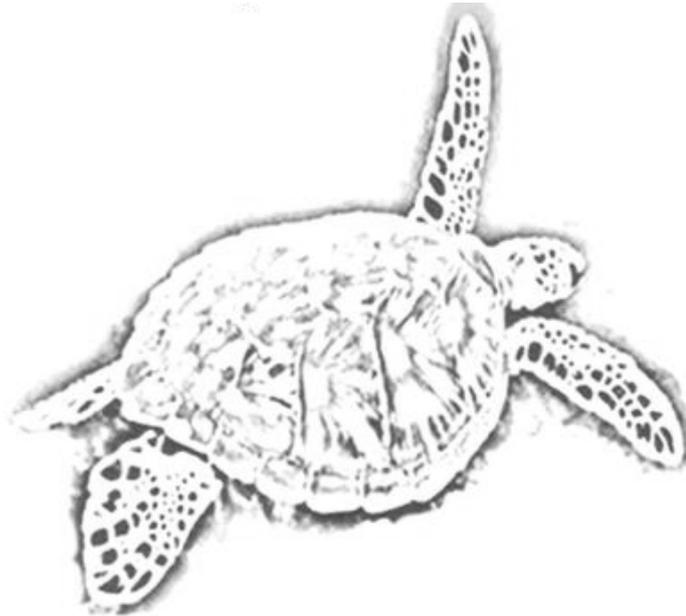


# **PROCEEDINGS OF THE SECOND MEDITERRANEAN CONFERENCE ON MARINE TURTLES**

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**LOGGERHEAD NESTING IN RETHYMNO, ISLAND OF CRETE, GREECE:  
FIFTEEN-YEAR NESTING DATA (1990-2004) INDICATE  
A DECLINING POPULATION**

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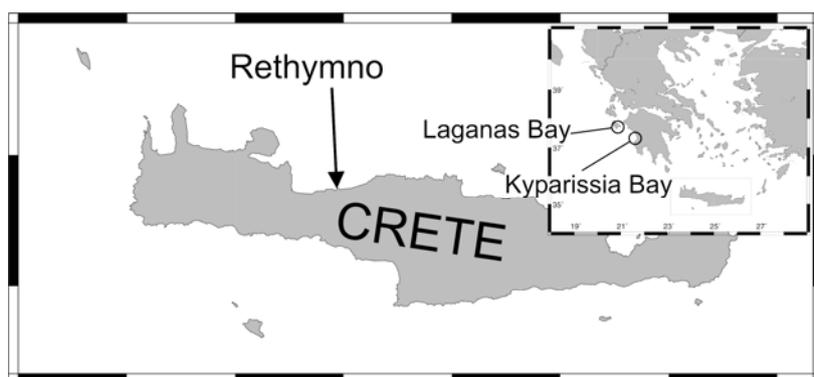
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**INTRODUCTION**

The loggerhead sea turtle is considered an endangered species worldwide (Baille and Groombridge 1996) and is protected through international conventions, European Union directives (e.g. Habitats Directive 92/43) and national legislation. The main nesting areas in Greece are Laganas Bay (Zakynthos) and southern Kyparissia Bay, which are monitored annually under a standardized programme by ARCHELON since 1984. In the course of a rapid assessment study, during 1989, new nesting areas were discovered on the island of Crete (Margaritoulis et al. 1995); the most important of these, Rethymno, was included in the routine annual monitoring programme of ARCHELON in 1990.

**STUDY SITE**

Crete is the largest island in Greece and the fifth largest in the Mediterranean with a coastline length of about 1,000 km. Crete is characterised by a diversity of landscape, including high mountains, valleys, gorges and plains. The southern coast is generally precipitous while the northern is much gentler, thus attracting most of the development. Rethymno nesting beach stretches east of Rethymno town for about 12 km (Fig. 1), 10.8 km of which consist of suitable nesting ground. The development status of the area ranges from "full development" especially close to the town, to "low development" in some sectors, with hotels and pensions scattered along the entire area. Several beach sections, especially in front of hotels, are under heavy human use crowded with beach furniture and lit, during the night, by bright lights.



**Fig. 1.** Map of Greece showing Crete and approximate location of Rethymno nesting area

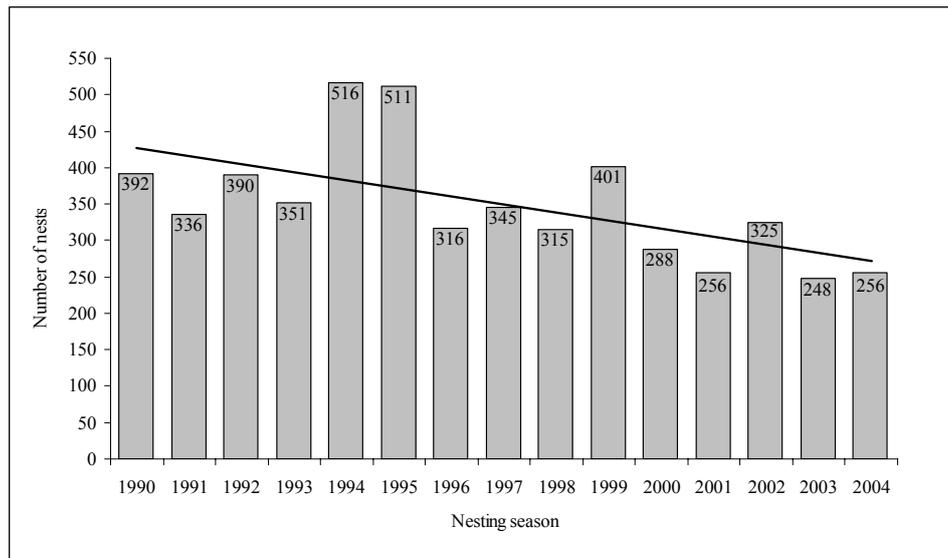
**METHODS**

Nesting activity (i.e., adult female emergences and nests) was assessed through daily beach surveys conducted early in the morning. Verification of nests was done through hand

excavation of the sand until appearance of top eggs. All nests were marked and monitored until emergence of hatchlings.

## RESULTS

The annual number of nests ranged from 248 to 516 with an average of 349.7 over the 15-year period (Fig. 2). Nesting density averaged 32.4 nests/km/season (range: 23.0 – 47.8 nests/km/season, N=15 seasons). The annual number of nests, over the monitored seasons, shows a downward trend which is highly significant ( $r^2=0.361$ ,  $<0.05$ ) (Fig. 2).



**Fig. 2.** Number of nests per season at Rethymno, over the period 1990-2004. The straight line above the bars shows the linear trend

## DISCUSSION

The documented annual nesting effort of the Loggerhead Turtle in the Mediterranean averages about 5,000 nests (Margaritoulis et al. 2003). Of these, about 26% are made in the 5.5 km beaches of Laganas Bay (Margaritoulis 2005) and about 11% along 9.5 km in southern Kyparissia Bay (Margaritoulis and Rees 2001). In the same context, Rethymno concentrates about 7% of all documented loggerhead nests in the Mediterranean. Rethymno's average nesting level (more than 100 nests/season) and average nesting density (more than 6 nests/km/season) classify this area as a "major" nesting site in Greece (Margaritoulis 2000).

Although that nesting data at the two longest monitoring projects in Greece, i.e. Laganas Bay (Margaritoulis 2005) and southern Kyparissia Bay (Margaritoulis and Rees 2001), do not show any apparent trend, the downward evolution of nesting levels at Rethymno is alarming.

One would argue that the downward trend at Rethymno is only a temporary situation as the number of monitored seasons is not large enough to provide a full picture of the nesting population over the years. However, the high degree of adverse factors in Rethymno (see next section) indicate that the noted trend is most probably a real one. ARCHELON will continue monitoring Rethymno in order to further assess this trend.

## **CONSERVATION ASPECTS**

Rethymno nesting area, when discovered in 1989, was already under severe tourist pressure, with several hotels in operation, many constructions under way, severe light pollution, etc. Further, it seems that human intervention has impacted beach-width as many buildings have covered parts of the high beach and the sand dunes, and various constructions at sea (e.g. groins) create substantial beach erosion in several cases. Narrowness of beach-width, combined with an increasing amount of beach furniture blocking the turtles' access to the back of the beach and concomitant seawater inundation, which is very frequent due to predominant northerly winds during summer, influence a great number of nests. Furthermore, light pollution has been responsible for increased hatchling mortality due to disorientation.

In an effort to mitigate these negative effects on a short-term basis, ARCHELON concentrates on protective measures on the beach by fencing and relocating threatened nests, and by shading hatching nests subjected to light disorientation. These are direct measures after a successful long process of involving the authorities, the tourist industry and the local people.

A large section of Rethymno nesting area has been included in the proposed sites for the Natura 2000 network of the Habitats Directive of European Commission (Dimopoulos et al. 2003). For the time being this provides only for Environmental Impact Assessments for any constructions within the site, which must be approved by the Ministry of Environment instead of the local authorities. A Management Plan was elaborated in 1997 by ARCHELON in the context of a LIFE–Nature project (Irvine et al. 1998). There is a continuous co-operation between ARCHELON and local communities to implement various aspects of this MP.

Further, an intense Public Awareness Programme is a permanent component of the conservation work in Rethymno. The general aim of this programme is to educate both tourists and locals about the loggerheads' presence and the conservation issues arising from human development and use of the nesting beaches. The aim is to point out the problems in the context of how the public could help solve them, in the hope that most problems could be avoided or substantially reduced by an informed public.

A special part of the project has been cooperation with the tourist sector. The long-term benefits of conservation for tourism were analysed to the interested parties, through presentations, personal contacts and the use of mass media. The target of ARCHELON is to show how many of the problems arising on the nesting beaches can be dealt with through low-cost solutions as described in the Management Plan. This would be of benefit to both parties since the long-term viability of the beaches as nesting sites can guarantee the quality of the tourist product in the future (Panagopoulou 2008).

## **ACKNOWLEDGEMENTS**

We are grateful to the many project leaders, field leaders, field assistants and hundreds of volunteers that worked in Rethymno nesting area over these years. We thank ARCHELON's office personnel for their support. Special thanks are due to the local authorities, the Prefecture of Rethymno, and the local municipalities for their cooperation and support. The project benefited greatly from the collaboration of the tourist sector, and especially from the Tourism Promotion Committee of Rethymno, TUI, HOTELPLAN, GRECOTEL. In the period 1995-97 the work at Rethymno was included in the LIFE-Nature project LIFE/A22/GR/1115/KRI. DM

and AFR thank the conference organisers for funds to attend the conference and associated workshops. The map was made using MapTool, a free of charge service of SEATURLE.ORG.

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