue of its excessive numbers in bycatch for other commercial species, yet there is increasing evidence that this is indeed possible (Casey and Myres 1998).

The existence of bycatch poses problems from a number of perspectives, both regarding the management of the target species and impacts of fishing on bycatch species. Where so-called "bycatch" species have a high economic value to the fishermen, fishing operations may be altered so as to cause a bias in the catch and effort data which are collected and used in assessing the state of the stocks of the target species. This can have direct negative consequences for the conservation regime of the target species.

However, bycatch can be a much more serious problem especially for low-fecundity, long-lived species; among fish, these include particularly the skates and sharks. The incidental mortality of marine mammals, seabirds, and turtles has also become more and more prominent as an issue of high concern in recent decades.

Recognition of the Bycatch Problem

Our perceptions of bycatch as a more serious problem was heightened by some high profile situations as listed below.

- Over 220,000 seabirds, mainly Thick-billed Murres, and 1500 harbour porpoises were taken by driftnets in the non-Greenland fishery for Atlantic salmon off West Greenland during 1972 (Christensen and Lear 1977, Lear and Christensen 1975). This fishery was since closed for the reasons related to salmon conservation.

- The 1970s saw the emergence of bycatch in the Eastern Pacific tuna purse seine fishery as a major conservation problem for dolphins. This resulted in aggressive legislative action, technological developments and a substantial improvement in the situation.

- The 1980s witnessed a major bycatch of marine mammals and seabirds in the Pacific high seas driftnet fisheries, the so-called "walls of death," before international action was taken to prohibit this activity.

- The 1994 Alverson Report (Alverson, et al. 1994) was a real eye-opener, as it provided an estimate of 27 million tons as the amount of fish catch discarded each year (range 18-40 million tons). This served to illustrate the extent of the bycatch problem on a global scale.

- Bycatch thus became an issue for environmentalists concerned with biodiversity conservation, for humanitarians who saw wastage of potential food, and of course for the fishermen themselves.

Institutional Responses

The policy context has also evolved rapidly in recent decades with new instruments and processes which bear directly on the problem:

- The 1992 *UN Convention on the Law of the Sea* (UNCLOS), in Article 61(4), specifies the obligations of States to consider the effects of fishing operations on "species associated with or dependent upon harvested species with a view to maintaining or restoring populations of such associated or dependent species above levels at which their reproduction may become seriously threatened."

- The 1992 *United Nations Conference on Environment and Development Agenda 21* provides an international framework for a global partnership in creating future agreements and understandings with respect to the environment, development and sustainable use of resources. It provides guidelines for sustainable development at the national level, and stresses the conservation, sustainable use and development, integrated management and environmental protection of marine living resources. It deals broadly with issues pertaining to genetic variability within species, the survival of species, and the integrity of ecosystems. But more specifically, Paragraphs 17.46 and 17.87 calls for States working alone and together, respectively, to:

  "Promote the development and use of selective fishing gear and practices that minimize waste in the catch of target species and minimize by-catch of non-target species and to develop agreed criteria for the use of selective fishing gear and practices to minimize waste in the catch of target species and minimize by-catch of non-target species... ."

The *Convention on Biological Diversity* entered into force in December 1993 as the first global convention to concentrate on conservation and sustainable use of species and ecosystems. The convention strives for "the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources." It has called on Parties to, *inter alia*:

- Cooperate directly and through international organisations for the conservation and sustainable use of biological diversity;
- Cooperate internationally for biological monitoring;
- Develop inventories of biological diversity; and
- Establish a system of protected areas and a set of criteria for their selection and management, and to conserve biological diversity outside protected areas.

In 1997, at a meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) held in Montreal, the topic of Conservation and Sustainable Use of Marine and Coastal Biological Diversity was thoroughly examined so that advice on recommended actions could be offered to the Conference of the Parties (COP). A committee of experts on marine and coastal biodiversity was appointed to develop a three-year work plan. Among its relevant elements were specific directions on developing collaborative links, collecting and disseminating information, arranging expert meetings and promoting capacity building in relation to ecosystem effects, notably on bycatch and other harmful fishing practices.

The 1995 Kyoto Conference was one of the largest international conferences ever held on fisheries. The conference adopted by consensus the Kyoto Declaration and the Kyoto Plan of Action. The Declaration, recognising present problems surrounding world fisheries, stipulates policies towards better management of fisheries. The Action Plan lists actions that should be taken urgently. This was the first major fisheries gathering to focus on the impacts of fishing on the ecosystem and biodiversity and as such was a precursor to the agreements and conventions discussed below.

The 1995 *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* includes biological reference points and application of the precautionary approach. The objective of the Agreement is to ensure the long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks. Among its General Principles is the promotion of the assessment of ecosystem impacts of fishing, minimising bycatch and the protection of biodiversity.

The Agreement requires States to "minimise pollution, waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, and impacts on associated or dependent species, in particular endangered species, through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques." It has more specific sections that require states to "protect biodiversity in the marine environment." Further, the "catch of non-target species, both fish and non-fish species, in particular endangered species must be minimised."

The FAO *Code of Conduct on Responsible Fisheries* (1995) sets out principles and international standards of behaviour for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity. It states in Article 6.6 that: "Selective and environmentally safe fishing gear and practices should be further developed and applied, to the extent practicable, in order to maintain biodiversity and to conserve the population structure and aquatic ecosystems. States and users of aquatic ecosystems should minimise waste, catch of non-target species, both fish and non-fish species, and impacts on associated dependent species." Further Article 7.2 defines as Management objectives that: d) biodiversity of aquatic habitats and ecosystems is conserved and endangered species are protected; e) depleted stocks are allowed to recover or, where appropriate, are actively restored; and f) adverse environmental impacts on the resources from human activities are assessed and, where appropriate, corrected... ."

In 1999 FAO adopted a voluntary *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries*, elaborated within the framework of the Code of Conduct for Responsible Fisheries. The IPOA-Seabirds applies to States in the waters of which longline fisheries are being conducted by their own or foreign vessels and to States that conduct longline fisheries on the high seas and in the exclusive economic zones of other States. Taking into account in particular the objectives of articles 7.6.9 and 8.5 of the Code of Conduct, the objective of the IPOA-Seabirds is to reduce the incidental catch of seabirds in longline fisheries where this occurs.

A common thread through all of these international conventions and agreements is the

precautionary approach, the exercise of due diligence to prevent the kinds of problems posed by excessive bycatch, by recognising that the environmental, and indeed the economic consequences (Pitcher and Chuenpagdee 1994, Pascoe 1997), can be severe. Another common element identified is the pressing need for more precise data gathering on the extent and magnitude of the problem. For example, in its special meeting on bycatch, COFI called upon all States to increase their surveillance and intelligence on "illegal, undocumented and unreported fishing." Indeed, it was a conclusion of the Workshop on the Bycatch of Seabirds held in Sidney B.C. in December 1998 (Morgan, et al. 1999) that, in countries with well- established fisheries observer programmes such as Canada, it would be relatively easy to expand these observer programmes to address the specific question of bycatch of seabirds as well.

This evolving policy context has thus led us to a much more aggressive pursuit of initiatives to address the problem, including a wide range of legal instruments and other mechanisms. We thus have both the recognition of the generic problem and a range of instruments and processes in place. What we need is to maintain the will and commitment to address the problem. Unfortunately issues often drift off the public agenda not because the problems have been solved, but because of fatigue or because they have been displaced by other high profile issues. We need only look to acid rain for an example of this process.

Mitigation Measures

While I do not wish to review in detail the range of measures that are available to reduce the negative aspects of bycatch and discarding I would like to make a few observations. To begin with, we need good information both on the extent of the bycatch and its significance to the bycatch species. This implies good monitoring and reporting of bycatch. It also implies the need for reasonable knowledge of the demographics of the bycatch species. It does not imply however, that mitigation should await refined data and analysis. We can apply general models and employ the precautionary principle in an adaptive management strategy.

Approaches may be regulatory or employ incentives/disincentives such as those listed below.

- Based on spatial and temporal patterns of abundance of the bycatch; e.g., by imposing seasons or closed area restrictions on a fishery to reduce the use of gillnets near seabird colonies in the breeding season.

- Establishment of Marine Protected Areas in areas of the ocean where significant seabird or other vulnerable populations are known to congregate for feeding or reproduction, so as to completely eliminate the incidence of accidental bycatch in these areas.

- Much can be accomplished through technological changes or improvements. We need to bear in mind that fishing gear has generally been designed for catching effectiveness not selectivity or avoidance of incidental mortality. We tend to know more about the behaviour of target species in relation to fishing gear i.e.: the process of evasion, escape or capture. We need to understand more about the behaviour of bycatch species and how fishing gears are operated in fishing. Technological changes can be employed in a variety of ways: fishing gears can be modified to reduce bycatch or catch of unwanted sizes of target species through adjustments in mesh sizes, hook sizes, etc., and gear can be

modified to take advantage of differences in behaviour of the different species, e.g., use of selection devices in trawls, aprons in purse seines coupled with backing up techniques (tuna/dolphin). Additional changes include: gear that can be modified to take advantage of the different size spectra of the targeted species and the bycatch species, such as the use of the Nordmore Grid in shrimp trawls to eliminate the catch of larger groundfish such as cod and redfish, while permitting the capture of the smaller, targeted shrimp, and special techniques can be used to keep the bycatch species from interacting with fishing gears; e.g., sonic pingers and acoustically visible components of fishing gear to discourage marine mammals, curtains and scarer devices to discourage birds feeding on longline baits, coupled with techniques to reduce the availability of baits (such as measures to sink longlines faster, etc.).

Dialogue and co-operation of all involved in recognising the significance of bycatch in the maintenance of species abundance, biodiversity and healthy ecosystems is essential for progress to be made. We need to address the social and economic dimensions at the same time as the biological. The productive approach is not one of good guys/bad guys, but of cooperating allies. Fishers themselves can often generate the innovations needed to reduce bycatch problems. It is very often to their immediate benefit (e.g., through increasing their efficiency) and longer term benefit (as the market increasingly moves to reward good conservation practices).

A major contribution to reducing the bycatch problem would come from addressing one of the key problems facing the management of most of the world's major fisheries; i.e., over-harvesting, usually associated with over-capacity and over-capitalisation of fishing fleets. Effective resource management, including maintaining high populations and catch rates of target species and reducing the level of fishing effort, could have a major positive impact on biodiversity conservation and contribute enormously to the economic and social security of those dependent on marine resources for their livelihoods.

The seabird bycatch problem is perhaps best viewed as a part of the broader bycatch problem, which is itself a part of the broader suite of problems facing the management of marine living resources. We thus need to nest our specific actions within a broad ecosystem approach.

Role of IUCN

The IUCN (as well as other organisations) has taken a direct interest in the bycatch issue as is reflected, for example, in the resolutions and recommendations adopted at our first World Conservation Congress, the "Montreal Congress," convened in 1996. Resolution 1.15, Incidental Mortality of Seabirds in Longline Fisheries, called upon AIUCN, its members, all states and regional fisheries institutions to reduce incidental seabird mortality within longline fisheries to insignificant levels for affected species' and urged a suite of related actions. Resolution 1.16, Fisheries Bycatch, called for an initiative in the IUCN programme using the expertise of all its Commissions "and the broad membership of IUCN to substantially reduce, and eventually reduce to insignificant levels, all fisheries bycatch in the long-term interest of marine biodiversity conservation... ." Resolution 1.17 on Coastal and Marine Conservation and Management dealt more generally with the broad problems of unsustainable resource use practices, and strengthened the call for member States to embrace the international conventions and agreements mentioned above.

Since that time, the IUCN has pursued a number of initiatives in this regard.

In 1998, IUCN and World Wildlife Fund (WWF) issued a joint global marine policy statement, "Creating a Sea Change," which focuses in three of its five objectives (Marine Protected Areas, Threatened Marine Species, and Fishing in a Sustainable Manner) on ways and means of avoiding harmful effects such as those created through bycatch.

IUCN has participated in the processes under the aegis of FAO in the development of the IPOA-Seabirds and on shark management. IUCN representatives (including Secretariat staff, representatives of the Species Survival Commission's Shark Specialist Group and TRAFFIC) promoted adoption by the FAO Committee on Fisheries (COFI) of the strongest possible international programmes of action. In this, IUCN has worked closely with Birdlife International, WWF, and with our IUCN Antarctic Advisory Committee.

Our Marine Programme is promoting a dialogue on the bycatch problem and is looking to convene a forum on policies and technologies to manage bycatch and discards in fishing. This should allow a more open and flexible participation and dialogue than might exist in formal inter-governmental consultations. With our broad network of offices and experts, and our ability to bring together players from government and civil society, IUCN could also play a useful role in contributing to progress on this topic under the framework of the IPOA-Seabirds.

From the perspective of IUCN, we are keenly interested in your work on seabird bycatch in arctic countries, how this fits into the bigger picture, and ways in which we can work with you on the problem. We particularly welcome the circumpolar perspective brought to bear by the Arctic Council and its working groups. Indeed, we were pleased to work with the Conservation of Arctic Flora and Fauna and Protection of the Arctic Marine Environment programs to organise a Circumpolar Arctic Marine Workshop in Montreal, in November 1999. As IUCN formalises its continuing relationship with the Arctic Council through permanent Observer Status, and moves to complete the development of its Arctic strategy, we look forward to working more closely with you in the future.

Thank you for the opportunity to speak at your opening session.

3.1.3 **Addressing the Problem: Seabird Mortality from Longline Fisheries in the Waters of Arctic Countries.** J. Cooper,[1] E. Dunn,[2] D. W. Kulka,[3] K. H. Morgan,[4] and K. S. Rivera[5], [1]BirdLife International Seabird Conservation Programme, Avian Demography Unit, University of Cape Town, Rondebosch 7701, South Africa; [2]Royal Society for the Protection of Birds, The Lodge, Sandy, Beds SG19 2DL, UK; [3]Department of Fisheries and Oceans, P. O. Box 5667, White Hills, St John=s, Newfoundland A1C 5X1, Canada; [4]Canadian Wildlife Service, Institute of Ocean Sciences, P. O. Box 6000, Sydney, British Columbia V8L 4B2, Canada; [5]Protected Resources Division, National Marine Fisheries Service, P. O. Box 21668, Juneau, Alaska 99802, USA.

Introduction

Demersal and pelagic fishing by longline is a common method practised in many parts of the world (George 1993, Bjordal and Løkkeborg 1996). Slowly moving vessels setting longlines with baited branch lines attract seabirds that habitually forage by scavenging at or near the sea surface. These birds may then be caught on hooks while seizing baits before they have sunk more than a few metres. The birds subsequently drown as the weight of the line drags them under (e.g., Brothers 1991). The deaths of sometimes large numbers of birds in this way has led to calls for the adoption of mitigation methods (e.g., Alexander et al. 1997; IUCN 1997; Cooper and Wanless 1999). Proven methods exist to reduce substantially seabird mortality on longlines (Brothers et al., 1999). Initiatives have been taken at a number of inter-governmental fora in the last few years to address the problem. For example, the Food and Agriculture Organisation of the United Nations (FAO) adopted its voluntary *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries* (IPOA-Seabirds) in 1999 (FAO 1999). Regionally, the *Conventions for the Conservation of Antarctic Marine Living Resources* and for the *Conservation of Southern Bluefin Tuna* have been active in reviewing the problem in the southern hemisphere and passing conservation measures to reduce its scale (Cooper et al. in press). Recently, the 6th Conference of Parties to the *Convention for the Conservation of Migratory Species of Wild Animals* (the Bonn Convention) adopted a resolution urging the development of a regional Agreement in the southern hemisphere for albatrosses, primarily because of the threats they face from longlining (CMS 1999). An inter-governmental meeting to draft this Agreement was held in Hobart, Australia in July 2000. Regional initiatives in the northern hemisphere have also taken place (Melvin and Parrish in press; this workshop). The Circumpolar Seabird Working Group of the Conservation of Arctic Flora and Fauna (CAFF) Program of the Arctic Council has reviewed the mortality of seabirds in commercial fisheries in seven Arctic countries, but with only limited attention paid to longlining (Bakken and Falk 1998). Mortality of Black-footed Albatrosses *Phoebastria nigripes* from longlining in the North Pacific, including in the Bering Sea/Aleutian Islands and Gulf of Alaska areas, was considered at a workshop in Hawaii, U.S. in October 1998 (Cousins & Cooper 2000).

We review what is currently known about seabird mortality (including historical information) from longline fisheries in the waters of nine high-latitude countries in the northern hemisphere: U.S.(Alaska), Canada, Greenland, Iceland, the Faeroe Islands, Norway, Sweden, Finland and Russia. All but the Faeroe Islands are members of CAFF. Where data are available, estimated annual mortality levels of affected species expressed as a proportion of their regional and global populations are used to prioritise potential conservation needs. Mitigation measures in use by each country are described and mitigation research mentioned. Progress in producing National Plans of Action in terms of the FAO's IPOA-Seabirds is then reviewed. Lastly, the desirability of a regional agreement to reduce seabird mortality in longlining by Arctic countries under the auspices of CAFF is addressed.

Methods

Information in this paper was gathered from both published and unpublished sources. It is to be noted that estimates of seabird mortality for each fishery considered are based on the best available data, gathered by observer programs with an often low percentage coverage of the fishing fleet (McElderry, et al. 1999), from fisher's logbooks, dockside interviews, recoveries of banded birds or reports of individual observers. Not all observer programs require bird mortality

data to be collected, or have observers sufficiently trained in bird identification. Again, not all programs that do record bird mortality (unusually by mass in some Canadian Atlantic fisheries, rather than by numbers) identify all killed birds to species, and none as yet gather data on sex and age class. Further, population estimates for most Arctic seabirds affected by longlining are incomplete, especially for all age classes. Because of all these limitations, estimates of seabird mortality given here are imprecise, but we believe there are sufficient data available to establish that many Arctic longline fisheries do cause seabird mortality at levels of conservation concern.

National Reviews

United States Of America

The U.S. longlines for Pacific cod *Gadus macrocephalus*, sablefish *Anoploma fimbria* and other demersal "groundfish" in the Arctic waters of the Bering Sea/Aleutian Islands region (BSAI) and in the Gulf of Alaska (GOA). Directed fishing for Pacific halibut *Hippoglossus stenolepis* is managed by the International Pacific Halibut Commission, in collaboration with the North Pacific Fishery Management Council and the National Marine Fisheries Service (NMFS). Vessels range from small boats to over 50 m in length (Brothers, et al. 1999; Stehn, et al. in press). There were 916 vessels registered in the groundfish fishery (which set *c*. 190 million hooks) and 1,247 in the Pacific Halibut fishery in 1998.

The U.S. also undertakes longlining outside Arctic waters in both the Pacific and Atlantic Oceans, primarily for pelagic species, in which bird mortality also occurs (Brothers et al. 1999, Cousins and Cooper 2000).

Within Arctic waters, only the groundfish fishery has onboard observer requirements, resulting in estimates of bird mortality. Data collected by the North Pacific Groundfish Program show that estimated annual mortality rates between 1993 and 1997 were 0.09 birds/1,000 hooks in the BSAI and 0.06 in the GOA (Stehn, et al. in press). Total estimated annual mortality was 14,031 birds over the same time period (range 9,400-20,200). Approximately 83% of the mortality occurred in the BSAI region.

Northern Fulmars *Fulmarus glacialis* represented about 66% of the estimated mortality, gulls *Larus* spp. 18%, albatrosses *Phoebastria* spp. 10%, and shearwaters *Puffinus* spp. 5% (calculated from Stehn, et al. in press). Only one Short-tailed Albatross *P. albatrus* was observed killed, although a total of six has been reported killed by longline fisheries over the period 1987-1999 (out of a total species population of only 1,200 birds, H. Hasegawa pers. comm.). The estimated annual mortality of fulmars (9,309) represents a small percentage (0.4%) of the estimated Alaskan breeding population of over a million pairs and only 0.2% of the total estimated Pacific population of 4.6 million birds, which includes Asian and non-breeding birds (Hatch and Nettleship 1998) and is thus not thought to be a serious conservation problem.

The situation with the Glaucous Gull *Larus hyperboreus* may be different. Applying the ratio of Glaucous to all identified gulls observed killed over the period 1993-1997 (81/235; Stehn et al. in press) to the total number (2,574) of gulls, including those unidentified to species, estimated killed annually suggests that 888 Glaucous Gulls may have been killed per year. Given an estimated

breeding population in Alaska of 15,000 pairs (Vermeer et al. 1993), this represents an annual mortality from longlining of 3.0%. This is a high enough figure to be of some conservation concern, although tempered by the fact that no account is taken here of the non-breeding part of the population, the fact that the species breeds in Russia and the two populations may intermingle, and that the Alaskan breeding survey dates from the 1970s. There is clearly a need to reassess the population size of this species, ascertain trends in its Alaskan population, and obtain better estimates of mortality from longlines, including by age-classes. To realize this, there is a need for the retention of samples of killed birds for expert examination, especially because the very large majority (91%) of gulls reported killed were not identified to species. This observation applies equally to all species killed (Stehn et al. in press).

Because of their larger populations, equal concern is not expressed for the Glaucous-winged Gull *L. glaucescens* (133,000 breeding pairs in Alaska, estimated annual mortality from longlining 0.6%) or Black-legged Kittiwake *Rissa tridactyla* (2.6 million birds on the North Pacific) (Hatch et al. 1993, Vermeer et al. 1993, Stehn et al. in press). Other species affected are either killed in small numbers (alcids) or have huge populations (shearwaters *Puffinus* spp.).

Estimated annual mortalities of Black-footed Albatrosses *P. nigripes* (642) and Laysan Albatrosses (*P. immutabilis* (715) over the period 1993-1997 represent small percentages (0.5% and <0.1%, respectively) of the total breeding populations of these two species of 62,000 and 558,000 pairs (Cousins and Cooper 2000). However, both species are killed by longlines elsewhere in the Pacific within their foraging ranges, so overall mortality is higher, leading to a conservation concern, especially for the former species (Cousins and Cooper 2000).

All the above calculations do not take into account birds killed by the halibut fishery, which does not have specific observer requirements. Trumble and Geernaert (1998) report on 3,018 dock-side interviews with 873 halibut fishing vessels in Alaskan ports. Only 67 birds (54 of which were fulmars) were reported killed, giving a catch rate of 0.006 birds/1,000 hooks. They considered this rate to be far too low, reflecting the inadequacy of this method of data gathering. There is a pressing need to obtain realistic annual mortality levels for all the longline fisheries in Alaska combined: this will require an observer scheme for halibut fishers managed by the International Pacific Halibut Commission, and the identification of all birds killed to species.

Use of mitigation measures has been obligatory in the groundfish fishery since 1997 and in the Alaskan halibut fishery since 1998 (Stehn, et al. in press). Government funds (US $ 400,000) have been made available for fishers to install mitigation devices on their vessels (U.S. Fish and Wildlife [FWS] press release, March 2000). A research project assessing the use of paired streamer lines and line weighting is currently underway to assess these and to make further recommendations (Melvin et al. 2000a,b, Stehn et al in press, see also Trumble 1998).

The U.S. made available its draft NPOA-Seabirds for public comment in December 1999 (Federal Register Vol. 64, No. 249, pp. 73017-73018). It is now under review by a Seabird Inter-Agency Working Group (made up of representatives of the U.S. Department of State, NMFS and USFWS) and the final version is expected to be published in the Federal Register during the course of 2000 (SIAWG 2000; A. Manville pers. comm.).

Canada

Canada undertakes longline fishing in both the North Pacific and North Atlantic Oceans. In the North Pacific off British Columbia, longline fishing is directed at Pacific halibut (5-6 million hooks set annually), spiny dogfish *Squalus acanthias* and rockfish *Sebastes* spp. (400,000 hooks) and sablefish (500,000 hooks) (McElderry 1998, Morgan et al. 1999). About 570 vessels are licensed to longline (McElderry 1998). Directed fishing for halibut is controlled by the International Pacific Halibut Commission. Limited direct information is available on bird mortality from these fisheries with only two Black-footed Albatrosses reported killed prior to 1998 (Brothers, et al. 1999, Morgan, et al. 1999), However, 805 interviews on levels of seabird mortality from 252 longline vessels in British Columbia ports during 1998 reported 25 birds killed (17 Black-footed Albatrosses, two Northern Fulmars, two shearwaters and four "others"; Trumble & Geernaert 1998). The authors estimated that this reported mortality came from 4.2 million hooks set for Pacific halibut (0.006 birds/1,000 hooks). Interviewed fishers reported four sightings of Short-tailed Albatrosses, but no fatalities. Along with Trumble & Geernaert (1998), we consider this level of mortality to be unrealistically low (compare for example with the Alaskan longline fisheries, where observers have reported levels roughly 10 times higher; Stehn et al. in press), reflecting the fundamentally flawed method of using dock-side interviews as a sole means of gathering data. In 1999, an observer program reported five Black-footed Albatrosses killed in a total of 269 fishing days by Canadian longliners in the Pacific Ocean (J. Fargo pers. comm.). Recent accounts by fishers indicate that high numbers of other species (thought to be Northern Fulmars) are quite frequently killed by longliners of the west-coast of Canada (G. Dalum pers. comm.).

Currently, no mitigation measures are required of Canadian longline fishers in the Pacific Ocean (Trumble and Geernaert 1998, Morgan et al. 1999). However, several vessels have voluntarily elected to use bird-scaring lines or other mitigation devices (G. Dalum pers. comm.). Gaining in popularity among biologists from Canadian and U.S. wildlife agencies is the notion that a "Pacific Coast Seabird Bycatch Working Group" should be established to address the problem along the west-coast of North America.

In North Atlantic Canadian waters, both demersal and pelagic longlining takes place. Demersal fishing is directed at Greenland halibut *Reinhardtius hippoglossoides*, Atlantic Halibut *Hippoglossus hippoglossus* and Atlantic cod *Gadus morhua*. Pelagic longlining is directed at porbeagle *Lamna nasus*, broad-bill swordfish *Xiphias gladius* and various tuna species *Thunnus* spp. The pelagic fishery falls under the International Convention on the Conservation of Atlantic Tunas, and takes place outside Arctic waters. Fisheries observers have been deployed to only 3-10% of the fleets' activities for these fisheries and have gathered information on seabird mortality since the mid-1980s, although birds have not always been identified to species.

Based on information collected by observers and compared to landing data, it is estimated that, on average, 75 million hooks have been deployed annually in the demersal and pelagic fisheries since the 1980s off Atlantic Canada. This estimate does not include the Gulf of St. Lawrence where seabird bycatch has not been recorded by observers. The fisheries have changed greatly over the years thus affecting the bycatch of seabirds over time. For example, prior to the mid-1980s, longlining for cod offshore by non-Canadian fleets was common off Nova Scotia, Newfoundland and Labrador, and to a lesser extent in the Gulf of St. Lawrence until the 1992 groundfish moratorium (Bakken and Falk 1998, Brothers at al. 1999). Limited longlining for cod

commenced again in 1997 along the south coast of Newfoundland. The effect of the historic cod longline fishery on seabirds is unknown. The tuna/swordfish and halibut fisheries have been exploited over the entire time period whereas turbot fishing off northern Labrador has been reduced since the mid-1990s. All of these changes have affected the numbers of birds killed.

Demersal longline fisheries in Canadian Atlantic waters had an associated bycatch rate of 0.016 birds/1,000 hooks over the 12-year period between 1986 and 1999. On average, 1.3 birds were taken on 3,100 hooks (per set) from the 27 demersal sets observed with seabird bycatch. It is estimated that 514 birds have been killed annually by demersal longliners, although the numbers have varied greatly from year to year depending on fishing effort. The fishery for Greenland halibut, taking place in an area along the shelf edge between Canada and Greenland, has been the primary source of mortality of seabirds by demersal longliners in Canadian Atlantic waters, with observers reporting mortality of Northern Fulmars and Great Black-backed Gulls *Larus marinus* at a rate of about 0.02 birds/1,000 hooks. Farther to the south, although Sooty *Puffinus griseus* and Greater *P. gravis* Shearwaters, murres or guillemots *Uria* spp. and Atlantic Puffins *Fratercula arctica* have been regularly captured in gillnets in the reopened cod fishery along the south coast of Newfoundland, no bird bycatch has been observed from demersal longliners fishing the same area, species and time period. The small breeding population of Northern Fulmars in Newfoundland is currently growing in size (Stenhouse and Montevecchi 1999).

The catch rate for pelagic longline fisheries in the Canadian Atlantic (outside Arctic waters) is estimated as 0.032 birds/1,000 hooks, double that observed for demersal fisheries. All of this fishing effort has taken place along the outer slope of the Scotian Shelf and the south-west slope of the Grand Banks. It is estimated that 1,393 birds have been killed annually by pelagic longliners. Bird mortality has been recorded when directed at tuna and swordfish but not for porbeagle. On average, four birds were taken on 1,700 hooks (per set) from the 55 pelagic sets observed with seabirds between 1986 and 1999. Species recorded were Northern Gannet *Morus bassanus*, Herring Gull *L. argentatus* and Great Black-backed Gull. Until recent years, most bird records in this fishery were not identified to species and it is thought that some of the catch may have also comprised shearwaters, since Sooty and Great Shearwaters have been captured in gillnets in the same and adjacent areas. None of the affected species is considered to be at serious conservation risk.

Currently, no mitigation measures are required for Canadian longline fisheries in the Atlantic Ocean, although some fishers do employ voluntary methods, such as towing a buoy during setting (J. Porter pers. comm.). Identification of seabirds killed by longline fisheries is now included within observer training programs for both Atlantic and Pacific Canadian longline fisheries (M. Showell and J. Smith pers. comm.). The Canadian Department of Fisheries and Oceans and the Canadian Wildlife Service recently constituted a joint National Working Group on Seabird Bycatch, which intends to produce a National Plan of Action, following an assessment to be conducted during the course of 2000, which will include a public consultation phase (J. Porter pers. comm.).

Greenland

Longlining off Greenland is concentrated on Greenland halibut in fjords and off the west and east coasts (Bakken and Falk 1998, F. Merkel pers. comm.). The fjord fishery (15,000-20,000 t

annual catch) is made up of small domestic vessels, whereas offshore fishing (1,000 t) in both west and east Greenland is conducted by Greenlandic and Norwegian vessels (Brothers at al. 1999, T. Hjarsen and F. Merkel pers. comm.). F. Merkel (pers. comm.) considers that the inshore fishery does not affect birds, based on the lack of reports by fishers and from fishery surveys. However, offshore fishing is presumed to kill Northern Fulmars, given that there are an estimated 200,000 to 750,000 breeding pairs in Greenland (Lloyd et al. 1991) and Canadian longlining vessels in the general region have reported mortalities (see above). However, there are no reports of bird mortality by dock-side inspectors (T. Hjarsen and F. Merkel pers. comm.). A small-scale longline fishery for wolffish Anarhichas spp. (200 t annually) exists in west Greenland in summer, with no bird mortality reported. In 1992/93, experimental longlining conducted off south-west Greenland resulted in some hundreds of Greater and/or Sooty Shearwaters being killed (T. Hjarsen and F. Merkel pers. comm.). Fishing in this region no longer occurs. No mitigation measures are currently required in Greenlandic waters and there are no onboard observer programs (T. Hjarsen and F. Merkel pers. comm.). Greenland has not as yet formally assessed the need for an NPOA-Seabirds.

Iceland

Icelandic longline vessels fish for Atlantic cod, tusk *Brosme brosme*, haddock *Melanogrammus aeglefinus* and other demersal fish species. In 1996, the fleet was composed of 805 vessels, setting 230 million hooks, of which 330 decked vessels caught 84% of the landings (Bakken and Falk 1998; Brothers et al. 1999).

Five banded Northern Fulmars and 15 Great Skuas *Catharacta skua* have been reported as killed on longline hooks over the period 1932 to 1994 (Bakken and Falk 1998; A. Petersen pers. comm.). The former species is caught in large numbers, but no quantitative data are available. A. Petersen (pers. comm.) surmised that the Icelandic fleet annually kills "thousands or low tens of thousands of fulmars". The Icelandic populations of these two species are 5,400 breeding pairs of Great Skuas and 1-2 million pairs of Northern Fulmars (Tucker and Heath 1994; Snow and Perrins 1998). The higher number of banded skuas recovered compared to fulmars may reflect greater numbers banded, rather than a greater propensity to be hooked.

At least one longline vessel uses a streamer line (J. O. Hilmarsson pers. comm.) although no regulations for use of mitigation measures or observer schemes to record mortality exist (Brothers et al. 1999). Iceland currently has no plans to produce an NPOA-Seabirds (K. Lilliendahl and A. Petersen pers. comm.) although it is considered that an assessment at least is required.

The Faeroe Islands

In the 1997/98 fishing season the Faeroes had a demersal longlining fleet of 718 vessels of varying sizes (644 small [less than 15 tonnes; gross registered tonnage] inshore vessels, 55 medium sized [15-110 GRT] vessels undertaking one- to two-day fishing trips within Faeroese waters and 19 large [>110 GRT] vessels fishing offshore, J. Reinert pers. comm.). Numbers of hooks set in 1997/98 for these three categories, were about 3.1, 42.3 and 107.7 million, respectively. Fish targeted are mainly Atlantic cod and haddock. In the past, Atlantic salmon *Salmo salar* were caught by longlines resulting in mortality of guillemots (murres) but this fishery is now closed.

The Northern Fulmar is the species most commonly taken, with mortality rates varying markedly between seasons and areas (B. Olsen pers. comm.). Indirect evidence for mortality of Great Skuas comes from banded birds received from "vessels at sea". The Faeroes support about 275 breeding pairs of Great Skuas and an estimated half a million pairs of Northern Fulmars (Hagemeijer and Blair 1997, Snow and Perrins 1998).

Nothing is known of mitigation measures in place, whether observer schemes exist or of plans to produce an NPOA-Seabirds.

Norway

In the past, Norway undertook pelagic longlining for Atlantic salmon, a fishery now closed. In 1969, a single longliner fishing for salmon killed 294 birds in 75 fishing days. The species involved included Northern Fulmar (52), Northern Gannet (3), Black-legged Kittiwake (43), guillemots or murres (107) and Atlantic Puffin (83) (Brun 1979). Based on the figures, Brun (1979) extrapolated to the then 120-vessel fishery to obtain estimates of 60,000 birds killed each summer.

Norway now undertakes demersal longlining only. Fish species caught include Atlantic cod, haddock, tusk and ling *Molva molva*. In 1996, the longlining fleet was comprised of 813 vessels (79 over 25 m, which landed 60% of the catch). Sixty-one autoliners set an estimated 476 million hooks in 1996 (Brothers et al. 1999). However, many other vessels use longlines on occasions; in 1996 vessels that set a longline at last once numbered 9,206 (BirdLife International 1999).

Seabirds killed by Norwegian demersal longliners include Northern Fulmars, Northern Gannets, Great Skuas, Glaucous Gulls, Great Black-backed Gulls, Lesser Black-backed Gulls *L. fuscus* and Herring Gulls (Bakken and Falk 1998; BirdLife International 1999; Brothers et al. 1999; Steel et al. 2000). Northern Fulmars were taken in the greatest numbers.

BirdLife International (1999) estimated the numbers of Northern Fulmars killed by the Norwegian autolining fleet in 1996, taking into account seasonal differences in catch rates, at 9,900 birds from the 476 million hooks set. The whole longlining fleet was roughly estimated to kill 20,000 fulmars annually, but the total might actually be as high as 50,000 to 100,000 birds. A conservative estimate of 50,000 to 100,000 fulmars (and possibly as much as twice as many) may be killed annually by the combined Nordic longlining fleets of Iceland, the Faeroe Islands and Norway (BirdLife International 1999; Steel et al. 2000). With an increasing population of about 2-4 million breeding pairs in the north-east Atlantic (Snow and Perrins 1998), this level of mortality (5% annually at the very most, which calculation does not take into account the large non-breeding population; Hatch and Nettleship 1998) is not considered to be of serious conservation concern (BirdLife International 1999).

The nominate subspecies of the Lesser Black-backed Gull *L. f. fuscus* occurring in northern Norway with a decreasing population of only 500-1,000 breeding pairs is listed as Endangered in the Norwegian Red Data Book (Myklebust 1996). It is regarded as at risk from longlining, although actual records of mortality are few (BirdLife International 1999, Steel et al. 2000).

Most of the large Norwegian longliners now voluntarily deploy bird-scaring or streamer lines (E.

Lekven pers. comm.), and underwater setting tubes have also been utilized on two vessels. Research has been undertaken as to the efficacy of streamer lines and underwater setting tubes, both singly and in combination (Løkkeborg 1998, BirdLife International 1999, G. Robertson pers. comm.). Mortality of seabirds ranged from 1.75 birds/1,000 hooks without mitigation measures to a low of 0.03/1,000 hooks with mitigation measures (BirdLife International 1999, Steel et al. 2000). No obligatory mitigation measures and observer schemes that record bird mortalities exist. Norway is currently producing an NPOA-Seabirds with a draft expected during 2000 (E. Lekven and S. Løkkeborg pers. comm.).

Sweden

No direct information has come to hand. It would seem, however, that very little longlining takes place in the Baltic Sea (see below).

Finland

In the past, Finland undertook longlining for Atlantic cod in the southern Baltic Sea, but this fishery declined after the stock collapsed in the early 1980s from eutrophication and low salinity, and has now practically ceased altogether (Brothers et al. 1999; M. Hario pers. comm.). Divers or loons Gavidae are reported as having been "entangled" in longlines in small numbers in the past (Bakken and Falk 1998, Brothers et al. 1999), but mortality from longlining is now considered to be "very small or nil" in Finnish waters (M. Hario pers. comm.).

Russia

Russia has undertaken longline fishing in two widely separate regions. In the western area comprising the Barents and White Seas, a small-boat longline fishery existed for Atlantic cod until the 1950s (Bakken and Falk 1998). This fishery was not thought to have caused mortality of seabirds. An autoliner has been fitted out to catch blue catfish *Anarhichas denticulatus* in the Barents Sea in the last few years (Brothers et al. 1999).

Longlining for Pacific cod and Pacific halibut takes place in the eastern regions, in the Sea of Okhotsk and the Bering Sea in the vicinity of the Kamchatka Peninsula (Brothers et al. 1999). Nothing is known of the size of this fishery, or its effects on birds, although it may be assumed that mortality occurs, given the USA experience in the Bering Sea.

No information is to hand on whether Russia intends to produce an NPOA-Seabirds, although it should be noted that the country is not a member of the FAO.

Discussion and Conclusions

Of the nine countries considered in this paper, all but Sweden and Finland undertake longline fishing. Of these seven, seabird mortality has been recorded for five, and it almost certainly occurs off Greenland and Russia. The species killed in the most numbers is the Northern Fulmar, but more conservation concern exists for the three species of North Pacific albatrosses, especially the Short-tailed Albatross. The conservation situation of Glaucous Gulls in the Pacific and the nominate Lesser Black-backed Gull of Norway needs to be assessed.

As far as it is known, only three CAFF countries are producing, or planning to produce, a National Plan of Action for Seabirds: the USA, Canada and Norway. It is considered that Iceland and the Faeroe Islands have serious enough mortality problems to warrant the production of NPOA-Seabirds. Both Greenland and Russia should undertake an assessment, following the FAO guidelines (FAO 1999), in order to ascertain whether production of NPOA-Seabirds is required.

It is clear that the levels of knowledge of mortality rates and mitigation measures, as well as their level of adoption, vary greatly among the Arctic countries. Such knowledge needs to be obtained by observer programs with adequate coverage that employ properly trained observers. Information on the status of seabird populations and therefore of the impact of longlining mortality, also vary between countries. It is therefore suggested that countries that are members of the Arctic Council consider the desirability of adopting a regional inter-governmental agreement, to be administered by the CAFF Program, which would aim to reduce seabird mortality from longlining (as well as from other fishing methods), by way of sharing biological knowledge and technical expertise and by the setting and adopting of obligatory mitigation measures. Such regional cooperation is encouraged by the FAO in Paragraph 19 of its IPOA-Seabirds (FAO 1999). In this regard it is noteworthy that only two Arctic countries, the USA and Norway, have to date conducted research on mitigation methods. Their findings need to be disseminated to the other longlining countries in the region.

Lastly, it could be argued that national action is only necessary when species are at conservation risk, a situation that does not appear to apply to the species most commonly killed on longlines in Arctic waters: the Northern Fulmar. However, the IPOA-Seabirds is not predicated on the conservation status of affected species but rather adopts the principle of the FAO *Code of Conduct for Responsible Fisheries* of 1995 that ´States´ should minimize waste, discards, catch of non-target species, both fish and non-fish species, and impacts on associated or dependent species´ (Paragraph 8.5.1, FAO 1995). It is in this spirit that the Arctic nations should act in reducing the mortality of seabirds by their longline fisheries.

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3.2 Other Presentations

3.2.1 **Fisheries Bycatch: Does It Threaten The Long-Term Sustainability Of Sooty**

Shearwater (Puffinus Griseus) Harvest by Rakiura Maori? S. Uhlmann and H. Moller, University of Otago, P.O.Box 56, Dunedin, New Zealand.

The previous sessions of this workshop noted a need for more studies testing the impact of fisheries bycatch on seabird populations. This project intends to investigate the impact of fisheries operations on the New Zealand breeding populations of Sooty Shearwaters, an abundant procellariiform in the Pacific Ocean. They breed on scattered islands around Stewart Island (New Zealand) and the sub-Antarctic, and migrate to the northern Pacific during the Austral winter (Marchant and Higgins 1990). The Sooty Shearwater (also called titi, or muttonbird) chicks are culturally harvested by Rakiura Maori, the southernmost indigenous people of New Zealand (Wilson 1979).

In 1994, a research team of the University of Otago, based in Dunedin, New Zealand, approached the Rakiura Maori community and suggested to jointly apply ecological science to help manage their traditional harvest. The *Kia Mau Te Titi Mo Ake Tonu Atu* (AKeep the titi forever') research project was initiated (Moller 1996, Taiepa et al. 1997). Its main scientific objective is to measure the current level of titi chick harvest and assess whether this level is sustainable in the long-term. However, Rakiura Maori also requested investigation of impacts other than harvest because they are concerned that changes at sea may be causing population declines. Titi may be encountering new difficulties from climate change and incidental bycatch in various fisheries (longlines, gill- and trawl-nets). Population viability analysis identified adult mortality and immigration rates as most important determinants of population trends of titi (Hamilton and Moller 1995), and this has been subsequently reconfirmed in a more detailed "perturbation analysis," using a model of the demography of a closely-related and similar-sized congenor, *P. tenuirostris*, the Short-tailed Shearwater (Hunter et al. in press). Fisheries bycatch is a source of increased adult mortality and therefore has the potential to greatly affect population trends.

Published reports indicated that titi are susceptible to bycatch. They are one of the most abundant and widespread seabird species both on their summer breeding grounds in the South Pacific and winter feeding grounds in the North Pacific. They therefore encounter several fishing fleets on their trans-equatorial migration. In the late 1970s, bycatch rates of 40,000-130,000 Short-tailed Shearwaters (STSH) were reported in the Japanese salmon gill-net fishery (DeGange et al. 1993, Ogi 1984) and 200,000-700,000 Sooty Shearwaters (SOSH) were killed per year in the Japanese squid driftnet fishery in the early 1990s (Johnson et al.1991, DeGange 1993). These high seas fisheries have since been banned, so there is a need to update the studies to determine how many adults are still being killed.

Many estimates of bycatch do not differentiate between STSH and SOSH. Thus, it is necessary to consider both species together for some of our research questions. Good demographic information is also available for STSH (reviewed by Skira 1991), so combining data for both species is potentially very powerful. The high abundance and widespread distribution of both species, while making the bycatch less of an immediate conservation threat, offers several statistical advantages in searches for pattern and general rules about bycatch. We can use these two abundant and widespread species to rank the relative risk posed by a wide range of fisheries and fishing methods, and to measure the relative efficacy of bycatch mitigation methods being tested.

Preliminary analysis of a few autopsy samples collected in the New Zealand squid trawl fishery (n=95) showed that 85% of the SOSH were male (Bartle 2000, Robertson 2000). Is the same trend observed in other Pacific waters? This could potentially double the impact on a breeding population of this monogamous seabird species, because the female partner cannot reproduce successfully for several years if the male partner is killed. Any sex bias in the bycatch also offers the opportunity for an indirect and immediate check of bycatch demographic impact. If males are mainly taken and the bycatch is significant, we should find an excess of females in the non-breeding segment of the population. However, if bycatch has a trivial impact on demography, no such sex ratio bias should be detected. Seasonal and annual fluctuations in sex ratios of SOSH at their breeding colonies will be measured by mitochondrial DNA analysis of feather samples that have been collected over the last four years of fieldwork.

We will conduct a literature review and formal meta-analysis (Hedges and Olkin 1985) to describe the temporal and spatial patterns of fishing effort in relation to bycatch rates and distribution of SOSH and STSH in the Pacific Ocean. The meta-analysis will assess factors which account for the temporal and spatial variance in catch rates, such as climate effects, prey availability, fishing fleet/effort, etc. We will also review mitigation measures currently in use to reduce seabird bycatch and to evaluate their effectiveness for reducing catch rates of SOSH and STSH.

Most researchers treat fisheries bycatch as a threat independent of other at-sea impacts on populations (e.g., climate change, pollution, and food depletion). We are concerned that climate and food impacts may interact with fisheries bycatch in important ways. SOSH numbers have apparently declined over the past decade in direct relation to the frequency and intensity of El Niño climate perturbations (Lyver and Moller 1999, Lyver et al. in press). Global climate change, if impacting on the intensity and frequency of El Niños, therefore represents a significant threat to the long-term abundance of SOSH. However, one potential mechanism for the recent decline in numbers is that the El Niño weather pattern puts the SOSH "in collision" with the fishing boats, either because alternative foods are scarcer or the distribution of birds at sea is altered to overlap more with where the fishing occurs. This potential interaction is important because, should it exist, removal of the fishery bycatch threat would then remove the global climate change threat.

In summary, our study will address the following questions listed below.

1. Where and when does SOSH and STSH bycatch occur in the Pacific Ocean (latitude, longitude, season, month, day/night)?
2. Do relationships exist between bycatch risk and sea-surface temperatures, prey abundance patterns and El Niño, La Niña events?
3. Which fisheries predominantly catch SOSH and STSH (do fleet-size, fishing effort, observer coverage, use of mitigation measures predict risk)?
4. Is a particular sex or age class being killed and is this reflected in skewed sex and age structure of the remaining non-breeding population?
5. What is the overall impact of bycatch on current SOSH and STSH population trends?
6. How much must bycatch be reduced to ensure the ongoing sustainability of the titi harvest for Rakiura Maori?

Progress on so many fronts will depend on sharing and collation of existing data from several different agencies and colleagues. In some instances the data may simply not exist, in which case our aim will be to rank the importance of the gap in knowledge and recommend ways of filling that gap if it seems crucial.

With this impact study of bycatch on two abundant and widespread seabirds we hope to make a contribution toward a more generic understanding of the role of seabird bycatch on the status of seabird populations and its implications for conservation and management. Many of the lessons learned may help in the interpretation and management of the bycatch threat to rare or endangered species, and improving the prospects for long-term sustainability of a culturally and socially important traditional harvest of an abundant bird by Rakiura Maori.

3.2.2 **Thoughts On Reduction Of Seabird Bycatch In Fishing Gear Based On Experiences In Mitigation Of Cetacean Bycatch By Fisheries - Understanding Both Animals And Fishermen.**

J. Lien and C. Hood, Biopsychology Programme, Whale Research Group, Memorial University of Newfoundland, St. Johns, Newfoundland, Canada AlC 5S7.

Summary

Fishing technology has generally been designed for catching effectiveness. Selectivity and incidental mortality caused by fishing has generally been of secondary interest. Solutions to bycatch problems in fisheries require an understanding of the target species and non-target animals involved, and an understanding of fishing and fishermen.

Fisheries involved in bycatch problems exhibit some typical characteristics. Often they are smaller, fixed gear fisheries that, on balance, have relatively better environmental records. The task for scientists and managers attempting to reduce bycatch is to achieve mitigation in such a way that these fisheries are not marginalised. Fisheries bycatch may be a symptom of a variety of conditions in the fishery, including depletion of bait or target species, quotas and allocations, gear practices, effort and timing of fishing. Bycatch can be the symptom of problems in the fishing system and not the primary problem which needs to be remedied. Mitigation of bycatch may involve several changes in practices and technology. Introduction of changes in fishing gear technology and its use usually occurs through fishermen themselves, based on a peer review process, common sense and trial and error. Generally the process of gear innovation used in fisheries is reliable and can be of substantial assistance in solutions to bycatch.

The Whale Research Group of Memorial University of Newfoundland has worked on cetacean bycatch for several decades and through this period has, hopefully, learned several lessons. Fishermen are often in a no-win situation with bycatch. They are the bad guys because they catch desirable animals. Often their response to such disclosures is to try to minimise or hide it. Because of concern over these catches, management actions are often initiated by scientists and managers. Thus even after mitigation, fishermen remain the bad guys, with others taking credit for finding solutions. It is important to establish a co-operative working relationship with fishermen and their managers, based on mutual trust, which can give the win-win solutions. Fishermen's knowledge of fishing gear and its operation can provide a valuable basis for developing bycatch solutions. However, for species other than target species of fish, little is known of how animals

captured by fishing gear function underwater. Sensory function and thresholds, barrier detection and typical detour behaviours are usually unknown, and there is typically little information on the sequence of events that results in capture. Studies of the underwater behaviour of captive seabirds should be a productive area of investigation in developing solutions to bycatch before widespread mitigation measures are introduced. At the end of the day, success in reducing seabird bycatch will depend on the ingenuity of solutions which are developed, and the quality of the relationship between fishermen and their technical helpers.

Awareness of the impact of fishing on the ocean ecosystem and ocean communities (Norse 1993) is quite recent. One troublesome, widespread impact occurs through unintentional mortalities on non-target species and bycatch (Alverson et al. 1994). Popular, charismatic animals such as turtles, cetaceans and seabirds are an important component in bycatch that has typically received only sporadic attention from responsible fishery agencies. Fisheries are complex and dynamic systems which include not only the fish and their environment, but people and their associated social and economic institutions and communities (DeYoung et al. 1999). Generally fixing problems in the fishery requires dealing with the fishing system rather than its isolated components. That will likely be true of seabird bycatch.

Characteristics of Fisheries that have Bycatch Problems

First, bycatch of creatures like turtle, birds and cetaceans, with the exception of industrial fishery driftnets, are most characteristic of small boat fishermen that use fixed fishing gear. Generally, it should be remembered that these smaller boat fisheries are among the most environmentally friendly, and as fishing goes, they compare very favourably with the environmental impact of mobile, industrial fishing fleets exploiting the same fish species. When compared with industrial fisheries, there is less non-target fish bycatch, less discarding and high-grading, lower quantities of fish killed per job created, less capital per job created and fish tonnage landed, less reduction to meal, and fewer litres of fossil fuel required per tonne of fish landed. On balance, fixed gear and trap fisheries appear environmentally superior to other types of fisheries. However, they often have a problem with bycatch. Much of the gear which these fishermen use, when operated optimally however, can minimize bycatch fairly easily if the motivation is there.

Second, the challenge for those of us concerned with bycatch is to find solutions for bycatch which do not marginalise these generally less-destructive fisheries. Often those concerned with cetacean or seabird conservation have paid inadequate attention to the human and ecology of bycatch. We have treated the disease and not the patient. Solutions to bycatch are often to be found in the larger context in which fishing and bycatch occurs. If baits are depleted, if stock collapse causes major changes in marine communities, if target fishery resources are depleted so that fishing effort increases or gear with greater capacity or bycatch problems comes into use, if oceans are not managed to conserve biodiversity but rather managed on a species-by-species basis as resource extraction areas, the problem one is dealing with is not fundamentally one of bycatch. Bycatch can be the symptom of other more basic problems with the fisheries system.

Third, fixed gear fishing is a human activity with some near-universal characteristics. Technological innovation in most fixed gear fisheries occurs at a somewhat slower pace than with mobile gear sectors which generally have higher cash flows, are richer and involve technically more sophisticated fishermen who can more readily learn and adopt new practices. Companies,

researchers and technologists, therefore, have typically found it advantageous to concentrate their efforts on mobile gear sectors because of their readiness, and their ability to pay for and adopt new technology.

Technical innovation in all fisheries, even those using fixed gear, has generally been rapid enough to stay well ahead of fishery managers. This has been cited as the reason for the frequent dysfunction of fisheries management, and sometimes, fishery science. Thus, it has typically proven necessary for fishermen to understand and agree with the motivation behind management actions, and the specific changes in practice which are recommended, if they are to be successful.

Innovation in most fisheries, but more typically those with less sophisticated technology, has been done as initiatives by fishermen on a trial-and-error basis with direct, hands-on involvement of fishermen in developing and testing innovations. Typically, formal evaluations of technology performance have not been required by fishermen who prefer to base evaluations of technology and practices on their own, collective experience. Such innovation in fisheries is a vernacular science that uses common sense and follows stringent rules which, in fact, generally insure good reliability and credibility. Central to this process is a strict peer review process.

Fourth, fishermen are frequently positioned in a no-win situation with bycatch. For most, bycatch is initially perceived as a minor inconvenience; e.g., the cost of doing business. There is little concern or understanding of conservation consequences, or public perceptions. Initial disclosures of bycatch are often emotional and overestimate the magnitude of the problem. This provokes public opinions or managerial investigations or actions. When confronted with these reactions, there are often defensive efforts by the fishing industry to minimize or hide the problem. This further provokes outsiders to the fishery and fishermen=s reputations as the bad guys becomes further entrenched. Win-win solutions to bycatch of non-target species are possible, but these require creative new partnerships between scientists, managers, the concerned public and fishermen (Lien 1995). Even after accepting that there may be a conservation impact because of bycatch, fishermen's motivation for mitigation may not be that of conservation, but one of avoiding market effects, or actions by managers.

A few years ago the Fisheries Resource Conservation Council held discussions with the fishing industry on conservation impacts of different types of fishing gear (FRCC 1997). Fishermen who used a particular gear type, and who were most familiar with any conservation problems which it could cause, were consulted. The exercise failed. Experts on any one type of gear typically minimized the impact of their fishing method and pointed to other gear sectors as the real problem in the fishery. Fishermen are not a homogenous lot. Although exhibiting some universal characteristics, such as willingness to shift responsibilities, awareness of the political realities of fishery sectors is required when working on fisheries bycatch. Often before the fishing industry seriously confronts a conservation problem which results from their technology or practices, they must be cornered such that the most beneficial option open is to forthrightly deal with the impact they cause.

Our Work on Cetacean Bycatch

Since l978, the Whale Research Group at Memorial University of Newfoundland has been attempting to mitigate bycatch of cetaceans in inshore, fixed fishing gear (Lien et al. 1994).

Bycatch of marine mammals in waters off Newfoundland has been extremely serious. Damage to fisheries amounts to millions of dollars in lost gear and time in some years. Mortality of seals amounts to tens of thousands per year, harbour porpoise bycatch amounts to thousands per year, and large baleen whales, such as humpbacks and minkes, can be caught in the hundreds per year (Lien 1995). Because of our experience with cetacean bycatch in Newfoundland and Labrador we have been able to work on marine mammals bycatch in many locations in several countries. There are several basic lessons we have learned over the years.

Lessons

I'll tell you a number of lessons, but the most important is to treat the problem of seabird bycatch as both a fisheries problem and a conservation problem. In Canada, Fisheries and Oceans licences a resource harvesting activity that has environmental consequences -bycatch- which may have conservation effects. In this day and age, it is clear that agency responsible for managing economic activities is responsible for insuring that any environmental impact it causes is mitigated. But for years seabird bycatch in Canada has not been recognized as a fisheries problem. Rather seabird biologists have expressed concern for conservation consequences, while there has been little concern or action from responsible managers in fisheries.

As an essential condition of accurate monitoring, assessment and mitigation, partnerships between responsible fisheries scientists and managers and seabird scientists and managers are required. Those responsible for seabirds will fail to achieve their objectives without the proactive participation of those responsible for fisheries. Without management activities to mitigate seabird bycatch, those responsible for fisheries will fail in meeting their responsibility to minimise environmental impacts of the activities they facilitate and licence.

A short sketch of our efforts at mitigation of bycatch of humpback whales provides a good illustration of how solutions to bycatch change over time.

In the late l970s, humpback whales redistributed inshore in response to depletion of capelin stocks. This placed them in direct contact with fixed, inshore fishing gear (Whitehead and Carscadden l985). Bycatch increased dramatically, causing unacceptable levels of mortality and excessive loses to the fishery (Lien 1994). Our first efforts at mitigation were to establish a programme to safely release animals alive that were entrapped in gear, and to minimise losses in fishing gear and down time for fishermen. Mortality of whales was cut from 50% to less than l0% and savings to fishermen were substantial. The programme was a success.

But as groundfish stocks declined, inshore fishing effort increased throughout the l980s (Lien 2000). Bycatch of humpbacks continued to increase, in spite of the development of an acoustic alarm which dramatically reduced the probability of collisions (Lien et al. 1990, 1992). Even with this assistance, by the late 1980s, humpback bycatch remained a serious problem. Collisions which resulted in entrapments of humpbacks had climbed to over l50 per year, because of increased fishing effort by fishermen as groundfish stocks declined. Finally, moratoria were established on most groundfish fisheries beginning in l992. Thereafter, fishing effort decreased dramatically, as did bycatch.

A few whales are still captured incidentally in a variety of fisheries. As limited fishing has resumed, small global quotas were established and allocated to fishermen in individual quotas (IQs). IQ management removed competitive fishing and encouraged fishermen to take their allocation with gear, and at a time, which produced the best prices. Hence, the gear types used changed to those less likely to catch whales, and major fishing effort shifted to fall months when whale abundance was low. At present, gear changes, shifts in timing of fishing effort, reduced fishing effort, adequate bait species, alarms for gear, and entrapment assistance minimise any conservation impact or effects on fishing (Lien 2000).

The lesson here is that bycatch is dependent on general factors in fisheries. The extent of any bycatch problem and solutions to it may depend on the general integrity of the marine ecosystem, quotas and their allocation, various management actions which control timing and locations of fishing effort, markets, gear changes or technical modifications to gear to reduce bycatch. Solutions to bycatch will change with time and place.

Our efforts on bycatch of harbour porpoise have followed quite a different course. Typically, harbour porpoise bycatch causes little gear damage, and they are a tasty little whale. Consequently, they are often a bonus for fishing families, at least in some areas. While motivation of fishermen to reduce bycatch of humpbacks was high because of the gear damage they caused, motivation of fishermen to deal with bycatch of harbour porpoise was basically non-existant. Such bycatch is simply not a problem for fishermen, although it is known that bycatch of this cetacean species threatens them world-wide.

Thus, motivation to mitigate bycatch of harbour porpoise came from managers and scientists. Because the fishermen caught them, didn't care that they did, and were reluctant to cooperate with monitoring or mitigation efforts, it was easy to make them the bad guys. Scientists and mangers who worked to solve the problem were the good guys (Richter 1998). We felt that it was critical to avoid such labels and to work toward fishermen accepting responsibility for solving the problem.

The first step in working with fishermen on harbour porpoise bycatch was to convince them that there was a problem, either from a conservation viewpoint, because their customers liked the animals and didn't want them killed, or that management action to minimize bycatch could threaten their fishery. To do this effectively, it was necessary to gain their trust as individuals that we were genuinely concerned about them and their fishery. Once in a position of trust, lead fishermen could be informed of the consequences of porpoise bycatch and persuaded that they were responsible for taking action to minimize it. This was not easy, but fishermen know well that they were better off fixing something themselves, rather than living with solutions that managers impose. Keeping responsibility for the problem of bycatch with fishermen, without villainising them, is probably best described as emphasising both the sticks and carrots inherent in the problem. We believe that keeping responsibility for fixing bycatch with the fishermen is a critical part of attaining successful solutions.
When large-whale bycatch became a serious problem in Newfoundland, fishermen generally believed that there were just too many humpback whales. That being the case, solutions to reduce bycatch were obvious. The truth was humpbacks had been greatly reduced in numbers, and much of their inshore occurrence in the late l970s was due to bait depletion. However, it did little good for a scientist to say this. Fishermen had to be lead into acceptance of this interpretation of the

problem to accept solutions which we might have proposed or developed.

Luckily, humpback whales can be individually identified. Normally fishermen would see one whale over and over again, counting each sighting as another whale. Hence, there were thousands of them! We developed teaching programmes to tell about how individual whales could be easily recognised and organised co-operative cruises with fishermen to count inshore humpbacks. Fishermen were impressed that our numbers and their counts more or less agreed, and that the actual numbers of animals was low. We made sure fishermen got to talk about results of these cruises and their findings on C.B.C.'s Fisheries Broadcast. Fishermen didn't learn to like whales but generally they came to realise that the problems the animals caused were not due to their sheer numbers.

Similarly, when we initially began the Entrapment Assistance Programme, fishermen were sceptical of the exercise as one that was just saving whales. As they saw our care with fishing gear, when we helped them with repairs, etc., gradually word began to spread that our efforts were to help them and the whales. Dealing with the bycatch as both a fishery problem and a conservation problem was a necessity to gain acceptance. Once a whale was released, we made sure that the fisherman got recognition, was satisfied with the help and that he got the opportunity to talk about his problem and the solution.

The point of telling you this is to say that often education is a necessary component of effective bycatch reduction programmes. Such programmes must be directed to the public who form the markets for fish, so that they will express support for management efforts, and at fishermen who need to understand the basis of the problem so they can buy into solutions. Typically these education programmes are not based on brochures, lectures or public announcements but require carefully planning to use opportunities which exist in each fishery.

Another initial problem in our programme was to determine the extent of bycatch, where and when it occurred, and how fishing activity was involved. Because of the nature of the fishery, this is an ongoing problem. Many involved in bycatch studies interview fishermen, add up the numbers given, and publish them (Lien et al. 1994b). Fishermen often count funny, using unequal intervals: 1,2,3,4 etc. dozens, hundreds, millions. Numbers obtained also depend, in part, on their perception of bycatch as a problem. Our estimates of bycatch were heavily influenced by the method we used to determine them. At the very least, reliability measures are required on bycatch estimates provided by fishermen. Accurate understanding of the nature of bycatch is critical. Good monitoring of one fishery, for instance, showed that over 80% of bycatch of harbour porpoise occurred in one small area during a two-week period (Hood 2000). This made suggestions regarding mitigation relatively easy.

Hood (2000) interviewed fishermen regarding harbour porpoise bycatch in three fishing areas. Fishermen were able to identify sink times of bottom fishing gear as a factor in bycatchs. Additionally, they identified bridles between nets in strings, or torn areas in gill-nets, as areas where bycatch occurred. Flume tank tests later showed that gill-nets in such areas tended to produce loose bags in which, if contact occurred, entanglement was likely. Views and knowledge of how their gear works and its catching effectiveness varies between fishermen. There are problems in systematically evaluating such information (Neiss 1995). But an earnest probing for such information is a recognition of credibility, indicates an openness and willingness to work

cooperatively, reminds technical people of the bycatch problem in the fisheries context, and does result in helpful information.

An extremely debilitating problem for us in trying to mitigate bycatch was that there was little information on how cetaceans functioned underwater. Sensory function, barrier detection and typical detour behaviours were all unknown. We knew whales were acoustic specialists and that there were very likely substantial differences among species. However, we still know little of the sequence of events that lead to their entrapment in fishing gear. Some mitigation technology, such as acoustic alarms, has been very successful, but it is unknown how it actually effects the animals. For instance, acoustic alarms on gear may help whales more readily detect gear. However, the manner in which these are placed on the gear is critical; some placements actually increase entrapments. This is because, as we learned, the animals use the sound not just to detect the gear but to define the type of barrier which a net creates. Also not knowing how acoustic alarms work has lead to controversies as to whether alarms result in habitat degradation and exclusion of animals from required habitat, or simply make nets more detectable, or net barriers avoidable. Even when mitigation works well, it is important to know how you are actually changing the factors that lead to bycatch.

Very little is known about the behaviour of seabirds underwater. What are their auditory and visual thresholds? How well do they detect nets or barriers? What cues do they use in foraging? What detour behaviours do they exhibit? All these questions are largely unknown and unstudied. We were surprised several years ago, when studying how diving ducks foraged on mussels, to find how little study had been done on the underwater behaviour of seabirds. It appears that using imprinted birds for captive studies of underwater behaviour would be an extremely productive area for concerted work to understand bycatch.

If birds simply can't detect monofilament gill-nets, then gear change, or time or area management modifications are required. If birds can detect the nets, but required detour behaviours are absent, the definition of the barrier for the animal or gear changes are required. If birds use gear to aid in foraging, or because of productivity in areas where gear is fished, then other solutions will be required. There is simply no substitute for knowledge of the animal's underwater behaviour.

Managing bycatch is challenging, but many modifications in fishery practices are possible which do not marginalise the industry but do effectively minimise bycatch. There must be motivation within the fishing industry, and in fishery managers, to work on the problem. The industry must receive help, which is sensitive to both the conservation issues and industry needs and perceptions. In addition to the inventiveness of solutions which are developed, it is the quality of the relationship between technical helpers and the fishing industry that typically determines long-term success in mitigating bycatch.

APPENDIX 1. Workshop Agenda

Conservation of Arctic Flora and Fauna (CAFF)
WORKSHOP ON SEABIRD INCIDENTAL CATCH IN THE WATERS OF ARCTIC COUNTRIES

Bedford Institute of Oceanography

Dartmouth, Nova Scotia

26-28 April 2000

Agenda

25 APRIL (TUESDAY)

1600-1930	Registration desk open, Westin Hotel
1930-2130	Reception/ice breaker at Westin Hotel; cash bar

26 APRIL (WEDNESDAY)

0800	Bus leaves Westin Hotel for Bedford Institute of Oceanography (BIO)
0845-0900	Welcome Remarks: Michael Sinclair, Department of Fisheries and Oceans (DFO), Alex Bielak, Environment Canada, Canadian Wildlife Service (CWS)
0900-0910	Changes to agenda. Julie Porter
0910-0925	What is CAFF? Kent Wohl, US Fish and Wildlife Service (USFWS)

General Session: Seabird bycatch: A conservation issue for CAFF countries.

Moderator: Julie Porter; Rapporteur: David Cairns

0925-0930	Session introduction
0930-1000	A perspective on the bycatch problem. Mac Mercer, IUCN, Canada Office
1000-1030	Addressing the problem: seabird mortality from longline fisheries in the waters of Arctic countries. John Cooper*, Euan Dunn, BirdLife International Seabird Conservation Programme, and Kim Rivera, National Marine Fisheries Service (NMFS)
1030-1100	Break
1100-1120	Seabird bycatch in net fisheries in Arctic countries: a summary of the CAFF report. John Chardine, CWS, Vidar Bakken, University of Oslo, and Knud Falk, Ornis Consult, Denmark
1120-1230	General discussion on seabird bycatch
1230-1330	Lunch provided by hosts

1330-1335	Session introduction
1335-1350	The distribution of fishing effort and seabird bycatch in the rockfish longline fishery off the west coast of Canada in 1998 and 1999. Jeff Fargo and K. Lynne Yamanaka. DFO
1350-1410	Seabird bycatch on longline fisheries in Atlantic Canada: David Kulka* and Mark Showell, DFO
1410-1430	Fisheries bycatch: does it threaten the long-term sustainability of Sooty Shearwater (*Puffinus griseus*) harvests by Rakiura Maori? Sebastian Uhlmann, University of Otago, New Zealand
1430-1500	The process of developing an international plan of action for reducing incidental catch of seabirds in longline fisheries (IPOA-Seabirds). John Valdemarsen, FAO, Rome
1500-1530	Break. For those interested Dr. René Lavoie, Assistant Director of Science will escort people on a 25 min. tour of the BIO facilities
1530-1550	US National Plan of Action. Al Manville*, USFWS and Steve Leathery NMFS
1550-1610	Canadian National Plan of Action. Julie Porter and Howard Powles, DFO
1610-1700	Open discussion on National Plans of Action
1715	Bus leaves BIO for Westin Hotel
1830-2130	Banquet at Westin Hotel hosted by workshop sponsors. Cash bar

27 APRIL (THURSDAY)

0800	Bus leaves Westin Hotel for Bedford Institute of Oceanography (BIO).
0845-0855	Introduction to Second Day and review of previous day: Julie Porter, DFO

Session 2: Seabird Bycatch in Gillnet Fisheries - The Problem and Solutions

Moderator: Richard Elliot; Rapporteur: Greg Robertson

0855-0900	Session introduction
0900-0920	Bycatch of waterbirds in mid-Atlantic coastal anchored gillnets during spring 1998. Doug Forsell, USFWS
0920-0940	Seabird mortality caused by nearshore gillnet fisheries in Lithuania, eastern Baltic Sea. Ramunas Zydelis, Vilnius University, Lithuania
0940-1000	Incidental mortality of seabirds in the salmon gillnet fishery in the Russian Far East EEZ, 1993-98. Y.B. Artukhin, V.N. Burkanov[1]*, and P.S. Vyatkin, Kamchatka Institute of Ecology and Nature Management, Russia, and [1.] Alaska SeaLife Center, Seward, Alaska.
1000-1020	Seabird bycatch in salmon gillnet fisheries in Puget Sound, Washington: a case

study. John Grettenberger, USFWS, Ed Melvin, and J. Parrish, Univ. of Washington

1020-1040 Break

1040-1100 Thoughts on the reduction of seabird bycatch in fishing gear based on experiences in mitigation of cetacean bycatch by fisheries: understanding both animals and fishermen. Jon Lien and Catherine Hood, Whale Research Group, Memorial University of Newfoundland

1100-1230 Open discussion of gillnet bycatch

1230-1330 Lunch provided by hosts

Session 3: Monitoring seabird bycatch effectively: how do we do it?Moderator: Alex Bielak; Rapporteur: Mark Showell

1330-1335 Session introduction

1335-1400 The collection of seabirds and seabird bycatch data by U.S. fishery observer programs: an overview. Victoria Cornish, NMFS

1400-1425 The Atlantic Canada fisheries observer program. Mark Showell, DFO

1425-1450 Incidental observations of seabirds taken incidentally by Alaskan nearshore commercial net fisheries: is it good enough? Brian Fadely, NMFS

1450-1515 Off the hook: monitoring the incidental catch of seabirds in British Columbia, Canada. Ken Morgan and Joanna Smith, CWS Pacific and Yukon Region

1515-1545 Break

1545-1700 Open discussion of seabird bycatch monitoring

1715 Bus leaves BIO for Westin Hotel

1900- No-host dinner and real ale at Granite Brewery, Barrington Street

2030- Meeting of Canadian DFO-CWS Seabird Bycatch Working Group, Westin Hotel

28 APRIL (FRIDAY)

0800 Bus leaves Westin Hotel for Bedford Institute of Oceanography

0845-0900 Introduction to third day and review of previous day. Julie Porter, DFO

Session 4: Fisher outreach and communication: approaches and needs Moderator: Jon Lien, Memorial University of Newfoundland; Rapporteur: Catherine Hood, Memorial University of Newfoundland

0900-0905	Session introduction
0905-1030	Open discussion on fisher outreach and communication
1030-1100	Break

Concluding session: concurrent focus groups 1. Longline bycatch, Moderator: Al Manville, Rapporteur John Cooper 2. Gillnet and other bycatch, Kent Wohl: Rapporteur Tony Lock

1100-1110	Introduction to concurrent focus group discussions. Julie Porter, DFO
1110-1230	Start concurrent focus group discussions
1230-1330	Lunch (BIO fish and chips)
1300 - 1500	Continue concurrent focus group discussions
1500-1530	Break
1530-1700	Summary of conclusions from focus groups - Where do we go from here?
	Longline bycatch: John Cooper, NMFS; Net bycatch: Kent Wohl, USFWS
1700	Workshop close
1715	Bus leaves BIO for Westin Hotel.

*denotes speaker in multi-authored presentations

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