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 exp

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 ñ**straddling stocks**ò, but article 63, clause 2 says: ñ[...] *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*ò 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 EEZôs to most of the fish being outside EEZôs. 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 ñpurely high seas stocksò for stocks that are not found within EEZs. This review uses the term ñ**other high seas stocks**ò to refer to stocks that are not highly migratory or straddling. It is preferred to ñdiscrete high seas stocksò 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 countryôs 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

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-

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-

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 t

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

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 ósharksô. Between 2000 and the early 2010ôs, the total

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

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 ôEndangered or Threatened Speciesô 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 worldôs 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

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*

(>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.

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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 ñother highly migratory speciesò 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 ñPomfrets, ocean breams not elsewhere includedò (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

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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*

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 ñDonut Holeò) became regulated by the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea. The

(*Trachurus symmetricus*) also remains lightly exploited since the mid-1990ŝs. 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

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 ñtraditionalò 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) seabrea38Q EMC /Span <</MCID 153/Lang (en-GB)>> BDC q0.00

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 (

3.2.6 Southeast Atlantic

The Southeast Atlantic Fisheries Organization (SEAFO) identified the following species as straddling:

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 F(r)-6(aTf1 0 0 1 459.82 675

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 (

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 ñother high seas fish stockò 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 ñother high seas fish stocksò 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

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]

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

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.