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THE STATUS OF FISHERIES RESOURCES IN THE WESTERN CENTRAL ATLANTIC REGION

SUMMARY

This document reviews the trends in the recorded landings of marine species in the WECAFC area, identifying any features of particular interest or concern to the WECAFC member countries. It then summarises the available knowledge on the status of the resources of the WECAFC region and of fisheries management. The information indicates that, as in the past, there is very high uncertainty about the status of even the more important fisheries resources of the region. This situation puts many of the resources, and the fisheries dependent on them, at risk through over-exploitation.

An essential first step for most countries of the region is to make improvements to the existing fishery monitoring and data collection programmes and systems. Given the high species diversity of the region and the scarce human and financial resources available for the task in many countries, landing monitoring systems will need to be designed to be as efficient as possible in identifying and monitoring relevant information. Consideration also needs to be given to implementing management measures and strategies that are less demanding of high quality and comprehensive data, and that are more robust to uncertainties in the available information.

INTRODUCTION

1. The area under the jurisdiction of the Western Central Atlantic Fisheries Commission (WECAFC) extends from Cape Hatteras in North Carolina, United States (35°N), to just south of Cape Recife in Brazil (10°S). It includes an area of nearly 15 million km^2 of which approximately 1.9 million km^2 is shelf area (Stevenson 1981). The major subdivisions in the area are the Southeast coast of the United States, the Gulf of Mexico, the Caribbean Sea and the Northeast coast of South America

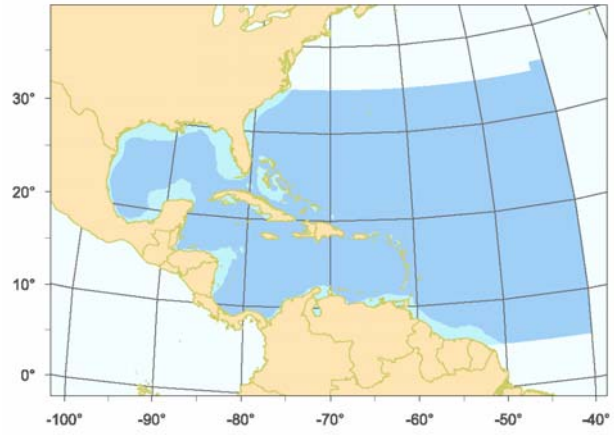

Figure B3.1 - The Western Central Atlantic (Area 31)

which includes the Guianas and Brazil (Figure B3.1).

2. The WECAFC area includes FAO Statistical Area 31 (Figure B3.1) and a portion of Area 41 occurring offshore of northern Brazil. This chapter deals mainly with Area 31. The region is geographically one of the most complex regions of the world, and is split up into a number of deep ocean basins separated by shallow zones, and a large number of island platforms, offshore banks and the continental shelf. The geographic complexity of the Western Central Atlantic results in equally complex bio-diversity, with at least 1172 species of invertebrates, fish and tetrapods occurring in the region. Of these, 987 are fish species and 23% of the fish species are 'rare or endemic to the region'. The zones of highest diversity are the waters of southern Florida, eastern Bahamas and northern Cuba. The Caribbean probably has the highest species-richness in the Atlantic (Smith et al. 2002).

3. The Western Central Atlantic area is characterised by anti-cyclonic (i.e. clockwise) flow of currents. The pronounced overall movement of water from south east to north west through the Western Central Atlantic is probably very important for distribution of larvae, for example of the Caribbean spiny lobster, but the area is also marked by substantial variability, with counter currents, meanders and eddies. The region also comes under the influence of runoff from the major rivers discharging into the region: the Mississippi, Orinoco and Amazon Rivers, and of frequent hurricanes.

PROFILE OF CATCHES

4. Nominal catches from Area 31 increased steadily from approximately 500 000t in 1950, to a peak of approximately 2.5 million tonnes in 1984. They subsequently declined but showed some increases in the early 1990s, with just under 2.0 million tonnes being landed in 1994 but have been stable at between 1.5 and 1.7 million tonnes since then (Figure B3.2). A worrying feature of records from the WECAFC region continues to be the poor identification of landings and, for example, Group 39 Marine fishes not identified accounted for nearly 168 000t of the total landings in 2001.

5. A total of 42 countries recorded landings taken from Area 31 in 2001, with just under 3 000t of finfish being recorded as coming from other, unidentified countries (Annex). Over half of the total recorded landings were made by the United States of America, followed by Venezuela and Mexico each with recorded landings of more than 15% of the total from the region. Guyana, Cuba and Surinam were next in the ranking, but with substantially lower landings of between 1 and just over 3% of the total. The top fourteen countries in the list account for over 95% of the total recorded mass of landings for the region.

6. The ISSCAAP group making the largest contribution to catches continues to be Group 35 Herrings, sardines, anchovies. This group is dominated by the Gulf menhaden (*Brevoortia patronus*) which occurs from the Yucatan Peninsula to Florida. Catches of the species increased irregularly from about 200 000t in 1950 to close to one million tonnes in 1984 but declined somewhat thereafter and have varied between just under 500 000t and 700 000t in recent years (Figure B3.3). There was also an important fishery for the other menhaden species, Atlantic menhaden (*B. tyrannus*), with peak catches of 140 000t in 1981, but the fishery declined steeply in subsequent years to under 4 000t in 1984. Catches have been under 40 000t since 1992 (Figure B3.3).

7. Including the substantive contribution from Group 35, small pelagics accounted for the largest catches by mass overall. Fishes from seven families dominate small pelagic catches in the region. These are: Exocoetidae (flyingfish); Clupeidae (herrings and sardines); Engraulidae (anchovy and anchoveta); Carangidae (jacks, bumpers and scads); Hemiramphidae (halfbeaks); Belonidae (needlefish) and Mugilidae (mullet). The round sardinella (*S. aurita*) is an important small pelagic species and total catches of this species increased steeply from 59 000t in 1990 to almost 200 000t in 1998 (Figure B3.4), mostly recorded by Venezuela. Landings have fallen substantially since then, with only 76 000t recorded in 2000 and 72 000t in 2001. Other small pelagic species occurring in ISSCAAP Groups 33 (Miscellaneous coastal fishes), and Group 35 (Herrings sardines anchovies)

include the flathead grey mullet (*Mugil cephalus*), unidentified mullets and the Atlantic thread herring (*Opisthonema oglinum*), all of which have generated catches under 20 000t in recent years (Figure B3.4). Atlantic thread herring landings fell to 7 000t in 2001, less than half those of immediately preceding years. There has been a substantial increase in landings of the unidentified jacks and crevalles of the genus *Caranx*. Fished mainly by Mexico and Venezuela, catches of this group approximately doubled from the early 1980s to their 1997 and 1998 values of over 12 000t, although they have fallen to around 9 000t per year since then. The four-winged flyingfish (*Hirundichthys affinis*) supports locally important fisheries in some of the lesser Antilles islands, including Barbados, Grenada and Tobago. Catches of this species peaked at nearly 6 000t in 1988, but more typically fluctuate between 1 000 and 2 800t, as they have done throughout the 1990s and in 2000 and 2001. The common dolphinfish (*Coryphaena hippurus*) is another pelagic species important to the small island states. It is also landed by the United States and Mexico, and a directed fishery for the species has developed in Venezuela in recent years. Catches of common dolphinfish in the region doubled from 2 014t in 1984 to 4 267t in 1997 but varied between 3 500t and 4300t over the next few years, falling to 2 900t in 2001.

8. The ISSCAAP Group 33 – miscellaneous coastal fishes also makes an important contribution to the catches of the region (Figure B3.2). This group covers a wide diversity of species, of which the following contribute most to catches : sea catfishes (*Ariidae*); the groupers, seabasses etc. (*Serranidae*) especially the groupers (*Epinephelus spp.*); grunts, sweetlips (*Haemulidae*); snappers, jobfishes (*Lutjanidae*), especially the unidentified snappers (*Lutjanus spp*.) and the yellowtail snapper (*Ocyurus chrysurus*); croakers, drums (*Sciaenidae*) especially the weakfishes (*Cynoscion spp.*) and the whitemouth croaker (*Micropogonias furnieri*); the ponyfishes (*Leiognathidae*); and the snooks (*Centropomidae*) especially the common snook (*Centropomus undecimalis*). The catches made up by members of this group totalled 144 000t in 2001, somewhat lower than during most of the previous decade.

9. The miscellaneous coastal fish can be subdivided into two broad groups based on habitat: those occupying areas with soft substrata and those typically occurring over reefs. Amongst those occupying areas with soft substrata, unidentified sea catfishes accounted for the highest catches in 2001, a substantial increase from under 5 000t in 1988 to over 20 000t in 2000, falling back slightly to 18 000t the following year (Figure B3.5). These species are recorded on the FAO database as being landed by mainland countries, especially Mexico and Venezuela. Unidentified weakfishes peaked at over 20 000t in 1995 but have also subsequently declined (Figure B3.5). Catches identified as spotted weakfish (*Cynoscion nebulosus*) totalled more than 6 000t in recent years, but fell to only 2 000t in 2001. The whitemouth croaker and common snook were also important contributors to catches of fish from soft-bottomed habitats. Landings of both these species have shown increases since 1950, with the whitemouth croaker generating catches of over 5 000t from 1991 to 1996, declining in the following years and then recovering to 7 000t in 2001. The common snook has produced landings of between approximately 5 000t and just over 6000t since 1995 (Figure B3.5).

10. Amongst the dominant reef fishes in catches, those of unidentified groupers increased markedly in the late 1970s and early 1980s, from under 10 000t to above 20 000t. Since the peak in the late 1980s, they show a generally decreasing trend (Figure B3.6). Catches of red grouper (*Epinephelus morio*) fell from a peak of over 12 000t in 1980 to 157t in 2001, while those of Nassau grouper (*E. striatus*) have fallen from 3 200t in 1967 to well under 1000t in recent years. However, at the second meeting of the WECAFC Scientific Advisory Group held in Martinique in April 2003, a member from Mexico quoted from Monroy et al. (2001) that landings of red grouper in Mexico had totalled 8 197t in 2001. These landings had presumably not been reported to FAO under that taxonomic group. The trend in red grouper landings shown in Figure 3.6 would therefore be very misleading as an indicator of the abundance of the species. Catches of the unidentified snappers and jobfishes have shown a substantial increase from under 2 500t in 1950 to more than 25 000t in 1994 although they have declined since then. Catches of northern red snapper (*Lutjanus campechanus*) and lane snapper (*L. synagris*) remained relatively constant in the 1970s and 1980s but, after reaching peaks in the early 1990s, showed steady declines from then to 2001, the most recent figures available.

11. There are also important fisheries for snapper on the Brazil-Guianas shelf, targeting particularly the southern red snapper (*L. purpureus*) but also lane snapper and the Vermillion snapper (*Rhomboplites aurorubens*). Several of the countries of the Brazil-Guianas shelf have local and foreign fleets fishing for snapper in their waters and Venezuelan vessels are particularly active, fishing legally in the EEZs of most countries in the area. Venezuelan authorities have reported that between about 3 500 and 5 000t of southern red snapper are landed annually in Venezuela, with over 50% caught in foreign waters (FAO 1999a).

12. The catches of ISSCAAP Group 36 tunas, bonitos, and billfishes have increased over the last three decades and catches during the 1990s averaged 87 000t (2001 landings = 106 000t), compared to averages of 80 000t in the 1980s and 52 000t in the 1970s. For management purposes, this group is divided into two sub-groups, the oceanic species whose distribution extends beyond the WECAFC region and can be trans-oceanic, and the coastal large pelagics whose distribution is largely confined to the WECAFC region. Amongst the oceanic species, by far the largest catches are for yellowfin tuna (*Thunnus albacares*), whose catches increased steeply in the early 1980s, as a result of increasing fishing effort mainly by fleets from within the region. Nearly 30 000t of the species was landed in 2001, compared to about a half of this amount or less for the other major species (Figure B3.7).

13. The coastal large pelagic catches were dominated by four species of *Scomberomorus*. In 2001, the recorded landings of these four were: king mackerel (*S. cavalla*) - 10 000t); Atlantic Spanish mackerel (*S. maculatus*) - nearly 7 000t; Serra Spanish mackerel (*S. brasiliensis*) – nearly 6 000t; and Cero (*S. regalis*) of which only 147t were landed. Catches of Atlantic Spanish mackerel decreased in recent years from a peak in the early 1990s (Figure B3.8).

14. Sharks (ISCAAP Group 38 – sharks, rays, chimaeras) have attracted considerable attention in recent years, as concerns have been raised about their over-exploitation. Within the WECAFC region, catches of chondrichthyans have escalated spectacularly since 1950, reaching a peak of 37 000t in 1994, but have fallen since then to only 21 000t in 2001 (Figure B3.9). The major contributors to the landings in 2001 were: rays, stingrays, mantas etc.; requiem sharks nei; and sharks, rays, skates etc nei, with much smaller landings of blacktip shark, dogfish sharks nei, longfin mako, shortfin mako and smoothhounds nei. The dominance of landings in only broadly identified taxonomic categories demonstrates the poor quality of much of the data submitted to FAO from the region. The fact that so little information is available on the species composition of the landings reinforces the need for improved and careful monitoring.

15. A report by Yegres *et al.* (1996) on the shark fishery in Venezuela, operating beyond the EEZ of that country in both the Caribbean Sea and the Atlantic Ocean in the south western reaches of the WECAFC area, listed 31 shark species as being caught. The most common, by number, in the industrial fleet included blue shark (*Prionace glauca* - 36%), reef shark (*Carcharhinus springeri* - 14%), and shortfin mako (*Isurus oxyrinchus* - 12%), and in the artisanal fleet, Caribbean sharpnose shark (*Rhizoprionodon porosus* - 21%), scalloped hammerhead (*Sphyrna lewini* - 14%) and smalleye hammerhead (*S. tudes* - 12%). Bonfil (1997) reported that 34 species of shark occur in the Mexican waters of the Gulf of Mexico, of which 14 are important in fisheries and nine of these he described as being of "prime importance". Included in the nine most important were five *Carcharhinus* species and two *Sphyrna* species.

16. Some of the most valuable fisheries in the Western Central Atlantic are crustacean fisheries, in particular that for Caribbean spiny lobster (*Panulirus argus*) and those for a number of shrimp species, particularly penaeid shrimps (Figure B3.10). Landings of spiny lobster in Area 31 (i.e. excluding those from Brazil) reached a peak of 33 000t in 2000 but fell to 28 000t in 2001. Landings of this species have a high monetary value per unit mass, and the resource is therefore one of the most valuable in the region. Recorded catches of unidentified penaeid shrimps were 53 000t in 2001, varying without meaningful trend, between approximately 40 000 and 58 000t since the mid-1970s. The most

productive shrimp species is the northern brown shrimp (*Farfantepenaeus aztecus*[1]), with 2001 catches of 68 000t, followed by the Northern white shrimp (*Litopenaeus setiferus*[1]) with catches of 41 000t in the same year. One shrimp species where catches have increased in recent years is that for the Atlantic seabob (*Xiphopenaeus kroyeri*). Catches were typically only approximately 5 000t in 1990 but reached over 32 000t in 2001.

17. Amongst the molluscs, the highest catches (given in total weight, including shell) in recent years have been of American cupped oyster (*Crassostrea virginica*), which varied during the 1990s from less than 60 000t (1991) to a peak of over 220 000t in 2000, and ark clams (*Arca spp.*) of which over 46 000t were landed in 2001. Catches of calico scallop (*Argopecten gibbus*) have been highly variable, peaking at nearly 400 000t total weight in 1984, but with no landings recorded in 1991 - 1993 and again since 1996.

18. Substantial increases have been observed in recent years in the recorded landings of common octopus (*Octopus vulgaris*) and the stromboid conchs (*Strombus spp.*). Catches of both have increased steadily since 1950 (Figure B3.11). Catches of common octopus were slightly over 8 500t in 1983 and subsequently climbed to an average of over 18 000t in the 1990s, with the highest recorded landings of over 28 000t in 1996. Landings of just under 21 000t were recorded in 2001. It was reported at the Second Meeting of the WECAFC Scientific Advisory Group that landings of Octopus on the Atlantic coast of Mexico actually consisted of substantial contributions from both common Octopus and a local endemic species the Mexican four-eyed octopus (*Octopus maya).* The increase in catches of stromboid conchs has also been marked. Catches in 1984 were over 10 000t but then fell to approximately 6 000t in 1987. Average annual catches during the 1990s were over 12 000t. The highest recorded landings of over 18 000t were registered in 2000 and 2001.

19. All species of Chelonidae, the sea turtles, have been listed on CITES Appendix 1 since 1977. Despite this, landings of the three species recorded on the FAO database for the WECAFC area (green, hawksbill, loggerhead) and those not identified, remained high until the late 1980s and, in fact, peaked at 1 600t in 1985. Thereafter, they declined rapidly, falling to only 36t in 2001, made up mainly of green and hawksbill turtles. Marine turtles have been harvested and utilised in the WECAFC region for a range of uses from subsistence to provision of luxury items (Fleming, 2001).

RESOURCE STATUS AND FISHERY MANAGEMENT

20. The capacity for fisheries management differs markedly between the different coastal states of the Western Central Atlantic. In some countries there are appropriate institutions, with fishing and fisheries being monitored and controlled in attempts to ensure sustainable utilisation, while in others fisheries are largely unmanaged or managed only in a rudimentary manner. However, even amongst the most advanced fisheries management agencies in the region, there are problems in coping with the high species diversity, and from the region as a whole there is little information on the status of the important resources and even less on the hundreds of species of lesser importance to the region's fisheries. In its 2002 report to Congress (NMFS 2002), the National Marine Fisheries Service of the United States (NMFS) recorded that of the 57 stocks falling under the jurisdiction of the Gulf of Mexico Fisheries Management Council (GMFMC), the status of 46 (81%) was either unknown or undefined. Of the 179 stocks falling under the jurisdiction of the United States Caribbean Fisheries Management Council (CFMC), the status of 175 (98%) was unknown or undefined. As stated in earlier reports, it is very unlikely that the state of knowledge is any higher than this in most other countries in the region.

[1] The genus structure of the penaeid shrimps was recently revised by Pèrez Farfante and Kensley (referred to in Carpenter 2002). This new system is applied here. Previously the species within these new genera would have been included in the genus *Penaeus*.

21. Based on their stock sizes, neither of the two menhaden species, the Gulf and the Atlantic menhaden, are considered to be overfished[2] (NMFS 2002). Amongst the small pelagics, the only quantitative estimate of status available was for the round sardinella in Venezuela, based on virtual population analyses (VPA) by Mendoza et al. (1994). They estimated that the stock was lightly exploited at that time, but that may have changed with the increased annual catches showed in Figure B3.4. The substantial fall in catch in recent years may well be cause for concern. The status of the many other species of small pelagics is largely unknown. Amongst these are the carangids, with 15 genera and 31 species occurring in the region. The general understanding of the stock status of small pelagics in the region is that they vary from under- to fully-exploited (FAO 1998).

22. The groundfish species are dominated by ISSCAAP Group-33 miscellaneous coastal fishes. Of these, the Nassau grouper (*Epinephelus striatus*) and Goliath grouper (Jewfish, *Epinephelus itajara*) are under rebuilding programmes for both the Gulf of Mexico and the Caribbean Fishery Management Councils. In the Gulf of Mexico, fishing mortality has been reduced below the desired threshold, but this is not reported for the stocks under the CFMC. The Red snapper (*Lutjanus campechanus*) and the Red drum (*Sciaenops ocellatus*) remain on rebuilding programmes for the Gulf of Mexico stocks, and reductions in fishing mortality are still being recommended or required for both of them. Fishing mortality for another two Gulf of Mexico stocks, Vermilion snapper (*Rhomboplites aurorubens*) and Gag grouper (*Mycteroperca microlepis*) is now considered to be above the minimum threshold biomass but a reduction in fishing mortality is recommended. The status of the Greater Amberjack (*Seriola dumerili*) in the Gulf of Mexico was estimated to be "not overfished", but NMFS recommend that a rebuilding programme is required for the stock. The Red grouper (*Epinephelus morio*) is considered to be overfished and to be undergoing undesirably high fishing mortality. A rebuilding programme is under development for the stock. In the coastal waters of Mexico, Red grouper has been estimated to be over-exploited (Arenas and Díaz de León 1998). The status of the remaining reef fishes falling under the jurisdiction of both Management Councils of the USA was unknown.

23. The latest estimates of the status of the groundfish stocks of the Brazil-Guianas shelf remains those produced under the joint activities of the FAO WECAFC *ad hoc* Working Group on the Shrimp and Groundfish Fishery of the Brazil-Guianas Shelf and the CARICOM Fisheries Resource Assessment and Management Programme (CFRAMP). The stocks which have undergone preliminary analyses are primarily soft-bottom dwellers and include some local stocks of whitemouth croaker (*Micropogonias furnieri*), Jamaica weakfish (*Cynoscion jamaicensis*) and green weakfish (*C. virescens*), smalleye croaker (*Nebris microps*), and king weakfish (*Macrodon ancylodon*). As a result of limited data, the results were only preliminary, but using yield and spawner biomass per-recruit reference points, there were indications that the stocks which were examined were being overexploited (FAO 1999a; 1999b). A recent assessment of *L. purpureus* in French Guiana, showed indications of over-exploitation of the stock (Charuau 1999).

24. Apart from these scientifically-based estimates, there is a general acceptance of the fact that the inshore reef and groundfish resources of the region are commonly fully exploited and some are over-exploited (FAO 1998). Mahon (1993) reported that "It is generally accepted that reef fish resources of the island platforms are extremely overexploited in most Lesser Antillean countries".

25. Interest continues amongst some states of the region for expanding their fisheries for large pelagics, both oceanic and coastal, and in recent years fisheries for these stocks have increased considerably. The stocks being targeted by these expanding fisheries fall under the mandate of the International Commission for the Conservation of Atlantic Tunas (ICCAT), but assessments are only undertaken for the oceanic stocks within their mandate. The most recent assessments available (ICCAT 2002) indicate that yellowfin tuna, which is considered to consist of a single Atlantic stock, is fully-exploited and possibly over-exploited. The ICCAT Standing Committee on Research and

[2] According to the USA Sustainable Fisheries Act, a stock is overfished when its size is below a prescribed biomass threshold, regardless of the cause(s).

Statistics therefore recommended that fishing mortality on this stock should not be increased. Some fishing for bigeye tuna (*Thunnus obesus*) occurs off the coast of Venezuela. The stock is considered to be over-exploited and fishing mortality is above the MSY rate. The stock structure of skipjack tuna (*Katsuwonus pelamis*) is not well known, but it is treated as two management units, an eastern and a western unit. The most recent assessment for this stock was done in 1999 and ICCAT (2002) estimated the status of the western stock to be 'stable'.

26. Several other large pelagic species fished in the western central Atlantic have also been assessed by ICCAT. The results of the 2002 assessments are: west stock of the Atlantic bluefin tuna (*Thunnus thynnus*) – overfished to a point where recruitment could be low because of low spawner stock biomass; Atlantic blue marlin (*Makaira nigricans*) - biomass estimated to be about 40% of B_{MSY} and over-fishing is considered to have been taking place for the last 10 to 15 years; white marlin (*Tetrapterus albidus*) – the stock is considered to be severely over-exploited and that over-fishing is continuing; western Atlantic sailfish (*Istiophorus platypterus*) – current catches are thought to be sustainable; and Northern Atlantic swordfish (*Xiphias gladius*) – status is considered to have improved in recent years and the biomass is estimated to be just below B_{MSY} and the fishing mortality to be below the MSY rate.

27. Amongst the coastal species, the status of Serra Spanish mackerel and Cero is unknown. NMFS (2002) consider a Gulf of Mexico "group" of the king mackerel to be have been overfished but that, under a rebuilding programme, fishing mortality is now below the threshold. The Atlantic "group" is considered to be "not overfished". Marcano *et al*. (1999) found no signs of overexploitation of King mackerel in their study on a fishery for the species in eastern Venezuela. Neither the Gulf nor the Atlantic "groups" of Atlantic Spanish mackerel are considered overfished by NMFS. Dolphinfish, which does not fall within the ICCAT mandate, is now considered to be a single stock throughout the Western Central Atlantic (Wingrove 2000 and Prager 2000, as reported in FAO 2002) and has been estimated to be well above B_{MSY} and fishing mortality to be below the MSY rate.

28. The status of the stocks of sharks in the region is poorly understood, but there is concern due to their vulnerability to over-exploitation. Bonfil (1997) referred to some assessments undertaken on shark in Mexico, suggesting fishing mortalities ranging from approaching that yielding the maximum sustainable yield (F_{MSY}) to above them. However, he stressed the preliminary nature of these assessments. He did draw attention to the concentration of fishing effort on juvenile sharks in Mexico, which he suggested was one of the most important concerns in these fisheries. Many of the stocks of shark in Area 31 are likely to be widely distributed and hence to require regional and international co-operation for adequate fishery management.

29. The Caribbean spiny lobster is listed in Annex III of the Protocol Concerning Specially Protected Areas and Wildlife (the SPAW protocol) of the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (the Cartagena Convention). For species listed on Annex III, contracting Parties to the SPAW protocol "shall adopt appropriate measures to ensure the protection and recovery of the species…and may regulate the use of such species in order to ensure and maintain their populations at the highest possible levels". The status of the species was examined at two WECAFC/CFRAMP workshops held in 1997 and 1998, attended by scientists from all the major lobster producing nations in the region (FAO 1999c), and reviewed at subsequent workshops in 2000 and 2002. The results from these workshops indicated a resource that is being fully or over-exploited throughout much of its range, although there were insufficient data from some areas to estimate the status reliably. The workshops concluded that in most countries there is an urgent need to control and in many cases to reduce the fishing effort in the lobster fisheries. As many countries have open access to their lobster fisheries, this may require implementing restricted entry systems into the fishery, ensuring that the resulting total effort is commensurate with the productivity of the resource, and the licensed fishers are able to obtain acceptable economic returns. In some areas, the size of the lobsters being caught was smaller than desirable and in these cases it was recommended that suitable minimum size restrictions should be implemented and enforced.

30. The other valuable crustacean fisheries in the region are those for shrimp, mainly penaeid shrimp, and also the Atlantic seabob. Stocks of brown, pink (*Farfantepenaeus duorarum*), white (*L. setiferus*) and royal red shrimp (*Hymenopenaeus robustus*) have been estimated by the GMFMC not to be overfished in that region, while the status of seabob (*Xiphopenaeus kroyeri*) is unknown. The WECAFC/CFRAMP workshops referred to above (FAO 1999a, b) have made some progress in assessing the status of important shrimp stocks in the Brazil-Guianas continental shelf, along the coastline of Venezuela, Trinidad and Tobago, Guyana, Surinam, French Guiana and the northern coast of Brazil. The results suggest that in most cases, the national stocks of southern white shrimp (*Litopenaeus schmitti*), southern pink shrimp (*F. notialis*) and brown shrimp (*F. subtilis*) which have been assessed are not being biologically overexploited but were probably being fished above the economic optimum fishing effort. There are indications of high rates of fishing mortality on red spotted shrimp (*F. brasiliensis*). However, in the Gulf of Paria that position is estimated to be reversed, with *F. subtilis* estimated to be over-exploited in 2001, while *F. brasiliensis* is estimated to have been close to B_{MSY} in 2001, indicating a fully-exploited stock (L. Ferreira, Trinidad and Tobago, pers.comm.).

31. Amongst the molluscs, the recent catches of Mexican four-eyed octopus (*O. maya*) have been estimated not to be sustainable (Arenas and Díaz de León 1998). Another molluscan stock, the Queen conch (*Strombus gigas*), is listed on CITES Appendix II which means that international trade in the species is controlled by the national CITES authorities, it is also listed on Annex III of the SPAW protocol of the Cartagena Convention. At the Queen Conch Stock Assessment and Management Workshop held in Belize in March 1999, it was found that many countries did not have sufficient or suitable data to make reliable estimates of the current status of the stocks (CFMC and CFRAMP, 1999). In those cases where there were sufficient data, the estimated status varied from lightly to over-exploited. NMFS (2002) reported that Queen conch is the subject of a rebuilding programme in the CFMC, but that fishing mortality is still too high in that management area and needs to be reduced.

32. An ecosystem approach to fisheries recognises that fish resources are dependent on the ecosystems in which they occur. Within the WECAFC region, many ecosystems are undergoing adverse impacts from human activities, and damage to critical habitats is one such concern. Important habitats found in the Caribbean include coral reefs, seagrass beds, mangroves, coastal lagoons, sandy beaches and mud bottom environments. Coral reefs are a cause of widespread concern and are important habitats for many exploited fishery resources. The report Status of Coral Reefs of the World 2002 (GCRMN, 2002) reported that in the northern Caribbean and western Atlantic, coral reefs were continuing to decline although possibly at a slower rate than previously. The main causes of the decline include pollution, disease, over-fishing, anchor damage and destructive fishing and tourism practices. In Central America, hurricanes in 2000, 2001 and 2002 caused extensive damage, destroying up to 75% of corals in parts of Belize. Intense fishing and overloading by nutrients and sediments from poor land-use are also causing damage. A major effort through a World Bank and Global Environment Facility (GEF) project is working for the conservation of the Mesoamerican Barrier Reef System. The Survey also reported that inshore reefs in the eastern Antilles are degraded while deeper reefs are in better condition. The causes of damage are similar to those for the northern Caribbean.

33. The Caribbean Environment Programme of the United Nations Environment Programme (UNEP, undated) reports that seagrass beds, mainly turtle grass *Thalassia testudinum* and manatee grass *Syringodium filiforme*, provide food for grazing species including some fish, turtles and sea urchins; shelter for many commercially important species such as snappers, grunts, lobsters and conch; and other ecosystem services. Mangroves are particularly important nursery areas for many commercially important marine species. Seagrass habitats are being damaged and reduced by human activities such as eutrophication and other forms of pollution, and poor land use practices leading to increased sediment transport and deposition from land to the sea. A major cause of damage to mangroves is physical clearance of forests for housing and tourism projects and for development of aquaculture sites. Suitable measures need to be taken to conserve these environments if the marine ecosystems of the region are to be conserved, and if their many benefits are to be used in a sustainable manner.

34. Once again, the most marked feature of the results and trends presented here is the very high uncertainty about the status of even the more important fisheries resources of the region. In general, greater uncertainty about the status of resources and the impact of fisheries on them requires more cautious management, with a resulting loss of potential benefits. In cases where there is little information, fisheries exploitation needs to proceed very cautiously and should be accompanied by concerted efforts to collect adequate, relevant data to enable the resources to be utilised responsibly. Unless urgent steps are taken to collect sufficient information on landings and effort to provide, at least, the minimum information necessary to ensure sustainable utilisation, there is a high risk that landings will continue to decline, as this review shows many have already done. This will lead to further erosion of the social and economic benefits currently being derived from the region's marine resources. As so many of the resources are shared between two or more countries, close co-operation between countries at a variety of international levels will commonly be advantageous and often essential in securing this.

35. The necessary first step for most countries of the region is to implement improvements to the existing fishery monitoring and data collection programmes and systems. Different fisheries, ecosystems and species will require different approaches, and monitoring and assessment programmes will need to be designed to optimise the use of limited human and financial resources in order to obtain the most useful information. In a number of cases, it will be important to identify key species, reflecting social, economic or conservation objectives, and to ensure that they are carefully monitored and regularly assessed, including sub-regionally or regionally where the stocks are shared, so as to ensure that the appropriate management action is taken. Obvious examples of these include species such as the Caribbean spiny lobster, the commercially important shrimp species, the species important to fisheries for large pelagics, queen conch, and others. In addition, a useful approach in high diversity communities is to monitor selected indicator species for each major habitat type and taxonomic group, to provide an index of the status and trends in broader species groups and, collectively, on the ecological community as a whole.

36. Further to improving data collection and generation of information to guide management, consideration also needs to be given to implementing management measures and strategies that are less demanding of high quality and comprehensive data, and that are more robust to uncertainties in the available information. In accordance with the ecosystem approach to fisheries, these measures also need to take into account, and minimise where appropriate, negative impacts on non-target species and sensitive habitats. Management measures that, properly applied, can be relatively robust to uncertainty include strict management of fishing effort and fishing capacity, greater use of closed seasons and closed areas (including MPAs), and suitable gear restrictions aimed at minimising bycatch of undesired species or size groups and other undesired ecosystem impacts. Fishing should also be prevented where species pass through particularly vulnerable life history stages, such as dense spawning aggregations. No single management measure or approach will adequately address all the conservation and utilisation objectives of fisheries, and an effective management system will usually consist of a suite of complementary management measures that, typically, would include a combination of closed areas and/or seasons, gear and vessel restrictions, an appropriate limited entry system, and input (effort) or output (catch) controls. Adequate enforcement of these measures is, of course, essential.

37. These efforts may require additional financial commitments in several countries, and these additional financial resources are likely to be hard to find. Where commercial fisheries exist, cost-recovery may be an option. However, in considering the costs of effective management, attention also needs to be given to the severe social and economic consequences of the alternative to effective management, which is almost certain over-exploitation of resources, resulting in their depletion and the loss of the benefits being derived from them.

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38. María Estela de Leon Gonzales, Centro de Investigaciones Pesqueras, Cuba, Lara Fereira (Fisheries Division, Trinidad and Tobago), Patrick McConney (Caribbean Conservation Association), Lionel Reynal (IFREMER, Martinique) and Juan Carlos Seijo (Centro Marista de Estudios Superiores, Mérida, Mexico) are thanked for helpful information used in this report.

REFERENCES

Details of the references given in the preceding text can be obtained from K.L. Cochrane, FIRM, FAO, Rome (kevern.cochrane@fao.org)

FIGURES

Figure B3.2 - Annual nominal catches ('000 t) by ISSCAAP species groups in the Western Central Atlantic (Area 31)

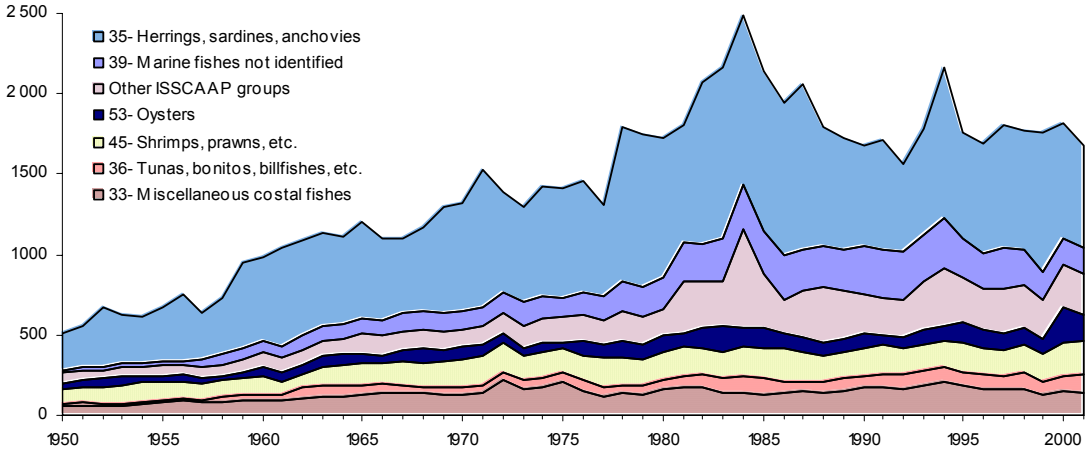


Figure B3.3 - Annual nominal catches ('000t) of selected species in ISSCAAP Groups 35, 39, Western Central Atlantic (Area 31)

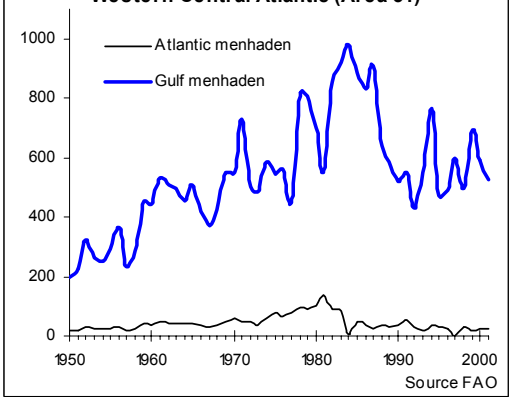
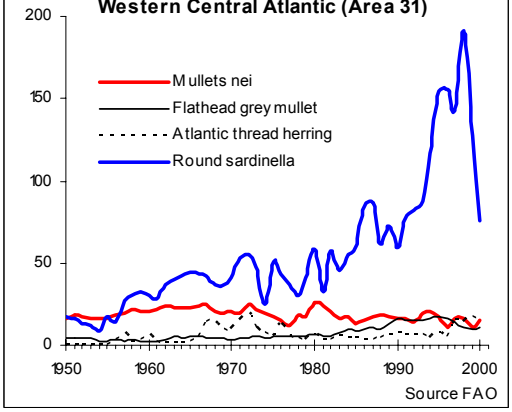


Figure B3.4 - Annual nominal catches ('000t) of selected species in ISSCAAP Groups 33, 35, Western Central Atlantic (Area 31)



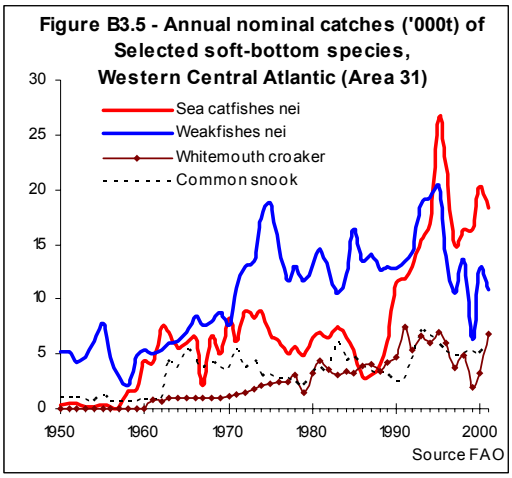


Figure B3.5 - Annual nominal catches ('000t) of Selected soft-bottom species, Western Central Atlantic (Area 31)
Sea catfishes nei
Weakfishes nei
Whitemouth croaker
Common snook
30
25
20
15
10
5
0
1950
1960
1970
1980
1990
2000
Source FAO

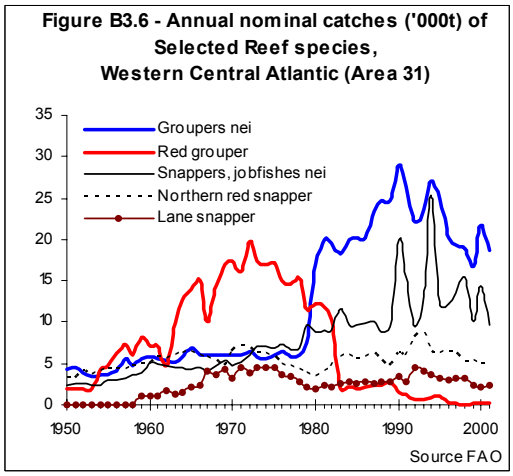


Figure B3.6 - Annual nominal catches ('000t) of Selected Reef species, Western Central Atlantic (Area 31)
Groupers nei
Red grouper
Snappers, jobfishes nei
Northern red snapper
Lane snapper
35
30
25
20
15
10
5
0
1950
1960
1970
1980
1990
2000
Source FAO

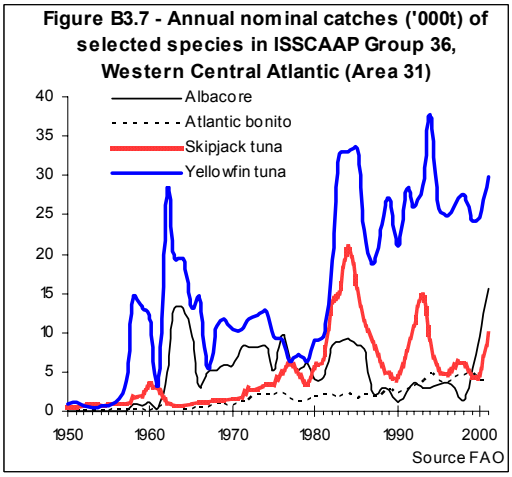


Figure B3.7 - Annual nominal catches ('000t) of selected species in ISSCAAP Group 36, Western Central Atlantic (Area 31)
Albacore
Atlantic bonito
Skipjack tuna
Yellowfin tuna
40
35
30
25
20
15
10
5
0
1950
1960
1970
1980
1990
2000
Source FAO

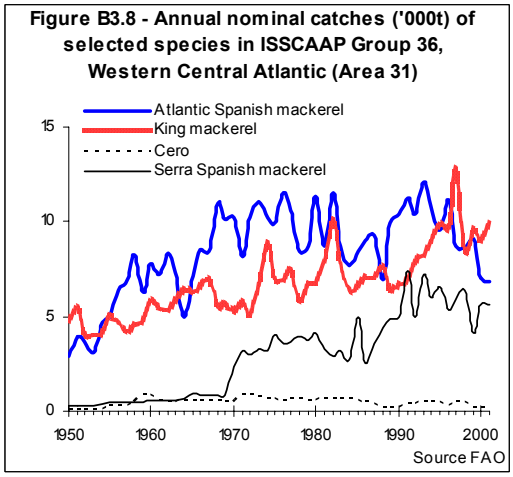


Figure B3.8 - Annual nominal catches ('000t) of selected species in ISSCAAP Group 36, Western Central Atlantic (Area 31)
Atlantic Spanish mackerel
King mackerel
Cero
Serra Spanish mackerel
15
10
5
0
1950
1960
1970
1980
1990
2000
Source FAO

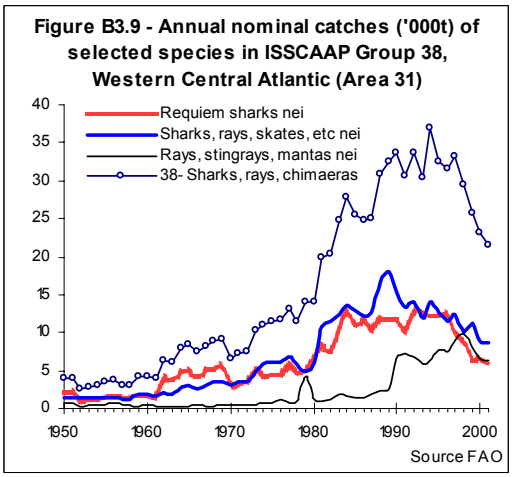


Figure B3.9 - Annual nominal catches ('000t) of selected species in ISSCAAP Group 38, Western Central Atlantic (Area 31)
Requiem sharks nei
Sharks, rays, skates, etc nei
Rays, stingrays, mantas nei
38- Sharks, rays, chimaeras
40
35
30
25
20
15
10
5
0
1950
1960
1970
1980
1990
2000
Source FAO

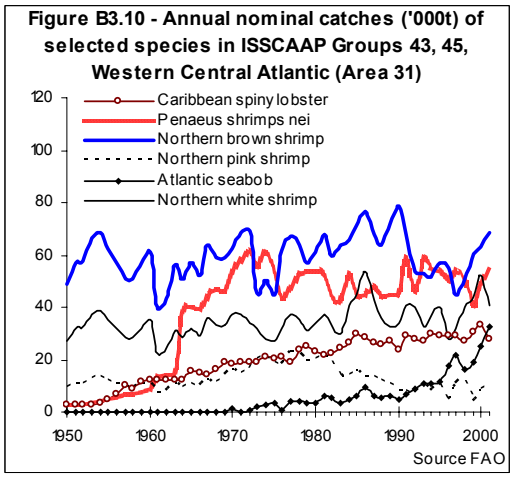
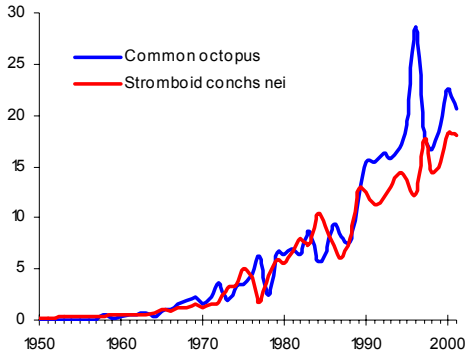


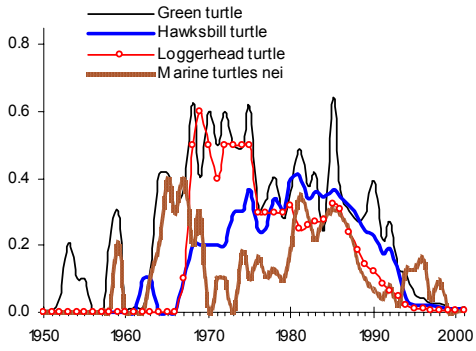
Figure B3.10 - Annual nominal catches ('000t) of selected species in ISSCAAP Groups 43, 45, Western Central Atlantic (Area 31)
Caribbean spiny lobster
Penaeus shrimps nei
Northern brown shrimp
Northern pink shrimp
Atlantic seabob
Northern white shrimp
120
100
80
60
40
20
0
1950
1960
1970
1980
1990
2000
Source FAO

Figure B3.11 - Annual nominal catches ('000t) of Common octopus and Stromboid conchs, Western Central Atlantic (Area 31)



Source FAO

Figure B3.12 - Annual nominal catches ('000t) of marine turtles Western Central Atlantic (Area 31)



Source FAO

APPENDIX 1: LANDINGS BY COUNTRY FOR 2001, AGGREGATED INTO MAJOR GROUPINGS. ARRANGED BY MAGNITUDE OF THE TOTAL RECORDED LANDING.

	PISCES	MOLLUSCA	CRUSTACEA	TOTAL
United States of America	**598190**	**116746**	**163279**	**878215**
Venezuela	**206153**	**52279**	**16362**	**274794**
Mexico	**149375**	**79822**	**29920**	**259117**
Guyana	**25754**		**26851**	**52605**
Cuba	**31934**	**5200**	**14241**	**51375**
Suriname	**11300**		**7415**	**18715**
Colombia	**11535**	**115**	**3350**	**15000**
Nicaragua	**4345**	**956**	**8143**	**13444**
Dominican Republic	**9195**	**1571**	**1293**	**12059**
Trinidad and Tobago	**10458**	**14**	**936**	**11408**
Taiwan Province of China	**10597**			**10597**
Guadeloupe	**9400**	**550**	**150**	**10100**
Bahamas	**1536**	**661**	**7089**	**9286**
Saint Vincent/ Grenadines	**8983**	**37**		**9020**
Martinique	**5300**	**700**	**190**	**6190**
Jamaica	**4702**		**548**	**5250**
French Guiana	**2500**		**2694**	**5194**
Spain	**4631**			**4631**
Haiti	**3800**	**300**	**400**	**4500**
Japan	**3996**			**3996**
Puerto Rico	**1923**	**1675**	**196**	**3794**
Other nei	**2923**			**2923**
Barbados	**2676**			**2676**
Honduras	**465**		**2074**	**2539**
Belize	**66**	**1980**	**471**	**2517**
Grenada	**2201**	**7**	**32**	**2240**
Saint Lucia	**1906**	**41**	**36**	**1983**
Antigua and Barbuda	**1274**	**37**	**272**	**1583**
Turks and Caicos Is.	**300**	**770**	**230**	**1300**
Dominica	**1150**			**1150**
Netherlands Antilles	**945**	**5**		**950**
Costa Rica	**694**		**122**	**816**
Saint Kitts and Nevis	**481**	**75**	**35**	**591**
Guatemala	**200**		**150**	**350**
Bermuda	**290**		**25**	**315**
US Virgin Islands	**264**	**1**	**35**	**300**
Anguilla	**180**	**10**	**60**	**250**
Korea, Republic of	**167**		**70**	**237**
Aruba	**163**			**163**
Cayman Islands	**125**			**125**
Montserrat	**50**			**50**
British Virgin Islands	**41**	**6**	**3**	**50**
Philippines	**37**			**37**
TOTAL				**1682435**