“

Half of shark
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with extinction”

CHAPTER 6/

Vulnerable megafauna

Deep-sea cartilaginous fish

(Chondrichthyes: sharks, rays, skates and chimaeras)

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Elasmobranchs, the taxonomic group comprising sharks, skates and rays, together with the chimaeras, form the chondrichthyans class. Approximately half of the known species (575 out of 1207 species), live in the deep ocean (below 200 m), yet little is known of the biology or life histories of most of these fish[1].

In the Mediterranean, a rich diversity with at least 48 species of sharks, 38 of rays and skates and two chimaeras occurs, even if some of them have to be confirmed[2]. The IUCN Red List of Threatened Species estimates that about half of elasmobranch species in the Mediterranean are threatened with extinction (i.e., assessed or estimated to be Vulnerable, Endangered, or Critically Endangered) and fishing is the principal threat causing a decline in the elasmobranch population[3] (Fig. 6.1). The level of threat may be worse because uncertainty in species status remains moderately high (17.8%) in the Mediterranean Sea. The life-history characteristics of these species such as low fecundity, slow growth and late reproductive maturity make them highly vulnerable to exploitation, and they suffer high mortality due to fishery by-catch[3,4].

Currently, the biology and ecology of deep-water sharks, rays and skates in the Mediterranean is poorly documented. A general problem in assessing populations is the lack of information on their fisheries and biology[3]. The following section provides an extensive historical literature review on these deep-sea species of the Eastern Mediterranean for both demersal and pelagic species, with information on status, spatial and depth occurrence when known. Additionally, fisheries independent data collected during MEDITS (Mediterranean Bottom Trawl Survey) surveys is provided.

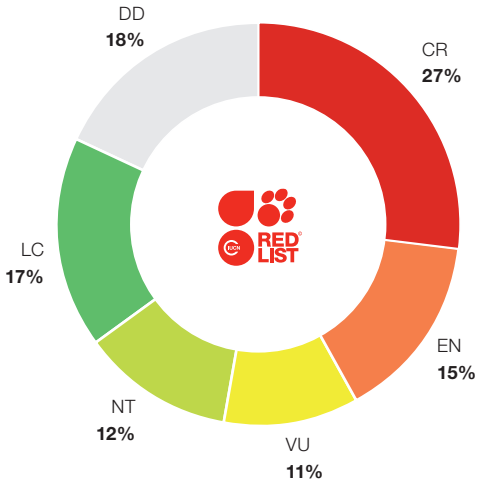


Fig. 6.1. Red List status of Mediterranean sharks, rays and skates. CR—Critically Endangered; EN—Endangered; VU—Vulnerable; NT—Near Threatened; LC—Least Concern; DD—Data Deficient

1 EASTERN IONIAN SEA

According to the most updated checklist of fishes[5], the Eastern Ionian Sea hosts at least 49 chondrichthyan species.

Demersal sharks and rays

Demersal sharks, rays and chimaeras (e.g. those living or occurring in deep-water or on the bottom of the sea) generally form small local stocks with limited and low connectivity to each other and can be highly susceptible to trawling activities. Prior to 2002, information on these species in the Eastern Ionian Sea was scattered and mostly related to occurrence with few investigations focused on specific biological traits of certain species. Among the earliest studies, the presence of 22 elasmobranch species was reported in depths between 300 and 1,200 m during 1999-2000, with the black mouth shark *Galeus melastomus,* the small-spotted catshark *Scyliorhinus canicula* and the thornback ray *Raja clavata* exhibiting the highest abundances[6]. Later studies identified the Near Threatened longnose skate *Dipturus oxyrinchus* as the most frequently caught species in depths between 350-700 m, in contrast to the ray *Raja clavata* and the marbled electric ray, *Torpedo marmorata*, which dominated catches over the lower continental shelf between 150-350m[7]. Biological reports made through the Mediterranean Bottom Trawl Survey Programme until 2001[8], also reported the longnose spurdog *Squalus blainville* as the second most abundant fish species at depths of 200-500 m, while in the 500-800 m depth stratum, two species, the black mouth shark, *Galeus melastomus* and *S. blainville* were observed as the fourth and sixth most abundant species, respectively.

The distribution patterns of demersal elasmobranchs from the MEDITS experimental surveys conducted in the area during 2001-2014 indicated up to 19 species in the 200-800 m bathymetric zone of the Eastern Ionian Sea, including species that also occur in shallow waters. Similar to previous works, five species occur frequently in deep waters (with high frequency of occurrence > 50%), namely, *Scyliorhinus canicula, Raja clavata, Squalus spp, Galeus melastomus* and *Dipturus oxyrhinchus*, while the other species were scarcely caught (Table 6.1.) based on catches for 2008, 2014 and 2016[9]. As with other Mediterranean reports, both the black mouth shark *Galeus melastomus,* and the *Squalus* species were more abundant in the slope. In contrast, the thornback ray *Raja clavata* and the small-spotted catshark *Scyliorhinus canicula,* a species that shows a high degree of site fidelity, were more abundant in the shelf and upper slope with a higher abundance around the shelf break. Among the recorded species, the ones almost exclusively found in waters deeper than 200 m were: the longnose skate *Dipturus oxyrinchus* (54%), the velvet belly lanternshark *Etmopterus spinax* (10%), the gulper shark *Centrophorus* cf *uyato*[1] (5.8%), the sharpnose seven-gill shark *Heptranchias perlo* (3.3%), the rare angular rough shark *Oxynotus centrina* (2.5%) and the kitefin shark *Dalatias licha* (0.8%). **The results from this latest work also suggested a biomass decline for almost all demersal shark and ray species in the region with an increasing fishing effort**[9]**.** The black mouth shark *Galeus melastomus* was an exception to this general pattern, as it has not been significantly affected by fishing effort, probably because its depth preference falls outside the main depth range of bottom trawl fishing operations in the area (50-300 m depth). Overall, the explanation for these findings further suggests that the distribution of these deep-sea sharks and ray species is related to the particular topography of the Eastern Ionian Sea (narrow continental slope with steep slope) and the existing local fishing restrictions in shallow areas that result in the aggregation of over 50% of trawler fishing effort on specific shelf areas.

1 Recent findings cited gulper sharks *Centrophorus* cf. *granulosus* and *Centrophorus* cf. *uyato*[10,11] as synomys and *Centrophorus* cf. *uyato* as the valid taxonomic name for the species, as adopted in the present document.

The blue shark *Prionace glauca* is listed as Critically Endangered in the Mediterranean since 2016. Blue Sharks are taken in large numbers in the region by both artisanal and commercial fisheries, mainly as bycatch but more recently it has also been targeted and increasingly retained as valued bycatch.

> “Over last 20 years, the number of endangered sharks such as the Bigeye thresher, Blue sharks, Mackerel sharks and Hammerhead sharks in the Eastern Ionian Sea has decreased between 73 and 99%[13]”

Table 6.1. Frequency of occurrence of the elasmobranch species caught in hauls conducted in the bathymetric zone 200-800 m of the Eastern Ionian Sea during MEDITS surveys from 2001-2014.
In red: Endangered, Vulnerable or Near Threatened species.

Species	Common name	Frequency of occurrence %
Scyliorhinus canicula	Small-spotted catshark	67,5
Raja clavata	Thornback ray	65,8
Squalus blainville	Longnose spurdog	60,8
Galeus melastomus	Blackmouth catshark	55,8
Dipturus oxyrhinchus	Longnose skate	54,2
Etmopterus spinax	Velvet belly	10
*Centrophorus cf uyato**	Gulper shark	5,8
Squalus acanthias	Picked dogfish	5,8
Heptranchias perlo	Sharpnose seven-gill shark	3,3
Raja asterias	Mediterranean starry ray	3,3
Torpedo marmorata	Marbled electric ray	3,3
Oxynotus centrina	Angular rough shark	2,5
Dasyatis pastinaca	Common stingray	1,7
Galeorhinus galeus	Tope shark	0,8
Raja montaqui	Spotted ray	0,8
Raja rondeletii	Rondelet's ray	0,8
Dalatias licha	Kitefin shark	0,8
Torpedo (Tetronarce) nobiliana	Electric ray	0,8
Torpedo torpedo	Common torpedo	0,8

**Centrophorus* cf *granulosus* has been updated to *Centrophorus* cf *uyato*[10,11]

Pelagic sharks and rays

Pelagic sharks can be distributed over large geographic areas[12] and they are regular visitors of the deep during their diurnal vertical migrations. Studies compiling time series of abundance indices from commercial and recreational fishery landings, scientific surveys, and sighting records suggested that abundance of the thresher shark *Alopias vulpinus,* the blue shark *Prionace glauca*, as well as mackerel sharks and hammerhead sharks in the Eastern Ionian Sea has decreased between 73 and 99% in the past two decades[13]. Today, all of these species are listed as Endangered and Critically Endangered in the Mediterranean[14]. Pelagic long line fishing in the Ionian Sea was ranked third, after the Alboran and Adriatic Sea in 2005, for catches of pelagic sharks, with a rate of 0.53 sharks/1,000 hooks[15]. More recently, researchers studying commercial catches in surface drifting longlines, have identified a statistically significant decline in the richness of pelagic shark species in the Ionian, with the probability of shark occurrence reducing to its lowest level in the most recent years[16].

Updated information

Based on a dataset compiled from the Hellenic Fisheries Data Collection Programme and the Fisheries Database of Hellenic Centre for Marine Research, which holds data from various projects relating to deep sea chondrichthyans, overall, 47 species of demersal and pelagic sharks, rays, skates and chimaeras were recorded during 1983-2016 in the Ionian Sea. This dataset included both experimental survey data and observations on

board commercial fishing vessels. Twelve species had been exclusively reported in depths > 200 m and 14 species exclusively in depths < 200 m. Another five species had an occurrence of more than 90% in depths > 200 m, however, they are currently classified as Least Concern (*Etmopterus spinax, Galeus melastomus, Hexanchus griseus, Pteroplatytrygon violacea, Rhizoprionodon acutus*). The Endangered, Vulnerable or Near Threatened category status with an occurrence of more than 90% in depths below 200 m, are summarized in Table 6.2.

Spatial occurrence of the most vulnerable species is provided in Fig. 6.2 and Fig. 6.3.

Squalus species.

Table 6.2. Occurrence by depth for the chondrichthyan species identified during 1983-2016 in the Eastern Ionian Sea, their IUCN Red List status in the Mediterranean and percentage of occurrence in waters > 200 m. IUCN Conservation status categories: DD = Data Deficient, LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered.
NOTE: It must be noted that for large pelagic sharks (e.g. *Prionace glauca*), the depths recorded refer to the depths of the sampling locations and not the actual depths of capture. Depth of capture was usually between 0-50 m from the surface, in the upper ocean layer.

Species	IUCN Red List Status	Min-Max depth occurrence (N)	% Occurrence > 200 m
Chimaera monstrosa	NT	225-1171 (444)	100%
Etmopterus spinax	LC	327-1171 (3620)	100%
Dalatias licha	VU	230-812 (67)	100%
*Dipturus batis***	CR	700 (1)	100%
Heptranchias perlo	DD	388-685 (19)	100%
Hexanchus griseus	LC	250-700 (7)	100%
Pteroplatytrygon violacea	LC	650-745 (2)	100%
Raja rondeleti	NE	604 (1)	100%
*Scyliorhinus stellaris***	NT	278 (7)	100%
Prionace glauca	CR	1402-4024 (11)	100%
Rhizoprionodon acutus	LC	3354 (1)	100%
*Squalus acanthias****	EN		96%
Galeus melastomus	LC		96%
Centrophorus cf *uyato**	VU		95%
*Squalus blainville****	DD		95%
Dipturus oxyrinchus	NT		92%
Scyliorhinus canicula	LC		80%
Galeorhinus galeus	VU		78%
Leucoraja circularis	CR		67%
Rhinobatos rhinobatos	EN		50%
Oxynotus centrina	CR		43%
Raja clavata	NT		34%
Raja brachyura	NT		25%

Species	IUCN Red List Status	% Occurrence > 200 m
Raja montagui	LC	20%
Raja polystigma	LC	16%
Raja asterias	NT	14%
Torpedo marmorata	LC	11%
*Dasyatis pastinaca*****	VU	4%
Tetronarce nobiliana	LC	2%
Mustelus mustelus	VU	2%
Torpedo torpedo	LC	1%
Raja miraletus	LC	1%
Dasyatis centroura	LC	0%
Gymnura altavela	VU	0%
Leucoraja melitensis	CR	0%
Leucoraja naevus	NT	0%
Mustelus asterias	VU	0%
Mustelus punctulatus	VU	0%
Myliobatis aquila	VU	0%
Pteromylaeus bovinus	CR	0%
Raja radula	EN	0%
Raja undulata	EN	0%
Rhinobatos cemiculus	EN	0%
Squatina oculata	CR	0%
Squatina squatina	CR	0%

* *Centrophorus* cf *granulosus* has been updated to *Centrophorus* cf *uyato*[10,11]
** *D. batis* and *S. stellaris* have not been reported during the last decade.
*** Perhaps two or three different species involved[17].
**** *D. pastinaca* synonym for *D. tortonesei*.

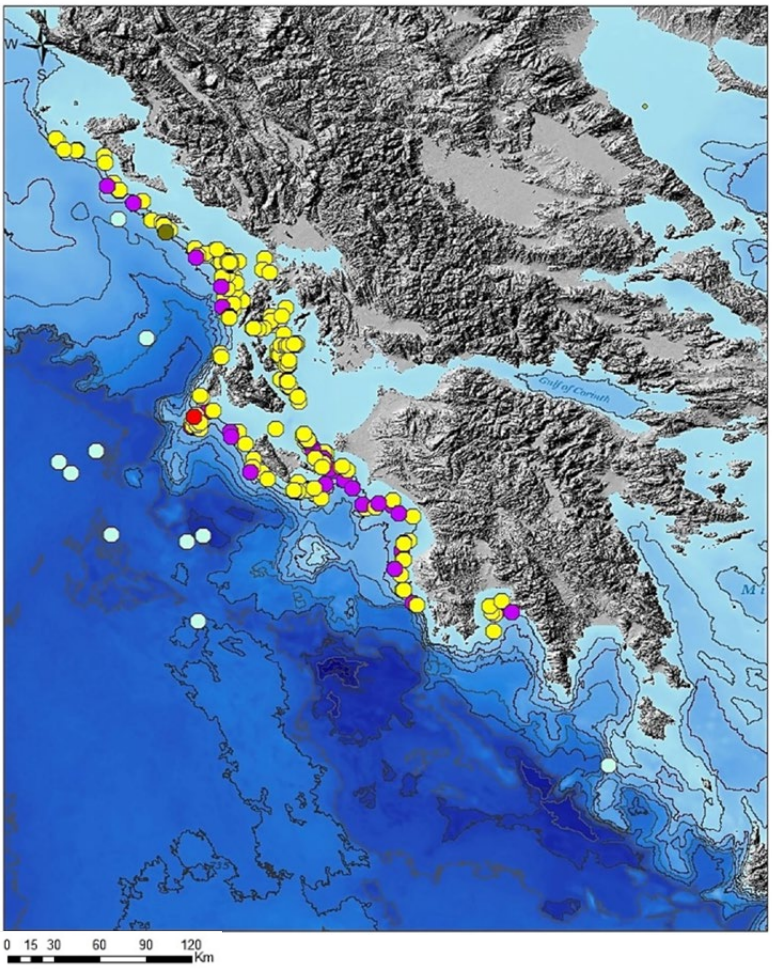


Fig. 6.2. Spatial occurrence of vulnerable chondrichthyans (*Dalatias licha* - kitefin shark, *Dipturus batis* - blue skate, *D. oxyrinchus* - longnose skate, *Prionace glauca* - blue shark, and *Scyliorhinus stellaris* - nursehound) in the E. Ionian Sea during the period 1983-2016.

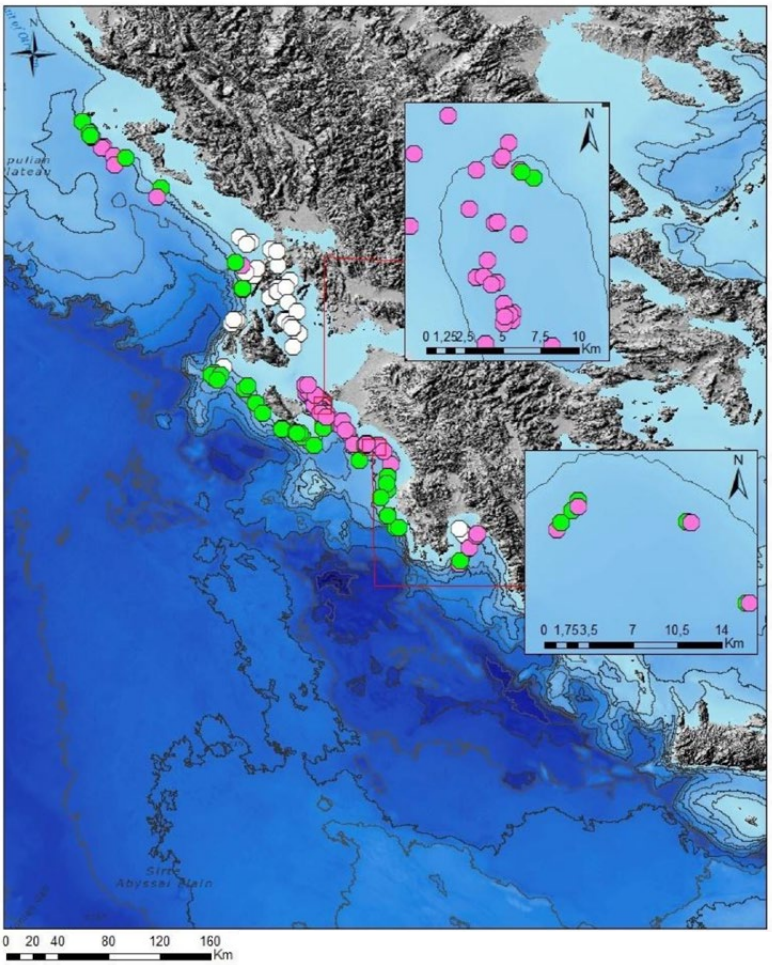


Fig. 6.3. Spatial occurrence of chondrichthyans (*Centrophorus* cf *uyato* - gulper shark, *Chimaera monstrosa* - rabbit fish, and *Squalus acanthias* - picked dogfish) in the E. Ionian Sea during the period 1983-2016.

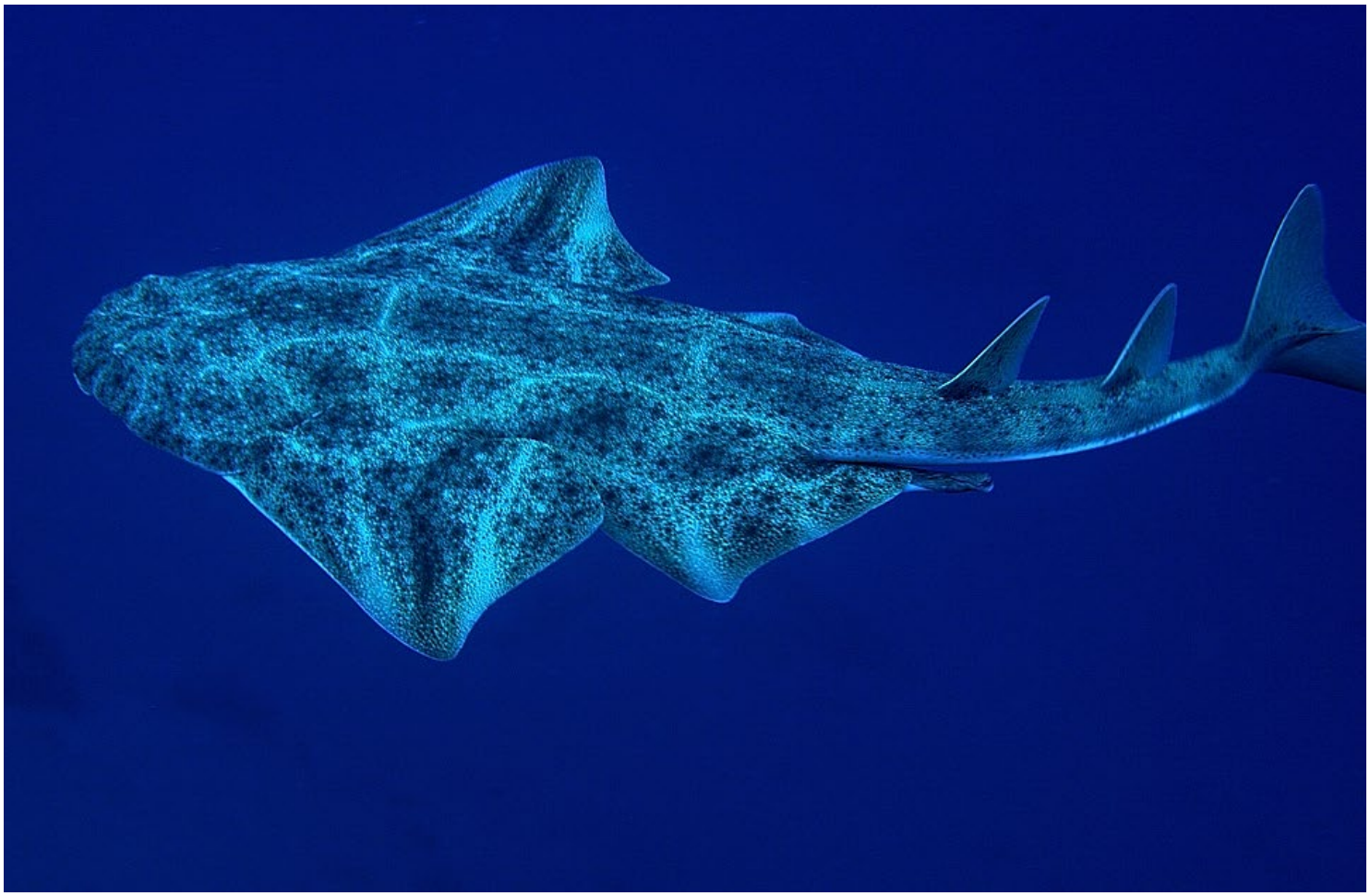
North and South Aegean Sea

According to the most updated fish checklists[5,18,19], the Aegean Sea hosts at least 63 chondrichthyan species (Table 6.3.).

Table 6.3. Shark, skate and ray species reported in the literature for the Eastern Mediterranean and their status according to the IUCN Criteria (recordings at depths of over 200 metres are marked as "••"). IUCN Conservation status categories: DD = Data Deficient, LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered.

Species	Common name	IUCN Status (Mediterranean assessment)	North Aegean	South Aegean	Aegean Sea	Ionian Sea	Levantine Sea	Libyan Sea	Reference(s)
Alopias superciliosus	Bigeye thresher shark	EN	•	••	•		•	••	[5, 19, 37, 38 ,40]
Alopias vulpinus	Thresher shark	VU	••	••	•		••	••	[5, 18, 19, 31, 32, 39, 40, 44]
Carcharias taurus	Sandtiger shark	CR	••		•		•		[18, 19, 39, 40, 44]
Carcharhinus altimus	Bignose shark	DD					•		[19, 32, 40, 44]
Carcharinus brevipinna	Spinner shark	DD			•		•		[18, 19, 39, 40, 44]
Carcharhinus falciformis	Silly shark						•		[32]
Carcharhinus limbatus	Blacktip shark	NE					•		[19, 36, 40, 44]
Carcharhinus melanopterus	Blacktip reef shark	NT					•		[39, 44]
Carcharhinus obscurus	Dusky shark	DD					•		[37, 38, 40, 41]
Carcharinus plumbeus	Sandbar shark	EN		•	•		••		[5, 18, 19, 32, 37, 38, 39, 40, 44]
Carcharodon carcharias	Great white shark	EN	•		•		•	••	[5, 18, 19, 39, 40, 44]
Centrophorus cf uyato	Gulper shark	VU	••	••	•	••	••		[5, 18, 19, 32, 37, 38, 39, 40, 41, 44]
Centrophorus moluccensis	Smallfin gulper shark	DD					••		[37, 38]
Centroscymnus coelolepis	Portuguese dogfish	LC		•					[5]
Cetorhinus maximus	Basking shark	EN	••	•	•		•		[5, 18, 19, 32, 37, 38, 40]
Chimaera monstrosa	Rabbit fish	NT	••	••	•	••	••		[5, 19, 36, 37, 38, 40, 42, 168]
Dalatias licha	Kitefin shark	VU	••	••	•	••	••		[5, 18, 19, 37, 38, 39, 40, 41]
Dasyatis centroura	Roughtail stingray	LC		••	•		•		[18, 19, 39, 40, 44]
Dasyatis chrysonota	Blue stingray	LC					•		[40]
Dasyatis marmorata	Marble stingray	DD					•		[19, 40, 41]
Dasyatis pastinaca	Common stingray	VU	••	••	•	••	••		[5, 18, 19, 36, 37, 38, 39, 40, 41, 42, 44]
Dipturus cf batis	Blue skate	CR	•	•	•	••	••		[5, 18, 19, 168]
Dipturus oxyrinchus	Longnose skate	NT	••	••	•	••	••	••	[5, 18, 19, 36, 37, 38, 39, 40, 41, 42, 44]
Echinorhinus brucus	Bramble shark	DD	••		•		••		[19, 42, 44]
Etmopterus spinax	Velvet belly	LC	••	••	•	••	••	••	[5, 18, 19, 32, 39, 40, 42, 43]
Galeocerdo cuvier	Tiger shark	DD						••	
Galeorhinus galeus	Tope shark	VU	•	••	•	••	••	••	[5, 18, 19, 39, 44]
Galeus melastomus	Blackmouth catshark	LC	••	••	•	••	••		[5, 18, 19, 36, 37, 38, 39, 40, 41, 42, 44, 168]
Gymnura altavela	Spiny butterfly ray	VU	•	•	•		••		[5, 18, 19, 36, 37, 38, 39, 40, 41, 44]
Heptranchias perlo	Sharpnose seven-gill shark	DD	••	••	•	••	••		[5, 18, 19, 36, 37, 38, 40, 41, 44]
Hexanchus griseus	Bluntnose sixgill shark	LC	••	••	•	••	••		[5, 18, 19, 36, 37, 38, 40, 41, 44]
Hexanchus nakamurai	Bigeye sixgill shark	DD		••					[5]
Himantura uarnak	Honeycomb stingray	VU					•		[19, 36, 40, 43, 44]
Hydrolagus mirabilis	Large-eyed rabbitfish	NT					••		[42, 43]
Isurus oxyrinchus	Shortfin mako	CR	•	••	•		••	••	[5, 18, 19, 36, 37, 38, 39, 40, 41]
Lamna nasus	Porbeagle	CR	•	•	•		•		[5, 18, 19, 39, 40, 44]
Leucoraja circularis	Sandy ray	CR	••	••	•	••	••		[5, 19, 43]
Leucoraja fullonica	Shagreen skate	CR	••	••	•		••		[5, 19]
Leucoraja melitensis	Maltese ray	CR	••	••					[5]
Leucoraja naevus	Cuckoo ray	NT	••	••	•		•		[5, 18, 19]
Mobula mobular	Devil fish	EN	•	•	•		•		[5, 18, 19, 32, 37, 38, 39, 40, 44]
Mustelus asterias	Starry smooth-hound	VU	••	••	•		•		[5, 18, 19, 32, 39, 40, 44]
Mustelus mustelus	Smooth hound	VU	••	••	•	••	••	••	[5, 18, 19, 36, 37, 38, 39, 40, 41, 44]
Mustelus punctulatus	Blackspotted smooth-hound	VU		••	•		•		[18, 19, 39, 44]
Myliobatis aquila	Common eagle ray	VU	••	•	•		•		[5, 18, 19, 32, 40, 44]
Odontaspis ferox	Smalltooth sandtiger shark	EN		••	•		•		[5, 18, 19, 36, 39, 40, 44]
Oxynotus centrina	Angular rough shark	CR	••	••	•	••	••	••	[5, 18, 19, 32, 37, 38, 39, 40, 44, 168]
Prionace glauca	Blue shark	CR	••	••	•	••	••	••	[5, 18, 19, 36, 39, 40, 44]
Pristis pectinata	Smalltooth sawfish	CR					•		[36, 40]
Aetomylaeus bovinus	Bull ray	CR	•	•	•		•		[5, 18, 19, 37, 38, 39, 40, 41, 44]
Pteroplatytrygon violacea	Pelagic stingray	LC		•	•	••	••		[5, 18, 19, 37, 38, 39, 40]
Raja asterias	Mediterranean starry ray	NT	••	••	•	••	••	••	[5, 18, 19, 39, 40, 42, 44]
Raja brachyura	Blonde skate	NT	••	••		••	••		[5]
Raja clavata	Thornback ray	NT	••	••	•	••	••	••	[5, 18, 19, 37, 38, 39, 40, 41, 44]
Raja miraletus	Brown ray	LC	••	••	•	••	••	••	[5, 18, 19, 36, 37, 38, 39, 40, 41, 44]
Raja montagui	Spotted ray	LC	••	••	•	••	••		[5, 18, 19, 32]
Raja polystigma	Speckled ray	LC	••	••	•	••	••		[5, 19, 18]
Raja radula	Rough ray	EN	••	•	•		•		[5, 18, 19, 37, 38, 39, 40, 44]
Raja rondeleti	Rondelet's ray	NE		••		••			
Raja undulata	Undulate ray	EN		•	•		•		[5, 19, 18]
Rhinobatos cemiculus	Blackchin guitarfish	EN		•	•		•		[5, 18, 19, 36, 37, 38, 39, 40, 41, 44]
Rhinobatos rhinobatos	Common guitarfish	EN		••	•	••	•		[5, 18, 19, 36, 37, 38, 39, 40, 41, 44]
Rhizoprionodon acutus	Milk shark	LC				••			
Rhinoptera marginata	Lusitanian cownose ray	NT			•		•		[18, 19, 39, 40, 43, 44]
Rostroraja alba	White skate	CR	••	••	•		••	••	[5, 19, 18]
Scyliorhinus canicula	Small-spotted catshark	LC	••	••	•	••	••	••	[5, 18, 19, 32, 37, 38, 39, 40, 44]
Scyliorhinus stellaris	Nursehound	NT	••	••	•	••	••		[5, 18, 19, 32, 39, 44]
Somniosus rostratus	Little sleeper shark	DD	•	•			••		[5, 37, 38]
Sphyrna mokarran	Great hammerhead	EN					•		[39, 44]
Sphyrna zygaena	Smooth hammerhead	CR		•	•		•		[5, 18, 19, 36, 39, 49, 44]
Squalus acanthias	Picked dogfish	EN	••	••	•	••	••	••	[5, 18, 19, 36, 39, 40, 44]
Squalus blainville	Longnose spurdog	DD	••	••	•	••	••		[5, 18, 19, 37, 38, 39, 40, 41, 44]
Squalus megalops	Shortnose spurdog	DD					••		[37, 38]
Squatina aculeata	Sawback angelshark	CR		••	•		••	••	[5, 18, 19, 37, 38, 40, 41, 44]
Squatina oculata	Smoothback angelshark	CR	•	••	•		•	••	[5, 18, 19, 37, 38, 39, 40, 41, 44]
Squatina squatina	Angelshark	CR	•	•	•		•		[5, 18, 19, 36, 37, 38, 39, 40, 44]
Taeniura grabata	Round stingray	DD					•		[19, 37, 38, 40, 41, 44]
Torpedo alexandrinsis	Alexandrine torpedo	NE					•		[44]
Torpedo marmorata	Marbled electric ray	LC	••	••	•	••	••		[5, 18, 19, 36, 37, 38, 39, 40, 41, 44]
Tetronarce nobiliana	Electric ray	LC	••	••	•	••	••	••	[5, 18, 19,37, 38, 39, 40, 41]
Torpedo sinuspersici	Variable torpedo ray	DD					••		[43]
Torpedo (Tetronarce) tokionis	Longtail torpedo ray	DD					••		[42]
Torpedo torpedo	Common torpedo	LC	•	••	•	••	•		[5, 18, 19, 36, 39, 40, 44]
	Total		**49**	**59**	**58**	**32**	**77**	**20**	

**Centrophorus* cf *granulosus* has been updated to *Centrophorus* cf *uyato*[10,11].



The Angelsharks (*Squatina squatina*) were formerly common throughout large areas of coastal and outer continental shelf seas in the Mediterranean and Black Seas. Their abundance have markedly declined during the past 50 years to the point where it is locally extinct from large areas and is nowadays listed as Critically Endangered in the IUCN Red list.

The deep waters of the Aegean Sea are still to be explored. There are significant gaps in present knowledge and considerable uncertainty around shark, ray and skate distribution and, moreover, their status. No specific survey has so far targeted Aegean deep-water species of this taxa and the available information presented was extracted from various studies in which chondrichthyans were reported from the Fisheries Database of the Hellenic Centre for Marine Research, MEDITS surveys and local fisheries knowledge studies[20,21].

2 NORTH AEGEAN SEA

According to the Greek National Fisheries Database, 45 sharks, rays, skates and chimaera species were reported during 1983-2016. Seven species were exclusively reported in depths of more than 200 m and 12 species were exclusively found in depths of less than 200 m. Another five species had an occurrence of more than 90% in depths more than 200 m, however, their status is considered of Least Concern (*Etmopterus spinax, Galeus melastomus, Hexanchus griseus*) or unknown because of lack of information (*Heptranchias perlo* and *Squalus blainville*). Information from all the species findings, and those from Endangered or Near Threatened species with their occurrence in depths below 200 m are summarized in Table 6.4. and their spatial occurrence in Fig. 6.4.

Additional reports from deep-trawl surveys conducted in Saros Bay (Northern Aegean Sea) in Turkey also indicated the presence of 17 elasmobranch and chimaera species in depths of more than 200 m between 2007-2008 and recent reports from Istanbul University have confirmed the presence of 12 chondrichthyans below 500 m depth[23].

White sharks (*Carcharodon carcharias*), have also been sporadically reported (10 sightings) in the North Aegean Sea since the 1990's however there are too few records to confirm their presence in deep waters[24,25]. The conservation status was raised from Endangered to Critically Endangered in the Mediterranean Red list and genetic samples from specimens seems to indicate little or no contemporary immigration from the Atlantic Ocean[25].

Table 6.4. Occurrence by depth for the chondrichthyan species identified during 1983-2016 in the North Aegean Sea, their IUCN Red List status and percentage of occurrence in waters > 200 m. IUCN Conservation status categories: DD = Data Deficient, LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered.

Species	IUCN Red List Status	Min-Max depth occurrence (N)	% Occurrence > 200 m
Centrophorus cf *uyato*	VU	518-546 (21)	100.0%
*Cetorhinus maximus****	EN	410 (1)	100.0%
Dalatias licha	VU	265-602 (719)	100.0%
*Echinorhinus brucus**	DD		100.0%
Heptranchias perlo	DD	362-548 (10)	100.0%
Hexanchus griseus	LC	291-441 (9)	100.0%
*Prionace glauca****	CR	292-1172 (8)	100.0%
Etmopterus spinax	LC		99.9%
Galeus melastomus	LC		97.5%
Chimaera monstrosa	NT		95.9%
Dipturus oxyrinchus	NT		93.7%
Scyliorhinus stellaris	NT		92.0%
*Squalus acanthias***	EN		85.5%
Rostroraja alba	CR		77.8%
Leucoraja circularis	CR		50.0%
Leucoraja melitensis	CR		50.0%
Raja asterias	NT		46.3%
Raja clavata	NT		45.6%
Scyliorhinus canicula	LC		34.4%
Leucoraja fullonica	CR		33.3%
Raja polystigma	LC		19.2%
Raja montagui	LC		13.5%
Oxynotus centrina	CR		12.9%

Species	IUCN Red List Status	% Occurrence > 200 m
Raja brachyura	NT	12.9%
Leucoraja naevus	NT	10.5%
Myliobatis aquila	VU	7.0%
Tetronarce nobiliana	LC	6.8%
Raja miraletus	LC	1.9%
Mustelus mustelus	VU	1.3%
Torpedo marmorata	LC	1.2%
Raja radula	EN	0.5%
Dasyatis pastinaca	VU	0.4%
Alopias vulpinus	VU	0.0%
Dasyatis centroura	LC	0.0%
Dipturus batis	CR	0.0%
Gymnura altavela	VU	0.0%
Mobula mobular	EN	0.0%
Mustelus asterias	VU	0.0%
Pteromylaeus bovinus	CR	0.0%
Sphyrna zygaena	CR	0.0%
Squatina oculata	CR	0.0%
Squatina squatina	CR	0.0%
Torpedo torpedo	LC	0.0%

* [26]
**Perhaps two or three different species involved[17].
***It must be noted that for large pelagic sharks, the depths recorded refer to the depths of the sampling locations and not the actual depths of capture. Depth of capture was usually between 0-50 m from the surface, in the upper ocean layer.

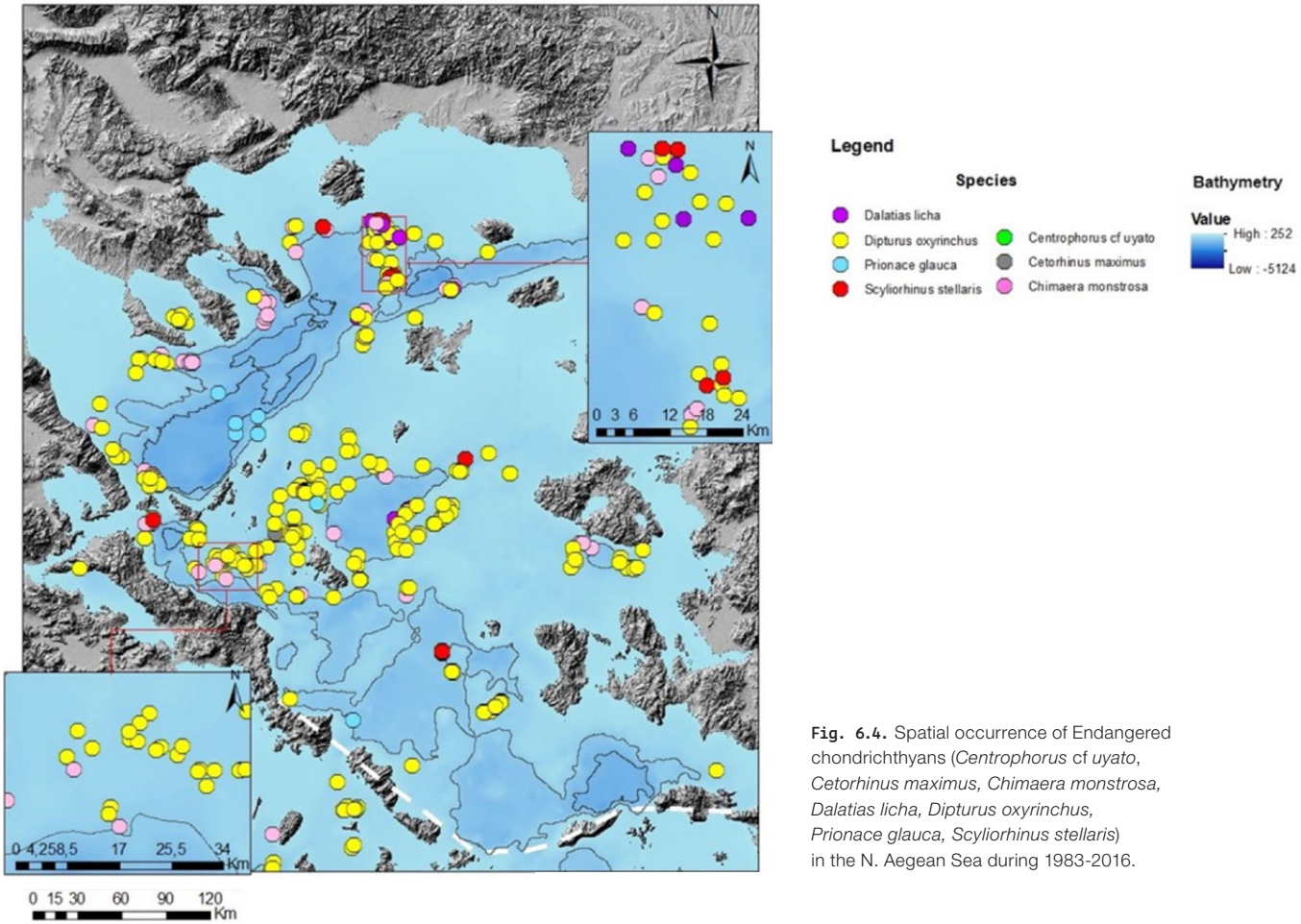


Fig. 6.4. Spatial occurrence of Endangered chondrichthyans (*Centrophorus* cf *uyato*, *Cetorhinus maximus, Chimaera monstrosa, Dalatias licha, Dipturus oxyrinchus, Prionace glauca, Scyliorhinus stellaris*) in the N. Aegean Sea during 1983-2016.

The Bluntnose Sixgill Shark (*Hexanchus griseus*) is a benthic, littoral, and semipelagic shark occurring in deep and shelf waters down to at least 2,500 m. Young tend to be found in shallow waters often just offshore and move into successively deeper waters as they grow. The species is caught as bycatch in deepwater fisheries although there is not much report of fishing catch and landings. At present, the species is considered Least Concern in the IUCN Red list for the region.

Reports from MEDITS surveys from 2001-2014 revealed twenty-eight (28) demersal elasmobranch species found in the 200-800 m bathymetric zone of the N. Aegean Sea, with the highest concentration in depths between shelf break and the upper slope (300-500 m)[9]. Moreover, only six demersal sharks and chimaera species were found exclusively at depths deeper than 200 m in the slopes, namely, the velvet belly shark *Etmopterus spinax,* the chimaera rabbit fish *Chimaera monstrosa,* the gulper shark *Centrophorus* cf *uyato,* the not well-known sharpnose sevengill shark *Heptranchias perlo,* the vulnerable kitefish shark *Dalatias licha* and the bluntnose six-gill shark *Hexanchus griseus* (Table 6.5.). The most common species, *Raja clavata* and the small-spotted catshark *Scyliorhinus canicula* were more abundant in the shelf break, whereas *Galeus melastomus* was more abundant in the slope. Depending on the region and season, most species are marketed under generic names (e.g.'galeos, 'vatos')[20,21].

Table 6.5. Frequency of occurrence of elasmobranch species caught in the hauls conducted in the bathymetric zone 200-800 m of the North Aegean Sea during MEDITS surveys from 2001-2014.
In red: Endangered, Vulnerable or Near Threatened species.

Species	Common name	Frequency of occurrence %
Scyliorhinus canicula	Small-spotted catshark	63.1
Raja clavata	Thornback ray	50.9
Galeus melastomus	Blackmouth catshark	49.1
Dipturus oxyrinchus	Longnose skate	25.1
Squalus acanthias	Picked dogfish	20.8
Etmopterus spinax	Velvet belly	18.1
Chimaera monstrosa	Rabbit fish	16.4
Raja polystigma	Speckled ray	6.2
Squalus blainville	Longnose spurdog	4.6
Leucoraja naevus	Cuckoo ray	3.8
Raja asterias	Mediterranean starry ray	3.2
Raja miraletus	Brown ray	2.2
Heptranchias perlo	Sharpnose seven-gill shark	1.9
Raja brachyura	Blonde skate	1.9
Raja montagui	Spotted ray	1.9
Dalatias licha	Kitefin shark	1.6
Leucoraja melitensis	Maltese ray	1.6
*Centrophorus cf uyato**	Gulper shark	1.1
Hexanchus griseus	Bluntnose sixgill shark	1.1
Oxynotus centrina	Angular rough shark	1.1
Rostroraja alba	White skate	1.1
Tetronarce nobiliana	Electric ray	1.1
Leucoraja circularis	Sandy ray	0.8
Torpedo marmorata	Marbled electric ray	0.8
Mustelus mustelus	Smooth hound	0.3
Leucoraja fullonica	Shagreen skate	0.3
Raja radula	Rough ray	0.3
Scyliorhinus stellaris	Nursehound	0.3

* *Centrophorus* cf *granulosus* has been updated to *Centrophorus* cf *uyato*[10,11].

3 SOUTH AEGEAN SEA

According to the Greek National Fisheries database, 49 chondrichthyan species were reported during 1983-2016. Twelve species were exclusively reported in depths of more than 200 m and five species were exclusively found in depths of less than 200 m. The Endangered, Vulnerable or Near Threatened species with an occurrence of more than 90% in depths below 200 m, are presented in Table 6.6. with their spatial occurrence in Fig. 6.5.

Table 6.6. Occurrence by depth for the chondrichthyan species identified during 1983-2016 in the South Aegean Sea, their IUCN Red List status and percentage of occurrence in waters > 200 m. IUCN Conservation status categories: DD = Data Deficient, LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered.

Species	IUCN Red List Status	Min-Max depth occurrence (N)	% Occurrence > 200 m
Alopias superciliosus	DD	496-1326 (3)	100.00%
Alopias vulpinus	VU	496-1326 (3)	100.00%
Dasyatis centroura	LC	234 (1)	100.00%
Hexanchus griseus	LC	305-366 (2)	100.00%
Hexanchus nakamurai	DD	230 (1)	100.00%
Isurus oxyrinchus	CR	524-914 (2)	100.00%
Mustelus punctulatus	VU	1-441 (1)	100.00%
Prionace glauca	CR	302-3840 (48)	100.00%
Raja rondeleti	NE	510 (1)	100.00%
Tetronarce nobiliana	LC	210-315 (4)	100.00%
Odontaspis ferox	EN	600 (1)	100.00%
Centrophorus cf *uyato*	VU		98.63%
Chimaera monstrosa	NT		98.26%
Galeus melastomus	LC		97.47%
*Squalus acanthias**	EN		96.41%
Dalatias licha	VU		95.65%
Galeorhinus galeus	VU		94.55%
Dipturus oxyrinchus	NT		93.12%
Squalus blainville	DD		92.48%
Squatina aculeata	CR		88.89%
Heptranchias perlo	DD		86.54%
Rhinobatos rhinobatos	EN		80.00%
Scyliorhinus canicula	LC		76.15%
Etmopterus spinax	LC		75.04%

Species	IUCN Red List Status	% Occurrence > 200 m
Scyliorhinus stellaris	NT	72.73%
Leucoraja fullonica	CR	66.67%
Raja clavata	NT	58.04%
Leucoraja circularis	CR	55.00%
Raja montagui	LC	51.01%
Squatina oculata	CR	50.00%
Oxynotus centrina	CR	40.00%
Mustelus mustelus	VU	35.58%
Raja polystigma	LC	35.35%
Leucoraja naevus	NT	32.67%
Torpedo torpedo	LC	30.43%
Raja brachyura	NT	30.00%
Rostroraja alba	CR	30.00%
Raja asterias	NT	26.17%
Torpedo marmorata	LC	19.90%
Raja miraletus	LC	15.25%
Mustelus asterias	VU	12.90%
Dasyatis pastinaca	VU	7.27%
Leucoraja melitensis	CR	1.75%
Gymnura altavela	VU	0.00%
Myliobatis aquila	VU	0.00%
Aetomylaeus bovinus	CR	0.00%
Raja radula	EN	0.00%
Raja undulata	EN	0.00%

*Perhaps two or three different species involved[17]

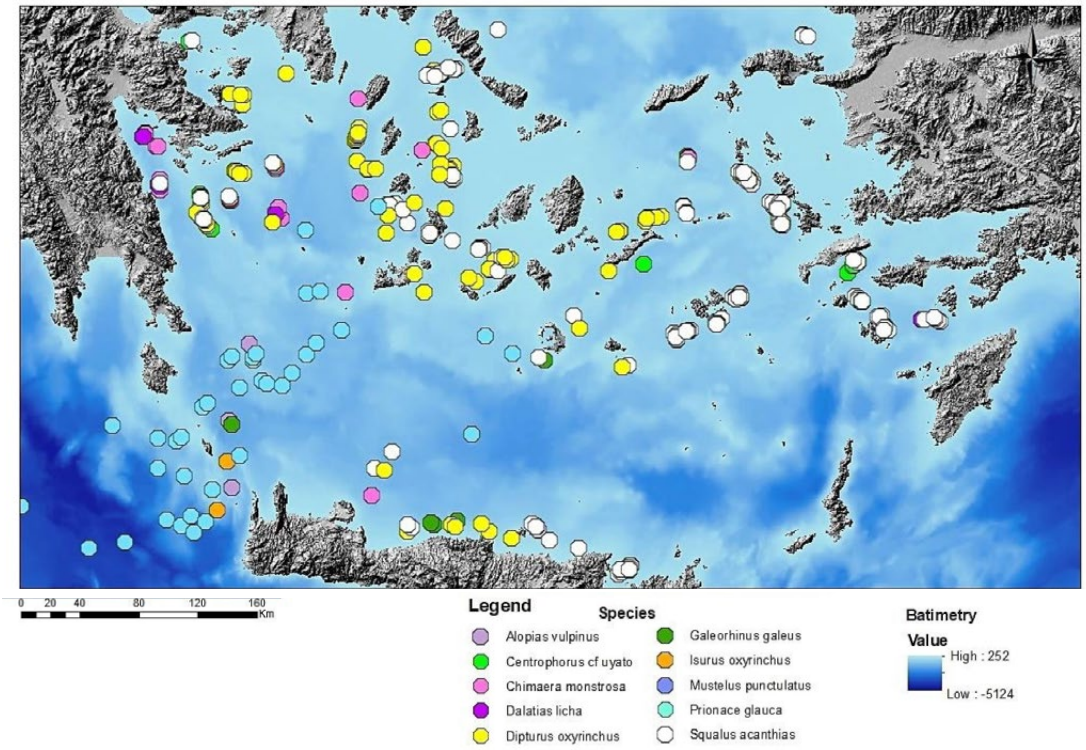


Fig. 6.5. Spatial occurrence of chondrichthyans (*Alopias vulpinus* - thresher shark, *Centrophorus* cf *uyato* - gulper shark, *Chimaera monstrosa* - rabbit fish, *Dalatias licha* - kitefin shark, *Dipturus oxyrinchus* - longnose skate, *Galeorhinus galeus* - tope shark, *Isurus oxyrinchus* - shortfin mako, *Mustelus punctulatus* - blackspotted smooth-hound, *Prionace glauca* - blue shark, and *Squalus acanthias* - picked dogfish) in the S. Aegean Sea during 1983-2016 (both experimental surveys and observations on-board commercial fishing vessels).

Fisheries independent data obtained from the MEDITS programme during 2001-2014, reported in total, twenty-nine (29) elasmobranch species in the 200-800 m bathymetric zone of the S. Aegean Sea. However, only eight species were found exclusively at depths greater than 200 m. Namely, *Etmopterus spinax, Chimaera monstrosa, Centrophorus* cf *uyato, Heptranchias perlo, Dalatias licha* together with the angelsharks (*Squatina aculeata, Squatina oculata*) and the electric ray *Tetronarce nobiliana*.

Compared to the Ionian Sea, the small-spotted catshark *Scyliorhinus canicula,* a bottom dwelling species, occurring primarily over sandy, gravel or muddy bottoms, was more abundant in the continental shelf, rather than the upper slope. Similarly, sharks of the genus *Squalus* showed a preference for deeper waters in this region, perhaps as a result of the more intense fishing pressure on the shelf in this region. The occurrence, biomass and abundance of sharks and ray species in general are also observed in higher numbers around the islands of the Eastern and central Aegean Sea (Table 6.7.).

Table 6.7. Frequency of occurrence of elasmobranch species in the bathymetric zone 200-800 m of the South Aegean Sea during MEDITS surveys from 2001-2014. In red: Endangered, Vulnerable or Near Threatened species.

Species	Common name	Frequency of occurrence %
Scyliorhinus canicula	Small-spotted catshark	78.9
Raja clavata	Thornback ray	70.5
Squalus acanthias	Picked dogfish	42.7
Galeus melastomus	Blackmouth catshark	38.7
Squalus blainville	Longnose spurdog	17.0
Dipturus oxyrinchus	Longnose skate	15.1
Etmopterus spinax	Velvet belly	12.1
Raja asterias	Mediterranean starry ray	8.8
Chimaera monstrosa	Rabbit fish	7.1
Centrophorus cf uyato	Gulper shark	6.5
Heptranchias perlo	Sharpnose seven-gill shark	3.3
Raja montagui	Spotted ray	2.7
Mustelus mustelus	Smooth hound	1.9
Oxynotus centrina	Angular rough shark	1.9
Raja polystigma	Speckled ray	1.9
Dalatias licha	Kitefin shark	1.7
Galeorhinus galeus	Tope shark	1.7
Torpedo marmorata	Marbled electric ray	1.7
Raja miraletus	Brown ray	1.5
Squatina aculeata	Sawback angelshark	1.0
Dasyatis pastinaca	Common stingray	0.8
Leucoraja naevus	Cuckoo ray	0.8
Leucoraja circularis	Sandy ray	0.6
Torpedo torpedo	Common torpedo	0.6
Leucoraja fullonica	Shagreen skate	0.4
Raja rondeleti	Rondelet's ray	0.2
Scyliorhinus stellaris	Nursehound	0.2
Squatina oculata	Smoothback angelshark	0.2
Tetronarce nobiliana	Electric ray	0.2

The Angular Rough Shark (*Oxynotus centrina*) is a neritic and deepwater, benthic shark distributed at depths of 60–800 m. This species is taken primarily as bycatch by offshore bottom trawlers in the Mediterranean Sea and the information available indicates a suspected decline of at least 80% over last 60 years. Today is listed as Critically Endangered in the Mediterranean.

4 LIBYAN SEA

As with other biodiversity information, data from the Libyan Sea is scarce. Early studies to identify trawlable fishing grounds, conducted by the LIBFISH project[27] off the Libyan coasts during 1993 and 1994, reported the presence of smooth hound sharks *Mustelus mustelus*, dogfish *Squalus acanthias*, and several *Raja* species, exhibiting a relatively high abundance. Nonetheless, information was not available on those found at deep-waters.

A second survey[28] funded by the Libyan Marine biology Research Centre (MBRC), conducted off the Libyan coast by the Hellenic Centre for Marine Research in 2003, (Fig. 6.6) recorded eleven species at depths of more than 200 m. In general, shark, rays and skates were among the most abundant fish species encountered. Rare species listed as critically endangered such as the angular rough shark *Oxynotus centrina* or angelsharks *Squatina oculata* (38 kg/km^2) and *Squatina aculeata* (41 kg/km^2), were reported as abundant at deep-waters at that time. Other species such as the dogfish *Squalus acanthias,* the rays *Raja clavata, Raja asterias* and the longnose skate *Dipturus oxyrinchus* were also very abundant, along with other ubiquitous species such as the electric ray *Tetronarce nobiliana*. The absence of *Galeus melastomus,* a species that is very common in the Mediterranean, was also a significant finding.

More recent reviews verified the presence of 59 chondrichthyan species along the coast and deep-waters of the Libyan Sea, including a rare report of the tiger shark, *Galeocerdo cuvier*, accidentally caught by a drifting longline for swordfish off the Libyan coast, Gulf of Sirte[29,30]. Other large pelagic sharks have been cited over the deep open waters of the Libyan Sea (in order of abundance): *Prionace glauca, Isurus oxyrinchus, Alopias vulpinus, Galeorhinus galeus, Alopias superciliosus, Carcharodon carcharias.* All of the aforementioned species are categorized from Vulnerable to Critically Endangered (Fig. 6.6).

> “In Libya, some artisanal fisheries using fixed gillnets, bottom set nets and drifting longlines still target endangered and little known cartilaginous sharks such as requiem sharks , mackerel or white sharks, guitarfishes and angelsharks such as *Squatina squatina*”

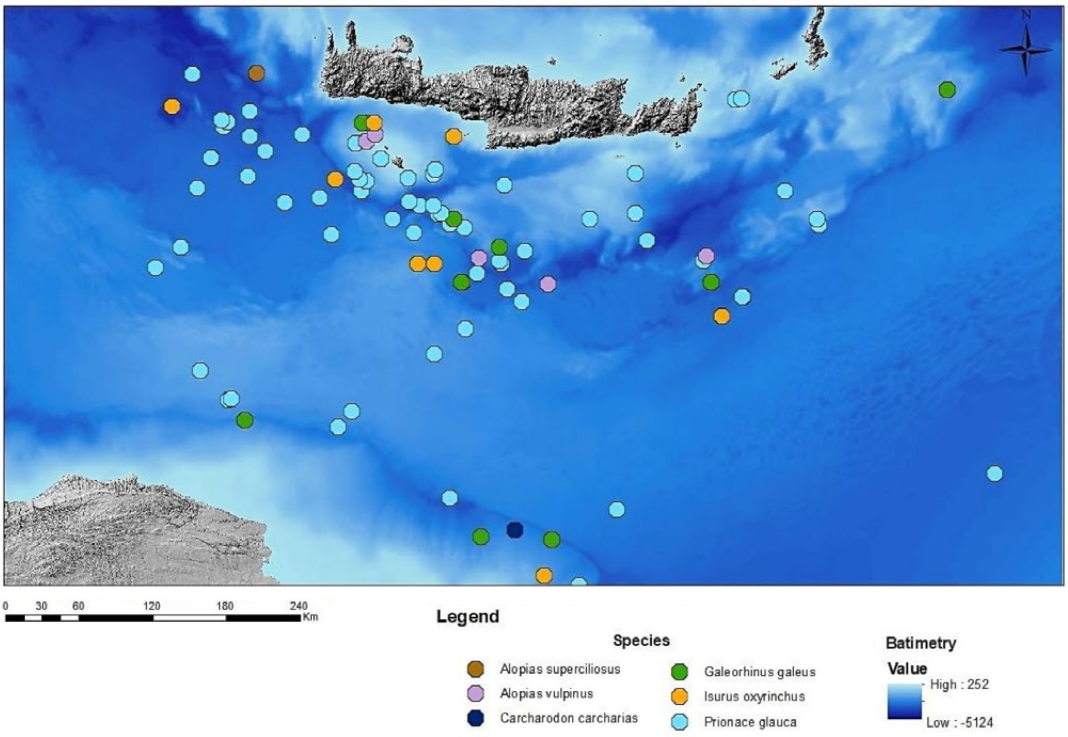
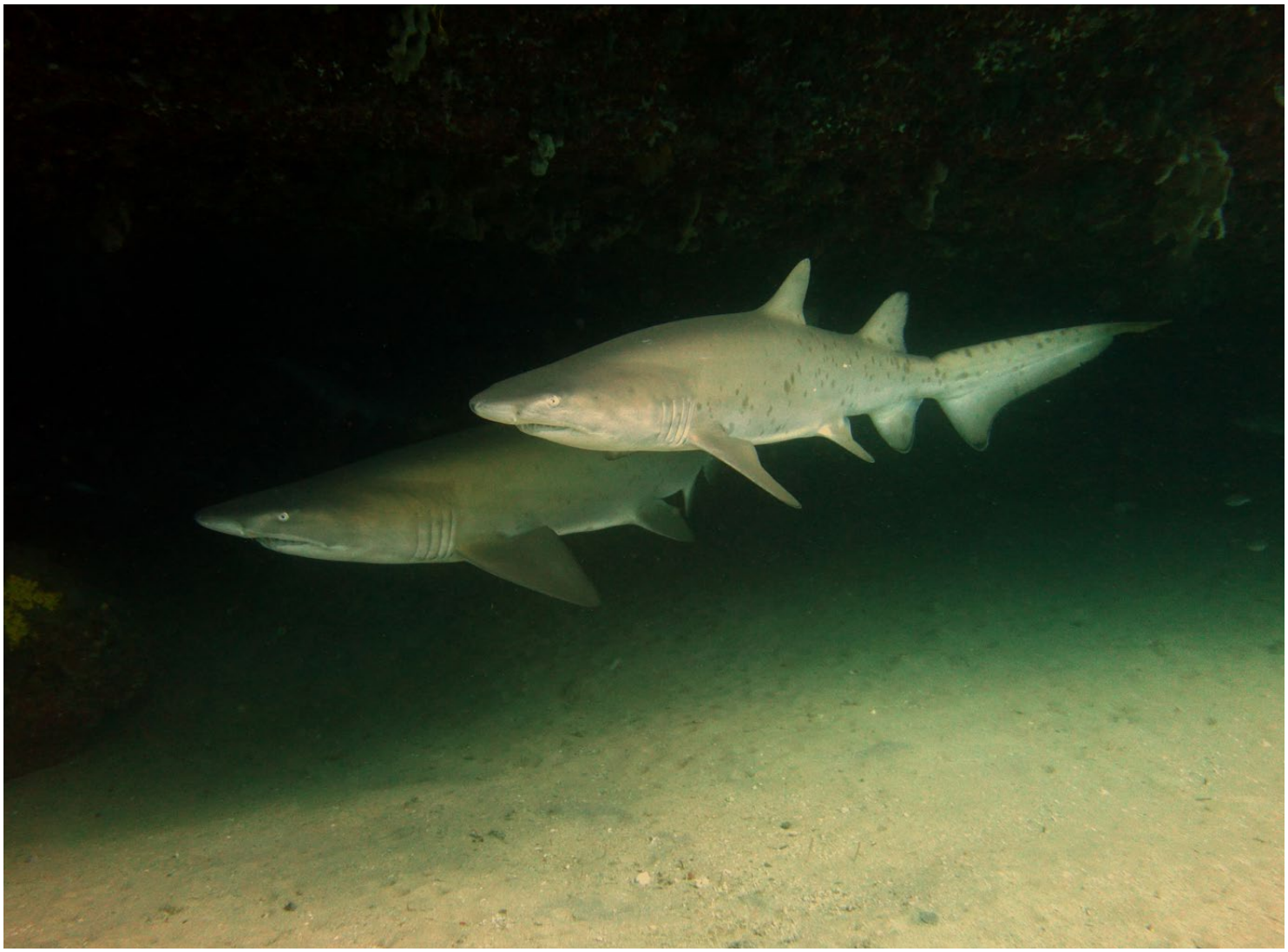


Fig. 6.6. Spatial occurrence of vulnerable large pelagic sharks (*Prionace glauca* - blue shark, *Isurus oxyrinchus* - shortfin mako, *Alopias vulpinus* - thresher shark, *Galeorhinus galeus* - tope shark, *Alopias superciliosus* - bigeye thresher shark, *Carcharodon carcharias* - great white shark) in the open waters of the Libyan Sea during 1998-2005[16].

Tiger shark © Hakbak, Dreamstime.



A pair of the critically endangered sand tiger sharks (*Carcharias taurus*) emerging from the darkness.

5 LEVANTINE SEA

The deep waters of the Levantine Sea are largely uncharted. There are significant gaps of knowledge on elasmobranchs and chimaeras in the region and information on bathymetric distribution is not provided in the majority of cases. According to the most updated fish checklists, the Levantine Sea hosts at least 78* chondrichthyan species (Table 6.8.).

Studies on deep sea fishes[2] in the Levantine has listed 11 species at depths between 800 and 2,300 m, namely: *Centrophorus* cf *uyato, Chimaera monstrosa, Dalatias licha, Etmopterus spinax, Galeus melastomus, Hexanchus griseus, Mustelus mustelus,* the little sleeper shark *Somniosus rostratus, Squalus acanthias, Squalus blainville, Oxynotus centrina* and *Torpedo marmorata*[31,32]. Other species such as the critically endangered Maltese skate *Leucoraja melitensis* or the Brown Stingray *Bathytoshia lata*[2], previously known as *Dasyatis centroura* are known to occur on sandy and muddy substrates down to 800m.

Off the Lebanese coast, several additional species have been found when examining offshore fishing grounds for the local artisanal fishery. Among them, *Raja montagui*, *Raja clavata* and *Raja miraletus, Dipturus oxyrinchus, Heptranchias perlo, Gymnura altavela,* and *Pteroplatytrygon violacea* were observed at depths of more than 200 m [32,33,34]. Furthermore, during the recent Deep-Sea canyon expedition along the Lebanese coast, the velvet belly lanternshark *Etmopterus spinax*, the longnose skate *Dipturus oxyrinchus* and the chimaera *Chimaera monstrosa* were reported at depths greater than 400 m (Fig. 6.7)[35].

2 According to recent taxonomic studies, all past records of Dasyatis centroura or Bathytoshia centroura should be considered as *Bathytoshia lata* (Garman, 1880) – see References[172,173].

Table 6.8. Checklist of chondrichthyans in the Levantine Sea, mentioned by country in the l literature, and their conservation status in the Mediterranean. IUCN Conservation status categories: DD = Data Deficient, LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered.

Species	IUCN Status	Turkey	Cyprus	Lebanon	Syria	Israel	Egypt	Reference(s)
Aetomylaeus bovinus	CR	•	•	•	•	•	•	[18,19,34,37,38,39,40,43]
Alopias superciliosus	EN	•	•		•	•	•	[19, 37,38, 40, 165, 167]
Alopias vulpinus	VU	•	•	•		•	•	[19, 18, 31, 32,39, 40,43]
Bathytossia lata	VU	•	•					[165,171]
Carcharhinus altimus	DD	•		•		•	•	[19,32,40,43]
Carcharhinus brevipinna	NT	•	•			•	•	[18, 19,39, 40,43]
Carcharhinus falciformis	NE			•				[32]
Carcharhinus limbatus	NE	•		•		•	•	[19, 36, 40, 43]
Carcharhinus melanopterus	NT		•				•	[39,43]
Carcharhinus obscurus	DD			•	•	•		[34, 37, 38, 40]
Carcharias taurus	CR	•	•			•	•	[19, 39, 40, 43]
Carcharinus plumbeus	EN	•	•	•	•	•	•	[18,19,32,37,38,39,40,43]
Carcharodon carcharias	EN	•	•			•	•	[18,19,39,40,43]
Centrophorus cf uyato	VU	•	•	•	•	•	•	[18,19,32,34,37,38,39,40,43]
Centrophorus moluccensis	DD				•			[37, 38]
Cetorhinus maximus	EN	•	•	•	•	•		[18,19, 32, 37, 38, 40, 165]
Chimaera monstrosa	NT	•		•	•	•	•	[19, 36, 37,38, 40, 41, 164]
Dalatias licha	VU	•	•	•	•	•		[18,19,34, 37,38,39,, 40]
Dasyatis centroura	LC	•	•			•	•	[19, 39, 40, 43]
Dasyatis chrysonota	LC					•		[40]
Dasyatis marmorata	DD	•	•	•		•		[19, 34, 40, 165]
Dasyatis pastinaca	VU	•	•	•	•	•	•	[18,19,34,36,37,38,39,40,41,43]
Dipturus batis	CR	•				•		[18,19,164]
Dipturus oxyrinchus	NT	•	•	•	•	•	•	[8,19,34,36,37,38,39,40,41,43]
Echinorhinus brucus	DD	•					•	[19,41,43]
Etmopterus spinax	LC	•	•	•	•	•	•	[18,19,32,39,40,41,42]
Galeorhinus galeus	VU	•	•				•	[18,19,39,43]
Galeus melastomus	LC	•	•	•	•	•	•	[18,19,34,36,37,38,39,40,41,43,164]
Glaucostegus cemiculus	EN	•	•	•	•	•	•	[19, 34,36,37,38,39, 40, 43]
Gymnura altavela	VU	•	•	•	•	•	•	[18,19,34,36,37,38,39,40,43]
Heptranchias perlo	DD	•	•	•	•	•	•	[19,34,36,37,38,39,40,43]
Hexanchus griseus	LC	•	•	•	•	•	•	[19,34,36,37,38,39,40,43]
Himantura uarnak	VU	•		•	•	•	•	[19, 36, 40, 43,43]
Hydrolagus mirabilis	NT				•		•	[42,43]
Isurus oxyrinchus	CR	•	•	•	•	•	•	[18,19,34,36,37,38,39,40]
Lamna nasus	CR	•	•			•	•	[19, 39, 40, 43]
Leucoraja circularis	CR	•	•		•			[19, 43, 165]
Leucoraja fullonica	CR	•	•					[19, 165]
Leucoraja melitensis	CR	•						[171]
Leucoraja naevus	NT	•	•					[19, 165]
Mobula mobular	EN	•	•	•	•	•	•	[18,19,32,37,38,39,40,43]
Mustelus asterias	VU	•	•	•		•	•	[18,19,32,39,40,43]
Mustelus mustelus	VU	•	•	•	•	•	•	[18,19,34,36,37,38,39,40,43]
Mustelus punctulatus	VU	•	•				•	[18,19,39,43]
Myliobatis aquila	VU	•	•	•		•	•	[18,19,32,40,43, 165]
Odontaspis ferox	EN	•	•	•		•	•	[19, 36,39, 40, 43]
Oxynotus centrina	CR	•	•	•	•	•	•	[18,19,32,37,38,39,40,43,164]
Prionace glauca	CR	•	•	•		•	•	[18,19,36,39,40,43]
Pristis pectinata	CR			•		•		[36, 40]
Pteroplatytrygon violacea	LC	•	•	•	•	•		[19,34,37,38,39, 40]
Raja asterias	NT	•	•			•	•	[19, 39, 40, 41,43]
Raja brachyura	NT		•					[165]
Raja clavata	NT	•	•	•	•	•	•	[18,19,34,37,38, 39, 40, 43]
Raja miraletus	LC	•	•	•	•	•	•	[19, 34,36,37,38,,39, 36, 40, 43]
Raja montagui	NE		•	•				[32, 165]
Raja polystigma	LC		•					[165]
Raja radula	EN	•	•		•	•	•	[18,19,37,38,39,40,43]
Raja undulata	NT		•					[165]
Rhinobatos rhinobatos	EN	•	•	•	•	•	•	[18,19,34,36,37,38,39,40,43]
Rhinoptera marginata	DD	•	•		•	•	•	[18,19, 39,40,42,43]
Rostroraja alba			•				•	[165, 167]
Scyliorhinus canicula	LC	•	•	•	•	•	•	[18,19,32,37,38,39,40,43]
Scyliorhinus stellaris	NT	•	•	•			•	[18,19,32,39,43]
Somniosus rostratus	DD				•			[37, 38]
Sphyrna mokarran	EN		•				•	[39, 43]
Sphyrna zygaena	CR	•	•	•		•	•	[19, 36,39, 40, 43]
Squalus acanthias	EN	•	•	•		•	•	[18,19,36, 39, 40, 43]
Squalus blainvillei	DD	•	•	•	•	•	•	[18,19,34,37,38,39,40,43]
Squalus megalops	DD				•			[37, 38]
Squatina aculeata	CR	•	•	•	•	•	•	[18,19,34,37,38,40,43, 165]
Squatina oculata	CR	•	•	•	•	•	•	[18,19,34,37,38,39,40,43]
Squatina squatina	CR	•	•	•	•	•	•	[18,19,36,37,38,39,40,43]
Taeniurops grabatus	DD	•	•	•	•	•	•	[19, 34, 37,38, 40, 43, 165]
Tetronarce nobiliana	LC	•	•	•	•	•		[18,19,34,37,38,49,40]
Torpedo (Tetronarce) tokionis	DD						•	[41]
Torpedo alexandrinsis	NE						•	[43]
Torpedo marmorata	LC	•	•	•	•	•	•	[18,19,34,36,37,38,39,40,43]
Torpedo sinuspersici	DD				•			[42]
Torpedo torpedo	LC	•	•	•		•	•	[18,19,36,39,40,43]

Fifteen chondrichthyans species have been identified at depths of more than 200 m off the Syrian coast: *Centrophorus moluccensis, Centrophorus* cf *uyato, Chimaera monstrosa, Dalatias licha, Etmopterus spinax, Galeus melastomus, Heptranchias perlo, Hexanchus griseus, Hydrolagus mirabilis, Oxynotus centrina, Scyliorhinus canicula, Somniosus rostratus, Squalus blainville, Squalus megalops* and *Torpedo sinuspersici* between 2000 and 2017 (Prof. Ali Malek, *personal comm.*). Seventeen shark species landed in the port of Lattakia during the period 2014-2016; however, no depth information has been provided[44]. Five species of large pelagic sharks were also reported in the open waters off the Israeli coast, while conducting experimental fishing surveys for swordfish: *Alopias superciliosus, Carcharhinus obscurus, Carcharhinus plumbeus, Isurus oxyrinchus*, and *Prionace glauca*[45,46]. In the Palmahim Disturbance, a salient submarine slide off the continental margin in southern Israel, critical endangered species as Common Skate (*Dipturus batis*) and the Angular Rough Shark (*Oxynotus centrina)* has been recently documented near the coral gardens at a depth of 600-700 meters, and near the cold seeps at 1,150 meters [164]. This site seems to hold also the elusive *Chimera monstrosa* and an remarkable large population of blackmouth catsharks (*Galeus melastomus).*

Twelve elasmobranch and chimaera species, at depths of more than 300 m, have been observed off the Egyptian coast: *Dasyatis pastinaca, Dipturus oxyrinchus, Raja asterias, Rostroraja alba, Tetronarce tokionis, Echinorhinus brucus, Hexanchus griseus, Galeus melastomus. Centrophorus uyato, Etmopterus spinax,* the large eye rabbitfish *Hydrolagus mirabilis* and *Chimaera monstrosa*; the last four were reported for the first time in Egyptian waters[41,166]. In the south Turkish waters, 15 chondrichthyans at depths of 200-900 m have been reported in Antalya Bay, among them: *Scyliorhinus canicula, Galeus melastomus, Squalus blainville, Etmopterus spinax, Centrophorus* cf *uyato, Heprtanchias perlo, Dalatias licha, Oxynotus centrina, Mustelus mustelus, Carcarhinus plumbeus, Raja clavata* and *Raja miraletus*[49]. In addition, 8 species were further reported at depths of 360-400 m offshore of Iskenderun Bay: *Heptranchias perlo, Squatina aculeata, Galeus melastomus, Etmopterus spinax, Oxynotus centrina, Scyliorhinus canicula, Raja clavata* and *Dipturus oxyrinchus*[48].

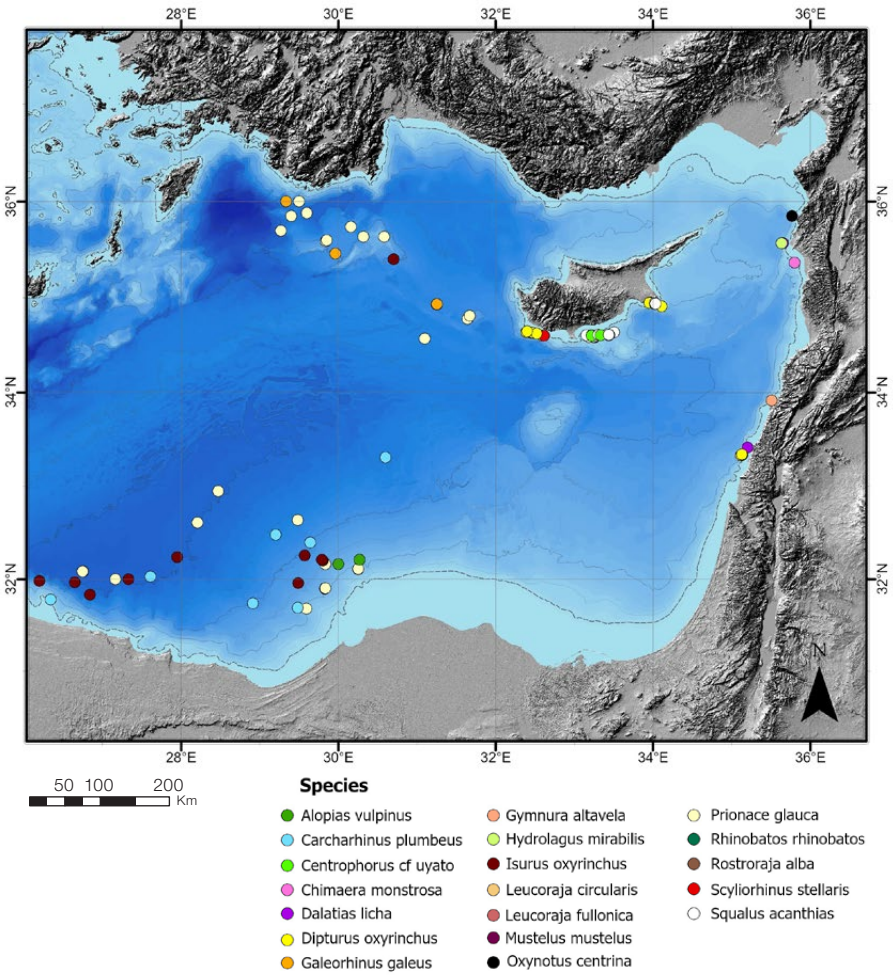


Fig. 6.7. Spatial occurrence of vulnerable chondrichthyans (*Alopias vulpinus* – thresher shark, *Carcharhinus plumbeus* – sandbar shark, *Centrophorus* cf *uyato* – gulper shark, *Chimaera monstrosa* – rabbit fish, *Dalatias licha* – kitefin shark, *Dipturus oxyrinchus* – longnose skate, *Galeorhinus galeus* – tope shark, *Gymnura altavela* – spiny butterfly ray, *Hydrolagus mirabilis* – large-eyed rabbit fish, *Isurus oxyrinchus* – shortfin mako, *Leucoraja circularis* – sandy ray, *Leucoraja fullonica* – shagreen skate, *Mustelus mustelus* – smooth hound, *Oxynotus centrina* – angular rough shark, *Prionace glauca* – blue shark, *Rhinobatos rhinobatos* – common guitarfish, *Rostroraja alba* – white skate, *Scyliorhinus stellaris* - nursehound, *Squalus acanthias* – picked dogfish) in the Levantine Sea[16,34,45,46,47,48,49].

The most comprehensive set of data comes from Cyprus, under the annual MEDITS surveys with thirteen and six species exclusively reported in depths > 200 m and depths < 200 m, respectively (Table 6.9.; Fig. 6.7). Five large pelagic shark species have been additionally reported over the deep open Cypriot waters during 1998 and 2005: the Critically Endangered species of blue shark *Prionace glauca* and shortfin mako *Isurus oxyrinchus,* the Endangered thresher shark *Alopias vulpinus,* the tope shark *Galeorhinus galeus,* with the occasional sighting of endangered sandbar shark *Carcharhinus plumbeus* ([16] – Fig. 6.7).

Table 6.9. Occurrence by depth for the chondrichthyan species identified during 2005-2017 in the Cypriot marine region (MEDITS survey), their IUCN Red List status and percentage of occurrence in waters > 200 m.

Species	IUCN Red List Status	Min-Max depth	% Occurrences > 200 m
Centrophorus cf uyato	CR	601-622 (25)	100%
Chimaera monstrosa	NT	612 (1)	100%
Etmopterus spinax	LC	525-622 (2607)	100%
Galeus melastomus	LC	525-622 (869)	100%
Heptranchias perlo	DD	570-622 (71)	100%
Hexanchus griseus	LC	578-614 (6)	100%
Leucoraja circularis	CR	612-616 (2)	100%
Leucoraja fullonica	CR	602-614(2)	100%
Mustelus mustelus	VU	254 (2)	100%
Rostroraja alba	CR	603 (1)	100%
Scyliorhinus stellaris	NT	260 (7)	100%
*Squalus acanthias**	EN	287-621 (168)	100%
Squalus blainville	DD	298-622 (59)	100%
Dipturus oxyrinchus	NT		97%
Raja brachyura	NT		89%
Scyliorhinus canicula	LC		88%

Species	IUCN Red List Status	% Occurrences > 200 m
Oxynotus centrina	CR	73%
Raja polystigma	LC	67%
Tetronarce nobiliana	LC	66%
Raja spp.		60%
Raja clavata	NT	51%
Raja asterias	NT	50%
Torpedo marmorata	LC	50%
Raja montagui	LC	43%
Dasyatis pastinaca	VU	1%
Dasyatis centroura	LC	0%
Leucoraja naevus	NT	0%
Raja miraletus	LC	0%
Raja radula	EN	0%
Raja undulata	EN	0%
Torpedo torpedo	LC	0%

*Perhaps two or three different species involved[17].

The nursehound (*Scyliorhinus stellaris*), also known as the large-spotted dogfish, is a medium-large catshark found at depths of less than 5 metres to ~400 m in the Mediterranean. It is taken as bycatch in bottom trawl, gill net, and longline gears, and targeted by artisanal fisheries for local consumption. At present, it is listed as Near Threatened given the evidences of declines in different areas and its patchy distribution.

The Common Blue Skate (*Dipturus batis*) is a Global Critically Endangered species once abundant from shallow shelf and continental slope areas as deep as 600m. More efforts are needed in clarifying the current status and taxonomy of this species in the Mediterranean.

STATUS OF THREATENED CHONDRICHTHYAN SPECIES IN THE DEEP WATERS OF THE EASTERN MEDITERRANEAN

The present analysis shows that at least 61 cartilaginous species have been reported at depths of over 200 metres in the Eastern Mediterranean Sea (Table 6.10.). The South Aegean (43) and the Levantine (41) were the areas with the highest number of species observed, in contrast to the Libyan Sea (19). It is more likely that the uneven research effort exerted in each area has biased these estimates.

Table 6.10. Summarised list of sharks, skates and rays species reported at depths of over 200 metres in the Eastern Mediterranean. IUCN Conservation status categories: DD = Data Deficient, LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered.

Species	IUCN Status	Eastern Ionian	N. Aegean	S. Aegean	Libyan Sea	Levantine
Alopias superciliosus	EN			•	•	
Alopias vulpinus	VU		•	•	•	•
Bathytosia lata	VU					•
Carcharias taurus	CR		•			
Carcharinus plumbeus	EN					•
Carcharodon carcharias	EN				•	
Centrophorus cf *uyato*	DD	•	•	•		•
Centrophorus moluccensis	DD					•
Cetorhinus maximus	EN		•			
Chimaera monstrosa	NT	•	•	•		•
Dalatias licha	VU	•	•	•		•
Dasyatis centroura	LC			•		
Dasyatis pastinaca	VU	•	•	•		•
Dipturus batis	CR	•				•
Dipturus oxyrinchus	NT	•	•	•	•	•
Echinorhinus brucus	DD		•			•
Etmopterus spinax	LC	•	•	•		•
Galeocerdo cuvier	DD				•	
Galeorhinus galeus	VU	•		•	•	•
Galeus melastomus	LC	•	•	•		•
Gymnura altavela	VU					•
Heptranchias perlo	DD	•	•	•		•
Hexanchus griseus	LC	•	•	•		•
Hexanchus nakamurai	DD			•		
Hydrolagus mirabilis	NT					•
Isurus oxyrinchus	CR			•	•	•
Leucoraja circularis	CR	•	•	•		•
Leucoraja fullonica	CR		•	•		•
Leucoraja melitensis	CR		•	•		•
Leucoraja naevus	NT		•	•		
Mustelus asterias	VU		•	•		
Mustelus mustelus	VU	•	•	•	•	•
Mustelus punctulatus	VU			•		
Myliobatis aquila	VU		•			
Odontaspis ferox	EN			•		
Oxynotus centrina	CR	•	•	•	•	•
Prionace glauca	CR	•	•	•	•	•
Pteroplatytrygon violacea	LC	•				•
Raja asterias	NT	•	•	•	•	•
Raja brachyura	NT	•	•	•		•
Raja clavata	NT	•	•	•	•	•
Raja miraletus	LC	•	•	•	•	•
Raja montagui	LC	•	•	•		•
Raja polystigma	LC	•	•	•		•
Raja radula	EN		•			
Raja rondeleti	EN	•		•		
Rhinobatos rhinobatos	EN	•		•		
Rhizoprionodon acutus	LC	•				
Rostroraja alba	CR		•	•	•	•
Scyliorhinus canicula	LC	•	•	•	•	•
Scyliorhinus stellaris	NT	•	•	•		•
Somniosus rostratus	DD					•
Squalus acanthias	EN	•	•	•	•	•
Squalus blainvillei	DD	•	•	•		•
Squalus megalops	DD					•
Squatina aculeata	CR			•	•	•
Squatina oculata	CR			•	•	
Torpedo marmorata	LC	•	•	•		•
Tetronarce nobiliana	LC	•	•	•	•	•
Torpedo sinuspersici	DD					•
Tetronarce tokionis	DD					•
Torpedo torpedo	LC	•		•		
Total		**32**	**36**	**43**	**19**	**44**

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> “Bycatch, the unintentional capture of non-targeted species during fishing operations, is considered as one of the most important factor in causing the decline of marine species worldwide, including vulnerable shark and ray species in the Mediterranean[4,50]”

From the 61 chondrichthyan species reported in the E. Mediterranean at > 200 m depth, 36 are of conservation concern and listed as Critically Endangered, Endangered, Vulnerable or Near Threatened. Present knowledge indicates that the Libyan Sea seems to have the highest percentage (79%) of vulnerable deep-water species of sharks, rays and chimaeras, with the Ionian Sea exhibiting the lowest values (50%) (Table 6.11.).

Table 6.11. Percentage of vulnerable chondrichthyan species reported at depths of over 200 metres, by study area, in the Eastern Mediterranean Sea (IUCN Red List Mediterranean status).

Area	% of vulnerable species
Libyan Sea	78.9
N. Aegean Sea	63.9
S. Aegean Sea	62.8
Levantine	53.7
Eastern Ionian Sea	50.0
Total	**59.0**

Today, a number of shark and ray species have been declared protected (i.e. cannot be kept on board, transferred, landed, stored, sold or in display) according to various international (EU Regulation 2102 (2015), GFCM/44/2021/16[3], GFCM/42/2018/2[4], ICCAT, Barcelona SP/BD Protocol) or national regulations (e.g. Greek National Ministry Directive 4531/2016 and Central Hunting Commission of Turkey 2019-2020 Resolutions).

Data has increased over time and has become more reliable as monitoring programmes (including on-board observers, interviews with fishers and logbooks) increase, along with data standardization. However, the current available information is still biased since efforts have been unequal over the Eastern Mediterranean Sea. For a few pelagic shark species, the Eastern Mediterranean region has been suggested to have some breeding or nursery grounds at shallow areas within the continental shelf (the great white shark *Carcharodon carcharias*[51] and the sandbar shark *Carcharhinus plumbeus*[52]). Additionally, research with underwater remotely operated vehicles on deep-water cold seep sites has provided proof of nursery areas at deep sites such as those of the blackmouth catshark (*Galeus melastomus*) egg-cases found between tubeworms or lying on the nearby ground of the North Alex Mud Volcano (depth 500 m – West Nile Delta, Egypt[53]) and Palmahim Disturbance off Israel coast close to deep brine pools and brine seeps.

3 Recommendation GFCM/44/2021/16 on additional conservation and mitigation measures for the conservation of elasmobranchs in the Mediterranean Sea

4 Recommendation GFCM/42/2018/2 on fisheries management measures for the conservation of sharks and rays in the GFCM area of application, amending Recommendation GFCM/36/2012/3

Deep-sea cetaceans and sea turtles

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Despite being a small part of the world's oceans, the Mediterranean Sea hosts a diverse marine mammal fauna, with a total of 28 different species known to occur, or to have occurred, in the region. Species currently recognised as regular in these waters are the Mediterranean monk seal (*Monachus monachus*) and 11 cetaceans (fin whale, *Balaenoptera physalus*; sperm whale, *Physeter macrocephalus*; Cuvier's beaked whale, *Ziphius cavirostris*; short-beaked common dolphin, *Delphinus delphis*; long-finned pilot whale, *Globicephala melas*; Risso's dolphin, *Grampus griseus*; killer whale, *Orcinus orca*; striped dolphin, *Stenella coeruleoalba*; rough-toothed dolphin, *Steno bredanensis*; common bottlenose dolphin, *Tursiops truncatus;* harbour porpoise, *Phocoena phocoena* relicta) that have been adapted well to the region's environmental conditions, but their coexistence with human is problematic[54].

Other cetacean species that can occur in the Eastern Mediterranean waters are the rough-toothed dolphin (*Steno bredanensis*), considered only an occasional species and found primarily in the eastern part[55,56]; the endangered Black Sea harbor porpoise, *Phocoena phocoena relicta* that has been increasingly sighted in recent years in the North Aegean Sea[57] and the Indian Ocean humpback dolphin, *Sousa plumbea* a shallow-water non-native dolphin, with recent observations in Greek waters[58].

> "Among the cetacean species regularly encountered, the sperm whale, Cuvier' s beaked whale and long-finned pilot whale are deep-diving species, that due to the short surface period and long dive time, make difficult their observation at sea"

Risso's dolphins also inhabit deep waters, common between 400 and 1,000 metres depth close to the continental slope and platform or associated to offshore archipelagos[59]. Other cetaceans are mainly found in waters shallower than 200 m depths or they display occasional or less common presence in offshore deep-waters.

The preferred habitat of Risso's Dolphins in the Mediterranean is continental slope waters with steep relief. The decline of abundance in part of its range, smaller area of distribution with their site fidelity categorised the species for the first time as Endangered in 2021.

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Sperm whales continue to be listed as Endangered species in the Mediterranean in 2021. Available data sources suggest that there are still fewer than 2500 mature individuals in the Mediterranean subpopulation and their decline is still ongoing from multiple threats, particularly with the increasing maritime traffic.

The Cuvier's beaked whale, *Ziphius cavirostris*, is frequently associated with high slope habitats with preference for submarine canyons and escarpments[60,61]. It is known to occurs at water depths exceeding 500–1,000 m, with a distinctive preference for depths of 1,000 m[62] and preys on various species of squids[63]. Much of the knowledge of its presence and distribution comes from stranding data but occasional sightings at sea are also reported. They occur mostly in small groups of 2 to 7, but are not uncommonly seen alone. Recently, it has been estimated that the Mediterranean subpopulation of Cuvier´s beaked whales is of approximately 3,700 individuals occurring in few, relatively high density areas. The Alboran Sea, the Hellenic Trench, the Southern Adriatic Sea, the Ligurian Sea and the Tyrrhenian Sea were indicated as high-density areas for the species.

Several reports pointed out that Cuvier's beaked whales are particularly affected by high-intensity military sonar and seismic surveying activities, due to the formation of air bubbles in their body which produce chronic and acute damage in their tissues resulting finally in their stranding[64,65,66]. The conservation status of the species in the Mediterranean has recently passed from Data Deficient to Vulnerable, thus showing the urgent need to address further conservation measures and address the gaps in knowledge on its bio-ecological features, suitable habitat and threats at local or wider scale.

The sperm whale, *Physeter macrocephalus*, is a truly cosmopolitan species, whose distribution is thought to be more extensive than that of any other marine mammal. Sperm whales swim in deep waters down to depths of 3,219 m, apparently limited only by the time it takes to swim down and back to the surface. Their distribution depend upon season and sexual/social status, however they are most likely to be found in waters inhabited by squid - at least 1,000 m deep - and with cold-water upwellings. The Mediterranean subpopulation of the sperm whales is genetically distinct from the Atlantic one and it contains fewer than 2,500 mature individuals with a continuing decline in numbers of mature individuals[5]. Sperm whales are thought to roam widely across the Mediterranean and pass between the Eastern and the Western Mediterranean deep water basins[67]. At present, they are classified as Endangered in the IUCN Red List in the Mediterranean due to a number of threats that can result in direct mortality. Among the most important ones are ship strikes, debris ingestion, illegal fishing using drift nets and noise disturbance (particularly related to intense maritime traffic, seismic surveys for oil and gas exploration and military sonar activities). Six **Im-**

5 https://www.iucnredlist.org/

portant Marine Mammal Areas (IMMAs)[6] have been designated in the Mediterranean for their importance to Sperm Whales: the Alborán Corridor and Alborán Deep, the Campanian and Pontino Archipelago, the Hellenic Trench, the Balearic Islands Shelf and Slope, and the North West Mediterranean Sea, Slope and Canyon System (Fig. 6.8). In addition, other potential sites have been identified in the Northern Sporades, the Shelf of the Gulf of Lion, the Strait of Gibraltar and Gulf of Cadiz, the waters of Ischia and Ventotene, and the Western Ligurian Sea and Genoa Canyon IMMAs.

The Long-finned Pilot Whale (*Globicephala melas*) is a predominantly offshore cetacean with a preference for deep waters of the continental shelf and slopes, generally deeper than 500 m[68,69]. They are found almost exclusively in the western basin[70] and no information exists about its possible presence in the Eastern basin. The Risso's dolphin, *Grampus griseus,* is considered a regular inhabitant of the Mediterranean, although scarcer in the Eastern basin probably due to the paucity of regional surveys[71,72]. It inhabits waters between 300 and 1,500 metres deep, which are close to the continental slope and platform or associated to offshore archipelagos[59,73]. There are different Mediterranean studies suggesting that the species shows preferences for waters above the continental slope, especially those areas with steep slopes and submarine canyons[74,75,76]. Although, the mean depth for this species varies between 700 and 1,280 metres with a peak at 1,000 metres, it has also been spotted in waters from 400 to 1,700 metres deep and in coastal waters where their abundance is estimated to be decreasing[7]. In the Mediterranean Sea, Risso's Dolphins are genetically differentiated from those in the Eastern Atlantic[77]. The principal known threats for the populations in the Mediterranean that may be causing declines for the species include bycatch in offshore gillnets, pelagic longlines, and other fishing gear. Other likely reasons for the estimated declines might be attributed to environmental variability effects (habitat degradation or climate change effects) combined with the impact of fishery on prey availability as well as higher impact of maritime traffic in more coastal areas that force the species to move in more pelagic areas[78]. Based on the estimated decline in the number of individuals at a local scale and the decrease in the area of occupancy the species is currently classified as Vulnerable in the IUCN listing for this species.

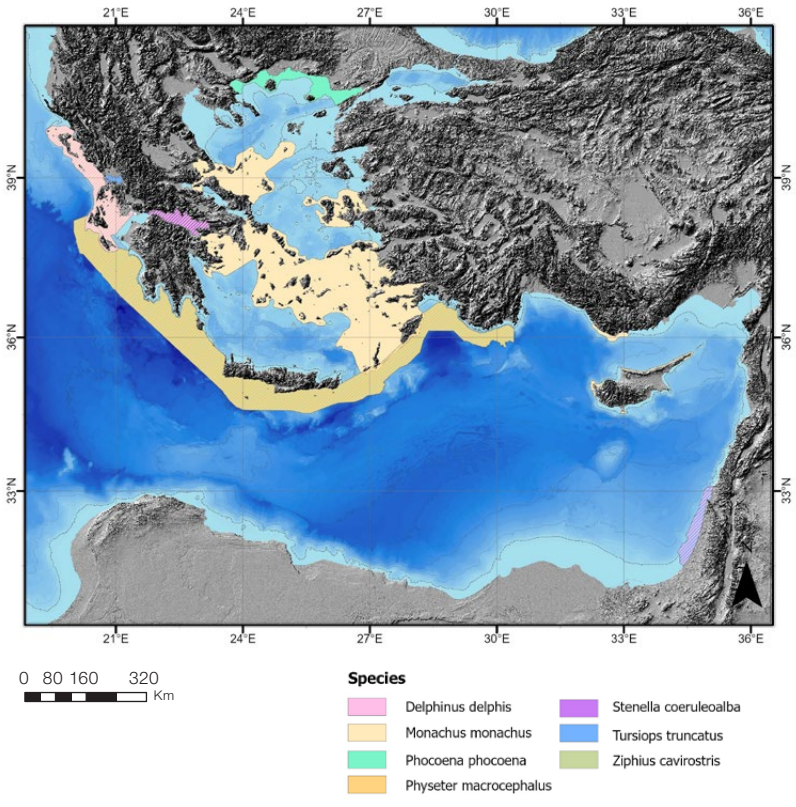


Fig. 6.8. Important Marine Mammal Areas (IMMAs) indicating the respective species for designation (*Delphinus delphis* – common dolphin, *Monachus monachus* – Mediterranean monk seal, *Phocoena phocoena* – harbour porpoise, *Physeter macrocephalus* – sperm whale, *Stenella coerueoalba* – striped dolphin, *Tursiops truncatus* – Atlantic bottlenose dolphin, *Ziphius cavirostris* – Cuvier's beaked whale).

6 https://www.marinemammalhabitat.org/immas/
7 https://www.iucnredlist.org/

Until recently, entanglement in pelagic driftnets had been the principal threat to sperm whales. Entanglements have decreased in recent years, but this source of mortality is ongoing.

Other benthopelagic and deeper cetacean divers shows only an occasional presence in the Eastern Mediterranean. The strandings of the fin whale *Balaenoptera physalus* are very rare and only few individuals of this species had been reported in the Eastern Mediterranean such as in Greek waters[79]. The humpback whale, *Megaptera novaeangliae* and the common minke whale, *B. acutorostrata*, are considered rare visitors to the Mediterranean, with less than a one sighting or stranded record per species, per year[80]. The false killer whale (*Pseudorca crassidens*) is a cosmopolitan species of the open sea, but it is very rare along the European and Mediterranean coasts[71].

Records on fishing interactions indicate that in recent years (since 2008), the incidental catch of cetaceans in Mediterranean fisheries has begun to decrease with respect to past levels, i.e. when bycatch of marine mammals in pelagic driftnets was relevant, as well as of other groups of large marine vertebrate species. The use of these nets was banned in 2005 and since then, only a few studies have reported the bycatch of marine mammals from other fisheries in the Mediterranean Sea[4]. Present knowledge indicates that most interactions with marine mammals are those used by small-scale fisheries in coastal areas, including bottom-set gillnets and trammel nets targeting several demersal species and few records shows incidental bycatch with deep cetacean divers. Drifting longline has been reported to bycatch some individuals of long-finned pilot whales, *Globicephala melas* and Risso's dolphins, *Grampus griseus* as well as one sperm whale *Physeter microcephalus* in the Western Mediterranean[81,82].

The relationships between marine mammals and plastic pollution is not well studied in the Eastern Mediterranean until now, although macroplastic debris (> 5 mm) were found in the stomachs of different cetaceans from four species (harbour porpoise, Risso's dolphin, Cuvier's beaked whale and sperm whale) with the highest frequency of occurrence in sperm whales (60%) stranded in Greece[83].

Sea turtles

Out of the seven species of sea turtles currently inhabiting the world's oceans, only two of them breed in the region: loggerheads (*Caretta caretta*) and green (*Chelonia mydas*). There are also occasional records of leatherbacks (*Dermochelys coriacea*), olive and Kemp's ridleys (*Lepidochelys olivacea* and *Lepidochelys kempii*)[84].

Green sea turtle *Chelonia mydas* are a global endangered species that have undergone a large population decrease over the past half century.

From them, only the leatherback turtle is considered a deep-water diver, as can dive for as long as an hour to depths as much as 1,000 m. Although leatherback turtles mainly inhabit the Atlantic and Pacific Oceans, occasionally enter the Mediterranean Sea, and most of the sightings had been made from the western part of the Mediterranean and the North Africa coast[85,86]. This species is the largest sea turtle and is able to carry out extensive migrations between different feeding areas during different seasons, to and from nesting areas. Indeed, the Mediterranean pelagic feeding grounds of leatherback sea turtles are frequented by individuals, adults and large juveniles (> 145 cm), from Atlantic populations. Nesting of this species is absent or exceptional in the Mediterranean[87], therefore, the leatherback turtles found in the region are likely to be of Atlantic origin[88].

Leatherback turtles (*Dermochelys coriacea*) are globally threatened and classed as Vulnerable in the IUCN Red List of threatened species due to anthropogenic impacts on populations worldwide[89]. This is mainly due to egg poaching on nesting beaches in other areas outside the Mediterranean[90], bycatch from longline fisheries[91,92] and drift-netting[93].

It is being estimated that around 121,000 sea turtles, mostly loggerheads and green turtles, are potentially caught in the Mediterranean each year, with about 33,000 considered potentially dead[4]. According to this Mediterranean review, in the last ten years, bottom trawlers seem to represent the fishery with the greatest impact on sea turtles (17.6%) followed by drifting longline and set net fisheries while other types of fishing gear might have a localised impact when overlap with important foraging areas for sea turtles (as in Egypt, Turkey and Israel). Reported cases of bycatch of leatherbacks (*Dermochelys coriacea*) are rare[4] and ultimately the bycatch-induced mortality will depend on the capacities of sea turtles to survive.

Information on the diving behaviour of leatherbacks at non-breeding grounds is limited, derived from satellite tracking or animal-borne cameras, and most of the information is from post nesting females[94]. However, the lack of information regarding the population size and demographic characteristics of leatherback turtles in the whole Mediterranean basin impedes our understanding how the anthropogenic impact affects the status of this species in the area.

The leatherback turtle (*Dermochelys coriacea*), is considered a deep-water diver, globally threatened and classed as Vulnerable in the IUCN Red List.

Few records are available from the Eastern Mediterranean, including specimens caught by drift nets, trammel nets, bottom trawl, coastal fisheries and unknown fishing gears off Greek[95], Syrian[96], Israeli[97], Cypriot, Egyptian[86] and Turkish waters[4,98]).

DATA INFORMATION

The following section provides a brief review on the presence records of deep-sea cetaceans and sea turtles of the Eastern Mediterranean, with information on status, spatial and depth occurrence when known. Knowledge on the distribution of all these deep-water diving species is mainly referred to the western Mediterranean region and there is a limited and fragmented information on their distribution in the Eastern Mediterranean. Most of this knowledge originates from acoustic surveys, sporadic sightings and stranding data.

Stranding data (including injured and dead cetaceans, marine turtles and other marine mammals) were obtained mainly through the national stranding networks when established, such as by the Hellenic Centre for Marine Research in collaboration with the Port Police authorities (Kapiris, *unpubl. data).* This network provides information to various recipients (ministries, research centres and NGOs) from data collected during mainly the period 2011-2016, and occasionally also the previous years. The database includes data concerning the species identification, geographical area of findings, body characteristics, cause of mortality according to the Port Authorities data and photos.

Observational information comes from sightings during aerial and photo-identification surveys, some regular monitoring efforts, and the basin-wide acoustic and block surveys carried out in 2018 as part of the ACCOBAMS Survey Initiative[99] (ASI)[8]. Other data gathered in the present work are coming from the bibliographic resources (papers, press and reports) and from personal communication with the relevant Authorities and scientists from some countries.

Available data on sea turtle and cetacean bycatch in the Mediterranean Sea has recently reviewed and provided a first indication where fishing activities overlap with sea turtle and cetacean habitats[4]. Nevertheless, data for some countries and types of fishing gear are missing and recent initiatives are complementing the gaps in several countries as Turkey and Cyprus.[9]

EASTERN IONIAN SEA

1

The Ionian is characterized by significant upwellings that guarantee the regular sightings of six species: striped dolphin (*Stenella coeruleoalba*), common bottlenose dolphin (*Tursiops truncatus*), short-beaked common dolphin (*Delphinus delphis*), Cuvier's beaked whale (*Ziphius cavirostris*), sperm whale (*Physeter macrocephalus*) and Risso's dolphin (*Grampus griseus*). In the Eastern Ionian, up to eleven cetacean species have been identified to occur and seven of them are found in deep and offshore waters (Fig. 6.9). including the rough-toothed dolphin (*Steno bredanensis*) a species to be part of a relict population that detached from the Atlantic population[56]. Other two species, the harbour porpoise (*Phocoena phocoena*) and the fin whale (*Balaenoptera physalus*), have been recorded locally in all seasons. One sighting of humpback whale (*Megaptera novaeangliae*) has been reported in the inner Ionian and one stranding in the south part of Corfu Island because of entanglement in fishing gear[100]. A dubious record of beaked whale (*Mesoplodon densirostris*) is also available for the E. Ionian Sea. The Gulf of Corinth also holds a isolated Striped Dolphin (*Stenella coeruleoalba*) subpopulation and a Short-beaked common dolphin (*Delphinus delphis*) subpopulation confined in this semi-enclosed bay with no evidence of individuals crossing the narrow Strait of Rion which connects the Gulf to open Ionian Sea waters. These supopulations are listed endangered and critically endangered, respectively. In the Gulf of Ambracia, another isolated population of *Tursiops truncatus* of less than 175 individuals is listed as critically endangered as a result of the increasingly degraded condition of the Gulf's water quality.

Sperm whales sightings and strandings have been recorded North-West Zakynthos Island[101] and West Peloponnisos coasts[102] along the North-West Hellenic Trench. According to various studies, a small and quite discrete sperm whale population unit is found in the Hellenic Trench that ranges from the Ionian Sea to the South Cretan Sea. The Hellenic Trench is a key area (IMMA) for sperm whales in Eastern Mediterranean Sea and possibly constitutes the most important habitat in this basin. Mass strandings of sperm whales are extremely rare in the Mediterranean Sea[103] and are also infrequent reported along the eastern Ionian coast, probably cause

8 https://accobams.org/main-activites/accobams-survey-initiative-2/accobams-survey-initiative/
9 MAVA Medbycatch and Cyprus bycatch project.

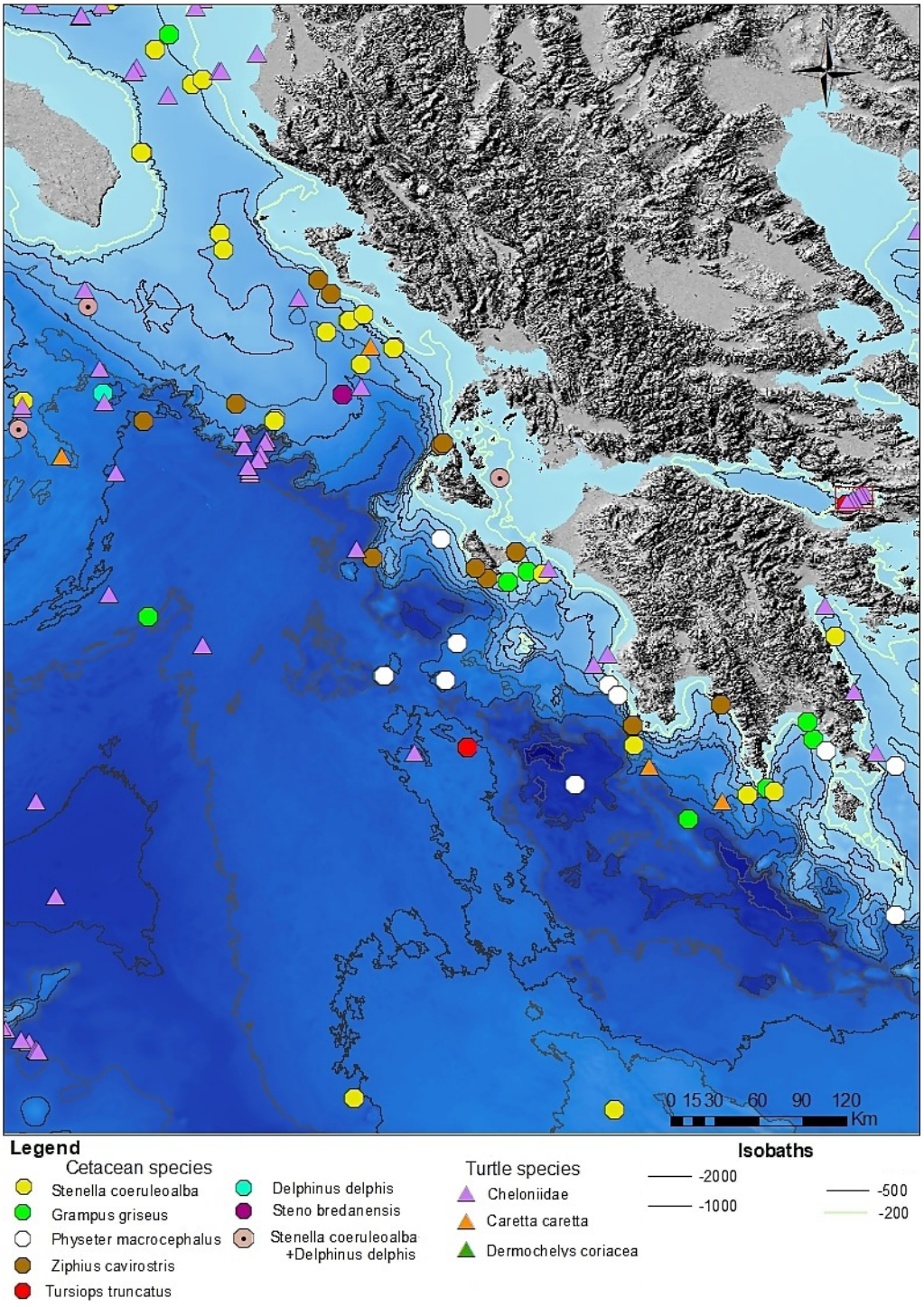


Fig. 6.9. Sightings of cetaceans and sea turtles in the Ionian Sea in offshore waters deeper than 200m. Data: ACCOBAMS Survey Initiative

by the deep seafloor morphology and wide abyssal plain that can limit risks of death. Causes of the strandings are often difficult to determine, but starvation and morbilliviruses have both been implicated in some events.

In the period 1991-2008, 1,352 strandings of deep-water cetaceans had been reported from all the Eastern Ionian Sea with eighty-two of them were Cuvier's beaked whales, while nineteen were sperm whales[100]. During the same period, 72 strandings of Cuvier's beaked whale have been recorded along the Greek Ionian and Aegean coasts, showing a mean value of 7.2 ind./year and representing the 10.7% of the total cetaceans strandings, with 37 individuals recorded in the area of E. Ionian Sea[79]. Most of the dead Cuvier's beaked whales are thought to be related to the military exercises of the Italian Navy using the military sonar, which occurred in the Ionian Sea over this

© Peer Grøndahl, Dreamstime.

Recent data provide a better significantly better understanding of the status of the Mediterranean sub-population of Striped Dolphin (*Stenella coeruleoalba*) and in 2021 is listed as Least Concern in the IUCN Red list. Striped Dolphins in the Gulf of Corinth are considered a geographically and genetically isolated population composed circa of 1,331 individuals and listed as Endangered.

period[10]. According to unofficial information, the local and apparently small Ionian population unit of Cuvier's beaked whales has suffered three stranding events in the past (plus one in east Sicily earlier) coinciding in time and space with the use of military exercises. However, the exact mortality reason of the dead Cuvier's beaked whales has never been documented.

Previous reports pointed out that the mass stranding event of Cuvier's beaked whale in Kyparisiakos Gulf in 1996, consisting of 14 animals (and reported later 16), was the first case reported in the Mediterranean Sea that was identified as being correlated in both space and time with sonar activities[104,105,106,107]. Two more mass strandings in October 1997, totalled 12 animals of Cuvier's beaked whale, took place in the same area (approximately 34 nm apart) and in the same time frame (within four days)[108]. The strandings of this species are more numerous in the Ionian Sea, than in other areas of the E. Mediterranean providing evidence of large aggregation of the species in this Sea[109]. These observations have made the Northern Ionian Sea be ranked as an area hosting preferential habitats of Cuvier's Beaked whales, implying also the need for protection of this area, at least in what it concerns military surveys.
Over the period from 2011 to 2016, a number of strandings of the cetaceans Cuvier's beaked whale (*Ziphius cavirostris*), sperm whale (*Physeter macrocephalus*) and Risso's dolphin (*Grampus griseus*) and leatherback turtle (*Dermochelys coriacea*), have been reported from the geographical area of the Eastern Ionian Sea. It has been noted here that no strandings of the above species has been reported in 2015 and none for Risso's dolphin (Fig. 6.10). This random incident cannot be attributed to certain specific causes.

Strandings have been reported from different areas of the Eastern Ionian Sea with most Cuvier's beaked whale carcasses have been found in the western and eastern coast of Corfu Island, while those of sperm whales are distributed along all the E. Ionian coasts; in Corfu (mainly in 2011), Lefkas, Paxi Islands and the south coasts of Peloponnese (Fig. 6.11).

Leatherbacks have been reported from the Ionian and the Aegean Seas, including coastal areas[110]. Overall, the species is considered very rare and sporadic in the E. Ionian while important nesting grounds of the logger-

10 http://www.pelagosinstitute.gr/gr/erevnitika_programmata/zifioi.html

head sea turtle *Caretta caretta* exist and observations of sea turtles are common[84]. In the past, leatherbacks have been reported from both regions with few strandings occasionally occurring as those reported in Korinthiakos Gulf in 2013 and in Kefallinia Island in 2016 (Fig. 6.11). Stranding events occur throughout the year with the lowest frequency occurring in spring and summer. According to the information provided by the local Port Authorities, approximately 36% of the events were attributed to unknown causes while 13.6% were human-related (fishery activity, boat strike, deliberate killing). Reference reports of bycatch are few related to drifting longline during surveys conducted during 1999-2000 and an estimated mortality rate of 4.7%[111].

Fishing bycatch of a leatherback turtle (*Dermochelys coriacea*).

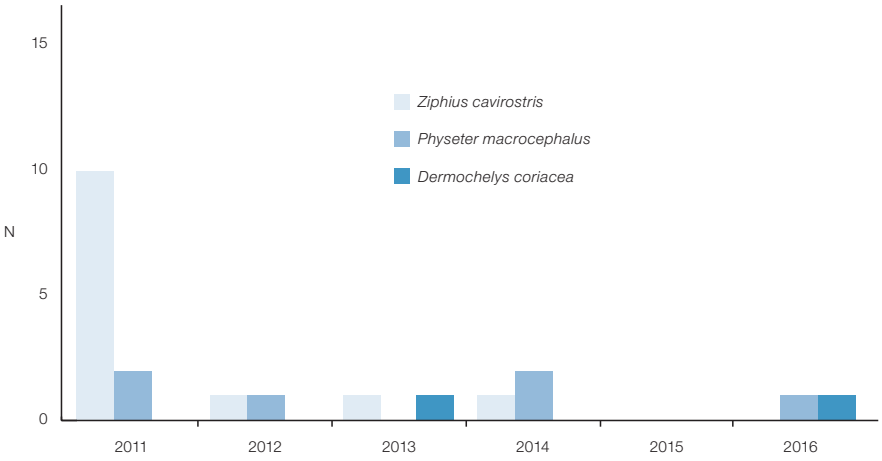


Fig. 6.10. Number of stranded Cuvier's beaked whale, *Ziphius cavirostris*, sperm whale, *Physeter macrocephalus* and Leatherback turtle, *Dermochelys coriacea* in the E. Ionian Sea during the period 2011-2016. Data source: HCMR Data base.

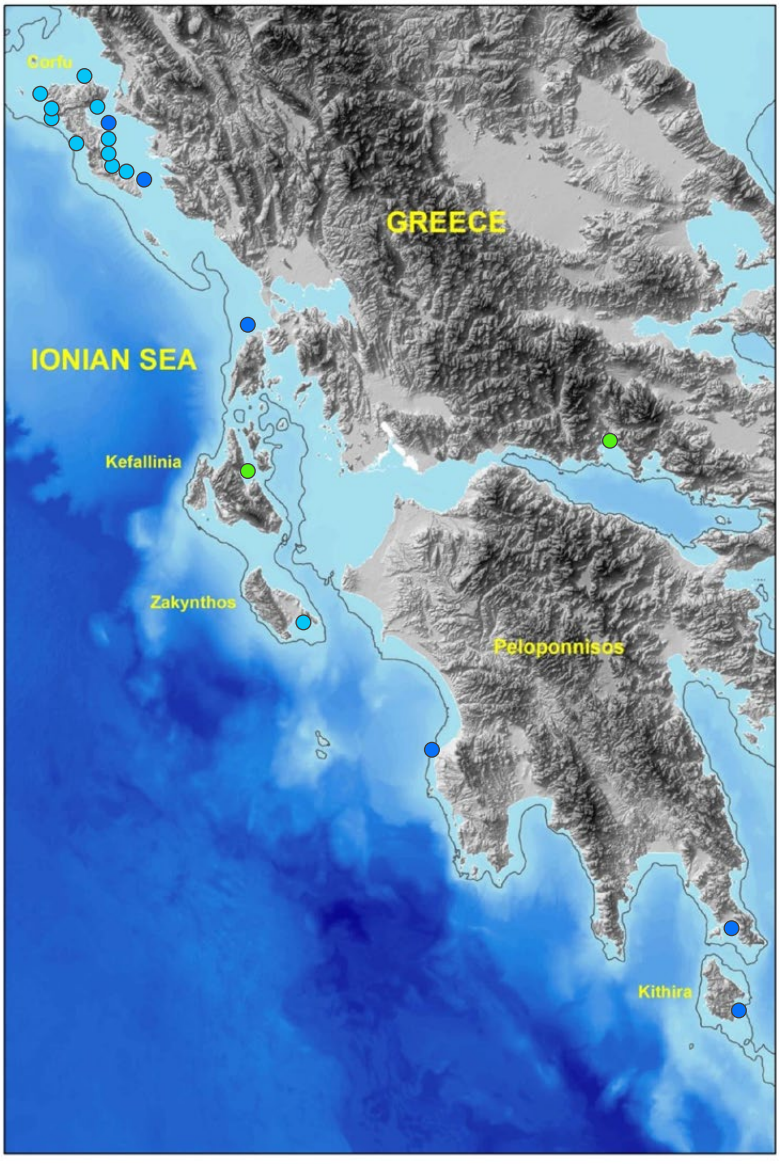


Fig. 6.11. Strandings areas of Cuvier's beaked whale, *Ziphius cavirostris* (light blue), sperm whale, *Physeter macrocephalus* (dark blue) and Leatherback turtle, *Dermochelys coriacea* (green) in the E. Ionian Sea during the period 2011-2016.

2 NORTH AEGEAN SEA

The North Aegean Sea has been stated as one of the most important areas for cetacean species in the Mediterranean. Northern Sporades, Chios and Turkish waters were identified as Important Marine Mammal Habitat due to its importance for the Mediterranean Monk Seals and Thracian Sea is delineated as an IMMA for the presence of harbor porpoises. Several Cetacean Critical Habitats (CCH) has been identified in the waters surrounding the northern Sporades, the northern Aegean Sea and the Turkish Straits system[11].

The presence of several deep-water cetaceans in the offshore waters of the North Aegean Sea is also documented by several studies involving opportunistic sighting reports, stranding records, fishing reports and hydrophone sound recordings[112,113] (Fig. 6.12). Despite the relevance of the entire region, there is only a handful of dedicated survey efforts existing in the area, with none of them consisting of a year-round effort and quantitative data on encounter rates and relative abundance, as well as distribution analyses of cetacean species for this region are still missing[100,113,114].

Sperm whales in offshore waters have been recently observed in northern Skopelos (between N. Skopelos, Sporades, and the Chalkidi peninsula) and Northern Mykonos basin as well as in the Ikaria Basin[113,115] (Fig. 6.12). The presence and distribution of the sperm whales is highly depended on prey availability, which is found at depths of 500-1,000 m[116,117], but individuals around these basins have been found as deep as 3,600m[115]. The proximity of these sites to main core habitats such as the Hellenic Trench as well as the presence of canyons and small and larger seamounts has been suggested as reasons for their presence on these waters.

Cuvier's beaked whales (*Ziphius cavirostris*) are often found in association with the sea canyons and steep escarpments. In the North Aegean region, their presence has been confirmed with acoustic surveys and field observations in the western North Aegean Through Canyons, northern Sporades to north of Lemnos Island, the Edremit Trough north of Lesbos and in the North Ikarian Basin[99,103,115,118]. The geomorphology of the North Ikarian Basin with its steep slope has been suggested to provide a suitable habitat for these whales to prey representing an important area for this rarely observed whale.

Risso's dolphin´s typical habitat is open waters offshore of North Aegean Sea and it is often found along the continental shelf and slopes as also confirmed by sightings observed off Chalkidi peninsula, the Skopelos basin and the Saronic Gulf[99]. Other no common deep-diving species such as striped dolphins and bottlenose dolphins are reported from the area. Striped dolphins are known to inhabit offshore waters from Aegean Sea and have been sighted in different locations, sometimes overlapping with the areas with common dolphins. Bottlenose dolphins are also commonly encountered along the continental shelf and in deeper waters in this region and it is known that several coastal waters in the North Aegean such as of the Gulf of Kavala, North Thassos and Foça, are important bottlenose dolphin habitats[112,119].

For the period 2011-2016, very few individuals of stranded Cuvier's beaked whale*,* sperm whales and Risso's dolphins had been found in the N. Aegean Sea (Fig. 6.13, Fig. 6.14 & Fig. 6.15). Few individuals of Cuvier's beaked whales were found stranded in Sporades and Lesvos Islands, a number higher that in previous periods 1991-2001 in the same area[79] (Fig. 6.13). Stranded Cuvier's beaked whales have also been reported off the Turkish coasts in the past[120] and in 2016, multiple strandings of another beacked whale, *Mesoplodon mirus,* were reported in Gökova Gulf and Seferihisar (southern part of the North Aegean)[121].

A small number of strandings of sperm whale are reported from the southern part of the North Aegean, north of Ikaria Island and east of Andros Island and Gokceada in the Eastern North Aegean Trough (Fig. 6.13 & 6.15). Strandings of Risso's dolphin have been found in Chalkidiki Peninsula, Gelibolu and Edremit (Fig. 6.16). According to the information provided by some local Port Authorities, approximately 88% of the events were attributed to unknown causes, while 12.5% were human-related (fishery activity) or from injuries.

11 https://accobams.org/conservations-action/protected-areas/

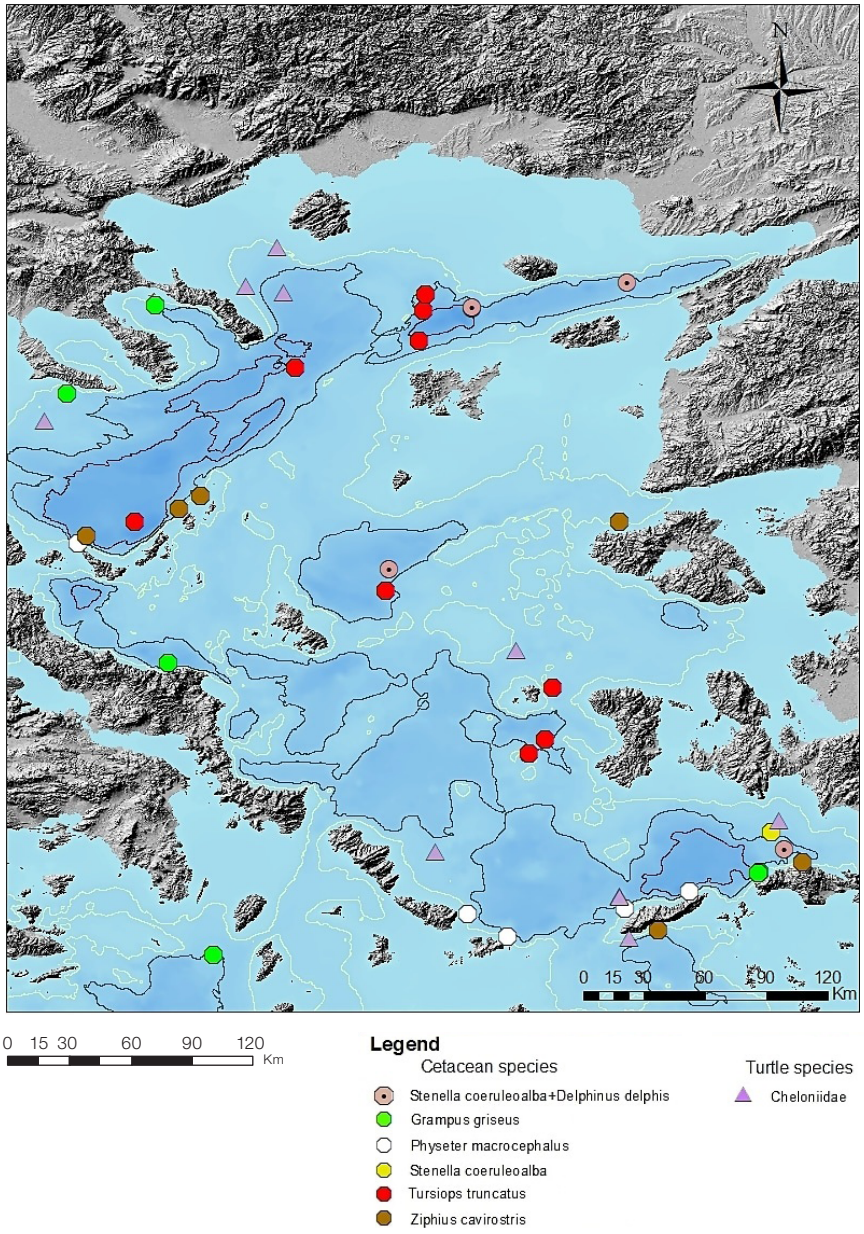


Fig. 6.12. Sightings of cetaceans and sea turtles in the North Aegean Sea in offshore waters deeper than 200 m during the Accobams survey in 2018.

In contrast to cetaceans, almost all stranded leatherbacks turtles reported in the North Aegean Sea, were recorded from Thermaikos, Pagasitikos and N. Evoikos Gulfs, Edremit Bay and Izmir Bay (Fig. 6.17). As in previous records from the area, it is worth noting that most strandings of this species were found in closed gulfs and several of them entangled in fishing gears[98,122,123]. The common occurrence of leatherback in the North Aegean Sea cannot be attributed to breeding reasons since regular nesting of the species in the Mediterranean is not known.

Is worth noting that the ambient noise levels in the Aegean Sea are highest where shipping thorough fares are geographically constrained by the complex network of islands. **Some of the noisiest areas correspond with sperm whale and beaked whale habitats**[113].

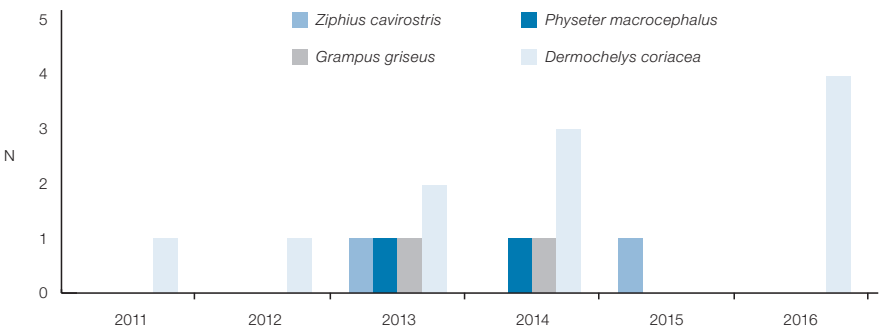


Fig. 6.13. Number of stranded Cuvier's beaked whale, *Ziphius cavirostris*, sperm whale, *Physeter macrocephalus,* Risso's dolphin, *Grampus griseus* and Leatherback turtle, *Dermochelys coriacea* in the North Aegean Sea during the period 2011-2016.

Often associated with steep slope habitats, submarine canyons and escarpments, the population of Cuvier's beaked whales, *Ziphius cavirostris* contains fewer than 10,000 mature individuals across the Mediterranean. Given its continue decline is considered as Vulnerable for the region.

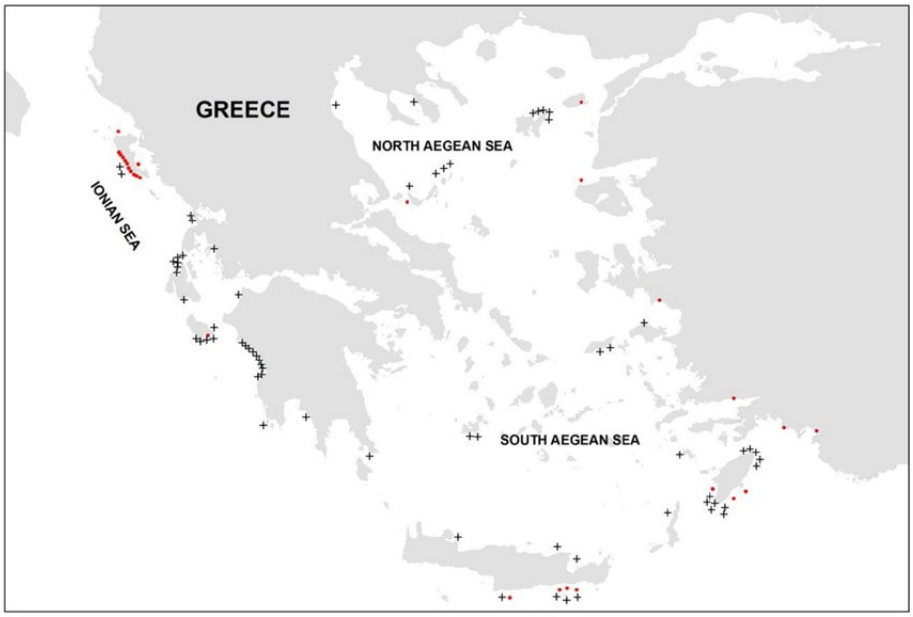


Fig. 6.14. Strandings areas of Cuvier's beaked whale in the Ionian, North and South Aegean Seas during 2011-2016 (red circles) (HCMR data). Data from [79] collected in 1991-2001 are also shown (black crosses). Source: HCMR Database and Öztürk et al (2016)[170].

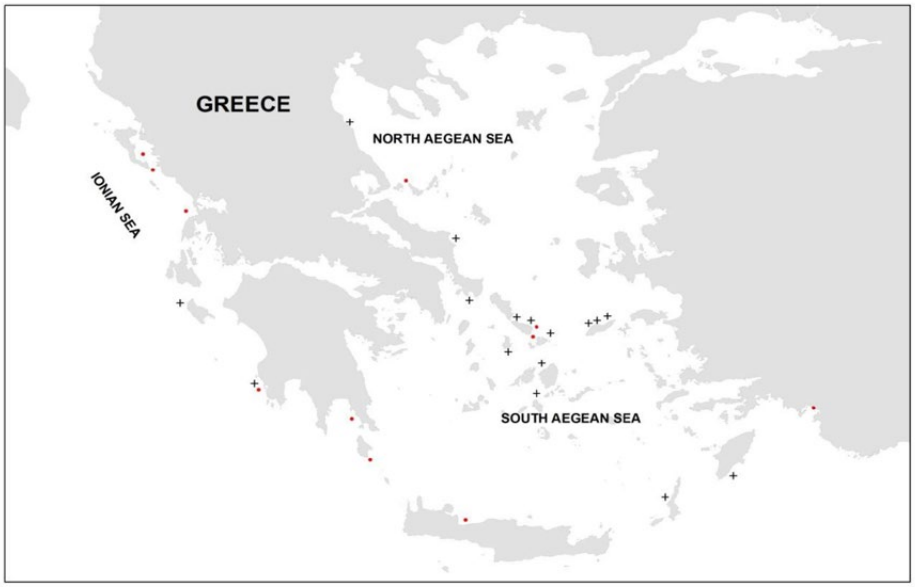


Fig. 6.15. Strandings areas of sperm whale in the E. Ionian, North and South Aegean Seas during 2011-2016 (red circles). Data from [79] collected in 1991-2001 are also shown (black crosses). Source: HCMR Database and Öztürk et al (2016)[170].

Fig. 6.16. Strandings areas of Risso's dolphin, *Grampus griseus*, in the E. Ionian, North and South Aegean Seas during the period 2011-2016 (red circles) (HCMR dataand Öztürk et al (2016)[170]). Data from [79] collected during the period 1991-2001 are also shown (black crosses).

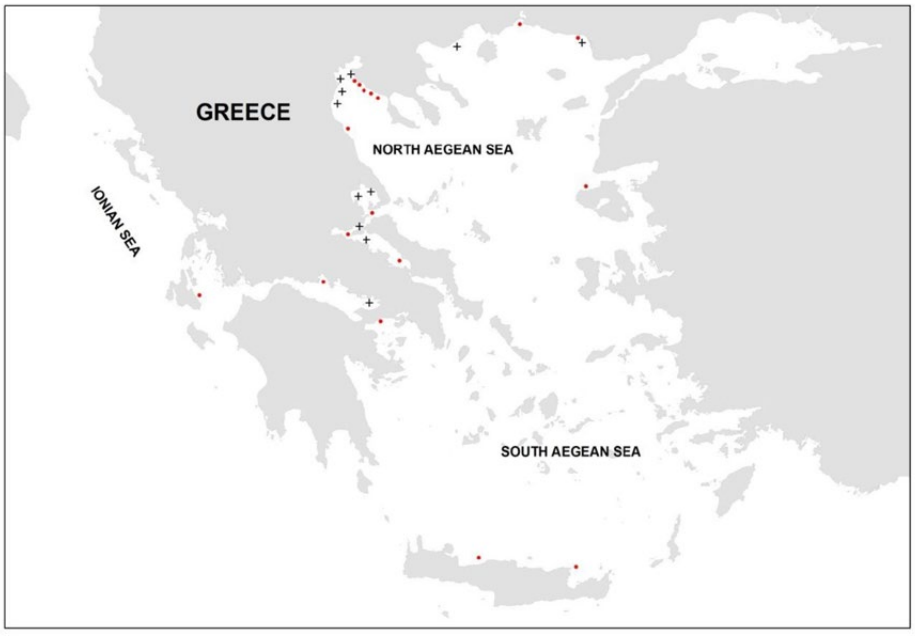


Fig. 6.17. Strandings areas of Leatherback turtle, *Dermochelys coriacea,* in the Ionian, North and South Aegean Seas during the period 2011-2016 (red circles) (HCMR data). Data from [95] collected during the period 1991-2001 are also shown (black crosses).

3 SOUTH AEGEAN SEA

In the South Aegean Sea, six species of cetaceans are known to be present year-round: striped dolphin (*Stenella coeruleoalba*), common bottlenose dolphin (*Tursiops truncatus*), short-beaked common dolphin (*Delphinus delphis*), Cuvier's beaked whale (*Ziphius cavirostris*), sperm whale (*Physeter macrocephalus*) and Risso's dolphin (*Grampus griseus*).

The Cyclades in the Central Aegean as well as the islands of Samos and Ikaria further north, have recently been listed as Important Marine Mammal Area (IMMA[12]) for the occurrence of Mediterranean monk seal and different species of cetaceans, including the common dolphin[59]. The Northern Dodecanese Archipelagos is designated as an area of interest for determining as a future candidate IMMA and designated as a Cetacean Critical Area.

Encounters with sperm whales in this region are reported surrounding the Maleas basin and South of Milos, South of Karpathos basin and southern Rhode Island towards the Levantine Sea. These observations might relate to sperm whales passing shallower waters around the Cyclades islands while traveling among underwater reliefs.

Here, the presence of Cuvier´s beaked whales has been confirmed with acoustic surveys[113] and through sightings by different surveys. Observations included their presence along the steep depressions at South Milos Island, west and northwest of Karpathos Island and in the North Cretan Sea)[13][118]. During the 2018 Accobams ASI programme, Cuvier's beaked whale were encountered in the south of Rhode Islands, South of Kasos and Nisyros, the later probably associated to the Nisyros-Tylos canyons (Fig. 6.18).

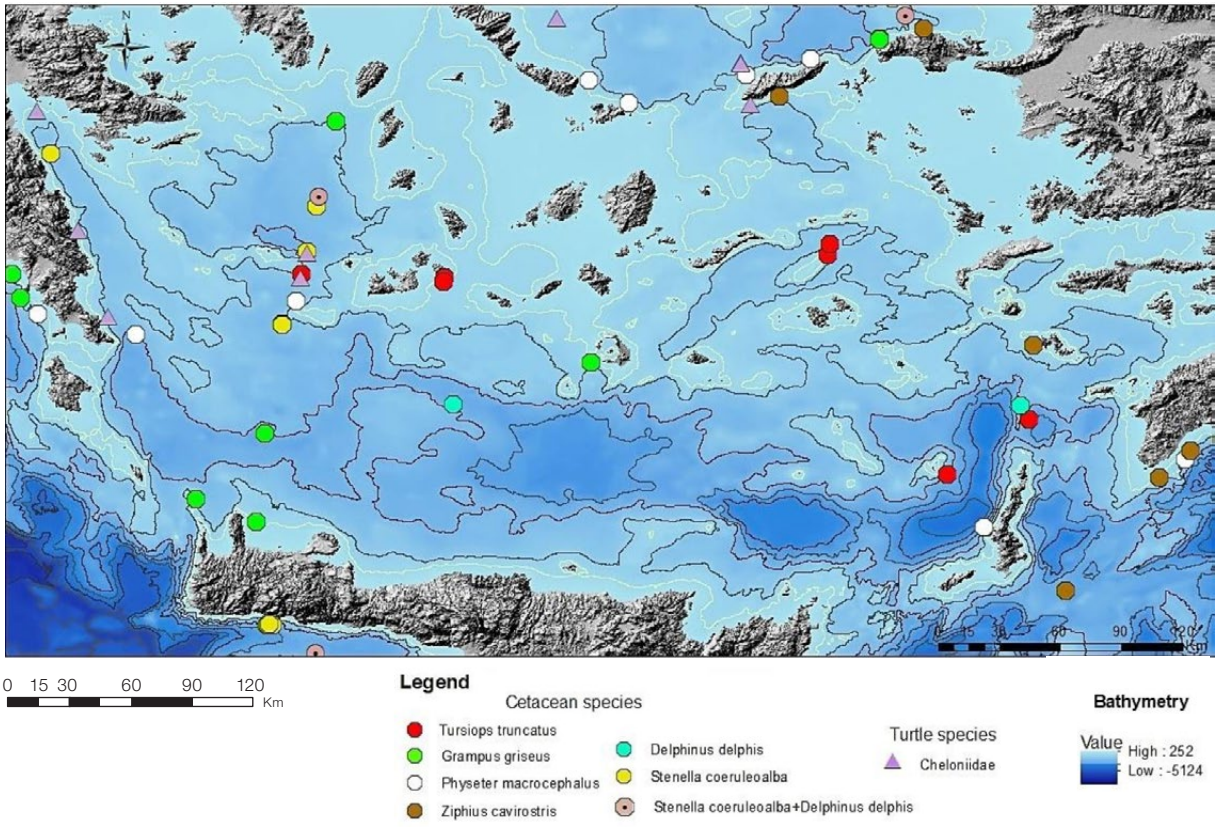


Fig. 6.18. Sightings of cetaceans and sea turtles in the South Aegean Sea in offshore waters deeper than 200 m during the Accobams survey in 2018.

12 https://www.marinemammalhabitat.org/
13 Pelagos Cetacean Research Institute, unpublished data. http://www.pelagosinstitute.gr/

Kokkari Samos Island. © Dreamstime.

In the South Aegean Sea, Risso´s dolphins are known to be relatively common from the Myrtoan Sea South (between the Cyclades and the Peloponnesos) to North-Western Crete as well as the North Aegean (Northern Sporades and Chalkidi Peninsula). There have been occasional sightings of other deep-water cetaceans such as the sighting of humpback whale (*Megaptera novaeangliae*) in Argolikos Gulf[100].

Resident species such as striped dolphins are known to be common in different offshore areas, where the water depth is greater than 500 m and less abundance at shallower areas. Common dolphins are present in both the neritic and pelagic waters of the Aegean Sea and the abundance estimates surrounding the waters south of Samos Island seems to indicate the importance of this area as a suitable habitat for the species[124,125]. Bottlenose dolphins in the other hand, occur mostly in coastal waters although they can be occasionally observed offshore including between South of Samos Island and Northern Dodecanese.

Regarding observations through stranding reports for the period 2011-2016, single stranding events had been reported for all the deep-water species every year less in 2012. Mortality events were attributed to unknown causes, while few individuals of Cuvier's beaked whale, Risso's dolphins and leatherback sea turtles were found stranded on the shore alive according to the information provided by local Port Authorities (Kapiris per.comm.).

The majority of the strandings of sperm whales over the last 30 years were found in the northern part of the S. Aegean or the southern part of North Aegean, close to North Mykonos and Ikaria Islands (Fig. 6.15). Cuvier's beaked whale strandings have been found only in Rhodes Islands as well as in the Cretan Sea, south of Ikaria Island, south of Milos Island, and Gokova Gulf; but less frequent than those observed in the Ionian Sea[79,126] (Fig. 6.14). Strandings are believed to be mostly related to military activities which have taken place in the Aegean region over the same periods. The majority of the Risso's dolphins strandings were found in S. Peloponnese and in Cyclades Islands, confirming observational distribution (Fig. 6.16).

Very limited is the occurrence of the stranded leatherbacks turtles in the S. Aegean Sea although they were more numerous than in the North Aegean Sea, with few reports in the Cretan Sea and Saronikos Gulf (Fig. 6.17).

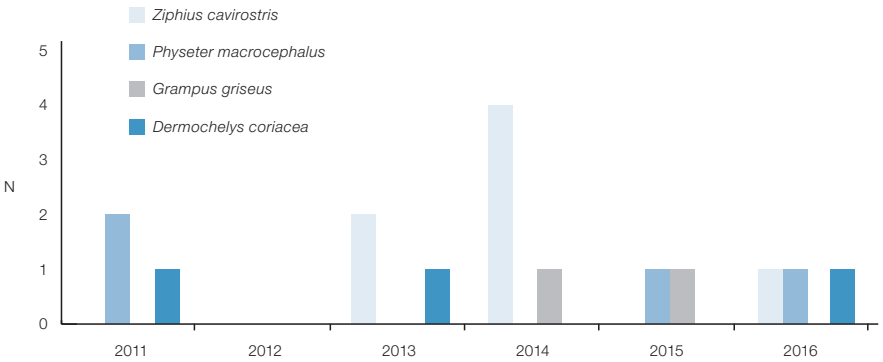
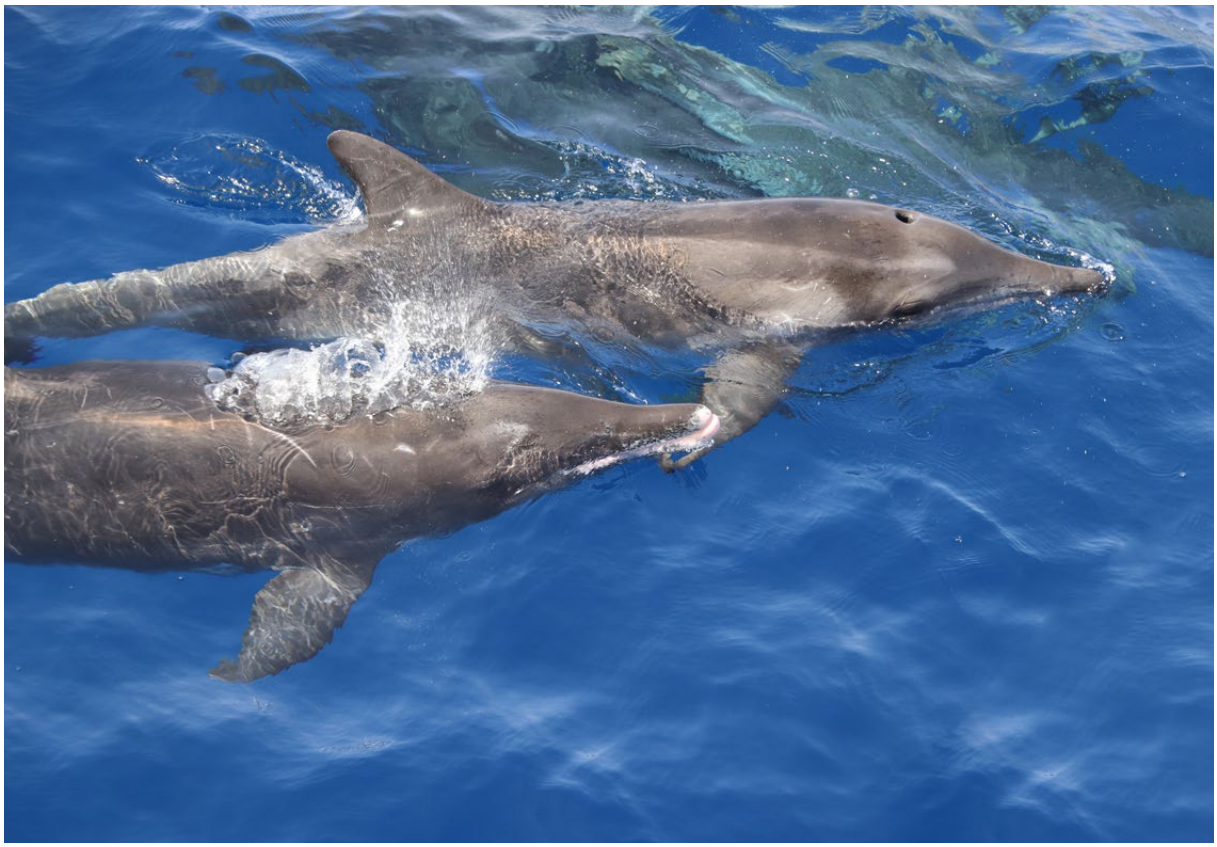


Fig. 6.19. Number of stranded *Ziphius cavirostris, Physeter macrocephalus, Grampus griseus* and *Dermochelys coriacea* in the S. Aegean Sea, during the period 2011-2016 (HCMR data).

4 LIBYAN SEA

Data from cetaceans in Libyan Sea are scarce and knowledge very uneven distributed. Its northern part, SW of Crete is part of the Hellenic Trench that runs from the Ionian Sea to the South Cretan Sea. This area is believed to be the core habitat of the Eastern Mediterranean sperm whale sub-population[127]. Population density of sperm whales in this area suggest that distribution is highly concentrated within a limited area, particularly along the 1,000 m depth contour, with lower number of individuals in both shallower and deeper waters[127]. Long-term studies along the SW of Crete have suggested that this is a consistent area of high concentrations of sperm whales where ship strike mortalities are known to have occurred (see Chapter 9, Fig. 6.20). The area is suggested as a focus for further investigation to ensure sufficient data are gathered to determine whether minor routing changes to shipping could achieve a significant risk reduction[128].

Cuvier's beaked whales have also been observed all along the Hellenic Trench, from northwestern Corfu to east Rhodos Island. The areas with the highest number of sightings are south of Crete and west to Lefkada[14], [99,118] (Fig. 6.22), coinciding with important density hotspots predicted by modelling data particularly close to the Plenny trench and off Libyan coasts of Kyrinian Peninsula[99]. A relatively increased number of Cuvier's beaked whale strandings have been found in the south part of Crete Island, during different periods, 2011-2016 (HCMR data) and 1991-2001[79] (Fig. 6.14) confirming also these observations.



The Rough-toothed Dolphin, *Steno bredanensis*, is an mid-oceanic species sighted as deep as 1,880 m in the Mediterranean. Even when residing in deep water, Rough-toothed Dolphins are considered to be surface feeders and prefers warm waters (> 22 degrees C) which during winter are restricted to the south-eastern corner of the Levant Basin, a region into which the population may retreat during the winter months.

14 Pelagos Cetacean Research Institute, unpublished data. http://www.pelagosinstitute.gr/

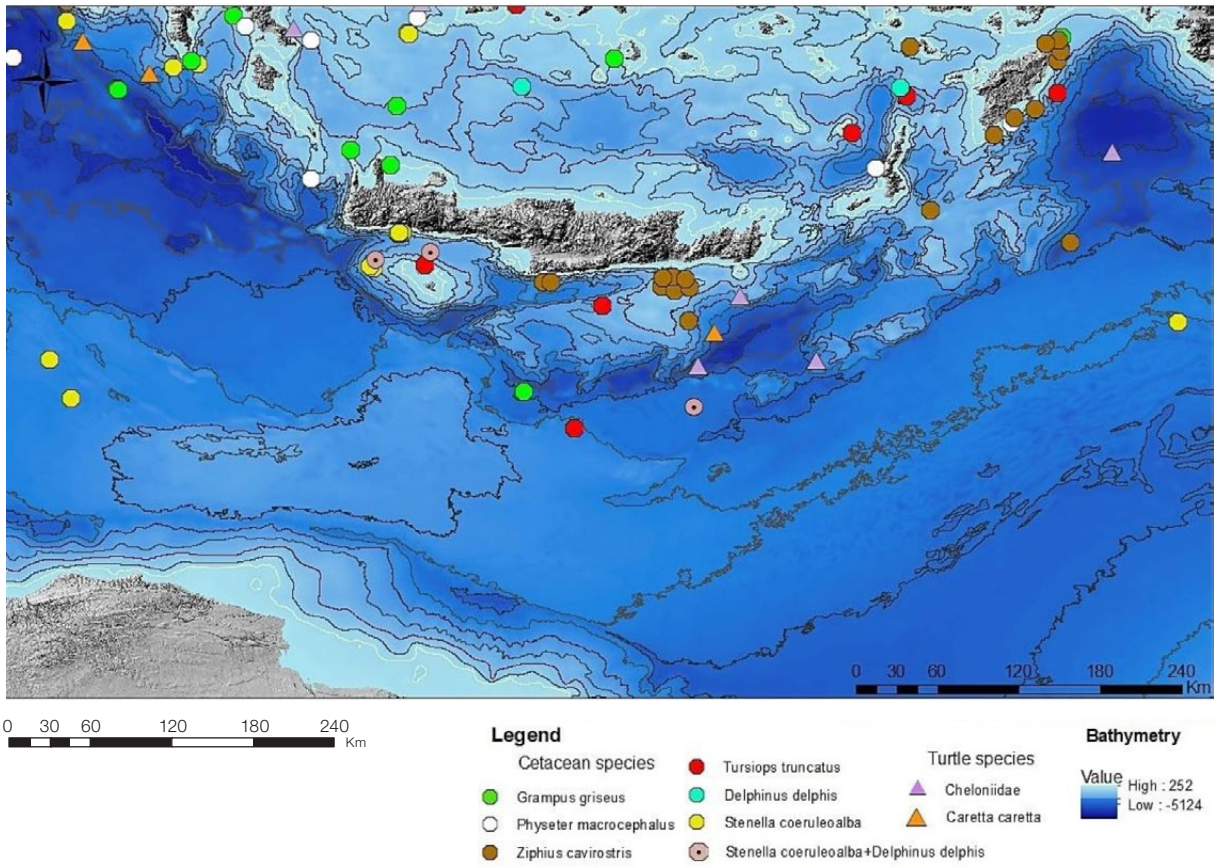


Fig. 6.20. Sightings of cetaceans and sea turtles in the South Aegean Sea in offshore waters deeper than 200 m during the Accobams survey in 2018.

Cetaceans in southern Libyan waters include sperm whales, striped dolphins and rough-toothed dolphin although cetacean studies in this subregion have been very few[99,129]. The animals are commonly regarded as "special" animals in the Libyan culture and as such, they are generally respected by fishermen and other people. Dolphins are believed to be rarely killed, even when they cause damage to fishing gear or when they reduce the catches[130]. Two recent encounters of sperm whales off Libya coast have been recently reported during the 2018 ASI cetacean observation programme[99] and several detections were also made of beaked whales near the Herodotus seamount.

The occurrence of cetacean bycatch in fishing gears along these waters in general is poorly documented but it seems to occur infrequently, possibly with purse seining, illegal pelagic drift netting use and midwater trawling. Strandings information of sperm whales are few and confirm the suggestion that the area appears to be used intermittently by this species. They are known reports in Derna (Eastern Libya) and in Ben Jawed (in the Gulf of Sirte) (Ben Amer, pers. comm[131]) while no strandings of Cuvier's beaked whales are known from this coast[61] and very limited published records of stranded Risso's dolphin are known in these waters[130].

Stranding events of the leatherback sea turtle are known to occur occasionally.

Encounters with sperm whales are reported in Fethiye on the south-western coast of Turkey.

5 LEVANTINE SEA

The Levantine Sea is home to several species of marine mammals and few that have not been reported from the western basin. Despite the lower relative abundances, the region is perhaps disproportionately important on some marine mammals considering the relatively unique assemblage of species including monk seal (*Monachus monachus*), the rough-toothed dolphin (*Steno bredanensis*), the Risso's dolphin (*Grampus griseus*) and the presence of false killer whales (*Pseudorca crassidens*) [99,113]. Among the occasional visitors could be considered the fin whale (*Balaenoptera physalus*) and the leatherback turtle reported in occasional sightings and strandings in the area[129].

Limited information is available on sperm whales strandings and sightings. Encounters with sperm whales are reported between Rhodes Island and Fethiye on the south-western coast of Turkey (in 4,485 m depth), Rhodes Basin (off E. Rhodos Island)[113], Antalya especially in the Finike Basin and Antalya Bay[132,133] and the coasts of Lebanon, Egypt and Syria[99,134,169]. Seasonally, most of these sightings are during spring and summer months (March-August 81%). Groups of sperm whales, including calves, have also been encountered off south Cyprus Island, as reported off Larnaca Marina in 2012[113,135] and in 2016 and 2017[136]. These surveys confirmed the presence of sperm whales in waters deeper than 500 m, with 83% observed in waters over 1,000 m deep. Other species such as the striped dolphins, Risso's, rough-toothed dolphins and common bottlenose dolphins had also been recorded in this region[99].

Single stranding events of sperm whales occur occasionally across this region. In Cyprus, strandings of sperm whales have been found along the south and western side as those in Fontana Amoroza in Akamas peninsula[15]. These detections are especially noteworthy as they confirmed the occurrence of sperm whales in an area where records are rare. Stranded individuals had also been found on the western Egyptian coast of Matrouh Province (in 2016[137]), off Beirut, Lebanon (coordinates unavailable) and on the Israeli coasts[134,135,138].

15 Source: 2004 Ioannis Thasitis, per.comm, March 2018; DFMR, 2017. Whales & Dolphins of Cyprus: Summary of 2016 & 2017 Research Surveys.

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The northeastern corner of the Levantine Basin and Eratosthenes seamount are considered a potential hotspot area for Risso´s dolphins, found above submarine canyons and seamounts”

Live sightings of Cuvier's beaked whales in northern Levantine waters are extremely rare. Previous to 2015, only two visual and seven acoustic reports were reported of the species from the northern Levantine Sea, over the Anaximander Seamounts off Kastellorizo Island and over the Adana Trough as well as one off Ashdod, Israel[113,135,139]. More recent observations, suggested that the area specifically between the Anaximander Seamounts, Antalya Canyon, and the Adana Trough, could be an area of importance for the distribution of Cuvier's beaked whales and that the species is regular in the area[126,140] (Fig. 6.21). Cuvier's beaked whales had also been detected acoustically off South-West Cyprus[136], and among coastal waters of Egypt and Libya in 2018[99,169].

Strandings of Cuvier's beaked whale in this region are very few and sporadic. The majority of the strandings have been reported from the Eastern Levantine coasts (Fig. 6.21;[140]), with some recent reports in Yakacik, Gazipasa, south Turkey coast (2016); Catalkoy, North Cyprus (2017) and Camyuva, Antalya (2017). Single strandings of Cuvier's beaked whales have also been reported from Cyprus in the past[107] at Akamas area, between Lara and Cape Arnaouti (2001); Agios Ermogenis Beach, Kourio (2002) (Ioannis Thasitis, pers.comm, 2018); and Agios Epiktitos (Catalkoy, 2017) in Kyrenia after apparently becoming tangled in a fishing net. In Israel shores, seven single male individuals of Cuvier's beaked whale have been stranded in 1993-2009 between March and July, none of them further south than Tel Aviv[135]. The frequency of these strandings have been made some researchers to propose that Cuvier's beaked whale within the Levantine Sea might be as regular as in the Western Mediterranean Sea[135].

There are a few sightings and stranding records of Risso's dolphins from the Levantine Sea with several records from Turkey[141], Cyprus[136] and Israel off Haifa[135,142,143,144]. Risso's dolphins encounters with several individuals and small groups had been also reported in Syrian and Egypt coastal waters during the 2018 surveys[99,169] and the species maybe present off Lebanon as other Levantine areas where research effort has been low or nil.

Presence of Risso's dolphins have been recorded with acoustics (associated with *S. coeruleoalba* individuals) in a depth of more than 2,000 m offshore over Anaximander mountains[132] and the south-eastern region of Cyprus at more tan 1,000 m depth[136]. Even though there is no evidence for reproduction in the area, the species is considered among the regulars of the Levantine Basin[135] and **the northeastern corner of the Levantine Basin and Eratosthenes seamount is considered a potential regional hotspot area for these cetaceans**[135].

Records of single strandings of Risso's dolphins are from Turkey - as bycatch of the swordfish fishery in the Fethiye region[145]; Cyprus - in Faros Beach, Pervolia (2010) and Fontana Amoroza, Akamas (2010; Ioannis Thasitis, pers. comm, March 2018); Libya[130], Lebanon[146], Israel[135,147] and none in Syria[148] or Egypt[136,137].

As in the Western Mediterranean, it has been reported that the species **frequent waters above submarine canyons and seamounts**[149].

Regarding the leatherback sea turtles, local fishers report that they occasionally encounter them during fishing operations in different areas[97,150]. There have been a few records of incidental catches of leatherbacks in Cypriot waters, mainly on long lines and trammel nets[151], commercial trawlers off Israel[97], in Libyan waters in Tripoli, near to Palm Island (2006), trammel nets in Syria close to Jableh town[96] as well as confirmed cases around Turkish waters with some individuals tagged and released into the sea (Mersin Bay;[151,152]). Leatherback turtles frequent Egyptian waters, though this is the rarest among the sea turtles species occurring in the area[153,154]. Sporadic occurrences of leatherback sea turtle of up to two observations/year regularly, are recorded in Israeli waters and several publications refer to the presence of marine turtles in Syrian waters, namely south of Lattakia[155,156,157].

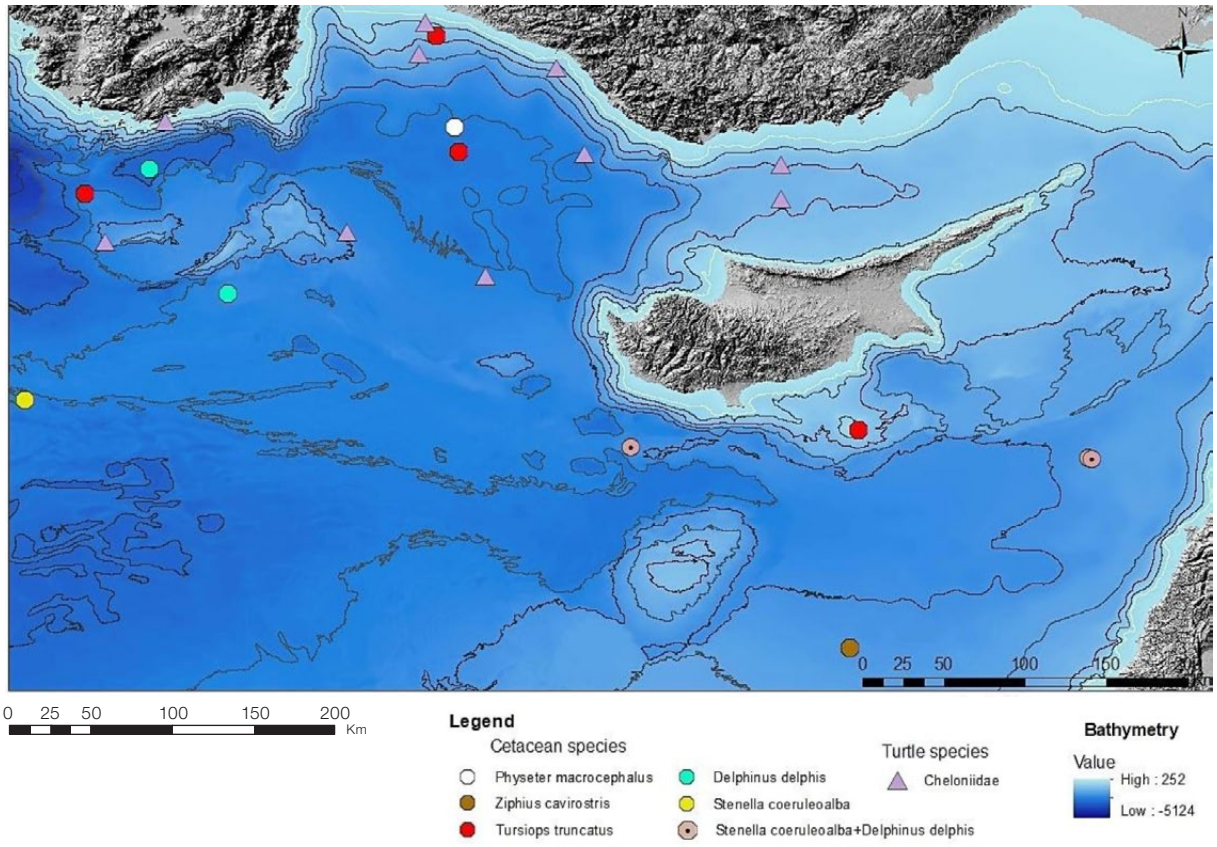

Fig. 6.21. Sightings of cetaceans and sea turtles in the Levantine offshore waters deeper than 200 m.

Stranded records are few around this coast, including in the southeastern Turkey Anamur-Bozyazı Highway, Adana and Balıkesir[125,161,165].

GENERAL CONSIDERATIONS

The present work present a brief summary on deep-water cetacean and sea turtle populations in the E. Mediterranean Sea to identify gaps and weaknesses in our present knowledge, particularly on their spatial distribution. Without information such as species composition, size and distribution of deep-water cetacean and sea turtle populations and habitats is difficult to develop effective conservation measures. Cetaceans and sea turtles travel across borders as migratory species and both regional and global efforts, are needed to study, monitor, manage and protect these animals. The available information seems to clearly indicate that in the eastern Mediterranean. Generally, information on the cetacean species occurring in and off the Syrian, Lebanon and Egypt waters is extremely scarce and limited to a handful of stranding and sighting records.

A number of Marine Protected Areas (MPAs) of different types, sizes and purposes have been established in several Mediterranean countries including in the Eastern Mediterranean, but specific measures for cetacean conservation are rarely included in their management plans. Moreover, several cetacean species are known or suspected to make long-range movements, and their presence may vary on a seasonal or annual basis. In these cases, the present MPAs in the Eastern Mediterranean may not represent the most effective conservation strategy to protect these deep-diving cetaceans, although they can help to protect ecologically important portions of their range.

In the eastern basin, sperm whales are predictably present along the Hellenic Trench (from the Ionian Sea to the South Cretan Sea), south of Rhodes Island and along the Turkish coast as far as the western part of Antalya Bay. They are also present off west and south Cyprus, and in the Aegean Sea, north of the Cyclades

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Further studies are necessary to complete the information needed to address conservation actions of these charismatic species that frequent deep-sea environments”

Islands and in the Ikaria basin. The Rhodes Basin has been recognised as an important region for sperm whales in a recent review[133] and has been proposed by some authors as a High Sea Marine Protected Area in part due to its importance for sperm whales[162]. Findings presented here lend credence to the notion that the Rhodes Basin is ecologically important for sperm whales, perhaps linked to the concentration of nutrients by the quasi-permanent Rhodes Gyre, making it the most productive area of the eastern basin with the largest phytoplankton biomass[163]. Sperm whales were also detected on several separate occasions in the Ikaria Basin, a region where sperm whales have been documented on at least four other occasions between October 2004 and November 2012[133]. Large portions of what is likely critical habitat for sperm whales remain unexplored (e.g., Rhodes Basin, the Egyptian EEZ), or still fall outside any type of protective regime (e.g., south-western Turkey). Those that have been established vary highly in the effectiveness of the protective measures deployed and enforced, which is challenging for pelagic waters. Nonetheless, the establishment of a network of genuinely protected areas, decrease noise and interaction with maritime traffic and the increase enforcement of the prohibition of pelagic driftnets across the basin should be important conservation goals for this species.

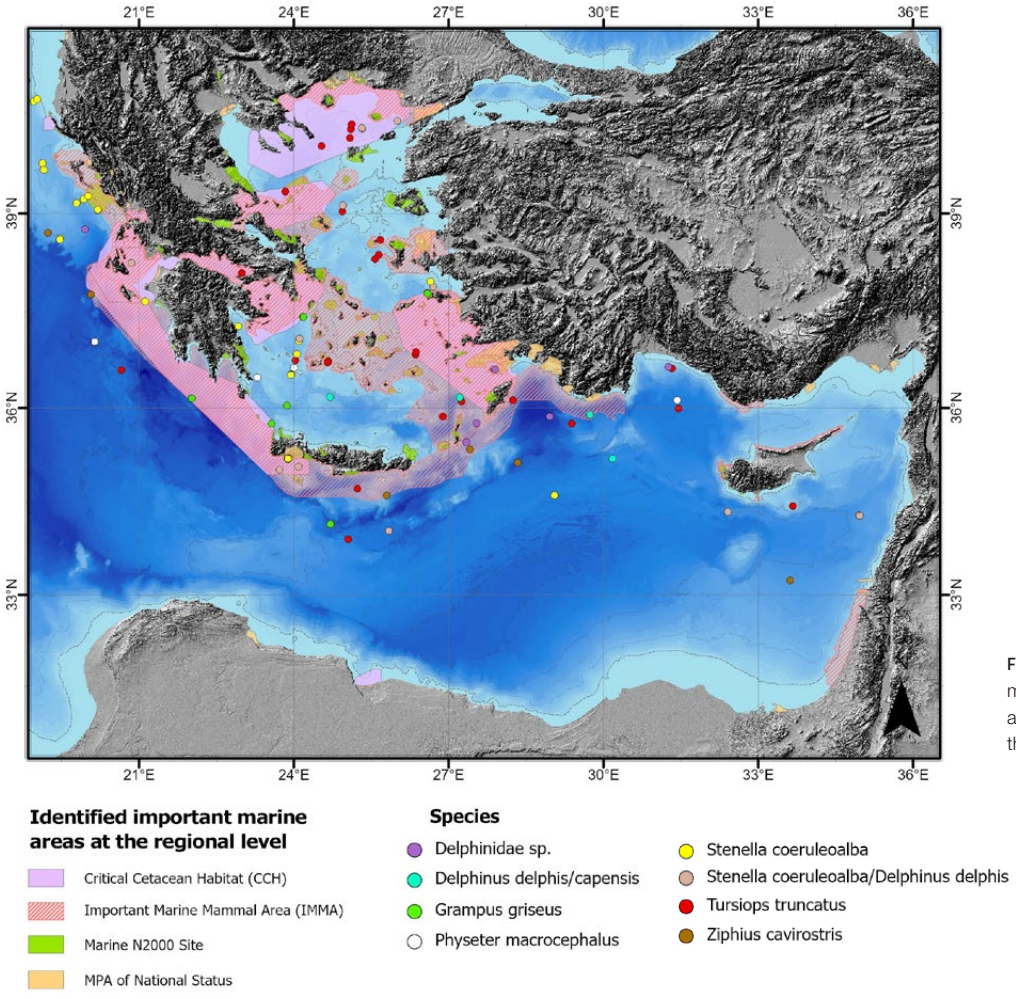

Fig. 6.22. Identified important marine areas at the regional level and sightings of cetaceans in the Eastern Mediterranean.

Further research effort is required to detect the seasonal use of the different sub-regions by sperm whales as all documented sightings have occurred between July and November; yet, it remains unclear if this is due to an effort bias. The occasional presence in Egyptian and Syrian´s waters call for further research and precautionary measures.

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Ikaria and Rhodes basins could be areas to consider special attention for the sperm whale protection”

The northern Levantine Sea and precisely between the Anaximander Seamounts, Antalya Canyon, and Adana Trough, is considered to be an area of importance for the distribution of Cuvier's beaked whales[140]. The present review showed that areas such as the E. Ionian (northern and central), the Hellenic Trench south of Crete, North Ikarian Basin and Anaximander Seamounts among other small locations are important areas of sightings and strandings for this species. Taking into account that the strandings coincide with the areas of high concentration of Cuvier's beaked whales (*Ziphius cavirostris)* these hotspot areas should receive special attention in terms of the species protection.

Risso's dolphins have also well-known strong habitat preferences for slope areas and the **creation of a network of cetacean sanctuaries for deep-water and coastal cetaceans in the Eastern Mediterranean as for example along the southern part of the Eastern Ionian Sea (Hellenic Trench)** will offer protection of critical habitats for a number of endangered and vulnerable cetacean species.

The promulgation and implementation of good management plans for the conservation of these species should be an important priority, despite the existing gaps regarding their population status. The emphasis should be on improving our existing knowledge and

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Spatio-temporal measures including MPA designation sites, to reduce underwater noise and military exercises are needed at least in hotspot areas of both sperm whales and Cuvier' s beaked whales occurrence”

creating a more integrated approach to marine activities around the Eastern Mediterranean. Generally speaking, the management can be improved by:

- Enforcing the existing national and international legislation on protection
- Increasing efforts to identify and establish any possible conservation areas that cover the full range of resident or frequently visited sites for these marine mammals and sea turtles
- Taking inventories to assess abundance and changes over time and to allow potential problems to be identified well in advance
- **Mitigate** mortality due to ship strikes by addressing measures to reduce ship velocity in areas overlaping with intense traffic and lanes as well as limiting the spread and intensity of noise by adapting vessels and other marine operational procedures
- **Mitigate** noise resulting from use of military sonars and seismic surveys.
  - Developing a comprehensive outreach and education strategy to promote responsible viewing of wild mammals by tourists and commercial marine operators, particularly in coastal waters
  - Identifying and implementing other specific measures, such as the study of the interactions between the fishery and their presence. If locations of repeated bycatch of cetaceans or sea turtles occur, test and adopt spatio-temporal technical measures for environmental friendly static nets and long lines, that can promote the avoidance of the sea turtle or cetacean entanglement on them.
- Reduce inputs of particular pollutants, including plastics.

CHAPTER 6/

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