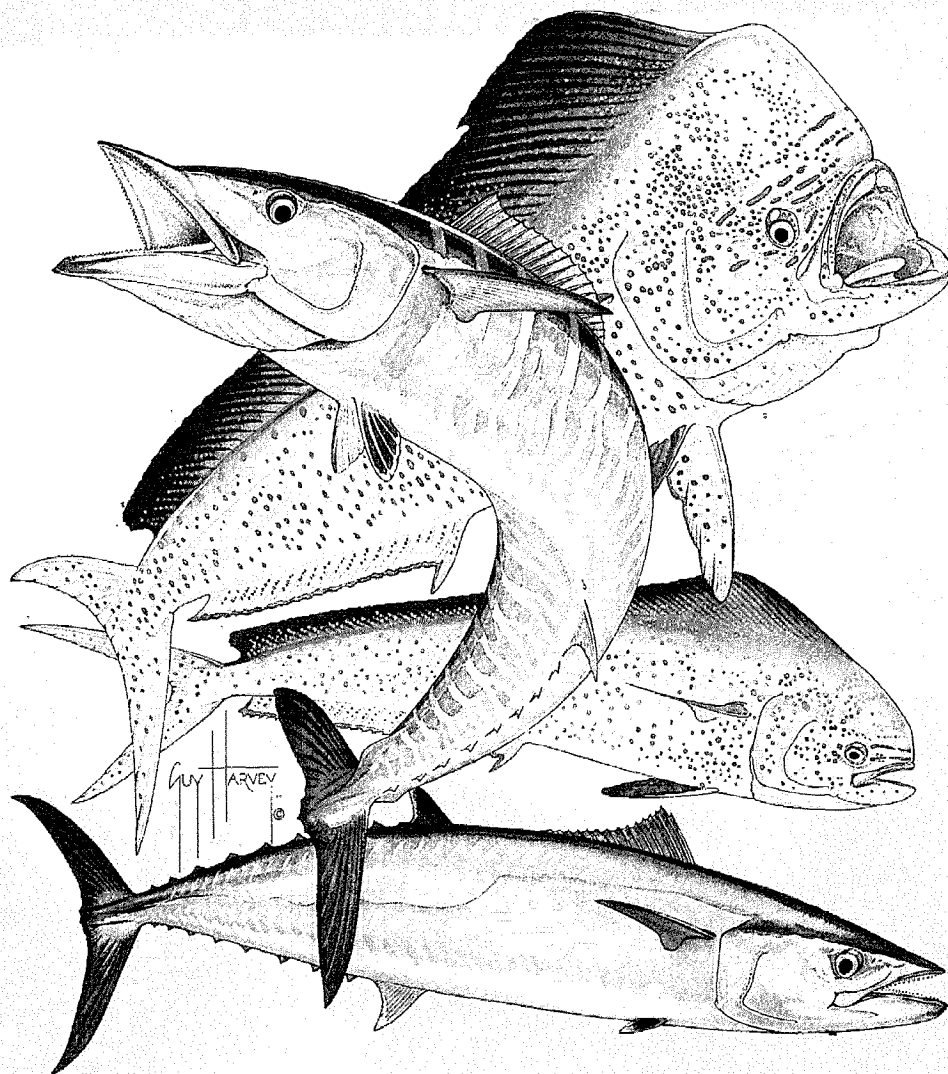


# Fisheries and research for tunas and tuna-like species in the Western Central Atlantic

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FISHERIES  
TECHNICAL  
PAPER

357

Implications of the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks



Food  
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by

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Food  
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Nations



Rome, 1996

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M-43  
ISBN 92-5-103870-8

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## PREPARATION OF THIS DOCUMENT

This document was prepared in response to the establishment of the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks as well as to the finalization of the Code of Conduct for Responsible Fisheries. Dr Robin Mahon, a consultant with an extensive expertise in the subject, elaborated the document in collaboration with the Fishery Resources Division, Fisheries Department, Food and Agriculture Organization of the United Nations. The western central Atlantic region was chosen due to the increasing importance of fisheries for tuna and tuna-like species to many developing countries, which have a very limited capacity to effectively comply with the requirements imposed by the Agreement and the Code.

## ACKNOWLEDGEMENTS

The author wishes to acknowledge the many colleagues who assisted in various ways by providing data and information, through discussion, and by reviewing the manuscript. These colleagues include Mr. Bissessar Chakalall, Dr. Kevern Cochrane, Dr. Jacek Majkowski, Dr. Patrick McConney, Dr. Peter Miyake, Mr. Peter Murray, Dr. Hazel Oxenford, Dr. Eric Prince, Dr. Joseph Powers, Dr. Susan Singh-Renton, Mr. Costas Stamatopoulos and Mr. Dennis Weidner. The cover illustration depicting male and female dolphinfishes, a kingfish and a wahoo was painted by Dr. Guy Harvey, a well-known artist and fisheries biologist from the Caribbean who lives and works in Jamaica.

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Fisheries and research for tunas and tuna-like species in the Western Central Atlantic: implications of the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks  
*FAO Fisheries Technical Paper*. No. 357. Rome, FAO. 1996. 62p.

#### ABSTRACT

In the Western Central Atlantic Fishery Commission (WECAFC) area large pelagics contribute only about 6% of total landings, but are nonetheless significant for many countries. Large pelagic fishes are caught in all WECAFC states, and within the WECAFC Region by several distant water fishing countries. However only 19 of 40 WECAFC Member States report catches to FAO. The fisheries range in scale and technological sophistication from artisanal fishers trolling from canoes to modern commercial longliners and purse seiners. The majority of large commercial vessels operating in the region are from distant water fishing fleets.

The available information on development of small-scale and large scale fleets targeting large pelagics, indicates a significant trend of increasing fishing capacity in the countries of the WECAFC Region. Reported data on effort trends support this conclusion. The steady increasing trend in landings overall for many species, particularly the smaller and less abundant ones, also indicates that exploitation is intensifying on large pelagics throughout the WECAFC area.

Several species which are not assessed by ICCAT are of considerable importance in large pelagic fisheries in the WECAFC Region. Overall, about half the landings of large pelagics in the WECAFC Region are from species which are assessed. This proportion varies considerably among groups of countries, from 100% for distant water fleets to as low as 17% in the Lesser Antilles. This is due to the relative importance of smaller and less abundant species in the fisheries of those islands. At the same time, much recent development has targeted these very species which show increasing trends in landings, even though the landings are underreported. Therefore, exploitation of these species is intensifying in the WECAFC Region without the benefit of proper information on total landings, much less assessment of the effects of exploitation on the stocks.

Although research effort is widely distributed throughout the region, the capacity to carry out fishery assessments is limited in all but a few countries. Thus, assessment is focused on the major stocks (e.g. swordfish, yellowfin tuna), largely via ICCAT, and on the other species in only a few countries; primarily the USA and Mexico. Various efforts to assess stock structure and status of the smaller and less abundant species have not produced a comprehensive body of information for management decision making. Nor is the information which is available routinely compiled, synthesised, evaluated and shared, as would be required by an ongoing management advisory mechanism, such as ICCAT.

Existing institutional mechanisms are not adequate for management of shared stocks, or of straddling fish stocks and highly migratory fish stocks, as per the recent UN Agreement. Any such institution must have linkages with extraregional organisations, primarily ICCAT, and, in order to maximise efficiency and avoid duplication, should also be able to deal with shared, straddling and migratory stocks other than pelagics, for example, lobster and reef fishes with planktonic early life history stages. WECAFC, with modifications to its statutes, appears to be the most feasible existing organisation to adopt such a role. Although management based on the best available scientific advice will be essential for the sustainable exploitation of large pelagic resources in the WECAFC Region, the current or future value of the resource may not justify implementation of the full range of functions outlined by the agreement. Therefore, if stock depletion is to be avoided, application of the precautionary approach may be a more prominent requirement in the WECAFC Region than in other regions of the world with more abundant tuna resources.

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## LIST OF ACRONYMS

ACS	Association of Caribbean States
CARICOM	Caribbean Community and Common Market
CFRAMP	CARICOM Fisheries Resource Assessment and Management Program
EEZ	Exclusive Economic Zone
GCFI	Gulf and Caribbean Fisheries Institute
ICCAT	International Commission for the Conservation of Atlantic Tuna
INP	Instituto Nacional de la Pesca (Mexico)
MSY	Maximum Sustainable Yield
NMFS	National Marine Fisheries Service
OECS	Organization of Eastern Caribbean States
SEFSC	Southeast Fisheries Science Center
SIDS	Small Island Developing States
UNDP	United Nations Development Programme
WATT	Western Atlantic Tropical Tunas (ICCAT)
WECAFC	Western Central Atlantic Fishery Commission



## 1. INTRODUCTION

In the Western Central Atlantic (FAO Fishing Area No. 31, Figure 1), tunas, tuna-like species and other large pelagic fishes contribute a relatively small proportion of total fishery landings (about 4% 1986-1990). Nonetheless, these resources support economically viable fisheries throughout the region, many of which are small-scale fisheries in developing countries. The prevailing opinion among government fisheries departments in the small developing countries is that large oceanic and coastal pelagics hold the greatest potential for increased fishery production in the region.

At the same time, resource assessments for the major tuna and tuna-like species carried out under the auspices of ICCAT indicate that those species are either fully or over-exploited. Most of the small, or less abundant species, including sharks, have not been assessed, although they have been widely exploited for decades.

Thus, the biological basis for expansion of pelagic fisheries is for many species, limited, and for others, unclear. There may, however, be a political basis for increased landings of large pelagic species by some countries, based on claims to a increased proportion of the existing sustainable yield. In most instances these claims have not been made explicit, but would be based primarily on the perceived proportion of the stock which occurs within the national EEZ.

In the Western Central Atlantic, tunas, tuna-like and large pelagic fishes are frequently considered in two categories (SEFSC 1994): oceanic and coastal. The former are those species that tend to be distributed offshore, and which tend to have wider geographical distribution than the coastal species that tend to occur on or near continental/island shelves (Table 1). In this report, these species will be referred to collectively as large pelagic species.

Owing to their wide distribution and in many cases migratory habits, most of these species fall into one of the categories: Shared Stocks, Highly Migratory Stocks or Straddling Stocks, as defined by the United Nations Convention on the Law of the Sea (The Convention)(UN 1983), and Thus, require at least some level of international cooperation for management. Approaches to international management for the migratory and straddling stocks have been elaborated in the "Agreement for the Implementation of the Provisions for the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks" (The UN Agreement)(UN 1995). The objective of The UN Agreement is to "ensure the long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks through effective implementation of the relevant portions of the Convention".

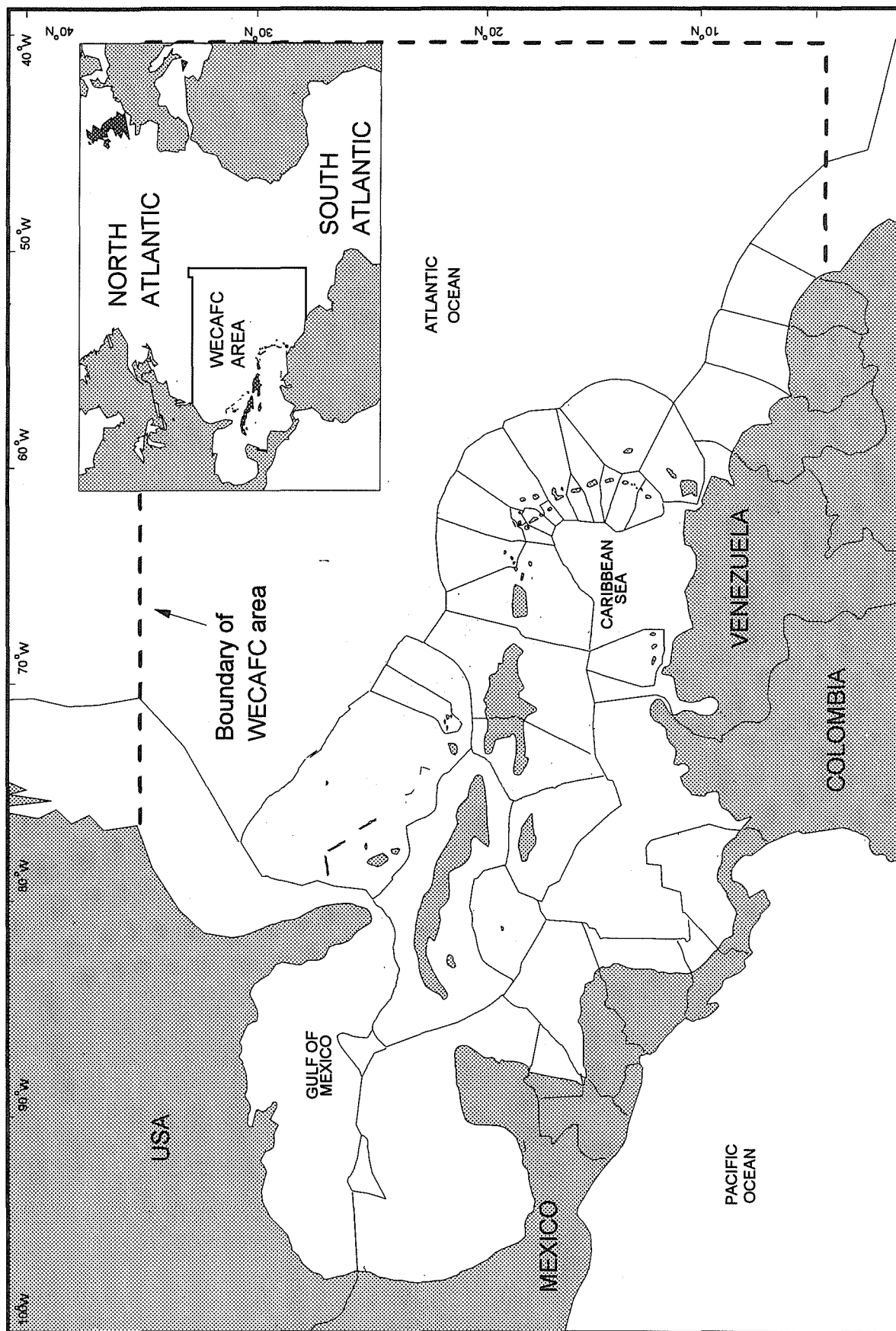


Figure 1. The approximate EEZs of WECAFC countries (for illustrative purposes only, adapted from Fenwick 1992).

**Table 1. large pelagic fishes exploited in the Western Central Atlantic in the categories oceanic and coastal large pelagics (after SEFSC 1994).**

Oceanic		Coastal	
Common name	Scientific name	Common name	Scientific name
skipjack tuna	<i>Katsuwonus pelamis</i>	king mackerel	<i>Scomberomorus cavalla</i>
yellowfin tuna	<i>Thunnus albacares</i>	Spanish mackerel	<i>Scomberomorus maculatus</i>
bigeye tuna	<i>Thunnus obesus</i>	serra mackerel	<i>Scomberomorus brasiliensis</i>
albacore	<i>Thunnus alalunga</i>	cero mackerel	<i>Scomberomorus regalis</i>
bluefin tuna	<i>Thunnus thynnus</i>	dolphinfish	<i>Coryphaena hippurus</i>
blackfin tuna	<i>Thunnus atlanticus</i>	cobia	<i>Rachycentron canadum</i>
Atlantic black skipjack tuna	<i>Euthynnus alletteratus</i>	amberjacks	<i>Seriola</i> spp.
frigate tuna	<i>Auxis thazard</i>		
bullet tuna	<i>Auxis rochei</i>		
Atlantic bonito	<i>Sarda sarda</i>		
Atlantic blue marlin	<i>Makaira nigricans</i>		
Atlantic white marlin	<i>Tetrapterus albidus</i>		
longbill spearfish	<i>Tetrapterus pfluegeri</i>		
Atlantic sailfish	<i>Istiophorus platypterus</i>		
swordfish	<i>Xiphias gladius</i>		
wahoo	<i>Acanthocybium solandri</i>		

The approaches described in The UN Agreement will require a considerable investment by the countries of the Western Central Atlantic Fisheries Commission (WECAFC) Region in organization and international cooperation, both within and outside of the region. There are elements of the institutional basis for implementation of The UN Agreement in place but these will require strengthening. The technical basis for collaboration and cooperation in management is weak for many species and geographical areas. Correcting the latter deficiency is a long-term objective, which must be pursued to the extent that funds and expertise permit, but which should not be used as a reason to delay development of institutional capability for cooperative management, or to delay taking management action to conserve pelagic fish stocks.

This report reviews trends in fisheries for large pelagic fishes in the WECAFC Region and their relationship to trends in the wider Atlantic. It also provides an overview of The UN Agreement and examines its implications for fishery development and management in the WECAFC Region.

## 2. AN HISTORICAL OVERVIEW

The first recorded attempt to take an organized approach to fisheries at a regional level in the wider Caribbean Region was the Caribbean Commission, which although primarily concerned with demersal fish resources, recognized the potential of large pelagic fishes (Caribbean Commission 1952). The preoccupation with demersal resources -- reef fishes, snappers, lobster, conch

and shrimp -- continued in subsequent regional efforts to promote development and management of fisheries.

The UNDP/FAO Caribbean Fishery Development Project (1965-1971) did carry out some surveys of large pelagics throughout the region with longlines, trolling and pole and line (Kawaguchi 1974, Wagner and Wolf 1974, and Wagner 1974). Catches were generally low relative to other primary tuna areas in the world, leading to the conclusion that there were no substantial tuna resources in the WECAFC area. However, although the surveys revealed some patterns of distribution and relative abundance, there was not enough fishing effort for the results to be conclusive (Wolf and Rathjen 1974). The next regional fisheries initiative was the WECAFC project (1976-1981). A review of fishery resources carried out for the WECAFC Project devoted only one of seventy-four pages to large pelagics (Klima 1976). A subsequent review of marine fishery resources of the WECAFC Region did not address large pelagics other than king and Spanish mackerel in US and Mexican waters (Stevenson 1981).

Similarly, large pelagics did not receive a great deal of attention at early WECAFC meetings. In 1977 and 1979 the Working Parties on assessment of fish resources touched lightly on the fisheries for *Scomberomorus* species (FAO 1977, 1979). Pelagics featured more prominently in the 1982 and 1984 meetings of the Working Party on Assessment of Marine Fishery Resources (FAO 1982, 1984), where issues of seasonality, migration and sharing of resources among the countries of the region were highlighted. Following the formation of the WECAFC Committee for the Development and Management of Fisheries in the Lesser Antilles, and its first two meetings in 1983 and 1985, large pelagics assumed greater significance in the deliberations of WECAFC for a few years.

In its second session the Lesser Antilles Committee gave high priority to a workshop on shared pelagic resources of the Lesser Antilles (FAO 1985). Consequently, the Expert Consultation on Shared Fishery Resources of the Lesser Antilles was held in 1986 (Mahon 1987), and the third session of the Lesser Antilles Committee devoted considerable discussion to issues of management of shared stocks which arose out of the Expert Consultation.

In parallel, meetings of the Working Party on Assessment of Marine Fishery Resources in 1986 and 1989, continued to discuss aspects of assessment and management of large pelagic fishes, but without any concrete advances in arrangements for cooperation in assessment and management (FAO 1986, 1989).

A subregional project to develop fishery management options for Lesser Antilles fisheries, emphasized the shared nature of pelagic resources, and the need for cooperation in conservation and management, both within the WECAFC area, and in the wider Atlantic (Mahon 1990). In 1990, the accepted view that demersal/coastal resources were generally overexploited, and that

oceanic pelagics were considered to hold the greatest potential for increasing production in the region was once again emphasized by the Fourth Session of the Lesser Antilles Committee (FAO 1991).

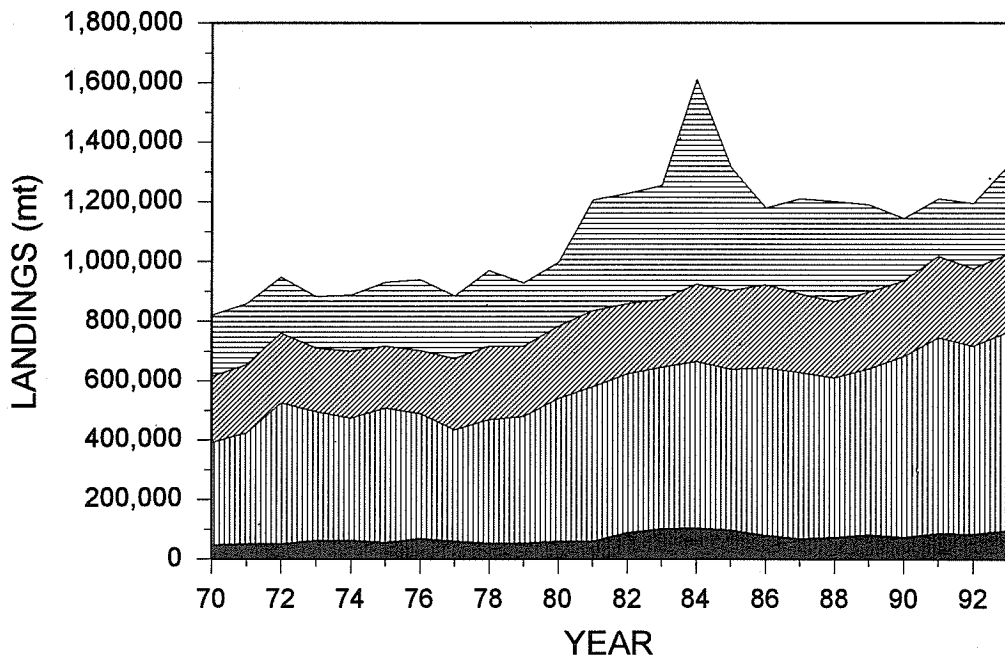
By that time, through the WECAFC activities described above, through the activities of the OECS Fisheries Unit in St. Vincent and the Grenadines, concerns regarding the sustainable development and cooperative management of large pelagic resources in the WECAFC area, and especially in the Lesser Antilles subregion, were clearly identified. Nonetheless, the Technical Consultation on Sustainable Fisheries Development in the WECAFC area, which held a special session on Institutional Requirement for Sustainable Fisheries Development in the Region, did not address the question of the institutional mechanism for management of shared large pelagic resources.

It is not clear whether the relatively low amount of attention paid to large pelagics in fisheries management circles has been due to their perceived value relative to other fishery resources in the WECAFC area (Figure 2), or to the establishment of ICCAT in 1969, with the following responsibility. "... for the study of the populations of tuna and tuna-like fishes (the Scombriformes with the exception of the families Trichiuridae and Gempylidae and the genus *Scomber*) and such other species of fishes exploited in tuna fishing in the Convention area as are not under investigation by another international fishery organization. Such study shall include research on the abundance, biometry and ecology of the fishes; the oceanography of their environment; and the effects of natural and human factors on their abundance" (ICCAT 1985).

Although ICCAT was responsible for large pelagic fish resources in the WECAFC Region, until recently only three countries from the region have been involved in ICCAT activities: the USA (since 1967), Cuba (from 1975 to 1991), and Venezuela (since 1983). Despite continuous efforts by ICCAT to acquire data and information from, and to encourage participation of, countries in the Western Central Atlantic, it was only in 1991, that CARICOM Member States began sending observers to ICCAT meetings (Mahon and Murray 1992a). Mexico became an observer in 1994. Thus, the ICCAT focus has been on stocks important to fleets operating in the Eastern Central Atlantic, on the High Seas, and in the North Atlantic. ICCAT's greatest impact in the Western Central Atlantic has been through its Billfish Program, which started in 1989. Eventually, recognizing the need for special attention to the Western Atlantic, ICCAT established a Working Group on Western Atlantic Tropical Tunas (WATT) in 1990, which met in Florida in 1991 (ICCAT 1992).

Even with the WATT Working Group, participation in ICCAT by WECAFC countries has not been sufficient to significantly influence the amount of attention paid to species and stocks of primary importance to the majority of countries in the WECAFC Region. As will be seen, despite the relatively low contribution of large pelagic fishes to total landings in the WECAFC area, fisheries for large pelagics continue to expand, and mechanisms for cooperative management are needed more urgently than ever.

(A) ALL COUNTRIES



(B) EXCLUDING THE USA

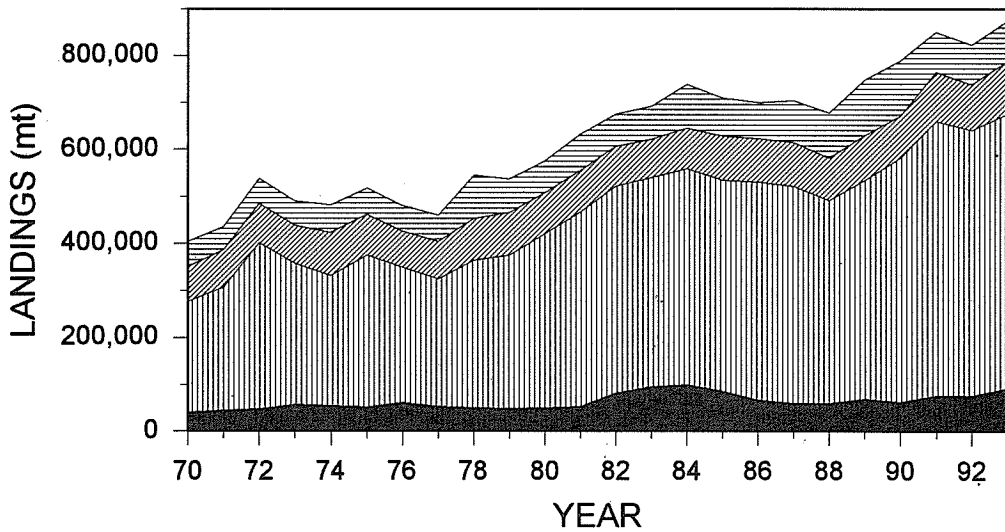


Figure 2. Fishery landings in the WECAFC area as reported to FAO.



The mechanism must be geared to the nature and value of the large pelagic resources which are exploited by the majority of WECAFC countries, rather than to the large commercial scale fisheries which are carried out by only a few countries. How this can be achieved, in light of the recent development in pelagic fisheries and The UN Agreement, will be discussed in a later section.

### 3. PELAGIC FISHERIES OF WECAFC COUNTRIES

The contribution of large pelagics to fishery landings in the WECAFC area is relatively low, but significant (Figure 2). These fisheries range in scale and technological sophistication from artisanal fishers trolling from canoes to modern commercial longliners and purse seiners. The majority of large commercial vessels operating in the region are from the distant water fishing nations listed in Table 2. Fisheries and fishing vessels will be referred to as artisanal, small-scale commercial and large scale commercial. These categories provide an artificial but convenient means of referring to the scale of the fishery. Artisanal is used to refer to small traditional vessels such as canoes and pirogues, small-scale commercial implies vessels which are using more modern technology and gear, and are usually less than 15-18 m. Large-scale commercial refers to larger industrial vessels.

Large pelagic fishes are caught in all WECAFC states, and within the WECAFC Region by several distant water fishing countries. However only 19 of 40 WECAFC Member States report catches to FAO (Table 2). The reasons for which countries do not report landings of large pelagic species are various. Landings of large pelagics may be reported in an aggregate category such as 'unspecified pelagic finfishes' or 'unspecified marine finfishes', or not at all, if countries lack the data management and reporting capability to compile accurate reports, or if landings are considered to be too small to be worth reporting separately. Recreational landings are seldom quantified and thus, seldom reported.

Appreciable but unknown amounts of large pelagic landings are hidden in the category 'unspecified marine finfishes'. For example, large pelagics contribute about 6% of finfish landings in Jamaica (about 450 mt), but this is not reflected in the reported landings (Sahney 1982). The importance of large pelagic fishes also varies considerably from country to country. In some countries, such as Belize, their contribution to landings is negligible, whereas in some islands of the southeastern Caribbean large pelagics may contribute more than 60% of reported landings (e.g. OECS 1993)

Fish attracting devices (FADs) are not widely used in fishing for pelagics in the WECAFC area, relative to other areas such as the South Pacific, Japan, Hawaii, and tropical eastern Atlantic. There have been several research and pilot projects to evaluate the potential for FADs to enhance landings and increase efficiency, particularly for artisanal and small-scale fishers with limited range (FAO 1993a, OECS 1992).

Table 2. Average annual landings of large pelagic fishes for five year time-periods, as reported to FAO by WECAFC countries (coastal and pelagic species as per Table 1, undetermined = aggregate groups that could be either category).

Country	Coastal										Oceanic										Undetermined					Total					
	70-74	75-79	80-84	85-89	90-93	70-74	75-79	80-84	85-89	90-93	70-74	75-79	80-84	85-89	90-93	70-74	75-79	80-84	85-89	90-93	70-74	75-79	80-84	85-89	90-93	70-74	75-79	80-84	85-89	90-93	
Venezuela	22,348	24,961	22,639	17,178	26,774	20,781	22,208	149,022	137,678	119,403	1,200	845	1,769	823	299	44,329	48,014	173,430	155,679	146,476	34,807	33,773	52,848	52,903	55,189	34,807	33,773	52,848	52,903	55,189	
Mexico	33,501	32,651	48,546	49,388	51,174	1,306	1,122	4,302	3,515	4,015	0	0	1,816	912	436	40,481	44,540	48,927	71,858	47,344	40,481	44,540	48,927	71,858	47,344	40,481	44,540	48,927	71,858	47,344	
USA	39,795	41,284	32,699	28,781	23,255	29,933	27,988	34,233	24,737	17,486	731	537	1,678	149	97	30,664	28,525	35,911	24,886	17,583	30,664	28,525	35,911	24,886	17,583	30,664	28,525	35,911	24,886	17,583	
Other Asia	5,211	8,797	6,394	13,067	14,278	0	0	78	0	3,266	0	0	0	0	0	5,211	8,797	6,472	13,067	17,544	5,211	8,797	6,472	13,067	17,544	5,211	8,797	6,472	13,067	17,544	
Trinidad/Tobago	6,050	10,385	10,531	10,280	8,170	4,570	2,640	2,362	2,310	1,840	4,570	2,640	2,362	2,310	1,840	10,620	13,025	12,893	12,590	10,010	10,620	13,025	12,893	12,590	10,010	10,620	13,025	12,893	12,590	10,010	
Guadeloupe	3,200	2,500	2,944	4,218	2,205	10,540	16,952	14,762	13,328	7,501	28	117	728	4,588	9,337	13,740	19,452	17,706	17,546	9,706	13,740	19,452	17,706	17,546	9,706	13,740	19,452	17,706	17,546	9,706	
Cuba	2,561	2,147	1,534	848	331	609	7,561	8,752	3,932	7,998	609	7,561	8,752	3,932	7,998	2,589	2,264	2,262	5,436	9,668	2,589	2,264	2,262	5,436	9,668	2,589	2,264	2,262	5,436	9,668	
Colombia	4,311	4,118	4,585	2,828	2,300	3,396	4,193	4,297	3,589	5,315	7,707	8,311	8,882	6,417	7,615	7,707	8,311	8,882	6,417	7,615	7,707	8,311	8,882	6,417	7,615	7,707	8,311	8,882	6,417	7,615	
Martinique	3,174	3,096	4,740	8,604	5,087	1,887	1,130	1,900	2,846	2,471	1,887	1,130	1,900	2,846	2,471	5,061	4,226	6,640	11,450	7,558	5,061	4,226	6,640	11,450	7,558	5,061	4,226	6,640	11,450	7,558	
Dominican Rep.	6	0	0	0	0	30,113	28,317	16,367	11,852	5,301	63	603	0	0	0	30,119	28,317	16,367	11,852	5,301	63	603	0	0	0	30,119	28,317	16,367	11,852	5,301	
Japan	3,226	5,748	4,596	6,396	3,806	1,061	1,968	1,040	1,355	668	1,061	1,968	1,040	1,355	668	4,350	8,319	5,636	7,751	4,474	4,350	8,319	5,636	7,751	4,474	4,350	8,319	5,636	7,751	4,474	
Barbados	0	1,006	479	545	750	1,934	2,245	2,162	3,333	3,067	1,934	2,245	2,162	3,333	3,067	1,934	3,251	2,641	3,878	3,817	1,934	3,251	2,641	3,878	3,817	1,934	3,251	2,641	3,878	3,817	
Grenada	0	0	0	0	0	1,785	2,179	2,770	2,930	2,350	1,785	2,179	2,770	2,930	2,350	1,785	2,179	2,770	2,930	2,350	1,785	2,179	2,770	2,930	2,350	1,785	2,179	2,770	2,930	2,350	
Neth. Antilles	469	573	648	306	315	452	398	417	490	331	452	398	417	490	331	921	971	1,065	796	646	921	971	1,065	796	646	921	971	1,065	796	646	
Puerto Rico	0	0	0	0	0	0	296	390	610	545	0	296	390	610	545	0	296	390	610	545	0	296	390	610	545	0	296	390	610	545	
Bermuda	27,520	18,492	9,833	6,575	496	27,520	18,492	9,833	6,575	496	0	892	419	363	0	27,520	19,384	10,252	6,938	496	27,520	19,384	10,252	6,938	496	27,520	19,384	10,252	6,938	496	
Korea Rep.	611	695	371	742	479	611	695	371	742	479	611	695	371	742	479	611	695	371	742	479	611	695	371	742	479	611	695	371	742	479	
St. Lucia	510	640	725	581	267	510	640	725	581	267	510	640	725	581	267	510	640	725	581	267	510	640	725	581	267	510	640	725	581	267	
Aruba	0	0	0	0	0	0	0	0	0	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
St Vincent/Gren.	0	0	15	30	81	0	0	15	30	81	0	0	15	30	81	0	0	15	30	81	0	0	15	30	81	0	0	15	30	81	
Other nei	4,637	533	0	0	0	4,637	533	0	0	0	4,637	533	0	0	0	4,637	533	0	0	0	4,637	533	0	0	0	4,637	533	0	0	0	
Costa Rica	14,291	19,521	12,483	2,374	0	14,291	19,521	12,483	2,374	0	1,945	5,663	1,034	0	0	1,945	5,663	1,034	0	0	1,945	5,663	1,034	0	0	1,945	5,663	1,034	0	0	
France	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	14,291	19,521	12,483	2,374	0	14,291	19,521	12,483	2,374	0	1,945	5,663	1,034	0	0	1,945	5,663	1,034	0	0	1,945	5,663	1,034	0	0	1,945	5,663	1,034	0	0	

Recreational fishing takes place to some extent in all countries. In most countries with a significant tourism sector, there is usually charter boat fishing for large pelagic fishes (e.g. Friedlander 1991, Gaertner *et al.* 1991, Harvey 1990). The fleets, fishing effort and landings associated with recreational and charter boat fishing for large pelagics are poorly known in most countries. In the case of charter boat fishing, the value of the resource is generally much higher than its market value when landed by a commercial fishery. However, there are few studies, in which the contribution of charter boat fishing to the economy of the country has been quantified, to support this contention (e.g. Clark *et al.* in press). In this regard, the potential of large pelagic fishes as the basis of an ecotourism industry is only recently being explored (Holland *et al.* in press).

### 3.1 Trends in fleets and gear

This section examines the trends in fishing fleets, gear and, where possible, fishing effort for the various types of fisheries which target large pelagics in the WECAFC Region. Large pelagic species have been exploited by local artisanal and small-scale fishers throughout the Caribbean from the earliest recorded times (e.g. Brown 1945, Caribbean Commission 1952). In most countries these fisheries were coastal, using small vessels such as canoes and pirogues for trolling. Fisheries for coastal species such as *Scomberomorus* spp., may be carried out using gillnets (e.g. Sturm *et al.* 1984). Several species may also be caught in artisanal fisheries using beach seines or lampara seines. These methods continue to be used in most countries with sporadic improvements in vessels and gear in several countries at various times.

Estimates of the numbers, types and activities of artisanal/small-scale vessels are widely scattered throughout the literature. Since most of the small vessels are used to fish a variety of species, estimates of the numbers of these vessels do not accurately reflect the fishing effort being directed at large pelagic fishes. Availability of many large pelagic species is strongly seasonal, particularly to artisanal vessels which do not venture far from shore (e.g. Mahon *et al.* 1990). Therefore, during the off-season, vessels may fish for demersal species, or small coastal species. Most of the information on seasonal variation in fishing activity has been inferred from seasonal variation in landings of large pelagics.

Even within a single fishing trip, fishing effort may be divided among fishing for demersals and pelagics. In islands of the southeastern Caribbean, the focus of a trip may be primarily large pelagic fishes, or during the flyingfish season, a combination of that species and large pelagics. In northern Lesser Antillean islands, similar vessels may fish for large pelagics only incidentally while travelling to and from demersal fishing areas, or may occasionally focus on large pelagics when they are available.

The lack of ancillary information needed to apportion effort with trips among types of fishing is a serious impediment to the use of artisanal catch

rates as indices of abundance. These data, even when available, can only provide rough estimates of seasonality and interannual variability in availability or abundance. Therefore, there are few time-series of fishing capacity or of effort expended in fishing for large pelagic fishes by domestic artisanal or small-scale fleets in the WECAFC Region.

Nonetheless, recent development trends in local fleets do indicate that there is a trend of increasing artisanal and small-scale fishing effort directed at these large pelagic species. Some cases are presented below as an illustration of the trends which are assumed to be common throughout the region.

In **Grenada**, in the Lesser Antilles, longline fishing for pelagics was introduced in the early 1980's with assistance from Cuba, and was adopted by the troll fishing fleet on the island's west coast in three phases. By 1993 there were 110 converted or locally purpose-built small longliners fishing 1-day trips, and seven Japanese-built short-stay longliners (Samlalsingh 1995). In addition to the increased number of vessels, there were considerable changes in the size of vessels, gear used and fishing power (Table 3).

**Table 3. Main changes which occurred during the development of the longline fishery in Grenada, 1983-1993 (after Samlalsingh 1995).**

Characteristic	Fishing seasons			
	Pirogues			Short-stay vessels
	1983/84- 1985/86	1986/87- 1987/88	1988/89- 1992/93	1992/93
Main gear type	box/line	box/line	reels/line	reels/line
Main hull type	wooden	fiberglass	fiberglass	fiberglass
Engine type	outboard	outboard	outboard	inboard diesel
Mean boat length (m)	6.0 - 7.5 +	8.8	8.8	10.9
Mean engine size (hp)	29	40 - 60 +	66	70
No. of crew	1 - 2	3	3	3
Mean length of longline (km)	2.5	2.5	6	8
Mean no. of hooks	45	45	110	150
Depth of fishing (m)	27 - 54	45 - 54	45 - 90	45 - 90
Distance from shore (km)	5.5	?	25 - 40	35 - 40
Mean catch per trip (kg)*	43	63	120	166

\* target longline species only (i.e. yellowfin tuna, Atlantic sailfish and blue marlin)

+ range of sizes in use

In the neighboring Lesser Antillean countries of **St. Vincent and the Grenadines** and **St. Lucia** there is also an emphasis on increasing harvest of large pelagic fishes, and both countries have seen recent increases in fishing capacity. In St. Lucia, 40 new 9 m vessels (not all fishing for large pelagics) and

5 new 15 m longline vessels were introduced between 1989 and 1992. In St. Vincent and the Grenadines 5 new 12.5 m multipurpose vessels equipped with longline and trolling gear were acquired from Japan in 1991 (Mahon and Singh-Renton 1992). Previously, the fleet in St. Lucia consisted of about 300 canoes and skiffs, 5-8 m in length, while that fishing for large pelagics in St. Vincent and the Grenadines consisted of pirogues 6-8 m in length (Mahon and Rosenberg 1988).

Several other Lesser Antillean countries, members of the Organization of Eastern Caribbean States, reported initiatives aimed at increasing pelagic fishing, ranging from introduction of longline gear on artisanal vessels, to acquisition of new small-scale longline vessels (OECS 1992).

**Trinidad and Tobago** has also increased its longline fleet. In 1988 two locally owned longline vessels began surface longlining. By 1992, eight vessels (14-23 m in length) were in operation (Mahon and Singh-Renton 1992).

Recently there has also been a significant expansion in the fishing capacity for large pelagics in **Barbados**. Between 1962 and 1979 the number of vessels fishing for pelagic fishes (flyingfish and large pelagics) was relatively constant at about 400. However during that period the fishing power of these day-trip trolling vessels more than doubled from 35 kg/day to 76 kg/day due to increased boat and engine size (Oxenford and Hunte 1987, Mahon *et al.* 1990). In 1979, the development of a new fleet of larger vessels, with ice holds, capable of staying at sea for 7-14 days, and thus, fishing farther afield, began with the introduction of one vessel. By 1989, 82 such vessels were in operation. Most were locally built and many were equipped with longline gear. Towards the end of this period, there were several joint ventures with USA vessel owners. Barbados remains committed to further development of its longline fleet provided that it is economically feasible. To evaluate this the Barbados Development Bank commissioned a study of the feasibility of further expansion of longline fishing in its waters (Hunte *et al.* 1993).

As indicated in a previous section, only four countries within the WECAFC area are, or have been, members of ICCAT -- Brazil, Cuba (which withdrew in 1992), Venezuela, and the USA -- and only the latter three have large commercial vessels operating within the area. An overview of the commercial fleets operated by Latin American and Caribbean countries is provided by Weidner and Hall (1993), who have compiled data on vessels registration and operations from a variety of sources. These data include vessels registered in these countries under flags of convenience.

The ICCAT database provides the most complete information on the sequence of fishing activity expended by large-scale commercial fisheries in the Western Central Atlantic. The Type II data in this database are fishing effort and catch by country, gear, year, month and square. Squares are either 10°, 5° or 1° on the side, with most data for longliners being recorded by 5° squares and those for surface fisheries by 1° squares. Trends in fishing effort are shown by

country for longlines, purse seines and bait boats (Figures 3 & 4). In the case of longlines, the trends are shown for two sets of squares, (1) those in the Atlantic, mainly to the east of national EEZs, and (2) those mainly in the area of national EEZs (Figure 5).

The growth of distant water fishing fleets in the late 1950s, brought a steady increase in Japanese longline fishing effort to the Western Central Atlantic from 1958 through 1966, in both groups of squares. The decline in Japanese effort in the late 1960s was accompanied by an increase in Taiwanese longline effort from 1967 to the mid-1970s in both areas, and in Korean longline effort from 1974 through 1979. The fleets comprising this succession of peaks was targeting yellowfin tuna. There was a second peak in Taiwanese effort in this area in 1986, primarily in the Atlantic to the east of the EEZs, targeting albacore. In later years, longline activity by Cuba is concentrated mainly between 1984 and 1987. The growth of Venezuela's large commercial fleets shows clearly from 1981-1985, and the increased activity of swordfish vessels from the USA is evident from 1986 on (Figure 3). Singh-Renton and Mahon (in press), provide a similar, but more detailed analysis, for a subset of squares relevant to EEZs of CARICOM countries.

The distribution of longline fishing effort by 5° square in the WECAFC area, for all countries combined, for the period 1986-1990 is shown in Figure 6. The concentrations of effort in the southeast, Gulf of Mexico and north central squares are reflected in the distribution of catches (Figure 6). The relatively low amounts of longline effort and catch in the Caribbean Sea are notable.

Purse seine and bait boat effort in the WECAFC area show similar patterns, in that they occur in the most recent years, and by Venezuelan vessels (Figure 4). Very little fishing by these gears occurred outside the squares in the area of the EEZs. Indeed effort by both gears was highly localized off the coast of Venezuela (Figures 7 & 8).

The **Venezuelan** tuna fishing fleet includes large purse seiners, small and large longliners and small baitboats. The development of the Venezuelan tuna fishing industry has been described by Weidner (1993). The Venezuelan purse seine tuna fishing fleet only began to expand rapidly in the early 1980s, increasing from 5 vessels in 1982, with a capacity of 5,600 short tons, to 25 vessels in 1988, with a capacity of 29,700 tons. These vessels range in size from 900-1,500 Gross Registered Tons (GRT). The main area of activity of the purse seine fleet is in the Eastern Tropical Pacific. However, they do catch appreciable amounts of tuna in the WECAFC area.

In 1992, the Venezuelan longline fleet consisted of two large longliners (about 60 m), which operate primarily in the western Atlantic, and about 80 small vessels (20-25 m) using about 33 km of longline. The small-scale fleet in general appears to be expanding, as there were only 58-60 vessels operating in 1990-1991. The exact number of these which target tuna is uncertain, with reports ranging from 15 to 33 vessels (Weidner 1993). Eslava and Gaertner (in

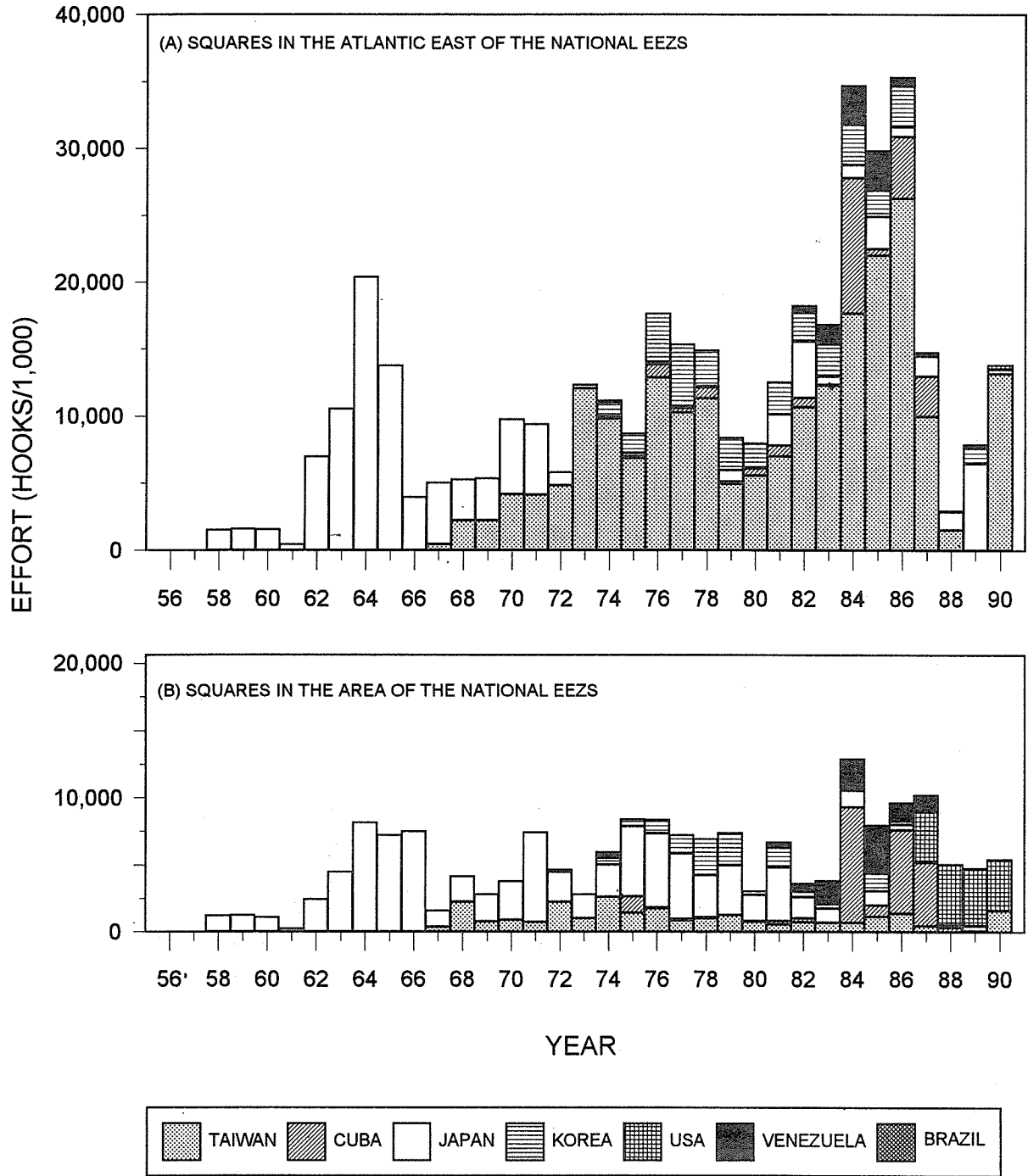


Figure 3. Trends in longline fishing effort by countries reporting landings in the WECAFC area.

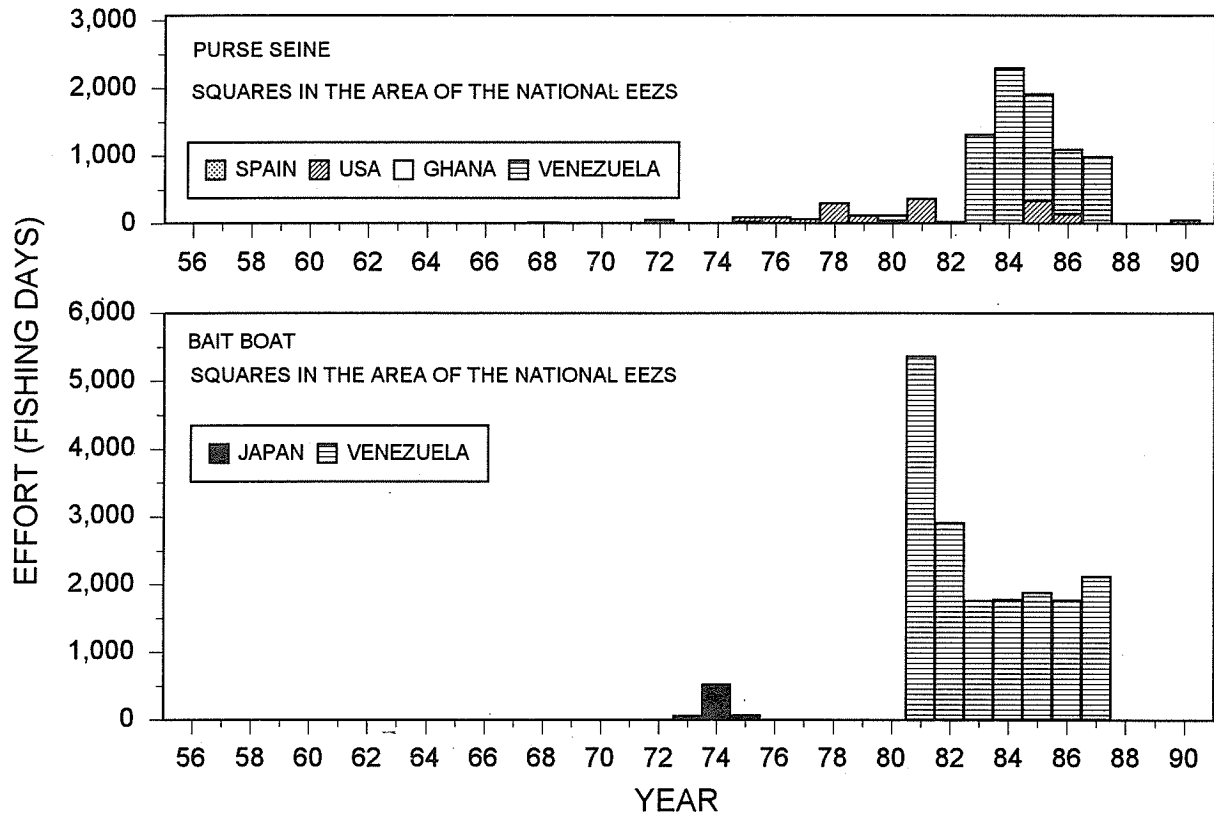


Figure 4. Trends in purse seine and baitboat fishing effort by countries reporting landings in the WECAFC area. There are too few data in the open Atlantic group of squares to display.

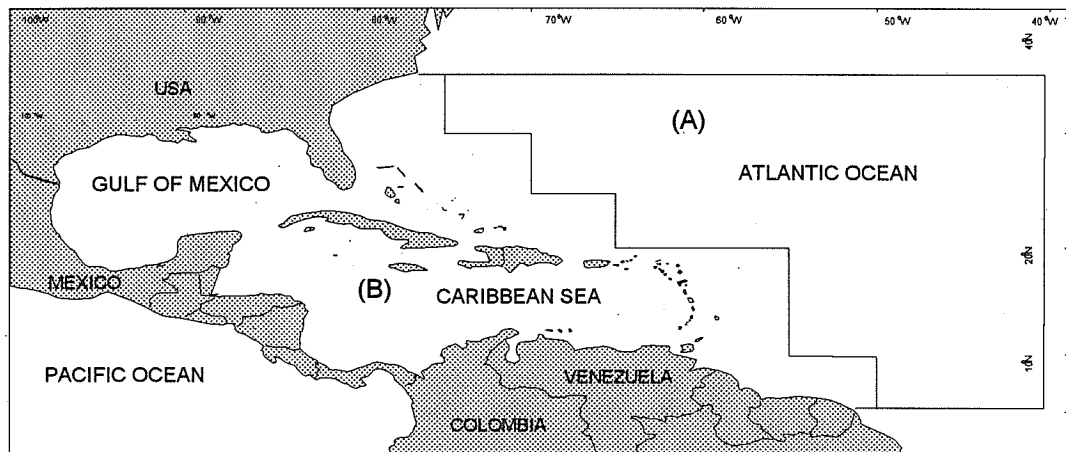


Figure 5. The line dividing the two groups of ICCAT reporting squares for which effort data are displayed: (A) squares in the Atlantic east of national EEZs; (B) squares in the area of national EEZs.



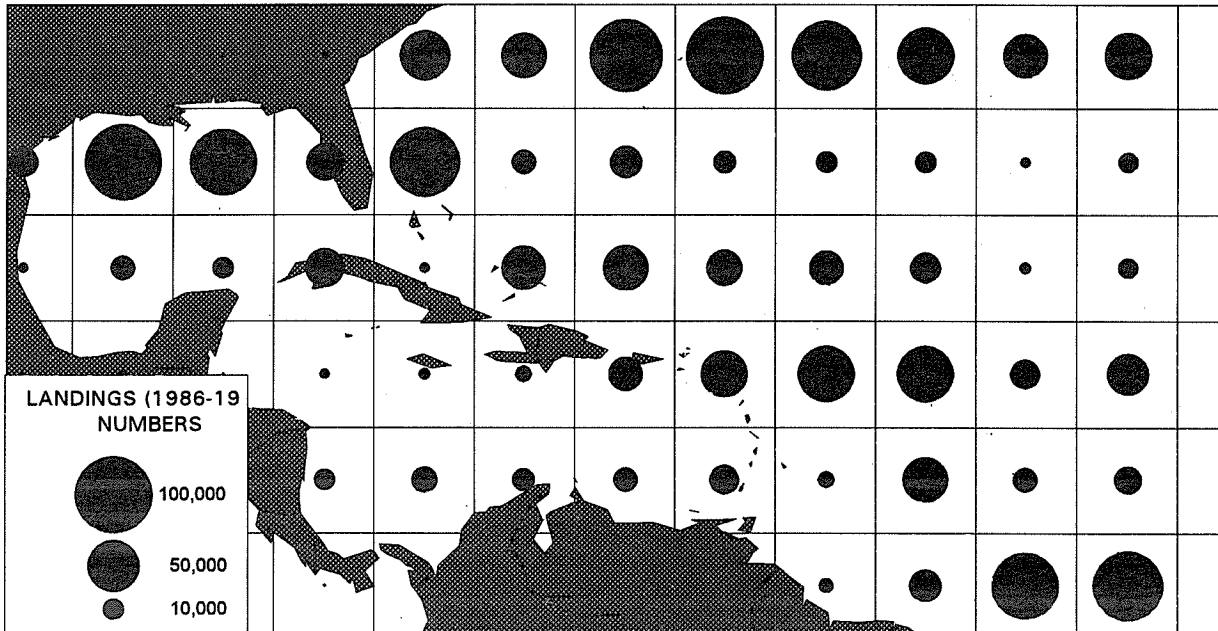
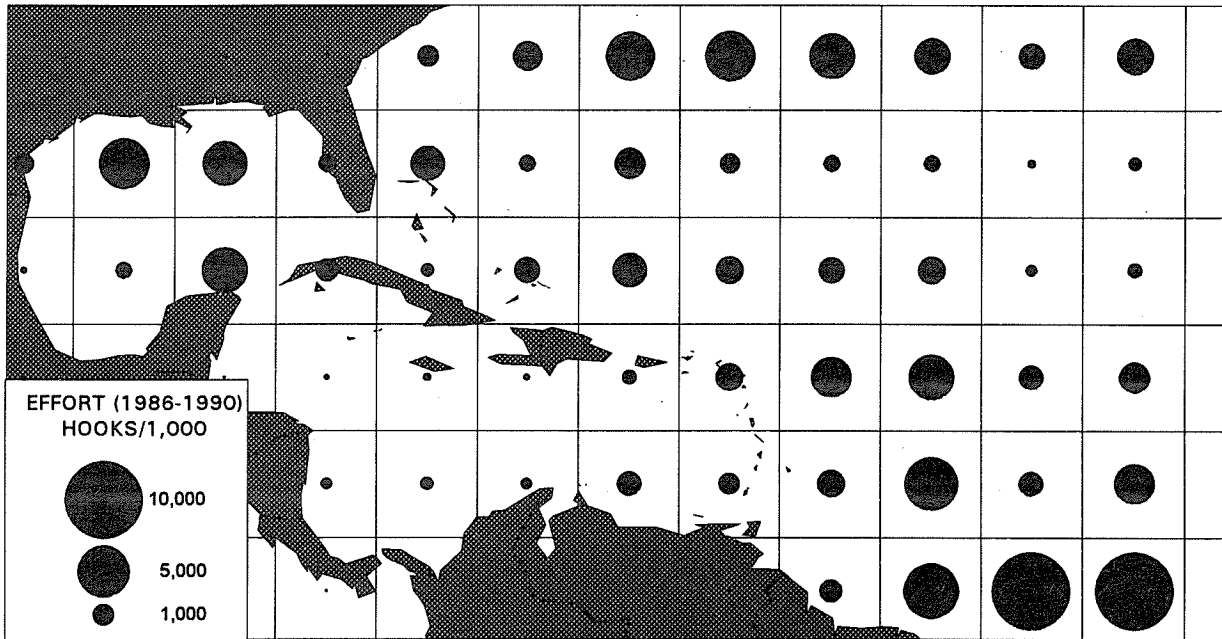


Figure 6. Longline fishing effort and landings in the WECAFC region by 5 degree squares as reported to ICCAT

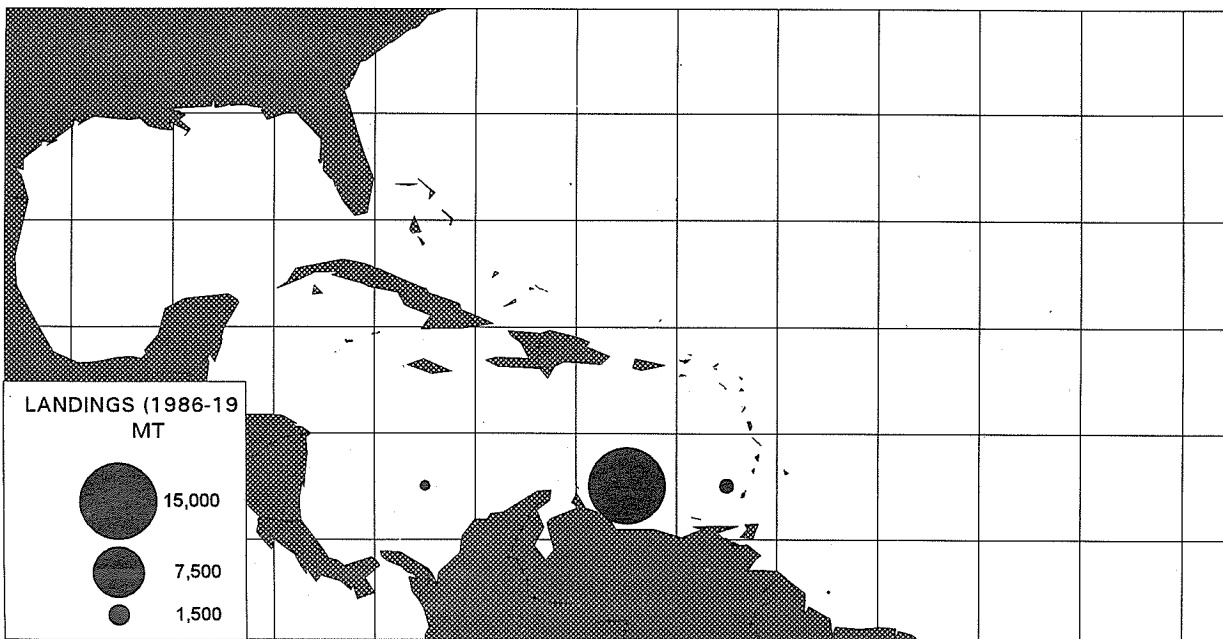
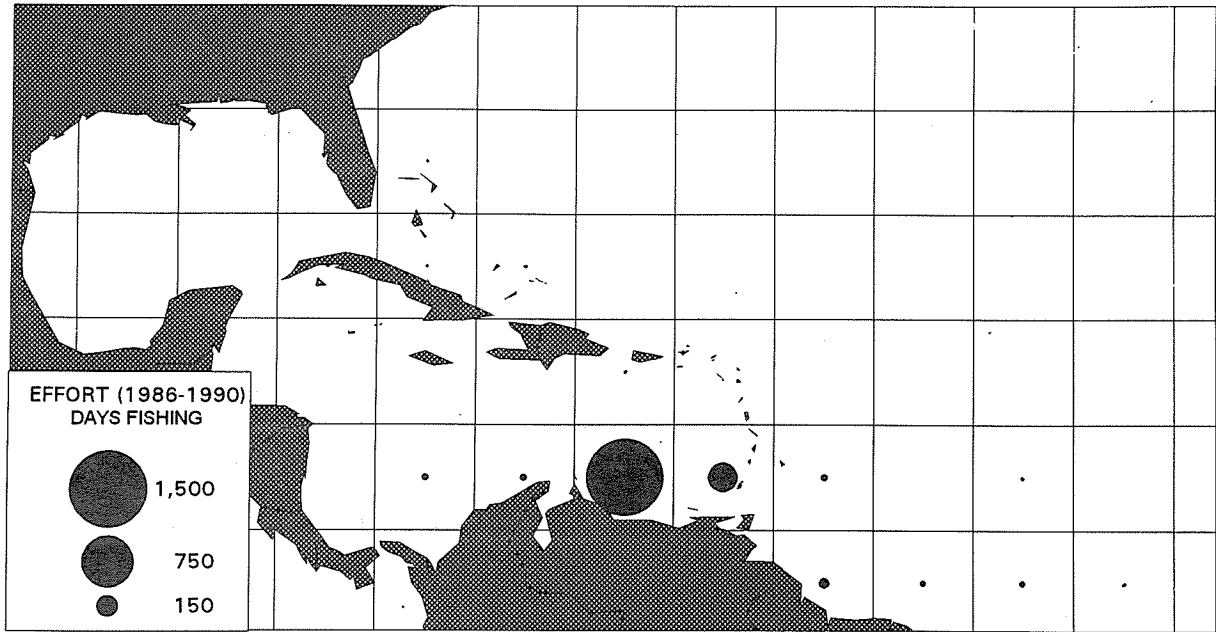


Figure 7. Purse seine fishing effort and landings in the WECAFC area by 5 degree square as reported to ICCAT

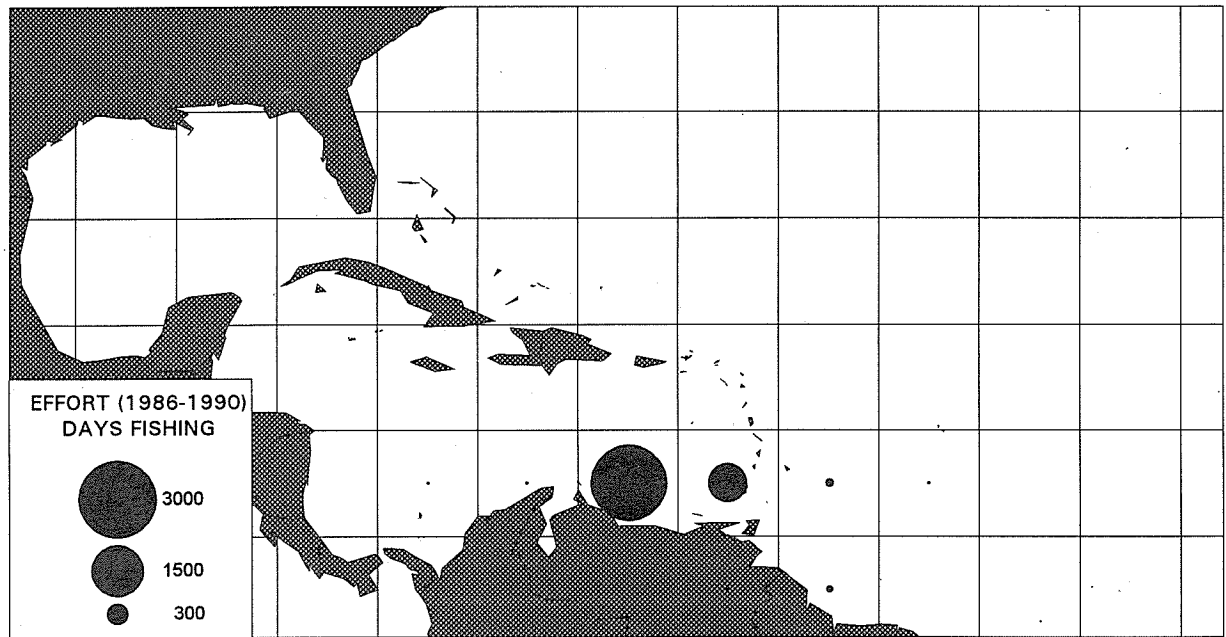
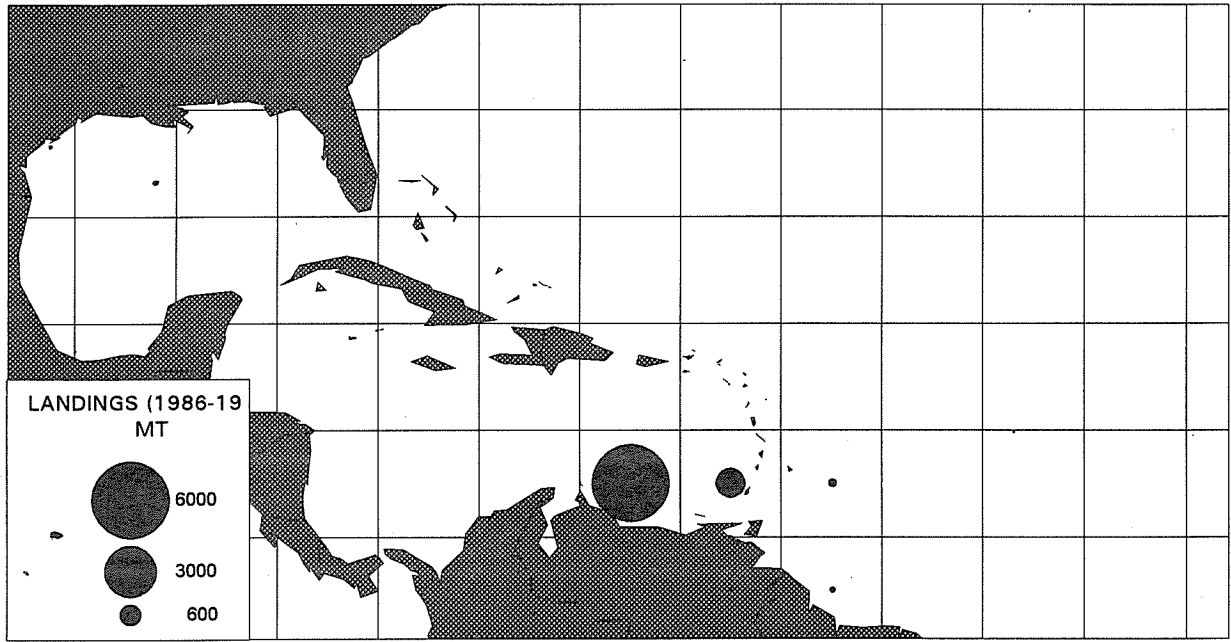


Figure 8. Bait boat fishing effort and landings in the WECAFC area by 5 degree square as reported to ICCAT

press) report four large longliners and only 15 small ones, noting that the latter fleet had declined recently due to difficult economic times in Venezuela.

In 1992 there were about 20 tuna baitboats active in Venezuela. Most of these appear to be small with limited range, and operate entirely within the WECAFC area. The vessels in this fleet are reported to be no larger than 50 GRT, and to have a total capacity of about 2,300 tons, but there are conflicting reports which suggest that there may be several vessels in the 50-150 GRT range (Weidner 1993).

**Cuba's** extensive large-scale commercial fleet consists primarily of trawlers. The tuna fleet, of 1 purse seiner and 10 longliners over 500 GRT reported to be operating in 1989, is believed to have been fishing primarily off West Africa. Figure 3, however, indicates some activity by Cuban longliners in the WECAFC area between 1984 and 1987. Details of the small-scale domestic fleet which fishes for large pelagics in the vicinity of Cuba are not readily available. Rodriguez (1989) indicates that there were about 60 small-scale pole and line fishing vessels and about 80 small-scale longliners in operation in Cuba in 1988. Weidner and Hall (1993) report that now that subsidized fuel is no longer available from the Soviet Union, fuel shortage is severely limiting Cuban fishing activities, particularly those of its distant water fleets.

Most fishing for large pelagics in the WECAFC area by the **USA** is by small-scale fleets for coastal pelagics. Two notable exceptions are the longline fleet fishing for yellowfin tuna in the Gulf of Mexico (Browder and Scott, 1992), and the swordfish longline fleet. The latter shifted its operations south through the Caribbean and down to the north coast of South America from about 1986 through 1991 and withdrew partially in subsequent years.

Virtually all of **Mexico's** large commercial tuna fishing vessels operate in the Pacific (Weidner and Hall, 1993). Most Mexican fisheries for large pelagics in the Caribbean and Gulf of Mexico are small-scale. Those for *Scomberomorus* spp. are coastal. In the early 1980s, Mexico began to develop a longline fishery for yellowfin tuna in the Gulf of Mexico. The longline fleet increased rapidly from 1 vessel in 1981 to 16 vessels in 1986 (Compeán Jiménez 1989). The area of operation of this fleet was reported as highly localized in the southwest Gulf of Mexico.

Although **Brazil** is a member of WECAFC, it does not report any landings from the WECAFC area. According to de Lima (1994) all Brazilian tuna fishing fleets operate south of the equator.

There also appears to be an increasing trend in the numbers of vessels which have been reflagged by WECAFC countries (Weidner and Hall 1993). The extent to which these actually fish in the Western Central Atlantic is not known. Vessels reflag for various reasons: to avoid domestic regulations or taxes, to gain access to crew at low wages, and to avoid reporting requirements. As the UN Agreement comes into force, vessels which violate reporting and other

management requirements may bring increasingly vigorous punitive repercussions for the state in which they are registered.

### 3.2 Trends in fish stocks

Documented trends in abundance and the current status of large pelagic fish stocks that are exploited in the WECAFC area are available only for the major species which are assessed by ICCAT. For most other species, assessments have only been carried out in only a few areas, primarily in the waters of the USA (SEFSC 1994). The ICCAT assessments of stock trends and status are provided in the ICCAT Biennial Reports (ICCAT 1996).

For all species it is useful to begin by examining trends in landings in the WECAFC area. These trends alone are not easily interpreted. Without ancillary information they cannot indicate whether a stock is under, fully, or over exploited. However, an increasing trend for a particular species does indicate that the fishery is expanding and that the resource should be assessed. In the case of a continuous decline in landings, or an increase and then a decline, unless there is a known decrease in fishing effort, there is probably cause for concern and the need for management measures to be put in place.

During the period covered by the FAO microcomputer database on fishery landings, 1970-1993 (Stamatopoulos 1993), landings of large pelagic fishes from the Western Central Atlantic Region have doubled from about 50,000 mt to about 100,000 mt (Figure 9). The overall general upward trend shown in Figure 9 is interrupted between 1981 and 1984 by a very rapid increase in landings from about 60,000 mt to over 100,000 mt, followed by a decrease from 1984 through 1987 to about 65,000 mt, after which the gradual upward trend continues. As will be seen later, this increase and decline between 1981 and 1987 is due largely to catches of yellowfin and skipjack tuna by Venezuela. Apart from the 1981-1987 event, all the major categories of large pelagics, except billfishes, show increases in landings over the period of record.

A breakdown of landings by groups of countries shows that there has been a steady decrease in the landings reported by distant water fishing countries (Figure 10). Landings by Caribbean Islands, both Lesser Antilles and other Antilles, including Cuba, have remained relatively small and constant in comparison to the landings by the USA and Mexico (much of it from the Gulf of Mexico) and by Venezuela and Colombia.

Closer examination of the reported landings of each species broken down by country reveals the basis for the overall patterns just described. In reviewing these figures, it is useful to bear in mind the extent to which the stock extends outside of the WECAFC Region, and the proportion of the landings from the stock which are taken in the Region. This information is summarized in Table 4.

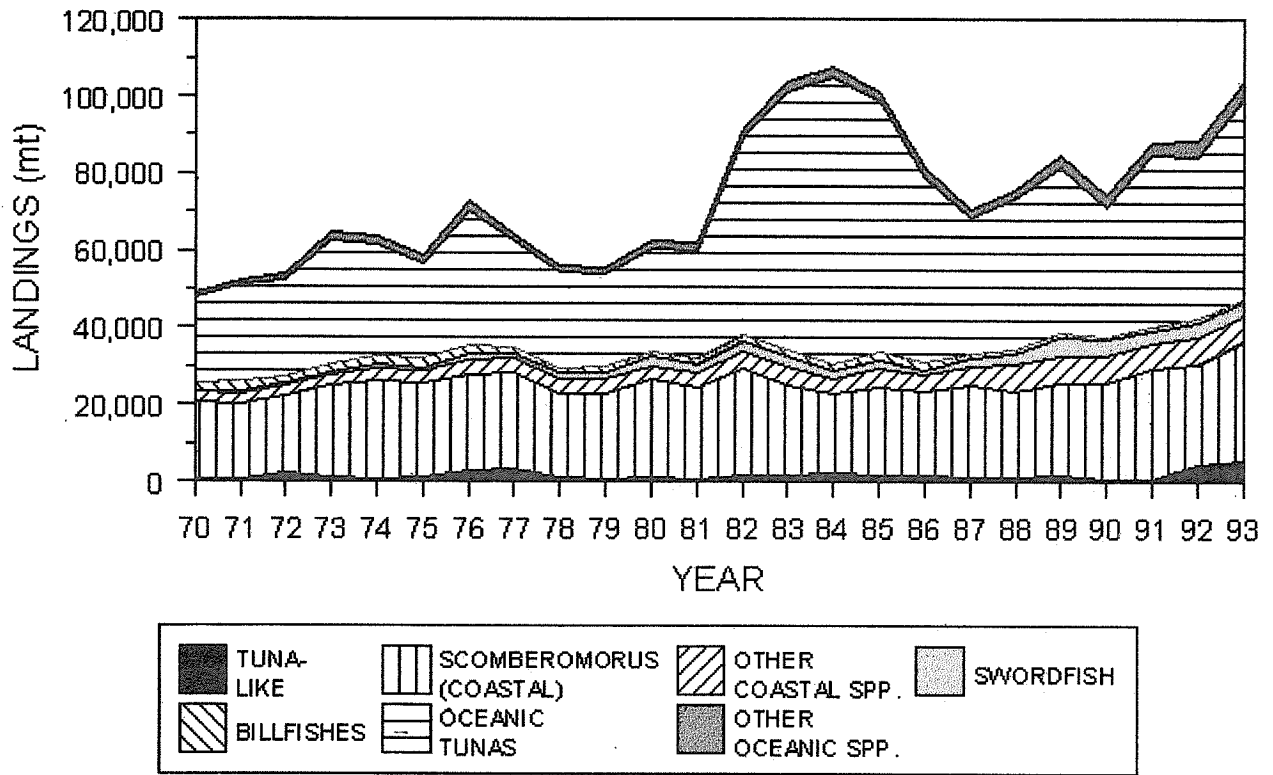


Figure 9. Fishery landings of large pelagics in the WECAFC area as reported to FAO

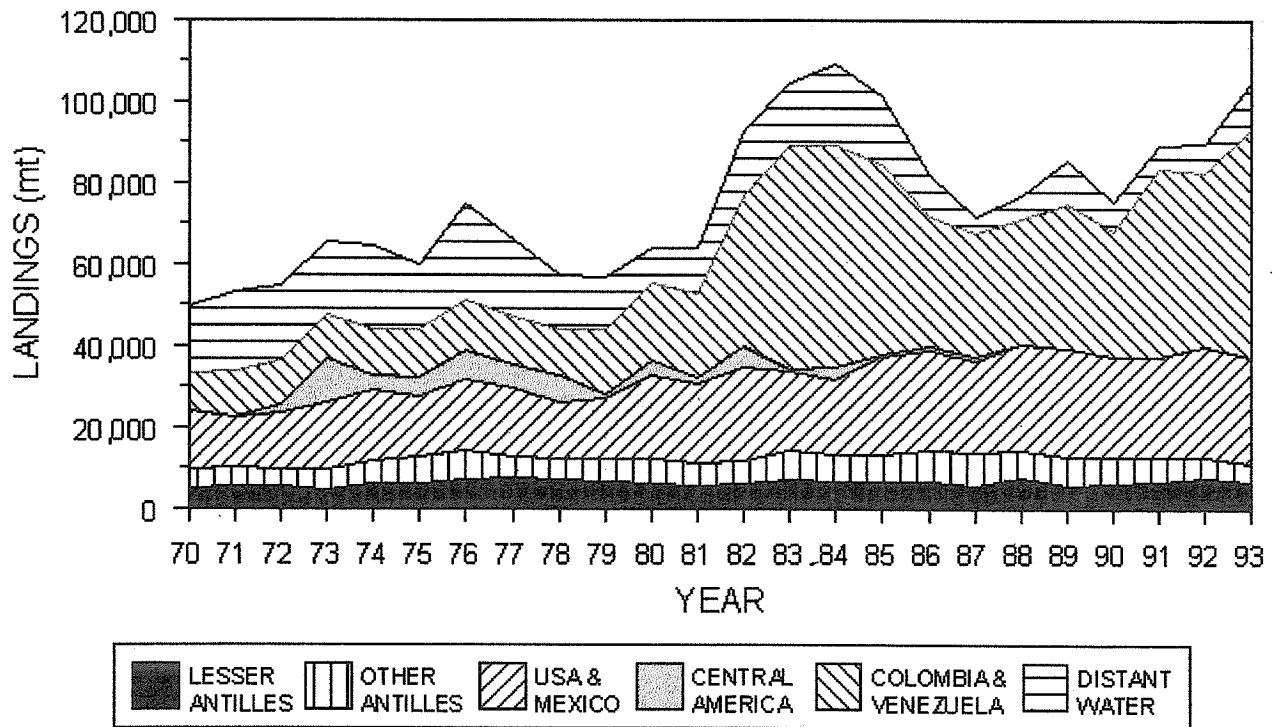


Figure 10. Fishery landings by country group in the WECAFC area as reported to FAO.

Table 4. An overview of the characteristics of the stocks of tunas and tuna-like large pelagic species which are exploited in the WECAFC Region. Average annual landings from the WECAFC Region and from the total stock were extracted from the FAO database (Stamatopoulos 1993). The potential is a qualitative evaluation based on the available data and information. Stock status is based on assessments by ICCAT (1995) and the SEFSC (1994). Species and stock distribution is based on Fischer 1978, Collette and Nauen 1983, Nakamura 1985 and ICCAT 1996.

Species	Distribution	Stock relevant to WECAFC Region	Major fisheries in WECAFC Region	Average annual landings (1989-1993)(mt)		Status
				WECAFC region	Total Stock	
<b>Oceanic</b>						
Yellowfin tuna	All tropical and subtropical waters	Single Atlantic stock	Purse seine, longline, pole and line	24,528	157,280	At or near MSY
Northern bluefin tuna	North Atlantic and North Pacific Oceans	Western Atlantic (with trans-Atlantic mixing)	Longline, occasionally trolling	239	2,631	Considerably overexploited
Albacore	Tropical and warm temperate Atlantic and Pacific Oceans (except E central Pacific), deeper in tropics	North Atlantic (N of 5 deg. N)	Longline, occasionally trolling	2,715	32,740	Uncertain, probably near full exploitation
Bigeye tuna	All tropical and subtropical waters	Single Atlantic stock	Deep longline, some surface gear	2,365	75,820	At or above MSY
Skipjack tuna	All tropical and warm temperate waters	Western Atlantic	Surface, purse seine, pole & line	6,787	26,940	Unknown
Blackfin tuna	West Central Atlantic	Probably local, associated with island or bank masses	Trolling, incidental on longline	2,632	3,000	Unknown
Atlantic black skipjack	E and W central Atlantic Ocean, Mediterranean and Black Seas	Probably local, associated with island or bank masses	Trolling, incidental on longline	1,831	18,800	Unknown
Atlantic bonito	Atlantic Ocean, Mediterranean and Black Seas	Unknown	Trolling, incidental on longline	2,874	7,900	Unknown
Frigate tuna	Worldwide tropical and temperate waters	Unknown	Trolling, incidental on longline	1,927	7,700	Unknown
Wahoo	All tropical and subtropical waters	Probably local stocks within the western Atlantic	Trolling, incidental on longline	749	1,600	Unknown

Species	Distribution	Stock relevant to WECAFC Region	Major fisheries in WECAFC Region	Average annual landings (1989-1993)(mt)		Status
				WECAFC	Total Stock region	
Blue marlin	Atlantic Ocean	Entire Atlantic Ocean	Longline, recreational	445	3,170	Overexploited
White marlin	Atlantic Ocean	North Atlantic	Longline, recreational	88	307	Overexploited
Longbill spearfish	Atlantic Ocean	Unknown	Longline	Combined with sailfish		
Sailfish	Tropical & temperate Atlantic	Western Atlantic	Longline, recreational	330	685	Fully or over exploited
Swordfish	All tropical & temperate waters	North Atlantic	Longline	4,073	15,677	Overexploited
<b>Coastal</b>						
King mackerel		Probably local stocks within the western Atlantic	Trolling, incidental on longline	6,671	10,100	Overexploited in US Gulf of Mexico waters, underexploited in US Atlantic waters, unknown elsewhere
Spanish mackerel	West Central Atlantic	Probably local stocks within the western Atlantic	Gill-nets	1,854	18,240	Overexploited in US waters, unknown elsewhere
Serra mackerel	West Central Atlantic	Probably local stocks within the western Atlantic	Gill-nets	?	?	Unknown
Cero mackerel	Coastal West Central Atlantic, particularly islands	Associated with island or bank masses	Trolling, some gill-nets	315	320	Unknown, no signs of overfishing of cero mackerel off Jamaica (Goodbody 1986)
Cobia	Coastal West Central Atlantic		Trolling	686	686	Unknown
Dolphin-fish	All tropical and subtropical oceans	Probably local stocks within the western Atlantic	Trolling, incidental on longline	2,829	?	Unknown



In reviewing the trends in landings for each species, their relationship to the overall stock, and to assessments that have been carried out, will be considered. ICCAT reports (ICCAT 1996) and the NOAA review of the status of fishery resources off the southeastern United States provide good general summaries for most of the major species.

### 3.2.1 Atlantic blue marlin

Atlantic blue marlin landings show an overall declining trend over the period of record (Figure 11a). The majority of landings are by distant water longline fleets, particularly in the early years. Only 14% of the landings for the entire Atlantic stock in the period 1989-1993 came from the WECAFC area. The blue marlin stock continues to be considered as overexploited. For this species and other billfishes, the catch is primarily bycatch in longline fisheries targeting other species. ICCAT resolutions in 1994 and 1995 are aimed at reducing this bycatch.

### 3.2.2 Atlantic white marlin

Atlantic white marlin are also taken primarily by distant water longline fleets (Figure 11b). The landings show two periods of rapid decline over the period of record, the first between 1976 and 1977 when landings reported by Japan declined to almost zero, and the second between 1986 and 1987, when the three remaining countries reported minimal landings. About 29% of the relatively small landings from the North Atlantic stock of white marlin are from the WECAFC area. The white marlin stock continues to be considered as overexploited.

### 3.2.3 Atlantic sailfish

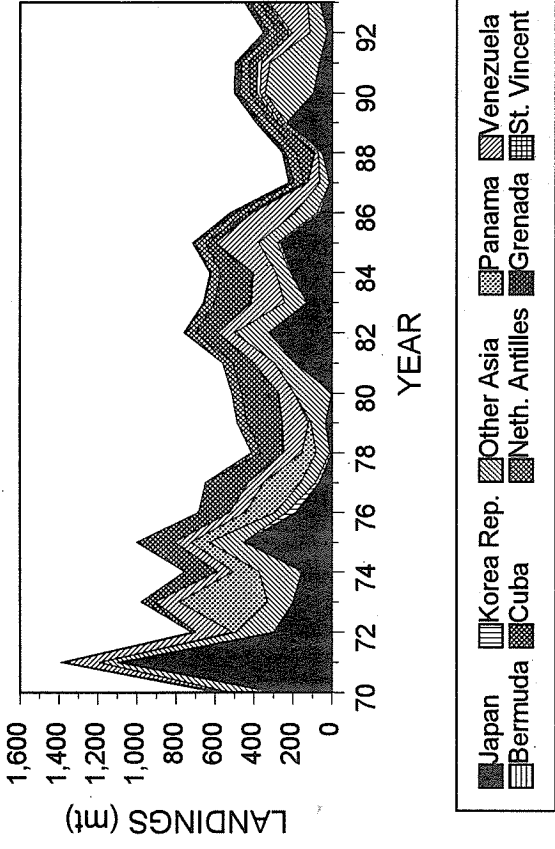
In contrast to the other billfishes, most of the landings of West Atlantic sailfish are taken by countries within the WECAFC area, notably Cuba, Venezuela and, in recent years, Grenada (Figure 11c). The increasing trend in landings from about 1978 to 1985 was due primarily to Cuban landings, after which there has been an overall declining trend through to 1993, despite increased landings by Grenada. ICCAT considers there to be a western Atlantic stock of sailfish, and just under 50% of the landings from that stock are taken in the WECAFC area. The remainder is taken by Brazil and distant water fleets from Asia.

ICCAT (1996) has expressed concern about the downward trend of Western Atlantic sailfish indices of abundance. This stock is considered to be at least fully exploited, if not overexploited, relative to an MSY reference point.

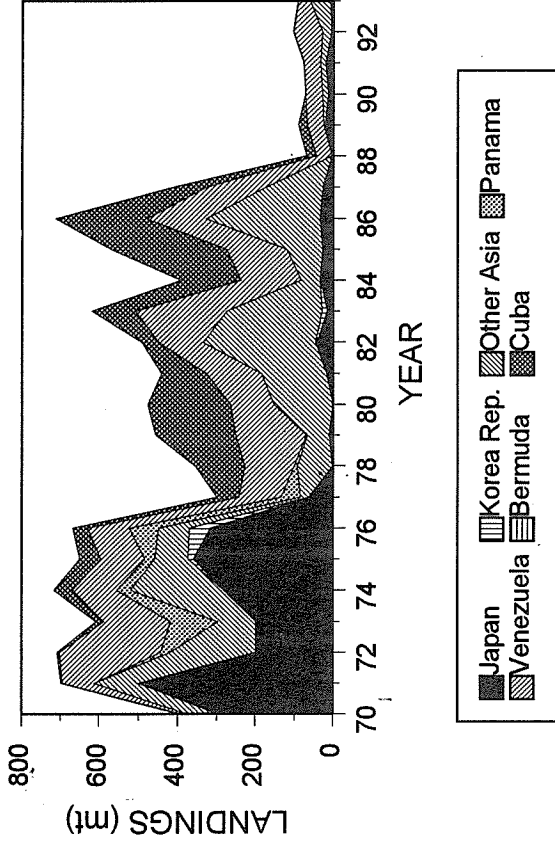
### 3.2.4 Billfishes (unidentified)

The category "billfishes unspecified" comprises about 10% of billfish landings, reported primarily by Barbados (Figure 11d). Oxenford (1990),

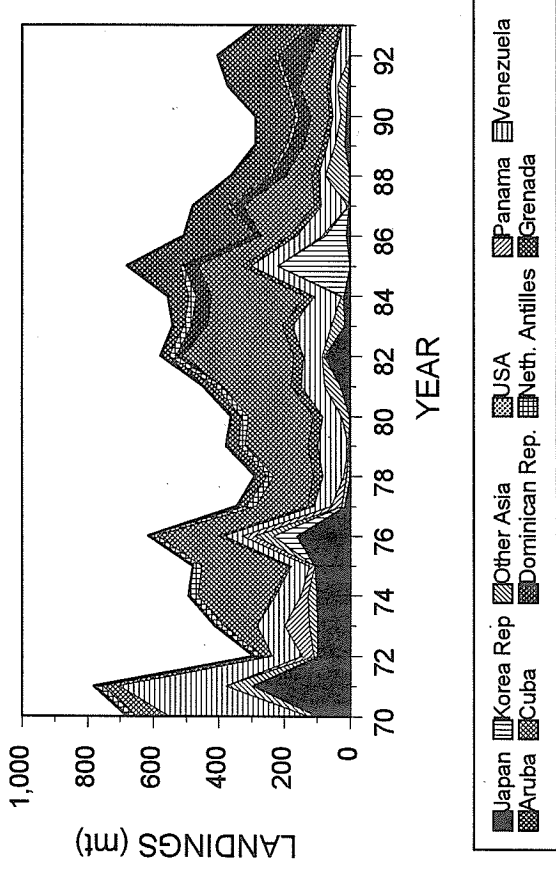
(A) ATLANTIC BLUE MARLIN



(B) ATLANTIC WHITE MARLIN



(C) ATLANTIC SAILFISH



(D) BILLFISHES

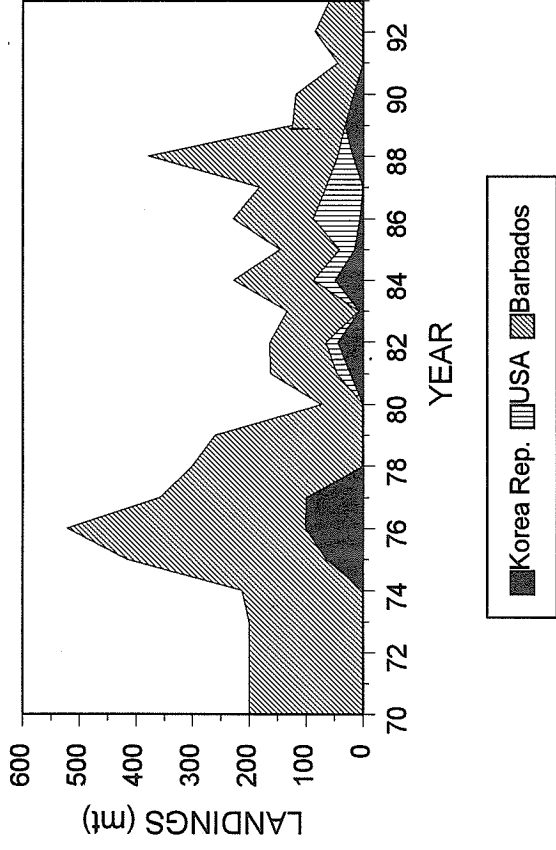


Figure 11. Trends in landings of individual species from the WECAFC area by country, as reported to FAO.

estimated the composition of billfish landings in 1989 was 21% sailfish, 16% white marlin, 54% blue marlin and 9% spearfish.

### 3.2.5 Albacore

Albacore landings in the WECAFC area are reported almost entirely by distant water fishing fleets. They are highly variable, but the lowest catches, and the most extensive period of low catches has been in recent years, 1987-1992 (Figure 11e). The majority of landings are reported from a longline fishery which takes place in the central North Atlantic, and which overlaps only the NE part of the WECAFC area. Thus, only 8.2% of landings from the entire stock came from the WECAFC Region in the 1987-1993 period.

The recent decline in albacore landings from the WECAFC Region is broadly consistent with trends for age 5+ abundance for the North Atlantic Stock (ICCAT 1996). Most of the decline in landings of albacore has been due to a shift in targeting and location by Taiwanese longliners towards bigeye tuna and areas to the south. In 1993, albacore were considered to be fully exploited relative to an Maximum Sustainable Yield (MSY) reference point (SEFSC 1994). In recent assessments by ICCAT (1996), MSY was considered to be too poorly estimated to be usable.

### 3.2.6 Bigeye tuna

Landings of bigeye tuna are also reported mainly by distant water fleets. However, from 1987-1992, Venezuela also reported considerable landings of this species in the WECAFC area. Bigeye tuna are less important than the other major species, with only 3.1% of the landings from the entire stock coming from this area. Thus, although there has been a steady upward trend, with landings for the entire stock doubling between 1970 and 1995 (ICCAT 1996), this trend is not reflected in landings from the WECAFC area, which have been highly variable without an evident trend (Figure 11f). This may be due to the tendency for small-scale commercial development to focus on surface fishing techniques. The Atlantic wide stock of bigeye tuna is considered to be overexploited relative to an MSY reference point (SEFSC 1994, ICCAT 1996).

### 3.2.7 Skipjack tuna

Skipjack tuna landings in the WECAFC area increased rapidly from 1979 through 1984 due to catches by Venezuelan purse seiners. Landings then declined equally rapidly to 1990 before increasing again to 1993. Venezuelan vessels continue to take the majority of skipjack tuna (Figure 11g). Notwithstanding the peak of about 23,000 mt in 1984, skipjack tuna landings over the entire period have shown a general increasing trend and have quadrupled. About 25% of the total landings from the western Atlantic skipjack stock as defined by ICCAT, are reported from the WECAFC Region. The majority of the remaining landings are taken outside the WECAFC area by Brazil (ICCAT 1996). In 1993, the western Atlantic stock of skipjack tuna was considered to

be fully exploited relative to an MSY reference point (SEFSC 1994). ICCAT, however, has never adopted an MSY estimate for western Atlantic skipjack tuna, and considers that there is still scope for expansion of the fishery (ICCAT pers comm.).

### 3.2.8 Yellowfin tuna

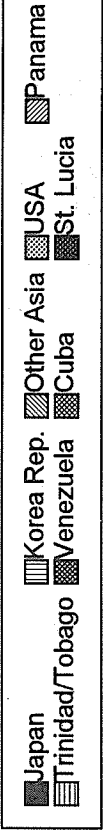
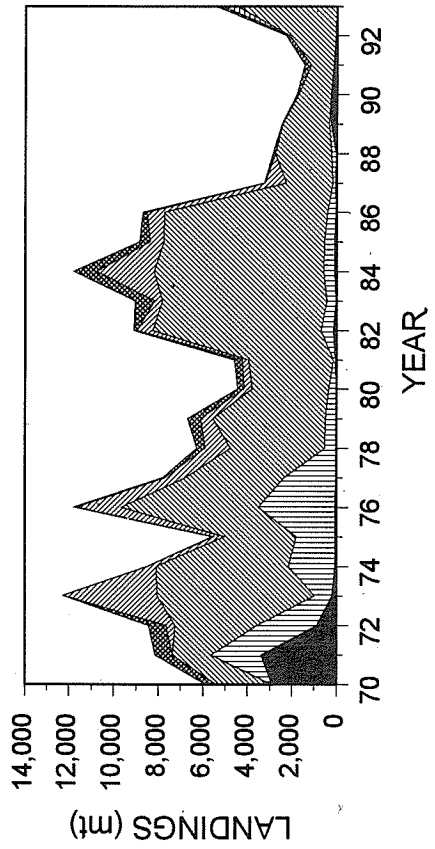
Yellowfin tuna landings in the WECAFC area show a slight decreasing trend from 1970 through 1978, then increased sharply from about 5,000 mt to about 32,000 mt in 1983. This increase was due to increased purse seine and longline effort by Venezuela. Following the peak in 1983, annual yellowfin landings declined slightly and have fluctuated in the vicinity of 20,000-25,000 mt/y (Figure 11h). Figure 11h shows the decreasing trend in landings by distant water fleets from Asia and Europe, and the increasing trend in landings by WECAFC countries, primarily Venezuela (in the Caribbean Sea and off the Guianas) and the USA longline operations (in the Gulf of Mexico) (Browder and Scott 1992). The proportion taken by other WECAFC countries is relatively small.

Since 1993, ICCAT has shifted from a two-stock (east and west Atlantic) hypothesis to a single Atlantic stock hypothesis for its yellowfin tuna assessments (ICCAT 1996). The pattern of landings for yellowfin tuna in the WECAFC area is similar to that for the entire Atlantic stock, for which landings increased quickly through to the early 1980s, declined for a couple of years, and increased slowly thereafter. Under the single stock hypothesis, landings from the WECAFC Region comprise about 16% of landings from the entire stock. The entire Atlantic stock of yellowfin tuna is considered to be fully exploited relative to an MSY reference point (ICCAT 1996).

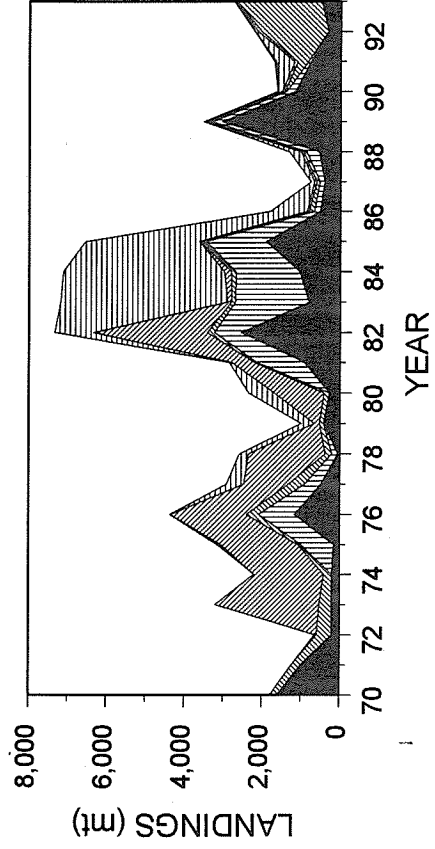
### 3.2.9 Bluefin tuna

Bluefin tuna landings from the western Atlantic are primarily from waters north of the WECAFC area, where only 9% of the landings are taken. The pattern of landings shown in Figure 11i is similar to that for the entire west Atlantic, where there was a sharp decrease in landings from 1981-1982, following the imposition of a catch limit (ICCAT 1995) aimed at rebuilding the stock. There is some doubt as to the validity of the bluefin tuna landings reported by the Dominican Republic (ICCAT pers comm.). The northern bluefin tuna stock is considered to be overexploited, and efforts at stock rebuilding continue (ICCAT 1996). Recently, the accuracy of Atlantic bluefin tuna assessments has been called into question due to mixing between the western and eastern Atlantic stocks. The effect of this mixing has not yet been satisfactorily accounted for in the recent assessments (ICCAT 1996).

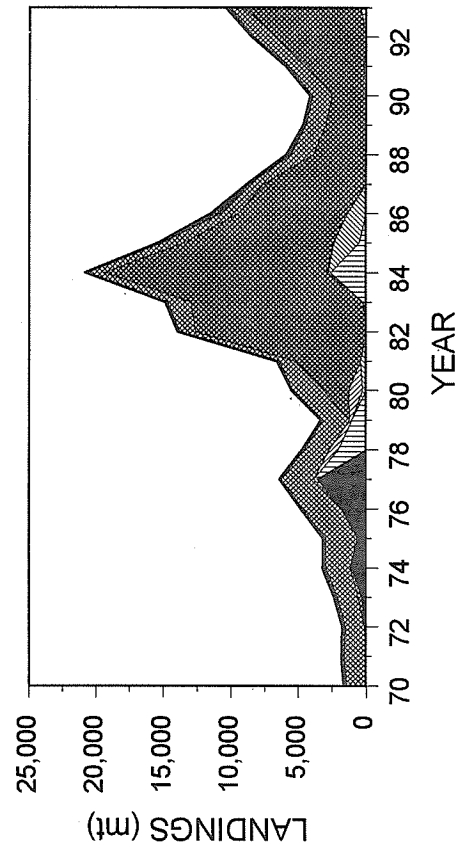
(E) ALBACORE



(F) BIGEYE TUNA



(G) SKIPJACK TUNA



(H) YELLOWFIN TUNA

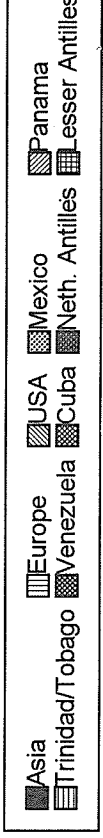
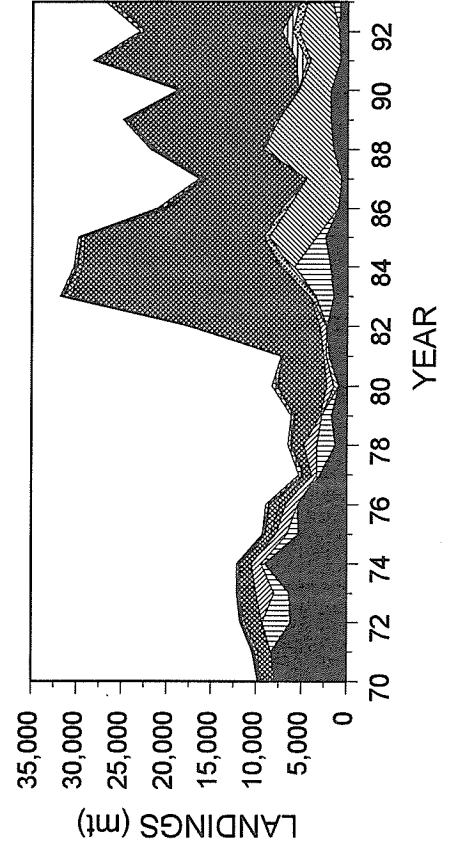


Figure 11. Continued

### 3.2.10 Swordfish

Swordfish landings from the WECAFC area represent about 26% of the landings from the entire north Atlantic stock. From 1978 onwards the majority of landings have been by the USA longline fleet which gradually expanded its fishing activities through the northern and eastern Caribbean to the waters off the north coast of South America (ICCAT 1995)(Figure 11j). In 1989, Spain reported landings for the first time and have reported more than half the landings taken in the WECAFC area each year since then. The north Atlantic swordfish stock is considered to be overexploited relative to both MSY and yield-per-recruit reference points (ICCAT 1996).

### 3.2.11 Wahoo

Wahoo landings from the WECAFC area increased slowly but steadily from about 350 mt in the early 1970s to about 500 mt in the late 1980s, then increased rapidly to about 900 mt between 1989 and 1993 (Figure 11k). Little is known of the stock structure of wahoo throughout the Atlantic. Therefore, it is not possible to estimate the proportion of landings from the stock, or stocks, of wahoo fished in the western Atlantic that is caught in the WECAFC area.

Although ICCAT monitors wahoo landings, the data are not considered to be adequate for an assessment of this species.

### 3.2.12 Tunas and tuna-like fishes

This is an aggregate category in which several countries report landings. Usually, the species reported in these categories do not contribute much to the landings of the country, and it is not considered worthwhile to report them separately. However, in some cases, significant amounts of catch appear in these categories, as shown for Panama in 1977 and for Colombia in 1992-1993 (Figure 11l).

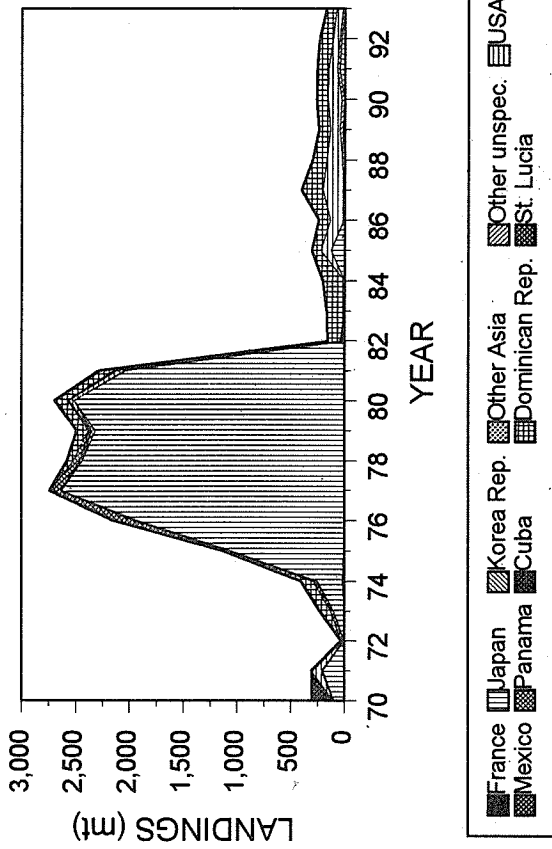
### 3.2.13 Atlantic black skipjack

Atlantic black skipjack landings are reported primarily by Cuba, with small quantities reported by Bermuda. The landings have shown a steady upward trend from 1982 to the present, from about 300 mt/y to about 2,000 mt/y (Figure 11m).

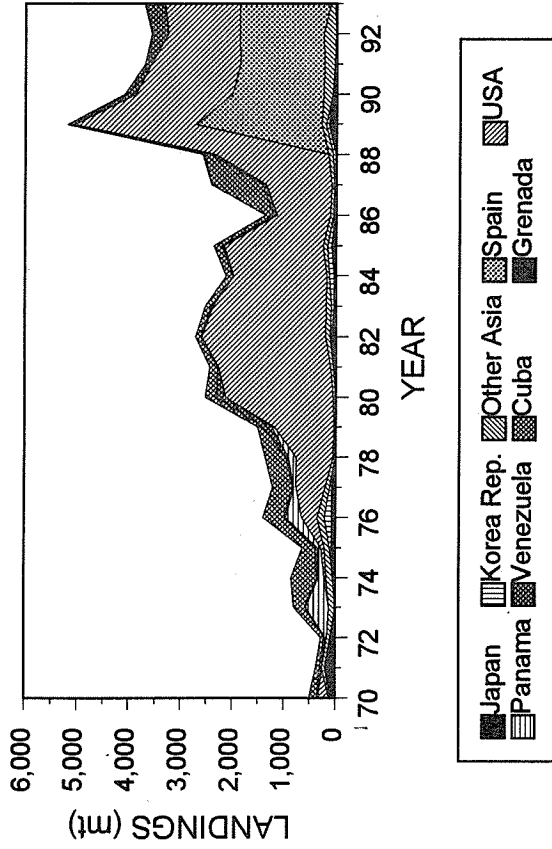
### 3.2.14 Atlantic bonito

From 1970 to 1985 Atlantic bonito landings fluctuated without an overall trend. From 1985 to 1993, there has been a distinct upward trend, with landings more than doubling (Figure 11n).

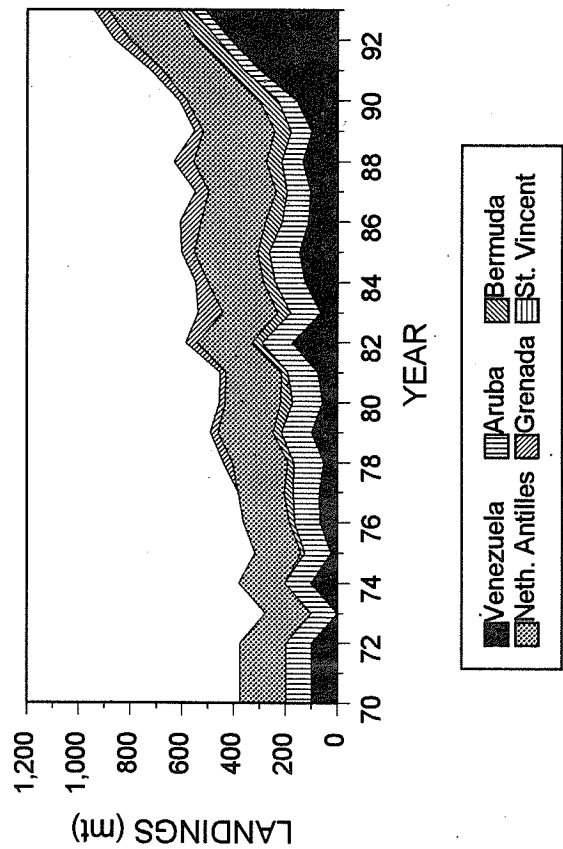
(I) NORTHERN BLUEFIN TUNA



(J) SWORDFISH



(K) WAHOO



(L) TUNAS AND TUNA-LIKE FISHES (UNID.)

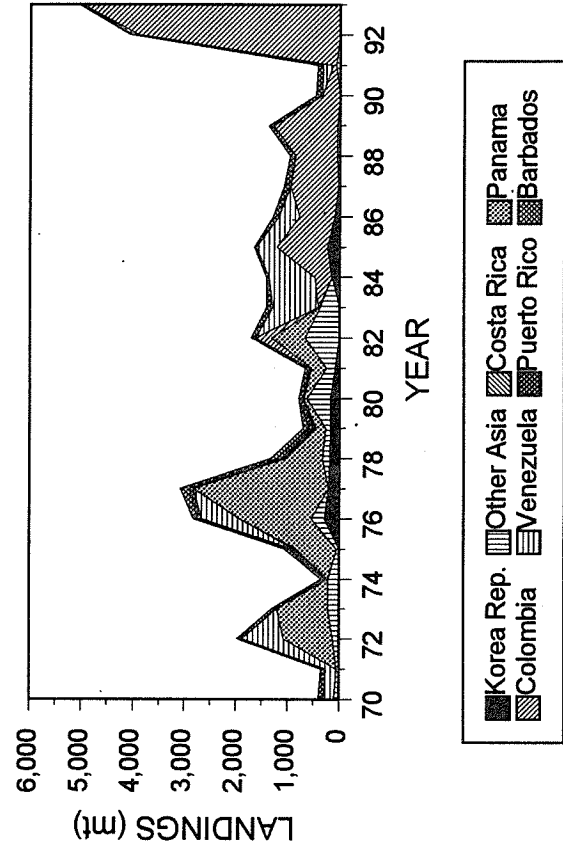


Figure 11. Continued

### 3.2.15 Blackfin tuna

Blackfin tuna landings declined from 1970 to 1973, increased slowly to 1981, declined slightly to 1985, then increased rapidly to 1990. the rapid increase was due to landings of over 1,000 mt/yr reported by Venezuela for four years. Venezuelan landings declined to almost zero between 1990 and 1992. Without the brief peak in landings by Venezuela, there would still be a slight overall increasing trend in landings from 1983 to 1993 (Figure 11o).

### 3.2.16 Auxis spp.

Virtually all landings of *Auxis* spp. are reported by Venezuela. These have fluctuated widely between 1970 and 1993, but are generally higher in later years (Figure 11p). The two species of *Auxis*, *A. rochei* and *A. thazard* are not reported separately.

### 3.2.17 Atlantic Spanish mackerel and serra mackerel

Landings of serra mackerel are not reported separately from those of Spanish mackerel. Presumably landings of Atlantic Spanish mackerel by Trinidad and Tobago, Venezuela, Colombia and Grenada are actually serra mackerel. Therefore, fisheries for this species appear to be expanding in the coastal waters off the north coast of South America (Figure 11q).

Landings that are actually Atlantic Spanish mackerel (USA, Mexico, Cuba, Dominican Republic) remained relatively constant over the period of record, with opposite trends for the two main fishing countries, the USA (decreasing) and Mexico (increasing). Landings by the Dominican Republic also show a tendency to be highest in recent years (Figure 11q).

The SEFSC has carried out assessments for local stocks of Atlantic Spanish Mackerel within the waters of the USA.

### 3.2.18 King mackerel

King mackerel landings show two peaks in 1972 and 1984, followed by a period of relatively low landings through to 1989, after which they increased steadily to their highest level in 1993 (Figure 11r). Throughout the entire period, USA landings decreased, while those of Mexico increased.

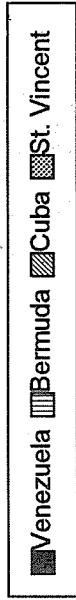
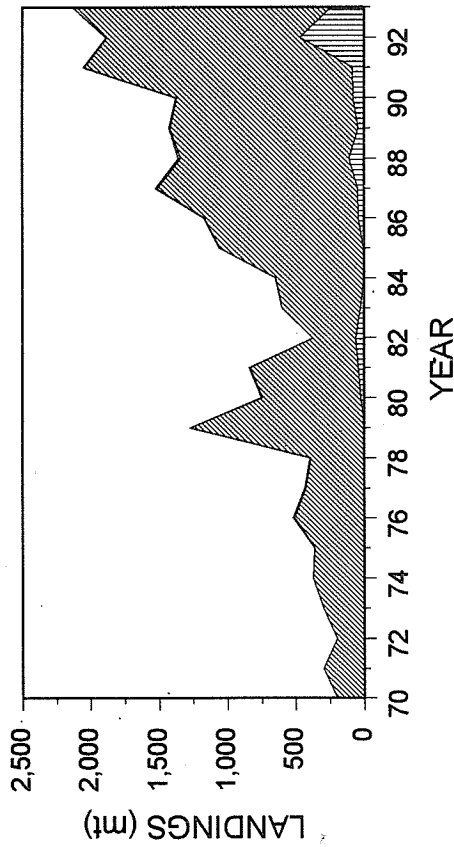
The SEFSC has carried out assessments for local stocks of king Spanish Mackerel within the waters of the USA.

### 3.2.19 Cero mackerel

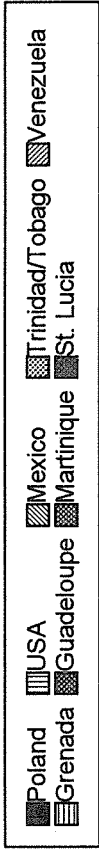
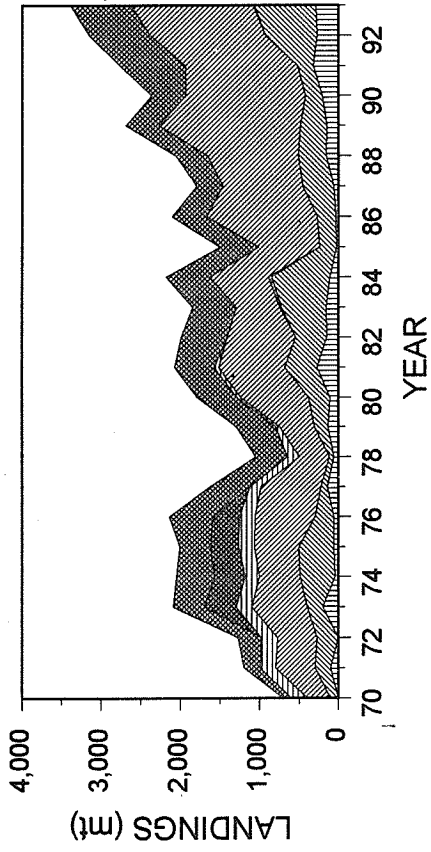
Cero mackerel are reported only by three island countries, the Dominican Republic, Guadeloupe and Martinique. There has been an overall decline in the landings of cero mackerel between about 1984 and 1988 (Figure 11s).



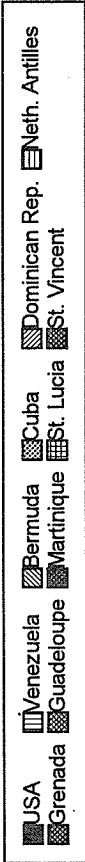
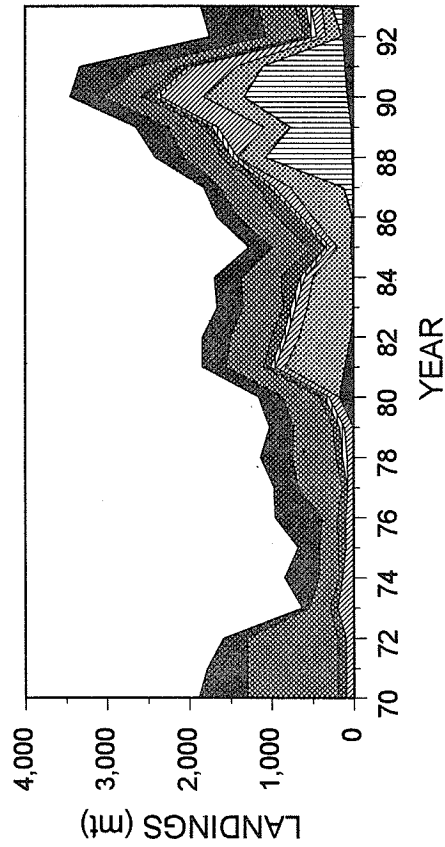
(M) ATLANTIC BLACK SKIPJACK



(N) ATLANTIC BONITO



(O) BLACKFIN TUNA



(P) FRIGATE AND BULLET TUNAS

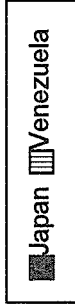
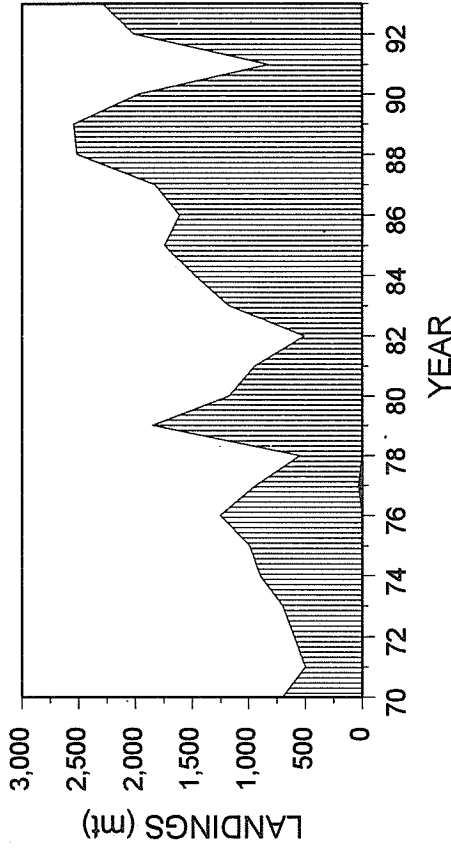


Figure 11. Continued

### 3.1.20 Scomberomorus spp. unidentified

The trends in the three *Scomberomorus* species described above must be interpreted in the context of the reported landings of unidentified *Scomberomorus* spp. (Figure 11t), the majority of which are reported by Trinidad and Tobago, and are probably serra mackerel. For Barbados and Puerto Rico, they are probably mainly cero mackerel.

### 3.2.21 Dolphinfish

Overall dolphinfish landings show an increasing trend from 1970 through 1992 (Figure 11u). From 1988 on, much of this has been due to a marked increase in landings by the USA. Dolphinfish are a significant component of the artisanal/small-scale commercial and recreational catch in all island countries (FAO 1993a), and in several mainland countries also. It is clear that the landings of this species are way under-reported.

Stock structure of dolphinfish in the western Atlantic is not known, but differences in life history parameters suggest that there is more than one stock within the WECAFC area (Oxenford and Hunte 1986).

### 3.2.22 Cobia

Cobia landings are reported only by the USA and Mexico, and have shown a rapid increasing trend from 1974 through 1989, and slight decline thereafter, but only in the landings by Mexico (Figure 11v).

### 3.2.23 Amberjacks

The increase in amberjack landings after 1984 is due to the USA (Figure 11w). Landings by Venezuela and the Dominican Republic, the only other two countries which consistently report amberjacks, have been without trend (Figure 11w).

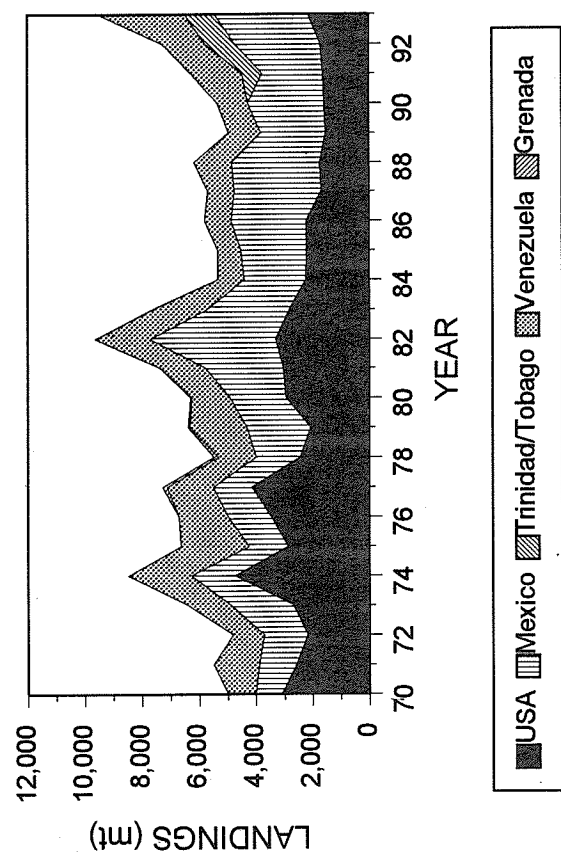
### 3.2.24 Barracudas

Barracudas are not strictly pelagic, but are frequently caught when trolling for large pelagics in coastal waters (Figure 11x). Mexico and Venezuela both show significant increases in landings of barracudas in the latter part of the period of record.

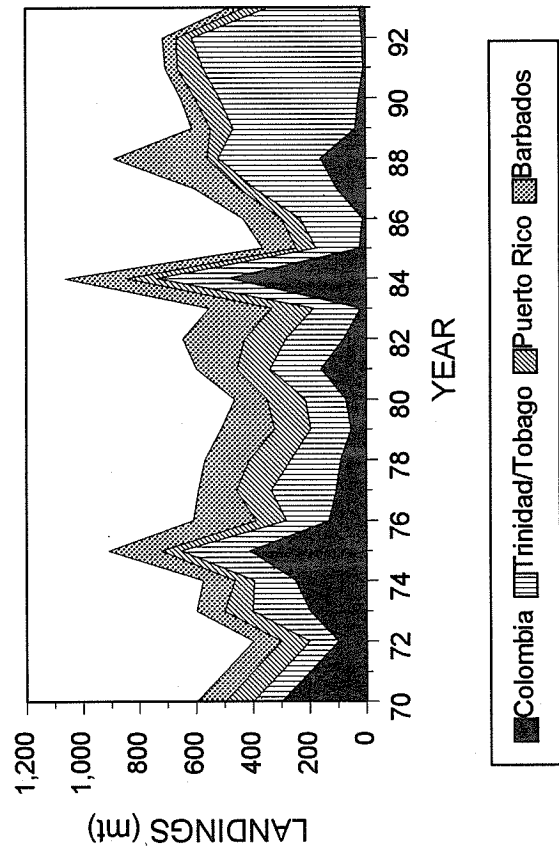
### 3.2.25 Sharks

In the FAO database, landings on pelagic sharks are not kept separately from those of demersal sharks. However, the possible impact of both incidental and targeted landings of sharks on these species is of increasing concern to ICCAT, which is attempting to include shark landings in its database. The USA distinguishes between pelagic and demersal sharks (SEFSC 1994) and has

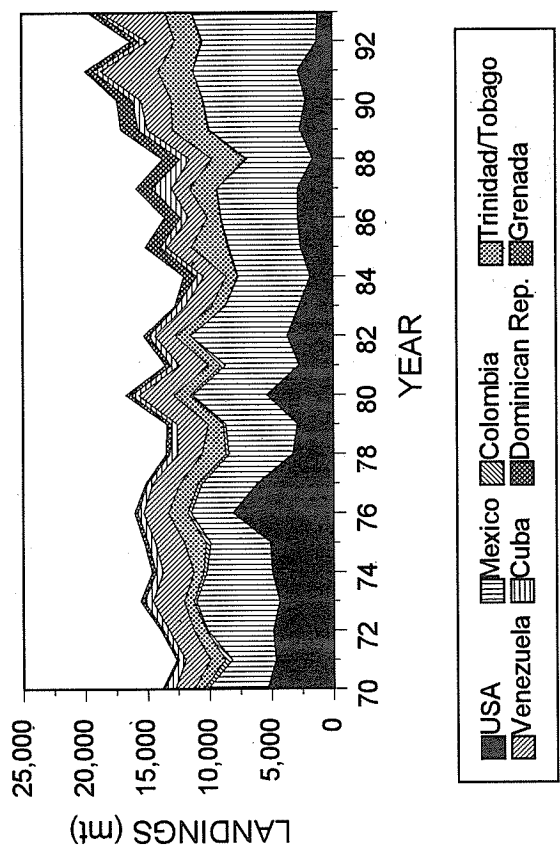
(R) KING MACKEREL



(T) SCOMBEROMORUS SPP.



(Q) ATLANTIC SPANISH MACKEREL



(S) CERO MACKEREL

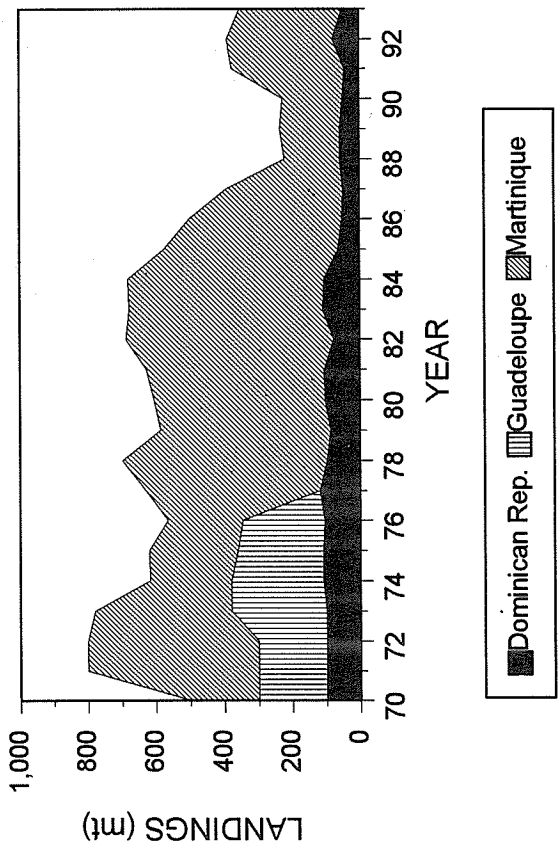
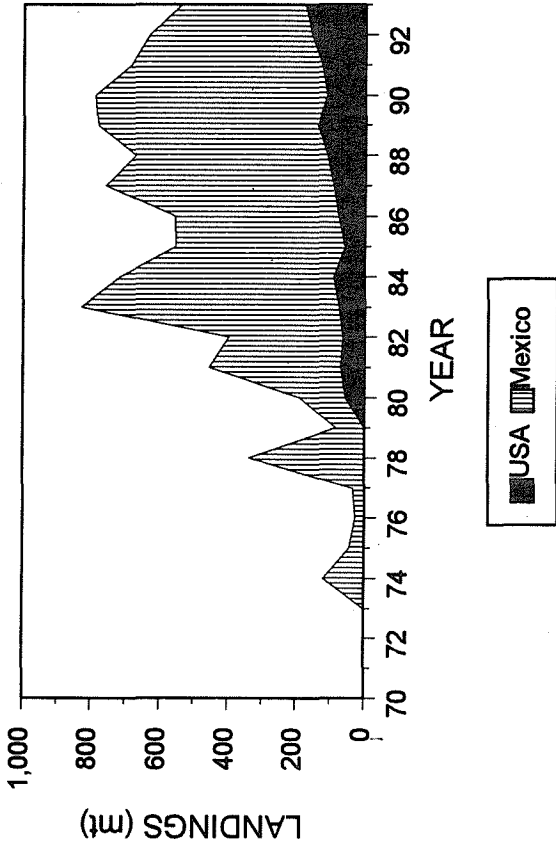
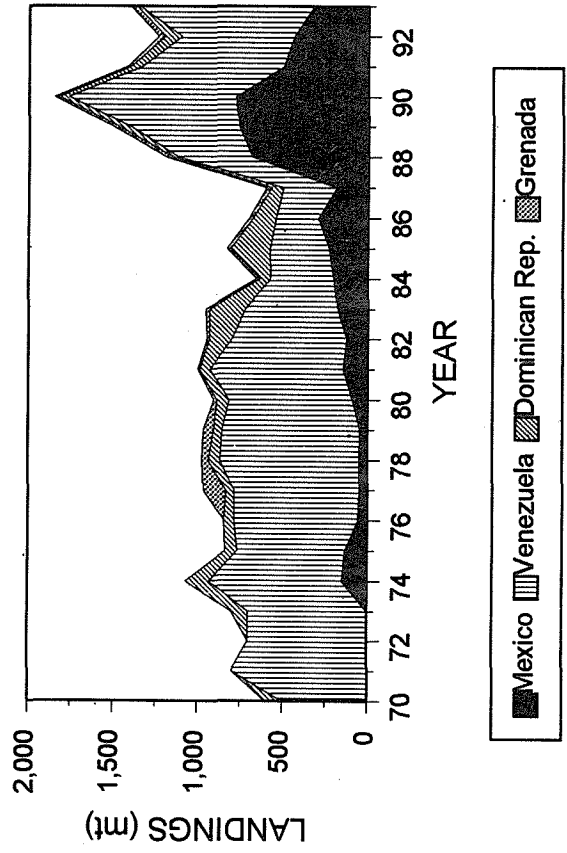


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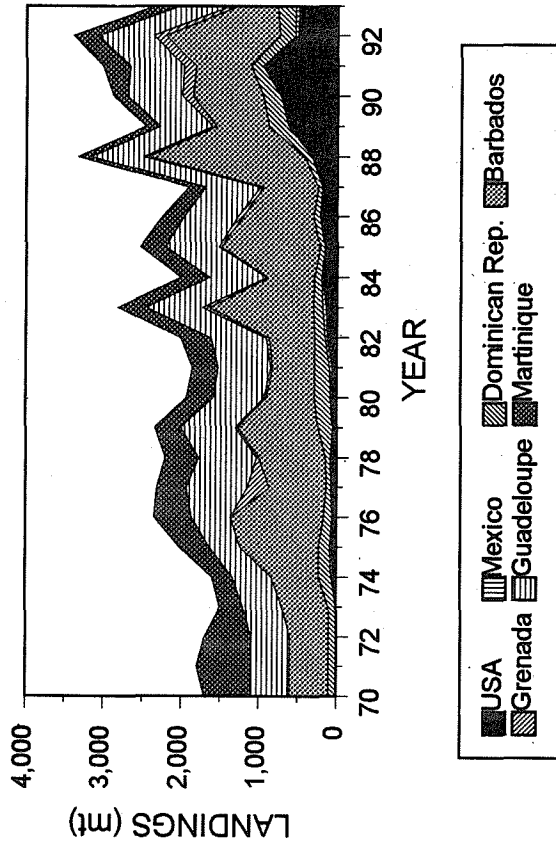
(V) COBIA



(X) BARRACUDAS



(U) DOLPHINFISH



(W) AMBERJACKS

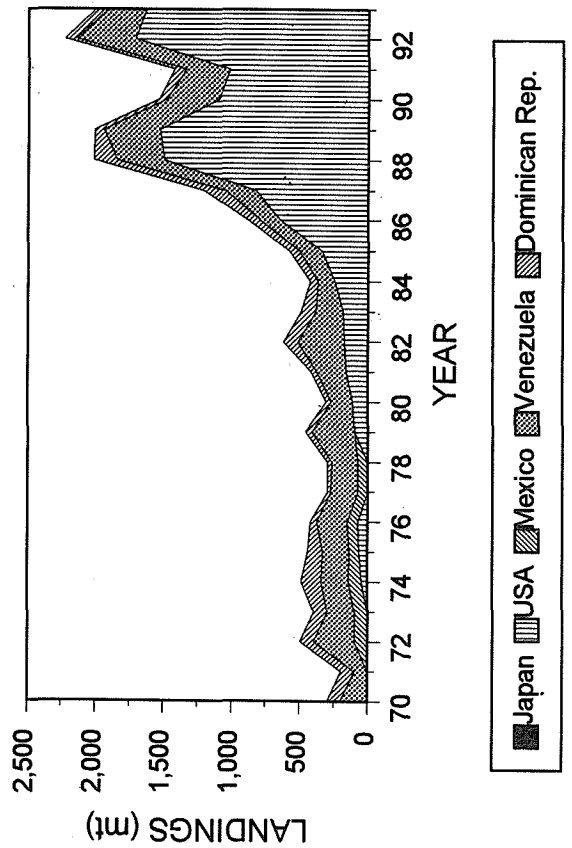


Figure 11. Continued

recently developed a Fishery Management Plan for sharks in the Atlantic Ocean (NMFS 1993). These species are particularly susceptible to overexploitation as they are late maturing and have low reproductive capacity.

Sharks are also caught by artisanal and small-scale fisheries throughout the WECAFC area, but are not recorded at the species level. Therefore, there is no way of knowing the relative contribution of sharks to pelagic fisheries in this region.

The species reviewed above display a variety of temporal patterns over the period of record. Interpretation of these is made more difficult by the interannual variability which is typical of fishery data. In order to summarize these patterns, principal components analysis was used to extract the major modes of temporal variation from the time series of reported landings for the 19 species shown in Figure 12.

The first three principal components accounted for 68% of the variability in the data. Each component was interpreted as reflecting the pattern for two groups of species: those which had high positive scores on the component, and those which had high negative scores. The general pattern exhibited by and the species membership of each of the six groups of species is shown in Figure 12.

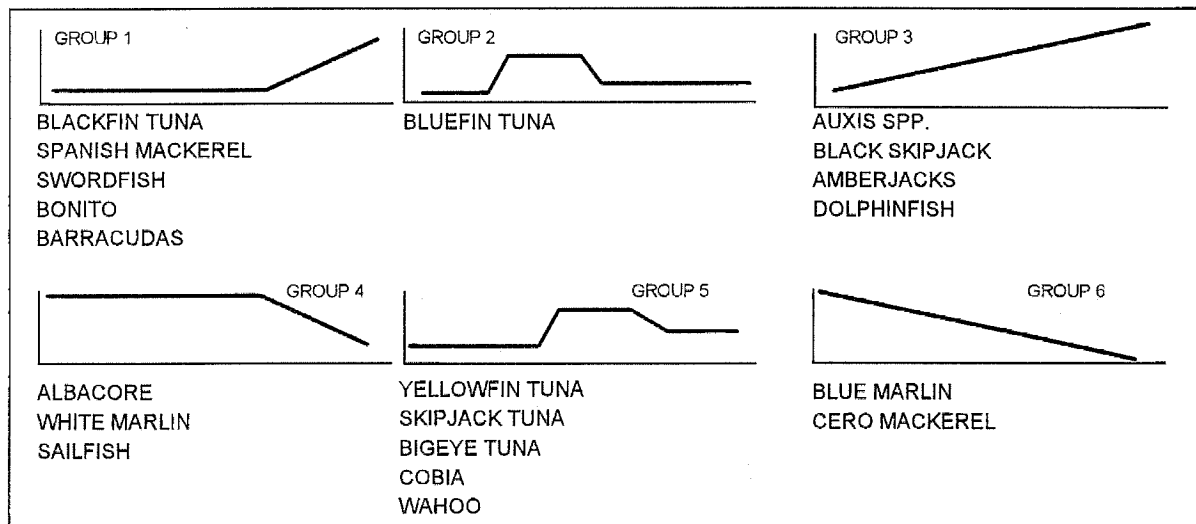


Figure 12. Six temporal patterns of landings over the period of record (1970-1993) picked out by principal components analysis of the time series of landings for each species. The species most closely associated with each pattern are listed beneath the graphic.

The species whose pattern is either a steady upward trend or a recent upward trend (Groups 1 and 3), are the smaller and less abundant species, to which exploitation has turned in the face of declining landings of the major species, which comprise the remaining groups.

### 3.3 Trends in research and stock assessment

A review of research findings on the biology and fisheries of large pelagic fishes which are exploited in the WECAFC area is beyond the scope of this report. One such review, carried out in 1986, and drew on information from studies throughout the Atlantic, and, for some species with circumtropical distributions, from studies in other oceans (Mahon and Mahon 1987). Rather than attempt to update that review, this document will examine where and how research on large pelagic fishes in the WECAFC area is done, and how it gets used in development and management. Several valuable reviews and compilations are, however, available from other sources, e.g. MRAG 1993, ICCAT 1996, SEFSC 1994, FAO 1993a.

At the national level applied research on large pelagic fishes is carried out in numerous national fisheries departments or marine research institutions, as well as in university departments, and a few private or non-governmental organizations. Freon *et al.* (1989) list 58 institutions in 23 countries in the WECAFC area which carry out fisheries research. The list included all island countries but did not include several large countries with active research programs, such as the USA, and Mexico, and several other mainland countries, such as Nicaragua, Colombia, Guyana and Suriname. On the basis of the average number of institutions per country in the above list, there are probably more than 80 institutions in the WECAFC area which conduct at least some research on large pelagics. However, few of these are primarily fisheries research institutions. In addition, relevant research may be carried out by several institutions outside the WECAFC area. Much of the output from these institutions remains in the "grey literature", or takes several years to be published in the primary literature, and is therefore inaccessible to WECAFC countries.

The USA, Mexico, Venezuela and Cuba produce the most research on large pelagic fishes. In the USA, the US Department of Commerce, National Oceanographic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center (NOAA NMFS SEFSC) conducts most of the research on large pelagic fishes. These are primarily the responsibility of the Miami Laboratory which manages logbook and observer programs, carries out stock assessments and is the home of the Cooperative Tagging Center with its Cooperative Tagging Program (SEFSC 1994). This program has provided the most comprehensive information on migration, and, by inference, stock structure for several species, primarily the major species, in the western Atlantic (Jones *et al.* 1995).

The Miami Laboratory of the NMFS SEFSC is also the focal point of the ICCAT Enhanced Research Program for Billfish and coordinates the overall program as well as the Western Atlantic component (Prince 1994). Primary research activities include providing catch and effort statistics, expanding the tagging program, and research on age and growth (Prince 1994). Much of the research and assessment work done at the SEFSC is on the major species, and

is done as input to the ICCAT process, but there is also a variety of work on species, mainly small tunas, which do not receive much attention at ICCAT (SEFSC 1994).

One of the major research initiatives on coastal species has been the collaborative MEXUS-Gulf project of the USA (NMFS SEFSC) and Mexico (Instituto Nacional de la Pesca) which was initiated in 1976. Through much of its duration project participants have focussed on fisheries for king and Spanish mackerels. Considerable progress has been made in understanding migratory patterns and stock structure of these species in the Gulf of Mexico. More recently, attention has turned towards other coastal pelagic species such as cobia, dolphinfish, bluefish and cero mackerel (NMFS/INP 1992, 1994).

Few organizations carry out research at the regional level. The CARICOM Fisheries Resource Assessment and Management Program (CFRAMP), based in Belize, coordinates and carries out research on fisheries, including large pelagics, for 12 participating CARICOM Member States, and will be expanding its mandate to cover four others through CARIFORUM (Figure 13). The Fishery Unit of the Organization of Eastern Caribbean States (OECS), now combined with the Natural Resources Management Unit (as of January 1996), has played a similar but less research-oriented role for its Member States.

CFRAMP has initiated a data collection and management program which will cover large pelagic landings in twelve CARICOM countries. CFRAMP will also be undertaking a variety of assessment related studies on large pelagic species (CFRAMP 1994). These include tagging and age and growth studies for several of the smaller and less abundant species.

In most countries throughout the WECAFC area there are data on landings and effort for large pelagic species. In some instances these are being compiled at subregional levels, for example, by the Caribbean Fishery Management Council, Puerto Rico, The OECS Fishery Unit, St. Vincent and the Grenadines, and the CARICOM Fishery Resources Assessment and Management Program, Belize. What is lacking is the institutional mechanism for region wide ongoing compilation, documentation, and interpreted of this information. Linkages of regional organisations with fishery data collection schemes for the wider Atlantic, such as the FAO Coordinating Working Party on Atlantic Fishery Statistics, are minimal.

Similarly, the various research activities in national and regional organizations throughout the WECAFC region, frequently have much wider applicability for management within the region than originally intended by those implementing the project. In spite of the apparent large number of institutions which may be involved in fisheries research in the WECAFC region, fisheries is usually only a small component of their program. Therefore, the critical mass for innovative, multidisciplinary fisheries research exist only in a few places. Given the current widely dispersed nature of fisheries expertise within the region, this critical mass can only be achieved through mechanisms for interaction and

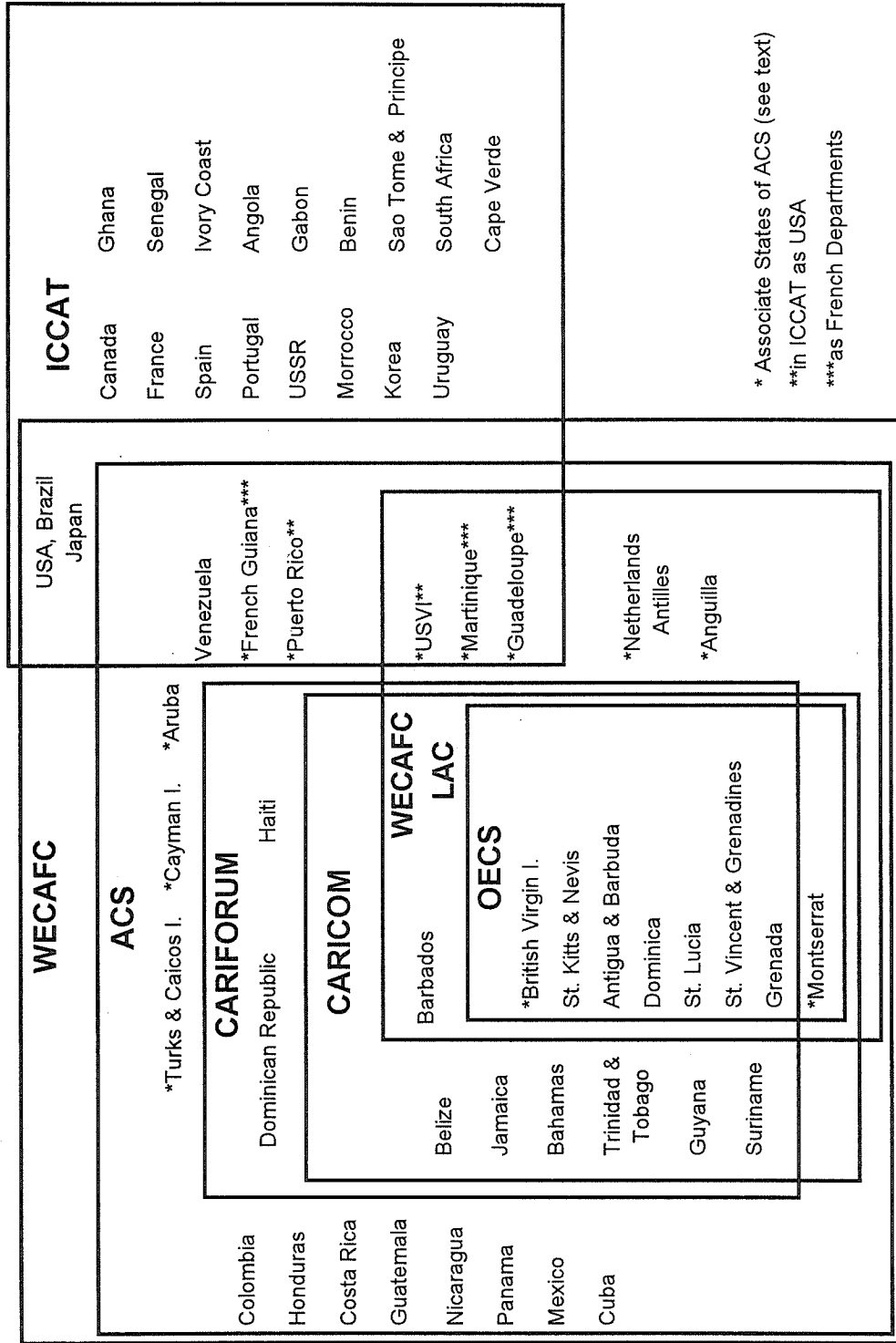


Figure 13. The membership of regional and international organisations with responsibility for fisheries management and development in the wider Caribbean (WECAFC = FAO West Central Atlantic Fishery Commission, ACS = Association of Caribbean States, CARICOM = Caribbean Community and Common Market, OECS = Organisation of Eastern Caribbean States, LAC = Lesser Antilles Committee, ICCAT = International Commission for the Conservation of Atlantic Tunas)



collaboration within and among countries. However, institutional mechanisms for regular communication of research results and plans, and thus, opportunity for collaboration within the WECAFC Region, appear to be minimal.

Compilation and synthesis of research, assessment and management information from the numerous countries and institutions of the WECAFC Region will require an extensive network which is dedicated to that task. At present, only the WECAFC Working Party on Marine Resource Assessment attempts to fulfil that role. However, there are no WECAFC Secretariat staff whose full time responsibility includes compilation and dissemination of fishery information, or coordination of research. The Gulf and Caribbean Fisheries Institute (GCFI) has, since 1948, provided an annual forum where most WECAFC countries have, at one time or another contributed their research findings. GCFI Proceedings provide the most extensive view of fisheries research within the WECAFC area, but are far from comprehensive.

Most pelagic fishes are migratory to some extent. Owing to the close proximity of the countries of the WECAFC Region and the complexity of ocean circulation and productivity in the wider Caribbean region, information on physical and biological oceanography has frequently been cited as necessary for understanding of the migratory patterns and their relation to current and potential fishery management units (IOCARIBE/NOAA in press).

The capacity for physical and biological oceanographic research in the WECAFC region is even more limited than that for fishery biological research. The USA, Venezuela, Cuba and Mexico are the only countries with an appreciable capacity. Recent efforts by other countries to develop this capability have included the CORE Project, a collaborative effort between CARICOM and India (Duncan 1991). However, given the high cost of research vessel operations and remote sensing technology, the sustainability of such efforts is doubtful.

IOCARIBE provides the greatest potential for regional collaboration in fisheries oceanography. Its recent focus in this area is encouraging. However, immediate follow-up activities appear to be aimed mainly at demersal species (lobster, conch and reef fishes)(IOCARIBE/NOAA in press).

**4. THE UNITED NATIONS "AGREEMENT FOR THE IMPLEMENTATION OF THE PROVISIONS OF THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA OF 10 DECEMBER 1982 RELATING TO THE CONSERVATION AND MANAGEMENT OF STRADDLING FISH STOCKS AND HIGHLY MIGRATORY FISH STOCKS": IMPLICATIONS TO WECAFC COUNTRIES.**

This agreement was prepared at a series of UN Conferences held to develop guidelines for the implementation of those articles of the United Nations Convention on the Law of the Sea (UN 1983) which pertain to the conservation and management of straddling and highly migratory fish stocks. The need for this effort was emphasized at the UN Conference on Environment and Development in order to address the problems of high seas management identified in Chapter 17 of Agenda 21 (UN 1993).

The UN Agreement covers the full range of topics which are critically important to successful collaboration for conservation and management of fishery resources which occur either fully or partly in the High Seas. Before considering the implication of The UN Agreement for WECAFC countries, an overview of the key elements of The Agreement will be provided below to orient the reader.

**4.1 An overview of key elements of The UN Agreement**

Article Two introduces the objective of The UN Agreement, which is "to ensure the long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks through effective implementation of the relevant provisions of the Convention" (Article 2, UN 1995). Articles 1, 3 and 4 outline terminology, applicability, and the relationship of The UN Agreement to the Convention. Part II of The UN Agreement broadly deals with the general principles upon which The UN Agreement is based (Box 1). These include elements from both the Convention and from Agenda 21 (UN 1993), and are further elaborated into guidelines in subsequent articles.

A precautionary approach, which has been incorporated into fisheries management since the United Nations Conference on Environment and Development, 1992, is given prominence in Article 6 (Box 2). The onus for precaution is placed on the fishing states, to be proactive in dealing with uncertainty, and to develop well specified and agreed upon mechanisms for doing so.

In the face of uncertainty, there is the requirement to adopt conservative management measures and to not use lack of information as a reason for failing to do so. States are then responsible for making all possible haste to acquire the necessary information for management. The concept of precaution applies not only to the exploited resources but also to possible impacts of exploitation on

the environment and associated species. Article 6, item 6 emphasizes the need for a precautionary approach new and exploratory fisheries.

**BOX 1**

**UN Agreement for [...] the conservation and management of straddling fish stocks and highly migratory fish stocks**

**Article 5: General principles**

In order to conserve and manage straddling fish stocks and highly migratory fish stocks, coastal States and States fishing on the high seas shall, in giving effect to their duty to cooperate in accordance with the Convention:

(a) adopt measures to ensure long-term sustainability of straddling fish stocks and highly migratory fish stocks and promote the objective of their optimum utilization;

(b) ensure that such measures are based on the best scientific evidence available and are designed to maintain or restore stocks at levels capable of producing maximum sustainable yield, as qualified by relevant environmental and economic factors, including the special requirements of developing States, and taking into account fishing patterns, the interdependence of stocks and any generally recommended international minimum standards, whether subregional, regional or global;

(c) apply the precautionary approach in accordance with article 6 [see Box 2];

(d) assess the impacts of fishing, other human activities and environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks;

(e) adopt, where necessary, conservation and management measures for species belonging to the same ecosystem or associated with or dependent upon the target stocks, with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened;

(f) minimize pollution, waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species (hereinafter referred to as non-target species) and impacts on associated or dependent species, in particular endangered species, through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques;

(g) protect biodiversity in the marine environment;

(h) take measures to prevent or eliminate overfishing and excess fishing capacity and to ensure that levels of fishing effort do not exceed those commensurate with the sustainable use of fishery resources;

(i) take into account the interests of artisanal and subsistence fishers;

(j) collect and share in a timely manner, complete and accurate data concerning fishing activities on, *inter alia*, vessel position, catch of target and non-target species and fishing effort, [...] as well as information from national and international research programmes;

(k) promote and conduct scientific research and develop appropriate technologies in support of fishery conservation and management; and

(l) implement and enforce conservation and management measures through effective monitoring, control and surveillance.

Article 7 addresses the need for compatibility among management approaches for stocks in national waters and on the High Seas. In so doing, it emphasizes the need for cooperation among States, and for States to play their part within a reasonable time frame. Should this not be the case, there are mechanisms for dispute settlement which are described in Articles 27-32.

**BOX 2**

**UN Agreement for [...] the conservation and management of straddling fish stocks and highly migratory fish stocks**

**Article 6: Application of the precautionary approach**

1. States shall apply the precautionary approach widely to conservation, management and exploitation of straddling fish stocks and highly migratory fish stocks in order to protect the living marine resources and preserve the marine environment.
2. States shall be more cautious when information is uncertain, unreliable or inadequate. The absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures.
3. In implementing the precautionary approach, States shall:
  - (a) improve decision-making for fishery resource conservation and management by obtaining and sharing the best scientific information available and implementing improved techniques for dealing with risk and uncertainty;
  - (b) apply the guidelines set out in Annex II [not included] and determine, on the basis of the best scientific information available, stock-specific reference points and the action to be taken if they are exceeded;
  - (c) take into account, *inter alia*, uncertainties relating to the size and productivity of the stocks, reference points, stock condition in relation to such reference points, levels and distribution of fishing mortality and the impact of fishing activities on non-target and associated or dependent species, as well as existing and predicted oceanic, environmental and socio-economic conditions; and
  - (d) develop data collection and research programmes to assess the impact of fishing on non-target and associated or dependent species and their environment, and adopt plans which are necessary to ensure the conservation of such species and to protect habitats of special concern.
4. States shall take measures to ensure that, when reference points are approached, they will not be exceeded. In the event that they are exceeded, States shall, without delay, take the action determined under paragraph 3 (b) to restore the stocks.
5. Where the status of target stocks or non-target or associated or dependent species is of concern, States shall subject such stocks and species to enhanced monitoring in order to review their status and the efficacy of conservation and management measures. They shall revise those measures regularly in the light of new information.
6. For new or exploratory fisheries, States shall adopt as soon as possible cautious conservation and management measures, including, *inter alia*, catch limit and effort limit. Such measures shall remain in force until there are sufficient data to allow assessment of the impact of the fisheries on the long-term sustainability of the stocks, whereupon conservation and management measures based on the that assessment shall be implemented. The latter measures shall, if appropriate, allow for the gradual development of the fisheries.
7. If a natural phenomenon has a significant adverse impact on the status of straddling fish stocks or highly migratory fish stocks, States shall adopt conservation and management measures on an emergency basis to ensure that fishing activity does not exacerbate such adverse impact. States shall also adopt such measures on an emergency basis where fishing activity presents a serious threat to the sustainability of such stocks. Measures taken on an emergency basis shall be temporary and shall be based on the best scientific evidence available.

Part III (Articles 8-16) focuses on mechanisms for international cooperation. The need for cooperation among states is emphasized in Article 8 (Box 3). This Article also clearly states the need for organization(s) with the mandate to establish conservation and management measures for each straddling or highly migratory fish stock. If such an organization does not exist they are obligated to participate in establishing one. Only those countries that participate in the organization are entitled to fish the resource.

In Part III, further specifies the nature and extent of cooperation which is considered to be necessary for conservation and management of straddling and highly migratory stocks (Boxes 4 and 5). The list of functions in Box 5 is self explanatory, ranging from agreement on management approaches, through assessment, regulation setting and coordination of monitoring control surveillance and enforcement.

### BOX 3

#### UN Agreement for [...] the conservation and management of straddling fish stocks and highly migratory fish stocks

##### Article 8: Cooperation for conservation and management

1. Coastal States and States fishing on the high seas shall, in accordance with the Convention, pursue cooperation in relation to straddling fish stocks and highly migratory fish stocks either directly or through appropriate subregional or regional fisheries management organizations or arrangements taking into account the specific characteristics of the subregion or region, to ensure effective conservation and management of such stocks.
2. States shall enter into consultations in good faith and without delay, particularly where there is evidence that the straddling fish stocks and highly migratory fish stocks concerned may be under threat of over-exploitation or where a new fishery is being developed for such stocks. [...].
3. Where a subregional or regional fisheries management organization or arrangement has the competence to establish conservation and management measures for particular straddling fish stocks or highly migratory fish stocks, States [...] shall cooperate by becoming members of such organization, or [...] by agreeing to apply the conservation and management measures established by such organization [...].
4. Only those States which are members of such an organization [...], or which agree to apply the conservation and management measures established by such organization or arrangement shall have access to the fishery resources [...].
5. Where there is no subregional or regional fisheries management organization or arrangement to establish conservation and management measures [...] relevant [...] States [...] shall cooperate to establish such an organisation or enter into other appropriate arrangements to ensure conservation and management [...] and shall participate in the work of the organization [...].

The obligation of States to provide data and information on the activities of fishing vessels flying their flag is emphasized in Article 14. This includes provision of scientific, technical, and statistical data, and participation in the development of data collection and management methods. These responsibilities extend to participation in analysis and interpretation of the data (assessments), and in the strengthening of capability for such analyses within the region.

The need for documentation and communication of the activities of the organization is clearly stated as follows: "States shall provide for transparency in the decision-making process and other activities of subregional and regional fisheries management organizations and arrangements" (Article 12, UN 1995).

Part IV briefly states that non-member States are obligated to respect the activities and regulations of the organization.

#### BOX 4

##### UN Agreement for [...] the conservation and management of straddling fish stocks and highly migratory fish stocks

###### Article 9: Subregional and regional fisheries management organizations and arrangements

1. In establishing subregional or regional fisheries management organizations or in entering into subregional or regional fisheries management arrangements for straddling fish stocks and highly migratory fish stocks, States shall agree, *inter alia*, on:

(a) the stocks to which conservation and management measures apply, taking into account the biological characteristics of the stocks concerned and the nature of the fisheries involved;

(b) the area of application, taking into account article 7, paragraph 1, and the characteristics of the subregion or region, including socio-economic, geographical and environmental factors;

(c) the relationship between the work of the new organization or arrangement and the role, objectives and operations of any relevant existing fisheries management organizations or arrangements; and

(d) the mechanisms by which the organizations or arrangement will obtain scientific advice and review the status of the stocks, including, where appropriate, the establishment of a scientific advisory body.

2. States cooperating in the formation of a subregional or regional fisheries management organization or arrangement shall inform other States which they are aware have a real interest in the work of the proposed organization or arrangement of such cooperation.

Part V of the Agreement outlines the "Duties of the Flag State". These are specified in Article 18 which requires that: (1) "A State whose vessels fish on the high seas shall take such measures as may be necessary to ensure that vessels flying its flag comply with subregional and regional conservation and management measures and that such vessels do not engage in any activity which undermines the effectiveness of such measures"; and (2) that "A State

shall authorize the use of vessels flying its flag for fishing on the high seas only where it is able to exercise effectively its responsibilities in respect of such vessels under the Convention and this Agreement".

**BOX 5**

**UN Agreement for [...] the conservation and management of straddling fish stocks and highly migratory fish stocks**

**Article 10: Functions of subregional and regional fisheries management organizations and arrangements**

In fulfilling their obligation to cooperate through subregional or regional fisheries management organizations or arrangements, States shall:

(a) agree on and comply with conservation and management measures to ensure the long-term sustainability of straddling fish stocks and highly migratory fish stocks;

(b) agree, as appropriate, on participatory rights such as allocations of allowable catch or levels of fishing effort;

(c) adopt and apply any generally recommended international minimum standards for the responsible conduct of fishing operations;

(d) obtain and evaluate scientific advice, review the status of the stocks and assess the impact of fishing on non-target and associated or dependent species;

(e) agree on standards for collection, reporting, verification and exchange of data on fisheries for the stocks;

(f) compile and disseminate accurate and complete statistical data, as described in Annex I, to ensure that the best scientific evidence is available, while maintaining confidentiality where appropriate;

(g) promote and conduct scientific assessments of the stocks and relevant research and disseminate the results thereof;

(h) establish appropriate cooperative mechanisms for effective monitoring, control surveillance and enforcement;

(i) agree on means by which the fishing interests of new members of the organization or new participants in the arrangement will be accommodated;

(j) agree on decision-making procedures which facilitate the adoption of conservation and management measures in a timely and effective manner;

(k) promote the peaceful settlement of disputes in accordance with Part VIII;

(l) ensure the full cooperation of their relevant national agencies and industries in implementing the recommendations and decisions of the organization or arrangement; and

(m) give due publicity to the conservation and management measures established by the organization or arrangement.

Part VI (Articles 19-23) focus on "Compliance and Enforcement". A State is obligated to "ensure compliance by vessels flying its flag". It must investigate violations by such vessels and by requiring that they cooperate fully with investigations. States are also required to cooperate with each other, and to participate in regional compliance and enforcement activities. Details regarding procedures for boarding and measures to be taken by port States are provided in the remaining two articles of Part VI.

The special requirements of developing States are considered in Part VII. The dependency of artisanal and small-scale fisheries in developing countries, particularly small island states, on marine resources is recognized, and the need to ensure access to fishery resources by these countries is emphasized (Box 6). Therefore, according to Article 25, all States are required to assist developing States to conserve and manage straddling and highly migratory stocks, and to develop their own fisheries for such stocks. This assistance is to include facilitation of access to such fisheries. It is also to include facilitation of their participation in the assessment and management process being carried out by regional fisheries management organizations.

The remaining parts of The UN Agreement are concerned with peaceful settlement of disputes, and aspects of implementation.

#### **BOX 6**

##### **UN Agreement for [...] the conservation and management of straddling fish stocks and highly migratory fish stocks**

###### **Article 24: Recognition of the special requirements of developing States**

1. States shall give full recognition to the special requirements of developing States in relation to conservation and management of straddling fish stocks and highly migratory fish stocks and development of fisheries for such stocks. To this end, States shall, either directly or through the United Nations Development Programme, the Food and Agriculture Organization of the United Nations and other specialized agencies, the Global Environment Facility, the Commission on Sustainable Development and other appropriate international and regional organizations and bodies, provide assistance to developing States.
2. In giving effect to the duty to cooperate in the establishment of conservation and management measures for straddling fish stocks and highly migratory fish stocks, States shall take into account the special requirements of developing States, in particular:
  - (a) the vulnerability of developing States which are dependent on the exploitation of living marine resources, including for meeting the nutritional requirements of their populations or parts thereof;
  - (b) the need to avoid adverse impacts on, and ensure access to fisheries by, subsistence, small-scale and artisanal fishers and women fisherworkers, as well as indigenous people in developing States, particularly small island developing States; and
  - (c) the need to ensure that such measures do not result in transferring, directly or indirectly, a disproportionate burden of conservation action onto developing States.



## 4.2 Implications of The UN Agreement

The UN Agreement has implications for States in the WECAFC area in several ways. These include:

- Access to resources by States which are currently expanding their pelagic fisheries;
- Technical capability for and costs of improved data collection and analysis;
- Costs of collaboration in surveillance and enforcement;
- Requirement for changes in national legislation and regulations;
- Maritime boundary delimitation;
- The structure, function and funding of the regional organization which will be responsible for managing straddling and highly migratory stocks.

The difficulty encountered in implementing the UN Agreement will vary considerably among WECAF Member States according to their size, degree of overall development and degree of fishery development. Many of these states are Small Island Developing States (SIDS), which have been recognized as being particularly dependent on coastal and marine resources (United Nations 1994). Owing to their small size and limited human resources, SIDS have also been recognized as having much to gain from regional cooperation and institutions.

The difficulties and costs for WECAFC countries which will arise from participating fully in the implementation of the UN Agreement, must be weighed against the loss of benefits which will result from the failure to do so. Most SIDS and other developing states in the WECAFC region are at a disadvantage regarding information about, and agreed access to large pelagic resources which occur, often seasonally, in their waters. Participation in implementation of the agreement is the only responsible approach to sustainable harvest of these resources.

### 4.2.1 Access to resources

The most important consideration, is what The UN Agreement means for States that are expanding, or are planning to expand their fisheries for large pelagics. The emphasis on conservation, and on the precautionary approach, especially for new and exploratory fisheries can be interpreted as counter to the expansion of fisheries for large pelagics planned by many WECAFC countries. Since most large pelagics are migratory and likely to be shared by several countries, and since many of the most widely distributed species are already fully exploited, any expansion at this stage may be perceived as not precautionary. Strictly, States should not expand their fisheries if doing so will result in overexploitation of even some of the targeted species.

There is also, however, the question of equitability. Many developing WECAFC States, particularly small-island States perceive that their current share of the large pelagic resources in the WECAFC Region is disproportionately low, relative to their historical dependence on the sea, and the relative sizes of their EEZs. Part VII, "Requirements of Developing States", indicates that there should be a reallocation of fishery resources among valid participants in the fisheries, such that the shares better reflect entitlement on the basis of agreed criteria.

For example, one approach that could be used to estimate shares would be based on EEZ areas relative to stock distribution areas, as done by Singh-Renton and Neilson (1993), but with shares adjusted by catch rates from the ICCAT database. A share of each species which is exploited in the WECAFC Region would be allocated to either a country (or group of countries), or the High Seas. The shares, for those species that are assessed by ICCAT, would be a portion of the estimated sustainable yield. For the remaining species, the shares would be a portion of the average annual landings for a specified period.

Development of the criteria for allocation and estimating and negotiating shares, will be a first, urgent order of business for a regional fishery management organization, if overexploitation due to continued expansion of pelagic fisheries is to be avoided.

#### **4.2.2 Technical capability**

The UN Agreement has important implications for national and regional institutions which are responsible for developing the technical basis for management decision making. Neither the data nor the capability for conducting full assessments of most fish stocks are currently available in many countries. The extent to which countries will invest in these data and the capability to analyze them will depend on the perceived current and future value of the resource. In many countries the value is not sufficiently high to justify the investment in assessment beyond monitoring catch and effort. Thus, at least in the initial stages, the emphasis in management decision making must inevitably be shifted to give greater weight to the Precautionary Approach (Article 6).

#### **4.2.3 Surveillance and enforcement**

Implementation of the UN Agreement will require that coastal states be able to carry out, or be assisted in carrying out monitoring, control and surveillance activities in their EEZs. Countries which are reflagging vessels will be obliged to monitor and control the activities of these vessels wherever they are fishing. They will also be obliged to carry out investigations of reported violations. When these vessels are fishing in distant waters, e.g. off Canada or west Africa, these investigations will be costly.

MCS activities may require greater subregional collaboration, such as has been the case in the OECS (OECS 1992).

#### **4.2.4 National legislation and regulations**

In order for WECAFC countries to implement the UN Agreement several will need to review and update their national legislation, or at least put new regulations in place.

#### **4.2.5 Maritime boundary delimitation**

Effective implementation of many aspects of the UN Agreement will require that maritime boundaries be delimited. In 1992, only 21 of 61 boundaries within the WECAFC region had been settled (Fenwick 1992).

#### **4.2.6 International and regional institutional arrangements**

The institutional requirements for cooperative management of shared, straddling and highly migratory fish stocks in the WECAFC area have been discussed at most WECAFC and other fishery meetings (e.g. FAO 1993b). This subject is a specific component of the CARICOM Fisheries Program (Mahon and Murray 1992b). However, the high number of countries and subregional organisations within a relatively small geographical area, presents a complex situation.

The various extra-regional, regional and subregional organizations with responsibility for fisheries in the WECAFC area, and their membership are shown in Figure 13. Only two, WECAFC and ICCAT, currently have the membership or potential membership and the structure (or the potential to assume the structure) to undertake the role of a regional organization with responsibility for conservation and management of large pelagic fishes. There are difficulties which must be overcome if either organization is to effectively fulfill this role. Also, according to The Convention and the UN Agreement, any organization other than ICCAT which adopts a management role for large pelagic fishes in the WECAFC area will have to interact extensively with ICCAT regarding several major species or stocks which are widely distributed throughout the Atlantic.

Although ICCAT presently has the mandate to be the regional organization for large pelagic fishes, there are two problem areas. The first is that participation in ICCAT may be too costly for many of the smaller, developing countries, most of them SIDS, in the WECAFC area. This is because of both the membership fees and the cost of attending the meetings (i.e. participating in the activities of the organization, as required by Article 8). However, it should be noted that some measure of technical participation is

possible by contributing data and analyses without actually attending the technical meetings.

To some extent, these problems may be overcome by joint representation of several such countries under the umbrella of a regional or subregional organization. This has recently been the case for CARICOM countries, which have sent observers to ICCAT meetings each year since 1991. However, there are several other countries for which there is no convenient umbrella organization. A short-term problem is that ICCAT does not accept organizations as members, but this is expected to change shortly. ICCAT has also been considering amending its convention to substantially reduce the cost of participation of developing countries, particularly those with minor catches.

At present, ICCAT does not devote much of its effort to many of the species which are presently of considerable importance to WECAFC countries. The species which ICCAT currently assesses account for only 49.5% of the average landings of large pelagic fishes in the WECAFC area from 1989-1993. However, wider membership of WECAFC countries in ICCAT would increase the attention which the currently unassessed species would receive. Since many of those species occur only in the western central Atlantic, and the stocks of others are likely to be contained therein, it may be more efficient to have a regional sub-secretariat of ICCAT and regional meetings for those stocks. Aspects of the widely distributed species such as statistics and research could also be dealt with by the sub-secretariat for input to the main meetings.

ICCAT has already recognized the need for special attention to the western Atlantic in establishing the Western Atlantic Tropical Tunas Working Group in 1992 (ICCAT 1993). However, this working group has not been very active, and has not addressed the minor species of concern to many WECAFC countries.

Consideration of ICCAT as the organization to be enhanced for the role of conservation and management of large pelagics in the WECAFC area, cannot proceed without taking account of the institutional requirements for management of other (non large pelagic) straddling and highly migratory fish stocks, and even shared stocks. These include species such as reef fishes, lobsters and conch with planktonic early life history stages during which they may be dispersed over long distances. Although several species may occur entirely within the EEZs of WECAFC countries, and may therefore be perceived as candidates for multilateral conservation and management arrangements, the stocks may extend over a sufficiently large number of EEZs, e.g. shrimp and associated demersal finfishes of the Guianas-Brazil subregion, that management may be most efficiently carried out through a regional organization.

Some of the demersal stocks which are shared, straddling or (possibly) highly migratory, are currently considerably more valuable than large pelagics, e.g. spiny lobster, conch and reef fishes, and may receive priority attention as recommended by IOCARIBE/NOAA (in press). Clearly, it will be most efficient for

there to be a single organization which deals with all aspects of management and conservation of such shared stocks as well as straddling and highly migratory stocks within the WECAFC Region. ICCAT's mandate does not enable it to adopt this wider role, even if it were to increase its activities, or even its presence in the WECAFC region. The membership, and past activities of WECAFC suggest that it may be the most appropriate organisation to adopt this wider role.

Although the Membership of the WECAFC is inclusive of all States within the wider Caribbean and several distant water fishing nations, the statutes and rules of procedure for the WECAFC do not provide for adoption of management measures which are binding upon the Member Countries (FAO 1976), as required by Article 10a of The UN Agreement (Box 7). The Terms of Reference for the WECAFC are oriented towards facilitation and coordination (Box 7) rather than binding management, as is the case for ICCAT (Box 8).

#### **BOX 7**

##### **Terms of Reference for the West Central Atlantic Fishery Commission**

The terms of reference of the commission shall be:

- (a) to promote and assist in the collection of national statistics and biological data relating to fisheries in general, and the shrimp fisheries in particular; and to provide for the compilation and dissemination of these data on a regional basis,
- (b) to facilitate the coordination of national research programmes and to promote, where appropriate, the standardization of research methods,
- (c) to promote the interchange of information relating to the fisheries of the region,
- (d) to promote and coordinate, on a national and regional basis, studies of the effect of the environment and of pollution on fisheries, and studies of appropriate methods of control and improvement,
- (e) to promote and assist the development of aquaculture and stock improvement
- (f) to encourage education and training through the establishment of improvement of national and regional institutions and by the organization of training centres and seminars
- (g) to assist Member Governments in establishing rational policies for the development and utilization of the resources consistent with national objectives and the conservation and improvement of the resources; and
- (h) to promote and coordinate international aid to further the achievement of the objectives referred to in the preceding sub-paragraphs.

At the eighth session of the WECAF Commission in 1995, it was recommended that FAO conduct a comprehensive assessment of the future role of the Commission and the prospects of enhancing regional cooperation (FAO in press). The findings of this study will be considered at the next WECAF Commission meeting. Should the countries of the WECAFC area agree to amend the rules and statutes of the Commission to enable it to adopt a management

**BOX 8**

**Excerpts from the Basic Texts of the International Commission  
for the Conservation of Atlantic Tunas (ICCAT)**

Article IV 1. In order to carry out the objectives of this Convention the Commission shall be responsible for the study of the populations of tuna and tuna-like fishes (the Scombriformes with the exception of the families Trichiuridae and Gempylidae and the genus *Scomber*) and such other species of fishes exploited in tuna fishing in the Convention area as are not under investigation by another international fishery organization. Such study shall include research on the abundance, biometry and ecology of the fishes; the oceanography of their environment; and the effects of natural and human factors upon their abundance.

Article VIII 1. (a) The Commission may, on the basis of scientific evidence, make recommendations designed to maintain the populations of tuna and tuna-like fishes that may be taken in the Convention area at levels which will permit the maximum sustainable catch. These recommendations shall be applicable to the Contracting Parties under the conditions laid down in paragraphs 2 and 3 of this Article.

Article IX 1. The Contracting Parties agree to take all action necessary to ensure the enforcement of this Convention. Each Contracting Party shall transmit to the Commission, biennially or at such other times as may be required by the Commission, a statement of the action taken by it for these purposes.

**BOX 9**

**Excerpts from the Preamble to the Convention for  
Establishing the Association of Caribbean States**

[...] Convinced of the critical importance of preserving the environment of the region and, in particular, their shared responsibility for the preservation of the environmental integrity of the Caribbean Sea, by deploying the collective capabilities of their peoples in developing and exploiting its resources on an environmentally sound and sustainable basis, in order to enhance the quality of life of present and future generations of Caribbean peoples:

**ARTICLE III: Nature, Purposes and Functions**

1. The Association is an organisation for consultation, cooperation and concerted action, whose purpose is to identify and promote the implementation of policies and programmes designed to: [...]

(b) develop the potential of the Caribbean Sea through interaction among Member States and with third parties;

(c) promote an enhanced economic space for trade and investment with opportunities for cooperation and concerted action, in order to increase the benefits which accrue to the peoples of the Caribbean from their resources and assets, including the Caribbean Sea;

2. In pursuit and fulfillment of the purposes set out in paragraph 1 of this Article, the Association shall promote gradually and progressively among its members the following activities: [...]

(d) the preservation of the environment and conservation of the natural resources of the region and especially of the Caribbean Sea;

role for widely shared, straddling and highly migratory stocks in the WECAFC area, it will be necessary to provide linkages with ICCAT for management of those large pelagic stocks which extend outside the WECAFC area.

A regional organization which may also have the potential to facilitate collaboration, if not adopt the management role, for widely shared, straddling and highly migratory stocks in the WECAFC area, is the newly established (July 1994) Association of Caribbean States (ACS). The membership of this organization includes all WECAFC States with the exceptions of Brazil and all distant water fishing nations (for geographical reasons) and the USA for political reasons (Figure 13). According to the Preamble to the Convention for Establishing the ACS (ACS 1994), the Association has a strong emphasis on marine affairs, specifically sustainable resource use and environmental conservation (Box 9).

## 5. SYNTHESIS AND CONCLUSIONS

Although far from comprehensive, the available information on development of small-scale and large scale fishing fleets targeting large pelagics, indicates a significant trend of increasing fishing capacity in the countries of the WECAFC Region. The ICCAT data on effort trends support this conclusion (Figs 3 & 4). The steady increasing trend in landings overall for many species, particularly the smaller and less abundant ones, also indicates that exploitation is intensifying on large pelagics throughout the WECAFC area.

The information reviewed above on the trends in species landings and the status of assessments indicates that several species which are not assessed by ICCAT are of considerable importance in large pelagic fisheries in the WECAFC Region. This is particularly evident when the landings reported by distant water fleets are excluded from consideration, as shown in Table 5, where reported landings are shown separately by species for groups of countries. Overall, species which are not assessed by ICCAT, account for about half the landings. Assessments of these species have been carried out locally in some areas, primarily in the waters of the USA and Mexico.

Within groups of countries, the proportion of landings coming from species that are assessed varies considerably. All species reported by distant water fleets are assessed. However, these fleets do not report any of the smaller or less abundant species such as blackfin tuna and dolphinfish, which are of primary importance to island countries, although these species must be taken as bycatch in appreciable quantities. A relatively large proportion of landings by the USA and Mexico comes from species that are assessed. This is primarily due to domestic efforts to assess the king and Spanish mackerel stocks occurring in coastal waters of these countries (SEFSC 1994, NMFS-INP 1994).

Owing to the emphasis on tunas in Venezuelan fisheries, the proportion of landings coming from assessed species is relatively high. However, in recent years, Venezuela has expanded fishing activity to target many species which are not assessed by ICCAT, and for which there are no assessments reported in the literature.

**Table 5. Average annual reported landings (1989-1993) of large pelagic species by country groups. Species are sorted by total landings. (Assess indicates that the stock is assessed by ICCAT, External = distant water fleets, Ven./Col. = Venezuela and Colombia, Less. Ant. = Lesser Antilles, Oth. Ant. = Other Antilles). The percent of landings assessed by ICCAT, and domestically, in the case of the USA and Mexico, is shown.**

Species	External	USA/ Mex.	Ven. /Col.	Less. Ant.	Other Ant.	Total	Assess
yellowfin tuna	1424	4455	17927	492	231	24528	x
Spanish mackerel		10652	5833	1	1569	18054	
skipjack tuna	81	40	5042	59	1566	6787	x
king mackerel		4401	2270			6671	
swordfish	2079	1744	195		51	4069	x
Atlantic bonito		688	1541	645		2874	
dolphinfish		683		1934	212	2829	
albacore	2393	6	317			2715	x
blackfin tuna		91	624	1170	736	2621	
bigeye tuna	2117	87	148	13		2365	x
<i>Auxis</i> spp.			1929			1929	
amberjacks		1399	365		78	1842	
Atlantic black skipjack		183	1586		62	1831	
barracudas		560	829	31	62	1483	
wahoo			298	44	398	741	
cobia		686				686	
blue marlin	231		77	31	105	444	x
Atlantic sailfish	22		28	145	135	330	x
cero mackerel				258	57	315	
bluefin tuna	45	83			104	232	x
white marlin	36		46		5	88	x
rainbow runner				17		17	
<b>Total</b>	<b>8426</b>	<b>25758</b>	<b>39056</b>	<b>4839</b>	<b>5371</b>	<b>83451</b>	
<b>% Assessed</b>	<b>100</b>	<b>83</b>	<b>61</b>	<b>17</b>	<b>41</b>	<b>50</b>	
billfishes	10			76		86	
<i>Scomberomorus</i> spp			501	54	79	634	
tunas/mackerels	32		2171	1358	87	3649	
tunas		126				126	

The countries with the highest proportion of landings coming from species that are not assessed are island countries, particularly the islands of the Lesser Antilles. This is due largely to the heavy dependence of these countries on blackfin tuna and dolphinfish. This situation is also evident from Murray's (1995) list of species which required assessment work in OECS countries:



dolphinfish, wahoo, yellowfin tuna, king mackerel, skipjack tuna, and blackfin tuna.

Most of these smaller and less abundant species show increasing trends in landings (Figure 12). Clearly, as the major tuna species become fully exploited, there is a diversification of targeting of small-scale fishing towards these species. It is also noteworthy that catches of these species are known to be taken by small-scale fisheries in several countries that do not report them, and as bycatch in large-scale commercial fisheries, that do not report them either (e.g. Gaertner *et al.* 1992).

Therefore, it is apparent that exploitation of these species is intensifying in the WECAFC Region without the benefit of proper information on total landings, much less any assessment of the effects of exploitation on the stocks. Indeed, little or nothing is known about the stock structure for most of these species, and thus, the extent of international cooperation that will be required for effective management.

Although research capability and efforts are widely distributed throughout the region, the funds and staff capacity to carry out fishery assessments is limited in all but a few countries. Thus, the efforts are highly focussed on the major stocks, largely via ICCAT, and on the other species in a few areas, primarily the waters of the USA and Mexico. Efforts to understand stock structure, and to assess exploitation status of the smaller and less abundant species have not produced a comprehensive body of information on which to base management decisions. Nor is the information which is available routinely compiled, synthesised, evaluated and shared as would be required by an ongoing management advisory mechanism, such as ICCAT. Advisors in many of the small developing countries must frequently rely on a miscellaneous array of studies carried out by various agencies. This situation is amply illustrated in the case of Jamaica, by the review of large pelagics prepared for WECAFC by Aiken (1985).

There are many problem areas in the assessment and management of large pelagic fishes in the western central Atlantic. The lack of the information required to define appropriate management units for many of the species is one such area. Interactions among fisheries: large-scale commercial, small scale, artisanal and recreational, is a growing problem which will intensify as development proceeds. There will always be the perceived need for better data and more research, as managers seek to reduce the uncertainty associated with the management advice which they receive. Several recent fishery management lessons have shown that, even with long time-series of data and substantial amounts of research, management advice and decision making processes may fail to conserve the resource for sustainable use. However, fishery management failures can usually be attributed as much to the failure to attain targets, as to the setting of incorrect targets. Therefore, management systems that use a broader array of reference points, which are agreed by participants and are more precautionary than has been typical in the past, will be required for sustainable exploitation (Caddy and Mahon in press, FAO 1995, UN 1995).

The emphasis on agreement on management measures, in the face of uncertainty and inadequate information speaks to the critical role which the institution for collaborative management will play. This institution will also play a critical role in facilitating the better use of the information currently available. If the current information on large pelagic species in various locations throughout the WECAFC area were to be compiled and synthesised and applied, it would significantly improve the technical basis for conservation and development decision making. This observation should not be used to discount the value of, and need for research. Instead, compilation and synthesis at the regional level would lead to more efficient use of research funds, by reducing duplication of effort and by having research focus on critical questions.

Existing institutional mechanisms are not adequate for management of shared stocks, or of Straddling Fish Stocks and Highly Migratory Fish Stocks, as per the recent UN Agreement. Any such institution must have linkages with extraregional organisations, primarily ICCAT, and, in order to maximize efficiency and avoid duplication, should also be able to deal with shared, straddling and migratory stocks other than pelagics, e.g. lobster and reef fishes with planktonic early life history stages. WECAFC, with modifications to its statutes, appears to be the most feasible existing organisation to adopt such a role.

Although management based on the best available scientific advice will be essential for the sustainable exploitation of large pelagic resources in the WECAFC Region, the current or future value of the resource may not justify implementation of the full range of functions outlined by the UN Agreement. Therefore, if stock depletion is to be avoided, application of the precautionary approach may be a more prominent requirement in the WECAFC Region than in other regions of the world with more abundant tuna resources.

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In the Western Central Atlantic Fishery Commission (WECAFC) area, large pelagics contribute only about 6 percent of total landings, but are nonetheless significant for many countries. Large pelagic fishes are caught in all WECAFC states and within the WECAFC region by several distant-water fishing nations. However only 19 out of 40 WECAFC states report catches to FAO. The fisheries range in scale and technological sophistication from artisanal fishers trolling from canoes to modern commercial longliners and purse seiners (mostly from distant-water fishing nations). The available information on development of small- and large-scale fleets targeting large pelagics indicates a significant trend of increasing fishing capacity in the countries of the WECAFC region.

Several species which are not assessed by the International Commission for the Conservation of Atlantic Tunas (ICCAT) are of considerable importance in large pelagic fisheries in the WECAFC region. Overall, about half the landings of large pelagics in the WECAFC region are from species which are assessed.

Existing institutional mechanisms are not adequate for the management of shared or straddling fish stocks and those of highly migratory fish, as per the recent United Nations agreement. Any such institution must have linkages with extraregional organizations, primarily ICCAT, and, in order to maximize efficiency and avoid duplication, should also be able to deal with shared, straddling and migratory fish stocks other than pelagics, for example, lobster and reef fishes with planktonic early life history stages. WECAFC, with modifications to its statutes, appears to be the most feasible existing organization to adopt such a role.

ISBN 92-5-103870-8 ISSN 0429-9345



M-43

W2351E/1/9.96/2000