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An updated checklist of chondrichthyans of Calabria (Central Mediterranean, southern Italy), with emphasis on rare species

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Abstract

In this contribution the checklist of chondrichthyans of Calabria (Central Mediterranean, southern Italy) is reported. Data presented is derived from twenty years of opportunistic and active surveys from 2000 to 2020. A total of 55 species of chondrichthyans is present in Calabrian seas: 33 sharks, 20 rays, and 2 chimaeras. These species represent approximately 62% of the total reported for the Mediterranean. Approximately 71% of Calabrian species have been reported in the Tyrrhenian Sea, 49% in the Ionian Sea, and 33% in the Strait of Messina. According to IUCN criteria, new records of Endangered and Critically Endangered species (i.e., *Carcharodon carcharias* [Linnaeus, 1758], *Lamna nasus* [Bonnaterre, 1788], *Cetorhinus maximus* [Gunnerus, 1765], *Mobula mobular* [Bonnaterre, 1788], *Sphyrna zygaena* [Linnaeus, 1758]) are reported, together with the first record of *Raya brachyura* Lafont, 1873 for the Ionian coasts and probably third confirmed record of the rare chimaera *Hydrolagus mirabilis* (Collett, 1904) for the Mediterranean.

Keywords: Cartilaginous fish; distribution; nursery area; conservation.

Introduction

The Mediterranean Sea is an area of high biodiversity for the cartilaginous fishes, and it is home to 88 chondrichthyan species (sharks, skates, rays, and chimaeras), which corresponds to *ca.* 7% of the global species diversity of the group (Cariani *et al.*, 2017; Serena *et al.*, 2020). However, the Mediterranean basin is one of the most threatened marine basins on the planet (Coll *et al.*, 2012), and Mediterranean chondrichthyan populations are affected by different direct and indirect anthropogenic pressures like, above all, direct and indirect fisheries pressures (Colloca *et al.*, 2017; Bradai *et al.*, 2018; Cashion *et al.*, 2019; Panayiotou *et al.*, 2020) and pollution (Bernardini *et al.*, 2018; Valente *et al.*, 2019). Despite this scenario, knowledge on distribution, biology and ecology for most Mediterranean cartilaginous fishes is limited (Leonetti *et al.*, 2020): few data are known for the Eastern Mediterranean (Murat *et al.*, 2002; Megalofonou *et al.*, 2005), the Adriatic Sea (Soldo & Jardas, 2002), North Tyrrhenian and Ligurian seas (Garibaldi & Orsi Relini, 2000; Vacchi

et al., 2002), Algerian Basin (Hemida & Labidi, 2000), Spanish waters (Mejuto *et al.*, 2002), Strait of Gibraltar (Buencuerpo *et al.*, 1998), and Gulf of Taranto (Filanti *et al.*, 1986). No data are available for Southern Tyrrhenian, South-western Ionian, or Strait of Messina, even if these areas are of high biogeographical and ecological value due to their central positions in the Mediterranean. Finally, as for many species in the Mediterranean, the IUCN conservation status has been classified as “Data Deficient” (Dulvy *et al.*, 2016), and data collection is the crucial base to overcome these information gaps. Management efforts from local to regional domains thus require an ocean observation system that monitors marine life in key areas (Costello *et al.*, 2017). Calabria lies in the centre of the Mediterranean, between the Tyrrhenian and the Ionian seas and, together with Sicily and the Tunisian coast, divides the Mediterranean Sea into western and eastern parts (Sperone *et al.*, 2012). Within the region, the Strait of Messina is very important because together with the Sicily-Tunisian Ridge it is one of the two conjunction points between the western and the eastern basins of the

Mediterranean Sea for both native and non-native species (Sperone *et al.*, 2015). For these reasons, the position of Calabria is strategic to collect data about chondrichthyans that historically occurred in the entire Mediterranean Sea, and a monitoring program of the University of Calabria has been collecting data on occurrence of the cartilaginous fishes in this important biogeographic area since 2000 (Sperone *et al.*, 2012; Sperone & Milazzo, 2018; Sperone *et al.*, 2018). Distribution, ecology, and biology of these fishes are little known for this region, especially for some charismatic and endangered species, such as the white shark (Huvneers *et al.*, 2018; Leone *et al.*, 2020; Mancusi *et al.*, 2020). The aim of this study is to provide a first complete species composition list of the Calabrian chondrichthyan fauna in order to improve the knowledge of the spatial distribution of these species in the Central Mediterranean.

Materials and Methods

Distributional data come from *ca.* twenty years of opportunistic surveys, performed from 2000 to 2020 in the Calabrian region in the Central Mediterranean. As for other research of this type, data detection sources are composed of: a) direct observations in the wild; b) observations of specimens landed in fishmongers and fish markets; c) photographic evidence of divers and citizen scientists depicting animals in the wild or stranded. All cases have been subject to cross-feedback (bibliographical verifications, documentary investigations, direct contact with observers involved in signalling, inspections, and cartographic audits). The outcome of this evidence

has determined the degree of reliability attributed to individual sightings. In general, the reliability of the signals coming from sources a), b), and c) it is to be considered to be very high. Chondrichthyes taxa were verified using published references from field guides (Soto & Vooren, 2004; Compagno *et al.*, 2005; Serena, 2005; Ebert & Stehmann, 2013; FAO 2018a; FAO 2018b). Online resources such as the Catalog of Fishes of the California Academy of Sciences (Fricke *et al.*, 2020a) were used to assess the scientific nomenclature at the species level. The checklist is arranged by order and family following Fricke *et al.* (2020b) and World Register of Marine Species (WoRMS Editorial Board, 2020). Genera and species within a family are arranged in alphabetical order. The number in parenthesis after each most inclusive taxon indicates the number of species. The number in brackets on categories higher than genera represents the number of genera. In those taxa higher than family the number preceding genera is the number of families. Authority and year of description of each species and genera follow Fricke *et al.* (2020a). After the authority name, the common English name is provided following FAO-ASFIS (2002), and finally the conservation status, referring to Dulvy *et al.* (2016). For each record, when available, we provided number of specimens, sex, biometric data (total length TL in cm and weight W in kg), locality and district (in brackets using IS for the Ionian Sea, TS for the Tyrrhenian Sea and MS for the Strait of Messina, as in Fig. 1), coordinates, date of the sighting, and type of sighting.

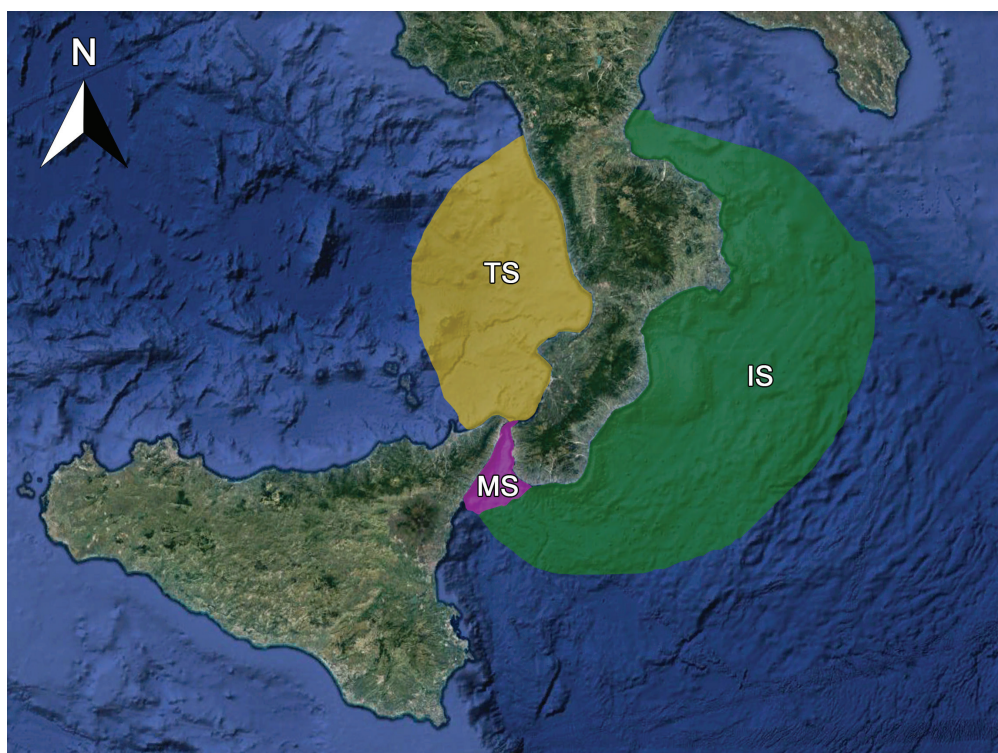


Fig. 1: Study area indicating the three main marine districts: IS (Ionian Sea), MS (Strait of Messina), TS (Tyrrhenian Sea).

Results

The chondrichthyan fauna of Calabria is composed of 55 species included in 36 genera, 25 families, and 9 orders. Figures 2-4 illustrate some of the observed species in the study area.

ANNOTATED CHECKLIST OF THE CHONDRICHTHYES OF CALABRIA 25/36/(55)

CLASS: ELASMOBRANCHII 23/34] (53)

INFRAClass: SELACHII 17/23] (34)

Order: Hexanchiformes 1/2/(2)

Family: Hexanchidae Gray, 1851 [2/(2)

Genus: *Heptranchias* Rafinesque, 1810 (1)

1. *Heptranchias perlo* (Bonnaterre, 1788). Sharpnose sevengill shark. Data Deficient

Records • 6 specimens; Villa San Giovanni (MS); 38.22956°N, 15.61619°E; 18 Nov. 2011; photographic evidence. (Fig. 3E). • 1 ♀, 150 cm; Bovalino (IS), 38,12037°N 16,21999°E; Aug. 2004; landed specimen.

Genus: *Hexanchus* Rafinesque, 1810 (1)

2. *Hexanchus griseus* (Bonnaterre, 1788). Blunt-nose sixgill shark. Least Concern

Records • 1 specimen; Bovalino (IS); 38.13777°N, 16.19164°E; 1 Sept. 2002; fish market. • 1 specimen; Tortora (TS); 39.90866°N, 15.73912°E; Nov. 2004; photographic evidence. • 1 specimen; Brancaleone (IS); 37.95860°N, 16.16350°E; 1 July 2006; landed specimen. • 1 ♂, 220 cm; Pizzo (TS); 38.75798°N, 16.17114°E; 1 June 2005; photographic evidence (Fig. 2C). • 1 ♀, 240 cm; Cirò Marina (IS); 39.36336°N, 17.15802°E; 1 Aug. 2007; landed specimen. • 1 specimen; Rossano (IS); 39.64220°N, 16.64495°E; 1 June 2006; landed specimen. • 1 ♂; Vibo Marina (TS); 38.72361°N, 16.10887°E; 1 May 2005; fish market. • 1 ♂, 1 ♀; Catanzaro Lido



Fig. 2: Photographs of chondrichthyans obtained during our surveys. A. *Alopias vulpinus*. B. *Alopias superciliosus*. C. *Hexanchus griseus*. D. *Hydrolagus* cf. *mirabilis*. E. *Heptranchias perlo*. F. *Lamna nasus*. G. *Galeus melastomus*. H. *Carcharodon carcharias*. I. *Carcharhinus obscurus*.

(IS); 38.72361°N, 16.10887°E; 1 May 2002; bycatch. • 1 ♀, 310 cm; Caulonia (IS); 38.32273°N, 16.48843°E; 13 Aug. 2014; landed specimen. • 1 ♀, 200 cm; Siderno (IS); 38.25680°N, 16.35088°E; 21 July 2013; landed specimen. • 1 ♀, 180 cm; Villa San Giovanni (MS); 38.22990°N, 15.61928°E; 30 June 2009; photographic evidence. • 1 ♀, 400 cm; Stretto di Messina (MS); 38.18863°N, 15.59426°E; 18 Feb. 2020; photographic evidence. • 1 ♀, 220 cm; Reggio Calabria (MS); 38.10297°N, 15.60530°E; 10 Sep 2019; bycatch. • 1 ♀, 350 cm; Torretta di Crucoli (IS); 39.46053°N, 17.07216°E; 18 June 2013; bycatch. • 1 ♀, 200 cm; Ardore (IS); 38.16232°N, 16.23500°E; 7 Sept. 2019; field observation. • 1 ♂, 210 cm; Sellia Marina (IS); 38.85164°N, 16.79930°E; 30 Apr. 2018; landed specimen. • 1 specimen, 300 kg; Marina di San Lorenzo (IS); 37.88250°N, 15.82750°E; 30 Aug. 2014; bycatch.

tch. • 1 ♂, 180 cm; Villa Piana Lido (IS); 39.80831°N, 16.55025°E; 2 Apr. 2014; landed specimen. • 1 ♂, 335 cm; Corigliano Calabro (IS); 39.67954°N, 16.59334°E; 3 June 2015; landed specimen. • 120 cm; Caulonia (IS); 38.32151°N, 16.48885°E; 1 July 2019; field observation. • 1 ♂, 200 cm; Lazzaro (MS); 37.96803°N, 15.64474°E; 25 Oct. 2013; landed specimen.

Order: Lamniformes 4[7](8)Family: Odontaspidae Müller & Henle, 1839 2

Genus: *Carcharias* Rafinesque, 1810 (1)

3. *Carcharias taurus* Rafinesque, 1810. Sand tiger shark. Critically Endangered

Records • 1 specimen; Stretto di Messina (MS);

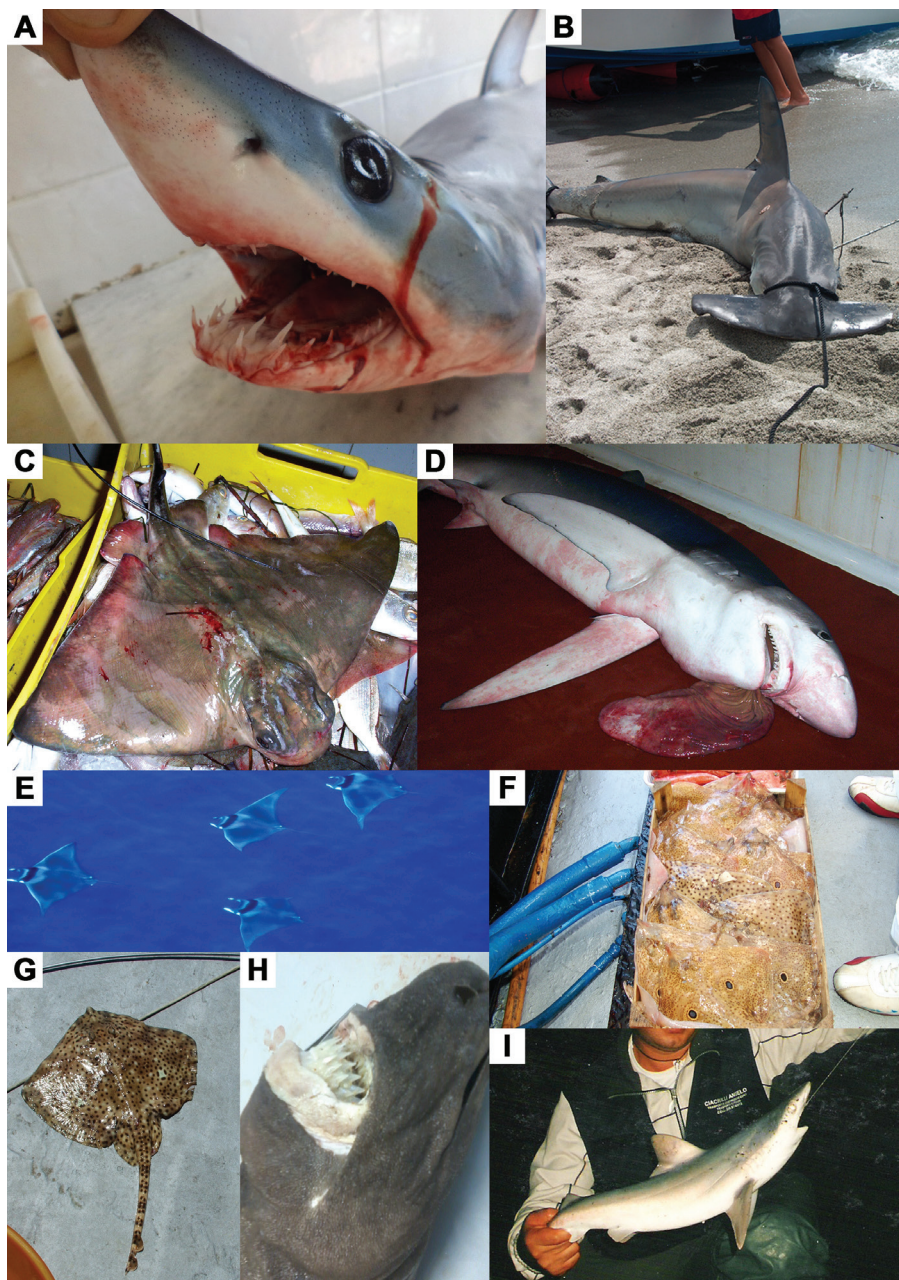


Fig. 3: Photographs of chondrichthyans obtained during our surveys. A. *Isurus oxyrinchus*. B. *Shpyrna zygaena*. C. *Myliobatis aquila*. D. *Prionace glauca*. E. *Mobula mobular*. F. *Raja miraletus*. G. *Raja brachyura*. H. *Dalatias licha*. I. *Carcharhinus falciformis*.

38.22701°N, 15.60787°E; 15 Nov. 1991; bycatch.

Genus: *Odontaspis* Agassiz, 1838 (1)

4. *Odontaspis ferox* (Risso, 1810). Smalltooth sand tiger. Critically Endangered

Records • 1 specimen, 350 cm; Briatico (TS); 38.72967°N, 16.03299°E; 1 May 2000; photographic evidence. • 1 specimen, 460 cm, 500 kg; Stretto di Messina (MS); 38.22483°N, 15.61245°E; 20 Apr. 2013; photographic evidence.

Family: Lamnidae Bonaparte, 1835 3

Genus: *Carcharodon* Smith, 1838 (1)

5. *Carcharodon carcharias* (Linnaeus, 1758).

Great white shark. Critically Endangered

Records • 1 ♀, 450 cm; Fiumefreddo Bruzio (TS); 39.23582°N, 16.03928°E; Summer 1930; photographic evidence (Fig. 2H). • 1 ♂, 250 cm; Pizzo (TS); 38.77711°N, 16.13904°E; 1 June 2007; fish market. • 1 specimen; Falconara Albanese (TS); 39.27618°N, 16.01781°E; Summer 2006; field observation. • 1 specimen; Capo Spartivento (IS); 37.91653°N, 16.06669°E; Summer 1989; bycatch. • 1 specimen; Soverato (IS); 38.69285°N, 16.56161°E; 3 July 2008; photographic evidence. • 1 ♀, 200 cm; Scilla (TS); 38.25959°N, 15.71165°E; 30 May 2018; field observation. • 1 specimen; Cetraro (TS); 39.51413°N, 15.92824°E; 14 May 2017; field observation. • 1 specimen; Melito di Porto

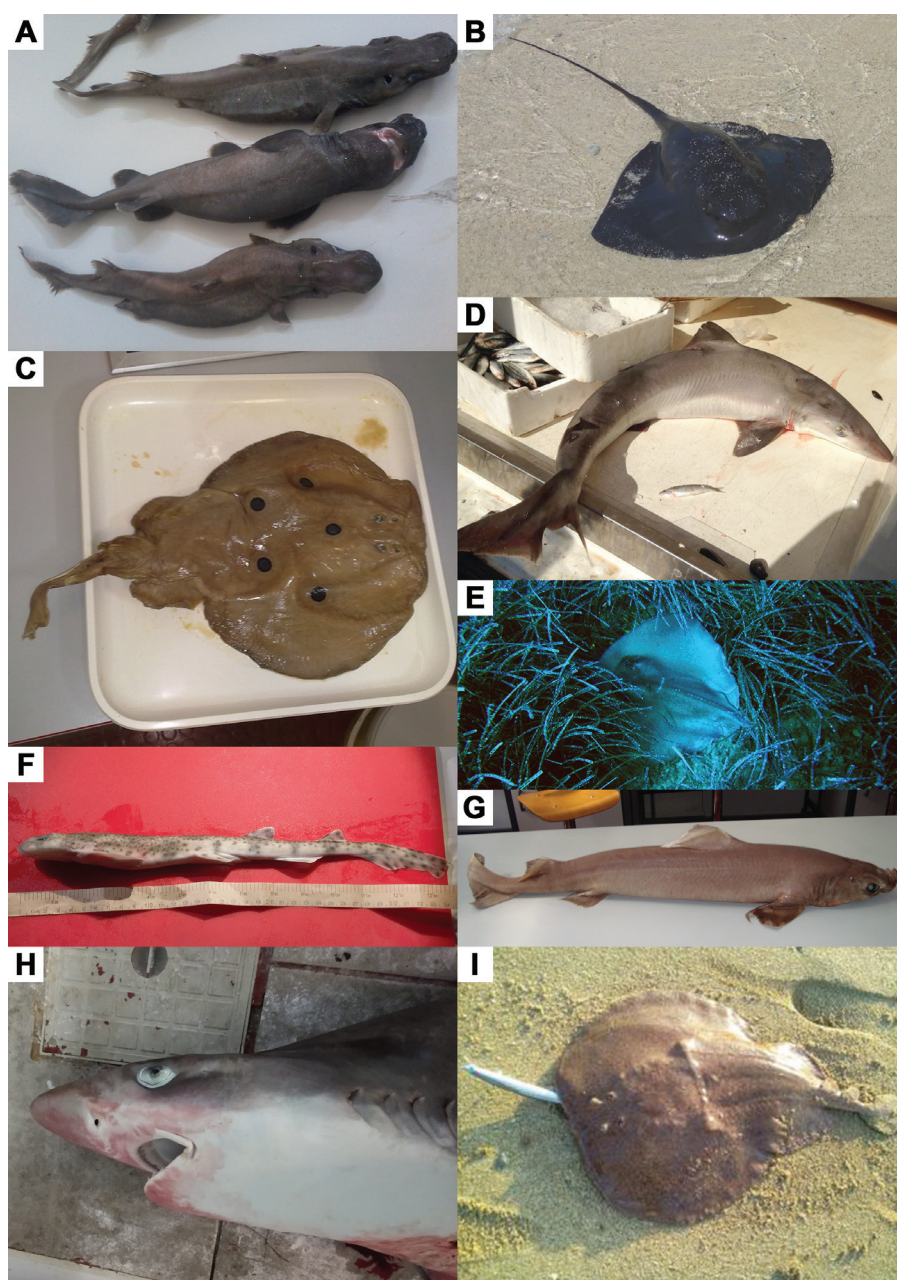


Fig. 4: Photographs of chondrichthyans obtained during our surveys. A. *Etmopterus spinax*. B. *Pteroplatytrygon violacea*. C. *Torpedo torpedo*. D. *Galeorhinus galeus*. E. *Dasyatis pastinaca*. F. *Scyliorhinus canicula*. G. *Centrophorus* cf. *granulosus* H. *Mustelus mustelus*. I. *Torpedo marmorata*.

Salvo (IS); 37.90091°N, 15.73348°E; 16 Aug. 2009; photographic evidence.

Genus: *Isurus* Rafinesque, 1810 (1)

6. *Isurus oxyrinchus* Rafinesque, 1810. Shortfin mako. Critically Endangered

Records • 1 ♂, 80 cm; Guardia Piemontese (TS); 39.46194°N, 15.92254°E; 1 July 2002; photographic evidence. • 1 ♀, 150 cm; Catanzaro Lido (IS); 38.82254°N, 16.63334°E; 24 June 2014; photographic evidence. • 1 ♀, 118 cm, 14 kg; Isola Capo Rizzuto (IS); 38.87618°N, 17.13871°E, 1 June 2014; fish market. • 1 specimen, 100 cm; Soverato (IS); 38.69255°N, 16.56555°E; 24 Aug. 2018; photographic evidence. • 1 ♀, 240 cm; Palizzi (IS); 37.90798°N, 15.98578°E; 17 Aug. 2016; bycatch. • 1 specimen, 310 cm; Copanello (IS); 38.76385°N, 16.57560°E; 16 June 2019; field observation. • 1 ♂, 230 cm, 130 kg; Crotone (IS); 39.08520°N, 17.15300°E; 14 Aug. 2010; photographic evidence. • 1 specimen, 150 cm; Capo Colonna (IS); 39.02576°N, 17.21102°E; 15 May 2018; photographic evidence. • 2 specimens, both about 100 cm; Rossano (IS); 39.64440°N, 16.64272°E; 20 June 2017; landed specimen. • 1 specimen, 200 cm; Cetraro (TS); 39.51398°N, 15.92860°E; 14 May 2017; field observation. • 1 ♀, 220 cm, 200 kg; Soverato (IS); 38.68903°N, 16.56305°E; 26 Oct. 2012; bycatch.

Genus: *Lamna* Cuvier, 1816 (1)

7. *Lamna nasus* (Bonnaterre, 1788). Porbeagle. Critically Endangered

Records • 1 ♀, 110 cm; Falerna (TS); 38.96674°N, 16.12190°E; 12 Dec. 2008; photographic evidence (Fig. 2F).

Family: Cetorhinidae Gill, 1861 1
Genus: *Cetorhinus* Blainville, 1816 (1)

8. *Cetorhinus maximus* (Gunnerus, 1765). Basking shark. Endangered

Records • 1 specimen; Scilla (TS); 38.26349°N, 15.71133°E; 18 May 2004; field observation. • 1 specimen; Spropoli (IS); 37.89911°N, 15.98230°E; 6 June 2008; field observation. • 1 specimen; Catanzaro Lido (IS); 38.82124°N, 16.63687°E; 23 July 2014; field observation. • 1 specimen, 400 cm; Briatico (TS); 38.73226°N, 16.02801°E; 30 May 2015; field observation. • 1 specimen; Palizzi (IS); 37.90041°N, 15.97994°E; 15 Aug. 2016; field observation. • 1 specimen, 600 cm; Schiavonea (IS); 39.65889°N, 16.54550°E; 17 Jan. 2016; field observation. • 1 specimen; Scilla (TS); 38.26105°N, 15.71301°E; 18 May 1994; photographic evidence. • 1 specimen, 300 cm; Villa San Giovanni (MS); 38.23347°N, 15.62323°E; 29 Aug. 2013; field observation. • 1 J, 205 cm; Le Castella (IS); 38.90558°N, 17.01729°E; 27 Feb. 2014; bycatch.

Family: Alopiidae Bonaparte, 1835 [1](2)
Genus: *Alopias* Rafinesque, 1810 (2)

9. *Alopias superciliosus* Lowe, 1841. Bigeye thresher. Endangered

Records • 1 ♀, 370 cm; Pellaro (MS); 38.01666°N, 15.63333°E; 16 Aug. 2011; landed specimen (Fig. 2B). • 1 specimen; Corigliano Calabro (IS); 39.68881°N, 16.57941°E; 2 Oct. 2019; bycatch.

10. *Alopias vulpinus* (Bonnaterre, 1788). Thresher. Endangered

Records • 1 specimen; Falconara albanese (TS); 39.27381°N, 16.01577°E; 1 Sept. 2006; photographic evidence. ITALY • 1 ♀, 350 cm, 200 kg; Strongoli Marina (IS); 39.23444°N, 17.13693°E; 16 Aug. 2017; bycatch (Fig. 2A). • 1 ♂, 280 cm; Roccelletta di Borgia (IS); 38.80529°N, 16.61374°E; 18 Mar. 2017; photographic evidence. • 1 ♀; Diamante (TS); 39.70008°N, 15.78381°E; 19 July 2014; photographic evidence. • 1 ♀; Schiavonea (IS); 39.65841°N, 16.54877°E; 20 Nov. 2013; fish market. • 1 specimen; Soverato (IS); 38.69121°N, 16.56229°E; 1 May 2008; photographic evidence.

Order: Carcharhiniformes 5[7](16)
Family: Pentanchidae Smith, 1912 1
Genus: *Galeus* Rafinesque, 1810 (1)

11. *Galeus melastomus* Rafinesque, 1810. Blackmouth catshark. Least Concern

Records • 8 specimens; Bovalino (IS); 38.13067°N, 16.21576°E; 1 July 2001; fish market. • 11 specimens; Falerna (TS); 38.99782°N, 16.11284°E; 21 Nov. 2013; fish market (Fig. 2G). • 3 specimens; Cetraro (TS); 39.50858°N, 15.91368°E; 10 Sept. 2008; bycatch. • 1 ♀; Crotone (IS); 39.07396°N, 17.165038°E; June 2011; fish market.

Family: Scyliorhinidae Gill, 1862 [1](2)
Genus: *Scyliorhinus* Blainville, 1816 (2)

12. *Scyliorhinus canicula* (Linnaeus, 1758). Small-spotted catshark. Least Concern

Records • 1 specimen; Palmi (TS); 38.39418°N, 15.82461°E; 17 Mar. 2007; fish market (Fig. 4X). • 1 specimen; Vibo Marina (TS); 38.72361°N, 16.10887°E; 1 Feb. 2009; fish market. • 3 specimens; Crotone (IS); 39.09534°N, 17.15851°E; 1 Sept. 2010; fish market. • 2 specimens; Scilla (TS); 38.25754°N, 15.71956°E; 1 Aug. 2019; field observation. • 2 specimens; Cetraro (TS); 39.51398°N, 15.92860°E; 1 Apr. 2007; fish market.

13. *Scyliorhinus stellaris* (Linnaeus, 1758). Nursehound. Near Threatened

Records • 1 specimen; Cetraro (TS); 39.513982°N,

15.92860°E; 17 Mar. 2007; field observation. • 2 specimens; Scilla (TS); 38.25908°N, 15.71758°E; 16 June 2018; field observation.

Family: Triakidae Gray, 1851 [2](4)

Genus: *Mustelus* Linck, 1790 (3)

14. *Mustelus asterias* Cloquet, 1819. Starry smooth-hound. Vulnerable

Records • 2 specimens; Crotone (IS); 39.10147°N, 17.17121°E; 12 Feb. 2016; fish market.

15. *Mustelus mustelus* (Linnaeus, 1758). Smooth-hound. Vulnerable

Records • 1 ♀, 130 cm; Cirò Marina (IS); 39.36732°N, 17.15429°E; 31 Jan. 2020; fish market (Fig. 4H). • 4 specimens; Reggio Calabria (MS); 38.11280°N, 15.61950°E; 13 Apr. 2020; fish market.

16. *Mustelus punctulatus* Risso, 1827. Blackspotted smooth-hound. Vulnerable

Records • 1 specimen; Crotone (IS); 39.07776°N, 17.18769°E; 12 Feb. 2016; fish market.

Genus: *Galeorhinus* Blainville, 1816 (1)

17. *Galeorhinus galeus* (Linnaeus, 1758). Tope shark. Vulnerable

Records • 1 specimen; Pellaro (MS); 38.02279°N, 15.62949°E; 26 Oct. 2016; photographic evidence (Fig. 4V).

Family: Carcharhinidae Jordan & Evermann, 1896 [2](7)

Genus: *Carcharhinus* Blainville, 1816 (6)

18. *Carcharhinus brachyurus* (Günther, 1870). Copper shark. Data Deficient

Records • 1 specimen; Stretto di Messina (MS); 38.23917°N, 15.62243°E; Spring 1999; bycatch.

19. *Carcharhinus brevipinna* (Valenciennes, 1839). Spinner shark. Not Applicable

Records • 1 specimen; Stretto di Messina (MS); 38.22645°N, 15.60572°E; 1 Jan. 2001; photographic evidence.

20. *Carcharhinus falciformis* (Bibron, 1839). Silky shark. Not Evaluated

Records • 4 specimens; Corigliano Calabro (IS); 39.67712°N, 16.57036°E; 17 Nov. 2011; photographic evidence (Fig. 3R).

21. *Carcharhinus limbatus* (Valenciennes, 1839). Blacktip shark. Data Deficient

Records • 1 specimen; Stretto di Messina (MS); 38.23917°N, 15.62243°E; Spring 1999; bycatch.

22. *Carcharhinus obscurus* (Lesueur, 1818). Dusky shark. Data Deficient

Records • 1 specimen; Sibari (IS); 39.76329°N, 16.52965°E; 12 Aug. 2012; photographic evidence. • 1 ♀, 60 cm; Vibo Marina (TS); 38.72285°N, 16.10090°E; 21 June 2010; photographic evidence (Fig. 2I).

23. *Carcharhinus plumbeus* (Nardo, 1827). Sandbar shark. Endangered

Records • 2 specimens; Isola Capo Rizzuto (IS); 38.87602°N, 17.09822°E; 14 Dec. 2011; bycatch.

Genus: *Prionace* Cantor, 1849 (1)

24. *Prionace glauca* (Linnaeus, 1758). Blue shark. Critically Endangered

Records • 1 ♀, 370 cm; Vibo Marina (TS); 38.72171°N, 16.10133°E; 7 Nov. 2007; fish market (Fig. 3M). • 1 ♀, 120 cm; Bovalino (IS); 38.13615°N, 16.19040°E; 1 Aug 2004; bycatch. • 1 specimen, 79 cm, 1.5 kg; Montepaone (IS); 38.72322°N, 16.56263°E; 8 June 2012. • 1 specimen, 80 cm, 3 kg; Cirò Marina (IS); 39.36626°N, 17.15308°E; 5 May 2014; bycatch. • 1 specimen, 75 cm; Mandatoriccio (IS); 39.55551°N, 16.90480°E; 4 Sept. 2014; landed specimen. • 1 specimen, 226 cm, 45 kg; Bianco (IS); 38.09054°N, 16.16281°E; 7 July 2014; landed specimen. • 1 specimen; Le Castella (IS); 38.90418°N, 17.02334°E; 3 Apr. 2014; landed specimen. • 1 specimen, 60 cm; Sibari (IS); 39.76282°N, 16.52162°E; 6 July 2015; landed specimen. • 1 ♂, 268 cm; Punta Alice (IS); 39.38370°N, 17.14596°E; 13 Aug. 2013; landed specimen. • 1 specimen; San Lucido (TS); 39.30678°N, 16.03778°E; 28 June 2019; field observation. • 1 ♀, 300 cm; Praia a Mare (TS); 39.88926°N, 15.76560°E; 26 Apr. 2020; photographic evidence. • 1 specimen, 100 cm; Corigliano Calabro (IS); 39.68558°N, 16.59096°E; 30 June 2014; photographic evidence. • 1 ♀, 350 cm; Villa Piana Lido (IS); 39.81069°N, 16.50076°E; 16 May 2017; photographic evidence. • 1 ♀, 300 cm; Vibo Marina (TS); 38.72191°N, 16.09910°E; 11 Apr. 2020; photographic evidence. • 1 ♀, 150 cm; Melito Porto Salvo (TS); 37.90893°N, 15.78231°E; 27 July 2016; landed specimen. • 1 ♀, 220 cm; Catona (MS); 38.18688°N, 15.62518°E; 9 July 2018; photographic evidence. • 1 ♀, 220 cm; Sellia Marina (IS); 38.87963°N, 16.75463°E; 29 Apr. 2018; photographic evidence. • 1 specimen; Villa San Giovanni (MS); 38.23401°N, 15.61980°E; 14 June 2014; landed specimen. • 1 ♀, 240 cm; Soverato (IS); 38.69083°N, 16.55974°E; 28 Apr. 2020; photographic evidence. • 1 ♀; Sant'Andrea Apostolo (IS); 38.62666°N, 16.57274°E; 27 Oct. 2019; photographic evidence. • 1 ♂,

230 cm; Scilla (TS); 38.25899°N, 15.71860°E; 27 Sept. 2014; photographic evidence. • 1 specimen, 50 cm; Siderno (IS); 38.26659°N, 16.31080°E; 10 June 2018; landed specimen. • 1 specimen, 70 cm; Roccelletta di Borgia (IS); 38.79568°N, 16.61834°E; 17 Mar. 2017; photographic evidence. • 7 specimens; Strongoli Marina (IS); 39.23560°N, 17.13214°E; 11 July 2018; photographic evidence. • 1 specimen, 50 cm; Catanzaro Lido (IS); 38.82273°N, 16.63863°E; 23 Aug. 2018; photographic evidence.

Family: Sphyrnidae Bonaparte, 1840 [1](2)
Genus: *Sphyrna* Rafinesque, 1810 (2)

25. *Sphyrna lewini* (Griffith & Smith, 1834). Scalloped hammerhead. Not Applicable

Records • 1 specimen; San Lucido (TS); 39.30811°N, 16.03606°E; 1 June 2009; field observation.

26. *Sphyrna zygaena* (Linnaeus, 1758). Smooth hammerhead. Critically Endangered

Records • 1 specimen, 200 cm; Palmi (TS); 38.372322°N, 15.832875°E; 1 July 2003; photographic evidence. • 1 specimen, 220 cm; Vibo Marina (TS); 38.746970°N, 16.111729°E; 15 Sept. 2008; fish market. • 1 ♂, 350 cm; Palizzi (IS); 37.894000°N, 15.992085°E; 8 Jan. 2004; field observation. • 1 ♂, 250 cm; Marinella (IS); 37.981746°N, 16.135125°E; 15 Aug. 2002; photographic evidence. • 1 specimen, 250 cm; Brancaleone (IS); 37.94209°N, 16.14027°E; 9 Feb. 2001; photographic evidence (Fig. 3K). • 1 specimen, 90 cm; Soverato (IS); 38.68762°N, 16.55802°E; 7 Jan. 2007; field observation.

Order: Squaliformes 6[6](7)
Family: Dalatiidae Gray, 1851 1
Genus: *Dalatias* Rafinesque, 1810 (1)

27. *Dalatias licha* (Bonnaterre, 1788). Kitefin shark. Vulnerable

Records • 1 specimen; Montauro (IS); 39.73940°N, 16.57045°E; 1 Aug. 2009; photographic evidence. • 1 specimen; Pizzo (TS); 38.75798°N, 16.17114°E; 1 Oct. 2011; photographic evidence. • 1 specimen; Vibo Marina (TS); 38.72361°N, 16.10887°E; 1 May 2008; landed specimen (Fig. 3Q). • 1 specimen; Crotone (IS); 39.08347°N, 17.17975°E; 1 Sept. 2012; landed specimen.

Family: Etmopteridae Fowler, 1934 1
Genus: *Etmopterus* Rafinesque, 1810 (1)

28. *Etmopterus spinax* (Linnaeus, 1758). Velvet belly. Least Concern

Records • 3 specimens; Crotone (IS); 39.08347°N, 17.17975°E; 12 May 2009; fish market. • 2 specimens; Stretto di Messina (MS); 38.22645°N, 15.60572°E; 1 June 2001; bycatch. • 4 specimens; Vibo Marina (TS);

38.72361°N, 16.10887°E; 1 Oct. 2008; fish market (Fig. 4S).

Family: Somniosidae Jordan, 1888 1
Genus: *Centroscymnus* Barbosa du Bocage & de Brito Capello, 1864 (1)

29. *Centroscymnus coelolepis* Barbosa du Bocage & de Brito Capello, 1864. Portuguese dogfish. Least Concern

Records • 4 specimens; Praia a Mare (TS); 39.88966°N, 15.76199°E; 16 May 2001; landed specimen.
Family: Oxynotidae Gill, 1863 1
Genus: *Oxynotus* Rafinesque, 1810 (1)

30. *Oxynotus centrina* (Linnaeus, 1758). Angular roughshark. Critically Endangered

Records • 1 ♀, 80 cm; Lazzaro (MS); 37.9671°N, 15.65133°E; 27 Apr. 2016; field observation. • 1 ♀; Belvedere Marittimo (TS); 39.64609°N, 15.81315°E; 1 May 2003; bycatch.

Family: Centrophoridae Bleeker, 1859 1
Genus: *Centrophorus* Müller & Henle, 1837 (1)

31. *Centrophorus* cf. *granulosus* (Bloch & Schneider, 1801). Gulper shark. Critically Endangered

Records • 1 specimen; Cetraro (TS); 39.51398°N, 15.92860°E; 27 Nov. 2006; photographic evidence (Fig. 4Y). • 1 ♀, 50 cm; Paola (TS); 39.36013°N, 16.01271°E; 16 June 2017; landed specimen.

Family: Squalidae de Blainville, 1816 [1](2)
Genus: *Squalus* Linnaeus, 1758 (2)

32. *Squalus acanthias* Linnaeus, 1758. Picked dogfish. Endangered

Records • 1 specimen; Cetraro (TS); 39.51398°N, 15.92860°E; 27 Aug. 2008; fish market.

33. *Squalus blainville* (Risso, 1827). Longnose spurdog. Data Deficient

Records • 1 ♀, 160 cm; Cetraro (TS); 39.51398°N, 15.92860°E; 10 Sept. 2008; bycatch • 1 specimen; Stretto di Messina (MS); 38.22645°N, 15.60572°E; 1 Aug. 2005; bycatch.

Order: Squatiniformes 11
Family: Squatinidae de Blainville, 1816 1
Genus: *Squatina* Duméril, 1805 (1)

34. *Squatina squatina* (Linnaeus, 1758). Angelshark. Critically Endangered

Records • 1 specimen; Pizzo (TS); 38.75798°N, 16.17114°E; July 1991; photographic evidence.

INFRAClass: BATOIDEA 6[11](19)

Order: Torpediniformes 1[1](2)

Family: Torpedinidae Henle, 1834 [1](2)

Genus: *Torpedo* Duméril, 1805 (2)

35. *Torpedo marmorata* Risso, 1810. Marbled electric ray. Least Concern

Records • 1 specimen; Bovalino (IS); 38.13843°N, 16.184726°E; 7 July 2002; landed specimen. • 2 specimens; Vibo Marina (TS); 38.72050°N, 16.10305°E; 1 May 2005; fish market. • 1 specimen; Tropea (TS); 38.68220°N, 15.89177°E; 15 Aug. 2017; field observation. • 1 specimen; Fuscaldo (TS); 39.40831°N, 16.00132°E; 8 June 2019; landed specimen. • 1 specimen; Praia a Mare (TS); 39.89163°N, 15.76060°E; 16 Oct 2016; photographic evidence. • 1 ♀; Briatico (TS); 38.73016°N, 16.0252741°E; 13 Aug. 2012; field observation.

36. *Torpedo torpedo* (Linnaeus, 1758). Common torpedo. Least Concern

Records • 1 ♀, 460 cm; Cetraro (IS); 39.51424°N, 15.93046°E; 5 May 2008; fish market (Fig. 4U). • 1 ♀; Bovalino (IS); 38.13330°N, 16.18334°E; 16 Aug. 2000; landed specimen. • 1 specimen; Brancaleone (IS); 37.93952°N, 16.14027°E; 30 May 2014; photographic evidence. • 1 ♀; Palmi (TS); 38.39179°N, 15.83979°E; 1 June 2012; photographic evidence. • 1 specimen; Amantea (TS); 39.12435°N, 16.06007°E; 28 Oct 2018; field observation. • 5 specimens; Crotona (IS); 39.07913°N, 17.17811°E; 2 June 2011; fish market. • 1 specimen; San Lucido (TS); 39.30618°N, 16.03589°E; 10 Apr. 2017; field observation. • 1 specimen; Paola (TS); 39.36102°N, 16.02023°E; 28 May 2018; field observation. • 1 specimen; Fuscaldo (TS); 39.41146°N, 15.99738°E; 1 June 2019; field observation. • 1 specimen; Longobardi (TS); 39.21086°N, 16.05398°E; 7 July 2019; field observation. • 1 specimen; Belvedere Marittimo (TS); 39.62322°N, 15.81192°E; 21 Aug. 2019; field observation. • 1 specimen; Siderno (IS); 38.25260°N, 16.32459°E; 8 Sept. 2006.

Order: Rajiformes 1[4](11)

Family: Rajidae de Blainville, 1816 [4](11)

Genus: *Dipturus* Rafinesque, 1810 (2)

37. *Dipturus cf. batis* (Linnaeus, 1758). Blue skate. Critically Endangered

Records • 1 ♂; Vibo Marina (TS); 38.72486°N, 16.10005°E; 8 Apr. 2007; fish market.

38. *Dipturus oxyrinchus* (Linnaeus, 1758). Long-nosed skate. Near Threatened

Records • 1 ♀; Crotona (IS); 39.07396°N, 17.16503°E; 16 June 2001; fish market.

Genus: *Leucoraja* Malm, 1877 (2)

39. *Leucoraja circularis* (Couch, 1838). Sandy ray. Critically Endangered

Records • 1 specimen; Corigliano Calabro (IS); 39.68009°N, 16.58647°E; 6 May 2011; fish market.

40. *Leucoraja fullonica* (Linnaeus, 1758). Shagreen ray. Critically Endangered

Records • 1 specimen; Gioia Tauro (TS); 38.43780°N, 15.85691°E; 4 Apr. 2015; fish market.

Genus: *Raja* Linnaeus, 1758 (6)

41. *Raja asterias* Delaroche, 1809. Mediterranean starry ray. Near Threatened

Records • 5 specimens; Vibo Marina (TS); 38.72003°N, 16.09936°E; 16 July 2007; fish market. • 2 specimens; Crotona (IS); 39.09796°N, 17.15408°E; 14 June 2011; fish market. • 3 specimens; Cetraro (TS); 39.51402°N, 15.92820°E; 9 June 2008; fish market. • 2 specimens; Bovalino (IS); 38.13898°N, 16.18755°E; 17 July 2004; photographic evidence.

42. *Raja brachyura* Lafont, 1873. Blonde ray. Near Threatened

Records • 2 specimens and egg cases; Catanzaro Lido (IS); 38.82205°N, 16.63808°E; 6 Sept. 2011; field observation (Fig. 3P).

43. *Raja clavata* Linnaeus, 1758. Thornback ray. Near Threatened

Records • 1 specimen; Vibo Marina (TS); 38.72043°N, 16.10339°E; 7 Nov. 2007; photographic evidence. • 2 specimens; Cetraro (TS); 39.51442°N, 15.93123°E; 9 July 2007; photographic evidence.

44. *Raja miraletus* Linnaeus, 1758. Brown ray. Least Concern

Records • 11 specimens; Cetraro (TS); 39.51381°N, 15.93158°E; 9 July 2007; photographic evidence.

45. *Raja montagui* Fowler, 1910. Spotted ray. Least Concern

Records • 1 specimen; Cetraro (TS); 39.51296°N, 15.93087°E; 11 Oct. 2000; fish market.

**46. *Raja polystigma* Regan, 1923. Speckled ray.
Least Concern**

Records • 1 specimen; Cetraro (TS); 39.51421°N, 15.93158°E; 16 Feb. 2001; fish market.

Genus: *Rostroraja* Hulley, 1972 (1)

47. *Rostroraja alba* (Lacépède, 1803). White skate. Endangered

Records • 1 specimen; Cetraro (TS); 39.51498°N, 15.92913°E; 4 Mar. 2000; fish market.

Order: Myliobatiformes 5 6

Family: Dasyatidae Jordan & Gilbert, 1879 2

Genus: *Dasyatis* Rafinesque, 1810 (1)

48. *Dasyatis pastinaca* (Linnaeus, 1758). Common stingray. Vulnerable

Records • 1 specimen; Paola (TS); 39.36035°N, 16.01285°E; 16 June 2018; field observation. • 1 specimen; Fuscaldo (TS); 39.40993°N, 15.99205°E; 1 Sept. 2019; field observation. • 1 specimen; Tropea (TS); 38.68046°N, 15.88654°E; 7 July 2016; field observation (Fig. 4W). • 1 ♀, 24 kg; Gizzeria Marina (TS); 38.95132°N, 16.14581°E; photographic evidence. • 2 specimens; Reggio Calabria (MS); 38.10128°N, 15.60564°E; 30 Aug. 2010; bycatch. • 1 specimen; Briatico (TS); 38.73040°N, 16.02349°E; 13 Aug. 2012; field observation.

Genus: *Pteroplatytrygon* Fowler, 1910 (1)

49. *Pteroplatytrygon violacea* (Bonaparte, 1832). Pelagic stingray. Least Concern

Records • 1 ♀; Falerna (TS); 38.99680°N, 16.11367°E; 6 June 2000; photographic evidence (Fig. 4T). • 1 specimen; Cirò Marina (IS); 39.36610°N, 17.16510°E; 29 July 2013; bycatch. • 1 specimen; Diamante (TS); 39.70027°N, 15.78659°E; 28 Aug. 2019; field observation. • 1 ♀, 90 cm; Tropea (TS); 38.67949°N, 15.88744°E; 27 Aug. 2019; photographic evidence.

Family: Gymnuridae Fowler, 1934 1

Genus: *Gymnura* van Hasselt, 1823 (1)

50. *Gymnura altavela* (Linnaeus, 1758). Spiny butterfly ray. Critically Endangered

Records • 1 specimen; Stretto di Messina (MS); 38.22409°N, 15.61596°E; 15 July 2000; field observation.

Family: Aetobatidae Agassiz, 1858 1

Genus: *Aetomylaeus* Garman, 1908 (1)

51. *Aetomylaeus bovinus* (Geoffroy St. Hilaire, 1817). Bull ray. Critically Endangered

Records • 1 specimen, 30 kg; Amantea (TS); 39.12529°N, 16.04600°E; 3 July 2019; photographic evidence. • 1 ♀, 12 kg; Cetraro (TS); 39.51412°N, 15.93241°E; 26 Oct. 2017; photographic evidence.

Family: Myliobatidae Bonaparte, 1835 1

Genus: *Myliobatis* Cuvier, 1816 (1)

52. *Myliobatis aquila* (Linnaeus, 1758). Common eagle ray. Vulnerable

Records • 1 ♀; Vibo Marina (TS); 38.72104°N, 16.10056°E; 23 July 2007; fish market (Fig. 3L). • 1 specimen; Paola (TS); 39.35963°N, 16.01963°E; 7 June 2019; field observation. • 1 specimen; San Nicola Arcella (TS); 39.84553°N, 15.76757°E; 4 Aug. 2019; field observation. • 1 specimen; Catanzaro Lido (IS); 38.82202°N, 16.63695°E; 17 Aug. 2015; field observation.

Family: Mobulinae Gill, 1893 1

Genus: *Mobula* Rafinesque, 1810 (1)

53. *Mobula mobular* (Bonnaterre, 1788). Devil fish. Endangered

Records • 1 specimen; Pizzo (TS); 38.77815°N, 16.14920°E; 27 Aug. 2014; field observation. • 1 specimen; Reggio Calabria (MS); 38.06156°N, 15.61464°E; 13 May 2020; field observation. • 4 specimens; Palmi (TS); 38.37050°N, 15.81383°E; 24 Aug. 2011; field observation. • 5 specimens; Bagnara Calabra (TS); 38.29191°N, 15.79322°E; 15 June 2017; field observation (Fig. 3N). • 1 specimen; Scilla (TS); 38.26026°N, 15.71929°E; 30 May 2018; field observation. • 1 specimen; Paola (TS); 39.35757°N, 16.01963°E; 12 Sept. 2017; field observation.

CLASS: HOLOCEPHALI 12

Order: Chimaeriformes 12

Family: Chimaeridae Rafinesque, 1815 1

Genus: *Chimaera* Linnaeus, 1758

54. *Chimaera monstrosa* Linnaeus, 1758. Rabbit fish. Near Threatened

Records • 1 specimen; Pizzo (TS); 38.75798°N, 16.17114°E; Feb. 2008; fish market.

Genus: *Hydrolagus* Gill, 1862

55. *Hydrolagus mirabilis* (Collett, 1904). Large-eyed rabbitfish. Not Evaluated

Records • 1 specimen, 0.2 m; Vibo Marina (TS); 38.72372°N, 16.10047°E; 16 June 2012; fish market (Fig. 2D).

Discussion

A total of 55 marine chondrichthyans were confirmed in this study, 34 sharks and 19 rays and 2 chimaeras. The order Carcharhiniformes with 16 species in 5 families was the most diverse, followed by Rajiformes (11 species in 1 family) and Lamniformes (8 species in 4 families). Among families, Rajidae (11 species) and Carcharhinidae (7 species) had the most specimens. The species observed during our survey represent *ca.* 62% of the total species reported in the Mediterranean Sea and *ca.* 5% of the total species reported for the world (Compagno *et al.*, 2005; Serena, 2005). Compared with other countries of the Mediterranean, Calabria had more shark and chimaera species than Turkey (26 sharks and 1 chimaera, Tunka Bengil & Başusta, 2018), Algeria (13 sharks, Ordines *et*

al., 2011) and the north coast of the Mediterranean (Spain, France and Italy, 18 sharks and 1 chimaera, Follesa *et al.*, 2019), but less ray species than these countries (Turkey 29, North Mediterranean 22, Algeria 9). Comparing the number of species of chondrichthyans with that of Greece (37 sharks, 29 rays, Giovos *et al.*, 2020), in Calabria it was lower. The more widely encountered species in Calabria were *P. glauca*, *H. griseus*, *T. torpedo*, and *I. oxyrinchus*: in fact, these species have been reported along all the regional coasts and are the ones that have been found most frequently. Abundance data are summarised in Table 1. Regarding the spatial distribution of species, 71% of them have been reported for the Tyrrhenian Sea, 49% for the Ionian Sea and 33% for the Strait of Messina. The presence of large endangered and critically endangered pelagic species (according to IUCN categories) in

Table 1. Species list of chondrichthyans detected in Calabria and their conservation status in the Mediterranean Sea. The conservation status referring to Dulvy *et al.* (2016). IUCN Red List code: DD = Data Deficient, LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered, NA = Not Applicable, NE = Not evaluated. For “District”: IS = Ionian Sea, TS = Tyrrhenian Sea, MS = Strait of Messina.

N° records	Species	District	IUCN	N° records	Species	District	IUCN
25	<i>Prionace glauca</i>	IS-TS-MS	CR	2	<i>Carcharhinus obscurus</i>	IS-TS	DD
21	<i>Hexanchus griseus</i>	IS-TS-MS	LC	2	<i>Raja clavata</i>	TS	NT
12	<i>Torpedo torpedo</i>	IS-TS	LC	2	<i>Aetomylaeus bovinus</i>	TS	CR
11	<i>Isurus oxyrinchus</i>	IS-TS	CR	1	<i>Centroscymnus coelolepis</i>	TS	LC
9	<i>Cetorhinus maximus</i>	IS-TS-MS	EN	1	<i>Squalus acanthias</i>	TS	EN
8	<i>Carcharodon carcharias</i>	IS-TS	CR	1	<i>Carcharias taurus</i>	MS	CR
6	<i>Alopias vulpinus</i>	IS-TS	EN	1	<i>Lamna nasus</i>	TS	CR
6	<i>Sphyrna zygaena</i>	IS-TS	CR	1	<i>Galeorhinus galeus</i>	MS	VU
6	<i>Torpedo marmorata</i>	IS-TS	LC	1	<i>Mustelus asterias</i>	IS	VU
6	<i>Dasyatis pastinaca</i>	TS-MS	VU	1	<i>Mustelus punctulatus</i>	IS	VU
6	<i>Mobula mobular</i>	TS-MS	EN	1	<i>Carcharhinus brachyurus</i>	MS	DD
5	<i>Scyliorhinus canicula</i>	IS-TS	LC	1	<i>Carcharhinus brevipinna</i>	MS	NA
4	<i>Dalatias licha</i>	IS-TS	VU	1	<i>Carcharhinus falciformis</i>	IS	NE
4	<i>Galeus melastomus</i>	IS-TS	LC	1	<i>Carcharhinus limbatus</i>	MS	DD
4	<i>Raja asterias</i>	IS-TS	NT	1	<i>Carcharhinus plumbeus</i>	IS	EN
4	<i>Pteroplatytrygon violacea</i>	IS-TS	LC	1	<i>Sphyrna lewini</i>	TS	NA
3	<i>Etmopterus spinax</i>	IS-TS-MS	LC	1	<i>Squatina squatina</i>	TS	CR
3	<i>Myliobatis aquila</i>	IS-TS	VU	1	<i>Dipturus cf. batis</i>	TS	CR
2	<i>Heptranchias perlo</i>	IS-MS	DD	1	<i>Dipturus oxyrinchus</i>	IS	NT
2	<i>Centrophorus cf. granulosus</i>	TS	CR	1	<i>Leucoraja circularis</i>	IS	CR
2	<i>Squalus blainville</i>	TS-MS	DD	1	<i>Leucoraja fullonica</i>	TS	CR
2	<i>Oxynotus centrina</i>	TS-MS	CR	1	<i>Raja brachyura</i>	IS	NT
2	<i>Odontaspis ferox</i>	TS-MS	CR	1	<i>Raja miraletus</i>	TS	LC
2	<i>Alopias superciliosus</i>	IS-MS	EN	1	<i>Raja montagui</i>	TS	LC
2	<i>Scyliorhinus stellaris</i>	TS	NT	1	<i>Raja polystigma</i>	TS	LC
2	<i>Mustelus mustelus</i>	IS-MS	VU	1	<i>Rostroraja alba</i>	TS	EN
				1	<i>Gymnura altavela</i>	MS	CR
				1	<i>Chimaera monstrosa</i>	TS	NT
				1	<i>Hydrolagus mirabilis</i>	TS	NE

the study area, such as *C. maximus*, *C. carcharias*, *I. oxyrhincus*, *S. zygaena*, and *M. mobular* is of high interest given the reduction of abundance in many of these species especially in the north-western Mediterranean Sea (Ferretti *et al.*, 2008). Considering our sightings and the complexity of trophic structures of the marine ecosystem of the region (Ricci *et al.*, 2019), Calabria could represent a refugium for some locally and globally threatened species (IUCN Med 2016 according to Dulvy *et al.*, 2016). In fact, according to Shephard *et al.* (2012), a “de facto refugia” is a naturally occurring areas where low fishing intensity overlaps with high elasmobranch density and where the demersal fish assemblage has approximately equal importance in explaining elasmobranch biomass. The higher flows of consumption of the benthic system observed in the Calabria food web could be influenced by a widespread presence of canyons along the continental edge which increase the benthic productivity. During the collection of data, the presence of pups and new-borns of some Endangered, Critically Endangered, and Data-Deficient species has been confirmed (Fig. 5). In particular, our observations refer to *S. zygaena*, *P. glauca*, *C. plumbeus*, *C. obscurus*, *C. falciformis*, *L. nasus*, and *I. oxyrhincus*. In details, sightings on new-borns of *S. zygaena*, *C. plumbeus*, *C. obscurus*, *C. falciformis*, and *L. nasus* were isolated cases both geographically and temporally. Instead, data for *P. glauca* and *I. oxyrhincus* showed a different trend, especially along the Ionian coast. In fact, these two species were more commonly encountered in this area than in other areas, they tended to remain or

return for extended periods, and in the area, new-borns have been repeatedly observed across years from 2002 to 2018. So, according to Heupel *et al.*, 2007 the Ionian coast of the region could be considered as a nursery area for *P. glauca* and *I. oxyrhincus*. In the same area, records of new-borns of other species were also reported (Fig. 5). Due to these observations, the Calabrian Ionian coast is characterised as an area of relevance for the presence of elasmobranchs. From a biogeographical point of view, the presence of *R. brachyura* along the Ionian coast of the Region should be remarkable. The presence of this species has been confirmed only for the western Mediterranean Sea with only one doubtful record for the Northern Aegean Sea (Relini *et al.*, 2000; Serena, 2005; Catalano *et al.*, 2007). For this reason, to our knowledge, our record would confirm the presence of the species also in the eastern Mediterranean basin. Moreover, we report the presence of the rare chimaera *H. mirabilis*. This species has been reported only recently for the Mediterranean with two confirmed records: the first one in Syrian waters (Hassan, 2013) and the second one off Egyptian coast (Farrag, 2016). Genetic analysis of the Calabrian specimen is currently underway in order to definitively confirm its specific identity. Finally, according to Serena *et al.* (2020), some taxonomic clarifications are necessary for the following species:

Centrophorus cf. *granulosus*: the validity of this species vs. *Centrophorus uyato* (Rafinesque, 1810) is still debated among taxonomists. Recently, Verissimo *et al.* (2014), demonstrated the presence of a unique mitochond-

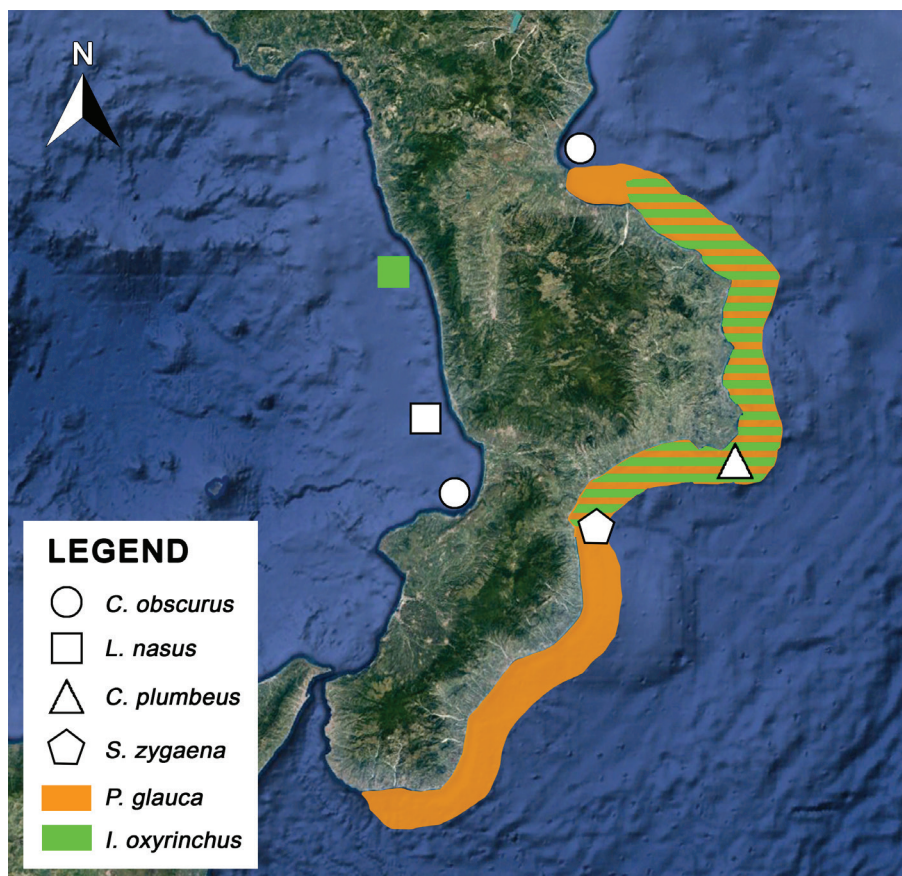


Fig. 5: Records of pups and/or new-borns of some endangered, critically endangered, or data-deficient elasmobranchs in the study area.

drial clade within the Mediterranean Sea, so a revision of the genus taxonomy in the area is needed (Serena *et al.*, 2020)

Dipturus cf. batis: the current status and taxonomy of this species is actually under debate: some authors (Iglésias *et al.* 2010) separate *Dipturus batis* species-complex into two nominal species, the blue skate (temporarily called *Dipturus cf. flossada* [Risso, 1826]) and the flapper skate (*Dipturus cf. intermedia* [Parnell, 1837]); others did not consider the species present in the Mediterranean (Last *et al.*, 2016)

Leucoraja fullonica: this species has been rarely found in the Mediterranean and its presence needs to be confirmed (Serena *et al.*, 2020)

Raja montagui: this species can be easily confused with *Raja polystigma*. Recently, Frodella *et al.* (2016) clarified that *Raja montagui* is limited to the north African coasts of Algeria and Tunisia, while *Raja polystigma* is endemic and distributed along the whole Mediterranean coasts. Further investigations of genetic and morphological aspects concerning these two species are needed.

Data collected during this research provide useful information about the distribution and presence of chondrichthyans for the Central Mediterranean in general, and along the Calabrian coasts in particular. They represent the starting point for improved management of these areas and for further research and monitoring.

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