

Biology and Conservation of Sea Turtles



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cover: Green turtle re-entering the surf, Asencion Island.
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Sea Turtles in the Eastern Mediterranean and Northern Red Sea

ABSTRACT

The ecology of the sea turtle in the Mediterranean Sea was a subject unfamiliar to science until the 1950s, even though in the first half of the century they were hunted indiscriminately and on a very large scale in Israel and Turkey.

This hunting did not bring the population to the brink of extermination. However, in Israel, a serious additional hazard developed in the 1950s, due to sand excavations. Since then the annual number of specimens in the sea, as well as the number of nests, has decreased. In 1979 only 2 nestings were recorded in Israel along 250 km of shore, as compared with 15 per km per year at the beginning of the 1950s.

There seems to be no chance of a natural revival even after the total prohibition of fishing, declaration of nesting preserves, and a slight improvement in the condition of sandy beaches. This year the Nature Reserves Authority in Israel began to collect eggs for the purpose of raising and freeing 1-year-old turtles into the sea. Activities of this type should be undertaken in cooperation with the other countries concerned, namely Turkey and Egypt.

Introduction

The sea turtle has been known as an economic factor in the eastern Mediterranean since before the beginning of the century. Gruvel (1931) reports on turtles off the shores of Syria and Turkey, and on trade in turtles with England and Egypt. A report on the fisheries of Palestine (Hornell 1934) describes the export of 2,000 turtles a year from Palestine to Egypt.

Lortet (1883) mentions sea turtles on the shores of Syria, Lebanon, and Israel (Haifa). In Haifa he saw "several hundreds which were washed up onto the shores." It is of course possible that these were females that had gone ashore to nest. In the 1920s Haifa children were accustomed to such sights; it is likely that these were turtles concentrated on shore for the purpose of being sent abroad.

At this point, all interest and recorded information ceased until our time. Nor did anyone foresee the almost total destruction of the turtle population in Israel and in Turkey until 1963.

Recent interest in sea turtles began in Israel in 1954, but not to the extent of developing serious research on the subject. Most of the observations until 1958 were made by amateurs. In the same year, organized recording began, though not on the level required by the subject. The destruction of the shores, which increased towards the end of the 1950s, convinced the Society for the Protection of Nature that serious action was required. This approach led to the first nesting research in Israel (1964) and to preliminary research in Turkey (1965) and Sinai (1968).

The basic purpose of the study was to define the problem of the survival of sea turtles in the Mediterranean. Thus, a partial study was undertaken of such aspects as incubation conditions on various shores, species composition of the population, and the size of nesting specimens. However, the information collected was insufficient, because only very small remnants of the population could still be found.

A most important source of information was an aged fisherman from Acre, the late Abu Hanafi, who had organized turtle hunting in the 1920s and the beginning of the 1930s. The data he gave us were accurate and should be treated accordingly. This conclusion is important in order to estimate correctly the extent of destruction of the turtle population in such a short time.

Relying on this and other sources, it is possible to estimate that between the end of the first world war and the end of the 1930s, at least 30,000 sea turtles were caught in systematic fishing off the shores of northern Israel by Abu Hanafi's crews. At the same time, other fishermen were also active in this field, but we have no definite information on them.

Similar numbers were caught in Turkey, off the coast of Mersin and Adana, mainly in the 1960s. Fishing in these areas continues today. Additional damage through occasional fishing, egg collecting, accidental destruction of clutches, pollution of the shores by crude oil, underwater explosions, and other disturbances also continues. As a cumulative result, the turtle population in the eastern Mediterranean has been thinned out alarmingly, especially in Israel.

Distribution of the Species

The following species have been found in the eastern Mediterranean: *Dermochelys coriacea*, *Chelonia mydas*, *Caretta caretta*, and *Trionyx triunguis* (see Appendix). *Eretmochelys imbricata* is mentioned by Gruvel (1931) and by Wermuth and Mertens (1961), but its occur-

rence has not been substantiated by our study in the eastern Mediterranean.

Dermochelys coriacea is rather rare, but we have some proof of possible nestings. On 30 June 1963 trails were found on the beach at Palmachim (south of Tel-Aviv, Figure 1), but the trails did not end in any nests. The width of the tracks, 1.10 m, and the incomplete excavation, about 2 m in diameter, indicate that these were tracks of *Dermochelys*.

Chelonia mydas, as related by fishermen, now appears at least singly in the eastern Mediterranean between Turkey and the Nile Delta.

Nesting shores in the past (as told by Abu Hanafi) were found on all sandy beaches in north Israel without any distinct relation to the size of the grains of sand. Grain size varies from a minimum of 0.065 mm on Acre beach to 1.7 mm on Nahariya beach. Abu Hanafi did not know of nesting on the shores of Syria and Lebanon, but he did know about the spring migration of the species to the shores of Turkey, and he assumed that nesting also occurred there.

In the course of our research, scattered nests were found in Israel in the following localities: the beaches of Netanya, Caesarea, Atlit, Nahariya, and Rosh Haniqra. As related by fishermen in Turkey, in 1965-67, there were nesting beaches at Viransehil, Kazanlı, Tuzla, Karatas, and Yumurtalik. In these places, according to the same sources, large numbers of turtles were caught, and there was also much nesting activity.

Smaller concentrations which were not hunted, and for which we have no estimates of quantities, are known at Tasucu, Silifke, Chahenem, and Side. According to information we received at Yumurtalik, nesting also occurs at Samandagy, but we found no on-site evidence.

Caretta caretta is known all along the shores of the eastern Mediterranean from Turkey to Egypt. Gruvel (1931) indicated that this was the most common species in the Bay of Iskenderun, whereas today *Chelonia* clearly is the most prevalent.

During the 1950s, I found some 15 nests per km a year on the stretch of coast between Nahariya and Rosh Haniqra (5 km). A similar number of nests were found in 1958 on the beach of Atlit (8 km). On the rest of the shores of Israel and northern Sinai, a length of about 400 km, we may find occasional nests. No accurate counts were undertaken, but a rough survey by aircraft counted 100-150 nests in 1968.

Since the beginning of our study, not a single emergence has been recorded on the shores of Haifa Bay (22 km), indicating a clear preference for the coarse-grained beaches. However, we have to note that the number of specimens caught before and during the 1960s off this coast, was large (Table 1).

Table 1. Quantity of turtles caught in Haifa Bay and north of Acre, and brought to the Acre market

Year	Chelonia	Caretta
1963	1	15
1964	2	16
1965	8	5
1966	7	4
1967	11	15
1968	0	0
1969	24	54
1970	0	0
1971	0	0
(All were tagged and released)		
Average weight of male (kg)	61.5	37.5
Average weight of female (kg)	45.2	27.7
Maximum weight (kg)	100	65

Fishing

Both common species of sea turtles, and sometimes their eggs, are eaten by Moslems and Christians in Israel and Egypt. In Turkey this is not customary.

Today in Israel there is no systematic fishing, and even collecting of eggs along the shores of northern Sinai is only incidental. We know about systematic fishing from various sources, but full and accurate data were furnished to us by Abu Hanafi.

Massive fishing in Israel started immediately after the first world war, and reached a peak in the middle of the 1930s off the shores of Nahariya, Haifa Bay, and Atlit. Abu Hanafi alone employed up to 12 crews of 2 boats each during the above period, April to July, the nesting and mating season. The size of the mesh in the nets was about 40 cm, and every specimen caught in these nets was taken.

At the height of the season, some 600 specimens were caught a day, 90 percent of them *Chelonia*. Hanafi estimated that during these years some 30,000 turtles of both species had been caught. The normal weight of *Chelonia* in those days was 100 to 150 kg, and *Caretta* weighed no more than 60 to 80 kg.

Systematic fishing was carried on into the 1960s but on a much reduced scale. In the second world war it stopped altogether due to the thinning out of the population and decreasing profit. From then until the 1960s, fishing continued based on occasional catches, but not for export. The quantities that reached Acre market, which has always been the center of turtle fishing and commerce, are shown in Table 1. Turtle fishing is prohibited by Israeli law. For the purpose of our research we encouraged fishermen to bring and sell us their entire catch, but sometimes turtles were slaughtered, and we were informed only afterwards or not at all. Therefore our data are not entirely complete.

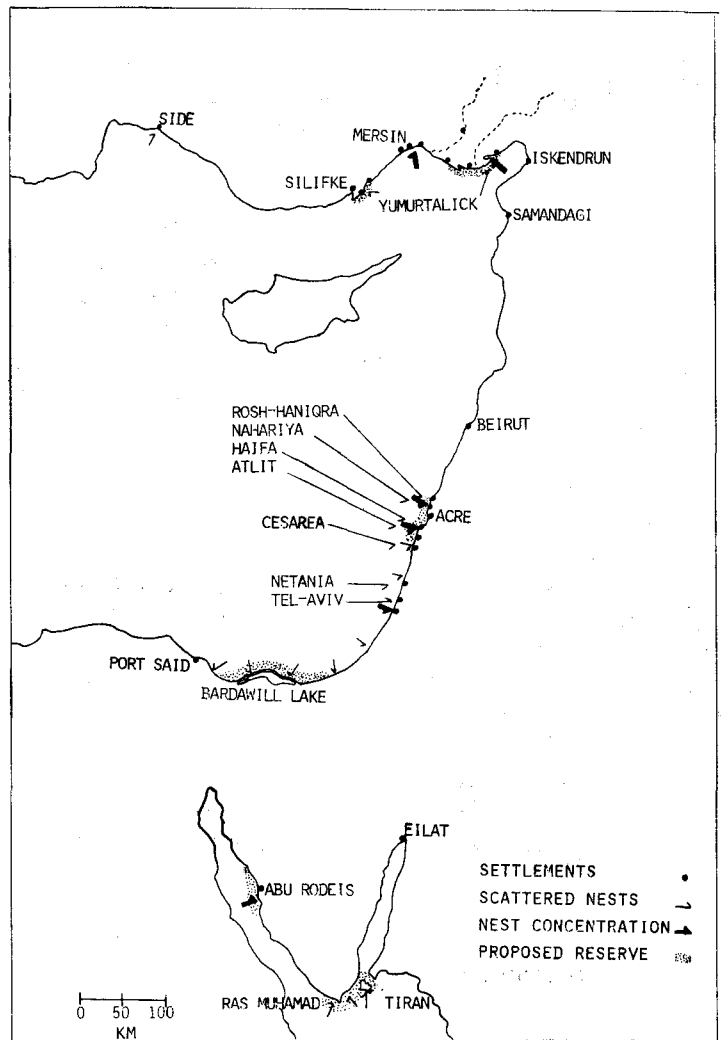


Figure 1. Eastern Mediterranean nesting sites and proposed turtle nature reserves.

Since 1970 trade in turtles in Acre has stopped altogether. Even turtles caught by chance are returned to the sea, owing more to lack of profit than prohibition by law.

Events in Turkey have followed a similar path since the 1950s. In May 1965, we made a trip to that country to locate the fishing and nesting shores. In 1967 we were given an additional chance to visit these shores and to meet the people who are actually involved in fishing and commerce.

Official records of turtle commerce before 1967 do not exist, and local people refrained from speaking for fear that the information would reach undesirable addresses. Nevertheless, in our opinion, the following information is reliable.

A fishing company from Iskenderun began to buy turtles from fishermen on the shores of Mersin and its surroundings. The slaughter house at Iskenderun could absorb a good number of turtles, and at the end of the 1960s a number of groups specialized in this field. This slaughter house's entire production was destined for Europe.

During the main hunting season, from April to June, 200 turtles and more were brought to the slaughter house each day. Usually they weighed 120 to 150 kg, but 15-kg juveniles were not returned to the sea (M. Swartz, personal communication).

Between 1952 and 1965, up to 15,000 specimens were taken from the shores of Mersin alone. Toward the mid-1960s, the turtle population thinned out considerably, and the center moved to the estuary of the Seyhan and Ceyhan rivers, south of Adana. In May 1965, 100 specimens or more were caught each day in this new hunting area, all *Chelonia*. In this single area by May 1965, apparently more than 10,000 turtles had been captured.

Dr. U. Hirsch observed turtle fishing off the shores of Yumurtalik in April 1972, and he was informed that the seasonal catch reached approximately 1,200 turtles (from a letter to Prof. Mendelsohn, Tel-Aviv University).

Excavations

Additional severe damage to the turtle population in Israel was brought about by the excavation of sand for the production of concrete in 1954–63 (Niv and Nir 1969). In these years the nesting beaches of Nahariya, Rosh Haniqra, and Atlit, which were previously the main and almost the only nesting beaches, were severely damaged. The strip of beach between Rosh Haniqra and Nahariya was destroyed down to the beach-rock layer. At Atlit a strip of beach 80 m wide was removed from the original 120 m (Figure 2). Other beaches were also badly damaged.

At the same time, increasing numbers of tracks ended without any nesting, clutches rotted, and embryos developed abnormally (Table 2).

The prerequisites for normal nesting and incubation are a stable temperature of $\pm 28^{\circ}\text{C}$ at a depth of more than 30 cm, and no flooding by waves. These 2 conditions became disrupted as soon as the excavations passed the natural line of the wave flow.

As compared with about 15 successful nestings per

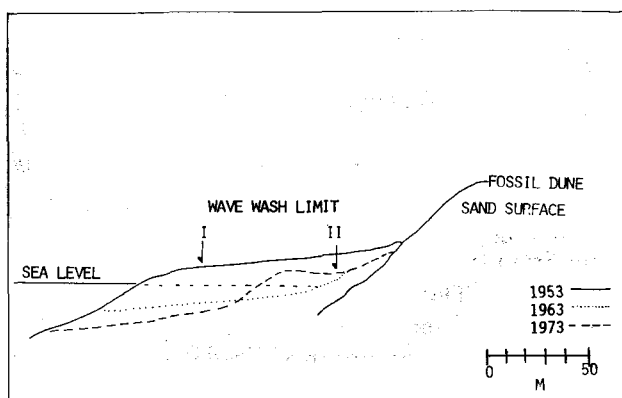


Figure 2. Beach destruction, Atlit, 1963.

Table 2. Nesting success, 1964

Category	No. on	
	Nahariya – Rosh Haniqra 5 km	Atlit 8 km
Nests	16	10
Barren emergences	10	18
Spoiled clutches	3	3
Abnormal hatchings	11	3
Normal hatchings	2	4

km per year until the 1960s, in 1964 the number of nests had decreased, as shown in Table 2.

All the defective or partially defective nestings were found within the wash line and were flooded at least once or as many as four times during the season. Some were found to be very near to the surface, and as a result underwent extreme temperature fluctuations of 18–35°C per day, resulting in spoilage. One nest was found in a concentration of gravel, and the young were not able to emerge to the surface.

At the urging of the Society for the Protection of Nature in Israel, a state committee was set up to examine the problems caused by the excavations. It recommended a halt to all the excavations on all the shores.

The recommendation was adopted, and within 5 years an improvement was apparent. However, this improvement has not yet brought the shores back to their original state. The destruction of the beaches, together with the extreme thinning out of the turtle population, seem to have reduced the number of turtles below the minimum necessary for natural survival of the species in Israel.

Results of the 1979 nesting survey by the Nature Reserves Authority show the steady decline in nest numbers. This year only 2 nests and 7 non-nesting emergences were encountered along the Israeli coast (250 km).

In Turkey in 1965, at least in the vicinity of Mersin, there were excavations on the nesting shores. We have no information as to what is happening there today.

Unnatural and Premature Mortality

An estimated 20 to 30 dead turtles are cast onto the shore every year between Nahariya and Ashqelon (200 km). Information nearly always reaches us too late to establish the cause of death or the date, or sometimes due to the disintegration of the corpse, the exact species. Each year, our count of dead turtles adds up to a similar figure. This is not logical because the number should decrease every year, in relation to the decrease in the number of nests and living turtles in the sea.

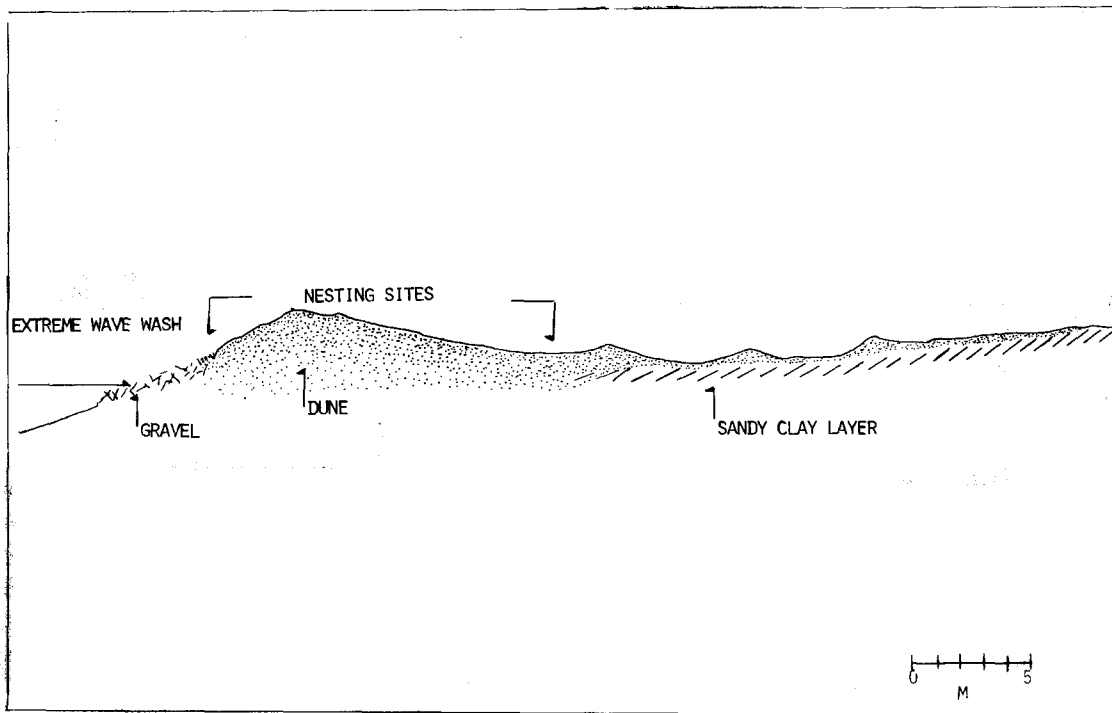


Figure 3. Cross section, Ras Shartibe nesting beach.

Summary and Conclusions

At the beginning of the century, 30,000 to 40,000 turtles lived off the northern shore of Israel (a length of 35 km). Some of the turtles hunted in Israel may have belonged to the Turkish population and may have been caught during their spring migration northwards. In Turkey, over about 100 km of shoreline, the numbers were similar. In both areas, the turtle populations have come close to extinction due to a similar process and over a similar length of time.

We have no knowledge of any other nesting grounds in the Eastern Mediterranean. Because of this and the very low potential rate of natural increase, we cannot foresee the rehabilitation of the species in the near future, if at all, without man's active intervention. Aid could come through preservation and rehabilitation.

In the framework of preservation, all sea turtles should be declared protected species (Israel has such a law) and hunting should be prohibited, at least for a limited period, pending the development of a method of artificial propagation. At the same time, international control of trade in turtles should be initiated. Nature reserves should be established with the main purpose of protecting the nesting beaches and mating area, irrespective of whether or not these two overlap (Figure 1).

Rehabilitation by artificial methods should be tested locally and in minimum quantities to ensure the survival of the 2 species. However, it is worthwhile to consider rehabilitation also for commercial purposes.

A common plan for the countries of the Eastern Mediterranean would be more economical than separate local plans, due to the migratory character of the turtles in this area.

In Israel the following plans are being implemented: besides 2 nature reserves in Atlit and Rosh Haniqra, an artificial raising system is being undertaken to raise 1-year-old turtles in the maximum number available.

The current state of research on turtles in the area is far from satisfactory. Therefore, before, and parallel with, any action for preservation and rehabilitation, research on a suitable level must be completed in the 3 main countries concerned: Turkey, Israel, and Egypt.

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Appendix 1. Sea Turtles in Sinai

Up to 1967 we gathered very little information on sea turtles in the Red Sea, or to be more precise, the tip of the Bay of Eilat. The information we possess today was gathered from Israeli sources.

On the shores of Sinai and the Island of Tiran the following species are known today:

1. *Caretta caretta*. Some bones (of a few specimens) were found in a small cave on the beach of Ras Muhammed (identification by Prof. A. Carr). None has yet been caught alive.
2. *Lepidochelys olivacea*. Two specimens have been identified south of the Peninsula (Prof. A. Ben-Tuvia, University of Jerusalem, personal communication).
3. *Dermochelys coriacea*. This species is very rarely seen and caught in Eilat Bay. A few were observed by a helicopter pilot from the air throughout the month of July 1969 off the nesting shore of *Chelonia* (see below) south of Abu Rodeis. No nests have been found (D. Ron, personal communication).
4. *Eretmochelys imbricata*. This species is occasionally seen and caught in various places along the shores of Sinai. No nests have been found to date.
5. *Chelonia mydas*. The green turtle is seen and caught more than any other species along the shores of Sinai. Nesting activity is known around the southern point of Sinai and Tiran.

Chance collecting of eggs and fishing are known in Sinai, but the Bedouin population on the Sinai shores is so sparse that they have no effect on the existence of the species there. Nevertheless, we can point to a few facts which jeopardize the existence of the only colony known to date.

The nesting areas of *Chelonia* were identified in a survey undertaken in 1968 (Figure 1). The entire shores of Sinai and the island of Tiran were examined during flight from a height of 100 m and driving by jeep.

In all cases except 1, nests were found scattered singly or in small groups. Only in 1 locality, Ras Shartib on the Bay of Suez south of Abu Rodeis, was a comparatively high concentration of nests found. In October 1967 we found no fewer than 40 nests, or what appeared to be nests. In July to September 1969, we counted 37 nests in a stretch of 200 m. In an aerial observation at the end of September, 30 more nests were observed (D. Ron, personal communication).

Congestion of the nests is very great here. Most are dug one on top of the other in a limited strip between the wash line and the end of the beach dunes, which are about 2 m above the regular boundary of the waves and no wider than 15 m. Beyond the belt of beach dunes, tiny sand mounds are scattered 30 to 50 cm high on a hard layer of sandy clay (Figure 3). In this section we found dozens of trial diggings but not a single nest. South and north of this section there are no beach dunes, and the waves wash up to the area of the small mounds. We found no additional nests 40 km north and 30 km south.

The coastal belt seems to have declined and destruction of the beach dunes to have advanced, leading to a constant reduction of the stretches suitable for nesting.

Due to lack of time and the great difficulties in finding nests dug one into the other, incubation conditions were not properly examined. However, from the small number we did find, the percentage of successful nesting is clearly very small. The general failure is increased by 2 new factors. An oil tank farm has been put up on the border of the nesting strip, and the shore is polluted by crude oil. Development of the oil industry naturally draws people and their dogs, which rove all over the area and dig up some of the nests.

From all of the above, it appears likely that the only proper colony known in Sinai is being destroyed.

Appendix 2. *Trionyx triunguis* in the Mediterranean Sea

This tropical fresh water species was once common in Israel in every stream and small river flowing into the Mediterranean. Today, because of pumping and pollution, they have become rare. They are also known in Lebanon, Syria and Turkey (related by fishermen).

In our study we found that this species appears regularly in the Mediterranean Sea. Gruvel (1931) gives evidence of finding this species as an unusual phenomenon in the Bay of Iskenderun at 30-m depths. We found soft-shelled turtles along the shores of the Eastern Mediterranean as shown below:

There is, therefore, no reason to think that their appearance in the sea is accidental, or that their penetration into the sea is caused by floods. In experiments carried out in the physiological laboratory of the Tel-Aviv University, Prof. A. Shkolnik and his student tried to "acclimatize" these turtles to sea water, but without success. This interesting phenomenon should be included in the framework of research and preservation plans for the turtles of the Mediterranean Sea.

<i>Place (from south to north)</i>	<i>Date</i>	<i>Dead or alive</i>	<i>Depth of sea (m)</i>	<i>Distance from shore (km)</i>	<i>Distance from fresh water (km)</i>
Bardawil Lake	Sept 1979	Disintegrated skeleton	On shore	—	150.0 ^a
Tel-Aviv	June 1978	Alive in net	?	?	6.0
Haifa Bay	Oct 1963	Alive on rod	6	2.5	3.0
Haifa Bay	June 1972	Alive in net	6	2.0	2.0
Haifa Bay	Sept 1972	Alive on rod	4	0.5	0.5
Iskenderun Bay	May 1965	Alive in net	10	12.0	25.0
Karatas Lagoon	June 1967	Disintegrated skeleton	On shore	—	20.0
Side Lagoon	May 1965	Disintegrated skeleton	On shore	—	12.0
Side Lagoon	May 1965	Alive in net	5	0.5	12.0

— No data.

a. This specimen undoubtedly died within historic times (according to the state of the skeleton) 150 km away from the nearest fresh water. Even the old eastern arm of the Nile Delta (Sne and Wisebrod, 1969), which dried up in the first century is 60 km away.