Seabird mortality in North Pacific longline fisheries.

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Abstract

One of the most globally critical threats to seabirds is mortality in longline fisheries. Available estimates for total albatross mortality in North Pacific pelagic longline fisheries, along with population modeling experiments on the Black-footed Albatross, highlight the concern that mortality in longline fisheries threatens the existence of Black-footed Albatrosses and may pose a significant threat to the other North Pacific albatross species. The potential exists to minimize seabird mortality in longline fisheries to insignificant levels, given the degree of international attention, the existence of legally binding accords, the availability of cost-effective seabird deterrent methods, and the usefulness of economic incentive instruments. To realize this potential, however, will require widespread implementation of relevant multilateral accords and initiatives, provision of strong economic incentives for vessels to voluntarily use effective seabird deterrents, and implementation of effective formal constraints that provide strong economic disincentives for noncompliance with seabird conservation measures. Adoption of an international performance standard for hook sink rate with concomitant standardization of gear line weighting by gear manufacturers is offered as a specific next step to help abate this problem.

Mortalidad de Aves Marinas en las Lineas Extensivas de Pesca en el Pacifico Norte

Una de las mas graves amenazas a nivel global para algunas especies de aves marinas es la mortalidad en lineas extensivas de pesca. Las estimaciones disponibles de la mortalidad total de albatroses en las lineas extensivas de pesca de la zona pelagica del Pacifico Norte, asi como tambien los experimentos sobre modelos poblacionales del albatros de patas negras, enfatizan el temor de que la mortalidad en pesca de linea extensiva amenaza la existencia del albatros de patas negras y pudiera ser una amenaza significativa para otras especies de albatroses del Pacifico Norte. Dado el grado de atencion internacional, la existencia de acuerdos legales restrictivos, la disponibilidad de metodos efectivos de prevencion de captura de aves que ademas reducen costos, y la utilidad de incentivos economicos, existe el potencial para minimizar la mortalidad de aves marinas en pesca de linea extensiva a niveles insignificantes. Sin embargo, para poder lograr este potencial, se requiere una implementacion amplia de acuerdos e iniciativas multilaterales relevantes, la provision de fuertes incentivos economicos a embarcaciones para el uso voluntario de metodos efectivos de prevencion de captura de aves marinas, y la implementacion de restricciones formales efectivas que impongan fuertes sanciones economicas para aquellos que no cumplan con las medidas de proteccion de aves marinas. La adopcion de un estandar internacional de efectividad del grado de hundimiento de anzuelos en combinacion con la estandarizacion del pesaje del equipo de linea hecha por los fabricantes, se ofrece como un siguiente paso especifico para abatir este problema.

Mortalite des Oiseaux Marins dans la Peche Palangriere du Pacifique du Nord

Une des menaces la plus serieuse globalement pour les oiseaux marins est leur mortalite dans la peche palangriere. Les estimations disponibles sur la mortalite totale des albatros dans la peche palangriere du Pacifique du Nord, avec des experiences modelant la population de l'albatros a pieds noirs, accentuent le souci que la mortalite dans la peche palangriere menace l'existence des albatros a pieds noirs et peut constituer une menace importante aux autres especes d'albatros du region. Le potentiel existe pour reduire la mortalite des oiseaux marins dans la peche palangriere a un niveau insignifiant, donne la priorite de la communaute internationale, l'existence des accords obligatoires, la disponibilite des mesures preventives des oiseaux marins efficace et economique, et l'utilite des instruments economiques. La realisation de ce potentiel, cependant, exige une execution repandue des accords et initiatives multilateraux pertinents, une fourniture forte d'incitations economiques pour que les navires emploient volontairement des mesures preventives des oiseaux marins, et mettent en oeuvre des contraintes formelles qui produisent de fortes preventifs economiques contre non-conformite aux mesures de conservation des oiseaux marins. L'acceptation d'une norme de rendement internationale pour le taux descensionnelle de crochet, associe avec un etalonnage du taux pesant par des fabricants d'attirails de peche est offerte comme une prochaine etape specifique pour assister a diminuer ce probleme.

Introduction to Seabird Mortality in Longline Fisheries

Of all the threats to seabirds, one of the most globally critical is mortality in longline fisheries (Brothers et al. 1999; Gilman 2001a). Birds are hooked or entangled primarily while fishing gear is being set and are dragged underwater and drown as the gear sinks. Hundreds of thousands of seabirds, including tens of thousands of albatrosses, are caught annually in longline fisheries

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worldwide (Brothers 1991; Gilman 2001a and b; CCAMLR 2002). During the 1980's the Japanese pelagic longline tuna fleet south of 30 degrees South latitude alone was estimated to take 44,000 albatrosses per year (Brothers 1991). Pirate fishing (illegal, unregulated and unreported) for Patagonian Toothfish (Dissostichus eleginoides) in the Southern Ocean, conducted primarily by vessels who choose a "flag of convenience" from a state which neglects to ensure that vessels flying its flag comply with fisheries management measures, kill approximately 145,000 seabirds per year (CCAMLR 2002).

The species of seabirds most frequently caught by longliners are albatrosses and petrels in the Southern Ocean; Arctic fulmar (Fulmarus glacialus) in North Atlantic fisheries; and albatrosses, gulls, and fulmars in North Pacific fisheries (Brothers et al. 1999). The health of populations of albatrosses and large petrels are most at risk from this threat.

According to IUCN (The World Conservation Union), of the 61 species of seabirds affected by longline fisheries, 25 are threatened with extinction, including 17 species of albatrosses, and there is compelling evidence that longline mortality is a significant component in the declines of many of these species (Gales 1998; Brothers et al. 1999). An estimated 10% of the world's population of Wandering Albatrosses (Diomedia albatrus) is killed on longline hooks each year (Brothers 1995). The Spectacled Petrel (Procellaria conspicillata), a single-island endemic with a small population, is taken in fisheries off the Atlantic coast of South America (Brothers et al. 1999). The remaining albatrosses of the family Diomedeidae, the Southern Giant Petrel (Macronectes giganteus), Northern Giant Petrel (M. halli), White-chinned Petrel (Procellaria aequinoctialis), and Grey Petrel (P. cinerea) of the Southern Ocean are other seabird species at risk of extinction that are taken in large numbers by the large pelagic longline fisheries targeting Southern Bluefin Tuna (Thunnus maccoyii) and the pirate fisheries for Patagonian Toothfish (Brothers et al. 1999).

The increase in anthropogenic-induced mortality above natural levels is especially significant in seabirds. Seabirds populations are particularly sensitive to increases in adult mortality rates because of their life history traits. Seabirds live relatively long lives (e.g., albatrosses live into their 60s), have delayed maturity (e.g., albatrosses do not begin breeding until they are between 5 and 12 years old), and have relatively low reproductive rates (seabirds can raise only one chick every one or two years) (Hamer et al. 2002). Both parents take part in incubation and chick rearing in most albatross species, so if one parent is killed on a longline hook, the chick likely will die of starvation. Also, albatrosses typically stay with the same partner for life, so if one partner is killed, it may take several years for the remaining bird to find a new mate. One-third of all albatross populations comprise fewer than 100 breeding pairs, making them extremely sensitive to acute increases in mortality rates (Gales 1998). All of these characteristics mean that seabird populations may be severely stressed by the continual loss of a large number of individuals.

North Pacific Albatrosses

North Pacific albatrosses include the Short-tailed (Phoebastria albatrus), Black-footed (P. nigripes) and Laysan (P. immutabilis) (Figure 1). A fourth member of this genus, the Waved Albatross (P. irrorata) is largely confined to the Galapagos Islands and surrounding waters. Although the Waved Albatross does range north of the equator, it does not forage as widely as the other three species (Anderson et al. 1998). The Waved Albatrosses' foraging distribution overlaps with the fishing grounds of the Peruvian artisanal pelagic longline fleet and Japanese eastern Pacific pelagic longline fleet off northern Peru, indicating that interactions with longline vessels in the Southern Hemisphere is a potential threat to this species. However, there is no direct information on whether Waved Albatrosses are captured in these longline fisheries (Anderson et al. 1998; Jahncke et al. 2001).

[FIGURE 1 OMITTED]

The total population of the Short-tailed Albatross is approximately 1,400 birds. The majority of breeding pairs nest in a single colony on the slopes of an active volcano in Japan. Historically, millions of Short-tailed Albatrosses roamed the Pacific. In the late 1800s and early 1900s, this species was brought to near extinction by the feather trade and volcanic activity. Slowly recovering, the species has experienced an average population increase of over 7% annually. This increase partly reflects efforts to improve nesting habitat. The Short-tailed Albatross is classified as Vulnerable in the 2002 IUCN Red List of Threatened Species (BirdLife International 2000; IUCN 2002).

The Black-footed Albatross, with a population of approximately 300,000, is also included on the 2002 IUCN Red List of Threatened Species as a Vulnerable species (BirdLife International 2000; IUCN 2002). There has been a 9.6%, decline in Black-footed Albatross breeding pairs from 1992 to 2001, a 1.1% annual decline, based on monitoring data from three colonies in Hawaii where over 75% of the world population nests (U.S. Fish and Wildlife Service 2001).

The Laysan Albatross, the most abundant of North Pacific albatrosses, has a population of approximately 2.4 million birds, with an IUCN status of Lower Risk, Least Concern

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(BirdLife International 2000; IUCN 2002). There has been a 30% decline in Laysan albatross breeding pairs from 1992 to 2001, a 3.3% annual decline, at three monitored nesting colonies where 90% of the world's population nest. The number of Laysan breeding pairs increased 2% from 1992 to 1997, but decreased more than 31% between 1997 and 2001 (U.S. Fish and Wildlife Service 2001). Scientists are reviewing the IUCN status of this species (Nel and Croxal12003).

These recent declines in breeding pairs of Laysan and Black-footed Albatrosses may result from numerous causes. For example, albatrosses may increasingly skip breeding years due to depleted food resources caused by El Nino and general warming of the oceans. This scenario would result in only a temporary decline in breeding pairs and no population declines. But declines may be real and may be influenced by various sources of actual mortality. One of the most significant sources of this mortality likely is from interactions with longline vessels.

Available estimates for total albatross mortality in North Pacific pelagic longline fisheries, along with population modeling experiments on the Black-footed Albatross, highlight the concern that mortality in longline fisheries may threaten the existence of Black-footed Albatrosses and poses a significant threat to Laysan and Short-tailed Albatrosses (Cousins and Cooper 2000; Gilman 2001b). Population modeling experiments indicate that the world Black-footed Albatross population can withstand a loss of no more than 10,000 birds per year from all mortality sources and remain stable (Cousins and Cooper 2000). Mortality in pelagic longline fisheries alone may exceed this threshold (Cousins et al. 2001; Crowder and Myers 2001; Gilman 2001b). Based on their lowest mortality estimates of 1.9% of the Black-footed population killed per year in pelagic longline fisheries, Crowder and Myers (2001) project that the Black-footed Albatross population likely will continue to decline over the next 20 years. Similar modeling experiments have yet to be conducted for the Laysan and Short-tailed Albatrosses.

Multilateral Initiatives and National Regulations

Several multilateral efforts directly address seabird mortality in longline fisheries in the North Pacific Ocean. The legally binding United Nations 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 contains several articles with measures to conserve associated or dependent non-target species, including seabirds (Haward et al. 1995). The Implementing Agreement became effective in December 2001. Contracting parties are obligated to implement the accord's provisions by adopting or amending national enabling legislation.

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Central and Western Pacific Region establishes a regional mechanism for the conservation and management of highly migratory fish stocks in the central and western Pacific Ocean (Gilman 2001a). Adopted in 2000, the Convention has yet to come into force. The Convention requires contracting parties to adopt measures to minimize catch of non-target species, including seabirds.

The United Nations Food and Agriculture Organization (FAO) produced an International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (FAO 1999). The plan is voluntary and not legally binding. The plan calls on all states to implement the plan, starting with an assessment of longline fisheries to determine if a seabird bycatch problem exists. If a problem exists, states are then encouraged to develop a National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries. At the FAO Committee on Fisheries session held in February 2001, eleven countries and one regional economic integration body (Australia, Brazil, Canada, China, the European Community, Japan, New Zealand, Norway, Philippines, South Africa, USA, and Vietnam) reported that they have made, or are in the process of making, a decision to produce a seabird national plan (Cooper 2001).

IUCN Resolution 1.15, adopted in 1996, entitled Incidental Mortality of Seabirds in Longline Fisheries, calls upon states to adopt the goal of reducing seabird bycatch within longline fisheries to insignificant levels, and immediately implement seabird bycatch reduction measures by longline fisheries (IUCN 1996). IUCN Resolution 2.66, Pirate Fishing and Seabird Mortality from Longlining in the Southern Ocean and Adjacent Waters, adopted in 2000, calls upon states and regional fishery bodies to combat pirate fishing for Patagonian Toothfish; to reduce the mortality of seabirds in longline fisheries in the Southern Ocean; to comply with the FAO International Plan of Action on seabird bycatch; and to support development of an Agreement for Southern Hemisphere Albatrosses and Petrels (IUCN 2000). Resolution 1.16, Fisheries By-catch, and Recommendation 19.61, By-catch of Non-target Species, also call on states and fishery bodies to address the problem of seabird bycatch in longline fisheries (Gilman 2001a). These IUCN resolutions and recommendation are advisory and not legally binding.

Pelagic longlining, where gear is suspended from line drifting at the sea-surface, mainly targets large tunas for sashimi markets, swordfish, and billfishes. Japan, China, Republic of Korea, and Taiwan constitute the main high seas pelagic longline nations with fleets operating in the North Pacific (Brothers et al. 1999). The U.S. and Mexico have smaller pelagic longline fleets operating in the North Pacific. There are over 3,000 pelagic longline vessels operating in the North Pacific. U.S. pelagic longline fisheries constitute less than 5% of this total. The U.S., Canada, Japan, and Russia have demersal longline fisheries in the North Pacific, where gear is set at the seabed to target species such as halibut, cod, and sablefish (Brothers et al. 1999). There are approximately 17,000 demersal longline vessels operating in the North Pacific. U.S. demersal longline fisheries constitute about 15% of this total.

Some national governments have adopted regulations to manage seabird mortality in their North Pacific longline fisheries. The following countries have promulgated regulations requiring employment of specified seabird deterrent methods and other measures: Japan (for both demersal and pelagic longline fleets); the U.S. (for Alaska demersal and Hawaii pelagic longline fisheries); and Canada (for British Columbia demersal longline fisheries) (U.S. National Marine Fisheries Service 1997, 1998 and 2002; Government of Japan 2001; Canada Department of Fisheries and Oceans 2002). The U.S. also has plans to adopt regulations to manage seabird mortality in pelagic longline vessels based out of the West Coast (U.S. Pacific Fishery Management Council 2001). China, Korea, Mexico, Russia, and Taiwan do not have seabird regulations (Brothers et al. 1999; Huang and Day 2000).

Mitigation Research

Over the past 15 years, national governments, regional organizations, and longline industries have developed and tested seabird deterrent methods. These methods include changes in fishing gear (e.g., adding weights to the line and using a line-setting machine), fishing practices (e.g., thawing bait, night setting, deploying bird-scaring tori lines, and establishing area and seasonal closures), and vessel layout (e.g., altering the location where offal and spent bait are discarded, and altering deck lighting) (Brothers 1995; FAO 1999; Brothers et al. 1999).

Several experiments on seabird deterrents have been conducted in North Pacific longline fisheries. In 1998, the U.S. Western Pacific Fishery Management Council sponsored research on the effectiveness of selected seabird deterrent measures in the Hawaii longline swordfish fishery (McNamara et al. 1999). The U.S. National Marine Fisheries Service conducted separate research to test the effectiveness of deterrent measures (Boggs 2001) and also conducted a statistical analysis of observer data collected in Hawaii longline fisheries to infer the effects of night setting and area closures on seabird interactions (U.S. National Marine Fisheries Service 2000). In 2001, the U.S. Washington Sea Grant Program completed a two-year study on vessels in the Alaska halibut and sablefish fishery and in the Pacific cod fishery to test selected seabird deterrent measures (Melvin et al. 2001). In 2002, the National Audubon Society, U.S. National Marine Fisheries Service, and Hawaii Longline Association collaborated to conduct performance assessment of an underwater setting chute in the Hawaii pelagic longline tuna fishery (Figure 2) (Gilman et al. 2002b). In 2000 Japan's Fisheries Research Agency conducted research on the effectiveness of blue-dyed bait to deter seabird interactions in the Japanese pelagic longline tuna fishery (Minami and Kiyota 2002). Results from these studies in the North Pacific indicate that several mitigation measures reduce seabird interaction rates in these fisheries by more than 90%.

[FIGURE 2 OMITTED]

Unfortunately, no single seabird deterrent measure can be expected to effectively and practicably reduce seabird mortality in all longline fisheries (Brothers et al. 1999). For instance, while an underwater setting chute has been shown to be very effective at avoiding seabird interactions in the Hawaii pelagic longline tuna fleet (Gilman et al. 2002b), trials of the chute in the Australian pelagic longline fishery have not been as promising, likely due to the seabird species complex found in Australian waters, the weighting design of Australian fishing gear, and the use of live bait (Brothers 2003). The underwater setting chute and other seabird deterrents are the subjects of ongoing research.

The Way Forward

The incidental mortality of seabirds in longline fisheries, one of several major threats to North Pacific albatrosses, can be feasibly addressed. The source and extent of longline mortality can be determined, management authorities already exist, there are internationally accepted principles regarding seabird mortality in both legal and pirate longline fisheries, and economically practical solutions are available. This warrants guarded optimism. Similar mechanisms may not be available to address other significant threats to seabirds, such as contaminants, plastic ingestion, and global climate change.

Implementation of incentive instruments can help minimize seabird mortality in longline fisheries (Gilman et al. 2002a). Incentive methods, inducements for stakeholders to avoid and minimize the mortality of seabirds, include eco-labeling, developing and raising industry awareness of

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effective seabird deterrent methods that increase fishing efficienc5 distributing mitigation devices for free, implementing a fee and exemption structure, and applying formal constraints (Gilman et al. 2002a). Instituting incentive instruments is especially important in fisheries where resources and political will for effective management and enforcement are scarce. In fisheries where formal constraints and enforcement are ineffective, alternative incentive instruments are needed to induce industry to voluntarily minimize incidental seabird capture. Incentive instruments can motivate longline fishers and industry to minimize seabird mortality by tapping their desire to continue their way of life; maximizing profit; being perceived by the public as good players; and fulfilling their conservation ethic. The longline industry likely responds most strongly to economic incentives and disincentives. Seabird mitigation methods that can be demonstrated to significantly increase fishing efficiency have the highest chance of being accepted by industry. Conversely, if regulations requiring fisheries to minimize seabird mortality are consistently enforced and carry significant economic consequences for noncompliance, this will likely result in broad industry compliance.

Most countries with longline fleets have a low degree of political will to address the problem of incidental seabird mortality, and have scarce resources for enforcement of seabird conservation measures. Few national fishery management authorities have frameworks to manage interactions between seabirds and longline vessels and do not require employment of effective seabird deterrents (Brothers et al. 1999; BirdLife International 2003; FAO 2003). A bottom-up approach that fosters a sense of industry ownership for effective seabird mitigation methods, and concomitant voluntary compliance with legally-required use of seabird deterrent methods, is needed in these countries. Longline fishers are among the most qualified people to innovate seabird mitigation methods, and should be encouraged to develop and test seabird deterrents. In this way, industry develops a sense of ownership for these tools and supports their required use.

Most longline vessels probably do not employ effective seabird deterrents despite the availability of effective seabird deterrents that also increase fishing efficiency. Reasons for this may be low industry awareness of the availability, effectiveness, and practicability of these seabird deterrent methods, or lack of a strong economic incentive to change long-standing fishing practices. Establishing an international performance standard for longline hook sink rate, and prescribing gear weighting designs that meet this standard that are achievable by all longline fisheries, will contribute to resolving this problem of low vessel use of seabird deterrents. Line weighting is one effective seabird deterrent method that facilitates high compliance because gear manufacturers would build the gear according to the international convention, and crew would use gear as provided by gear suppliers. While standardized line weighting and hook sink rate alone would not adequately minimize seabird interactions in all fisheries, an international standard would be an important step forward, especially for fleets that currently do not employ any seabird deterrent methods, including pirate fisheries.

Adequate onboard observer coverage throughout the region would allow fishery management authorities to determine if regulatory requirements and performance standards are being met, estimate the level of seabird mortality from this data source, and estimate trends in seabird mortality in longline fisheries. The protocol to estimate seabird capture should be standardized so that observers estimate seabird capture during the set and not the haul, and normalize capture rates for bird abundance (Gilman et al. 2002b). Seabird catch rates recorded on fishing vessels from observations of dead birds hauled aboard are conservative underestimates because not all seabirds that are caught are hauled aboard, as there is unobserved discarding of incidentally caught seabirds by crew, and seabirds can fall from the hooks before hauling (Brothers 1991; Gales et al. 1998; Gilman et al. 2002b). Normalizing seabird bycatch rates for seabird abundance allows for more meaningful comparisons between seabird interaction rates, allowing for an accurate evaluation of a vessel's and fisheries' efforts to minimize seabird interactions (Gilman et al. 2002b).

Given the degree of international attention, the existence of relevant legally binding accords, the availability of both effective and cost-saving seabird deterrent methods, and the usefulness of incentive instruments, the potential exists to minimize seabird mortality in longline fisheries to insignificant levels. To realize this potential, however, will require widespread implementation of relevant multilateral accords and initiatives, implementation of effective formal constraints that provide strong economic disincentives for noncompliance with seabird conservation measures, provision of strong economic incentives for vessels to voluntarily use effective seabird deterrents, and standardization of gear line weighting to meet an international performance standard for hook sink rate.

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