UN environment programme

CMS

CONVENTION ON MIGRATORY SPECIES

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SINGLE SPECIES ACTION PLAN FOR THE ANGELSHARK (*Squatina squatina*) IN THE MEDITERRANEAN SEA

Adopted by the Conference of the Parties at its 14th Meeting (Samarkand, February 2024)

Noting that the Angelshark (*Squatina squatina*) was listed on CMS Appendices I and II in 2017 and in Annex 1 of the Memorandum of Understanding on the Conservation of Migratory Sharks in 2018,

Alarmed by the significant population declines over the past 50 years due to extensive exploitation, slow growth and low productivity, the species has become exceedingly rare throughout most of its historical range,

Concerned that the Angelshark was assessed by the *IUCN Red List of Threatened Species* in 2017 as 'Critically Endangered' and the population assessed as decreasing, raising serious concerns about the viability of the species given ongoing high threat levels,

Deeply concerned that the species and its habitat are persistently threatened by intense demersal fisheries, recreational fisheries, coastal commercial and tourism development, and habitat degradation throughout its range,

Recognizing that a multi-pronged approach is required that simultaneously addresses knowledge, resource, capacity and legal gaps that hinder effective conservation of the species, while, at the same time, implementing and enforcing existing laws and regulations that can mitigate threats to the species,

Recognizing the long-standing concern and support of many stakeholders working in the species' range that led to the Concerted Action for the Angelshark, as well as the support of the Angel Shark Conservation Network (ASCN) in its implementation,

Noting the links between the Single Species Action Plan and the Memorandum of Understanding on the Conservation of Migratory Sharks (Sharks MOU),

Further noting the high relevance of several work areas of the CMS to the conservation of the Angelshark, especially concerning bycatch, marine pollution and habitat conservation, and

Affirming the need to address the threats to the species and its habitat in close collaboration with the General Fisheries Commission for the Mediterranean (GFCM),

The Conference of the Parties to the
Convention on the Conservation of Migratory Species of Wild Animals

1. *Adopts* the Single Species Action Plan for the Angelshark (*Squatina squatina*) in the Mediterranean Sea (SSAP Angelshark Med) contained in the Annex, with the goal of promoting the long-term sustainability of its populations and their habitats by reducing the negative effects of human activities through legislation and enforcement, fisheries management measures, research, awareness-raising and capacity-building;

2. *Urges* Parties and *invites* non-Party Range States to implement the relevant provisions of the SSAP Angelshark Med;

3. *Calls on* Range States to strive for active collaboration between stakeholders within each range country to maximize the effective use of resources and expertise, to ensure that the results of research and awareness-raising activities can support the design and implementation of effective policy and management;

4. *Further calls on* Range States to facilitate regional collaboration between stakeholders in different *Squatina squatina* Range States to ensure that knowledge and experience gained in one country can be used to most effectively implement conservation action in another, especially in countries where cross-border populations are suspected to occur;

5. *Encourages* Parties and non-Party States to provide technical and/or financial support to implement the activities outlined in the SSAP Angelshark Med;

6. *Invites* other relevant intergovernmental frameworks, in particular the GFCM, to take into account the provisions of the SSAP Angelshark Med in the consideration of their activities and to support implementation of relevant SSAP Angelshark Med activities that fall within their mandate, as appropriate;

7. *Invites* the Angel Shark Conservation Network (ASCN) to continue its active support of research and conservation measures for this species; and

8. *Instructs* the Secretariat to bring the SSAP Angelshark Med to the attention of all Range States and relevant intergovernmental organizations and to assist with and monitor the implementation of the SSAP subject to the availability of resources.

UN environment programme

Convention on the Conservation of Migratory Species of Wild Animals

CMS

CONVENTION ON THE CONSERVATION OF MIGRATORY SPECIES OF WILD ANIMALS
AND
MEMORANDUM OF UNDERSTANDING ON THE CONSERVATION OF MIGRATORY SHARKS

SINGLE SPECIES ACTION PLAN FOR THE ANGELSHARK (*Squatina squatina*) IN THE MEDITERRANEAN SEA

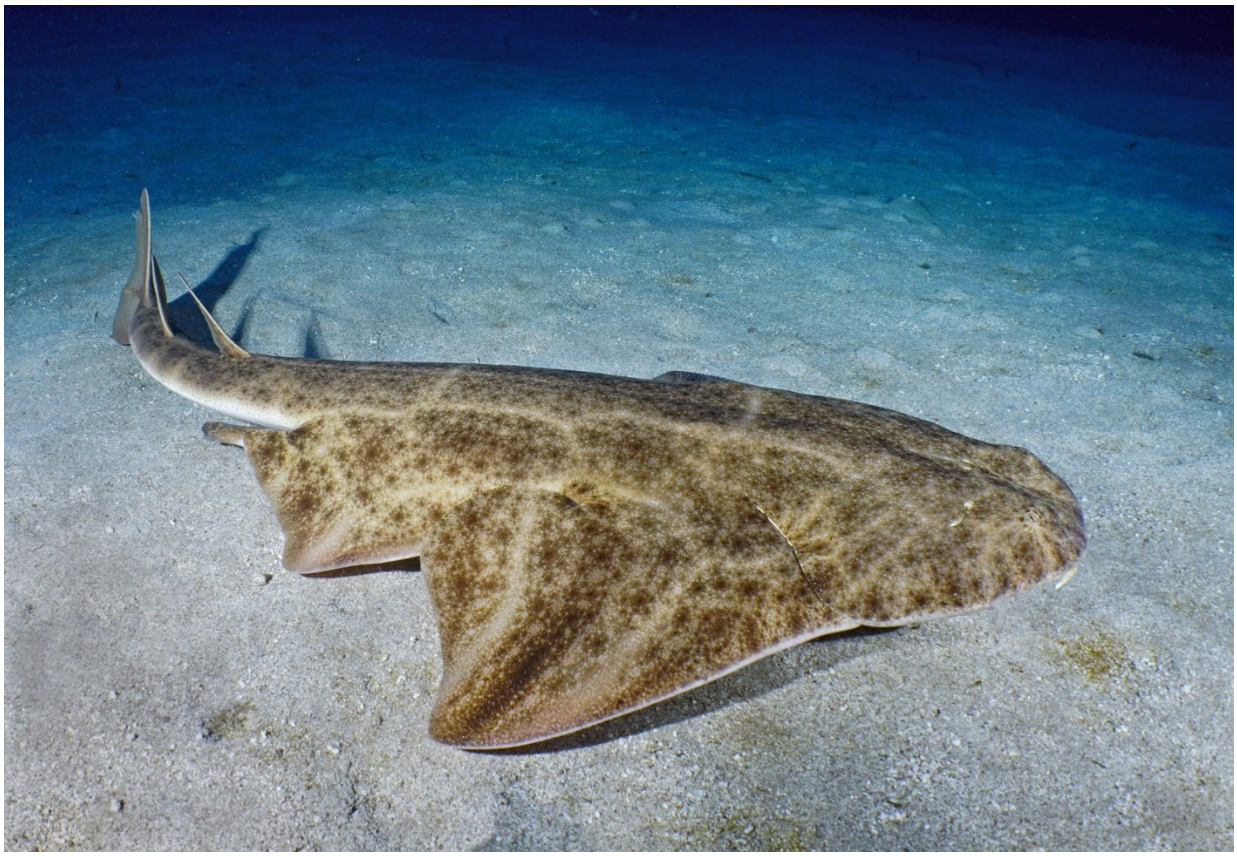


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INTRODUCTION

Alongside the inclusion of the Angelshark (*Squatina squatina*) at the 12th Conference of the Parties to the Convention (CMS COP12) in Appendices I and II, Parties approved a Concerted Action for the species, which was updated and extended until 2023 at CMS COP13 (Concerted Action 12.5 (Rev.COP13))[1]. Among other activities, it was agreed to develop regional Conservation Plans, including for the Mediterranean region.

In March 2019, a workshop was hosted by the Shark Trust and the National Institute of Marine Sciences and Technologies (INSTM) in Tunisia, bringing together members of the Angel Shark Conservation Network (ASCN) along with local and global experts, to create the Mediterranean Angel Sharks: Regional Action Plan (MedRAP)[2]. This action plan collated information on three species of Angel Shark within the Mediterranean Sea and developed a strategy for Angel Shark conservation within the region. The MedRAP was designed for a range of stakeholders including governments, researchers, NGOs, as well as commercial and recreational fishing industries.

To implement parts of the CMS Concerted Action and build upon the work developed by the MedRAP, CMS has developed this Single Species Action Plan (SSAP) for the Angelshark (*Squatina squatina*) in the Mediterranean region to work alongside the MedRAP. The SSAP provides a clearly defined plan for CMS Parties, Signatories of the Sharks-MOU, and other Range States, to officially adopt and implement with specific guidance on how this could be achieved.

ACKNOWLEDGEMENTS

The development of the SSAP was led by James Ellis, vice-chair of the Advisory Committee of the Sharks MOU, and Marino Vacchi, Committee member for Europe. Significant advice was provided by other Committee members and experts from the Angel Shark Conservation Network (ASCN), including the Angel Shark Project (a collaboration led by Universidad de Las Palmas de Gran Canaria, Zoological Research Museum Alexander Koenig and Zoological Society of London), the Shark Trust, supported by the Secretariat and CMS interns Jennifer Pytka, Manon Seyssaut, and Fenella Wood.

In addition to its status as a stand-alone CMS SSAP, this plan will be annexed to the Mediterranean Angel Sharks: Regional Action Plan (MedRAP) - compiled by the Shark Trust, which was also used in the development of this plan.

The Principality of Monaco spear-headed this action by submitting the proposal to list Angelsharks on CMS Appendices I and II and proposing the Concerted Action[1]. It also provided financial support for the development of this Single-Species Action Plan.

[1] Concerted Action 12.5 (Rev.COP13): https://www.cms.int/en/document/concerted-action-angelshark-squatina-squatina-1
[2] Mediterranean Angel Sharks: Regional Action Plan (Gordon *et al.* 2019): https://www.cms.int/sites/default/files/document/Med-Angel-Sharks-Regional-Action-Plan_2019_EN.pdf

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ACRONYMS

ASCN	Angel Shark Conservation Network
CASA	Critical Angel Shark Area
CBD	Convention on Biological Diversity
CECAF	Fishery Committee for the Eastern Central Atlantic
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CPUE	Catch Per Unit Effort
EIA	Environmental Impact Assessment
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FRA	Fisheries Restricted Area
GFCM	General Fisheries Commission for the Mediterranean
GFCM GSA	Geographical Subareas of the General Fisheries Commission for the Mediterranean Geographical Subareas
ICES	International Council for the Exploration of the Sea
IUU	Illegal, Unreported and Unregulated Fishing
LEK	Local Ecological Knowledge
MPA	Marine Protected Area
MedRAP	Mediterranean Angel Sharks: Regional Action Plan
NGO	Non-Governmental Organisation
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
Sharks MOU	Memorandum of Understanding on the Conservation of Migratory Sharks
SPA	Specially Protected Area
SPA/RAC	Specially Protection Areas Regional Activity Centre
SSAP	Single-Species Action Plan
UNEP-MAP	United Nations Environment Programme -Mediterranean Action Plan (Barcelona Convention)

GLOSSARY

Aggregate extraction	The extraction of sands and gravels for supplying construction industries.
Angelshark	Used for species common names, for example Angelshark (*Squatina squatina*).
Angel Shark	Refers to multiple species of the family *Squatinidae*.
Anterior	Located on or near the front of the body.
Artisanal fisheries	Traditional fisheries involving fishing households, using a relatively small amount of capital and energy, relatively small fishing vessels (if any), short fishing trips, close to shore, mainly for local consumption.
At-vessel mortality	The proportion of the individuals caught by a fishing gear that are dead when the gear is retrieved (see also post-release mortality).
Bifurcated	Forked or divided into two parts or branches.
Bottom longline fisheries	Commercial fishing technique that deploys a long main line, with small anchors or weights to keep it on the seafloor, with side traces and baited hooks targeting demersal fish species.
Bottom trawl	A cone-shaped net that is towed by boat(s) along the seafloor.
Bycatch	The capture of a non-target species in fisheries.
Caudal/caudal fin	Relating to, resembling, or in the position of the tail.
Cephalopods	Group of molluscs comprising octopus, cuttlefish and squid.
Critical Angel Shark Area (CASA)	A specific geographic area that contains essential features necessary for the conservation of Angel Sharks. This may include an area not currently occupied by the species that will be needed for its recovery or conservation e.g., nursery, mating, aggregation, and foraging areas.
Decapod crustaceans	Group of crustaceans that comprised shrimps, prawns, crabs and lobsters.
Dorsal/dorsal fins	Situated on or toward the upper side of the body, equivalent to the back.
eDNA	Environmental DNA – DNA that can be extracted from environmental samples such as seawater or sediment, which can identify the presence of an organism in the area.
Eutrophication	Excessive richness of nutrients in a body of water, frequently due to run-off from land, which causes a dense growth of plant life.
Extant	Still in existence.
Genetic bottleneck	A sharp reduction in population size reducing the gene pool of the population. The remaining smaller population has a low genetic diversity, which remains low even after repopulating. Genetic diversity only increases with the influx from another population via gene flow.
Genetic diversity	Genetic variability present within a species or population.
Ghost fishing	When discarded, lost, or abandoned fishing gear continues to trap, entangle, or kill marine life.

Gillnet	An entangling net which sits vertically in the water, either at the surface, midwater, or bottom. Mesh size can be altered to target specific fish, designed to catch fish by their gills.
Hypoxia	Low or depleted oxygen levels in a water body. It is often associated with the overgrowth of certain species of algae, which can lead to oxygen depletion when they die, sink, and decompose. Hypoxia causes 'dead zones'.
Invasive species	An organism that causes ecological or economic harm in a new environment where it is not native.
Nasal barbel	Slender, whisker-like tactile organ extending from the head of certain fishes.
Ocelli	A marking that resembles an eye.
Pathogens	A bacterium, virus, or other microorganism that can cause disease.
Population fragmentation	When groups of animals become separated from other groups of the same species and are no longer connected in a way that allows for gene flow between groups. Increases the risk of inbreeding and lowers genetic diversity.
Posterior	Located on or near the rear of the body.
Post-release mortality	The proportion of specimens that are released alive after being captured by a fishing gear, but subsequently die due to the direct or indirect effects of the capture process (see also at-vessel mortality).
Pseudobranchial lamellae	Various thin layers of membranes which make a structure resembling a gill. Has respiratory role during the embryonic stage, but not as an adult.
Recreational fisheries	Activity of catching or attempting to catch fish, principally by rod and line, pole, or hand-held line for non-commercial purposes.
Rod and Line	Rod with fishing line attached with hooks.
Spatulate	Broad at the apex and tapered to the base.
Spearfishing	Activity of fishing using a spear, either underwater or from the surface (either from a boat or standing in shallow water).
Spiracles	Small respiratory opening behind the eye of sharks and rays.
Surfcasting	Fishing by casting a line into the sea from the shore.
Tangle net	An entangling net with a headline much shorter than the length of the netting panel so that the net hangs in folds. Mesh size is smaller than a gillnet, designed to catch fish by their nose or jaw.
Trammel net	An entangling net which sits vertically in the water, usually comprised of a small inner mesh between two panels of large mesh netting within which fish will entangle.

1. BIOLOGICAL ASSESSMENT

1.1. Taxon

Three species of Angel Shark occur in the Mediterranean Sea: Angelshark (*Squatina squatina;* Table 1), Smoothback Angelshark (*Squatina oculata*) and Sawback Angelshark (*Squatina aculeata*). All species have a broadly similar morphology, and misidentifications can be made between the three species. Only one species, Angelshark *Squatina squatina*, is listed on the Appendices of the Convention on the Conservation of Migratory Species (CMS) and is the subject of this Single Species Action Plan.

Table 1: Taxonomic classification of the Angelshark (*Squatina squatina*) and common names in multiple languages.

1.1. Class:	Elasmobranchii[3]
1.2. Order:	Squatiniformes
1.3. Family:	Squatinidae
1.4. Genus:	*Squatina* (Duméril, 1805)
1.5. Species:	*Squatina squatina* (Linnaeus, 1758)
1.6. Common names: [4]	English: Angelshark; European angelshark; Fiddlefish, Monkfish French: Ange de mer; Ange de mer commun; Angelot Spanish: Angel; Angelote; Pez ángel Arabic: القرش الملاك

The three Mediterranean Angel Shark species can be described as (i) Angelshark (*Squatina squatina;* Figure 1a); reddish or greenish brown with scattered small white spots with dorsal dark dots. Lacks ocelli and midline spines (in adults). Max size: (M) 183 cm and (F) 244 cm. (ii) Smoothback Angelshark (*Squatina oculata;* Figure 1b); smallest of three Mediterranean species. Grey-brown, with small white and dark spots, with dark ocelli. Lacks midline spines. Max size: (M) 145 cm and (F) 160 cm. (iii) Sawback Angelshark (*Squatina aculeata;* Figure 1c); colouration is light grey/brown mottled with darker brown. Large dorsal spines present on the midline and head. Lacks ocelli. Max size: 188 cm. See Figure 1 for further detail.

[3] Taxonomic classification according to Fricke *et al.* (2022).
[4] Common names in official UN languages. For names in additional languages, please see Chapter 2 (page 9) of the MedRAP (Gordon *et al.*, 2019) or search FishBase..

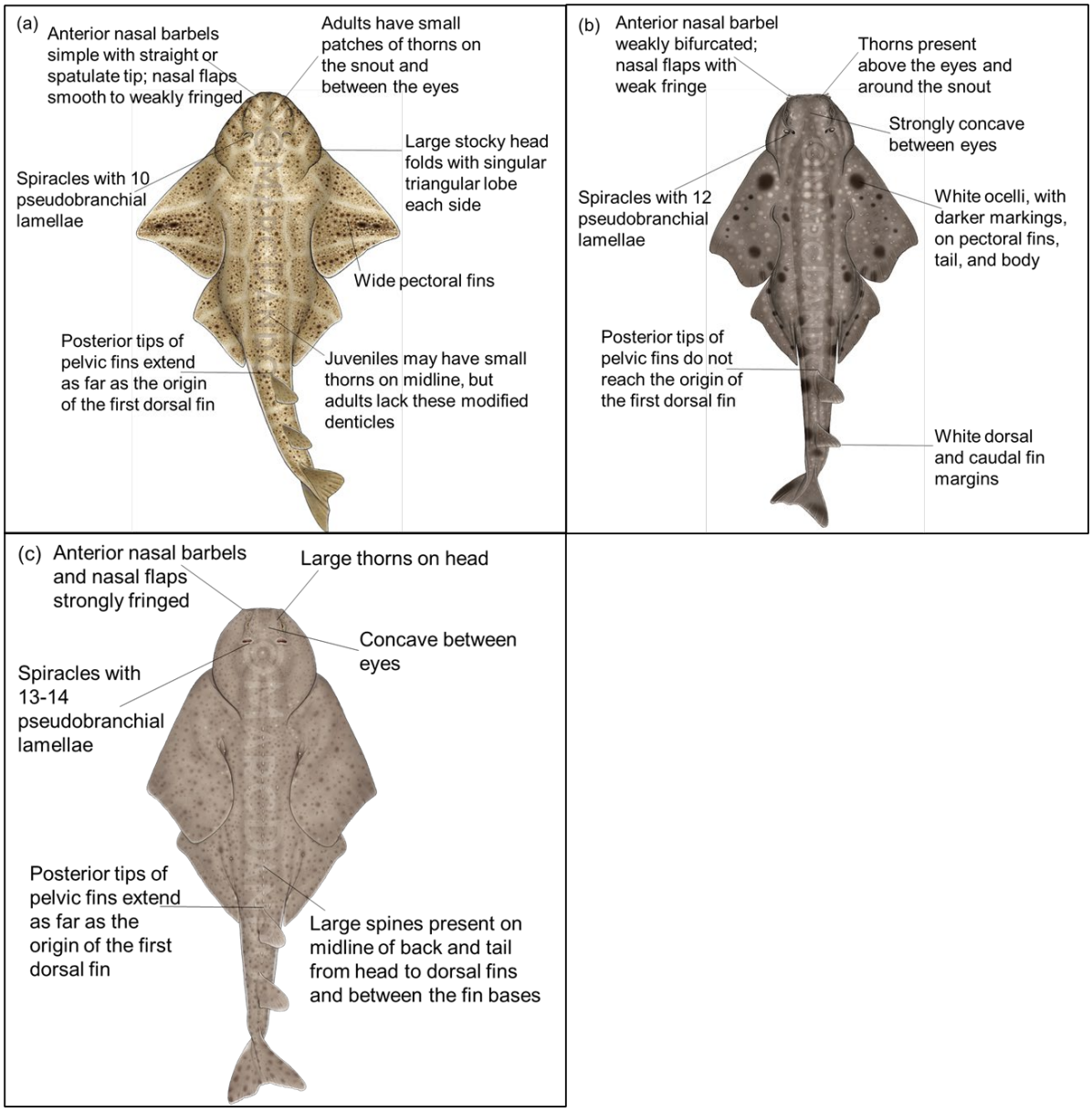


Figure 1: Diagram highlighting distinguishing features of the three species of Angel Shark occurring in the Mediterranean Sea. Adapted from Compagno (1984), Roux (1984), Gordon *et al.* (2019) and Ebert *et al.* (2021). Illustrations © Marc Dando. (a) *Squatina squatina*, (b) *Squatina oculata*, (c) *Squatina aculeata*.

1.2. Distribution

Angelshark (*S. squatina)* is distributed along the coasts and continental shelf of the North-east Atlantic, from Scotland in the North to as far south as North-west Africa, including the Canary Islands, and extending throughout the Mediterranean Sea (Lawson *et al.*, 2020; Figure 2). Whilst not distributed over the wider Black Sea, occasional specimens are reported from the Turkish waters in the South Western parts of the Black Sea, i.e. areas close to the Turkish Strait system (Sea of Marmara) (Kabasakal, H., 2021). The southern limits of this species along the coast of North-west Africa are somewhat uncertain. The maximum depth is unknown, though they are generally reported from waters less than 200 m deep. As such, it occurs in FAO Areas 27 (North-east Atlantic), 34 (Central Eastern Atlantic) and 37 (Mediterranean Sea). S. squatina records in an analysis of Pike et al. (2019) supported published literature on habitat preference, with 62 % of sightings in the Mediterranean located shallower than 50m depth on soft sediments.

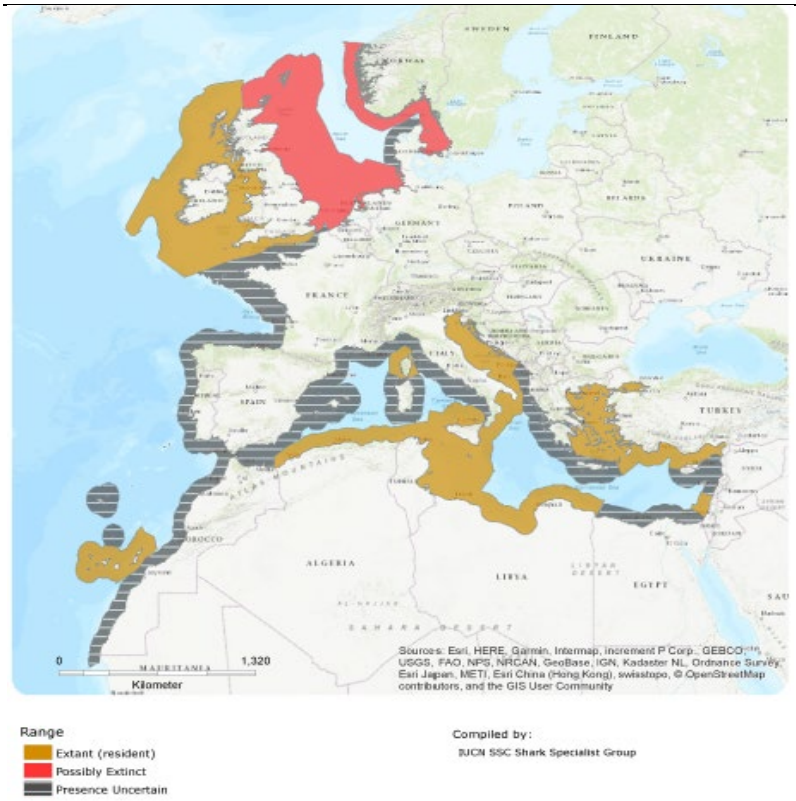


Figure 2: Range of Angelshark, *Squatina squatina*. Source: Morey *et al.* (2019) and Lawson *et al.* (2020)[5].

1.3. Population productivity and trend

Angelshark populations are considered to have declined over much of its geographical range, with the majority of the evidence originating from northern Europe and the Mediterranean region. Population decline has been inferred largely due to documented losses from former parts of the species range over the last century. Life-history studies for Angelshark in the Mediterranean Sea are limited (e.g. Capapé *et al.*, 1990) and quantitative data on populations or indices of abundance are lacking, due to there being limited published contemporary data. Population trends off the Atlantic coast of north-western Africa are uncertain.

The decline of *S. squatina* was first reported by Quéro and Cendrero (1996), who noted that the species had declined along the Atlantic coast of France, which included areas such as the Baie d'Arcachon where it had historically been subject to targeted fisheries. Subsequent studies have highlighted the decline in *S. squatina* records from the North Sea (Sguotti *et al.*, 2016; Bom *et al.*, 2020), English Channel (Rogers & Ellis, 2000; McHugh *et al.*, 2011), Irish Sea and Bristol Channel (Ellis *et al.*, 2002; Hiddink *et al.*, 2019), Adriatic Sea (Fortibuoni et al., 2016), and west coast of Ireland (Shephard *et al.*, 2019), with extant populations in some of these areas, including coastal waters around Wales (Barker *et al.* 2020, Hiddink *et al*. 2019) and Ireland (Fitzmaurice *et al.,* 2003; Shephard *et al.,* 2019).

Within the Mediterranean Sea, the absence of *S. squatina* in recent trawl surveys (in comparison with historical trawl surveys), has been shown for the Adriatic Sea (Jukic-Peladic *et al.*, 2001, Fortibuoni *et al.*, 2016) and elsewhere in the Mediterranean (Ragonese *et al.*, 2013). Giovos *et al.* (2019), Lawson *et al.* (2020), and Giovos *et al.* (2022) have provided overviews of the Mediterranean distribution of *S. squatina*, with available information also summarised by Ellis *et al.* (2021).

[5] The distribution for Angelshark shown above (Morey *et al.,* 2019) was refined in a subsequent study that involved many of the same authors (Lawson *et al*., 2020). The revised distribution by Lawson *et al.* (2020) reported that Angelshark was extant in the eastern Ionian Sea and south-western Black Sea. It is noted that the distribution of Angelshark in the Black Sea is limited to the coastal waters of Türkiye, close to the Turkish Straits system, but it is not considered to occur in the more northerly and easterly parts of the Black Sea.

Historical data on the quantity of Angelshark catches in the Mediterranean are limited. However, one example is a report by Vinciguerra (1884), who indicated Angelshark to be the most abundant species of cartilaginous fish caught in the Gulf of Tunis (Tunisia), with an annual catch of 2700 kg in 1879. Quantitative data relating to a declining population were provided by Vacchi *et al.* (2000), who analysed historical catch information for *Squatina* spp. in "tonnarella" tuna traps. These traps were set at depths of 2–15 m in the Gulf of Baratti (Tyrrhenian Sea). The number of *Squatina* spp. recorded (and the annual frequency of occurrence) declined from 134 (100%) in the period 1898–1905, to 95 (87.5%) over the years 1906–1913, and then to 15 (33.3%) for the final period of the study (1914–1922). These data also indicated that the decline of *S. squatina* records has been a longer-term trend, occurring over much of the 20th century (Vacchi *et al.*, 2000). Similarly, Soldo (2006) reported that Angelshark was caught regularly in the Adriatic Sea during the 19th century but has been considered to be Critically Endangered (both globally and within the Mediterranean) since the early 21st century. Recent analyses based on local ecological knowledge have helped identify sites with recent occurrence, including the Molat Island archipelago in Croatia (Pike *et al.*, 2019), and comparable studies are required for other parts of the Mediterranean Sea.

2. THREATS

The primary threats to the distribution and abundance of Angelsharks in the Mediterranean Sea have been identified as capture in fishing activity and habitat destruction (Gordon *et al.*, 2019).

2.1. Unsustainable exploitation

Historically, Angelshark was utilised for both food and its skin. In the first half of the 20th century, Angelsharks were subject to some localised targeted fisheries performed by specialized types of nets, often named after the local name of the species: *Escatera* (Spain), *Squaenera* (Italy), *Sklatara* (Croatia), *Martramou* (France). Over the latter half of the 20th century, Angelsharks continued to be a bycatch in a range of fisheries, including bottom trawl and bottom net fisheries (e.g., gillnet, trammel net, and tangle net) and, to a lesser extent, bottom longline fisheries. In some parts of its range, there has been additional fishing mortality through recreational fisheries and in others through continued targeted fisheries.

Excessive fishing pressure has been identified as the most probable impact at the population level, given the broadscale decline in geographical extent. Given the largely coastal distribution of Angelshark, though noting that there can be seasonality in their distributions, there is usually a high overlap between their populations with commercial, artisanal, and recreational fisheries. In addition to a reduction in population size and range, overfishing can result in population fragmentation and subsequent impacts on genetic population structure.

Prohibitions on the retention of Angelshark now exist in various parts of the Mediterranean (see Annex III), and so any bycaught Angelshark should be discarded. The degree of discard survival is unquantified.

2.2. Habitat degradation (including pollution)

Given that contemporary data on the habitat and distribution of Angelsharks are limited, the potential impacts of habitat degradation and other anthropogenic pressures on this species are uncertain. Angelsharks often occur on sandy habitats close to more complex features (e.g., seagrass meadows and reefs) and have an inshore distribution, especially gravid females and neonates that may occupy very shallow waters (Meyers *et al.* 2017, Jiménez *et al.* 2020). Angel Shark Project: Canary Islands have identified and mapped key potential stressors for juvenile Angelsharks in the Canary Islands (Barker *et al.* 2019) and it is likely that other anthropogenic activities (e.g., infrastructure development, coastal defence and beach nourishment, aggregate extraction, habitat loss, and coastal pollution) may have had a negative impact. There have also been hypoxic events in some parts of the Mediterranean Sea (Riedel et al., 2008; Giani et al., 2012), including inshore areas, which can be important pupping and nursery grounds for Angelsharks. Whilst the effect of hypoxia on Angelsharks has not been studied, reduced levels of dissolved oxygen, which may be due to natural or anthropogenic factors, may influence their localised distributions, given that Angelshark partially bury in soft sediments and have restricted breathing movements of the gills, as part of their cryptic nature (Tomita et al., 2018).

Various forms of contaminant, including heavy metals and organic pollutants, can biomagnify and bioaccumulate in long-lived predatory fish, especially those occurring in anthropogenically-disturbed coastal waters. However, few studies have examined the levels of such contaminants in Angelshark tissues, and so the potential impacts on the health of individual fish, as well any potential population-level effects, are unknown. Similarly, the potential impact of plastic pollution is also unknown.

The potential disturbance on *Squatina* spp. due to the magnetic fields generated by underwater cables, including offshore wind farms (currently under development in some Mediterranean coastal areas), also needs to be investigated (Gill & Taylor, 2001).

2.3. Other factors

Whilst there has been some consideration of other factors that may affect Angelsharks, including prey availability, multi-species interactions, genetic bottlenecks due to fragmented populations and climate change, these are not considered here to be of significant impact at the population level.

Angelsharks are ambush predators that are known to predate on a range of demersal fish species, both commercial and non-commercial, and larger invertebrates (e.g., cephalopods and decapod crustaceans). Given the diverse range of potential prey, it is unlikely that prey availability has impacted the global population.

In relation to climate change, it may be noted that some warmer-water fish species have displayed a northward extension in geographic range. However, this has not been observed for the Angelshark, perhaps due to sparsity of records, so we cannot currently assess whether increased water temperatures have, or would, impact the population.

2.4. Threat prioritisation

Each threat outlined above has been assessed using a pre-defined matrix (Table 2) to determine its relative impact on Angelsharks across their range.

The matrix considers the consequences of a threat or impact on Angelsharks and the likelihood of occurrence of that threat. Where mitigation/management measures do exist and have been implemented, the likelihood of the threat has been assessed assuming that these measures continue to be applied appropriately.

Likelihood of occurrence has been categorised as 'Almost Certain', 'Likely', 'Possible', 'Unlikely', and 'Rare/Unknown'. Consequence classifications are defined as follows:

i. Unknown/Not yet evaluated – No known impact on species decline if not addressed.
ii. Minor – Possible, but not known, contribution to species decline. Should not be prioritised over other threats.
iii. Moderate – Could contribute to species decline, but not an immediate threat.
iv. Major – Could result in significant declines of species in an area if not addressed.
v. Catastrophic – Could lead to the loss of the species in an area if not addressed and contribute to extinction risk.

The threat matrix has been considered for this action plan for the Mediterranean region only. The matrix uses a qualitative assessment drawing on peer-reviewed literature and expert opinion from CMS and outputs from the Mediterranean Workshop hosted in Tunisia to develop the MedRAP (Gordon *et al.,* 2019). Levels of risk and the associated priority for action are defined as follows:

Very High	immediate additional action required
High	additional action and the precautionary approach should be applied
Moderate	obtain additional information and develop additional action, if required
Low	monitor the occurrence of threats and reassess the level of threat if the likelihood or consequences change

It is very important to recognise that addressing individual threats in isolation – both geographically and in the context of other impacts - is likely to have limited effects and that interventions should be coordinated where possible.

2.5. Threat matrix

Table 2: Threat matrix showing the combination of likelihood of occurrence (considering existing mitigation measures) and consequence of each threat, to determine the level of risk to the Angelshark in the Mediterranean Sea. Risk is categorised into four ratings: green – low, blue – moderate, yellow – high, red – very high. Threat matrix adapted from Gordon *et al.* (2019).

Likelihood	Consequences: Unknown / Not yet valuated	Minor	Moderate	Major	Catastrophic
Almost Certain			Degradation of habitat.	Bycatch in small-scale & large-scale fisheries (including bycatch mortality[6]).	
Likely	Pollution from micro/macroplastics[7] Renewable energy (e.g., wind farms, underwater turbines, lagoons) Extractive industries (e.g., aggregate, mining, dredging) Pipelines and electrical cables Anchor damage of habitats Shipping disturbance	Water pollution/runoff leading to accumulation of contaminants Water pollution/runoff and sewage leading to eutrophication Increasing number of tourists and recreational activity in coastal waters. Recreational watersports (including diver disturbance and boating)	Low genetic diversity (genetic bottlenecks/population fragmentation) Coastal building and infrastructure development that alter seafloor morphology Changing water temperature	Mortality from targeted and accidental catch due to recreational and sports fishing (e.g., rod & line, surfcasting, spearfishing). Bycatch in small-scale and large-scale fisheries and illegal retention. Degradation of Critical Habitats	
Possible	Pathogens Disturbance or competition from non-indigenous species	Alteration of the food web (overfishing of preferential prey species)[8].	Ghost fishing Hypoxia		Targeted / IUU fisheries or retained bycatch in small-scale inshore fisheries.
Unlikely					
Rare / Unknown			Oil spills		

[6] Bycatch mortality included the proportion that is dead when the gear is retrieved (at-vessel mortality) and the proportion of specimens released alive that subsequently die due to the capture process (post-release mortality).
[7] Impact of plastic pollution is currently not well understood. Further research is required, and the risk category may be revised with further information.
[8] Any localised overfishing may result in a greater threat on a local scale.

3. POLICIES AND LEGISLATION RELEVANT FOR MANAGEMENT

3.1. Conservation and legal status

Table 3: Details of international conservation instruments that list Angelshark, *Squatina squatina*. Numbers in parentheses indicate the year a species was assessed or listed on an agreement.

International legal and non-legal instruments	Angelshark listed under protection measure or assessment
International Union for Conservation of Nature (IUCN) Red List of Threatened Species	Critically Endangered A2bcd (2019)[9]: Population reduced an observed, estimated, inferred, or suspected reduction of at least 80% over the last 10 years or three generations, whichever is the longer, based on the following: a) an index of abundance appropriate for the taxon, b) a decline in area of occupancy, extent of occurrence and/or quality of habitat, c) actual or potential levels of exploitation.
Convention on the Conservation of Migratory Species of Wild Animals (CMS)	Angelshark listed in Appendix I (2017) Angelshark listed in Appendix II (2017)
Memorandum of Understanding on the Conservation of Migratory Sharks (CMS Sharks-MOU)	Angelshark listed in Annex 1 (2018)
Barcelona Convention and the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol)	Angelshark listed in Annex II “list of endangered or threatened species”

[9] Angelshark was globally assessed as Critically Endangered by the IUCN.

General Fisheries Commission for the Mediterranean (GFCM)	Article 6 of GFCM/42/2018/2 states that "*CPCs shall ensure a high protection from fishing activities for elasmobranch species listed in Annex II of the SPA/BD Protocol of the Barcelona Convention, which must be released unharmed and alive, to the extent possible*". This listing applies to Angelshark (*S. squatina).* Article 7 of GFCM/42/2018/2 states that "*Specimens of shark species listed in Annex II of the SPA/BD Protocol shall not be retained on board, transhipped, landed, transferred, stored, sold or displayed or offered for sale*". This listing applies to Angelshark (*S. squatina).* *Part II of GFCM/44/2021/16 states management measures that apply to Angelshark (S. squatina):* (4) CPCs are invited to take the necessary steps to reduce the mortality of any elasmobranchs species incidentally caught during fishing operations by adopting relevant mitigation measures including the establishment of a system that provides incentives to vessel captains to reduce incidental elasmobranch mortality, as well as a system of technical training and certification for captains; and by conducting research to improve fishing gear, equipment and fishing techniques to reduce bycatch elasmobranch mortality and increase post-release survival rate[10]. (5) CPCs are invited to adopt mitigation measures to minimize and eliminate where possible incidental catch of elasmobranchs during fishing operations in high-risk bycatch fisheries determined by the SAC and where possible in low-risk bycatch fisheries, accompanied by appropriate monitoring to establish the efficacy of the actions. Such mitigation measures may include, inter alia, - gear modifications and alternative gear types; - improvements on gears' marking and detection; - time-area fishing restrictions or closures, if appropriate; - implementation of maximum potential bycatch thresholds; - implementation of magnetic deterrent devices, when based on scientific studies and after a cost-benefit evaluation. (6) CPCs may also consider on a voluntary basis other types of management such as "incentive-based management", which rewards low impact operators while simultaneously driving poorly performing operators to adopt better practices or leave the industry; "market-based incentive management" by employing, for example, "elasmobranch-safe" (or "elasmobranch-friendly") labelling in medium to high-risk fisheries. (7) CPCs shall require fishing vessels, catching accessorily and incidentally sharks species, to limit bycatch of

[10] See Accobams/GFCM/FAO Good practice guide for the handling of sharks and rays caught incidentally in fisheries http://www.fao.org/gfcm/publications/projectsandinitiatives/en/

	sharks listed in Annex III of the SPA/BD Protocol to a maximum percentage of the total catch by fishing trip in weight or no more than three specimens. In 2023, the SAC shall assess the most up-to-date species-level catch and composition data. Based on the scientific advice, the 46th session of GFCM will decide on a maximum percentage of catch limit, expressed in weight. In addition, Part III – Article 12 in GFCM Rec. 2021/44/16 states another requirement which applies to Angelshark (*S. squatina*): CPCs shall report by 30 April 2026 at the latest on at least one activity per species/gender from Annex 1 present in the GSA area where fishing activities are carried out, or at least five species-specific actions in total to improve the conservation status of elasmobranch species, mitigate and where possible eliminate the risk of incidental taking of elasmobranch in fishing operations and the associated mortality

3.2. Range State Status under CMS Instruments

The table below (Table 4) provides the presence status of Angelshark in each Range State in the Mediterranean Sea, considering a subset of four of the six IUCN presence codes. The presence statuses were determined and defined by Lawson *et al.* (2020), adapted from IUCN (2018).

i. Extant - the species is known or thought very likely to occur presently in the area, usually encompassing current or recent localities where suitable habitat at appropriate altitudes remains (or depths in the case of aquatic species).
ii. Possibly Extant - There is no record of the species in the area, but the species may possibly occur, based on the distribution of potentially suitable habitat at appropriate altitudes, although the area is beyond where the species is Extant, and the degree of probability of the species occurring is lower.
iii. Possibly Extinct - there is no record of the species in the area, but the species was formerly known or thought very likely to have occurred, but it is most likely now locally extinct from the area because habitat loss/other threats are thought likely to have eliminated the species and/or owing to a lack of records in the last 30 years.
iv. Presence Uncertain - the species was formerly known or thought very likely to occur in the area, but it is no longer known if it still occurs.

Table 4: List of the Range States of the Mediterranean Sea with the presence status of Angelshark (*Squatina squatina*) and whether they are a member party or signatory of either CMS or Sharks-MOU. Presence statuses are based on Lawson *et al.* (2020) or if available, most recent information. It has been described in the following footnotes where Morey *et al.* (2019) or another source provided a differing presence status to Lawson *et al.* (2020). Unless specified, both sources (Lawson *et al.* 2020 & Morey *et al.* 2019) determined the same presence status per Range State. 'Not Evaluated' means that Angelsharks have not been assessed in the area by either Morey *et al.* (2019) or Lawson *et al.* (2020). (✓) indicates CMS Party and Sharks MOU Signatory. (-) indicates non-CMS Party and non-Sharks MOU Signatory.

Range State (or Party/Signatory)	**Presence** (in accordance with Lawson et al. 2020*)*	**CMS**	**Sharks MOU**
European Union	Extant	✓	✓
Albania	Presence Uncertain	✓	-
Algeria	Extant	✓	-
Bosnia and Herzegovina	Presence Uncertain	✓	-
Croatia	Extant	✓	-
Cyprus[11]	Extant	✓	-
Egypt	Presence Uncertain	✓	✓
France:		✓	✓
Mediterranean Coast	Presence Uncertain		
Corsica	Extant		
Greece:		✓	-
Mainland	Extant		

[11] Possibly Extant according to Morey et al. (2019). However, there has been further evidence of *S. squatina* in Cyprus as documented in the SubRegional Action Plans for GSA 25 (Giovos *et al.*, 2021 & Bengil *et al.*, 2021).

Crete	Presence Uncertain		
Ionian Sea	Not present		
Aegean Sea	Extant		
Israel	Extant	✓	-
Italy: [9, 12]		✓	✓
Mainland	Extant		
Sardinia, Sicily Strait and Pelagie Islands	Extant		
Lebanon	Presence Uncertain	✓	-
Libya	Extant	✓	✓
Malta	Extant	✓	-
Monaco	Presence Uncertain	✓	✓
Montenegro	Presence Uncertain	✓	-
Morocco	Presence Uncertain	✓	-
Slovenia	Extant	✓	-
Spain:		✓	-
Mediterranean Coast	Presence Uncertain		
Balearic Islands	Presence Uncertain		
Syrian Arab Republic	Presence Uncertain[13]	✓	✓
Tunisia	Extant[14]	✓	-
Türkiye	Extant	-	-
United Kingdom:		✓	✓
Gibraltar	Presence Uncertain[15]		
Sovereign Base Areas of Akrotiri and Dhekelia (on Cyprus)	Not Evaluated[16]		

[12] Presence Uncertain according to Lawson *et al.* (2020) and Morey *et al.* (2019). However, it is Extant due to recent literature and information on social media reporting occurrences of the species in Eastern Sardinian and South Sicilian waters (Marino Vacchi, personal communication) and off Lampedusa Island (Bottaro et al.,in preparation).

[13] Presence of all three species of Angelshark in Syria reported for the period 2001-2004: https://www.researchgate.net/publication/282171575_Shark_exploitation_and_conservation_in_Syria

[14] Presence Uncertain according to Morey et al. (2019), However, during the MedRAP workshop, their presence in the region was confirmed (Mohamed Nejmeddine Bradai, personal communication).

[15] Morey et al. (2019) has not assessed the status of Angelsharks in Gibraltar.

[16] Presence is not evaluated for the Sovereign Base Areas of Akrotiri and Dhekelia as is extant elsewhere around the Island of Cyprus.

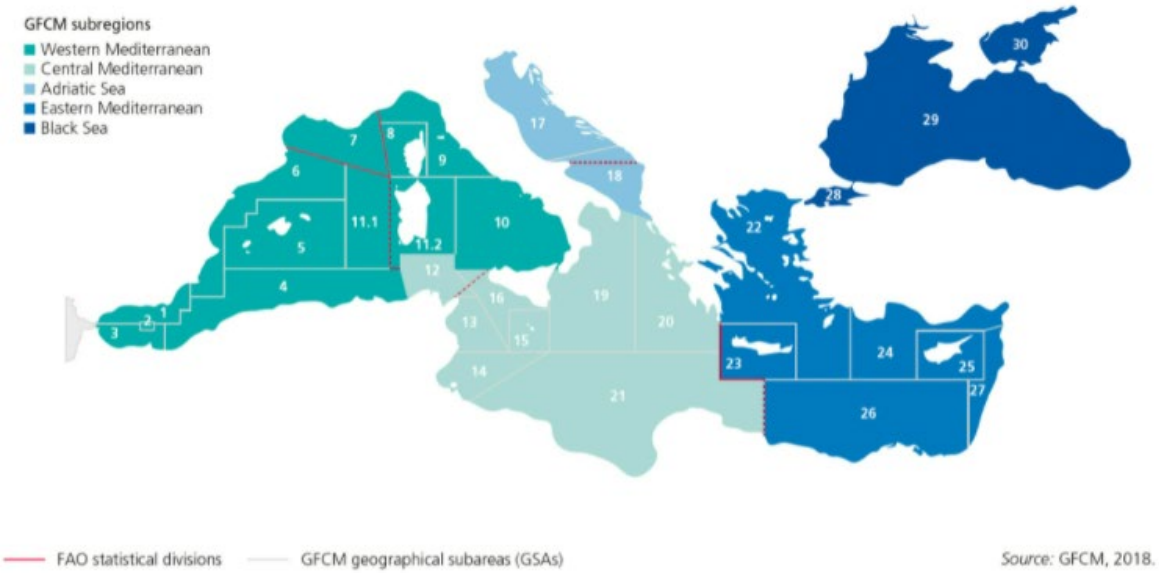


Figure 3: Map of the Mediterranean region, FAO Major Fishing Area 37, showing the geographical position of the various GFCM Geographical Subareas (GSAs) and their respective borders. Source: FAO, 2020.[17]

[17] https://www.fao.org/documents/card/en/c/cb2429en

Table 5: List of GFCM Geographical Subareas (GSAs) with presence status of Angelsharks (*Squatina squatina*). Angelsharks were deemed 'extant' in a GSA, when one or more Range State in the area was classified as extant by Lawson *et al.* (2020) or if available, most recent information. Angelsharks were deemed 'presence uncertain' in a GSA, when all Range States were classified as 'presence uncertain' by Lawson *et al.* (2020). It is described in the following footnotes where Morey *et al.* (2019) or another source provided a differing presence status to Lawson *et al.* (2020). Unless specified, both sources (Lawson *et al.* 2020 & Morey *et al.* 2019) determined the same presence status per Range State.

GFCM Geographical Subareas (GSAs)		Presence Status
1	Northern Alboran Sea	Presence Uncertain
2	Alboran Island	Presence Uncertain
3	Southern Alboran Sea	Presence Uncertain
4	Algeria	Extant
5	Balearic Islands	Presence Uncertain
6	Northern Spain	Presence Uncertain
7	Gulf of Lion	Presence Uncertain
8	Corsica	Extant
9	Ligurian Sea and Northern Tyrrhenian Sea	Extant
10	Southern and Central Tyrrhenian Sea	Extant
11.1	Western Sardinia	Presence Uncertain
11.2	Eastern Sardinia	Extant[18]
12	Northern Tunisia	Extant[13]
13	Gulf of Hammamet	Extant[13]
14	Gulf of Gabès	Extant[13]
15	Malta	Extant
16	Southern Sicily	Extant[19]
17	Northern Adriatic Sea	Extant
18	Southern Adriatic Sea (part)	Extant
19	Western Ionian Sea	Extant
20	Eastern Ionian Sea	Presence Uncertain
21	Southern Ionian Sea	Extant
22	Aegean Sea	Extant
23	Crete	Presence Uncertain
24	Northern Levant Sea	Extant
25	Cyprus	Extant[11]
26	Southern Levant Sea	Presence Uncertain
27	Eastern Levant Sea	Extant
28	Marmara Sea	Extant
29	Black Sea	Extant[20]
30	Azov Sea	Species does not occur

[18] Presence Uncertain according to Lawson *et al.* (2020) and Morey *et al.* (2019). However, it is Extant due to recent literature and information on social media reporting occurrences of the species in Eastern Sardinian waters (Marino Vacchi, personal communication).
[19] Angelsharks have not been assessed in the area by either Morey *et al.* (2019) or Lawson *et al.* (2020). However, it is Extant due to recent literature and information on social media reporting occurrences of the species in South Sicilian waters (Marino Vacchi, personal communication).
[20] Present, but only in close proximity to GFCM GSA 28 (Jim Ellis, personal communication).

3.3. Relevant organisations operating in the Angelshark range

CECAF: Fishery Committee for the Eastern Central Atlantic
CMS: Convention on the Conservation of Migratory Species of Wild Animals
CBD: Convention on Biological Diversity
EU: European Union
GFCM: General Fisheries Commission for the Mediterranean
ICES: International Council for the Exploration of the Sea
OSPAR: Convention for the Protection of the Marine Environment of the North-East Atlantic
UNEP-MAP: United Nations Environment Programme -Mediterranean Action Plan (Barcelona Convention)

3.4. National/EU legislation and management measures specific to the Angelshark

Annex III provides an overview of national and EU legislation, including management measures of Range States in the Mediterranean that directly or indirectly relevant for the protection and conservation of Angelshark.

4. FRAMEWORK FOR ACTION

Threats to Angelshark abundance and distribution were identified and attributed a level of risk using the threat matrix (see Table 2). Threats classified as very high risk were the focus of the following framework for action.

4.1. Goal

To strengthen coordination, harmonisation, delivery of data collection, conservation, and management efforts for the Angelshark across its range within the Mediterranean Sea.

4.2. Objectives, Actions, and Results

A collaborative Regional Action Plan for three Angel Shark species in the Mediterranean was developed in 2019 (Gordon *et al*., 2019) and, under this, the suggested actions were broadly spread across three higher-level goals, namely:

(1) National legislation for Angel Sharks is established, implemented and enforced;
(2) Fisheries-based Angel Shark mortality is minimised in the Mediterranean; and
(3) Angel Shark habitat is identified and protected.

The various objectives and actions identified in the earlier Regional Action Plan (Gordon *et al.,* 2019), under which governments and CMS Parties had been identified as best placed to act on some selected actions, are summarised in Annex I.

Consequently, CMS Parties could usefully consider more focused work on Angelshark, *Squatina squatina*, including furthering the progress of the Concerted Action for Angelshark in the Mediterranean Sea, specifically in relation to:

- Species protection
- Identification of Critical Angel Shark Areas (CASAs) and spatial management if required
- Scientific studies and data collection
- Secure further resources

These four broad topics, which would also address the various potential actions (as indicated by

the Regional Action Plan), would all be in alignment with the CMS Convention Text, and demonstrate the commitment of the Parties to the Concerted Action Plan.

The objectives and corresponding actions and results are set out in the tables below (Tables 6, 7, 8, and 9) for the threats identified for Angelshark.

4.3. Species protection

The main anthropogenic sources of mortality of Angelshark are expected to be the result of (i) commercial fisheries (including artisanal and subsistence fisheries), and (ii) recreational fisheries.

Recommendation GFCM/42/2018/2 states that "Specimens of shark species listed in Annex II of the SPA/BD Protocol shall not be retained on board, transhipped, landed, transferred, stored, sold or displayed or offered for sale"[21]. Given the listing of *S. squatina* on the Barcelona Convention, this indicates that it should be a 'prohibited species' in relation to commercial fisheries.

Whilst GFCM/42/2018/2 and the legislation referred to in Annex III confer a degree of species protection, depending on levels of education, monitoring, compliance, enforcement, and implementation, they may not confer full protection. For example, Angelshark may also be taken in a range of recreational fisheries, including rod-and-line and spearfishing.

In addition, GFCM/44/2021/16 strengthens GFCM recommendation 42/2018/2 as it requests that contracting parties adopt additional mitigation measures, including bycatch mitigation measures within both commercial and recreational fisheries in order to improve the conservation status and measures to mitigate or eliminate where possible the risk of incidental catch of elasmobranch, including Angelshark. CPCs are invited to ask for support for the development of pilot projects.

Hence, there is a rationale for Parties to determine whether there are other national legislative instruments that can provide more wide-ranging species protection. Furthermore, improved education, monitoring and enforcement to facilitate compliance by fishers may also be required.

Such efforts would align with the Convention (Article II, Section 3(b); Article III, Section 5).

4.4. Identification of Critical Angel Shark Areas (CASAs)

A range of scientific studies have provided overviews of some of the recent occurrences of Angelshark. However, such studies may not have had full access to all available national data, both historical and contemporary.

Hence, national programmes to collate information on the sites of Angelshark occurrence (both historical and contemporary) would be useful, with potential data sources, including: fisheries reports, commercial landings and observer data, historical accounts, fisher knowledge, citizen science programmes, social media, local ecological knowledge (LEK) and dedicated non-destructive surveys. Habitat modelling and environmental DNA (eDNA) could also be useful tools to identify potential sites of occurrence. The collation of national data (in a standardised format) would allow Parties to determine the current occurrence of Angelsharks and suitable Angelshark habitats in both national waters, and regional seas, and would allow subsequent aggregation of available data for the wider Mediterranean region. Such data could then be used to inform on (1) habitat modelling and identification of other potential sites, (2) potential role of spatial management,

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

and (3) options for non-destructive surveys to monitor trends in stock size. Such efforts would align the Convention (Article III, Section 4(a)).

4.5. Scientific studies, data collection and liaison with the fishing industry

In support of the Concerted Plan of Action, there is a rationale for national programmes to improve scientific data collection as well as improved liaison between fisheries scientists with fishing industries and fishing communities (including artisanal and subsistence fisheries, and recreational fisheries).
Such initiatives could facilitate improved knowledge of historic and contemporary distribution of Angelshark, a better understanding of the current levels of bycatch, and estimates of discards (including dead and live discards).

Projects involving science-fisher collaboration can enhance scientific data collation and provide assistance to educational initiatives (e.g., in relation to GFCM recommendations and any national management measures).

There is also a strong rationale for the results of scientific studies to be used in collaborative scientific studies with other Parties. In particular, population genetics could reveal insight into connectivity between fragmented populations.

Such efforts would be in alignment with the Convention (Article II, Section 3(a)).

4.6. Secure sufficient resources for ongoing Angelshark conservation

To successfully achieve the results of this Action Plan, sufficient resources need to be secured to implement actions at a national and regional scale. Parties might consider establishing national working groups that consist of local experts and stakeholders to support implementation on a national level.

4.7. Objectives Framework

To address the objectives, actions and results, as introduced in section 4.2, the following framework (Tables 6, 7, 8, and 9) has been created. For each objective, there is an intended result that will be achieved through several actions, each of which has a priority, time scale, and Range States responsible for the action specified. ‘Range States Responsible’ contains two categories, ‘All Range States’ and ‘Range States where Angelsharks are extant’, the categorisation of Range States corresponds to Table 4.

Actions below have been prioritized as:

- Essential
- High
- Medium
- Low

Timescales have also been attached to each Action using the following scale:

- Immediate: completed within the next year
- Short: completed within the next 3 years
- Medium: completed within the next 5 years
- Long: completed within the next 10 years
- Ongoing: currently being implemented and should continue

- Completed: completed during review of Action Plan

All Range States should aim to undertake Actions 1.1-1.4, Actions 2.1-2.3, Action 3.1, and Actions 4.1 and 4.2. The outcomes of these Actions will inform on the practicalities and merits of undertaking subsequent Actions in national waters, and as to how more collaborative, regional studies could be conducted.

4.8. National Implementation

This plan forms a guide for all Range States and other stakeholders. Not all aspects will be relevant for all countries. In addition, some national governments may need additional capacity building to be able to undertake some aspects of this plan. Governments are encouraged to develop their own workplans to organize national implementation guided by this Single Species Action Plan and agreed priorities and according to existing national management measures.

4.9. Resources, guidelines, and tools available

In order to streamline efforts across the range, Parties and implementing partners shall strive to make use of available guidance and tools already developed by members of the Angel Shark Conservation Network (ASCN). These include fisheries guidelines, research techniques and protocols following an ethically approved standard. A full overview of the resources available is provided in Annex IV to this document.

The ASCN may also serve as a reference partner and advisory body for the development of any further guidance materials, protocols, and capacity-building materials to aid countries in the implementation of the SSAP.

Table 6: *Objective 1* – Ensure appropriate species-level protection for Angelshark *Squatina squatina*				
Result	***Action***	***Priority***	***Time Scale***	***Range States Responsible***
Appropriate species protection in line with CMS Appendix I listing, and relevant GFCM recommendations (GFCM/42/2018/2) and GFCM/44/2021/16) are enforced or introduced for Angelshark *Squatina squatina**. Such protection may need to apply to both commercial and recreational fisheries (and should also consider other potential sources of anthropogenic mortality), in order to comply fully with obligations to protect CMS Appendix I listed species. Awareness programme to ensure relevant stakeholders are aware of regulations protecting Angelsharks and subsequent monitoring of compliance and enforcement, where necessary. [* and other relevant species]	1.1 Prohibition in fisheries regulations: Secure national fisheries regulations to ensure that it is prohibited to fish for, retain, tranship, and land Angel Sharks (*Squatina* spp.) in support of GFCM Recommendation GFCM/42/2018/2 and GFCM/44/2021/16. Note it is important to also prohibit intentional catches of Smoothback Angelshark (*Squatina 25culate)* and Sawback Angelshark (*Squatina aculeata)* due to the difficulty to identify and distinguish between the three Angel Shark species found within the Mediterranean.	Essential	Immediate	All Range States.
	1.2 Species-protection: Establish national species-level protection against the deliberate killing, injuring, or taking of Angelshark. This is of particular importance for those nations where prohibited species regulations (see 1.1) only apply to commercial fishing vessels, as additional protection against other sources of potential mortality (e.g., artisanal and recreational fisheries) may be required.	Essential	Short	All Range States.
	1.3 Awareness programmes: Initiate educational and awareness programmes with relevant stakeholder groups in both the fisheries sector (e.g. enforcement officials, fishing industry, fish markets) and recreational sector (e.g. recreational fishers, spearfishers, and amateur divers) as to the prohibited and/or protected status of Angelsharks With a particular focus on species identification to distinguish between the three *Squatina* spp.*,* but also for classification purposes as Angelsharks are often reported as rays and not sharks. Share resources already developed by the Angel Shark Project for best practice to safely release Angelsharks if accidentally caught and the Angel Shark Sightings Map to report sightings.	Essential	Medium	Range States where Angelsharks are extant.

	1.4 Monitoring and enforcement: Ensure that enforcement staff undertake appropriate monitoring of commercial fisheries and landings, particularly regarding those fleets that are more likely to encounter Angelsharks. Develop, or extend, national reporting framework for collating the number of inspections undertaken (by port, fleet, and month) and instances of infringement with regards to Angelsharks.	High	Ongoing	Range States where Angelsharks are extant.

Table 7: *Objective 2* – Identification of sites and habitats of Angelshark *Squatina squatina*				
Result	***Action***	***Priority***	***Time Scale***	***Range States Responsible***
To identify former, current and potential Critical Angel Shark Areas (CASAs) and ascertain the status of Angelshark in these areas.	2.1 Data collation: Collate national data (including both contemporary and historic sources) regarding the presence of Angelsharks *Squatina squatina* (and sister taxa) from relevant sources (including published studies, commercial and recreational fisheries data, fish market data, fisher and diver interviews, citizen science programmes, trawl survey data, discard observer data,museum specimens, Angelshark survey data and historical resources) to better document the contemporary and historical occurrence of Angelsharks in national waters. Such data may also be enhanced through the collection of data on the current presence of Angelshark through the use of social media. Such data could be usefully collated in a common format (see Annex II), with institutes collating national data collaborating with other national institutes in order that more robust regional data are available. The collation of comparable data for other species of Angel Shark should also be undertaken, in order to aid in the interpretation of data for *Squatina squatina.* The Angel Shark Sightings Map[22], hosted by the Angel Shark Conservation Network, is already established, open access and widely used and could be utilised for this purpose.	High	Ongoing	All Range States.

[22] Angel Shark Sightings Map: https://angelsharknetwork.com/#map

	2.2 Habitat modelling: Based on data from action 2.1, undertake Angelshark habitat modelling in national waters and regional seas, in order to better understand and predict Critical Angel Shark Areas (CASAs), including habitats used by key life-history stages, including nursery, mating grounds, pupping and overwintering grounds.	High	Ongoing	All Range States.
	2.3 Environmental DNA (eDNA) sampling: undertake eDNA sampling of appropriate areas (i.e., former, current and potential Angelshark habitats identified in 2.2) to gauge potential presence of Angelshark in the region.	Medium	Medium	All Range States
	2.4 Non-destructive site sampling: Depending on the results of 2.1, 2.2, and/or 2.3, undertake non-destructive surveys (e.g., underwater visual census) of contemporary/potential Angelshark habitat to determine whether effective non-extractive field programmes could be developed in order to monitor localised populations of Angelshark.	High	Medium/Long	All Range States
	2.5 Role of current MPA network: Undertake appropriate sampling (e.g., eDNA sampling, underwater visual census) of existing Marine Protected Areas which may provide suitable habitat for Angelshark, in order to ascertain the likely presence/absence of Angelshark and the effectiveness of conservation measures in place in the current MPA network.	Medium	Long	All Range States

Table 8: *Objective 3* – Support and undertake scientific studies, including data collection and liaison with the fishing sectors, to improve scientific knowledge of Angelsharks *Squatina squatina*, including population trends.				
Result	***Action***	***Priority***	***Time Scale***	***Range States Responsible***
	3.1 Scientific monitoring: Based on the results of 2.1, 2.2, and/or 2.3, initiate (or expand) scientific observer programmes to ensure dedicated and robust observer coverage of those commercial fleets that may interact with Angelshark, covering Angelshark habitats in order to improve contemporary data on the presence of Angelshark and their interactions with fisheries.), and associated biological information (length, gender, females that are pregnant or giving birth).	High	Medium	Range States where Angelsharks are extant
Improved scientific data from commercial fisheries on Angelsharks becomes available, to inform on the status of the species, pressures and enable more robust monitoring of population trends. Improved scientific data from recreational fisheries and other recreational activities on Angelsharks becomes available, to inform on the status of the species, pressures and enable more robust monitoring of population trends.	3.2 Commercial fishery-dependent catch-per-unit-effort data: Improved reporting of interactions with commercial fishing fleets, including data on the numbers of Angelsharks caught, fate (discarded alive or discarded dead). Comparable data on fishing effort, especially for those fleets expected to have a higher number of interactions with Angelsharks, should also be recorded. Such work could utilise the existing reporting requirements of GFCM and potentially focus on a particular 'reference fleet' as a case study.	High	Short (Implementation) Ongoing (monitoring)	Range States where Angelsharks are extant
	3.3 Recreational fishery: Encourage reporting of sightings to both the relevant national fisheries institute and the Angel Shark Sightings Map[22]. Adapt and distribute a code of conduct to safely release Angelsharks if accidentally caught (already developed by the Angel Shark Project) to the recreational fishing community.	High	Ongoing	Range States where Angelsharks are extant
	3.4 Citizen science: Through awareness programmes developed in Action 1.3, encourage reporting of Angelshark sightings to both the relevant national fisheries institute and the Angel Shark Sightings Map[22], whether amateur or commercial divers, recreational fishers or someone sighting them in a market.	Medium	Ongoing	Range States where Angelsharks are extant

	Adapt and share a code of conduct for scuba and snorkel[23] (already developed by Angel Shark Project) with the diving community.			
	3.5 Fishery-independent survey trends: For any areas of localised Angelshark abundance or suitable Angelshark habitat (as surveyed under Actions 2.2, 2.3 and 2.4), initiate standardised, longer-term, non-destructive monitoring programmes to understand seasonal and annual trends in the presence and relative abundance of Angelsharks. Such work could involve collaborative studies with relevant stakeholder groups (e.g., commercial fishers, recreational fishers, divers etc.).	High	Medium (Implementation) Ongoing (monitoring)	Range States where Angelsharks are extant
	3.6 Quantification and characterization of discarded Angelshark survival and options for minimising discard mortality: Depending on the results of Action 3.1 and 3.2, detailed studies are needed to provide more robust estimates of discard survival (at-vessel mortality and post-release mortality) of Angelsharks from commercial fleets. Such work should be undertaken in conjunction with current levels and patterns of fleet activity and should be designed in such a way that would decrease fishing mortality on Angelsharks. Such work should also identify where changes in fisher behaviour (e.g., soak times of nets) can prevent or minimise mortality of incidentally caught Angelshark.	High	Long	Range States where Angelsharks are extant
	3.7 Tagging: For any areas of localised Angelshark abundance (as surveyed under Action 2.4), consider the utility of visual and/or electronic tagging to inform on seasonality, habitat use, home range and movement. Such studies should be designed carefully and follow an ethical review process, to avoid increasing mortality.	Medium	Long	Range States where Angelsharks are extant
	3.8 Population structure and connectivity: Collect opportunistic tissue samples (e.g., from dead bycatch) and ensure appropriate longer-term archiving and storage. Subsamples of	Medium	Long	All Range States

[23] Code of conduct for scuba and snorkel: https://angelsharknetwork.com/wp-content/uploads/sites/16/2018/08/Code-of-Conduct-English.pdf

	this material should be made available for scientific studies to facilitate Atlanto-Mediterranean genetic analyses to understand Angelshark connectivity in the region and global range.			
	3.9 Life-history studies: Depending on studies being undertaken under the Concerted Action Plan, relevant national institutes could usefully collect life-history information (length, sex, weight, maturity, collection of biological material for supporting studies, including genetic samples, stomach contents, tissue samples, and parasites). In accordance with the "no taking" rule described in CMS Article III (5[24]) such work should only be undertaken when based on specimens of incidental dead bycatch and under authorised derogation from relevant national regulatory frameworks (see Objective 1).	Medium	Ongoing	Range States where Angelsharks are extant
	3.10 Longer-term, historical population dynamics: Depending on the data available (see Action 2.1), undertake analyses of longer-term population trends of Angelsharks for national waters and regional seas to understand historical population trends.	Low	Long	All Range States

[24] CMS Article III (5):
Parties that are Range States of a migratory species listed in Appendix I shall prohibit the taking of animals belonging to such species. Exceptions may be made to this prohibition only if:
a) the taking is for scientific purposes;
b) the taking is for the purpose of enhancing the propagation or survival of the affected species;
c) the taking is to accommodate the needs of traditional subsistence users of such species; or
d) extraordinary circumstances so require.

Table 9: *Objective 4* – Sufficient resources secured for long-term Angelshark *Squatina squatina* conservation actions				
Result	***Action***	***Priority***	***Time Scale***	***Range States Responsible***
Resources shall be secured on a long-term basis for the implementation of the Single Species Action Plan.	4.1 Provide Resources: National and regional governments secure the necessary funds for the implementation of the actions at national and regional levels. Parties shall strive to provide funds to implement priority actions in the plan and financially contribute to staff time and coordination.	High	Ongoing	All Range States
	4.2 Establish an international working group (IntWG) for the Mediterranean region: An IntWG will be established to coordinate and monitor the implementation of this Single Species Action Plan.	High	Ongoing	All Range States
	4.3 Appraise protected areas: Expand the existing MPA network to include any identified CASAs and the effectiveness of MPA networks is continually monitored.	Medium	Long	All Range States

REFERENCES

Barker, J., Davies, J., Wray, B., Sharp, R., Gollock, M., Evans, J., O'Connor, J., Evans, S., Gordon, C., Moore, A., Nelson, M., Dulvy, N. K., Hiddink, J., Fish, J., Jiménez-Alvarado, D., Brittain, R., Meyers, E., Goralczyk, M., Bull, J., Jones, N., Sims, W. & Clark, M. (2020). Wales Angel Shark Action Plan. Zoological Society of London, UK. 42 pp. https://angelsharknetwork.com/wp-content/uploads/sites/16/2020/08/Wales-Angelshark-Action-Plan-2020.pdf

Bengil, E.G.T., Godley, B.J., Gillham, R.L., Hood, A.R., Snape, R.T.E. (2021) Mediterranean Angel Sharks: SubRegional Action Plan (SubRAP). GSA 25* (Cyprus – Northern Cyprus)

Boletín Oficial del Estado (BOE, 2019). Orden TEC/596/2019, de 8 de abril, por la que se modifica el anexo del Real Decreto 139/2011, de 4 de febrero, para el desarrollo del Listado de Especies Silvestres en Régimen de Protección Especial y del Catálogo Español de Especies Amenazadas. https://www.boe.es/eli/es/o/2019/04/08/tec596 & https://www.boe.es/buscar/pdf/2011/BOE-A-2011-3582-consolidado.pdf

Bom, R. A., van de Water, M., Camphuysen, K. C., van der Veer, H. W. & van Leeuwen, A. (2020). The historical ecology and demise of the iconic Angelshark *Squatina squatina* in the southern North Sea. Marine Biology, 167, in press.

Capapé, C., Quignard, J. P. & Mellinger, J. (1990). Reproduction and development of two angel sharks, *Squatina squatina* and *S. 32culate* (Pisces: Squatinidae), off Tunisian coasts: semi-delayed vitellogenesis, lack of egg capsules, and lecithotrophy. Journal of Fish Biology, 37: 347–356.

Compagno, L. J. V. (1984). FAO Species Catalogue. Sharks of the World: an annotated and illustrated catalogue of shark species known to date. Part 1: Hexanchiformes to Lamniformes. FAO Fisheries Synopsis, 125, 4(1): 1–250.

Ebert, D.A., Dando, M., Fowler, S., (2021) Sharks of the World: A Complete Guide. Wild Nature Press.

Ellis, J. R., Armstrong, M. J, Rogers, S. I. & Service, M. (2002). The distribution, structure and diversity of fish assemblages in the Irish Sea. In J.D. Nunn (Ed.) Marine biodiversity in Ireland and adjacent waters. Belfast: Ulster Museum, 93–114.

Ellis, J. R., Barker, J., McCully Phillips, S. R., Meyers, E. & Heupel, M. (2021). Angel sharks (Squatinidae): A review of biological knowledge and exploitation. Journal of Fish Biology, 98: 592–621.

FAO. (2020). The State of Mediterranean and Black Sea Fisheries 2020. *General Fisheries Commission for the Mediterranean.* Rome.

Fitzmaurice, P., Keirse, G., Green, P., and Clarke, M. (2003). Angel Shark Tagging in Irish Waters. Central Fisheries Board, Dublin, Ireland. 19 pp

Fortibuoni, T., Borme, D., Franceschini, G., Giovanardi, O. & Raicevich, S. (2016). Common, rare or extirpated? Shifting baselines for common angelshark, *Squatina squatina* (Elasmobranchii: Squatinidae), in the Northern Adriatic Sea (Mediterranean Sea). Hydrobiologia, 772: 247–259.

Fricke, R., Eschmeyer, W. N. & van der Laan, R. (2022). Eschmeyer's Catalog of Fishes: Genera, Species, References. Available at: http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp

Giani, M., Djakovac, T., Degobbis, D., Cozzi, S., Solidoro, C. & Umani, S.F. (2012). Recent changes in the marine ecosystems of the northern Adriatic Sea. Estuarine, Coastal and Shelf Science, 115: 1-13.

Gill, A. B. & Taylor, H. (2001). The potential effects on elasmobranchs of electromagnetic fields generated by cabling between offshore wind turbines. Contract No.: FC 73-02-192 Offshore Windfarm Studies tI. CCW Science Report No. 488.

Giovos, I., Stoilas, V. O., Al-Mabruk, S. A., Doumpas, N., Marakis, P., Maximiadi, M., Moutopoulos, D., Kleitou, P., Keramidas, I., Tiralongo, F. & de Maddalena, A. (2019). Integrating local ecological knowledge, citizen science and long-term historical data for endangered species conservation: Additional records of angel sharks (Chondrichthyes: Squatinidae) in the Mediterranean Sea. Aquatic Conservation: Marine and Freshwater Ecosystems, 29: 881–890.

Giovos, I., Gillham, R., Hadjioannou, L., Hood, A., Kleitou, P., Spyridopoulou, R.N.A., Papageorgiou, M. (2021). Mediterranean Angel Sharks: SubRegional Action Plan (SubRAP). GSA 25* (Cyprus – Republic of Cyprus)

Giovos, I., Katsada, D., Spyridopoulou, R.N.A., Poursanidis, D., Doxa, A., Katsanevakis, S., Kleitou, P., Oikonomou, V., Minasidis, V., Ozturk, A.A., Petza, D., Sini, M., Yigin, C.C., Meyers, E.K.M., Barker, J., Jiménez-Alvarado, D., Hood, A.R. (2022). Strengthening Angel Shark Conservation in the Northeastern Mediterranean Sea. Journal of Marine Science and Engineering. 10(2):269.

Gordon, C.A., Hood, A.R., Al Mabruk, S. A. A., Barker, J., Bartolí, A., Ben Abdelhamid, S., Bradai, M.N., Dulvy, N.K., Fortibuoni, T., Giovos, I., Jimenez Alvarado, D., Meyers, E.K.M., Morey, G., Niedermuller, S., Pauly, A., Serena, F. and Vacchi, M. (2019). Mediterranean Angel Sharks: Regional Action Plan. The Shark Trust, United Kingdom. 36 pp. Available at: https://www.sharktrust.org/news/action-plan-for-mediterranean-angel-sharks

Hiddink, J. G., Shepperson, J., Bater, R., Goonesekera, D. & Dulvy, N. K. (2019). Near disappearance of the Angelshark *Squatina squatina* over half a century of observations. Conservation Science and Practice, 1: e97.

IUCN. 2018. Mapping Standards and Data Quality for the IUCN Red List Categories and Criteria Version 1.16. Gland, Switzerland and Cambridge, UK. 30 pp. Available at: https://nc.iucnredlist.org/redlist/resources/files/1539098236-Mapping_Standards_Version_1.16_2018.pdf

Jiménez Alvarado, D., Meyers, E.K., Caro, M.B., Sealey, M.J. & Barker, J. (2020). Investigation of juvenile angelshark (Squatina squatina) habitat in the Canary Islands with recommended measures for protection and management. Aquatic Conservation: Marine and Freshwater Ecosystems, 30(10), pp.2019-2025.

Jukic-Peladic, S., Vrgoc, N., Krstulovic-Sifner, S., Piccinetti, C., Piccinetti-Manfrin, G., Marano, G. & Ungaro, N. (2001). Long-term changes in demersal resources of the Adriatic Sea: comparison between trawl surveys carried out in 1948 and 1998. Fisheries Research, 53: 95–104.

Kabasakal, H. (2021). Chapters from the life story of common angel shark, Squatina squatina, from Turkish waters: a historical, ethnoichthyological and contemporary approach to a little-known shark species. J. Black Sea/Mediterranean Environment Vol. 27, No. 3: 317-341.

Lawson, J.M. Pollom, R., Gordon, C.A., Barker, J., Meyers, E.K.M., Zidowitz, H., Ellis, J.R., Bartolí, A., Morey, G., Fowler, S.L., Jiménez Alvarado, D., Fordham, S., Sharp, R., Hood, A.R., & Dulvy, N.K. (2020). Extinction risk and conservation of Critically Endangered angel sharks in the Eastern Atlantic and Mediterranean Sea. ICES Journal of Marine Science, 77(1): 12–29.

McHugh, M., Sims, D. W., Partridge, J. C. & Genner, M. J. (2011). A century later: Long-term change of an inshore temperate marine fish assemblage. Journal of Sea Research, 65: 187–194.

Meyers, E.K., Tuya, F., Barker, J., Jiménez Alvarado, D., Castro-Hernández, J.J., Haroun, R. & Rödder, D. (2017). Population structure, distribution and habitat use of the Critically Endangered Angelshark, Squatina squatina, in the Canary Islands. Aquatic Conservation: Marine and Freshwater Ecosystems, 27(6), pp.1133-1144.

Morey, G., Barker, J., Hood, A., Gordon, C., Bartoli, A., Meyers, E. K. M., Ellis, J., Sharp, R., Jimenez-Alvarado, D. & Pollom, R. (2019). *Squatina squatina*. The IUCN Red List of Threatened Species 2019: e.T39332A117498371. http://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T39332A117498371.en

Pike, C., Barker, J., Dragicevic, B., Ugarkovic, P., Kristinic, P., Kanski, D., Meyers, E., Jiménez Alvarado, D., Gomei, M. & Niedermüller, S. (2020). Saving the last Angel Sharks of the Mediterranean Sea: X-ray report on spatial protection, with a focus on the Adriatic Sea. WWF Mediterranean. https://angelsharknetwork.com/wp-content/uploads/sites/16/2020/12/AS_Adriatic_2020.pdf

Quéro, J. C. & Cendrero, O. (1996). Incidence de la pêche sur la biodiversité ichtyologique marine : Le bassin d'Arcachon et le plateau continental sud Gascogne. Cybium, 20: 323–356.

Ragonese, S., Vitale, S., Dimech, M. & Mazzola, S. (2013). Abundances of demersal sharks and chimaera from 1994–2009 scientific surveys in the central Mediterranean Sea. PloS one, 8(9): e74865.

Riedel, B., Zuschin, M. & Stachowitsch, M. (2008). Dead zone: a future worst-case scenario for northern Adriatic biodiversity. In: Briand, F. (Ed.), Climate warming and related changes in Mediterranean marine biota. CIESM Workshop Monograph N. 35, pp. 73-77.

Rogers, S. I. & Ellis, J. R. (2000). Changes in the demersal fish assemblages of British coastal waters during the 20th century. ICES Journal of Marine Science, 57: 866–881.

Roux, C. (1984). Squatinidae. In P. J. P. Whitehead, M.L. Bauchot, J.C. Hureau, J. Nielsen & E. Tortonese (Eds.), Fishes of the North-eastern Atlantic and the Mediterranean Vol. I (pp. 148–150. Paris: UNESCO).

Sguotti, C., Lynam, C. P., García-Carreras, B., Ellis, J. R. & Engelhard, G. H. (2016). The distribution of skates and sharks in the North Sea: 112 years of change. Global Change Biology, 22: 2729–2743.

Shephard, S., Wögerbauer, C., Green, P., Ellis, J. R. & Roche, W. K. (2019). Angling records track the near extirpation of angel shark *Squatina squatina* from two Irish hotspots. Endangered Species Research, 38: 153–158.

Soldo, A. (2006). Current status of the sharks in the eastern Adriatic. Cetaceans, sea turtles and sharks of the Adriatic Sea – Cattolica (RN), Italy – 27-28 Oct. 2006. Conference Proceedings: 8 pp.

Tomita, T., Toda, M. & Murakumo, K. (2018). Stealth breathing of the angelshark. Zoology, 130: 1-5.

Vacchi, M., Biagi, V., Pajetta, R., Fiordiponti, R., Serena, F. & Notabartolo Di Sciara, G. (2000). Elasmobranch catches by tuna trap of Baratti (Northern Tyrrhenian Sea) from 1898 to 1922. Proceedings of the Fourth European Elasmobranch Association, 177–183.

Vinciguerra D. (1884). Materiali per lo studio della fauna tunisina raccolti da G. E L. Doria, I. Pesci. Annali Mus.civ.Stor.nat. Genova, 20: 393-445, 2 fig.

ANNEXES

(available at: https://www.cms.int/en/document/single-species-action-plan-angelshark-squatina-squatina-mediterranean-sea)

- **Annex I**: Goals, Objectives, and Actions adapted from Gordon et al., 2019.
- **Annex II**: Suggested field headings and descriptions for collation of data on Angelshark presence.
- **Annex III**: Legislation relevant to the conservation of Angelshark (*Squatina squatina*).
- **Annex IV**: Tools and Guidelines to Support Implementation of the SSAP