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Overview of the Conservation Status of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea

Compiled by Rachel D. Cavanagh and Claudine Gibson

IUCN Red List of Threatened Species ™ - Mediterranean Regional Assessment No. 3

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Rachel D. Cavanagh and Claudine Gibson

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Participants of the IUCN Shark Specialist Group Mediterranean Red List Workshop, September 2003, San Marino.

This report is dedicated to the memory of Dr Ransom A. Myers (1952–2007).
Ram attended the IUCN Mediterranean Red List Workshop and
gave so much of his boundless energy to shark conservation.

1. Introduction

Chondrichthyans are a relatively small (approximately 1,200 species) evolutionarily-conservative group that has functioned successfully in diverse ecosystems for over 400 million years. Despite their evolutionary success, many chondrichthyans are increasingly threatened with extinction as a result of human activities and the conservative life history traits of this group of fishes. Generally, chondrichthyans are slow growing and late to mature, with low fecundity. These characteristics result in very low rates of potential population increase with little capacity to recover from overfishing (direct or indirect) and other threats such as pollution and habitat destruction (Fowler *et al*. 2005).

In 2003, the IUCN World Conservation Union's Shark Specialist Group (SSG), in collaboration with the IUCN Centre for Mediterranean Cooperation, established a regional group of experts to work more coherently towards improved conservation and management of chondrichthyan fishes in the Mediterranean. One of the primary aims of the group was to assess the threatened status of each chondrichthyan species that occurs in the Mediterranean by applying the IUCN Red List criteria. This work constitutes part of the SSG's global programme to complete IUCN Red List assessments for all chondrichthyan fishes. A summary of the results of the Mediterranean assessments is presented in this report, highlighting species of conservation concern as well as those of least concern. It is envisaged that the information contained within this report will facilitate further development and improved implementation of the United Nations Environment Programme (UNEP) Mediterranean Action Plan (UNEP MAP RAC/SPA 2003) and the development of priority research, conservation and management actions for the region.

This IUCN overview summarises the SSG's full report (Cavanagh *et al*. in prep.), which provides an in-depth overview of regional issues and contains detailed summaries of IUCN Red List assessments for all chondrichthyan fishes that occur in the Mediterranean Sea.

1.1 Chondrichthyan fishes in the Mediterranean

The Mediterranean Sea covers an area of approximately 2.5 million km^2 (about 0.7% of the world's ocean surface area) and has an average depth of 1,500m (reaching 5,200m at its deepest point in the Ionian Sea). The coastline extends for 46,000km and is bordered by 21 countries (Zenetos *et al*. 2002).

Figure 1. Map of the Mediterranean Sea and surrounding countries.

Although the Mediterranean is a semi-enclosed sea, the chondrichthyan fish fauna is relatively diverse with an estimated 80 species (approximately 7% of total living chondrichthyans), comprising 45 species of sharks from 17 families, 34 batoid species from nine families and one species of chimaera (Compagno 2001; Compagno *et al*. 2005; Compagno in prep a; Compagno in prep b; Serena 2005). An illustrated checklist of all 80 species of chondrichthyans thought to occur in the Mediterranean Sea is provided in Appendix 1. However, this report focuses on 71 of the 80 species as the occurrence of the remaining nine species within the Mediterranean is either infrequent, questionable, or cannot be confirmed due to taxonomic uncertainty (e.g. shortnose spurdog *Squalus megalops*), and these nine species are not known to breed within the region. They include species which rarely occur in the Mediterranean at the very edge of their range (e.g. milk shark *Rhizoprionodon acutus*), occasional visitors from the Atlantic (e.g. silky shark *Carcharhinus falciformis*), or vagrants from the Red Sea that have travelled through the Suez Canal (e.g. blacktip reef shark *Carcharhinus melanopterus*).

Endemism of chondrichthyans in the Mediterranean is low, with only four batoid species (Maltese skate *Leucoraja melitensis*, speckled skate *Raja polystigma*, rough ray *R. radula* and giant devilray *Mobula mobular*) that could be considered endemic (Serena 2005). Within the Mediterranean, the distribution of chondrichthyan fishes is not homogenous (Serena 2005). Some areas are considered critical habitat for chondrichthyans. For example, Tunisian waters provide a nursery area for white shark *Carcharodon carcharias*. Aggregations of basking shark *Cetorhinus maximus*, have been observed in the northern Balearic region, the Northern Adriatic and the Tyrrhenian Sea (Walker *et al*. 2005). A strong correlation between the presence of *C. maximus*, chlorophyll concentration and prey abundance in these areas indicate they are important feeding sites (Sims 2003; Sims *et al*. 2003). Some species have a restricted range within the Mediterranean, for example a small population of the smalltooth sand tiger shark *Odontaspis ferox* seems resident in a particular area off Lebanon (Walker *et al*. 2005). The low rate of exchange between isolated populations, for example angelshark *Squatina* spp. populations around the Balearics, leaves them especially prone to local depletion, given that recolonisation rates will be extremely low (Massutí and Moranta 2003).

1.2 Overview of threats to Mediterranean chondrichthyans

Available evidence indicates that chondrichthyans in the Mediterranean are generally declining in abundance, diversity and range and are possibly facing a worse scenario than chondrichthyan populations elsewhere in the world (Walker *et al*. 2005). These declines can be attributed to a number of factors, including the life history characteristics of chondrichthyans in combination with the semi-enclosed nature of the Mediterranean Sea and intense fishing activity throughout its coastal and pelagic waters; effects of habitat loss; environmental degradation; and pollution (Stevens *et al*. 2005; Walker *et al*. 2005). Large coastal species (which are biologically the most vulnerable to exploitation) and species that occur in areas subjected to prolonged and/or intensive fishing pressure are of particular concern. Such species include the sand tiger shark *Carcharias taurus*, white skate *Rostroraja alba* and porbeagle *Lamna nasus*.

1.2.1 Life history characteristics

Although considerable variation occurs, chondrichthyans exhibit strongly K-selected life history strategies especially when compared with teleost fishes (Cailliet *et al*. 2005). Chondrichthyans are generally slow growing, late to mature, have low fecundity and productivity, long gestation periods, high natural survivorship of all age classes and long life (Cailliet *et al*. 2005; Camhi *et al*. 1998). These biological traits result in low reproductive potential and low capacity for population increase for many species. Such characteristics have serious implications for chondrichthyan populations; limiting their capacity to sustain fisheries and recover from declines (Cailliet *et al*. 2005; Camhi *et al*. 1998).

1.2.2 Fisheries

The commercial value of chondrichthyans is low compared to that of teleost fishes and shellfishes in the Mediterranean. Currently chondrichthyans represent 0.78% of the total landings in the Mediterranean Sea (FAO 2006). Between 1970 and 1985, landings of chondrichthyan fishes in the Mediterranean, as reported to the Fisheries and Agriculture Organization of the United Nations (FAO), increased from 10,000t to 25,000t. Subsequently, reported landings declined to 1,000t by 2004 (FAO 2006; SGRST 2003).

Benthic trawl effort has increased in the shelf and slope area of the Mediterranean over the past 50 years (Aldebert 1997). Increased fishing intensity and technological advancement of fishing gear has resulted in a decline in many chondrichthyan species commercially captured by trawls in the north-western Mediterranean (Walker *et al*. 2005). Several demersal species are utilised commercially, while only a few pelagic species are marketed. The major chondrichthyan fishing countries within the Mediterranean are Turkey, Tunisia, Greece, Italy and Spain and the species most commonly taken in coastal fisheries are: smoothounds *Mustelus* spp., skates *Rajids*, catsharks *Scyliorhinus* spp., dogfish *Squalus* spp., eagle rays *Myliobatids* and whiptail stingrays *Dasyatids* (Walker *et*

al. 2005). Unfortunately, data collected are incomplete and some of the most important landings are not recorded due to several species being reported under one group. For example, only thornback ray *Raja clavata* has separate records data among the Rajids. Additionally, FAO data only report official landings and therefore bycatch returned to the sea is not included (Walker *et al*. 2005). Several species, (e.g. common skate *Dipturus batis*, sawback angelshark *Squatina aculeata* and smoothback angelshark *S. oculata*) are now considered locally extirpated or commercially extinct in the Mediterranean. Exploitation of such species continues, however, as they constitute bycatch in many other fisheries (Walker *et al*. 2005).

Although directed fisheries have caused stock collapse for some species, more significant threats to chondrichthyans are mortality in mixed species fisheries and bycatch in fisheries targeting more valuable species (Musick and Bonfil 2005; Stevens *et al*. 2005). There are no Mediterranean pelagic fisheries that target migratory oceanic sharks. However, longline fisheries targeting swordfish and tunas (which have increased in effort over the past three decades) pose a great threat to susceptible chondrichthyans taken as bycatch in this fishery (ICCAT 2001). Bycatch is poorly documented and data are rarely incorporated into national and international (FAO) statistics, therefore numbers of sharks caught as bycatch can only be crudely estimated (Camhi *et al*. 1998). Driftnetting catches large numbers of chondrichthyans. This fishing method, once used widely throughout the Mediterranean, is now prohibited here (see 6.2), however illegal driftnetting still occurs (WWF 2005). Chondrichthyans most vulnerable and frequently caught with driftnets include blue shark *Prionace glauca*, common thresher *Alopias vulpinus*, shortfin mako *Isurus oxyrinchus*, porbeagle *Lamna nasus*, basking shark *Cetorhinus maximus*, giant devil ray *Mobula mobular*, pelagic stingray *Pteroplatytrygon violacea*, requiem sharks *Carcharhinus* spp. and hammerheads *Sphyrna* spp. (Tudela 2004; Walker *et al*. 2005).

Recreational sport fisheries have increased noticeably over the past few years, particularly off the Italian, Spanish and French coasts. Although data are limited, target species mainly include thresher sharks *Alopias* spp. and blue shark *Prionace glauca*, with catches primarily composed of young individuals. Anglers are increasingly releasing their catches alive (SGRST 2003; Walker *et al*. 2005).

1.2.3 Habitat loss, environmental degradation and pollution

Pressures resulting from human population growth along the coastline are detrimentally affecting the marine ecosystem and are contributing to the threats faced by chondrichthyans. Rapid urban and industrial development and associated pollution have degraded critical coastal habitats, such as nursery and spawning areas (Camhi *et al*. 1998; Stevens *et al*. 2005; UNEP MAP RAC/SPA 2003). Fisheries activities such as intensive bottom-trawling reduce the complexity of benthic habitats, affecting the epiflora and epifauna and reducing the availability of suitable habitats for predators and prey (Stevens *et al*. 2005). Pollution can contaminate food sources, concentrating in animals at the top of the food chain and potentially affecting physiology and functioning (UNEP MAP RAC/SPA 2003). A number of studies have shown that some Mediterranean sharks, such as the spiny dogfish *Squalus acanthias*, contain illegally high (>0.50mmg/kg) concentrations of mercury. Trace metals and organochlorine residues have been found in the eggs, muscles, liver and kidneys of deepsea sharks such as gulper shark *Centrophorus granulosus* and blackmouth catshark *Galeus melastomus*, confirming that deepwater species are also being affected by pollution (UNEP RAC/SPA 2002).

1.3 Management implications

Due to their life history characteristics, it is not appropriate to apply conventional management models of teleost fisheries to chondrichthyan populations, and the need for a precautionary approach to their management has been repeatedly highlighted (e.g. in FAO 2000; Fowler and Cavanagh 2005a). International and regional conventions and agreements relevant to Mediterranean chondrichthyans are discussed in section 5 of this report. Protection has been granted to a very small number of shark and ray species and some fishing restrictions are in force. These restrictions are often unsatisfactory, however. In general, the management techniques and enforcement measures currently in place are inadequate to ensure the long-term survival of many species and populations (Camhi *et al*. 1998; Fowler and Cavanagh 2005a).

1.4 The IUCN Red List of Threatened Species™ – a tool for management

The IUCN Red List of Threatened Species™ (IUCN Red List) is widely recognised as the most comprehensive, scientifically-based source of information on the global status of plant and animal species. IUCN Red List Categories and Criteria are applied to individual species assessments (which contain information on aspects such as ecology and life history, distribution, habitat, threats, current population trends and conservation measures), to determine their relative threat of extinction. Threatened species are listed as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). Taxa that are either close to meeting the threatened thresholds or would be threatened were it not for ongoing conservation programmes are classified as Near Threatened (NT). Taxa evaluated as having a low risk of extinction are classified as

Least Concern (LC). Also highlighted within the IUCN Red List are taxa that cannot be evaluated due to insufficient knowledge, and therefore assessed as Data Deficient (DD). This category does not necessarily mean that the species is not threatened, only that their risk of extinction cannot be assessed with the current data available (IUCN 2006).

IUCN Red List assessments can be used as a tool for measuring and monitoring changes in the status of chondrichthyan biodiversity and our knowledge of the taxa. They are an essential basis for providing targets for management priorities, and for monitoring the long term success of management and conservation initiatives.

1.5 The IUCN Shark Specialist Group's Red List programme

The SSG is currently part way through a programme to complete global assessments for all chondrichthyan species (~1,200 worldwide) by the end of 2007. This 'Global Chondrichthyan Assessment' is primarily being undertaken through a series of regional workshops in order to facilitate detailed discussions and pooling of resources and regional expertise. Regional assessments are collated to produce the global assessment for each species (unless a species is endemic to the region, in which case the regional assessment will also be the global assessment). For widespread species, some regional assessment categories may differ from the global assessment. To date, workshops have been held for seven regions: Australia and Oceania, sub-equatorial Africa, South America, North and Central America, the Mediterranean, Northeast Atlantic and West Africa. There have also been two generic workshops; one for Batoids (skates and rays) and one for deepsea species.

1.6 Objectives

The two main objectives of the SSG's regional assessment process are:

- **to develop a network of regional experts** to enable species assessments to be continually updated as new information is discovered and to provide expert opinion on policy and management recommendations, and;
- **to assist in regional planning and policy development** for the conservation and sustainable management of chondrichthyan fishes in different regions through the provision of comprehensive information reporting on their current status.

This regional report summarises the results of the SSG's Mediterranean workshop. It provides a regional overview of the conservation status of the chondrichthyan fish species known to occur and breed within the Mediterranean Sea. Its main outputs are:

- a comprehensive species list of Mediterranean chondrichthyans;
- IUCN Red List categories for each species;
- a summary of the main threats affecting Mediterranean chondrichthyans (illustrated by case studies); and
- recommendations for the future.

2. Methodology

2.1 Workshop procedure

The SSG held a regional IUCN Red List workshop in San Marino, September 2003, which was funded by the IUCN Centre for Mediterranean Cooperation and the David and Lucile Packard Foundation. Thirty regional and international experts from 14 countries convened to evaluate the Mediterranean chondrichthyan fish fauna and to formulate priorities for conservation and management action in the region.

During the workshop, experts produced regional IUCN Red List assessments for the 71 species of chondrichthyan fishes known to occur and breed in the Mediterranean Sea. The nine remaining species, whose occurrence in the Mediterranean is questionable, or that are at the very edge of their range and therefore rare, were not evaluated (NE) regionally. Information on these species' occurrence in the Mediterranean has been noted in their global assessment.

As the IUCN's *Guidelines for application of IUCN Red List criteria at regional levels* (IUCN 2003a) were in the process of being developed at the time of the workshop, all species had their status assessed according to the global *IUCN Red List categories and criteria* (IUCN 2001). The nine IUCN Red List categories are: Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern, Data Deficient and Not Evaluated. Classification of species into the threatened categories (Critically Endangered, Endangered and Vulnerable) is through a set of five quantitative criteria based on biological factors related to extinction risk, including: rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation. These are summarised in Appendix 2. Workshop participants did, however, refer to the penultimate draft of the application of IUCN Red List criteria at regional levels (Gärdenfors *et al*. 2001), as appropriate.

Expert preparation and evaluation of chondrichthyan species IUCN Red List assessments. IUCN-SSG Mediterranean workshop, San Marino. ©*Rachel Cavanagh.*

2.2 The precautionary approach

The IUCN guidelines recommend assessors should adopt a precautionary, but realistic approach when applying criteria, but that all reasoning should be explicitly documented (IUCN 2005). For example, where a population decline is known to have taken place (e.g. as a result of fisheries) but no management has been applied to change the pressures on the population, it can be assumed the decline is likely to continue in the future. If fisheries are known to be underway, but no information is available on changes in catch per unit effort (CPUE), data from similar fisheries elsewhere may be used by informed specialists to extrapolate likely population trends. Additionally, where no life history data are available, the demographics of a very closely related species may be applied (Fowler and Cavanagh 2005b).

2.3 Regional and global assessments

At the Mediterranean workshop, it was not always possible to produce the global assessment for a species after completing its regional assessment. This was largely due to a lack of information from outside the region. In these cases, the global assessment is currently 'in preparation', pending information from other regions and subsequent review by the wider SSG network (~200 members worldwide).

It should be noted that not all species assessments carried out at the Mediterranean workshop currently appear on the IUCN Red List (2006), as they require additional information before their global assessment can be submitted. All global assessments are subject to review before being finalised and submitted to the IUCN Red List, after which time they will be periodically revisited and updated as new information becomes available. The IUCN Red List is updated yearly; readers are therefore urged always to consult the current IUCN Red List (www.redlist.org), to obtain the most up to date assessments.

2.4 Geographically distinct populations

The IUCN Red List allows for the separate assessment of geographically distinct populations. These subpopulations are defined as "geographically or otherwise distinct groups in the (global) population between which there is little demographic or genetic exchange "typically one successful migrant individual or gamete per year or less" (IUCN 2001). Subpopulation assessments are displayed separately on the IUCN Red List website and Mediterranean subpopulations are identified in this report (Table 3.1).

2.5 Review process

Since the Mediterranean workshop in 2003, some species assessments have been reviewed and updated at the SSG's Northeast Atlantic workshop (February 2006). All Mediterranean assessments and documentation have undergone significant review and editing following circulation to the wider SSG network. The resulting assessments are, therefore, a product of scientific consensus concerning species status and are supported by relevant literature and data sources.

3. Results and discussion

The regional threatened status of the 71 chondrichthyan species known to occur and breed in the Mediterranean Sea has been assessed.

The IUCN Red List category assigned to each species during the workshop and/or subsequent review process is presented in Table 3.1. For species assessed globally, this category (as seen on the IUCN 2006 Red List (www.redlist.org)), and the year of assessment are also shown. The 'in preparation' column indicates whether a new global assessment or an update to an existing global assessment is currently being prepared. Finally, the 'subpopulation' column indicates whether the species has a geographically distinct subpopulation in the Mediterranean.

3.1 Summary of threatened status

A summary of the numbers of Mediterranean chondrichthyans currently assigned to each IUCN Red List category regionally and globally (2006) is presented in Table 3.2. Currently, 35 of the 71 Mediterranean species have existing global assessments. Twenty-three out of these 35 species presently have updates to their global assessment in preparation. All 36 of the remaining species, which have not yet been evaluated globally, have global assessments in preparation. As species assessments are continually being reviewed and updated, readers are always urged to consult the current Red List (www.redlist.org), to obtain the most up to date species assessments.

Table 3.1 Summary of the regional and global IUCN Red List status of all Mediterranean chondrichthyan fish species.

Scientific name	Common name	Threatened Status Mediterranean assessment	Threatened Status Global assessment (year submitted)	New/updated global assessment in preparation	Sub-population
Oxynotus centrina	Angular roughshark	CR A2bd	NE	✓	
Squatina aculeata	Sawback angelshark	CR A2bcd+3cd+4bcd	EN (2006)	✓	
Squatina oculata	Smoothback angelshark	CR A2bcd+3cd+4bcd	EN (2006)	✓	
Squatina squatina	Angelshark	CR A2bcd+3cd+4bcd	CR (2006)		
Pristis pectinata	Smalltooth sawfish	CR A2bcd+3cd+4bcd	CR (2006)		
Pristis pristis	Common sawfish	CR A2bcd+3cd+4bcd	CR (2006)		
Dipturus batis	Common skate	CR A2bcd+4bcd	CR (2006)		
Leucoraja melitensis	Maltese skate	CR A2bcd+3bcd+4bcd	CR (2006)		
Rostroraja alba	White skate	CR A2cd+4cd	EN (2006)		
Gymnura altavela	Spiny butterfly ray	CR A2bcd	NE	✓	✓
Carcharias taurus	Sand tiger shark	CR A2abcd+3cd+4abcd	VU (2000)	✓	✓
Isurus oxyrinchus	Shortfin mako	CR A2acd+3cd+4acd	NT (2000)	✓	
Lamna nasus	Porbeagle shark	CR A2bd	VU (2005)		✓
Squalus acanthias	Spiny dogfish	EN A2bd+4bd (VU Black Sea)	VU (2006)		✓
Rhinobatos cemiculus	Blackchin guitarfish	EN A4cd	NE	✓	
Rhinobatos rhinobatos	Common guitarfish	EN A4cd	NE	✓	
Leucoraja circularis	Sandy skate	EN A2bcd+3bcd+4bcd	NE	✓	
Mobula mobular	Giant devilray	EN A4d	EN (2006)		
Odontaspis ferox	Smalltooth sand tiger	EN A2abd+4abd	DD (2003)	✓	
Carcharodon carcharias	Great white shark	EN A2bc+3bc+4bc	VU (2000)	✓	
Carcharhinus plumbeus	Sandbar shark	EN A2bd+4bd	NT (2000)	✓	
Heptranchias perlo	Sharpnose sevengill shark	VU A2d+3d+4d	NT (2003)	✓	
Centrophorus granulosus	Gulper shark	VU A3d+4d	VU (2006)		
Alopias vulpinus	Thresher shark	VU A2bd+3bd	DD (2001)	✓	
Cetorhinus maximus	Basking shark	VU A2bd	VU (2000)	✓	
Galeorhinus galeus	Tope shark	VU A2bd	VU (2005)	✓	

Table 3.1 cont'd. Summary of the regional and global IUCN Red List status of all Mediterranean chondrichthyan fish species.

Scientific name	Common name	Threatened Status Mediterranean assessment	Threatened Status Global assessment (year submitted)	New/updated global assessment in preparation	Sub-population
Mustelus asterias	Starry smoothhound	VU A2ab+3bd+4ab	LC (2000)	✓	
Mustelus mustelus	Smoothhound	VU A2ab+3bd+4ab	LC (2000)	✓	
Prionace glauca	Blue shark	VU A3bd+4bd	NT (2000)	✓	
Sphyrna zygaena	Smooth hammerhead	VU A4bd	NT (2000)	✓	
Chimaera monstrosa	Rabbitfish	NT	NE	✓	
Hexanchus griseus	Bluntnose sixgill shark	NT	NT (2000)	✓	
Dipturus oxyrhynchus	Sharpnose skate	NT	NE	✓	
Leucoraja naevus	Cuckoo skate	NT	NE	✓	
Raja clavata	Thornback skate	NT	NT (2000)		
Raja polystigma	Speckled skate	NT	NE	✓	
Dasyatis centroura	Roughtail stingray	NT	NE	✓	
Dasyatis pastinaca	Common stingray	NT	NE	✓	
Pteroplatytrygon violacea	Pelagic stingray	NT	NE	✓	
Myliobatis aquila	Common eagle ray	NT	NE	✓	
Rhinoptera marginata	Lusitanian cownose ray	NT	NE	✓	
Galeus atlanticus	Atlantic catshark	NT	NE	✓	
Scyliorhinus stellaris	Nursehound	NT	NE	✓	
Etmopterus spinax	Velvet belly	LC	NE	✓	
Centroscymnus coelolepis	Portuguese dogfish	LC	NT (2003)	✓	
Somniosus rostratus	Little sleeper shark	LC	NE	✓	
Torpedo marmorata	Spotted torpedo ray	LC	NE	✓	
Torpedo torpedo	Ocellate torpedo ray	LC	NE	✓	
Raja asterias	Atlantic starry skate	LC	NE	✓	
Raja miraletus	Twineye skate	LC	NE	✓	
Raja montagui	Spotted skate	LC	NE	✓	
Galeus melastomus	Blackmouth catshark	LC	NE	✓	
Scyliorhinus canicula	Smallspotted catshark	LC	LC (2000)		
Hexanchus nakamurai	Bigeye sixgill shark	DD	NE	✓	
Echinorhinus brucus	Bramble shark	DD	DD (2003)	✓	
Dalatias licha	Kitefin shark	DD	DD (2000)	✓	
Torpedo nobiliana	Great torpedo ray	DD	NE	✓	
Leucoraja fullonica	Shagreen skate	DD	NE	✓	
Raja brachyura	Blonde skate	DD	NE	✓	
Raja radula	Rough skate	DD	NE	✓	
Raja undulata	Undulate skate	DD	NE	✓	
Dasyatis chrysonota	Blue stingray	DD	NE	✓	
Himantura uarnak	Honeycomb whipray	DD	NE	✓	
Taeniura grabata	Round fantail stingray	DD	NE	✓	
Alopias superciliosus	Bigeye thresher	DD	NE	✓	
Mustelus punctulatus	Blackspot smoothhound	DD	NE	✓	
Carcharhinus altimus	Bignose shark	DD	NE	✓	
Carcharhinus brachyurus	Bronze whaler shark	DD	NT (2003)	✓	
Carcharhinus brevipinna	Spinner shark	DD	NT (2000)	✓	
Carcharhinus limbatus	Blacktip shark	DD	NT (2000)	✓	
Carcharhinus obscurus	Dusky shark	DD	NT (2000)	✓	

Table 3.2 Summary of numbers of Mediterranean species assigned to each IUCN Red List category regionally and globally.

IUCN Red List Categories	Number of Mediterranean chondrichthyan species	
	Regional Assessment	Global Assessment (IUCN Red List, 2006)
Critically Endangered (CR)	13	5
Endangered (EN)	8	4
Vulnerable (VU)	9	7
Near Threatened (NT)	13	12
Least Concern (LC)	10	3
Data Deficient (DD)	18	4
Not Evaluated (NE)	0	36
Total number of species	**71**	**71**

Globally, of the 546 chondrichthyans assessed to date (Figure 3.1), 20% (110 species) are considered threatened, 17% (95 species) Near Threatened, 25% (136 species) Least Concern and 38% (205 species) Data Deficient. The results of this study demonstrate, however, that the status of chondrichthyans in the Mediterranean appears far worse.

Forty-two percent (30 species) of Mediterranean chondrichthyan fishes are considered threatened (Critically Endangered, Endangered or Vulnerable) within the region. Of these, 18% (13 species) are Critically Endangered, 11% (8 species) are Endangered and 13% (9 species) are Vulnerable. A further 18% (13 species) of Mediterranean chondrichthyans are assessed as Near Threatened and 14% (10 species) are assessed as Least Concern. Little information is known about 26% (18 species), which have therefore been assessed as Data Deficient (Figure 3.2).

Considering threatened species alone, most of which have global as well as regional assessments, a higher percentage of Mediterranean chondrichthyans are clearly more seriously threatened inside the Mediterranean than they are globally (Figure 3.3). Thus, of the 13 species assessed as Critically Endangered inside the Mediterranean, only five are also Critically Endangered globally (three are Endangered, two Vulnerable, one Near Threatened and two Not Evaluated). Of the eight Endangered Mediterranean species, one is also Endangered globally, while the others are Vulnerable (two species), Near Threatened (one species), Data Deficient (one species) or Not Evaluated (three species). Finally, only three of the nine Mediterranean Vulnerable species are also Vulnerable globally. The others are Near Threatened (three species), Data Deficient (one species) or Least Concern (two species). Of course, the Data Deficient and Not Evaluated global assessments may prove also to be threatened globally

Figure 3.1 Percentage of globally assessed chondrichthyan fishes (*n=546*) within each IUCN Red List category, IUCN Red List 2006.

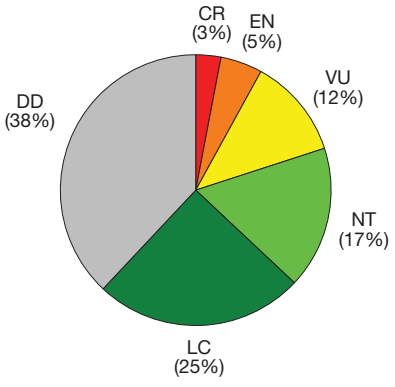


Figure 3.2 Percentage of Mediterranean species within each IUCN Red List category; regional assessment, IUCN Red List 2006.

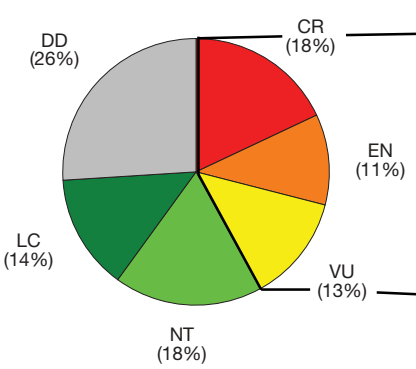
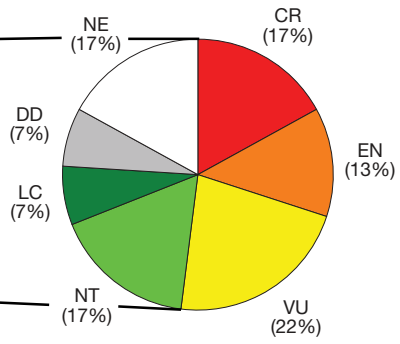


Figure 3.3 The global status of the 30 threatened Mediterranean species, IUCN Red List 2006.



Key: CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; LC: Least Concern; DD: Data Deficient; NE: Not Evaluated

when more data become available, but it is notable that only one species, the deepwater Portuguese dogfish *Centroscymnus coeloloepis* has a better conservation status inside the Mediterranean than it has globally.

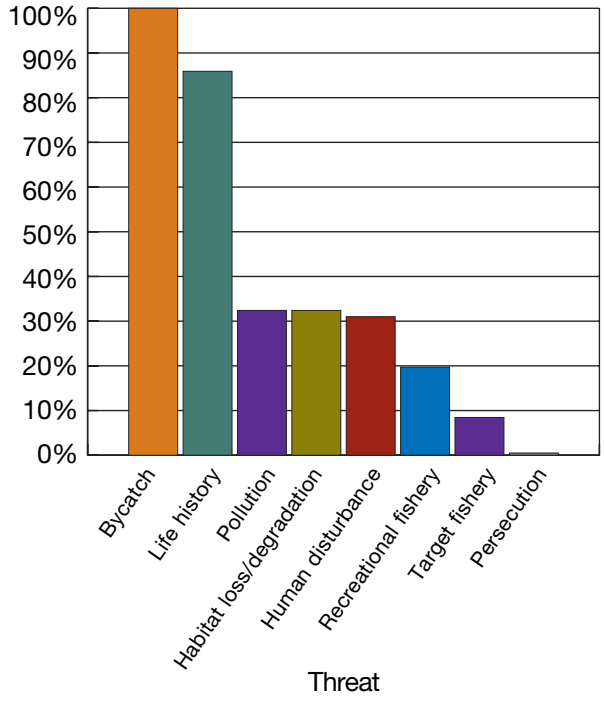
3.2 Major threats

A summary of the major threats to chondrichthyans in the Mediterranean, as identified in the IUCN Major Threats Authority File for each species IUCN Red List assessment, is presented in Table 3.3. The percentage of chondrichthyans currently susceptible to each of the major threat categories within the Mediterranean is presented in Figure 3.4.

Table 3.3 Historical, current and future threats to chondrichthyans in the Mediterranean. Note: More than one threat category can be selected for each species.

Type of threat	No. of species affected		
	Past threat	Present threat	Future threat
Bycatch	71	71	71
Life history	62	62	62
Pollution	23	23	23
Habitat loss / degradation	23	23	23
Human disturbance	22	22	22
Recreational fishery	16	14	14
Target fishery	15	6	8
Persecution	3	0	0

Figure 3.4 Percentage of chondrichthyan species (*n*=71) currently susceptible to each of the major threats in the Mediterranean, as detailed in the species' IUCN Red List assessments.



3.2.1 Bycatch

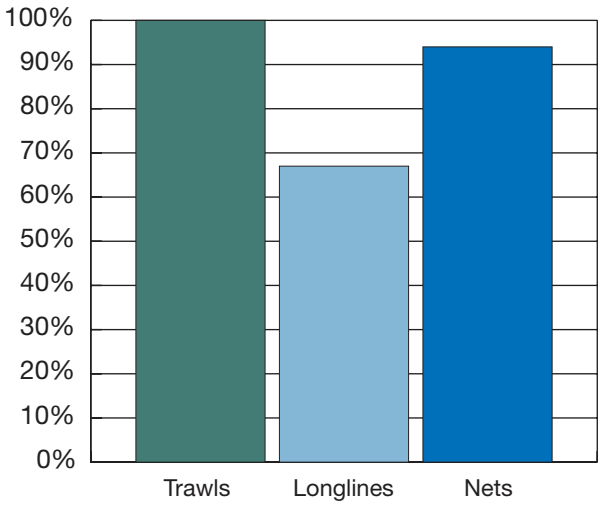
Chondrichthyan fishes are caught incidentally as bycatch in most fisheries worldwide (Camhi *et al*. 1998). The extent of bycatch is very often poorly documented, as a large proportion of bycatch is estimated to be discarded at sea and therefore unreported in official statistics (Camhi *et al*. 1998; Stevens *et al*. 2005). All species of chondrichthyans in the Mediterranean have been and are currently threatened or potentially threatened through bycatch in fisheries. Furthermore, bycatch will remain a major threat if changes to the current fisheries practices in the region are not implemented. The percentage of species susceptible to capture in various gear types as bycatch in the Mediterranean are shown in Figure 3.5.

IUCN Red List assessment results show that bycatch in trawls is currently considered to be the greatest threat to chondrichthyans in the Mediterranean, with all species affected or potentially affected (albeit for certain pelagic species such as blue shark *Prionace glauca* and makos *Isurus* spp.) it may only be certain life stages that are affected. Bycatch in nets (gillnets, purse seines and driftnets) is considered a possible threat to 67 (94%) of Mediterranean chondrichthyans and bycatch in longlines fisheries is a potential threat to 48 (67%) of species (Figure 3.5).

3.2.2 Life history

It is well known that the K-selected life history characteristics of most chondrichthyan fishes render them intrinsically vulnerable to fishing pressure. Once depleted, their life history traits also mean that populations have little capacity to recover. Sixty-two of the 71 species (87%) occurring in the Mediterranean are considered particularly threatened as a result of their inherently higher vulnerability due to limiting life history characteristics (Table 3.3, Figure 3.4).

Figure 3.5 Percentage of chondrichthyan species (*n*=71) within the Mediterranean, for which bycatch in trawls, longlines and nets, pose a major threat.



3.2.3 Target fisheries

Target fisheries are currently considered less of a threat to sharks and rays than in the past. Historically, 15 species were affected by targeted fisheries, but this number has now reduced to six species (8%) (Figure 3.4). The reduction in numbers of species affected can be explained by the fact that some chondrichthyans, such as angelsharks *Squatina* spp., have become commercially extinct and are therefore no longer targeted by fisheries.

3.2.4 Anthropogenic activities

Approximately 32% of all chondrichthyans in the Mediterranean are threatened or potentially threatened by anthropogenic activities, such as pollution, disturbance, habitat loss and degradation. Species most affected are those with predominantly coastal habitats.

3.3 Threatened species

Forty-two percent of Mediterranean chondrichthyans have been assessed as threatened (Critically Endangered, Endangered or Vulnerable) in the region. The status of all 30 of these species must be monitored particularly closely and, crucially, management and recovery plans should be implemented without delay. Further research and monitoring should also be conducted to better understand species' biology, threats and conservation needs.

Taxa at highest extinction risk in the Mediterranean include several species of bottom-dwelling chondrichthyans highly susceptible to trawling activities and with vulnerable life histories. For example, the three species of angelsharks *Squatina* spp. are all seriously threatened (Critically Endangered), having suffered severe declines and range contractions, yet all were historically abundant (Walker *et al*. 2005). Their demise is almost certainly due to intense demersal fishing pressure from which they have been unable to recover. A number of other demersal species are similarly affected, such as the angular rough shark *Oxynotus centrina* (Critically Endangered), formerly abundant but now rare with localised extinctions. Its large spiny dorsal fins and relatively large body size make it particularly vulnerable to trawls (Aldebert 1997; Baino *et al*. 2001; Dulvy *et al*. 2003). The same is true for many of the large skate species, such as the common skate *Dipturus batis* (Critically Endangered), the white skate *Rostroraja alba* (Critically Endangered) and the spiny butterfly ray *Gymnura altavela* (Critically Endangered) whose large size at maturity mean that exploitation and probable capture before breeding is likely to be high. The Maltese skate *Leucoraja melitensis* (Critically Endangered), a Mediterranean endemic, was formerly common within a restricted range (Stehmann *et al*. 1984). The species has a depth range that coincides with that of trawling activity, however, and is now considered rare within a decreasing area of occurrence.

Both species of sawfish in the Mediterranean are seriously threatened (Critically Endangered). Smalltooth sawfish *Pristis pectinata* has been wholly or nearly extirpated from large areas of its former range by fishing and habitat modification. Common sawfish *P. pristis* was once common in the Mediterranean but is now thought to have been extirpated. Sawfishes are extremely vulnerable to bycatch in nets due to their large rostra. Without timely intervention there is a high probability that both of these species will become extinct in the Mediterranean, if this is not already the case.

Other seriously threatened species include the porbeagle *Lamna nasus* (Critically Endangered), shortfin mako *Isurus oxyrinchus* (Critically Endangered), sandbar shark *Carcharhinus plumbeus* (Endangered), giant devilray *Mobula mobular* (Endangered), and blue shark *Prionace glauca* (Vulnerable). Unsustainable fisheries (target and bycatch, usually by longlines) are the main threats to these species.

3.4 Near Threatened species

Thirteen species (18%) are assessed as Near Threatened, reflecting concern that they are close to qualifying for a threatened category and could do so in the near future. For example, there is concern for several species that are taken as bycatch in fisheries, yet may be unable to withstand continued indirect exploitation pressure. These include the sharpnose skate *Dipturus oxyrinchus*, common stingray *Dasyatis pastinaca* and common eagleray *Myliobatis aquila*. It is essential that these species are monitored closely and, where possible, management action should be taken to avoid them becoming listed as threatened in the future.

3.5 Least Concern species

Only ten chondrichthyan species (14%) in the Mediterranean are not considered to be under any threat of extinction now or in the foreseeable future. These species include some of the catsharks (e.g. smallspotted catshark *Scyliorhinus canicula* and blackmouth catshark *Galeus melastomus*) and smaller skate species (e.g. Atlantic starry skate *Raja asterias* and spotted skate *R. montagui*). Many of these species are generally abundant and/or widespread with limited fishing pressure; are not particularly susceptible to fisheries; or are relatively productive and resilient to current pressures. These species may still benefit from conservation management action, even though they are listed as Least Concern.

3.6 Data Deficient species

This initial effort to produce IUCN Red List assessments for Mediterranean chondrichthyans has confirmed that there is a significant lack of information on the status of many species in the region. Twenty-six percent of species assessed were categorised as Data Deficient, indicating there is not enough information to enable accurate assessment of their extinction risk. This is often due to a lack of research, or because species are (or have become) rare, or have a limited geographic distribution. Therefore, they may be especially vulnerable to anthropogenic threats, in particular over-exploitation. Research efforts focusing on species for which there is currently little knowledge must be dramatically increased. A Data Deficient listing does not mean that these 18 species are not threatened. In fact, as knowledge improves, such species are often found to be amongst the most threatened (or suspected as such from available evidence). It is therefore essential to direct research efforts and funding towards these species as well as those in threatened categories (Cavanagh *et al*. 2003). This is particularly important when there are apparent threats yet virtually no available data on population sizes or biological parameters. In addition, many of the large shark species such as the bigeye thresher shark *Alopias superciliosus*, copper shark *Carcharhinus brachyurus*, dusky shark *C. obscurus* and spinner shark *C. brevipinna* pose a particular dilemma. Are these species rare in the Mediterranean, or just rarely caught and reported? In most cases it is currently not possible to be certain. Studies like the Mediterranean Large Elasmobranch Monitoring Project (MEDLEM, http://www.arpat.toscana.it/progetti/pr_medlem_en.html) will provide more information on the status of such species in the near future (Walker *et al*. 2005) and should be encouraged and expanded.

4. Case studies

Eight case studies from Mediterranean IUCN Red List assessments are presented below, illustrating a range of factors affecting chondrichthyan populations in the Mediterranean Sea. The case studies provide examples of species assigned to each of the six IUCN Red List categories. Summaries of all species assessments from the region are included in Cavanagh *et al*. (in prep).

4.1 Maltese skate *Leucoraja melitensis* (Clark, 1926)

Mediterranean: Critically Endangered A2bcd+3bcd+4bcd
Global (Mediterranean endemic): Critically Endangered A2bcd+3bcd+4bcd (2006)

Mediterranean assessment authors: Ungaro, N., Serena, F., Dulvy, N.K., Tinti, F., Bertozzi, M., Pasolini, P., Mancusi, C. and Notarbartolo di Sciara, G.

The Maltese skate *Leucoraja melitensis* is a Mediterranean endemic that is under imminent threat of extinction. It was previously found over a relatively restricted area (about 1/4 of the total area of the Mediterranean Sea) in the depth range where trawl fisheries routinely operate (Ungaro *et al*. 2006). This species is now extremely rare, recorded in only 20 out of 6,336 hauls in broadscale surveys of the north Mediterranean coastline from 1995–1999 (Baino *et al*. 2001; Bertrand *et al*. 2000). Its main range now appears to be restricted to the Sicilian channel. It is also now rare off Malta and rare or absent off Tunisia, where it was previously considered moderately common (Bradai 2000; Schembri *et al*. 2003; Stehmann and Burkel 1984). Historically, *L. melitensis* was reported from the Gulf of Lions but was not found in comparable surveys carried out in the 1990s (Aldebert 1997). Although population data are lacking, given the small range of the remaining population the potential detrimental impact of trawl fisheries is likely to be significant. The Maltese skate is assessed as Critically Endangered at the global level on the basis of very rapid population declines, which are estimated to exceed 80% in three generations. The species now appears to be restricted to only one small Mediterranean location, which is subject to heavy trawling activity (Ungaro *et al*. 2006). Urgent protection of this endemic species and its critical habitats is required to prevent further decline of the remaining population. Further research is also needed on the exploitation, distribution, biology and ecology of this species, as well as trends in abundance (Ungaro *et al*. 2006).

4.2 Giant devil ray *Mobula mobular* (Bonnaterre, 1788)

Mediterranean: Endangered A4d
Global: Endangered A4d (2006)

Mediterranean assessment authors: Notarbartolo di Sciara, G., Serena, F. and Mancusi, C.

The giant devil ray is a huge pelagic plankton feeder, predominantly restricted to the Mediterranean Sea, which gives birth to a single large pup at unknown intervals. Its limited range and low reproductive capacity make it very vulnerable to overfishing. Although no direct fishery for giant devil rays exists, high mortality rates are reported from accidental catch in pelagic fisheries in the Mediterranean. It is at threat from driftnetting, which continues despite being banned in Mediterranean waters (WWF 2005), and from accidental capture by longlines, purse seines, trawls and fixed traditional tuna traps "tonnare". The giant devil ray is listed on Annex II 'List of endangered or threatened species' of the Barcelona Convention (see 5.2.2), which requires Parties to ensure maximum protection and aid the recovery of listed species. It is also listed on Appendix II (Strictly protected fauna species) of the Bern Convention (see 5.2.1). These listings are only implemented in Malta and Croatia. Recently, the General Fisheries Commission for the Mediterranean (GFCM) and International Commission for the

Conservation of Atlantic Tuna (ICCAT) introduced legislation to ban the use of pelagic driftnets within the Mediterranean basin. If implemented, this would eliminate one of the most severe threats to the giant devil ray. Without implementation of these measures, it is inferred that this giant ray will become increasingly rare in the Mediterranean; it is assessed as Endangered. Strict enforcement of protection and raising awareness with fishermen may prevent this ray from becoming more threatened in the future (Notarbartolo di Sciara *et al*. 2006).

4.3 White shark *Carcharodon carcharias* (Linnaeus, 1758)

Mediterranean: Endangered A2bc+3bc+4bc
Global: Vulnerable (2000). Update in preparation

Mediterranean assessment authors: Fergusson, I.K., Soldo, A., Morey, G. and Bonfil, R.

This flagship species has long been the focus of negative media attention as a result of its occasional lethal interactions with humans and perceived nuisance to some commercial fisheries (Fergusson *et al*. 2005). Due to this much exaggerated perception there are occasional attempts to capture and kill these sharks, which have been targeted in the past for sportfishing, commercial trophy hunting or human consumption (although no directed Mediterranean fishery has ever existed) (Fergusson *et al*. 2005). Although currently under review, the white shark has been listed as globally Vulnerable on the IUCN Red List since 2000. However, it is considered to be at a higher risk of threat in the Mediterranean, and has therefore been assessed as Endangered in this region (Fergusson *et al*. in prep.). Historical quantitative data for *Carcharodon carcharias* in the Mediterranean are patchy, but available information provides sufficient evidence for declines of 50–60% to be inferred and an increasing scarcity of white sharks through the latter half of the 20th century (Fergusson *et al*. in prep.). Records are declining despite increased scientific monitoring (especially in Italy, Malta, Croatia, Tunisia and Spain) and considerable growth in tourism and resort development during the last 40 years, which should have increased opportunities for sightings.

Offshore records in the Mediterranean have included captures across all size-classes made by pelagic longlines, bottom trawls, driftnets and purse seines. *C. carcharias* has a tendency to approach boats readily and to scavenge from fishing gear, which increases their vulnerability, potentially resulting in accidental entrapment or deliberate killing by commercial fishermen (Fergusson *et al*. 2005). In certain regions, such as Sicily, the white shark has traditionally been viewed negatively, as a costly interference to fisheries (Fergusson *et al*. in prep.). The impact of habitat degradation might be especially acute in the Mediterranean, where growing areas of intensive human inhabitation, especially for tourism, overlap with white shark habitat . Declines of traditional regionally- important prey such as blue fin tuna (Morey *et al*. 2003; Soldo and Dulcic 2005) alongside threats to other important prey, including small cetaceans (Morey *et al*. 2003) and other demersal and pelagic fishes, are suspected to have had a serious impact on white sharks in the Mediterranean (Fergusson pers. comm.).

Entrapment in fixed tuna rearing pens and towed tuna cages may also pose a threat to white sharks in the region. Although little is known of the direct impacts of tuna cages, their increasing use, evidence for unreported encounters (Morey pers. comm.), and the potential for white sharks to be illegally killed through conflict with industry workers raises concerns. Similar issues are known to have arisen in southern Australia and Mexico (Galaz and Maddalena 2004).

The Mediterranean white shark population is classified as Endangered on the evidence of declines and the likely fishery pressures placed upon their apparent reproductive and nursery grounds in the Sicilian Channel (Fergusson *et al*. in prep.). This species has been included in both Appendices of the Convention of Migratory Species (Bonn Convention) since 2002, with the objective of providing a framework for an improved coordination by range states to adopt and enact protective measures (see 5.1.1). It has also been listed on Appendix II of the Convention on International Trade in Endangered Species (CITES) since 2004 (see 5.1.2). In the Mediterranean, the white shark is listed as an 'Endangered species' on Annex II of the Barcelona Convention (see 5.2.2), and as a 'Strictly protected species' on Appendix II of the Bern Convention (see 5.2.1). Since October 1999 the white shark has been protected in Maltese waters by specific legislation enacted under its Environment Protection Act No. 5 (1991) Flora and Fauna Protection (Amendment) Regulations 1999, and was also recently declared a strictly protected species in Croatian waters.

Conservation management of this species in the Mediterranean Sea poses a challenge as it is rare, wide ranging and diffusely distributed, with little known on seasonal movements or key elements of its population biology (Fergusson 1996; 2002). Effective enforcement of management measures already in place could significantly

improve the situation for the white shark. An additional approach could be to implement a scheme of protective management in 'critical habitats', selected by interpreting biogeographical data. Such efforts should focus upon the Sicilian Channel and its environs (Fergusson 2002; Fergusson *et al.* in prep.).

4.4 Blue shark *Prionace glauca* (Linnaeus, 1758)

Mediterranean: Vulnerable A3bd + 4bd
Global: Near Threatened (2000). Update in preparation

Mediterranean assessment authors: Soldo, A., Megalofonou, P., Bianchi I. and Macias, D.

Prionace glauca is believed to be among the most wide-ranging of all shark species. It is an oceanic shark, found throughout the world's tropical and temperate seas. The population in the Mediterranean is considered independent of the North Atlantic population for fisheries management purposes, however, the extent of exchange between these populations (if any) is poorly understood (Fitzmaurice *et al.* 2005; Heessen 2003).

The blue shark constitutes a major bycatch of longline and driftnet fisheries, much of which is often unrecorded (Stevens 2005). It is a major bycatch and secondary target species of European large pelagic fisheries, and there is mounting evidence that it is increasingly targeted for its fins (Tudela *et al.* 2005). Even though driftnetting is banned in Mediterranean waters, this practice continues illegally (WWF 2005) and the driftnet fishery in the Alboran Sea is catching large numbers of blue sharks (estimated at more than 26,000 individuals per year) (Tudela *et al.* 2005).

Increasing effort of large pelagic fisheries throughout the Mediterranean over the last 30 years is inferred to have had a considerable impact on the blue shark population. Comparison of historical data from swordfish fisheries in the Gulf of Taranto with a more recent study has revealed that the catch rates in this area over the last 20 years have decreased by an average of 38.5% (De Metrio *et al.* 1984; Megalofonou *et al.* 2005). Furthermore, during a study of large pelagic fisheries in the Mediterranean from 1998–1999, 91.1% of 3,771 blue sharks measured were under 215cm TL and 96.3% under 257cm TL, indicating that the huge majority had not yet reached maturity (Megalofonou *et al.* 2005). Similar results were obtained from the Bay of Biscay where all the specimens caught were immature (Lucio *et al.* 2002).

Recently this species has increased in commercial value and incidental catches are now very rarely discarded (Megalofonou *et al.* 2005), with the meat marketed in Greece, Italy and Spain and fins exported to Asia. There is strong concern that future tuna and swordfish catch quotas will increase the demand placed upon the blue shark, with adverse consequences on the stock. Furthermore, increased demand for meat and fins in the Northeast Atlantic fishery could potentially result in the blue shark also becoming a direct target species in the Mediterranean Sea. Given the high probability for the persistent removal of significantly large numbers of this species from the Mediterranean and adjacent Northeast Atlantic; and concern over increased targeting; this species has been assessed as Vulnerable.

The UNEP RAC/SPA Action Plan for the Conservation of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea lists the blue shark among the main commercial species, for which it primarily recommends the development of sustainable management programmes for fisheries catching these species (as target or bycatch). The blue shark is also listed on Appendix III 'Protected fauna species' of the Bern Convention, meaning the protection of this species is required, but with a certain amount of exploitation permitted if population levels allow (see 5.2.1). Implementation of the recommendation outlined in the UNEP RAC/SPA Action Plan, enforcement of measures required under the Bern Convention, along with close monitoring of catch levels (including bycatch), would contribute to ensuring current population declines do not continue. Studies such as the Mediterranean Large Elasmobranch Monitoring Project (MEDLEM) should help to fulfil this need by providing further specific data on the status of this, and other shark species, in this region.

4.5 Rabbitfish *Chimaera monstrosa* Linnaeus, 1758

Mediterranean: Near Threatened
Global: Not Evaluated (an assessment has been completed and submitted to IUCN for inclusion in the 2007 IUCN Red List).

Mediterranean assessment authors: Dagit, D.D., Hareide, N. and Clò, S.

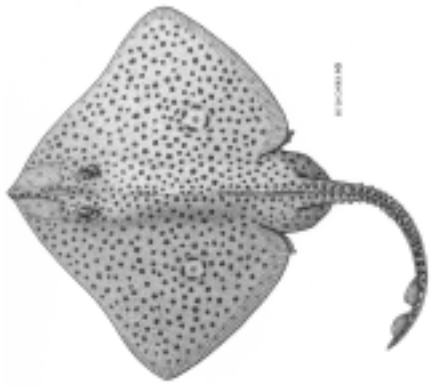
Chimaera monstrosa is widely distributed throughout the Northeast Atlantic and western Mediterranean Sea, but rarely recorded from the eastern Mediterranean. Although one of the better known of the chimaeroid fishes, limited information is available regarding its biology and ecology. Data on the life-history parameters of *C. monstrosa* are also limited, but it is long-lived (estimated 30 years for males and 26 years for females) and likely to be vulnerable to population depletion (Calis *et al*. 2005). In the Mediterranean, this species is found at depths from 100m, but is most abundant between 500–800m (Baino *et al*. 2001). Several specimens have also reported from the Balearic Sea at depths of 650m and from the eastern Ionian Sea at 800m (Sion *et al*. 2004). Commercial trawling is intense between depths of 50–700m in the Mediterranean (Colloca *et al*. 2003). Bottom trawling below depths of 1,000m in the Mediterranean has been prohibited by the General Fisheries Commission for the Mediterranean (GFCM), although the effectiveness of this measure is unknown. The preferred depth range of *C. monstrosa* occurs at depths less than 1,000m, however, and it is therefore still vulnerable to deepwater fisheries.

Although no specific data on population trends over time are available, considering this species' preferred depth range is entirely within the range of current fishing activity, its unproductive life history characteristics, and suspected high rate of mortality to discards, this species has been assessed as Near Threatened (Dagit *et al*. in prep.). Further information is required on deepwater fishing activities (including catch and bycatch levels, effort and trend monitoring). The ban on deepwater trawling below 1,000m may afford some protection to the deepest part of the stock. However, given that its preferred depth range is entirely within the range of fisheries in this region, both present and future fishing pressure are likely to be unsustainable for *C. montrosa* and additional management measures are required.

4.6 Spotted ray *Raja montagui* Fowler, 1910

Mediterranean: Least Concern
Global: Not Evaluated (an assessment has been completed and submitted to IUCN for inclusion in the 2007 IUCN Red List).

Mediterranean assessment authors: Ungaro, N., Serena, F., Tinti, F., Bertozzi, M., Pasolini, P., Mancusi, C., Notarbartolo di Sciara, G., Dulvy, N. and Ellis, J.



Raja montagui is a small, relatively fecund skate, found from Norway in the Northeast Atlantic to Tunisia and western Greece in the Mediterranean Sea (Bauchot 1987; Serena 2005; Stehmann and Burkel 1984). In the Mediterranean, the majority of the population appears to exist between 100–500m, although it occurs from the shallows to 600m (Baino *et al*. 2001). As intense commercial trawling occurs between 50–700m, the entire depth range of *R. montagui* is within the depths of fisheries and this species is captured as bycatch (Colloca *et al*. 2003). Despite these levels of fishing pressure, and although temporal fluctuations in abundance have occurred, populations of *R. montagui* appear to be stable in most parts of the Mediterranean (Relini *et al*. 2000). The small body size of this species (average total length 60cm), means it is possibly more resilient to fishing impacts compared to the larger-bodied skate species. Therefore, this species has been assessed as Least Concern in the Mediterranean, although population trends and bycatch levels should be monitored to ensure a stable population is maintained. *R. montagui* may also benefit from general conservation measures (e.g. landing size regulations and effort reduction) to ensure that it remains Least Concern in the future (Ungaro *et al*. in prep.).

4.7 Portuguese dogfish *Centroscymnus coelolepis* (Bocage and Capello, 1864)

Mediterranean: Least Concern
Global: Near Threatened (2003), Update in preparation

Mediterranean assessment authors: Clò, S. and Hareide, N.

Centroscymnus coelolepis is one of the deepest living sharks. It is widely but patchily distributed in the Atlantic, Pacific and Indian Oceans, living on or near the sea bottom over continental slopes and upper and middle abyssal plain rises. This species has very slow growth and low fecundity, resulting in a very low intrinsic rate of increase and making it vulnerable to population decline where it is fished (Stevens and Correia 2003).

The Mediterranean population of *C. coelolepis* appears to be distributed deeper than populations in the Atlantic and Pacific (Clò *et al*. 2002). Bottom trawl surveys indicate that it is found from 1,301m to a maximum depth of 2,863m (Clò *et al*. 2002; Grey 1956; Massutí and Moranta 2003; Priede and Bagley 2000; Sion *et al*. 2004). In trawl surveys in the western Mediterranean (Balearic Islands), Massutí and Moranta (2003) recorded this species from 1,301–1,700m and Sion *et al*. (2004) from 1,500–2,500m. Both studies reported that *C. coelolepis* increased in abundance at the greatest depths surveyed. The species was also recorded using a video camera in the eastern Mediterranean at 1,500–2,500m in the Cretan Sea and at 2,300–3,850m in the Rhodos Basin (Priede and Bagley 2000). In February 2005 the General Fisheries Commission for the Mediterranean (GFCM) adopted the Decision to refrain from expanding deep water fisheries operations below depths of 1,000m, which entered into force in September 2005 (FAO 2005, see 6.1). The effectiveness of this measure is unknown.

Although data for this species in the region are scarce, there is no evidence that the population has declined. The few data available indicate that *C. coelolepis* generally increases in abundance with depth in the Mediterranean, affording it refuge from fishing pressure. In the absence of evidence for population declines, and given that the GFCM Decision offers it refuge from fishing pressure, *C. coelolepis* is considered Least Concern in the Mediterranean. Although not targeted in the Mediterranean Sea, any level of bycatch would be of concern because of this species' intrinsic biological vulnerability to depletion. Therefore its status will rely on the strict implementation of the GFCM deepwater trawling ban; the efficacy of this measure should be monitored and bycatch of deepwater fisheries accurately reported. If fishing expands below 1,000m in the future, this assessment will need to be revisited.

4.8 Bigeye thresher *Alopias superciliosus* (Lowe, 1839)

Mediterranean: Data Deficient
Global: Not Evaluated (in preparation)

Mediterranean assessment authors: Vacchi, M., Macias, D., Fergusson, I., Mancusi, C. and Clò, S.

Alopias superciliosus has been poorly documented in the Mediterranean and is considered scarce or rare (Barrull and Mate 2002). There are no available data on catch trends for this species in the region, although significant reductions in thresher sharks have been reported through catch per unit effort (CPUE) comparisons in the Northwest Atlantic pelagic longline fishery (Baum *et al*. 2003), and suspected declines have occurred elsewhere.

A. superciliosus is a bycatch of the semi-industrial fisheries (swordfish and other pelagic fisheries) of southern Spain, Morocco, Algeria, Sicily and Malta, and of artisanal trammel and gillnet fisheries elsewhere in the Mediterranean Sea (Bauchot 1987). In recent years, increasing numbers of new records from the eastern Mediterranean (sometimes multiple captures) demonstrate that this species also penetrates widely to the east of Malta, occurring in the waters off Israel (Levantine basin), in the Aegean Sea off Turkey and southern Greece, and off southern Crete (Fergusson pers. comm; Golani 1996). Evidence from offshore pelagic fisheries in southern Sicily and Malta indicate that *A. superciliosus* is caught in unknown numbers each year, but routinely discarded at sea (hence the vernacular name 'false thresher', because of a perceived low local value).

Despite the apparent threat posed by bycatch, the lack of records and further information on the population of *A. superciliosus* in the Mediterranean prevents an assessment beyond Data Deficient at this time (Vacchi *et al*. in prep.). This species, like many other large shark species in this region, poses a particular dilemma – is it rare in the Mediterranean, or just rarely caught and reported? It is

important to note that this species may prove to be threatened in the Mediterranean and in need of urgent management action. The UNEP RAC/SPA Action Plan for the Conservation of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea lists *Alopias* spp. within the primary group for which development of sustainable fisheries management programmes is recommended (UNEP MAP RAC/SPA 2003). Strict enforcement of existing regulations, including the International Commission for the Conservation of Atlantic Tunas (ICCAT) ban on driftnetting in Mediterranean waters, adopted in 1992, is needed to prevent this species from declining before an accurate assessment of the population can be made. Research is required to provide information on the status of this and other large shark species in the Mediterranean. It is anticipated that studies like the Mediterranean Large Elasmobranch Monitoring Project (MEDLEM) will soon provide further information on the status of such species and species-specific monitoring should be a continued priority.

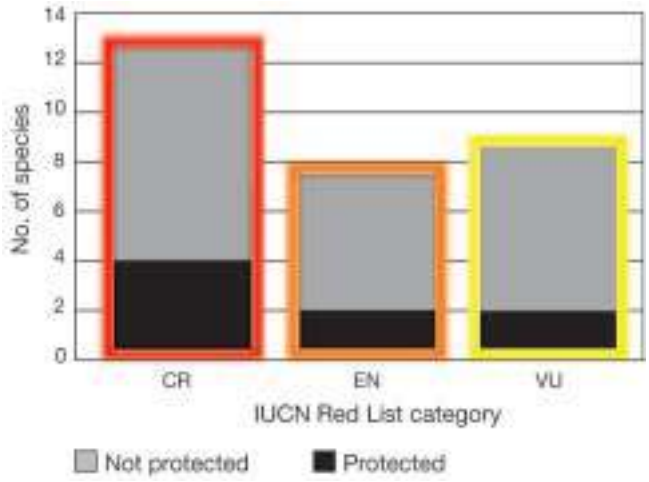
5. International and regional instruments relevant to the conservation and management of Mediterranean chondrichthyans

Protection currently granted to chondrichthyan fish species in the Mediterranean Sea under various regional and international conventions is summarised in Table 5.1. Only two species; white shark *Carcharodon carcharias* and basking shark *Cetorhinus maximus*, are listed on the appendices of all four international conventions.

The giant devilray *Mobula mobular* also receives some protection, being listed on Appendix II of the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) and on Annex II 'List of endangered or threatened species', of the Barcelona Convention. The Bern Convention listing renders *M. mobular* a strictly protected species (see 5.2.1), and requires that Parties endeavour to carry out appropriate measures with the aim of ensuring the species is maintained in a favourable conservation state.

A further five species (shortfin mako *Isurus oxyrinchus*, porbeagle *Lamna nasus*, blue shark *Prionace glauca*, angelshark *Squatina squatina*, and white skate *Rostroraja alba*) are listed on Appendix III of the Bern Convention and on Annex III of the Barcelona Convention.

Figure 5.1 Numbers of regionally threatened chondrichthyans (Critically Endangered, Endangered, Vulnerable) granted some form of protection within the Mediterranean.



The Bern Convention Appendix III listing requires Parties to protect these species, but a certain amount of exploitation is permitted if population levels allow (COE 2006). The Annex III listing on the Barcelona Convention also requires the exploitation of these species to be regulated (EUROPA 2006a).

The numbers of threatened species (Critically Endangered, Endangered or Vulnerable) granted some form of protected status in the Mediterranean Sea are presented in Figure 5.1. It is important to note how few of the threatened species are listed under relevant conventions. A total of 30 out of 71 Mediterranean species (42%) were regionally assessed as threatened. Of these, just eight (27%) are granted some form of protection. This means 22 of the 30 threatened species (over 73%) currently receive no form of protection in the Mediterranean. Furthermore, only four of the 13 (31%) Critically Endangered chondrichthyans are afforded any kind of protected status.

5.1 Global instruments

5.1.1 The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention)

CMS recognises the need for countries to cooperate in the conservation of animals that migrate across national boundaries, if an effective response to threats operating throughout a species' range is to be made. The Convention actively promotes concerted action by the Range States of species listed on its Appendices. CMS Parties should strive towards strictly protecting the endangered species on Appendix 1, conserving or restoring their habitat, mitigating obstacles to migration and controlling other factors that might endanger them (CMS 2006). The Range States of Appendix II species (migratory species with an unfavourable conservation status that need or would significantly benefit from international cooperation) are encouraged to conclude global or regional Agreements for their conservation and management (CMS 2006). The white shark and basking shark are listed on Appendices I and II of the CMS. The

Table 5.1 Mediterranean chondrichthyans currently included in the text of International Conventions.

Bern Convention Convention on the Conservation of European Wildlife and Natural Habitats (1979)	**Appendix I** ***Strictly protected flora species***	**Appendix II** ***Strictly protected fauna species***	**Appendix III** ***Protected fauna species***
		White shark *Carcharodon carcharias* Basking shark *Cetorhinus maximus* Giant devil ray *Mobula mobular*	Shortfin mako shark *Isurus oxyrinchus* Porbeagle *Lamna nasus* Blue shark *Prionace glauca* Angelshark *Squatina squatina* White skate *Rostroraja alba*
CMS or Bonn Convention Convention on the Conservation of Migratory Species of Wild Animals (1983)	**Appendix I** ***Strictly protected endangered migratory species***	**Appendix II** ***Migratory species with an unfavourable conservation status that would benefit from international cooperation***	
	White shark *Carcharodon carcharias* Basking shark *Cetorhinus maximus*	White shark *Carcharodon carcharias* Basking shark *Cetorhinus maximus*	
CITES Convention on International Trade in Endangered Species of Wild Fauna and Flora (1975)	**Appendix I** ***Species threatened with extinction – trade permitted only in exceptional circumstances***	**Appendix II** ***Species not currently threatened with extinction but trade must be controlled in order to avoid utilization incompatible with the survival of the species***	**Appendix III** ***Species protected in at least one country, which has asked other CITES Parties for assistance in controlling trade***
		Basking shark *Cetorhinus maximus* White shark *Carcharodon carcharias*	
Barcelona Convention (Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean) (1976, amended in 1995) Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SAP-Bio) (1995)	**Annex I** ***Common criteria for the choice of marine and coastal areas that could be included in the SPAMI list***	**Annex II** ***List of endangered or threatened species***	**Annex III** ***List of species whose exploitation is regulated***
		White shark *Carcharodon carcharias* Basking shark *Cetorhinus maximus* Giant devil ray *Mobula mobular*	Shortfin mako shark *Isurus oxyrinchus* Porbeagle *Lamna nasus* Blue shark *Prionace glauca* Angelshark *Squatina squatina* White skate *Rostroraja alba*

8th Conference of Parties in 2005 agreed to begin the development of a CMS Instrument for the conservation of all migratory shark species listed on CMS. Progress towards this goal will be initiated in 2007. See: http://www.cms.int/ for more information.

5.1.2 The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES was established in recognition that international cooperation is essential for the protection of certain species from over-exploitation through international trade. It creates the international legal framework for the prevention of trade in endangered species of wild fauna and flora and for the effective regulation of international trade in other species which may become threatened in the absence of such regulation. Two Mediterranean shark species are listed on Appendix II of CITES: basking shark and white shark. Proposals to list two more Mediterranean species on Appendix II (porbeagle *Lamna nasus* and spiny dogfish *Squalus acanthias*) and all species of sawfish Pristidae on Appendix I may be debated by the 14th Conference of Parties in 2007.

CITES' other major role in promoting the sustainable management of wild species (arguably as important, if not more important than species listings on its Appendices), is through the adoption of Resolutions and Decisions. Resolution Conf. 12.6 encourages Parties, *inter alia*, to identify endangered shark species that require consideration for inclusion in the Appendices, if their management and conservation status does not improve. Decision 13.42 encourages Parties to improve their data collection and reporting of catches, landings and trade in sharks (at species level where possible), to build capacity to manage their shark fisheries, and to take action on several species-specific recommendations from the Animals Committee. Many of the latter taxa are threatened in the Mediterranean, including spiny dogfish, porbeagle, white shark, tope shark *Galeorhinus galeus*, sawfishes family Pristidae, gulper sharks genus *Centrophorus*, requiem sharks genus *Carcharhinus*, guitarfishes Order Rhinobatiformes, and devil rays family Mobulidae. Angel sharks family Squatinidae, sandtiger sharks family Odontaspidae, and thresher sharks family Alopidae, were also identified as of potential concern.

Parties were also urged, through FAO and regional fisheries organizations, to develop, adopt and implement new international instruments and regional agreements for the conservation and management of sharks, and to consider recommendations for activities and guidelines to reduce mortality of endangered species of sharks in bycatch and target fisheries (CITES 2006; Fowler and Cavanagh 2005a). See http://www.cites.org/ for more information.

5.1.3 United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS provides a framework for the conservation and management of fisheries and other uses of the sea by giving Coastal States the right and responsibility for the management and use of fishery resources within their national jurisdiction (the territorial sea, which can extend up to 12 nautical miles). UNCLOS also recognises Coastal States' right to claim an exclusive economic zone (EEZ) of up to 200 nautical miles. The management goal adopted by UNCLOS (Article 61(3)) is that of maximum sustainable yield, qualified by environmental and economic factors. The provisions of UNCLOS directly related to the conservation and management of sharks include the duty placed on Coastal States to ensure that stocks occurring within their jurisdictional waters are not endangered by overexploitation. See http://www.un.org/Depts/los/index.htm for more information.

Within the Mediterranean, the majority of States have established their 12-mile territorial waters (except Greece and Turkey). A few countries are in the process of claiming an EEZ. However, because of the difficulties associated in the delimitation of what is a relatively narrow sea and since most States want to maintain their basin-wide access to fisheries, few have claimed an EEZ (Chevalier 2005). As a consequence, there is a large area of high seas in the Mediterranean, which requires cooperation between Coastal States to ensure the sustainable use of fisheries resources and conservation of marine biodiversity (Chevalier 2005).

5.1.4 United Nations Agreement on the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UNFSA)

UNFSA was established to implement the provisions of UNCLOS pertaining to the conservation and management of straddling and highly migratory fish stocks. UNSFA (adopted in 1995, ratified in 2001) calls for Parties to protect marine biodiversity, minimise pollution, monitor fishing levels and stocks, provide accurate reporting of and minimise bycatch and discards, and gather reliable, comprehensive scientific data as the basis for management decisions. In the absence of scientific certainty, it mandates a precautionary approach to the management of straddling and highly migratory stocks and species. Cooperation for such species is achieved though regional fisheries arrangements or organisations. According to Annex I of UNCLOS, Coastal States and other States who fish in areas where highly migratory species occur are required to ensure the conservation and promote optimum utilisation of listed species.

The following chondrichthyans are listed on UNCLOS Annex I, Highly Migratory Species: sixgill shark *Hexanchus griseus*, basking shark, thresher sharks family Alopiidae, requiem sharks family Carcharhinidae (including blue shark), hammerhead sharks family Sphyrnidae, and mackerel sharks family *Isuridae* (including shortfin mako and porbeagle). Other chondrichthyan species may be classified as 'straddling stocks' (Article 63 (2)) under the Convention. This is of particular relevance to the Mediterranean, where State jurisdiction is not extended to 200 nautical miles. States are required to agree upon measures to ensure the conservation of qualifying chondrichthyan species or stocks which straddle coastal waters and high seas. The final mandate is for chondrichthyans that only occur on the high seas: fishing States must individually, or in cooperation with other fishing States, take measures to ensure these stocks are conserved (Fowler and Cavanagh 2005a). See http://www.oceanlaw.net/texts/unfsa.htm for more information.

5.1.5 FAO International Plan of Action for the Conservation and Management of Sharks (IPOA–Sharks)

The implementation of the IPOA–Sharks is voluntary. It was developed in 1999 by FAO within the framework of their 'Code of Conduct for Responsible Fisheries' in response to the request made in CITES Resolution Conf. 9.17 (Fowler and Cavanagh 2005a). The IPOA-Sharks is supported by Technical Guidelines (FAO 2000) addressed to decision makers and policy-makers associated with the conservation and management of chondrichthyans. Its objective is to ensure the conservation and management of sharks (and their relatives) and their long-term sustainable use. The Technical Guidelines say 'States contributing to fishing mortality on a species or stock should participate in its management'.

The IPOA-Sharks calls upon all States to produce a Shark Assessment Report (SAR), to determine whether or not they need to develop and implement a National Plan of Action for Sharks (NPOA-Sharks) (FAO 2000). An NPOA should identify research, monitoring and management needs for all chondrichthyan fishes that occur in the waters of a particular State (Fowler and Cavanagh 2005a). It was intended that NPOAs should have been completed by the FAO's Committee on Fisheries (COFI) session of early 2001; to date, however, Italy is the only Mediterranean State that has prepared a draft NPOA and this has not yet been implemented (CITES AC 2004). Tunisia has indicated that it intends to adopt an NPOA for cartilaginous fishes in the future (Serena unpubl.). An Action Plan for the Conservation of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea (see 5.2.3), produced by UNEP, encourages the development of NPOAs throughout the region (UNEP MAP RAC/SPA 2003). The European Union has pledged to develop a draft plan of action for sharks in 2007.

5.2 Regional protection instruments

5.2.1 The Bern Convention on the Conservation of European Wildlife and Natural Habitats

The Bern Convention aims to conserve wild flora and fauna and their natural habitats, especially where the cooperation of several States is required (SGRST 2003). The basking shark and giant devil ray are both listed on Appendix II of the Bern Convention, meaning appropriate measures should be taken to ensure the special protection of the species (COE 2006).

Species listed on the Bern Convention are also added to the EU Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna). The main aim of the EC Habitats Directive is to promote the maintenance of biodiversity. The Directive requires Member States to take measures to maintain or restore natural habitats and wild species (listed on its Annexes), at a favourable conservation status, introducing robust protection for those habitats and species of European importance (JNCC 2006). This requires measures to be taken to maintain or restore to favourable conservation status in their natural range, habitats and species of wild flora and fauna of Community interest and listed in Annexes to the Directive (SGRST 2003).

5.2.2 The Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean

The Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) was adopted in 1976 and came into force in 1978 followed by a succession of landmark Protocols. It was revised in 1995 (UNEP 2005). The Barcelona Convention's Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean lists three chondrichthyans (white shark, basking shark, and giant devil ray) on Annex II 'List of endangered or threatened species'. A further five species (shortfin mako, porbeagle, blue shark, angelshark, white skate) are listed on Annex III of the Protocol, meaning the exploitation of these species should be regulated. Although these regional instruments are in place, implementation has not yet followed (Serena 2005). Malta and Croatia are the only States in the Mediterranean to have provided any legal protection for listed species (white shark, basking shark and giant devil ray) in their national legislation. Species listed under these instruments have continued to decline without any management, and are in urgent need of protection measures (Serena 2005).

5.2.3 Action Plan for the Conservation of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea

In 2003, the United Nations Environment Programme's Regional Activity Centre for Specially Protected Areas (UNEP RAC/SPA), in collaboration with the IUCN Centre for Mediterranean Cooperation and the IUCN SSG, developed the *Action Plan for the Conservation of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea*. The Action Plan was developed in line with many of the international and regional instruments applying to the conservation and management of sharks in the Mediterranean, outlined in this section, including the Protocol concerning Specially Protected areas and Biological Diversity (Barcelona Convention), the FAO IPOA-Sharks, and the UN Fish Stocks Agreement (UNEP MAP RAC/SPA 2003). The production of this Action Plan has identified specific measures required for improving the conservation and sustainable management situation of sharks in the Mediterranean Sea. It is important, however, that recommendations contained within the Action Plan are implemented and that the Action Plan is periodically updated, to ensure it is effective.

6. Fishing restrictions and management applying to chondrichthyans in the Mediterranean

The General Fisheries Council for the Mediterranean (GFCM), responsible for Mediterranean fisheries, has not yet taken action to implement management specifically for chondrichthyan fishes, whether through a Mediterranean Shark Plan (under the FAO IPOA–Sharks) or other measures, but is addressing the issue.

6.1 Deepsea fisheries

The GFCM recently decided to refrain from expanding deep water fishing operations beyond the limit of 1,000m. This Decision was adopted at the 29th session of the GFCM held in Rome in February 2005 and came into force in September 2005 (FAO 2005). It significantly reduces the threat of potential exploitation pressure to highly vulnerable deepwater species, many of which are seriously threatened outside the Mediterranean. The restriction of deep water fisheries has made it possible to list the Portuguese dogfish *Centroscymnus coelolepis* and the little sleeper shark *Somniosus rostratus* as Least Concern within the Mediterranean region, because these species occur below 1,000m and are now protected from fisheries. Many other deepsea chondrichthyan species occur at depths less than 1,000m (Sion *et al*. 2004), however, and are therefore still vulnerable to fishing in the Mediterranean.

6.2 Driftnetting

The UN global moratorium on all large-scale pelagic driftnet fishing was adopted in 1992. Driftnetting with nets greater than 2.5km in length was prohibited in the Mediterranean by the EC in that same year and under a binding Resolution by the GFCM in 1997. A total ban on driftnet fishing came into force from the beginning of 2002. Also in 2003, the International Commission on the Conservation of Atlantic Tuna (ICCAT) banned the use of driftnets, making it illegal for non-EU as well as EU fleets to use driftnets in the Mediterranean. Despite these bans, driftnetting in the Mediterranean continues illegally with a large scale Moroccan driftnet fleet and sizeable Italian, French and Turkish driftnet fleets operating (Tudela 2004; Tudela *et al*. 2005; WWF 2005). Loopholes in Mediterranean fishing regulations have created a new category of anchored floating gillnets. These modified gillnets have, however, been described as an attempt to disguise driftnet fishing under another name, since they are still large scale driftnetting gears that target large fish species, and are therefore illegal (WWF 2005).

6.3 Shark finning

Shark finning refers to the removal and retention of shark fins with the rest of the shark discarded at sea. This wasteful practice results in the utilisation of only 2–5% of the shark with the remainder being thrown away. Finning threatens many shark stocks, the stability of marine ecosystems, sustainable traditional fisheries and socio-economically important recreational fisheries (IUCN 2003b). Increasing demand for shark fins, driven by traditional Asian cuisine, has led to such a dramatic increase in world shark fin prices that they are now extremely valuable. Thus the increased incentive to target and fin sharks that might previously have been released alive is now a major global concern (Rose and McLoughlin 2001).

The extent of finning within the Mediterranean region is unknown. Two finning regulations apply within Mediterranean waters: the EU has adopted a finning ban (Regulation 1185/2003, Europa 2006b), as has the International Council for the Conservation of Atlantic Tunas (ICCAT 2005). Finning was likely occurring prior to these regulations (SGRST 2003). To date there is no information on the enforcement of these regulations in the Mediterranean, but concerns have been voiced that the EU Regulation may be ineffective because it allows permits to be issued for removing shark fins on board and landing them separately from the carcasses. The permitted fin:carcass ratio adopted in the EU and under ICCAT is also higher than in other regions of the world and can potentially enable fishers to land fewer sharks than were actually finned (Fordham 2006; IUCN 2003b; IUCN SSG 2003).

7. Chondrichthyan monitoring programmes in the Mediterranean

Lack of adequate scientific information is often cited as being one of the reasons for failing to introduce or implement suitable management measures for chondrichthyan fishes. It is widely recognised, however, that the need for precautionary management is urgent and should proceed based on whatever information is available. Several research and monitoring programmes have taken place and continue to operate in the Mediterranean Sea that contribute knowledge, enabling efforts to develop shark conservation and management to progress. For example, the MEDLEM project (Mediterranean Large Elasmobranch Monitoring) collects data on incidental captures, sightings and strandings of cartilaginous fishes in the Mediterranean Sea. This project was initiated in 1985, and was accepted by the FAO-GFCM Scientific Advisory Committee meeting when presented in 2004 (GFCM 2004). It is anticipated that the GFCM will officially adopt the MEDLEM database in the near future. See http://www.arpat.toscana.it/progetti/pr_medlem.html for more information.

The Mediterranean International Bottom Trawl Survey Project (MEDITS) was initiated in 1993, in response to the difficulties of obtaining estimates of demersal resources from fishing activity, and to support the regulation of these heavily exploited demersal fisheries in the Mediterranean. The aim of the MEDITS Project is to provide standardised information on the status of these resources within the Mediterranean region by carrying out a universal programme of repetitive trawl surveys. The objectives of the surveys are (i) to contribute to the characterization of bottom fisheries resources in the Mediterranean in terms of population distribution (relative abundance indices) as well as demographic structures (length distributions), and (ii) to provide data for modelling the dynamics of the studied species (Baino *et al*. 2001; IOF 2006). See http://www.izor.hr/eng/international/medits.html for more information.

The Italian national demersal survey programme GRUND (Gruppo Nazionale Risorse Demersali), initiated in 1982, covers the whole of the Italian coastline, which is divided into 11 areas. Each area uses their typical trawl gear to carry out surveys. These are not identical but similar, as they all derive from the original commercial Italian trawl (Fiorentini *et al*. 1999). See http://www.politicheagricole.gov.it/default.htm for more information.

Additional information on species biology and ecology can be obtained from scientific research carried out through programmes such as tagging of migratory species. For example, the MedSharks project uses techniques such as photo-identification and tagging to carry out research in the Mediterranean. Sandbar sharks *Carcharhinus plumbeus* have been the focus of MedSharks research since 2001, and basking sharks are also being monitored. See http://www.medsharks.org/home_eng.htm for more information.

8. Conclusion

This report presents the first comprehensive regional IUCN Red List of chondrichthyan fishes of the Mediterranean Sea. With 30 out of 71 species considered threatened (42% are Critically Endangered, Endangered or Vulnerable); the Mediterranean region has some of the most threatened chondrichthyan populations in the world. Currently, just eight species (six sharks and two rays) are granted some form of protection under international or regional agreements. Three main management measures (deepsea fisheries, driftnetting and shark finning bans) are now in place in the Mediterranean; these should directly benefit chondrichthyan populations. However, effective implementation of these protection and management tools is vital for these measures to have any beneficial impact. It is clear that additional management measures are urgently needed for threatened species, and to regulate exploitation of depleted commercial stocks.

Due to insufficient knowledge and information, 18 species have been assessed as Data Deficient. Despite the current lack of data, this group could actually include some of the most vulnerable chondrichthyans; increased funding and research attention needs to be directed towards these species. Although limited data availability is often cited as a problem, it should not, however, be used to justify the lack of management.

Bycatch is considered the biggest threat to chondrichthyan fishes in the Mediterranean, potentially affecting all species present. In many cases it is unclear whether current catch levels are sustainable, mainly because of the lack of species-specific reporting. Any increase in fishing effort, particularly if unregulated, is therefore an obvious cause for concern. Improved research and monitoring of chondrichthyan bycatch is vital.

Particularly vulnerable life history characteristics were considered to contribute to the threatened status of 87% of Mediterranean chondrichthyans, emphasising the need for a precautionary approach to their management (FAO 1995).

Habitat loss, habitat degradation, human disturbance and recreational fisheries all pose a threat to a number of chondrichthyans in the Mediterranean. Considering the usually high trophic level of this group of fishes and hence contribution to ecosystem function, it is essential to conserve their diversity as well as whole ecosystems (Tudela 2004). Healthy fisheries are dependant on the productivity of the ecosystem. Responsible fisheries management should take into account the profound interactions between fisheries and their supporting ecosystems by applying the ecosystem approach to fisheries (FAO 2003). Management measures such as 'no take zones' and Marine Protected Areas could be employed to reduce pressures on chondrichthyan populations and safeguard critical habitats.

Assessing the threatened status of Mediterranean chondrichthyans would not have been possible without the collaboration of experts from many countries within the region. However, information is still lacking from many countries, particularly in the south and eastern Mediterranean. It is essential that this strong regional cooperation continues, and that new collaborations with other countries are forged, so that the work carried out to produce this first evaluation of the threatened status of Mediterranean chondrichthyans can be progressively broadened and updated as new information becomes available.

9. Recommendations

The following recommendations were formulated by the participants of the IUCN SSG Mediterranean IUCN Red List workshop, after considering the results presented in this report and consulting with the UNEP RAC/SPA A*ction Plan for the Conservation of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea.* These recommendations are intended to complement and take forward existing advice for the conservation and management of chondrichthyans within the Mediterranean region, in light of newly collated information on the IUCN Red List status of Mediterranean chondrichthyans summarised within this report.

1. CITES Parties to implement Resolution Conf. 12.6 on the conservation and management of sharks (http://www.cites.org/eng/res/12/12-06.shtm) and Decision 13.42 (http://www.cites.org/eng/dec/valid13/13-42&43.shtml) directed to Parties, including species-specific recommendations in document CoP 13 Doc. 35 Annex 2 (http://www.cites.org/eng/cop/13/doc/E13-35.pdf).

2. Improve coordination between existing environmental and fisheries organisations and international and regional Conventions that address shark conservation and management in the Mediterranean and Black Sea, by increasing collaboration and ensuring a uniform application of the ecosystem approach and the precautionary principle.

3. UNEP-RAC/SPA to update the priority list of species in the *UNEP Mediterranean Action Plan for the Conservation of Chondrichthyan Fishes* and the Appendices of the SPA protocol, in light of this comprehensive IUCN Red List assessment of Mediterranean chondrichthyans, and to continue to do so as more IUCN Red List assessments are become available/are updated.

4. Mediterranean States urgently to make provisions for the legal protection of species identified as being threatened in the Mediterranean.

5. Mediterranean States to develop and implement National Plans of Action, as outlined by the UN FAO IPOA-Sharks.

6. GFCM to initiate the development of a Regional Shark Plan and management strategies specifically aimed at the conservation and sustainable use of commercially exploited chondrichthyan fish species and species taken as bycatch, in the context of the precautionary principle.

7. GFCM and Mediterranean States to develop and support fishing practices that minimise bycatch and/or facilitate live release.

8. The current moratoriums on driftnetting and deepsea fishing should remain in place but need to be strengthened to improve their effectiveness. Adequate enforcement measures are crucial.

9. Mediterranean States to support existing research programmes and develop new research programmes on the biology, ecology and population dynamics of threatened species and in areas that are poorly known or under threat. Resources urgently need to be directed towards species assessed as Data Deficient, which are potentially threatened.

10. Financial donors, such as the EU, should highlight such research programmes, including long-term monitoring, as a priority for funding.

11. Researchers to identify and map critical habitats for endangered species.

12. Mediterranean States should restore and protect identified critical habitats through appropriate monitoring and management measures.

13. UNEP RAC/SPA, in conjunction with GFCM, should develop and facilitate training, particularly in the fields of taxonomy and monitoring methods, (to enable the accurate collection of species-specific landings) and stock assessment.

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Appendix 1. Checklist of chondrichthyan fishes in the Mediterranean Sea

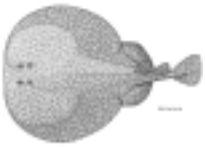
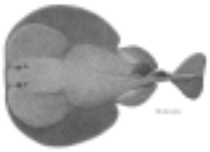
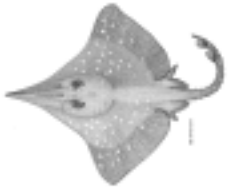
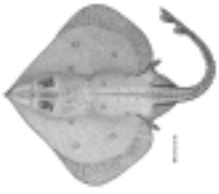
This checklist of Mediterranean chondrichthyan fauna was compiled from Leonard Compagno's (2005) *Global Checklist of Living Chondrichthyan Fishes*. This list is the standard used by the SSG to ensure consistency across assessments, although there is some contention within the chondrichthyan scientific community over the naming and classification of some species and this checklist does not necessarily represent the views of all systematists within the IUCN/SSC Shark Specialist Group network. Fabrizio Serena's *Field Guide to the Sharks and Rays of the Mediterranean and Black Seas* (2005) was also referred to in the preparation of the list.

Class: CHONDRICHTHYES				
	Family	**Scientific name**	**Common name**	
Subclass Holocephali				
Order CHIMAERIFORMES Modern Chimaeras	CHIMAERIDAE Shortnose Chimaeras	*Chimaera monstrosa*	Rabbitfish	
Subclass Elasmobranchii				
Order HEXANCHIFORMES Cow and Frilled sharks	HEXANCHIDAE Six and Sevengill sharks	*Heptranchias perlo*	Sharpnose sevengill shark	
		Hexanchus griseus	Bluntnose sixgill shark	
		Hexanchus nakamurai	Bigeye sixgill shark	
Order SQUALIFORMES Dogfish sharks	ECHINORHINIDAE Bramble sharks	*Echinorhinus brucus*	Bramble shark	
	SQUALIDAE Dogfish sharks	*Squalus acanthias*	Spiny dogfish	
		Squalus megalops	Shortnose spurdog	Occurrence of this species in the Mediterranean Sea is uncertain

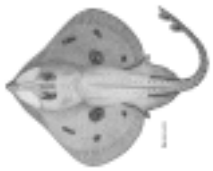
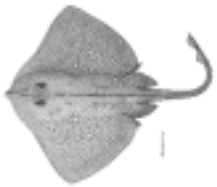
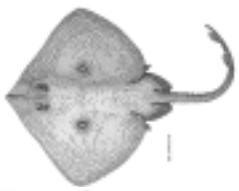
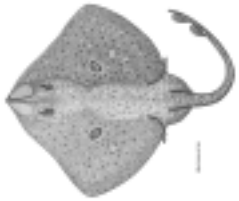
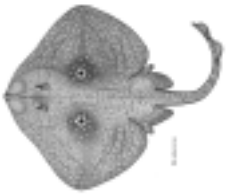
* Illustrations are not to scale.

Class: CHONDRICHTHYES				
	Family	**Scientific name**	**Common name**	
Order SQUALIFORMES Dogfish sharks cont'd	CENTROPHORIDAE Gulper sharks	*Centrophorus granulosus*	Gulper shark	
	SOMNIOSIDAE Sleeper sharks	*Centroscymnus coelolepis*	Portuguese dogfish	
		Somniosus rostratus	Little sleeper shark	
	OXYNOTIDAE Roughsharks	*Oxynotus centrina*	Angular roughshark	
	DALATIIDAE Kitefin sharks	*Dalatias licha*	Kitefin shark	
Order SQUATINIFORMES Angel sharks	SQUATINIDAE Angel sharks	*Squatina aculeata*	Sawback angelshark	
		Squatina oculata	Smoothback angelshark	
		Squatina squatina	Angelshark	
Order RAJIFORMES Batoids **Suborder** PRISTOIDEI Sawfishes	PRISTIDAE Modern sawfishes	*Pristis pectinata*	Smalltooth sawfish	
		Pristis pristis	Common sawfish	

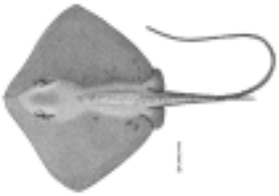
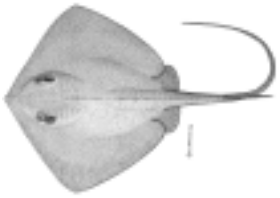
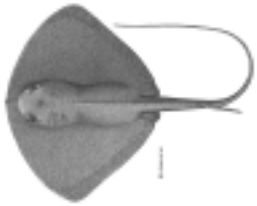
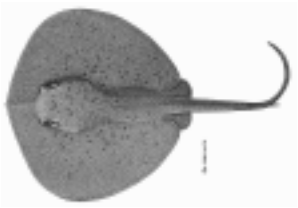
* Illustrations are not to scale.

Class: CHONDRICHTHYES				
	Family	**Scientific name**	**Common name**	
Suborder RHINOBATOIDEI Guitarfishes	RHINOBATIDAE Guitarfishes	*Rhinobatos cemiculus*	Blackchin guitarfish	
		Rhinobatos rhinobatos	Common guitarfish	
Suborder TORPEDINOIDEI Electric rays	TORPEDINIDAE Torpedo rays	*Torpedo marmorata*	Spotted torpedo ray	
		Torpedo nobiliana	Great torpedo ray	
		Torpedo sinuspersici	Marbled electric ray	Occurrence of this species in the Mediterranean Sea is uncertain
		Torpedo torpedo	Ocellate torpedo ray	
Suborder RAJOIDEI Skates	RAJIDAE Skates	*Dipturus batis*	Common skate	
		Dipturus oxyrhynchus	Sharpnose skate	
		Leucoraja circularis	Sandy skate	
		Leucoraja fullonica	Shagreen skate	

* Illustrations are not to scale.

Class: CHONDRICHTHYES			
Family	Scientific name	Common name	
Suborder RAJOIDEI Skates cont'd	*Leucoraja melitensis*	Maltese skate	
	Leucoraja naevus	Cuckoo skate	
	Raja asterias	Atlantic starry skate	
	Raja brachyura	Blonde skate	
	Raja clavata	Thornback skate	
	Raja miraletus	Twineye skate	
	Raja montagui	Spotted skate	
	Raja polystigma	Speckled skate	
	Raja radula	Rough skate	

* Illustrations are not to scale.

Class: CHONDRICHTHYES	Family	Scientific name	Common name	
Suborder RAJOIDEI Skates cont'd		*Raja undulata*	Undulate skate	
		Rostroraja alba	White skate	
Suborder MYLIOBATOIDEI Stingrays	DASYATIDAE Whiptail Stingrays	*Dasyatis centroura*	Roughtail stingray	
		Dasyatis chrysonota	Blue stingray	
		Dasyatis pastinaca	Common stingray	
		Himantura uarnak	Honeycomb whipray	
		Pteroplatytrygon violacea	Pelagic stingray	
		Taeniura grabata	Round fantail stingray	

* Illustrations are not to scale.

Class: CHONDRICHTHYES	Family	Scientific name	Common name	
Suborder MYLIOBATOIDEI Stingrays cont'd	GYMNURIDAE Butterfly rays	*Gymnura altavela*	Spiny butterfly ray	
	MYLIOBATIDAE Eagle rays	*Myliobatis aquila*	Common eagle ray	
		Pteromylaeus bovinus	Bullray	Occurrence of this species in the Mediterranean Sea is uncertain
	RHINOPTERIDAE Cownose rays	*Rhinoptera marginata*	Lusitanian cownose ray	
	MOBULIDAE Devil rays	*Mobula mobular*	Giant devilray	
Suborder LAMNIFORMES Mackerel sharks	ODONTASPIDIDAE Sand tiger sharks	*Carcharias taurus*	Sand tiger shark	
		Odontaspis ferox	Smalltooth sand tiger	
	ALOPIIDAE Thresher sharks	*Alopias superciliosus*	Bigeye thresher	
		Alopias vulpinus	Thresher shark	

* Illustrations are not to scale.

Class: CHONDRICHTHYES				
	Family	**Scientific name**	**Common name**	
Suborder LAMNIFORMES Mackerel sharks cont'd	CETORHINIDAE Basking sharks	*Cetorhinus maximus*	Basking shark	
	LAMNIDAE Mackerel sharks	*Carcharodon carcharias*	Great white shark	
		Isurus oxyrinchus	Shortfin mako	
		Isurus paucus	Longfin mako	
		Lamna nasus	Porbeagle shark	
Order CARCHARHINIFORMES Ground sharks	SCYLIORHINIDAE Catsharks	*Galeus atlanticus*	Atlantic catshark	
		Galeus melastomus	Blackmouth catshark	
		Scyliorhinus canicula	Smallspotted catshark	
		Scyliorhinus stellaris	Nursehound	
	TRIAKIDAE Houndsharks	*Galeorhinus galeus*	Tope shark	
		Mustelus asterias	Starry smoothhound	

* Illustrations are not to scale.

Class: CHONDRICHTHYES			
Family	**Scientific name**	**Common name**	
Order CARCHARHINIFORMES Ground sharks cont'd	*Mustelus mustelus*	Smoothhound	
	Mustelus punctulatus	Blackspot smoothhound	
	Carcharhinus altimus	Bignose shark	
	Carcharhinus brachyurus	Bronze whaler shark	
	Carcharhinus brevipinna	Spinner shark	
	Carcharhinus falciformis	Silky shark	
	Carcharhinus limbatus	Blacktip shark	
	Carcharhinus melanopterus	Blacktip reef shark	
	Carcharhinus obscurus	Dusky shark	
	Carcharhinus plumbeus	Sandbar shark	

* Illustrations are not to scale.

Class: CHONDRICHTHYES				
	Family	**Scientific name**	**Common name**	
Order CARCHARHINIFORMES Ground sharks cont'd		*Prionace glauca*	Blue shark	
		Rhizoprionodon acutus	Milk shark	
	SPHYRNIDAE Hammerhead sharks	*Sphyrna lewini*	Scalloped hammerhead	
		Sphyrna mokarran	Great hammerhead	
		Sphyrna zygaena	Smooth hammerhead	

* Illustrations are not to scale. All illustrations by Alejandro Sancho Rafel.

Appendix 2. Summary of the IUCN's Red List Categories and Criteria Version 3.1

These five criteria (A–E) are used to evaluate whether a species belongs in a category of threat (Critically Endangered, Endangered or Vulnerable)

Use any of the criteria A–E	**Critically Endangered**	**Endangered**	**Vulnerable**
A. Population reduction	Declines measured over the longer of 10 years or 3 generations		
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%
Al. Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible **AND** understood **AND** have ceased, based on and specifying any of the following: **(a)** direct observation **(b)** an index of abundance appropriate to the taxon **(c)** a decline in area of occurrence, extent of occurrence, and/or habitat quality **(d)** actual or potential levels of exploitation **(e)** effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.			
A2. Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased **OR** may not be understood **OR** may not be reversible, based on (a) to (e) under Al.			
A3. Population reduction projected or suspected to be met in the future (up to a maximum of 100 years) based on (b) to (e) under Al.			
A4. An observed, estimated, inferred, projected or suspected population reduction (up to a maximum of 100 years) where the time period must include both the past and the future, and where the causes of reduction may not have ceased **OR** may not be understood **OR** may not be reversible, based on (a) to (e) under Al.			
B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)			
B1. Extent of occurrence	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy	< 10 km²	< 500 km²	< 2,000 km²
AND at least two of the following:			
(a) Severely fragmented, **OR** Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** area, extent and/or quality of habitat; **(iv)** number of locations or subpopulations; **(v)** number of mature individuals.			
(c) Extreme fluctuations in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** number of locations or subpopulations; **(iv)** number of mature individuals.			
C. Small population size and decline			
Number of mature individuals	< 250	< 2,500	< 10,000
AND either C1 or C2:			
C1. An estimated continuing decline of at least: (up to a max. of 100 years in future).	25% in 3 years or 1 generation	20% in 5 years or 2 generations	10% in 10 years or 3 generations
C2. A continuing decline **AND** (a) and/or (b):			
(a) (i) No. of mature individuals in each subpopulation.	< 50	< 250	< 1,000
(a) (ii) or % individuals in one subpopulation at least.	90%	95%	100%
(b) extreme fluctuations in the number of mature individuals.			
D. Very small or restricted population			
Either (1) number of mature individuals **OR** (2) restricted area of occupancy	≤ 50	≤ 250	≤ 1,000 Area of occurrence < 20 km² or ≤ 5 locations
E. Quantitative Analysis			
Indicating the probability of extinction in the wild to be at least:	≥ 50% in 10 years or 3 generations (100 years max)	≥ 20% in 20 years or 5 generations (100 years max)	≥ 10% in 100 years

Source: IUCN Standards and Petitions Working Group 2006; http://intranet.iucn.org/webfiles/doc/SSC/RedList/RedListGuidelines.pdf

IUCN
The World Conservation Union

IUCN – The Species Survival Commission

The Species Survival Commission (SSC) is the largest of IUCN's six volunteer commissions with a global membership of 8,000 experts. SSC advises IUCN and its members on the wide range of technical and scientific aspects of species conservation and is dedicated to securing a future for biodiversity. SSC has significant input into the international agreements dealing with biodiversity conservation.
www.iucn.org/themes/ssc

IUCN – Shark Specialist Group

The IUCN SSC Shark Specialist Group (SSG) was established in 1991, in response to growing awareness and concern of the severe impact of fisheries on populations of cartilaginous fishes around the world. It promotes the sustainable use, wise management and conservation of all sharks, skates, rays and chimaeras (~1,200 species worldwide). The SSG has a global volunteer network of over 200 expert members across eleven ocean regions. Its work programme is directed by two Co-Chairs and an Executive Committee and supported by two fulltime staff members - a Programme Officer and a Red List Officer.
www.flmnh.ufl.edu/fish/Organizations/SSG/SSG.htmt

IUCN – Centre for Mediterranean Cooperation

The Centre was opened in October 2001 and is located in the offices of the Parque Tecnologico de Andalucia near Malaga. IUCN has over 172 members in the Mediterranean region, including 15 governments. Its mission is to influence, encourage and assist Mediterranean societies to conserve and use sustainably the natural resources of the region and work with IUCN members and cooperate with all other agencies that share the objectives of the IUCN.
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