



Threats to Sea Turtles and Possible Solutions

Introduction

Sea turtles are one of the most ancient reptiles in the world dating back some 110 million years ago, surviving the extinction of the dinosaurs. Their complex life cycle, covering several developmental habitats and migrations of hundreds or thousands of miles between feeding zones and nesting beaches, exposes them to many threats to their survival, both natural as well as anthropogenic (human induced), over a broad geographical area. Today, their populations have been drastically reduced so that all seven species of sea turtles in the world are considered threatened or in danger of extinction.

Below you will find a description of the main natural threats and human activities that negatively impact sea turtles while offering some solutions and conservation measures to take.

Natural Threats

Over their existence of millions of years, sea turtles have survived various catastrophic climatic and geological changes, which have resulted in drastic changes to their distinct habitats. Furthermore, sea turtles, their nests and hatchlings (neonates) are faced with many habitual threats. While in the nest, the eggs and hatchlings face many predators like ants, crabs and raccoons. After leaving the nest, hatchlings encounter crabs, birds and a vast number of predators in the ocean (for example, fish and sharks). Very few, perhaps only one out of every 1,000 turtles hatched, will survive to maturity. As adults, the number of natural threats decreases significantly and they have very few natural predators, among them sharks and jaguars. However, it is the increase in negative human impacts that have caused these species to teeter on the brink of extinction, by placing additional pressure on every stage of their life cycle, from nesting areas to mortality in the open ocean.



Coatis preying on a green turtle nest in Tortuguero, Costa Rica.

Over-exploitation of Sea Turtles and Egg Harvesting

The global decline of sea turtles may be attributed to their over-exploitation due to their direct capture and harvesting their eggs for commercial and subsistence purposes along many coastal zones. The chronicles of the European conquerors of the XV and XVI centuries tell the story of difficulties in navigating ships through the Caribbean due to the sheer quantity of turtles present, like thousands and thousands of tiny rocks. Until very recently, green turtle meat, hawksbill carapaces (shells) and the leathery skin of ridley turtles, among other items, represented export products for many nations. At



Green turtle hunted in Tortuguero, Costa Rica.

American Convention for the Protection and Conservation of Sea Turtles (IAC) agree to prohibit intentional capture, retention or killing of, and domestic trade in, sea turtles, their eggs, parts or products and comply with the obligations established under CITES. Nevertheless, illegal harvesting of nests and trade of sea turtle products and sub-products has been reported at the local level, generating great concern¹. Despite national prohibitions, consumption of turtle meat is still a highly appetizing dish. Many articles are made from the carapace of hawksbill turtles, including eyeglass frames, combs, bracelets and more. Carapaces and desiccated individuals of all sizes are frequent articles of trade; many are just juveniles, sacrificed without ever having the opportunity to reproduce. The traffic of these articles seems to be present in many nations and is often detected through the products that are sold to tourists^{2, 3}. It is evident that the motivation behind many of these activities is economic; therefore, an integrated approach must be applied in order to control the over-exploitation of sea turtles, establish incentives that favor their appropriate management, promote non-consumptive uses of sea turtles and regulations on such use, and ensure an efficient application of the laws prohibiting the sale of these products, among others⁴.



Hawksbill articles.

Traditionally nesting beaches have been protected from illegal harvesting of eggs and sea turtles through permanent beach patrols during the nesting season, leaving the majority of the nests *in situ*, or untouched. Naturally, these patrols should be carried out throughout the day in the same manner they are carried out at night, when nests are also subject to poaching. To care for a nesting beach 24 hours a day during the entire four to six month nesting season, implies the need for a great deal of manual labor as well as a high financial cost.

the present time, it would be impossible, in most cases, to think about harvesting the quantity of sea turtles needed to satisfy world markets. The magnitude in which global sea turtle populations have declined is a consequence of their uncontrolled consumption.

Currently, all species of sea turtles are listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), thus their trade between nations is prohibited. Furthermore, the Parties of the Inter-

Transporting nests to artificial hatcheries is also a common conservation technique when nests are threatened, especially by the presence of illegal poachers or erosion. However, it is important to only use this technique as the last case scenario due to the fact that manipulating nests often results in skewed sex ratios or in decreased hatching success, depending on the conditions of the hatcheries. Every hatchery must follow the existing, standardized methods in place for hatchery construction and management. For more information see the manual *Management and Research Techniques for the Conservation of Sea Turtles* (<http://iucn-mtsg.org/publications/>) prepared by the Marine Turtle Specialist Group of IUCN/SSC.

Habitat Alteration and Loss

Development occurring in coastal zones used by sea turtles for nesting is often incompatible with this crucial stage of their life cycle. Buildings and structures such as seawalls on the beach or in adjacent zones, beach nourishment or extraction of sand, and eliminating natural vegetation on the dunes, significantly exacerbates erosion and directly affects the condition of this important habitat for sea turtles. On the other hand, the temperature of the sand determines the sex of the hatchlings (in general, higher temperatures produce females, while cooler temperatures produce males). In some cases, constructing tall buildings or clearing natural vegetation along the coast can alter sand temperature, which may result in a skewed hatchling sex ratio. Many questions arise regarding the effects global warming might have on sea turtles; ranging from a change in the sand temperature to an increase in the rate of beach erosion.



Beach nourishment on Jupiter Beach, Florida.

Coastal development and human presence on the beach creates additional threats, such as: predation of eggs and hatchlings by domestic animals like pigs, cats and dogs, and the occurrence of motorized vehicles on the beach. Although very difficult to resolve, some programs meant to mitigate or reduce threats caused by domestic predators exist, for example, predator control (elimination) or placing a treated wire or plastic mesh cage just over the nest with a mesh large enough to allow the passage of the hatchlings to the surface⁵. Animals are unable to move or penetrate the nest through the cage. On the other hand, the presence of motorized vehicles should not be allowed on the beaches during the nesting season because they contribute to the mortality of hatchlings by squashing the eggs and emerging hatchlings, as well as making the actual nesting process and hatchling emergence from the nests more difficult⁶.

Poor watershed management often results in beaches being covered in different organic and inorganic materials originating from upstream. Beach cleaning before the arrival of nesting females and hatchlings is very important; sea turtles must have access to a clean beach, free from obstacles, allowing proper nesting above the high

tide line. On the other hand, if hatchlings are faced with many obstacles on their journey to the sea, they will get stuck or lose their energy, converting into easy prey for their predators.

Artificial Lighting

Artificial lighting that frequently accompanies urban development can be disturbing to females coming ashore to nest and disorientating to hatchlings trying to reach the ocean, using the brightness of the horizon as their visual clue. Even though a turtle may experience difficulties in nesting, she will return to the ocean and try again later that same night or the following. However, as hatchlings orientate themselves toward the light source; it often leads them to roadways frequented by motorized vehicles resulting in fatal consequences. Similarly, hatchlings will become disorientated, causing them to use up their energy stores and become easy prey to both wild and domestic animals. It is important to adopt programs that educate residents and beach visitors on the harmful effects of artificial lighting and on existing alternatives. For more information, see *Understanding, assessing, and resolving light-pollution problems on sea turtle nesting beaches*, publication of the Florida Marine Research Institute (http://www.floridamarine.org/education/view_article.asp?id=20125).

Tourism

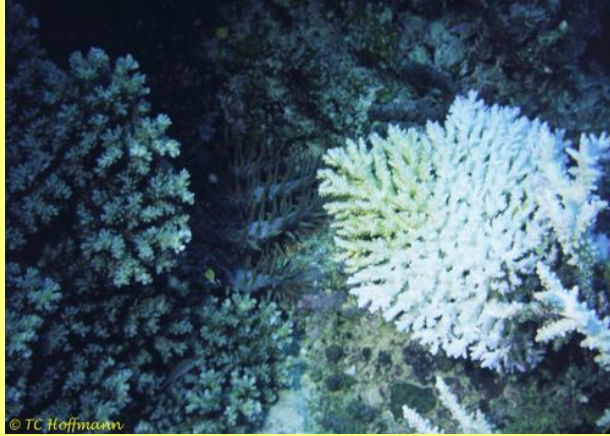
The observation of nesting sea turtles has become a great tourist attraction for coastal area visitors. Participation in this activity is important because it provides people with a deeper knowledge of sea turtles, thus increasing public awareness in general and the number of people protecting and caring for sea turtles. This activity also generates an important source of employment and income for the local population. However, the presence of humans on the beach can also be harmful to nesting females, if bothered; they can abort their nesting process. It is extremely important to promote programs using certified guides who have adequate training and follow certain codes of conduct when observing nesting turtles. Various ways of endorsing such codes of conduct currently exist; one example is the guide *Turtle Watching* (<http://coralreefalliance.org>) by the Coral Reef Alliance (CORAL) and Wider Caribbean Sea Turtle Conservation Network (WIDECAST).



Nesting site in Singer Island, Florida.

Pollution and Marine Debris

Consequences of poor watershed management are runoff of chemical products and fertilizers, dumping of domestic and industrial wastes, and soil erosion and sedimentation in the coastal marine zone, negatively impacting marine ecosystems and directly or indirectly affecting sea turtles. Seagrasses and coral reefs inhabiting the shallow waters of the continental platform are exposed to these sediments and



contaminants, eventually covering and suffocating them by creating barriers to light penetration, a vital life source for these organisms. This results in the destruction of coral reefs and seagrasses, an important habitat for the feeding and protection of sea turtles. Furthermore, challenging issues facing these habitats are the rising sea level and sea temperatures as a part of the greenhouse effect, provoking in some cases coral bleaching or even the death of corals.

Coral bleaching.

In general, there is a lack of information about the harmful effects of pollution in the ocean and coastal zones on sea turtles. However, bioaccumulation of heavy metals and pesticides has been observed in some marine mammals and has been linked with immune suppression, increasing their risk of disease⁷. This same concern is valid in the case of sea turtles. Recent studies also indicate that the disease that causes tumors in turtles, known as fibropapillomas, may be linked to pollution in near-shore waters or even in the oceans.



Green turtle with fibropapillomas.

All stages of the sea turtle's life cycle are susceptible to the harmful effects of oil exploration and exploitation as well as the debris produced by marine vessels, either through direct contact or habitat destruction. Ingesting tar or non-biodegradable wastes, such as bags and plastic packaging materials (sometimes confused as a food source), can cause obstructions in the esophagus and intestines, reducing their ability to feed and thus resulting in a slow death⁸. Many turtles die every year by becoming entangled in larger pieces of marine debris generated through marine activities, such as fishing. Entanglement in nets, ropes or other debris can complicate their ability to float, reduce their mobility or result in the loss of limbs, subjecting weakened turtles to infection, predators or collision with boats.

Fisheries and Incidental Capture

A large number of sea turtles are captured in various types of nets and hooked on longlines during fishing tasks aimed at other species (incidental capture). Existing information on this subject is scarce due to the fact that the majority of fishery activities have no records about incidental capture, except in the case of the tuna floats in the Pacific. In this case, the Inter-American Tropical Tuna Commission (IATTC) estimates that the industrial tuna fisheries on the high seas alone lowers some 200 million fish hooks each year in the Pacific ocean where they have recorded incidental capture of sea turtles⁹. A recent study on incidental capture of leatherbacks and loggerheads on longlines in the Pacific suggests that quantities that would allow an eventual recovery of these threatened populations have already been exceeded¹⁰.



Green turtles captured in fishing nets.



Leatherback captured in trawl fishery.

Although sea turtles can be submerged for extended amounts of time, those that are forcibly submerged for whatever reason, eventually suffer fatal consequences from prolonged anoxia and seawater infiltration into their lungs. If their capture does not result in mortality, very little is known on the survival rate of those turtles that are released with injuries from hooks, rope or other types of fishing gear.

In the case of shrimp trawlers, Turtle Excluder Devices, commonly known as TEDs, represent an alternative that

decreases sea turtle mortality caused by trawl nets by allowing their escape. One of the measures of the IAC is the required use of this device on shrimp trawl vessels that operate within the Convention Area. Its use is also mandatory for US shrimp trawlers and for those in nations exporting shrimp to this country. It is important to initiate training and exchange programs among fishermen from different regions that have experience with appropriate use of TEDs.

Concerned by the magnitude of incidental capture by pelagic longlines, fishermen and conservationists alike are working on creating new techniques that reduce sea turtle capture and cause less injury. Many nations within the region are carrying out a series of studies related to the use of new circular hooks that, in theory, significantly reduce

incidental capture because they are wider than the original “J” hooks. They are also working on what depth the longline gear should be set to reduce interactions with turtles. For more information regarding these types of studies see *Catch Fish not Turtles Using Longlines* (<http://www.iacseaturtle.org/iacseaturtle/English/pub.asp>), by Eric Gilman of Blue Ocean Institute.

It is extremely important that all stakeholders involved in this problem continue their efforts to mitigate incidental capture, with the purpose of establishing cooperative mechanisms, generating much needed information through sharing ideas and knowledge. It is also important to establish parallel environmental education programs at the same time.

The Inter-American Convention for the Protection and Conservation of Sea Turtles has the legal, administrative and technical components required to facilitate a joint search for measures to reduce by-catch and be able to call upon governments, scientists, industry representatives and civil society for this purpose.

Some Legal Challenges

Under the framework of the IAC, identifying the diverse threats to sea turtle populations would help orientate future priority actions that the Parties need to take. However, there are also some priority legal aspects that need to be tended to, which are discussed in this section. Studies suggest that in some countries within the area of action of the Convention there are contradictions between environmental laws and those related mainly to fisheries, to the detriment of sea turtles^{2,11}. There must be a clear definition of the competencies of the different governmental entities to avoid legal gaps and contradictions when applying the laws. Similarly, as previously mentioned, some countries continue to consume various sea turtle products, although existing legislation prohibits its consumptive use. For those cases where the Convention allows subsistence use, laws and regulations should exist that control such activities. Often the legal framework relating to sea turtles falls under general wildlife laws, which in some cases have not been updated according to the social and economic reality of each nation.

In summary, the IAC is an adequate mechanism for helping Contracting Parties to develop legal frameworks and management activities necessary for the protection and conservation of sea turtles. It also established the possibility for cooperation with other Party and non-Party nations, international organizations and other key stakeholders working on these matters.

Conclusions

There is plenty of evidence that human activities have seriously diminished sea turtle populations. Although the majority of these actions are unintentional, for example coastal development, pollution and incidental capture, many intentional threats such as direct take of sea turtles and egg harvesting are evident.

Although many important research efforts initiated over half a century ago, there is much to learn about the life cycle of these marine reptiles. For example, relatively little is known about their migratory routes, use of different habitats and their spatial and temporal distributions. In order to have successful conservation programs, one must improve existing knowledge on sea turtles through increased scientific research and technical capacity using standardized methodologies that recognize economic and cultural forces behind threats, encourage active participation of local communities and regional coordination of conservation efforts between governments, researchers, and NGOs.

There are many successful examples of communities and volunteers directly participating in the management of nesting beaches. The involvement of local communities in managing nesting beaches has been going on for many years. At the beginning, these conservation projects observed a strong conflict between local customs of harvesting sea turtle products and conservation objectives. Today, one can see communities experiencing great success in stimulating economic growth at a local level through non-consumptive rather than consumptive use of sea turtles. Training programs for local guides have been developed to assist in sea turtle protection while at the same providing the guides with additional income and stimulating local economies.

Both national and international volunteer programs are important for various reasons, one being that they involve individuals of the civil society in sea turtle conservation activities, providing them with a technical awareness while promoting a greater public awareness. On the other hand, these same individuals working on nesting beaches require services such as lodging, food and transportation from the different sectors during their stay. These services are generally provided by the local population, which in turn, provide them with important economic benefits, improving the local economy.

One way to protect nesting beaches is to declare them as protected areas, applying the pre-existing management categories of each country; for example, creating marine protected areas. A declaration of this type establishes the legal and administrative competencies, in the terrestrial as well as marine environments, necessary to comply with the legislation, thus allowing the necessary measures to be taken for sea turtle conservation and protection. Often wildlife laws do not protect sea turtles throughout their entire range of action; therefore, their application is not very effective.

Conservation programs to be implemented will be different in every country or region, depending on the variety of factors previously discussed. Nevertheless, the need to act is urgent at all levels worldwide in order to prevent the current population decline of sea turtles.

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