MANAGEMENT OF LONGLINE FISHERY TO MITIGATE INTERACTIONS WITH ECOLOGICALLY RELATED SPECIES

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ABSTRACT

Longline fishery has been regarded as an environmentally friendly fishing method. However, recently, there is a growing concern over the impact of longline fishing on untargeted marine species. Sharks are often claimed to be susceptible to heavy fishing pressure judging from their large body size and low fecundity. But our analysis of fishing data indicated that catch rates of pelagic shark species showed no signs of decrease and that their stocks were in sound condition. Further stock assessment of sharks and management of longline fishery are important to solve the shark problem. Large scavenging seabirds, mostly albatrosses and petrels, are incidentally taken in tuna longline fishery at the sea surface near fishing vessels. Since introduction of mitigation measures to the limited risky zone around the operating fishing vessels can effectively reduce incidental catches of seabirds, Japan has been making efforts to develop mitigation measures and to promote their prevalent use. Sea turtles are also taken incidentally in longline fishery and the impacts of incidental catch have been claimed as a cause of decline in some populations. However, comprehensive management of marine and terrestrial environment is indispensable for the conservation of sea turtles because various factors are affecting them other than fisheries. Japan made a proposal to implement a plan of action for the conservation of sea turtles at FAO-COFI in 2001. Although the proposal was not accepted, research and development have been initiated in Japan for the solution of sea turtle issue. Since information is still deficient for many sea turtle populations in Asia, international co-operation of Asian countries for research and management is very important for the sustainable co-existence of sea turtles and human activities

Keywords: longline fishery, incidental catch, sharks, seabirds, sea turtles

INTRODUCTION

Longlining is a passive fishing method which uses a number of baited hooks and branch lines attached to a long main line. Longline fishing is suitable for catching scattered and/or motile fish at various depths. The operation of longline gear requires low fuel consumption and causes little destructive effects on the marine environment. Compared to net and trawl fisheries, longlining offers greater selectivity for target fish and catches fish of higher quality, so it makes lower discards of undersized and unwanted fish (Lokkeborg 1998). Therefore, longlining has been regarded as an environmentally friendly fishing method compared with some other types of fishing. Actually, alternative use of longline instead of gillnet fishing has been encouraged by some

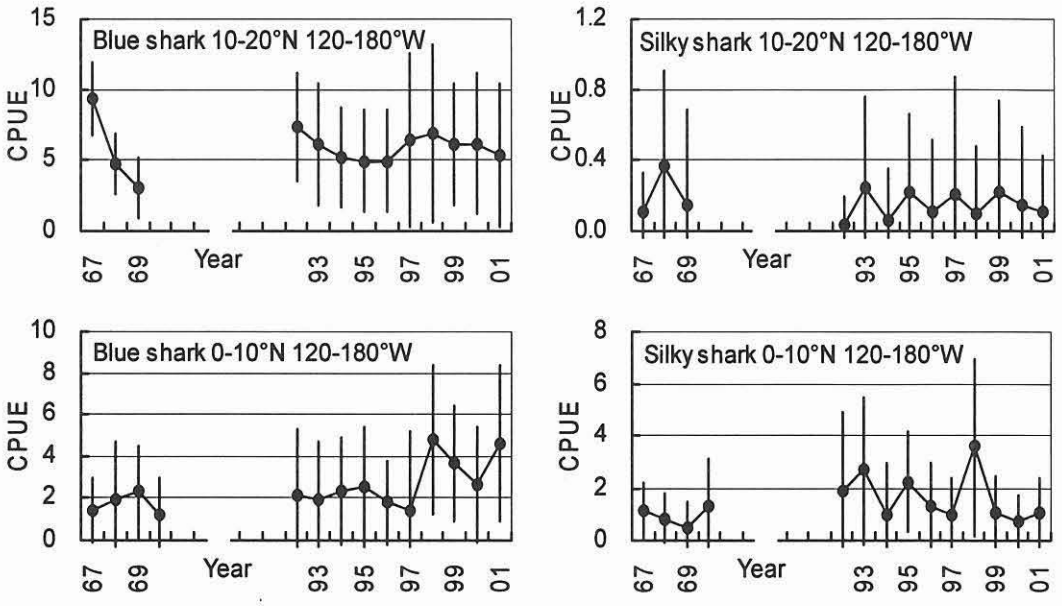

Fig. 1. Comparison of standardized CPUEs (catch per 1,000 hooks) of blue shark and silky shark in longlining by the Japanese research and training vessels in the Pacific Ocean between the late 1960s and the 1990s. Vertical bars indicate 95% confidence intervals.

local governments (Jahncke et al. 2001). However, in recent years, there is a growing concern over the impact of longline fishing on non-targeted species. Fishing nations and international fishing organizations have commenced actions to manage the interactions between longline fishery and non-target species such as sharks, seabirds and sea turtles. Here we introduce the Japanese efforts to resolve the interactions between pelagic tuna longline fishery and ecologically related species as an example of attempts for the co-existence of fishery and marine wildlife.

SHARKS

Sharks are top-level predators of the marine ecosystem. Compared with teleost fish, sharks have specific biological features characterized by relatively large body size, slow growth, late maturation, low fecundity and high survival rate. Judging from these aspects, sharks are sometimes claimed to be vulnerable to the effects of overfishing. But general lack of baseline information about catch, landings and trade of sharks in most countries together with the paucity of biological information has obstructed stock assessment and fishery management of sharks. Since pelagic sharks are commonly caught in tuna longline fishery, the impact of the fishery to oceanic shark species has become an

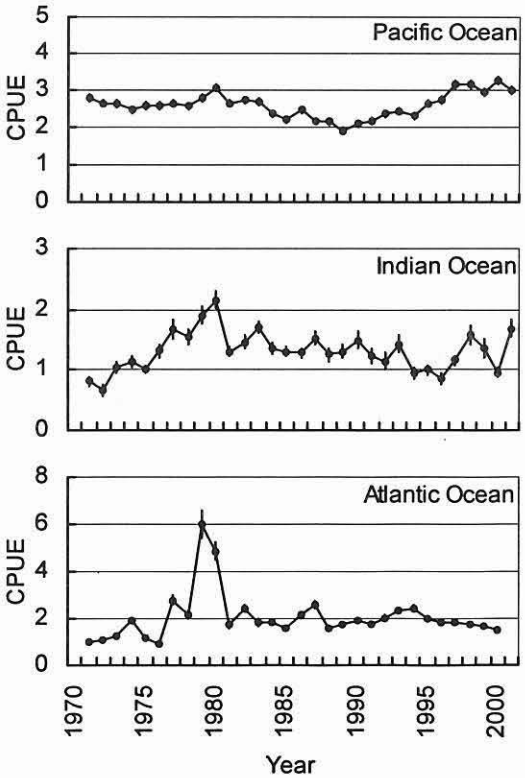

Fig. 2. Trends in standardized CPUEs (catch per 1,000 hooks) of total sharks in Japanese commercial longline fishery in the three oceans. Vertical bars indicate 95% confidence intervals.

issue since 1990s. We analyzed Japanese data on tuna longline fishery to assess the stock status of pelagic sharks. Scientific data collected by Japanese research and training vessels showed that the catch rates of shark species by longlining in the Pacific Ocean in the 1990s were not significantly different from those in the 1960s. Figure 1 illustrates the CPUE (catch per unit effort) levels of blue shark, *Prionace glauca*, the most frequently caught species in the tropical and temperate seas, and silky shark, *Carcharhinus falciformis*, common shark in the tropical waters, in the two period. Logbook data from commercial longline vessels also indicated that the trends in CPUE of total shark did not have signs of decline in the world oceans (Fig. 2). In addition, biological studies on the life-history characteristics of pelagic sharks have revealed that growth and maturation of pelagic sharks were not very slow as were suspected in preceding studies (Oshitani et al. in press). These results demonstrate that stock status of pelagic sharks are in sound condition and that their reproductive potential is high enough to sustain their population level under the current fishing pressure. Stock assessment and management of fishery play a primary role in the solution of shark problem, rather than developing mitigation measures to avoid shark catches, and therefore collection of long-term data on fishery is fundamental for the solution.

Table 1. List of potential mitigation measures to reduce incidental take of seabirds in longline fishery (modified after Brothers et al. 1999).

Bird deterrent devices
Tori-pole (bird-scaring line)
Brickle curtain
Water cannon
Flash light and laser beam
Use of acoustic, magnetic and electric stimuli
Improvement of sinking speed of baited hooks
Weighting the longline gear
Thawing bait and puncturing swim bladder
Bait casting machine
Underwater setting
Reducing visibility of bait
Colored bait and artificial bait
Line setting at night
Reducing attractiveness of the vessel
Control of offal discharge

SEABIRDS

Seabirds are attracted to fishing baits and accidentally hooked during longline operations. Large-sized surface scavenging seabirds, mostly albatrosses and petrels, interact with longline fishing gear. Incidental mortality can cause a threat to some seabird populations which had been depleted by past over-exploitation and destruction of nesting colonies. However, incidental hooking of seabirds occurs in a special context which is quite different from catching fish. During line setting, seabirds, which try to feed on fishing baits near the sea surface and accidentally swallow hooks, are caught near the sea surface, pulled underwater and drowned. Some birds are also caught during line hauling but the incidence is very low and most of seabirds caught are retrieved alive. Since the incidental take of seabirds occurs near the fishing vessel, where baited hooks are exposed to seabirds near the sea surface, introduction of mitigation measures in the limited risky zone can effectively reduce incidental catches. In Japan and other fishing countries, efforts have been made to develop various kinds of mitigation measures (Table 1): i) Bird deterrent devices keep seabirds away from the baited hooks which drift near the sea surface. A Tori-pole streamer uses a line and streamers towed from a pole installed on the stern of a fishing vessel (Fig. 3). Albatrosses, which are poor in flight maneuverability, cannot approach the baited hooks thrown beneath the line and streamers. Other objects and stimuli have been tested for bird deterrent devices, i.e., water-jet, sound, light, magnetic field and electricity. ii) Improvement of sinking speeds of baited hooks reduces bait-taking by seabirds because most scavengeous seabirds are not good at diving (Prince et al. 1994). Use of fully thawed bait,

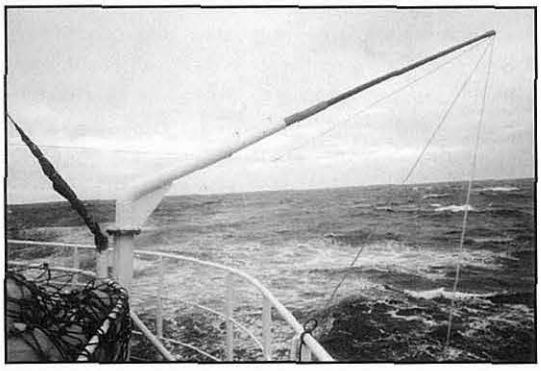

Fig. 3. A Tori-pole streamer deployed on the stern of a longline fishing vessel to reduce interference of seabirds with baited hooks.

weighted lines, bait casting machines and underwater setting chutes, and avoidance of propeller turbulence will enhance rapid sinking of baited hooks. iii) Reduction of visibility of baits can prevent bait-taking by seabirds. Use of blue-dyed baits makes it difficult for seabirds to search baited hooks visually from the sky. Line setting at night can also avoid seabirds since most scavengeous seabirds forage during daytime. iv) Proper control of offal and discards can reduce attractiveness of fishing vessels to seabirds and thus minimize interactions. Since bait loss caused by seabirds spoils the fishing efficiency of target fish, fishermen are willing to avoid interference with seabird during line setting. Actually, Tori-poles were developed voluntarily by Japanese fishermen. Enlightenment of fishermen through seminars and educational materials which introduce proper usage of mitigation measures will help to minimize the seabird-longline interactions.

Other than fisheries, seabird populations are affected by a number of natural and artificial factors. For the conservation of seabirds, all the potential impacts should be assessed and managed. For example, Short-tailed albatross (*Diomedea albatross*) was once brought close to extinction due to over-exploitation for feathers until the late 1930s. Small number of birds were re-discovered in Torishima of Izu Islands, Japan in the 1950s, and since then efforts have been made to recover the breeding colony of this species. Management of terrestrial environment of the Torishima island, including extermination of feral cats, prevention of landslides and erosion by constructing wooden fences and by transplanting native grasses, and foundation of a new colony to a stable location by attracting birds with decoys and vocal playbacks, has successfully recovered the population up to 1,400 birds by 2002 (information from the Ministry of the Environment, Japan).

INTERNATIONAL FRAMEWORK FOR THE SOLUTION OF LONGLINE ISSUE

As shown so far, Japan has tackled with the longline interaction issue with a vision that stock monitoring and management of fishery are important for sharks and that development and prevalent use of mitigation measures is the key for reducing the impacts of incidental catch on seabird population. International organizations have initiated efforts to mitigate interactions in longline fishery. The International Commission for the Conservation of Atlantic Tunas (ICCAT), the Inter-American Tropical Tuna Commission (IATTC), and the Northwest Atlantic Fisheries Organization (NAFO) are encouraging member countries to collect information on shark catches to conduct stock assessments of sharks. Actions to mitigate seabird interactions were first made in the Antarctic Ocean by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) in the 1980s, and established formal measures to mitigate incidental catch of seabirds in 1994. In the Southern Ocean, the Convention for the Conservation of Southern Bluefin Tuna (CCSBT) set a special task for the management of "ecologically related species" (ERS), and formed an ERS working group in 1995 to consider the seabird incidental catch. To develop a worldwide framework for the solution of longline interaction issue, Japan helped the Food and Agriculture Organization (FAO) of the United Nations (UN) to organize technical working groups for sharks and seabirds in 1997, and at the 23rd Session of the FAO Committee of Fisheries (COFI) in 1999, the International Plans of Action for the Conservation and Management of Sharks (IPOA-SHARKS) and for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-SEABIRDS) were endorsed. The international plans require all the relevant member nations to implement the IPOAs through the development of national plans of action. Japan and the United States submitted their national plans to the 24th Session of FAO-COFI in 2001.

SEA TURTLES

Sea turtles are also taken occasionally in longline fishery, and the impact of incidental catches has been noticed as one of the causes for declines in some populations. Incidental take of sea turtles has a mixed feature of shark and seabird interactions. Their major habitat is the vast ocean and incidental hooking of sea turtles occurs underwater in the same context with sharks and targeted fish. However, since their reproduction takes place on land, they are affected by various factors surrounding the nesting environment. For example, intentional (harvesting and pouching) and non-intentional (vehicle and ship traffic, increased activities on the beach, artificial lighting) human disturbance on nesting sea turtles, erosion and destructive use of nesting beaches, predation by feral and wild animals, and plastic ingestion are known to cause negative impacts on sea turtle populations. Therefore, comprehensive management of marine and terrestrial environment, in parallel with

the management of human activities, is indispensable for the conservation of sea turtles. Practically, for the sustainable management of sea turtle populations, it is important to monitor the actual size and trends of each local population, to specify factors affecting sea turtles on land and at sea, and to minimize the negative impacts on populations. Based on this concept, Japan made a proposal to develop a plan of action for the conservation of sea turtles at the 24th Session of FAO-COFI in 2001. Although the proposal was not accepted, efforts have been initiated in Japan for the conservation of sea turtle populations and management of longline fishery. i) Development of mitigation measures to reduce incidental hooking of sea turtles: Modification of fishing gear and baits is being experimented. Techniques for retrieve and release of live-caught sea turtles are being developed. ii) Investigation of ecology of sea turtles at sea: Distribution, migration and diving behavior of sea turtles a re investigated using satellite telemetry. iii) Monitoring of nesting populations in Japan and in other countries: the Japanese government is encouraging and supporting local governments, non-profit organizations (NPOs) and volunteers to assess and protect sea turtles on the nesting beaches. iv) Assessment of environmental and artificial factors affecting sea turtles: Information on potential impacts are being collected through inspecting nesting beaches, interviewing local people and examining stranded animals. v) Improvement of techniques to enhance sea turtle populations: Technique for captive breeding and headstarting is being developed as a potential measure to restore a depleted population. The efforts of fishers to mitigate interactions should be coupled with these efforts on land to assess and conserve the nesting populations and the beach environment. But information is still inadequate for many sea turtle populations in Asia, as is also true for many other areas of the world. International co-operation of Asian countries for research and management is very important for the sustainable co-existence of sea turtles and human activities.

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