Sea Turtles and Fisheries

Fisheries & Sea Turtles

Fisheries are a very important livelihood and food source for many people around the world. Globally, developing countries currently supply seventy percent of the fish for human consumption. The United Nations' Food and Agriculture Organization (FAO) estimates that more than 38 million people worldwide are directly engaged in fishing and fish farming as a full-time or part-time occupation. Fisheries exports generate more foreign exchange than the revenues earned from any other traded food commodity and account for almost 16% of global animal protein intake.[1]

Although FAO has estimated a slight decline in global marine catches over the past few years, the average marine capture over the last decade was 7 million tons more than the preceding decade's average. The percentage of stocks exploited at or beyond their maximum sustainable levels varies widely among fishing regions. Nevertheless, many of them are already fully exploited or overexploited, suggesting that the maximum fishing potential has been reached and that more cautious and restrictive management measures, such as the precautionary approach to fisheries, are needed.[1]

Fisheries are not only experiencing a decline in their target species, but their lack of selectivity leads to incidental capture (or "bycatch"). FAO defines bycatch as the part of a fishing unit taken incidentally in addition to the target species towards which fishing effort is directed. Bycatch is usually returned to the sea as discards, typically dead or injured to an extent that death is most likely. These actions may increase fishing pressure on resources targeted by other fisheries as well as cause undesirable impacts on endangered and protected species, such as sea turtles, certain species of marine mammals, sea birds and sharks. Because the specimens are usually discarded, they are considered a waste of resources, which contributes to additional overfishing. According to FAO, the quantity of marine fish caught and discarded is said to have fallen by several million tons over the past decade. This has come about through improved gear selectivity and fishing practices, no-discard policies in some countries and a growing demand for different types of fish and improved technologies and opportunities for utilizing bycatch.[1] In the case of incidental capture of sea turtles, these problems have led scientists to work hand in hand with fisheries officials and the fishing industry to focus on finding sustainable solutions.

Incidental Capture of Sea Turtles

Although sea turtles are threatened or endangered with extinction as a result of many human-related activities, incidental capture in fisheries is perhaps the greatest threat to juvenile and adult sea turtle populations worldwide. Incidental capture in fishing gear such as trawls, longlines and gillnets, as well as the ingestion or entanglement

in discarded or lost fishing gear, are all cited as major sources of mortality for sea turtles[2].

Sea turtles frequently carry out long migrations of hundreds or thousands of kilometers during their life cycle, usually between feeding and nesting areas. Unfortunately, these vast migrations and their tendency to concentrate in highly productive areas often coincide with the majority of fishing efforts, making them vulnerable to incidental capture. Sea turtles may be attracted to the bycatch discarded by these fisheries thus further increasing their risk of being captured or entangled. The majority of sea turtle species are also known to occasionally get hooked on fishing gear by feeding on the bait. Certain species, such as the leatherback (*Dermochelys coriacea*), may get caught in the floating lines of the longline fisheries where their prey also becomes entangled. They may also mistake specific types of gear, such as chemical light sticks used on longlines to attract their target species, for jellyfish luminescence[3]. The ingestion of fishing hooks may cause severe damage to the turtle's digestive system and little is known regarding survival rates of turtles released after sustaining internal and external injuries from hooks, rope or other fishing equipment. Turtles that become entangled or hooked are endangered of drowning, which may seem ironic since sea turtles are able to go under water for extensive periods; however, those that are submerged by force will eventually suffer fatal consequences of prolonged anoxia and infiltration of marine water in their lungs[4].

X-Ray showing several fishing hooks in throat of a *Chelonia mydas* sea turtle

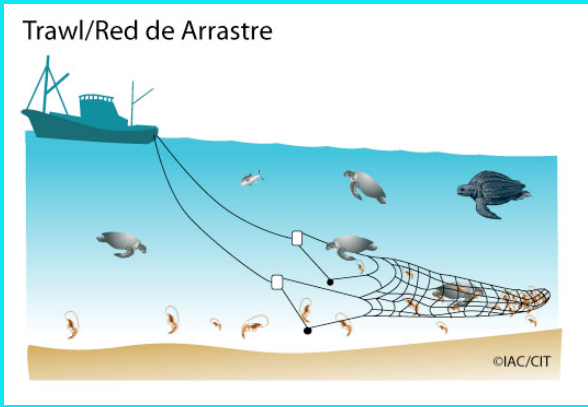
What happens to fisheries when sea turtles disappear?

Sea turtles play a critical role in the marine ecosystem. They are keystone species; meaning that although their relative abundance within the ecosystem is small, their removal would have a profound effect on the composition, structure and functioning of the community. For example, one theory explains that the removal of the leatherback sea turtle, a main predator of jellyfish that feed on the larval forms of commercially-important food fish, would cause a dramatic increase in jellyfish populations. The concern is that increased numbers of jellyfish feeding on fish larva will result in fewer large fish for commercial fisheries[3]. Another example is the hawksbill turtle (*Eretmochelys imbricata*), which is a highly selective feeder. By feeding on specific groups of sponges, hawksbills assist rarer species to become established on coral reefs and ultimately, help maintain the biodiversity of the reef; their presence usually indicates a healthy coral reef.

Fishing techniques and what is being done

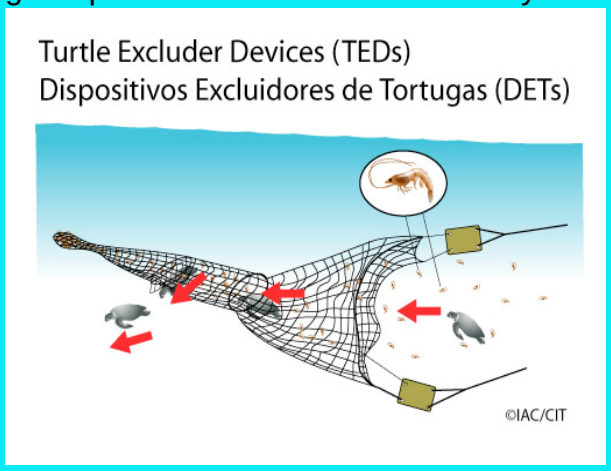
Several different types of fishing gear, from lobster and crab pots to hooks and lines are known to cause sea turtle injuries and mortality. However, trawling, longlining and gillnetting fishing techniques have long been cited as major sources of sea turtle mortality. Below is a brief description of the main fishing techniques threatening sea turtles and what is being done to help reduce their incidental capture.

Trawling



Trawl nets are cone or funnel-shaped nets that are towed through midwater or along the bottom of the ocean to catch a variety of marine crustaceans, mainly shrimp, and fish. Sizes vary from those used by artisanal and recreational fisherman, around 10 ft., to massive commercial trawls up to 200 ft. long[5]. Simultaneous use of two or more trawls by large shrimp vessels is not uncommon. According to FAO, shrimp trawlers experience among the world's highest amount of bycatch - up to 80% - of which incidental capture of sea turtles is cited as very significant. Although the loggerhead (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*), kemp's ridley (*Lepidochelys kempii*) and green sea turtles (*Chelonia mydas*) are most frequently caught, leatherbacks have also been sited. A worldwide estimate of annual mortality of sea turtles in shrimp trawls is 150,000 individuals[2].

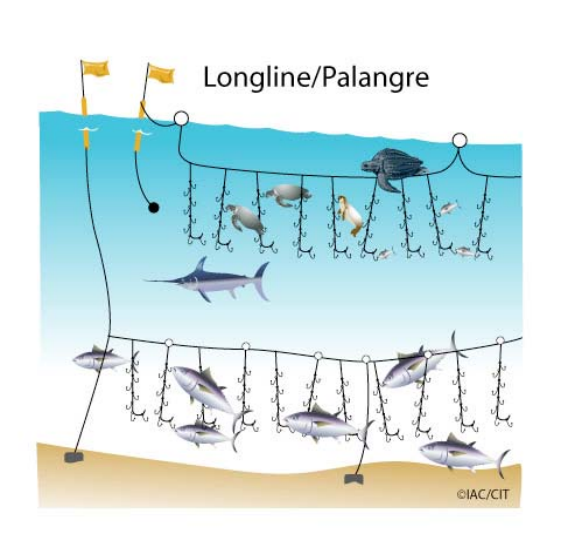
Mitigation - Reduced tow times, seasonal closures and/or area restrictions based on sea turtle spatial and temporal distribution are just some of the options to prevent or reduce the impact of trawling on sea turtles. However, the use of a Turtle Excluder Device (TED), grids that are installed in the trawl allowing shrimp to pass to the back of the net while sea turtles are directed out through an escape opening, have showed great promise to reduce sea turtle bycatch by more than 90% when correct use and application is given to the equipment. Since 1994, TEDs have been required by federal law on all shrimp vessels in United States waters. Other nations wanting to export trawl-caught shrimp into the U.S. market must also use approved TEDs. The Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) requests that each Party require shrimp trawl vessels subject to its jurisdiction and operating within the Convention Area, to use recommended TEDs.



Longlining

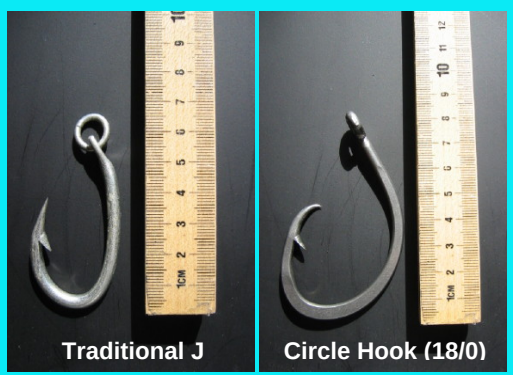
Longliners use a type of fishing gear in which baited hooks are attached to short lines hanging vertically from a longer main line at regular intervals. Longlines are either suspended horizontally at a predetermined depth with the help of surface floats (pelagic longlines) or laid on the bottom of the ocean (bottom longlines). These lines are then left to rest, usually overnight, in the hopes of catching species such as tuna, swordfish and other billfish. The main lines can be several miles long and have several thousand hooks, thus resulting in billions of hooks being set per year. Evidence shows that sea turtles not only bite the baited hooks and become hooked, but also become entangled in the lines. Although most sea turtles are released alive, the survival rate for injured turtles is unknown and most likely will lead to death.

Worldwide, the turtle stocks most affected by longline fishing are loggerheads in the north and south Pacific Ocean, leatherbacks in the eastern Pacific, and loggerheads and green turtles in the Mediterranean Sea[6]. Although there is not much information on the capture of sea turtles in bottom longliners, they have the potential to take reef dwelling turtles such as loggerheads and hawksbills due to the fact that they are set on the sea bottom, usually over a reef or other hard bottoms frequented by these species.



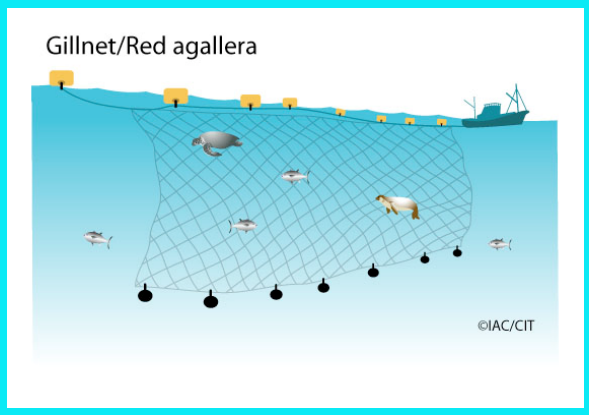
Mitigation – One way to mitigate fisheries interactions with sea turtles is to simply avoid them; however, this is usually not usually the case since the same productive areas conducive to fishing are attractive feeding grounds for sea turtles. Although much information regarding their spatial and temporal distribution and abundance is still needed, one way to limit interactions would be through reducing fishing efforts via temporal and spatial closures. These options are not always in the best interest of the fisherman; thus encouraging the fishermen, together with others from the fishing industry, scientists and conservationists to improve efforts to reduce incidental capture through increased selectivity of fisheries. This is accomplished through modifying gear and modifying fishing practices, such as setting the gear below the depths frequented by sea turtles, as well as training on the release of captured turtles, including the use of de-hooking devises. Onboard observer programs have also been instituted to help document the incidental capture of sea turtles and other protected species, in order to better understand the relative impact of these threats as well as to help improve modifications of gear and fishing practices.

Various studies on the use of different hook types, sizes and bait, reduced soak time and alternative gear placement are currently being carried out. One study on hook design and bait type conducted by NOAA in cooperation with U.S. pelagic longline fishing industry in the western North Atlantic Ocean showed that changing traditional J hooks baited with squid for larger (18/0) circle hooks baited with mackerel can significantly reduce loggerhead catch by 90% and leatherbacks by 65% without negatively impacting the primary target species catch rate; however, in the case of the leatherback, a slightly larger reduction (66%) was achieved by using traditional J hooks with mackerel bait. In the case of the loggerhead, circle hooks also changed the hooking locations, resulting in less internal hooking or swallowing of the hooks, potentially reducing post-release mortality. There was no pronounced change in the hooking location with leatherbacks since they are most often hooked externally or entangled; nevertheless, the majority of those hooked in the mouth were actually taken on circle hooks with squid bait[7]. After being closed for almost four years, the Hawaii shallow-set longline swordfish fishery was reopened in 2005 with new regulations, such as the use of circle hooks and established maximum annual



limits on the numbers of interactions with sea turtles, specifically the leatherback and loggerhead, which are monitored by on board observers. Shortly into the 2006 season, the allowable interaction level with loggerheads had been reached, and the fishery was once again closed. Increased interactions with sea turtles was said to be caused by a greater density of turtles in the area due to changes in sea surface temperatures where the vessels were operating. Experimental programs designed to reduce sea turtle bycatch are also being carried out in Costa Rica, Ecuador and Guatemala. A hook exchange program was implemented to allow fishermen to voluntarily test circle hooks by exchanging their line for an experimental one containing 2/3 circle hooks and 1/3 J hooks. If the fishermen became dissatisfied at any time, they had the option to request their original hooks back. A review of different strategies to reduce sea turtle bycatch in pelagic longline fisheries points to the fact that their effectiveness may be fishery-specific, depending on the size and species of turtles and target species, and therefore, it may be necessary to test these strategies in individual fleets.[8] It is important to reinforce the need to investigate not only the different hook types, but all of the other factors influencing sea turtle interactions, such as bait, sea temperatures and set depth as well as explore options of limiting fishing efforts in areas with high density of sea turtles.

Gillnetting (Entangling Net) & Purse Seiners



Fish may become entangled, enmeshed, or gilled in these nets (the fish are literally caught by their gill covers when they encounter the net and retreat, hence the name “gillnets"). Mesh sizes range between 2 to 16 inches, with the size of the holes determining the size of the catch. For example, large holes allow larger fish to be caught while smaller fish pass through. They are used to fish on the surface, in mid-water or on the bottom, stretching from 50 to 200 meters; sometimes groups of nets are tied together extending thousands of meters. Set nets are attached to the bottom by weights and floats along the top; on the contrary, drift nests are released by the boat and allowed to drift with the current. Pelagic drift nets target species such as swordfish and other billfish, sharks, mackerels and mahi mahi. Gillnets are non-selective and responsible for the deaths of large number of seabirds, marine mammals and sea turtles. Drift nets often become unattached, turning into “ghost nets” that trap marine life for long after they have been abandoned. This is the main reason why gillnets have been banned in many places. The commercial use of gillnets in Chile and Peru are also thought to have contributed to the collapse of the Pacific leatherback population[9]. Coastal gillnets are often set close to shore or laid atop reef flats, a primary sea turtle feeding area. Turtles entangled in these nets face a high risk of drowning.

Purse seine nets can be considered a type

of small mesh gillnet that hangs vertically in the water, the ends are then drawn together like a purse and enclose the fish. The target species are fish for both human consumption and bait.

Mitigation – Gear modifications, such as changing the mesh size, changes in fishing practices by limiting soak time as well as closing specific areas to gillnet fishing seasonally or permanently, have been implemented in order to reduce bycatch. Although biodegradable nets may offer some protection to the "ghost net" problem, it is important that the nets be properly attended to.

Conclusions

International cooperation is essential for achieving efficient management that would ensure the survival of sea turtles while sustaining the economic benefits provided by fisheries. In 1995, the Code of Conduct for Responsible Fisheries (http://www.fao.org) was adopted by the 28th Session of the FAO Conference. This Code sets out principles and international standards of behavior for responsible practices to ensure the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity. It addresses conservation of endangered species and urges that countries minimize catch of non-target species. In 2004, 28 countries worked with FAO to produce a set of recommendations for reducing incidental capture of sea turtle in fisheries as well as requesting that FAO develop policy and management guidelines and provide technical assistance on specific steps in doing so, especially for developing countries lacking

Proposed contents of international guidelines for reducing turtle by-catch (FAO - Bangkok, 2004)

Fishing operations

- Boats should promptly release any accidentally caught turtles, always carrying with them the necessary equipment for doing so.
- Purse seiners should avoid encirclement of sea turtles and in the case of entanglement should take all possible measures to safely release them. Fish-aggregating equipment used by purse seiners that may entangle turtles should be monitored regularly, and captured turtles released promptly. Research in modifications to this equipment that reduces likelihood of by-catch should be conducted.
- In long-line fisheries, combinations of hook design, bait types, fishing depths, gear specifications and fishing practices should be used to minimize accidental deaths of turtles. Longline boats should always have the equipment necessary for release of capture turtles on hand.
- For other fisheries, studies on sea turtle by-catch and mortality are required, as well as research into changes to fishing techniques and equipment to reduce by-catch. In particular, priority should be given to gillnet fisheries.
- In all fisheries, temporary and spatially-limited controls on fishing, especially in locations and during periods of high concentrations of turtles, should be considered when appropriate.
- Plans to avoid loss of nets and retrieve drifting nets and fishing gear, which can harm turtles, should be developed in all fisheries.

Monitoring and research

- Countries need to assemble more data on sea turtle-fishing interactions for all fisheries.
- Research into the socio-economic impacts of sea turtle conservation and management measures on fisheries and fishing industries is needed in order for those measures to succeed.
- Regional fisheries bodies should be used as a mechanism to share information about sea turtle-fisheries interactions and by-catch reduction strategies.
- Where such programs are economically and practically feasible, countries could develop observer programs in fisheries that have impacts on turtles.

Education, training and capacity building

- Educational materials on avoiding turtle by-catch and proper release procedures should be developed and used in trainings and workshops with fishers.
- Countries should cooperate closely in research activities on the status and behavior of turtles. In particular, for developing countries this is a way for them to leverage scant resources.

technical capacity or financial resources to implement such practices. FAO will be producing reports which provide updates on the status of sea turtle stocks as well as on progress in reducing fisheries related impacts.

The Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) has the legal, administrative and technical components required to facilitate a joint search for measures to reduce bycatch and be able to call upon governments, scientists, industry representatives and civil society for this purpose. All Parties to the Convention are called to reduce, to the greatest extent practicable, the incidental capture of sea turtles in the course of fishing activities, through the appropriate regulation of such activities, as well as the development, improvement and use of appropriate gear or techniques, including TEDs. Furthermore, during the Second IAC Conference of the Parties, a Memorandum of Understanding between the Latin American Organization for Fisheries Development (OLDEPESCA) and IAC was signed, recognizing the need to support responsible fishery activities and to establish cooperative mechanisms between multilateral organizations in the region.

Many strategies currently underway to help mitigate sea turtle bycatch have been discussed. Obtaining sufficient data on theses efforts is key to providing a complete panorama of incidental mortality of sea turtles in fisheries and the effectiveness of such measures as mitigation tools. Also, by having the fishermen and fishing industries directly involved in creating solutions to bycatch, awareness and attitudes toward conservation within this industry have been changing positively. Opportunities for the general public to get involved have also been presented, such as through the 2006 international “Smart Gear” competition (www.worldwildlife.org/oceans/projects/smartgear.cfm), supported by World Wildlife Fund, with the purpose of finding fishing gear that reduces accidental marine life deaths. One will also find a variety of websites dedicated to providing consumers with sustainable seafood guidelines, such as www.seafoodwatch.org.

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