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20. Sea Turtle Conservation Programmes: Factors Determining Success or Failure

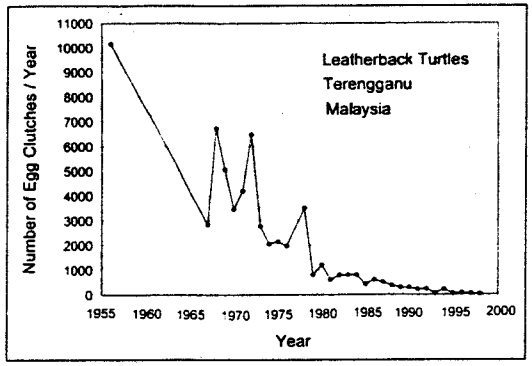
This case discusses three sea turtle conservation programmes, one MPA deemed a failure, and two which have been successful in reversing population decline. The protective measures implemented by each programme are described along with the historical events that led to problems. These are evaluated in an effort to discern what factors determine success or failure of such programmes. The case studies involve: the leatherback (Dermochelys coriacea) rookery at Rantau Abang, Malaysia; the hawksbill (Eretmochelys imbricata) rookery at Cousin Island, Seychelles; and the populations of green turtles (Chelonia mydas) and hawksbills in the Chagos archipelago, British Indian Ocean Territory (BIOT).

The Leatherback Turtles of Malaysia

In 1956, leatherback turtles laid more than 10,000 egg clutches along the east coast of Peninsular Malaysia (Hendrickson & Alfred, 1961) making the Rantau Abang leatherback population one of the most important in the world (Wyatt-Smith, 1960). Unfortunately, virtually all the eggs have been harvested for human consumption. In 1961, a hatchery was established and during the next 26 years an average of 33,000 eggs were incubated annually. But, this represented only 4% of the estimated annual egg production of 1956, and hatching success was low, averaging only 50% (Fisheries Department Statistics; Mortimer, 1989).

Since 1956, the nesting population has declined catastrophically (Figure III-16) as documented by a tagging programme conducted in 1967-76 by the Fisheries Department of Terengganu (Chua, 1988), surveys of egg collectors in 1978 (Siow & Moll, 1982) and 1979-84 (Siti & de Silva, 1985), and by systematic compilation of nesting statistics since 1984 (Fisheries Department of Terengganu). Malaysian conservationists, scientists, and fisheries personnel put pressure on the authorities to implement protective measures (Chan, 1993).

FIGURE III-16.



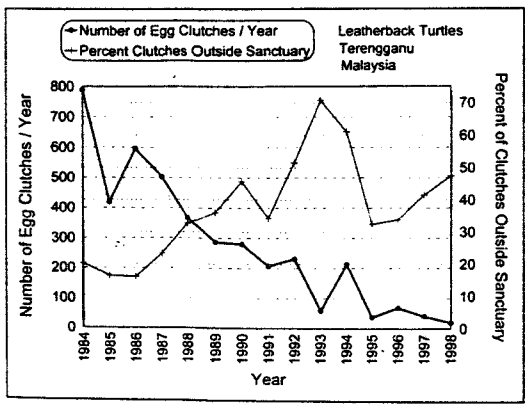
Number of leatherback egg clutches laid annually in Terengganu, Malaysia between 1956 and 1998.

In 1988 the State Government of Terengganu established the Rantau Abang Turtle Sanctuary along 14 km of prime leatherback nesting beach, and adopted regulations to control the activities of tourists within the sanctuary and to curb further development within its borders. It also banned the commercial sale and consumption of leatherback eggs in Terengganu, thus requiring 100% of leatherback egg harvest to be sold to the Department of Fisheries for incubation in hatcheries.

Studies by Chan *et al.* (1988) and the Department of Fisheries (Jabatan Perikanan Terengganu, 1989) highlighted threats posed by large-mesh gill nets, and led (in 1990) to a national ban on the use of driftnets with mesh sizes exceeding 25.4 cm. A radio-telemetry study (Chan *et al.*, 1991) identified the offshore zone where internesting activity was most concentrated, and led to establishment of the Rantau Abang Fisheries Prohibited Area (in 1991) as an offshore sanctuary (extending 10 km seaward, along 30 km of shoreline) to protect gravid leatherback turtles during the nesting season.

Unfortunately, the leatherback population continued to decline, and nesting became more diffuse after 1987 (Figure 2), with 32-71% occurring outside the boundaries of the Turtle Sanctuary, compared to 16-23% during 1984-87 (Figure III-17). Whether the turtles were driven out of the Sanctuary by disturbances from uncontrolled and unsupervised crowds of tourists (Chan & Liew, 1996), or by a decline in nesting site fidelity associated with a reduction in population size below some critical threshold, the effect was to undermine whatever protection the offshore sanctuary may have afforded the inter-nesting females. In 1998, only 19 egg clutches were laid in Terengganu, 47% of them outside the Sanctuary (Department of Fisheries Statistics).

FIGURE III-17.



Relationship between the number of leatherback egg clutches laid annually in Terengganu and the percentage of those nestings that occurred outside the boundaries of the Rantau Abang Turtle Sanctuary during 1984-98

The provisions of the Rantau Abang Sanctuary and Fisheries Prohibited Area might have been adequate to protect the nesting population had they been implemented 20 (or perhaps even ten) years earlier. Unfortunately, by the time the authorities took action in 1988, the population was already on the verge of extinction (Mortimer, 1991, 1995). Eggs had been harvested intensely for at least four decades--since well before 1951 (Chan & Liew, 1996).

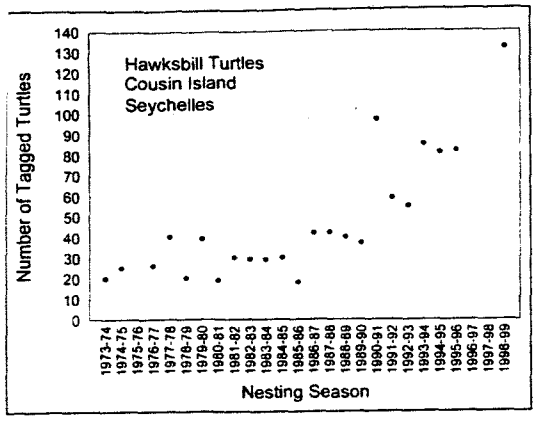
The decline of the Malaysian leatherback population was also exacerbated by mortality from fishing gear in both international and Malaysian waters. Chan & Liew (1996) identified two periods of especially sharp declines in the nesting population: one, from 1972-74, which correlated with rapid development in the fishing industry in Terengganu; and the other, from 1978-80, which coincided directly with the introduction of the Japanese high seas squid driftnet fishery of the North Pacific. In Malaysian waters, mortality is caused by trawling nets, drift nets, and gill nets (Chan *et al.*, 1988). Entanglement in the float lines of sunken fish traps set in near shore water was involved in the mortality of at least 5-10% of the females that nested during the 1989-91 nesting seasons (Mortimer, 1989, pers. observ.). Spotila *et al.* (1996) implicated accidental capture of adults and juveniles in fishing gear as a major factor in the worldwide decline of leatherback populations.

The Hawksbill Turtles of Cousin Island, Seychelles

In 1968, the designation of two nature reserves in the colony of Seychelles, at Cousin Island and Aldabra Atoll, constituted the first protection afforded nesting hawksbills in Seychelles. Although legislation adopted in 1979 by the Republic of Seychelles prohibited turtle harvest at an additional four sites, enforcement was problematic (Mortimer, 1984). During the period from the 1960's through the early 1990's, the Japanese paid such high prices for raw turtle shell that most hawksbills attempting to breed in Seychelles were slaughtered, often before they laid eggs (Mortimer, 1984).

At Cousin Island, however,—a nature reserve administered by BirdLife International (formerly ICBP) and now BirdLife Seychelles—nesting hawksbills have been well protected since 1970 (see Case 6 in Part III). This is due to a combination of factors, including dedicated staff and a relatively easily patrolled coastline. Unauthorized vessels have been restricted within one km of the high tide line, thus facilitating protection of mating pairs and gravid females in offshore waters. During the past 27 years, apparently in response to this protection, nesting activity has more than tripled at Cousin (Figure III-18), increasing from some 30 females per year to 70-130 (Mortimer & Bresson, 1994). Nevertheless, there was concern as to whether this relatively small population (which in the early 1980s represented only 5% of the total hawksbill population of Seychelles (Mortimer, 1984) could maintain itself over time, should other hawksbill rookeries in the country be exterminated (Mortimer & Bresson, 1994).

FIGURE III-18.



Number of individual female hawksbills nesting per season at Cousin Island, Seychelles between 1973-74 and 1998-99 (excluding the 1975-76, 1996-97, and 1997-98 seasons for which data are not reliable.)

Fortunately, in the 1990s, the situation elsewhere in Seychelles improved dramatically. Beginning in 1992, the management of nearby Cousin Island began actively protecting its hawksbills, and the Government of Seychelles took extraordinary action on behalf of the hawksbill. In 1993-94, it implemented an artisan compensation and re-training programme that eliminated domestic trade in hawksbill shell. In 1994, it provided complete legal protection for all sea turtles, and in 1998, publicly burned its stockpile of raw hawksbill shell during the Miss World Pageant (Mortimer, 1999).

Before 1970, most of the hawksbills that came to nest at Cousin Island were killed during their first breeding season. If protected, however, female hawksbills have the potential to lay 25 to 50 egg clutches over a 20 year period (Mortimer & Bresson, 1999). Thus, the increase in nesting activity reported during the past two decades probably results from an increase in average reproductive output per turtle. Because individual hawksbills can take decades to mature (Limpus, 1992), it may yet be too early to expect to see a large number of new females in the population. Nevertheless, the increased reproductive output is expected to eventually yield a true population increase.

The increase in nesting activity at Cousin Island suggests that now rates of adult mortality at the foraging grounds are probably relatively low, thus enabling hawksbill turtles that escape slaughter at the nesting beach to survive to breed again in a subsequent nesting season. This is corroborated by catch statistics and satellite tracking data. During 1979-86 when it was legal to kill adult hawksbills in Seychelles, catch statistics included few captures of adults outside the nesting season (Mortimer, 1984, unpubl. data). Nor have any tagged females been recovered outside the country. Satellite transmitters, attached to five post-nesting hawksbill turtles at Cousin Island in 1998, showed the adult foraging habitats to be located within the boundaries of the Seychelles Bank (Mortimer & Balazs, in press) in habitats that apparently lack significant agents of turtle mortality.

Hawksbills and Green Turtles in the Chagos Archipelago

The first permanent settlement of the islands of the Chagos Archipelago occurred in the late 1780s when coconut plantations were established on Diego Garcia atoll. During the 1800s coconuts were intensely planted and harvested on all atolls in the group (Stoddart, 1971). The workers greatly relished green turtle meat and eggs and historical documents indicate that exploitation of hawksbill shell occurred throughout the period of human settlement. Export statistics are available only for the present century, but show a decline in the numbers of hawksbills captured between 1904 and 1929 (Frazier, 1977). Historical documents also indicate that the abundance of both green turtles and hawksbills was much greater during the early years of settlement (Mortimer & Day, 1999).

The turtles got some relief from exploitation in the mid-1900s when rising costs of transportation and labour resulted in many islands being abandoned. Although regulations were enacted in 1968 to prohibit the take of green turtles, interviews with island residents in 1970 indicated a continuing harvest (Frazier, 1977). The harvest was effectively terminated during 1970 and 1971, however, when the last island residents were evacuated to Mauritius in preparation for an Anglo-American military base which was constructed and has been active ever since (Stoddart, 1971).

Today, the only permanent human habitation on Chagos is the military base at Diego Garcia (British Indian Ocean Territory—BIOT) which occupies less than 25% of the land area of the atoll. The movements of base personnel are restricted and all wildlife is strictly protected (creating a *de facto* MPA). Ongoing habitat damage associated with the base appears to be minor. Currently, the greatest threat to Chagos turtles may be *illegal* harvest by commercial fishing vessels or private yachts (Mortimer & Day, 1999).

Overall, the protection afforded the Chagos turtles by the BIOT administration appears to have been effective. In 1970, Frazier (1977) estimated the nesting population to number some 300 females of each species. Data collected by Mortimer (Mortimer & Day, 1999) during a six week survey of the archipelago in 1996 indicate that twice as many turtles now nest annually, including some 400-800 green turtles and 300-700 hawksbills.

A significant population of immature hawksbills forages in the lagoon at Diego Garcia and is also well protected by BIOT (Mortimer & Day, 1999). Analysis of patterns of mitochondrial DNA variation could not differentiate populations of juvenile hawksbills foraging at Diego Garcia from those foraging in the Seychelles (Mortimer & Broderick, 1999). This suggests that the juvenile foraging populations of both countries comprise individuals originating from rookeries either in Seychelles, Chagos, or possibly the Arabian Peninsula or other unsampled localities in the region. Thus, the protection provided the turtle populations in Chagos is of regional importance to sea turtle conservation.

Conclusions

Turtles are particularly vulnerable during reproduction, and historically, over-exploitation of eggs and breeding adults has probably been the most important factor in the demise of sea turtle populations. Thus, protection at the nesting beach may be the most critical component of any sea turtle conservation programme. But, marine turtles have complicated life cycles. As a turtle passes from one life history stage to another (egg, hatchling, juvenile, subadult and adult) it utilizes a series of habitat types which may be separated from each other by hundreds or thousands of kilometers (Musick & Limpus, 1997). Extinction is avoided when a turtle population maintains adequate rates of survival at all stages in the life cycle. To achieve this end, regional cooperation is essential. The involved states need to endorse and support international agreements and programmes that provide for coordinated species protection and MPA habitat conservation measures.

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