

TURTLES AND TOURISM IN THE IONIAN, THE PROBLEMS AND POTENTIAL

A. C. SMART

Department of Zoology, University of Leicester, University Road, Leicester LE1 7RH

Increasing concern about the status of loggerhead turtles, *Caretta caretta*, in the Ionian Sea has resulted in studies of their status on the island of Zakynthos, arguably the most important nesting site in the eastern Mediterranean, by Greek researchers. On the island of Cephalonia to the north, a smaller population exists and is facing the same problems now affecting the Zakynthos rookeries. The author worked on Cephalonia with an Earthwatch project led by Mr. James Sutherland during 1985 and assisted Mr. Sutherland's project during 1986.

The island of Cephalonia (Kefallinia) lies in the Ionian sea ($38^{\circ} 15'N$, $20^{\circ} 33'E$), some 100 km south of Corfu and 40 km off the Greek mainland (Fig. 1). It has approximately 170 km of coastline although only a few beaches are used as rookeries by loggerhead turtles, *Caretta caretta*.

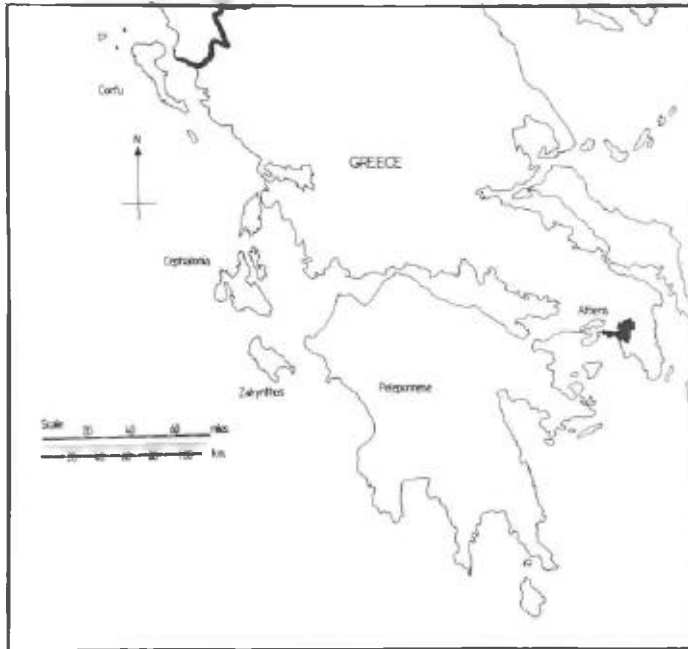


Figure 1 Outline map of southern Greece indicating the position of Cephalonia and Zakynthos.

To the south, the island of Zakynthos (Zakinthos/Zante) has five rookeries, described by Margaritoulis (1982). Twenty years ago the island had little pressure from tourism, but the last six years have seen a massive increase in tourist facilities (Spencer 1986), catering mainly for British tourists. This increase in pressure on the beaches has led to a drop in the number of turtles nesting on the island. The beaches around Lagenas bay on Zakynthos are of great importance as rookeries for the loggerhead in the Mediterranean, with densities of 214 to 525 turtles nesting per km per season (Spencer 1986).

On Cephalonia, the beaches have much lower numbers, approximately 22 nests per km during 1985 (Marine Turtle Research Project 1985), although records for the 1986 season on Cephalonia's

main rookery (Sutherland, unpublished data) suggest a higher density using the beach than in 1985.

Only one of the turtles observed on Cephalonia in 1985 had been tagged previously on Zakynthos, suggesting that the two islands have separate populations of nesting turtles. If this is indeed the case, then there is little chance of Zakynthos turtles moving to nest on the relatively undisturbed rookeries on Cephalonia.



The loggerhead turtle, *Caretta caretta*, a protected species in an endangered habitat.

From June to August, adult female loggerheads emerge to nest during the night, crawling up the beach leaving a distinctive track. In some cases a female may not dig but returns to the sea, leaving a "U-turn" track, though often these non-nesting emergences involve attempts at digging nests. Whether these non-nesting emergences are due to disturbance or lack of required nesting conditions is not known. Margaritoulis (1983) reports that this behaviour occurs on the Zakynthos rookeries. On Cephalonia females have been recorded emerging without nesting for several nights in a row, before eventually laying eggs.

Initially the female digs a body pit, digging herself lower into the sand and removing the dry sand from the area of the nest. Then, using only her hind flippers, the female excavates a nest pit. At this point it is unlikely that a cautious approach will disturb the turtle, and it is advantageous to be in position behind the turtle as the first eggs are laid in order to accurately record clutch size. Once all the eggs are laid the turtle covers the nest pit and then enters the camouflaging stage, which involves the scattering of sand across the nesting area. This may be repeated several times as the turtle moves forward and results in a considerable area being covered with scattered sand beneath which the nest lies, with often two or three similarly camouflaged areas. Once camouflaging is completed, the turtle returns to the sea.

Measurements were normally recorded while the turtle was covering the eggs and caused no apparent disturbance. Tagging was left until the turtle had completed nesting because of the possibility of the disturbance causing an interruption in laying, an occurrence observed on Zakynthos (Margaritoulis 1983). Turtles were weighed before they returned to the sea and this appears to have no effect on females, with individuals returning to nest soon after being examined during a non-nesting emergence.

The number of nesting females drops towards the end of August and the first hatchlings emerge.



Loggerhead hatchlings, *Caretta caretta*, emerge and crawl down the beach to the sea.

Hatchlings emerge in the late evening, night and early morning, generally in twos and threes, with often 50-100 emerging from a nest during a night. If the hatchlings emerge too late in the morning, they may dehydrate and die during the crawl to the sea.

The Cephalonia project used wire cages with a plastic mesh insert to attempt to accurately assess nesting success, weight and condition of hatchlings. The plastic mesh insert restricted the possibility of the hatchlings being damaged by caging and of predators reaching them through a single mesh. The cages were placed over nests as they neared hatching date. By burying the cages some 15 cm in the sand and weighting them in position with rocks, it was possible to prevent them being dug up by dogs.

Some nests were monitored to examine how nest temperature relates to development and success rates. The temperature of the developing nest determines the sex ratio of the clutch. Mrosovsky and Yntema (1980) report that loggerheads have a "pivotal temperature" of approximately 30°C with hatchlings predominately female from nests incubated above that temperature. Incubation time varies over the season, again related to temperature, a 1°C decrease in nest temperature corresponding to a 5 day increase in incubation time (Mrosovsky and Yntema 1980).

During 1985, a total of 27 turtles were tagged on Cephalonia and 17 were recorded nesting successfully, producing 48 nests. Margaritoulis (1983) records multiple nesting on Zakynthos rookeries, a behaviour pattern observed in 13 loggerheads on Cephalonia in 1985. One individual was recorded emerging 12 times in 4 weeks, and laid three clutches. During the study period the maximum number of clutches laid by any individual was four (Marine Turtle Research Project 1985).

Of the 48 nests recorded, 43 clutches were examined and clutch size varied from 6 to 164 eggs (mean 100). The average hatchling emergence success rate was 47% with 34 of the 44 nests on the main rookery emerging and a total of 1302 hatchlings estimated reaching the sea from that rookery (Marine Turtle Research Project 1985).

The main rookery on Cephalonia remains undeveloped at present, though the numbers of

tourists camping behind the beach is high. The only apparent predation of hatchlings on the beach is by dogs, which pick off hatchlings as they crawl to the sea and dig up nests before they emerge, eating many eggs and hatchlings, scattering nests and exposing any remaining eggs. The dogs, belonging to both tourists and locals, seem to detect the nests and visit them regularly until the hatchlings are beginning to emerge. During 1985, only four nests were lost to dogs, but fewer numbers of nests were caged in 1986, and predation by dogs became a serious problem. It appears that caging does reduce this predation, but it is impossible to cage all the nests without a large budget. This could be solved by transplanting eggs to a fenced "nursery area" on the beach, or by transplantation involving the removal of associated clues, in a similar manner to methods used to reduce predation by raccoons, *Procyon lotor*, in South Carolina, U.S.A. (Stancyk, Talbert and Dean 1980). The hatchlings also face motorcycle and car tyre tracks in the sand, which they find very difficult to escape. This sometimes results in dehydration of individuals which emerge during early morning.



A hatchling loggerhead, *C.caretta*, predation by dogs on the main Cephalonia rookery seriously depletes numbers reaching the sea.

The threat of tourist development on the island is a serious one. During 1986, Skala, the village nearest to the rookeries has been developed as a tourist resort catering in particular for British tourists. Although no new hotels have been built, the pressure on the beaches in the area has increased dramatically within the two years the project has been running. A new airport will soon open the island to a greater number of visitors. Perhaps the most worrying of present problems on Cephalonia is lights and music at night disturbing adult females emerging to nest on the rookery nearest Skala. The main rookery is some distance from Skala and is still free from this disturbance to a great extent, though the potential for development is present, as this is one of the few completely sandy beaches on the island. It is important that some measures be taken to ensure that the situation on Cephalonia does not become similar to that on Zakynthos.

On Zakynthos the beaches are already under great pressure from tourists and developers. Although in the last five years, the loggerhead has become protected by presidential decree within Greece and a zoning law now restricts building on a 500 metre wide strip along the Zakynthos rookery, there has been little change in the situation on the island. Building on

the beach continues, with the islanders, outnumbered two to one in the summer months, relying on the income obtained from tourism. In some extreme cases, fear that loss of income would result from a reserve in the area has led to turtles being repeatedly disturbed during nesting. Despite this, research has been able to continue on the Zakynthos rookeries over the past 5 years and attempts are in progress to educate local inhabitants as to the importance of the rookeries. Any changes on the island must be brought about gradually and with great care or damage to relations with the islanders could put the turtle population at greater risk. Problems from tourist development include: lights and music disturbing emerging adults; shade trees reducing nest temperatures and humidity; tourist umbrellas piercing eggs and damaging nests; lights disrupting the hatchlings' sense of direction; the compacting of sand above the nest; and tour operators taking parties of tourists out to see the nesting turtles. The Greek team headed by Dr. D. Margaritoulis have set up a "Turtle Information Centre" on Zakynthos, and the potential for a wildlife reserve has not gone unnoticed.

Lagenas bay on Zakynthos has five nesting beaches, the two most important being those least used by tourists. If these two could be isolated as reserves, with restricted access, (proposed by Margarita Arianoutsou, Associate Professor of Ecology at the University of Thessaloniki[Spencer 1986]), it would be a major step forward in saving this important site. If correctly managed this could be an asset rather than a hindrance to the tourist industry. On the tourist beaches, it would be possible to continue the research programme presently in progress, but if the nests are exposed to damage from tourism, an investigation into transplanting the eggs each morning to the "safe" beaches would be of value. Such a scheme could eventually become self funding if a fee were charged for tourists to view the nesting turtles under the supervision of "wardens".

On Cephalonia, a "nursery area" could be set up on the main rookery, in order to try to restore the numbers of turtles nesting on this beach by increasing the number of hatchlings reaching the sea. This would involve some manipulation of clutch temperatures or a careful choice of a heterogeneous "nursery area" to ensure the sex ratio is not disrupted. Local people consider the number of adults using this beach to nest to have declined considerably in the last twenty years. The situation on Cephalonia is worsening, and it is important to consider the conservation potential now before the pressures which are causing so much difficulty on Zakynthos appear.

I hope this article will stimulate some discussion and that moves to improve the present situation will occur. The further development of these sites will lead to a reduction in the numbers of loggerheads in the Mediterranean, and we cannot allow these magnificent reptiles to reach such a precarious situation.

ACKNOWLEDGEMENTS

1985: Thanks to Earthwatch/James Sutherland, the Earthwatch team and volunteers; and members of the U.C.L. Zoology Department Expedition which was funded by: The Explorers Club, New York; University College London; The Gilchrist Expedition Fund; Dunnsheath Convocation Award, University of London; The Cornish Match Company; and The Royal Automobile Club.

1986: Thanks to James Sutherland, Andrew Beckett, Colin Adams and the people of Skala. Also thanks to Dr. David Harper for comments on the manuscript.

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Further information is available on the present situation in Zakynthos from:

The Sea Turtle Protection Society,
P.O. Box 51154,
GR-145 10 KIFISSA,
GREECE.

Post script: While writing this article, the threat to the Loggerhead in the Mediterranean has increased. Newspaper reports (*Independent* 7/5/87, *Daily Telegraph* 21/4/87) indicate that in Dalyan, Turkey, a tourist development worth •15 million per year is underway. This beach is reported to be as important a rookery site as Zakynthos once was. One can only hope that the damage to the Greek populations of Loggerheads is not repeated as Turkey 'opens up' to tourism.