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# Sea turtle bycatch – a global issue

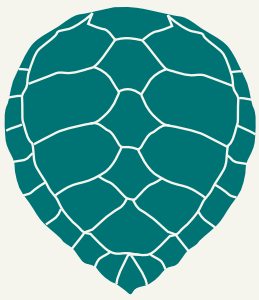
## THE PROBLEM

Of the seven species of sea turtles that inhabit our planet's seas, the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species classifies the hawksbill and Kemp's ridley as "Critically Endangered", the green as "Endangered", the olive ridley as "Vulnerable", and certain sub-populations of loggerhead and leatherback as "Critically Endangered", while the flatback turtle is currently considered as data deficient. While sea turtles face a growing number of human-induced threats, including marine pollution and loss of nesting habitat due to coastal development or degradation, incidental capture of turtles – also known as bycatch - in fisheries poses the single most serious threat to marine turtles worldwide[1]. Bycatch occurs in both large-scale and small-scale fisheries (SSFs) using trawls[2], longlines[3,4], gillnets[5,6], trammel nets, seine nets, and many other gears.

According to one 2004 study, pelagic longline fleets from 40 countries set an estimated 1.4 billion hooks in the water, the equivalent of 3.8 million hooks every day[7]. Trained observers working on longline fleets and other large scale industrial fishing vessels, have generated a wealth of data through a focus on these fisheries to avoid further sea turtle population declines[3,7,8]. The cumulative impacts of these large-scale fisheries are of high conservation concern, and have driven the mobilization of resources to monitor and reduce sea turtle bycatch through collaboration between NGOs, researchers, governments, the fishing industry, and regional fisheries management organisations (RFMOs)[9].

However, estimating rates of bycatch in small-scale fisheries (SSFs), which operate predominantly in nearshore waters and use a range of gear types including gillnets, trammel nets, and traps, is much more challenging. Several studies show that turtles are less likely to survive entanglements in gillnets than trawls or longlines, leading to a higher mortality rate[10,11]. In 2014, 85% of the world's motorized fishing vessels were under 12m in length[12], too small to host on-board observers. SSF fishing effort is also widely dispersed, making it difficult to sample a representative portion of the fleet with interviews or fish landing site inspections[13]. Furthermore, small-scale fisheries are most prominent in developing countries where resources are limited for monitoring of fisheries[5,14]. Recent studies indicate that turtle bycatch in small-scale (gillnet) fisheries may be responsible for as much if not more sea turtle mortality than large-scale fisheries[2,10,15,16]. As such, finding effective ways to assess, monitor and mitigate bycatch in SSF should be a high conservation priority.

Without efforts to reduce bycatch in both large and small-scale fisheries, many marine turtle populations face a serious threat of extinction.



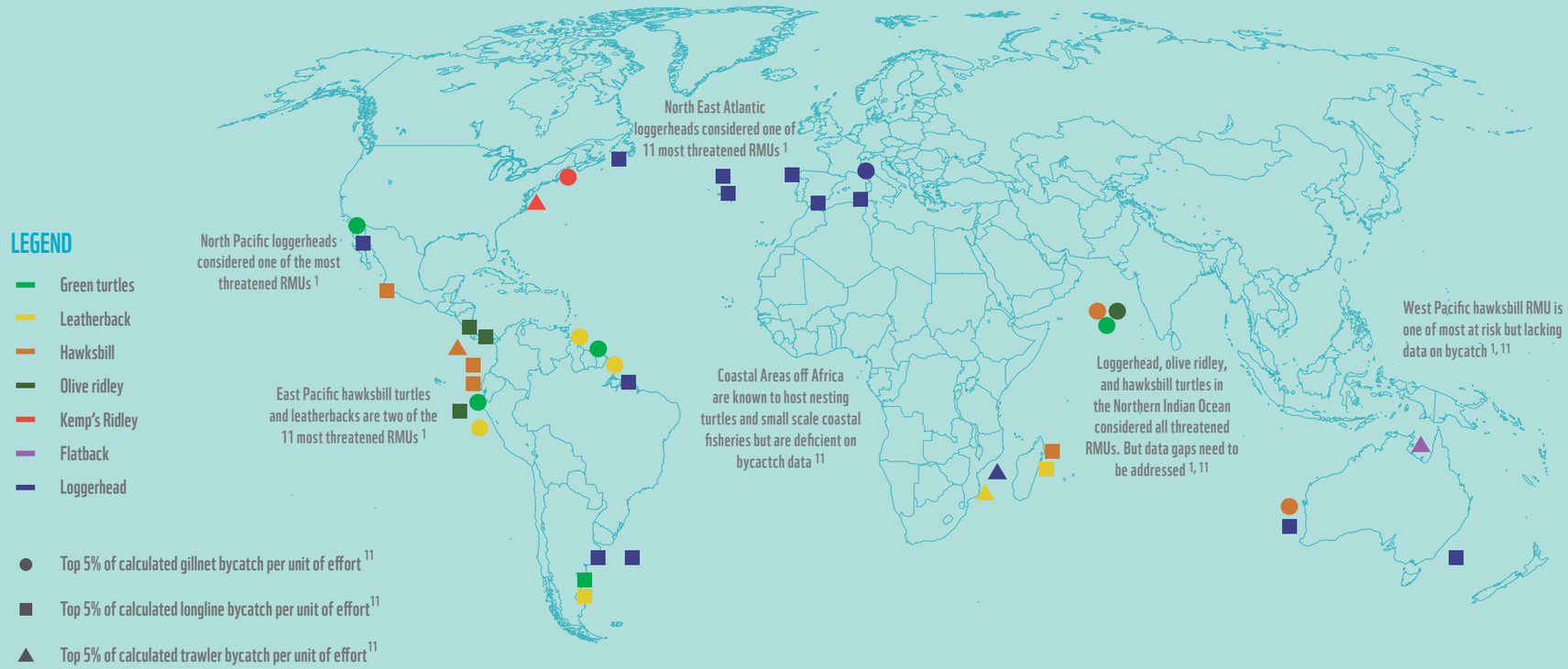
**BYCATCH IN FISHERIES POSES THE SINGLE MOST SERIOUS THREAT TO MARINE TURTLES WORLDWIDE[1].**

# Global distribution of turtle bycatch: Hotspots where mitigation efforts should be focused

For conservation management purposes, sea turtle populations around the globe have been categorized into Regional Management Units (RMUs)[17] that take into account information from genetic, nesting, mark-recapture and satellite telemetry studies. The RMU framework allows researchers and conservation managers to assess the risk that bycatch poses to turtle populations around the world on a biologically meaningful scale. For example, high rates of bycatch of loggerhead turtles in fisheries off the coast of Peru where they feed, could be the cause of reduced numbers of reproductive females on Australian coasts, where they nest.

A 2013 study of over 1,800 sea turtle bycatch records from 230 sources found that the highest bycatch rates occurred in the East Pacific, Northwest and Southwest Atlantic, and Mediterranean regions[11]. However, these were also the regions that contributed the highest volume of data. Over 60% of this data comprised records from longline fisheries[11]. While the bycatch occurring in these fisheries is of serious conservation concern, the authors point out that "data poor" coastal areas off Africa, within the Northern Indian Ocean and throughout Southeast Asia are also known to host numerous nesting colonies of turtles from RMUs that are under high threat from small-scale fisheries[11,13]. As such, the magnitude of the threat posed by small-scale gillnet fisheries in these areas where so little research on bycatch has occurred may not be accurately reflected in the map to the right.

This map depicts areas where various populations of turtles are known to be at significant risk from different types of fisheries. The data were synthesized from two global studies of turtle bycatch and one of global threats to turtle populations [1,11,18].




# Reducing turtle bycatch: tools at our disposal

The likelihood that a turtle is accidentally captured in fisheries is influenced by the interaction between its behaviour, ecology, and life history, and its susceptibility due to spatial or temporal overlap with fishing gear[14]. The most logical, and only certain way to prevent turtle bycatch is to reduce the overlap of fishing effort with turtle distribution through the creation of protected areas or seasonal closures on known feeding or breeding grounds[5]. Where this is not possible, successful mitigation strategies need to account for turtle behaviour and ecology and have minimal impact on the yield of the target fisheries. This requires direct collaboration with the fishers themselves, to devise and implement measures that they will perceive as acceptable and sustainable[19]. Decades of research and trials have led to the development of a few potentially successful tools for each of the three main categories of fisheries that cause sea turtle bycatch:

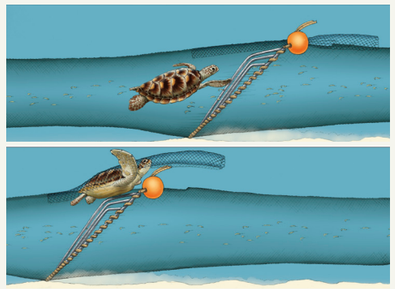
"J" Hook (left) and an adapted "C" Hook (right) which are known to drastically reduce turtle bycatch © WWF-US / Jill Hatzai

## ■ LONGLINES

Longline fisheries for swordfish, tuna, sharks and mahi mahi (dolphin fish) account for a large percentage of documented turtle bycatch around the world[11]. Various mitigation measures have been trialled based on evidence that lines set below 100m depth have lower turtle bycatch rates than lines near the surface; that leatherbacks are more often caught during night time sets than those during daylight hours; and that longer soak times result in higher catches of loggerhead turtles[21]. However, the most successful and widespread bycatch reduction tool for longline fisheries is the replacement of the traditional narrow "J" hook with the circle, or wider "C" hook. Numerous studies in fisheries around the world have concluded that C hooks generally have the potential to reduce turtle bycatch without impacting the yield of targeted fish species[3,21-24], with the most successful example being that of the Hawaiian swordfish longline fishery where the introduction of C hooks led to 83% reduction of leatherback turtle captures and a 90% reduction of loggerhead turtles[25]. However, researchers warn that there is no "one size fits all" measure, as in some studies the introduction of circle hooks reduced target fish catches, reducing their attractiveness. Properly monitored trials need to be conducted in every fishery to make sure that new measures are in fact reducing bycatch and not increasing bycatch of other species[3,27].

## ▲ TRAWL FISHERIES

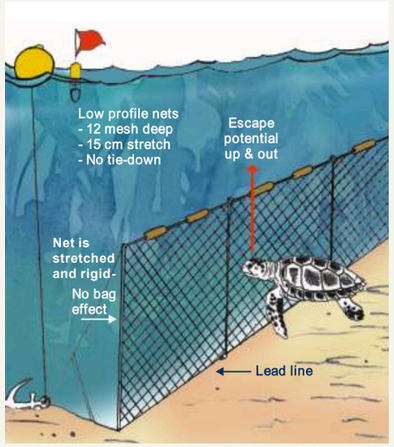
Trawls became the focus of sea turtle bycatch reduction efforts in the 1980s, when shrimp fisheries in the Gulf of Mexico were recognized as one of the largest sources of sea turtle mortality in US waters. Turtle excluder devices (TEDs) were developed to allow turtles and other large marine animals to escape from trawl nets. A metal grid inserted into the neck of the trawl forces the turtle and other animals out of an opening in the bottom or top of the net, while allowing the smaller shrimp and fish to pass through into the "bag end" of the net. TEDs have a proven ability to exclude at least 97 percent of turtles that enter a shrimp trawl with minimal target catch losses (under 2%)[20]. TEDs are now being used in trawl fisheries all over the world, and when used properly, are dramatically reducing turtle bycatch and mortality[14].



Turtle Excluder Device (TED) / Illustration by Marc Dando

## ● GILLNETS

Despite their prevalence throughout the world, less progress has been made on finding technical gear-related solutions to reduce bycatch in gillnet fisheries. Measures that have met with some success include increasing the depth of nets from the surface [26], net illumination with LED lights[28], alteration to net tie-downs and net weight to increase the rigidity of nets, and removal or reduction of floats[5]. However, in these fisheries time/area closures based on knowledge of turtle seasonal presence are more likely to be effective than any other measure tested to date[5,14].




Modified net without tiedowns / FAO guidelines

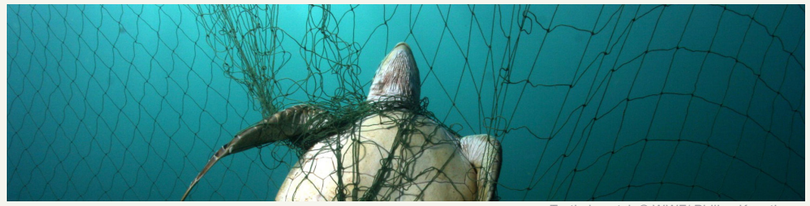
## TURTLE HANDLING TECHNIQUES

In addition to the fisheries-specific measures above, there is also evidence that appropriate handling techniques during disentanglement from gear in both large- and small-scale fisheries can have a significant impact on turtles' survival rates post-release[29]. More effort should be placed into awareness raising and training with fishers to spread good practices such as the removal of trailing line from turtles that have ingested hooks, lifting turtles from the water by the carapace or with nets instead of by lines or flippers, and the use of specialized tools for removing hooks or cutting line away from turtles that cannot be lifted onto the deck[30].

## The way forward

WWF has been committed to sea turtle conservation for over 50 years and is actively involved in monitoring and reducing fisheries bycatch all over the world. We are committed to helping promote the use of proven bycatch reduction methods such as TEDs and circle hooks in those fisheries where they are appropriate, and to work with fishing communities to seek new and innovative solutions to reducing bycatch in small-scale and gillnet fisheries, including turtle handling and release methods. We welcome new strategies, such as the development of at-sea advisory programs that provide real-time information to fishers on observed bycatch[31], portable and affordable remote electronic video monitoring systems for small-scale fisheries, and the use of fishery certifications or eco-labelling to provide incentives for fishers to help solve the problem while maintaining their livelihoods.

For more information and detailed illustrations on turtle bycatch and mortality reduction in fisheries, see also: the FAO guidelines to reduce sea turtle mortality in fishing operations, publically available at http://www.fao.org/docrep/012/i0725e/i0725e.pdf.



Turtle bycatch © WWF/ Philipp Kanstinger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**Why we are here**
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.