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WESTERN CENTRAL ATLANTIC FISHERY COMMISSION (WECAFC)
FIFTH SESSION OF THE SCIENTIFIC ADVISORY GROUP (SAG)
Puerto Morelos, Mexico, 27–29 October 2011
State of fisheries resources in the WECAFC region

B3. WESTERN CENTRAL ATLANTIC

FAO Statistical Area 31

INTRODUCTION

The area covered by the Western Central Atlantic Fisheries Commission (WECAFC) extends from Cape Hatteras in North Carolina, United States (35^{o}N), to just south of Cape Recife in Brazil (10^{o}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 which includes the Guianas and Brazil.

The WECAFC area includes FAO Statistical Area 31 and a portion of Area 41 occurring offshore of northern Brazil. This chapter deals only with Area 31 (Figure B3.1 and Table B3.1). 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 major island groups in Area 31 are the Bahamas and adjacent banks and islands, which account for over half of the islands and banks shelf area, the Greater Antilles (Cuba, Puerto Rico, Jamaica and Hispaniola), and the Lesser Antilles (Stevenson, 1981).

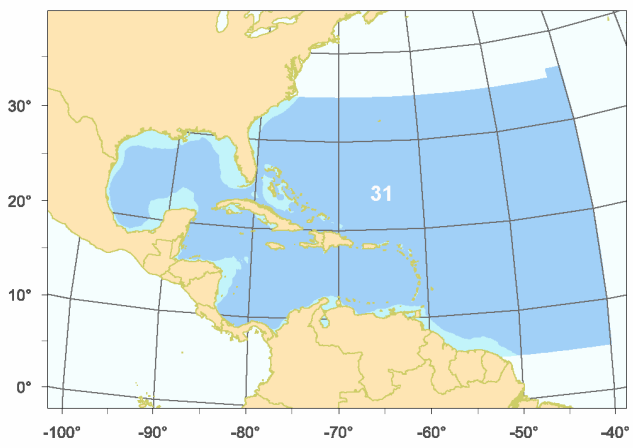

Figure B3.1 – The Western Central Atlantic (area 31)

The North Equatorial Current flows westward slightly north of the Equator; it meets the Guiana Current before splitting in two branches: the Caribbean Current that enters the Caribbean Sea and the Antilles Current that flows northwards along the Antilles and joins the Florida Current to form the Gulf Stream. The Caribbean Current flows north-westwards through the Caribbean Sea, with a number of meanders, filaments and eddies that show spatio-temporal variability. Eventually, the water flows through the Yucatan Channel into the Gulf of Mexico, where it becomes the Loop Current that flows clockwise through the Gulf and through the Straits of Florida to become the Florida Current.

Freshwater discharges from the Mississippi, the Orinoco and the Amazon have an important influence in the Region in terms of freshwater entry, sediments discharge and ocean circulation. The productivity of the waters is recognized to be influenced by these major rivers, even though the runoff is seasonal.

The productivity of the Region is quite heterogeneous, alternating areas of high and low productivity. Areas of high productivity are typically the plumes of the main rivers, coral reefs, mangroves and seagrass beds. These last three are the coastal habitats of main interest, as they provide coastal protection against waves and storm surges and host the spawning and nursery grounds of a number of living marine species (Heileman, 2007). Seasonal upwelling is also a source of high productivity, especially during the first semester in the southern Caribbean (Muller-Karger & Aparicio-Castro, 1994).

The WECAFC area is characterized by a high diversity of species, in particular occurring around southern Florida, eastern Bahamas and northern Cuba, as well as a high level of endemicity within the Caribbean. The Caribbean Sea has the highest level of species diversity in the tropical Atlantic and is considered a global hot spot of marine biodiversity (Roberts *et al.*, 2002; Miloslavich *et al.*, 2010). Species of interest to fisheries include molluscs, crustaceans (lobster, penaeid shrimps, crabs), coastal fishes occupying various substrata (soft bottom or reefs), large migratory fish species and deep slope fish species.

Table B3.1 Locality and area of the major coastal shelf zones in the WECAF area (Stevenson, 1981).

LOCATION	AREA ('000 km^2)	FAO Area
Continental Shelf		
U.S. east coast	110	31
Gulf of Mexico	600	31
Yucatan – Eastern Venezuela	250	31
Guyana, Surinam, French Guiana	200	31
Northern Brazil	360	41
TOTAL Continental shelf	1520	
Islands		
Islands and offshore banks	380	31
GRAND TOTAL	1900	

PROFILE OF CATCHES

The total landings in Area 31 increased steadily from about 0.5 million tonnes in 1950 to a peak of near 2.5 million tonnes in 1984, followed by a rapid decline between 1984 and 1992, and stabilized at around 1.5 million tonnes until 2003 (Fig.B3.2). They further declined over the last few years to 1.3 million tonnes in 2009. This decrease is mainly due to the diminished catches of ISSCAAP Groups 33 (misc. coastal fishes that include groupers, snappers, mugilidae) and 35 (small pelagic fish, herrings, sardines and anchovies).

The proportion of non identified species remained stable throughout the years (between 15 and 20 per cent), indicating that no or limited progress was made in the identification of the species in the landings. ISSCAAP Group 39 Marine fishes not identified accounted for 124 000t and 117 000t of the total landings in 2008 and 2009 respectively (around 10 per cent of the catches).

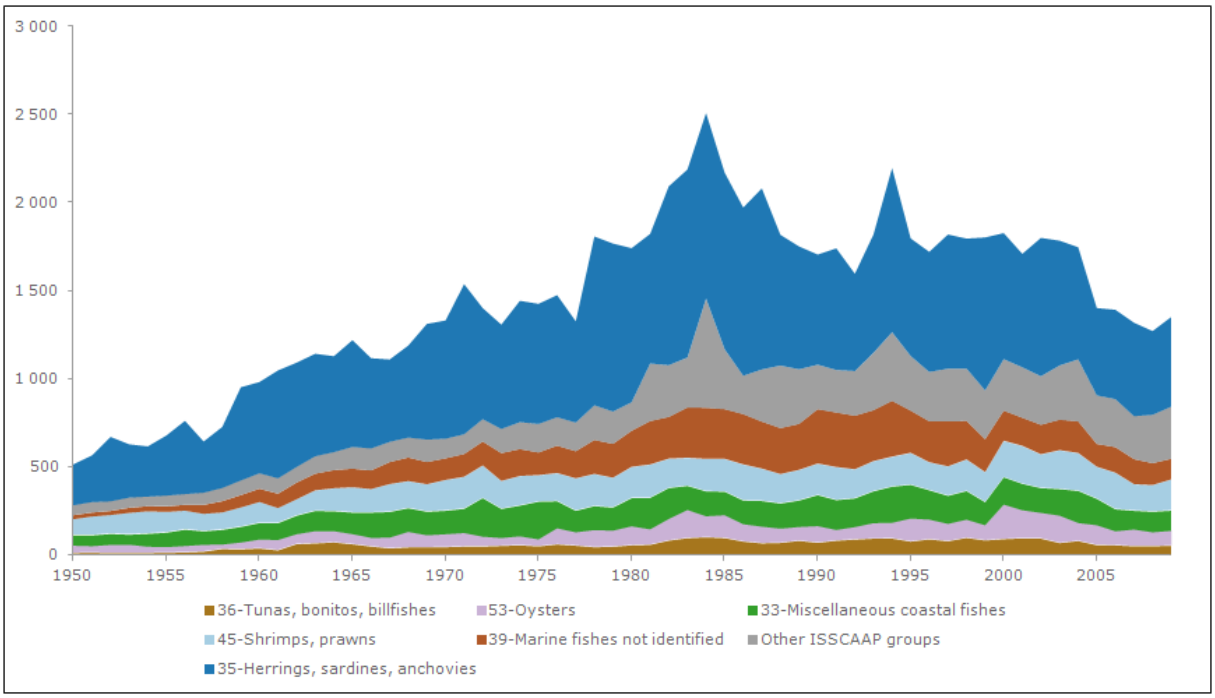

Fig.B3.2 – Annual nominal catches ('000t) by ISSCAAP species groups in the Western Central Atlantic (Area 31)

The ISSCAAP Group 35 - herrings, sardines, anchovies - makes the largest contribution in the catches, with 44 per cent of the total catches in the Region in 2009. This is mostly due to the Gulf menhaden (*Brevoortia patronus*) caught mainly by the United States of America (USA). Catches of this species increased irregularly from about 200 000t in 1950 and reached a peak in 1984, at one million tonnes. After 1984, the catches declined, dropping to 433 000t in 1992. In the most recent years, the landings have been relatively stable, fluctuating between 450 000t and 500 000t, with a minimum recorded in 2005 at 370 000t (Figure B3.3). The most recent declines in landings are in part because of the active tropical storm season in 2004 and the two major hurricanes, Katrina and Rita in 2005 that damaged vessels and processing plants (Vaughan *et al.*, 2007). Atlantic menhaden (*B. tyrannus*) is the other species that used to be important in terms of landings in the USA, but has experienced a continuous decrease in catch over the last few years, reaching a historical low of 120 t in 2009.

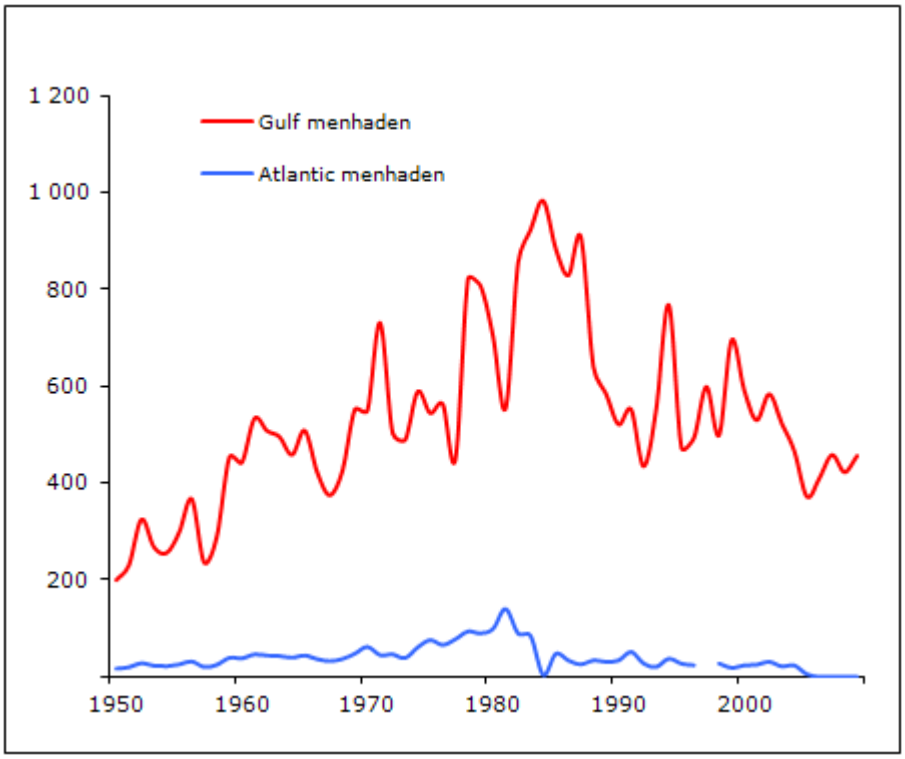

Figure B3.3 – Annual nominal catches ('000t) of selected species in ISCAAP Group 35 in the Western Central Atlantic (Area 31)

Six families dominate the small pelagic catches from ISSCAAP Groups 35 (herrings, sardines, anchovies) and 37 (Other Miscellaneous pelagic fishes): Exocetidae (flyingfishes); Clupeidae (herrings and sardines); Engraulidae (anchovies and anchovetas); Carangidae (jacks, bumpers and scads); Hemiramphidae (halfbeaks); and Mugilidae (mullets).

The round sardinella (*Sardinella aurita*) still accounts for important catches in weight; however, the landings show wide fluctuations, with a spectacular increase in the 1990s, reaching a maximum of 191 000t in 1998, followed by a steep decrease in the last years of the series, from 160 000t in 2002 to 37 000t in 2009, mostly reported by Venezuela (Figure B3.4). As for the previous years, the flathead grey mullet (*Mugil cephalus*), unidentified mullets and the Atlantic thread herring (*Opisthonema oglinum*) represent a significant proportion of the catches, accounting for 21 000t in 2009. The flathead grey mullet catches decreased by nearly two-thirds in the last years, from 16 700t in 1996 to 6 000t in 2009, reported by Venezuela and Mexico only. The countries declaring Atlantic thread

herring are mainly Venezuela, Cuba and the USA; the landings show wide fluctuations over the last 15 years, with a minimum of 4 500t in 2002 and a maximum of 17 700t in 2004; the last value of the series amounts to 9 000t in 2009. Whereas the Atlantic thread herring catches have fluctuated over the years, with successive high and low catches, those of the mullets show an overall decreasing trend over the last two decades.

The catches of unidentified jacks and crevalles of the genus *Caranx* are reported mainly by Venezuela, Mexico and Trinidad and Tobago. They show a regular increase from 3 000t in 1950 to a maximum of 12 800t in 1997 and then a steep decrease, from 12 400t in 2003, down to 5 400t in 2009, mainly due to a reduction in the landings declared by Mexico. This decrease actually corresponds to a change in the reporting system, as in 2005, Mexico started reporting blue runner (*Caranx crysos*). If the landings of *Caranx* spp. and *Caranx crysos* are summed, the trend actually shows fluctuations around an annual average of 10 800t over the period 2003-2009, hence illustrating that the changes are due to improved species identification rather than any underlying change in the fishery or ecosystem

The four-winged flyingfish (*Hirundichthys affinis*) is known to support important local fisheries in the Eastern Caribbean as bait fish and for human consumption. The landings statistics have suffered poor quality, but were recently corrected for Barbados, Tobago, Grenada, Saint-Lucia, Saint Vincent and Grenadines, Martinique and Dominica, providing estimates of values fluctuating around 3 500t in the period 1985-2004, followed by a decrease in the last years when catches reached 2 500t (FAO, 2010). As for the common dolphinfish (*Coryphaena hippurus*), the countries reporting the highest catches in the last period are Venezuela, Barbados, France (Guadeloupe), Saint-Lucia and USA. The catches of this species increased regularly since the 1950s; they reached 4 500t in 1997, then they decreased to 2 600t in 2005, before increasing again to over 5 000t in 2009. Venezuelan catches account for one third of the total in 2008 and 2009.

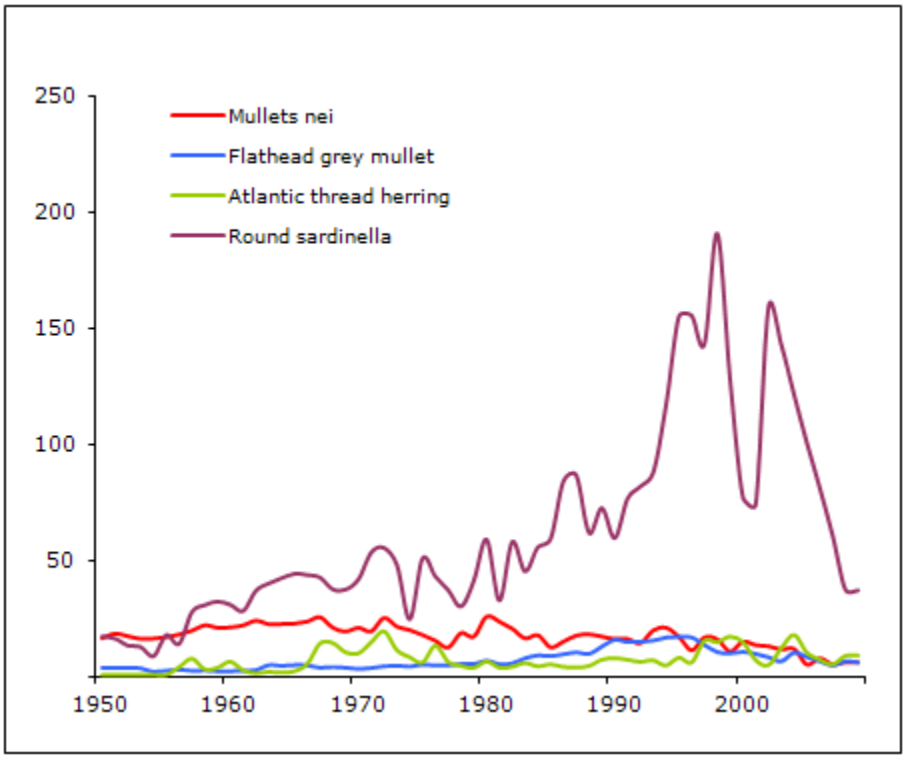

Figure B3.4 - Annual nominal catches ('000t) of selected species in ISCAAP Groups 33, 35, 37 in the Western Central Atlantic (Area 31)

The ISSCAAP Group 33 –miscellaneous coastal fishes continues to contribute a significant fraction of the landings (Figure B3.2). This group accounted for around 9 per cent of the catches in the region in 2009. The species or families that contribute the most to this group are: marine catfishes (*Ariidae*); groupers, seabasses etc. (*Serranidae*), especially the groupers (*Epinephelus* spp.); grunts, sweetlips (*Haemulidae*); snappers, jobfishes (*Lutjanidae*), especially the northern red snapper (*Lutjanus campechanus*), the yellowtail snapper (*Ocyrus chrysurus*) and the vermilion snapper (*Rhomboplites aurorubens*) ; croakers, drums (*Sciaenidae*), especially the weakfishes (*Cynoscion* spp.) and the whitemouth croaker (*Micropogonias furnieri*) ; the snooks (*Centropomidae*) especially the common snook (*Centropomus undecimalis*). Overall, the catches of this group are lower than in the previous decade, despite a peak over 2003-2005; the current catches are around 119 000t (Table D3).

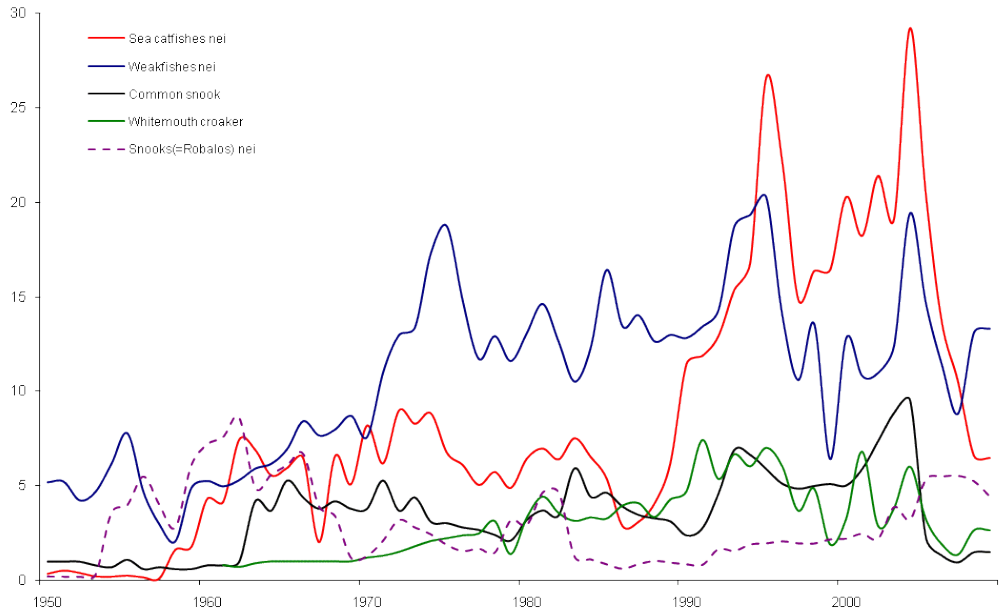

Figure B3.5 - Annual nominal catches ('000t) of Selected soft-bottom species, Western Central Atlantic (Area 31)

The subdivision of the miscellaneous coastal fish (soft substrata and reef fishes) of the previous review was kept in this analysis of the landings. The sea catfish catches increased from 1950 reaching nearly 30 000t in 2004, but have since decreased steeply over the last five years, dropping below 7 000t in 2009, only one quarter of its 2004 peak (Figure B3.5). The main fishing countries remain Mexico and Venezuela. The weakfish catches alternated from a peak over 19 000t in 2004, before dropping below 9 000t in 2007 and increased again to 13 000t in 2009, which corresponds to the average value over the period 1970-2009; they are mainly landed by Venezuela and to a lesser extent by Mexico and French Guiana. Spotted weakfish (*Cynoscion nebulosus*) catches dropped significantly from over 6 000t in 2002 to less than 400t in 2009. Similarly, landings of common snook decreased substantially from over 9 000t in 2004 to 1 500t in 2009, mainly because of the decrease in the catches declared by Mexico. In contrast, unidentified snook catches in Mexico almost doubled over the last years, from 2 000t in 2003 to over 3 800t in 2009, which indicates a deterioration in species identification of the reported catches. Even though showing great fluctuations, whitemouth croaker catches have also demonstrated a clear decline from about 6 000t in 2004 to 2 700t in 2009 (Figure B3.5). This species is mainly fished by Venezuela.

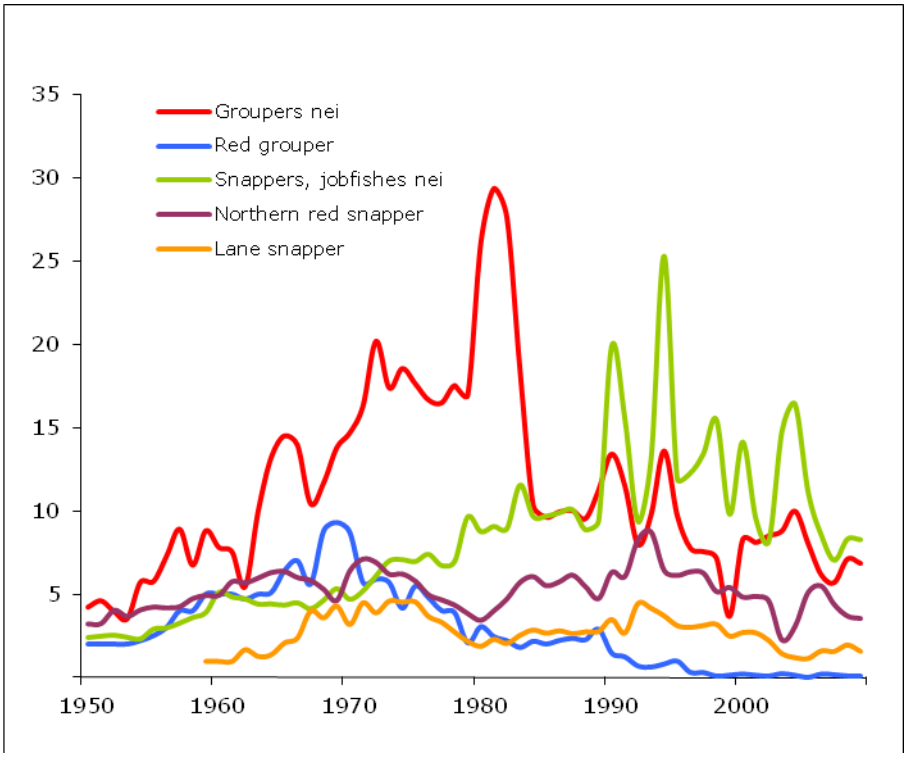

Figure B3.6 - Annual nominal catches ('000t) of selected reef species in the Western Central Atlantic (Area 31)

Catches of unidentified groupers show an important decreasing trend since their peak value of 29 000t in 1981, reaching 7 000t in 2009. Red grouper (*Epinephelus morio*) landings have decreased more or less continuously from the maximum of 9 300 t observed in 1970 until the end of the series. However, the series for red grouper only reflects landings by Cuba and Dominican Republic and not those of the major producers in the region: Mexico and USA. Landings of unidentified snappers and jobfishes increased throughout the years until 1990 and then started showing wide oscillations. Despite the fluctuations, there seems to be a decreasing trend since the 1990s; the last value of the series is 8 000t. Venezuela, Mexico and the Dominican Republic are the countries that declare the highest landings of unidentified snappers and jobfishes. The northern red snapper (*Lutjanus campechanus*) and the lane snapper (*L. synagris*) landings show fluctuations along the series, with a decreasing trend since the early 1990s (Figure B3.6).

The decreasing trend of Nassau grouper (*Epinephelus striatus*) continued in the last years, with a minimum of 246t reached in 2009, most of which was declared by The Bahamas. Nassau groupers have been severely depleted by fishing and it has been listed on the IUCN red list of threatened species in 2003. Many of the remaining spawning aggregations are protected; this accounts for the decrease of the landings in recent years.

Vermillion snapper (*Rhomboplites aurorubens*) started to be declared in 1997, with an average of 800t per year until 2004, but in the last 5 years of the data series, the landings reached an average of 3 700t per year. This is due mainly to the fact that Mexico started reporting high landings in 2005, as well as to a slight increase in the USA catches. More than an increase in catches, this is likely due to an improved identification of the species and hence more correct reporting of the landings. This is also reflected in the statistics on other coastal

species, such as yellowtail snapper (*Ocyurus chrysurus*), unidentified snappers and jobfishes, grey snapper (*Lutjanus griseus*), cubera snapper (*Lutjanus cyanopterus*), white grunt (*Haemulon plumierii*), unidentified snooks (*Centropomus* spp), sea catfishes (Ariidae), unidentified porgies and seabreams (Sparidae). For example, Mexican landings show high variations between 2004 and 2005, with some landings that doubled or even tripled from one year to the other. This reallocation of the catches would explain why some species show a spectacular decline in 2005 in Mexico, as for example common snook (*Centropomus undecimalis*) (5 400t in 2004 to 20t in 2005).

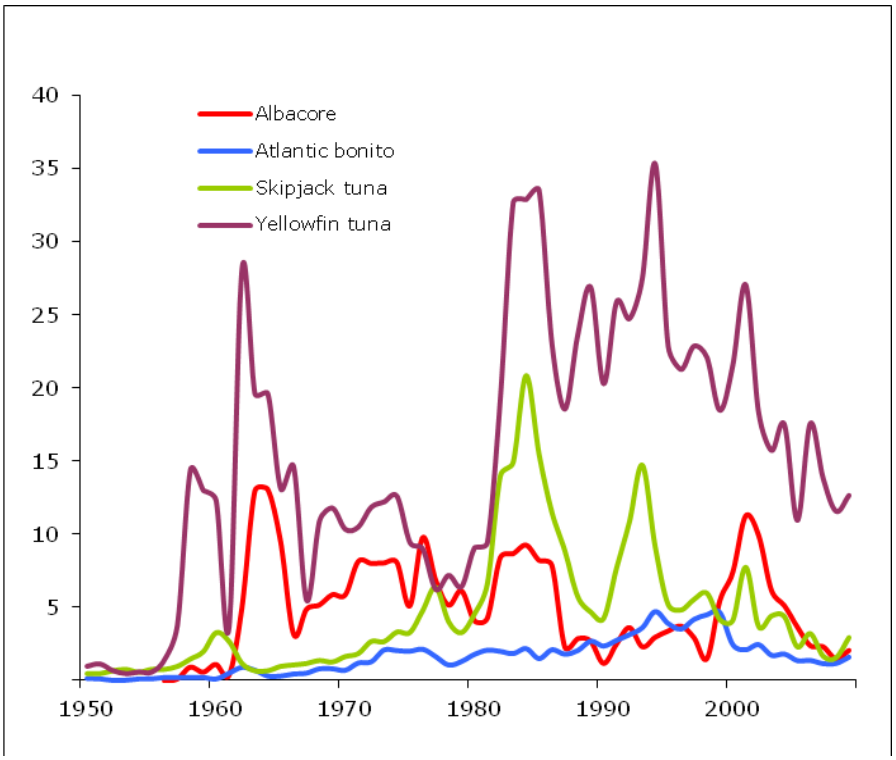

Figure B3.7 - Annual nominal catches ('000t) of selected species in ISCAAP Group 36 in the Western Central Atlantic (Area 31)

The catches of the ISSCAAP Group 36 tunas, bonitos, and billfishes show great inter-year fluctuations. The major species presented a clear decreasing trend, although the starting year of the decline varies among species (Fig.B3.7). The overall catch of the group averaged 87 000t in the 1990s and 71 000t in the 2000s.

Yellowfin tuna (*Thunnus albacares*) remains the most landed species. Two distinct periods could be identified while analyzing the catches of this species: from 1950 to 1980, the catches increased up to a maximum of 28 000t in 1962, before decreasing down to 6 400t in 1979; a notable increase occurred between 1980 and 1985 (33 500t) and since then catches show an overall decrease until 2009 when they reached 12 700t. The decrease is attributed to reduced fishing effort , but in some cases also to environmental conditions that may have affected abundance (ICCAT, 2009). The albacore (*Thunnus alalunga*) catches have continued decreasing, from 10 000t in 2002 to 2 000t in 2009, probably because of a reduction in effort of the Taiwan Province of China fleet. Skipjack tuna (*Katsuwonus pelamis*) landings fluctuated during the last period, but with a decreasing trend, from 3 700t in 2002, to 3 000t in 2009. The main fishing countries are Venezuela and, to a lesser extent, Cuba. The Atlantic bonito (*Sarda sarda*) landings have increased regularly since the 1950s, reached a maximum

of 4 700t in 1994 and then started decreasing again, reaching 1 600t in 2009; the catches are mainly reported by Mexico.

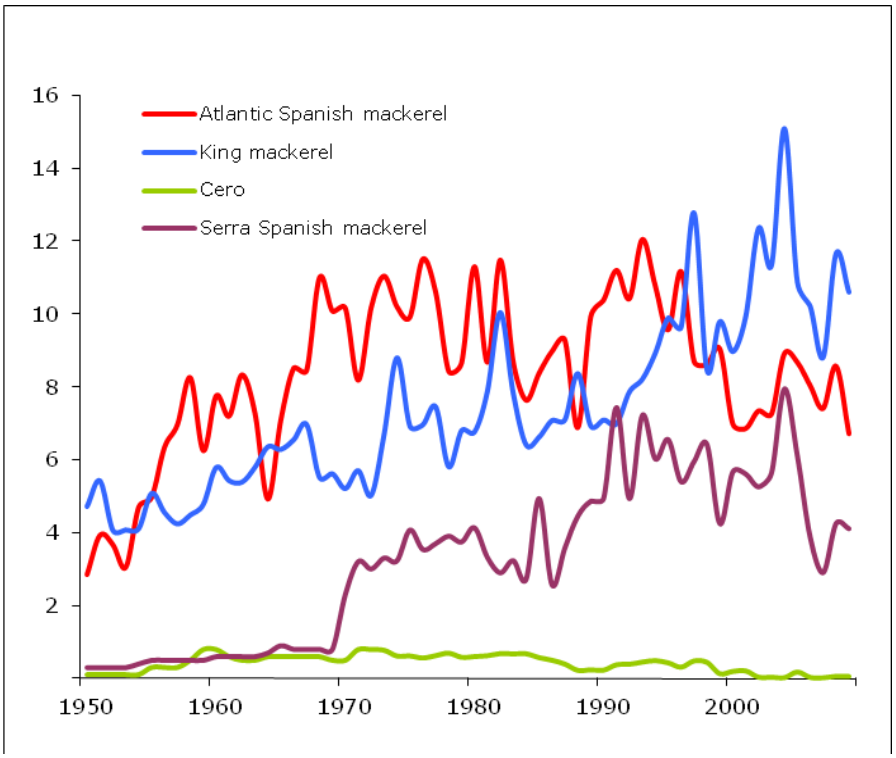

Figure B3.8 - Annual nominal catches ('000t) of selected species in ISCAAP Group 36 in the Western Central Atlantic (Area 31)

The coastal large pelagic catches are dominated by the same species as in the previous years: king mackerel (*Scomberomorus cavalla*) declared mainly by Mexico, the USA, Venezuela and Trinidad and Tobago; Atlantic spanish mackerel (*Scomberomorus maculatus*) in Mexico and the USA; serra spanish mackerel (*Scomberomorus brasiliensis*) in Venezuela and Trinidad and Tobago; and cero (*Scomberomorus regalis*). The catches of all four species are characterised by wide fluctuations. Over the last years, there seems to be an overall decreasing trend for the Atlantic spanish mackerel, with catches as low as 6 700t in 2009 and an overall increasing trend for king mackerel over the whole data series. In 2009, the catches of king mackerel and serra spanish mackerel were 10 600t and 4 100t respectively. The recorded cero catches show low values in the years 2000s compared to the 1990s, they fluctuated around an average of 50t during the period 2002-2009. In light of the most recent landings statistics, it appears that landings of cero have a totally different pattern compared to the historical data (1950-1984). The years 1990s and 2000s are characterized by a sharp decrease in landings and the last values of the series represent only 5 per cent of what the catches used to be at the time of the historical maximum of 800t in the 1960s/1970s. The species is declared only by the Dominican Republic and Puerto Rico thereafter.

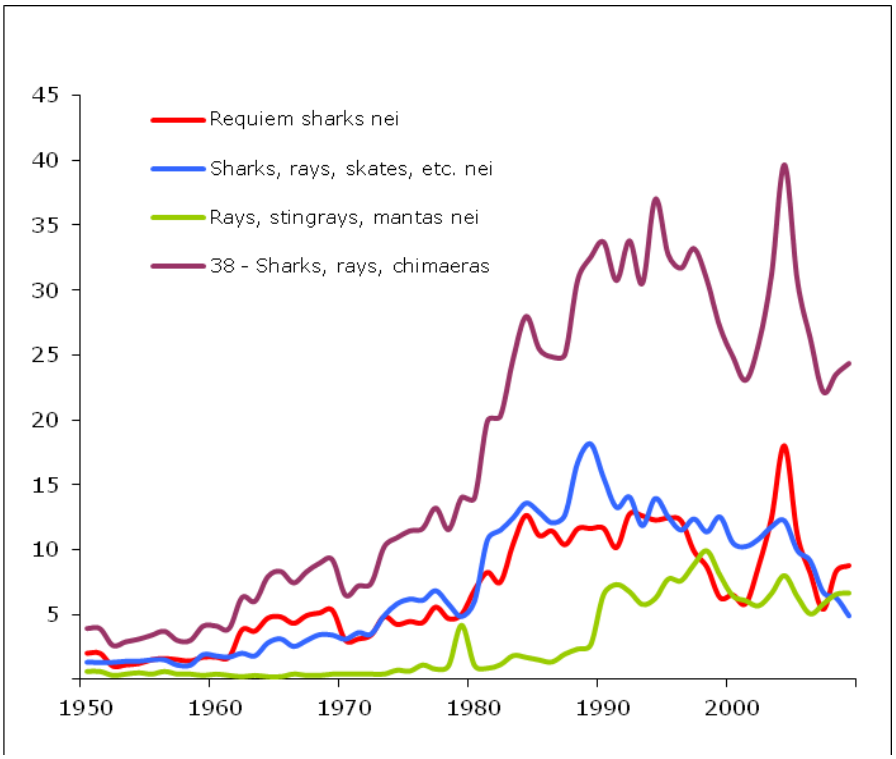

Figure B3.9 - Annual nominal catches ('000t) of selected species in ISCAAP Group 38 in the Western Central Atlantic (Area 31)

After an overall increase until the mid-1990s, the catches of ISSCAAP Group 38 – sharks, rays, chimaeras seem to be decreasing since 1994, but in 2004 the catches suddenly increased and reached a historical peak at 39 600t (Fig.B3.9). The 2004 peak seems to be due mainly to an increase in the requiem sharks by Venezuela (catches increased by more than two fold between 2002 and 2004) and to a lesser extent by unidentified rays, stingrays, mantas by Venezuela and the ISSCAAP Group 38 landings from Guyana.

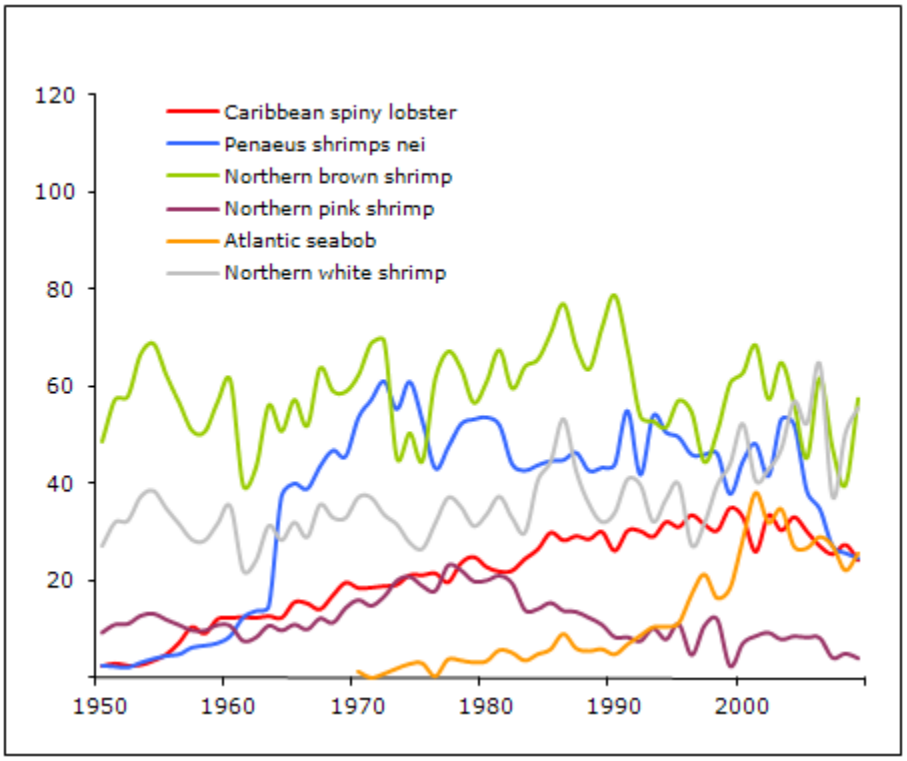

Figure B.3.10 - Annual nominal catches ('000t) of selected species in ISCAAP Groups 43, 45 in the Western Central Atlantic (Area 31)

The Caribbean spiny lobster (*Panulirus argus*) catches have decreased over the last years, from 34 000t in 2002 to 24 000t in 2009 (Fig.B3.10). Caribbean spiny lobster landings are declared by 26 countries, but Nicaragua, Honduras, Cuba and The Bahamas altogether accounted for 70 per cent of the catches in the Region in 2009.

In the last years, landings of unidentified penaeid shrimps dropped from a peak of over 50 000t in 2003 and 2004 to 25 000t in 2009. The northern brown shrimp (*Farfantepenaeus aztecus*) and the northern white shrimp (*Litopenaeus setiferus*) are the two most productive shrimp species, with similar landings over 55 000t in 2009 (Fig.B3.10). However, they seem to show opposite trends over the last years, with an increase for the northern white shrimp and a decrease for the northern brown shrimp. Both species are mainly reported by the USA. The trend of the Atlantic seabob (*Xiphopenaeus kroyeri*) landings seems to have reverted over the last years; after a continuous increase until 2001 (38 000t), the catches decreased continuously down to 26 000t in 2009. The bulk of the landings are reported by Guyana and Suriname, with over 90 per cent of the catches of the Region. Landings of northern pink shrimp have been declining more or less continuously since 1978 when they peaked at 22 000t to 4 000t in 2009, catches by USA accounted for 70% of the total in this last year.

As for the molluscs, oysters remain the main catches of the group in the area, in particular the American cupped oyster (*Crassostrea virginica*) declared by the USA and Mexico. The landings dropped by more than half, from the 195 000t historical peak in 2000 to 84 000t in 2009, due to a sharp decline in the USA landings. Ark clams (*Arca* spp.) production shows a continuous increase throughout the data series and reached a historical maximum at 71 000t in 2009, mainly reported by Venezuela.

Even though with fluctuations, catches of stromboid conchs (*Strombus* spp.) have declined since their historical maximum of 40 000t in 1995 down to 23 000t in 2009 (Fig. B3.11). This is partly in response to the listing of queen conch (*Strombus gigas*) on Appendix II of CITES in 1992, controlling its export, and to national management efforts targeted at reducing harvests. The countries declaring the highest landings are Mexico, Jamaica, Turks and Caicos, Belize, Dominican Republic and Nicaragua, but conchs are declared by a number of other countries. Landings of common octopus (*Octopus vulgaris*), mainly caught in Mexico, show important inter-annual fluctuations over the last years of the series, alternating between a maximum of 24 000t in 2004 and a minimum of 7 000t in 2005; the most recent value is 17 000t in 2009. Landing of Mexican four-eyed octopus (*Octopus maya*) are reported since 2005; they account for one third of octopus catches in Mexico, with an average of 5 400t per year.

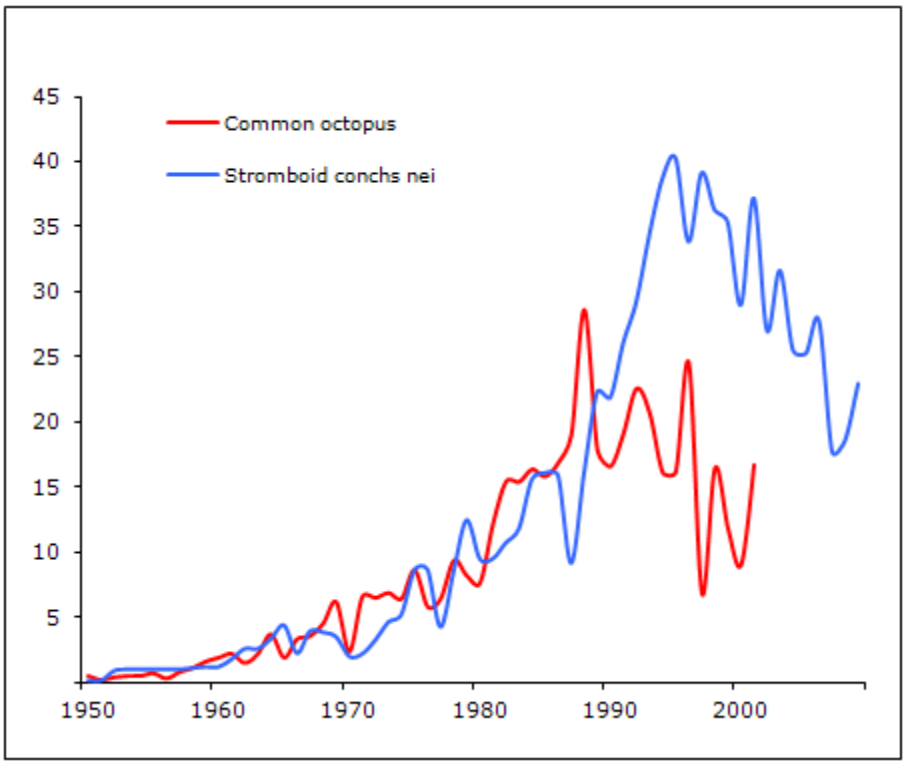

Figure B.3.10 - Annual nominal catches ('000t) of Common octopus and Stromboid conchs in the Western Central Atlantic (Area 31)

Reported landings of turtles decreased steadily since 2002 and practically disappeared from the statistics in 2009. The green turtle (*Chelonia mydas*) landings decreased from 14t in 2002, to 1t in 2008, but no landings were reported in 2009. All of the Caribbean sea turtle species are considered endangered or critically endangered (IUCN Red List of threatened species) and all are listed on Appendix I of CITES, preventing export trade in these species.

An interesting feature is the recent inclusion of unidentified sea cucumbers (*Holothurioidea*) in the landings, mainly reported by Nicaragua, 5t in 2006 and 720t in 2009, even though there is indication that the fishery dates back to 1994 (Toral-Granda, 2008). This increase is likely due to new markets for this group opening up in China.

RESOURCES STATUS AND FISHERY MANAGEMENT

There is a number of institutional arrangements promoting and facilitating the responsible utilization of the fisheries and other aquatic resources, with different geographical coverage and mandates: Western Central Atlantic Fisheries Commission (WECAFC) of the FAO, the International Commission for the Conservation of Atlantic Tuna (ICCAT), the Caribbean Regional Fisheries Mechanism (CRFM), the Caribbean Fisheries Management Council (CFMC), the Latin American Organization for Fishery Development (OLDEPESCA), the Central American Organization for the Fisheries and Aquaculture Sector (OSPESCA), the Association of Caribbean States (ACS), the Organization of Eastern Caribbean States (OECS), the National Oceanic and Atmospheric Administration (NOAA). The different institutions adapt to the informal arrangements that are agreed upon, and some of them took the lead in the assessment and management of particular fisheries resources, as for example WECAFC for shrimp, groundfish and flyingfish, CRFM for other regional pelagics, conch, lobster and shrimp, OSPESCA for lobster resources (Fanning and Mahon, 2011). However, despite the relatively high number of existing arrangements, information that can be used for management purposes still needs to be improved in the region. The launching of the GEF-funded Caribbean Large Marine Ecosystem Project[1] in 2009 is likely to provide valuable assistance to the Caribbean countries to improve the knowledge on and the management of their shared fisheries resources.

The stock abundance of Gulf menhaden (*Brevoortia patronus*) was estimated to be between its target and limit reference points and thus not considered to be overfished, nor subject to overfishing. However, the stock would approach its limit reference points if the population fecundity decreases and fishing mortality continues to increase (Vaughan *et al*., 2007). Atlantic menhaden (*Brevoortia tyrannus)* was not considered to be overfished nor was overfishing occurring in 2008, even though uncertainties in the assessment led to the conclusion that overfishing was potentially occurring in 2008 (ASMFC, 2011).

Following a survey carried out in 2009 along the Venezuelan Eastern coasts, the biomass of Round Sardinella (*Sardinella aurita*) was estimated to have decreased significantly over the last years, probably because of a combined effect of natural and fishing mortality coupled with unfavourable environmental conditions that hampered recruitment success. The stock currently shows signs of overexploitation, if not depletion (López, Venezuela, pers. comm.). In the USA, despite the reduction in commercial landings since 1995 on the west coast of Florida, fishery independent surveys dating back to 2003 indicate no increase in abundance in recent years and suggest that factors other than fishing may be responsible for changes in abundance (Mahmoudi *et al.*, 2002).

As for flyingfish (*Hirundichthys affinis*), analysis of data until 2008 suggests that the eastern Caribbean stock is not experiencing overfishing, but because of the poor regional data available, the assessment could not determine whether local depletion is taking place (FAO, 2010). As part of the CLME Project, a case study is currently focusing on the improvement of availability of data and information including catch/effort data and will hopefully lead to more reliable assessment in the future (CRFM, 2010b). No formal stock assessment of Atlantic thread herring (*Opisthonema oglinum*) seems available in the region.

[1] http://www.clme.iwlearn.org/

Assessments of flathead grey mullet carried out in Mexico show that, depending on the Province, the species is either exploited at the MSY (Tamaulipas), or deteriorating (Veracruz), as evidenced by the sharp decrease of the catches. Current management measures include a minimum landing size of 31 cm as well as a minimum mesh size of 101 mm (SAGARPA, 2010). The most recent assessment of flathead grey mullet in Florida waters indicates that the stock was not overfished nor overfishing was occurring (Mahmoudi, 2008).

Greater amberjack, together with a number of highly migratory species (blue marlin, white marlin, sailfish, albacore, bluefin tuna) was found to be subject to a high fishing mortality, with biomass below the biological threshold specified in the fishery management plan. Sailfish in the Western Atlantic is no longer overfished, but still subject to overfishing (NMFS, 2011).

As for the common dolphinfish, any decline in the stock seems impossible to detect because of incomplete information available, therefore no status could be clearly attributed from the last assessment carried out with data from Caribbean, Venezuela, USA and Brazil (CRFM, 2010). However, the standardized CPUE indices for the eastern Caribbean seem to show that the stock is not declining. The stock has also been linked to its major prey item, flying fish and improved assessments of both species may result when they are considered together.

Yellowfin tuna in the Atlantic was assessed with data up to 2006 (ICCAT, 2009), and the stock was neither overfished nor subject to overfishing in 2006; however, the yellowfin tuna in the Atlantic Ocean is treated as a unit stock. The last assessment available for North Atlantic albacore stock indicates that the stock is likely to be overexploited and the recommended a reduction in its Total Allowable Catch (TAC) (ICCAT, 2010). The assessment of the western stock of skipjack tuna, based on the data up to 2006 (ICCAT, 2009) concludes that the current catch is unlikely to be higher than the replacement yield, but no clear status was assigned.

Assessment of the king mackerel fishery in U.S. waters estimated that in the Gulf of Mexico and Atlantic the species was not overfished. However, uncertainty in stock assessments did not allow to establish if overfishing was occurring (SEDAR, 2009). In the southern Caribbean there has not been significant changes in fishing mortality in the last 10 years, but it is not known if the stock is overfished or not (CRFM, 2007). For spanish mackerel in the south Atlantic coast of the U.S. results indicated that overfishing was not occurring, but there was uncertainty regarding the overfished status of the stock (SEDAR, 2008).

The shrimp trawl fishery in Venezuela was closed since March 2009. Mendoza *et al.* (2010) analysed available information on landings of different taxonomic groups and their nominal fishing effort by fleet between 1970 and 2008 in eastern Venezuela and estimated biomass trajectories, Maximum Sustainable Yields (MSY), and the fishing effort corresponding to MSY, thus providing retrospective information on the status of different stocks. Except for the red spotted shrimp (*Farfantepenaeus brasiliensis)*, all stocks analyzed seemed to show signs of overfishing at the end of the analysed time series. Signs of slight recovery in abundance were seen for whitemouth croaker (*Micropogonias furnieri)*, king weakfish (*Macrodon ancylodon*) along the Orinoco Delta or the Jamaica weakfish (*Cynoscion jamaicensis*) on the Margarita-Sucre platform. However, the authors cautioned the use of the results, due to considerations of data limitations and inconsistencies in the measurement of fishing effort.

In its annual report to Congress, the NMFS indicated that several species of snappers and groupers are either subject to overfishing, overfished or both in the South Atlantic, Gulf of Mexico and Caribbean areas. Northern red snapper, misty grouper, Nassau grouper, red grouper, yellowedge grouper, yellowfin grouper and black seabass were indicated as both subject to overfishing and overfished in USA waters. The status of gag grouper was previously unknown in the USA, but evidence was found that it was subject to overfishing in the South Atlantic and overfished and subjected to overfishing in the Gulf of Mexico (NMFS, 2011). In Mexico the red grouper is overfished and effort reductions have been recommended (SAGARPA, 2010). Only general indication is available for some stocks or species, as for example in Mexico where various coastal fishes stocks are considered to be deteriorating (SAGARPA, 2010). Another example is the southern red snapper (*Lutjanus purpureus*) in French Guiana where a high recruitment was recorded in the last years, with a high level of adult biomass. This may indicate that the stock might be improving, at least in the short term, but the status is still unknown because no formal assessment was carried out (IFREMER, 2011).

Determination of sharks status does not seem to be dealt with in a systematic way and therefore only limited and scattered information is available. Using data collected until 2006, Tavares (2009) examined the exploitation status of sharks and rays in Venezuela where they sustain an important artisanal fishery operating along most of the coasts and islands of the country. The author underlines the difficulty of collecting data in the landing harbours scattered along the coast. A total of 97 species (62 of sharks and 35 of ray species) were recorded in the landings, with a predominance of the genus *Mustelus* and *Rhizoprionodon*. In the islands, the catch composition was dominated by *Carcharhinus limbatus*, *C. perezi* and *Ginglymostoma cirratum*. In contrast, catches of the industrial fishery are dominated by *Prionace glauca* and *C. signatus*. No stock assessment was carried out due to the lack of detailed data and information. Loss of biodiversity and decrease in abundance indices of several species were described (Tavares and Arocha, 2008), but there are still high uncertainties regarding the status of these stocks.

In Mexico, some rays (*Dasyatis americana*, *Dasyatis sabina*, *Aetobatus narinari*, *Gymnura micrura*, *Rhinoptera bonasus*) are known to be target species, and their status was estimated to be exploited at the MSY. However, it was recommended not to increase fishing effort further (SAGARPA, 2010).

Sandbar shark, dusky shark and blacknose shark are subject to overfishing and overfished, while the shortfin mako is subject to overfishing (NMFS, 2011). Other species assessed such as: finetooth shark, Atlantic sharpnose and bonnethead are neither overfished nor subject to overfishing, as well as the blacktip shark in the Gulf of Mexico (SEDAR, 2006; SEDAR, 2007).

Spiny lobster in the Yucatan and Quintana Roo area, Mexico was estimated to be exploited at around MSY. It was recommended to establish a reliable effort control system to prevent any further increase in fishing mortality (SAGARPA, 2010). However, Chavez (2009) estimates that lobster populations in southern Mexico are overexploited.

In the Southeast USA, the latest assessment could not establish the status of the stock, as the results of the assessment models were rejected by an external review panel. However, new genetics data suggest that the southeast USA lobster population is highly dependent on external recruitment of post larval lobsters from other spawning stocks throughout the

Caribbean (SEDAR, 2010). However, Ehrhardt & Fitchett (2010) estimated that a significant proportion of recruitment was explained by the Floridian local population.

This corroborates the conclusions of a CRFM working group that underlined that the spiny lobster does not migrate over deep water as an adult and hence there is a strong hypothesis that there are distinct management units, even though they might depend to an unknown extent on external recruitment (CRFM, 2009). As a result separate assessments were carried out by country.

In Jamaica, even though not conclusive, because of data limitations and poor reliability of the modelling results, an assessment of the spiny lobster stock of Pedro Bank carried out in 2009 with data until 2007 suggests the stock was not overfished and current catches would not result in overfishing (CRFM, 2009). However, more recent assessment trials led to the recommendation that the current effort and catch levels be closely monitored, as there is a potential danger for the fishery if the current levels are maintained (CRFM, 2010a).

In Belize, the lobster stock was assessed to be half-way between fully and over exploited; its total biomass, spawning biomass and recruitment declined over the last years as a result of high fishing mortality (FAO, 2009b). Very similar results were found for the lobster stock in Nicaragua (FAO, 2009c) where fishing mortality was found to be too high and exploitation pattern not sustainable. An assessment carried out within the CRFM for Turks & Caicos concluded that in 2005 and 2006 overfishing was occurring. The assessment provided baseline information for determining a total allowable catch (CRFM, 2007). An assessment of the spiny lobster fishery in Los Roques Archipelago in Venezuela using the PARFISH approach (Hoggarth *et al.*, 2006) indicated that the stock was overexploited and current biomass in 2008-2009 was estimated at 14 per cent of virgin biomass (Manzo, 2009).

The main landed shrimp species in Nicaragua (*Penaeus notialis*, *P. brasiliensis*, *Farfantepenaeus subtilis* and *Litopenaeus schmitti*) were assessed to be fully exploited in 2008. A reduction in fishing effort was reported, mainly due to increasing operating costs (FAO, 2009a). In Mexico, status differs from species to species. The brown shrimp (*F. aztecus*) stock was found to be fully exploited, with a decreasing effort and an increasing fishing yield. The redspotted shrimp (*F. brasiliensis*) and the rock shrimp (*Sicyoria brevirostris*) show signs of deterioration, as biomass has fluctuated over the last few years, but with a decreasing trend. The northern pink shrimp (*F. duorarum*) has suffered from an excessive fishing effort in the past, as well as illegal fishing, habitat loss and unfavourable environmental conditions that led to the current historical low catches. The stock was considered as being overexploited and a reduction of fishing effort was recommended. Seabob (*Xiphopenaeus kroyeri*) in Mexico seems fully exploited, even though no biomass estimate is currently available (SAGARPA, 2010) and in Suriname and Guyana which are the main fishing countries it appears to be neither overfished nor subject to overfishing (CRFM, 2009b). In the USA the pink shrimp was classified among the overfished stocks in the South Atlantic (NMFS, 2011), whereas brown and white shrimps were found to be not overfished (Nance, 2010).

Blue crab (*Callinectes sapidus*) sustains an important fishery in Western Venezuela (Lake Maracaibo). Due to the introduction of longlines in 2002, its landings increased steadily from 5 000 t in 2001 to 10 500t in 2008. Andrade de Pasquier *et al.* (2010) report a decrease in average size and an increase in the proportion of immature individuals in the catches, thus indicating a higher risk of overfishing caused by the use of longlines, which is less selective

than the pots that were used prior to 2002. On the other hand, recent assessments of the blue crab fishery in Florida waters indicated that the species was most likely not being overfished in the period 2002-2005 (Murphy et al, 2007). Whereas, in Mexico *Callinectes* spp. is estimated to be exploited at the MSY level (SAGARPA, 2010).

As in the previous period, the queen conch has shown signs of overexploitation where data are available, despite its inclusion in the CITES Appendix II list and the presence of rebuilding programmes. Several management measures are currently applied, such as harvest level cap, minimum legal size limit, seasonal closure and ban of harvesting in some areas. In the USA, the queen conch was found to be subject to overfishing and overfished (NMFS, 2011). In Mexico, the stock was found to be in a deteriorating state (SAGARPA, 2010), even though recovery signs were detected in areas under protection (Cárdenas and Aranda, 2010). In St Lucia, an assessment carried out with data until 2008 shows that the abundance of the stock continues to decline and that the stock is showing signs of overexploitation that could lead to a collapse if no management action is taken (CRFM, 2009b). Recent surveys in The Bahamas indicate that the conch fishery at Andros Island is no longer viable or occurs at unsustainable levels (Stoner and Davis, 2010) while the fishery in the Berry Islands bank was not functioning at a sustainable level (Stoner *et al.*, 2009). In contrast, the Turks and Caicos stocks seem to be stable, with an acceptable level of biomass, even though recent hurricanes Hanna and Ike are likely to have caused negative effects on this species (CRFM, 2010a). In Jamaica, catches of this stock have decreased in recent years, as the national TAC (and individual quotas in the industrial fishery) have been reduced (Aiken *et al.*, 2006). The stock seems to be neither overfished nor subject to overfishing. However, the lack of data made the results of the assessment not entirely satisfactory. Information is still badly needed in some areas for reliable assessment of the status of the stocks and there is significant concern over the continued IUU fishing on Pedro Bank by foreign vessels.

American cupped oyster represents the most important fishery in the Gulf of Mexico in terms of landings, but is a low valued species. Catches of American cupped oyster increased over the last years in Veracruz due to an increase in fishing effort, whereas they have been stable in Tabasco. In Tamaulipas and Campeche, catches decreased by over 50% due to unsatisfactory sanitary conditions which prevented commercialization. Recently installed depuration plants helped improving sanitary conditions to comply with required standards. The American cupped oyster is considered to be exploited at maximum sustainable yield in 3 provinces (Veracruz, Tabasco and Campeche) and underexploited in the province of Tamaulipas (SAGARPA, 2010). In The USA historic low catches of American cupped oyster on the east coast led to an evaluation in order to establish if the species should be listed as threatened or endangered under the Endangered Species Act, but the review team concluded that the species was not at risk (Eastern Oyster Biological Review Team, 2007).

In Venezuela no formal assessment exists for the expanding ark shell fishery that has recently exceeded 70 000t and become the country's most important fishery, but there is concern that these levels of exploitation may not be sustainable (Mendoza, Venezuela, pers. comm.).

In relation to octopus species in Mexico (SAGARPA, 2010), which is the country reporting the highest catches, *Octopus maya* is exploited at its MSY, whereas some increase in the landings are believed to be possible for *O. vulgaris*, based mainly on the fact that the species is caught down to 36 m, whereas its habitat is likely to extend down to 150 m.

The Region includes 10 per cent of the world's coral reefs, with a relatively low diversity, but high endemicity (Burke *et al.*, 2011). Coral cover has declined for decades and since the 1980s a major cause has been declining nearshore water quality and the impact of diseases affecting many corals, as well as the long-spined sea urchin (*Diadema antillarum*) which has an important ecological role as a herbivore on overfished coral reefs. The international Year of the Reef and the 11th International Coral Reef Symposium in 2008 was the occasion for taking stock of the status of coral reefs around the World and of major initiatives that have been undertaken. Because of unusually high temperatures in 2005, the Caribbean was one of the regions reporting the highest levels of damage to coral reefs, due to mass coral bleaching as well as hurricanes in 2005 and 2006 (Wilkinson and Souter 2008). Significant loss of hard coral cover from bleaching and disease outbreaks was recorded in the U.S. Virgin Islands and Florida, Puerto Rico, the Cayman Islands, St. Maarten, Saba, St. Eustatius, Guadeloupe, Martinique, St. Barthelemy, Barbados, Jamaica, Cuba and Trinidad and Tobago. However, reefs at low risk are still reported, either remote (Wider Caribbean) or well managed (Cuba) and signs of recovery have been detected in Florida and Jamaica. Nevertheless, the overall situation is still fragile, and the impact of projected climate change (mainly elevated sea surface temperatures, ocean acidification and increased storm intensities) coupled with continuing harmful human activities such as overfishing, marine construction, sediment and nutrient pollution is a serious concern for the future of the reefs in the Region. This led several countries of the area (The Bahamas, Dominican Republic, Jamaica, Grenada, St. Vincent and the Grenadines) to pledge to conserve 20% of their marine and coastal habitats by 2010 through the Caribbean Challenge, with the support of the GEF, the German government, and the Nature Conservancy (Wilkinson, 2008). As of today, more than 75 percent of the reefs are considered threatened, with overfishing being one of the most important threats (Burke *et al.*, 2011).

Information on seagrass at regional scale dates back to 2003, with a synthesis of the distribution and status of seagrass beds (Green and Short, 2003), indicating the presence of the various species, but not providing details on the seagrass actual extent. Research using remote sensing information and based on image processing was initiated to fill this gap and obtained promising results (Wabnitz *et al.*, 2008). However, only preliminary results at very local scales are available so far.

Mangroves are among the important coastal habitats of ecological relevance to fisheries resources. Unlike in other areas of the World, the use of mangrove for fuelwood is not widespread in the Caribbean. Tourism, urban and coastal development have contributed to damaging the mangroves; however, nature-based tourism (boat trips, birdwatching, sport fishing) is important enough to provide economic incentive to protect mangroves in some areas and several countries including USA, Mexico and Cuba are showing considerable interest in mangrove protection (Spalding, Kainuma and Collins, 2010).

Overall catches have declined since 1984; this is likely to be at least partly the result of overfishing, although in some cases, it is also likely to be due to improved responses by management to overfishing risks, thereby limiting catches, even though management authorities are often slow to act on scientific advice. Although overall productivity in terms of biomass may be low, the value and value per capita is likely to make these resources more important in terms of socio-economic contributions at the local and national level. For example, fish resources supplying local markets for tourists in the Lesser Antilles fetch high prices.

Uncertainty about the status of many stocks in the Region remains high and the collection and processing of fisheries-related data can be substantially improved. However, some improvements were noted, as in the case of identification of sharks in Venezuela or more detailed reporting systems by Mexico. Compared to previous years, there is no substantial increase in the number of assessments available in the region; the information available seems to vary from one year to another, as assessments are still not undertaken on a regular and annual basis.

A number of fisheries resources are known to suffer from overexploitation. Moreover, coastal habitat destruction through tourism, pollution and urban development is commonly reported, as well as overall ecosystem degradation, especially of coral reefs and associated fisheries. Yet, these habitats are at the basis of small scale fisheries that have important economic, social and cultural roles in the Region. It should be noted that this review is based on the species that are predominant in the landings reported by the countries; therefore it focuses on large scale fisheries due to their higher relative contribution to those landings and may not reflect correctly the status of the species targeted by the artisanal insular fisheries that dominate the Insular Caribbean. Small countries with very low populations that usually declare low nominal catches are easily overlooked, specially because it is likely that very limited landing and stock status information is available for those countries. In the future, the per capita consumption of fish, as well as trade information (exports and imports) should be used to identify those countries that deserve additional attention and where efforts should be concentrated to improve the quality of data and information or undertake data collection.

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