FAO's Input to the UN Secretary-General's Comprehensive Report for the 2023 Resumed Review Conference on the UN Fish Stocks Agreement

Document outline

1. General Considerations

The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea (UNCLOS)[1] of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (herein referred to as the Fish Stocks Agreement or FSA)[2] was adopted on 4 August 1995 by the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks and it entered into force on 11 December 2001.
As provided in Article 36 of the FSA, a Review Conference on the Agreement was held in New York, 22 to 26 May 2006, four years after it entered into force, with a view to assess the effectiveness of the Agreement in securing the conservation and management of straddling fish stocks and highly migratory fish stocks.

In preparation for the 2006 Review Conference, the General Assembly requested the Secretary- General to submit to the conference a report prepared in cooperation with FAO providing a comprehensive report on the state of exploitation of stocks and fisheries in the high seas. To this end FAO prepared a background document reviewing the knowledge on the state of exploitation of highly migratory species and straddling stocks, as well as the state of discrete high seas stocks and non-target and associated dependent species, using the best available information until 2005. FAO's inputs were integrated into the UN Secretary-General Report of the 2006 Review Conference[3]. Following a request made by the eighth round of Informal Consultations of States Parties to the FSA, held in New York, 16-19 March 2009 to the Secretary-General, FAO prepared an updated comprehensive report and submitted it to the resumed Review Conference in 2010. Responding to the following request made by the eleventh round of Informal Consultations of States Parties to the FSA, held in New York, 16- 17 March 2015, FAO prepared a third update of the report and submitted to the resumed Review Conference in 2016.

General Assembly resolution 74/18 adopted on 10 December 2019 requests the Secretary-General to submit an updated comprehensive report, prepared in cooperation with FAO, to provide information and analysis on relevant technical and scientific issues to assist the 2023 resumed Review Conference in discharging its mandate under article 36, paragraph 2, of the Agreement. In response to this request, this paper provides background information with updates on the landings and estimates of the state of exploitation of stocks of highly migratory species, straddling stocks, discrete high seas stocks and non-target and associated dependent species. The paper follows the outline of previous reports prepared by FAO as inputs to the UN Secretary-General's Comprehensive Report for the Review Conferences in 2006, 2010 and 2016 and updates any relevant information based on the best available scientific data.

1.1 Species and Stock Terminology

FAO (1994)[4] provides a general elaboration on species and stock[5] terminology. For the purpose of this review, **highly migratory species** are the species listed in Annex 1 of UNCLOS[6]. This is a legal

1 UNCLOS is available at: http://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf
2 The Fish Stocks Agreement is available at: http://daccessdds.un.org/doc/UNDOC/GEN/N95/274/67/PDF/N9527467.pdf
3 UN Secretary-General Report of the Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, held in New York, 22 to 26 May 2006 (UNGA Document A/CONF.210/2006/1)
4 FAO 1994. World review of highly migratory species and straddling stocks. FAO Fisheries Technical Paper 337, 70pp.
5 While the definition of a species is straightforward (members of the same species can reproduce with one another), the definition of a stock can vary according to the knowledge available. For example, early in the development of a fishery, two species (e.g. of redfish) with similar characteristics could be considered as a stock for management purposes.
6 Note that whales (i.e. Cetaceans) are included in Annex 1 of UNCLOS as highly migratory species. The International Whaling Commission (IWC) has management authority for the harvest of whales. At present there is a moratorium on commercial whaling, although there is some aboriginal subsistence whaling, whaling under scientific permits, and whaling in coastal state waters by countries lodging an "objection" within IWC. Whaling is not addressed in the FSA and

definition rather than a scientific definition based on the actual migratory behaviour of the species. Nevertheless, the species listed in Annex 1 are in general capable of migrating relatively long distances, and stocks of these species are likely to occur both within EEZs and on the high seas. Where available, information on individual stocks is provided.

UNCLOS does not use the term "**straddling stocks**", but article 63, clause 2 says: "[...] *the same stock or stocks of associated species [which] occur both within the exclusive economic zone and in an area beyond and adjacent to the zone*" which can be taken as a working definition of the concept of straddling stock. The Fish Stock Agreement, while using the term extensively, does not define it. The concept of straddling fish stock can cover a continuum from most of the fish being inside EEZ's to most of the fish being outside EEZ's. No minimum portion outside or inside has been defined, but usage seems to indicate that as long as there is some directed fishing effort at catching the stock on either side of the EEZ line, it is considered to be straddling.

Neither the term **discrete high seas fish stocks** nor the concept behind it are used in UNCLOS: Part VII of the Convention addresses the living resources of the high seas in general. The term or concept does not appear either in the Fish Stock Agreement, because of the nature and scope of the Agreement as originally conceived and negotiated. FAO (1994) used the term "purely high seas stocks" for stocks that are not found within EEZs. This review uses the term "**other high seas stocks**" to refer to stocks that are not highly migratory or straddling. It is preferred to "discrete high seas stocks" because the discreteness of such stocks is generally unknown (e.g. fish caught on distinct seamounts hundreds or thousands of kilometres apart do not necessarily belong to discrete separate biological units). The list of other high seas stocks used in this review is considered provisional as new resources continue to come under exploitation.

Associated and dependent species are those that are caught and/or impacted in fisheries for straddling fish stocks, highly migratory fish stocks, and other high seas fish stocks. Since any landed catch that is not from a straddling fish stock or highly migratory fish stock, may be regarded as from other high seas fish stocks, this review considers associated species as impacted species that are not part of the landed catch.

This document does not consider EEZ stocks (those found either entirely within one country's EEZ or stocks occurring within the exclusive economic zones of two or more coastal States, but not on the high seas) or the sedentary species of the continental shelf in the sense described in Article 77 of the United Nations Law of the Sea.[7]

1.2 Approach Including Data Issues

The paper is based on information from Regional Fishery Organizations[8] in particular, the Commission for the Conservation of Southern Bluefin Tuna (CCSBT), the Indian Ocean Tuna Commission (IOTC), the Inter-American Tropical Tuna Commission (IATTC), the International Commission for the Conservation of Atlantic Tunas (ICCAT), the Northeast Atlantic Fisheries Commission (NEAFC), the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the Western and Central Pacific Fisheries Commission (WCPFC), the International Council for the Exploration of the Sea (ICES), and national fishery management authorities. Information from the latest FAO's publication on the State of World Fisheries and Aquaculture[9] is also used, particularly on the state of selected straddling

Cetaceans are not considered in this review.

7 7 Article 77 of UNCLOS refers to "…living organisms belonging to sedentary species, that is to say, organisms which, at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil" with respect to continental shelf resources. These species are generally known as "creatures of the shelf" and they are subject to the jurisdiction of coastal nations.

8 For information on Regional Fisheries Organizations, including their web addresses, visit the following FAO web address: http://www.fao.org/fi/body/rfb/index.htm

9 FAO. 2022. The State of World Fisheries and Aquaculture 2022. FAO, Rome.

stocks. Catch information is from the FAO Global Capture Production Database[10]. The most recent complete year of data is 2020.

Species /stocks were classified according to a three-level classification scheme used previously by FAO[11] as follows:

Overfished: include stocks whose abundance is below that which would, on average and on the long-term, produce the maximum sustainable yield MSY (B_{MSY}). These are in general stocks that have been exploited at rates above the optimal for some time. It includes also stocks that are depleted or are recovering from a depletion or collapse. To account for uncertainty in status determination, stocks are classified in this category if the information available indicates that their current abundance (B_{curr}) is below 80% of B_{MSY} i.e. $B_{curr}/B_{MSY} < 0.8$.

Maximally Sustainably fished: include stocks whose abundance is close to that which would, on average and on the long-term, produce the maximum sustainable yield MSY (B_{MSY}). To account for uncertainty in status determination, stocks are classified in this category if the information available indicates that their current abundance (B_{curr}) is above 80% but below 120% of B_{MSY} i.e. $08 < B_{curr}/B_{MSY} < 1.2$

Non-maximally fished/Underfished: include stocks whose abundance is above that which would, on average and on the long-term, produce the maximum sustainable yield MSY (B_{MSY}). These are in general stocks exploited by undeveloped or new fisheries, with a significant potential for expansion in total production, or stocks that have been exploited with a low fishing effort, with some limited potential for expansion. To account for uncertainty in status determination, stocks are classified in this category if the information available indicates that their current abundance (B_{curr}) is above 120% of B_{MSY} i.e. $B_{curr}/B_{MSY} > 1.2$.

While these species (or species group)-statistical area combinations reviewed in this paper are referred to as stocks, in many cases they are a collection of several stocks according to either a management or biological perspective. For example, cod in the Northwest Atlantic (FAO statistical area 21) is reported on as a single entry although there are 10 separate management units for cod fisheries in the area, and often more than one reproductively isolated breeding populations (i.e. stocks from a biological perspective) probably exists in some of these management units. In spite of these limitations, the state of stocks compiled here and in previous FAO reviews derives from the best available global sources of information on state of stocks, including from Regional Fisheries Bodies, national fisheries authorities and fishery specific knowledge of FAO Fisheries and Aquaculture Division staff and its consultants.

Information on the species associated with fisheries for highly migratory species, straddling fish stocks and other high seas fish stocks is very limited. Rarely are catches of these species reported. Most are discarded at sea. Some countries collect data on discards, but the information is incomplete and it is not routinely reported to FAO. Thus, this review highlights known and potential issues concerning associated species, but at present a comprehensive assessment is still not possible.

Information on the biological characteristics and geographic distribution of the species is kept at a minimum level in this paper, as it is extensively covered in previous reports prepared by FAO (including FAO, 1994 and Maguire et al., 2006). Information is also available in various FAO information sources

10 Downloadable at: http://www.fao.org/fishery/statistics/software/fishstatj/en
11 FAO 2011. Review of the state of world marine fishery resources. FAO Fisheries and Aquaculture Technical Paper No. 569. Rome, FAO. 2011. 334 pp. Page 4

including the FAO species catalogues and other information products provided by the FAO Species Identification and Data Programme (FishFinder)[12], Search Species Fact Sheets[13], and FishBase[14].

2. Highly Migratory Species

As indicated above, highly migratory species are legally defined as those listed in Annex 1 of UNCLOS. They include tuna and tuna-like species, oceanic sharks, pomfrets, sauries, and dolphinfish. Some of these species may only occur and/or be caught within EEZs but the available global database does not allow distinguishing between catches made on the high seas and those made within EEZs. Highly migratory species are therefore discussed without regard to stocks of occurrence within EEZs or on the high seas.

2.1 Tuna and tuna-like species

2.1.1 The resources

All tuna and tuna-like highly migratory species (billfishes, bonitos, mackerels and tunas) belong to the sub-order Scombroidei. The tunas (*Thunnini*) include the most economically important species referred to as principal market tunas because of their global economic importance and their intensive international trade for canning and sashimi. Tunas are sub-classified into four genera (*Thunnus, Katsuwonus, Euthynnus* and *Auxis*) with fourteen species all together.

The tunas included in Annex 1 of UNCLOS, in the order they are listed in Annex 1, are: albacore tuna (*Thunnus alalunga*) which occurs in tropical and temperate waters; bluefin[15] tuna (*Thunnus thynnus*), mostly found in temperate waters of the Atlantic, including the Mediterranean, and Pacific Oceans; bigeye tuna (*Thunnus obesus*), found in the Atlantic (but absent from the Mediterranean), Indian and Pacific Oceans; skipjack tuna (*Katsuwonus pelamis*) with a worldwide distribution in tropical and temperate waters; yellowfin tuna (*Thunnus albacares*), also with a worldwide distribution in tropical and sub-tropical more temperate seas, but absent from the Mediterranean; blackfin tuna (*Thunnus atlanticus*) found in the western Atlantic in tropical and warm seas; little tuna[16] (*Euthynnus alleteratus*), found in tropical and subtropical waters of the Atlantic, including the Mediterranean, the Black Sea, the Caribbean Sea and the Gulf of Mexico, and *E. affinis*, in the Indian and Pacific Oceans; southern bluefin tuna (*Thunnus maccoyii*), in temperate waters of the southern hemisphere in the Atlantic, Indian and Pacific Oceans; and, frigate mackerel[17] (*Auxis thazard* and *A. rochei*) found in the Atlantic (including the Mediterranean Sea where only *A. rochei* is found), Indian and Pacific Oceans.

The tuna species listed as highly migratory species in the 1982 UN Convention have extensive distribution on the high seas. Although their total catches amount to less than 5% of the total world marine fish catches, their landed value has been estimated to account for nearly 20% of the global total.
Tuna species can be loosely categorised into tropical and temperate tunas. They exhibit a wide range of life histories, ranging from the skipjack tuna, which has a short lifespan, high fecundity and wide distribution in tropical and temperate waters, to the bluefin tuna which is long lived, breeds late and has well defined breeding and migration patterns. Differing life histories result in contrasts in vulnerability to overfishing. Skipjack are generally considered to be more resilient to exploitation, while bluefin are considered more vulnerable, all the more because of their extremely high market value. The other species have life history characteristic that are intermediate between those two extremes.

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12 The web address for FishFinder is: http://www.fao.org/fishery/fishfinder/en
13 The web address for Search Species Fact Sheets is: http://www.fao.org/fishery/species/search/en
14 The web address for Fishbase is: http://www.fishbase.org
15 Since the drafting of UNCLOS, bluefin tuna in the northern Pacific has been identified as a different species, Pacific bluefin tuna (Thunnus orientalis) while bluefin in the Atlantic has been re-named Atlantic bluefin tuna.
16 Presently, *Euthynnus alleteratus* is called little tunny and E. affinis is called kawakawa.
17 Presently, *Auxis thazard* is referred to as frigate tuna and A. rochei as bullet tuna.

The **tuna-like** species included in Annex 1 of UNCLOS also have an extensive distribution. These are: marlins[18] of which there are nine species (*Tetrapturus angustirostris*, *T. belone*, *T. pfluegeri*, *T. albidus*, *T. audax*, *T. georgei*, *Makaira nigricans M. indica*, *M. nigricans*) with one or more species found in every Ocean; sailfishes, with two species, *Istiophorus platypterus (*formerly restricted to the Indian and Pacific Oceans, but is now found in the Mediterranean Sea where it entered via the Suez Canal), and *I. albicans* found in the Atlantic and migrating in the Mediterranean Sea; and swordfish (*Xiphias gladius*) found in the Atlantic, Indian and Pacific Oceans, the Mediterranean Sea, the Sea of Marmara, the Black Sea and the Sea of Azov.
Little tunny (*E. alleteratus*) and kawakawa (*E. affinis*), and to some extent, blackfin tuna (*T. atlanticus*), black skipjack (*E. lineatus*), bullet tuna (*A. rochei*) and frigate tuna (*A. thazard*) are less oceanic and more associated with the continental shelves than the other tunas and tuna-like species in Annex 1 of UNCLOS. The longtail tuna (*T. tonggol*) is also an important tuna, not included in UNCLOS Annex 1, which also has a wide but less oceanic distribution associated with the continental shelves. Other important tuna-like species not in Annex 1 of UNCLOS include slender tuna (*Allothunnus fallai*), butterfly kingfish (*Gasterochisma melampus*), wahoo (*Acanthocybium solandri*), bonitos (*Cybiosarda*, *Orcynopsis* and *Sarda*), and species of the genus *Scomberomorus* (Spanish mackerel, king mackerels, seerfish and sierra). Slender tuna and butterfly kingfish (with a circumpolar distribution in the Southern Ocean) are now caught mostly as bycatch of the longline fishery targeting southern bluefin tuna.

2.1.2 The fisheries

Tuna fisheries[19] are among the oldest fisheries in the world with records of Phoenician trap fisheries[20] for bluefin tuna occurring around 2000 BC. They are mentioned by Aristotle, Oppian and Pliny the Elder, and they are also recorded in excavations at prehistoric sites. Until the second part of the 20th century, fishing occurred mostly in coastal areas. As a result of increasing demand for tuna for canning, industrial fisheries began during the 1940s and 1950s. During the 1950s, the major industrial fisheries were the Japanese longline fishery and the pole-and-line fisheries of the United States and Japan, which operated in the Pacific Ocean. The longline fishery reached the Atlantic Ocean during the late 1950s. Also, some European pole-and-line vessels, based in local ports, began fishing off the west coast of Africa at that time.

During the 1960s, European pole-and-line and purse-seine vessels began fishing for tunas off tropical West Africa. Japanese pole-and-line vessels increased and expanded their area of operation in the western and central Pacific. Japanese longliners also expanded their fishing operations all over the world, targeting mostly albacore and yellowfin for canning. During the mid-1960s, vessels of the Republic of Korea and Taiwan Province of China became involved in large-scale longline fishing for tunas. At the end of the decade, improvements in freezing technology and cold storage systems developed for Japanese longliners, made it possible to produce fish that was acceptable for the sashimi market, which, in turn, led the vessels to shift their target species from yellowfin and albacore for canning to bluefin and bigeye for sashimi. In the eastern Pacific Ocean, the pole-and-line vessels of the United States were almost completely replaced by purse-seine vessels. Quotas for yellowfin in that region were first established in 1966.

During the 1970s the European purse-seine fishery in the tropical eastern Atlantic developed quickly

18 Presently, *Tetrapturus* are referred to as spearfishes.
19 This description of the fisheries is based on FAO (2005c) which reports on the FAO Project on "Management of tuna fishing capacity: conservation and socio-economics".
20 Ravier and Fromentin (2001. ICES Journal of Marine Science 58:1299-1317) analyzed tuna catches from ancestral trap fisheries in the Mediterranean and Atlantic.

while the United States purse-seine fishery of the tropical eastern Pacific expanded offshore. In the tropical eastern Pacific a number of vessels of the United States either changed flags to Central and South American countries to avoid the national regulations aimed at reducing the incidental mortality of dolphins or shifted their fishing effort to the western and central Pacific Ocean, where the association of yellowfin with dolphins was not observed.

A purse-seine fishery for tunas began in the western Indian Ocean during the 1980s, when European vessels, which had fished in the Atlantic Ocean until then, moved to that area. In the Pacific Ocean the purse-seine fishery further expanded its fishing area, particularly in the western and central Pacific Ocean. In the Atlantic, countries such as Brazil and Venezuela entered the purse-seine fisheries. During the same period, the numbers of Japanese and Korean large-scale longliners began to decrease, whereas the fleet of Taiwan Province of China, and the numbers of vessels reflagged to countries of open registry increased rapidly.

Purse seiners began fishing with artificial fish-aggregating devices (FADs) in the Atlantic Ocean early in the 1990s, and the method quickly spread to the Indian and Pacific Oceans. Management intensified during the 1990s and continues to do so in response to stock concerns and increasing focus on illegal, unreported and unregulated (IUU) fishing. The catch by small-scale coastal longline fisheries increased greatly during the 1990s. Another important aspect is the development of bluefin tuna farming which can increase fishing pressure, particularly on juvenile life history stages. Tuna are fished, traded, processed and consumed globally. The industrial fleets often transfer their operations from one ocean to another in response to changing conditions either in fish availability, markets, and/or fishing regulations, which makes it difficult to manage fishing capacity on a regional scale. In addition, the fish caught are frequently transported to other parts of the world for processing. Also, substantial illegal, unreported and unregulated (IUU) fishing, which occurs in all oceans in spite of recent efforts to control it, significantly complicates the management of the fisheries for tunas.

In 2020, tuna and tuna-like species classified as highly migratory in Annex 1 of UNCLOS accounted for landings of about 6 million tonnes. Two species, skipjack tuna and yellowfin tuna, accounted for 73% of the catch (4.4 million tonnes) in that year. Not all the catches are from the high seas however, and a substantial portion is caught within EEZ’s.

2.1.3 State of the stocks

Most highly migratory **tropical** tunas have very high fecundity, wide geographic distribution, opportunistic behaviour and other characteristics that make them highly productive and resilient to exploitation. With proper management, they are capable of sustaining high yields, but possibilities of overexploitation and stock depletion nevertheless exist if fishery management is not adequate. Highly migratory **temperate** tunas have life history characteristics that make them much more sensitive to exploitation. As a result, expected yields are lower and the risks of overexploitation are higher, making it all the more important to exercise prudent management.

Bluefin tuna was depleted in the past in both western and eastern Atlantic. Both stocks have shown signs of recovery in the last decade, following the adoption of rebuilding plans. The stocks in the eastern and western Atlantic have both recovered as of 2019 and are now considered as maximally sustainably fished in both sides of the Atlantic. Southern bluefin tuna has also recovered to interim management targets and is projected to be at 30% of unexploited Biomass (B0) levels within the next few years, a lot earlier than initially expected. However, Pacific Bluefin tuna stocks remain overfished, with current biomasses at very low levels (3% of B0 as of the last assessment).

Albacore stocks are estimated to be maximally sustainably fished in the North and South Pacific, as well as in the North Atlantic and South Atlantic. Albacore is probably also maximally sustainably fished in the Indian Ocean while the state of exploitation in the Mediterranean Sea is overfished as of the last assessment conducted at ICCAT. Although bigeye tuna is tropical and has a life span shorter than bluefin, there is increasing concern that its exploitation may be too intense. In addition to being overfished, there is concern that increasing purse seine catches of small bigeye associated with FADs may negatively affect the longline catches of large bigeye, which have a much higher price. Bigeye tuna is maximally sustainably fished in the eastern Pacific, with fishing mortality rates and levels of spawning biomass slightly below the level corresponding to MSY. In the western Pacific the stock is now considered to be maximally sustainably fished. Bigeye tuna is estimated to be overfished in the Atlantic and maximally sustainably fished in the Indian ocean. The stock of yellowfin tuna in the Indian Ocean is now considered to be in a state of overexploitation. Yellowfin is currently maximally sustainably fished in the Atlantic and also maximally sustainably fished in the Pacific Ocean.

Skipjack tuna is considered to be underfished in the Pacific and maximally sustainably fished in the Indian Ocean. Although the state of skipjack stocks in the Atlantic is less certain, the stocks are likely to be close to maximally sustainably fished. In 2022, the 1st assessment of skipjack is being conducted in the eastern Pacific, as well as an updated analysis in the Atlantic oceans.

The state of exploitation of many other tuna and tuna-like species is highly uncertain or unknown. Given the absence of reliable information on the state of exploitation, caution should be exercised in managing these fisheries, and it would not be prudent to allow fisheries to expand. Significant uncertainties in the state of exploitation of many billfishes represent a serious conservation problem. In the Atlantic, blue and white marlins and sailfish (eastern stock is overfished but the western stock is categorized as maximally sustainably fished), seem to be overfished even though they are not generally targeted. Blue marlin is estimated to be maximally sustainably fished in the eastern Pacific. Striped marlin is overfished in the northern Pacific and the Indian ocean, likely to be maximally sustainably fished in the eastern Pacific and is likely to be overfished in the southwestern Pacific. Other than striped marlin, most stocks of billfish in the Indian Ocean are considered to be maximally sustainably fished. Blue marlin is likely to be maximally sustainably fished while striped marlin is considered overfished. Preliminary assessments of black marlin and sailfish indicate that the stocks are close to maximally sustainably fished. Because of commercial exploitation, there is more known on the state of swordfish exploitation than for other billfishes. The stock of swordfish in the North Atlantic is considered rebuilt and currently maximally sustainably fished. Although the situation in the South Atlantic is less certain, the available indicators suggest a lower exploitation rate than in the North Atlantic. Swordfish is overfished in the Mediterranean. Stocks are maximally sustainably fished in the South Pacific, and underfished in the Indian Ocean. The assessment of the state of exploitation of swordfish in the western and central north Pacific indicates that the stock is probably underfished. Of the other tuna-like species included in Annex I of UNCLOS, the only species that has been assessed in recent years is the kawakawa (*E. affinis*), which is considered maximally sustainably fished in the Indian Ocean.

In summary, the scientific information from FAO’s work on the assessment of the State of the Worlds Marine Fisheries indicates that there has been substantial improvements in Atlantic Bluefin tuna management, though the rest of the fisheries have primarily remained the same. Approximately 40% of the stocks still remain overfished, and 60% sustainably fished (underfished plus maximally sustainably fished). This has declined from the previous report by 4%, i.e. the overfished category has increased from 36% to 40%, and sustainably fished has decreased from 64% to 60%.

As noted in the previous assessment, there are probably few opportunities to increase exploitation of tunas and tuna-like species, except in some areas of the Pacific and Indian oceans, where increases in catches of skipjack tuna might be sustainable. However, if current fishing techniques are used, this can only be done at the expense of undesired increases of catches of other species.

2.2 Oceanic sharks

2.2.1 The resources

Sharks covered under this heading are those listed in Annex 1 of UNCLOS: Bluntnose sixgill shark (*Hexanchus griseus*), basking shark (*Cetorhinus maximus*), thresher sharks (family Alopiidae), whale shark (*Rhincodon typus*), requiem sharks (family *Carcharhinidae*), hammerhead, bonnethead, or scoophead sharks (family *Sphyrnidae*), and the mackerel sharks (family *Lamnidae*[21]).

Unfortunately, the state of many shark populations is unknown, or poorly known. However, the life history of highly migratory sharks in general (e.g. slow growth, long life span, low fecundity) make them particularly vulnerable to overexploitation and depletion such that fishing sharks and managing the fisheries exploiting them requires great caution. Furthermore historical landings data is sparse and what data that does exist is often labeled as general 'sharks'. Between 2000 and the early 2010's, the total reported catches of species and families of sharks, listed in the Annex 1 of UNCLOS, gradually increased from less than 120 000 tonnes to over 230 000 tonnes, and since have declined to between 168 000 tonnes and 157 000 tonnes in 2019 and 2020 respectively. Throughout this period requiem sharks (*Carcharinidae*) accounted for the majority of these catches, at between 76 percent and 86 percent of total shark catches (81 percent in 2020). The increasing trend in reported catches observed in recent years may be due to a combination of factors related to species exploitation, changes in market demand, fisheries management, monitoring, and enhanced species breakdown in the catch statistics reported. The wider application of restrictions on shark finning may be leading to increased landings of whole sharks that were traditionally targeted for their fins. It is also possible that the market demand for shark meat has increased in response to changes in consumer preferences and marketing strategies, as traditional fisheries reach levels of full or overexploitation. The observed increase in landings of these species also reflect improved species identification and reporting by shark fishing nations that used to report shark catches in highly aggregated taxonomic categories. For instance, in the same period of increasing catches of highly migratory sharks there has been a decreasing trend in unidentified catches reported as "Elasmobranchii" (Sharks, rays, skates, etc. nei), from over 370 000 tonnes in the early 2000's to 220 000 tonnes or less in recent years.[22][23][24]

2.2.2 The fisheries

Shark fisheries pre-date recorded history and every part of these animals has been used for some purpose. Shark meat is important food consumed fresh, dried, salted or smoked. In many communities fins of sharks are among the world's most expensive fishery products. Shark cartilage and other products are increasingly sought for medicinal purposes. Few fisheries use the whole animal however: some use only the meat, others only use the fins, or livers or skin. Whereas in the past, in the majority of cases, only parts of the sharks (mainly the fins) were utilized and the rest discarded at sea, in recent years there has been an increasing trend to fully utilize shark catches.

Fisheries for sharks are common throughout the world and use a variety of fishing gears and vessels.

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21 The family Lamnidae is listed as Isurida, using an old family name, in UNCLOS
22 FAO. Shark statistics in the FAO capture database.
23 FAO. 2009. The State of World Fisheries and Aquaculture 2008 (SOFIA). FAO. Rome. 176 p.
24 Fischer, J., Erikstein, K., D'Offay, B., Guggisberg, S. & Barone, M. 2012. Review of the Implementation of the International Plan of Action for the Conservation and Management of Sharks. FAO Fisheries and Aquaculture Circular No. 1076. Rome, FAO. 120 pp.

Sharks are taken mainly by gillnet and hook or trawl in industrial and artisanal fisheries. Small amounts are taken in traditional and recreational fisheries (including game fishers and divers) and in beach gillnet and drumline fishing nets as bather protection programmes. There are several fisheries directed at one or a small number of species of shark, but most sharks are caught either as bycatch in multispecies fisheries where the fishers tend to target more highly valued traditional bony fish species, or in mixed fisheries that switch targets as various species become abundant (e.g. swordfish and blue shark).

The following categories of shark fisheries can be identified: coastal hook and gillnet fisheries, demersal trawl bycatch fisheries, deep water bycatch fisheries, pelagic bycatch fisheries (primarily bycatch in tuna longline and purse seine fisheries) and freshwater shark fisheries. Since most shark catch is taken as bycatch, most of the catch is reported as unidentified shark, mixed fish or is not reported at all. This lack of species identification of the catches and lack of information on fishing effort means basic data for fish stock assessment are usually not available for most species. Reporting requirements have changed in many RFMO's, for example blue shark, silky shark, oceanic whitetip shark, mako sharks, thresher sharks, porbeagle shark (south of 20°S), hammerhead sharks (winghead, scalloped, great, and smooth), and whale shark catches are now required to be reported for all captures in the WCPFC.

An important concern about fisheries that catch sharks is that harvest strategies designed to maximize economic and social benefits from multi-species fisheries have a high probability of depleting the least productive species (such as sharks), unless methods for making fishing more selective (thus able to avoid overfishing-vulnerable species like sharks) are developed and implemented. In recognition of this fact RFMO's have passed conservation and management measures (CMMs) in an attempt to increase the overall selectivity of various fishing gear. In many areas effective bycatch mitigation techniques continue to be active areas of research[25].

2.2.3 State of the stocks

Bluntnose sixgill shark (*Hexanchus griseus*)
There are no assessments of the state of the stock(s) or exploitation of the bluntnose sixgill shark (*Hexanchus griseus*). This is a deepwater shark that occurs nearly worldwide in offshore waters. The most recent IUCN assessment for the European waters notes that there is "no strong evidence of a historical decline and catch rates are low and stable in surveys, Bluntnose Sixgill Shark is assessed as Least Concern in European waters[26]." However like many species of sharks, it has life history characteristics that make it sensitive to exploitation. Qualitative assessments of the status of the stocks have been carried out in different regions however stock delineation, regional levels of connectivity have not been sufficiently informed. While catches in the Atlantic Ocean and Mediterranean Sea show an overall increasing trend since the late 1990's, catches in recent years have generally fluctuated between 50 and 33 tonnes (38 tonnes in 2020). Because of its life history characteristics (e.g. reported age of maturity of females range between 18 and 35 years) the species is susceptible to overexploitation even at low levels of fishing. Unless demonstrated otherwise, it is therefore prudent to consider these species as being maximally sustainably fished or overfished globally.

Basking shark (*Cetorhinus maximus*)
The basking shark (*Cetorhinus maximus*) are extremely vulnerable to overexploitation, perhaps more so than most sharks, and this can be ascribed to its slow growth rate, advanced age of maturity, long gestation period, low fecundity (like all sharks), and probable small size of existing populations. It is currently listed as endangered by the IUCN[27]. Reported catches in excess of 8 000 tonnes were common

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25 https://www.bmis-bycatch.org/mitigation-techniques
26 Walls, R., Soldo, A., Bariche, M., Buscher, E., Cook, S.F. & Compagno, L.J.V. 2015. Hexanchus griseus (Europe assessment). The IUCN Red List of Threatened Species 2015: e.T10030A48939463. Accessed on 12 December 2022.
27 Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M.,

during the period from 1960 to 1980, but they have been much less since the end of the 1990s, with less than 100 tonnes reported per year since 2005 and no catches reported between 2013 and 2019 (< 1 tonne reported in 2020). There are few data on regional abundance, no estimates for abundance worldwide and no good data on population trends. The species is probably overfished globally. Globally the population decline may now be beginning to stabilize, based mostly on information from Northeast Atlantic, although abundances are still estimated to be well below historic levels, there is ongoing demand for the high-value fins, and there is little information for regional stock assessment. Basking shark is listed on the Protocol 'Endangered or Threatened Species' of the Barcelona Convention for the Protection of the Mediterranean Sea, on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and on the Convention on the Conservation of Migratory Species of Wild Animals (CMS). It is also legally protected by several countries, including EU countries, USA, New Zealand, Mexico and Canada.

Thresher sharks (family Alopiidae)

There are three species of thresher sharks (family Alopiidae): *Alopias pelagicus*, *Alopias superciliosus* and *Alopias vulpinus*. All three species are believed to occur in temperate and tropical waters of all oceans. The total reported catches of thresher sharks were generally stable at less than4 000 tonnes for most of the 1990s until the mid-2000s Since 2005 there has been a remarkable increase in reported catches, peaking at almost 23 000 tonnes in 2011 (but have declined to less than 10 000 tonnes since 2018). This recent increase in catches is mostly due to improved reporting of shark statistics by Indonesia, the world's top shark fishing nation, although no information is available on the catches by species, which continue to be reported to FAO as *Alopias spp.*. Likewise, catches of *A. pelagicus* have been recorded by countries fishing in the Southeastern Pacific Ocean only since 2006. Given their life-history characteristics, these species are not expected to have a high resilience to exploitation. Recent estimates of proxy biological reference points ($F_{40\%}$ and $SBR_{40\%}$) for all three thresher shark species in the eastern Pacific Ocean indicate that *A. superciliousus* and *A. pelagics* are highly vulnerable to the pelagic fisheries, while *A. vulpinas* are least vulnerable[28]. Stock state of exploitation remains uncertain in most areas of occurrence. Unless demonstrated otherwise, it is prudent to consider these species as being maximally sustainably fished or overfished globally. The three species of thresher sharks are listed on Appendix II of both CMS and CITES.

In the Indian Ocean there remains considerable uncertainty in the bigeye and pelagic thresher stock status due to lack of information necessary for assessment or for the development of other indicators of the stock). The ecological risk assessment (ERA) conducted for the Indian Ocean by IOTC in 2018 consisted of a semi-quantitative risk assessment analysis and bigeye thresher shark received a high vulnerability ranking, while pelagic thresher shark received a medium vulnerability rating.

Whale sharks (*Rhincodon typus*)

Whale sharks (*Rhincodon typus*) have been fished sporadically by some countries around the Indian and Western Pacific Oceans and are most often encountered when purse seine vessels set upon schools of fish that prey upon the whale sharks main forage fish[29]. However, either no catches or minimal numbers (i.e. < 25 individuals) have been reported recorded in the FAO Global Capture Production database. There exists a paucity of reliable assessments of population densities and size of *R. typus* that can allow the effective monitoring of their status and abundance. Given its life-history characteristics, the whale shark is

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Marshall, A., Romanov, E. & Kyne, P.M. 2021. Cetorhinus maximus (amended version of 2019 assessment). The IUCN Red List of Threatened Species 2021: e.T4292A194720078. https://dx.doi.org/10.2305/IUCN.UK.2021-1.RLTS.T4292A194720078.en. Accessed on 14 December 2022.

28 Shane Griffiths, Leanne Fuller, Joanne Potts, Simon Nicol, 2022. SAC-13-11 Vulnerability status for sharks in the EPO: EASI-fish assessment

29 http://www.fao.org/figis/servlet/FiRefServlet?ds=species&fid=2801

expected to have low resilience to exploitation, but the state of stocks remains uncertain in most areas. Unless demonstrated otherwise, it is prudent to consider the species as being maximally sustainably fished globally. The species is listed on the Appendix II of both CMS and CITES.

Requiem sharks (family *Carcharhinidae*)

Requiem sharks (family Carcharhinidae), have a worldwide distribution in tropical and temperate waters. There are 50 species in the family (30 in genus *Carcharhinus*) which is, by far, the most important shark family for fisheries in the tropics. The main species from a fisheries point of view are: *Carcharhinus falciformis*, *Carcharhinus signatus*, *Carcharinus longimanus*, *Carcharinus sorrah* and *Prionace glauca*. *Carcharinus sorrah*, however is not an oceanic species and will not be considered further. Catches of requiem sharks reported to FAO were generally less than 10 000 tonnes in the 1950s, increasing to 40 000-50 000 tonnes in the 1960s and 1970s. After a brief decline in the early 1980s, reported catches have increased more or less steadily to a peak of 194 000 tonnes in 2012, before declining to less than 140 000 tonnes in recent years (128 000 tonnes in 2020). Catches are reported from the Atlantic, Indian and Pacific Oceans with blue shark, spot-tail shark (*Carcharinus sorrah*, a coastal non-oceanic species) and silky shark being the most important species.

Silky shark, *Carcharhinus falciformis*

The silky shark, *Carcharhinus falciformis*, is one of the three most common oceanic sharks, along with the blue shark (*Prionace glauca*) and oceanic whitetip shark (*Carcharinus longimanus*), and one of the more abundant large marine organisms. It is very commonly taken by pelagic longline and purse seine fisheries, more rarely occasionally by fixed bottom nets. The stock in the western central Pacific has been assessed and is considered overfished. The state of exploitation in other regions is unknown, however preliminary data limited approaches in the Eastern Pacific Ocean and Indian Ocean indicate overexploitation[30]. Its wide distribution and high abundance in most tropical shelves of the world suggests that presently there are no major concerns over the conservation of this species globally. However, as for other sharks, considering the low resilience of the species to overexploitation, it is likely that the stocks are overfished. The silky shark is at present relatively free of threats in the form of habitat destruction because it does not live inshore nor does it utilise coastal lagoons as pupping or nursery areas like other shark species. Recorded catches peaked at 27 000 tonnes in 1999 and have steadily declined since then. Catches have been oscillating between 3 000 and 8 900 tonnes a year since 2004. The silky shark is included on Appendix II of both CMS and CITES

Night shark, *Carcharhinus signatus*

The night shark, *Carcharhinus signatus* is an oceanic species generally occurring in outer continental shelf waters in the western Atlantic Ocean from Delaware (USA) to Argentina and in the eastern Atlantic from Senegal to northern Namibia. Although a decline in catches of night sharks occurred in some fisheries in the western Atlantic, it is unclear whether this decline is due to population declines. Abundance data from the northeastern Atlantic were inconclusive but indicated that the species has not suffered declines of abundance of large magnitudes[31][32]. The stock in the northeastern Atlantic is considered at least maximally sustainably fished. The state of the species in other parts of its range is

30 Ortiz de Urbina J, Brunel T, Coelho R, et al (2018) A Preliminary Stock Assessment for the Silky Shark in the Indian Ocean Using a Data-Limited Approach. In: IOTC - 14th Working Party on Ecosystems and Bycatch. IOTC-WPEB14-2018-033, Cape Town, South Africa, p 14 & BYC-11 INF-B – Purse-seine indicators for silky sharks in the EPO, 1994-2021

31 Carlson, J. K., Cortes, E, Neer, J. A., Mccandles, C. T. And L. R. Beerkircher. 2008. The Status of the United States Population of Night Shark, Carcharhinus signatus. Marine Fisheries Review 70:1-13

32 Carlson, J., Charvet, P., Blanco-Parra, MP, Briones Bell-lloch, A., Cardenosa, D., Crysler, Z., Espinoza, E., Herman, K., Morales-Saldaña, J.M., Naranjo-Elizondo, B., Pacoureau, N., Pérez Jiménez, J.C., Schneider, E.V.C., Simpson, N.J. & Talwar, B.S. 2021. Carcharhinus signatus. The IUCN Red List of Threatened Species 2021: e.T60219A3094326. https://dx.doi.org/10.2305/IUCN.UK.2021-1.RLTS.T60219A3094326.en. Accessed on 14 December 2022.

unknown, but considered to be either maximally sustainably fished or endangered by the IUCN[33].

Oceanic Whitetip shark, *Carcharinus longimanus*

Oceanic Whitetip shark, *Carcharinus longimanus*, is an oceanic shark found in tropical and warm-temperate waters of the Atlantic, possibly in the Mediterranean Sea, in the Western Indian Ocean and in the Pacific. It is one of the most common oceanic species of shark. The highest catches (1 430 t) were recorded in 2000. Catches declined to less than 75 tonnes in 2007, increased to around 1 100 tonnes in 2009 and 2010 before declining again to less than 250 tonnes in 2020. The stock is assessed as overfished in the western central Pacific. The global population is considered critically endangered[34]. Considering the marked decline in the abundance observed in many parts of its range[35], it is likely that the species is globally either maximally sustainably fished or overfished. The species was listed on the Appendix II of CITES in 2013.

Blue shark, *Prionace glauca*

Blue shark, *Prionace glauca*, has a worldwide distribution in temperate and tropical oceanic waters. It is one of the most abundant and the most heavily fished shark in the world, often as bycatch in pelagic longlines fisheries, but also on hook-and-lines, in pelagic trawls, and even bottom trawls near the coasts. Globally the total recorded catches of blue sharks have increased sharply since the mid-1990s, from less than 40 000 tonnes in 1997 to over 144 000 tonnes in 2013, before declining to less than 105 000 tonnes in recent years (93 000 tonnes in 2020).. The Northern stock in the Pacific Ocean was last assessed in 2017. The northern stock of blue sharks in the Pacific Female spawning biomass in 2015 (SSB2015) was 69% higher than at MSY and estimated to be 295,774 mt (see report Table NPBSH-1; Figure NPBSH-1B). The recent annual fishing mortality ($F_{2012-2014}$) was estimated to be well below F_{MSY} at approximately 38% of F_{MSY} (See report Table NPBSH-1; Figure NPBSH-1C). The reference run produced terminal conditions that were predominately in the lower right quadrant of the Kobe plot (not overfished and overfishing not occurring).

The Southern blue shark stock in the Pacific Ocean was last assessed in 2021. Stock biomass is likely increasing, and fishing pressure has declined through the recent decade. The results indicate that, if assessed against conventional reference points, it is likely that the stock will not be found to be overfished nor would overfishing be occurring.

Blue sharks in the North and South Atlantic Ocean were last assessed in 2015, and the status of the North Atlantic stock is unlikely to be overfished. However, because of the considerable uncertainties of the assessments, resulting from data limitations, the assessment group recommended that until these uncertainties are resolved catch levels should not increase beyond those of recent years. Blue Sharks in the North and South Atlantic Ocean are provisionally scheduled to be assessed in 2023.

Blue shark stocks in the Indian Ocean were last assessed in 2021. The results indicate that, if assessed against conventional reference points, it is likely that the stock will not be found to be overfished.

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33 Carlson, J., Charvet, P., Blanco-Parra, MP, Briones Bell-lloch, A., Cardenosa, D., Crysler, Z., Espinoza, E., Herman, K., Morales-Saldaña, J.M., Naranjo-Elizondo, B., Pacoureau, N., Pérez Jiménez, J.C., Schneider, E.V.C., Simpson, N.J. & Talwar, B.S. 2021. Carcharhinus signatus. The IUCN Red List of Threatened Species 2021: e.T60219A3094326. https://dx.doi.org/10.2305/IUCN.UK.2021-1.RLTS.T60219A3094326.en. Accessed on 14 December 2022.

34 Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019. Carcharhinus longimanus. The IUCN Red List of Threatened Species 2019: e.T39374A2911619. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T39374A2911619.en. Accessed on 14 December 2022.

35 FAO. 2013. Report of the fourth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-exploited Aquatic Species, Rome, 3–8 December 2012. FAO Fisheries and Aquaculture Report No. R1032. Rome, FAO. 161 pp. Page 12

Hammerhead Sharks (family *Sphyrnidae*)

The family Sphyrnidae comprises nine species: the winghead shark (*Eusphyra blochii*), the scalloped bonnethead (*Sphyrna corona*), the whitefin hammerhead (*Sphyrna couardi*), the scalloped hammerhead (*Sphyrna lewini*), the scoophead (*Sphyrna media*), the great hammerhead (*Sphyrna mokarran*), the bonnethead (*Sphyrna tiburo*), the smalleye hammerhead (*Sphyrna tudes*), and the smooth hammerhead (*Sphyrna zygaena*). The members of the family are considered coastal; occasionally occurring in brackish water with a global distribution mostly in warm waters. Global catches have steadily been increasing in recent years, from around 7 000 tonnes in 2010 to over 10 000 tonnes in 2020. Although all species are caught, catches are generally only available by species for scalloped hammerhead and the smooth hammerhead in the FAO statistics, while the majority of catches continue to be reported as *Sphyrnidae* (Hammerhead sharks, etc. nei). The scalloped hammerhead (*S. lewini*) is probably the most abundant hammerhead. This species is apparently highly mobile and in part migratory, forming huge schools of small migrating individuals. Owing to its abundance, the species is common in inshore artisanal and small commercial fisheries, as well as offshore operations. Given its life-history characteristics, the scalloped hammerhead shark is expected to have very low resilience to exploitation. Unless demonstrated otherwise, fishing the species should only be allowed under strict controls. The status of the species is unknown. However, considering the marked decline in abundance observed in different parts of the species range[36], it is likely that stocks of *S. lewini* are either maximally sustainably exploited or overfished. Concerns about the conservation status of *S. lewini* led to its inclusion in Appendix II of CITES in 2013. The great hammerhead (*S. mokarran*) and the smooth hammerhead (S. zygaena) were also included in Appendix II for look-alike reasons.

In the Eastern Pacific Ocean (EPO) all five species of hammerhead sharks that are caught in the pelagic fisheries of the Eastern Pacific Ocean(*S. lewini*, *S. mokarran*,*S. zygaena*, *S. media*, and *S. corona*) assessed were classified as "most vulnerable" with the Ecological Assessment for the Sustainable Impacts of Fisheries (EASI-Fish) method that was used to quantify the vulnerability of bycatch species to the cumulative impacts of multiple fisheries in the EPO. Smooth hammerhead (*S. zygaena*) had the highest vulnerability of all shark species assessed, while scalloped hammerhead (*S. lewini*), scoophead (*S. media*), scalloped bonnethead (S. corona) and great hammerhead (*S. mokarran*) also ranked highly. This result lends support to the growing evidence that hammerheads are experiencing unsustainable impacts from fishing, not only throughout the EPO (Pérez-Jiménez, 2014; Zanella et al., 2019) but in all oceans of the world (Pacoureau et al., 2021).

In the Atlantic Ocean, Great hammerhead (*S. mokarran*), Scalloped Hammerhead (*S. lewini*), Smooth hammerhead (*S. zygaena*) are currently under assessment in the U.S. Gulf of Mexico and U.S. Atlantic[37], with preliminary results that all are overfished and that overfishing may be occurring on *S. lewini*. These results are likely similar across stock components in the Atlantic Ocean, and NAFO has estimated the stock status for S. lewini as overfished and overfishing occurring. The stock assessment indicated a 95% probability that the stock was overfished and 73% that overfishing was occurring[38].

The stock status of each of the Scalloped Hammerhead, Great Hammerhead and Smooth Hammerhead in the Western Central Pacific (WCPO) is unknown. Species-specific catch records of these hammerhead

36 FAO. 2013. Report of the fourth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-exploited Aquatic Species, Rome, 3–8 December 2012. FAO Fisheries and Aquaculture Report No. R1032. Rome, FAO. 161 pp. Page 13

37 https://sedarweb.org/assessments/sedar-77/

38 Lack, M., Sant, G., Burgener, M., and Okes, N. (2014) Development of a rapid managementrisk assessment method for fish species through its application to sharks: framework and results. Report to the Department of Environment, Food and Rural Affairs. Defra Contract No. MB0123.

sharks from the WCPO are extremely sparse. The hammerhead sharks appear to be distributed patchily both temporally and spatially (Brouwer and Harley 2015; Rice et al. 2015).

In the Indian Ocean, and specifically for the western Indian Ocean the IUCN status is 'Endangered'. The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type (Murua *et al.* 2018). Scalloped hammerhead shark received a low vulnerability ranking (No. 17) in the ERA.

The current IUCN threat status of 'Critically Endangered' applies to scalloped hammerhead sharks globally.

Mackerel sharks (family *Lamnidae*)

Mackerel sharks (currently family *Lamnidae*, although UNCLOS Annex 1 refers to them as *Isurida*) include the great white shark (*Carcharodon carcharias*), the shortfin mako (*Isurus oxyrinchus*), the longfin mako (*Isurus paucus*), the salmon shark (*Lamna ditropis*), and the porbeagle (*Lamna nasus*). Reported catches of Lamnidae have increased steadily from less than 2 000 tonnes in the early 1980s to over 16 000 tonnes in 2012, with the shortfin mako accounting for the bulk of catches. Since 2012 catches have declined to under 11 000 tonnes per year (10 500 tonnes in 2020).

Great white shark (*Carcharodon carcharias*)

The great white shark (*Carcharodon carcharias*), is of little interest to commercial fisheries. Information on population status and trends are scarce. There are no stock assessments for White Shark. Some estimates of population sizes from South Africa, California (US), and Australia exist, though the level of connectivity and stock structure is highly uncertain. The sensitivity of the species to harvest has led to its listing in Appendix II of CITES as well as on CMS and in the Protocol 'Endangered or Threatened Species' of the Barcelona Convention for the Protection of the Mediterranean Sea. The species is also protected in several range states including South Africa, Australia, USA, and Malta.

Mako Sharks- Shortfin mako (*Isurus oxyrinchus*)

The shortfin mako (*Isurus oxyrinchus*) is an important species for longline fisheries where it occurs, because of its high-quality meat. Given its life-history characteristics, the shortfin mako is expected to have medium resilience to exploitation (relative to other sharks). Its worldwide distribution and relatively high abundance in some areas probably means it is not currently at risk, but like all elasmobranchs it can be easily overfished and localized depletion is always a risk. An important caveat of the assessment of mako sharks is the common misidentification of longfin mako (*I. paucus*) for the more common *I. oxyrinchus* throughout their overlapping global distributions[39] (Levesque, 2007; Mucientes et al., 2013).
The most recent stock assessment (2017) indicated that the North Atlantic stock is overfished and overfishing is occurring[40]. The assessment of the southern stock indicated that the stock is possibly overfished with overfishing occurring.

In the Pacific Ocean the 2018 assessment of the northern stock indicated that, relative to MSY, the North Pacific shortfin mako stock is likely (>50%) not in an overfished condition and overfishing is likely

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39 Levesque, J.C., 2007. A comprehensive review of the biology and preliminary investigation of interactions with the US pelagic longline fishery for the shortfin (Isurus oxyrinchus) and longfin (Isurus paucus) mako sharks. Nova Southeastern University, Fort Lauderdale, FL. & Mucientes, G., Banon, R., Queiroz, N., 2013. Updated distribution range of longfin mako Isurus paucus (Lamniformes: Lamnidae) in the North Atlantic. J. Appl. Ichthyol 29, 1163-1165.

40 https://www.iccat.int/documents/scrs/execsum/shk_eng.pdf

(>50%) not occurring relative to MSY-based abundance and fishing intensity reference points[41].

In the Indian Ocean, the ecological risk assessment (ERA) conducted in 2018 consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type (Murua et al. 2018). Shortfin mako sharks received the highest vulnerability ranking (No. 1) in the ERA. An attempt was made to assess the shortfin mako stock in 2020, there is no quantitative stock assessment currently available for shortfin mako shark in the Indian Ocean. Therefore, the stock status is unknown.

The current IUCN threat status of ‘‘Endangered’ applies to shortfin mako sharks globally. The stock state in other areas is unknown. The shortfin mako is listed on Appendix II of both CMS and CITES.

Longfin mako (*Isurus paucus*)
Little is known about the distribution and state of longfin mako (*I. paucus*) populations. Catches have been only recorded in the Atlantic, with the highest catch (20 t) recorded in 2013. The species is probably often mistaken for the apparently far more common shortfin mako shark (*Isurus oxyrinchus*) or included with records for it. Without such information, management should be cautious with fisheries that catch this species. The longfin mako is listed on Appendix II of both CMS and CITES.

Salmon shark (*Lamna ditropis*)
The salmon shark (*Lamna ditropis*) is a common coastal-littoral, offshore and epipelagic shark, found in cool waters of the north Pacific. Historically, salmon shark was the second most important species, after the blue shark, caught by Japanese pelagic fisheries (longline and driftnet), with annual landings in the period from 1992-2006 ranging from 1 400 to 4 400 tonnes. They are also caught in salmon seines, by salmon trollers towing hooks, and possibly by bottom trawlers off Alaska. They are occasionally trammel-netted by halibut fishermen off California and as bycatch in gillnets set for swordfish and threshers sharks off California. The population appears to be stable and at relatively high levels of abundance. Currently there is no directed fishery in the Northeast Pacific, apart from a small sport fishery for the species in Alaska. Bycatch in the Northeast and Eastern Central Pacific appears to be at low levels and is not increasing at this point-in-time. Additionally, with the current ban on commercial fishing in Alaska state waters and fairly conservative sport fishing limits, it appears that the population is stable. Bycatch in the Eastern and Western Central Pacific has been significantly reduced since the elimination of the drift gillnet fishery and the population appears to have rebounded to its former levels. In addition, the most recent demographic analysis supports the contention that salmon shark populations in the Northeast and Northwest Pacific are stable at this time and it is assessed as Least Concern.

Porbeagle (*Lamna nasus*)
The porbeagle (*Lamna nasus*) is a coastal and oceanic, amphitemperate species, with its centres of distribution in the North Atlantic, and in a circumglobal band of temperate water of the southern Atlantic, southern Indian, southern Pacific and Antarctic Oceans. The species has been heavily fished commercially and utilized for human consumption in the temperate North Atlantic and the Mediterranean, but is also caught as bycatch in the Southern Hemisphere (e.g., it is the second most common shark taken as bycatch of the New Zealand longline fishery). Stocks in the North Atlantic have shown signs of serious overexploitation as indicated by a large decline in catch.

The northwestern Atlantic stock is considered overfished with overfishing occurring. A management plan

41 SC14-SA-WP-11 Stock Assessment of Shortfin Mako Shark in the North Pacific Ocean Through 2016. https://www.wcpfc.int/node/31025

to rebuild the stock is being implemented in the United States and Canada and catch quotas have been reduced to support the population recovery. The northeast Atlantic stock is also considered overfished, however it is uncertain if overfishing is occurring. Recent regulations adopted by the European Commission have prohibited the capture and landing of porbeagle shark in EU waters and also by fishing vessels flagged to the EU.

Porbeagle are an important bycatch of Japanese longliners and probably of the pelagic fishing fleets of other countries fishing in the southern Indian Ocean and elsewhere in the Southern Hemisphere. The catch is poorly known and may be little-utilized except for fins. The state of the stock(s) in the Southern Oceans is unknown, although available assessments indicate substantial declines in abundance in parts of the species range in the southern hemisphere. Recent impact assessments indicate that although the stock status of the species is currently unknown there is a very low risk that the Southern Hemisphere porbeagle shark is subject to overfishing anywhere within its range[42]. Porbeagle is listed on Appendix II of CMS and was also recently listed on Appendix II of CITES.

Conclusions

The general paucity of data about the shark species listed in Annex I of UNCLOS precludes a comprehensive assessment of the status and trends in exploitation of these species. According to the available information reviewed above, the state of exploitation is currently known for some stocks of only ten species (*C. falciformis, C. signatus, C. longimanus, P. glauca, S. lewini, S. mokarran, S.zygaena, I. oxyrinchus, L. ditropis and L. nasus*). About 65 percent of the stocks with available information are considered overfished. Effective conservation measures are required to protect these species against further declines and to recover their productive capacity. In general, sharks are vulnerable to overexploitation and depletion, especially locally. In the absence of stock specific information on the state of fisheries and fishery resources, it is prudent to consider the state of shark populations as being at least maximally sustainably fished, and to apply a precautionary approach to management.

2.3 Other highly migratory species

The species in this section, unlike tunas and to some extent sharks, have not attracted large or high profile fisheries. Therefore, there is little information about the biology of these species and the state of exploitation, other than reported catches[43]. The main “other highly migratory species” are pomfrets, sauries and dolphinfish.

The pomfrets (family Bramidae) include eight genera and 21 species. Annex I refers to the family Bramidae without listing individual species. Thus all 21 species are considered Highly Migratory with respect to UNCLOS. It is a family of pelagic, benthopelagic and bathypelagic fishes found in temperate and tropical waters of the Atlantic, Indian and Pacific Oceans. The main characteristic of most of the species is that they are oceanodromous, that is, they are migrating within oceans typically between spawning and different feeding areas, with migrations being cyclical, predictable and covering more than 100 km. The worldwide landings of pomfrets are poorly documented. The FAO database lists Atlantic pomfret (*Brama brama*), Southern rays bream (*Brama australis*), Sickle pomfret (*Taractichthys steindachneri*), Brilliant pomfret (*Eumegistus illustris*) and “Pomfrets, ocean breams not elsewhere included” (nei). Catches oscillated around an average of about 7 000 tonnes per year until the early 2000s. There was a marked increase in reported catches in recent years, from 11 700 tonnes in 2007 to a

42 WCPFC-SC13-SA-WP-12 Southern Hemisphere porbeagle shark (Lamna nasus) stock status assessment Rev 2 (6 December 2017). https://www.wcpfc.int/node/29525
43 The FAO Species Identification and Data Programme (SIDP) web site, Fishbase and other FAO information resources were used as sources of information on the biological characteristics and geographical distribution of the species of other highly migratory species.

historical high in excess of 58 000 tonnes in 2019. Total catches of 49 700 tonnes were reported in 2020, of which almost 80 percent originated from the Pacific Ocean, while the rest came from the Atlantic Ocean. Although fifteen countries report landings of pomfrets, five countries (Chile, the Russian Federation, Spain, Kazakhstan and South Africa) accounted for 96 percent of the reported catches in recent years . Because pomfrets are mostly caught as a bycatch in other fisheries, there is very limited biological information on the species. Pomfrets are included in some national management plans but are not assessed by international fisheries bodies. Although their state of exploitation is not known, they are unlikely to be overfished.

Sauries belong to the Scomberesocidae family. The species included in Annex 1 of UNCLOS are the Atlantic saury (*Scomberesox saurus*), the Pacific saury (*Cololabis saira*), the saury (C. *adocetus*), and the king gar (*Scomberesox saurus scombroides*)[44]. These species are pelagic, schooling and oceanodromous. Landings have fluctuated between 200 000 tonnes and 600 000 tonnes since 1950 without a clear long term trend. However, since 2014 (when catches reached an all-time high of 632 000 tonnes) catches have decreased substantially, reaching their second-lowest harvest in recorded history at 149 000 tonnes in 2020. That year, the Pacific saury (*C. saira*) was responsible for more than 99 percent of the total landings. Historically, Japan, Taiwan Province of China, Republic of Korea and the Russian Federation accounted for the bulk of the reported catches. Similar to pomfrets, sauries are included in national management plans but they are not a species of direct interest in international fisheries bodies. Recent assessment of Pacific saury (*C. saira*) done by NPFC indicated that the stocks were overfished with a high certainty.

The two dolphinfishes of the Coryphaenidae family, the common dolphinfish (*Coryphaena hippurus*) and the Pompano dolphinfish (*Coryphaena equiselis*), are included in Annex 1 of UNCLOS. Both species follow boats and associate with floating objects which may be used as attracting devices in fisheries. More than sixty countries reported dolphinfish landings to FAO (*C. hippurus* only). Reported landings show a sustained increasing trend from 7 000 tonnes in 1950 to almost 102 000 tonnes in 2020 after a maximum reached in 2015 at 125 000 tonnes. The Pacific Ocean accounts for more than 70 percent of catches in recent years, with Peru, Indonesia, Taiwan Province of China and Ecuador being the largest contributors. Dolphinfish are considered in some national fishery management plans and are assessed regularly by some international fishery bodies. Although the state of exploitation is not known, considering that the species is widely distributed and highly productive, it is unlikely that dolphinfish are overfished.

3. Selected Straddling Fish Stocks

The following sections summarize the state of the main straddling stocks in each FAO Statistical Area, based on the list of species identified by FAO for the 2005 Review Conference. The state of stocks is based mostly on the State of World Fisheries and Aquaculture 2014 (SOFIA)[45]. The main species that constitute straddling stocks are generally well studied (e.g. cod, pollock, flounders) compared to several highly migratory species, particularly the non-tunas. Therefore, this document does not review the biology, and life history and migratory behaviour of these species. Such information is readily available from various published sources of information or regional fishery bodies.

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44 The list contains three species and one subspecies belonging to one of the species cited. The species Scomberesox saurus has two subspecies: *S. saurus saurus* and *S. saurus scombroides*. It is assumed that *Scomberesox saurus* in Annex 1 is Scomberesox saurus saurus.

45 FAO. 2014. The State of World Fisheries and Aquaculture 2014 (SOFIA). FAO. Rome. 243 p.

3.1 Pacific Ocean

3.1.1 Northwest Pacific

Straddling stocks in the Northwest Pacific include Alaska (Walleye) pollock (*Theragra chalcogramma*), flying squid (*Ommastrephes bartrami*), Boreal clubhook squid (*Onychoteuthys borealjaponica*), Boreopacific armhook squid (*Gonatopsis borealis*), Pacific Ocean Perch (*Sebastes alutus*), pelagic armourhead (*Pentaceros richardsoni*) and the alfonsino (*Beryx splendens*).

The pollock stocks that produced record catches in the late 1980s, declined in the early 1990s mainly due to unregulated fishing in the international waters of the Northwest Pacific. In 1995, pollock fishing in the high seas areas of the Central Bering Sea (including in the “Donut Hole”) became regulated by the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea. The stock in the western Bering Sea showed a substantial decline in biomass in the early 1990s and remains at a low level since then[46]. Of the 3 management units of this stock, 2 are overfished and 1 maximally sustainably fished.

The stocks of squids display large variability in catches, abundance and distribution in response to changing environmental conditions in the North Pacific. There is scanty information about the state of the stocks. In general, considering that oceanic squids are widely distributed and highly productive, it is unlikely that they are currently overfished. However, from assessment done in 2019, it is considered that Japanese flying squid may be overfished but all other stocks are maximally sustainably fished.

Based on reported landings, the Pacific Ocean Perch was considered overfished in the 2010 review. A slight increase in catches has been reported since then, but the 2020 catches of 2 800 tonnes still represent a small fraction of the historical peak of 41 000 tonnes reported in 1979. In teh absence of new information, the state of the stock is likely to remain unchanged. The state of pelagic armourhead and alfonsino is also not known. Major decline in catch per unit effort of alfonsino in the North Pacific indicates that stocks are probably overfished or depleted[47].

3.1.2 Northeast Pacific

Straddling stocks in the northeast Pacific include Jack mackerel (*Trachurus picturatus symmetricus*) and Alaska (Walleye) pollock (*Theragra chalcogramma*). The Jack mackerel is widespread in the northeastern and northwestern Pacific and are considered to be maximally sustainably fished. The stocks of Alaska pollock in the Eastern Bering Sea and Aleutian Islands region are also maximally sustainably fished.

3.1.3 Western Central Pacific

There is no information on straddling stocks in the Western Central Pacific.

3.1.4 Eastern Central Pacific

The straddling stocks of giant squid (*Dosidicus gigas*) and Spanish mackerel (*Scomber japonicus*) in the Eastern Central Pacific are not overfished. The giant squid stocks had peak landings in the mid 1990’s of 120 000 tonnes. Since then, landings have declined and in 2020 were around 7 300 tonnes. However, Pacific Chub mackerel/Spanish (*Scomber japonicus*) has seen landings increase almost 11 fold from 8 000 tonnes in 2011 to around 94 000 tonnes in 2018. Landings in 2020 were 51 000 tonnes. While no information is available for this stock, the 2018 landings were the highest on record and it is likely that the stock is maximally sustainably fished to overfished in recent years. The stock of jack mackerel

46 18th meeting of the Scientific and Technical Committee of the Parties to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea, 16 – 30 September 2013.

47 Bensch, A.; Gianni, M.; Gréboval, D.; Sanders, J.S.; Hjort, A. 2009. Worldwide review of bottom fisheries in the high seas. FAO Fisheries and Aquaculture Technical Paper. No. 522, Rev.1. Rome, FAO. 2009. 145p. Page 16

(*Trachurus symmetricus*) also remains lightly exploited since the mid-1990's. Catches of jack mackerel have shown a clear downward trend from the late 1970s until 1995, a year for which no landings were recorded. In 2020 there was a slight increase (444 tonnes were reported landed), which is still well below the historical peak of 66 000 tonnes recorded in 1952. The severe decline and low catches of jack mackerel in the last decades appears to be mostly due to lack of commercial interest in the species.

3.1.5 Southwest Pacific

There are two types of straddling fish stocks in the southwest Pacific. The more common types associated with large continental shelves and another type associated with small islands with limited continental shelves whose fishery depend on oceanic resources found both within and outside their EEZ's. Species with straddling stocks include orange roughy (*Hoplostethus atlanticus*), oreo dories (*Allocyttus verrucosus, A. Niger, Neocyttus rhomboidalis, Pseudocyttus maculatus*) and hoki (*Macruronus novaezealandiae*). Straddling oceanic resources include the narrow-barred Spanish mackerel (*Scomberomorus commerson*), flying squids, and flying fish.

Orange roughy (*Hoplostethus atlanticus*) is overfished, oreo dories are maximally sustainably fished to overfished and hoki is maximally sustainably fished. The state of exploitation of narrow-barred Spanish mackerel, flying squid and flying fish is unknown, though landings have declined by more than 50% in some cases.

3.1.6 Southeast Pacific

Straddling stocks in the southeast Pacific include jumbo squid (*Dosidicus gigas*) and Chilean jack mackerel (*Trachurus picturatus murphyi*). Spanish mackerel (*Scomber japonicus*) is designated as overfished (catches are a 3rd, 200 000 tons compared to the peak at 700 000 tons in the early 2000's). The Chilean jack mackerel is considered maximally sustainably exploited to overfished, while the stock of jumbo squid is maximally sustainably fished, and catches have increased to 800 000 tons annually.

3.2 Atlantic Ocean

3.2.1 Northwest Atlantic

Straddling stocks in the northwest Atlantic include cod (*Gadus morhua*), American plaice (*Hypoglossoides platessoides*), redfish (*Sebastes marinus*), witch flounder (*Glyptocephalus cynoglossus*), Atlantic halibut (*Hippoglossus hippoglossus*), black halibut (*Reinhardtius hippoglossoides*), yellowtail flounder (*Pleuronectes ferruginaeus*), grenadiers (Macrouridae), capelin (*Mallotus villosus*) and shrimp (*Pandalus borealis*). It should be noted that stocks of some of the species on the Flemish Cap (NAFO Division 3M), such as cod, redfish, American place and shrimp, may be separate from EEZ stocks, and as such, may be other high seas fish stocks, rather than straddling stocks. Therefore their status is discussed separately in this section.

Based on the most recent assessments by the Northwest Atlantic Fisheries Organization (NAFO)[48], the stocks of redfish in the Flemish Cap are designated overfished by NAFO. The stock of American place has shown some slight increase in biomass in recent years and is now estimated to be maximally sustainably fished to overfished. The stock of shrimp in Flemish Cap is now considered overfished to maximally sustainably fished and in recent years the catches have been a record high of 83 000 tonnes and 59 000 tonnes in 2018 and 2019 respectively.

As for the main straddling stocks, cod is under a rebuilding plan and a moratorium implemented in 1994 but remains overfished, with very low levels of biomass. The stocks of American plaice and Atlantic

48 http://www.nafo.ca/science/advice/nafo-stocks.html

halibut are considered maximally sustainably fished, while those of capelin and shrimp are estimated to be overfished. Witch flounder stocks are overfished. The stocks of redfish are considered maximally sustainably fished and those of yellowtail flounder are considered maximally sustainably fished to overfished. The stock of halibut was considered maximally sustainably fished. The state of grenadiers is unknown.

3.2.2 Northeast Atlantic

The main "traditional" straddling stocks in the northeast Atlantic are: blue whiting (*Micromesistius poutassou*), oceanic redfish (*Sebastes mentella*), cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), black (Greenland) halibut (*Reinhardtius hippoglossoides*), Norwegian spring-spawning herring (*Clupea harengus*), mackerel (*Scomber scombrus*) and horse mackerel (*Trachurus trachurus*).

The stocks of blue whiting, mackerel, herring and Greenland halibut are maximally sustainably fished. The stocks of horse mackerel appear to be maximally fished to overfished. The stocks of haddock are estimated to be maximally sustainably fished and those of cod are maximally sustainably fished to overfished. Oceanic redfish was considered maximally sustainably fished.

In addition to these, most deep water species for which fisheries have developed in recent decades are also considered as being straddling. These species are: Baird's smoothhead (*Alepocehalus bairdii*), Risso's smoothhead (*Alepocephalus rostratus*), Blue antimora (Blue hake, *Antimora rostrata*), Black scabbardfish (*Aphanopus carbo*), Iceland catshark (*Apristuris* spp), Greater silver smelt (*Argentina silus*), Alfonsinos (*Beryx* spp.), Tusk (*Brosme brosme*), Gulper shark (*Centrophorus granulosus*), Leafscale gulper shark (*Centrophorus squamosus*), Black dogfish (*Centroscyllium fabricii*), Portuguese dogfish (*Centroscymnus coelolepis*), Longnose velvet dogfish (*Centroscymnus crepidater*), Deep water red crab (*Chaceon* (*Geyron*) *affinis*), Rabbit fish (Rattail) (*Chimaera monstrosa*), Frilled shark (*Chlamydoselachus anguineus*), Conger eel (*Conger conger*), Roundnose grenadier (*Coryphaenoides rupestris*), Kitefin shark (*Dalatias licha*), Birdbeak dogfish (*Deania calceus*), Black (Deep water) cardinal fish (*Epigonus telescopus*), Greater lanternshark (*Etmopterus princes*), Velvet belly (*Etmopterus spinax*), Blackmouth dogfish (*Galeus melastomus*), Mouse catshark (*Galeus murinus*), Bluemouth (Blue mouth redfish) (*Helicolenus dactylopterus*), Bluntnose six-gilled shark (*Hexanchus griseus*), Orange roughy (*Hoplostethus atlanticus*), Silver roughy (Pink) (*Hoplostethus mediterraneus*), Large- eyed rabbit fish (Ratfish) (*Hydrolagus mirabilis*), Silver scabbard fish (Cutless fish) (*Lepidopus caudatus*), Eelpout (*Lycodes esmarkii*), Roughhead grenadier (Rough rattail) (*Marcrourus berglax*), Blue ling (*Molva dypterigia*), Ling (*Molva molva*), Common mora (*Mora moro*), Sailfin roughshark (Sharpback shark) (*Oxynotus paradoxus*), Red (blackspot) seabream (*Pagellus bogaraveo*), Forkbeards (*Phycis* spp.), Wreckfish (*Polyprion americanus*), Round skate (*Raja fyllae*), Arctic skate (*Raja hyperborea*), Norwegian skate (*Raja nidarosiensus*), Straightnose rabbitfish (*Rhinochimaera atlantica*), Knifetooth dogfish (*Scymnodon ringens*), Small redfish (Norway haddock) (*Sebastes viviparous*), Greenland shark (*Somniosus microcephalus*), Spiny (Deep-sea) scorpionfish (*Trachyscorpia cristulata*).

Fisheries for deep water species typically develop rapidly in the Northeast Atlantic stimulated by management limitations and reduced resource availability of traditional species in shallower water. These "new" fisheries tend to last for a decade or so before catches decline and/or restrictive measures are adopted. This pattern is stock dependent but has been observed from the 1970s to around the early 2000s. Several of these species are caught as bycatch in multispecies fisheries and, with very few exceptions, the state of stocks is not assessed using traditional stock assessment methodologies because of the limited data available. For data-limited stocks, ICES[49] provides advice on precautionary catch levels based on

49 http://www.ices.dk/community/advisory-process/Pages/Latest-Advice.aspx

ancillary information, including CPUE trends.

Recommendations to increase or maintain constant the allowable catches are made for stocks that show consistent increasing or stable trends in abundance indicators. This is the case, for instance, for the stocks of alfonsino, black scabbardfish, greater forkbeard, ling, some stocks of roundnose grenadier, greater silver smelt and tusk. These stocks are probably maximally sustainably fished.

For stocks with declining trends in abundance indicators or a past history of depletion, the recommendation is to decrease catches or to not allow any catch from direct and bycatch fisheries. Among the stocks in this situation are the orange roughy, red (blackspot) seabream and some stocks of blue ling, great silver smelt, roundnose grenadier and tusk. These stocks are probably overfished. No information is available on the state of the other species.

In the ABNJ part of the NE Atlantic, managed by NEAFC, there are bans on directed fishing for deep sea sharks, rays and chimaeras since 2020, and the deployment of gillnets since 2006.

3.2.3 Eastern Central Atlantic

The analysis of catches by non-coastal States in the Eastern Central Atlantic indicated that the target stocks are composed of a mixture of coastal and oceanic species such as common cuttlefish (*Sepia officinalis*), octopuses (Octopodidae), red porgy (*Pagrus pagrus*), West African goatfish (*Pseudupeneus prayensis*), common sole (*Solea solea*), cuttlefish (Sepiidae), bobtail squids (Sepiolidae), European hake (*Merluccius merluccius*), Natantian decapods, Croakers and drums (Sciaenidae), tonguefish (Cynoglossidae), chub mackerel (*Scomber japonicus*), European pilchard (*Sardina pilchardus*), jack and horse mackerel (*Trachurus* spp), alfonsinos (*Beryx* spp), flatfishes (Pleuronectiformes), Senegalese hake (*Merluccius senegalensis*) and other marine fishes. Considering that most of these species are likely to be distributed inside EEZs, and are being caught under fishing agreements with coastal States, it was concluded, as in the previous review elaborated by FAO, that there are no significant fisheries for straddling stocks outside of EEZs at present in the Eastern Central Atlantic.

3.2.4 Western Central Atlantic

The analysis of catches by non-coastal States was also performed for the Western Central Atlantic. It identified catches of a mixture of coastal and oceanic species in general categories such as: sharks, rays and skates (Elasmobranchii), croakers and drums (Scianidae), Natantian decapods and other marine fishes (Marine fishes nei), which suggest that these catches were probably made within EEZs under fishing agreements with coastal States. As for the Eastern Central Atlantic, it was concluded that there are no significant fisheries for straddling stocks outside EEZs at present in the Western Central Atlantic.

3.2.5 Southwest Atlantic

Straddling stocks in the southwest Atlantic include short-fin squid (*Illex argentinus*), common (Patagonian) squid (*Loligo* spp.), a flying squid (*Martialia hyadesi* of the Ommastrephidae family), the hakes (*Merluccius hubbsi* and *M. australis*), the southern blue whiting (*Micromesistius australis*), the pink cusk eel (*Genypterus blacodes*), the Patagonian toothfish (*Dissostichus eleginoides*), the tadpole mora (*Salilota australis*), the Patagonian grenadier (*Macruronus magellanicus*), the grenadier (*Macrourus whitsoni*), the Antarctic cod (*Notothenia rossii*), rockcods (*Notothenia* spp.) and sharks and rays.

The state of stocks of flying squid, tadpole mora, grenadier, Antarctic cod, rockcods and the shark and rays are not known. The Patagonian grenadier is overfished to maximally sustainably fished and the Patagonian squid are maximally sustainably fished. The Patagonian toothfish and the shortfin squid are estimated to be maximally sustainably fished.

The stocks of pink cusk eel, the southern blue whiting, southern hake (*M. australis*) and the Argentinean hake (*M. hubbsi*) are considered to be overfished.

3.2.6 Southeast Atlantic

The Southeast Atlantic Fisheries Organization (SEAFO) identified the following species as straddling: alfonsinos (Family Bercycidae), orange roughy, horse mackerel (*Trachurus* spp.), lanternfish (Family Myctophidae), mackerel (*Scomber* spp), skates (Family Rajidae), sharks (Order Selachomorpha), armourhead (*Pseudopentaceros* spp), cardinal fish (*Epigonus* spp), deep sea red crab (*Chaceon maritae*), octopus (Family Octopodidae), squids (Family Loliginidae), and wreckfish (*Polyprion americanus*). There is a general lack of data on the state of fisheries and stocks of most of these species. As a precautionary measure against overfishing, catch limits based on harvest control rules and closed areas have been established by SEAFO for some deep water species considered highly vulnerable to fishing, including orange roughy, oreo dories, alfonsino, armourhead, cardinal fish, wreckfish and deep-sea red crab. However, the state of exploitation is unknown for all of the species except for stocks of horse mackerel which vary from maximally sustainably fished to overfished.

3.3 Indian Ocean

No fisheries on straddling stocks have been identified in the Indian Ocean. There are straddling resources (e.g. deep water snapper), but they are not fished to any significant extent. As noted by Maguire et al. (2006), there are also areas in the Indian Ocean that are suitable for straddling stocks in terms of topography with relatively shallow water extending from an EEZ into the high seas, such as shelf areas off Mauritius and the Seychelles in the Western Indian Ocean and the South Tasmanian Rise in the Eastern Indian Ocean. However, as noted also in the previous review prepared by FAO, fishing on straddling stocks does not seem significant at present in those areas.

3.4 Southern Ocean

The Southern Ocean is considered to be delimited by the Antarctic Convergence where cold Antarctic waters meet warmer waters of the Atlantic, Pacific and Indian Oceans to the north. There is a unique legal situation for the Southern Ocean (FAO statistical areas 48, 58, and 88) which is within the jurisdiction of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)[50]. Claims of sovereignty over the Antarctic Continent or its continental shelf have been put aside under provisions of the Antarctic Treaty (which entered into force in 1961)[51]. However, several countries have established EEZs within the Southern Ocean area of CCAMLR off the coasts of their island territories in that area, in addition to the EEZs extending from the tip of South America. Given the unique situation of the Southern Ocean with respect to territorial and jurisdictional claims, this review reports on all of the species fished in the CCAMLR convention area as if they were straddling fish stocks or other high seas fish stocks.

Prior to the mid-1960s, only whale catches were reported to FAO from the Southern Ocean. Since then, the fisheries have targeted various species including marbled rockcod, mackerel icefish, humped rockcod, south Georgian icefish, Patagonian and Antarctic toothfish and Antarctic krill. Reported catches exceeded 600 000 tonnes in the early 1980s, but dropped to almost 73 000 tonnes in 1993 and followed a gradual increasing trend since then, with 462 000 tonnes reported in 2020. Catches in the last decade (2010-2019) have been dominated by Antarctic krill (*Euphausia superba*) (93%), Patagonian toothfish (*Dissostichus eleginoides*) (4%) and Antartic toothfish (*Dissostichus mawsoni*) (2%). About fifty species are reported in the remaining 1% of the total catches. IUU (Illegal, Unreported and Unregulated) fishing is a concern within the convention area of CCAMLR and creates uncertainties on the actual volume of catches, especially of the Antarctic toothfish.

Antarctic krill is non-maximally fished as catches are well below the precautionary catch limit established

50 http://www.ccamlr.org/default.htm

51 http://www-old.aad.gov.au/information/treaty/treaty.asp

by CCAMLR. Lanternfishes (Myctophidae) are also probably non-maximally fished in all FAO Areas. The Patagonian toothfish and the Antarctic toothfish are considered maximally sustainably fished and the mackerel icefish is considered overfished. No new information was available on the status of these stocks and they were assumed to remain unchanged.

3.5 Mediterranean Sea

Most of the Mediterranean states have not exercised their right to establish, implement or give effect to the claims on exclusive economic zones (EEZs) beyond the 12 nautical miles of territorial sea, so many of the exploited stocks correspond to the definition of a straddling stock. The General Fisheries Commission for the Mediterranean (GFCM) uses the concept of shared stocks, exploited by two or more countries on the high seas and only by the riparian countries in territorial waters. Such stocks in the Mediterranean include hake (*Merluccius merluccius*) in the Gulf of Lions, deep sea shrimps, the blue and red shrimp (*Aristeus antennatus*) and the giant red shrimp (*Aristaeomorpha foliacea*), sardines (*Sardina pilchardus*) in the Sea of Alboran and Adriatic Sea and anchovy (*Engraulis encrasicolus*) in the gulf of Lions and the Adriatic sea. The blue and red shrimp and the giant red shrimp are considered to be overfished in the western Mediterranean. The state of these stocks in the eastern Mediterranean is unknown. The stocks of rose shrimp and hake are considered to be from maximally sustainably fished to overfished in different zones. The estimated state of sardines and anchovies ranges from maximally sustainably fished to overfished, depending on the zone. It should be noted that fishing with towed gears beyond 1 000 m depth is forbidden by GFCM.

4. Other High Seas Fish Stocks

This section considers the fish stocks that are not comprised of highly migratory species and occur exclusively in the high seas, i.e. in waters beyond the areas of national jurisdiction, as referred to in section 1.1. The high seas stocks comprise deep water demersal and pelagic species, and include finfish and shellfish[52]. Most fisheries[53] for these deep water species are relatively recent, with many developing in the late 1970s and 1980s when the demersal stocks showed a very high biomass comprised mostly of old unproductive individuals. The development of the majority of these fisheries outpaced the ability to provide scientific information and to implement effective management, although at this time there was no fisheries management of the high seas. A considerable amount of knowledge on these fisheries and on the harvested stocks has accumulated over the past 20 years and now all, or almost all, are actively managed by RFMOs.

Some of the deep-water species, especially those associated with seamounts, are vulnerable to over-exploitation and depletion (at least localized) because of their slow growth and late maturity. These species are also slow to recover from over-fishing and their biology and stock structure is poorly understood. Many species form dense aggregations which are accessible to fisheries which have developed the capability to fish in deep water (to 1 500 m or more) with the development of targeted trawling in the 1990s. Deep water fisheries often exploit aggregations associated with topographic features like seamounts, ocean ridges and canyons. However, fisheries associated with particular topographic features usually do not persist, presumably because of localized depletion of the fishery

52 The information from this section is drawn / adapted from the chapter on Deepwater fisheries in the last Review of the State of World Marine Resources (*FAO Fisheries Technical Paper* No. 569), Deep Sea 2003, an international Conference on Governance and Management of Deep-Sea Fisheries (*FAO Fisheries Report* No. 772), advice and information from the Advisory Committee on Fisheries Management of the International Council for the Exploration of the Sea, and other Regional Fisheries Organisations.

53 There is no rigorous definition of a deep water fishery, but in general, they occur in depths of at least 500 m, and they are commonly though of as occurring at depths of 1000 m or more. Current technology allows fishing to depths of about 2500 m.

resource.

Important species that form deep water aggregations include orange roughy (*Hoplostethus atlanticus*) and the oreos (*Allocyttus* spp., *Neocyttus* spp. *Pseudocyttus* spp., etc), alfonsinos (*Beryx* spp.) in lower latitude fisheries, Patagonian toothfish (*Dissostichus eleginoides*) in Southern Ocean fisheries, pelagic armourhead (*Pseudopentaceros wheeleri*) and various species of Scorpaenidae found on both coasts of North America. A number of deep water species, treated under straddling stocks in the North East Atlantic, also potentially make up other high seas fish stocks.

The Orange Roughy (*Hoplostethus atlanticus*), a member of the Trachichthyidae family, is found in the North and South Atlantic, in the Southern Indian Ocean, the Tasman Sea, around New Zealand, and in the South Pacific. They are found within EEZs, some are straddling stocks, while others are distributed entirely on the high seas. The proportion of the resource outside of the fished area is not known. Fisheries appear to have serially depleted fish aggregations that may or not correspond to distinct stock units. The biological characteristics of this species (slow growth and exceptional longevity) and its aggregating behaviour make it vulnerable to overfishing. As such, many smaller fisheries for this species have been closed down as the stocks have been overfished and the fishery has become commercially unviable.
The Oreo dories (*Allocyttus* spp., *Neocyttus* spp. and *Pseudocyttus* spp.), members of the Oreostomadidae, occur close to the seabed in deep waters. They form large aggregations over rough grounds near seamounts and canyons in the Antarctic, Atlantic, Indian, and Pacific oceans (reported primarily off South Africa, New Zealand and southern Australia). As for orange roughy, the proportion of the resource outside of the fished area is not known and fisheries appear to have serially depleted fish aggregations that may or may not correspond to distinct stock units.

The Alfonsino (*Beryx splendens*), belong to the Bericidae family and are found in the Atlantic, Indian, western and central Pacific Oceans though they are generally not present in the northeast Pacific. They inhabit the outer shelf (180 m) and slope to at least 1 300 m depth, and they may make vertical migrations at night. Genetic studies suggest that Alfonsinos may have an ocean-wide population structure, but the relationship between the various fish aggregations is not known. Unlike many other deep-water species, Alfonsino growth rates are not very low and the species is moderately productive, which means that the species should be better able to sustain higher catch rates than other less productive deep water species.

Toothfishes (*Dissostichus* spp.), belong to the Notothenidae family and have a circumpolar distribution within Antarctic and Southern Ocean waters. Patagonian toothfish (*D. eleginoides*) are found asymmetrically around southern South America and Antarctic toothfish (*D. mawsoni*) occurs in high latitudes, in the Pacific region. The two species overlap between 60°S and 65°S and both occur to depths of 3 000 m. The northern limit for most populations of Patagonian toothfish is 45°S, except along the Chilean and Argentinean coasts where they may extend north in deeper cold water. Significant populations of Patagonian toothfish exist in the waters of, and adjacent to, the various sub-Antarctic islands and of Chile, Argentina, Uruguay and Peru. The problem of illegal, unregulated and unreported fishing (IUU) has been considerably reduced in recent years. However, it still remains a major concern in many regions but is difficult to quantify.

Pelagic armourhead (*Pseudopentaceros wheeleri* and *P. richardsoni*), belong to the Pentacerotidae family. The species is associated with seamounts, especially in the North Pacific, but the family is distributed throughout the Indian and Pacific Oceans and in the southwestern Atlantic. Trawling by Japanese and Russian vessels between 1969 and 1982 depleted the stocks of pelagic armourhead along the Emperor Seamount chain and the Northern Hawaiian Ridge. The species was later replaced in the area by alfonsino (*Beryx splendens*), although the alfonsino has never been as abundant as the pelagic armourhead was. The stocks of both species are at low levels, though both currently support small fisheries. Pelagic armourhead undergoes years of good and poor recruitment and the management catch limits reflects that.

Hoki (*Macruronus novaezelandiae*) is a benthopelagic Merlucciidae, that usually lives near the bottom of the southwest Pacific Ocean, but the species also form mid-water aggregations for spawning. Large adult fish generally occur deeper than 400 m, while juveniles may be found in shallower water. Midwater trawl fisheries target aggregations near canyons that are often close to coasts in areas of narrow continental shelves. While fisheries for hoki are generally considered deep water fisheries, most of the catch is from EEZs. The significance of hoki as a “other high seas fish stock” is probably minor. Management experience in at least some jurisdictions indicates that fisheries exploiting hoki can be sustainably managed.

A further suite of deep water, or at least slope species, have been the target of fisheries in many tropical regions. These can be targeted by small-scale deep-water fisheries usually along the shelf break and shelf slope wherever the continental shelf is relatively narrow and the fishing grounds are accessible to fishermen using small fishing boats. The principal species consist of members of the Lutjanidae (snappers), Serranidae (Sea basses: groupers and fairy basslets), and Carangidae (Jacks and pompanos) families and mostly importantly include the Eteline snappers (e.g. *Etelis coruscans* and *E. carbunculus*) and the jobfishes (e.g. *Pristomopoides filamemtosus*, *P. typus* and *P. multidens*). These fisheries are particularly important to small island states that often have few other demersal fish resources though they are also widely found along the continental margins in tropical and sub-tropical areas. However, their significance as “other high seas fish stocks” is probably minor.

5. Associated Species

As mentioned earlier in this review, associated species are considered to be impacted species that are not part of the landed catch. Fisheries for straddling fish stocks, highly migratory fish stocks, and other high seas fish stocks, impact other species as a result of (1) discards, (2) physical contact of fishing gear with organisms (and habitat) that are not caught, and (3) indirect processes. Since the preparation of the FAO report to the 2006 Review Conference there was no new comprehensive review of these impacts on a global scale. Considering that the information presented in 2006 remain relevant, the sections below summarize the main consideration made about these mechanisms.

5.1 Discards

Information on global fisheries discards was last reviewed by Perez-Roda et al (2019)[54]. The highest discard rates[55] are associated with shrimp trawling fisheries. Where use of bycatch reduction devices (BRDs) is mandated (e.g. as in the Labrador and Flemish Cap fishery), the discard rate is relatively low. There are a variety of finfish and invertebrate species caught, including juveniles of target species of many fisheries.

Fisheries for straddling fish stocks and other high seas fish stocks are primarily conducted with bottom trawlers using otter trawls. The estimated discard rate for bottom trawlers using otter trawls is 30.9% (for all fisheries). As this also includes some tropical crustacean trawls, it is possible that the rate for finfish is lower, but there is no basis to judge if the rate is likely to be higher or lower for straddling fish stocks and

54 Pérez Roda, M.A. (ed.), Gilman, E., Huntington, T., Kennelly, S.J., Suuronen, P., Chaloupka, M. and Medley, P. 2019. A third assessment of global marine fisheries discards. FAO Fisheries and Aquaculture Technical Paper No. 633. Rome, FAO. 78 pp.

55 Percentage of total catch discarded.

other high seas fish stocks than for stocks entirely within EEZs. Many species are discarded depending on the target species (typically the species composition differs between flatfish and roundfish fisheries), geographic area, and depth. Discards of juveniles of the target species are common, as well as species with low commercial value, such as horse mackerel, long jawed mackerel (*Rastrelliger* spp), elasmobranchs (e.g. dogfish and skates), arrowtooth flounders and flathead sole. Many benthic invertebrates are discarded, such as molluscs, echinoderms (e.g. urchins and starfish), crabs, rajids, and whelks. Deepwater trawling (often at 1 000 m or more) results in discards of additional species, such as grenadiers, whiptails, rabbitfish, oreos, chondrichthyans (e.g. birdbeak dogfish), batoids and chimaeroids, and cold water corals (*Lophelia sp.*).
In addition to bottom trawlers, demersal longlining is an important form of fishing in the Southern Ocean in the CCAMLR area (Statistical Areas 48, 58, 88). The discard rate for this type of fishing is estimated as 23.9% (with a 95% confidence interval from 18% to 31.1%). The overall discard rate in the CCAMLR area is estimated as 7.5% resulting in about 18 500 tonnes annually.

Charismatic species[56] and endangered, threatened and protected (ETP) species are known bycatch of fisheries for highly migratory fish stocks, straddling fish stocks and other high seas fish stocks. Sea turtles and seabirds are a well-documented bycatch in longline fisheries for tuna and tuna-like species and for demersal species, such as the Southern Ocean demersal longline fishery for toothfish. Concern about seabird mortality from longline fisheries leads the FAO Committee on Fisheries to adopt an International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries[57]. FAO also held both an Expert Consultation[58] and a Technical Consultation[59] to consider ways of reducing mortality of sea turtles in fishing operations, including in longline fisheries. Measures introduced in several fisheries and RFBs (such as changes in hook shape, bait type and the use of torilines) have reduced significantly the bycatch of sea birds and sea turtles in longline fisheries. Nevertheless, the latest FAO report suggests that one million seabirds and 8.5 million sea turtles are still captured and discarded annually, but most of these are probably captured in EEZ's.

Bycatch of marine mammals is known to occur in some trawl fisheries (particularly large high speed pelagic trawls) and to a lesser extent on longlines. It is unclear to what degree marine mammal bycatch by trawlers and longliners occurs in high seas fisheries, but there is probably some. In the case of purse seine fishing for tuna in the Eastern Tropical Pacific, dolphins are intentionally encircled in the nets since they are an indicator of the location of schools of tuna. This practice has resulted in a cumulative mortality of several million dolphins since the 1960's, jeopardizing some dolphin species. This led to the negotiation of the Agreement on the International Dolphin Conservation Program (AICDP), which entered into force in 1999, and whose Secretariat is provided by the Inter-American Tropical Tuna Commission (IATTC). The Program reduced drastically the mortality from 132 000 dolphins in 1986 to about 800 in 2013. In spite of this success, dolphin populations appear to have been slow to recover[60]. The most recent FAO report indicates that 650 000 marine mammals are estimated to be caught and discarded, but also in this case, it is not really possible to provide an estimate of the fraction of these that comes from fisheries in the high seas.

56 Species which significant segments of society want protected regardless of their abundance.

57 http://www.fao.org/figis/servlet/static?dom=org&xml=ipoa_seabirds.xml

58 FAO. 2004. Expert Consultation on the Interactions between Sea Turtles and the Fisheries within an Ecosystem Context. Rome, Italy, 9-12 March 2004. *FAO Fisheries Report* No. 738. Rome, 37p. http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/007/y5477e/y5477e00.htm

59 FAO. 2004. Technical Consultation on Sea Turtles Conservation and Fisheries. Bangkok, Thailand, 29 November-2 December 2004. *FAO Fisheries Report* No. 765. Rome, FAO. 31p. http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/007/y5887e/y5887e00.htm

60 http://www.iattc.org/DolphinSafeENG.htm for the IATTC conservation program and http://swfsc.nmfs.noaa.gov/PRD/ for the Southwest Fisheries Science Center (US National Marine Fisheries Service) research program on dolphin conservation.

The recent expansion of trawl fisheries to deepwater (often much more than 1 000 m) into areas previously unfished has resulted in the bycatch of cold-water corals (*Lophelia sp.*), sometimes as boulder size pieces. For instance, it was estimated that in the first year of the deepwater trawl fishery for orange roughy on the South Tasman Rise straddling the Australian EEZ 10 000 tonnes of coral were caught associated with a catch of about 4 000 tonnes of orange roughy[61].

5.2. Physical contact by fishing gear with organisms that are not caught, and indirect processes

Trawling, bottom set gillnets, longlines and pots are the primary type of fishing that results in physical contact between fishing gear and the sea floor. Bottom fishing conducted on habitats containing cold water corals or sponges, will result in damage to these habitats which will be very slow to recover. Such habitats are called vulnerable marine ecosystems (VMEs) and they are susceptible to significant adverse impacts from bottom fisheries. Impacts that take longer than 15-20 years to recover are deemed significant and mitigation measures must be adopted to avoid further impacts. This became the subject of discussions in the UN in the early 2000s and resulted in the adoption of UNGA Resolution 61/105 in 2006 and the development of the FAO DSF Guidelines in 2008[62].

From around 2010, RFMOs started to designate areas within their high seas area of competence that gave protection to VMEs. This includes limiting fisheries to the historical footprint and closing areas containing VMEs to bottom fishing. Fishing outside of the historical footprint require the completion of a special exploratory fishing protocol under the supervision of the RFMO. Further, there are encounter protocols in place to identify and close further VMEs areas should they be discovered during the course of fishing. By 2022, the management of high seas bottom fisheries has been completely transformed with a high percentage of observer coverage, mandatory vessel position reporting through VMS, identification of where high seas vessels are fishing, and full catch reporting.

6. Straddling fish stocks, highly migratory fish stocks and other high seas fish stocks for which no measures have been adopted by regional fisheries management organisations or arrangements

Fisheries on highly migratory tuna and tuna-like species as defined by UNCLOS Annex I, are all under some form of management. However, the global nature of some highly migratory species fishing fleets and of markets, make it more difficult for regional organizations to manage fisheries on these species than it is to manage fisheries that are less global.

Unlike fisheries for tuna and tuna-like species, management of fisheries for oceanic sharks and other highly migratory species listed in Annex 1 is spotty and incomplete. The International Plan of Action for the Conservation and Management of Sharks is a non-binding instrument that should guide management of oceanic sharks, but it does not implement conservation measures. Regional Fisheries Organizations that have jurisdiction over fisheries that interact with oceanic sharks and other highly migratory species (particularly longline fisheries) are aware of bycatch issues, but for the most part, it is unregulated. In

61 Anderson, O.F. and M.R. Clark. 2003. Analysis of the bycatch in the fishery for orange roughy, *Hoplostethus atlanticus*, on the South Tasman Rise. Marine and Freshwater Research. **54**: 643-652. Also see a review by Matthew Gianni (2004. High seas bottom trawl fisheries and their impacts on the biodiversity of vulnerable deep-sea ecosystems: options for international action. IUCN. 83 pp. http://www.iucn.org/themes/marine/pdf/Gianni_HS- BottomTrawling_FullVersion.pdf)

62 FAO. Report of the Technical Consultation on International Guidelines for the Management of Deep-sea Fisheries in the High Seas. Rome, 4–8 February and 25–29 August 2008. FAO Fisheries and Aquaculture Report. No. 881. Rome/Roma, FAO. 2008. 86p.

recent years several RFMOs have adopted measures to combat the finning of sharks and to prevent the capture and landing of sharks species of conservation concern, including those listed in the Appendices of CITES.

With the exception of a few species producing large catches (e.g. tunas and swordfish), knowledge of the biology and state of exploitation of highly migratory species (such as billfishes and sailfishes) remains scarce. Knowledge is even more limited for most shark species included in UNCLOS Annex I.
Fisheries on pomfrets, sauries and dolphinfish are sometimes included in national fishery management plans, either as a component of the plans for other species or on their own, but generally speaking, a more systematic treatment of these species is necessary before it could be said that the fisheries exploiting them are properly managed.

Most fisheries on straddling fish stocks are either covered, or in the process of being covered, by existing regional fisheries management organizations, or organizations and arrangements that are in the process of being formed. The situation is more variable for fisheries for other high seas fish stocks, especially those that are associated with the seafloor. The management of deep-sea fisheries in the high seas are presently addressed by the General Fisheries Commission for the Mediterranean (GFCM, in force 1949), North East Atlantic Fisheries Commission (NEAFC, 1954), Northwest Atlantic Fisheries Organization (NAFO, 1979), the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR, 1982), South East Atlantic Fisheries Organisation (SEAFO, 2003), South Pacific Regional Fisheries Management Organisation (SPRFMO, 2012), the South Indian Ocean Fisheries Agreement (SIOFA, 2012), and the North Pacific Fisheries Commission (NPFC, 2015). The more recently established RFMOs have either recently adopted their spatial measures to protect VMEs or are in the process of doing so.

7. Conclusions

One of the main impediments to assess the state of exploitation of highly migratory species, straddling stocks and other high seas fish stocks is the considerable limitation in fisheries and biological data on these species. Problems noted in the previous FAO contributions to the Review Conference still pose considerable challenges to evaluate the performance of the FSA in maintaining stocks within sustainable levels of exploitation.

The lack of a global data set that allows the catch and state of straddling and other high seas fish stocks to be separated from EEZ fisheries is a particular limiting factor. Likewise, evaluating the protection afforded to associated species under the FSA is difficult with the available data on bycatch and state of exploitation, or lack thereof. Furthermore, the link between high-seas fishing and the state of associated species is difficult to determine since many of the associated species are impacted by EEZ fisheries (often more so than high seas fisheries), coastal development and other human activities.

Some progress has been made in improving the reporting of catches of highly migratory shark species in recent years, but with rare exceptions, the information available does not allow a comprehensive evaluation of the state of exploitation of this group of species.

Following the overall global promotion by FAO for the implementation of fisheries management systems compatible with the Ecosystem Approach to Fisheries (EAF), some progress has also been made in the incorporation of ecosystem considerations in the management regimes of deep-sea fisheries in the high seas, including in the inventory of areas particularly vulnerable to the impact of bottom fisheries. A global database on Vulnerable Marine Ecosystems (VME database)[63] was launched by FAO in response to the

63 http://www.fao.org/in-action/vulnerable-marine-ecosystems/en/

request from the UN General Assembly (61/105, paragraph 90). It builds on the FAO International Guidelines for the Management of Deep-sea Fisheries in the High Seas (FAO DSF Guidelines), which provides details on the VME concept for fisheries management. The database was developed in collaboration with the regional bodies with mandates to manage deep-sea fisheries in the high seas and provides interactive maps and factual information on management measures taken to reduce current or potential impacts on areas where VMEs are known or likely to occur.

Despite the current data limitations, this report attempted to provide an updated summary of the situation of stocks and fisheries in the high seas using the best available information. There were no major changes in the overall state of stocks and fisheries catches since the first review prepared by FAO in 2005. The majority of the species for which information is available are considered either maximally sustainably fished or overfished, and with a few exceptions (mostly tuna) most of the species exploited in the high seas have a low productivity and low resilience to exploitation. This situation reinforces the need for countries fishing on the high seas to cooperate either directly or through RFBs to employ effective measures to sustainably manage fisheries and to conserve stocks already overfished. Cooperation among countries will also be key to improve the monitoring of fisheries in the high seas. The quality of future evaluations of the performance of the FSA hinges on substantial improvements in the availability of data on the high seas stocks and fisheries.