Alice Cerghet

Green Sea Turtle Human Exploitation, Conservation and Rebound Potential

The tropic and sub-tropic seas display an astonishing range of organisms inhabiting many diverse ecosystems. Of these many organisms, one which is notable for nesting around shallow water and tourist beach locations has been *Chelonia mydas* – the green sea turtle. This turtle species is one of the most prevalent marine organisms in the tropics and mostly grazes off plant material in adult stages, maintaining a herbivorous diet (Balazs & Chaloupka, 2004). Green sea turtles undergo a shifting life history as their aging demands changes in habitat for feeding and nesting habits (Arthur et al., 2008).

During their development, green sea turtles may reside in periodic home ranges or go migrate to other regions (Arthur et al., 2008). As juveniles they spend 5-10 years as pelagic organisms (in open sea) and maintain an omnivorous diet consisting of ctenophores, jellyfish and crustaceans (Arthur et al., 2008). Once they have reached their maximum growth (up to 44cm in curved carapace length), they may migrate to a shallower habitat for feeding on seagrass, mangrove and microalgae (Arthur et al., 2008). Many adult females migrate and come ashore to specific beach regions every year for nesting, where they may come in contact with humans on foraging grounds (Balazs & Chaloupka, 2004).

One of the most pressing issues in ecology today is the exponential increase in number of animal species entering endangered and extinct states. Endangered statuses invoke a sense of international alarm, as any species with this classification is susceptible to becoming permanently extinct. The green sea turtle, having undergone a worldwide decline of 37-61% (spanning the last 141 years), has been classified as endangered (Troeng & Rankin, 2005). This classification, like all other endangered species statuses, stems from a decline in population caused by one or more factors. For green sea turtles, one key contributing factor to this population decline may be attributed to the capture of turtles for meat, eggs and other products (Troeng & Rankin, 2005).

The prevalence of human exploitation with a lack of restriction on capture activity has led to decline in many green turtle populations. One prime example is the Hawaiian stock which experienced massive turtle harvesting on foraging grounds from the mid 1800s to 1974, as well as egg harvesting until 1960 (Balazs & Chaloupka, 2004). In Nicaragua, an annual capture rate of 10,000 turtles between 1969 and 1971 has threatened green sea turtle populations (Troeng & Rankin, 2005). What was once considered an abundant and renowned species, has now become threatened towards extinction.

To tackle the issue of declining sea turtle populations, conservation efforts must be aimed at forming a recovery plan as well as a method for tracking progress. Much like humans, green sea turtles are a species that experience late maturity; green turtles reach maturity after 26 years (Troeng & Rankin, 2005). In the context of biology this translates to the age at which a species has fully reached sexual maturity. Since green sea turtles are a species that experience late maturity, they require conservation efforts that are focused on reproductive females and nests (Troeng & Rankin, 2005). Whenever the conservation of an endangered species with late

maturity is considered, the respective species must be given enough time to demonstrate that populations of hatchlings were able to grow to maturity (Troeng & Rankin, 2005).

One solution which has been implemented to help reverse the decline of green turtle stock and nesting has been through the change of policy on human exploitation (Balazs & Chaloupka, 2004). Policy intervention is a key solution as prohibiting the behaviour of turtle and egg hunting decreases anthropogenic factors influencing turtle stock decline. It is through this prohibition that scientists are able to conduct nest transect (longitudinal) surveys, to determine the effect of conservation efforts on turtle populations spanning decades.

Many policy changes have been implemented during the late 20th century in hopes of mitigating green turtle capture and increasing survivorship (Troeng & Rankin, 2005). The largest green turtle stock in the Atlantic basin is based in Costa Rica at Tortuguero (Troeng & Rankin, 2005). The Caribbean Conservation Corporation first began research into a recovery plan for turtles in Tortuguero in 1955 (Troeng & Rankin, 2005). Crucial policies to the cause included: ban on turtle & egg extraction at Tortuguero (1963), the declaration executive degree (1970) and by-law by Tortuguero National Park (1975) and the prohibition of calipee export in 1969 (Troeng & Rankin, 2005). Akin to having shark fin soup, the eating of calipee (food made from a turtle's shell) is considered a delicacy. These policies put in place aim to increase safety for green turtles and survivorship while lowering capture in beach nested areas (Troeng & Rankin, 2005). Additionally, emphasis was placed on creating new forms of ecotourist and villager activities in Tortuguero to steer away from turtle capturing (Troeng & Rankin, 2005).

Similarly, Nicaragua made changes in policy starting 1976 to ban the extraction of native green sea turtles (Troeng & Rankin, 2005). The country signed an agreement with the Convention on International Trade in Endangered Species (CITES) from 1978 and export of green turtles became illegal from that point onward (Troeng & Rankin, 2005). Green turtles inhabiting US water regions (especially Hawaii) also became protected after 1978 due to the US Endangered Species Act (Balazs & Chaloupka, 2004).

After policies have been established and regulated, it is important to track whether nesting populations really are experiencing a positive rebound from their depleted states. In order to do this, and knowing that green turtles are a late maturing species, scientists must devise a plan for monitoring nesting populations over a prolonged period of time (the time it takes for hatchlings to mature, i.e. 25 years). Surveys that are conducted over a brief period of time, for example 10 years, are not useful because green turtles live for a long time and often females affected by nutritional limitations may go several seasons without nesting (Balazs & Chaloupka, 2004).

In Tortuguero, weekly nest surveys have been conducted since 1971 and 1986 and have spanned an 18 km and 29.6km respectively (Troeng & Rankin, 2005). These surveys aim to determine the number of nests deposited each night through analysis of soft sand tossed over the nesting area or through difference of track lengths between female turtle arrival and departure on beach area (Troeng & Rankin, 2005). Using a General Additive Model (GAM), the mean for green sea turtle nest deposits could be estimated (Troeng & Rankin, 2005). Overall, the longitudinal study depicted a positive nest trend showcasing 471% and 61% increases in nesting along Tortuguero

beach sites since 1971 and 1986 respectively (Figure 2 and 3; Troeng & Rankin, 2005). A similar study was conducted for 30 years assessing the prevalence of green turtle nesting in Hawaii East Island region (Balazs & Chaloupka, 2004). The US Fish and Wildlife and US National Marine Fisheries services utilized annual studies and GAM to demonstrate a drastic increase of five times the initial domestic abundance over the span of the study (Figure 1; Balazs & Chaloupka, 2004).

While anthropogenic effects like human exploitation have been shown to confer devasting drops in green sea turtle population, actions can be taken to reverse this disaster. The increased Tortuguero and Hawaii nesting populations demonstrate that recovery from an endangered state is possible, but requires intervention through policy changes and rigorous monitoring spanning 20 to 30 years. Through continued international cooperation and conservation efforts, the abundance of the lovely *Chelonia mydas* may once again see the light of day.

REFERENCES

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Balazs, G. H., & Chaloupka, M. (2004). Thirty-year trend in the once depleted Hawaiian green sea turtle stock. *Biological Conservation, 117*(5), 491-498.

Troeng, S., & Rankin, E. (2005). Long-term conservation efforts contribute to positive green turtle *Chelonia mydas* nesting trend at Tortuguero, Costa Rica. *Biological Conservation, 121*(1), 111-116.

FIGURES

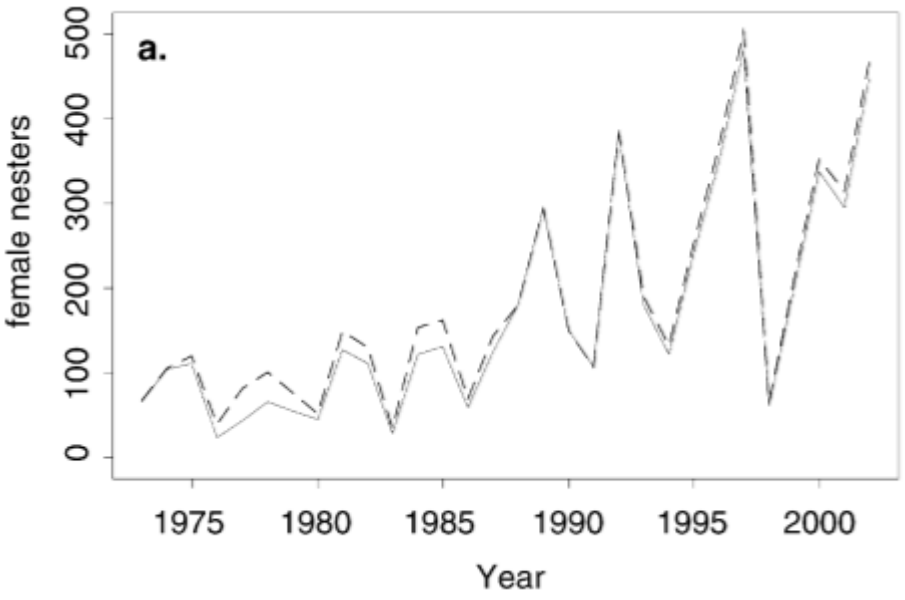

Figure 1. Nesting trend of Hawaii East Island Green Sea Turtles from 1973 to 2002 (Balazs & Chaloupka, 2004).

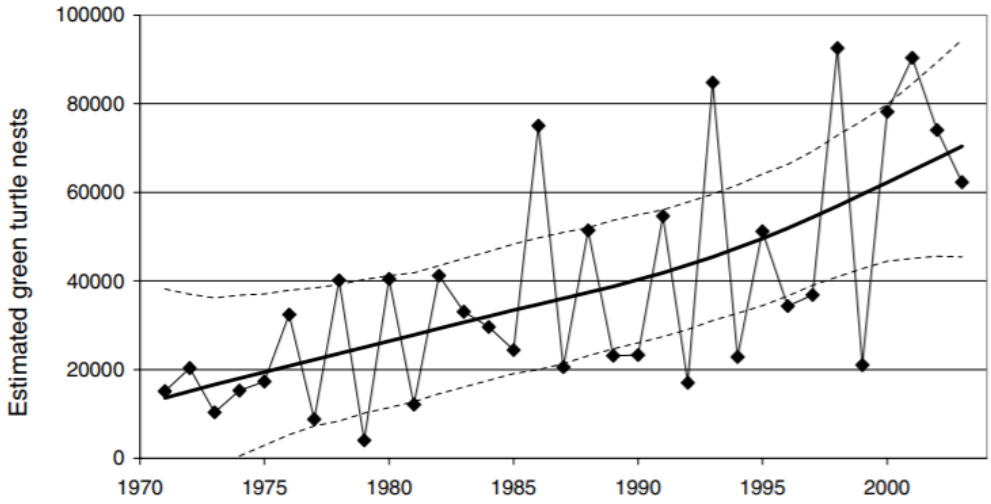

Figure 2. Nesting trend at Tortuguero, Costa Rica spanning the initial 18km region from 1971 to 2003 (Troeng & Rankin, 2005).

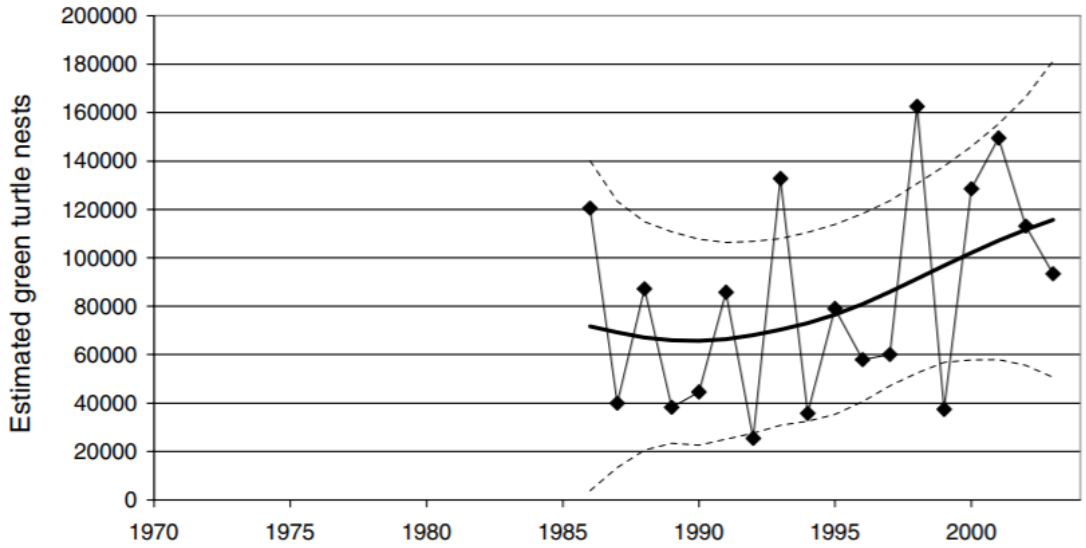

Figure 3. Nesting trend at Tortuguero, Costa Rica spanning entire beach (29.6km) from 1986 to 2003 (Troeng & Rankin, 2005).