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WESTERN CENTRAL ATLANTIC FISHERY COMMISSION

National reports and technical papers presented at the

FIRST MEETING OF THE WECAFC AD HOC WORKING GROUP ON THE DEVELOPMENT OF SUSTAINABLE MOORED FISH AGGREGATING DEVICE FISHING IN THE LESSER ANTILLES

Le Robert, Martinique, 8-11 October 2001

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2002

PREPARATION OF THIS DOCUMENT

This document was prepared by the Food and Agriculture Organization of the United Nations (FAO), which organized the First Meeting of the WECAFC Ad Hoc Working Group on the Development of Sustainable Moored Fish Aggregating Device Fishing in the Lesser Antilles, in collaboration with the French Research Institute for the Exploitation of the Sea (Ifremer). It includes the National Reports of the participants and technical papers on the development and management of fishing around Fish Aggregating Devices.

The work was accomplished under the guidance and supervision of FAO/WECAFC/FIIT.

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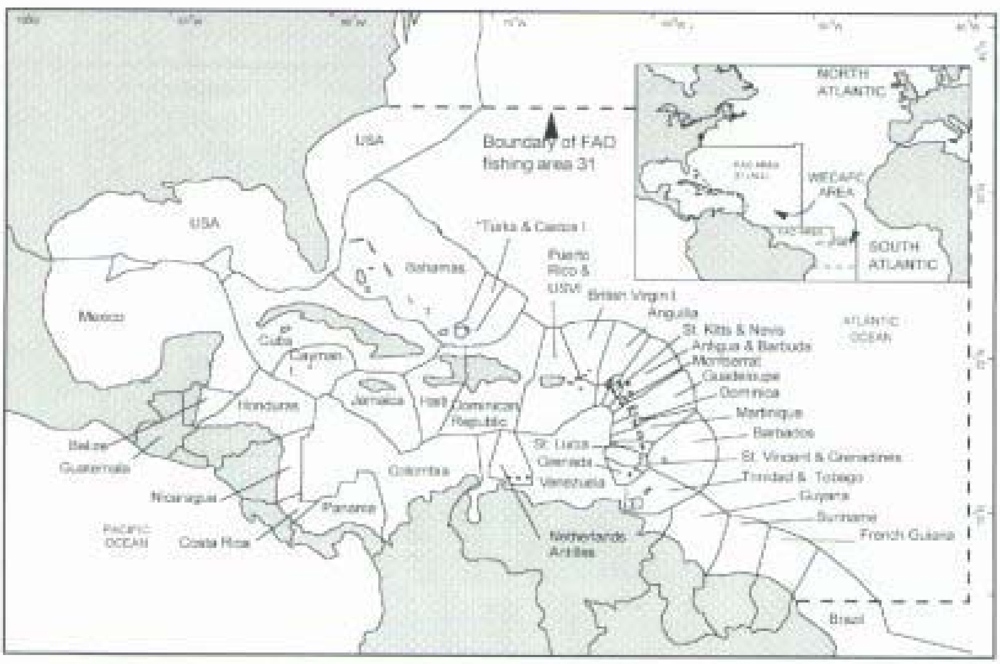
ABSTRACT

This publication contains the national reports and technical papers presented at the First Meeting of the WECAFC Ad Hoc Working Group on the Development of Sustainable Moored Fish Aggregating Device Fishing in the Lesser Antilles held in Le Robert, Martinique, from 8 to 11 October 2001.

The reports and papers are reproduced in the language in which they were presented at the meeting.

Les îles des Petites Antilles et leurs ZEE dans la zone FAO n° 31 en pointillés (tiré de Mahon, 1999)

The Lesser Antilles and their EEZ within the FAO No. 31 zone in dashes (from Mahon, 1999)



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National report of Antigua and Barbuda

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NATIONAL SYNTHESIS ON LARGE PELAGIC FISHERIES

In Antigua and Barbuda, mainly the sport-fishing vessels target the large pelagics. There are 35 vessels registered in the LRS database at the Fisheries Division that states trolling for large pelagics as their Primary fishing method. These vessels range in size from 6.0 meters to 17.5 meters. There is no special type or configuration of vessels engaged in trolling in Antigua and Barbuda but following is a list of the main types and configurations.

a. Decked vessels: with inboard or outboard motor(s), and use either gasoline or diesel fuel. These vessels are made from various materials- Fibreglass, wood, aluminium, steel, and Plywood covered with fibreglass. Engine horsepower ranges from 75 to 1100.

b. Undecked vessels: open with steering console, or walk-around cabin. These vessels are powered by inboard or outboard motor(s), and uses either diesel or gasoline fuel. The hull material for this type of vessels are fibreglass, wood, plywood covered with epoxy or fibreglass, and aluminium. Engine HP ranges from 40 to 500.

c. The average crew size for this type of fishing is 2 on each fishing vessel for regular weekend trips and pre paid deep sea fishing charters and 5 during fishing tournaments, which averages 3.5 per vessel per year. This total makes a total crew size of 123.

Types of fishing

Trolling, with rods and reels, is the only type of fishing done in Antigua and Barbuda, to target large pelagics. In the past 15 years there were at least 5 vessels engaged in surface longline fishing targeting swordfish and large tunas, but none of them are in operation at the present moment (October 2001).

Some traditional trap fishing vessels troll to and from the fishing areas using hand lines made from small rope, wire, or thick monofilament lines. The operational speed of these vessels is within trolling speed, so some captains use the opportunity to catch a meal or subsidise the fuel cost. The main difference is, these vessels would not leave port to do only trolling for an entire fishing trip, as done by the sport fishing vessels with rods and reels.

Species targeted

In major tournaments, Blue marlins are targeted, mainly for points, but on regular fishing trips, there is no discrimination in targeted species. The pelagic species landed in Antigua and Barbuda from trolling trips are: Yellow fin tuna, Big eye tuna, skip-jack, little tunny, black fin tuna, albacore, and other small tunas, Dolphin fish, Wahoo, King mackerel, Spanish mackerel, Cero mackerel, Atlantic Sailfish, White Marlin, Blue marlin, Sword fish, Pelagic sharks, Barracuda.

Gear used

Rods and Reels, with monofilament or monel lines are commonly used. The types of bait used include artificial lures, spoon baits, flying fish, and Ballyhoo.

Fishing area

The fishing area consists of the waters within the Exclusive Economic Zone of Antigua and Barbuda.

Activity schedule

The majority of trips take place on the weekends, but fishing is also done during local sport fishing tournaments, Public holidays, and Pre-paid Deep-sea fishing charters. There is also the odd times, such as: during spawning aggregation of King mackerel, and periods of exceptional dolphin activity, that these vessels go fishing during the week as well.

PRODUCTION/LANDINGS COVERAGE

Sampling plan

A random sampling plan is used to collect data from the landing sites on a routine basis and a census is done during the weighing period at fishing tournaments. During these weighing periods the Fisheries Division measures each fish, but the organizers of the fishing tournament weighs and records each fish.

Data collected

Length, weight, sexual maturity, and other biological data are collected.

Fishing effort data collection

The data collected is usually 'catch and effort'. No data is collected for monthly catches per species, type of boats, gears, for pelagic fish in Antigua and Barbuda. The fish is usually sold directly to housewives, restaurants, hotels, and supermarkets by the fishers, so records of landings are not readily available.

Social and economic issues

The selling prices for pelagic species are not fixed or controlled; rather prices are agreed to between seller and buyer. Prices can vary from EC$ 5.00 to EC$ 11.00 per pound. This depends on the marketed condition of the fish. Some fish is sold whole, while some is sold filleted.

Some fish processing establishments, supermarkets, and hotels import large pelagic fish species from within CARICOM, when none is available locally. There are no exports of pelagic fish species from Antigua and Barbuda.

Although there is a draft Fisheries Management Plan for Antigua and Barbuda, there are no specific management rules or strategies in force for the large pelagic species.

SYNTHESIS OF MOORED FAD FISHING

Moored FAD Fishing activities

The Fisheries Division is not aware of any fishing techniques being used in FAD fishing. There is also no information on yields, targeted species, seasonality, number or size. There are about 4 sport fishers who are experimenting with FAD fishing at the moment, but they are secretive with locations and any other information relating to their operations.

SOCIAL AND ECONOMIC ISSUES

FAD Fishing Management

There are no FAD fishing management regulations or strategies in force in Antigua and Barbuda.

Economic Issues

There is no information to suggest that the price of fish caught around FAD is different from fish caught in open waters. At this moment, the same conditions apply to fish caught around fads as fish caught in the open waters.

Ecomonic Impact of FAD Fishing on the Fishery

Not enough data is available to do a comparative analysis of the impact that FAD has on the fisheries in Antigua and Barbuda.

Development Dynamics

Although there is no official policy on FAD development in Antigua and Barbuda, the issue has been under consideration in the Fisheries Division. The strategy under consideration is likely to involve the following promotional activities on the part of the division:

a. Develop the moored FAD fishery to a level that fishers could fish for large pelagic species with lesser expense and increased landings; and
b. Promote awareness of the benefits of co-management, and conservation of the pelagic fish stocks, by the early introduction of fishers to practices such as minimum size limits, close seasons and quota system, for all species targeted around FAD.

The developmental chronology envisioned by the Fisheries Division is:

a. Promoting awareness, by organizing meetings that address the relevant topics on FAD.
b. Consultations with present FAD operators and prospective operators to discuss FAD management issues
c. Draft legislation to regulate, monitor, and enforce the use and management of FAD in Antigua and Barbuda.
d. Put feedback system in place in the form of logbooks for fishers, which over time could provide enough information to ensure sound management decisions.

National report of Cuba

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I. Description of the Fishing Fleets for Pelagic Fisheries

Based on economic reasons the Cuban pelagic fleet was reduced in the last 10 years, at present, 42 vessels are dedicated to the pole and line and long line (Cuban type) fisheries. The main type of boat is the Cayo Largo (fig. 1), wooden made, which is18 metres in total length. It has an inboard engine (150-225 HP) and 8 metres long fish/ice hole, and a tank for live bait of about 7metres in length. Their typical fishing trip is about 10 days. The ferro-cement type boats (16 metres total length) have similar characteristics. There are also 2 steel-hulled boats (18.9 metres) and a fibreglass one which is about 23 metres in total length and having an engine of 300 horsepower; this has much better facilities for the crew.

All types of boats have simple navigational equipment and only a few of them have radar and GPS and also have the equipment necessary for the crew safety indicated by the international law.

Fig. 1: Small tunas fishing boat.

Crew Number

The crew for pole and line fishery is 8-10 fishers per boat, while for the longline fishery the crew is 6-8 fishers. The total number of the fishers involved in both fisheries is about 360.

Target Species

Pole and line: Skipjack (*Katsuwonus pelamis*), blackfin tuna (*Thunnus atlanticus*) and yellowfin tuna (*Thunnus albacares*).

Long line: White marling (*Ictiophorus platypterus*), sailfish (*Tetrapturus albidus*), blue marling (*Makaira nigricans*) and common dolphin (*Coryphaena hippurus*)

Gears in Use

In the pole and line fishery in Cuba, the fishers are only allocated in the stern of the boat in a sort of balcony attached to the stern.

The longline used is made with monofilament ('nylon'), with evenly spaced floats (buoys) and vertical lines with baited hooks. Generally about 500 hooks are used on a longline.

Fishing Area

Pole and line:

Fishing area	Catch (%)	Fleet (%)
SW	40.7	31.5
NW	28.5	25.7
NCE	30.7	42.8

Species composition of the captures

Fishing area	Skipjack (%)	Black fin tuna (%)	Yellow fin tuna(%)
SW	54	43	3
NW	67.3	32.4	0.3
NE	86.6	1.6	11.8

Longline: Presently used only in the NE area.

Species composition of the captures (%)

Fishing area	White marling	Sail fish	C. dolphin	Blue marling	Sharks
NE	48.5	11.7	9	3.8	27

Data Collection System

Sampling plan: The Ministry of Fishing Industry have a good statistics collection in all the fishing ports of the country; this systems include a catch (by species) and effort, boats at fishing and gears among other aspects of the activity.

A group of Fisheries Research Centre (FRC) observers in each provinces of Cuba is in charge of biological samplings and others tasks related to the fisheries. All information collected is sent monthly to the FRC.

Social and Economical Issues

The catches of the small tunas in the Western part of Cuba are canned and part of them is exported to Europe. The spearfishes are sold in local market.

Cuba has no management regulations for these species, except for the prohibition of catches skipjack and blackfin under 30 centimetres fork length.

The Cuban social security laws protect the fishers, because of that; they do not need an extra job. They only work in fishery activities.

II. Moored FAD Fisheries Development

The employment of FAD for the fishing of big pelagic fishes is at the moment in experimental phase; three have only been moored in the oriental north coast with good productive results, in about three months they had been obtained some 10-ton. of spearfish mainly. The high cost of these devices has stopped its massive use; nevertheless they are considered in the plans for the development of the pelagic fisheries.

The used FAD is similar to the employees in Martinique; 60% of the capture was of white marling, 25% of sailfish and 15% of common dolphin

Progress report on Curacao fishery monitoring programme
(November 2000 - July 2001)

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During the first three months of the fishery monitoring a frame survey was conducted to detect the landing practices and to count the number of landing sites, the number of fishing vessels, the number of gear types, and the number of fishers involved. Because of the great diversity in the artisanal fishing vessels, the vessels were grouped in the following 5 length categories (Table 1). Length categories 1 to 4 consist of artisanal fishing vessels. Gasoline outboard engines usually propel the artisanal vessels up to 7 meters, while the vessels between 7-12 meters are predominantly equipped with Diesel inboard engines. The vessels larger than 12 meters are primarily semi-industrial fishing vessels.

Table 1. Different length categories Curacao fishing vessels

Length categories	Length (m)
1	<5
2	5-7
3	7-9
4	9-12
5	>12

Trolling lines and hand lines are the gear types most commonly used in the artisanal fishery, but certain species are also targeted using beach seines, fish traps, spear guns, and gill nets. The semi-industrial fishing vessels use drift longlines and/or bottom drop longlines.

There are currently 435 fishing vessels present at the fishing harbours in Curacao, but only 111 (25.5%) of these vessels are active in the fishery. Active vessels are those that were observed fishing. The vast majority of the fishing vessels remain unused due to mechanical- and/or financial problems, migration of the owner or other reasons*. The number of full time fishing vessels, i.e. between 100-200 fishing days a year, is 44. This is 10.1% of the total number of existing fishing vessels and 39.6% of the active vessels. The remnant, 67 fishing vessels or 60.4% of the active vessels, operate on a part time basis (less than 100 days a year).

*During the last few years import duties on engines, spare parts and other needed production items have risen markedly. The price of Diesel fuel also increased considerably. On the other hand low import duties (5.5%) are paid on imported fish in order to protect the customer. The price of local fish, which is generally of higher quality than the imported fish, is usually somewhat higher than that of the imported fish, but cannot rise very high above it. Thus the rising costs for the fishers could be passed to the customer only partly. This is one of the main causes of the financial difficulties fishers experience nowadays and the main reason why many fishers migrated to the Netherlands, and many boats remain unused.
Fishers also frequently report that the targeted fish species have become scarce. One has to go further and fish longer and increase fishing effort in order to equal the catch of years ago. This could be due to natural

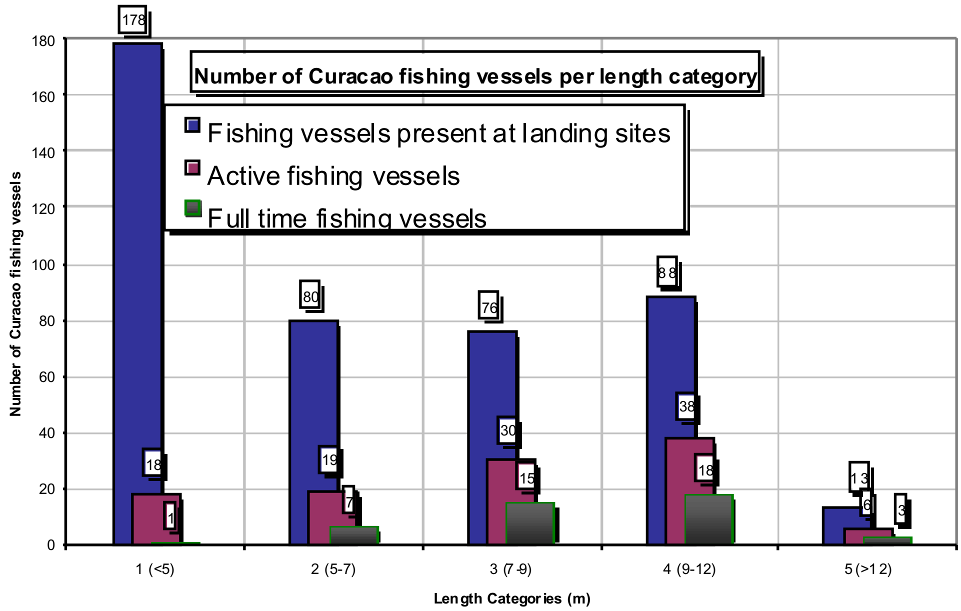

Figure 1. The total number of Curacao fishing vessels, the number of active Fishing vessels, and the number of full time fishing vessels

fluctuations in abundance of pelagic stocks, which may be related to El Niño and la Niña oscillations. It can also be related to a general decline of pelagic stocks as a result of overfishing in the Atlantic Ocean and the Caribbean Sea.

The boats are commonly operated by 1 or 2 fishers and the trip duration is usually one day, although some fishers sometime venture out the Klein Curacao and Bonaire where they stay over for several days. The total number of fishers is 183 of which 83 can be considered full time (Figure II). On occasion fishers from Bonaire visit the Island to sell their surplus of fish. In general the full time fishers operate the larger vessels. It is likely that the number of part time fishers, especially for the small vessels, is much larger, but continued monitoring at the landing sites, which also covers the weekends, is needed to determine this number.

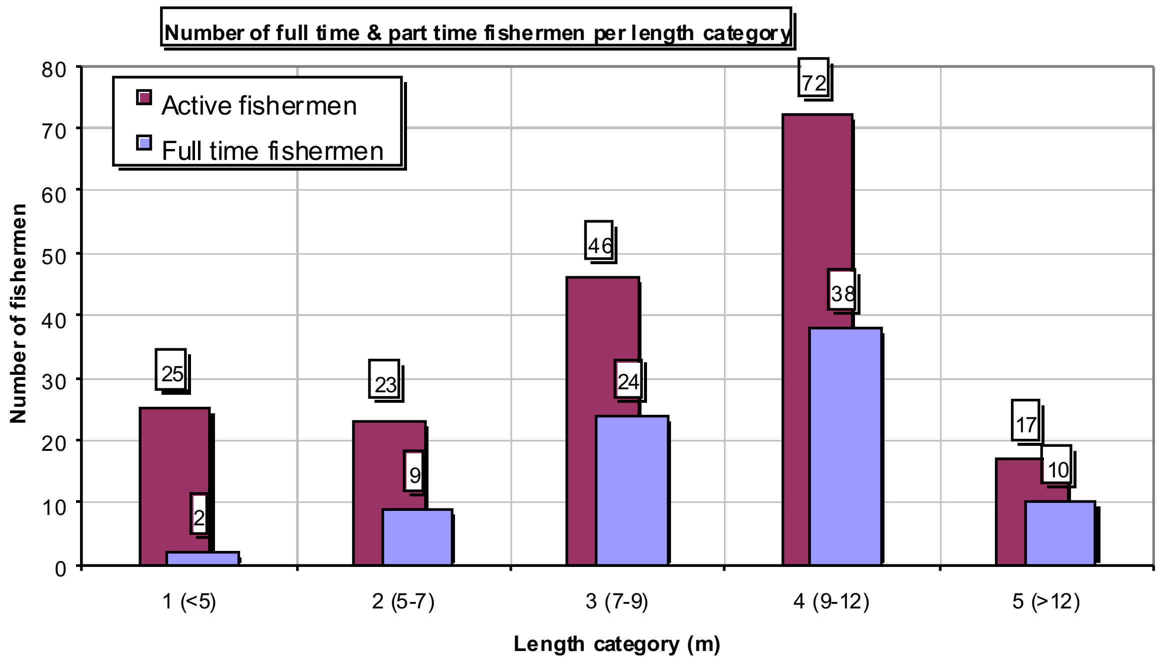

Figure 2. Number of active fishers and full time fishers in Curacao

Due to the vast diversity of landing sites and a shortage of qualified data collectors. There is also a shortage of transportation, so the landing sites were monitored proportionally, i.e. landing sites were not visited based on the number of fishing units, but based on total fishing effort per landing site. Rather sites were monitored based on the frequency of the fishing trips and size of the fishing vessels.

Target species and by-catch

The Curacao artisanal fishers engage in different types of fisheries targeting pelagic and demersal species. There is no clear distinction between target species and by-catch. Fish species with the highest market value include wahoo, dorado, red-snappers and groupers (14-18 Nafl/kg). Less desired fish species such as shark, marlin and tuna are still sold at relative high market prices (7.50-11.00 Nafl/kg) compared to prices of chicken (4.14 Nafl/kg) and pork meat (5.53 Nafl/kg).

The longline vessels target predominantly pelagic fish species such as bigeye tuna, yellowfin tuna and swordfish. Other pelagic species such as dorado, jacks, sharks, escolar, and marlin are considered by-catch.

Catch and Effort Data

Catch and effort data were collected from the landing sites on a daily basis, including also the fishing method, fishing grounds and catch composition. The data were entered on a data form, and later in an MS-Access database program. The required information included also date, boat category, fishing hours, number of fishing gear, weight of catch and by-catch.

During the monitoring period a catch of 10,505.3 kilograms was recorded. In order to obtain the approximate total catch a multiplying factor has to be used. The following table (Table II.) shows the recorded catch and fishing effort per length category. Taking the relative high CPUE (catch per unit of effort) of spear fishing into account, it is evident why spear fishing is still being practised in Curacao, although the law prohibits it. It is a major cause of over-fishing. It is also clear that there is a correlation between boat length and CPUE.

Table 2. Catch, fishing effort, catch per unit of effort and the number of samples taken per length category from February to July 2000

Length Category	Catch (kg)	Fishing Effort (hrs)	CPUE (kg/hr)	# samples
1 (<5)	221,3	235,6	0,940	42
2 (5-7)	625,3	436,3	1,433	61
3 (7-9)	1185,1	747,4	1,586	85
4 (9-12)	3459,0	1091,4	3,169	72
5 (>12)	4964,6	493	10,070	8
Spear gun	50	8	6,250	2
Total:	**10505,3**	**3011,7**		**270**

The table below (Table III) shows the landing sites monitored in this survey. Total catch and fishing effort are shown per landing site per length category. It is remarkable that the catches of 1 long line vessel, operating from the Motetwerf in Otrabanda, in 6 fishing trips almost equal the catch of 264 fishing trips of the artisanal fishing vessels. To get an idea of the relative economic performance of the vessels, the CPUE per length category has to be compared to the relative cost per trip. The costs per trip are of course much higher for the longliners. Nevertheless in general the catches of the artisanal fishing fleet, irrespective to the gear type used, can be considered marginal.

Table 3. Catch and effort per length category per landing site from February 2001 to July 2001

Sint Michiel

Length Category	Catch (kg)	Fishing Effort (hrs)	CPUE (kg/hr)	# samples
1 (<5)	52.8	88.8	0.595	16
2 (5-7)	42.5	47.0	0.904	8
3 (7-9)	16.0	15.8	1.016	2
4 (9-12)	45.0	72.3	0.623	10
Total:	**156.3**	**223.8**		**36**

Caracasbaai Vissershaven LVV

Length Category	Catch (kg)	Fishing Effort (hrs)	CPUE (kg/hr)	# samples
1 (<5)	9.5	8.3	1.145	1
2 (5-7)	18.9	9.0	2.100	6
3 (7-9)	597.0	450.2	1.326	52
4 (9-12)	3244.5	934.9	3.470	50
5 (>12)	31.0	13.0	2.385	2
Total:	**3872.5**	**1398.1**		**111**

Oude Vissershaven Caracasbaai

Length Category	Catch (kg)	Fishing Effort (hrs)	CPUE (kg/hr)	# samples
1 (<5)	0.0	11.0	0	2
2 (5-7)	88.5	48.9	1.810	5
3 (7-9)	133.0	119.0	1.118	3
4 (9-12)	0.0	28.0	0.000	5
5 (>12)				
Total:	**221.5**	**206.9**		**15**

Westpunt

Length Category	Catch (kg)	Fishing Effort (hrs)	CPUE (kg/hr)	# samples
1 (<5)	144.0	123.5	1.166	22
2 (5-7)	305.3	250.4	1.219	42
3 (7-9)	439.1	162.4	2.704	28
4 (9-12)	169.5	56.3	3.011	9
5 (>12)				
Spear Gun	50	8	6.250	2
Total:	**1107.9**	**600.6**		**103**

Santa Cruz

Length Category	Catch (kg)	Fishing Effort (hrs)	CPUE (kg/hr)	# samples
1 (<5)	15.0	4.0	3.75	1
2 (5-7)				
3 (7-9)				
4 (9-12)				
5 (>12)				
Total:	**15.0**	**4.0**		**1**

Motetwerf, Otrabanda

Length Category	Catch (kg)	Total number hooks	Catch/100 hooks (kg)	# samples
1 (<5)				
2 (5-7)				
3 (7-9)				
4 (9-12)				
5 (>12)	4965	8810	56.4	6
Total:	**4965.0**	**8810.0**		**6**

The CPUE fluctuates per length category and per landing site. This can be explained by the fact that some landing sites are situated closer to the main fishing areas (Figure III). Figure VI shows the CPUE per length category per fishing area. The CPUE of length category 1 and 4 of the Oude Vissershaven Caracasbaai can be considered outliners, since the vessels sampled had no catch those particular days. The low CPUE of St Michiel can be explained by the fact that this particular landing site is situated at a relatively long distance from the main fishing areas. The main fishing areas are situated at the northern coastline, the eastern coastline and on the Western parts of the island and around the island of Klein Curacao.

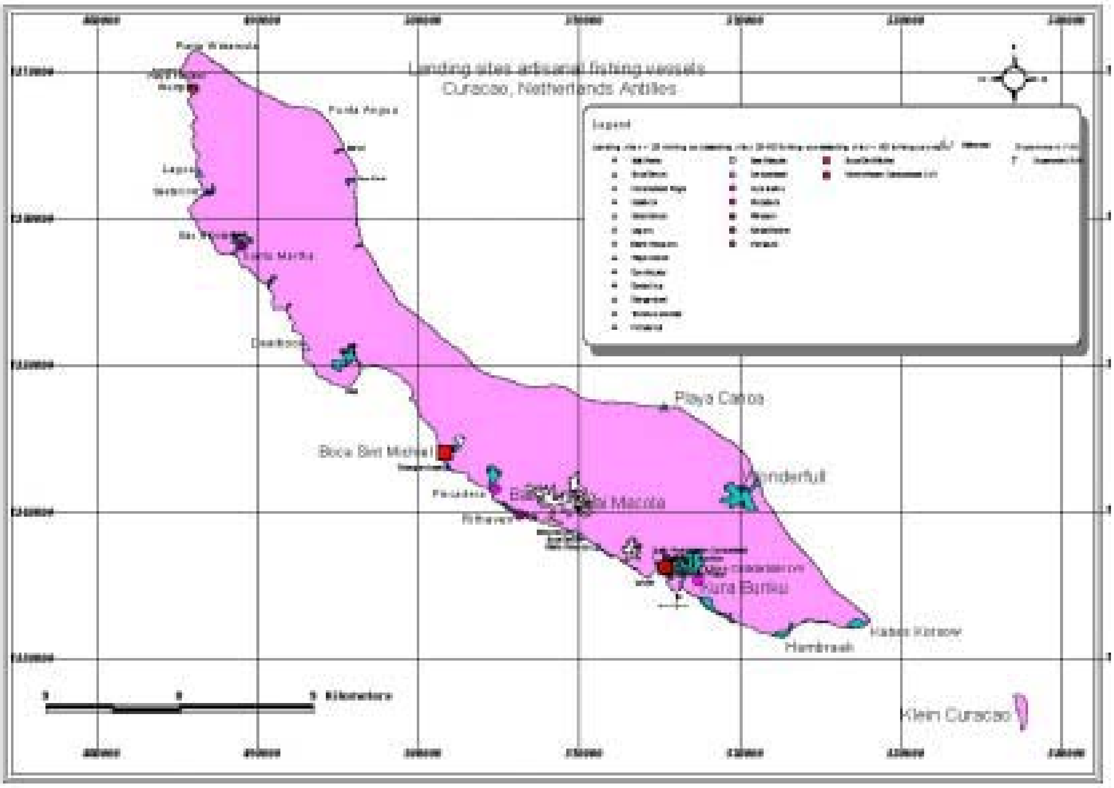

Figure 3. Map of the landing sites and fishing grounds around the island of Curacao

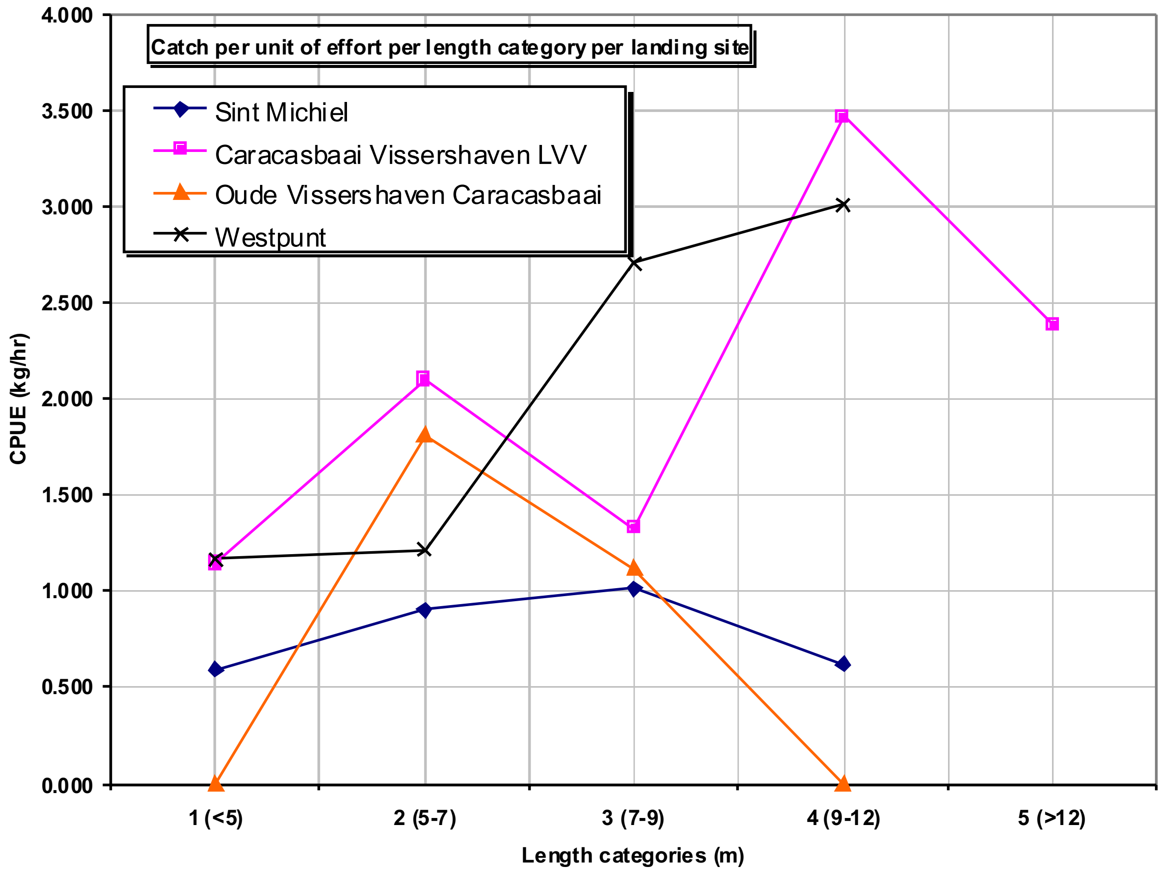

Figure 4. CPUE per length category per landing site from February 2001, to July 2001

The next figure (Figure V) displays the catch per unit of effort (CPUE) and average fishing effort per trip. The figure shows a clear correlation between these two entities, which can be explained by the fact that small vessels are restricted to the vicinity of their fishing harbour, while larger vessels can go to the richer fishing areas, which results in a higher CPUE. However to get an idea of the relative economic performance of these vessels, the costs per trip should also be compared.

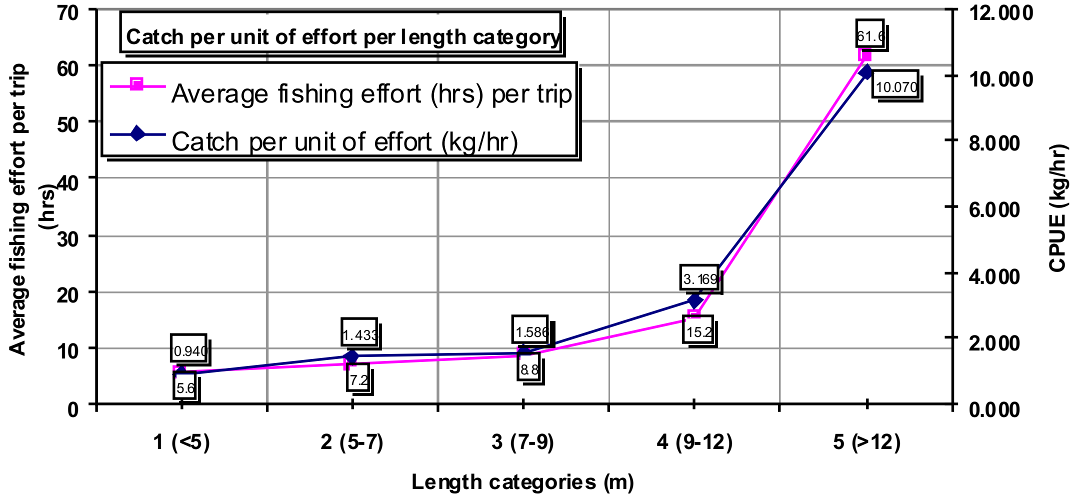

Figure 5. Catch per unit of effort and average fishing effort per trip per length category from February, to July 2001

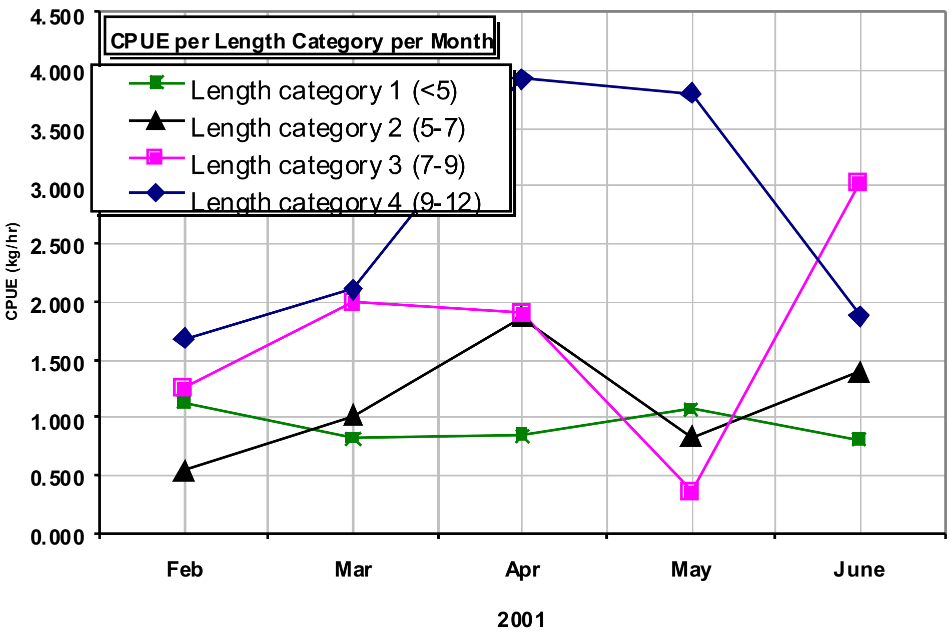

Figure 6. CPUE per month per length category from February to June 2001

Catch Composition

Figure VI shows the CPUE per month per length category. One can see the steep fluctuations in monthly CPUE in length categories 2,3 and 4 characteristic for a fishery targeting pelagic species. In general pelagic species are highly seasonal because of their migratory patterns. In category 1, the smallest vessels, show a more even monthly CPUE, which can be explained by the fact that a large part of their daily catch consists of demersal species.

Fishers with vessels from length category 1, target both demersal and pelagic species. The following tables (Table IV) show the total catch and catch composition of all length categories.

Table 4. Total catch and catch composition of fishing vessels sampled (n=42) of length category 1 from February to July 2001

Total Catch and Catch Composition Category 1			
English Name	**Papiamento name**	**Catch (kg)**	**Percentage of total (%)**
Pelagic species:	Piská di lamán grandi:		
Flying Fish	*Buladó*	26.0	11.7
Tuna's	*Buní*	24.5	11.1
Rainbow Runner	*Grastèlchi lamán*	14.0	6.3
Wahoo	*Mulá*	29.0	13.1
Dorado	*Dradu*	8.0	3.6
Marlins	*Balaú*	0.0	0.0
Needlefish	*Gepi*	9.5	4.3
Sub Total:		**111.0**	**50.2**
Demersal species:	Piská di fondu:		
Snappers	*Korá*	10.3	4.7
Great Barracuda	*Pikú*	20.0	9.0
Round Scad	*Moulo*	6.5	2.9
Pot fish	*Piská di kanaster*	73.5	33.2
Sub-total:		**110.3**	**49.8**

Table 5. Total catch and catch composition of fishing vessels sampled (n=61) of length category 2 from February to July 2001

English Name	**Papiamento name**	**Catch (kg)**	**Percentage of total (%)**
Pelagic species:	Piská di lamán grandi:		
Flying Fish	*Buladó*	71,0	11,3
Tuna's	*Buní*	258,5	41,3
Rainbow Runner	*Grastèlchi lamán*	11,5	1,8
Wahoo	*Mulá*	165,8	26,5
Dorado	*Dradu*	20,0	3,2
Marlins	*Balaú*	0,0	0,0
Needlefish	*Gepi*	15,0	2,4
Sub Total:		**541,8**	**86,5**
Demersal species:	Piská di fondu		
Snappers	*Korá*	8,0	1,3
Great Barracuda	*Pikú*	24,0	3,8
Round Scad	*Moulo*	7,0	1,1
Pot fish	*Piská di kanaster*	46,0	7,3
Sub-total:		**85,0**	**13,6**
Total Catch (kg):		**626,0**	**100,0**

Table 6. Total catch and catch composition of fishing vessels sampled (n=85) of length category 3. From February to July 2001

Dorado	*Dradu*	164.5	13.9
Marlins	*Balaú*	15.5	1.3
Needlefish	*Gepi*	0.0	0.0
Sub Total:		**991.1**	**83.6**
Demersal species:	Piská di fondu:		
Snappers	*Korá*	10.0	0.8
Great Barracuda	*Pikú*	36.5	3.1
Round Scad	*Moulo*	21.5	1.8
Pot fish	*Piská di kanaster*	126.0	10.6
Sub-total:		**194.0**	**16.4**
Total Catch (kg):		**1185.1**	**100.0**

Table 7. Total catch and catch composition of fishing vessels sampled (n=72) of length category 4. From February to July 2001

English Name	**Papiamento name**	**Catch (kg)**	**Percentage of total (%)**
Pelagic species:	Piská di lamán grandi:		
Flying Fish	*Buladó*	0,0	0,0
Tuna's	*Buní*	1457,0	42,1
Rainbow Runner	*Grastèlchi lamán*	82,0	2,4
Wahoo	*Mulá*	799,0	23,1
Dorado	*Dradu*	863,0	24,9
Marlins	*Balaú*	152,0	4,4
Needlefish	*Gepi*	8,0	0,2
Sub Total:		**3361,0**	**97,2**
Demersal species:	Piska di fondu:		
Snappers	*Korá*	26	0,8
Great Barracuda	*Pikú*	17,0	0,5
Round Scad	*Moulo*	15,0	0,4
Pot fish	*Piská di kanaster*	40,0	1,2
Sub-total:		**98,0**	**2,8**
Total Catch (kg):		**3459,0**	**100,0**

Drift Longline Vessels

The longline vessels operate in the Southern economic fishery zone (EFZ) of the Netherlands Antilles, i.e. north of the islands of Curacao and Bonaire (Figure VII).

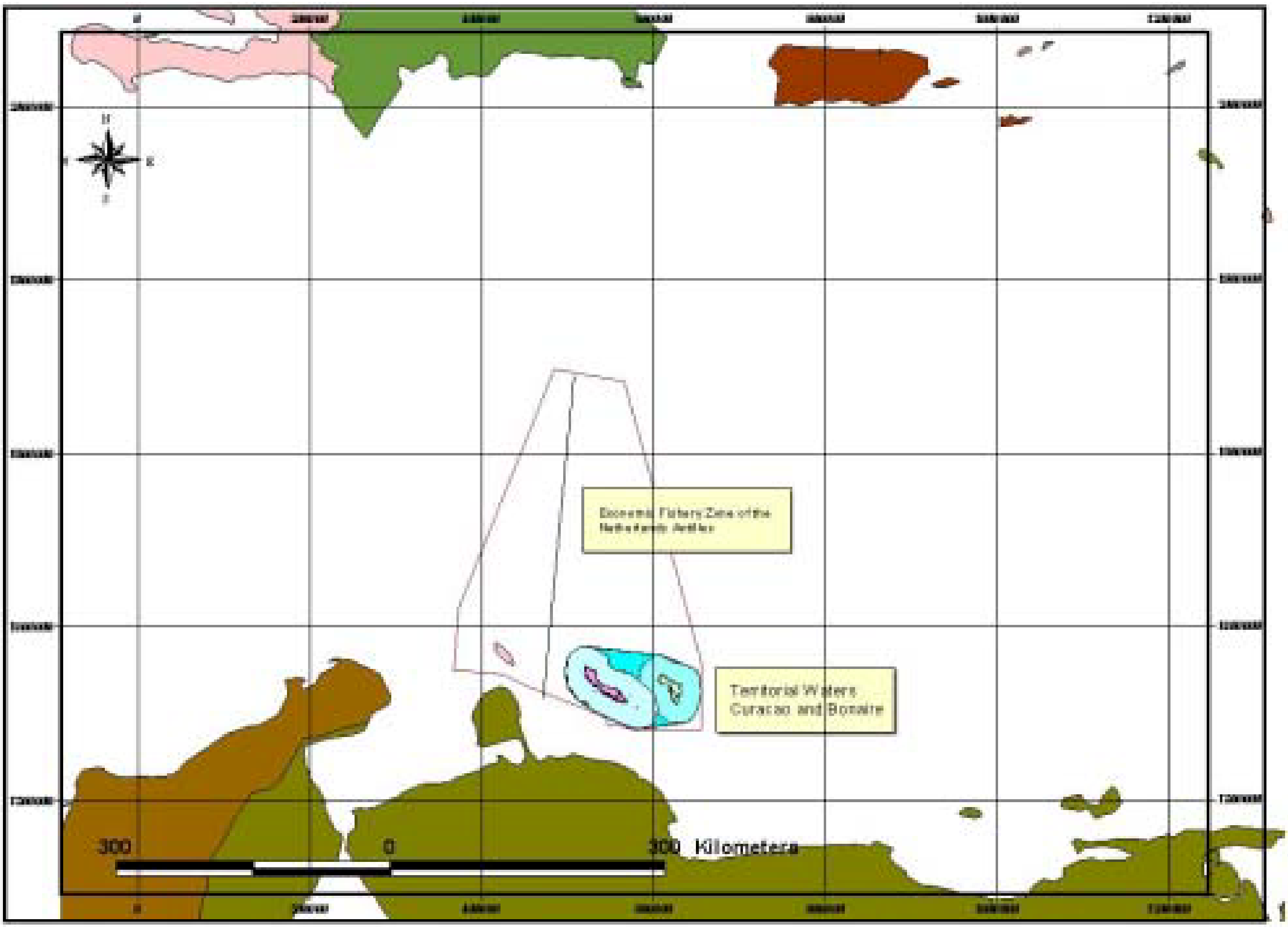

Figure 7. Economic Fishery Zone (EFZ) around the islands of Curacao and Bonaire

The longline vessel catch is predominantly exported to the U.S. and the targeted species in the fishery are bigeye tuna's, yellowfin tuna's and swordfish. The by-catch in this fishery consists of under-sized swordfish (mini swordfish) (16.9%), and sharks and shark fins (10.9%), small tuna's (9.2%), and other pelagic species (Table VIII).

Table 8. Total catch and catch composition Curacao long line vessels sampled (n=6) from February, to July 2001

English Name	Papiamento name	Export Catch (kg)	Percentage of grand total (%)
Bigeye tuna	*Buní wowo grandi*	530,2	10,7
Yellowfin tuna	*Buní alfashi*	180,5	3,7
Swordfish	*Balaú tonini*	1638,1	33,2
Sub Total:		**2348,8**	**47,6**
		By-Catch (kg)	
Dorado	*Dradu*	127,2	2,6
Escolar	*Kaka sin sintí*	406,4	8,2
Mini swordfish	*Balaú tonini chikí*	832,1	16,9
Mini tuna	*Buní chikí*	452,0	9,2
Sharks	*Tribón*	527,5	10,7
Rainbow runner	*Grastèlchi lamán*	6,5	0,1
Sharkfins	*Ala di Tribón*	12,0	0,2
Jacks	*Korkobá*	59,5	1,2
Rays	*Chu-Chu di lamán grandi*	19,7	0,4
Marlins	*Balaú*	146,3	3,0
Sub Total:		**2589,2**	**52,4**
Total Catch (kg):		**4938,0**	**100,0**

Conclusions and recommendations

- During the last 6 months it has become evident that the Curacao fishery sector is of importance to the island economy of Curacao. The sector provides employment to a relative large number of people, while relative large groups of people find part-time employment and so generate additional income in the fishery sector. Of a total labour force of 52.236 people (DEZ, 2001), 183 people (0.35%) find employment in the fishery sector.

- The added value and the savings of foreign currency to the island economy are high.

- It is evident that it is a necessity to continue monitoring the fishery. In order to show annual trends at least two full years should be monitored. The conclusions drawn from the collected data will help improve management of the fishery resources and formulate sensible regulations that will result in the improvement of the fishery sector as a whole.

- The collected data also function as a basis for a future fishery island ordinance.

- The collected data allows us to better understand the seasonality (migration patterns) of the pelagic target species. The accumulated data can allow us to understand how to improve fishing methods and catch of the artisanal fishing vessels.

- It is clear that there is a strong correlation between boat length and catch per unit of effort. It is advisable to expand the number of larger vessels of the artisanal fishing fleet, and to increase the number of longline vessels in order to exploit the fishery resources of the economic fishery zone around Bonaire and Curacao to their full potential, taking care to avoid over-fishing.

- It is important to present the results of the collected data during a meeting with the fishers in order to give the necessary feedback, while there will also be an opportunity to discuss the draft fishery ordinance with the resource users.

Island of Curacao FAD programme

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INTRODUCTION

In many countries a large number of people derive either full-time or part-time income from artisanal fisheries. In addition to the fishers themselves, some people market the fish, fishing vessels are built and maintained locally etc. thus adding a considerable multiplier effect. Even though the fisheries sector is seldom of great importance in terms of its contribution to the Gross National Product (GNP), it does have a substantial social impact. In many countries a considerable amount of foreign exchange is being saved which would have had to be spent on food imports. Because of those reasons, efforts to develop fisheries, within the framework of responsible use of existing resources, make economic sense.

The use of FAD can improve the production of artisanal fishers, lowering fuel costs and reducing the time spent loitering at sea looking for fish. The FAD act as a habitat for juvenile fishes which otherwise might have perished and probably have some positive influence on fish production. Nevertheless the enhancement role of FAD is of very limited importance. Basically FAD do not "produce" fish, but only aggregate dispersed fish making it easier to catch them. As with all fishing methods however there are certain drawbacks. There are limitations where FAD can be placed. Conflicts can arise between fishers from competition for space around the FAD and in some area's FAD are known to attract large numbers of juvenile fish, thus creating the problem of over-harvesting a part of the population which has not yet reached its reproductive potential.

Design Parameters

In Curacao FAD have been in use since 1993. During these years several somewhat different FAD have evolved, which however all have the same basic design. Key elements of this design are the following:

- Use of a spar buoy. A spar buoy design is well suited to waters with short-length, choppy waves. Use of a sparbuoy design, with constant tension on the moving chain will avoid slamming and jerking of the surface buoy.

Such a buoy can withstand fairly rough weather although may be not a full-blown hurricane passing directly overhead. With a spar buoy design all the loads can be transmitted via the nose cone to the centre-pole (a three-chain bridle can be avoided). The buoy can move up and down in the water and adjust to changing loads more gradually than a flat cylinder buoy. When properly ballasted with chain as external load, the buoys have a very seaworthy motion. Even in choppy waters, the spar buoy type float will dampen motions and will not jerk or slam like a flat tyre-type buoy.

Divers on a spar buoy type FAD used in Curacao confirmed this through observations. The spar buoy was able to withstand periods with very rough seas; we believe that the fact that this type of design was used is a decisive factor in determining the survival of these buoys in the open seas. In areas with short waves such as the Caribbean the spar buoy has an obvious advantage, which may be less pronounced in areas with long waves. Nevertheless in areas with long waves short waves are often superimposed on the long waves, especially during periods of bad weather. In such conditions a spar buoy design could hold a decisive advantage. One of the disadvantages of a spar-buoy design is that quite some ballast is needed. Using the mooring chain as ballast can reduce this need for ballast. The chain acts as external ballast and is more effective in keeping the buoy upright than the internal ballast since it is attached at the end of the centre-pole, which works as a lever. The internal ballast can thus be reduced somewhat, making it easier to tow the buoy behind the ship in a horizontal position and leaving more reserve buoyancy since the buoy can be kept fully upright with less total ballast.

There is only one mainline, attached to a single chain, a three-way bridle is avoided. Liberal use of sacrificial anodes (at least 3 anodes of 2 kg or 2,5 kg each), and maintenance to replace these anodes about once every 1,5 years.

Use of buoys with submersible top-lights.

There are many advantages if the surface buoy can be completely submersible. Such a buoy can be towed behind the vessel. When the buoy is launched the vessel will only have to carry the anchor and mooring lines. Most top-lights with solar panels and battery boxes are not submersible. If such a light is attached to the buoy this will greatly complicate the deployment of the buoys. In areas with choppy waves it is next to impossible to attach a light, solar panel and battery box to the unit when it is already moored in the water. The solution is to either using a fully submersible top-light with solar panel and battery in a plastic unit or not to use a top-light at all.

The use of a short anchor chain, with depth buoys, that does not touch bottom.

A one-piece inverted mushroom anchor, a heavy iron block and a one-piece concrete and iron block was used. The anchor is constructed as a low box (0,5 x 1 x 1 m^3) made of steel plates, which are filled, with concrete (approx.1 550 kg: 400 kg of steel, 1 150 kg of concrete). A reinforcement mat can also used. If the concrete cracks from the impact of the anchor hitting the bottom, the concrete would still be contained in the steel box and the structural integrity of the anchor would be maintained. The bottom side of the anchor is provided with two 2" (5.08 cm) U beams to increase grip on the substrate and to prevent the anchor from sliding

Having ample reserve buoyancy

The strength of the currents had originally been underestimated and this has been one of the main problems encountered. In view of the strength of the current in Curacao the maximum mooring depth for the deepwater FAD with the MKII surface buoy should probably be limited to around 600 meters. Under such conditions and with some maintenance a lifetime of three years or more for each FAD can be realised.

Use of nylon strands as underwater attractors

The ideal underwater attractor should provide a sizeable shelter structure while minimizing drag. Its durability and drag characteristics are very important. A main problem is that, while they can hold out for a considerable time in calm or moderate seas, most underwater attractors do not last very long in rough seas. Plastic fibres can be used which are enmeshed in the mooring chain or mooring line of the FAD. In the newer Curacao FAD, strands made of 14 mm nylon rope, which were fastened to the mooring chain, were used. Up to now these have outlasted all previous underwater attractors, which were tested

Deployment

To deploy a medium or Deepwater FAD a fairly accurate estimate of depth is needed. In some areas where accurate nautical maps exist and depth contours are far apart, which is the case where a broad underwater shelf exists, the use of an echo-sounder is less critical and the depth could be taken from the map, using one's position. In areas with a sloping bottom topography the nautical maps give depth contours which have been extrapolated from a grid of fairly dispersed readings, and thus cannot be relied upon for the precise positioning of a Deepwater FAD. It is necessary to adjust or correct for variations in sound velocity. When launching the buoys two vessels were used. One served as the launching vessel and the other as marker vessel. The “anchor last” method was used. The techniques for deployment of the FAD and calibration of the echo sounder were extensively described in earlier papers (van Buurt 1995, 1999).

Main Problem Encountered

The strength of the currents was initially underestimated. On some days with strong currents the MKI buoys which were first used were leaving a wake and if approached by boat it would seem as if they were slowly moving ahead under power. On such days the buoy would be drawn down considerably and waves would sometimes wash over the top cover. In Curacao the Curacao Port Authority measures currents at the South coast near the harbour entrance. Current meters are situated at a depth of 5 and 10 m below the surface and are attached to a platform, which stands in 12 m of water. A mean current value of 0,5 knots is recorded with maximum values up to 2,5 knots. Almost every year there will be some days when the strength of the current ranges from 2 to 2,4 knots. About once every two or three years the current will be above 2,4 knots. Usually this will last for only a few hours. Once a current of 2,6 knots was recorded.

Further out from the coast a mean current of about 1-1.5 knots flowing W-NW is usually encountered. It is not known how the strength of this current is related to the current measured at the harbour entrance. We now assume that in the areas where our FAD are moored a 2,7 knots (approx. 1,35 m/s) surface current can be reached, if only for a few hours once every two or three years. We also assume that this current will affect the whole layer of surface water above the thermocline, say the upper 150 m of depth. During any year there will be currents of about 2,4 knots (approx. 1,2 m/s). It could very well be that currents in Curacao could be much stronger, if only for a short peak period of time, than anything similar FAD would have encountered out in the open sea near oceanic islands in the Indo-Pacific. This observation draws us back to the observation in the 1984 South Pacific Commission Handbook on deep-water FAD (Boy, R.L. and Smith, B.R, 1984). The handbook stated that "the passage of typhoons in the Pacific Area has been a major problem - making it difficult to achieve the goal of developing permanent deepwater FAD". According to the handbook even the best designs do not fare too well when a typhoon passes. When a typhoon passes short wavelength and choppy waves are suddenly superimposed on the long-waves.

It is also likely that a passing hurricane or typhoon can generate surface currents of abnormal strength, if only for a relatively short period of time. Several of the designs discussed in the SPC handbook and also those in the later (1996) Vol II of the Manual (Gates, P.D., Cusack, P., and Watt, P., 1999) would certainly have insufficient reserve buoyancy for the Curacao environment. They would probably not be expected to last more than a few months at most, probably less, in our waters. The Curacao MKII design has more than twice the reserve buoyancy of some of the pacific designs that are moored in waters of 1500 - 2000 m depth. We now do not moor buoys in waters exceeding 600 m depth anymore and this decision seems to work well. The strength of the currents has originally been underestimated and this has been the main problem encountered. We have estimated that under such conditions and with some maintenance a lifetime of three years or more for each FAD can probably be realised.

Once a cylindrical buoy is drawn below the surface, the drag increases and the hydrodynamic forces will usually pull it down to its collapsing depth (communication by M.Taquet). Thus usually the buoy will not resurface. It is thus important to moor the buoys at such a maximum depth that it is unlikely that currents could ever pull them down.

It should be possible to calculate the maximum mooring depth for each type of FAD at the maximum current strength that can occur at a given site over say a five-year period. Each FAD can than be "rated" to a certain maximum depth, and one would make sure not to moor the FAD any deeper. In practice however it is difficult to do this. Too many assumptions are involved; such as the exact maximum current strength, the current strength with depth and the actual drag of the surface buoy and its mooring chain. Even though computer simulations cannot thus be used to determine a precise maximum mooring depth "rating", they are nevertheless very useful since they do give a basic idea of the operating limits of the FAD.

Economics

There are few detailed discussions on the economic performance of FAD. Usually there are not sufficient data available to justify a detailed discussion of economic performance. Economists are trained to always ask questions on economic performance. Those who have to fund projects want to arrive at estimates of economic performance even when crucial data are not available. The idea is that an estimate, of certain parameters (cq. which is an educated guess) can nevertheless help to give a basic idea of the margins within which economic performance must lie. The problem with this approach, which is quite sensible in itself, is that it is often carried to ridiculous extremes. Estimates which one is forced to give in order not to be deemed uncooperative, turn up as fixed reference points in reports by others 20 years later. Although the early experimental stage is now over, FAD design and techniques are still being developed. It is very difficult to apply economic analysis to a programme that is still to a large extent experimental. Since the effectiveness of FAD depends to a large extent on their location it is very difficult to measure economic performance, and the catch capacity of different designs. It will be possible to measure performance of a system of FAD once the optimum locations have been determined. Once a FAD programme in a particular area reaches a mature stage. Economic performance depends, among others, on the following factors:

Location

The location of a FAD is very important. The FAD should be placed in an area where fish are known to occur. A FAD cannot aggregate fish if these fish are not present. A deepwater FAD should be situated in an area where migrating pelagics are known to pass.

Catches Around FAD

For a proper evaluation of the effectiveness of FAD monitoring of catches is necessary. Accurate catch and effort data around FAD are often lacking. Then to be able to make a meaningful comparison it is also necessary to have a basic idea of catches before the FAD were installed. One of the main problems with FAD used in artisanal fisheries is that it is usually quite costly to collect such data. In the Caribbean Ifremer in Martinique (Battagglia, A., Lagin, A., Reynal, L., 1991) and Guadeloupe (Lagin, A., Ledouble, O., Reynal, L. 1993) made the most extensive studies in this field. In St. Kitts and Nevis, Goodwin (1986) collected data on the performance of FAD. Feigenbaum *et al* collected data around a FAD in Puerto Rico. These studies all indicated that the FAD does increase catches significantly. Another problem is that even if catch data are collected at considerable costs, they may not give a good idea of actual economic performance possibilities unless the FAD programme has already matured; that is unless FAD are moored in the right locations and a suitable design is used.

Costs Versus Longevity

The ratio of costs vs. longevity of a FAD is one of the most important economic factors, once we assume that a suitable location has been found. On one hand we have the costs of construction, deployment and maintenance on the other hand the expected longevity. The longevity will also depend on the depth at which the FAD is moored. The cost of deployment would depend in a large measure on the price of the vessel used. The weight of the FAD and its anchor will influence the size of the vessel needed and thus the deployment costs.

New Developments

Five new MKII FAD and two 5 m PVC FAD have been under construction since 1998 and are now almost finished. Due to financial and organisational difficulties as a result of the severe economic crisis on the island and IMF imposed measures there have been numerous delays in constructing these buoys. The project was based on matching funds and due to some of the budget cuts, some of these matching funds were not available anymore, leaving us saddled with half finished buoys.

The Curacao FAD programme will now be extended to the islands of Aruba and Bonaire. Funds from the sale of the Marcultura aquaculture facilities in Bonaire will be used to pay for this new FAD program. The Marcultura facilities were privatised, these were owned by the Marcultura foundation in which the three islands of Aruba, Curacao and Bonaire participate. To avoid endless delays in constructing the buoys ourselves, which we have experienced in the past, buoys will be bought in the Netherlands, completely finished, made to our specifications. 12 additional buoys will be constructed (four for each island). Even so it has been difficult to find anyone interested to construct just a few buoys. The new buoys will be made of stainless steel 216-L.

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National report of the Commonwealth of Dominica

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1. SYNTHESIS OF LARGE PELAGIC FISHERIES

1.1 Introduction

The large pelagic species fisheries form a very important component of the marine fisheries of Dominica. It is doumented that large pelagic fishes like yellowfin tuna, dolphin fish, kingfish, swordfish are becoming important species in the local landings from the resources in our marine habitat. They are generally considered to be seasonal and fetch high prices on the market. Efforts to increase the landed volume of large pelagic species locally have been ongoing. Artisanal longline fishing techniques are being introduced, and various fishing communities are showing interest in building and deploying fish aggregating devices to improve fish production. Table 1 summarises the available data on size of the national fishing fleet, the number of fishers and the main species they target.

Table 1. Showing boat description, target species, crew and number of fishers

Vessel	Registered	Average Size (Feet)	Species Targeted	Crew
Canoe	509	17	Demersal (bottom dwelling) and small coastal pelagics	2-3
Keel	402	18	Yellowfin tuna, kingfish, marlin, swordfish, dolphinfish; also demersal species	2
Fibre glass	50	22	As above	2-3
*Long line vessels	3	35	Pelagic species	5
Fishers: Part-time Full-time	 1800 435			

Source: Dominica Fisheries Division 2000

In Dominica the migratory pelagic species are targeted during the months of January to June, when it becomes the major fishing activity. This fishery contributed about (38%) of total fish landings in 1998 and has increased by 10% in 2000. Table 2 shows the place of the large migratory species in the overall national fisheries landings

Table 2. Showing Status of Major Fisheries

Fisheries Groups	Exploitation Level	Trends	Potential	Constraints
Reef fisheries	168.3 tons	Declining both in terms of catches and size of individual fish	Fisheries can be sustainable if managed properly	In addition to heavy fishing pressure, there are negative impacts on habitat from non-fishing, land-based sources of pollution
Deep slope fisheries	58.5 tons	Production has remained relatively steady over the years at a low level of exploitation	Has great potential for increase in production	Lack of line haulers and other tackle. Small unstable fishing platforms for in use on the Windward coasts; Bottom longline expensive to maintain
Coastal pelagic fishery	485 tons	Shows an increasing trend	Shows great potential for development as it is caught in large quantities	Habitat affected by land-based sources of pollution. Some species are underutilized.
Fishery for migratory pelagics	367 tons	Increasing trend	Has greatest potential for development	Small size of boats Lack of use of navigational aids Fishing fleet presently operates within a 12 mile radius of the island.

Source: Dominica Fisheries Division 2000

1.2 Fishing area

Dominican fishers take most of their catch off the west, north and south coasts of the island. A variety of fishing gears is used. They include: Gillnets, beach seine. The use of these gears will depend on factors such as, weather condition, size of craft and engine and the experience of the crew.

1.2.1 Fishing activities schedules

Fishing activities are not always consistent. For example beach seine fishing can occur at anytime, depending on the availability of the targeted species. A better understanding of the fishing activities and schedules is illustrated below.

Table 3. Fishing Activities Schedules - ILLustrated

Gear	Soak time	Comments
Longline	4 hours	All year, but intense in July to August
Beach seine		May depend on time, crew, and presence of species targeted etc
Pot/trap	5-8 days	Usually done from July to December
Troll		Usually done from January to June
Gillnet	4-6 hours	May depend on current/tide etc

1.3 History of data collection system

The Fisheries Division has been collecting catch and effort data since 1982. The data collection system was part of an Organisation of Eastern Caribbean States (OECS) Fisheries Initiative. Later (1992) it became part of the CARICOM Fisheries Resource Assessment and Management Programme. The data was entered by daily landings and not according to fishing trips.

The information, which was generated, was very limited, as the available analytical programmes could not be used to manipulate the data, for the production of various reports. Total landings for various sampled sites as well as total annual landings could be estimated quite easily. However, it was not possible to obtain any production information by species, boat categories or by gear type.

1.3.1 Present catch and effort data system

Catch and effort data has been collected on a random sampling system basis. Officially thirty-two fish landing sites are recognized. Catch and effort data is presently collected from eleven of these sites, including parts of the west coast as well as areas in the north and south

1.3.2 Sampling schedule

Sampling schedule is a joint initiative of the data collector and the data collector supervisor who visists each landing site at least once monthly. During the visit, data collectors highlight difficulties faced, problems with sampling techniques, difficulty with fish species or fishing gear and methods. Discussion with fishers and other stakeholders form an important component of work of the data collector. This is important as it helps to strengthen links between the data collectors and fishers.

1.3.3 Data management

Data is brought to the office during the first week of every month. The data sheets are checked by data entry personnel and all errors corrected before entry into the computer databases.

Fish catch and effort data is stored in the Trip Interview Programme (TIP) database and Licensing and Registration data is stored into Licensing and Registration Systems (LRS) Database. There is a schedule for making 'backups' of the data once every two weeks but this is not strictly enforced. However, backups of all data entered into the computer from 1994 are available in TIP or Excel format and those done before that period are available in Lotus 123 format.

1.4 Marketing and distribution

1.4.1 Domestic

Prior to the establishment of the Roseau Fisheries Complex (RFC) most fish were sold directly from landing sites.[1] When there is an over supply at the RFC, the excess catch is sold to near-by and distant communities in most cases from hired trucks or from boats. Fish is not usually gutted when sold to the public. Very often small pelagic fish species such as flyingfish, skipjack, and robin, are sold from landing sites, but blackfin tuna, yellowfin tuna, marlin, swordfish and dolphinfish are only sold in rural communities when a glut exist.

Although on prime objectives of the RFC was to absorb the glut, it has been observed that on some occasions its storage capacity and the rate of sales/ stock-turnover have affected fishers. During the last few years for example, in the months of August to December FAD and artisanal longline fishers have produced large amounts of yellowfin tuna, marlin and swordfish. Because of the over supply, the average price has dropped; in addition, there has been some evidence of lost income though spoilage. Normally the retail prices for fish in Dominica are as follows: pelagic species at EC $6.00 per pound*, d*emersal species at EC$5.00 per pound

1.4.2 Imports

Dominica imports some quantities of canned seafood, salted cod and very small amounts of frozen fish.

[1] The RFC is equipped with storage and processing facilities and a marketing outlet. It was constructed with Japanese grant aid.

1.4.3 Exports

There are no records of fish exports.

1.5 Management options and policies

Besides its efforts to manage the fish stocks, the role of the Fisheries Division also include the provision of the necessary support to the human dimension of fisheries. Social and economic issues of fisheries are very important.

The fisheries Act of Dominica (1987) gives the government the authority to manage fisheries. To date the draft fisheries regulations are yet to be gazetted. An important provision in the draft regulations refers to a co-management approach of the fish resources of Dominica.

A joint approach to management is strongly advocated. The term "Co-management" also called collaborative, joint, mixed, multi-part, community base is priority. It is believed that fisheries is not just about managing or catching fish, rather it should include managing those who catch the fish. Therefore policy makers recognize this as important to the fisheries industry. According to Farvar, M.T & Feyarahere, B.G 2000 "Natural Resource Management (NRM) is also a political issue".

2. MOORED FISH AGGREGATING DEVICES

The concept of moored Fish Aggregating Device (FAD) was introduced in Dominica during the mid 1980's, but it was not until a few years later that the first FAD was officially constructed and deployment. Assistance for developing FAD came from the Food & Agriculture Organisation (FAO). In the development process the idea was promoted among individual fishers, Fisheries Study Groups and Co-operatives. Some experimental FAD were deployed offshore of a number of fishing communities.

Fishers were aware that pelagic fish aggregated around floating objects such as, nets, logs and other debris. Normally they would monitor hovering seabirds that followed drifting objects around. Occasionally they would encounter schools of pelagic species around such objects offshore. The use of stabilized objects or anchored platforms around which both large and small pelagics can shelter soon became an alternative to making long circuits in search of drifting objects. Reports that fishing around moored FAD has been yielding excellent results have heightened fisher interest in Dominica. Fisheries officials are pleased with this development because it may, for example, ease the fishing pressure on demersal species and it is more cost effective in terms of the daily expenses for long trips. It is also seen as a way of reducing the costs of search and rescue when fishers go missing on longer trips. Table 4 summarises the available information on FAD construction and deployment in Dominica.

Table 4. FAD Constructed and Offshore Distance of Deployment

Landing	No. Fads Constructed & Deployed
Capuchin	1
Portsmouth	2
Bioche	1
Colihaut	2
Marigot	1
Salisbury	1
Fond St Jean	1
Atkinson	1
San Sauveur	1

The devices were deployed ranging from about 3-6 miles off shore.

2.1 Acceptability

Despite several training sessions on the merits of FAD, the concept has recently gained favour among fishers, after eight years. Recognizing its importance the Fisheries Division persisted with the concept, which is now hailed a success story. More details on the current status of FAD is provided in the following sections.

2.2 Materials used

Generally, a FAD is constructed from bamboo in lengths between 20-30 feet and about 10-15 fee wide. Other materials consist of rope, tyres, anchor, shackles and swivels. For easy siting, materials such as flagpole and RADAR reflectors are installed.

2.3 FAD in recent times

More recently FAD are constructed from medium to large pieces of purse seine net, plastic containers, circle and PB 7 buoys. In some instances green coconut branches are also used. Bamboo constructed ones are not very common nowadays. It is not clear why, however some fishers indicate that constructing them out of bamboo is too time consuming and may be even less effective.

2.4 Location

Recently the location of Fish Aggregating Devices has been given lots of attention. In some instances they have been located between 30-35 miles due west of the village of Dublanc, 10-15 miles west of Cabrits, about 7 miles off Colihaut and 8 miles out of Mahaut. In contrast to 14 years ago when the idea was newly introduced, over the last few years there has been a sharp increase in the number of FAD deployed and the will of fishers to construct more is rising. Attributed to this is the significant increase in pelagic fish fished on FAD mainly on the northwest, west and south coast.

2.5 Costing

Constructing a FAD is not cheap. Since the idea has caught on well, the amount of money fishers spend for fuel and time is less. The cost is often based on the complexity and the size. On average one cost about EC$3000 for floating materials alone. Rope for anchor EC$500.00 and anchor EC$300.00. Added to that, there is the cost of deployment, which is determined by factors such as distance or location and size of boat.

Proper maintenance of a device is very important. In fact, it is better not to construct one if in doubt on how to maintain it. A few Dominican fishers who are experienced in that field say that for a durable FAD, maintenance is important. They did not deny that depending on its location and a reasonable life expectancy period more that half of the construction and deployment cost is needed for maintenance.

2.6 Management and Social and Economic Considerations

The management and Social Economic Considerations of FAD is perhaps not well understood. Detailed information of fish caught on FAD, where deployed, and the types of FAD are now being addressed. Over the last year about four zonal consultations were held. During these consultations and in the daily working of the Fisheries Division, FAD management is discussed but sometimes not in a significant way. However community-based meetings specifically in areas where FAD are deployed continue.

It is generally felt that the management of FAD is not easy. Continuous dialogue and surveillance at sea is a must. At this point the later is infrequent from the Division's standpoint.

Fishers often complain of the lack of cooperation among them when fishing on FAD. Few are willing to contribute towards the construction, deployment and management of it. Theft is becoming a regular complaint. When a large number of fishers are fishing on a FAD they may each deploy several lines; in such cases it is becoming routine to hear of suspicions where a fish caught on one fisher's line is removed by another. Lines entangling, allegations of persons wilfully cutting FAD, or vessels mistaking cutting FAD are other serious concerns.

It is hoped that when the Fisheries Regulations are gazetted much of these problems will be eliminated or mitigated. They will include an important provision relating to FAD. It will specify that "*No fisherman/one will be able to deploy a FAD without written permission from the Chief Fisheries Officer and surveillance would be compulsory*"**.**

It is evident that more attention should be given towards the management of FAD. Lack of cooperation among fishers encourages "free riders"

2.7 Yields, Seasonality and Catch

The principal function of FAD is being achieved in Dominica. The sharp increase in catch is a success story. Reports from fishers indicate that catches have increased by 60-70% and more. According to Guiste, 2001, landings of yellowfin tuna and tuna-like species have increased in number during the months of July and August. He attributed this to the deployment of a number of FAD between 4-30 miles off the coast of Dominica, and the budding artisanal longline fishing activities. The catches recorded for 2001 are as follows:

FAD Data from July – August 2001

Species	**Amount in lbs**
Yellow fin tuna	174,961
Skipjack tuna	191,431
Blackfin tuna	186,325
Wahoo	102,783
King mackerel	78,148

There is no specific data bank/center for FAD, however, a few fishers in some pockets on the island records their catch.

National report of Grenada

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Location/Description

Grenada is a tri-island state comprised of Mainland Grenada, and its dependencies Carriacou and Petite Martinique. The Island has an area of 340 km^2, it's the most southerly of the O.E.C.S chain and is located approximately 12.7 degrees north latitude and 61.40 degrees west longitude.

The island has a coastline of 121 km, a territorial sea of 12 nm, and lies on the edge of the hurricane belt; the hurricane season lasts from June to November. The terrain is volcanic in origin with a central mountain range, with a tropical climate that is tempered by the northeast trade winds. There are six Parishes/Political Divisions and one town on the mainland, and the capital city is St. George's.

People

As of 1999 the population on the Island was 100,703, which consists of mainly "Black African", and "East Indian" to a lesser extent. English is the official language and is widely spoken, however, it is not uncommon to hear some French Patois. The level of literacy is 98%

Economy

The economy is agriculture based, however, tourism is the leading foreign exchange earner. Nevertheless, fisheries, textile and light manufacturing contribute quite significantly to foreign exchange earnings.

FISHING FOR LARGE PELAGIC FISH SPECIES

Fishing Fleet Targeting Large Pelagic Fishes

There are four (4) categories of fishing vessels targeting large pelagic species in Grenada. A description of each category and its capability follows:

Small scale open longliners (Category I)

Boat Size:	14 – 18 feet; open boat
Power:	Single gasoline outboard engine 15 – 25 hp
No.of Boats in Fishery:	75 boats.

<u>Small scale open longliners (Category I)</u>

Crew Size:	2 men
Fishing Area:	1 – 10 miles from land.
Activity Schedule:	Day trips. Leave 6 - 7 a.m., Return 4 – 7 p.m
Gear Used:	Light Monofilament longline with up to 100 hooks. 1 manual mainline reel 1 manual hook reel.
Species Targeted:	Yellowfin tuna (*Thunnus albacares*), dolphinfish (*Coryphaena hippurus*), billfish (marlin and sailfish)
Navigation / Safety:	60 % of fleet carry VHF handheld radio, life jackets, handheld compass.

<u>Medium scale longliner</u> (Category 2)

Boat Size:	26 – 32 feet (Forward cabin)
Power	2 x gasoline outboard engine 45 – 90 HP
No. of Boats in Fishery:	30 active boats and 30 inactive.
Crew Size:	3 men.
Fishing Area:	5 - 30 miles off shore. West of Grenada
Activity Schedule:	Single day trip. Leave 6 – 8 am Return 7 – 11 pm.
Gear Used:	Monofilament longline with up to 250 hooks 1 manual mainline reel 1 manual hookline reel 1 manual buoyline reel.
Species Targeted:	Yellowfin tuna, and billfish.
Navigation / Safety:	90 % of fleet carry VHF base radio, GPS, life jackets, flares.

<u>Large longliners (Category 3)</u>

Boat Size:	34 – 60 feet.
Power:	Single 70 – 350 hp diesel inboard engine.
No. of Boats in Fishery:	63 boats.
Crew Size:	4 men.
Fishing Area:	25 – 80 miles west and North west of Grenada.
Activity Schedule:	4 – 7 Day trip. Fish & Ice storage on board.
Gear Used:	Monofilament longline with up to 700 hooks. 1 hydraulic mainline reel. (70 % of Fleet) 2 manual hookline reel. 3 Manual buoyline reel.
Species Targeted:	Yellowfin, tuna and billfish (marlin sailfish and swordfish).
Navigation / Safety:	100 % of Fleet carry GPS, VHF base radio, life jackets, flares

<u>Open pirogues (Trolling) (Category 4)</u>

Boat Size:	18 – 24 feet.
Power:	Single 45 – 75 gasoline outboard engine
No.of Boats in Fishery:	215 boats
Crew Size	2 men
Fishing Area:	5 – 40 miles East of Grenada.
Activity Schedule:	Day Trip. Leave 4:00 am Return 11:00 – 12:00 am
Gear Used:	Trolling lines with artificial bait.
Species Targeted:	Kingfish, dolphinfish, blackfin tuna
Navigation / Safety:	50 % of fleet carry VHF handheld radio, Flares, life jackets

To the north and south of the Island various species of lobsters, conchs, turtles, and demersal species such as snappers, groupers, and hinds are harvested. Fishers use open pirogues fishing crafts (18-28 ft) to harvest these stocks. However, in the Grenadine Islands (Carriacou and Petite Martinique), larger fishing vessels known as sloop (35-45 feet), and equipped with hand lines are used to harvest the demersal stock. Conch is harvested by hand, lobster is harvested by loop, trap and hand, and turtle is harvested by net.

There are thirty fish landing sites on the mainland and ten in the Grenadines. Of these, seven has fish markets with cold storage facilities and three with ice making plants. Three of these sites have landing jetties and two of the others share space with commercial ports. These facilities are provided and maintained by Government with paid staff. There are sixty private wholesalers/retailers that sell their product locally, which operate out of six of these markets. A fee regime is established for use of these facilities. There are also five exporters/primary processors (one Government owned) with processing plants. They purchase and prepare fish for the export market. A flow chart of fish distribution channel can be found in appendix A. The Fisheries Division, which is under the Ministry of Agriculture, Lands, Forestry and Fisheries, is responsible for management of the industry.

Data collection system landing coverage

Data is collected in the form of a total sample at the six fish markets situated in each major landing area around the Island. These markets are staffed with Government paid employees, and all fish that pass through the market system is recorded. However, any fish that is landed and does not pass through the market is not recorded. It must be noted that the level of data coverage varies for different fishery. The deep-sea large pelagic and coastal small pelagic has the highest coverage, approximately 80%. This is followed by demersal, approximately 70; then inshore pelagic, approximately 60%; and lastly the shellfish fishery, approximately 25%. There are plans to institute a more structured sampling plan to arrive at a accurate estimate of total landing.

Catch-by-species-by-boat is collected on a daily basis. Effort is also collected as a total sample similar to landings Effort is measured in boat-days due to the multi-gear used in our multi-species fishery

Management practices

Management practices in the Grenada fisheries sector are aimed at controlling competition and conflict among fishers. Efforts are ongoing to introduce the ‘co-management approach’ to certain coastal areas. The introduction of closed seasons for threatened and endangered species, and enforcing size limits for various commercially important fish species are also being practiced as strategies for management of our fisheries resources.

Fisher dependent indicators

Changes in fisher income, access to health care, education and housing are used as indicators of improvement in fisher welfare in the Grenada’s fisheries sector.

THE STATUS OF FISH AGGREGATING DEVICES IN GRENADA

In the early 1990's, the Fisheries Division deployed two moored, Fish Aggregating Devices. No official data was kept from the production of these FAD, however it was well established that fishers had very good catches during the time the FAD were in position. One FAD built with the assistance of the FAO was anchored in approximately 1200 feet of water on the East Coast of Grenada. Species caught around the FAD include yellowfin tuna, dolphinfish, kingfish, and other small tunas.

In 1998, one bamboo FAD was constructed by the Fisheries Division and deployed about two hundred meters from a fishing beach. Fishers harvested many species of fish around the FAD, however six months after been deployed it was destroyed by a passing boat.

Due to the result of this FAD, two unused wooden fishing boats were anchored in the same position. Today, there are twenty (20) to thirty (30) fishing boats fishing around these two anchored boats and catching mainly black fin tuna and kingfish. The fishers would use live bait stored in a basket on the side of their boats and use this live bait for fishing. There are no other active FAD in Grenada.