

Recovery of green turtles on Aldabra

Jeanne A. Mortimer

The numbers of green turtles that nest on Aldabra's beaches have increased significantly in the past 20 years. The author, who studied the turtles between 1981 and 1984, suggests explanations for the recovery. It is likely that the Aldabra population is still well below that which thrived there before exploitation began, and with sustained conservation efforts turtle numbers could continue to increase.

During the first two-thirds of this century, large numbers of green turtles *Chelonia mydas* were slaughtered in the Seychelles to produce a variety of products, of which calipee (the gelatinous substance from beneath the shell, regarded as a delicacy) was the most important. The export was mainly to Western Europe, notably England. Most of the turtles were taken from the southern islands — especially Aldabra, Assumption, Cosmoledo and Astove islands. At that time, there were few restrictions on the capture of turtles and little enforcement of existing legislation. The resulting over-harvest led to a serious drop in population levels (Frazier, 1974; Stoddart, 1976, 1984); this decline is reflected in trade statistics documenting exportation of calipee between 1907 and 1968 (Figure 1). A decrease in the annual harvest is apparent, with variations in the rate of decline explained by backlogs in shipping rather than upsurges in production.

The localities for which records of the exploitation of turtles are most complete are Assumption Island and Aldabra Atoll. Situated some 1150 km south-west of the Granitic Islands where 95 per cent of the human population resides, they are

the most remote islands in the Seychelles. At the turn of the century, the turtle populations of Aldabra and Assumption were probably more or less equivalent in size. Although the two islands are only about 25 km apart, their turtle populations have suffered different fates.

The history of Assumption Island is a classic case documenting the over-exploitation of a green turtle colony (Frazier, 1975; Stoddart, 1976; Mortimer, 1983). At the peak of the nesting season in the early 1900s, as many as 200–300 females could be turned on the beach at Assumption in one night (Hornell, 1927). In 1927 about 1000 turtles were still being harvested annually (Dupont, 1929), but after that the population declined drastically. Frazier (1975) estimated that only 100 females nested at Assumption in 1973, and in 1982 Mortimer (1983) estimated that 160–240 females nested.

The destruction of the turtle population of Assumption Island is attributable to a combination of historical and physical factors. Assumption, with only 11.1 sq km of land surface area, was intensely mined for guano during most of the present century, and upwards of 100 labourers resided on the island almost continuously. The location of the human settlement is unfortunately immediately adjacent to that of the principal nesting beach, a stretch of sand that continues unbroken for about 5 km. Thus, the labourers had easy access to the nesting turtles at a time when calipee was fetching high prices on the international market.

In contrast, Aldabra Atoll lacks exploitable guano deposits and has an inhospitable terrain. These features have provided a degree of protection

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from the incursions of man. The 2.5–3.0 km of available green turtle nesting grounds comprise some 50 beaches that are scattered along 83 km (Gibson, 1979) of a coastline characterised by rugged karst limestone, and impenetrable *Pemphis* scrub on the north and south-west coasts. With a terrestrial surface area of 153.1 sq km, Aldabra is the largest island in the Republic of Seychelles, and the more remote parts of the atoll are at times almost inaccessible. Because of restrictions caused by tidal fluctuations, travel by sea in nearshore waters and in the inner lagoon is often difficult, and was especially so prior to the 1960s when pirogues driven by oars were the primary mode of travel. Partly because of these combined factors, Aldabra has retained a larger nesting population of green turtles than any other island in the Seychelles.

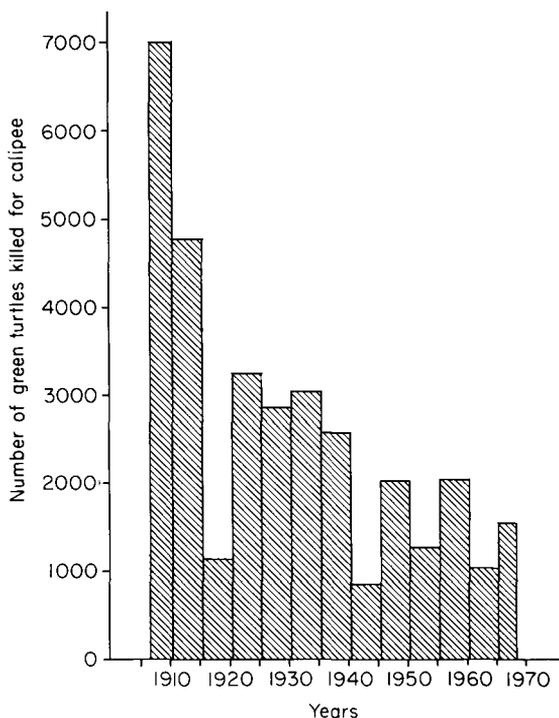


Figure 1. Numbers of green turtles killed for calipee between 1907 and 1968. The average number killed during a five-year period is shown by each bar, except by the first and last bars which, respectively, depict four- and three-year periods. Figures were obtained by converting the amounts of calipee exported each year into turtle equivalents—i.e. one turtle yields about 1.5 kg of calipee. Sources: *Trade Reports, Colony of Seychelles*; Stoddart (1976, 1984).

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Conservation of Aldabra's resources took a more active form in the late 1960s when the Royal Society began to manage Aldabra Atoll as a scientific research station and nature reserve. In 1968 a total ban on the capture of green turtles everywhere in the Seychelles was imposed. This ban was unenforceable, unpopular, and ignored virtually everywhere but at Aldabra. In 1976 the ban was repealed, and local consumption of green turtle meat continued. Nevertheless, the 1968 ban did bring about an end to the foreign export of green turtle products from the Seychelles, and the green turtles at Aldabra have enjoyed complete protection since 1968. The status of Aldabra as a nature reserve was further enhanced in 1982 when the United Nations Educational, Scientific and Cultural Organization, with the encouragement of the Government of Seychelles, listed Aldabra as a World Heritage Site.

There is now evidence to suggest that the nesting population of green turtles at Aldabra has increased significantly within the past two decades.

The turtle study, 1981–1984

Between February 1981 and January 1984, a study of the ecology and natural history of the marine turtles of the Seychelles was conducted, which included a stock assessment for each island in the country. The author made five visits to Aldabra and spent a total of four months on the atoll, gathering data on the density and behaviour of nesting turtles. Daily track counts were made on as many beaches as possible and a total of 300 turtles were tagged, many of which were subsequently encountered again on the nesting beaches. During periods when the author was absent from the atoll, the resident wardens (John Collie, Ron Pimm and Jim Stevenson) made regular track counts every month along a 6-km stretch of shoreline, between Passe Grabeau and Anse Tamarind on the south-west coast of the atoll, where about 30–45 per cent of the nesting on Aldabra occurs.

Based on this study, the following numbers of turtles were estimated to nest at Aldabra: 1900–2500 in 1981; 2030–2675 in 1982; and 2210–2915 in 1983. A detailed description of these

results and the procedure used in estimating nesting density is in preparation.

Estimates of current nesting density at Aldabra are more than twice as high as those made by investigators in the 1960s and early 1970s. In independent studies carried out in 1967 by Hirth and Carr (1970) and in 1968, 1969 and 1970 by Frazier (1971, 1975, 1976), the nesting population was estimated to number fewer than 1000 females per year. Although Frazier (1976) noted a slight apparent increase in nesting density in 1973 over previous years, Gibson (1979) estimated that only 700 females nested on the island in 1975.

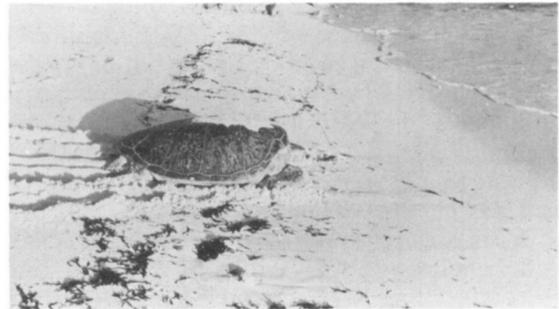
A close examination of the data presented in the earlier papers confirms that nesting density has in fact increased during the past 16 years. Seychellois labourers who have worked intermittently on the island during the past 30–40 years have also reported an apparent increase in the density of nesting turtles. The magnitude of this increase is difficult to quantify exactly. Part of the difference between the various estimates may be attributed to different techniques in deriving them. Because the most recent estimates are based on data gathered regularly over a 3-year period, it is unlikely that the observed increase in nesting density is due to the sort of annual fluctuations that have been reported for other nesting populations (Carr *et al.*, 1978). However, in order to determine with greater certainty that the apparent population increase at Aldabra is real, and not just an artifact caused by fluctuations, nesting density should be monitored for at least several more years. Provision has been made for this. The warden at Aldabra has continued regular track counts even after the departure of the author from the Seychelles.

Explanations for the apparent increase in the Aldabra population

It is tempting to attribute the increased nesting density to the total protection that the turtles have received at Aldabra since 1968. Although more eggs have probably been laid annually since 1968 than during previous years, it is unlikely that hatchlings from those seasons are now returning to Aldabra as nesting adults. Recent studies indicate that green turtles take much longer than

13 years to reach sexual maturity; most estimates range from 25 to 60 years (Limpus, 1979; Balazs, 1979, 1981; Limpus and Walters, 1980; Mendonça, 1981; Burnett-Herkes *et al.*, 1984; K.A. Bjorndal, University of Florida, pers. comm.). The apparent recovery of the Aldabra population is perhaps better explained by a combination of other factors.

Tagging studies in other parts of the world have shown that female green turtles may return repeatedly to the same nesting grounds after intervals of two, three, four or more years spent at their feeding grounds (Carr *et al.*, 1978; Hughes, 1981). After 1968, there was a significant decrease in human-induced mortality among the turtles nesting at Aldabra. Hence, a larger proportion of females nesting in any given year would survive to remigrate to Aldabra in subsequent seasons and to breed again. This probably accounts for much of the observed increase in green turtle nesting at Aldabra.



Green turtle returning to sea at dawn after nesting (Jeanne A. Mortimer).

It is also possible that earlier legal protection is partly responsible for the increase. In 1948, a six-month-long close season (December until May) was established for female green turtles at Aldabra and Cosmoledo—S.I. No. 452 of 1948 (Seychelles Government, 1948). In 1962, a law (S.I. No. 29 of 1962) was passed, making it completely illegal to kill female green turtles on some islands, and establishing a close season for the slaughter of them on others. At Aldabra, the close season was reduced to four months' duration, from December until March (Seychelles Government, 1962). It is difficult to assess how well these laws were enforced at Aldabra prior to 1968, but it is possible that, as a result of the

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legislation imposed, relatively fewer females were killed and more eggs laid than in previous years. Since 1981, 33 years after the inception of legislation protecting females, young that emerged from clutches laid after 1947 may have reached adulthood and returned to the nesting beach to breed.

Economic factors may have caused fewer turtles to be killed at Aldabra between 1945 and 1955 than in previous years. When the lease of Aldabra to M. D'Emmerz de Charmoy expired in 1945, 'commercial exploitation (of Aldabra) lapsed temporarily' until 1955 when M. Harry Savy acquired a new lease (Stoddart, 1971). The 36 years between 1945 and 1981 would appear to be enough time for the hatchling turtles produced in 1945 to have reached maturity and reinforced the present breeding population.

Implications of a population increase at Aldabra

Many Seychellois are of the opinion that a large portion of the green turtles that breed in the Seychelles are subsequently killed when they migrate to foraging grounds in the territorial waters of other nations. In fact, between 1968 and 1976 this was one of the strongest arguments employed in favour of lifting the 1968 ban on the killing of green turtles (Salm, 1976; Frazier, 1979). 'Why should the Seychellois give up turtle meat only to let people in other countries kill the same turtles?'

The evidence presented in this paper, however, indicates that the protection of breeding grounds within the boundaries of the Seychelles has been sufficient to bring about an increase in the green turtle population at Aldabra. It is unfortunate that turtles do not recognise international boundaries. Nevertheless, the heaviest responsibility for ensuring the survival of a population rests upon the country within whose territory the breeding grounds occur. Turtles are far more vulnerable to exploitation at the nesting beach than on the foraging grounds. Large numbers of breeding turtles concentrate in nearshore waters and emerge on limited sections of shore. In contrast, the same turtles, when feeding, will disperse over tens of thousands of sq km of foraging pastures, often located far from land. Moreover, the

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behaviour of breeding turtles makes them easy to kill. They often mate very close to shore, and at this time the males are so preoccupied with copulation that they are oblivious to danger. Finally, when the females emerge onto the land to lay eggs, their vulnerability is at its peak.

The evidence that recovery is taking place in the green turtle population of Aldabra may evoke demands for resumed exploitation there. Such action would, however, be premature. For the following reasons, the population should be allowed to rebuild until it more closely approaches its level prior to the onset of exploitation.

(i) Assuming that the Aldabra population is still well below carrying capacity, it can be expected to increase by larger increments now than it did when it comprised fewer animals. It would be short-sighted to destroy the momentum of population increase prematurely, after so many years of exemplary conservation effort.

(ii) Needless to say, the sustainable harvest of a large population of animals is greater than that of a smaller population of the same species. Economically, it would make more sense to wait until the population approaches carrying capacity before recommencing exploitation.

(iii) Now that Aldabra is a World Heritage Site, every attempt should be made to restore its ecosystems to a condition as natural as possible. To allow the turtle population to return to carrying capacity would be consonant with that aim.

(iv) It is possible that turtles that nest at Aldabra may at some stage of their life cycle disperse to other parts of the Seychelles. Thus, Aldabra may serve, to some degree, as a source of green turtles for other islands where turtles are currently being intensely exploited.

There has been some debate as to what the original nesting density was on Aldabra's 2.5–3.0 km of nesting beaches. Frazier (1974, 1976) suggested that more than 12,000 turtles were captured there in one year at the turn of the century. This figure was disputed by Stoddart (1976) who believed that only about 3000 turtles were killed annually during the peak of the calipee trade. Even Stoddart's more conservative figure indicates that a serious decline has occurred in the Aldabra green turtle population since the turn of the century.

In its early years, the green turtle fishery was carried on mainly by turning nesting females on the beaches (Hornell, 1927). Thus, a large proportion of the estimated 3000 turtles killed annually at Aldabra were probably females. We may assume that a portion of the trade in green turtle products was illicit and went unreported (Frazier, 1974). In as much as many of the turtle beaches at Aldabra are relatively inaccessible, and that turtles nest during every month of the year, a reasonable guess is that the figure of 3000 accounted for less than half of the annual population of nesting females. A reasonable estimate of the nesting population early in this century would thus be about 6000–8000 females per year, or three to four times as many as are presently estimated to nest at Aldabra.

In this age of rapidly expanding human populations, highly effective capture techniques and efficient transportation, it is essential for the nations that have sea turtle resources to exercise a degree of self-discipline in exploiting them. As the turtle populations decrease in size, it will become increasingly more difficult, if not impossible, to rebuild them. Some sacrifice will have to be made now for the sake of future generations.

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- Jeanne A. Mortimer, University of Florida, Department of Zoology, 223 Bartram Hall, Gainesville, Florida 32611, USA.