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Study suggests the Mediterranean Sea may be losing large predatory sharks.

SHARK DECLINES IN THE MEDITERRANEAN SEA

A SUMMARY OF NEW SCIENTIFIC ANALYSIS:

Ferretti, F., Myers, R.A., Serena, F., and Lotze, H.K. 2008. Loss of large predatory sharks from the Mediterranean Sea. *Conservation Biology.*

POPULATIONS OF LARGE SHARKS are declining in many parts of the world, including in the Mediterranean Sea where humans have been fishing for thousands of years. These sharks are threatened with extinction because of overfishing, habitat degradation, and slow recovery rates. The loss of sharks is a concern because they play crucial roles as predators in marine ecosystems. However, management is difficult because there is generally a lack of information about shark populations, especially in the Mediterranean.

Francesco Ferretti and his co-authors reconstructed population trends of large sharks over the last 200 years in the Mediterranean Sea, where some of the largest and earliest declines in sharks may have occurred. The scientists found that all species studied decreased by more than 97 percent in number and catch weight over time. Their findings suggest several Mediterranean shark species are at risk of extinction, especially if current levels of fishing pressure continue. This *Lenfest Ocean Program Research Series* report is a summary of the study's findings.

MEDITERRANEAN SHARKS

The Mediterranean Sea has a long history of marine resource use. Its fisheries have traditionally targeted many high-value species, including tuna and swordfish. However, non-targeted species, such as sharks, have also been caught unintentionally in fishing gear (called "bycatch"). For example, pelagic longline fishing for high-value fish such as swordfish can capture large numbers of sharks as bycatch.

Forty-seven species of sharks live in the Mediterranean Sea, of which 20 are considered top predators. Historically, these sharks were found throughout the Sea. However, almost all of the large sharks in the Mediterranean have decreased in abundance because of unintended capture in open ocean fisheries, targeted shark fishing, and human population pressure in coastal areas.

A comprehensive monitoring program for fisheries has been difficult to implement in the Mediterranean because of the artisanal (small and localized) nature of its fisheries and the large number of countries bordering the Sea. Data on populations of fish with perceived low value, such as sharks, are even more difficult to obtain. There are currently no catch limits for commercially-fished shark species in the Mediterranean Sea.

MEDITERRANEAN SHARKS AND THE IUCN RED LIST

The blue, smooth hammerhead, and thresher sharks were classified as "Vulnerable" according to the latest IUCN-World Conservation Union Red List Criteria for extinction risk. Two mackerel sharks, porbeagle and shortfin mako, were classified as "Critically Endangered". Many other large sharks are classified as "Data Deficient".

TABLE 1: DATA SETS, STUDY AREAS, AND TYPES OF SHARKS USED IN THE ANALYSIS

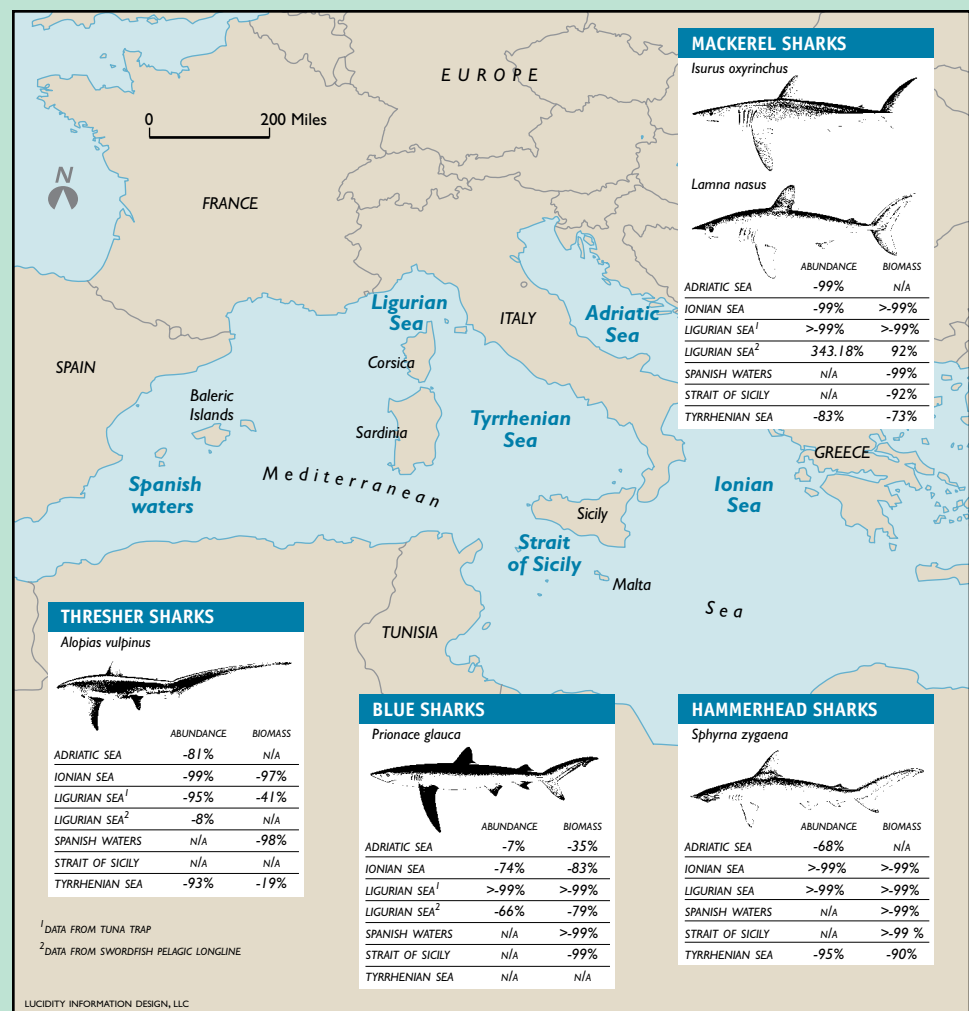| Fishing gear	Geographic area (timespan)	Groups of sharks	Source of information
Sightings records	Adriatic Sea (1827–2000)	Mackerel; Hammerhead	Published data
Tuna trap	Tyrrhenian Sea (1898–1922)	Thresher; Mackerel; Hammerhead	Fisher logbooks
Tuna trap	Ligurian Sea (1950–2006)	Thresher; Mackerel; Blue; Hammerhead	Fisher logbooks
Swordfish pelagic longline	Ionian Sea (1978–1999)	Thresher; Mackerel; Blue; Hammerhead	Published data
Pelagic longline	Strait of Sicily (1979–2001)	Mackerel; Blue; Hammerhead	Official statistics of Valletta's wholesale fish market
Swordfish pelagic longline	Spanish Mediterranean waters (1979–2004)	Thresher; Mackerel; Blue; Hammerhead	Published data
Swordfish pelagic longline	Adriatic Sea (1984–1999)	Blue	Published data
Swordfish pelagic longline	Ligurian Sea (1990–1998)	Thresher; Mackerel; Blue	Published data
Big game rod and reel fishing	Adriatic Sea (1995–2006)	Thresher	Yacht–club logbooks

STUDY METHODS

Ferretti and his colleagues used nine different sources of data to calculate abundance and biomass (an estimate of catch weight, in kilograms) trends over time. These included information from fishermen's catch logbooks, shark landings, specimens from museums, and visual sightings on the water (see Table 1). Information for each species was used only if it occurred in two or more data sets and more than three times within each data set. Only five species of sharks offered sufficient information for analysis, including the blue shark (*Prionace glauca*), one thresher shark species (*Alopias vulpinus*), two mackerel shark species (*Lamna nasus* and *Isurus oxyrinchus*), and one hammerhead shark species (*Sphyrna zygaena*). The authors combined the two mackerel shark species for the analysis because of ambiguity in some of the data sets regarding species identification.

Using these data, Ferretti and his co-authors estimated a percent change in abundance and biomass over time for each shark species or group in each of several regions of the Mediterranean Sea (see Table 1 and Figure 1). The authors then combined these estimates to formulate a general rate of change in shark populations across all study sites in the Mediterranean (see Table 2).

FIGURE 1: PERCENT CHANGE IN SHARK ABUNDANCE AND BIOMASS OVER TIME IN EACH STUDY SITE IN THE MEDITERRANEAN SEA
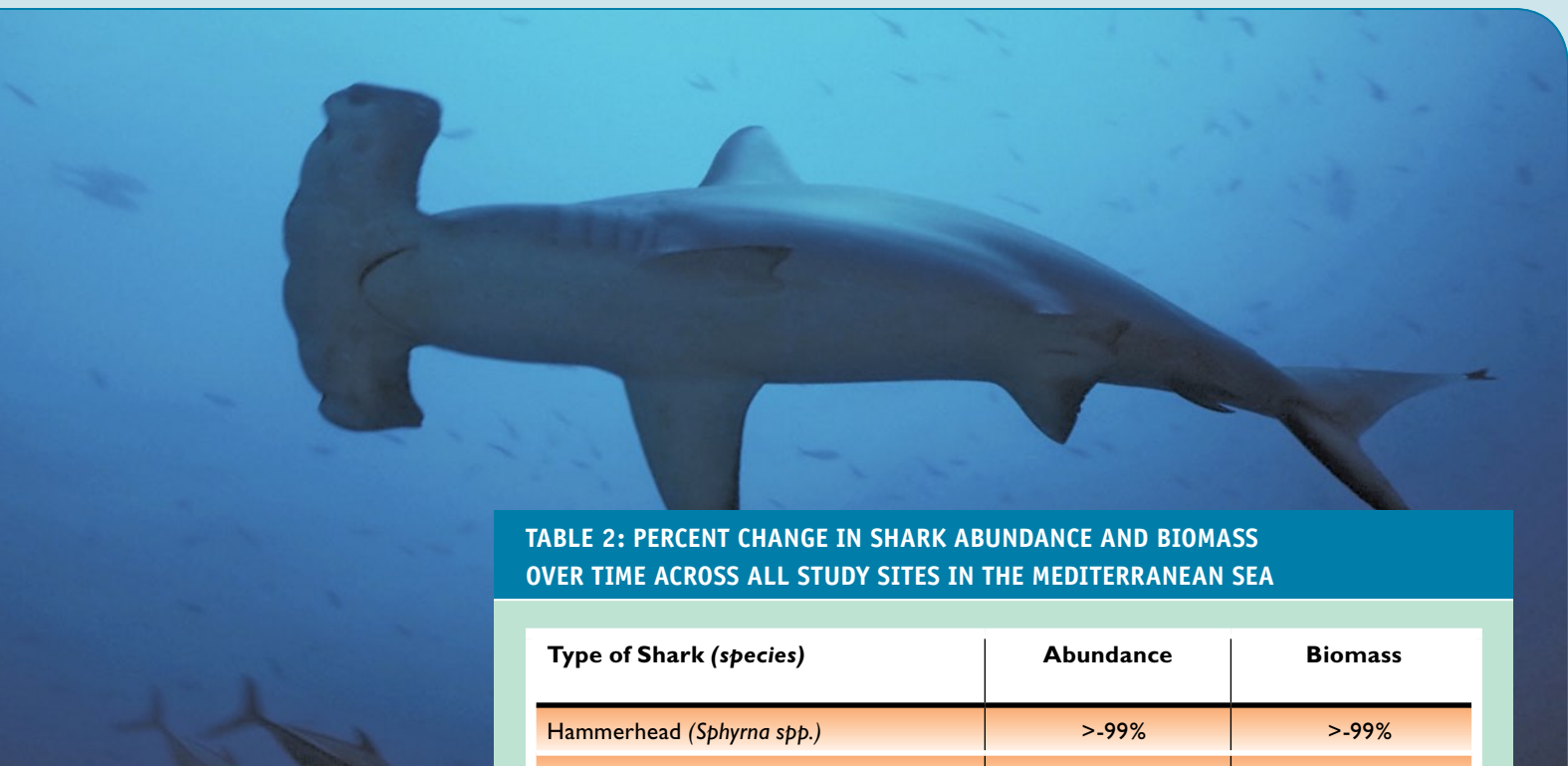

MACKEREL SHARKS

Isurus oxyrinchus

Lamna nasus

	ABUNDANCE	BIOMASS
ADRIATIC SEA	-99%	N/A
IONIAN SEA	-99%	>-99%
LIGURIAN SEA[1]	>-99%	>-99%
LIGURIAN SEA[2]	343.18%	92%
SPANISH WATERS	N/A	-99%
STRAIT OF SICILY	N/A	-92%
TYRRHENIAN SEA	-83%	-73%

THRESHER SHARKS

Alopias vulpinus

	ABUNDANCE	BIOMASS
ADRIATIC SEA	-81%	N/A
IONIAN SEA	-99%	-97%
LIGURIAN SEA[1]	-95%	-41%
LIGURIAN SEA[2]	-8%	N/A
SPANISH WATERS	N/A	-98%
STRAIT OF SICILY	N/A	N/A
TYRRHENIAN SEA	-93%	-19%

[1] DATA FROM TUNA TRAP

[2] DATA FROM SWORDFISH PELAGIC LONGLINE

BLUE SHARKS

Prionace glauca

	ABUNDANCE	BIOMASS
ADRIATIC SEA	-7%	-35%
IONIAN SEA	-74%	-83%
LIGURIAN SEA[1]	>-99%	>-99%
LIGURIAN SEA[2]	-66%	-79%
SPANISH WATERS	N/A	>-99%
STRAIT OF SICILY	N/A	-99%
TYRRHENIAN SEA	N/A	N/A

HAMMERHEAD SHARKS

Sphyrna zygaena

	ABUNDANCE	BIOMASS
ADRIATIC SEA	-68%	N/A
IONIAN SEA	>-99%	>-99%
LIGURIAN SEA	>-99%	>-99%
SPANISH WATERS	N/A	>-99%
STRAIT OF SICILY	N/A	>-99 %
TYRRHENIAN SEA	-95%	-90%

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TABLE 2: PERCENT CHANGE IN SHARK ABUNDANCE AND BIOMASS OVER TIME ACROSS ALL STUDY SITES IN THE MEDITERRANEAN SEA

Type of Shark (species)	Abundance	Biomass
Hammerhead (Sphyrna spp.)	>-99%	>-99%
Blue (Prionace glauca)	-97%	>-99%
Mackerel (Isurus oxyrinchus and Lamna nasus)	>-99%	>-99%
Thresher (Alopias vulpinus)	>-99%	>-99%

SHARK LIFE HISTORIES AND RECOVERY FROM FISHING

Sharks have life history characteristics that make them vulnerable to impacts from external pressures such as fishing. These include delayed maturity, small numbers of young produced at birth, high age at first breeding, lengthy reproductive cycles, and long life spans. The resilience of these kinds of animals can depend on large, mature individuals living long enough to reproduce multiple times and replenish the population.

FINDINGS AND IMPLICATIONS

Ferretti and his colleagues made several conclusions based on their analysis:

- All assessed Mediterranean shark species declined by more than 97 percent in abundance and biomass, or catch weight, over the last 150–200 years across the Mediterranean Sea (Table 2). These declines classify them as "Critically Endangered" according to World Conservation Union-IUCN Red List criteria.

- The authors could only assess the status of five of the twenty large predatory shark species recorded in the Mediterranean. They suggest this is evidence the Sea has lost much of its predator diversity due to a prolonged and intense human exploitation.

- Biomass declines over time were generally greater than decreases in numbers of sharks. This may indicate that more young and immature sharks are being caught, which may impair the reproductive potential of these species. The size of sharks caught in the Mediterranean is among the lowest in the world.

- Sharks species that occurred within a limited range in the Sea tended to have much less information available, despite historical records confirming their presence in the northwestern parts of the basin. These sharks may have declined in the Mediterranean prior to the study period as a consequence of prolonged coastal fishing and coastal development.

- The declines in sharks, or top predators, observed in this study may have implications for the structure and function of Mediterranean marine ecosystems. Ferretti and his co-authors point to evidence in other parts of the Atlantic that shows the depletion of large sharks has resulted in changes in food webs.

About the Authors

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The rates of shark declines in the Mediterranean are higher than those for comparable species in the Gulf of Mexico and similar to trends in the Northwest Atlantic Ocean.

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