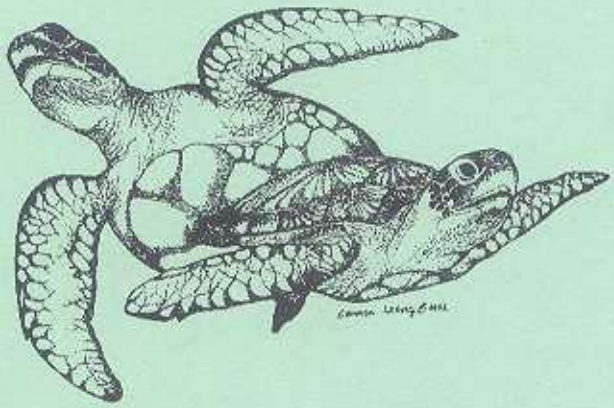
NOAA Technical Memorandum NMFS-SEFSC-536

PROCEEDINGS OF THE TWENTY-THIRD ANNUAL SYMPOSIUM ON SEA TURTLE BIOLOGY AND CONSERVATION



"Living with Turtles"

17 to 21 March 2003, Kuala Lumpur, Malaysia

Compiled by: Nicolas J. Pilcher

U.S. DEPARTMENT OF COMMERCE
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March 2006

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TELEMETRY OF LOGGERHEAD TURTLES (*CARETTA CARETTA*) IN AMVRAKIKOS BAY, GREECE

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Introduction

After identifying and protecting the major nesting beaches in Greece, ARCHELON has begun focusing its work on protecting turtles at sea, in accordance with the priorities set-out in the Action Plan for the Conservation of Mediterranean Marine Turtles, within the framework of the Barcelona Convention.

Amvrakikos Bay, a closed bay in western Greece, is characterised by shallow waters, lagoons, and wetlands hosting many threatened species of wildlife, among them marine turtles. The bay is a Ramsar site, and a proposed NATURA 2000 site in the context of the European Union's Habitats Directive (Fig. 1). In conjunction with a regional management agency (ETANAM) and in the context of a co-funded, EU LIFE-Nature project, ARCHELON initiated a telemetry study to provide insight in the habits of marine turtles in the bay. The study involves deploying both satellite and radio and acoustic transmitters. The satellite transmitters were deployed during June 2002 and the radio and acoustic transmitters in September of the same year.

Methods

All sea turtles used in the study to date were deliberately captured for this purpose, using a large mesh net and 'rodeo' technique. Forays into a specific shallow (<1.5 m deep) area of the Arachthos-Vovos Estuary System (A-VES) (Fig. 1) were undertaken using a small boat. The time between turtle-capture and subsequent release was generally under 4 hours.

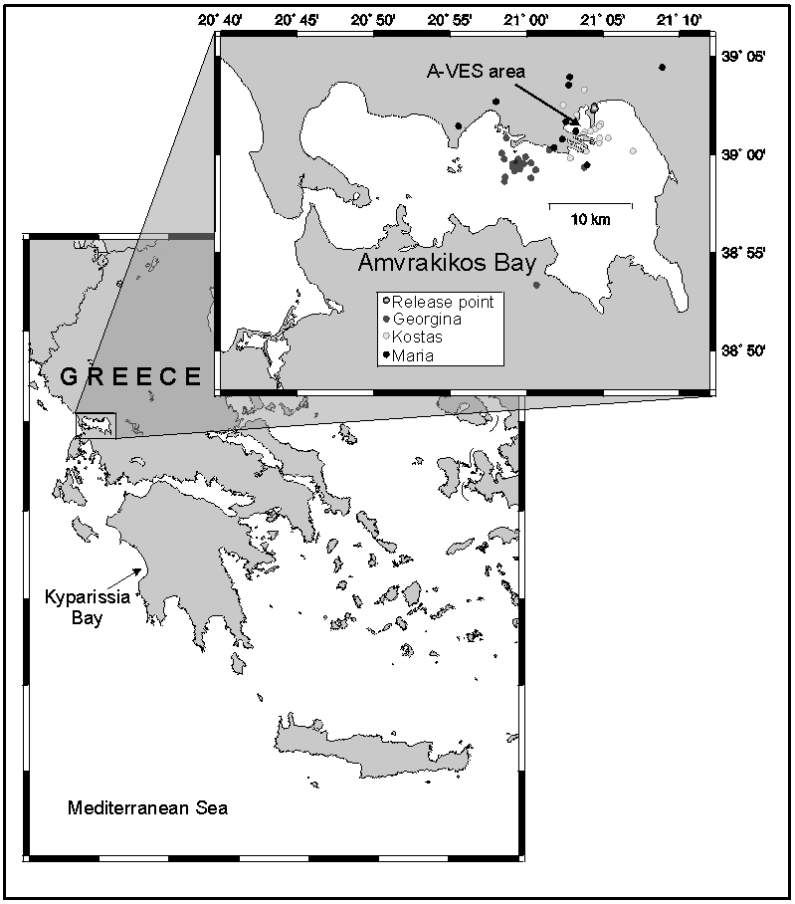

Figure 1. Locations of Amvrakikos and Kyparissia Bays within Greece and turtle locations obtained from Argos tracked turtles. See text for details of locations included and omitted.

Once the turtles were ashore, they were enclosed in a specifically built wooden box and their heads were covered with damp cloths to block their vision. Satellite transmitters were KiwiSat 101 PTTs (Sirtrack Ltd.), using the Argos data collection system. Argos provide quality indexed locations (LC), three have assigned accuracy (LC 3, 2 & 1 <1 km) and three without assigned accuracy (LC 0, A & B). Radio and acoustic transmitters (RAT) were RMMT_3 and CAFT11_4 (Lotek Wireless Inc.). Location information obtained from these transmitters involved on-site investigation; the bay was patrolled in a small boat to observe the telemetered turtles and then locations made using a hand-held GPS unit. A total of eight field visits were made for the RAT system from 6/9/02 until 31/10/02 at which time weather and other factors made it impractical to undertake further investigation. Attachment of the three types of transmitter was achieved employing the same process, after Balazs *et al*. (1996). Satellite and radio transmitters were attached to the second central scute of the carapace and acoustic transmitters was attached to the fifth central or lateral scute.

Results

By March 2003 six turtles (all loggerheads) had been equipped with transmitters, three received satellite transmitters (Georgina, Kostas & Maria) and three radio and acoustic transmitters (Iouli, Grigoris & Zoë). Sex was determined by presence or absence of a long tail. Iouli (the smallest turtle) was assumed female as she was larger than the minimum size nesting turtles in Greece (69 cm in Margaritoulis, 1988) and displayed no evidence of male-specific tail development. Interestingly, one turtle (Zoë) equipped with transmitters on 7/9/02 had been observed nesting in southern Kyparissia Bay on 30/6/02.

Data acquired from the Argos system are shown in Table I and Figure 1. All LC A fixes have been included in Figure 1, as they have been shown similar in accuracy to LC 1 (Hays *et al*., 2001; Vincent *et al*., 2002). LC B fixes have been plotted when they lie within 7 km of water, as they have been demonstrated to have 7 km accuracy (but with significant variability) (Hays *et al*., 2001). After promising initial results indicating the turtles were at least temporarily resident within the bay, even possibly, with distinct "home ranges" (see data for Georgina, Fig. 1), the location data has ceased, with only on-board sensor data being received. Table I shows the differing amounts and quality of data that have been received to date from the three transmitters. It can be seen that the proportion of quality-assured locations varied between individuals from 0 to 35% and that all locations were acquired during the first two months of transmission (Table I). The abrupt cessation of transmissions from Georgina may, sadly, be due to death of the turtle, as during one field visit, rumour amongst the friendlier fishermen was that another had deliberately killed a turtle that bore a transmitter on its carapace. This story has however not been confirmed.

Table 1. Data obtained from Argos for satellite tracked turtles.

	Iouli	Grigoris	Zoë
Observations in A-VES	3	4	5
Observations out of A-VES	1	1	0
Total number of observations	4	5	5

Initial results from the RAT system were also encouraging. Upon first return to the A-VES area, where the turtles were captured, all three individuals were identified by radio signal and at least two turtles were noted in close proximity, confirmed by overlapping acoustic signals. After this first investigation no further signals were obtained from the acoustic transmitters, despite strong signals being received from the radio transmitters. It is not known why. From the fourteen recorded re-encounters, twelve were from within or at the mouth of A-VES and the remaining two were obtained west of this area (Table 2). No signals were ever recorded to the east of A-VES, although other turtles were regularly observed along the shore in the area. The recording of Grigoris outside of the A-VES was near to a mussel farm, but it is not known if the turtle was foraging on the farmed molluscs. There were no physical landmarks noted and no GPS location taken for the observation of Iouli out side of A-VES, therefore this record is of incidental importance.

Discussion

We can group the telemetry data gained thus far from the Satellite and RAT systems together with other on-site observations to make some inferences on the behaviour of sea turtles that inhabit Amvrakikos Bay. From direct, but not-quantified, observations of turtles in the bay, it is clear that the north and north-east area of the bay (characterised by warm shallow waters) hosts numerous loggerhead turtles at considerable density during the summer months (at least June through to September). All locations obtained from the Satellite and RAT systems showed the turtles remaining in the same northerly area of the bay, for periods of up to two months. These are some of the longest foraging site fidelities published for Mediterranean loggerheads (compare; Houghton *et al*., 2000; Bentivegna, 2002; Godley *et al*., 2003). The demonstrated specificity of habitat utilisation is an important finding as it allows conservation activities to be directed in specific area and target group i.e. the fishermen who live and work around the A-VES area.

Local fishermen have the belief that turtles remain in the bay year-round and that they move to deeper waters from the shallows during the winter. This observation is partially supported by the RAT results that showed the turtles to be generally located

within the A-VES area at times of fine weather and less likely to be observed there during periods of rough or cold weather. It was obvious, though not properly quantified that fewer and fewer turtles were spotted in the A-VES area during the field activity season of September and October. Early maximum observations were upwards of ten turtles observed from the boat at one location and dropped to spotting only one turtle within the whole A-VES area during the last patrol.

None of the satellite transmitter equipped turtles were confirmed as leaving the bay although this may be the case for Kostas and Maria as they were both still intermittently transmitting sensor data but no location information has been received since July and August respectively. It is hoped that further locations will be provided during the expected spring migrations to reproduction areas, as Plotkin (1998) has demonstrated that satellite transmitter performance can be dependent on turtle behaviour. Use of the bay by migrating mature female turtles has already been proven by tag return information gathered by ARCHELON (unpublished data and this study) and also has been reported for a male turtle captured, fitted with a PTT and released in the Gulf of Naples (Bentivegna, 2002). Thus it may be that turtles specifically choose Amvrakikos Bay as a foraging habitat, due to its favourable conditions, and may travel many kilometres to the bay from the north Ionian and bordering seas.

As conventional flipper tagging was also undertaken for the turtles used in this study these individuals will be identifiable when observed away from the bay even if the transmitters have become dislodged and lost. Thus despite the apparent lack of interesting and novel findings within from this first stage of the telemetry project (i.e. no migrations out of the bay or significant shifts proven within the bay), the repercussions of these first actions are wide ranging and long lasting, with potential to gain data on important aspects of Mediterranean loggerhead biology.

Table 2. Locations of turtles with RAT. Observations are from a total of eight field visits.

Location Class	Georgina	Kostas	Maria
3	1	2	0
2	1	1	0
1	1	3	0
0	0	0	0
A	5	0	2
B	17	11	11
Total Locations	25	17	13
Locations, Class 3-1	12%	35%	0%
Transmissions with no location calculated	124	88	136
Deployment date	6/16/2002	6/18/2002	6/19/2002
First Location	6/22/2002	6/18/2002	6/27/2002
Last Location	8/8/2002	7/2/2002	8/24/2002
Duration (days)	47	14	58
First Transmission	6/16/2002	6/18/2002	6/19/2002
Last Transmission	8/12/2002	2/24/2003	3/5/2003
Duration of Transmissions (days)	57	251	259

Acknowledgements
Fieldwork was carried out mainly with the assistance of Yannis Roussopoulos, Andreas Koutsodendris, Kostas Pasas and Kostas Dimos. Attendance to the symposium was made possible (for AFR) thanks to the Symposium Overseas Travel Committee and funding assistance from the Sea Turtle Symposium, Fisheries Canada, WWF (UK) and also through the Amvrakikos Bay LIFE-Nature project. The map for the figure was created using "Maptool" provided without charge by seaturtle.org.

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TAGGING OF SEA TURTLES IN BANGLADESH

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Introduction

Along the coast of Bangladesh, from Sundarbans to St. Martin Island, 14 areas have so far been identified for sea turtle nesting. Research on sea turtle inter-nesting periods and movements have not been done due to lack of tags until recent years, although conservation work was initiated in 1996 at St. Martin island (Islam, 1998). In 1997-1998, 16 nesting olive ridley were marked with waterproof white paint (Plate 1) but on return none of them were recognized. A few of the individuals might not have been renested, but it is presumed the majority of the painted females emerged subsequently and were not recognized, presumably washed off in the seawater (Islam, 1998, Islam et al 1999, 1999a).

Marine turtles are highly migratory and each turtle typically lives for several years at feeding grounds and return to its natal nesting area to reproduce. Most of the knowledge of migration of marine turtles has been revealed from the capture of female turtles that were originally tagged while laying eggs on nesting beaches. This research has now been more reliable confirmed by the use of satellite tracking. Simple flipper tags can help determine foraging habitat in offshore areas and also post nesting feeding grounds with tag recoveries, though the turtles are not easy to capture. Data on nesting turtle health can be an indicator of the overall environmental situation in the nesting areas offshore and the internesting habitat. While not all tagged turtles are recaptured, tagging can provide some answers related to movements and habitat distribution. The Marinelife Alliance at St. Martin island started tagging for the first time in Bangladesh to determine internesting periods, migration, foraging habitats and threats in offshore areas.

Tag Information

Tagging activity started in 2000 following methods in Balazs(1999). Tags were donated by Dr. George Hughes of Kawa Zulu Natal (Natal Parks Board) of South Africa, and were of Monel metal (No. 49) with numbers ranging from N401 to N500 and H300 to H400. The return address on the tags read O. RESEARCH BOX 736, DURBAN, SOUTH AFRICA. Tags were applied on the hind margin of the front flipper (left/right)s and some were also attached on rear flipper.

Results and Discussion

Tagging activity revealed some of the unknown parameters of the sea turtles' life cycle in Bangladesh, and of threat levels inshore and offshore that have high significance in terms of conservation measures. The major achievements of the tagging objective were the determination of interesting period (nesting interval); movements to and from the nesting beach; recognition of beach disturbance and threats in offshore areas. So far 65 individuals have been tagged from both species. The following summarises data from tagging and tag recovery during the period 2000-2003:

- Olive ridley turtles come to nest every year, but green turtles spend at least one year out of the nesting area;
- Olive ridley emerge to nest on the same beach with varying distance from the previous nest or original site that can be as close as 8 m;
- Simple light disturbance from a beach side resort can take displace nesting females to other sites adjacent to original site;