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## Multidecadal records (1968–2024) of leatherback sea turtles in Greece

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Leatherback sea turtles *Dermochelys coriacea* are oceanic animals ranging from the equator to sub-polar latitudes. In the Mediterranean Sea, leatherbacks are the third most encountered sea turtle species, albeit at a low frequency. Along the coasts of Greece, 14 records were reported until 1984. Combining these data with 43 additional records collected over the ensuing 40-year period 1985–2024, we infer that most records were reported from the Aegean Sea, north of 39 degrees latitude, in the warmer months of the year (May–November). The size range of measured specimens (123–180 cm curved carapace length) indicate that these were large juveniles and adults. The spatial and seasonal distribution of the recorded leatherbacks, as well as their sizes, suggest that these individuals enter the Mediterranean basin during a foraging migration from their nesting beaches in the western Atlantic. Most of the recorded leatherbacks were captured in fishing gears, primarily gillnets, with only few of them released. It is unknown how many of these animals that enter the Mediterranean return for breeding to their natal beaches.

**Keywords:** *Dermochelys coriacea*, Mediterranean, fisheries interaction, jellyfish blooms

The leatherback sea turtle *Dermochelys coriacea* is a circumglobal species roaming all ocean basins (Pritchard, 1971). In contrast to other sea turtle species, leatherbacks can tolerate low water temperatures and may inhabit sub-polar latitudes (Eckert et al., 2012). Venture into waters of low temperature is facilitated through a specific metabolic and thermoregulatory mechanism (Paladino et al., 1990). Leatherbacks are primarily pelagic foragers and feed mostly on jellyfish and other invertebrates using the entire water column, occasionally diving to great depths (see Bjorndal, 1997 for a review). The leatherback's main nesting areas are found in the Atlantic Ocean (central and south America, Caribbean, Africa), Indian Ocean (India, Indonesia, Malaysia) and Pacific Ocean (Central America), mainly in tropical latitudes (Pritchard, 1971). *Dermochelys coriacea* is listed globally as Vulnerable in the IUCN Red List of Threatened Species (Wallace et al., 2013).

In the Mediterranean, leatherbacks have been known for centuries (Fretey & Bour, 1980; Lescure et al., 1989). The type locality of the species, described in 1761 by Vandelli and in 1766 by Linnaeus, is in the Mediterranean, which resulted in *D. coriacea* being known for some time as “the Mediterranean turtle” (Pritchard, 1971; Brongersma, 1972). Although there are few reports of nesting attempts and hatchlings (see Lescure et al., 1989 for a review and Jony et al., 2025 for a more recent observation), leatherbacks in the Mediterranean are considered as visitor species originating from nesting areas in western Atlantic (mainly French Guiana and Suriname) (Brongersma, 1972; Oliver, 1986; Camiñas, 1998). This hypothesis was reinforced by their more frequent occurrence in western Mediterranean than in the eastern (see Oliver, 1986 and references therein). In 2006, a leatherback tagged after her nesting in Trinidad, Caribbean Sea, was stranded in the easternmost part of the Mediterranean basin (Iskenderun, Turkey; Sönmez et al., 2008) providing tangible proof of a transatlantic migration. More recently, genetic studies verified the origin of leatherbacks in the Mediterranean (Vella & Vella, 2016; Roden et al., 2017; Garofalo et al., 2020).

There are numerous publications of leatherback records in the Mediterranean, mainly in the western basin, that contain strandings per country or captures in fishing gears (e.g. Capra, 1949; De Metrio et al., 1983; Oliver, 1986). The latest regional review is that of Casale et al. (2003), who attributed the relative lack of records from the eastern basin to non-reporting. Indeed, after 2003 many new records from the eastern Mediterranean appeared in the literature, such as the present records from Greece, and those from Turkey (Sönmez et al., 2008; Taşkavak et al., 2015; Candan & Canbolat, 2018), Israel (Levy et al., 2005), Syria (Jony & Rees, 2022; Jony et al., 2025) and Cyprus (Palmer et al., 2024).

The existing information on leatherbacks in Greece covered the period 1968–1984, in which 14 individuals were recorded (Margaritoulis, 1986). Here, we update this information by presenting additional records in the ensuing 40-year period (1985–2024). Combining all available data, we comment on the species' spatial and seasonal distribution in Greece, which in relation to the body size of measured individuals confirm a

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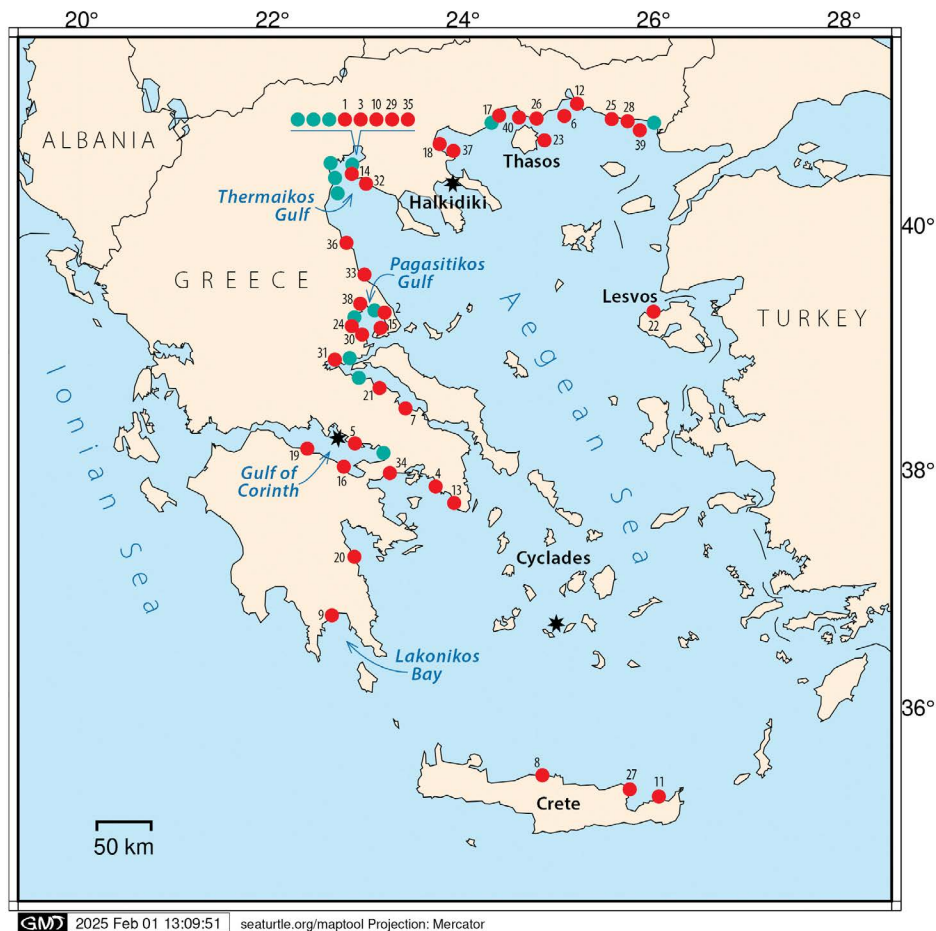
**Table 1.** Records of *Derموchelys coriacea* in Greece for the 40-year period 1985–2024. CCL measurements with an asterisk were converted from SCL measurements. ID numbers refer to the map (Fig. 1).

ID	Date	Location	CCL (in cm)	Remarks
1	27/08/85	Neoi Epivates		Stranded, signs of entanglement
2	29/01/86	Kala Nera	148*	Stranded in advanced decomposition
3	18/09/86	Agia Triada	175	Caught in gillnets, head injury, brought ashore dead
4	25/09/86	Glyfada	135	Caught in gillnets, eye injuries, brought ashore dead
5	08/10/86	Vathy	155	Caught in gillnets, eye injury, brought ashore, died 10/10
6	05/07/88	Porto Lagos	160	Stranded, entangled in gill nets, eye injuries
7	23/09/88	Skroponeria		Caught in gillnets, brought ashore dead
8	05/11/88	Sisses	135	Caught in longlines, disentangled ashore, released
9	20/09/89	Gytheio		Reported dead by fishers to Coast Guard, not found
10	24/10/89	Agia Triada		Caught in gillnets, brought ashore, died on land
11	XX/09/90	Siteia		Caught in longlines, disentangled ashore, released
12	09/09/92	Porto Lagos	170	Caught in gillnets, brought ashore dead
13	25/06/96	Patroklos Isl	131	Caught in gillnets, brought dead in STRC, necropsied
14	14/09/97	Mikro Emvolo	153*	Floating dead, brought ashore
15	25/09/97	Mikra Island	150	Caught in gillnets, head injury, brought ashore dead
16	28/09/97	Vrahati	150	Stranded, entangled in gillnets, head injury
17	04/10/02	Nea Peramos	132	Stranded, signs of entanglement
18	19/10/03	Stavros	168*	Stranded, entangled in gillnets
19	26/06/04	Derveni	140	Stranded, entangled in gillnets
20	21/09/04	Paliohano		Stranded, smashed head
21	29/10/04	Theologos	148*	Stranded
22	17/10/05	Kalo Limani	145	Trapped in shallow bay, assisted to return offshore
23	24/11/05	Skala Potamias		Stranded
24	04/09/06	Marathos	158*	Entangled in ropes, released onsite by Coast Guard
25	04/05/08	Alexandroupolis	166	Stranded, signs of entanglement, head/eye injuries
26	10/07/11	Pontolivado	128	Caught in gillnets, brought ashore dead
27	07/08/11	Agios Nikolaos	147	Stranded, head injury
28	06/10/12	Alexandroupolis	175	Stranded, signs of entanglement, head/eye injury
29	18/10/13	Peraia		Stranded, signs of entanglement, head/eye injury
30	19/09/14	Nies	158*	Stranded
31	14/11/14	Stylida	158*	Stranded, line from mouth, head/eye injury
32	15/11/14	Nea Mihaniona	140	Stranded, fully entangled in gillnets
33	04/10/16	Platamonas	170	Stranded, signs of entanglement
34	16/10/16	Agioi Theodoroi	148*	Stranded, signs of entanglement, head injury
35	15/08/18	Thessaloniki		Stranded, decomposed, missing head & body part
36	15/09/19	Olympiaki Akti	158*	Stranded
37	08/08/21	Nea Vrasna	150	Stranded, smashed head
38	22/09/21	Dimitriada		Stranded
39	14/08/22	Agia Paraskevi	158*	Stranded
40	27/08/23	Perigiali	140	Stranded, entangled in gillnet, head/eye injury

recent model regarding the transatlantic developmental migrations of leatherback turtles (Lalire & Gaspar, 2019).

Presented data (locality, species, sex, description of injuries, carapace dimensions) were drawn from a nationwide database of records curated and coordinated by ARCHELON, the Sea Turtle Protection Society of Greece ([www.archelon.gr](http://www.archelon.gr)). In our analysis we

used the curved carapace length (CCL), measured over the curvature of carapace from the nuchal notch to its posterior tip, because this measurement was taken in most instances. Some observers (ten cases) measured instead the straight carapace length (SCL) between the same points. In these cases, SCL was converted to CCL with the formula of Tucker & Frazer (1991).



**Figure 1.** Map showing all leatherback records in Greece in the period 1968–2024. Red circles: the 40 unpublished records of the period 1985–2024. The numbers beside each circle (ID number) refer to Table 1, where more data of the specific record are shown. Green circles: Records of the period 1968–1984, published in Margaritoulis (1986). Black stars: Records published in Bearzi et al. (2015), in Kapantagakis (2001), and from social media in 2024 (see text).

Over the 40-year period 1985–2024, we recorded 40 leatherback turtles along the coasts of Greece (Table 1). These are added to the previously reported 14 records in the period 1968–1984 (Margaritoulis, 1986). Three additional records; i.e. a sighting in the Gulf of Corinth on 7 August 2012 (Bearzi et al., 2015), a long-line capture on 29 July 2000 in Cyclades (Kapantagakis, 2001) and a recent sighting off Pyrgos in Halkidiki, northern Aegean, posted on 26 August 2024 in Herpetofauna of Greece and Cyprus, raise the total number of leatherbacks in Greece to 57 individuals, over the period 1968–2024. The approximate locations of all records are shown on Figure 1. Of the 57 records, 51 (89.5%) were recorded in the Aegean Sea and only six (10.5%) in the Ionian Sea (five in the Gulf of Corinth and one in Lakonikos Bay). From the 51 records in the Aegean Sea, 38 (74.5%) were reported north of 39°N.

The relatively few records from the Greek Ionian Sea can possibly be a bias resulting from non-reporting, since leatherbacks were caught in the nearby Gulf of Taranto (northern Ionian Sea) and in the Adriatic Sea (Italy, Albania, Croatia: De Metrio et al., 1983; Haxhiu, 1998; Lazar et al., 2008; Surdo & Verducci, 2023). However, the noted imbalance of records in Greece may also be a result of a difference in food availability. Casale et al.

(2003), in explaining spatial differences, suggested that leatherbacks in the Mediterranean seem to concentrate to specific areas for feeding. Indeed, there are indications that phytoplankton blooms, which may cause blooming of jellyfish, the main diet of leatherbacks, are more frequent in the Aegean than in the Ionian Sea (e.g. Varkitzi et al., 2020).

The large majority of the 57 records (55 individuals; 96.5%) were reported in the period May through November, with >50% observed in September and October (Fig. 1S in supplementary materials). Although this conclusion could be biased by the increased human presence along the coasts during the summer, such bias seems unlikely for such a large and rare species (Fig. 2S in supplementary materials). A similar seasonality was noted for leatherbacks caught along the northern Mediterranean coasts, as in the Aegean Turkish coasts (Taşkavak & Farkas, 1998; Taşkavak et al., 2015), in the northern Ionian (De Metrio et al., 1983), in the Adriatic (Lazar et al., 2008) and in Mediterranean France (Oliver, 1986). In contrast, leatherbacks in the south Mediterranean are recorded all year round (e.g. Tunisia: Hachaichi & Rais, 1985; Karaa et al., 2013). Supporting our observations, Casale et al. (2003), examining more than 400 leatherback records in the Mediterranean, found a

gradient between southern and northern latitudes, with turtles moving northwards during summer.

Considering all records in Greece, the mean CCL of measured turtles was 150.4 cm (range: 123–180 cm; SD = 14.4; n = 37), with the most common size between 145 and 159 cm (17 individuals; 46.0%) (Fig. 3S in supplementary materials). The size (CCL) range in Greece is narrower than the size range reported by Casale et al. (2003: 112–190 cm, SD = 16.4, n = 44) and of that reported by Karaa et al. (2013) in Tunisia (100–210 cm, n = 35). Further, all leatherbacks recorded by Lazar et al. (2008) in the Adriatic had a body size of CCL > 120 cm. Excluding a small specimen (6.6 cm), reported by Lescure et al. (1989), leatherbacks with CCL below 100 cm do not occur in the Mediterranean. Eckert (2002) showed that leatherback turtles < 100 cm CCL are only found in waters warmer than 26 °C, which restricts this size-class to the tropical zone. As juveniles increase in size, they develop their thermoregulation system and after attaining a certain size become able to venture northwards in the Atlantic and enter Mediterranean. Provided that adult leatherbacks are considered those with CCL > 145 cm (Eckert et al., 2012), the individuals encountered in Greece, belong to late juvenile and adult stages.

Body sizes in Greece and elsewhere in the Mediterranean comply with the model of Lalire & Gaspar (2019), who simulated, with particle dispersal, an 18-year movement of neonate leatherbacks from nesting beaches in South America. According to this model, hatchlings follow the Gulf Stream, and after about 4–6 years reach the African and European coasts with several of them entering Mediterranean by the surface inflow at Gibraltar. Sightings of leatherbacks entering Mediterranean have been reported by several authors (e.g. Brongersma, 1972; Fernandez & Moreno, 1984). Further, Lalire & Gaspar (2019) deduced, from the size of leatherbacks in Tunisia (Karaa et al., 2013), that neonates from South America may reach Tunisian waters after eight years on the average.

From the 40 leatherbacks analysed by us, 26 were found stranded (or floating) dead, with 17 of them bearing conspicuous marks of fisheries interaction (e.g. entanglement injuries, presence of hooks or fishing lines or injuries, on head and eyes, presumably inflicted intentionally after capture), 12 turtles were brought ashore (dead or alive) by fishers after capture in fishing gears, and two turtles were reported alive trapped (and released on site). From those 12 that were brought ashore only two turtles (No. 22 and No. 24; Table 1) were eventually released (Fig. 4S in supplementary materials). In total, at least 29 turtles (72.5% of the 40 records), were apparent victims of fisheries interaction (Fig. 5S in supplementary materials). A similar percentage of captures (73%) was also reported by Margaritoulis (1986) during the period 1982–1984, as well as those recorded in the Adriatic Sea (Lazar et al., 2008) and in Tunisia (Karaa et al., 2013), with Casale et al. (2003) indicating that the set/drift gillnets are the primary cause of leatherback bycatch in the Mediterranean.

Another threat identified for leatherbacks in the Mediterranean comes from ingestion of marine debris, especially plastics, presumably mistaken for jellyfish. In the only turtle of our study (No. 13; Table 1), that was necropsied at ARCHELON's Sea Turtle Rescue Centre (STRC), plastic sheets, with a total surface area of 9.8 m<sup>2</sup>, were found in the rectum, colon and stomach. Examination of the digestive tracts of four leatherbacks in Italy (Tyrrhenian Sea) revealed plastics, fishing lines and pieces of nets (Travaglini et al., 2006). Plastic bags were found also in leatherbacks in Tunisia (Karaa et al., 2013). Ingestion of plastic waste in the sea is therefore a ubiquitous problem for marine life that requires considerable attention.

In addition, global warming may be another factor that would affect leatherbacks in the Mediterranean, as sea temperature is linked to increased jellyfish blooms, the preferred prey of leatherbacks. Increased sea temperatures and more frequent jellyfish blooms may actually increase the Mediterranean's suitability for leatherbacks that until now do not use it as part of their core distribution. But such temperature and environmental changes may cause imbalance to other parts of the Mediterranean ecosystems.

Finally, it would be worthwhile to investigate whether leatherbacks in the Mediterranean, managing to survive in this oligotrophic and over-fished environment, are able to return to their natal beaches in the western Atlantic for breeding as has been established for Atlantic loggerhead turtles *Caretta caretta* that enter the Mediterranean (Eckert et al., 2008) or whether the Mediterranean Sea acts as a population sink. To elucidate the status of leatherback turtles in the Mediterranean, we recommend use of satellite telemetry.

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### Data accessibility

All data are given in the main text; supplementary figures associated with this article are provided in a separate file.

### Author contributions

Dimitris Margaritoulis collected the records and wrote the manuscript. Alan Rees collected records and assisted in writing the manuscript. Both authors contributed to improving the manuscript and approved the final version. The authors declare no conflicts of interest.

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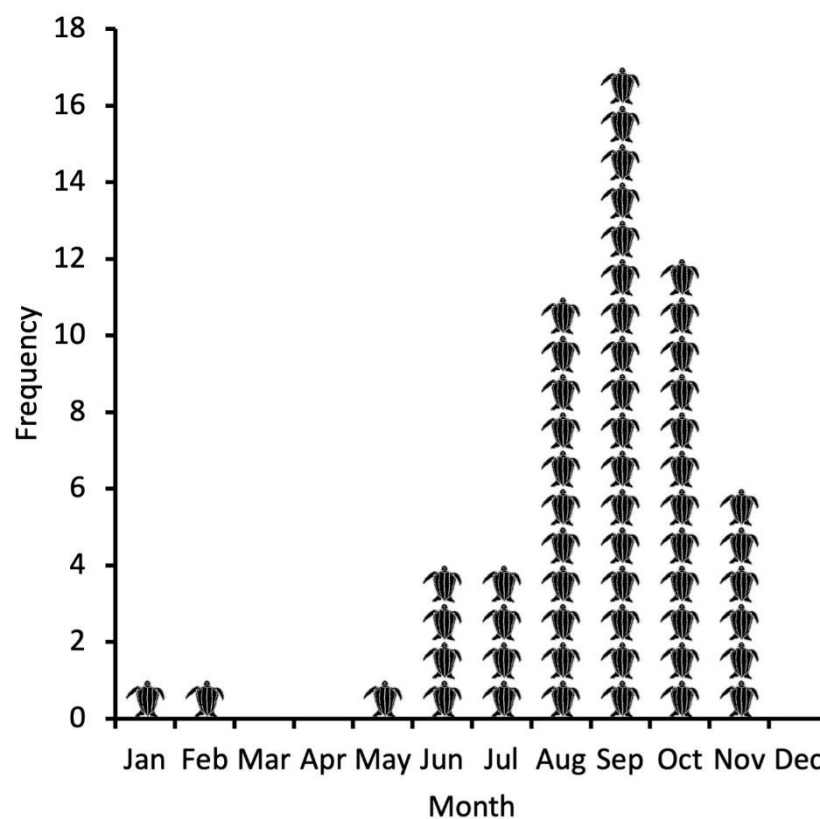
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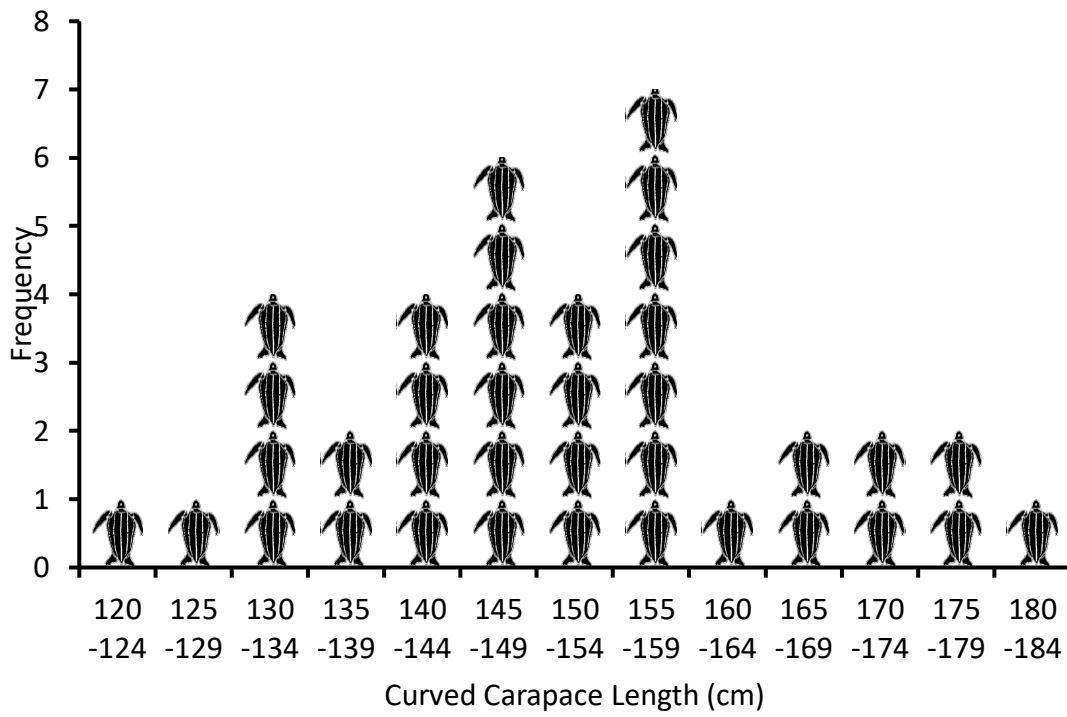
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**Figure 1S.** Monthly distribution of leatherback records in Greece in the 57-year period 1968–2024 (n = 57 records). The record in January was a stranded specimen in advanced decomposition (Turtle No 2; Table 1).



**Figure 2S.** Stranded leatherback turtles, being impressive and rare animals, usually attract the attention of mass media and the public (Turtle No 1; Table 1).



**Figure 3S.** Length frequency of leatherback turtles in Greece measured in the period 1968–2024 (n = 37 turtles).



**Figure 4S.** Male leatherback (Turtle No 11; Table 1) entangled in drifting long-lines, brought ashore for disentanglement. Note the large amount of removed long-lines and the turtle's protruded penis. The turtle was released offshore after disentanglement.



**Figure 5S.** Stranded female leatherback (Turtle No 26; Table 1) after disentanglement from gillnets in Pontolivado, close to Kavala, northern Aegean Sea. Note the removed bulk of nylon gillnet that had covered the entire body of turtle.