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Jeffrey A. Seminoff

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Southeast Fisheries Science Center  
75 Virginia Beach Drive  
Miami, FL 33149 USA

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## The discovery of a green turtle developmental habitat in Greece advocates a stronger regional cooperation

Dimitris Margaritoulis and Kostas Teneketzis

ARCHELON, the Sea Turtle Protection Society of Greece, P. O. Box 51154, GR-145 10 Kifissia, Greece

The green turtle, *Chelonia mydas*, has evolved a fairly isolated local population in the Mediterranean Sea. The nesting areas of this population are confined in the easternmost part of Mediterranean, because of favorable climatic conditions. The occurrence of green turtles away from this part of Mediterranean is considered rather rare. However, in the course of a fisheries interaction study in Lakonikos Bay, southern Greece, it was found that this bay represents an important developmental habitat of the Mediterranean green turtle population. A three-year (1997-2000) systematic study, in cooperation with local fishermen, was conducted during the fishing period (October-May) to assess the magnitude of incidental catch. About 26% of the total fishing effort (by 25 trawlers, beach seines and gill-

netters) was monitored by an observer recording catches as soon as the fishing vessels returned to port. Fishermen were trained to identify marine turtle species, classify turtles' CCL in four size classes and record their physical condition as well as the approximate location and depth of captures. During the study period, 188 turtles were caught by the monitored fishing vessels. Of these, 112 (59.6%) were loggerheads and 76 (40.4%) were green turtles. All green turtles were classified as juveniles, providing evidence that Lakonikos Bay is a developmental habitat of the Mediterranean green turtle population. This finding will certainly change existing conservation aspects and provide stimulus for better regional cooperation by supranational conventions as well as among states.

## Marine turtles and fisheries in the Mediterranean: are we missing something?

Bojan Lazar and Nikola Tvrtkovic

Adriatic Marine Turtle Program, Department of Zoology, Croatian Natural History Museum, Demetrova 1, HR-10000 Zagreb, Croatia

### INTRODUCTION

The first studies on marine turtles in the Mediterranean basin were started in the early 1980s, on the nesting beaches in Greece and in Cyprus. Today, the main nesting areas of the two species that reproduce in the region, the loggerhead turtle and the green turtle, are well known, concentrated almost exclusively in the eastern basin (Margaritoulis et al., in press).

The first at-sea studies started with a decade's delay, in the late 1980s' and early 1990s', and were carried out through the assessment of interactions between marine turtles and fisheries (Delaugerre 1987, De Metrio and Megalofonou 1988, Laurent 1990, 1991, Argano et al. 1992). Almost all these studies were and still are focused on large-scale commercial fisheries, longlines and trawls. Indeed, the first results revealed a high level of bycatch by both fisheries, and identified the fishery interactions as the main threat to sea turtles in marine habitats in the Mediterranean (see review by Gerosa and Casale 1999). More than 22,000 juveniles a year are caught just by the Spanish longline fleet operating in the Balearic Sea (Aguilar et al. 1995), while estimates of the annual bycatch in bottom trawls also range in thousands of turtles caught. Nevertheless, direct mortality rates in both fisheries seems to be rather low: 0.4% in longlines, and 0-10% in trawls.

However, there is another fishery widely distributed in the Mediterranean, one that is almost ignored in all such studies: the gill net fishery. The gill net fishery exists in almost all coastal zones around the globe on a large and a small scale, and it is one of the oldest fishing techniques. It uses a variety types of nets and methods, and therefore it is not easy to classify it. In this paper we analyze data on the bycatch of loggerhead sea turtles in coastal gill nets in the eastern Adriatic Sea, and discuss the interactions of turtles and the gill net fisheries in the Mediterranean basin.

### MATERIAL AND METHODS

We present the data on the bycatch of 59 loggerhead sea turtles by eastern Adriatic gill-netters in the coastal waters of Slovenia and Croatia in the period 2000-2002. We analyzed bycatch incidents with regard to temperature regimes. For this purpose we divided the year into two periods: the "warm period" (from the beginning of May to the end of October) and the "cold period" (from the beginning of November to the end of

April), and tested the temporal distribution of bycatch by means of a chi sq. test.

Data on the gill net fishing fleet were obtained from the Directorate of Fisheries, the Ministry of Agriculture and Forestry of Croatia, and through personal interviews with fishermen in Slovenia.

### RESULTS AND DISCUSSION

Forty-four turtles were captured in gill nets during the warm period, with the highest number of incidents coming from the northernmost part of the eastern Adriatic Sea (Slovenian waters and northern Croatian waters). In contrast, we recovered just 15 loggerheads in the cold period, all along the southern Croatian coast, in sea temperatures >14 °C. There is a significant association between bycatch in gill nets and the warm period ( $\chi^2=4.33$ ,  $p=0.03$ ,  $d.f.=1$ ). This means that loggerheads in the eastern Adriatic are mostly involved with gill nets during the period of increased activity, between the end of April and November. Furthermore, our study showed that gill nets affect both small juveniles (<50 cm CCL) and large, benthic size-classes (>50 cm CCL), in the ratio 1.2:1, respectively. The mean mortality was 54.9% ( $n=51$ ).

The gill net fishery in the eastern Adriatic Sea, as well as throughout the whole of the Mediterranean, is mostly a small-boat-based, traditional fishery, which uses low-cost boats. Out of 2,400 fishing vessels that operate with gill nets along about 3,000 km of the total coastline of Croatia, 89.4% are less than 12 m in length. A total of 12,142 km of gill nets are registered, which gives about 5 km of gill nets per boat, or 3.3 to 6.2 times more than is allowed by the law, depending of the type of net. About 60 gill netters are registered along 44 km of Slovenian coast, fishing with 2-4 km of gill nets per boat. In total, between 120 and 240 km of gill nets are set along 44 km of Slovenian coastline, causing a direct mortality of loggerheads of 65.4%.

Gerosa and Casale (1999) gave a general overview of interactions of marine turtles and fisheries in the Mediterranean. There is an obvious lack of data and systematic studies on turtles and gill nets in the region. There are several main reasons for this: First, the gill net fishery is a "dispersed" fishery, based on thousands of small vessels situated in numerous ports, which makes it very difficult to assess. Second, besides professional fishermen, there are numerous non-occupational (recreational) fishermen who use gill nets on an irregular basis, so it is difficult