

Marine Turtles in the Central Mediterranean Sea

DIETER GRAMENTZ

Földerichstr. 7, 1000 Berlin 20, Federal Republic of Germany

(Received 5th November 1988; accepted with revisions 27th November 1989)

ABSTRACT

The population of loggerheads in Lampedusa was examined during the nesting season in 1985. After successful nesting, it was observed that 101 eggs were laid, of which 67 hatched.

This study reveals that Conigli Beach is the only remaining rookery of *Caretta caretta* in the central Mediterranean. At least five other nesting sites in Lampedusa were rendered unsuitable for nesting due to buildings and bathing by residents and tourists. *Rattus rattus* was found to be the main predator, besides man, at Conigli Beach.

The capture of one specimen of *Chelonia mydas* near Lampione in summer 1983 is reported.

In spring and summer 1986, loggerheads which were caught by fishermen were examined in Malta for injuries and pollution. Results showed that 19.5% of the examined turtles had injuries on flippers and carapace, and over 20% suffered from physical or chemical pollution.

The capture of two *Eretmochelys imbricata* – one specimen caught in summer 1984 near Lampedusa, and one in 1980 near Gozo – is reported. One leatherback was observed in Lampedusa, close to the shore of Conigli Beach, where it was probably trying to nest. Information on 12 *Dermochelys coriacea*, captured or sighted in Maltese waters between 1970 and 1980, is given.

This study includes a historical review of former reports of turtles in the central Mediterranean. Former detections of *Lepidochelys kempfi* and *Chelonia mydas* are also briefly described. The number of loggerheads killed annually is estimated at 150-300 in Lampedusa and 500-600 in Malta.

It is therefore proposed that, if the last loggerhead rookery left in the central Mediterranean at Conigli Beach is to be preserved, this beach should be immediately closed to the public during the nesting period.

Introduction

Seven fairly large islands are situated in the central Mediterranean, namely – the Pelagic Islands: Lampedusa, Lampione and Linosa – the Maltese Islands: Malta, Comino and Gozo, and – the island of Pantelleria.

In 1847, Pietro Calcara was the first to report sea turtles from the central Mediterranean – namely *Caretta caretta* from Lampedusa. He wrote: “Fra i rettili esiste in abbondanza nel mare di Lampedusa la *Chelonia caretta*...” Trabucco (1890), who was probably supported by the data of Calcara from Lampedusa, reported: “In mare abbandonando la:..., *Thalassochelys corticata*, ...” Again in 1890, Gulia reported from Malta: “Comunissima è la *Thalassochelys caretta* di Bonaparte, detta dei maltesi *Fekruna tal-baħar*, la quale talora cresce alla lunghezza di sei piedi: in estate la testuggine di mare si avvicina alle spiagge arenose per deporre un gran numero di uova perfettamente rotonde, dalle quali in men di venti giorni il sole fa sbucciare le piccole testuggini”, and Minà-Palumbo (1890): “... frequente in Pantelleria ...” In 1907 Sommier reported again from Lampedusa: “Non rara, nel mare di Lampedusa, e la grande tartaruga marina (*Thalassochelys corticata* Rondel.) ...” Despott (1915) wrote about *C. caretta* from the Maltese Islands: “The loggerhead turtle is very common in our seas and from August to November is taken in large numbers; in spring it also reappears, and has been known during that season to lay its eggs on our unfrequented sandy beaches, especially at Gozo. It is largely used as an article of food by the majority of the population.” This report by Despott contains the first remarks about an exploitation of sea turtles in the central Mediterranean. Further reports on sea turtles from the Pelagic Islands are by Lanza & Bruzzone (1960), DiPalma (1978) and Gramentz (1986); and from the Maltese Islands by Despott (1930a,b), Mertens (1968), Bonett (1982) and Lanfranco (1983).

Materials and Methods

The work at Conigli Beach, Lampedusa, which lasted 97 nights, began on 21 June 1985 and ended on 26 September 1985. During this period, beach controls were made every 15 - 25 minutes throughout the night.

Juvenile and adult turtles were tagged with self-piercing monal metal tags of the National Band & Tag Co., U.S.A. The tags were attached to the trailing edge of the left fore limb of the nesting female on her way back to sea. Two circular fences were erected to protect the clutch. The first fence, enclosing an area approximately 80cm in diameter, afforded protection against different predators on Conigli Beach and provided a means to count the hatchlings. The second fence, enclosing an area approximately 150cm in diameter, was erected to prevent intrusion by people. All the hatchlings were allowed to run from the nest to the sea. They were then gathered and, the next morning, they were taken by dinghy to a point approximately 0.8 nautical miles away from their native beach. The hatchlings were released here to avoid *Larus argentatus* and to eliminate the risk of traversing a sea lane in frequent use by the local fishermen.

In Malta, 101 specimens of living *Caretta caretta* were examined during the periods March-May and June-October 1986. These turtles were caught by Maltese fishermen either unintentionally – on hooks baited for *Xiphias gladius* or in nets intended for *Coryphaena hippurus* – or they were purposely caught from the water surface using a lance. The turtles were bought, examined, tagged with red plastic tags of Dalton Supplies Ltd., U.K. and released from vantage points on the island.

Both types of tags used show the return address of the Musée Océanographique de Monaco on the back. The nomenclature of Boulenger (1889) and Loveridge & Williams (1957) was used in counting the epidermal plates of the carapace, i.e. nuchal, vertebral, costal, marginal and supracaudal.

Geography of beaches and reasons for decline

Lampedusa (Fig. 1)

Sea turtles have often been observed laying their eggs at Conigli Beach, Cala Croce, Cala Guitgia, Cala Francese and possibly Cala Pisana before 1940-1950. At present, Cala Pisana is a dirty beach, 15m long and 17m wide. It is littered with stones, dust and human refuse. This beach was originally four to five times as long, probably 33m by 35m. Use of this beach as a nesting site in the past is not certain, however one sea turtle was found there in 1920-1925.

Turtles were observed laying eggs at Cala Francese prior to 1970. In 1970-1978 a beach house was built here. A stone wall, built 12m from the sea almost all along the 50m long beach, prevented the turtles from laying their eggs.

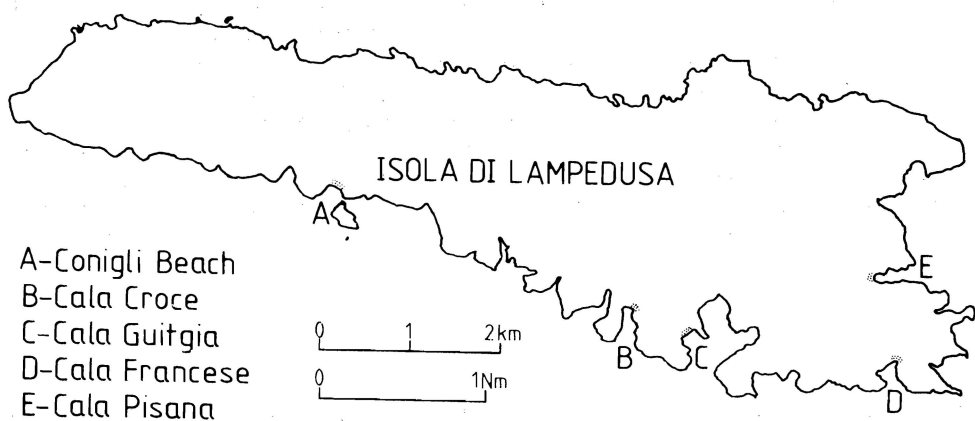


Fig. 1 – Map of Lampedusa showing the former and recent loggerhead rookeries.

Marine turtles were last observed to successfully deposit their eggs at Cala Guitgia in 1970. This 95-100m long beach, which varies in width from 17 to 25m, is the second most important tourist attraction in Lampedusa after Conigli Beach. Tourists seldom visit the beach at night. Hotel and restaurant lights around the beach and the harbour next to it are probably the cause for the turtles' disappearance.

Cala Croce is a widely-used tourist beach 35m long and 20-23m wide. The last observations of sea turtles here were made between 1975 and 1980. Conigli Beach is approximately 130m long and 12-26m wide. At its western end there is an area of 180m² strewn with fist-size stones, from the surface to deep down. This hinders the turtles' digging to the extent that eggs cannot be successfully deposited in this restricted area. At present, it is the most visited beach in Lampedusa – during August 1985, 280-300 people were counted by day and 30-50 people were counted by night. The islanders still remember the large number of sea turtles that used to come to the beach. A few decades ago, eggs and hatchlings were common toys with children. The inhabitants think that since 1950, turtle numbers have steadily decreased. It is their widespread belief that the turtles completely disappeared during the last 5 - 10 years.

Linosa

A resident of Lampedusa reported to me the nesting of a loggerhead on the beach of Cala Pozzolana di Ponente in summer 1965/70. This beach is about 150m long and 9m wide. The egg-laying was photographed by the observer, but it was not possible to verify the nesting. Inhabitants' statements, about the presence of sea turtles at Cala Pozzolana di Ponente, are contradictory. Hatchlings were never reported from the beach.

Sommier (1908) reported *C. caretta* in Lampedusa, but not in Linosa. He would have certainly reported the latter if he had any indications of their presence there.

Females do occasionally enter this beach, but today there are no signs of regular nestings.

Gozo

The beach of Ramla l-Hamra, situated on the north coast of Gozo, represents a former rookery for *C. caretta*. It is approximately 300m long and 20-50m wide. There are dunes on the east side and rocks on the west side of the backland.

Gulia (1890) reported the deposition of eggs on the Maltese Islands. He did not, however, refer to any beaches. Despott (1915) too reported the deposition of eggs. His report mentions the island of Gozo without specifying any beaches. It seems likely, however, that he was referring to the beach at Ramla l-Hamra. There has been record of loggerheads breeding at Ramla l-Hamra since 1930 (Schembri pers. comm.).

Although the sea turtles are still hunted legally on the Maltese Islands, the main cause for the turtles' entire disappearance seems to be the large number of resident and tourist bathers.

Pantelleria

During the present study, I could not visit the island of Pantelleria. Minà-Palumbo (1890) made the first report of sea turtles in Pantelleria. He reported frequent sightings of *C. caretta* on the Island, but he did not specify whether these were offshore aggregations or nestings. To my knowledge, this report represents the only record of sea turtles on this island.

***Caretta caretta* at Conigli Beach, Lampedusa**

The first female to nest in 1985 came on 27 June at 0335hr. After a track of 8m, it laid 101 eggs, the size of which was 40-41mm (\bar{x} = 40.4mm, n = 30). The turtle was tagged on its way back to the sea (ME 5102). On 19 July (after 23 days), this turtle reappeared at 1150hr. It made two attempts to dig an egg-hole, but both failed because of the stones on the beach. Its way back to the sea was probably influenced by a bonfire on the eastern part of the beach. A body-pit was made on the way, but activity ended soon. The curved carapace length and width of ME 5102 were 78cm and 69cm respectively.

On 2 September 1985, at 0700hr, a tourist found a loggerhead soon after its second attempt to lay eggs was hindered by stones. As the tourist inspected the turtle more closely, the loggerhead was frightened and made for the sea. This female may not have been ME 5102 since the tourist examined it very closely but did not see any tag.

The clutch of ME 5102 began to hatch on the night between 31 August and 1 September, after an incubation period of 66 days. The hatching was complete on 8 September, after 74 days of incubation (Fig. 2). Hence the incubation period had an arithmetic mean of 68.1 days (n = 63). 78 turtles hatched, averaging a 77% hatching

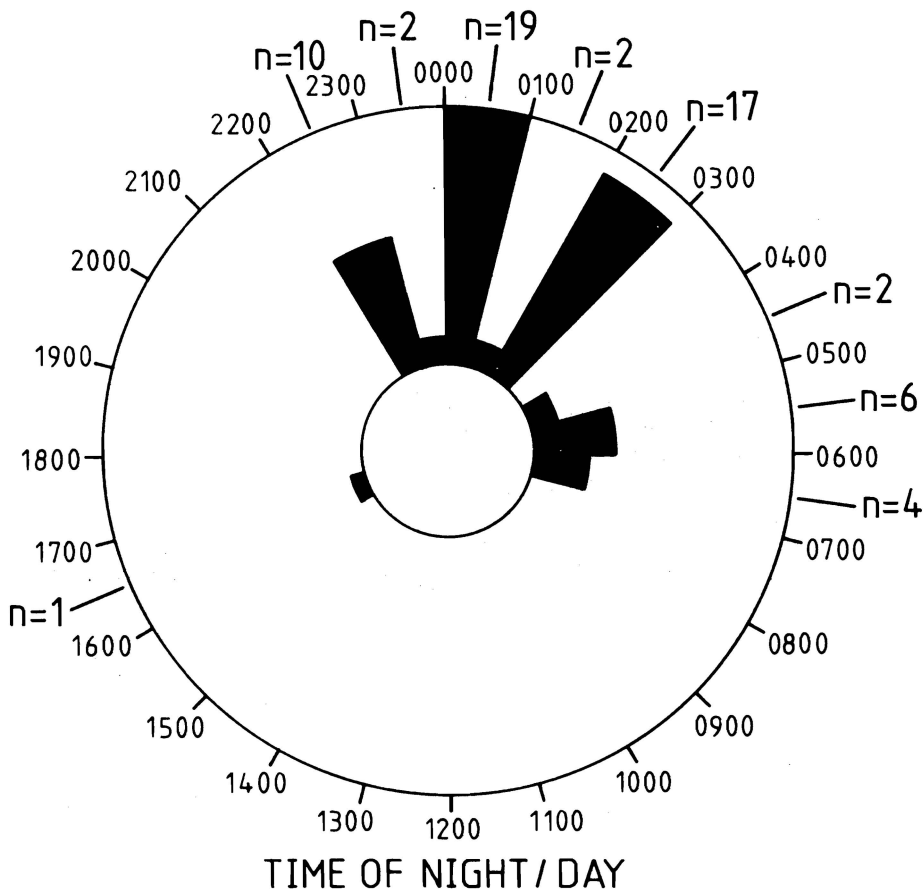


Fig. 2 - Hatchtime distribution of 63 *Caretta caretta* hatchlings from the clutch of ME 5102.

success. Of these, 63 were observed hatching: 62 hatched during the night or early morning and one turtle hatched in the afternoon (Fig. 2).

Like all other hatchlings that I examined in the Mediterranean, all of the observed hatchlings from this clutch were greyish when dry and black when wet. A morphological and morphometrical examination was carried out on 52 of the hatchlings. The marginal plate distribution of the hatchlings was 11 L/11 R 63%, 12 L/12 R 23.1%, 12 L/11 R 5.8% and 13 L/12 R 1.9%. The inframarginal plate distribution of the hatchlings was 4 L/4 R 48.1%, 4 L/3 R 26.9%, 3 L/3 R 23.1% and 3 L/4 R 1.9%. The relation of marginal and inframarginal plates, given in Fig. 3, shows a 11 L/11 R and 4 L/4 R predominance. The hatchlings' straight carapace length measured 40-46mm (\bar{x} = 43.4mm) and weighed 15-19g (\bar{x} = 17.3g).

***Caretta caretta* in Malta**

All of the 101 turtles studied in Malta had their carapacial and plastral plates examined. Teratological features of the costal, vertebral and marginal plates were

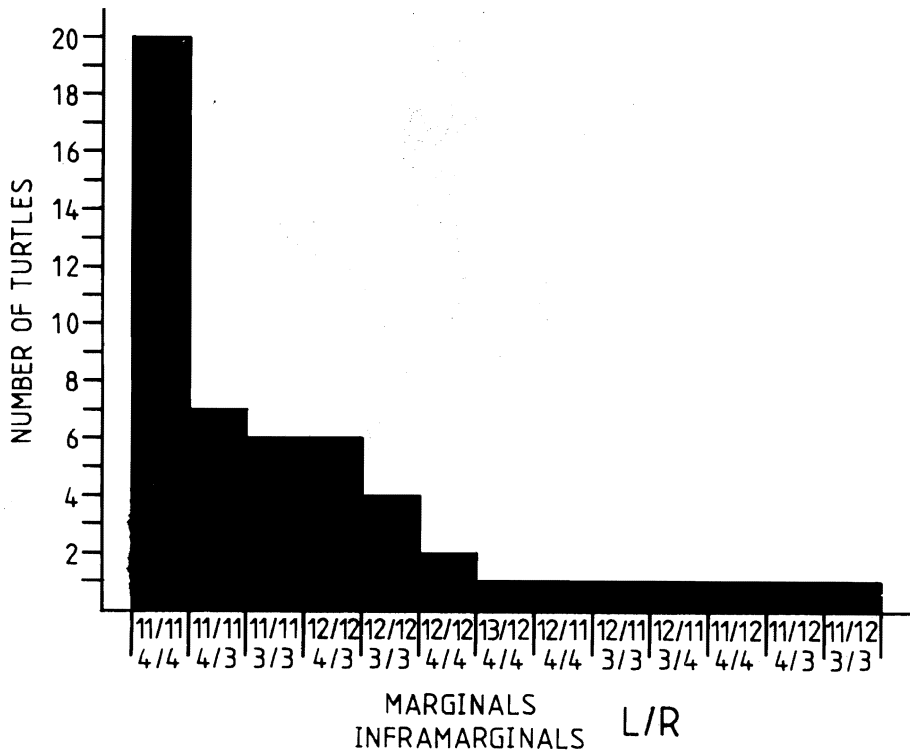


Fig. 3 – Distribution of the marginals/inframarginals of 52 *Caretta caretta* hatchlings from the clutch of ME 5102.

evident on 12 turtles (12%). In two turtles, the nuchal plate was entirely divided into two parts, while in another two, it was partly divided, with the seam starting from the cranial end. A supernumerary, restricted to the posterior section of the carapace, was observed on 9 turtles. In contrast, the other 3 turtles had supernumerary plastral plates in the anterior section of the shell.

In Malta, 123 loggerheads, consisting of living turtles and “shell-trophies”, were scrutinized for marginal plate distribution. Of these, 68 specimens of *C. caretta* (55%) showed a predominant 12 L/12 R distribution. A more detailed overview of this subject is given in Fig. 4.

A group of 82 loggerheads were examined for injuries caused by predators. The damage suffered by 16 of the specimens (19.5%) ranged from insignificant little notches on the rear flippers and posterior marginal plates, to entire loss of one of the extremities. The entire loss occurred in 4 turtles (4.9%). In both M575 and M753, the left rear flippers were missing (Fig. 5), while in M506 and M525, the right fore flippers were cut off. (Fig. 6).

Apparently, turtles are able to survive the severe damage caused by the loss of an entire flipper, mainly because of the rapidity with which their blood coagulates. Not only do they survive the loss of a hind limb, which is used mainly for guidance, but also the loss of a fore flipper, which is their major swimming organ. The survival of turtles after losing an extremity was previously reported by Barth (1962) and Bustard (1972).

All four turtles seemed to be in good condition. It was difficult to decide when they were injured, since they were all old and well healed. However it seemed unlikely that their injuries occurred when they were very young. Turtles M506 and M525 were both

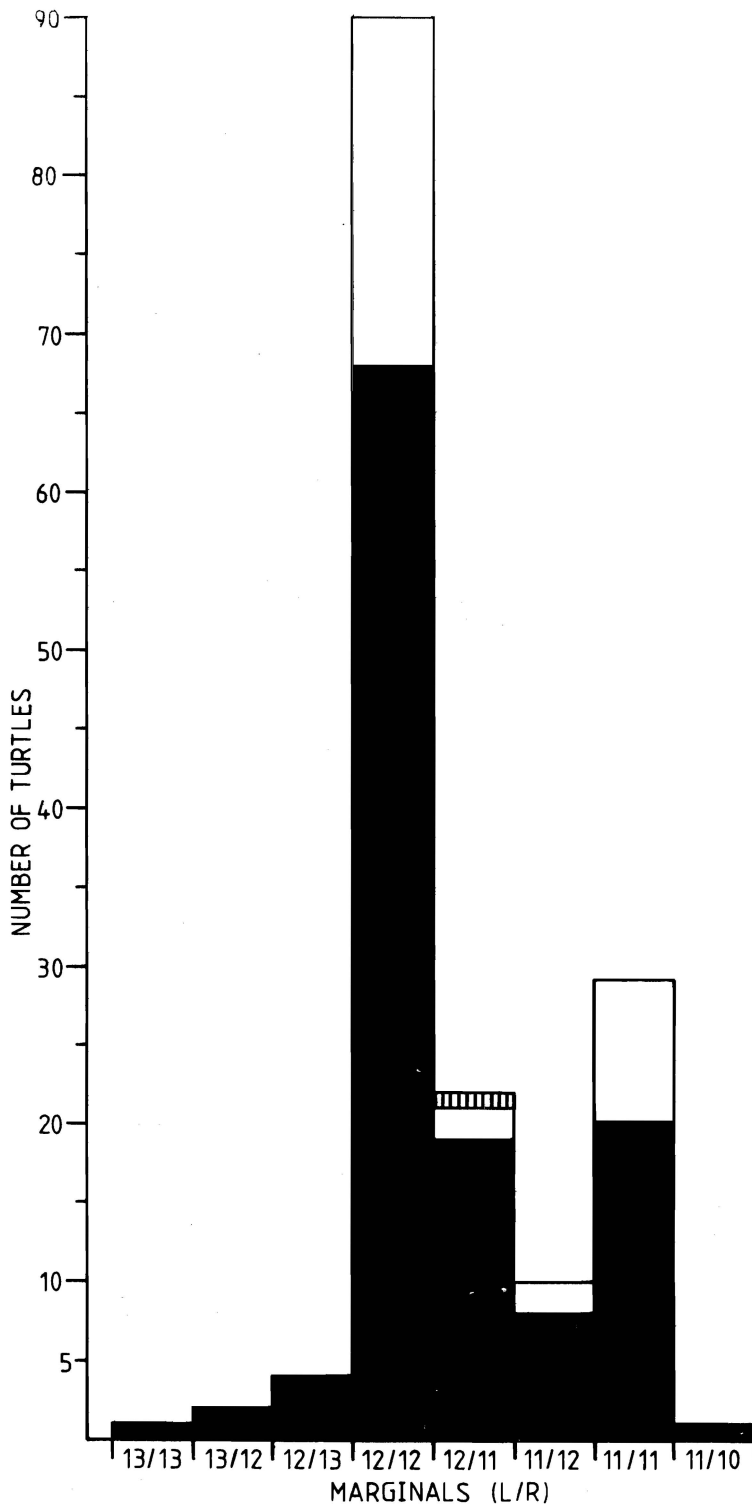


Fig. 4 – Marginal shield distribution of 159 examined loggerheads which were captured by Lampedusan fishermen (white), Maltese fishermen (black) and the nesting female from Conigli Beach (striated).

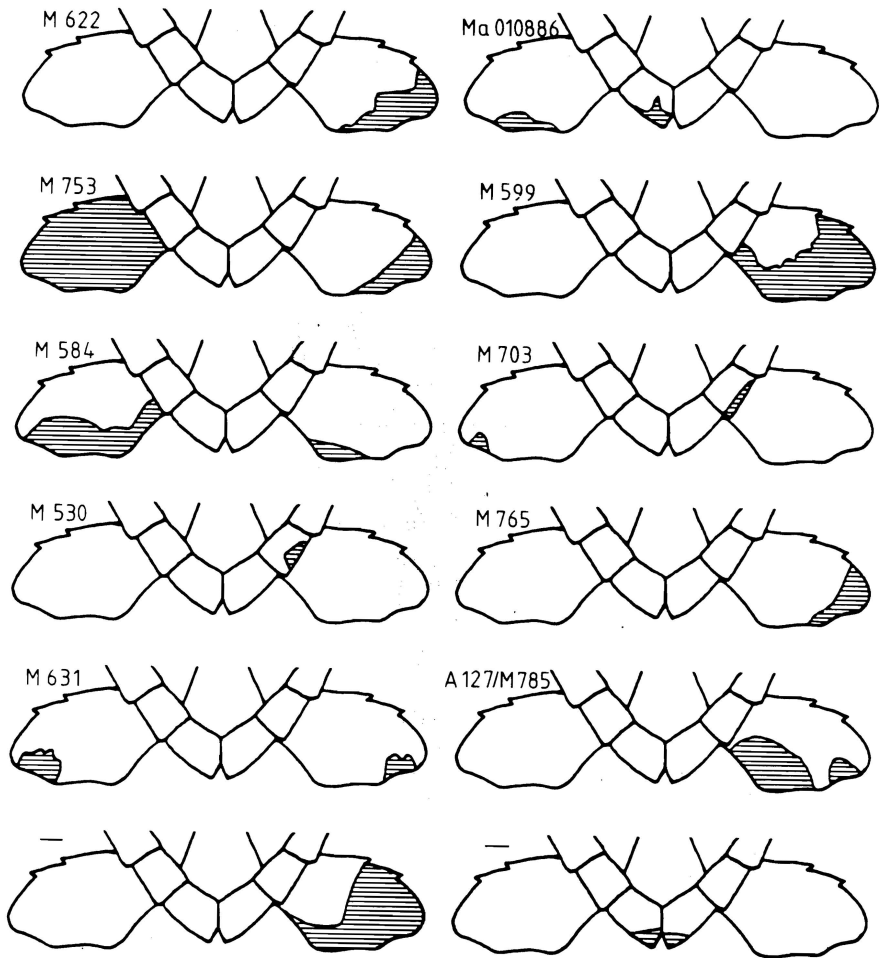


Fig. 5 – Injuries of 12 *Caretta caretta* captured around Malta. Missing parts striated.

obviously handicapped in swimming speed and diving when they were released. The size distribution of the injured turtles is given in Fig. 7. Turtle M506 measured: straight carapace length/width 45.9/38.7cm and curved carapace length/width 49/46cm, while M525 measured: straight carapace length/width 53.5/45cm and curved carapace length/width 58.5/55cm.

Over 20% of the 99 loggerheads examined for pollution were contaminated with plastic or metal litter and petroleum hydrocarbons (Gramentz 1988).

Chelonia mydas

Lampedusa

In summer 1983, Lampedusan fishermen caught one adult green turtle from the surface water near Lampedusa using a lance. The turtle was reported as being bigger and different from other loggerheads which were usually captured. It was too heavy to be lifted in the small boat – it was estimated to weigh 150kg – so it was released. The turtle was clearly identified from photographs as *Ch. mydas*.



Fig. 6 – M525 with right fore flipper missing.

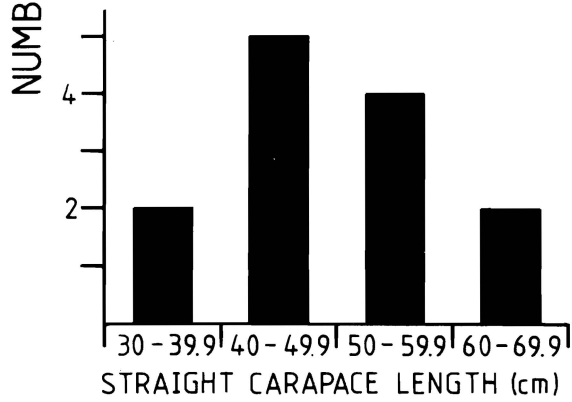
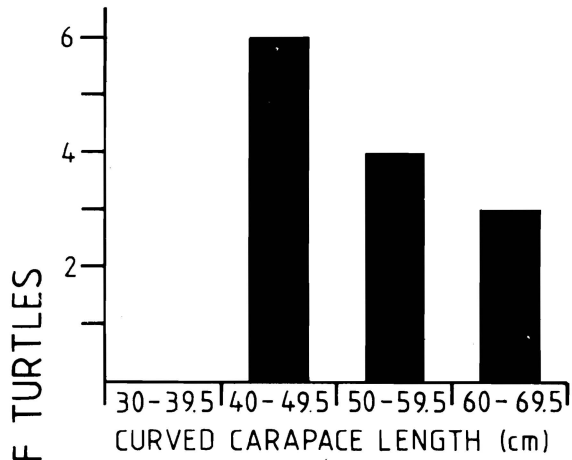


Fig. 7 – Size distribution of 13 Caretta caretta found with injuries.

Malta

An immature specimen of *Ch. mydas* was caught about one mile from the mouth of the Grand Harbour of Valletta (Despott 1930a, b) on 12 October 1929. The meat of this turtle was sold, and its carapace was given to the National Museum of Natural History in Mdina, from where it was lost in World War II. Some populations of green turtles living outside the Mediterranean Sea are known to be long distance migrants. However the green turtles in the Mediterranean live predominantly in the warmer eastern basin. Their rookeries are in Turkey (Geldiay *et al.* 1982), Cyprus (Demetropoulos & Hadjichristophorou 1981, 1982) and Israel (Sella 1981). There are no known green turtle rookeries in the Mediterranean west of 28°E Latitude. Rookeries were detected in the Adriatic Sea (Nardo 1864, Camerano 1891), in Greek waters (Margaritoulis *et al.* 1986), and in small numbers in other parts of the Mediterranean and the Black Sea (Beskov & Beron 1964).

Eretmochelys imbricata

In 1909, Mourgue reported the capture of one specimen of *Eretmochelys imbricata* from Marseille, France. This was the first reported capture of this species in the Mediterranean.

Lampedusa

One hawksbill was caught near Lampedusa by local fishermen in 1984 (details of the date and location are not available). Although this was illegal, the turtle was killed. Its carapace was sold as a trophy to a resident in Palermo, Sicily, who has kept it since. The curved carapace length and width of this specimen are 47cm and 39cm. It has a 11 L/11 R marginal plate distribution.

Malta

In September 1980, a hawksbill was caught by Maltese fishermen approximately 5 nautical miles east of Gozo (Vella-Gaffiero, pers. comm.). It was taken to the National Museum of Natural History in Mdina, Malta, where it was preserved. The curved carapace length and width of the specimen are 49cm and 41cm respectively. It has a 11 L/11 R marginal and 4 L/4 R inframarginal plate distribution.

The locations of origin of the detected migrants are not known since *Eretmochelys imbricata* does not breed in the Mediterranean Sea. It is likely that they came from the nesting sites on Seil Ada Kebir Island in the Suakin Archipelago, Sudan (Ross & Barwani 1982; Hirth & Latif 1980) in the Red Sea and on Perim and Jabal Islands, P.D.R. Yemen (Hirth & Carr 1970; Frazier 1982) in the Indian Ocean. Several marine organisms have found their way into the central area of the Mediterranean via the Suez Canal. Hence, these specimens of *E. imbricata* probably followed this route.

Lepidochelys kemp

Malta

On 12 October 1929, a specimen of *L. kemp* was captured about one mile from the mouth of the Grand Harbour in Valletta, Malta. It was brought to Dr. Giuseppe Despott, the curator of the National Museum of Natural History, together with a specimen of *Ch. mydas*, which was caught in the same area on the same day. He erroneously identified both turtles as *Ch. mydas* (Despott 1930 a,b). A detailed report by Brongersma & Carr (1983) however shows that the former turtle was *Lepidochelys kemp*.

Dermochelys coriacea

Bleakney (1965) and Lazell (1980) discussed the migration route of both sexes of *D. coriacea* from their mating and nesting grounds along the north coast of South America. Since these turtles feed mainly on *Cyanea capillata*, which travels northward along the Gulf Stream, they migrate along the east coast of North America.

Lazell (1980) suggested to follow the southward migration of *D. coriacea* along the European Atlantic coast. Data from Brongersma (1972) and Duguay (1983) gave evidence of this migration. Further indications of this route are given by nine detections of *D. coriacea* on the Portuguese coast between 1978 and 1983 (Pereira, pers. comm.), and by Pasteur & Bans (1960), who reported leatherbacks on the Moroccan Atlantic Coast off Ed-Dâr-El-Beida (Casablanca) and Cap Beddouza (C. Cantin). These turtles probably swim to their mating and nesting grounds via the Canary and North Equatorial Currents.

It seems probable that the Mediterranean specimens are members of the southward migration who accidentally enter the Mediterranean through the narrow Straits of Gibraltar. They cannot reorientate themselves to leave this area and hence they are trapped.

Lampedusa

Dermochelys coriacea was observed twice during the 1985 survey on the island of Lampedusa.

1) On 14 July 1985, a leatherback was observed, at 0310hr, during a patrol. It was 2-3m from the beach, heading towards the land. The turtle kept this position without moving for almost three minutes. It then turned south-east and swam or drifted in the direction of Isola dei Conigli, where it disappeared at 0325hr. I estimated that the turtle was 180-200cm in total length.

The search for tracks required considerable attention since nightly patrols were carried out mostly without lights. In fact, this turtle was seen at a distance of 4-5m just as it was about to leave the water. The observation was continued lying down. However, the movement on the beach probably accounted for its turning back to the sea rather than making a landing.

2) On 19 August 1986, tourists on the ferry connecting Lampedusa and Linosa to Sicily observed one leatherback turtle. The tourists' attention was first attracted by a loggerhead just after the ferry left Lampedusa from Linosa (approximately 2 nautical miles away). They then saw the leatherback, probably an adult, about 20m further away. As long as it was in sight, it was swimming on the surface, rather slowly, seemingly escaping from the boat.

The first detection of a nesting attempt by *D. coriacea* in the Mediterranean Sea on 30 June 1963 at Palmachim, Israel, was reported by Sella (1982). Bruno (1978) reported oviposition by a leatherback on Macconi beach in Sicily. Though these observations in Israel, Sicily and Lampedusa represent exceptional cases, it seems probable that these turtles do try to nest in the Mediterranean. Mrosovsky & Pritchard (1971), Frair *et al.* (1972), Greer *et al.* (1973) and Mrosovsky (1980) discuss the physiological adaptations of *D. coriacea* which enable these turtles to survive in temperate areas. Factors which reduce, or even prevent, development during incubation may be the reason why no juvenile specimens were even caught.

Malta

The following is a list of occasions on which *Dermochelys coriacea* was sighted or caught in Maltese waters from 1970-1980.

1) 5 August 1970: A leatherback was caught by fishermen at a point about 10

nautical miles off Żurrieq. It was estimated to be about 195cm long and to weigh 320-360kg. It was captured using a spear which caused a continuously bleeding lacerated wound, 10cm by 15cm. The turtle, which survived the wound, was brought to Maltaquarium, in Malta. It died here on 6 August 1970 as a result of external haemorrhage. (Anon. 1970 a, b, c; Lanfranco 1983; Caruana, pers. comm.).

2) 22 March 1970: A specimen about 135cm long and weighing approximately 101kg, was landed at Żurrieq by local fishermen. Information about the exact location of the capture and the fate of this turtle is not available (Galea 1972; Lanfranco 1983).

3) 9 October 1975: No details are available of the sighting at the Strand, Sliema (Lanfranco 1983).

4) 13 May 1976: No details are available of the sighting/catching at Marsaxlokk (Lanfranco 1983).

5) 3 July 1976: A specimen, measuring around 195cm in length and 300kg in weight, was captured and killed by fishermen around Filfla. It was transported to the Natural History Museum in Mdina, where its preservation was attempted (Lanfranco 1983).

6) August 1976: A turtle, probably an adult leatherback, was observed by fishermen who were fishing 8 nautical miles south-east of Delimara Point. It surfaced close to the boat, swam towards it and even knocked its head against the hull. The turtle dived as the fishermen moved from the stern to the bow to catch it.

7) 9 November 1976: A turtle, 185cm long, was captured somewhere around Gozo. It was taken to the University of Malta where the skeletal material and visceral organs were preserved (Lanfranco 1983). In August 1986, I tried to examine this material, but it has disappeared and is certainly lost.

8) 3 June 1977: A dead specimen, 185cm long, was found at Spinola Bay (Lanfranco 1977).

9) 13 July 1977: One specimen was captured off Marsaxlokk. No further details are available (Lanfranco 1983).

10) November 1978: A leatherback was found entangled in the ropes of a palm tree "kannizzata" used to catch *Coryphaena hippurus* at a point approximately 70 nautical miles south of Malta. The estimated carapace length was 180cm and the weight was 300kg. The turtle was killed and left there by fishermen.

11) July 1979: A turtle was captured on the long line for *Xiphias gladius* about 10 nautical miles south-east of Malta. It was estimated to have a carapace length of 210cm and carapace width of 90cm. It was brought into Marsaxlokk Harbour and tied to the quay, where it died a week later. The carcass was taken to sea and drowned.

12) End of July 1980: A specimen was found entangled in the line for *Xiphias gladius* about 81 nautical miles south-east of Malta. The estimated carapace length was at least 180cm and the weight was about 400kg. The turtle was released after five crew members failed to lift it onto the boat. One crew member filmed the attempt to lift the turtle.

Predators at Conigli Beach

The principal predator of Conigli Beach is *Rattus rattus*. *Larus argentatus* and *Ocyropode cursor* are other predators. *Larus argentatus* is found on the beach at sunrise and sunset. It remains on Isola dei Conigli and nearby rocks overnight. *Rattus rattus* can be found, in great numbers, everywhere all night long. For many years, it has been observed by inhabitants to catch hatchlings. Both species benefit from the refuse left by tourists.

Ocyropode cursor occurs relatively frequently on Conigli Beach. Its predatory effects were reported by Hill & Greene (1971), Mortimer (1983) and Kabraji & Firdous (1984). Ghostcrabs, and their holes and tubes, were found all along the beach. However there

was no increase in their concentration around the clutch.

Although Feral domestic dogs are found in great numbers on Lampedusa, they were seldom seen at night on Conigli Beach.

Fishery

Lampedusa

Italian law forbids the capture of sea turtles. However, once they are caught accidentally on the longline for *Xiphias gladius*, they are seldom released again. Occasionally, in summer, one fishing boat may catch as many as six turtles per day/night by spearing them in the surface water. If the shell is not going to be sold as a trophy or souvenir, the turtle is killed at sea and only a few kilograms of meat are smuggled in.

Two living specimens of *Caretta caretta* were retrieved from fishermen during summer 1985. They were tagged (ME 5101 and ME 5104) and released. 32 preserved specimens, most of which were exposed in restaurants, were examined. These were captured between 1968 and 1985 at a distance of 15-25 nautical miles from Lampedusa. Argano (1979) estimated that the number of turtles killed in Lampedusa is 100-500 per year. Since such activity is illegal, it is difficult to get information from fishermen. However, it seems likely that the number of turtles killed around the island is 150-300 per year.

Malta

In Malta, no laws have yet been enacted to protect sea turtles. Nor are there any regulations which limit the amount of turtles that can be caught.

Bonett (1982) counted 92 loggerheads at the Valletta Fish Market from January to December 1981. These were counted at midday and therefore represent only those which were left unsold, since turtles are killed and sold early in the morning. Many Malta Agricultural and Fishery Abstracts 1959-1967 record part of the catch for the years 1959-1966. The actual weight sold was noted for 1960-1964 (Table 1). The declared values, however, represent minimum values since dealers are often observed not to fill in the vouchers so as to get better profits. Hence most of the turtles sold do not appear in the statistics.

Argano (1979) estimated that 100-500 turtles are caught annually in Malta.

In summer of 1986, 20 loggerheads were counted during 10 visits to the Valletta Fish Market. Six of these were bought and released.

Another 91 turtles were counted at Marsaxlokk, the most important fishing village in Malta. Of these, 76 were bought and released. The 91 turtles do not represent the whole catch, as 50-60 other turtles were killed during the time of examination. One loggerhead was provided by residents who obtained it from fishermen at Wied iz-Zurrieq. Out of 101 loggerheads that were examined, 74 had swallowed the hook from the longline on which they were caught. Of the 83 turtles actually bought, 66 had swallowed the hook as evidenced by the nylon cord still protruding from the mouth. The hooks in 13 of the 66 specimens were stuck well into the gullet, and were therefore removed surgically. Details of the operation will be published elsewhere. Hence 53 turtles were released with at least one hook in their mouth. These turtles were inadvertently hooked on the longlines intended for swordfish. These lines mainly use *Scomber scombrus* as bait. This also attracts *C. caretta*. During the swordfish season, in spring and summer, about 1500-2500 loggerheads are captured by Maltese fishermen. When the turtle swallows the hook and bait, the line is cut off and it is released. Sometimes, the turtle is killed to retrieve the hook. Certainly, 500-600 loggerheads

Table 1 – Weight of turtles sold at the Valletta Fish Market from 1960-1964 (cwts/kg).

	J	F	M	A	M	J	
1960	4/200	4/200	4/200	12/600	14/700	4/200	
1961	—	—	4/200	8/400	7/350	4/200	
1962	—	—	—	—	—	—	
1963	—	—	—	—	—	—	
1964	—	—	—	—	—	—	
	J	A	S	O	N	D	Total
1960	7/350	13/650	7/350	11/550	5/250	4/200	89/4450
1961	7/350	13/650	5/250	3/150	—	—	51/2550
1962	—	6/300	—	—	—	—	6/300
1963	—	—	6/300	—	—	—	6/300
1964	—	5/250	14/700	10/500	—	—	29/1450

are killed every year in Malta. Carapaces are sold on weekends at local markets and in souvenir shops.

Conservation measures needed

Conigli Beach, in Lampedusa, is the only rookery of *C. caretta* left in the central Mediterranean Sea. A very small population of females is left – 1-2 nestings per year or 5-7 per three year cycle. If no conservation measures are taken immediately, there is a danger that the last rookery in the central Mediterranean will come to an end. Killing of loggerhead turtles must be absolutely forbidden on the Maltese Islands, and the law for their protection must be enforced by local authorities in Italy. Conigli Beach must definitely be closed, both to tourists and residents of the Island, from May to October, day and night, if turtles are to survive on Lampedusa.

Protective laws however, cannot change the practice of fishing for swordfish in Lampedusa, Malta, Gozo or Sicily. An enormous amount of turtles are hooked every year during the swordfish fishing season. If these are released by the fishermen, the swallowed hook remains in the pharynx or stomach. Occasionally, turtles, having two or three hooks in different stages of corrosion, are recaptured. Although the majority of turtles captured are not killed by the fishermen, they are potentially in danger of death anyway, depending on the position of the hook. A method must therefore be found whereby the number of turtles caught during swordfish fishing is considerably reduced.

REFERENCES

- Annual Abstract of Statistics (1962). Dept. of Information, No. 15, 1961, Valletta, Malta: 11.
 Annual Abstract of Statistics (1963). Dept. of Information, No. 16, 1962, Valletta, Malta: 11.
 Annual Abstract of Statistics (1965). Dept. of Information, No. 18, 1964, Valletta, Malta: 11.
 Annual Abstract of Statistics (1966). Dept. of Information, No. 19, 1965, Valletta, Malta: 20.
 Annual Abstract of Statistics (1967). Dept. of Information, No. 20, 1966, Valletta, Malta: 20.
 Anonymous (1970) Giant turtle hooked off Żurriq. *Times of Malta*, 6 August 1970, Progress Press, Valletta, Malta: 2.
 Anonymous (1970) British zoo's interest in rare turtle. *Times of Malta*, 7 August 1970, Progress Press, Valletta, Malta: 2.
 Anonymous (1970) "Myrtle" the turtle dies. *Times of Malta*, 8 August 1970, Progress Press, Valletta, Malta: 15.
 Aragano, R. (1979) Preliminary report on western Mediterranean sea turtles. *Annual Report WWF Project 1474*.
 Barth, R. (1962) Beobachtungen an einer verstümmelten Schildkröte *Chelonia mydas* L. *An. Acad. Brasileira Ciências*, 34: 411-414.

- Beskov, V. and Beron, P. (1964). *Catalogue et bibliographie des amphibiens et des reptiles en Bulgarie*, Académie Bulgare des Sciences, Sofia.
- Bleakney, J.S. (1965). Reports of marine turtles from New England and eastern Canada. *Canadian Field Nat.* **79**: 120-128.
- Bonett, G. (1982). Loggerhead turtles in Maltese Waters. *Potamon* **9**: 107-109.
- Boulenger, G.A. (1889). Catalogue of Chelonians, Rhynchocephalians and Crocodiles in the British Museum (Natural History), London.
- Brongersma, L.D. (1972). European Atlantic turtles, Zool. Verh., Leiden (E.J. Brill), **121**: 1-318 + 12 pls.
- Brongersma, L.D. and Carr, A.F. (1983). *Lepidochelys kempi* (Garman) from Malta, *Proc. Koninkl. Ned. Akad. van Wetenschappen*, Ser. C, Vol. **86**(4): 445-454.
- Bruno, S. (1978). Le tartarughe nei mari italiani e nel Mediterraneo. *Nat. e mont.*, **3**: 5-17.
- Bustard, R. (1972). Sea turtles: Their Natural History and Conservation. Collins, London: 1-220.
- Calcara, P. (1847). Descrizione dell'Isola di Lampedusa. Stamperia di Raffaele Pagano, Palermo: 38.
- Camerano, L. (1891). Monografia dei cheloni italiani. *Mem. Acc. Sc. Torino*, Ser. II: 477-479.
- Demetropoulos, A. and Hadjichristophorou, M. (1981). Chelonians of Cyprus. *Bull. Biol. Soc. Cyprus*, **1**: 13-17.
- Demetropoulos, A. and Hadjichristophorou, M. (1982). Turtle Conservation in Cyprus. *Bull. Biol. Soc. Cyprus*, No. **2**: 23-26.
- Despott, G. (1915). The reptiles of the Maltese Islands. *The Zoologist*, 4th ser. **19** (891): 821-827.
- Despott, G. (1930a) Cattura di due esemplari di *Chelone mydas* Schw. *Naturalista Siciliano*, 27th year, New Ser., **7**(1-12): 73-75.
- Despott, G. (1930b). Herpetological note. *Bulletin of the Museum*, **1**(11): 80-82.
- Di Palma, M.G. (1978). Notizie sulle tartarughe marine in Sicilia. *Il Naturalista Siciliano*, **2**(1-2): 1-6.
- Duguy, R. (1983). La tortue luth (*Dermodochelys coriacea*) sur les côtes de France. *Ann. Soc. Sci. Nat. Char. Mar.* Supplément: 1-38.
- Frazier, J. (1982). Status of Sea Turtles in the Central Western Indian Ocean. In *Biology and conservation of sea turtles*. K. Bjorndal (ed.) Smithsonian Institution Press, Washington D.C.: 385-389.
- Frair, W., Ackman, R.G. and Mrosovsky, N. (1972). Body temperature of *Dermodochelys coriacea*: warm turtle from cold water. *Science* **177**: 791-793.
- Galea, M.R. (1972). Heritage of the sea. *Times of Malta*, 24 April 1972, Progress Press, Valletta, Malta: 10.
- Geldiay, R., Koray, T. and Balik, S. (1982). On the status of sea turtle populations (*Caretta c. caretta* and *Chelonia m. mydas*) in the northern Mediterranean Sea, Turkey. In *Biology and Conservation of sea turtles*. K.A. Bjorndal (Ed.). Smithsonian Institution Press, Washington D.C.: 425-434.
- Gramentz, D. (1986). Loggerhead turtles at Lampedusa, Italy. *Marine Turtle Newsletter*, **36**: 3.
- Gramentz, D. (1988). Involvement of Loggerhead Turtle with the plastic, metal, and hydrocarbon Pollution in the Central Mediterranean. *Mar. Pollut. Bull.*, **19**(1): 11-13.
- Greer, A.E., Lazell, J.D. and Wright, R.M. (1973). Anatomical evidence for a countercurrent heat exchanger in the leatherback turtle (*Dermodochelys coriacea*). *Nature* **244**: 181.
- Gulia, G. (1890). Erpetologia Maltese. *Il Naturalista Maltese*, **1**(2): 14-15.
- Hill, R.L. and Green, D.J. (1971). Investigation of the damage by the crab *Ocypode quadrata* to the eggs of the Green turtle *Chelonia mydas*. *Surinam Turtle Notes*, **2**: 11-13.
- Hirth, H.F. and Carr A. (1970). The green turtle in the Gulf of Aden and the Seychelles Islands. *Verh. Koninkl. Ned. Akad. van Wetenschappen, Afd. Nat. (Tweede Reeks)* **58**(5): 1-44.
- Hirth, H.F. and Latif, E.M.A. (1980). A nesting colony of the Hawksbill Turtle *Eretmodochelys imbricata* on Seil Ada Kebir Island, Suakin Archipelago, Sudan. *Biol. Conserv.*, **17**: 125-130.
- Kabraji, A.M. and Firdous, F. (1984). Conservation of turtles Hawkesbay and Sandspit, Pakistan. *Unpublished report, WWF Project 1451*.
- Lanfranco, G. (1977). The Leathery turtle, a rare animal in Maltese waters. *Times of Malta*, 25 July 1977, Progress Press, Valletta, Malta: 5.
- Lanza, B. and Bruzzone, C.L. (1960). Reptilia. In Zavattari and coll.: *Biografia delle isole Pelagie. Rendiconti Acc. Naz. XL*, Ser. IV, **11**, Roma: 288-328.
- Lazell, J.D. (1980). New England Waters: Critical habitat for marine turtles. *Copeia*, **2**: 290-295.
- Loveridge, A. and Williams, E.E. (1957). Revision of the African tortoises and turtles of the suborder *Cryptodira*. *Bull. Mus. Comp. Zool.* **115**: 163-557.
- Margaritoulis, D., Arapis, T., Kornaraki, E. and Mytilineou, C. (1986). Three specimens of the green sea turtle *Chelonia mydas* (L.) recorded in Greece. *Biol. Gallo-Hellenica*, **12**: 237-243.
- Mertens, R. (1968). Reptielen van de Malte-eilanden. *Lacerta* **27**(2): 11-15.
- Minà-Palumbo, F. (1890). Rettili ed Anfibi Nebrodensi. *Naturalista Siciliano*, 9th year, **4**: 91-95.
- Mortimer, J.A. (1983). Marine turtles in the Republic of Seychelles. *Unpublished report WWF Project 1809*.

- Mourgue, M. (1909). Capture de *Chelone imbricata* ♀, en rade de Marseille. *Feuille des jeunes naturaliste*, **39**: 144.
- Mrosovsky, N. (1980). Thermal biology of sea turtles. *Amer. Zool.* **20**: 531-547.
- Mrosovsky, N. and Pritchard, P.C.H. (1971). Body temperatures of *Dermochelys coriacea* and other sea turtles. *Copeia* **4**: 624-631.
- Nardo, D. (1864). Indi il m. e. dott. Nardo legge sopra una nuova rarissima specie di *Cheloniano* pescato nelle nostre spiagge, e ch'egli durante la lettura sottopane allo esame dell'Istituto. *Atti Istituto Veneto*, **9**, ser. 3: 1418-1423.
- Pasteur, G. and Bans, J. (1960). Catalogue des reptiles actuels du Maroc. *Travaux de l'Institut Scientifique Chérifien. Sér. Zool.* **21**: 28-29.
- Report on the working of the Department of Agriculture for the year 1963 (1964). Dept. of Information, Valletta, Malta: 73.
- Report on the working of the Department of Agriculture for the year 1964 (1967). Dept. of Information, Valletta, Malta: 68.
- Report on the working of the Department of Agriculture for the year 1960 (1962). Dept. of Information, Valletta, Malta: 9.
- Ross, J.P. and Barwani, M.A. (1982). Review of Sea Turtles in the Arabian Area. In *Biology and conservation of sea turtles*. K. Bjorndal (ed.) Smithsonian Institution Press, Washington D.C.: 373-383.
- Sella, Y. (1982). The sea turtles in the eastern Mediterranean and northern Red Sea. In *Biology and Conservation of sea turtles*, K.A. Bjorndal (Ed.). Smithsonian Institution Press, Washington D.C.: 417-423.
- Sommier, S. (1908). Le isole Pelagie Lampedusa, Linosa e Lampione e la loro flora. Pellas, Firenze: 1-345.
- Statistical Abstract of the Maltese Islands, year 1958 (1959). Dept. of Information, Valletta, Malta: 10.
- Statistical Abstract of the Maltese Islands, year 1959 (1960). Dept. of Information, Valletta, Malta: 8.
- Statistical Abstract of the Maltese Islands, year 1960 (1961). Dept. of Information, Valletta, Malta: 17.
- Trabuccio, G. (1890). L'isola di Lampedusa. Studio geo-paleontologico. *Boll. Soc. Geol. Italiana*, **9**(3): 3-38.