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Introduction

Conservation of Hawksbill Sea Turtles: Perceptions and Realities

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The publication of this special issue of *Chelonian Conservation and Biology* focusing on the hawksbill sea turtle (*Eretmochelys imbricata*) is timely. The last status review for the hawksbill in the Caribbean was compiled over ten years ago for the Second Western Atlantic Turtle Symposium (WATS II) in 1987 (Meylan, 1989). Also, the hawksbill was recently designated as Critically Endangered in the *IUCN Red List of Threatened Animals* (Baillie and Groombridge, 1996), and the IUCN has been asked to justify this designation. Meylan and Donnelly (1999) provide a thorough justification in this publication. I will explore why the designation has been controversial and why we have been slow to recognize the extreme plight of hawksbill populations in the Caribbean and elsewhere. Because several of these problems are not limited to hawksbills or to sea turtles, this essay addresses challenges that we face in conserving many slow-growing, long-lived marine species.

Assigning a single conservation status category to a species with a global distribution and a large number of genetically distinct, but geographically overlapping, populations is difficult. We face this problem with most sea turtle species. For example, hawksbills are found throughout the tropical and sub-tropical regions of all ocean basins, and they nest on beaches in at least 60 different nations (Groombridge and Luxmoore, 1989). The advantages of assigning status categories to regional populations of sea turtles, perhaps at the level of ocean basins, should be considered. Any system that attempts to designate one status category for a species that has substantial variation in status among regions is doomed to failure unless it is agreed that the status of the regional (= significant) population with the most imperiled survival outlook will be applied to the entire species. This approach has two clear advantages. First, it embraces the precautionary principle (Lauck et al., 1998); any error in designation is made in favor of the protection of the species. Second, this approach allows us to pursue what should be the goal of species conservation — conserving each species so that it fulfills its ecological role and maintains the natural structure, biodiversity, and functions of ecosystems. This goal was endorsed in *A Global Strategy for the Conservation of Marine Turtles* by the Marine Turtle Specialist Group (1995). By adopting this approach, we affirm that it is not acceptable to have any sea turtle species survive in only a limited area of its natural range. Sea turtles must occur throughout their natural ranges to ensure that they fulfill their ecological roles. For example, hawksbills are primary predators in coral reef ecosystems and thus assist in maintaining the biodiversity and ecological processes of these complex ecosystems.

Unfortunately, as is made all too clear in the status justification (Meylan and Donnelly, 1999), the status of the hawksbill worldwide as Critically Endangered does not need to rely on the status of hawksbill populations in only one or two significant regions. The survival outlook for hawksbills is bleak in almost all regions, including the Caribbean. But why have we been so slow to perceive the dire survival status of Caribbean hawksbills? I believe four concepts are primarily responsible.

First, and most critical, we do not have the proper perspective, or a reliable baseline, against which to assess declines in hawksbill populations. For centuries, hawksbills have been extensively exploited for the keratinized scutes covering their shells, which are the source of tortoiseshell or *bekko* (Parsons, 1972; Groombridge and Luxmoore, 1989; Meylan, 1999). Thus, populations were already greatly reduced or extirpated before they were recorded and/or quantified. This lack of proper perspective is not restricted to hawksbill populations (Dayton et al., 1998) and has been termed the “shifting baseline syndrome” (Pauly, 1995; Sheppard, 1995) or the use of inappropriate baselines to assess population change or stability. Referring to fisheries management, Pauly (1995) first described the syndrome as the tendency of scientists to use population levels at the beginning of their careers as the baseline against which to measure population change. He stressed the importance of incorporating historical anecdotes of fish abundance into population models of commercial fish species. Jackson (1997) discussed the misinterpretations of the present status of Caribbean coral reef ecosystems, in general, and the sea urchin, *Diadema antillarum*, and the green turtle, *Chelonia mydas*, in particular, as a result of the shifting baseline syndrome. Based on old landing records and calculations of carrying capacity, Jackson (1997) estimated that green turtle populations in the Caribbean have declined by at least 99% since the arrival of Columbus. Bjorndal et al. (1999) evaluate the trend in green turtle nesting at Tortuguero, Costa Rica, in the perspective of the shifting baseline syndrome.

Because hawksbill populations have been intensively exploited for centuries and we have little knowledge of early population levels, it is difficult to grasp the magnitude of the population declines. Instead, most studies are limited to population trends that have occurred over a few decades, at most (Meylan, 1999) — roughly equivalent to one or two generation times for hawksbills.

The second concept that has delayed our recognition of the dismal status of Caribbean hawksbill populations is that of "economic extinction." This condition occurs when it is no longer economical to exploit a population, so the population is released from commercial exploitation and, it is hoped, saved from biological extinction. For hawksbills, however, the level at which economic extinction occurs may well be at biological extinction (Carr and Meylan, 1980). Tortoiseshell is a luxury item, so the price continues to rise as the product becomes more rare. Along the Caribbean coast of Panama, for example, the money that could be earned from the sale of scutes from one adult hawksbill was a significant portion of the average annual income of fishermen in the region (Carr and Meylan, 1980). Clearly, it was profitable for fishermen to invest substantial time in pursuing the few remaining hawksbills. The other flaw in the economic extinction concept is that hawksbills share their habitat with, and are taken during the harvest of, another very economically important species — the spiny lobster (*Panulirus argus*). While divers throughout the Caribbean hunt spiny lobster, they encounter, and can easily capture, the remaining hawksbills. Thus, even in areas where fishermen do not target hawksbills because their numbers are too low, hawksbills are still collected by the extensive fishery that targets spiny lobster. Therefore, the number of hawksbills caught in an area can suggest the presence of a much larger population unless the efficiency of the exploitation is comprehended.

The recent near total cessation of legal international trade in hawksbill products (Donnelly, 1991) was expected to end the intense harvest of hawksbills. By ending the demand for hawksbill scutes for international trade, economic extinction should have been attained. It is critical to understand, however, that the motivation to continue the total harvest of hawksbills remains strong. Hawksbills and their eggs continue to be taken as a source of food. More importantly, however, hawksbill scutes can be stored easily for long periods of time with no degradation. The scutes are too valuable a commodity for fishermen to stop catching hawksbills because of what may be perceived as just a pause in international trade. Every case of illegal trade and every request to reopen any form of legal international trade encourages fishermen to continue to stockpile scutes, in the belief that eventually they will be rewarded when markets reopen or when opportunities for illegal trade arise. By continuing to vacillate in the commitment to end international trade in hawksbill products, we prevent the cessation of trade from having its full impact on the conservation of hawksbills.

The third concept is that delayed sexual maturity can obfuscate the true status of a population (Bjorndal, 1985). Any species with delayed sexual maturity has, of necessity, many year-classes of subadults. In hawksbills, for which the best estimate of sexual maturity is about 20 to 40 years (Chaloupka and Limpus, 1997; Crouse, 1999), even a small population of adult hawksbills will have a relatively large number of juveniles in the 20 to 40 age classes of subadults. These are not "excess" turtles that can be removed from the population without affecting population status; they are the minimum number required to sustain a small breeding population. Thus, the number of turtles in a region often belies the true status of the population and can give a perception of population stability that does not reflect reality.

Of equal importance, delayed sexual maturity and the corresponding large number of immature age classes mask the effects of intense harvests, so that over-exploitation can be mistaken for sustainable utilization for years, with eventual disastrous results. Year after year for decades, every nesting female and every nest can be killed on a nesting beach, and still, against any reasonable expectation, hawksbills will continue to crawl out on the nesting beach. What appears to be astonishing resilience to total exploitation is in fact not resilience at all, but merely the harvesting of 20 to 40 years' worth of subadults as they become sexually mature and venture onto the nesting beach for the first time. Of course, if total exploitation is maintained for the duration of the immature period, the supply of subadults reaching sexual maturity will be exhausted and the population will come to an abrupt end. Fortunately, humans are rarely so tenacious of purpose. Events intervene to disrupt the total harvest, and a few turtles manage to reproduce in peace. Thus, delayed sexual maturity also has a positive effect as a buffer against extinction. This buffer has not been sufficient to protect all hawksbill populations from extirpation, but undoubtedly many more populations would have been lost if age at sexual maturity was five years, as total harvest on the nesting beach for only five years could then extirpate a population. This buffer, however, not only has the positive effect of delaying extinction, it has an equivalent, negative effect of delaying the rate of population recovery. Management programs initiated on nesting beaches will not yield results in the form of increased numbers of nesting hawksbills for several decades.

The fourth and final concept, or misconception, that has delayed our acceptance of the dire straits of the Caribbean hawksbill populations has been the impression that we do not have sufficient knowledge of hawksbill biology to judge their status accurately. I do not need to address this issue; the contents of this publication reveal the error of this perception.

With the hawksbill, we have the opportunity to demonstrate that regional management of a long-lived, wide-ranging marine species can succeed. Success will require cooperation among all nations in regions that share hawksbill populations. As summarized in this publication, we have sufficient knowledge of hawksbill biology to generate reasonable management plans and to protect hawksbill habitats. However, for development of the most effective management plans, carefully designed, integrated studies are needed to quantify demographic parameters, define the regulating mechanisms of individual and population productivity, and document interactions between hawksbills and other species and hawksbills and their environment. Free exchange of data throughout the world is critical. These management efforts will only be successful if we are realistic about demographic constraints and set realistic goals — goals that account for "shifting baselines," that strive to restore the ecological role of the hawksbill, and that recognize that population recovery will be slow.

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