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An Inventory of Some Relatively Large Marine Mammals, Reptiles, and Fishes Sighted, Caught, By-Caught, or Stranded in the Mediterranean Coast of the Gaza Strip-Palestine

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Abstract

The Mediterranean Sea is home to an interesting biodiversity. The current cumulative and descriptive study aims to enumerate some relatively large marine mammals, reptiles, and fishes that have been spotted, caught, by-caught, or stranded on the coast of the Gaza Strip, Palestine, which extends about 42 km

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along the Mediterranean Sea. This 20-year study from 2003 to 2022 relied much on frequent field visits, meetings, and discussions with stakeholders, following local media sites and social media pages, and photography. The study recorded at least 26 giants or relatively large marine organisms on the Mediterranean coast of the Gaza Strip, Palestine. Certainly, the coming years may bring other marine organisms of relatively large sizes. Marine mammals included three species of cetaceans with the Fin Whale (*Balaenoptera physalus*) being the largest mammal and even the largest animal ever recorded in this study. Marine reptiles included three species of sea turtles, the largest of which is the Leatherback Sea Turtle (*Dermochelys coriacea*), which is in fact the world's largest sea turtle. The bony fishes were represented by ten species, the largest of which was the Ocean Sunfish (*Mola mola*), which is the largest bony fish in the world. The cartilaginous fishes included ten species with the largest specimens encountered were the Shortfin Shark (*Isurus oxyrinchus*), Bluntnose Sixgill Shark (*Hexanchus griseus*), Scalloped Hammerhead Shark (*Sphyrna lewini*), and Giant Devil Ray (*Mobula mobular*). Seabirds were not included in the study. The Alexandria Pompano (*Alectis alexandrinus*) and the Silver-Cheeked Toadfish (*Lagocephalus sceleratus*), which are bony fishes, appear to be the relatively smallest marine organisms recorded here. In conclusion, the role of the various parties must be coordinated to ensure the sustainability of human activities and their compatibility with the task of conserving local marine biota, including the gigantic or relatively large ones.

Keywords

Mediterranean Sea, Marine Biodiversity, Marine Mammals, Sea Turtles, Bony Fishes, Cartilaginous Fishes, Gaza Strip, Palestine

1. Introduction

The Mediterranean, bordered by Europe to the north, Asia to the east, and Africa to the south, and connected to the Atlantic Ocean by the 14-kilometre-wide Strait of Gibraltar, is a nearly enclosed basin harboring an important diversity of marine vertebrates and invertebrates [1]. There have been numerous studies, reports, and research dealing with the forms of wildlife and biodiversity in the Mediterranean, including marine mammals, sea turtles, and fishes, both bony and cartilaginous. Those studies presented in their content many giants and relatively large marine organisms that are sighted, caught by different fishing gear or incidentally fall into fishing nets and methods, or are stranded alive or dead on the shores of the Mediterranean [1] [2]. For example, the Ocean Sunfish (*Mola mola*), which is an inedible species in most of its occurrence waters, was caught or incidentally by-caught in the Mediterranean waters [3]-[8]. Several global and regional studies have shown the sighting, fishing, or stranding of many marine mammals, reptiles, and fishes of relatively large sizes. In a comprehensive approach, Bariche [1] prepared a field identification guide for the living marine

creatures inhabiting the eastern and southern Mediterranean Sea. Of course, many giant marine organisms were mentioned in this important guide to the Mediterranean region. Silvani *et al.* [5] studied the incidental catches of marine biota, including relatively large creatures, by the Spanish driftnet fishing in the western Mediterranean Sea.

With regard to marine mammals, work on cetaceans appears to be abundant in many countries of the Middle East. Goffman *et al.* [9] highlighted the cetacean fauna prevailing on the Israeli coast of the Mediterranean Sea. Brand *et al.* [10] investigated the dietary habits of Common Dolphins occurring in the southern neritic waters of Israel. Shoham-Frider *et al.* [11] investigated the trace elements found in tissues of rarely stranded cetacean species along the Israeli Mediterranean coast. Bearzi [12] prepared an action plan for marine mammals prevailing in Israel in the period enclosed between 2017 and 2022. Kerem *et al.* [13] updated the cetacean fauna occurring in the Mediterranean Levantine basin. More recently, Mevorach *et al.* [14] studied in detail the dynamics of the critically endangered population of the Short-Beaked Common Dolphin (*Delphinus delphis*) in Israel. In Türkiye, Dede *et al.* [15] reported on seeing several species of baleen and toothed whales in the eastern Mediterranean during a cruise in 2008. Kasparek [16] recorded the False Killer Whale (*Pseudorca crassidens*) as a new whale species in the Syrian Mediterranean waters. Henda-Benrekaa and Moulaïb [17] worked on cetacean strandings on the Algerian coast. Frantzis *et al.* [18] denoted the Humpback Whale (*Megaptera novaeangliae*) occurrence in the Mediterranean Sea. Authier *et al.* [19] studied the actions needed for cetacean conservation in the Mediterranean and Black Seas. Work on marine reptiles is of great importance due to the conservation status of sea turtles worldwide. Casale [20] studied the different species of sea turtles occurring in the Mediterranean Sea in terms of distribution, threats, and conservation priorities. Canbolat [21] reviewed the nesting activity of sea turtles along the Mediterranean coast of Türkiye. Barreiros and Barcelos [22] focused on plastic ingestion by a Leatherback Turtle (*Dermochelys coriacea*) as the largest sea turtle worldwide. Casale *et al.* [23] assessed the best approaches for assessing debris ingestion in sea turtles occurring in the Mediterranean Sea.

As far as bony and cartilaginous fishes are concerned, the studies in Middle East countries are escalating day by day. Abdul Malak *et al.* [2] studied the various fishes inhabiting the Mediterranean Sea. Bilge *et al.* [24] and Bilecenoglu *et al.* [25] surveyed the ichthyofauna of Türkiye and gave some beneficial notes on some relatively large fishes. FAO [26] presented the state of fisheries in the Mediterranean and Black Seas. Golani [27] updated the checklist of fishes existing in the Mediterranean waters of Israel, with particular emphasis on some Lessepsian migrants. Goren and Galil [28] reviewed the impact of invasive fish species on fish assemblages in Levantine inland and marine ecosystems. Al-Hassan and Al-Silini [29] shed light on various bony fishes, including giant individuals and species, which were collected from the Mediterranean coast in Benghazi, Libya. Houghton [30] investigated the distribution, abundance, and behavior of the

Ocean Sunfish (*Mola mola*), the largest bony fish worldwide, in the Irish and Celtic Seas. Akyol *et al.* [31] investigated the drift-net fishery for Swordfish (*Xiphias gladius*), which is a relatively large and strange bony fish, in the Aegean Sea which is connected to the Mediterranean Sea. Bariche *et al.* [32] surveyed the native and Lessepsian herbivorous fishes prevailing on the Lebanese Mediterranean coast.

Ferretti *et al.* [33] sounded the alarm about the huge sharks that have become threatened and may have been lost from the waters of the Mediterranean. Canese *et al.* [34] investigated the diving behavior of the Giant Devil Ray (*Mobula mobular*) as an endangered cartilaginous fish species in the Mediterranean Sea. Hemida *et al.* [35] gave considerable info on the captures of the Giant Devil Ray (*Mobula mobular*) off the Mediterranean coast of Algeria. Abdulla [36] studied the sharks in the Mediterranean Sea in terms of status and conservation status. In Istanbul-Türkiye, Başusta *et al.* [37] wrote the proceedings of a workshop on Mediterranean cartilaginous fishes with a focus on the southern and eastern Mediterranean. Golani [38] surveyed the cartilaginous fishes of the Mediterranean coast of Israel, of which 57 species were extant (31 sharks, 25 skates and rays, and only one species of Chimaera). He highlighted Honeycomb Stingray (*Himantura uarnak*) as a Red Sea species. Ariel and Barash [39] surveyed the sharks and rays prevailing in the Israeli Mediterranean waters. Lteif [40] studied the biology and ecology of the cartilaginous fish recorded along the Lebanese coast in the eastern Mediterranean. Moore [41] investigated the extinction risks and conservation actions toward Guitarfishes as unique cartilaginous fishes. Mancusi *et al.* [42] worked on the data collection regarding the large Elasmobranches inhabiting the Mediterranean and Black Seas.

Some scientific reports and articles have found their way to the Mediterranean Sea in the Gaza Strip describing some of its vertebrate biodiversity. The Ministry of Environmental Affairs (MEnA) [43] noted in its report some marine organisms that inhabit the marine environment of the Gaza Strip, such as fishes, turtles, and marine mammals. Abd Rabou *et al.* [3] and Abd Rabou [44] dealt with the threats facing the marine environment and fishing in the Gaza Strip and pointed to some important marine organisms that fall into fishing nets, especially Ocean Sunfishes (*Mola mola*) and sea turtles, which are among the giant and relatively large sea creatures in the world. Shaheen [45] and Abu Amra [46] carried out two M.Sc. dissertations and referred to marine fish species prevailing in the Gaza Strip and noted some species with relatively large sizes and weights. Abudaya *et al.* [47] indicated that the cartilaginous Giant Devil Ray (*Mobula mobular*), which is indigenous to the Mediterranean Sea, is listed as an endangered species by the International Union for Conservation of Nature (IUCN) and the Gaza Strip is the only area where this species is targeted.

Abd Rabou [48] studied the health risks of the invasive Silver-Cheeked Toadfish (*Lagocephalus sceleratus*) in the Gaza Strip. Bariche *et al.* [49] documented the occurrence of the Sohal Surgeonfish (*Acanthurus sohal*) and the Reef Stonefish (*Synanceia verrucosa*) as exotic ichthyofauna in the marine ecosystem of the

Gaza Strip. Abd Rabou *et al.* [50] studied the cetacean fauna by-caught or stranded along the Mediterranean coast of the Gaza Strip. They pointed out that three cetacean species were recorded since the 1980s. Al-Mabruk *et al.* [51] gave more data on the Narrow-Barred Spanish Mackerel (*Scomberomorus commerson*) occurring in the Mediterranean waters of both Palestine and Libya. Abd Rabou *et al.* [4] carried out a modest study on the Ocean Sunfishes (*Mola mola*) by-caught off the Mediterranean coast of the Gaza Strip. Although the Gaza Strip (365 km^2) is a small piece of land lying on the southwestern coast of Palestine on the Mediterranean Sea, its 42 km coast experienced from time to time the catch and stranding of giants or relatively large mammals, reptiles, bony fishes, and cartilaginous fishes. The key aim of this study is to provide information on the giant or relatively large mammalian, reptilian, and fish fauna sighted, caught, by-caught, or stranded on the Mediterranean coast of the Gaza Strip, Palestine. This study is a unique addition to the knowledge of the Palestinians about their unique marine resources of relatively large sizes in the Mediterranean marine waters of the Gaza Strip.

2. Materials and Methods

2.1. The Gaza Strip

The Gaza Strip (31˚25'N, 34˚20'E) is an arid to semi-arid strip of the Palestinian land along the southeastern Mediterranean (**Figure 1**), having an area of about 365 km^2 [43], and a recent population of about 2.3 million, of whom the majority are United Nations-registered refugees. The Gaza Strip is one of the most densely populated places in the world [52]. It has a total number of at least 3500 fishermen working on more than 1000 fishing vessels of different sizes and capacities. The total production of fisheries resources is about 3480 tons per year [48]. The accessibility and exploitation of Gazan fishermen to the fluctuating fishing area are often governed by the Israeli occupation. The Directorate General of Fisheries, Ministry of Agriculture, is the competent, responsible, and authorized authority to ensure the maximum utilization of fishery resources in the Palestinian Territories [48].

2.2. Procedure

The current study is cumulative and descriptive in its style, extending for 20 years starting from 2003 to 2022. During this long period of time, frequent field visits have been carried out to the coast of the Gaza Strip which extends about 42 km along the Mediterranean Sea. Particular visits have been conducted to the Gaza Fishing Harbor and fish markets (Dalalah Market or Al-Hisba) in an attempt to investigate the different marine biota (**Figure 2**). Meetings and discussions with the staff of the Directorate General of Fisheries, Ministry of Agriculture and Gazan fishermen have been carried out to fill the gaps needed in data collection concerning the marine fauna, of which the giant or relatively large creatures is a capital part. During the study period, data have been gathered from

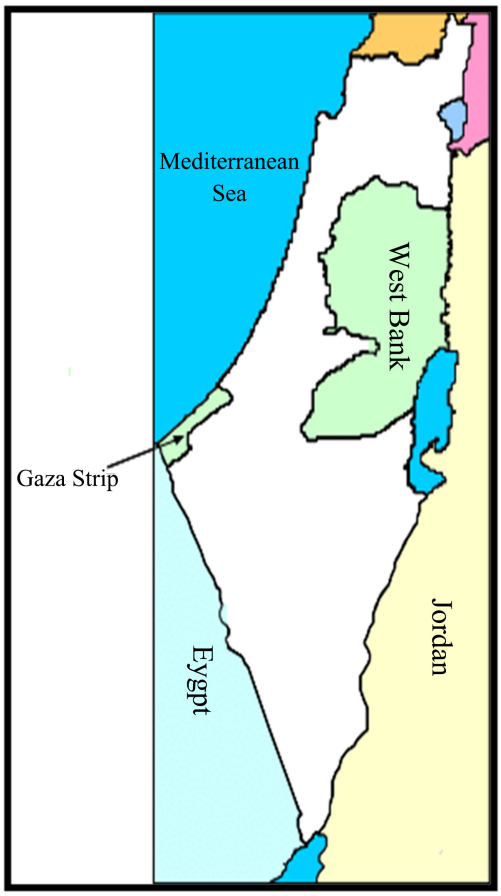

Figure 1. Location of the Gaza Strip at the southwestern corner of Palestine.

Figure 2. Visits to the Hisba fish market in Gaza City to identify relatively large species of marine organisms, especially fish.

the stakeholders regarding the sighting, stranding, catch and bycatch of such creatures. In addition, the local media and social media reports regarding the

giant or relatively large marine creatures have been chased and reviewed by the authors. In certain circumstances, the authors have been able to take approximate measurements and available notes on some caught, by-caught or discarded specimens. Finally, professional digital cameras have been used throughout the study period and photos have been taken for documentary and confirmatory purposes.

3. Results

The current study is characterized as a cumulative and descriptive work spanning 20 years, starting from 2003 to 2022. The study recorded at least 26 marine organisms considered giant or relatively large among the biodiversity of the Mediterranean coastal waters of the Gaza Strip. Of course, the coming years may witness other records of other giant or relatively large creatures. The current study focused on giant organisms that are seen in the sea, caught or incidentally dropped into fishing gear, or stranded alive or dead on the seashore in the Gaza Strip. The marine organisms here included three species of cetaceans (Class Mammalia), three species of sea turtles (Class Reptilia), ten species of bony fish (Class Osteichthyes) as well as ten species of cartilaginous fish (Class Chondrichthyes) as shown in **Table 1**. Due to the nature of the study and poor follow-up of seabirds, bird fauna (Class Aves) was not included in the current study. The Fin Whale (*Balaenoptera physalus*) is the largest organism ever recorded, while the Alexandria Pompano (*Alectis alexandrinus*) and the Silver-Cheeked Toadfish (*Lagocephalus sceleratus*) appear to be the relatively smallest of the organisms encountered.

3.1. Marine Mammals

The current study recorded the occurrence of only three species of marine mammals as eye sightings during the sea outings of Gazan fishermen or strandings on the beach (**Figure 3**). The species were the Fin Whale (*Balaenoptera physalus*), the Common Bottlenose Dolphin (*Tursiops truncatus*) and the Short-Beaked Common Dolphin (*Delphinus delphis*). Thus, the Fin Whale is the largest marine creature that the Gaza Strip has witnessed up to this moment. The following paragraphs provide important information about the registered species.

Fin Whale (*Balaenoptera physalus* Linnaeus, 1758)

Over the past two decades, Gazan fishermen have encountered very few baleen whales that have been seen diving into the open sea or stranded dead on shore. At least two of the strands have been identified as Fin Whales (*Balaenoptera physalus*). The Fin Whale is the second largest animal on Earth after the Blue Whale (*Balaenoptera musculus*) and is one of the fastest whales. It is considered a cosmopolitan species in the sense that it is found in the oceans of the entire world. It has a long, slender, gray body and feeds on flocks of small fish, squid and crustaceans. Despite the relative smallness of the specimen of the Fin

Table 1. A list of the most important relatively large sea creatures sighted, caught or stranded in the Mediterranean coast of the Gaza Strip, Palestine.

Order	Family	Scientific Name	Common Name	Arabic Name
Class: Mammalia (طائفة الثدييات)				
Cetacea	Balaenopteridae	*Balaenoptera physalus*	Fin Whale (Finback Whale)	الحوت الزعنفة
	Delphinidae	*Tursiops truncatus*	Common Bottlenose Dolphin	الدولفين قاروري الأنف الشائع
		Delphinus delphis	Short-Beaked Common Dolphin	الدوافين الشائع قصير المنقار
Class: Reptilia (طائفة الزواحف)				
Testudines	Dermochelyidae	*Dermochelys coriacea*	Leatherback Sea Turtle (Lute Turtle or Luth)	السلحفاة البحرية جلدية الظهر
	Cheloniidae	*Caretta caretta*	Loggerhead Sea Turtle	السلحفاة البحرية ضخمة الرأس
		Chelonia mydas	Green Sea Turtle	السلحفاة البحرية الخضراء
Class: Osteichthyes (طائفة الأسماك العظمية)				
Tetraodontiformes	Molidae	*Mola mola*	Ocean Sunfish (Common Mola)	سمكة الشمس المحيطية
	Tetraodontidae	*Lagocephalus sceleratus*	Silver-Cheeked Toadfish	سمكة الأرنب السامة
Scombriformes	Scombridae	*Thunnus thynnus*	Atlantic Bluefin Tuna	سمكة التونا الصفراء
		Thunnus alalunga	Albacore Tuna	سمكة التونا الزرقاء المخططة
		Scomberomorus commerson	Narrow-Barred Spanish Mackerel	سمكة الغزلان (الكنعن)
Carangiformes	Coryphaenidae	*Coryphaena hippurus*	Common Dolphinfish	سمكة الحرباة
	Carangidae	*Seriola dumerili*	Greater Amberjack	سمكة الإنتياس
		Alectis alexandrinus	Alexandria Pompano	سمكة الجمل
Istiophoriformes	Xiphiidae	*Xiphias gladius*	Swordfish	سمكة أبو سيف (سياف البحر)
Perciformes	Serranidae	*Epinephelus aeneus*	White Grouper	سمكة الهامور (اللوقس الأبيض)
Class: Chondrichthyes (طائفة الأسماك الغضروفية)				
Hexanchiformes	Hexanchidae	*Hexanchus griseus*	Bluntnose Sixgill Shark (Cow Shark)	كلب أبو ستة
Lamniformes	Lamnidae	*Isurus oxyrinchus*	Shortfin Mako Shark	ماكو قصير الزعانف قرش
Carcharhiniformes	Carcharhinidae	*Carcharhinus plumbeus*	Sandbar Shark	القرش الرمادي
	Sphyrnidae	*Sphyrna lewini*	Scalloped Hammerhead Shark	القرش أبو مطرقة (إسكندرا)
	Triakidae	*Mustelus mustelus*	Common Smooth-hound	كلب البحر الأملس النَّاعم
		Galeorhinus galeus	Tope Shark	قرش أبو سليمان
Rhinopristiformes	Rhinobatidae	*Rhinobatos rhinobatos*	Common Guitarfish	سمكة السلفوح أو القيثارة الشائعة
	Mobulidae	*Mobula mobular*	Giant Devil Ray	سمكة شيطان البحر العملاقة
Myliobatiformes	Myliobatidae	*Rhinoptera marginata*	Lusitanian Cownose Ray	سمكة البقرة
	Dasyatidae	*Taeniura grabata*	Round Fantail Stingray	سمكة الثور

Whale that stranded dead in an advanced state of decomposition in 2009 in Rafah, southern Gaza Strip, the specimen that stranded dead in February 2021 in the city of Ashkelon in southern Palestine, several kilometers away from the northern Gaza Strip, reached 17 meters in length. Thus, the Fin Whale is considered by far the largest marine creature that drifted on or near the Mediterranean waters in the Gaza Strip.

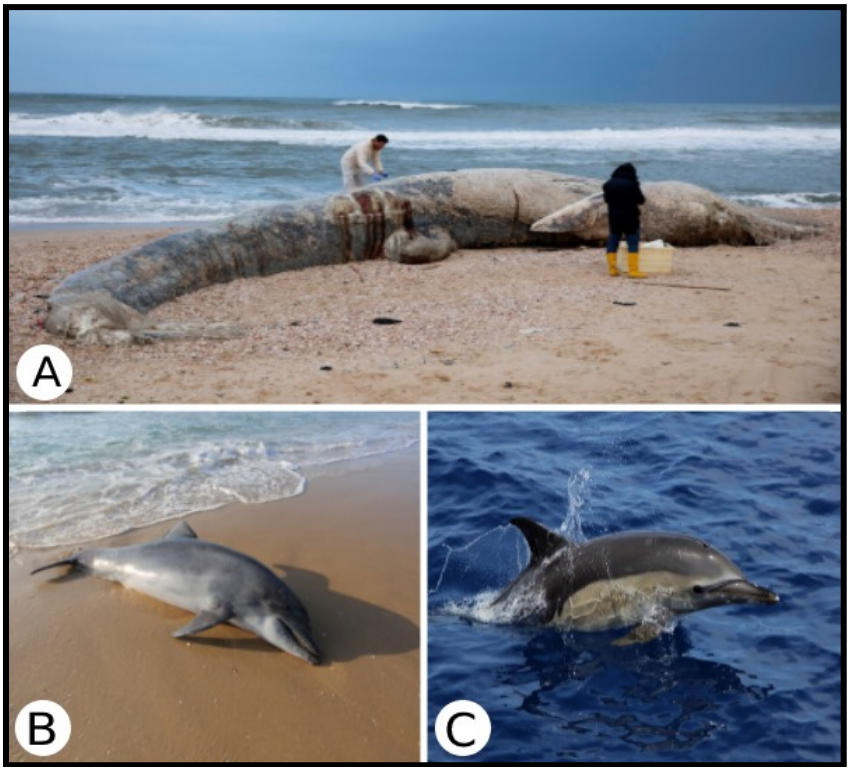

Figure 3. Cetaceans sighted in the Mediterranean or stranded on the seashore of the Gaza Strip during the past 20 years: (A) A Fin Whale (*Balaenoptera physalus*) with a length of 17 meters stranded on the shore of the city of Ashkelon in southern Palestine, several kilometers north of the Gaza Strip in February 2021, (B) Common Bottlenose Dolphin (*Tursiops truncatus*) and (C) Short-Beaked Common Dolphin (*Delphinus delphis*).

Common Bottlenose Dolphin (*Tursiops truncatus* Montagu, 1821)

This is the most frequent species of dolphins stranded throughout the year along the 42 km coastline of the Gaza Strip. Over the past 20 years, dozens of this dolphin have been encountered as strandings on the beach, and most specimens were dead and sometimes decomposing. On the other hand, seeing this dolphin alone or in groups was highly confirmed by some fishermen and even some other marine forums that used to frequent the sea for various purposes. In fact, this dolphin is a very common dolphin species that lives in warm and temperate oceans all over the world. It is very common in the Mediterranean. While the length of an adult Common Bottlenose Dolphin reaches 3.5 meters, most specimens found stranded in the Gaza Strip measured 1.5 - 2.5 meters. Many threats were found to affect the populations of dolphins worldwide and sometimes in the Gaza Strip. These included marine pollution like oil spills, chemical discharges, and hunting for food purposes. Also, dolphins are sometimes killed inadvertently as a by-catch of fishing.

Short-Beaked Common Dolphin (*Delphinus delphis* Linnaeus, 1758)

The Short-Beaked Common Dolphin is rarely encountered either as sightings or strands on the Palestinian waters and coasts of the Gaza Strip. Discussions with marine forums, including fishermen, showed that during the past twenty

years, the stranding of this species on the shore was limited to dead specimens that did not number on the fingers of two hands. The specimens stranded were of about 1.0 - 1.5 meters in length. On the other hand, seeing this dolphin alone or in groups was confirmed by some fishermen who used to frequent the sea and fish. The back of the dolphin is dark while the belly is white. This dolphin was rarely by-caught by the various fishing gear applied in the Gaza Strip. Many fishermen mentioned that the species can become entangled or captured in commercial fishing gear such as gillnets, seines, trawls and even longlines.

3.2. Marine Reptiles

The current study recorded the presence of only three species of sea turtles during fishermen's outings in the sea, falling into fishing nets and equipment, or stranding on the beach (Figure 4). The species were the Leatherback Sea Turtle (*Dermochelys coriacea*), the Loggerhead Sea Turtle (*Caretta caretta*) and the Green Sea Turtle (*Chelonia mydas*). Thus, the Leatherback Sea Turtle is the largest sea turtle worldwide and the Gaza Strip as well. The following paragraphs provide important information about the registered species.

Leatherback Sea Turtle (*Dermochelys coriacea* Vandelli, 1761)

The Leatherback Sea Turtle has many common names such as the Lute Turtle or Leathery Turtle or the Luth. It is known as the largest of all living turtles. Its name comes from the fact that its carapace is covered by oily flesh and flexible, leather-like skin. In spite of these facts, the species is rarely by-caught or being

Figure 4. Sea turtles caught, by-caught or stranded in the Mediterranean coast of the Gaza Strip during the past 20 years: (A) The carapace of a slaughtered Leatherback Sea Turtle (*Dermochelys coriacea*) caught in 2008, (B) Two species of sea turtles caged at Gaza zoo after being caught in 2008; the Loggerhead Sea Turtle (*Caretta caretta*) in the right and the Green Sea Turtle (*Chelonia mydas*) in the left, and (C) A stranded dead Loggerhead on the seashore of Gaza City.

stranded alive or dead in the Gaza Strip. Over the past two decades, about ten specimens have stranded on the Mediterranean coast of the Gaza Strip. The largest and heaviest specimen of this sea turtle was stranded alive near the Gaza Fishing Port in Gaza City in April 2008. This happened because the turtle in Egyptian marine waters collided with an Egyptian hook in one of its front flippers. As a result, the turtle ran aground towards the beach in Gaza City and was noticed by some fishermen who continued dragging it to the seashore. One of the old fishermen slaughtered the turtle in front of the vacationers, and then distributed its meat to nearly 20 Palestinian families living near the sea to eat. The whole scene was filmed by the media at the time and it was spread all over the media. Two days later, a fisherman preserved the carapace of the slaughtered turtle by treating it with salt to use it later as a decoration at home.

Loggerhead Sea Turtle (*Caretta caretta* Linnaeus, 1758)

Loggerhead Sea Turtles are distributed all over the world including the Mediterranean. It seems to be the second largest turtle in the world after the previously mentioned Leatherback Sea Turtle. The skin of the species ranges from yellow to brown in color, and the shell is typically reddish brown. This species feeds mainly on bottom-dwelling invertebrates because it has large, powerful jaws that serve as an effective tool for dismembering its invertebrate preys. It is the most caught or stranded sea turtle species in the Gaza Strip. In several occasions, strands of the Loggerhead exceeding 90 cm in carapace length where encountered along the coastline of the Gaza Strip. The Loggerhead is considered a vulnerable species by IUCN. The greatest threats facing the Loggerheads in the Gaza Strip include loss of nesting habitats due to coastal development and human disturbances, trash pollution and suffocation after being trapped in fishing nets. Loggerhead nesting on the beach in the Gaza Strip is subject to much controversy, despite some indications of nesting and hatching occurring during 2021 in the south and possibly the north of the Gaza Strip. Many caged Loggerheads have been noted in Gaza zoos or sometimes at homes. Slaughtering of the Loggerhead was recorded in many fish markets in Gaza and North Gaza governorates of the Gaza Strip.

Green Sea Turtle (*Chelonia mydas* Linnaeus, 1758)

The Green Sea Turtle, which is also known as the Green Turtle, Black Sea Turtle or Pacific Green Turtle, is the only species in the genus *Chelonia*. The common name refers to the usually green fat found beneath its carapace, not to the color of its carapace, which is olive to black. The species is mostly herbivorous in the sense that it feeds on various species of sea grasses. It is listed as endangered by the global conservation agencies such as IUCN and CITES. Nesting of the species in the Gaza Strip is unknown and seems to be impossible because of the demographic, ecological and environmental factors that impede such nesting activities. The catch, by-catch and stranding of this species is very little if compared to the Loggerhead Sea Turtle. The information available in the field and from various sources indicates that, at least, the number of accidental falls

into nets and strandings of the species does not exceed 20 specimens of various sizes per year. In a few occasions, many specimens of the Green Sea Turtle were found to have a carapace length of about 100 cm (one meter). Slaughtering of the species was recorded in many fish markets in Gaza and North Gaza governorates of the Gaza Strip.

3.3. Marine Bony Fishes

The bony fishes are considered to be the main animal communities that inhabit the marine environment in the world, and this reality applies to the Gaza Strip as well. The current study recorded at least 10 giant or relatively large species of them (Figure 5 and Figure 6), headed by the Ocean Sunfish (*Mola mola*), which is considered the largest bony fish in the world. The following paragraphs provide information about observed species.

Figure 5. Bony fishes caught or by-caught in the Mediterranean coast of the Gaza Strip: (A) Ocean Sunfish (*Mola mola*), (B) Silver-Cheeked Toadfish (*Lagocephalus sceleratus*), (C, D and E) Atlantic Bluefin Tuna (*Thunnus thynnus*), (F) Albacore Tuna (*Thunnus alalunga*), and (G) Narrow-Barred Spanish Mackerel (*Scomberomorus commerson*).

Figure 6. Bony fishes caught or by-caught in the Mediterranean coast of the Gaza Strip: (A and B) Common Dolphinfish (*Coryphaena hippurus*), (C and D) Greater Amberjack (*Seriola dumerili*), (E) Alexandria Pompano (*Alectis alexandrina*), (F) White Grouper (*Epinephelus aeneus*), and (G) Swordfish (*Xiphias gladius*).

Ocean Sunfish (*Mola mola* Linnaeus, 1758)

The Ocean Sunfish or Common Sunfish or Common Mola, which belongs to the Molidae family, is the heaviest and largest bony fish in the world. It has occasionally been recorded in the marine ecosystem of the Gaza Strip. Over the past twenty years, 20 to 25 specimens of this species have been known to be caught separately or stranded from the Mediterranean coast of the Gaza Strip. The heaviest specimen was recorded on December 12, 2006. It had a total length of about 2.8 m from head to pseudo-tail and about 2.85 m from the tip of the dorsal fin to the tip of the anal fin. The weight of the fish exceeded 2000 kg. Because of the toxins contained in its meat, this species has no commercial value in the Gaza Strip. By-catch and floating litter have been considered as major threats to the Ocean Sunfish locally.

Silver-Cheeked Toadfish (*Lagocephalus sceleratus* Gmelin, 1789)

The Silver-Cheeked Toadfish is one of the most recent invaders into the Mediterranean Sea. It represents a serious ecological risk to Mediterranean biodiversity and fisheries resources and a health risk to public health. The first record of the Silver-Cheeked Toadfish in the Mediterranean coast of the Gaza Strip was in 2006 as claimed by fisheries parties. The by-catch of the species by fishing gear extended over the entire length of the Mediterranean coast of the Gaza Strip (42 km). The species was said to damage fishing nets, lines and hooks by its strong teeth. Prior to its banning in early 2010s, all pufferfishes including the species in question were sold freely in Gaza fish markets. Although most of the recorded fish's lengths ranged from 20 to 30 centimeters, several specimens that fell into fishing nets exceeded half a meter in length, and some of them reached a length of 90 centimeters, and this size is considered relatively large for such a fish. The fish contains a strong and potent marine toxin called Tetrodotoxin (TTX), which can be very poisonous and even lethal to humans. Several cases of hospitalization have been reported in the Gaza Strip after consumption of the Silver-Cheeked Toadfish. The symptoms of TTX intoxication included nausea and vomiting, dizziness, headache, abdominal pain, perioral paraesthesia, and tingling over the entire body. In the last three or four years there have been reported two deaths of a woman and a girl locally caused by their meals of Silver-Cheeked Toadfish. Most of their family members were also poisoned. Many awareness campaigns have been conducted by fisheries parties to warn both fishermen and local people from the ecological and health risks associated with the Silver-Cheeked Toadfish and TTX intoxication.

Atlantic Bluefin Tuna (*Thunnus thynnus* Linnaeus, 1758)

The Atlantic Bluefin Tuna or Tunny is one of the largest bony fishes occurring at the Mediterranean Sea and the neighboring Atlantic waters as the names of the fish implies. It is usually caught commercially using longlines, purse seines and other fishing gear. The fish has a strong crescent-shaped caudal fin for propulsion. Locally, the Atlantic Bluefin Tuna is named as the "stubborn Tuna" or "*Al-Tuna Alaneedah*" because of its stubbornness and the difficulty of fishing it by professional Gazan fishermen. The exceptional lengths of some specimens of Atlantic Bluefin Tuna caught locally from the Mediterranean waters of the Gaza Strip approached the two-meter threshold and weighed about 160 - 180 kg. However, it is rarely fished in the Mediterranean waters of the Gaza Strip, and its catch requires sailing distances exceeding 8 - 10 nautical miles, as the Gazan fishermen say. Moreover, Gazan fishermen have claimed that the Atlantic Bluefin Tuna is a fish that tends to swim aggressively in deep waters where it is caught by chance while chasing groups of migratory fish of sardines and others. Locally, this Tuna species is usually caught with hooks, which is a difficult method and requires patience and chase, and secondly, they are accidentally caught in a trawl or purse seine while feeding on seasonal fish available as pasture and which gather on the lights of boats at night. The fish is famous worldwide and locally for its fresh and required meat in addition to its high price.

Albacore Tuna (*Thunnus alalunga* Bonnaterre, 1788)

The Albacore Tuna or Longfin Tuna is an epipelagic and mesopelagic fish species, and it has an elongated and spindle-shaped body. Its colors range from dark blue dorsally to shades of silvery white on the ventral side. It has remarkably long pectoral fins. Gazan fishermen claimed that the fish could be up to one meter in length although common fishing lengths range from 70 to 100 centimeters. This rarely caught species is listed as Near Threatened by the IUCN. It is not found in abundance in the eastern Mediterranean, where Palestine is located. Gazan fishermen used to catch this species during the period between December and February. This species is considered of great nutritional value to Gazans compared to other tuna species.

Narrow-Barred Spanish Mackerel (*Scomberomorus commerson* Lacépède, 1800)

The Narrow-Barred Spanish Mackerel has blue to dark grey colors along its backs and flanks but the colors fade to silvery blue-grey on the belly. It has scores of narrow and vertical lines down their sides. It invaded the Mediterranean Sea from the Red Sea through the Suez Canal since decades. The species may reach a length of more than 1.2 meters. The species has a good commercial value in the Gaza Strip because of its delicious flesh. Gazans are fond of cooking and roasting the Narrow-Barred Spanish Mackerel, as it is commonly caught in a variety of sizes and sold at varying prices in the Gaza Strip.

Common Dolphinfish (*Coryphaena hippurus* Linnaeus, 1758)

The Common Dolphinfish, which is also known as Mahi-mahi, has a large head, a compact body and a long dorsal fin that extends almost from head to tail. Common Dolphinfishes are golden, blue, and/or green on their sides with white and yellow shading underneath. The fish's ability to color out of the water after being caught contributed to its Arabic name "*Harbaia*", which means "chameleon". The Mediterranean Chameleon or Common Chameleon (*Chamaeleo chamaeleon*) is one of the Palestinian lizards known for its ability to color according to the background in which it resides. The Common Dolphinfish can reach a length of about two meters and a weight of about 40 kg, although the largest specimens caught in the Gaza Strip were from 1.0 to 1.5 meters in length and weighed 15 - 25 kg. The Common Dolphinfish is an excellent swimmer and is known for its ability to catch flying fish in, its favorite prey.

Greater Amberjack (*Seriola dumerili* Risso, 1810)

Great Amberjack has a lot of common names like Allied Kingfish, Great Amberfish, Purple Amberjack, Greater Yellowtail, etc. It is the largest species in the family Carangidae. It is a large predatory fish that has a dorsal surface color that contrasts with the underparts. According to Gazan fishermen, these fishes are found as solitary individuals or in small schools that live in the depths of the Mediterranean waters. Although it is usually caught in small sizes (30 cm or more), the largest sizes of species caught over the past 20 years range from 100 to 150 cm. The fish is caught locally by purse seines, hooks and lines, and its meat

is highly valuable to the Gazan community.

Alexandria Pompano (*Alectis alexandrina* É. Geoffroy Saint-Hilaire, 1817)

The Alexandria Pompano or African Threadfish is a species of large marine fish in the Carangidae family. The species is found along the coast of the Mediterranean Sea as its name indicates. The fish is of minor commercial importance as it is rarely caught from the Mediterranean waters of the Gaza Strip. The fish has a pronounced angular body, strongly compressed. It has large mouth and long fork dorsally. The color is silver with a faint blue on upper third of body and head. Although it was recorded with lengths varying between 20 and 50 cm in fish markets of the Gaza Strip, caught specimens reaching lengths of about a meter were recorded as well in 2020. The species is considered as a valuable marine food item, in spite of its rarity in the Gaza Strip.

White Grouper (*Epinephelus aeneus* Saint-Hilaire, 1817))

Many Grouper species are known to be caught in the Mediterranean coast of the Gaza Strip. The White Grouper (*Epinephelus aeneus*) is a famous species to Gazans because of its delicious meat. The White Grouper has greenish-grey color and blackish spots on body, with darker fins. There are two or three prominent oblique stripes lying on the two sides of the head. It occurs on substrates of rock or mud and sand. The maximum total length of this species caught in the Gaza Strip was of about one meter, although they are more common at around 40 - 60 centimeters.

Swordfish (*Xiphias gladius* Linnaeus, 1758)

The Swordfish has an upper jaw prolonged into a long, flat and pointed bill. It has large eyes and an elongated and rounded body that becomes devoid of scale with the age of maturity. Although it can be up to 3 meters in length, the locally caught individuals are found in the range from 1.0 to 1.7 meters in length. There is a belief among Gazan fishermen that the sword owned by the Swordfish is used to facilitate catching and dragging the fish prey that feeds on it. It is also used as a spear in case of dangers against the threatening large fishes including sharks. Despite this, the Swordfish depends mainly on its great speed and agility in the water to catch its prey, as it is one of the fast fishes in the marine environment.

3.4. Marine Cartilaginous Fishes

Despite the sizes that cartilaginous fish enjoy as carnivores in marine environments, they are less diverse in terms of species compared to the aforementioned bony fish. This reality applies to the Gaza Strip as well, as the current study recorded at least 10 giant or relatively large species (**Figures 7-10**). The following paragraphs provide important information about the registered species:

Bluntnose Sixgill Shark (*Hexanchus griseus* Bonnaterre, 1788)

The Bluntnose Sixgill Shark or Cow Shark has a large body, a long tail, a sharp, broad snout, and small eyes. The six gill slits give the shark its name. The Bluntnose Sixgill Shark can reach a length of five to six meters. The fish has a

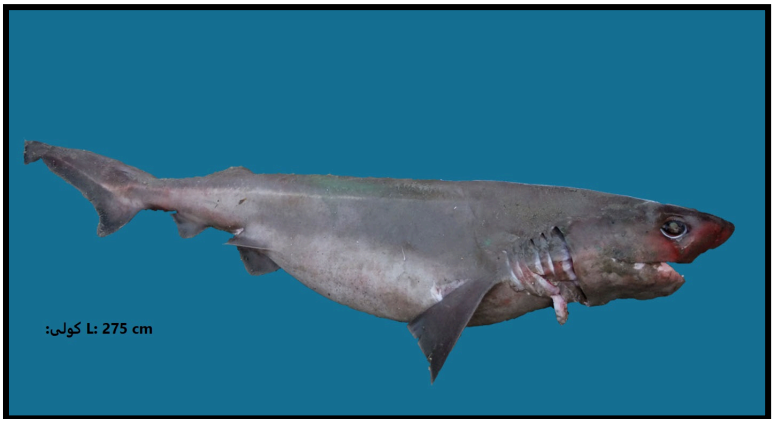

Figure 7. The Bluntnose Sixgill Shark (*Hexanchus griseus*) after being caught in the Gaza Strip.

Figure 8. A 4.2 meter long Scalloped Hammerhead (*Sphyrna lewini*) was caught in 2019 in the Gaza Strip.

single dorsal fin located near the caudal fin, while the pectoral fins are broad. The Bluntnose Sixgill Shark is classified as a generalist species because of its wide range of prey including fish, rays, squid, crabs, shrimp, seals, and other marine creatures. Although its catch is limited in the Gaza Strip, it is sold for the sake of its meat, which is accepted by the Gazans. It is worth noting that Gazans are more willing to buy shark meat than the meat of other cartilaginous fish such as skates and rays. This is due, of course, to the quality of shark meat and the prestige of sharks as predatory and frightening animals in the marine environment, which prompted some fishermen to say: "the honorable name is enough for us".

Figure 9. Cartilaginous fishes caught or by-caught in the Mediterranean coast of the Gaza Strip: (A and B) Shortfin Mako Shark (*Isurus oxyrinchus*), (C) Sandbar Shark (*Carcharhinus plumbeus*), (D) Common Smooth-hound (*Mustelus mustelus*), and (E) Tope Shark (*Galeorhinus galeus*).

Scalloped Hammerhead Shark (*Sphyrna lewini* É. Griffith & C. H. Smith, 1834)

The Scalloped Hammerhead Shark, which is known as Bronze Hammerhead Shark, Southern Hammerhead Shark or simply Hammerhead as well, is a globally endangered cartilaginous fish in spite of the fact that it is the most common of all hammerheads. As in all hammerheads, the most distinctive feature of this shark is its hammer-shaped head. The broad, hammer-shaped head gives these sharks their common name. The eyes and nostrils of the species are located at the tips of the extensions. They have small mouths relative to their large body size. Gazan fishermen go on to say that the Scalloped Hammerhead Shark gathers

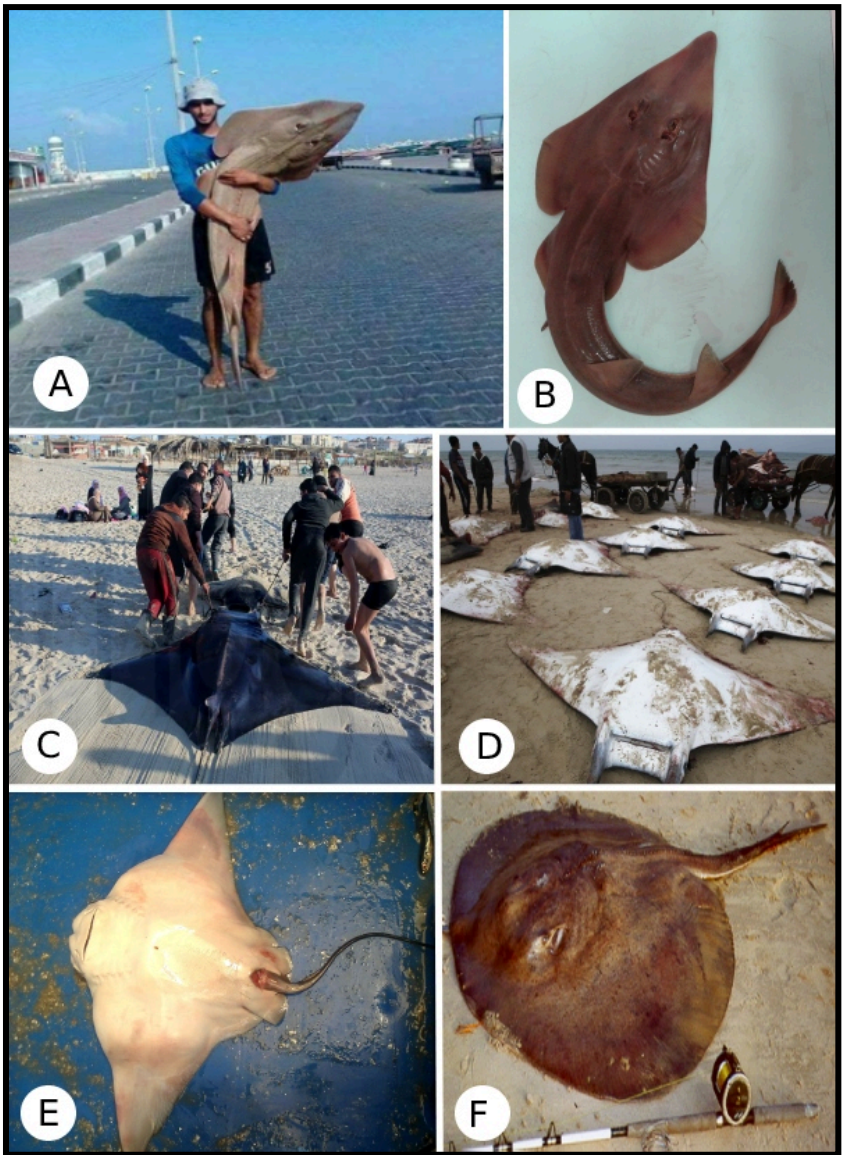

Figure 10. Cartilaginous fishes caught or by-caught in the Mediterranean coast of the Gaza Strip: (A and B) Common Guitarfish (*Rhinobatos rhinobatos*), (C and D) Giant Devil Ray (*Mobula mobular*), (E) Lusitanian Cownose Ray (*Rhinoptera marginata*), and (F) Round Fantail Stingray (*Taeniura grabata*).

in the marine environment in large groups, making it vulnerable to targeted fishing. The species is commonly fished using longlines, gill nets, bottom nets and trawls. Although the species is rarely caught in the Mediterranean waters of the Gaza Strip, it is well known among Gazans because of its unique shape. The locally caught individuals were of various sizes; with a 4.2 meter long specimen was caught in 2019.

Shortfin Mako Shark (*Isurus oxyrinchus* Rafinesque, 1810)

The Shortfin Mako Shark, which is also known as the Mackerel Shark, Aka Mako, Blue Pointer or Bonito Shark is a fairly large species of shark. It is cylindrical in shape, with a vertically elongated tail. This species exhibits counter-

shading, with brilliant metallic blue coloration dorsally and white ventrally. It is classified as Endangered by the IUCN. The species is sometimes caught in various sizes from the Mediterranean coast of the Gaza Strip. Although it can reach a size of 4 m in length, the maximum length reached for a locally caught individual was 3 m in Khan Younis Governorate, southern Gaza Strip, in 2013. Gazan fishermen claimed that the Shortfin Mako Shark is powerful, fast and aggressive and its probable attacks on humans may come as a result of harassment or the shark being caught on a fishing line.

Sandbar Shark (*Carcharhinus plumbeus* Nardo, 1827)

The Sandbar Shark, also called the Brown Shark or Thickskin Shark, is one of the largest coastal sharks in the world. It can be distinguished by its very high first dorsal fin which is triangular in shape and very high. The second dorsal fin and the anal fin are close to the same height. Its body color can vary from bluish-gray to brownish-gray to bronze, with a white or pale underside. Most of the specimens taken from this shark are 1 - 1.5 cm in size and may be slightly larger than that. It is considered one of the most common and caught sharks in the Gaza Strip due to its presence in the coasts.

Common Smooth-hound (*Mustelus mustelus* Linnaeus, 1758)

The Common Smooth-hound, which is a houndshark, is one of the sharks inhabiting the Mediterranean Sea, and as a result it is sometimes caught from the marine ecosystem of the Gaza Strip. It is fairly slender with a short head and snout. It has a gray-brown color on the back and white on the underneath. In their natural habitats, they congregate in large numbers like packs of dogs which is why they are called hound sharks. Locally, the animal is vulnerable to catches in a variety of fishing gear such as gillnets, trammel nets, trawls and lines. The caught individuals were 100 - 120 cm of length though they were sometimes found to exceed a size of about 150 cm.

Tope Shark (*Galeorhinus galeus* Linnaeus, 1758)

The Tope Shark, commonly known as the School Shark, Snapper Shark or Soupfin Shark, is a houndshark that can reach nearly 2 meters in length, although locally caught specimens range from 70 cm to 180 cm. The Tope Shark is a shallow-bodied shark with an elongated snout. It is a carnivorous, feeding primarily on pelagic and seabed fishes. This shark is popular with Gazan fishermen for its frequent catch and delicious meat. Gillnets, longlines and trawling nets are common fishing gear involved in its catchment. The IUCN has classified this species as critically endangered.

Common Guitarfish (*Rhinobatos rhinobatos* Linnaeus, 1758)

The Common Guitarfish, which belongs to the family Rhinobatidae, is native to the Mediterranean Sea. In fact, the combination of a disc-shaped head, pectoral and pelvic fins on one side, and a thick tail on the other, gives this species its guitar-like shape, hence the name Guitarfish. The IUCN has assessed its conservation status as "Critically Endangered". It is a benthic or bottom-dwelling fish that feeds on crustaceans, invertebrates, and other fish. Its lifestyle makes it

vulnerable to trawling and other fishing methods. Although the normal lengths of the Common Guitarfish caught in the Gaza Strip range between 50 and 70 cm, exceptional lengths of about 150 cm have been recorded in some cases. The Common Guitarfish is considered one of the most cartilaginous fish caught in the Gaza Strip. It is also widely used for the purposes of scientific anatomy in the lessons and laboratories of the vertebrate courses in Palestinian universities of the Gaza Strip.

Giant Devil Ray (*Mobula mobular* Bonnaterre, 1788)

Fishing and landing of Giant Devil Rays are common during a short period of each year, extending from February to April, reaching their maximum extent in February 2013. The Gazan fishermen dragged hundreds of this endangered rays out of the waters off the Gaza Strip. At that times, the Palestinian media reported that the Giant Devil Rays had made a comeback in the waters off the Palestinian territory after years of absence, and began that local fishermen had hauling them to the markets.

Lusitanian Cownose Ray (*Rhinoptera marginata* É. Geoffroy Saint-Hilaire, 1817)

The Lusitanian Cownose Ray is a species of eagle ray (Myliobatidae) that appears very rare in the Mediterranean. They feed on bottom-dwelling organisms such as mollusks, crustaceans, and fish. Although it rarely occurs in the waters of the Mediterranean Sea of the Gaza Strip, it is known that some caught specimens reached a length of about 170 - 180 cm.

Round Fantail Stingray (*Taeniura grabata* É. Geoffroy Saint-Hilaire, 1817)

The Round Fantail Stingray or Round Stingray lives in sandy, muddy or rocky coastal habitats in the eastern Mediterranean. This dark-colored fish is recognizable by its rounded pectoral fin disc and short tail which bears one or more stinging spines on the upper surface. Locally caught specimens were known to reach a length of nearly one meter or more. Due to the nature of its habitat, the Round Fantail Stingray is sometimes caught with bottom trawls and trammels nets.

4. Discussion

The current study is a cumulative and descriptive in its style trying to document the giant or relatively large mammalian, reptilian and fish fauna that have been sighted, caught, by-caught or stranded in the Mediterranean coast of the Gaza Strip, Palestine. Seabirds were excluded from the results of this study, although they appear in significant numbers in the marine environment of the Gaza Strip. The exclusion came because most of them are not huge in size, and specialized studies on seabirds are almost non-existent. The scientific marine fleet is not available, and the beaches are crowded, possibly polluted, and their depth is very limited, and sometimes it may be zero, as is the case in the Al-Shati Camp beach. The study of Dardona and Khalaf [53] showed some aquatic birds that are some-

times found, and some of them may be common, on the beaches of Gaza City. Other general studies of wild birds in Wadi Gaza and other Gazan environments showed the presence of species of cormorants (**Figure 11**), seagulls, terns, herons and pelicans. Usually, some of these birds are spotted in the wetland ecosystem of Wadi Gaza or the ponds of Al-Mawasi area, as a unique ecosystem adjacent to the sea in the far southwest of the Gaza Strip. Some seagulls may be seen in the solid waste dumps and waste water treatment plants spread throughout the Gaza Strip [48] [54] [55] [56] [57] [58].

With regard to the 26 species described in this study, they seem few compared to other relatively large marine organisms such as mammals, reptiles, and fish that the eastern basin of the Mediterranean harbors. The limitation of the species mentioned and included in this study may be explained by several angles.

1) The small fishing area in the Gaza Strip is completely controlled by Israel and does not exceed, at best, 12 nautical miles, although what was stipulated in the political agreements allows the Palestinians to fish up to 20 nautical miles. As a result, Palestinians are prevented from navigating the high seas, and therefore Palestinian marine resources will not be fully studied or surveyed.

2) The Gaza Strip (not to mention the West Bank, which is the second part and the largest block of the homeland) suffers from a complete lack of specialists in the field of marine biodiversity, especially marine mammals. This would significantly reduce the amount of knowledge about marine mammals, especially baleen and toothed whales that occur in the marine waters of the Gaza Strip. On

Figure 11. The Cormorant (*Phalacrocorax carbo*) is one of the commonest and largest seabirds of the Gaza Strip. It is often seen standing on solid targets, including fishermen's boats, in the Gaza Fishing Port.

the other hand, there are many species of huge whales and dolphins that occur in the entire marine waters of historical Palestine, extending from Lebanon in the north to Egypt in the south [50]. Abd Rabou *et al.* [50] showed sighting or delinquency of only three species of cetaceans, which are the same ones mentioned in the current study (**Table 1**).

3) Museums or exhibitions of stuffed animals in Palestinian universities and even the Directorate General of Fisheries in the Gaza Strip are described as meager and do not rise to the level of simple museums in universities in other countries [59]. This is mainly due to financial, technical and administrative reasons. If the small specimens face challenges in preserving and mummifying, then it is foremost that the large and huge marine specimens do not find a way for them towards mummification and preservation in those museums, and this in turn implies the limited outputs of this study.

4) The weakness of the Palestinian technical capabilities related to the sea sector, in terms of the very fragile and old naval fleet. If this fleet does not meet the needs of fishing, how can it meet in-depth and specialized studies on other marine creatures, especially huge and relatively large ones such as whales, turtles and other marine fish?

Cetaceans, whether baleen or toothed, recorded by the current study and the study of Abd Rabou *et al.* [50], represented by three species that were seen at sea by fishermen or marine police officers or stranded on the Mediterranean shore of the Gaza Strip, are only a small part of the cetaceans that exist in the marine environment of the entire coast of Palestine extending from Lebanon to the Sinai Peninsula [13] [50] [60]. This is expected due to Israel's prevention of Palestinians from navigation on the high seas, and as a result, Palestinian marine resources, including marine mammals or cetaceans, have not been fully studied, surveyed or even exploited. Kerem *et al.* [13] stated that a single Fin Whale (*Balaenoptera physalus*) was spotted 55 km off the Gaza Strip at a depth of 600 meters, so how can the Palestinians document this giant creature, which is the largest after the Blue Whale (*Balaenoptera musculus*), and other creatures (mammals, reptiles and fish) when they cannot catch fish freely in the fishing zone made available to them by Israel [3] [44]?

The Fin Whale is the most watched or stranded baleen whale on the coasts of Palestine in general and the Gaza Strip in particular. This controversy can be attributed to the fact that this species is the most commonly observed mysticetes within the Mediterranean [61]. Knowledge of this species of whale in the Mediterranean Sea was reported by Notarbartolo di Sciara *et al.* [62] although the available evidence grants it a status as a visitor to the eastern Mediterranean basin as suggested by Kerem *et al.* [13]. The whale was known to be stranded in a variety of countries' coastlines as revealed by Shoham-Frider *et al.* [11], Dede *et al.* [15], Abd Rabou [59] and Stephens *et al.* [61]. Kerem *et al.* [13] noted that several separate cases of young single individuals of Fin Whale encountered entering Israeli ports, whether swimming alive or floating dead. Despite the small

number of cetacean species recorded in the marine waters of the Gaza Strip, the multiplicity of sightings and stranding of cetaceans on the small coast of the Gaza Strip, which is 42 km long, shows the importance of the eastern Mediterranean basin in harboring a relatively large number of cetaceans, and this has been proven by research [12] [13] [14] [15] [60]-[71].

The Common Bottlenose Dolphin and the Short-Beaked Common Dolphin were the only toothed whales encountered as sighting or stranding cases in the Mediterranean waters of the Gaza Strip. The first is by far the most frequently encountered species year-round and along the 42-km coastline of the Gaza Strip. These observations include calves and adults of different sizes. The majority of sightings were close to shore. The relative high number of Common Bottlenose Dolphin strandings in comparison to the other species suggests that this species is particularly abundant in the Palestinian shores of the Mediterranean [72]. The Common Bottlenose Dolphin is a regular Mediterranean inhabitant [73]. Recent cetacean listings from neighboring eastern Mediterranean countries have the species ranking high on the list [3] [65] [74]. As far as the Israeli sightings of the species in question are concerned, many group sightings were made; one of which were for 30 individuals including six calves, were sighted 50 km west of the Gaza Strip on August 2007. Similar results were found by El-Hili *et al.* [75] who studied the cetaceans stranded along the Tunisian northern-coasts. Although it was confirmed by local fishermen, no precise data on the number of dolphins suffering by getting caught in the Gazan fishing gear. The diet of the Common Bottlenose Dolphin consists mainly of eels, squid, shrimp and a wide variety of fishes [76]. For this reason, many Gazan fishermen claimed the incidental by-catch of the species while fishing. According to Brand *et al.* [76], the slender Balearic Eels (*Ariosoma balearicum*), which are frequently found protruding from the net's eyes, presumably making easy prey for dolphins.

Most forums concerned with Short-Beaked Common Dolphins report that their presence is very rare among stranded dolphins on the seashore in the Gaza Strip compared to the aforementioned species, and this may be attributed to the general decline in their populations in the waters of the Mediterranean Sea, and this was confirmed by Bearzi *et al.* [77] and Christensen [78] who showed that the Mediterranean Sea is experiencing a clear decline in populations of this species. Notarbartolo di Sciara and Birkun [73] pointed that the Mediterranean Sea may now be the last stronghold of the Short-Beaked Common Dolphin's relative abundance. Currently, the species is classified as threatened under the IUCN Red List [77]. Even in Israel, the record is rather poor for the Short-Beaked Common Dolphin [13]. In general, the local stranding of cetaceans can result from marine pollution, entanglement in fishing gear, injuries, gunfire by Israeli forces stationed at sea off the Gaza Strip, or other human causes including noise. Indeed, these and other reasons have been agreed upon by researchers around the world for marine mammal strandings [79]-[84]. Of course, climate change is imposing its severe effects on global biodiversity, of which marine mammals are

an important part as emphasized by Schumann *et al.* [85].

Sea or marine turtles are reptiles of the order Testudines. Sea turtles are one of the best navigators of the animal kingdom. There are at least seven species in the seas and oceans of the world: Green (*Chelonia mydas*), Loggerhead (*Caretta caretta*), Leatherback (*Dermochelys coriacea*), Flatback (*Natator depressus*), Hawksbill (*Eretmochelys imbricata*), Kemp's Ridley (*Lepidochelys kempii*), and Olive Ridley (*Lepidochelys olivacea*) Sea Turtles. These mentioned species of sea turtles belong to two families: Cheloniidae and Dermochelyidae. Species belonging to the former have hard shells, while those belonging to the latter have soft shells. In fact, hundreds of three species of sea turtles from the two aforementioned families (**Table 1**) are seen, caught, by-caught and stranded annually in the coastal sea waters of the Gaza Strip, and this was confirmed by the researchers' field trips, Palestinian news websites, and Facebook pages, in addition to previous studies [3] [44]. Since humans are the most dangerous species that sea turtles encounter, many Gazans and even fishermen have resorted to catching or killing adult sea turtles in order to obtain their meat and use their shells in crafts or home decoration.

Abd Rabou *et al.* [3] and Abd Rabou [44] stated that a few people during the previous century used the carapaces of some large sea turtles as a sleeping bed for infants. Gazans should be aware of the danger of sea turtles being caught or suffocated by incidental falling into fishing nets [43] [44], and this matter is confirmed and documented globally [86] [87] [88] [89]. Pollution of the seas, especially with nylon bags and plastic materials, poses a danger to many marine creatures, especially sea turtles, which usually devour nylon bags, thinking that they are jellyfish [90]. This event often causes sea turtles to suffocate and die, and then stranded with varying degrees of decomposition on the beaches, depending on the extent of their stay while they are dead in the sea [3].

The marine ecosystem of the Gaza Strip, despite its limitations, witnesses a significant diversity of fish resources that belong to bony and cartilaginous fishes, and this is what was covered by some modest local reports and studies [43] [45] [46] [59] [91] [92] [93]. Sardines historically constituted approximately 60 percent of the total fish catch in the Gaza Strip [3] [94]. In fact, the sardine season dominates the agenda of Gazan fishermen twice a year, the first from April to mid-June and the second from mid-September to November. Regardless of the species of fishes caught in the marine environment of the Gaza Strip, whether they are native or invasive (exotic, alien or non-native), most of them are of small or medium sizes, and rarely are the fishes caught of relatively large or giant species. In fact, most of the studies that targeted fish catches and conducted some tests on specific fish species in the Gaza Strip were for fishes that were not large, but most of them were small in size [49] [59] [94]-[100].

On the other hand, the studies that reported on relatively large or gigantic bony or cartilaginous fish species appear to be very limited [47] [48] [59] [101]. Several news websites mentioned and this was confirmed by field observations

about the ability of Gazan fishermen to catch a mass of hundreds (perhaps 500 fish, each weighing 150 - 250 kg) in February 2013 of Devil Fish or Giant Devil Ray (*Mobula mobular*), which are classified as endangered cartilaginous fishes according to the IUCN Red List [102] [103] [104]. The entire scene has been described previously by Abudaya *et al.* [47], Couturier *et al.* [101] and Ben Zion [105]. In fact, significant numbers of these fishes are usually caught during the months of February and March of each year in the Gaza Strip, but in no way will their number reaches the catch of 2013 (Field Observations and Special Communications). Fishing for cartilaginous fishes (sharks, skates, and rays) in general is very acceptable among fishermen in the Gaza Strip, and generates a lot of profits for them, although fishing for these fishes is often prohibited or forbidden in other countries. The Giant Devil Ray was found to be caught off the Mediterranean coast of Algeria as revealed by Hemida *et al.* [35].

Estimates of the Directorate General of Fisheries in the Gaza Strip indicate that there are 20 - 30 species of cartilaginous fish in the Gaza Strip [92], and thus they represent about 30% of the species in the Mediterranean. According to Serena [106], the population of sharks and rays in the Mediterranean has about 80 species, of which 49 are sharks, 34 are rays, and one is a species of Chimaera. Scientific reports have defined the Mediterranean as the most dangerous place on Earth for cartilaginous fishes, with more than 42% of cartilaginous fish species in the Mediterranean are endangered [2] [107]. The threat posed by fishing in the Gaza Strip to cartilaginous fish stems from the fact that the recovery of their populations is very slow and difficult. This is because they have a relatively long life expectancy and gestation period, a delay in reaching sexual maturity, and a small number of offspring [39] [108]. In fact, cartilaginous fishes of various sizes, including gigantic and relatively large ones (**Figure 9** and **Figure 10**), are usually caught in distances often exceeding 6 nautical miles in the marine ecosystem of the Gaza Strip. Recently, a fisherman was bitten in the leg by a shark in the Gaza Strip when he was cleaning fish caught in fishing nets. This fisherman was admitted to the hospital for treatment [109]. It is worth noting that sharks and rays are usually considered carnivores, although some may be located at the top of the trophic pyramid in the marine ecosystem. Consequently, their disappearance may lead to the collapse of the necessary balance of the marine food web. This collapse may be represented by the significant increase in the number of species that are real prey for sharks and rays [39]. In the 1950s, dwindling shark populations in many regions of the world led to population declines of about 90 percent [33]. Fishing for cartilaginous fish in the Gaza Strip is not as strange or surprising as some like to say, as the fishing of sharks and rays takes place all over the world due to the increasing demand for their fins, skin, jaws and meat [110].

Since it is the world's largest among bony fishes and is sometimes even considered among the zooplankton, the Gaza Strip, despite the small length of its sea coast, witnessed during the past 20 years the catch or stranding of more than 25

Ocean Sunfishes (*Mola mola*). The largest specimen was stranded in December 2006, and this was confirmed by Abd Rabou *et al.* [3] [4]. The Ocean Sunfish is characterized by its toxicity and inedibility due to its feeding on poisonous jellyfish, the most famous of which in the Mediterranean is the Nomad Jellyfish (*Rhopilema nomadica*), which invaded the Mediterranean environment during the seventies of the last century [3]. In fact, these fish and sea turtles are natural enemies of jellyfish that thrive in the marine environment of the Gaza Strip, especially in the summer, and harm vacationers with their poisonous stings. Therefore, ecological awareness of the importance of these marine organisms must be increased and their fishing or trafficking should be prevented locally. Even if they incidentally fall into fishing gear, the principle is to free them and release them back into their marine environment.

5. Conclusion

In conclusion, the Mediterranean coast of the Gaza Strip is home to a significant number of marine biota, especially marine mammals, reptiles, birds, and fishes, whether bony or cartilaginous. The urgent need for local scientific and ecological agencies to conduct comprehensive surveys of marine animals in the Gaza Strip increases, and this in turn requires financial, technical, and academic support. The role of the various parties must be coordinated to ensure the sustainability of human activities and their compatibility with the task of preserving local marine natural resources, including giant or relatively large creatures, given their important ecological role in the marine ecosystem.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Bariche, M. (2012) Field Identification Guide to the Living Marine Resources of the Eastern and Southern Mediterranean. Food & Agriculture Organization of the United Nations (FAO), Rome, 610 p.

[2] Abdul Malak, D.A., Livingstone, S.R., Pollard, D., Polidoro, B.A., Cuttelod, A., Ba-

riche, M., Bilecenoglu, M., Carpenter, K.E., Collette, B.B., Francour, P., Goren, M., Kara, H., Massutí, E., Papaconstantinou, C. and Tunesi, L. (2011) Overview of the Conservation Status of the Marine Fishes of the Mediterranean Sea. IUCN, Gland, 61 p.

[3] Abd Rabou, A.N., Yassin, M.M., Saqr, T.M., Madi, A.S., El-Mabhouh, F.A., Abu Nada, F.M., Al-Masri, M.K., Doulah, M.H. and Al-Haj Ahmad, M.M. (2007) Threats Facing the Marine Environment and Fishing in the Gaza Strip: Field and Literature Study. Theme XII: Environmental Design Trends and Pollution Control, *The 2nd International Engineering Conference on Construction and Development* (*IECCD-II*), Gaza Strip, 3-4 September 2007, 11-31.

[4] Abd Rabou, A.N., Al-Agha, M.R., Abd Rabou, M.A., Abualtayef, M.T., Elnabris, K.J., Elkahlout, K.E., El-Bashiti, T.A., Abu Amra, H.E., Attallah, A.J., Abu Hatab, H.G. and Aboutair M.A. (2020) On the Ocean Sunfishes (*Mola mola*, Linnaeus 1758) By-Caught off the Mediterranean Coast of the Gaza Strip, Palestine. *Biomedical Journal of Scientific and Technical Research*, **29**, 22624-22632. https://doi.org/10.26717/BJSTR.2020.29.004831

[5] Silvani, L., Gazo, M. and Aguilar, A. (1999) Spanish Driftnet Fishing and Incidental Catches in the Western Mediterranean. *Biological Conservation*, **90**, 79-85. https://doi.org/10.1016/S0006-3207(98)00079-2

[6] Gerovasileiou, V., Akyol, O., Al-Hosne, Z., Rasheed, R.A., Atac, E., Bello, G. and Zava, B. (2020) New Records of Rare Species in the Mediterranean Sea (May 2020). *Mediterranean Marine Science*, **21**, 340-359.

[7] Pope, E.C., Hays, G.C., Thys, T.M., Doyle, T.K., Sims, D.W., Queiroz, N. and Houghton, J.D. (2010) The Biology and Ecology of the Ocean Sunfish *Mola mola*: A Review of Current Knowledge and Future Research Perspectives. *Reviews in Fish Biology and Fisheries*, **20**, 471-487. https://doi.org/10.1007/s11160-009-9155-9

[8] Ahuir-Baraja, A.E. (2022) First Evidence of Presence of Plastic Debris in Digestive System of *Mola mola* (L.) from Western Mediterranean Sea. *Marine Pollution Bulletin*, **175**, Article ID: 113326. https://doi.org/10.1016/j.marpolbul.2022.113326

[9] Goffman, O., Roditi, M., Shariv, T., Spanier, E. and Kerem, D. (2000) Cetaceans from the Israeli Coast of the Mediterranean Sea. *Israel Journal of Ecology and Evolution*, **46**, 143-147. https://doi.org/10.1560/LBJB-Y6CP-7E4G-HT2P

[10] Brand, D., Edelist, D., Goffman, O., Hadar, N., Scheinin, A. and Kerem, D. (2021) Common Dolphins, Common in Neritic Waters off Southern Israel, Demonstrate Uncommon Dietary Habits. *Aquatic Conservation: Marine and Freshwater Ecosystems*, **31**, 15-21. https://doi.org/10.1002/aqc.3165

[11] Shoham-Frider, E., Kerem, D., Roditi-Elasar, M., Goffman, O., Morick, D., Yoffe, O. and Kress, N. (2014) Trace Elements in Tissues of Cetacean Species Rarely Stranded along the Israeli Mediterranean Coast. *Marine Pollution Bulletin*, **83**, 376-382. https://doi.org/10.1016/j.marpolbul.2014.03.017

[12] Bearzi, G. (2017) Action Plan for Marine Mammals in Israel 2017-2022. Israel Marine Mammal Research & Assistance Center (IMMRAC), Haifa, 101 p.

[13] Kerem, D., Hadar, N., Goffman, O., Scheinin, A., Kent, R., Boisseau, O. and Schattner, U. (2012) Update on the Cetacean Fauna of the Mediterranean Levantine Basin. *The Open Marine Biology Journal*, **6**, 6-27. https://doi.org/10.2174/1874450801206010006

[14] Mevorach, Y., Scheinin, A., Galili, O., Santostasi, N.L. and Tchernov, D. (2022) Common Dolphins (*Delphinus delphis*) in Israel: Unique Dynamics of a Critically Endangered Population. *Frontiers in Marine Science*, **9**, Article ID: 916950.

https://doi.org/10.3389/fmars.2022.916950

[15] Dede, A., Saad, A., Fakhri, M. and Öztürk, B. (2012) Cetacean Sightings in the Eastern Mediterranean Sea during the Cruise in Summer 2008. *Journal of Black Sea/ Mediterranean Environment*, **18**, 49-57.

[16] Kasparek, M. (1997) The False Killer Whale, *Pseudorca crassidens* (Cetacea: Delphinidae), New for Syria. *Zoology in the Middle East*, **14**, 23-26. https://doi.org/10.1080/09397140.1997.10637700

[17] Henda-Benrekaa, A. and Moulaïb, R. (2021) First Data on Cetacean Strandings and *in Situ* Observations along the Algerian Coast. *Acta Zoologica Lituanica*, **31**, 37-44. https://doi.org/10.35513/21658005.2021.1.7

[18] Frantzis, A., Nikolaou, O., Bompar, J.M. and Cammedda, A. (2004) Humpback Whale (*Megaptera novaeangliae*) Occurrence in the Mediterranean Sea. *Journal of Cetacean Research and Management*, **6**, 25-28.

[19] Authier, M., Commanducci, F.D., Genov, T., Holcer, D., Ridoux, V., Salivas, M. and Spitz, J. (2017) Cetacean Conservation in the Mediterranean and Black Seas: Fostering Transboundary Collaboration through the European Marine Strategy Framework Directive. *Marine Policy*, **82**, 98-103. https://doi.org/10.1016/j.marpol.2017.05.012

[20] Casale, P. (2010) Sea Turtles in the Mediterranean: Distribution, Threats and Conservation Priorities. IUCN, Gland.

[21] Canbolat, A.F. (2004) A Review of Sea Turtle Nesting Activity along the Mediterranean Coast of Turkey. *Biological Conservation*, **116**, 81-91. https://doi.org/10.1016/S0006-3207(03)00179-4

[22] Barreiros, J.P. and Barcelos, J. (2001) Plastic Ingestion by a Leatherback Turtle (*Dermochelys coriacea*). *Marine Pollution Bulletin*, **42**, 1196-1197. https://doi.org/10.1016/S0025-326X(01)00215-6

[23] Casale, P., Freggi, D., Paduano, V. and Oliverio, M. (2016) Biases and Best Approaches for Assessing Debris Ingestion in Sea Turtles, with a Case Study in the Mediterranean. *Marine Pollution Bulletin*, **110**, 238-249. https://doi.org/10.1016/j.marpolbul.2016.06.057

[24] Bilge, G., Yapici, S., Filiz, H. and Cerim, H. (2014) Weight-Length Relations for 103 Fish Species from the Southern Aegean Sea, Turkey. *Acta Ichthyologica et Piscatoria*, **44**, 263-269. https://doi.org/10.3750/AIP2014.44.3.11

[25] Bilecenoglu, M., Kaya, M., Cihangir, B. and Cicek, E. (2014) An Updated Checklist of the Marine Fishes of Turkey. *Turkish Journal of Zoology*, **38**, 901-929. https://doi.org/10.3906/zoo-1405-60

[26] FAO (2018) The State of Mediterranean and Black Sea Fisheries. General Fisheries Commission for the Mediterranean, Rome, 172 p.

[27] Golani, D. (2021) An Updated Checklist of the Mediterranean Fishes of Israel, with Illustrations of Recently Recorded Species and Delineation of Lessepsian Migrants. *Zootaxa*, **4956**, 1-108. https://doi.org/10.11646/zootaxa.4956.1.1

[28] Goren, M. and Galil, B. (2005) A Review of Changes in the Fish Assemblages of Levantine Inland and Marine Ecosystems Following the Introduction of Non Native fishes. *Journal of Applied Ichthyology*, **21**, 364-370. https://doi.org/10.1111/j.1439-0426.2005.00674.x

[29] Al-Hassan, L.A., and El-Silini, O.A. (1999) Checklist of Bony Fishes Collected from the Mediterranean Coast of Benghazi, Libya. *Revista de Biologia Marina y Oceanografía*, **34**, 291-301.

[30] Houghton, J.D., Doyle, T.K., Davenport, J. and Hays, G.C. (2006) The Ocean Sunfish (*Mola mola*) Insights into Distribution, Abundance and Behavior in the Irish and Celtic Seas. *Journal of the Marine Biological Association of the United Kingdom*, **86**, 1237-1243. https://doi.org/10.1017/S002531540601424X

[31] Akyol, O., Erdem, M., Unal, V. and Ceyhan, T. (2005) Investigations on Drift-Net Fishery for Swordfish (*Xiphias gladius* L.) in the Aegean Sea. *Turkish Journal of Veterinary and Animal Science*, **29**, 1225-1231.

[32] Bariche, M., Letourneur, Y. and Harmelin-Vivien, M. (2004) Temporal Fluctuations and Settlement Patterns of Native and Lessepsian Herbivorous Fishes on the Lebanese Coast (Eastern Mediterranean*). Environmental Biology of Fishes*, **70**, 81-90. https://doi.org/10.1023/B:EBFI.0000022928.15148.75

[33] Ferretti, F., Myers, R.A., Serena, F. and Lotze, H.K. (2008) Loss of Large Predatory Sharks from the Mediterranean Sea. *Conservation Biology*, **22**, 952-964. https://doi.org/10.1111/j.1523-1739.2008.00938.x

[34] Canese, S., Cardinali, A., Romeo, T., Giusti, M., Salvati, E., Angiolillo, M. and Greco, S. (2011) Diving Behavior of the Giant Devil Ray in the Mediterranean Sea. *Endangered Species Research*, **14**, 171-176. https://doi.org/10.3354/esr00349

[35] Hemida, F., Mehezem, S. and Capapé, C. (2002) Captures of the Giant Devil Ray *Mobula mobular* Bonnaterre, 1788 (Chondrichthyes: Mobulidae) off the Algerian Coast (Southern Mediterranean). *Acta Adriatica*, **43**, 69-76.

[36] Abdulla, A. (2004) Status and Conservation of Sharks in the Mediterranean Sea. IUCN, Gland, 6 p.

[37] Başusta, N., Keskin, Ç., Serena, F. and Seret, B. (2006) The Proceedings of the Workshop on Mediterranean Cartilaginous Fish with Emphasis on Southern and Eastern Mediterranean. Turkish Marine Research Foundation, Istanbul, Publication Number 23, 262 p.

[38] Golani, D. (2006). Cartilaginous Fishes of the Mediterranean Coast of Israel. *The Proceedings of the International Workshop on Mediterranean Cartilaginous Fish with Emphasis on Southern and Eastern Mediterranean*, Istanbul, 14-16 October 2006, 95-100.

[39] Ariel, A. and Barash, A. (2015) Action Plan for Protection of Sharks and Rays in the Israeli Mediterranean. EcoOcean Association, Tel Aviv, 44 p.

[40] Lteif, M. (2015) Biology, Distribution and Diversity of Cartilaginous Fish Species along the Lebanese Coast, Eastern Mediterranean. Ph.D. Thesis, Université de Perpignan, Perpignan, 262 p.

[41] Moore, A.B.M. (2017) Are Guitarfishes the Next Sawfishes? Extinction Risk and an Urgent Call for Conservation Action. *Endangered Species Research*, **34**, 75-88. https://doi.org/10.3354/esr00830

[42] Mancusi, C., Baino, R., Fortuna, C., De Sola, L.G., Morey, G., Bradai, M.N. and Serena, F. (2020) MEDLEM Database, a Data Collection on Large Elasmobranchs in the Mediterranean and Black Seas. *Mediterranean Marine Science*, **21**, 276-288. https://doi.org/10.12681/mms.21148

[43] MEnA (2001) Gaza Coastal and Marine Environmental Protection and Management Action Plan. Ministry of Environmental Affairs (MEnA), Palestinian National Authority, Gaza City, 112 p.

[44] Abd Rabou, A.N. (2013) Priorities of Scientific Research in the Fields of Marine Environment and Fishery Resources in the Gaza Strip-Palestine. *Priorities of Scientific Research in Palestine*: *Towards a National Directory of Scientific Research*, Gaza Strip,

25-26 March 2013, 481-522.

[45] Shaheen, A.L. (2016) Assessment of Pisciculture Status in the Gaza Strip. M.Sc. Thesis, Al-Azhar University, Gaza Strip, 163 p.

[46] Abu Amra, H.E. (2018) A Survey of Marine Bony Fishes of the Gaza Strip, Palestine. M.Sc. Thesis, Islamic University of Gaza, Gaza Strip, 110 p.

[47] Abudaya, M., Ulman, A., Salah, J., Fernando, D., Wor, C. and di Sciara, G.N. (2018) Speak of the Devil Ray (*Mobula mobular*) Fishery in Gaza. *Reviews in Fish Biology and Fisheries*, **28**, 229-239. https://doi.org/10.1007/s11160-017-9491-0

[48] Abd Rabou, A.N. (2019) On the Occurrence and Health Risks of the Silver-Cheeked Toadfish (*Lagocephalus sceleratus* Gmelin, 1789) in the Marine Ecosystem of the Gaza Strip-Palestine. *Biodiversitas*, **20**, 2618-2625. https://doi.org/10.13057/biodiv/d200926

[49] Bariche, M., Sayar, N. and Balistreri, P. (2019) Records of Two Non-Indigenous Fish Species *Synanceia verrucosa* (Bloch and Schneider, 1801) and *Acanthurus sohal* (Forsskål, 1775) from the Gaza Strip (Eastern Mediterranean Sea). *BioInvasions Records*, **8**, 699-705. https://doi.org/10.3391/bir.2019.8.3.27

[50] Abd Rabou, A.N., Abd Rabou, M.A., Qaraman, A.A., Abualtayef, M.T., Abd Rabou, A.A., Khalaf, N.A., Al-Sweirki, S.H., Jaber, I.M., Elnabris, K.J., Elkahlout, K.E., Shafei, A.A., Wafi, A.M., Abd Rabou, O.A., Ibrahim, Y.K., Al-Bursh, A.A., Jarayseh, B.S., Al-Hali, D.I., Hamode, K.A., Benmessaoud, R.M., Cherif, M.M., Madkour, H.A. and Madkour, F.A. (2021) Sightings and Strandings of the Cetacean Fauna in the Mediterranean Coast of the Gaza Strip, Palestine. *Israa University Journal of Applied Science* (*IUGAS*), **5**, 152-186. https://doi.org/10.52865/NUWV7692

[51] Al-Mabruk, S.A., Di Natale, A. and Zava, B. (2021) Additional Data on the Narrow-Barred Spanish Mackerel (*Scomberomorus commerson*, Lacépède, 1800) in Libya and Palestine. *Collective Volume of Scientific Papers ICCAT*, **78**, 59-66.

[52] UNEP (2003) Desk Study on the Environment in the Occupied Palestinian Territories. United Nations Environment Program (UNEP), Nairobi, 188 p.

[53] Dardona, A.W. and Khalaf, N.A. (2015) Studying Aquatic Birds in the Area between the Gaza Fishermen Port and Wadi Gaza Estuary, Gaza Strip, Palestine. *Gazelle*: *The Palestinian Biological Bulletin*, No. 124, 22-39.

[54] Abd Rabou, A.N. (2005) An Ecological Survey and Assessment of Wadi Gaza Nature Reserve, Gaza Strip-Palestine, with Particular Emphasis on Wildlife. Ph.D. Thesis, Al-Neelain University, Khartoum, 278 p.

[55] Abd Rabou, A.N. (2011) Environmental Impacts Associated with the Beit Lahia Wastewater Treatment Plant, North Gaza Strip, Palestine. *Middle-East Journal of Scientific Research* (*MEJSR*), **7**, 746-757.

[56] Abd Rabou, A.N. (2011) On the Ecology of Wadi Gaza, Gaza Strip: Survey and Assessment (Wildlife Is Focused). LAP Lambert Academic Publishing, Saarbrucken, 304 p.

[57] Abd Rabou, A.N. (2019) Ornithofauna Prevailing at Al-Mawasi Ecosystem of the Gaza Strip, Palestine. *Open Journal of Ecology* (*OJE*), **9**, 360-400. https://doi.org/10.4236/oje.2019.99025

[58] Abd Rabou, A.N., Yassin, M.M., Al-Agha, M.R., Hamad, D.M. and Ali, A.S. (2007) The Avifauna of Wadi Gaza Nature Reserve, Gaza Strip-Palestine. *The Islamic University Journal* (*Series of Natural Studies and Engineering*), **15**, 39-85.

[59] Abd Rabou, A.N. (2020) The Palestinian Marine and Terrestrial Vertebrate Fauna Preserved at the Biology Exhibition, Islamic University of Gaza, Bombarded by the

Israeli Army in December, 2008. *Israa University Journal of Applied Science* (*IUGAS*), **4**, 9-51. https://doi.org/10.52865/HFRS6095

[60] Khalaf, G., Fakhri, M., Ohanian, C., Abi-Ghanem, C. and David, L. (2003) Distribution and Relative Abundance of the *Tursiops truncatus* in Lebanese Marine Waters (Eastern Mediterranean). *Journal of Life Sciences*, **7**, 1-8.

[61] Stephens, G., Baş, A.A., Hardy, J., Awbery, T., Rudd, L., Abbiss, L., Araç, N. and Lyne, P. (2021) Sightings and Stranding Reports of Fin Whales (*Balaenoptera physalus*) in the Levantine Sea. *Journal of Cetacean Research and Management*, **22**, 55-60. https://doi.org/10.47536/jcrm.v22i1.212

[62] Bearzi, G. (2002) Interactions between Cetacean and Fisheries in the Mediterranean Sea. In: Notarbartolo di Sciara, G., Ed., *Cetaceans of the Mediterranean and Black Seas: State of Knowledge and Conservation Strategies*, ACCOBAMS, Monaco, 20 p.

[63] Pace, D.S., Tizzi, R. and Mussi, B. (2015) Cetaceans Value and Conservation in the Mediterranean Sea. *Journal of Biodiversity & Endangered Species*, **S1**, S1.004.

[64] Gaspari, S., Scheinin, A., Holcer, D., Fortuna, C., Natali, C., Genov, T. and Moura, A.E. (2015) Drivers of Population Structure of the Bottlenose Dolphin (*Tursiops truncatus*) in the Eastern Mediterranean Sea. *Evolutionary Biology*, **42**, 177-190. https://doi.org/10.1007/s11692-015-9309-8

[65] Öztürk, B. and Öztürk, A.A. (1998) Cetacean Strandings in the Aegean and Mediterranean Coasts of Turkey. *Rapport Commissione Internationale Mer Méditerranée*, **35**, 476-477.

[66] Öztürk, A.A., Tonay, A.M. and Dede, A. (2011) Strandings of the Beaked Whales, Risso's Dolphins, and a Minke Whale on the Turkish Coast of the Eastern Mediterranean Sea. *Journal of the Black Sea/Mediterranean Environment*, **17**, 269-274.

[67] Weitkowitz, W. (1992) Sightings of Whales and Dolphins in the Middle East (Cetacea). *Zoology in the Middle East*, **6**, 5-12. https://doi.org/10.1080/09397140.1992.10637606

[68] Bazairi, H., Ben Haj, S., Boero, F., Cebrian, D., De Juan, S., Limam, A., Lleonart, J., Torchia, G. and Rais, C. (2010) The Mediterranean Sea Biodiversity: State of the Ecosystems, Pressures, Impacts and Future Priorities. UNEP-MAP RAC/SPA, Tunis, 100 p.

[69] IUCN (2012) Marine Mammals and Sea Turtles of the Mediterranean and Black Seas. IUCN, Gland, 32 p.

[70] Abo-Taleb, H.A., El-feky, M.M.M., Mohamed A.M., El-Tabakh, M.A.M., Hendy, D.M. and Maaty, M. (2020) First Record of Bryde's Whale (*Balaenoptera brydei* Olsen, 1913) in the Southeastern Mediterranean Sea, Alexandria, Egypt. *Egyptian Journal of Aquatic Biology and Fisheries*, **24**, 667-695. https://doi.org/10.21608/ejabf.2020.76557

[71] Farrag, M.M.S., Ahmed, H.O., TouTou, M.M.M. and Eissawi, M.M. (2019) Marine Mammals on the Egyptian Mediterranean Coast "Records and Vulnerability". *International Journal of Ecotoxicology and Ecobiology*, **4**, 8-16. https://doi.org/10.11648/j.ijee.20190401.12

[72] Reeves, R. and Notarbartolo di Sciara, G. (2006) The Status and Distribution of Cetaceans in the Black Sea and Mediterranean Sea. IUCN Center for Mediterranean Cooperation, Malaga, 137 p.

[73] Notarbartolo di Sciara, G. and Birkun, A. (2010) Conserving Whales and Dolphins in the Mediterranean and Black Seas: An ACCOBAMS Status Report. ACCOBAMS, Monaco, 212 p.

[74] Gonzalvo, J. and Bearzi, G. (2008) Action Plan for the Conservation of Cetaceans in Syria. Regional Activity Centre for Specially Protected Areas, Contract 39/2007-RAC/SPA.

[75] El-Hili, H.A., Cozzi, B., Ben Salah, C. Podesta, M., Ayari, W., Ben Amor, N. and Mraouna, R. (2010) A Survey of Cetaceans Stranded along the Northern Coast of Tunisia: Recent Findings (2005-2008) and a Short Review of the Literature. *Journal of Coastal Research*, **26**, 982-985. https://doi.org/10.2112/JCOASTRES-D-09-00010.1

[76] Brand, D., Edelist, D., Goffman, O., Hadar, N., Scheinin, A. and Kerem, D. (2019) Common Dolphins, Common in Neritic Waters off Southern Israel, Demonstrate Uncommon Dietary Habits. *Aquatic Conservation: Marine and Freshwater Ecosystems*, **31**, 15-21. https://doi.org/10.1002/aqc.3165

[77] Bearzi. G., Reeves, R.R., Notarbartolo di Sciara, G., Politi, E., Conadas, A., Frantzis, A. and Mussi, B. (2003) Ecology, Status and Conservation of Short-Beaked Common Dolphins *Delphinus delphis* in the Mediterranean Sea. *Mammal Review*, **33**, 224-252. https://doi.org/10.1046/j.1365-2907.2003.00032.x

[78] Christensen, V. (2011) From Common to Rare: The Case of the Mediterranean Common Dolphin. *Biological Conservation*, **144**, 2490-2498. https://doi.org/10.1016/j.biocon.2011.07.003

[79] Aguilar, A. and Borrell, A. (1994) Abnormally High Polychlorinated Biphenyl Levels in Striped Dolphin (*Stenella coeruleoalba*) Affected by the 1990-1992 Mediterranean Epizootic. *Science of the Total Environment*, **154**, 237-247. https://doi.org/10.1016/0048-9697(94)90091-4

[80] Kuiken, T., Simpson, V.R., Allchin, C.R., Bennett, P.M., Codd, G.A., Harris, E.A. and and Phillips, S. (1994) Mass Mortality of Common Dolphins (*Delphinus delphis*) in South West England Due to Incidental Capture in Fishing Gear. *The Veterinary Record*, **134**, 81-89. https://doi.org/10.1136/vr.134.4.81

[81] Kirkwood, J.K., Bennett, P.M., Jepson, P.D., Kuiken, T., Simpson, V.R. and Baker, J.R. (1997) Entanglement in Fishing Gear and Other Causes of Death in Cetaceans Stranded on the Coasts of England and Wales. *The Veterinary Record*, **141**, 94-98. https://doi.org/10.1136/vr.141.4.94

[82] Hampton, J.O., Mawson, P.R., Coughran, D.K. and Vitali, S.D. (2014) Validation of the Use of Firearms for Euthanizing Stranded Cetaceans. *Journal of Cetacean Research and Management*, **14**, 117-123. https://doi.org/10.47536/jcrm.v14i1.528

[83] Weilgart, L.S. (2007) The Impacts of Anthropogenic Ocean Noise on Cetaceans and Implications for Management. *Canadian Journal of Zoology*, **85**, 1091-1116. https://doi.org/10.1139/Z07-101

[84] Luksenburg, J.A. (2014) Prevalence of External Injuries in Small Cetaceans in Aruban Waters, Southern Caribbean. *PLOS ONE*, **9**, e88988. https://doi.org/10.1371/journal.pone.0088988

[85] Schumann, N., Gales, N.J., Harcourt, R.G. and Arnould, J.P.Y. (2013) Impacts of Climate Change on Australian Marine Mammals. *Australian Journal of Zoology*, **61**, 146-159. https://doi.org/10.1071/ZO12131

[86] Bianchi, C.N. and Morri, C. (2000) Marine Biodiversity of the Mediterranean Sea: Situation, Problems and Prospects for Future Research. *Marine Pollution Bulletin*, **40**, 367-376. https://doi.org/10.1016/S0025-326X(00)00027-8

[87] Guimaraes, S.M., Tavares, D.C. and Monteiro-Neto, C. (2018) Incidental Capture of Sea Turtles by Industrial Bottom Trawl Fishery in the Tropical South-Western Atlantic. *Journal of the Marine Biological Association of the United Kingdom*, **98**, 1525-1531. https://doi.org/10.1017/S0025315417000352

[88] Miguel, C., Becker, J.H., de Freitas, B.S., Touguinha, L.B.A., Salvador, M. and Oliveira, G.T. (2020) Physiological Effects of Incidental Capture and Seasonality on Juvenile Green Sea Turtles (*Chelonia mydas*). *Journal of Experimental Marine Biology and Ecology*, **533**, Article ID: 151460. https://doi.org/10.1016/j.jembe.2020.151460

[89] Awabdi, D.R., Pestana, I.A., Bondioli, A.C.V., Zappes, C.A. and Di Beneditto, A.P.M. (2021) Incidental Capture of Sea Turtles in Southeast Brazil: Assessment of the Perceptions of Artisanal Fishers. *Ocean & Coastal Management*, **210**, Article ID: 105696. https://doi.org/10.1016/j.ocecoaman.2021.105696

[90] Houghton, J.D.R., Doyle, T.K., Wilson, M.W., Davenport, J. and Hays, G.C. (2006) Jellyfish Aggregations and Leatherback Turtle Foraging Patterns in a Temperate Coastal Environment. *Ecology*, **87**, 1967-1972. https://doi.org/10.1890/0012-9658(2006)87[1967:JAALTF]2.0.CO;2

[91] Abu Aouda, S.A., Abu Aouda, L.M. and Zuhud, N.H. (2008) A Preliminary Survey of Marine Fishes in the Gaza Strip. B.Sc. Dissertation, Islamic University of Gaza, Gaza, 64 p.

[92] Salah, J.Y. and Abutair, M.E. (2012) Common Fishes of the Gaza Strip: Brochures. Directorate General of Fisheries, Ministry of Agriculture, Palestinian National Authority, Gaza Strip.

[93] Al-Agha, M.R., Abd Rabou, A.N. and Saqer, T.M. (1999) On the Marine Environment and Fisheries Resources in the Gaza Strip. Green Peace Association, Gaza Strip, 25 p.

[94] El-Haweet, A., Sabry, E., Abuhatab, H. and Hegazy, M. (2004) Assessment of Purse Seine Fishery and Sardine Catch of Gaza Strip. *Egyptian Journal of Aquatic Research*, **30**, 306-321.

[95] Sabry, E.A., Hegazy, M.R., El-Haweet, A. and Abu Hatab, H.G. (2005) Population Dynamics of *Boops boops* L. from Gaza and Alexandria Mediterranean Waters. *Alexandria Journal of Agricultural Research*, **50**, 23-32.

[96] Muzyed, S.K. (2011) Heavy Metal Concentrations in Commercially Available Fishes in Gaza Strip Markets. M.Sc. Thesis, Islamic University of Gaza, Gaza Strip, 64 p.

[97] Elnabris, K.J., Muzyed, S.K. and Al-Ashgar, N.M. (2013) Heavy Metal Concentrations in Some Commercially Important Fishes and Their Contribution to Heavy Metals Exposure in Palestinian People of Gaza Strip (Palestine). *Journal of the Association of Arab Universities for Basic and Applied Sciences*, **13**, 44-51. https://doi.org/10.1016/j.jaubas.2012.06.001

[98] Zaqoot, H.A., Aish, A.M. and Wafi, H.N. (2017) Baseline Concentration of Heavy Metals in Fish Collected from Gaza Fishing Harbor in the Mediterranean Sea along Gaza Coast, Palestine. *Turkish Journal of Fisheries and Aquatic Sciences*, **17**, 101-109. https://doi.org/10.4194/1303-2712-v17_1_12

[99] Salah, J.Y. and Ahmed, M.S. (2019) Fishing in the Gaza Strip. Directorate General of Fisheries, Ministry of Agriculture, Palestinian National Authority, Gaza Strip, 130 p.

[100] Abudaya, M., Harper, S., Ulman, A. and Zeller, D. (2014) Correcting Mis- and Under-Reported Marine Fisheries Catches for the Gaza Strip: 1950-2010. *Acta Adriatica*, **54**, 241-252.

[101] Couturier, L.I.E., Bennett, M.B. and Richardson, A.J. (2013) Mystery of Giant Rays off the Gaza Strip Solved. *Oryx*, **47**, 480. https://doi.org/10.1017/S0030605313000793

[102] Hussein, K.B. and Talet, L.B. (2019) New Record of Giant Devil Ray (Chondrich-

thyes: Myliobatidae) from Oran Bay (Western Mediterranean Sea). *Indonesian Fisheries Research Journal*, **25**, 55-63. https://doi.org/10.15578/ifrj.25.1.2019.55-63

[103] Hosegood, J., Humble, E., Ogden, R., De Bruyn, M., Creer, S., Stevens, G.M. and Carvalho, G. (2020) Phylogenomics and Species Delimitation for Effective Conservation of Manta and Devil Rays. *Molecular Ecology*, **29**, 4783-4796. https://doi.org/10.1111/mec.15683

[104] Notarbartolo di Sciara, G., Stevens, G. and Fernando, D. (2020) The Giant Devil Ray *Mobula mobular* (Bonnaterre, 1788) Is Not Giant, but It Is the Only Spinetail Devil Ray. *Marine Biodiversity Records*, **13**, Article No. 4. https://doi.org/10.1186/s41200-020-00187-0

[105] Ben Zion, I. (2013) Gaza's Massive Haul of Devil Rays Sparks Big Fish Story. The Times of Israel. https://www.timesofisrael.com/gazas-haul-of-massive-devil-rays-sparks-big-fish-story

[106] Serena, F. (2005) Field Identification Guide to the Sharks and Rays of the Mediterranean and Black Sea. Food & Agriculture Organization of the United Nations, Rome, 96 p.

[107] Cavanagh, R.D. and Gibson, C. (2007) Overview of the Conservation Status of Cartilaginous Fishes (Chrondrichthyans) in the Mediterranean Sea. IUCN, Gland. https://doi.org/10.2305/IUCN.CH.2007.MRA.3.en

[108] Ferretti, F., Worm, B., Britten, G.L., Heithaus, M.R. and Lotze, H.K. (2010) Patterns and Ecosystem Consequences of Shark Declines in the Ocean. *Ecology Letters*, **13**, 1055-1071. https://doi.org/10.1111/j.1461-0248.2010.01489.x

[109] Khalaf, N.A. (2022) Shark Bite Incident in Khan Younis Sea, Gaza Strip, State of Palestine. *Gazelle*: *The Palestinian Biological Bulletin*, **20**, 1-16.

[110] Stevens, J., Bonfil, R., Dulvy, N. and Walker, P. (2000) The Effects of Fishing on Sharks, Rays, and Chimaeras (Chrondrichthyans), and the Implications for Marine Ecosystems. *ICES Journal of Marine Science*: *Journal du Conseil*, **57**, 476-494. https://doi.org/10.1006/jmsc.2000.0724