ACTION ON GHOST GEAR

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Ghost gear—intentionally or unintentionally abandoned, lost, or otherwise discarded fishing gear—is a global conservation problem that affects dozens of marine species, including sea turtles. Ghost gear continues to catch target and nontarget species long after being lost, abandoned, or discarded, a process called ghost fishing. Historically, fishing gear was made from naturally occurring materials such as coconut, palm leaves, jute, or bamboo, which broke down quickly in the oceans. But over the past 60 years, fishers around the world have switched to gear made from synthetics such as nylon, polypropylene, and polyethylene. Those plastics are extremely resistant to ultraviolet radiation and may remain in the marine environment a very long time without degrading. Each year, around 640,000 tons of ghost gear are generated globally, accounting for around 10 percent of the world's marine debris.

Those sometimes enormous tangles of nets, ropes, buoys, hooks, floats, and other debris kill hundreds of thousands of marine animals every year. Ghost gear also threatens the marine environment by smothering coral reefs and seagrass beds and by introducing alien species. It can be detrimental to fisheries by depleting valuable fish species without generating financial benefit and can have a negative effect on marine-related tourism. Ghost gear can travel long distances from its point of origin and can accumulate in ocean gyres, making it a complex, transboundary problem that involves multiple stakeholders at different economic and social scales.

Marine debris, including ghost gear, affects all seven species of sea turtles in various ways. The life cycle of sea turtles makes them particularly vulnerable to entanglement in ghost gear because they occupy various habitats during different life stages. Ghost gear on nesting beaches may act as obstacles for nesting females or may entangle hatchlings trying to crawl to the ocean. The early life stages of sea turtles are relatively unknown, but it is generally accepted that once hatchlings reach the ocean, they drift with the currents and winds to convergence zones, where they encounter floating mats of algae that provide protection and shelter. Unfortunately, marine debris follows those same paths and accumulates in the same convergence zones. Moreover, ghost nets serve as a substrate for sedentary organisms such as bryozoans and barnacles, which attract opportunistic feeders such as juvenile turtles, which in turn attract larger predators, and so on. Many turtles become entangled when they use the ghost net mats as shelter and as a food source. We have witnessed an olive ridley turtle become entangled after it climbed atop a mat, possibly to warm up or to rest.

For sea turtles, entanglement can cause exhaustion, dehydration, decreased swimming ability, reduced feeding, life-threatening injuries, and eventually death. The number of turtles that survive entanglement in ghost gear is unknown. A turtle's struggle to get free of an entanglement may result in a debilitating injury, such as lost limbs or other physical disfigurement, which could reduce the animal's ability to swim, feed, and reproduce.

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In Maldives, we have recorded green, hawksbill, and olive ridley turtles with healed injuries consistent with surviving an entanglement. In northern Australia, where green, loggerhead, olive ridley, flatback, and hawksbill turtles are affected by ghost nets, we have found recently injured turtles both alive and dead. How the injuries may affect sea turtle populations as a whole is still unknown, and understanding long-term effects is difficult.

By its very nature, ghost fishing is difficult to measure, and efforts to quantify this problem and its effects on marine animals have been few and far between. Despite evidence suggesting that ghost gear affects sea turtles at various life stages, no globally standardized methods for data collection are in place to calculate mortality rates or identify hotspots. The Olive Ridley Project (ORP) and GhostNets Australia (GNA), two organizations dedicated to collecting data on ghost fishing and turtle entanglements, are helping to diminish this threat.

Since 2013, ORP has been working in Maldives, where fishing nets (except small bait nets) are not used. Instead, fishing is mostly done using either pole and line or hand lines. Therefore, most ghost gear found in Maldives has drifted in from neighboring Indian Ocean countries or is from illegal fishing operations. Between July 2013 and December 2015, ORP volunteers in Maldives reported more than 203 entangled olive ridley turtles, mostly juveniles. Additionally, 4 green turtles, 10 hawksbills, 1 leatherback, and 3 turtles of unknown species were reported entangled. Of the entangled turtles, 191 were released alive.

ORP volunteers have collected and discarded 259 net accumulations, which consist of almost 600 nets, ropes, bags, buoys, bottles, and other debris from India, Maldives, Oman, Pakistan, Sri Lanka, and Thailand. Throughout the Indian Ocean region, ORP held seminars and workshops that educated hundreds of fishers, schoolchildren, tourists, dive professionals, and community members about the dangers of ghost nets and about helping record valuable data.

In the Indian Ocean region, ORP is developing programs to encourage the reuse and recycling of fishing gear at the end of its useful life. Created in 2014 to focus on threats to turtles in Bangladesh, India, Maldives, Pakistan, and Sri Lanka, the Northern Indian Ocean Marine Turtle Task Force recognized ORP as the main organization working on ghost gear for the region. ORP also received a SWOT grant in 2015 (see p. 45) to support its important work.

Since 2004, GhostNets Australia has been working in remote regions of the Gulf of Carpentaria in northern Australia. There, GNA has been training and supporting groups of rangers from coastal indigenous communities to locate, retrieve, and dispose of ghost nets and to record entangled marine life (see *SWOT Report*, vol. IV, pp. 31–33). GNA has invested heavily in the rangers, creating the tools, providing relevant training, and building the group's capacity so they can work beyond short-term funding cycles. The rangers now monitor nesting sites and protect turtle populations from egg predation by feral pigs, another serious threat in the region. To date, the rangers have removed approximately 13,000 ghost nets from the coasts of northern Australia, of which only 8.2 percent originated from Australian fisheries. The remainder of the gear floats in from the Arafura Sea to the north, which is bounded by Australia, Indonesia, Papua New Guinea, and Timor-Leste (East Timor).

More than 80 percent of the entangled animals observed by GNA have been sea turtles. Although the number of entanglements reported over the span of the program has risen in tandem with improved data collection, it is still considered an underestimate of the true effect of ghost nets on marine life. Concerned that the approximately 800 turtles recorded by the rangers from 2004 to 2012 was an underestimate—rangers were able to patrol beaches only three to six times a year—GNA partnered with two research projects to develop better estimates of the ghost net effects.

In 2012, a postgraduate student from Queensland University investigated the decay rates of marine turtles in tropical waters. At the same time, the Commonwealth Scientific and Industrial Research Organization conducted a risk assessment. Those two projects concluded that the actual number of sea turtles affected by ghost nets during the eight-year period likely was 4 to 20 times worse than the rangers estimated.

THIS PAGE: Olive Ridley Project Pakistan project coordinator, Absar Khan, removes a ghost net from the ocean floor while diving off Charna Island, Pakistan. © MARTIN STELFOX
PREVIOUS SPREAD: Local divers disentangle an olive ridley turtle from a ghost net in Baa Atoll, Maldives. © THOMAS BADSTUBNER

The transboundary effects of ghost gear and sea turtle interactions highlight the urgent need for collaborative efforts between the governments, fishers, and turtle researchers of neighboring regions. Regional databases should quantify turtle entanglements in ghost gear by recording details such as species, sex, size, location, and injuries sustained. Such a database could help answer questions regarding turtle mortality and help identify entanglement hotspots and problem fisheries. Genetic sampling of entangled turtles could highlight population dynamics and identify the origins of entangled turtles. By combining this information with oceanic current modeling, researchers could identify hotspot areas likely to need attention. New technologies, such as aerial drone surveys, could also help locate entangled animals to direct immediate attention as well as ground truth the predictive models.

Addressing the hazards of ghost gear requires educating local communities to build capacity and increase the quantity of data collected. Involving citizen scientists—members of the general public who contribute to scientific research—in data collection reduces costs and increases the geographic areas a research team can cover. However, citizen scientists must be well trained, whether they are rangers, divers, snorkelers, fishers, or boat captains, so that standard procedures are followed and the quality of data remains high.

The entanglement of marine turtles in ghost gear is a significant but understudied cause of turtle mortality and habitat threats, especially in the Indian Ocean. Scientists, conservationists, and governments must work together urgently to better quantify the problem of ghost fishing and to find local, regional, and global solutions both to clean up ghost gear and to prevent gear from being lost or discarded in the oceans in the future. ■