CONSERVATION ACTIVITIES FOR PROTECTION OF THE LOGGERHEAD SEA TURTLE(*CARETTA CARETTA*) IN KYPARISSIA BAY, GREECE, DURING 2001.

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INTRODUCTION

Kyparissia Bay is located in central Western Peloponnese. The majority of the Bay is composed of a single, wide sandy beach approximately 44 km in length. In general, tourism and tourist facilities are not developed along the Bay. Low and high dunes and coastal forest or agricultural land generally backs the beach. It is divided into 2 parts by the river Neda.

ARCHELON has worked in Kyparissia Bay since 1981 and to aid monitoring and reporting the Bay has been divided into sectors, south to north they are: O and A through to K (Figure 1). Since the early 1990s, conservation work has focused on the core area of nesting which is on the 9.5 km of beach south of Neda (Sectors O and A-C) that hosts about 84% of the nests (Margaritoulis & Rees, 2001).

Figure 1.
Sketch map of Kyparissia bay area showing beach sectors

Conservation work in Kyparissia Bay consists of three integral parts that enhance protection of the loggerhead turtles: 1. Monitoring of nesting activity, 2. Nest management, protects nests from environmental and animal destruction and 3. Public awareness (PA) work, helps prevent human disturbance to turtles, on land and sea, and their nests by increased understanding of the turtles' status and biological requirements.

The most direct threats facing nests in the Bay are depredation by red foxes (*Vulpes vulpes*) and domestic dogs, and inundation from the sea by storm waves (Margaritoulis, 1988).

Early in the project history it was realised that local inhabitants and visitors to the area needed to be informed of the plight of the turtles and consequently the Public Awareness (PA) Programme was formed with the objective to "minimise disturbance or threats to sea turtles both on land and at sea, and have everyone actively contribute to their protection". The initial activities comprised mainly the operation of an information station in the village of Kalonero and presenting occasional informative slide shows at public events. The PA work subsequently expanded to include information stations at the village of Elaia and more regular slide shows given in local hotels, camp sites and to visiting parties. Since the start of 2001 a permanent Environmental Centre (E.C.) has been operational at Agiannaki. It has an exhibition hall displaying information on sea turtles and the local environment, it provides slide shows on the same theme and guided tours of the local forest and dune system.
This article presents the results of conservation activities carried out at the core area of Kyparissia Bay (monitored beach) during 2001.

MONITORING AND NEST MANAGEMENT - METHODS

Monitoring and assessment of nesting activity on the monitored beach was carried out daily at first light during Morning Survey (MS) as described by Margaritoulis (1988).

To combat the identified threats, nests were relocated from within the storm wave line and covered with protective wire screens to hinder predation. A sample of relocated nests were transferred to a natural beach hatchery, which is a small area of beach fenced off with chicken wire. During the MS each existing nest was checked for events which may affect its incubation, characteristically inundation from the sea, defined as having occurred when waves passed over the protective screen, or mammalian predation, defined as evidence of digging and damaged eggs found at the nest site. These events were recorded to determine nest fates.

Margaritoulis (1988) and Margaritoulis *et al* (1996) describe more fully the nest monitoring and protection methods.

To obtain information on hatching success and clutch size a sample of nests were excavated post-hatching (nine days after first hatching) or after 70 days if the nest had not hatched. Eggs were classified as hatched or unhatched. Dead and live hatchlings remaining in the nest were also recorded and reburied (for natural nocturnal emergence of the more fit live ones). Smaller, yolkless eggs were noted but excluded from total egg count and larger, multi-yolked eggs were counted as single eggs (see Miller, 1999).

MONITORING AND NEST MANAGEMENT - RESULTS

Duration of Turtle Activity

The first adult emergences and nests appeared on May 23. The last nest of the season was made on August 13 (first to last nest, 83 days) and the last adult emergence on August 18 (first to last emergence, 88 days). The first hatching nest and hence onset of the hatching season was recorded on July 21. Figure 2 shows evolution of nesting and hatching over the season.

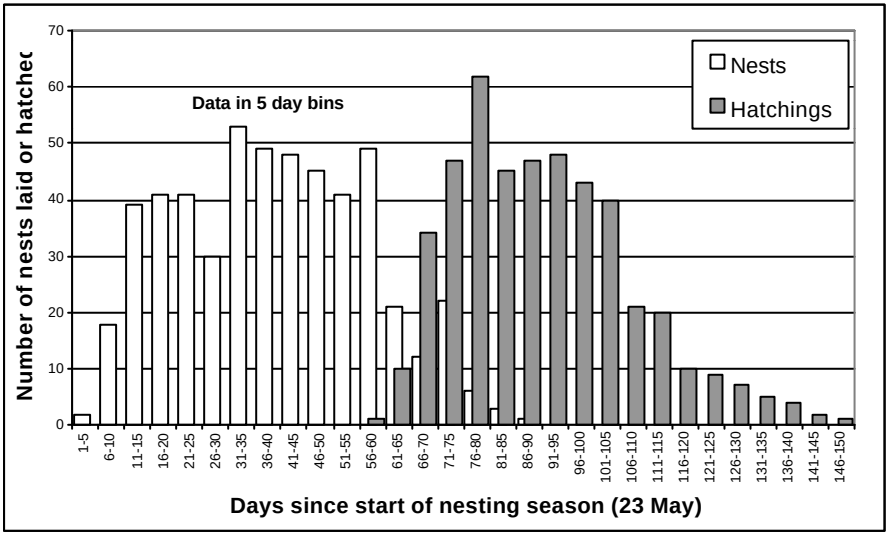

Figure 2.
Through season nesting and hatching activity on the monitored beach, 2001.

Nesting Levels and Nesting Success

A total of 522 nests were recorded during 2001. Nesting levels and density varied between the beach sectors studied. Highest nesting levels and nesting density occurred on Sector A whereas lowest levels and density were recorded for Sector C (Table 1). However, this year the nesting activity took a distinct northward shift. Sector O, that normally holds about 25% of the nests, had only 21.1% and Sector C, which normally has 10 – 15% of the nests, had 19.5%. Finally, Sector B had almost the same nesting density as Sector A (Table 1), which is an uncommon result (Margaritoulis & Rees, 2001).

Sector	Length (km)	Nests			Emergences		Nesting Success (%)
		Tally	% of total	Density (nests/km)	Tally	% of total	
O	2.2	110	21.1	50.0	394	32.1	27.9
A	2.5	165	31.6	66.0	403	32.9	40.9
B	2.2	145	27.8	65.9	252	20.6	57.5
C	2.6	102	19.5	39.2	177	14.4	57.6
Overall	9.5	522		54.9	1226		42.6

Table 1.
Nesting activity on the monitored beach, 2001

As with all previous seasons (Margaritoulis & Rees, 2001) the nesting success decreased during the season and is attributed to drying of the beach caused by lack of precipitation and high daytime temperatures. Figure 3 shows the progress of seasonal air temperature and precipitation variation from Pyrgos, a town 50km to the north of the monitored beach.

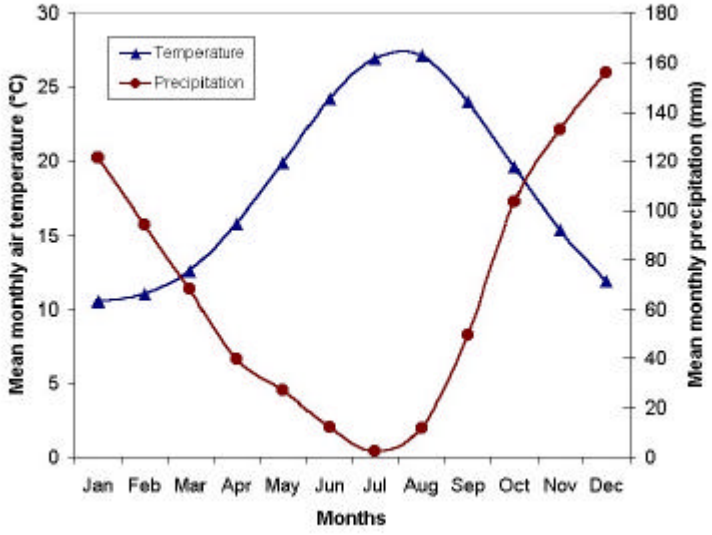

Figure 3.
Mean monthly air temperature and precipitation at Pylos.
Data for period 1930 to 1975 from Andreakos (1978).

Nest Screening and Predation

From the 522 nests made, 480 nests (92%) were protected, with wire screens or fenced in the beach hatchery, the morning after deposition. All other nests were fenced upon location by evidence of predation or hatching.

Monitoring and protection methods reduced the predation rate from around 57% (Margaritoulis, 1988) to only 6.7% in 2001. Predation response varied between sectors. Sector B had the highest rates for both protected and unprotected nests and Sector C the lowest. Table 2 shows the individual predation rates per sector and for the entire core area. Figure 4 shows the fates of all nests.

Sector	Unprotected nests			Protected nests			All nests		
	Total	Predated	%	Total	Predated	%	Total	Predated	%
O	7	2	28.6	103	4	3.9	110	6	5.5
A	7	6	85.7	158	4	2.5	165	10	6.1
B	9	8	88.9	136	6	4.4	145	14	9.7
C	19	4	21.1	83	1	1.2	102	5	4.9
Overall	42	20	47.6	480	15	3.1	522	35	6.7

Table 2.
Predation rates for nes ts on the monitored beach, 2001

Relocation and Inundation

From the 522 nests made, 40 "doomed nests" (7.7% of total) were relocated the morning after deposition. "Doomed nests" are those which are made too close to the sea so that at times of high surf they would become inundated and drowned. All other nests were left to remain *in situ* for the duration of their incubation. Two nests from Sector A were relocated to the hatchery and the rest were relocated to other sites, generally further up the beach, away from the sea. Despite relocation, 16 nests were still inundated with varying affects to their hatching success and 174 of the 482 (36.1%) of the *in situ* nests were inundated. Of these, Sector O had the lowest inundation rate (22.7%) due to the rocky offshore approach that dissipates wave energy. The overall inundation rate was 36.4%. Table 3 shows the individual inundation rates per sector and for the entire core area. Figure 4 shows the fates of all nests.

Sector	*In situ*			Relocated			All Nests		
	Total	Inundated	%	Total	Inundated	%	Total	Inundated	%
O	100	22	22.0	10	3	30.0	110	25	22.7
A	150	60	40.0	15	6	40.0	165	66	40.0
B	137	61	44.5	8	4	50.0	145	65	44.8
C	95	31	32.6	7	3	42.9	102	34	33.3
Overall	482	174	36.1	40	16	40.0	522	190	36.4

Table 3.
Relocation and inundation levels on the monitored beach, 2001
NB. Of the 482 *in situ* nests, 42 were not located the morning after deposition and hence inundation events for these nests may have been missed.

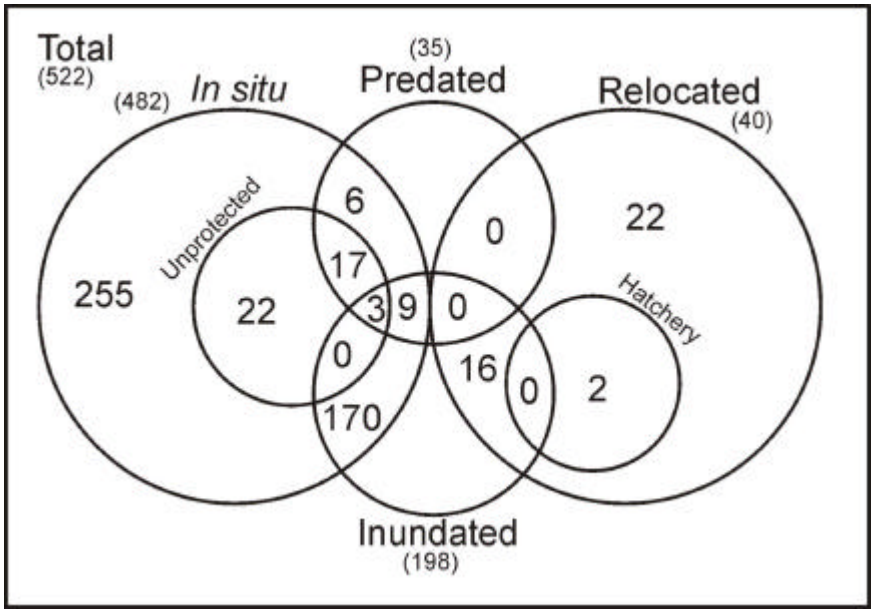

Figure 4. Diagrammatic representation of incubation events and nest fates from the monitored beach, 2001.

Hatching Success

The overall hatching success (percentage of eggs that hatched) derived from excavation of 243 *in situ*, protected nests that were neither inundated nor predated (undisturbed nests) was 72.7%, 14.2% of the hatchlings produced had not emerged from the nest (and were mainly found dead at excavation), thus the resulting emerged hatching success was 62.4%. The hatching success for *all* relocated nests that were not subsequently inundated nor predated was 67.9%, 4.8% lower than that of undisturbed nests. Table 4 shows overall and per sector hatching successes.

Sector	Hatched eggs (%)	Hatchlings in nest as % of total hatchlings	Emerged hatching success (%)	Sample (nests)
O	73.7	9.5	66.7	60
A	70.0	14.4	60.0	79
B	72.6	18.4	59.2	63
C	76.3	13.6	65.9	41
Overall	72.7	14.2	62.4	243
Relocated	67.9	16.5	56.7	23

Table 4.
Hatching success data from the monitored beach, 2001

PUBLIC AWARENESS PROGRAMME - ACTIVITIES

PA activities ranged from static information signs placed at the hatchery and on every protected nest, to scheduled presentations at targeted audiences. The majority of the activities were concentrated in the operation of the two information stations at key sites of the project and the centrally located E.C. of Agiannaki. These were opened for fixed periods per day that were timed to coincide with the busiest period at that location.

At all information stations, there were information leaflets to be distributed to all visitors and, also, display boards with photographs, situated to attract passers by. Personnel in attendance provided supplemental information to interested visitors. Additional to the facilities of the Information stations, the E.C. presented facts on the local area and its cultural and biological diversity, thus providing a more holistic image of the importance of the region, not only its nesting sea turtle population. The E.C. operated as the focal point of outreach, aiming also at providing environmental education to local school children. School parties in attendance were taken on a guided tour of the vicinity, incorporating coastal forest and sand dune components, extra to the information provided within the exhibition.

Slide shows were conducted at specific venues around the project area (e.g. hotels and campsites) and created opportunity to inform a targeted and responsive audience for the improvement of understanding and protecting sea turtles and their nesting beaches.

Finally, whenever members of the public and tourists were encountered during monitoring fieldwork they were offered on-site interpretation of activities by project personnel.

PUBLIC AWARENESS PROGRAMME - RESULTS

The Information Stations operated July through to mid-September and it is estimated that over 2,500 tourists and local people visited them and hence received information, during this period. The E.C. of Agiannaki operated for a similar time frame and during this period presentations were conducted for over 250 school children. The E.C. is, however a permanent centre operating on a year round basis and continues to host presentations for school children and other organised groups after closure of the summer project.

A total of 10 slide shows were conducted during the summer period, thus reaching almost 300 individuals. Furthermore, as during the previous year, a presentation was organised at the main square of Kyparissia town with the support of the respective Municipality.

Additional PA results were obtained through several interviews given by project staff to newspaper reporters as well as television and radio journalists.

CONCLUSIONS

Kyparissia Bay is one of the most important areas for the loggerhead sea turtle in the Mediterranean and the conservation activities carried out there provide successful remedies and solutions to the threats facing the nesting sea turtle population.

Using hatching success values and other relevant data, we can estimate that approximately 13,500 more hatchlings were successfully produced as a direct result of ARCHELON's conservation programme in Kyparissia Bay during 2001.

Much progress has been made in sensitising the local communities to the plight of the turtles and this can only reap rewards if the programme continues to operate in a similar or more efficient manner during the forthcoming years.

ACKNOWLEDGMENTS

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Lenio Karatzas made Figure 1.

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