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AMERICA'S DEVELOPMENT FOUNDATION

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A PRE INVESTMENT STUDY IN WEST AFRICA FOR THE PROCESSING AND MARKETING OF TRIGGERFISH IN SENEGAL, THE GAMBIA AND GUINEA BISSAU

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(U.S.A.I.D.)

Prepared by:

America's Development Foundation, Inc.

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1. Introduction

In September 1982, the U.S. Agency for International Development approved a $46,500 grant to America's Development Foundation for its project proposal to conduct a feasibility study in West Africa designed to evaluate the opportunities for private sector investment in Senegal, the Gambia and Guinea Bissau to process and market the underutilized plentiful Balistes resource (also known as Triggerfish) as minced fish products for domestic, regional and international food markets.

The objective of the feasibility study was to help identify private sector investment opportunities in fisheries development which could add to food supplies in the region and generate employment opportunities, income and foreign exchange.

Underutilized Fisheries Resources

In the waters off West Africa, there has been tremendous growth of the Balistes fisheries resource which is not being utilized. America's Development Foundation (See Appendix I) had been requested by private and public sector officials in West Africa to help identify how this resource could be productively utilized.

Preliminary information indicated that the Balistes resources potential for the region was very significant and should be utilized to meet the nutritional and economic needs of the countries in the region. According to data later obtained from a fisheries resource survey conducted in 1981 by the Norwegian research vessel "Dr. Fridtjof Nansen", in collaboration with the United Nations Food and Agricultural Organization (FAO), the biomass of Balistes resources in the Gulf of Guinea region increased rapidly over ten years from a few tons in 1970 to a total biomass of some one and half million tons in 1981.

However, almost throughout the region, the abundant Balistes resources were not being utilized due to local consumer resistance because of the fish's tough skin, bony scale and small size. The Balistes which are caught by commercial vessels are being discarded at sea. On the other hand, in other countries, Balistes are considered a good quality fish. For example, consumers in countries such as Ghana and the United States, whose consumers have grown more familiar with the flesh of the fish enjoy it for ite excellent flavor, whiteness and texture.

A major objective of America's Development Foundation study was to consider the utilization of minced fish technology to transform the Balistes into acceptable food products for local markets and for export. This technology is based on the productio of minced fish by utilizing equipment for the mechanical separatio

of bone, skin, viscera and scales from the flesh of the fish. The product thus obtained from a mechanical fish separator is raw material suitable for the manufacture of a variety of foods to supply the needs of a range of consumers in urban and rural areas. Furthermore, the waste generated by this technology can be utilized to produce feed for livestock.

The utilization of minced fish technology was considered appropriate for fish species such as balistes, which, owing to their form and size, had little market value. The advantages of the processing technique is that the fish loses its original identity. It can be mixed with other food ingredients and the product's properties and appearance can be adapted to suit the taste of markets and consumers. Also, the utilization of minced fish allows the addition of anti-oxidants and other ingredients to improve product preservation and avoid the significant problems existing throughout Africa of fish losses due to handling, climatic conditions and insect infestation.

The terms of reference for the project included evaluation of the opportunities for private sector investment to process and market the abundant balistes resources and to produce minced fish products for domestic and international markets. When, in the course of the study, it was determined that Balistes were not being landed by the commercial fishermen, it became necessary to significantly increase the terms of reference to include an analysis of the costs of conducting a targeted fisheries for Balistes to harvest the resource for subsequent processing and marketing of products.

An America's Development Foundation team, comprised of Mr. Michael Miller and Dr. John Sainsbury, conducted the study through on-site visits, meetings and consultations with members of the private and public sectors in Senegal, The Gambia and Guinea Bissau (See Appendix II).

The study team received very helpful cooperation and technical support from Mr. George Everett, Senior Program Leader and other staff of the United Nation's Food and Agricultural Organization of the United Nations (FAO) Fishery Committee for the Eastern Central Atlantic (CECAF) project, headquartered in Dakar, Senegal. The CECAF technical studies were an important component of the information and references important to the research and information needs of the Foundation. (See Appendix III)

The study team benefited from the cooperation and technical support of Dr. Richard Young and other staff of the Overseas Development Authority/Tropical Products Institute (TPI) of the United Kingdom. TPI's work in cooperation with the Technological Institute of Monterrey and the Mexican Fisheries Department

regarding evaluation of systems to utilize shrimp by-catch for human food consumption was useful in consideration for use with other underutilized fish, such as Balistes.

Also, the Foundation study significantly benefited from the technical support and research provided by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northwest and Alaska Fisheries Center, Utilization Research Division. The Support of Dr. John Spenilli and his staff at the Utilization Research Division was invaluable in conducting special analysis and development of Balistes products for consideration in the study.

Most importantly, America's Development Foundation is most appreciative of the special technical and administrative support provided in support of the study by Mr. Norman Pease and Mrs. Doris Martin and others of the Africa Bureau, U.S. Agency for International Development, and in the USAID missions in Senegal, The Gambia and Guinea Bissau.

PART I

2. An Overview of the Fisheries Resources in West Africa

The countries of Senegal, The Gambia and Guinea Bissau are member countries of the Eastern Central Atlantic (CECAF region) which is an area with one of the world's largest and most abundant coastal fishing grounds. The CECAF region covers the area of West Africa from Morocco to Zaire and includes several high value species (e.g., tuna, shrimp, flatfish, cephalopods) and unexploited resources. The northern zone which includes coastal countries from Morocco to Guinea have the more abundant marine resources in the CECAF region with about 75% of the estimated potential yield. Regional trade is marked by local industrial exports of fish from the northern to the more populous southern zone where demand exceeds supply of locally available fish. The bulk of production of the non-African fleets totaling about 62% of the region's total catch in 1980 was exported outside of the region, but some of that catch was exported to a few African countries in the southern zone such as Nigeria and Ivory Coast.

The overall catch in the region rose gradually to a maximum 3.8 million tons in 1977 before declining sharply in 1978 (3.3 million) and 1979 (2.8 million). This decline was due mainly to reduced fishing effort because of extension of Exclusive Economic Zones (EEZs) and the consequent exclusion of some fishing fleets from certain waters. The main decline was of Soviet and East European catches. The decline was reversed in 1980 as fishing resumed or intensified and the catch increased to 3.5 million tons in 1980 (after Soviet and European fleets increased fishing efforts on conclusion of fishing agreements with coastal countries). The Soviet Union caught 942,000 tons, or 27 percent of the total catch, in 1980. (See Table I.2.1)

The extension of the exclusive economic zones, now applied throughout the region, gave each of the coastal states both the opportunity to exploit their fisheries resources for their own benefit and the responsibility for ensuring through proper conservation and management measures that the maintenance of the living resources in the zone wasnot endangered by over exploitation. Unfortunately, the countries have not yet developed effective capabilities to prevent unauthorized foreign fishing ("poaching") or ensuring the observance of agreed measures, by both permitted foreign fishing vessels and their national fleets, in respect to management of fish stocks.

There exists a significant opportunity for West African countries to develop their capacity to harvest a larger portion of their resources. In a few countries, such as Senegal, there has been some development of local industrial fisheries. It is evident that the local industrial fisheries are principally organized for production of high value demersal species and shrimp for export market. Nevertheless, there are some products

of the industrial fisheries which are available for local consumption.

It is estimated that the artisanal small scale fishermen catch about 75% of the total weight of the fish landed by locally based vessels in West Africa. Therefore, the artisanal fisheries account for much of local supply of fish. Unfortunately, problems in processing fish at the artisanal level result in fish losses amounting to about 20 to 40% of the total catch.

Fish is a traditional and significant source of protein in most of the West African states. The per capita fish consumption has increased for all the states in the region. The region's per capita consumption of fish is about twice that of meat which is more expensive. The total demand for fish in the region has increased at about 6% per annum and is expected to continue to grow as rapidly as population increases.

The greater exploitation, on an industrial level, of West Africa's underutilized fisheries could significantly increase regional food supplies of fish protein content. Also with the adoption of more efficient processing techniques, post harvest losses could be avoided and make food supplies of fish more widely available on the market.

The harvesting and processing of Balistes, an unexploited species by local fleets, could add significantly to improve supply of food for local and regional consumption, and increase employment and foreign exchange earnings. These potential gains are especially important in view of the serious shortages, poverty and nutritional health needs existing in the countries or the region.

TABLE 2.1

Provisional indicative composition of landings (1980)

'000 tonnes

	Tuna	Crustacea	Demersal	Cephalopod	Mackerel	Small pelagic	Mixed	Total
Morocco 1/	3.0	1.5	20.0	30.0	25.0	200.0	27.5	307.0
Mauritania 2/	0.5	-	4.5	6.0	2.0	7.0	1.2	21.2
Senegal 2/	1.0	5.0	30.0	2.0	26.0	141.0	50.0	255.0
Cape Verde	5.0	0.2	1.0	-	0.8	1.0	0.4	8.4
Gambia, The	-	0.5	0.5	-	-	6.0	3.3	10.3
Guinea Bissau	-	1.5	1.5	-	-	-	2.2	5.2
Guinea	-	-	-	-	-	12.5	5.0	17.5
Sierra Leone	-	0.7	4.0	-	-	24.0	5.5	34.2
Liberia	-	-	2.0	-	-	2.5	3.3	7.8
Ivory Coast 3/	10.0	0.5	15.0	-	-	30.0	6.4	61.9
Ghana	22.0	0.5	33.0	-	30.0	80.0	21.1	186.6
Togo	-	-	2.3	-	-	2.3	-	4.6
Benin 4/	-	-	2.4	-	-	2.5	-	4.9
Nigeria	-	4.0	30.0	-	25.0	115.0	118.4	292.4
Cameroon	-	2.0	8.8	-	3.8	4.8	-	19.4
Equatorial Guinea	-	-	-	-	-	-	2.5	2.5
Gabon	-	1.5	9.0	-	-	9.0	6.9	26.4
Sao Tome and Principe	-	-	-	-	-	-	1.5	1.5
Congo	-	-	4.0	-	2.0	10.0	3.9	19.9
Zaire	-	-	0.2	-	0.5	-	-	0.7
Spain	70.0	20.0	30.0	80.0	-	150.0	77.6	427.6
Portugal	5.0	-	8.0	-	-	-	2.7	15.7
Japan	15.0	-	5.0	5.0	-	-	2.7	27.7
USSR	12.0	-	24.0	7.0	225.0	516.0	158.3	942.3
Korea	20.0	-	15.0	30.0	-	-	15.3	80.3
France	50.0	2.0	10.0	-	-	-	3.2	65.2
Others 5/	12.0	2.0	35.0	10.0	300.0	200.0	3.6	562.6
Total	225.5	41.9	295.2	170.0	640.1	1 513.6	522.5	3 408.8

1/ - Las Palmas landings included
2/ - Catch in EEZ by non-local flag vessels excluded
3/ - Lagoon catch included
4/ - Lagoon catch excluded
5/ - GDR, Romania, Bulgaria, Poland, Bermuda, Angola, Cuba, USA, Italy, Greece, Panama and Cayman Islands

Source : FAO Statistics (Provisional) and CECAF Project estimates

3. Oceanographic Conditions of the Senegal, Gambia, Guinea Bissau Region

The Senegal, Gambia, Guinea Bissau area lies between the Canary and Equatorial Regions of the Atlantic with their different temperature zones. The front between these regions varies during the year and the area of present interest is within the zone of fluctuation.

The front moves towards the north in summer and autumn, while during January the cold water moves south to the Bissagos Islands and reaches its extreme southern position below Sierra Leone in February. By May/June the front has moved to the north of Dakar, while warm salty tropical water dominates from Dakar through Guinea Bissau. During July and August warm less salty Guinea water pusher north to the northern border of Guinea Bissau, while the equatorial warm salty water exists throughout Sene-Gambia and to the north up to the cold front. By October, the cold front is again pushing south, but the Senegal, Gambia, Guinea Bissau coast remains under the influence of warm desalinated water.

In winter, surface temperatures are relatively cold as the area lies to the north of the frontal zone, between 22 to 23° C. from January to April, while during June to November they rise to more then 26° C. May and December are months of transition.

Waters over the shelf area are relatively stable with offshore currents (in depths above 100 m.) parallel to the coast and generally to the southeast up to 0.5 knots from February to May, with an inshore counter current running northeast predominantly in June, July, August, November and December. During September, October and January the southeast current probably predominates and at some seasons there is anti-clockwise rotation from the southeast offshore current to the inshore counter current.

Tides are semi-diurnal and run parallel to the coast inshore; amplitudes are variable, reaching seven meters in the rivers. Tidal currents up to 1.5 knots exist in the Bissagos Islands region, and in the river entrances up to four knots may be found. Offshore, the currents are semi-diurnal and change direction in an elliptical pattern having principal axis southeast/northeast, and with maximum velocity about 0.6 knots in depths of 30 to 50 meters. In depths greater than 50 meters the direction is perpendicular to the coast.

The area is within the southern limit of the Northwest Tradewinds during February and the northern limit of the Southwest Trades which dominate in August. In general, dominant winds are Beaufort Force two to four with a mean of Force three, while the direction varies during the year. Pilot Charts indicate

north/northeast in November through January, north/northwest from February through May, northwest/west in June, west/southwest from July through September. During October, the wind is very variable and weak (20° N, 15° W, 10° NE). Nearer the coast, the winds turn 20° to 50° towards the west and south with strong diurnal variation.

The mean annual air temperature in the area is around 25° C. with a variation of about 5.5° C. between the coldest month (February), and the warmest (November). Two different seasons are found: dry season, December to May with temperatures less than 25° C., and the rainy season from June to December with temperatures greater than 25° C.

The monsoon rains occur in the southern part of the area from May through November and in the upper part from June through October. Amounts are greater towards the south: e.g., 2500 MM. in the south of Guinea Bissau to less than one third of that amount just to the south of Dakar. See Figures I.3.1, I.3.2 and I.3.3 for oceanographic conditions.

Figure I.3.1

PRINCIPAL REGIONS OF THE ATLANTIC

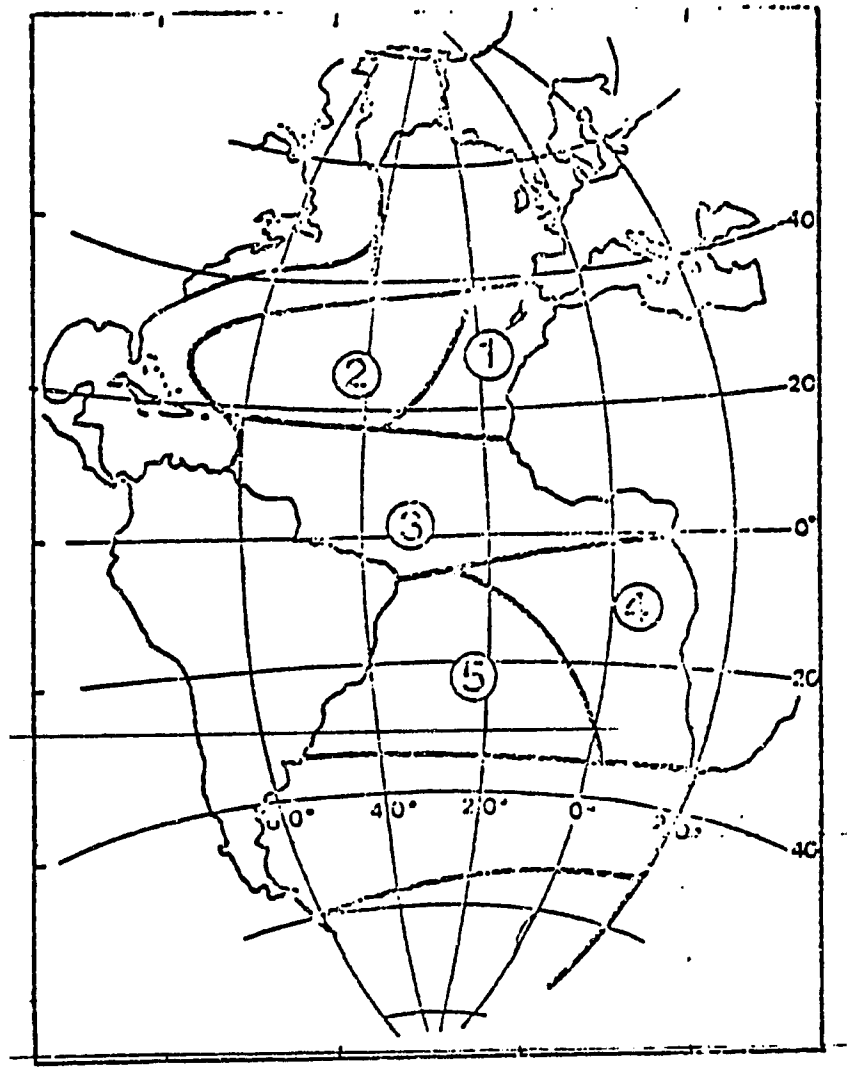
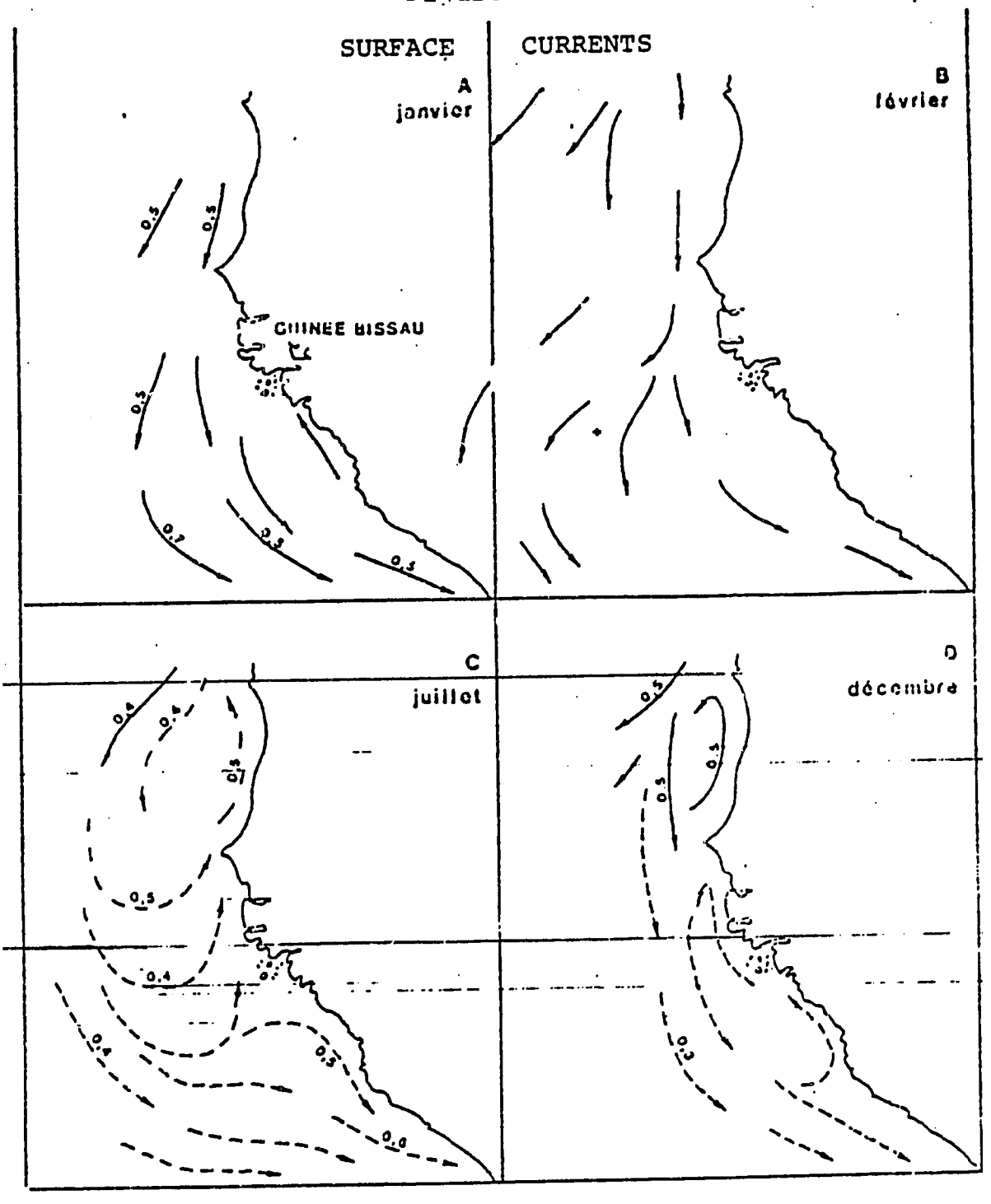
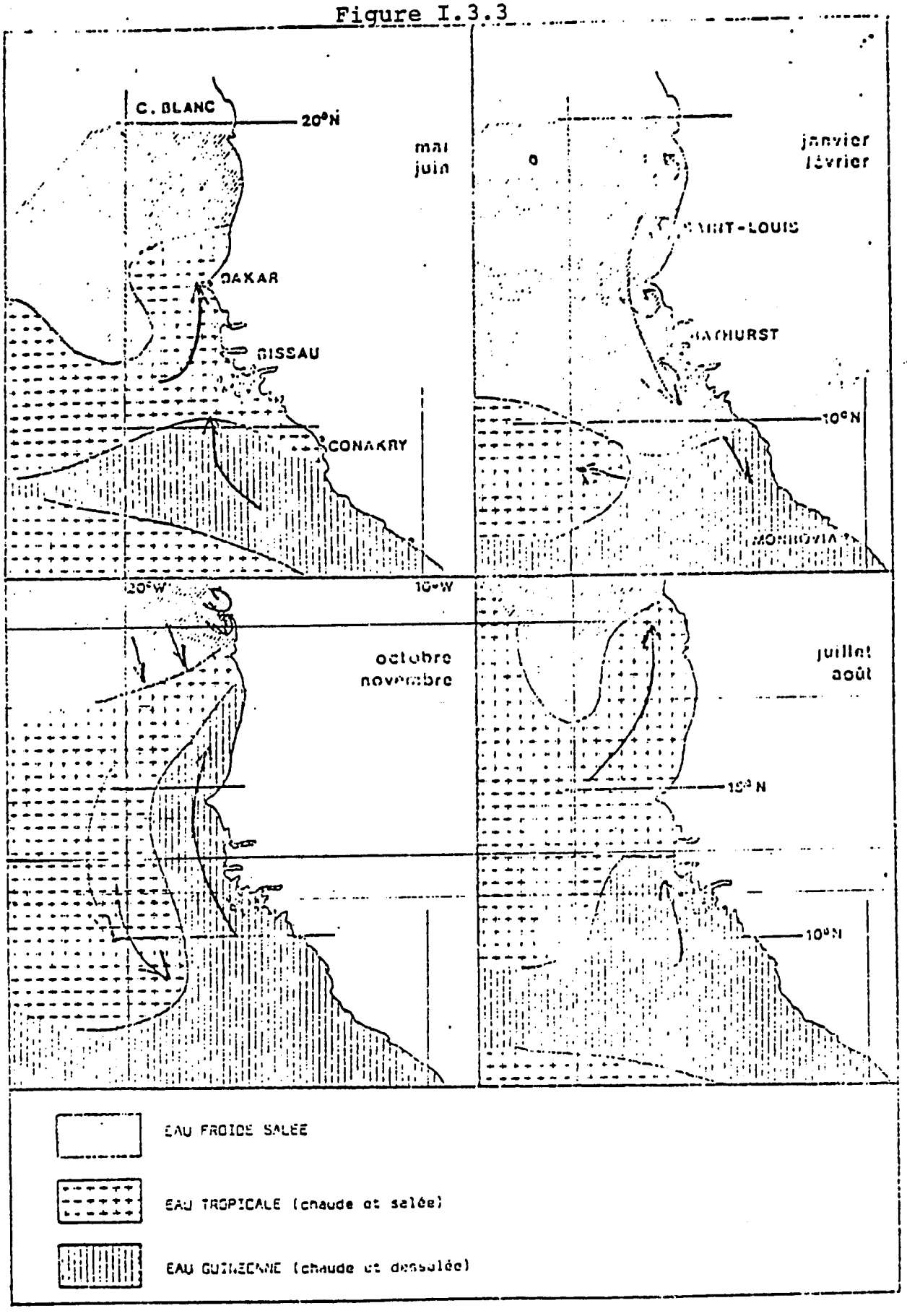


Figure I.3.2



SURFACE CURRENTS

Figure I.3.3



VARIATIONS OF SURFACE TEMPERATURES WITH THE SEASON: MOVEMENT OF WARM FRONT

4. The Balistes Resources

The Balistes Capriscus (Balistes Carolinensis in some references) is a member of the coastal strip Sparid community whose population in the Gulf of Guinea region has increased rapidly during the past ten years from a few tons reported in 1970 to a total biomass of some one and a half million tons in 1981. Some reports indicate a possible levelling off at this amount. The reasons for this explosion are little understood; the fish is a voracious eater of available food sources and one theory is that as existing stocks of highly desirable fish such as croaker and bream have become reduced through heavy fishing, the Balistes has flourished. Similar explosions of species having similar characteristics are reported to have occurred also in the China Sea and other areas.

The effect of significant exploitation of Balistes on the other fisheries is extremely complex. A likely effect of heavily fishing Balistes might be a lower level of competition and hence more abundant food sources for other species. However this is by no means clear, and studies over a number of years would be necessary to determine and monitor the actual effect.

Geographical limits of the Gulf of Guinea Balistes stocks are known to extend from Nigeria in the east to Mauritania in the north, with distribution up through Morocco. A number of surveys employing both integrating echosounder technology together with trawl samples using bottom and pelagic gear have bee undertaken in the region during the past six years. The latest of these was undertaken by the Norwegian H/V Dr. Fridtjof Nanser during May, June and September of 1981.

The Nansen survey made a particular study of Balistes and confirmed the existence of two principal stocks; a western stock with an estimated biomass of around 1,050,000 tons is centered around the Guinea/Guinea Bissau area extends from Sierra Leone in the south to (seasonally) Mauritania to the north. An eastern stock with an estimated biomass of some 500,000 tons is distributed from Nigeria in the east to the Ivory coast/ Liberia border in the west.

Within the waters of Senegal, the Gambia and Guinea Bissau, the Nansen report provided the following estimate of Balistes biomass (See Table I.4.1).

TABLE I.4.1

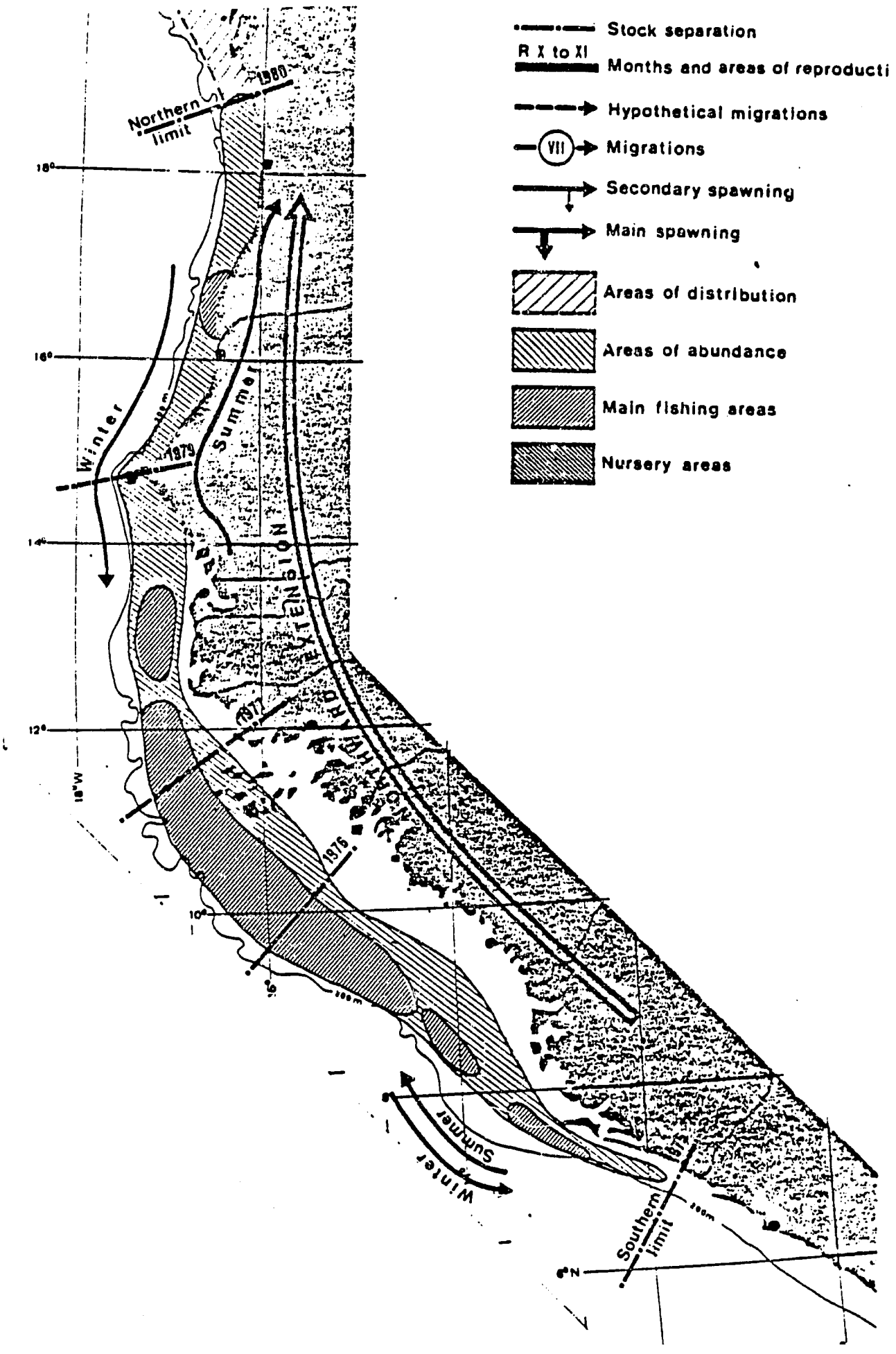
ESTIMATED BALISTES BIOMASS

Country	Shelf area between 0 - 200 m. nm.^{2}	May - June 1981		September 1981		Change May/Sept. % total biomass
		biomass '000 tons	% of total biomass	biomass '000 tons	% of total biomass	
Mauritania	10,687	0	0	2,000	0.3	+ 0.3
Senegal	9,687	64,800	5.3	87,400	12.6	+ 7.3
The Gambia		6,400	7.5	54,200	41.6	+34.1
Guinea Bissau	11,912	382,000	42.0	345,300	58.6	+16.6
TOTAL	32,286	453,200	n/a	488,900	23.5	n/a
TOTAL for SeneGambia & Guinea Bissau	21,599	453,200	20.4	486,900	34.5	+14.1

Balistes can be seen to represent a significant protion of the total biomass of the three country SeneGambia/Guinea Bissau region.

The Balistes stock has been gradually extending northward and moves seasonally northwards in summer and towards the south in winter (See Figure I.4.2). This seasonal movement is reflected in the tabular figures shown above.

Figure I.4.2


Stock separation
R X to XI
Months and areas of reproducti
Hypothetical migrations
VII
Migrations
Secondary spawning
Main spawning
Areas of distribution
Areas of abundance
Main fishing areas
Nursery areas
Northern limit
1980
1979
1977
1976
Winter
Summer
Southern limit
18°
16°
14°
12°
10°
8°N
18°W
100m

5. Biology of the Balistes

A general description of Balistes in general, will be found in the FAO Species Identification sheets included in Appendix IV.

During the period 1960 to 1970 Balistes was rarely evident in West African catches, although three small stocks in Guinea Bissau, Ghana and Gabon were discovered in 1963-64. Commencing in 1970, the Ghana stock expanded rapidly to represent 25% of coastal trawler catches by 1972, 43% in 1973 and 53% in 1974. Since 1976, Balistes represent over 80% of this catch. As noted previously, the Guinea stock has also expanded. The gabonese stock appears to be reasonably stable, although the Balistes are reported to be increasing off Angola.

Balistes is both pelagic (as younger fish) in 25 - 300 m. depths and demersal (as larger fish) between 25m. amd 80 m., with a main abundance peak around 35 to 40 m. depth. In most areas, Balistes are not present in the cold season, when it is thought that they migrate towards the warmer waters further offshore. Experience with tank housed fish indicate a toleranc of wide slainity levels of the warmer waters which push north during the summer and autumn.

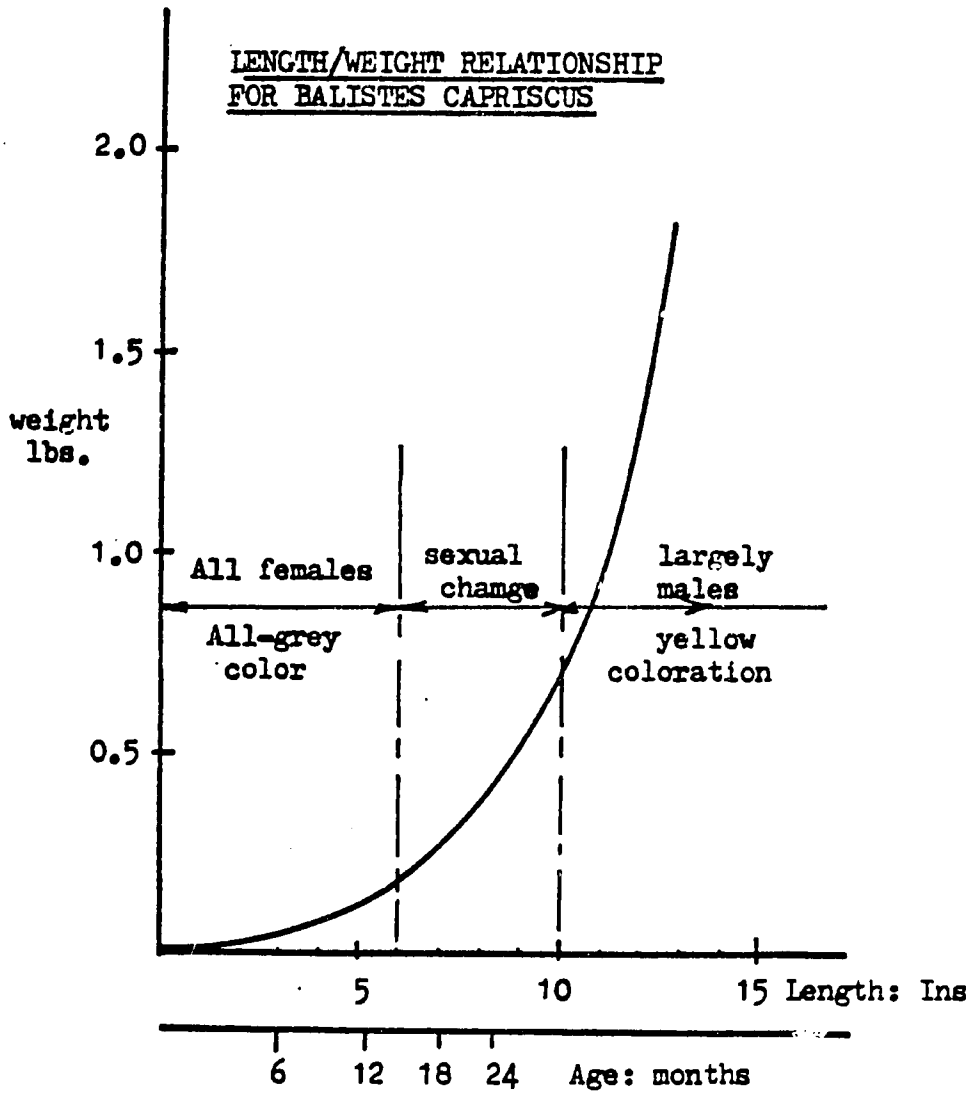
The fish is a voracious feeder and predator with a diversified diet. In the pelagic stages it eats all forms of plantton and small fish. While in the demersal stage, it will eat all types of live and dead benthos including bivalves and crabs When in captivity in a tank, they eat whatever they are given.

The Balistes appears to be sexually dimorphous. Smaller fish are female, while the large fish are predominately male, the latter being identifiable by their yellow coloring.

Some principal features of the Balistes in terms of weight size, age and sex are presented in Figure I.5.1. Maximum size reached appears to be from twelve to fourteen inches in fork length.

For the Eastern Gulf of Guinea stock there appear to be two spawning seasons, November and May/June. In Guinea Bissau and Sierra Leone, Soviet scientists have identified a spawning season from October to March.

FIGURE I.5.1


LENGTH/WEIGHT RELATIONSHIP
FOR BALISTES CAPRISCUS
2.0
1.5
weight
lbs.
1.0
0.5
All females
All-grey
color
sexual
change
largely
males
yellow
coloration
5
10
15 Length: Ins
6
12
18
24
Age: months

6. Exploitation Potential for Balistes

The Balistes has an average lifespan of five to seven years. It is often estimated that for a fish having such a lifespan, between 25% and 35% of the biomass can be harvested annually without marked deterioration of the stock.

In the case of the Guinean (Western) Balistes stock, this would give a first rough estimate of between 262,500 tons and 367,500 tons available annually.

Although the Eastern stock is fished by some bordering countries, especially Ghana, the Western stock is not utilized to any important extent by Senegal, The Gambia or Guinea Bissau. Catch from this Western stock presently comes from three sources:

a. Small amounts caught by artisanal fishermen mainly in Senegal to the north of Dakar where the fish are often caught inshore and by beach seines. The fish are often discarded, only being marketable when landings of other food species are low. Quantity is unknown, but small.

b. Discards from trawlers and purse seiners mainly in Senegal waters. Balistes are caught as a by-catch when fishing for desired species and are discarded at sea, at times forming up to one third of the total discards. Estimates are that some 10,000 to 15,000 tons are discarded each year, but it is unknown what proportion, if any, survives.

c. Catch of the Soviet Fleet fishing in Guinea Bissau waters. This catch has increased from zero in 1979 to 75,000 tons in 1981 and up to an estimated 95,000 tons in 1982. There are some reports of Soviet vessels fishing Balistes in Guinea and Sierra Leone also, but no pertinent information has been found. Balistes are, reportedly, used as food fish by the Soviets, but no information could be found concerning the manner of processing.

The total catch for the three country region may therefore reach some 110,000 tons annually, most of which is transported directly out of the region by the Soviet vessels.

Except for the coastline north of Dakar, Balistes are rarely taken by artisanal fishermen. Also the nature and distribution of artisanal landing sites throughout the three country region would make it extremely difficult to obtain and gather Balistes in the amount and at a price needed for an effective processing operation.

As the fish is presently caught in large numbers by off-shore vessels as a by-catch, it appears that fishing operations utilizing these type of vessels at the industrialized level is appropriate.

It should prove possible to increase the total catch in the Region by a factor of between two and three depending upon the level to which the stocks are being exploited (if at all) in Guinea and Sierra Leone waters. The resource therefore, appears adequate to provide for an on-going Balistes fishery based on any or all of the countries under consideration; e.g., if the average catch of a vessel were 3,000 tons per year, then a fleet of some thirty to forty vessels might be supported without affecting the resource or requiring a reduction in existing foreign fishing effort.

7. Potential for a Directed Balistes Fishery

The major source of information concerning the potential for a directed Balistes fishery in Senegal, Gambia and Guinea Bissau is to be found in the report of the R/V Dr. Fridtjof Nansen survey in the area during May/June and September 1981.

The areas of main concentration of triggerfish during the June/September surveys that year are depicted in Figure 7.1. It may be seen that the largest concentrations were found in th waters of Guinea Bissau/Guinea and off The Gambia. The "Nansen relied principally on integrating echo sounder techniques to assess the densities of fish concentrations; however, a number of bottom and pelagic trawl tows were made to assist in definin species mix, as considered necessary. The results of these tows which showed a large proportion of Balistes are plotted in Fig.I.7.1. It must be emphasized that tows were not made unless necessary to assist in interpreting the echo sounder results, so that the plots of Figure I.7.1 are of a "spot" rather than regular nature, and therefore can only be used to illustra the level of catch rate which may be possible.

The bottom trawl used was a modified 134 ft. headline shrimp trawl with 0.5 m. rubber bobbins and 40 ft. bridles, having a horizontal opening of about 25 m. and a vertical openi of about 6 m. The pelagic trawl was about 120 m. circumference with a vertical opening of 13 m. Engine horsepower was 1500 HP.

While the bottom trawl used had the same vertical opening as a modern high rise trawl used by small vessels (75 - 90 ft.), the headline length and horizontal opening were somewhat greate

It might appear from Figure I.7.1 that bottom and pelagic t are both effective in catching Balistes, and that in areas of Balistes concentration, catch rates of 1 - 5 ton/hr. can be anticipated. It may be noted also that quite reasonable catch rates are also reported outside the main Balistes concentration and that when Balistes are caught in large quantities only small amounts of other species were included in the hauls (about 8%). These findings are supported by remarks in other reference which indicate that "clean" hauls of Balistes can be taken in areas of predominance, and that trawlers avoid such areas and water depths in order to avoid catching them so far as possible.

As noted previously, Balistes are a directed fishery for the Soviet vessels working Guinea Bissau waters, as may be seen from Figure I.7.2 which shows that Balistes comprised over 50% of the catch over much of the year. It may be seen that greatest amounts of Balistes were caught in 1982 from April to July, with February and March being the poorest months. This might be expected in view of the seasonal movement of cold and warm

waters, so that it may well be possible to work a directed Balistes fishery for at least ten months each year.

Catch rates for the Soviet operation, in tons/vessel/day fished are shown in Figure I.7.3. A maximum rate of about 57 tons/vessel/day in August as opposed by some 2 to 3 tons/vessel/day in February and March, with an 11 month average of over 20 tons/vessel/day.

FIGURE I.7.1

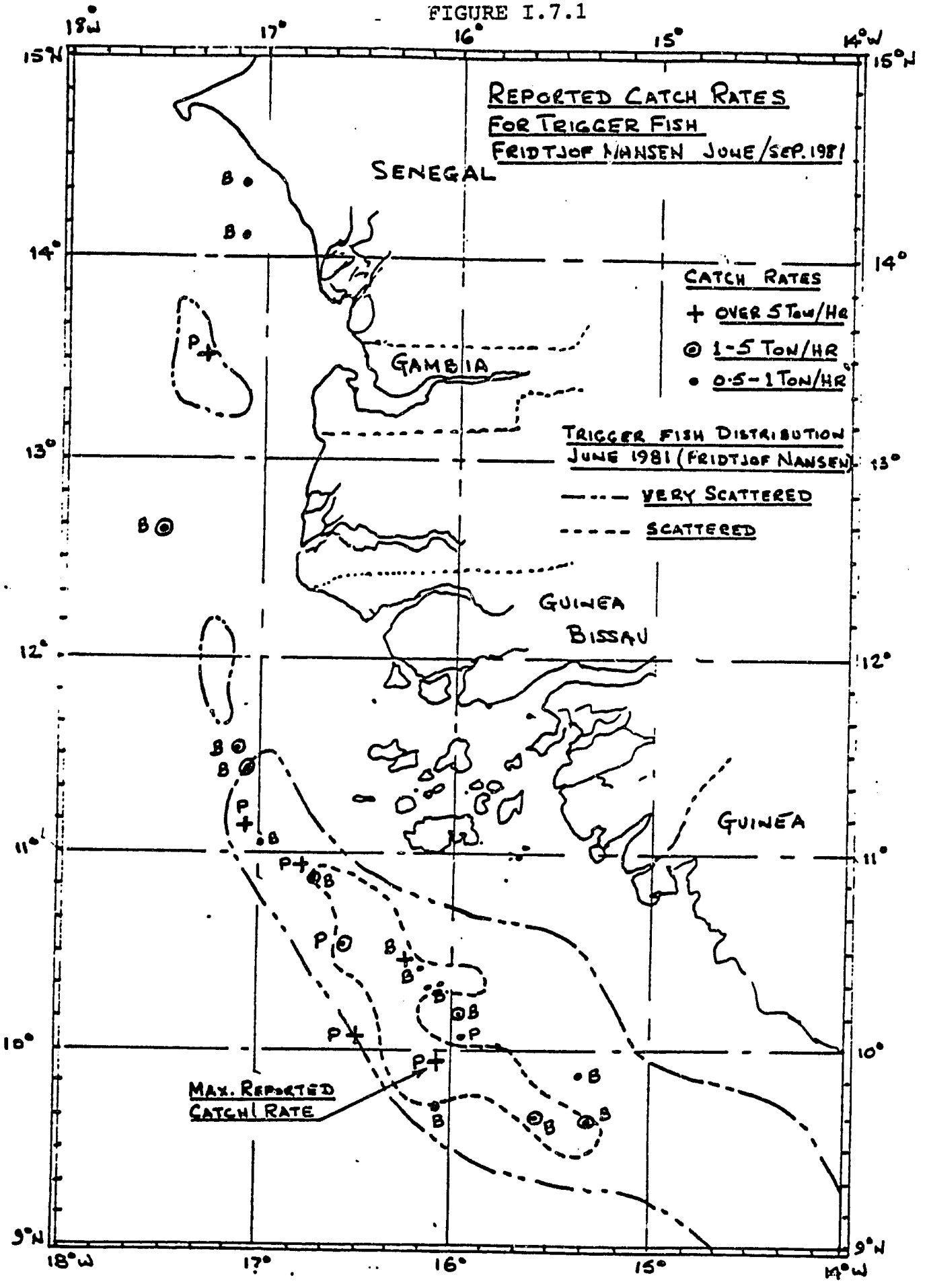

REPORTED CATCH RATES
FOR TRIGGER FISH
FRIDTJOF NANSEN JUNE/SEP. 1981
SENEGAL
GAMBIA
GUINEA BISSAU
GUINEA
CATCH RATES
+ OVER 5 TON/HR
⊙ 1-5 TON/HR
• 0.5-1 TON/HR
TRIGGER FISH DISTRIBUTION
JUNE 1981 (FRIDTJOF NANSEN)
VERY SCATTERED
SCATTERED
MAX. REPORTED
CATCH RATE
18°W
17°
16°
15°
14°W
15°N
14°
13°
12°
11°
10°
9°N

FIGURE I.7.2

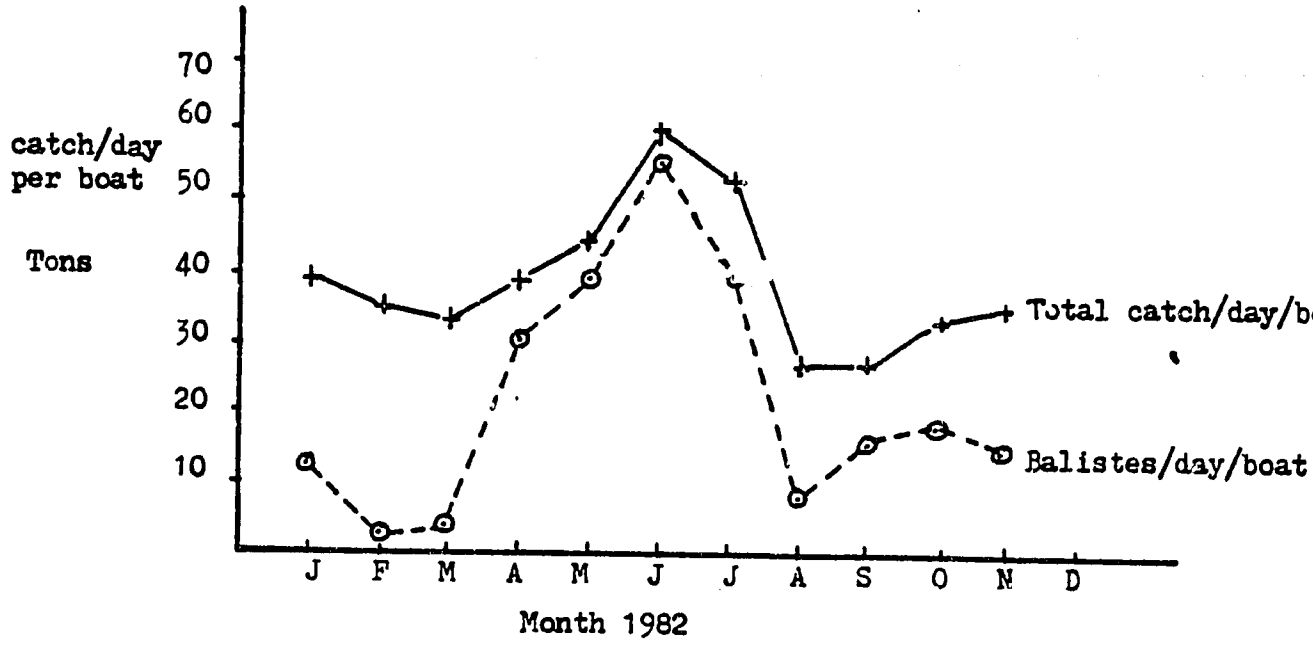
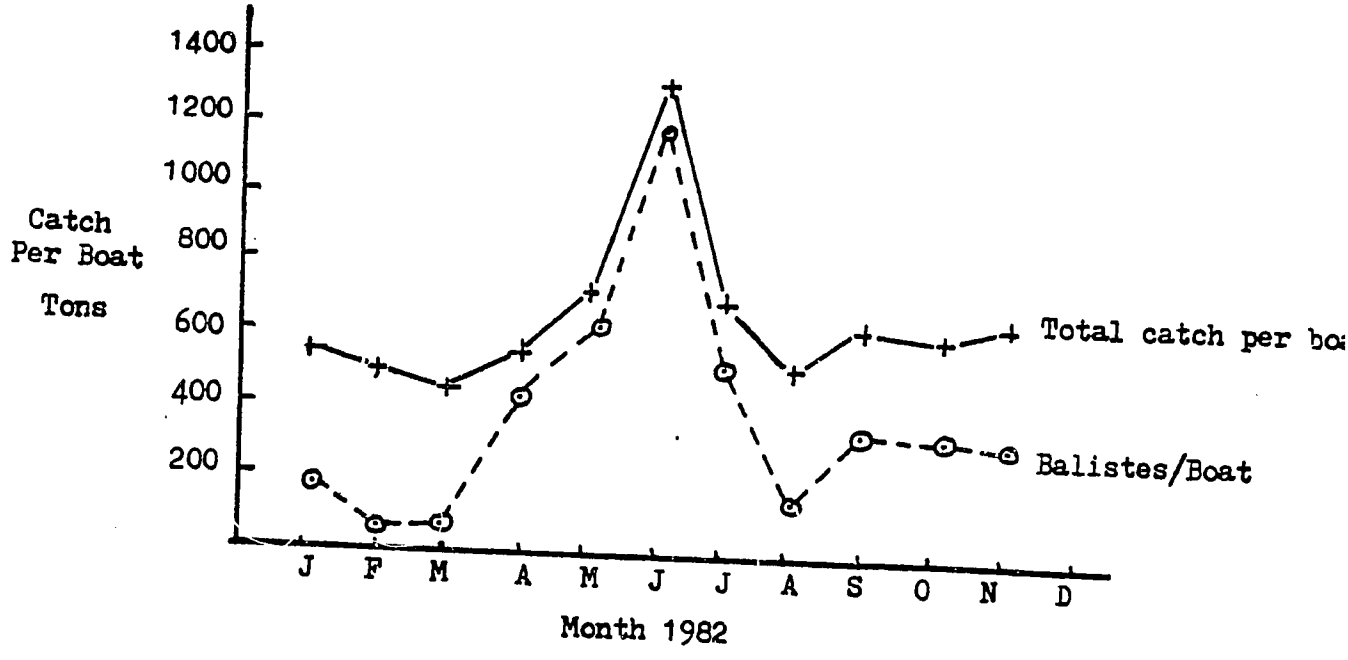


FIGURE I.7.3



8. Methodology For Calculating Landed Cost of Balistes

In order to estimate the landed raw material cost of Balistes for onward processing into the various products, it was necessary to undertake an economic analysis of targeted Balistes fishing operation for each of the three countries. Considerations regarding the various parameters involved are discussed under the following headings.

Vessels

Vessels used for the analysis were assumed to be of U.S. origin and representative of those suitable for the fishing operations. The following vessel types and costs were used to provide a range of investment possibilities: either refrigerated seawater/brine tank or iced fish holding appears suitable for use with Balistes. Therefore, costs for both of these methods were determined for both new and used vessels. Vessel investment costs includes the cost of its transport to West Africa and refurbishing in the case of the used vessel.

Principal particulars are as follows: length: 78ft., H.P.: 415, Gross Tonnage: 84 Approx.

Assumed Investment Cost:

Refrigerated Sea Water/Brine:	new vessel	$675,000
	used vessel	$475,000
Iced Fish:	new vessel	$600,000
	used vessel	$400,000

In each case financing arrangements typically available in the U.S. were assumed: one third down payment with fifteen year amortization at 15% interest on the annual declining balance. Capital costs for first year operation were calculated as follows:

Total Investment cost $	1/3 down payment $	First year interest $	First year amortization $	Total first year capital cost $
675,000	225,000	67,500	30,000	322,500
600,000	200,000	60,000	26,667	286,667
475,000	158,333	47,500	21,111	226,944
400,000	133,333	40,000	17,778	191,111

Note that first year capital costs only have been included. Second and subsequent years would reduce considerably.

Catch Rate

Due to uncertainty regarding the practical commercial catch rate, a range of rates has been used for the analysis varying from 1.25 tons/hr to 0.5 tons/hr.

It has further been assumed that a maximum load per trip of 60 tons may be carried and that the vessel continues fishing on each trip until full. The number of days fishing per year and per trip will therefore vary with catch rate. The total number of days at sea per year have been set as 240 days a year working from Dakar and 225 days a year working from The Gambia and Guinea Bissau. The differences allow for the more difficult working and support conditions together with increased down time due to delays in receipt of spares and supplies in the latter countries.

The following table I.8.1 show the basic operating and catch data used for the analysis, and based on the above considerations.

TABLE I.8.1

Catch rate tons/hr	catch/ day (12 hr.)	days to catch 60 tons	steam-ing time days	trip length days	days at sea p.a.	no. of trips p.a.	steaming days p.a.	fishing days p.a.	total catc. p.a. ton
Guinea Bissau									
1.25	15	4	1	5	225	45	45	180	2700
1.00	12	5	1	6	225	37.5	37.5	187.5	2250
0.75	9	6.66	1	7.66	225	29.4	29.4	195.6	1760.4
0.5	6	10	1	11	225	20.5	20.5	204.5	1227
The Gambia									
1.25	15	4	0.5	4.5	225	50	25	200	3000
1.00	12	5	0.5	5.5	225	40.9	20.5	204.5	2454
0.75	9	6.66	0.5	7.16	225	31.4	15.7	209.3	1883.7
0.5	6	10	0.5	10.5	225	21.4	10.7	214.3	1285.8
From Dakar									
1.25	15	4	1	5	240	48	48	192	2880
1.00	12	5	1	6	240	40	40	200	2400
0.75	9	6.66	1	7.66	240	31.3	31.3	208.7	1878.3
0.5	6	10	1	11	240	21.8	21.8	218.2	1309.2

It is calculated that about 8% catch of high value food fish will be caught during the Balistes trawling operations. This has been calculated in the analysis in addition to the Balistes catch, and its value was included as a credit which lowers the cost of landing Balistes.

Vessel Operating Costs

These include:

Fuel: Estimated consumption and price in each country

Oils: 8% of fuel cost

Gear: replacement and repair. Gear costs for a standard bottom trawler using 180 fishing days per year are approximately $57,000. Cost of gear has therefore been estimated as:

$$\frac{\text{No of fish days/yr}}{180} \times \$57{,}000$$

Ice: (if used) based on a 1:1 fish:ice ratio plus 20% allowance for loss

Insurance: taken as 3.5% of investment cost

Fishing license: varies with country

Port Taxes: varies with country

Maintenance and repair: for a new vessel taken as 5.5% of investment cost per annum. For a used vessel assumed as 8.5% of investment cost.

Crew expenses: expenses for local crew usually include food and transportation allowance. The amount established is to allow for housing and transportation costs of a U.S. origin skipper.

Crew Cost

Crew requirements vary according to the regulations, practic and remuneration arrangements customary in each country. In all cases it has been assumed that a U.S. origin captain will be engaged. The pay scale for his position has been set at $3,400 per month plus $6 per ton of fish landed. This arrangement is common in these countries. The pay of local crew is based in each case on a scale and bonus recommended by knowledgeable people.

Administration Cost:

The average administration costs for West African vessels is approximately 4% of total costs. (operating and crew costs)

Cost of Landing Balistes

The total cost of fishing in each case has been calculated as:

Total Cost = vessel operating cost + crew cost + administration cost + capital cost

The actual cost of landing Balistes is then calculated as:

Total cost of Balistes = Total Cost - Value of other fish

From this, the unit cost of Balistes was calculated as:

$/Ton.
Cents/pound
Cents/kilogram
local currency/kilogram

Note: In each case calculations use Metric tonnes which are assumed equivalent of long tons of 2240 pounds.

9. Utilization of Minced Fish Processing Technology and Potential Products

Minced fish processing technology is an appropriate technology available to transform underutilized fish into different food products. The production of minced fish is based on the mechanical separation of bone, skin, viscera and scales from the flesh of the fish. See Figures I.9. and I.9.2.

The process involves beheading, eviscerating and splitting the fish, and then putting it, after washing, through a flesh separation. A special benefit of this technology is the fact that higher yield of flesh is obtained compared to that from traditional fish filleting procedures. It is especially applicable to species such as Balistes, which, owing to their form and size, have little market value.

It has been demonstrated in several countries that recovered minced, deboned fish is a most suitable material for additional processing into a wide range of products for human consumption tailored to the requirements of a wide range of consumers.

There has been rapid development in the minced fish manufacturing field, including the production of innovative products with good market opportunities. The general trend in the manufacture of fish mince has been to produce a high quality frozen minced fish block for further processing that resembles as closely as possible the standard fillet blocks. Such frozen minced fish blocks have found a ready market for use in the preparation of high-volume food products such as fish sticks and portions.

Also, there have been advances made in the development of dried/salted products, frozen surimi and fish jelly products and canned products from deboned minces. Furthermore, minced fish has been used as raw material for production of canned products, such as pates and sausages, intended to simulate meat products already existing in the market. Industrial production of such minced fish products are under way and are planned in numerous countries.

Minced fish processing techniques can serve to transform the identity of underutilized fish into food products adapted to meet different consumer tastes. Furthermore, the use of minced fish permits the addition of anti-oxidants and other ingredients to improve product preservation. Therefore, minced fish technology can be most useful in coping with the serious problems existing throughout Africa of more economically preservin fish which is otherwise subject to serious post harvest losses. It is possible for some dried and properly packaged salted fish products to have almost indefinite shelf life.

Also, the wastes (eviscerating and deboning wastes) from

minced fish processing can be fully utilized. Such wastes may be converted into fish silage for local use as an animal feed for livestock such as poultry and swine. Feeding trials conducted in several countries have shown that silage prepared from such wastes has resulted in good growth rates in the animals utilizing the fish silage.

Recognizing the economic interests and conditions of the countries in the study, it seemed most appropriate to design an industrial plant with an integrated production system with the following products: dried minced fish products for national and regional export markets in Africa to meet nutritional food needs: production of frozen fish blocks for export principally to industrial countries to generate foreign exchange earnings; and production of fish silage for animal feed in the local market. The following plant design, incorporating such production capacities, was selected for its potential to initially serve potential markets. Of course, it is possible to elaborate the design with additional production lines to further diversify the product mix to develop additional markets as interests and conditions permit.

Figure I.9.1

A FLESH AND BONE SEPARATOR MACHINE

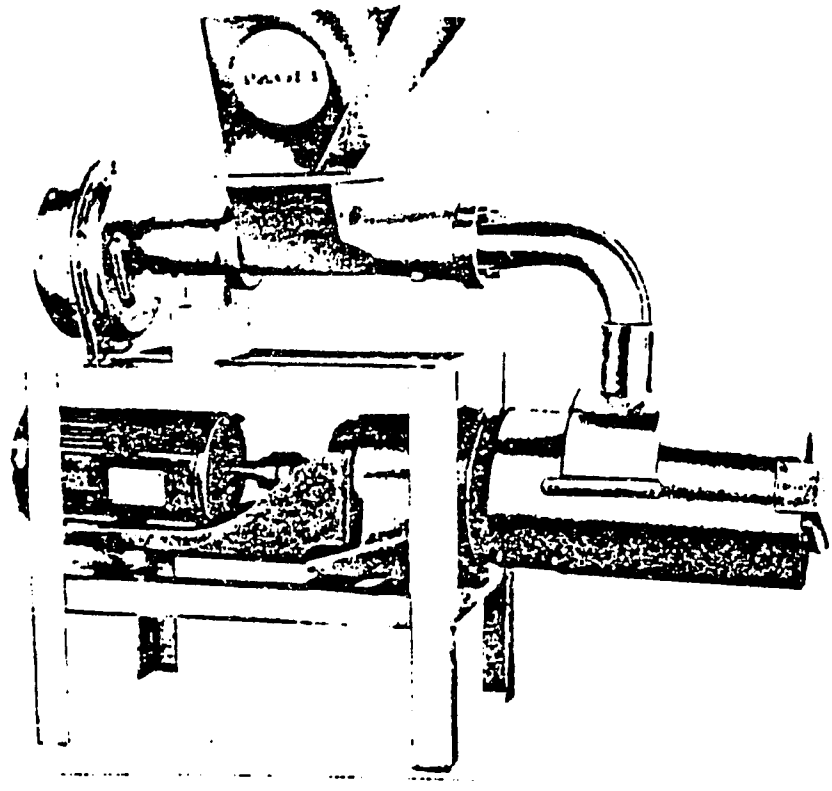


Figure I.9.2

Perfect boneless fish meat after separating of bones

Fish meat with skin and bones before separating the bo

Remaining particles of skin and bo

10. Industrial Plant Design, Operations and Production

On the basis of product development activities and relevant experience of others, the following industrial plant design was developed for the processing of Balistes into various fish products. The plant model especially benefits from the significant experience achieved in the U.K. Overseas Development Administration Tropical Products Institute's joint technical cooperation program with the Instituto Tecnologico y de Estudios Superiores de Monterrey (ITESM) to develop a system for the processing of Mexican shrimp by-catch into food products.

The following industrial plant model is designed to process 2,700 tons of Balistes per year. Therefore, the plant, based on 294 days a year operations, would process 9.18 tons of Balistes per day. On an annual basis about 976 tons of minced fish would be produced for further processing into dried fish products and frozen fish blocks and 1,724 tons of waste material (heads, viscer bones and skin) would be available for further processing into fis silage.

An illustration of the processing operations is presented in Figure I.10.1. A summary of the various stages involved in the industrial process is as follows:

Raw Material Cold Storage

Balistes would be transported via a vehicle to the processing plant from the vessel. The driver and other personnel will assist in loading, unloading, weighing and transport of the fish to the plant's cold store. The plant would be located relatively near a dock such that transport of the fish would not result in significant thawing or ice melt. A cold store of capacity 20 tons (at -30°C) would be appropriate both for storage of whole Balistes and for the storage of the frozen minced fish blocks.

Evisceration of the Raw Material

The raw material would enter the evisceration stage either by direct delivery from the vessel or from the cold store. It has been estimated that 13 eviscerators will be necessary to complete the required heading and gutting to the 9.18 tons of whole fish being processed a day. These operations would be carried out on a double conveyor belt with headed and gutted portions remaining on the top belt and wastes placed on the lower belt.

According to analytical tests performed on Balistes by the U. S. National Marine Fisheries Service for America's Development Foundation the weight of the headed and eviscerated Balistes

amounts to 54.9% of the weight of the whole fish. Therefore, the weight of the headed and eviscerated fish will amount to 5.04 tons a day and the wastes (heads and guts) will amount to 4.14 tons a day at this stage of processing.

The waste material would be collected in containers and regularly transported throughout the day to the silage plant. The gutted fish would fall directly into a washing tank with a continuous flow of chlorinated water. Thereafter, the washed eviscerated fish would be carried from the washing tanks by a conveyor to the flesh and bone separator machine. An inspector would be present to check the quality of the fish and to eliminate any undesirable species.

Flesh and Bone Separation

The headed and eviscerated fish would be fed directly to a flesh and bone separator machine. This machine would need to handle .63 tons/hr. Based on the tests performed on Balistes by the U.S. National Marine Fisheries Service for America's Development Foundation, it is estimated there will be a yield of about 66% minced flesh from the headed and gutted fish entering the flesh and bone separator. Therefore, it is estimated that the output of mince from the deboner machine would amount to about 3.33 tons/day. The wastes from the flesh and bone separator machine (bones, skin and scales) would amount to 1.71 tons/day. The mechanical flesh and bone separator equipment would be operated by a skilled technician and a trained assistant.

The minced flesh would be collected in plastic fish boxes and fed to either the processing line for production of dried fish cake or the processing line for production of frozen fish blocks. The wastes from the flesh and bone separation machine would be collected in containers and transported to the silage plant.

The general processing operations for production of the three basic products are as follows:

(1) Production of Dried Fish Products:

One-half (1.665 tons) of the total daily production of 3.33 tons of the minced fish would be continuously fed to the processing line for production of dried fish products by salting and dehydration procedures.

Mixing the Fish Mince with Salt

The mince would be thoroughly mixed with 20% salt in an industrial size mixer for about 5 minutes. The mixing time is controlled in order to effect optimum binding properties in the

salt/fish mix. The resultant mixture is the then transported to the moulder.

Moulding the Fish Cakes

The moulder would automatically press the wet salt/fish mix into cakes of a size and shape to suit market requirements. The pressed cakes would be carried from the moulder by a conveyor belt from which they would be removed by hand and placed into trays for subsequent loading into the cooker/drier. The estimated daily production of formed wet cakes is 1.998 tons/day.

Pre-Cooking/Dehydration Process

The subjection of the wet cakes to appropriate temperatures controls serves to ensure correct flavor and product texture.

Experience indicates that wet cakes require careful pre-cooking at 100°C for 1 hour followed by gentle drying for up to 36 hours at 40°C. The selection of an appropriate drying kiln with smoking capabilities would allow for the production of regular dried salted fish cakes or "smoked" dried salted fish cakes to serve consumer market tastes. The pre-cooking dehydration operation would be continuous over 24 hours and 3 shifts would be worked to load and unload the drier and pack the end product. Formed wet cakes could be buffer-stored if necessary since their high salt content would prevent any deterioration.

Packaging the End-Product

Trucks emerging from the drier would be unloaded by workers onto packing benches. Marketing tests need to be undertaken to determine local and regional preference for appropriate packaging. Experience in Mexico indicated that it was desirable to pack the fish cakes in polythene bags with a cardboard base that included instructions for food preparation, in units of two cakes a packet. The packs of cakes would be individually heat-sealed and stacked in cardboard cartons for distribution. The dried fish cake products have almost indefinite shelf life and may be dry stored for subsequent distribution. The estimated production of dried salted cakes is about .618 tons a day and 182 tons a year.

(2) Production of Frozen Minced Fish Blocks

The other half (1.665 tons) of the total daily production of 3.33 tons of minced fish would be continuously fed to the processing line for production of frozen minced fish blocks.

Mixing of the Minced Fish with Additives

The minced fish would be thoroughly mixed with additives such as sodium chloride, sugar, phosphates and water which serves as a formulated binder (about 7.5% concentrate) to bond the minced fish particles together, giving a smooth, moist, cohesive texture. The binder and the minced flesh are mixed in an industrial mixer and the mix produced is prepared for packing into freezing trays.

Packing the Minced Fish for Freezing

The mix of minced fish and binder are packed into cartons of various sizes of market requirements, placed in a plate freezer and fast frozen into blocks.

Storage of the Frozen Minced Fish Blocks

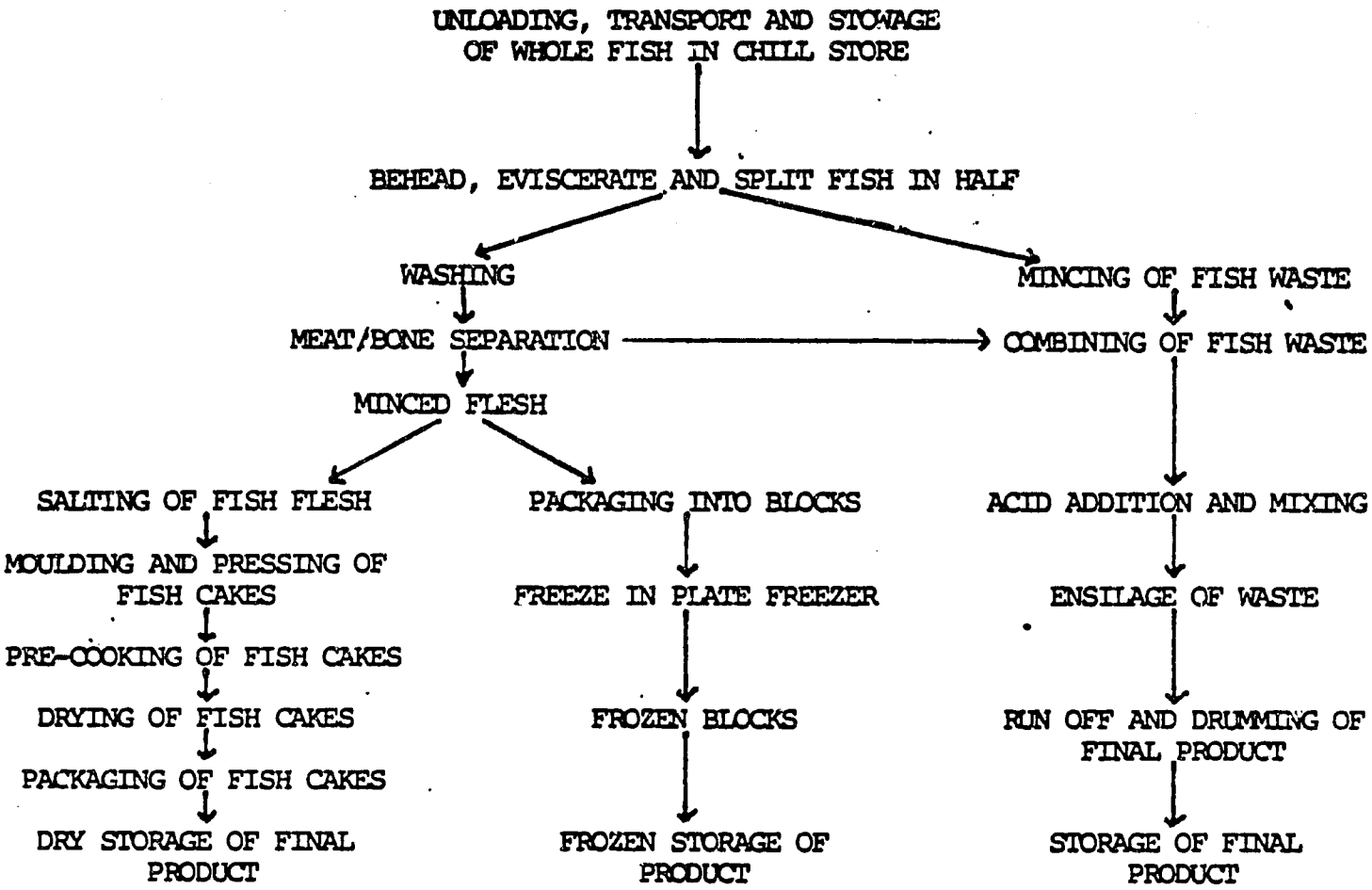
The frozen minced fish blocks are transported to the cold store and stored at -18°C or lower until market distribution. Experience indicates that such frozen minced fish blocks have a storage life of six to nine months. The estimated production of frozen minced fish blocks is about 1.79 tons a day and 526 tons a year.

(3) Fish Silage Production from Processing Wastes

The wastes utilized in the production of fish silage derives from the total amount of wastes resulting from heading and eviscerating the fish (4.14 tons/day) and from the process of flesh and bone separation (1.71 tons/day). The total daily amount of wastes (5.85 tons) would be continuously collected and transferred to the silage plant.

The plant consists of a polypropylene tank sunk in the ground and surmounted by a metal grill which supports a chopper pump submerged in the liquid fish broth in the tank. The fish wastes are dropped through the grill and hydrolysis initiated by the addition of formic acid used for ensiling at a concentration of 3.5%. After the completion of hydrolysis requiring about 24 hours, the silage may be pumped out of the tank into non-corrosive drums for storage and distribution. The product could be distributed to farmers in the same drums which would be returned to the plant when empty. The estimated production of silage is about 6.054 tons a day and 1780 tons a year.

Figure I.10.1


UNLOADING, TRANSPORT AND STOWAGE OF WHOLE FISH IN CHILL STORE
BEHEAD, EVISCERATE AND SPLIT FISH IN HALF
WASHING
MINCING OF FISH WASTE
MEAT/BONE SEPARATION
COMBINING OF FISH WASTE
MINCED FLESH
SALTING OF FISH FLESH
PACKAGING INTO BLOCKS
ACID ADDITION AND MIXING
MOULDING AND PRESSING OF FISH CAKES
FREEZE IN PLATE FREEZER
ENSILAGE OF WASTE
PRE-COOKING OF FISH CAKES
DRYING OF FISH CAKES
FROZEN BLOCKS
RUN OFF AND DRUMMING OF FINAL PRODUCT
PACKAGING OF FISH CAKES
DRY STORAGE OF FINAL PRODUCT
FROZEN STORAGE OF PRODUCT
STORAGE OF FINAL PRODUCT

11. Investment Capital and Operating Costs of Processing Plant

The investment capital and operating costs for the processing plant are calculated on a basis that all such costs are necessary for the new enterprise. To the degree that the new processing plant operations would become part of an existing fish processing plant and/or had other facilities and resources available to it, it would be possible to reduce some capital and operating costs.

Capital Costs

The investment capital required to establish the processing plant amounts to $1,051,704. The different components of these costs are presented in Table I.11.1 The land and buildings amount to $398,000 or 37.8% of the total costs. The processing equipment amounts to $385,204 or 36.6% of the total costs. Vehicles and other equipment and inventory for the plant amount to $95,500 or 9.1% of the total costs. The cost of services to establish the enterprise and required working capital amounts to $173,000 or 16.4% of the total costs.

Operating Costs

The annual operating costs of the processing plant amounts to $471,055. The major operating costs, including personnel, consumables, and services are presented in Table I.11.2

The cost of personnel, including social benefits amounts to $166,000 or 35.2%. The plant would employ forty-five employees including management and operations personnel. The General Manager would be an expatriate experienced in fisheries, minced fish technology and marketing of products. He would serve to direct and train personnel in the management and operations of the enterprise and develop the Assistant Manager, a national of the country, to eventually take over the General Manager's responsibilities. The breakdown of the personnel costs is presented in Table I.11.3

The cost for consumables represents the most expensive operating cost since it amounts to $211,597 or 44.9% of such costs. The data in Table I.11.4 reflects that most of the consumables comprise chemicals utilized in production of product and packing materials

TABLE I.11.1

CAPITAL COSTS OF PROCESSING PLANT

1.	Land		$ 78,000
2.	Buildings		320,000
3.	Processing Equipment		
	A. Fish Handling/Storage		$ 28,760
	Platform Scales/Carts	$ 1,850	
	Cold store	26,910	
	B. Raw Material Preparation		$ 83,630
	Conveyors	$ 4,840	
	Waste containers	1,010	
	Washing tanks	1,250	
	Deboner	74,220	
	Processing hand tools	2,300	
	C. Dried Fish Cakes Production		$151,134
	Mixer	$ 7,690	
	Moulder	27,150	
	Conveyor	1,120	
	Steam Sterilizing Tank	1,010	
	Cooker/Dryers (2)	112,500	
	Packing benches	520	
	Packing sealers	720	
	Packing scales	424	
	D. Frozen Fish Blocks Production		$ 65,900
	Conveyor	$ 1,120	
	Mixer	7,690	
	Trays & Covers	4,300	
	Plate Freezer	52,790	
	E. Silage Production		$ 55,780
	Plant equipment	$ 49,000	
	Drums	6,780	
4.	Vehicles		$ 45,000
	Insulated Truck	$ 24,000	
	Fork-lift Truck	11,000	
	Automobile	10,000	
5.	Other Equipment and Inventory		$ 50,500
	Standby generator	$ 20,000	
	Mechanical tools	3,200	
	Spare Parts Inventory	10,180	
	Protective clothing for workers	4,460	
	Office equipment & furniture	8,600	
	Mobile steam cleaner	4,060	
6.	Services		$ 58,000
	Pre-investment technical costs	$ 23,000	
	Legal and administrative	10,000	
	Misc. Pre-Operating expenses	25,000	
7.	Working Capital		$115,000
		TOTAL	$ 1,051,704

TABLE I.11.2

ANNUAL OPERATING COSTS OF PROCESSING PLANT

1.	Personnel[1]	$ 166,000
2.	Electricity[2]	54,000
3.	Fuel & Oil[3]	24,700
4.	Water[4]	1,460
5.	Other consumables[5]	211,597
6.	Insurance[6]	10,798
7.	External Maintenance	2,500
	TOTAL	$ 471,055

Notes:

1- See table I.11.3

2- Annual utilization of about 45,000 KWH of electricity

3- Annual utilization of about 13,000 gallons of fuel oil and vehicle fuel

4- Annual utilization of about 1,320,000 gallons

5- See table I.11.4

6- Buildings, plant equipment and spares insured at 1% of value and vehicles insured at 5% of value per annum

TABLE I.11.3

ANNUAL PERSONNEL COSTS[1]

PROCESSING PLANT

Administration	
General Manager (expatriate)	$44,000
Assistant Manager	32,000
Office Manager	6,000
Bookkeeper	4,800
Secretary	2,500
Other (2 x $ 1,500/yr)	3,000
Plant Operations	
Supervisors/Technicians (4 x $4,800/yr)	$19,200
Processing (28 x $1,500/yr)	42,000
Maintenance (2 x $2,000/yr)	4,000
Drivers (2 x $2,000/yr)	4,000
Other (3 x $1,500/yr)	4,500
	$ 166,000

(1) Total of forty-five employees

TABLE I.11.4

CHEMICALS, PACKING MATERIALS AND OTHER CONSUMABLES

PROCESSING PLANT

Ice	31,360
Salt and other Additives	26,000
Packing Materials	62,896
Formic Acid	59,811
Caustic Soda	1,200
Spares	14,130
Protective Clothing	8,200
Miscellaneous	8,000
	$ 211,597

12. Markets, Prices and Income from Products

It is useful to recognize the opportunities for marketing minced fish products and by-products in the context of the general marketing environment for fishery products which is characterized by several factors. First, is the growing world wide pressure on existing food resources and shortage of animal protein which increased supply of seafood can play a major role. Second, within the general context of rising food prices and worldwide inflationary trends, there is a growing pressure and search for cheaper food items. Third, due to the growing cost-price squeeze, producers are increasingly looking for alternate and cheaper raw materials in order to develop more reasonably priced consumer products. Fourth, is the growing cross-elasticities within the various components of the food sector and particularly between meat and fish. The consumer is becoming more and more price sensitive and appears to be switching from one protein source to another primarily on the basis of price. Fifth, a net result of the developing countries extension of the Exclusive Economic Zones (EEZs) will be an increase in the growth of world fisheries trade. It will be necessary for some industrialized countries which have substantial import requirements to increase their fisheries imports to maintain their existing levels of consumption and to meet increased demand for products.

In national and export markets, the marketing of minced fish has numerous strengths. For example, the production of minced fish blocks requires only one-third the amount of labor that goes into the regular fillet block. Therefore, minced fish blocks provides a fairly inexpensive source of raw material, in comparison with the traditional fillet blocks, for the production of fish sticks, fish portions and related convenience foods.

Another major marketing opportunity relates to the high degree of versatility for utilization of minced fish. It can be easily blended with other ingredients such as vegetables, meat, cereals, etc. to suit the tastes of different markets and consumers. In the context of present and future food prices, minced fish products can represent high value at a relatively low price. This is a fundamental strength of the product.

The production in West Africa of minced fish products and by-products requires an understanding of the actual and potential markets for these products. In general, such markets fall basically into two categories as follows:

(1) the export markets serving consumers with purchasing power in the industrialized countries and several countries in Africa and

(2) the national and regional export markets serving principally the large rural inland populations who have limited purchasing power but must spend most of their income on food.

The different national, regional and export markets for frozen minced fish blocks, dried fish products and fish silage are discussed below.

Frozen Fish Blocks

The growing markets for minced frozen fish blocks are already established in many industrialized countries such as in the United States, Europe and Japan. Except for Japan, the general trend in the manufacture of minced fish has been to produce a frozen minced fish block for further processing into high volume products such as fish sticks, portions and various minced fish based products. It is possible to effectivel compete in this growing international market with the production of products that maintain quality, assured shelf-life and hygienic packaging controls to meet internationally acceptable food standards.

The size of the export markets in the industrialized countries is reflected in their growing imports of such minced fish blocks. For example, in 1982, the U.S. imported 142,296 m. tons of regular and frozen minced fish blocks and slabs valued at $273.9 million. Of that total, minced fish blocks and slabs amounted to 13,714 m. tons and was valued at $15.0 million. Over the past eight years, U.S. imports of regular and minced fish blocks represented more than 99% of its total supply of such products. Japan's use of minced fish is very considerable as evidenced by the fact that its production of frozen surimi in 1980 was about 400,000 m. tons.

Of course, the price for the frozen minced fish blocks composed of Balistes must be determined in the marketplace. However, since Balistes is a fish with high quality lean white flesh, it is considered likely that frozen fish blocks comprised of the species should easily gain market acceptance. In regard to price for product, available U.S. data indicates that the average FOB price for frozen minced fish blocks of other fish species to be 48.84¢ lb or $1,094 a m. ton. Therefore, the annual projected plant production of 526 tons of frozen fish blocks should yield income of $574,444 to the enterprise.

Also it may be possible to develop an export market for the frozen minced fish blocks in several countries in Africa, such as Nigeria and the Ivory Coast. Nigeria offers the most promising market prospects. In 1980, Nigeria consumed an estimated 1,500,000 tons of fish of which about 900,000 tons were imported. This was almost exclusively whole frozen fish. Since Nigeria has the largest population in Africa (around 77 million in 1980) and large cold storage capacity, it will continue to be a growing market for frozen fish imports. It has been estimated that by 1985 Nigerian total consumption of fish will reach more than 2 million tons and about 1.4 million tons will have to be

imported. At present, Ivory Coast is the second largest importer of fish in West Africa, with imports in 1980 of about 100,000 tons per year. The Ivory Coast imports about one-half its consumption. Furthermore, since domestic production is not expected to significantly increase, the country will have to rely on imports (estimated at 150,000 tons in 1985) to satisfy further increases in demand.

However, it must be recognized that the large amount of frozen fish imports into Nigeria, Ivory Coast and other West African countries consists of frozen whole fish. Consumer education and market development would be necessary to successfully introduce frozen minced fish blocks into such countries and other African markets that have adequate capacities for cold storage. Although the minced fish product is nontraditional, its physical attributes permit it to be adapted into the major traditional meals of the region (e.g. fish soups). As in other countries, there exists a potential market to sell the product directly to institutions and some urban consumers in the form of small blocks for either daily supply or for their own cold storage.

The price for frozen minced fish blocks to be sold in Africa would have to be determined in the marketplace. However, for reference purposes it is important to note that the Nigerian government has imposed a ceiling price of $580 ton CIF for whole frozen fish. The ceiling price is not applicable to fish fillets, or other processed fish which is allowed to command higher prices. The main purpose of the ceiling price is to reportedly control the amount of foreign exchange utilized each month for fish imports. It is a fact that such a ceiling price has a marked influence on the type of fish imported and encourages development of a market for processed fish, which could include frozen fish blocks and dried fish cakes.

Dried Fish Cakes

Indications are that major markets exist throughout West Africa for dried fish products to meet the food needs especially of the large rural inland populations. Although there are consumer preferences for fresh fish, dried fish continues to be the mainstay of local fish trade and consumption. The production of cured fish at the artisanal level is the only means to preserve and transport fish to many rural markets which lack cold storage facilities. Unfortunately, there is a serious inadequate supply of dried fish products. The existing supply of dried fish products is of poor quality and is much more expensive than fresh fish due to various costs.

The artisanal fisheries process the cured fish which is utilized for local consumption. Smoking is the most widespread method of preservation and in some countries in West Africa,

smoke-cured fish, together with dry salted, sun-dried and fermented fish may constitute more than half the total artisanal supply of fish for local market. However, the traditional process of smoking is very primitive and the products are susceptible to spoilage by bacteria, or fungi or destruction by insects. As noted before, in many countries the total spoilage amounts to about 20-40% of total fish processed. Such losses are due to spoilage rendering the fish or fish products unfit to eat, to physical destruction and to the lowering of the nutritional value of the product.

The processing and distribution of cured fish is carried out at the artisanal level with the transport of cured fish from often remote and isolated fishing camps to various regional population centers and rural inland markets. As a consequence of the problems involved in the processing and distribution of cured fish, it is generally available only in limited supply and a prices significantly higher than fresh fish.

There are no established prices for cured fish. However, indications are that the regional market prices for dried fish appear to be in general about six times the price for the same weight of whole fresh fish. For example, in Guinea Bissau, the price of the lowest grade fresh fish set at 22.50 pesos a kilo has a price of 135 pesos a kilo or $3.38 a kilo ($1.54 a lb.) in the form of dried fish. The general price reference is that it takes about three kilos of fresh fish to make one kilo of dried fish and such costs are doubled to cover the additional costs of processing and marketing the dried fish product. Of course, the price of dried fish varies in the different countries according to the available supply of fresh fish and prices are seasonally established for the product for whatever the market can bear.

Various local distributors in the countries indicated that with consumer education and market development, there would be a large national and regional African market for improved dried fish products as the dried fish cakes. Allowing for a mark up by distributors and middlemen, it was estimated that the enterprise could sell the dried fish cakes for about $2.87 a kilo ($1.30 a lb.). Therefore, the annual projected production of 182 tons a year of dried fish cakes could yield an income of $522,340.

Fish Silage

Indications are that a local market should exist for the production of fish silage as an alternative to fish meal for use in animal feed, especially for poultry. The market for fish silage (20% crude protein) does depend on the size and growth of the local animal fattening industry in each country. The

demand for the product will derive from the recognition of its cost-effective, profitable use in mixed foods for poultry, livestock and farmed fish.

For countries, such as The Gambia and Guinea Bissau, the protein food supplies (mostly fish meal) for animal feed purposes must be imported with scarce foreign exchange and consequently, supply of such products is both expensive and difficult to secure. On the other hand, a country such as Senegal which may have an expensive fish plant, produce fish meal for export to industrialized countries to generate hard foreign exchange earnings. The product is generally not available to local livestock producers.

Fish silage can be very competitively priced with fish meal as feed for animals that provide poultry, meat, egg, fish and milk products for human consumption. Very favorable results in feeding and animal growth rate trials, proving the nutritive value of the fish silage product, have been conducted in many parts of the world. Given the positive results in many different countries using fish silage, it is likely that the fish silage produced could prove a very important local source of animal feed for the countries of West Africe. In many cases, it can help to significantly reduce the foreign exchange costs of importing fish meal.

The distribution of fish silage is more difficult than fish meal because it is a liquid feed and must be transported in drums. However, it is possible that the solar drying of fish silage with cereal mixtures may be a helpful means in some areas of providing a more easily transported animal feed. Fish silage would appear most useful for large and medium scale farms formulating their own feed mixtures. The introduction of fish silage with consumer education and market development should secure a place in the local markets of the countries.

Recognizing that the European price of fishmeal in 1982 (about 60% protein) was $368 a metric ton, it is estimated that locally produced fish silage (20% protein) would be competively priced at $123 a metric ton when considering the foreign exchange savings for the countries in West Africa. Future prices should improve since such calculations were based on a period when the world prices of fish meal probably hit their all time lowest levels.

PART II

REVIEW OF INDIVIDUAL COUNTRIES

A. GUINEA BISSAU

B. THE GAMBIA

C. SENEGAL

A. GUINEA BISSAU

1. Fisheries Situation

With a coastline of 350 KM and an extensive continental shelf are (45,000 KM^2), Guinea Bissau has potentially significant fisheries resources which, if adequately developed, would substantially contribute to the country's nutritional food and economic needs. The country's fishing potential has been estimated at between 250,000 and 350,000 tons of annual catch. The sector reportedly contributes about 3.4% GNP, including an industrial production of about 3,700 tons and a subsistance production of about 3,800 tons.

Although subsistence fishing has been practiced in Guinea Bissau for centuries and fish is a common component in the diet of its people, industrial fisheries exploitation significantly started only in 1975. Lacking qualified labor, capital, and experience in industrial fishing, the country negotiated a set of bilateral agreements with other countries which provided for the granting of fishing permits, the setting up of mixed enterprises, and the provision of technical assistance and training to its workers. So far, agreements have been reached with about 15 countries, including the USSR, France, Algeria, Portugal, Senegal, and more recently with the EEC countries. In 1979, 54 foreign boats were authorized to fish in Guinea Bissau waters, representing roughly 80-90,000 tons of catch. Fishing permits are granted to foreign boats against a previously accorded fee per gross weight ton (gwt). The boats are thereby authorized to operate in Guinea Bissau territorial waters and catch a "theoretically" fixed amount of fish and shrimp. However, the Guinea Bissau Government has little capability to enforce the terms of such agreements with respect to total catch and limits imposed on specific species.

Pricing policy for the permits depends on the terms of each bilateral agreement. A fixed price per gross weight ton (gwt) is the most common practice, ranging from US$100 for the Portuguese vessels to US$300 for the EEC vessels. Total revenues from fishing permits are estimated at US$1.2 million in 1979, and enter the government budget as non-tax revenues to finance government current expenditures. This total excluded the revenues from fishing permits granted to the Soviet vessels (1% of the total catch), which have been invested in the recent construction by a Spanish company of a government owned cold storage plant in Bissau.

2. Structure of the Fishing Sector

The fishing sector in Guinea Bissau is characterized by the following features: (1) a generous policy of extending fishing permits under bilateral agreements; (2) a small but growing industrial sector, comprised of three mixed enterprises and one private enterprise; and (3) a large subsistance artisanal fishing sector.

Industrial Fisheries/Public Sector

Since the country's independence in 1974, three mixed enterprises were established with 51% participation by the Guinea Bissau government as follows: (1) Estrello do Mar, formed in 1975 with the USSR and limited to commercializing the catch of eight leased boats (four Soviet and four Guinea Bissau); (2) Guialp, formed in 1976 with Algeria with eight boats provided by that country and (3) Sema-Pesca, formed in 1979 with France and Senegal (the Senegalese party subsequently withdrew) which operated with about 5 small boats. Both Guialpe and Sema-Pesca have become inactive due to various financial and management difficulties. Therefore Estrello do Mar remains the only mixed company still operating.

Industrial Fisheries/Private Sector

The private sector consists of one enterprise, Eugenio Rosado Peralta, dating back to colonial times. The company was closed after independence and a fleet of net-equipped canoes was offered to its employees in 1975. The company fisheries catch declined from 1,480 to 27 tons between 1976 and 1980. With the return and management of the former owner to Bissau, the company has begun to recover. It is renovating the one old vessel it formerly used for offshore fishing and is operating one river transport vessel to collect fish from artisanal fisheries for the Bissau market. The company has a small icemaking capability and is rehabilitating its old shipyard. It employs 78 people, of which 32 are fishermen operating their canoes and selling part of their catch to the company.

Artisanal Fishing

Artisanal fishing, mostly for subsistence, is practiced by about 2,000 fishermen working in inland waters and along the seacoast. The artisanal fleet had been estimated at 826 boats, 700 of which are non-motorized. In 1979, artisanal catch was estimated at 3,700 tons, which represented 51% of the total national catch.

The development of artisanal fishing has been strongly supported by the Government. The first project with thi aim started in 1979 in the Bijagos Archipelago financed by SIDA. It

provides boats, motors and nets to 124 traditional fishermen, two transportation boats and for the construction of a 50-ton cold storage facility. A second artisanal development project financed initially by USAID and afterwards by the EEC, began in 1981 in the Cacheu region. Both projects are designed to increase production and improve the fisherman's catch so their fish can be made available on the domestic market.

3. Production and Marketing

Production of fish and shrimp grew from insignificant levels before independence, to 3,571 tons and 568 tons, respectively in 1977 (see table II.3.1). Fish production has been declining since 1978, when many trawlers were immobilized for repairs and re-equipped for shrimping. This change probably reflects the higher value and wider acceptance of shrimp in the export market. The share of fisheries products in total exports has been increasing since independence, and in 1980 they accounted for 35% of total exports (31% were shrimp). Fish exports have declined but the rise in prices and volume of shrimp exported increased the total value of fishery product exports by more than five times between 1975 and 1980. The traditional sector contributes some 66% of domestic consumption of fish. There are no exports from this sector. Domestic sales (estimated as a residual) are around 5,500 tons a year, with almost no shrimp being sold on the domestic market (25 tons in 1978). Fish processing beyond the simple freezing for export should be promoted. Out of the annual catch potential of 300,000 tons, only 7,500 tons are actually landed in Bissau.

The landings of Estrello do Mar vessels are stored as frozen whole fish at Guialp's cold storage facilities (since it does not have its own such facilities) and local sales of the fish are made from there and through the city's few retail markets. Even if an estimated 89,000 tons of fish are caught by the Soviets under licensing, there is still substantial opportunity for further increase in fishing production.

The landings from the artisanal fisheries are also brought to Bissau and sold through the market. The artisanal fishermen may work throughout the river system selling their fish locally. What fish marketing is done in the interior of the country is practiced by small private traders, but the lack of storage and transportation facilities constitutes a serious constraint to the provision of fish to the interior of the country.

Current statistics regarding fish catch and consumption are unavailable. However, government officials and other sources emphasize that there is insufficient production to serve the needs of the people in Bissau and especially the population in the interior of the country. It has been estimated that only about 1/3 of the country's potential fish consumption is being

met. Some statistics indicated that in Guinea Bissau per capita consumption is around 7.4 kg/year, as compared to 22 kg/year in Cape Verde and 44 kg/year in Senegal.

The prices for fresh/frozen fish in Guinea Bissau are established by the government according to the following classes:

		% of Total
Class 1	50,00 PG	5%
2	40,00 PG	15%
3	30,00 PG	10%
4	22,50 PG	70%

A proportion of the fish landed is processed at the local artisanal level into sundried products or occasionally smoked. The price of such dried fish is not government controlled and is established through the market forces. Due to the basic constraints in Guinea Bissau of inadequate production for local markets and problems in transport to markets especially in the interior, there exists a significant unmet demand for cured fish products throughout the country.

TABLE II.3.1

FISH PRODUCTION AND MARKETING, 1975-79
(in metric tons)

	1975	1976	1977	1978	1979	1980 1/
Production:						
Industrial	1,271 2/	5,591	4,139	3,818	3,652	3,503
of which:						
Fish	1,271	5,323	3,571	3,127	2,950	2,585
Shrimp	-	268	568	691	702	918
Artisanal 3/	1,784	2,141	2,570	3,083	3,772	5,140
Total	3,055	7,732	6,709	6,901	7,352	8,642
Exports:						
Fish	433	2,013	1,928	838	739	..
Shrimp	-	179	545	666	742	..
Total	433	2,192	2,473	1,504	1,481	..
Available for Domestic Consumption	2,622	5,540	4,236	5,397	5,717	..
Memo item: Industrial Production by Main Enterprise						
Estrela do Mar	1,271	3,711	3,936	3,699	3,154	2,106
Guialp	—	400	—	—	-- 4/	--
Semapesca	--	—	--	—	400	1,370
ERPeralta	--	1,480	203	119	98	27

1/ Provisional.

2/ Production of ERPeralta not included.

3/ Estimate; 1979 and 1980 includes 72 and 700 tons, respectively, obtained in the Bijagos Project.

4/ Five months only.

.. Not available.

Note: These values were taken from the Chapter on Fisheries of the 1980-81 Investment Program. Export values do not coincide with those published by the external trade statistics.

Source: Biennial Investment Program, Vol. 1, Ministry of Planning, 1980.
World Bank

4. Fisheries Infrastructure

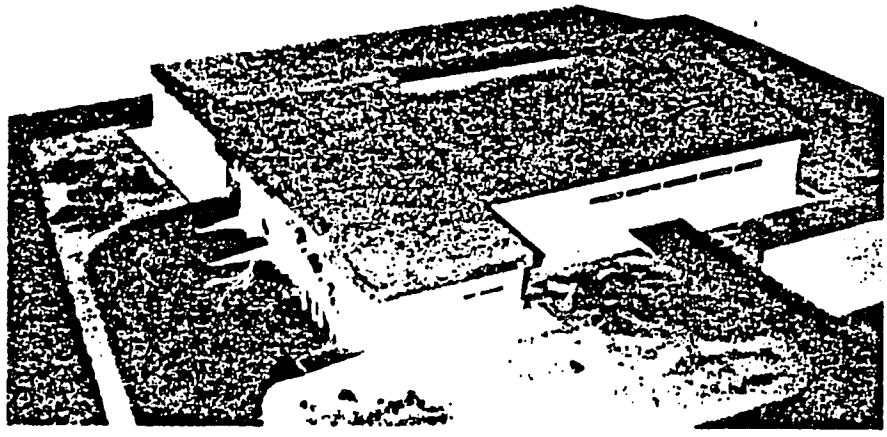
The port facilities of Bissau include a commercial T pier utilized by international cargo vessels, local river transport vessels and commercial fishing vessels. Fish are off loaded onto trucks for transport to cold store facilities (approximately one mile from the dock). Existing berthing space is available to accomodate moderately expanded fishing operations and further port development and additional berthing facilities are in the planning stages.

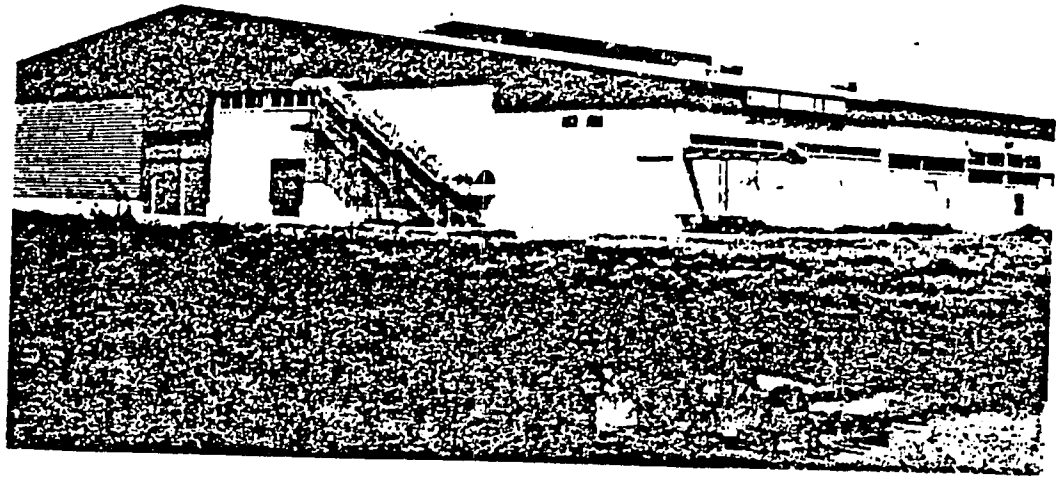
Vessel repair and maintenance facilities are offered by both the private and public sector. E.R. Peralta, the private enterprise, operates a yard which includes a marine railway capable of handling river transport craft, barges and other vessels of restricted draft up to some 30 meters in length. Ships capabilities include metal and wood fabrication, welding, smithy, lathes, etc. The company's workers have many years experience working with steel and wood vessels and appear capable of achieving effective results with the minimal resources available. The military public sector marine railway and shop facilities, available to the private sector, are capable of handling much larger vessels including those appropriate for any anticipated commercial fishing operations. At present, all fuel must be imported although the government is negotiating with oil companies for the domestic development of offshore resources. The price of fuel is government controled, rationed and at times is unavailable.

Fish Processing Facilities

There are no commercial fish processing facilities as such which exist in the country. However, extensive cold stores are available which include blast freezing tunnels. The existing facilities of Semapesca and Guialp have been greatly expanded through the recent completion of a government owned refrigerated complex constructed by a Spanish company with funds arising from fees paid by the USSR for fishing permits. The new complex (see Figure II4.1includes the following 7,600 cubic meters of refrigerated coldstores, 30 tons per day blast freezer capacity, 20 tons per day of flake ice and 10 tons per day of block ice. Operating and maintenance personnel of the plant have been trained in Spain. It is anticipated that Estrello do Mar activities based at the Guialp cold store will move to the new complex shortly. Also, discussions are now taking place to determine the availability of the complex for other users. No rates for the use of the facilities have been yet established. In the private sector, E.R. Peralta offers block ice-making capacity of about 2.5 tons per day.

Figure II.4.1





Transportation Facilities

Transportation facilities available to distribute fish within the country includes powered river craft and barges up to approximately 35 meters. Also, privately operated pick-up type vehicles and bicycles on an ad hoc basis serve as transport for people to sell their fish in remote areas. In the public sector, there are transport craft which transport fish from the Bijogos region to Bissau and two isolated trucks are also available within the country.

5. Model for Directed Balistes Fisheries Operation

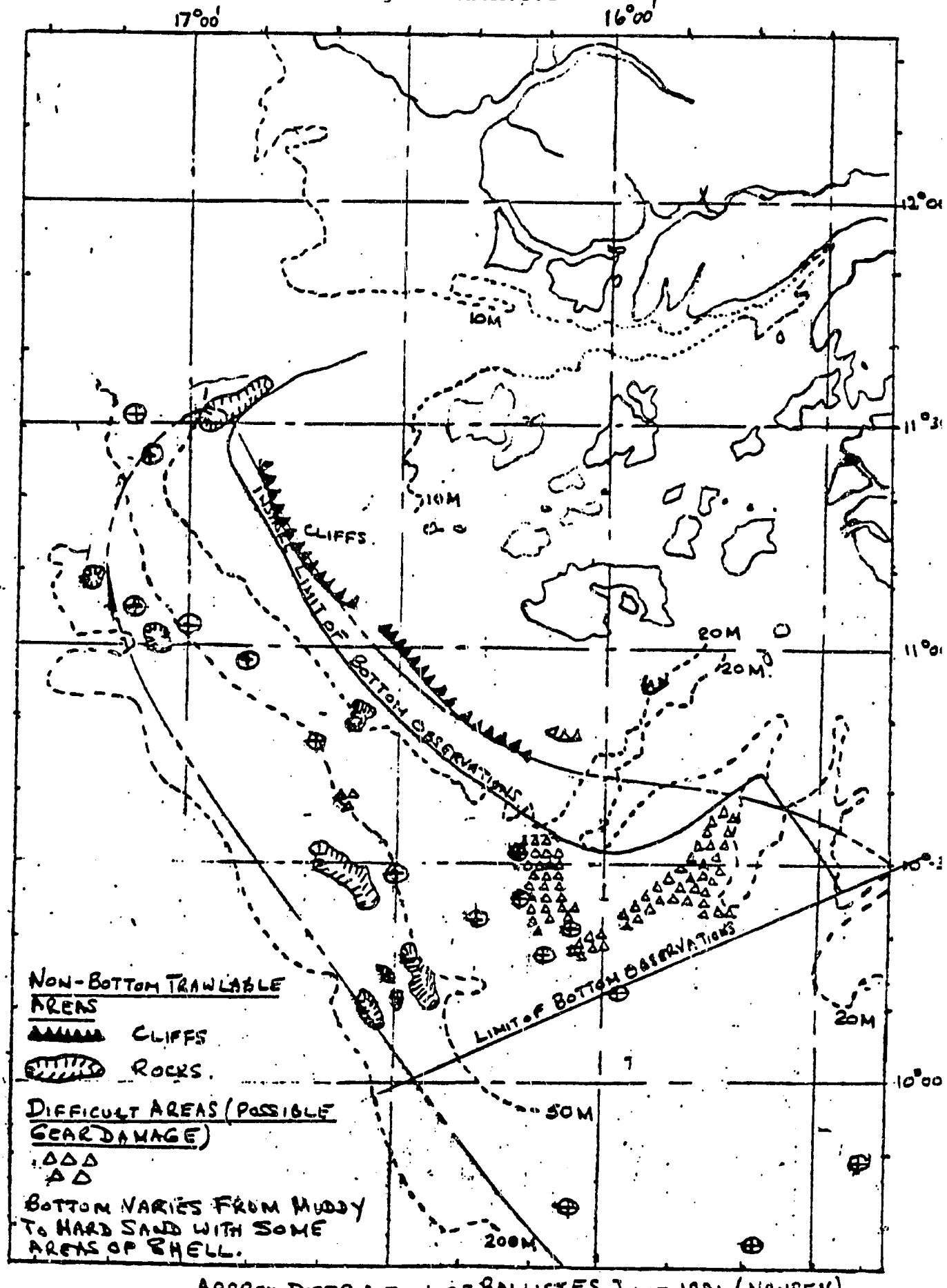
As outlined previously in Part I, major concentrations of Balistes are found throughout much of the offshore waters of Guinea Bissau's fisheries zone. Therefore, Guinea Bissau provides a favorable geographic situation for a directed fisheries operation on the Balistes stocks. The Balistes are found in Guinea Bissau waters between approximately 20 to 200 meters in depths and are concentrated as shown in Figure II.A.5.1. The figure also includes data concerning the sea-bed features within the area. There are a few locations where bottom-trawling would not be possible; however, the most part, the conditions are favorable for the utilization of appropriate net rigging and bottom gear to conduct bottom trawling operations within almost the total area of Balistes concentrations

The model for a direct Balistes fisheries operation is based upon the utilization of a used 78 ft. 415 HP vessel as described in Part I. See Figure II.A.5.2 for the cost of operations of this vessel and Figures II.A.5.3,II.A.5.4 and II.A.5.5 for the other vessels considered in the analysis.

The variation in unit costs for landing Balistes with different commercially attainable catch rates and different values for vessels utilized are shown in Figures II.A.5.6 and II.A.5.7. Clearly, the used vessel with a refrigerated sea water system offers the opportunity for the most cost effective operation. Also, the importance of achieving maximum possible catch rates is demonstrated in that unit costs jump 250% if the catch rate is reduced from 1.25 tons to 0.5 tons per hour.

The basic information and assumptions noted in Table II. A.5.8 were developed based on discussions with knowledgeable people in the government and private sector concerning local costs of operations and administration of fishing vessels.

Figure II.A.5.1



APPROX. DISTRIBUTION OF BALLISTES JUNE 1981 (NANSEN)

⊕ BOTTOM TRAWL LOCATIONS JUNE/SEPT 1981 (NANSEN)

Figure II.A.5.2

COUNTRY: GUINEA BISSAU

CATCH STORAGE: REFRIG. SEA WATER

VESSEL COST: $475,000 (USED)

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	45	37.5	29.4	20.5
Days/Trip	5	6	7.66	11
Days at Sea/Year	225	225	225	225
Days Fishing/Year	180	187.5	195.6	204.5
Catch: Balistes	2,700	2,250	1,760.4	1,227
Other (8%)	216	180	140.8	98.2
Total (tons)	2,916	2,430	1,901.2	1,325.2
Ice: WT/year (tons)	-	-	-	-
Price $/ton	-	-	-	-
Cost/Year $	-	-	-	-
Fuel: Gal/HR	15	15	15	15
Gal/YR	81,000	81,000	81,000	81,000
Price $/GAL	1.90	1.90	1.90	1.90
* Cost/Year $	153,900	153.900	153,900	153,900
*Oils: 8% Fuel	12,636	12,636	12,636	12,636
*Gear Cost: $/year	57,000	59,375	61,940	64,758
*Insurance: 3.5%(INV)$	16,625	16,625	16,625	16,625
*Fishing License $/YR	-	-	-	-
*Port Taxes $/YR	37,093	30,911	24,184	16,858
*Maint. & Repair: $/YR	40,375	40,375	40,375	40,375
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	329,629	325,822	321,660	317,152
Crew Cost $/YR	90,936	85,979	80,941	77,485
Total Oper. Exp + Crew $/YR	420,565	411,801	402.601	394,637
Administrative Exp. $/YR	16,823	16,472	16,104	15,785
Capital Cost (FIRST YR. $)	226,944	226,944	226,944	226,944
TOTAL COST ($)	664,332	655,217	645,649	637,366
Value of other Fish $/YR	192,456	160,380	125,452	87,496
Total Cost of Balistes $/YR	471,876	494,837	520,197	549,820

Cost of Balistes $/ TON	174,8	219.9	295.5	448,1
¢/LB	7.8	9.8	13.2	20.0
¢/KG	17.2	21.6	29.0	44.0
Pesos/KG	6.9	8.6	11.6	17.6

*Items Included in Total Operating Expenses

Figure II.A.5.3

COUNTRY: GUINEA BISSAU

CATCH STORAGE: REFRIG. SEA WATER

VESSEL COST: $675,000 (NEW)

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	45	37.5	29.4	20.5
Days/Trip	5	6	7.66	11
Days at Sea/Year	225	225	225	225
Days Fishing/Year	180	187.5	195.6	204.5
Catch: Balistes	2,700	2,250	1,760.4	1,227
Other (8%)	216	180	140.8	98.2
Total (tons)	2,916	2,430	1,901.2	1,325.2
Ice: WT/year (tons)	-	-	-	-
Price $/ton	-	-	-	-
Cost/Year $	-	-	-	-
Fuel: Gal/HR	15	15	15	15
Gal/YR	81,000	81,000	81,000	81,000
Price $/GAL	1.90	1.90	1.90	1.90
* Cost/Year $	153,900	153,900	153,900	153,900
*Oils: 8% Fuel	12,636	12,636	12,636	12,636
*Gear Cost: $/year	57,000	59,375	61,940	64,758
*Insurance: 3.5%(INV)$	23,625	23,625	23,625	23,625
*Fishing License $/YR	-	-	-	-
*Port Taxes $/YR	37,093	30,911	24,184	16,858
*Maint.& Repair: $/YR	37,125	37,125	37,125	37,125
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	333,379	329,572	325,410	320,902
Crew Cost $/YR	90,936	85,979	80,941	77,485
Total Oper. Exp + Crew $/YR	424,315	415,551	406,351	398,387
Administrative Exp. $/YR	16,973	16,622	16,254	15,935
Capital Cost (FIRST YR. $)	322,500	322,500	322,500	322,500
TOTAL COST ($)	763,788	754,673	745,105	736,822
Value of other Fish $/YR	192,456	160,380	125,452	87,496
Total Cost of Balistes $/YR	571,332	594,293	619,653	649,326

Cost of Balistes $/ TON	211.6	264	352	529
¢/LB	9.4	11.8	15.7	23.6
¢/KG	20.8	25.9	34.6	52.0
Pesos/KG	8.3	10.4	13.8	20.8

*Items Included in Total Operating Expenses

Figure II.A.5.4

COUNTRY: GUINEA BISSAU

CATCH STORAGE: ICED

VESSEL COST: $400,000 (USED)

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	45	37.5	29.4	20.5
Days/Trip	5	6	7.66	11
Days at Sea/Year	225	225	225	225
Days Fishing/Year	180	187.5	195.6	204.5
Catch: Balistes	2,700	2,250	1,760.4	1,227
Other (8%)	216	180	140.8	98.2
Total (tons)	2,916	2,430	1,901.2	1,325.2
Ice: WT/year (tons)	3,499.2	2,916	2,281.4	1590.2
Price $/ton	50.0	50.9	50.9	50.9
Cost/Year $	178,109	148,424	116,123	80,941
Fuel: Gal/HR	14	14	14	14
Gal/YR	75,600	75,600	75,600	75,600
Price $/GAL	1.90	1.90	1.90	1.90
* Cost/Year $	143,640	143,640	143,640	143,640
*Oils: 8% Fuel	11,491	11,491	11,491	11,491
*Gear Cost: $/year	57,000	59,375	61,940	64,758
*Insurance: 3.5%(INV)$	14,000	14,000	14,000	14,000
*Fishing License $/YR	-	-	-	-
*Port Taxes $/YR	37,093	30,911	24,184	16,858
*Maint. & Repair: $/YR	34,000	34,000	34,000	34,000
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	487,333	453,849	417,378	377,688
Crew Cost $/YR	90,936	85,979	80,941	77,485
Total Oper. Exp + Crew $/YR	578,269	539,828	498,391	455,173
Administrative Exp. $/YR	23,131	21,593	19,936	18,207
Capital Cost (FIRST YR. $)	191,111	191,111	191,111	191,111
TOTAL COST ($)	792,511	752,532	709,438	664,491
Value of other Fish $/YR	192,456	160,380	125,452	87,496
Total Cost of Balistes $/YR	600,055	592,152	583,986	576,995

Cost of Balistes $/ TON	222.2	263.2	331.7	470.2
¢/LB	9.9	11.7	14.8	21.0
¢/KG	21.8	25.8	32.6	46.2
Pesos/KG	8.7	10.3	13.0	18.5

*Items Included in Total Operating Expenses

Figure II.A.5.5

COUNTRY: GUINEA BISSAU

CATCH STORAGE: ICED

VESSEL COST: $600,000 (NEW)

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	45	37.5	29.4	20.5
Days/Trip	5	6	7.66	11
Days at Sea/Year	225	225	225	225
Days Fishing/Year	180	187.5	195.6	204.5
Catch: Balistes	2,700	2,250	1,750.4	1,227
Other (8%)	216	180	140.8	98.2
Total (tons)	2,916	2,430	1,901.2	1,325.2
Ice: WT/year (tons)	3,499.2	2,916	2,281.4	1,590.2
Price $/ton	50.9	50.9	50.9	50.9
Cost/Year $	178,109	148,424	116,123	80,941
Fuel: Gal/HR	14	14	14	14
Gal/YR	75,600	75,600	75,600	75,600
Price $/GAL	1.90	1.90	1.90	1.90
* Cost/Year $	143,640	143,640	143,640	143,640
*Oils: 8% Fuel	11,491	11,491	11,491	11,491
*Gear Cost: $/year	57,000	59,375	61,940	64,758
*Insurance: 3.5%(INV)$	21,000	21,000	21,000	21,000
*Fishing License $/YR	-	-	-	-
*Port Taxes $/YR	37,093	30,911	24,184	16,858
*Maint. & Repair: $/YR	33,000	33,000	33,000	33,000
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	493,333	459,841	423,387	383,688
Crew Cost $/YR	90,936	85,979	80,941	77,485
Total Oper. Exp + Crew $/YR	584,269	545,820	504,319	461,173
Administrative Exp. $/YR	23,371	21,833	20,173	18,447
Capital Cost (FIRST YR. $)	286,667	286,667	286,667	286,667
TOTAL COST ($)	894,257	854,320	811,159	766,287
Value of other Fish $/YR	192,456	160,380	125,452	87,496
Total Cost of Balistes $/YR	701,801	693,940	685,707	678,791

Cost of Balistes $/ TON	259.9	308.4	389.5	553.2
¢/LB	11.6	13.8	17.4	24.7
¢/KG	25.5	30.3	38.3	54.3
Pesos/KG	10.2	12.1	15.3	21.7

*Items Included in Total Operating Expenses

Figure II.A.5.6

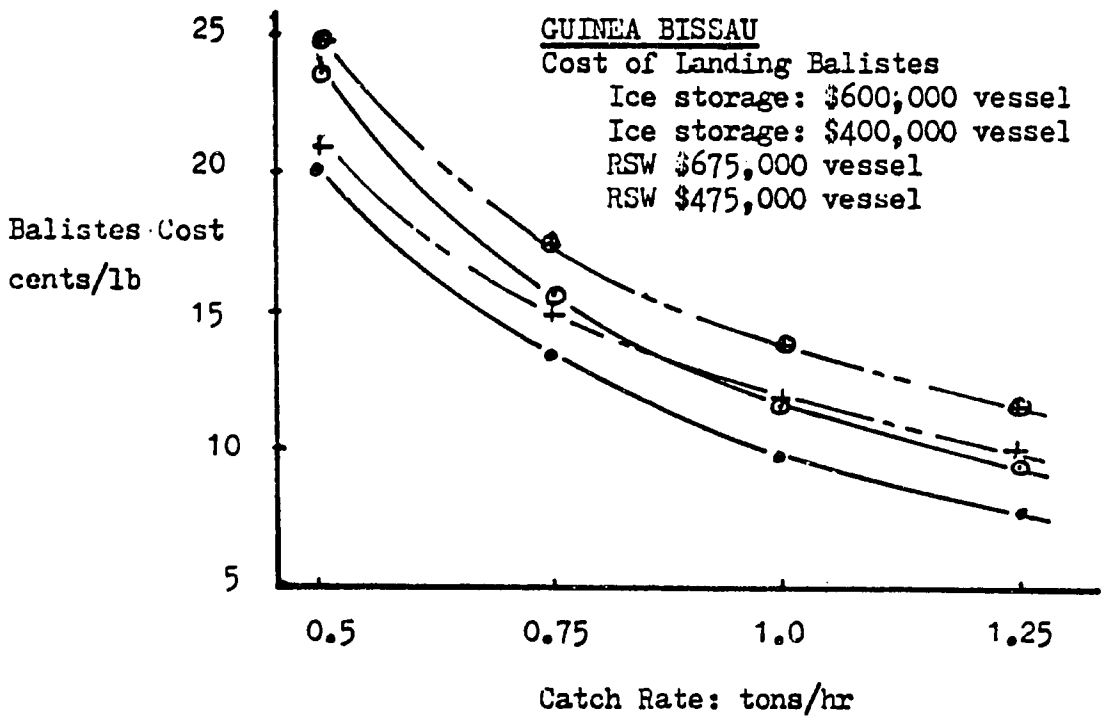


Figure 1..A.5.7

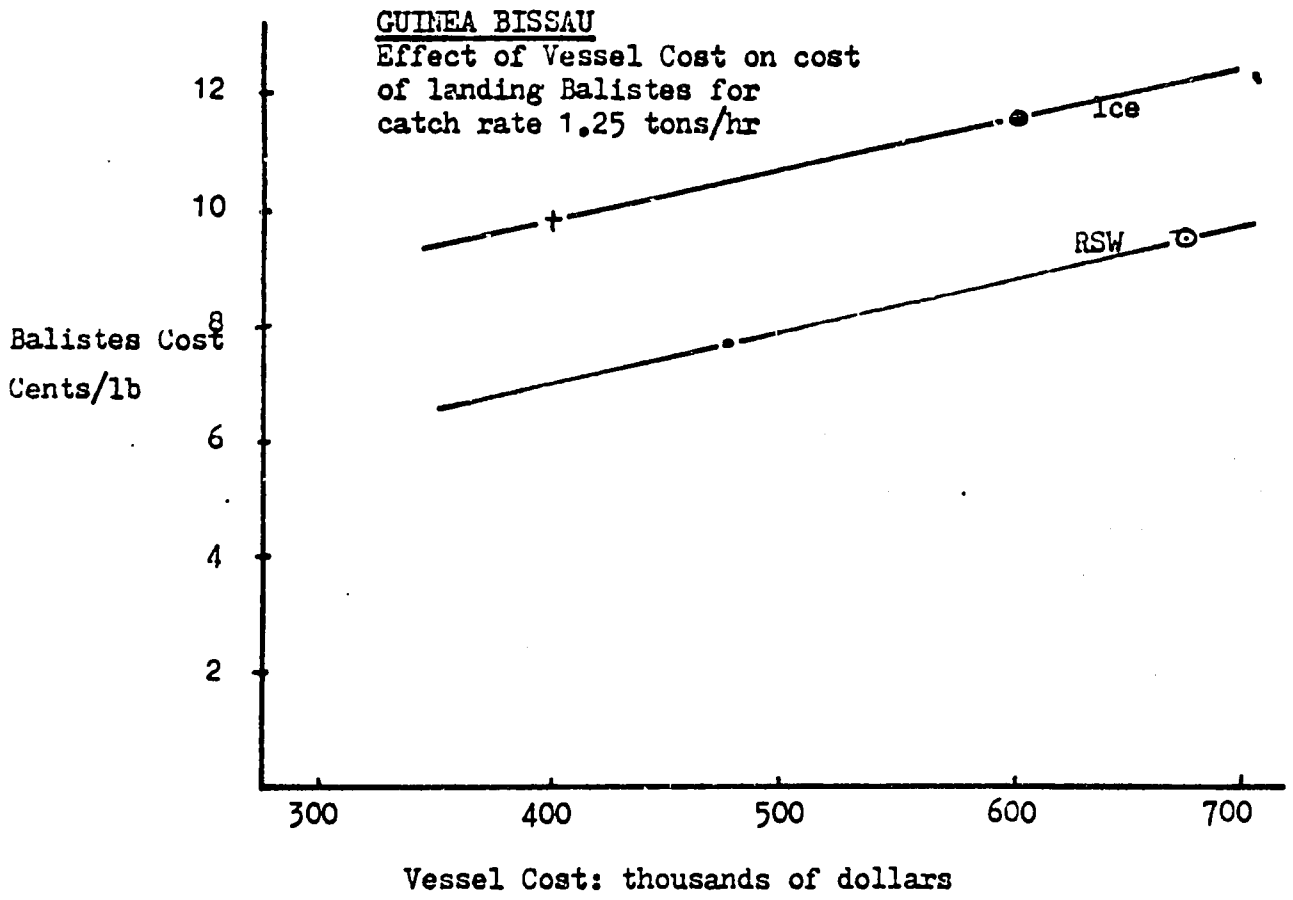

GUINEA BISSAU
Effect of Vessel Cost on cost of landing Balistes for catch rate 1.25 tons/hr
Ice
RSW
Balistes Cost Cents/lb
12
10
8
6
4
2
300
400
500
600
700
Vessel Cost: thousands of dollars

Table II.A.5.8

SUMMARY OF BASIC INFORMATION: GUINEA BISSAU

Exchange Rate (February 1983) = 40 PG/#1

Ice Cost (Feb 1983) 2 Pesos/KG = $50.0 per Long Ton

Diesel Fuel 20 Pesos/liter = $1.90 US gal.

Port Taxes (Bissau) 40 Pesos = 0.5 Pesos/KG landed
= $ [(1 +12.75 (Tons landed)]

Crew Cost

Captain:	U.S. National	$36,000/YR + $6 Ton=$36,000 + Bonus
Engineer:	Portuguese	$20,000/YR + bonus (crew)
Mate:	National	$1,860/YR + bonus (crew)
Asst. Engr.:	National	$1,860/YR + bonus (crew)
Cook:	National	$1,650/YR + bonus (crew)
Deckhands (5):	Nationals 5x	$1,500/YR + bonus (crew)

Bonus shared by local crew: 1% of catch value over 10 ton/day.

Subsistence Allowance (at sea)

1,000 pesos per day for but plus 40 pesos per man for each day at sea plus 24 kilos of rice/month/person (18 pesos/kg).

Fishing Licenses

None required for Guinea Bissau registered vessel.
For foreign vessels (e.g.,ECC) $300 per GRT; for Senegal $150/GRT

Fish Prices: (Official: May sell lower but not higher)

Class	Bought from Vessel	Retail (Bissau)
1	30 Pesos/kg	50
2	22.50 Pesos/kg	40
3	15 Pesos/kg	30
4	13.5 Pesos/kg	22.50

Minimum Wage

3,400 Pesos/month = $1,020 Pesos/YR

Electricity

4.5 Pesos/kwh (11.25 cents)

6. Financial Model of Enterprise in Guinea Bissau with Integrated Directed Balistes Fisheries and Processing Plant Operation

The financial model of an enterprise in Guinea Bissau with an integrated directed Balistes fisheries and processing plant operation is presented below.

As discussed previously, the directed fisheries operation utilizing the used vessel with a refrigerated sea water system (See Figure II.A.5.2) offers the opportunity for the most cost effective operation. It is assumed that the fisheries operation will successfully catch 1.25 tons of fish an hour resulting in 2,700 tons of Balistes annual production with a by catch of higher value fish worth $192,456 as presented in the calculations.

The total costs of the directed Balistes fisheries operation were initially calculated on the basis of operating as an independent, self-sufficient fishing operation. However, with an integrated Balistes fisheries and processing plant, the cost of the vessel and its operations will be considered as part of the full enterprise.

Therefore, based on financial data presented in the models for a directed Balistes fisheries and for the processing plant, the establishment of an integrated Balistes fisheries and processing plant is projected to have costs in investment capital and annual operations with income from product sales as follows:

Financial Model of Enterprise with Integrated Balistes Fisheries and Processing Plant

Investment Capital Costs	
Vessel	$ 475,000
Processing Plant	1,051,704
TOTAL	$1,526,704
Annual Operations Costs	
Vessel	$ 420,565
Processing Plant	471,055
TOTAL	$ 891,620
Annual Income Product Sales	
Dried Fish Cakes	$ 522,340
Frozen Fish Blocks	575,444
Fish Silage	218,940
High Value Fish	192,456
TOTAL	$1,509,180

Based on an assumption that if it were necessary to finance all the investment capital and the appropriate investment and tax incentives were in place, a projected pro-forma statement of income and expenses for the first year of operation of the enterprise could be as presented below:

Pro-Forma
Statement of Income and Expenditure

Income	
Sales:	
Dried Fish Cakes	$ 522,340
Frozen Fish Blocks	575,444
Fish Silage	218,940
High Value Fish	192,456
Gross Income	$1,509,180
Expenses	
Vessel operations	420,565
Processing plant operations	471,055
Interest (1)	229,005
Total Expenses	$1,120,625
Net Income from Operations	$388,555

(1) 15% of total capital investment costs of $1,526,704 It is likely that more concessional interest rates would be available.

7. Feasibility of Private Sector involvement in Development of Balistes Fisheries and Processing Operations

As previously discussed, the only industrial private enterprise in fisheries in Guinea Bissau is E.R. Peralta. E.R. Peralta has indicated a definite interest in participating in a joint venture to harvest available Balistes resources and produce fish products for local and export markets.

However, Mr. Peralta recognizes that there also exists in Guinea Bissau waters an abundance of high value fisheries resources which offer an immediate potential for harvesting and marketing as traditional products. Therefore, as a first step in expanding his operations, his priority interest was to obtain a trawler to work in the fisheries where he has experience. In the use of the vessel for trawling operations, E.R. Peralta would then be able to conduct on a regular basis, experimental fishing operations for Balistes in order to determine commercially attainable catch rates. He recognizes that such data would help him determine the actual landed costs of Balistes and provide raw material in the form of fresh fish. After his company had developed some economic strength as the result of harvesting and marketing traditional fish species which are available to known markets, E.R. Peralta believes he could then most effectivel make use of Balistes to develop non-traditional products for market.

The economic feasibility of Mr. Peralta utilizing a vessel as he proposed was examined by America's Development Foundation's team. Economic projections were undertaken which confirmed the merits of such an operation. The team was most impressed with Mr. Peralta's management capabilities within the fisheries and marine sector which allowed him to operate under difficult conditions. His high level of motivation to utilize additional resources to develop Guinea Bissau fisheries was most evident. Such favorable observations of Mr. Peralta's abilities were confirmed in discussions with both government and private sources.

8. Government Support for the Private Sector

Since the country gained independence in 1976, the government of Guinea Bissau has organized the country around a governmental centrally planned economy. However, very recently, there have been strong indicators that the government intends to open up opportunities for private interprise development. In this regard, a new investment law is under consideration which is expected to encourage foreign investment to the country.

In discussions with government officials in both the Fisheries and Commerce Departments, America's Development Foundation's team identified significant support for E.R. Peralta's

further development of the private sector activities in fisheries, with the support of foreign investment. Also, all indications pointed to active support by the government including its possibility to make available local currency financing by the national bank to support such fisheries project development.

9. Conclusions

1. There exists abundant Balistes resources together with traditional high value food fish within Guinea Bissau fisheries limits which are greatly underutilized. There is a potential catch of an additional 125,000 tons of Balistes from the northern stock. Also, of the approximately 50,000 tons of the annual fish catch available on the continental shelf only some 3,500 tons are landed at Bissau.

2. There exists a major need for supplies of fresh and cured fish for Bissau and the markets throughout the country to meet the nutritional food needs of the population. It has been estimated that annual per capita fish consumption in Guinea Bissau is around 7.4 kg as compared with 44kg for Senegal.

3. There exists one private enterprise company, E.R. Peralta which is most interested in pursuing fisheries development activities of the type of project under consideration by using a step level approach. E.R. Peralta is capable of participating in such a venture and welcomes the opportunity to participate in a joint venture with other investors to undertake further fisheries development activities. The strengthening and support of an indigenous private enterprise, as E.R. Peralta, will allow it to respond to profitable opportunities which will generate nutritional food production, jobs and foreign exchange. Also, the activities of E.R. Peralta will serve as a model to encourage development of the private sector with management and technical skills responsive to the economic needs of the country.

4. There exists significant government support for private sector fisheries development activities involving E.R. Peralta Company and overseas investors. Such government support for private enterprise development represents a major breakthrough in the orientation of the public sector.

5. In light of existing conditions and the expressed interests of E.R. Peralta, it is suggested that a phased step by step level approach toward increased fisheries production for local export markets be pursued. The harvesting of Balistes could be undertaken in conjunction with production of traditional food fish for known markets. With experience and data gained from such expanded fishing operations, a targeted fisheries for Balistes could be developed for the processing and production of non-traditional products for local and export markets.

6. As a first step, local and international development institutions, supportive of private sector inititve, such as USAID, should be responsive to the plan being developed by E.R. Peralta to initially acquire a trawler to expand his fishing operations. Upon the financial strengthening of his enterprise, E.R. Peralta will be prepared, as will foreign investors, to then organize financing for development of the opportunities identified in the integrated Balistes fisheries and processing plant model presented on Guinea Bissau.

B. THE GAMBIA

1. Fisheries Situation

Although having a continental shelf area of 3,900 square km., and a coastline of only 70 km., The Gambia has an extensiv river system which contributes a large portion of the total annual catch (1980) of 10,255 metric tons, worth approximately $3.97 million. This was down from 15,000 metric tons in 1977.

Estimated resource potential varies with the seasonal movement of species with the warm front, from some 84,700 tons in May to some 130,000 tons in September.

The Gambia in 1979 exported $2,462,000 worth of fish and imported $280,000 of fish. Exports are primarily frozen shrimp and other high value species to Europe and frozen sardinella to Ghana.

The fisheries of The Gambia are essentially artisanal, mainly for bonga, shrimp and some demersal species, caught from canoes by floating and bottom gillnets, supplemented by some handlining.

Resource availability is not a constraint in the developme of the Gambian fisheries. The unexploited fisheries could be f ther developed through a combination of demersal fishing by mod methods, trawling and lining and increased landings of bonga an sardinella.

The fish for local consumption is provided mainly by the artisanal sector caught from canoes working from several beach landing sites. Sales are direct negotiations between the vessel owner and the buyer and prices naturally fluctuate according to the level of supplies and market conditons. The buyers consist of very small traders (middlemen) who buy the fish and transport it fresh or frozen to rural inland areas. A local processors buy the fish and after smoking it sell it dire ly or through middlemen. Unfortunately, a large proportion (30%) of the processed fish produced at the artisanal level is lost through spoilage and insect infestation.

Inland prices vary considerably, mainly depending upon travel distances. During certain times of the year, referred to as "The Hungry Season" much of the population is without necessary food supplies, such as fish. It has been estimated that consumption of fish in Banjul and a few other urban areas is about 45 kg per capita and for the rest of the country, that comprises 74% of the total population, consumption is on the order of 19.5 kg per capita.

Fishing Agreements are in force allowing access for a small number of vessels, principally from Senegal and the Common Market, to Gambian resources within the 200 mile extended jurisdiction zone. The Gambia does not have a fishing fleet to take advantage of its recently concluded agreement to fish in Senegalese waters.

2. Structure of the Fisheries Sector

At this time, the only effective industrialized marine fishing operation based in the Gambia is that of Seagull Fisheries, a Ghanaian owned company which operates purse seiners which catch Sardinella and exports all its catch to Ghana.

A Japanese/Gambian joint venture which caught and exported principally shrimp became defunct in 1977 and the extensive facilities, now in disuse and disrepair, was taken over by the Government owned Fish Marketing Corporation, (FMC) a para-statal organization created in 1977 to engage in the buying, freezing and marketing fish. The Fish Marketing Corporation is seeking to develop international funding for rehabilitation of the fisheries company. Two Danish trawlers made available to the FMC have engaged in some fishing operations with marginal results.

The local buying, freezing and export of shrimp and other high value species is now undertaken by a private company, "National Fisheries Enterprises, which finances and operates about 250 canoes on the river (principally for shrimp) and off the river mouth for various fish species. This company has excellent newly constructed facilities for processing shrimp and fish including icemaking, processing and freezing areas. The company has recently acquired a former FAO trawler (approx. 58 ft) to expand operations to engage in marine fisheries.

3. Fisheries Infrastructure

The port facilities at Banjul include fairly extensive commercial wharfs used by international cargo vessels and local river transport craft. Facilities of Seagull Fisheries including processing and freezing are situated within the general waterfront area. Fish destined for the Fish Marketing Corporation are offloaded and trucked as necessary on an "as required" basis.

Vessel maintenance and repair facilities are offered by a full service yard which has marine railways capable of handling craft up to at least 200 ft. The operation is effectively managed with a skilled work force and with well qualified assistance available for hull and machinery survey and electronics maintenance, installation and repair. Reasonably rapid delivery of

parts is available through Dakar.

Fuel is imported in the free market and available at a subsidized rate for Gambian registered fishing vessels.

Fish processing facilities include the Seagull Fisheries Operation (restricted to Sardinella exports to Ghana), the government Fish Marketing Corporation (unoperational facilities) and the new facilities of National Fisheries Enterprises Ltd.

Transportation of fish inland is handled by individual entrepreneurs using small vehicles on a sporadic basis. Typically such an enterprise may employ one or two canoe fishermen and buy from other fishermen at the market rate, smoke the fish in a traditional manner and then transport the fish inland for sale as soon as a sufficient quantity is processed. These operations are marginal and characterized by equipment breakdowns and seasonal variations in fish availability.

Export transportation is principally by refrigerated vessel to Dakar for transhipment for container delivery to European markets, and worldwide destinations.

4. Model for Directed Balistes Fisheries Operation

As outlined in Part I, considerable concentrations of Balistes appear within Gambian shelf waters during a large part of the year. As the fish appear to move behind the warm water front into the shelf waters, it may be expected that the main fishing season might extend from April through November. During at least these eight months, the situation appears favourable for a directed fisheries operation on the Balistes stocks which are concentrated within the 20 to 100 meter depths. (See Figure II.B.4.1)

Sea bed features indicate that only a very small portion of the shelf area is designated as "non-trawlable". However, there are a number of areas shown as difficult "trawling" so that it may be necessary to use relatively heavy ground gear. This should prove little problem in the fishing since Balistes are apparently found above the sea bed.

The model for a direct Balistes fisheries operation is based upon the utilization of a used 78 ft. 415 HP vessel as described in Part I. See Figure II.B.4.2 for the cost of operations of this vessel and Figures II.B.4.3, II.B.4.4 and II.B.4.5 for the other vessels considered in the analysis.

The variation in unit costs for landing Balistes with different commercially attainable catch rates and different values for vessels utilized are shown in Figures II.B.4.6 and II.B.4.7. Clearly, the used vessel with a refrigerated sea water system offers the opportunity for the most cost effective operation.

Figure II.B.4.1

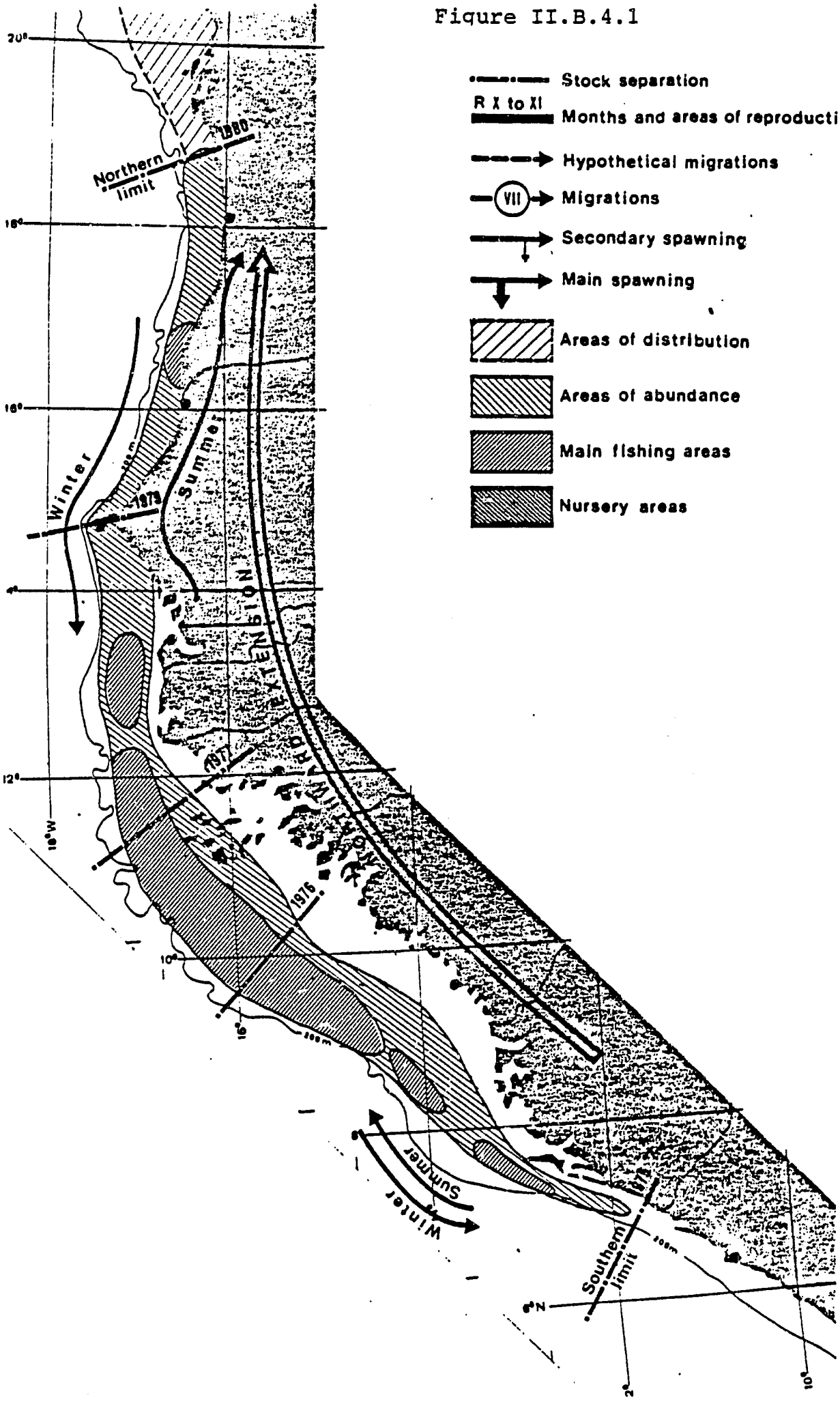


Figure II.B.4.2

COUNTRY: THE GAMBIA

CATCH STORAGE: REGRIG. SEA WATER

VESSEL COST: $475.000 (USED)

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	50	40.9	31.4	21.4
Days/Trip	4.5	5.5	7.16	10.5
Days at Sea/Year	225	225	225	225
Days Fishing/Year	200	204.5	209.3	214.3
Catch: Balistes	3,000	2,454.0	1,883.7	1,285.8
Other (8%)	240	196.3	150.7	102.9
Total (tons)	3,240	2,650.3	2,034.4	1,388.7
Ice: WT/year (tons)	-	-	-	-
Price $/ton	-	-	-	-
Cost/Year $	-	-	-	-
Fuel: Gal/HR	15	15	15	15
Gal/YR	81,000	81,000	81,000	81,000
Price $/GAL	1.22	1.22	1.22	1.22
* Cost/Year $	98,820	98,820	98,820	98,820
*Oils: 8% Fuel	7,906	7,906	7,906	7,906
*Gear Cost: $/year	57,000	58,283	59,650	61,076
*Insurance: 3.5%(INV)$	16,625	16,625	16,625	16,625
*Fishing License $/YR	2,016	2,016	2,016	2,016
*Port Taxes $/YR	171	171	171	171
*Maint. & Repair: $/YR	40,375	40,375	40,375	40,375
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	234,913	236,196	227,563	238,989
Crew Cost $/YR	85,920	80,023	73,864	67,407
Total Oper. Exp + Crew $/YR	320,833	316,219	311,427	306,396
Administrative Exp. $/YR	12,833	12,649	12,457	12,256
Capital Cost (FIRST YR. $)	226,944	226,944	226,944	226,944
TOTAL COST ($)	560,610	555,812	550,828	545,596
Value of other Fish $/YR	172,800	141,336	108,504	74,088
Total Cost of Balistes $/YR	387,810	414,476	442,234	471,508

Cost of Balistes $/ TON	129.3	168.9	234.8	366.7
¢/LB	5.8	7.5	10.5	16.4
¢/KG	12.7	16.6	23.1	36.0
Dalasis/KG	0.051	0.066	0.092	0.144

*Items Included in Total Operating Expenses

COUNTRY: THE GAMBIA

Figure II.B.4.3

CATCH STORAGE: REFRIG. SEA WATER

VESSEL COST: $675,000 (NEW)

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	50	40.9	31.4	21.4
Days/Trip	4.5	5.5	7.16	10.5
Days at Sea/Year	225	225	225	225
Days Fishing/Year	200	204.5	209.3	214.3
Catch: Balistes	3,000	2,454	1,883.7	1,285.9
Other (8%)	240	196.3	150.7	102.9
Total (tons)	3,240	2,650.3	2,034.4	1,388.7
Ice: WT/year (tons)	-	-	-	-
Price $/ton	-	-	-	-
* Cost/Year $	-	-	-	-
Fuel: Gal/HR	15	15	15	15
Gal/YR	81,000	81,000	81,000	81,000
Price $/GAL	1.22	1.22	1.22	1.22
* Cost/Year $	98,820	98,820	89,820	98,820
*Oils: 8% Fuel	7,906	7,906	7,906	7,906
*Gear Cost: $/year	57,000	58,283	59,650	61,076
*Insurance: 3.5% (INV) $	23,625	23,625	23,625	23,625
*Fishing License $/YR	2,016	2,016	2,016	2,016
*Port Taxes $/YR	171	171	171	171
*Maint. & Repair: $/YR	37,125	37,125	37,125	37,125
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	238,663	239,946	241,313	242,739
Crew Cost $/YR	85,920	80,023	73,864	67,407
Total Oper. Exp + Crew $/YR	324,583	319,969	315,177	310,146
Administrative Exp. $/YR	12,983	12,799	12,607	12,406
Capital Cost (FIRST YR. $)	322,500	322,500	322,500	322,500
TOTAL COST ($)	660,066	655,268	650,284	645,052
Value of other Fish $/YR	172,800	141,336	108,504	74,088
Total Cost of Balistes $/YR	487,266	513,932	541,780	570,964

Cost of Balistes $/ TON	162.4	209.4	287.6	444.1
¢/LB	7.25	9.3	12.8	19.8
¢/KG	15.9	20.6	28.2	43.6
Dalasis/KG	0.064	0.082	0.113	0.174

*Items Included in Total Operating Expenses

Figure II.B.4.4

COUNTRY: THE GAMBIA

CATCH STORAGE: ICED

VESSEL COST: $400,000 (USED)

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	50	40.9	31.40	21.4
Days/Trip	4.5	5.5	7.16	10.5
Days at Sea/Year	225	225	225	225
Days Fishing/Year	200	204.5	209.30	214.3
Catch: Balistes	3,000	2,454.0	1,883.70	1,285.8
Other (8%)	240	196.3	150.7	102.9
Total (tons)	3,240	2,650.3	2,034.4	1,388.7
Ice: WT/year (tons)	3,888	3,180	2,441	1,606
Price $/ton	21.2	21.2	21.2	21.2
Cost/Year $	82,426	67,416	51,749	34,047
Fuel: Gal/HR	14	14	14	14
Gal/YR	75,600	75,600	75,600	75,600
Price $/GAL	1.22	1.22	1.22	1.22
* Cost/Year $	92,232	92,232	92,232	92,232
*Oils: 8% Fuel	6,594	6,594	6,594	6,594
*Gear Cost: $/year	57,000	58,283	59,650	61,076
*Insurance: 3.5%(INV)$	14,000	14,000	14,000	14,000
*Fishing License $/YR	2,016	2,016	2,016	2,016
*Port Taxes $/YR	171	171	171	171
*Maint. & Repair: $/YR	34,000	34,000	34,000	34,000
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	300,439	286,712	272,412	256,136
Crew Cost $/YR	85,920	80,023	73,864	67,407
Total Oper. Exp + Crew $/YR	386,359	366,735	346,276	323,543
Administrative Exp. $/YR	15,454	14,669	13,851	12,942
Capital Cost (FIRST YR. $)	191,111	191,111	191,111	191,111
TOTAL COST ($)	592,924	572,515	551,238	527,596
Value of other Fish $/YR	172,800	141,336	108,504	74,088
Total Cost of Balistes $/YR	420,124	431,179	442,734	453,508

Cost of Balistes $/ TON	140.00	175.7	235.0	352.70
¢/LB	6.25	7.8	10.5	15.75
¢/KG	13.75	17.3	23.1	34.60
Dalasis/KG	0.055	0.069	0.092	0.139

*Items Included in Total Operating Expenses

Figure II.B.4.5

COUNTRY: THE GAMBIA

CATCH STORAGE: ICED

VESSEL COST: $600,000 (NEW)

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	50	40.9	31.4	21.4
Days/Trip	4.5	5.5	7.16	10.5
Days at Sea/Year	225	225	225	225
Days Fishing/Year	200	204.5	209.3	214.3
Catch: Balistes	3,000	2,454.0	1,883.7	1,285.8
Other (8%)	240	196.3	150.3	102.9
Total (tons)	3,240	2,650.3	2,034.4	1,388.7
Ice: WT/year (tons)	3,888	3,180.0	2,441.0	1,606.0
Price $/ton	21.20	21.20	21.20	21.2
Cost/Year $	82,426	67,416	51,749	34,047
Fuel: Gal/HR	14	14	14	14
Gal/YR	75,600	75,600	75,600	75,600
Price $/GAL	1.22	1.22	1.22	1.22
* Cost/Year $	92,232	92,232	92,232	92,232
*Oils: 8% Fuel	7,379	7,379	7,379	7,379
*Gear Cost: $/year	57,000	58,283	59,650	61,076
*Insurance: 3.5%(INV)$	21,000	21,000	21,000	21,000
*Fishing License $/YR	2,016	2,016	2,016	2,016
*Port Taxes $/YR	171	171	171	171
*Maint. & Repair: $/YR	33,000	33,000	33,000	33,000
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	307,224	293,497	279,197	262,921
Crew Cost $/YR	85,920	80,023	73,864	67,407
Total Oper. Exp + Crew $/YR	393,144	373,521	353,061	330,328
Administrative Exp. $/YR	15,726	14,941	14,122	13,213
Capital Cost (FIRST YR. $)	286,667	286,667	286,667	286,667
TOTAL COST ($)	695,537	675,129	653,850	630,208
Value of other Fish $/YR	172,800	141,336	108,504	74,088
Total Cost of Balistes $/YR	522,737	533,693	545,346	556,120

Cost of Balistes $/ TON	174.2	217.5	289.5	432.5
¢/LB	7.8	9.7	12.9	19.3
¢/KG	17.1	21.4	28.4	42.5
Dalasis /KG	0.068	0.086	0.114	0.170

*Items Included in Total Operating Expenses

Figure II.B.4.6

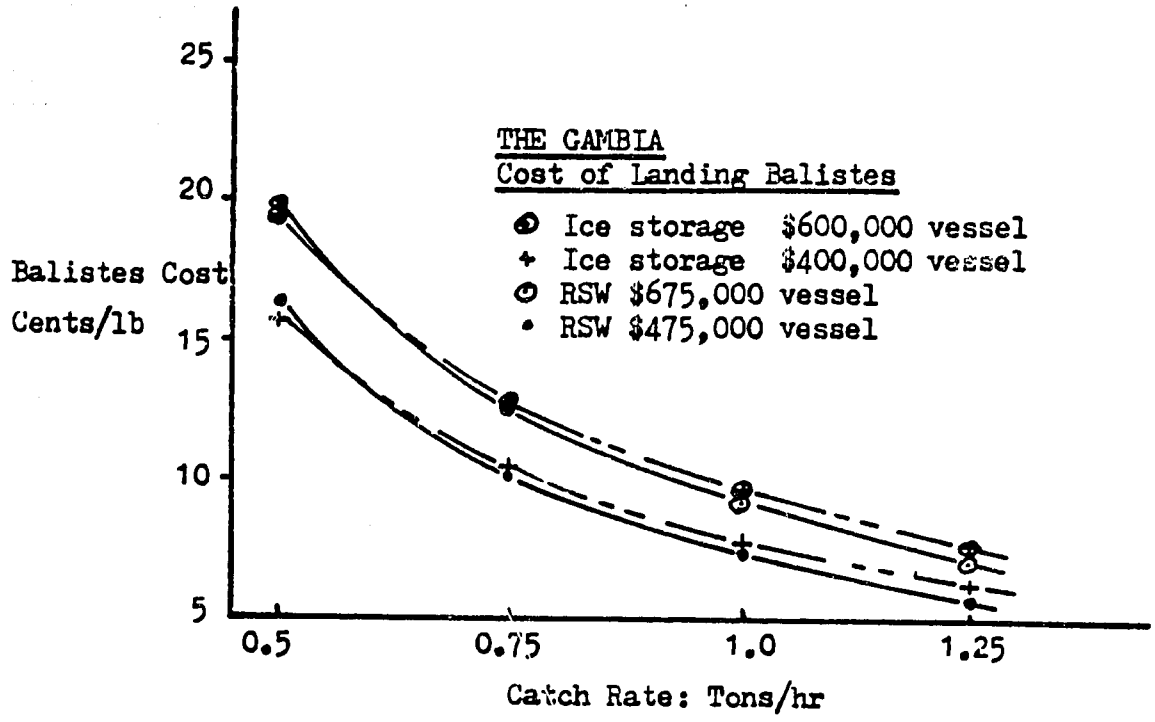


Figure II.B.4.7

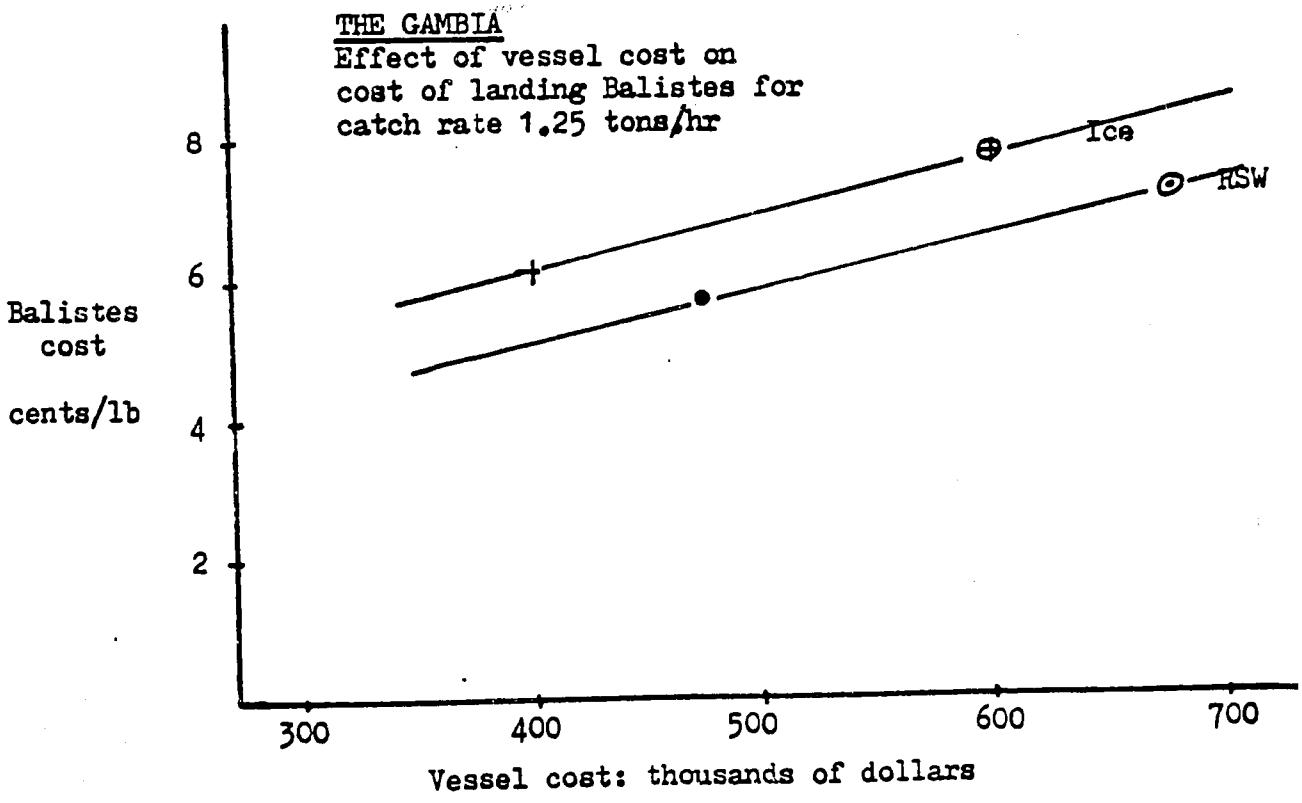


TABLE II.B.4.8

SUMMARY OF BASIC INFORMATION: The Gambia

Ice Cost (Feb 1983):
Manufacture Cost at NFE: 53 DAL./Ton = $21.20/Long Ton

Diesel Fuel (Feb 1983): 0.8 DAL./Lit.= $ 1.22/U.S. Gallon
(Tax Free for Country Regitry Vessels)
Regular Cost

Port Taxes, Banjul: Private Mooring 15 DAL/Month
Freshwater 13 DAL/Month
Assumed Cost: Private Mooring plus 25,000 Gals. Water/year

Crew Cost

Captain:	U.S. National $3,400/month + $6/Ton	=	$40,800 + bonus
Engineer:	700 DAL/Month + share of bonus		3,360 + bonus
Mate:	550 DAL/Month " " "		2,640 + bonus
Asst. Eng.:	350 DAL/Month " " "		1,680 + bonus
Cook:	250 DAL/Month " " "		1,200 + bonus
Deckhands (4):	200 DAL/Month " " "		3,840 + bonus
	Bonus shared by Local Crew: $4/Ton		$53,520 + bonus

Total Crew Cost = $53,520 = $10/Ton

Subsistence Allowance

Total of $12,000/yr allowed to provide for local crew costs plus, travel, transport and living allowance for captain.

Fishing License

60 DAL/GRT for vessels over 400 HP = $24/GRT
30 DAL/GRT for vessels less than 400 HP = $12/GRT

Fish Prices (Value of By-catch during directed Balistes fishing)

Average price received by NFE for exported food fish (Lady Fish, Croaker, Snapper, Shrimp, Sole, Lobster, etc.) = $720/long ton.

The basic information and assumptions noted in Table II. B.4.8 were developed based on discussions with knowledgeable people in the government and private sector concerning local costs of operations and administration of fishing vessels.

5. Financial Model of Enterprise in The Gambia with Integrated Directed Balistes Fisheries and Processing Plant Operation

The financial model of an enterprise in The Gambia with an integrated directed Balistes fisheries and processing plant operation is presented below.

As discussed previously, the directed fisheries operation utilizing the used vessel with a refrigerated sea water system (See Figure II.B.4.2) offers the opportunity for the most cost effective operation. It is assumed that the fisheries operation will successfully catch 1.25 tons of fish an hour resulting in 3,000 tons of Balistes annual production with a by-catch of higher value fish worth $172,800 as presented in the calculations. (No value was determined for the amount of Balistes excess to the 2,700 tons utilized in calculations of the model processing plant operation.)

The total costs of the directed Balistes fisheries operation were initially calculated on the basis of operating as an independent, self-sufficient fishing operation. However, with an integrated Balistes fisheries and processing plant, the cost of the vessel and its operations will be considered as part of the full enterprise.

Therefore, based on financial data presented in the models for a directed Balistes fisheries and for the processing plant, the establishment of an integrated Balistes fisheries and processing plant is projected to have costs in investment capital and annual operations with income from product sales as follows:

Financial Model of Enterprise with Integrated Balistes Fisheries and Processing Plant

Investment Capital Costs	
Vessel	$ 475,000
Processing Plant	1,051,704
TOTAL	$1,526,704
Annual Operations Costs	
Vessel	$ 320,833
Processing Plant	471,055
TOTAL	$ 791,888
Annual Income Product Sales	
Dried Fish Cakes	$ 522,340
Frozen Fish Blocks	575,444
Fish Silage	218,940
High Value Fish	172,800
TOTAL	$1,489,524

Based on an assumption that if it were necessary to finance all the investment capital and the appropriate investment and tax incentives were in place, a projected pro-forma statement of income and expenses for the first year of operation of the enterprise could be as presented below:

Pro-Forma
Statement of Income and Expenditure

Income	
Sales:	
Dried Fish Cakes	$ 522,340
Frozen Fish Blocks	575,444
Fish Silage	218,940
High Value Fish	172,800
Gross Income	$1,489,524
Expenses	
Vessel operations	$ 320,833
Processing plant operations	471,055
Interest (1)	229,005
Total Expenses	$1,020,893
Net Income from Operations	$ 468,631

(1) 15% of total capital investment costs of $1,526,704. It is likely that more concessional interest rates would be available.

6. Feasibility of Private Sector Involvement in Development of Balistes Fisheries

The only locally owned industrial private enterprise capable of undertaking the harvesting and processing of Balistes product is the National Partnership Enterprises, Ltd. (NPE). As previously noted, the company's activities involve the operations of about 250 canoe fisherman and has recently expanded operations through the purchase of an FAO trawler to initiate demersal fishing operations.

The NPE was incorporated in 1974. It is a private company that specializes in the catching, processing and marketing of seafoods. The NPE is fully locally owned and its managing director is Mr. O. B. Conateh. Mr. Conateh had acquired substantial experience in fisheries activities prior to his establishment of the NPE by serving as marketing manager of the Japanese/Gambia government joint venture fisheries organization (The Gambia Fisheries Ltd.) that was involved in the processing, freezing and export of fish and shrimp.

The NPE was established in 1974 in order to fill the vacuum left by the withdrawal of the Japanese in the exploitation of the fisheries resources of the Gambia and, at the same time, provide a commercial outlet for the catch of the numerous artisanal fishermen.

Prior to April 1980, NPE sold all its catch of high value shrimp and fish (mainly sole) to the FMC which processed the catch for export. However, with the collapse of the FMC, NPE established its own small processing plant and negotiated direct export sales to Senegal and European markets.

Recently, NPE began operations at its new and enlarged processing factory complex. Its new factory complex provides the NPE with its own in house capabilities including processing, packing, freezing and cold storage facilities. The new factory was financed by the Gambia Commercial and Development Bank and the Central Bank of the Gambia and the plant's equipment and facilities include the following:

(a) 3 x 50 TON COLD STORAGE ROOMS
Room: length 9.60m: width 5.80m; height 3.15m;
Room temperature - 25°C
Current actual average capacity utilization is rated at about 40%

(b) 1 x 15 TON CHILL ROOM
Room: length 4.80m; width 4.65m; height 3.15m.
Room Temperature 0°C
Current actual average capacity utilization is rated at about 35%

(c) 1 x 75 TON PLATE FREEZER
Room: Station Area 1.55m x 1.12m.
No. of Stations - a
Actual Freezing Capacity utilization =
5.4 tons per 24 hour.

(d) 1 x 5 TON BLAST FREEZER
Capacity divided into 4 six hour cycles per day.

(e) 1 x 15 TON FLAKE ICE MACHINE
Capacity is nominal; actual production is rated at about 10 Tons per day in tropical areas. The Machine is complemented with an ice store.

NPE's processing operations utilizes marine fin fish, shrimp and lobster. Fish is collected by trucks from open beaches at Gunjur, Brufut and Kartong (along the Atlantic Coast) and shrimp from Tendaba, Faraba, Pirang and Mandinary by road along the South Bank, and by out-board driven canoes from Albreda Tubakolong and Dog Island on the North Bank of the River Gambia.

The fish are caught by artisanal fishermen and supplied year round without much seasonal variations in catch. Sole, Barracuda Catfish, Cassave and lower grade demersal fish are caught all year round. Lady-fish is available mainly between July and December and Grouper mainly between January and June.

NPE's catch landings for fish (all types), shrimp and lobster, projected for the first five years of operating the new factory are stated below (in tons):

	Fish	Shrimp	Lobster
1982/83	2,841	482	35
1983/84	3,450	636	43.5
1984/85	3,600	685	53.5
1985/86	4,200	775	55
1986/87	4,875	790	62.5

NPE indicates that it has received numerous firm export orders which previously it had not been able to pursue because of lack of processing and cold storage capacity. Now, however, it has a growing capability to serve existing export markets for large quantities of the Company's products in France, U.S.A., U.K Belgium and in several West African countries.

Now, NPE seeks an adequate supply of seafood to fully utilize its plant capabilities. NPE current fishing arrangements provides the company with a profitable volume but not as much as would be possible if its operations were complemented with

fishing trawlers. With only one very small trawler now just beginning operations, the NPE views that it is obtaining less than the most profitable level of operations possible.

Mr. Conateh has indicated a definite interest in NPE participating in a joint venture to harvest available Balistes resources and process innovative fish products for local and export markets. He believes that there is a market for the production of improved dried fish products in the inland population areas of the Gambia and in other countries in West Africa, expecially during "The Hungry Season". Also, there were several small individual entrepreneurs in the Gambia who expressed a desire to locally market such products as such products would become available.

However, Mr. Conateh indicated that his priority interest was in obtaining a larger trawler vessel to provide NPE with greater throughput of traditional high value species fish. He recognized there is an unmet market demand for such products and wishes to initially develop such operations to service NPE's existing financial commitments and to generate new capital for further development.

Mr. Conateh expressed the interest to utilize such a larger trawler vessel for experimental Balistes fishing operations in order to determine obtainable catch rates. He understands that such data would help determine actual landed cost of Balistes and provide raw material for marketing. Based on the development of his present plans, he would be willing to undertake an integrated targeted Balistes fisheries and processing plant operation in order to develop non traditional products for local export markets.

The economic feasibility of Mr. Conateh utilizing a larger trawler vessel as he proposed was examined by the America's Development Foundation team. Economic projections were undertaken which confirmed the merits of such an operation. The team was most impressed with the capabilities of Mr. Conateh and his NPE management team. Their high level of motivation and capabilities suggest that with financial and technical support they will succeed in their present and future plans. These favorable observations of Mr. Conateh's company were confirmed in discussions with both private and government sources.

7. Government Support for the Private Sector

The government of the Gambia through a range of policy actions has demonstrated its significant support to develop the country's national capabilities in fisheries to meet the nutritional needs of its people and to increase fisheries export.

Investment and financial incentives are available from the Development and Central Bank of The Gambia and have been previously utilized by the NPE. Overall, the Gambia is open to private enterprise and relatively unencumbered by complex investment, import, tax or labor regulations. It has a liberal investment climate as reflected in the Development Act and there are no specific regulations concerning minimum local equity participation and there are instances of majority foreign ownership (as Seagull fisheries which is 51% owned by Ghanians).

The government has given encouragement to private sector activities to help it develop its industrial fisheries, especially in light of the introduction of its 200 mile exclusive economic zone. As a result of his previous accomplishments, Mr. Conateh's company has the full support of the appropriate government departments. They have indicated an interest and willingness to support NPE in further expansion of its activities in fisheries.

The government of the Gambia was extremely interested in the opportunities to utilize Balistes fisheries to produce products for the nutritional needs of its people especially during the "Hungry Season" as well as provide fisheries production for export markets. The government was most supportive of Mr. Conateh's interests to increase Gambia's catch of high value demersal fish species for export to generate increased foreign exchange earnings

8. Conclusions

1. There exists adequate Balistes resources together with underutilized high value fisheries resources within the Gambia's fisheries limits. There is a potential catch of an additional 125,000 tons of Balistes from the northern stocks. Also, at the present time, there are no significant landings of demersal fish by industrial vessels in the Gambia. The offshore Gambia resources remain virtually unharvested by Gambian nationals.

2. There exists a major need to develop Gambia's demersal fisheries to provide for the country's local markets and for export. There exists a special need for increased supplies of cured fish of improved quality to serve the needs of the rural inland population areas of the country.

3. There exists only one indigenous private enterprise company, National Partnership Enterprises Ltd., having the financial and management strength to undertake fisheries development activities of the type of project under consideration. Once NPE has indicated that it has progressed in its traditional fisheries development activities, it would like to undertake development of an enterprise with an integrated Balistes fisheries and processing plant operation.

4. There exists strong government support for a private sector fisheries development project involving National Partner ship Enterprises and foreign private investors.

5. In order for NPE to meet existing commitments and better develop a solid financial base of operations, it is considered important that NPE be supported in its ongoing effor to acquire an additional trawler vessel to provide additional supply of high value fish to fully utilize existing plant capac of NPE's new processing complex. At the same time, with the production of high value food fish for existing markets, experi mental harvesting of Balistes could be conducted. Such an experience would provide NPE with a financial base and experien to take advantage of opportunities to catch Balistes and produc non traditional fish products for local and export markets.

6. Local and international financial institutions should be responsive to the interests of NPE to purchase a larger trawler to engage in catching and processing of high value mari species of fish. As NPE gains financial strength from the profitable operations of such a venture, it will then be prepar as will other interested investors to develop a joint venture to develop the opportunities identified in the integrated balistes fisheries and processing plant model for The Gambia.

C. SENEGAL

1. The Fisheries Situation

Senegal has a total continental shelf area of some 23,800 sq. km and a coastline of about 718 km. In the north, the shelf is relatively narrow, extending some 35 km. from the coast, whil in the south with its extensive river systems, the shelf extends up to 125 km from the coast. The seasonal upswellings which occur off the coast of Senegal give rise to some of the richest fish stocks off the entire West African coast.

Total annual catch (1980) was 254,951 metric tons, (down fr a high of 294,052 metric tons in 1978 having a value of approximately US$71,350,000. Estimated resource potential varies with the season from 1,220,900 metric tons in May to 691,800 metric tons in September.

In 1979, Senegal exported 62,168 metric tons worth $80,006, and imported 11,732 metric tons valued at $9,680,000. Therefore Senegal is a net fish exporting nation. Considerable progress h been made in expanding processing and cold storage facilities, primarily for freezing shrimp and other high value species for export, mainly to Europe. The majority of the tuna catch is exported direct to France and landings allocated to local cannir plants are insufficient to maintain much more than 50 percent operating capacity.

The fishing industry plays a significant role in the Senega economy, both as a supplier of food for domestic consumption and a source of foreign exchange. The value of fish production now exceeds that of the crop of goundnuts, traditionally Senegal's most important commodity. Fish consumption is on a national ave age more than double that of all forms of meat. Its fish consumption ranks among the highest in Africa and depends almost entirely on local production. The pattern of consumption varies markedly from region to region, being considerably higher in Dakar, along the coast generally, and in the Senegal River Valle than in inland areas.

2. Structure of the Fisheries Sector

Fish for in-country consumption is provided mainly by the artisanal sector working from a number of large fishing centers along the coast. In spite of the introduction of a growing numb of modern fishing vessels, the traditional canoe fishing (6,442 canoes in 1979) remains the most important sector of the Senegalese fishing industry.

In 1979, the industrialized sector of the locally based fleet consisted of some 35 tuna vessels, 84 trawlers, 12 purse seiners and 15 gillnetter/handliners. The trawlers fish mainly for shrimp and other high value demersal species along the coast of Senegal and farther south. The medium sized purse seiners exploit the abundant stocks of sardenilla. Pole and line and purse seine fishing for tuna is a long established activity in Senegal and significant quantities of tuna are still taken by these methods.

Fishing agreements are in force which allow foreign vessels, to fish Senegalese waters and either land their catch in Dakar or transport it to their home port. Also, Senegal has negotiated agreement to allow its vessels to fish in the adjacent waters of Mauretanis, The Gambia and Guinea Bissau.

Senegal usually obtains financial compensation from countries with whom it signs bilateral agreements to fish in Senegalese waters. For instance, it obtained CFA 2.5 billion from the EEC, and CFA 2.3 billion from Spain. Also, these countries participate in training and research programs, and 33 percent of the fishermen aboard their vessels must be Senegalese.

Although Senegal, as other coastal states in the CECAF region has national laws and bilateral agreements to limit and control fishing activities in its waters, there is at present little capacity for effective enforcement.

3. Fisheries Infrastructure

Modern fishing port facilities with adequate room for expansion are available in Dakar, as the result of recent World Bank supported development. Vessel repair and maintenance facilities are available for vessels up to 60,000 tons. There is good technical capability to support services.

Flight connections with Europe, the U.S., South America, and African countries into Dakar, allow rapid delivery of spare parts and supplies from these areas. Sea transportation utilizing container cargo is available to worldwide destinations from the port of Dakar.

The government provides a subsidy to reduce fuel costs for both industrial vessels and artisanal canoes, and allows fishing gear to be sold free of tax. In general, however, fishing costs are reported to be high compared with vessels of other countries fishing in the region. The government is encouraging the expansion of privately owned Senegalese companies to expand the fisheries activities and increase national production.

4. Model for Directed Balistes Fisheries Operation

As discussed previously, considerable amounts of Balistes are caught each year by trawlers and purse seiners fishing for higher or more sought-after species. It is thought that such by-catch fish from some vessels could be retained aboard and landed with appropriate financial incentives providing such an operation proved economic.

Another alternative would be to operate a directed fisheries for Balistes from Dakar, working the concentrations south of Dakar down to The Gambia and Casamance region. This fishery can be expected to be seasonal, but be viable for a considerable part of the year, perhaps from April through November, following the movement of the warm front (See Figure II.C.4.1)

Sea bed features indicate that very little of the area between 20 and 100 meters depth is unsuitable for bottom trawling, although large areas require careful working and appropriate bottom gear. Trawls may be rigged to avoid hard ground contact since Balistes are usually found above the sea bed.

The model for a directed Balistes fisheries operation is based upon the utilization of a used 78ft. 415 HP vessel as described in Part I. See Figure II.C.4.2 for the cost of operations of this vessel and Figures II.C.4.3, II.C.4.4 and II.C.4.5 for the other vessels considered in the analysis.

The variation in unit costs for landing Balistes with different commercially attainable catch rates and different values for vessels utilized are shown in Figures II.C.4.6 and II.C.4.7. Clearly, the used vessel with a refrigerated sea water system offers the opportunity for the most cost effective operation.

The basic information and assumptions noted in Table II. C.4.8 were developed based on discussions with knowledgeable people in the government and private sector concerning local costs of operations and administration of fishing vessels.

5. Financial Model of Enterprise in Senegal with Integrated Directed Balistes Fisheries and Processsing Plant Operation

The financial model of an enterprise in Senegal with an integrated directed Balistes fisheries and processing plant operation is presented below.

As discussed previously, the directed fisheries operation utilizing the used vessel with a refrigerated sea water system (See Figure II.C.4.2) offers the opportunity for the most cost effective operation. It is assumed that the fisheries operation will successfully catch 1.25 tons of fish an hour resulting in

Figure II.C.4.1

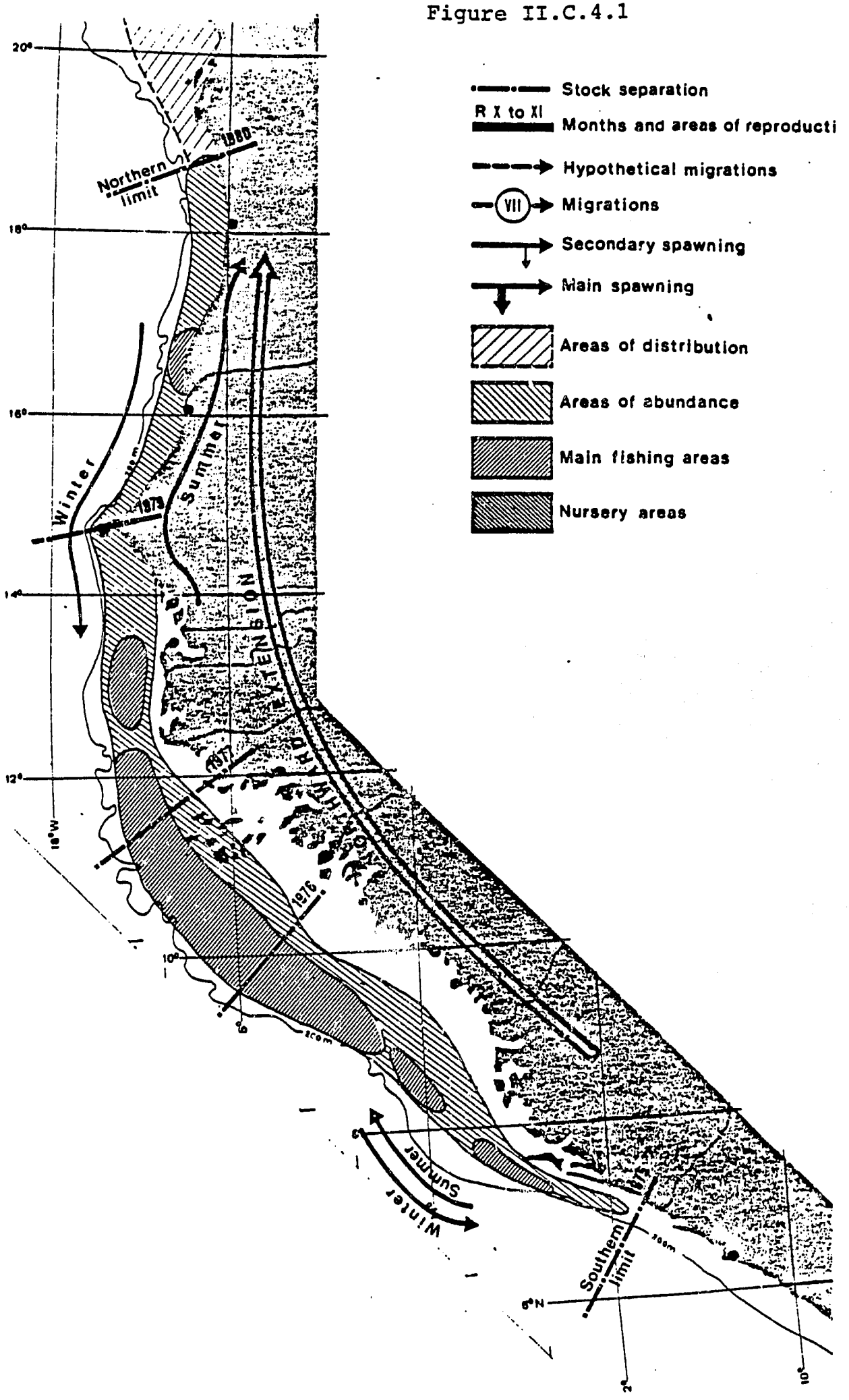


Figure II.C.4.2

COUNTRY: SENEGAL (DAKAR)

CATCH STORAGE: R.S.W.

VESSEL COST: $475,000 (USED)

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	48	40	31.3	21.8
Days/Trip	5	6	7.66	11
Days at Sea/Year	240	240	240	240
Days Fishing/Year	192	200	208.7	218.2
Catch: Balistes	2,880	2,400	1,878.3	1,309.2
Other (8%)	230.4	192	150.3	104.7
Total (tons)	3,110.4	2,592	2,028.6	1,413.9
Ice: WT/year (tons)	-	-	-	-
Price $/ton	-	-	-	-
Cost/Year $	-	-	-	-
Fuel: Gal/HR	15	15	15	15
Gal/YR	86,400	86,400	86,400	86,400
Price $/GAL	0.77	0.77	0.77	0.77
* Cost/Year $	66,528	66,528	66,528	66,528
*Oils: 8% Fuel	5,322	5,322	5,322	5,322
*Gear Cost: $/year	60,800	63,333	66,088	69,097
*Insurance: 3.5%(INV)$	16,625	16,625	16,625	16,625
*Fishing License $/YR	2,100	2,100	2,100	2,100
*Port Taxes $/YR	5,400	5,400	5,300	5,300
*Maint. & Repair: $/YR	40,375	40,375	40,375	40,375
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	209,150	211,683	214,338	217,347
Crew Cost $/YR	91,304	86,120	80,486	74,339
Total Oper. Exp + Crew $/YR	300,454	296,803	294,824	291,686
Administrative Exp. $/YR	12,018	11,912	11,793	11,667
Capital Cost (FIRST YR. $)	226,944	226,944	226,944	226,944
TOTAL COST ($)	539,416	536,659	533,561	530,317
Value of other Fish $/YR	165,888	138,280	108,216	75,384
Total Cost of Balistes $/YR	373,528	398,379	425,345	454,933

Cost of Balistes $/ TON	129.7	166.0	226.5	347.5
¢/LB	5.8	7.4	10.1	15.5
¢/KG	12.7	16.3	22.2	34.1
/KG	38.2	48.9	66.7	102.4

*Items Included in Total Operating Expenses

Figure II.C.4.3

COUNTRY: SENEGAL (DAKAR)

CATCH STORAGE: R.S.W.

VESSEL COST: $675,000 (NEW) 300cfa/$

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	48	40	31.3	21.8
Days/Trip	5	6	7.66	11
Days at Sea/Year	240	240	240	240
Days Fishing/Year	192	200	208.7	218.2
Catch: Balistes	2,880	2,400	1,878.3	1,309.2
Other (8%)	230.4	192	150.3	104.7
Total (tons)	3,110.4	2,592	2,028.6	1,413.9
Ice: WT/year (tons)	-	-	-	-
Price $/ton	-	-	-	-
Cost/Year $	-	-	-	-
Fuel: Gal/HR	15	15	15	15
Gal/YR	86,400	86,400	86,400	86,400
Price $/GAL	0.77	0.77	0.77	0.77
* Cost/Year $	66,528	66,528	66,528	66,528
*Oils: 8% Fuel	5,322	5,322	5,322	5,322
*Gear Cost: $/year	60,800	63,333	66,088	69,096
*Insurance: 3.5%(INV)$	23,625	23,625	23,625	23,625
*Fishing License $/YR	2,100	2,100	2,100	2,100
*Port Taxes $/YR	6,500	6,400	6,300	6,300
*Maint. & Repair: $/YR	37,125	37,125	37,125	37,125
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	214,000	216,433	219,088	222,097
Crew Cost $/YR	91,304	86,120	80,486	74,339
Total Oper. Exp + Crew $/YR	305,304	302,553	299,574	296,436
Administrative Exp. $/YR	12,212	12,102	11,982	11,857
Capital Cost (FIRST YR. $)	322,500	322,500	322,500	322,500
TOTAL COST ($)	640,016	637,155	634,057	630,793
Value of other Fish $/YR	165,888	138,240	108,216	75,384
Total Cost of Balistes $/YR	474,128	498,915	525,841	555,409

Cost of Balistes $/ TON	164.6	207.9	279.9	424.2
¢/LB	7.3	9.3	12.5	18.9
¢/KG	16.2	20.4	27.5	41.7
/KG	48.5	61.2	82.5	125.0

*Items Included in Total Operating Expenses

Figure II.C.4.4

COUNTRY: SENEGAL (DAKAR)

CATCH STORAGE: ICED

VESSEL COST: $400,000 (USED)

Catch Rate: Tons/HR	1.25	1.0	0.75	0.5
Trips/Year	48	40	31.30	21.80
Days/Trip	5	6	7.66	11.00
Days at Sea/Year	240	240	240	240
Days Fishing/Year	192	200	208.70	218.2
Catch: Balistes	2,880.0	2,400	1,878.30	1,309.2
Other (8%)	230.4	192	150.3	104.7
Total (tons)	3,110.4	2,592	2,028.6	1,413.9
Ice: WT/year (tons)	3,732	3,110	2,434	1,697
Price $/ton	40	40	40	40
Cost/Year $	149,280	124,400	97,360	67,880
Fuel: Gal/HR	14	14	14	14
Gal/YR	80,640	80,640	80,640	80,640
Price $/GAL	0.77	0.77	0.77	0.77
* Cost/Year $	62,093	62,093	62,093	62,093
*Oils: 8% Fuel	4,967	4,967	4,967	4,967
*Gear Cost: $/year	60,800	63,333	66,088	69,097
*Insurance: 3.5% (INV) $	14,000	14,000	14,000	14,000
*Fishing License $/YR	2,100	2,100	2,100	2,100
*Port Taxes $/YR	6,400	6,200	5,900	5,600
*Maint. & Repair: $/YR	34,000	34,000	34,000	34,000
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	345,640	325,095	298,508	271,757
Crew Cost $/YR	91,304	86,120	80,486	74,339
Total Oper. Exp + Crew $/YR	436,944	409,213	378,994	346,076
Administrative Exp. $/YR	17,478	16,368	15,160	13,843
Capital Cost (FIRST YR. $)	191,111	191,111	191,111	191,111
TOTAL COST ($)	654,533	616,692	585,265	551,030
Value of other Fish $/YR	165,888	138,280	108,216	75,384
Total Cost of Balistes $/YR	479,645	478,412	477,049	475,646

Cost of Balistes $/ TON	166.5	199.4	254.0	363.3
¢/LB	7.4	8.9	11.3	16.2
¢/KG	16.4	19.6	24.9	35.7
/KG	49.1	58.7	74.8	107.0

*Items Included in Total Operating Expenses

Figure II.C.4.5

COUNTRY: SENEGAL (DAKAR)

CATCH STORAGE: ICED

VESSEL COST: $600,000 (NEW)

Catch Rate: Tons/HR	2.36	1.0	0.75	0.5
Trips/Year	48	40	31.30	32.8
Days/Trip	5	6	7.66	11.0
Days at Sea/Year	240	240	240	240
Days Fishing/Year	192	200	208.7	218.2
Catch: Balistes	2,880.0	2,400	1,878.3	1,309.2
Other (8%)	230.4	192	150.3	104.7
Total (tons)	3,110.4	2,592	2,028.6	1,413.9
Ice: WT/year (tons)	3,732	3,110	2,434	1,697
Price $/ton	40	40	40	40
Cost/Year $	149,280	124,400	97,360	67,880
Fuel: Gal/HR	14	14	14	14
Gal/YR	80,640	80,640	80,640	80,640
Price $/GAL	0.77	0.77	0.77	0.77
* Cost/Year $	62,093	62,093	62,093	62,093
*Oils: 8% Fuel	4,967	4,967	4,967	4,967
*Gear Cost: $/year	60,800	63,333	66,088	69,096
*Insurance: 3.5%(INV)$	21,000	21,000	21,000	21,000
*Fishing License $/YR	2,100	2,100	2,100	2,100
*Port Taxes $/YR	7,400	7,100	6,900	6,600
*Maint. & Repair: $/YR	33,000	33,000	33,000	33,000
*Crew Expenses $/YR	12,000	12,000	12,000	12,000
Total Operating Exp./Yr	352,640	329,993	305,508	278,737
Crew Cost $/YR	92,304	86,120	80,486	74,339
Total Oper. Exp + Crew $/YR	443,944	416,113	385,994	353,076
Administrative Exp. $/YR	17,758	16,644	15,440	14,123
Capital Cost (FIRST YR. $)	286,667	286,667	286,667	186,667
TOTAL COST ($)	748,369	719,424	688,101	653,866
Value of other Fish $/YR	165,888	138,280	108,216	75,384
Total Cost of Balistes $/YR	582,481	581,144	579,885	578,482

Cost of Balistes $/ TON	202.2	242.1	308.7	441.8
¢/LB	9.0	10.8	13.8	19.7
¢/KG	19.9	23.8	30.3	43.4
/KG	59.6	71.3	91.0	130.2

*Items Included in Total Operating Expenses

Figure II.C.4.6

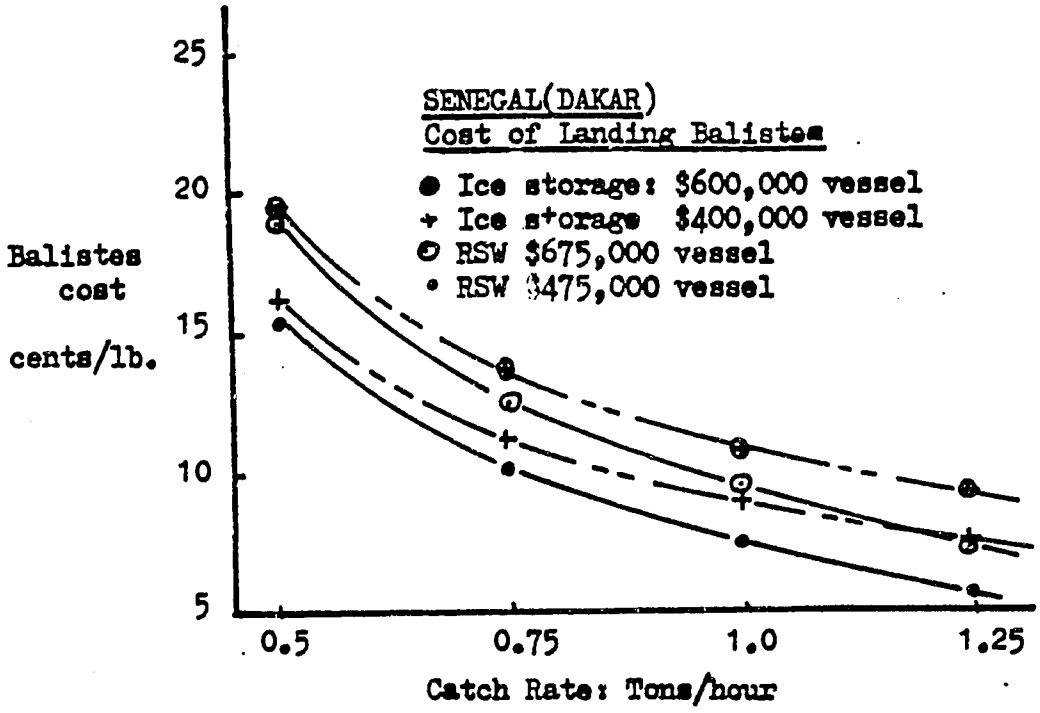


Figure II.C.4.6

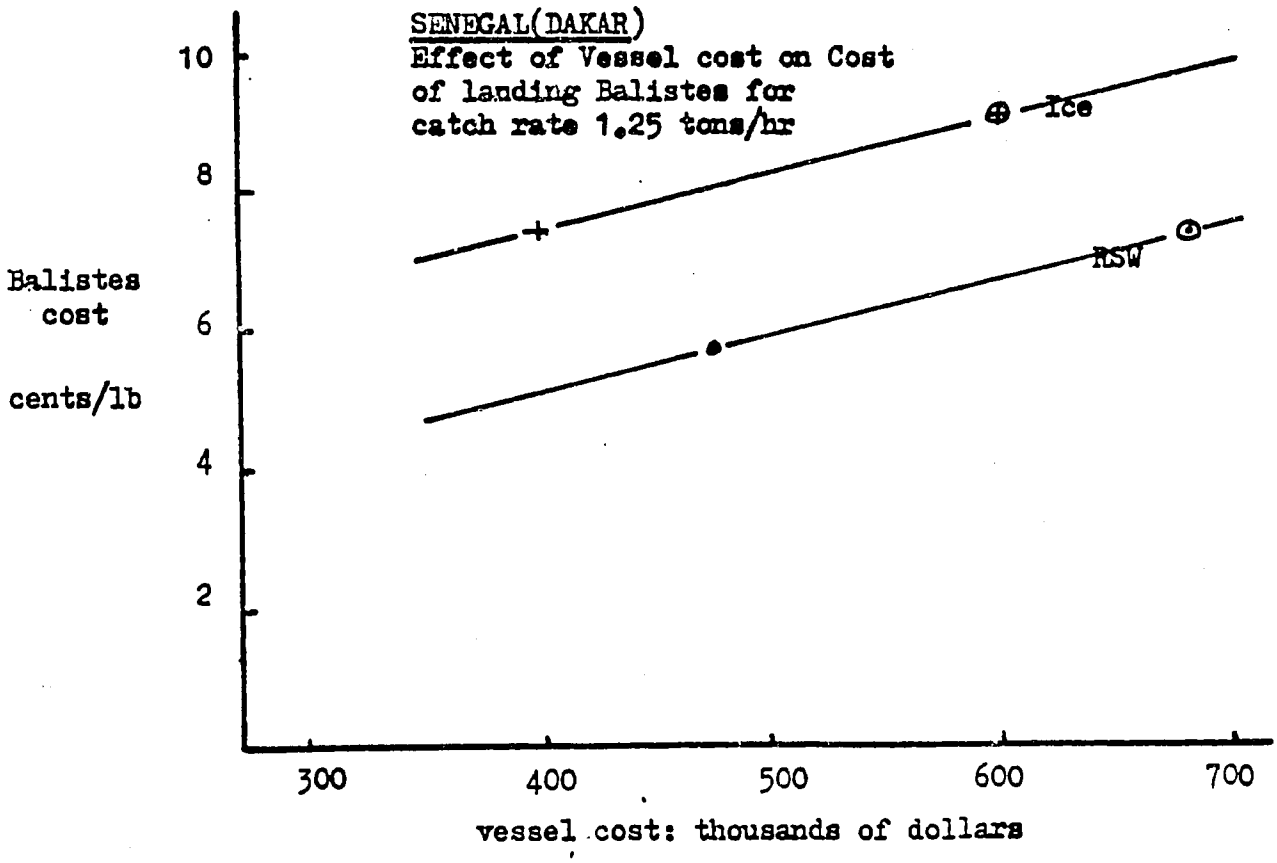


TABLE II C.4.8

SUMMARY OF BASIC INFORMATION: Senegal (Dakar)

Exachange Rate (Feb. 1983) = 300 cfa/$

Ice Cost (Feb. 1983) 12,000 cfa/Ton = $40/Ton

Diesel Fuel 61 cfa/liter = $0.77/U.S. Gal.

Port Taxes (Dakar) 1% Landed Value of Catch

Crew Cost

The following are assumed, based on data and information provided by CECAF:

Captain:	U.S. National $3,400/month + $6/ton =	$40,800 + bonus
Engineer:	90,000 cfa/Month + bonus	3,600 + bonus
Mate:	80,000 cfa/Month + bonus	3,200 + bonus
Asst. Eng:	60,000 cfa/Month + bonus	2,400 + bonus
Cook:	55,000 cfa/Month + bonus	2,200 + bonus
Deckhands (4):	50,000 cfa/Month + bonus	8,000 + bonus
		$60,200 + bonus

Assumed Total bonus $10/Ton

Subsistence Allowance:

For crew members: 900/16,000 cfa/month food + 4,500 transport
Total of $12,000 per year allowed to provide for local crew costs plus travel, transport and living allowance for captain.

Fishing License

7,500 cfa/GRT = $25/GRT

Fish Prices

Average price for fish exports between $600 - 800 per ton.
Assumed average value: $720/Ton (as for The Gambia)

2,880 tons of Balistes annual production with a by-catch of higher value fish worth $165,888 as presented in the calculations. No value was determined for the amount of Balistes excess to the 2,700 tons utilized in calculations of the model processing plant operations.

The total costs of the directed Balistes fisheries operation were initially calculated on the basis of operating as an independent, self-sufficient fishing operation. However, with an integrated Balistes fisheries and processing plant, the cost of the vessel and its operations will be considered as part of the full enterprise.

Therefore, based on financial data presented in the models for a directed Balistes fisheries and for the processing plant, the establishment of an integrated Balistes fisheries and processing plant is projected to have costs in investment capital and annual operations with income from product sales as follows:

Financial Model of Enterprise with Integrated Balistes Fisheries and Processing Plant

Investment Capital Costs	
Vessel	$ 475,000
Processing Plant	1,051,704
TOTAL	$1,526,704
Annual Operations Costs	
Vessel	$ 300,454
Processing Plant	471,055
TOTAL	$ 771,509
Annual Income Product Sales	
Dried Fish Cakes	$ 522,340
Frozen Fish Blocks	575,444
Fish Silage	218,940
High Value Fish	165,888
TOTAL	$1,482,612

Based on an assumption that if it were necessary to finance all the investment capital and the appropriate investment and tax incentives were in place, a projected pro-forma statement of income and expenses for the first year of operation of the enterprise could be presented as follows:

Pro-Forma
Statement of Income and Expenditure

Income	
Sales:	
Dried Fish Cakes	$ 522,340
Frozen Fish Blocks	575,444
Fish Silage	218,940
High Value Fish	165,888
Gross Income	$1,482,612
Expenses	
Vessel operations	$ 300,454
Processing plant operations	471,055
Interest(1)	229,005
Total Expenses	$1,000,514
Net Income from Operations	$ 482,098

(1) 15% of total capital investment costs of $1,526,704 It is likely that more concessional interest rates would be available.

6. Feasibility of Private Sector Involvement In Development of Balistes Fisheries

There exists a considerable number of industrial companies which are engaged in the catching, processing and marketing of fish and fisheries products. These companies, practically all based in Dakar, may be locally owned or mixed companies and in many cases are operated by expatriate partners. These companies mostly produce high value fish for export largely to European markets. However, there is a fleet of purse seiners which catch sardinella mostly for African markets.

Throughout much of the year, considerable quantities of Balistes are caught as a by-catch by both the trawler and purse seiner fleets operating in Senegalese waters. It has been estimated that about 10,000 to 15,000 tons of Balistes are discarded from such vessels each year (i.e. about 1/3 total discards).

The America's Development Foundation team met with many of the principal industrial fisheries companies in Senegal. These companies, without exception, showed little interest in development of a non-traditional fisheries to catch and process Balistes. They confirmed their interests was in the production of high value fish for export. Furthermore, they had keen interest in securing additional vessels and equipment to increase their catch and processing capabilities. Also, there was one company which wished to diversify its operations and to produce, on an industrial level improved whole smoked fish from sardinella and other species for which they had identified significant demands in the African markets.

The existence of large quantities of Balistes by-catch offers an opportunity for commercial supply of Balistes to support a processing plant operation provided there was sufficient financial inducement to vessels to handle, store and land the Balistes by-catch.

The cost figures for landing Balistes from a directed fisheries operation offer a guide as to the maximum price appropriate for a processing plant operation to purchase Balistes by-catch. Discussions with several of the companies indicated that interest could be generated by vessels to land Balistes by-catch within that cost figure.

There were no companies which expressed an interest to participate in the processing of Balistes. The development of an enterprise to process Balistes would have to be found from other sources of capital. The private sector companies with which America's Development Foundation's team met included the following: AMERGER, SURGEL, SAFCOP, SWCAS, AFRISEN and SODIPROMER

7. Government Support for the Private Sector

The government offers a range of investment incentives supportive of private sector development of fisheries. Such incentives include tax incentives and subsidized fuel for Senegalese registered fishing vessels. Also, there is favorable maritime fishing credit programs to provide financing for purchase of vessels and equipment for fisheries development. The government is eager to obtain foreign investment and its 1978 investment code and the industrial tax free zone of Dakar offer numerous incentives designed to stimulate such investments.

Discussions with government officials reflected a strong interest in the private sector to develop utilization of Balistes and other nonutilized fish species available in Senegal's waters. The officials expressed special support for the development of improved cured fish products of the type contemplated in the proposed project to supply food needs of the rural inland population areas of Senegal and other African countries.

8. CONCLUSIONS

1. There exists adequate Balistes resources within the waters of Senegal for the development of a directed fisheries operation, principally to the south of Dakar and in the Casamance region.

2. There exists a significant amount of potential Balistes raw material resources from the Balistes by-catch of the existing trawler and purse seiner fisheries fleet that is presently being discarded at sea but which could be encouraged to be landed for a processing facility by appropriate financial incentives.

3. There does exist a need for increased supplies of cured fish products to meet the food and nutritional needs expecially of the rural inland population.

4. The existing fisheries companies are principally interested in the production of high value fish for export markets. There was no evidence of any local interests in developing a processing operation to produce Balistes products. Therefore, it would be necessary to identify other local sources of capital to establish such a processing facility.

5. There exists strong government support for private sector activities to develop Senegalese fisheries including the utilization of Balistes. There was especially strong interest in development of fisheries processing technology to produce cured fish products that have extended shelf life to meet the food and nutritional needs of the rural inland population.

6. The investment opportunities for the industrial process of fish into dried fish products produced for high value whole fish involving minced fish technology for underutilized species, for the African market needs to be brought to the attention of potential local and foreign investors through investment opportunity seminars and other communications.

Appendix I

AMERICA'S DEVELOPMENT FOUNDATION

600 SOUTH LEE STREET, OLD TOWN, ALEXANDRIA, VIRGINIA 22314, TELEPHONE (703) 836-2717

MARINE RESOURCES AND AQUACULTURE DEVELOPMENT PROGRAM

America's Development Foundation (ADF) is a U.S. non-profit, scientific research, educational and economic development institution. The Foundation is organized to conduct, stimulate and accelerate research, development and management of living aquatic resources to assist countries to meet their nutritive, economic and social needs. Since marine resources and aquaculture development is a complex interrelationship between economic, environmental, technical, social and other factors, ADF offers a wide range of services and resources, including: resources assessment and development; utilization of underexploited marine species; development of fuel efficient vessel designs and sail technology; training and educational services; and vessel and marine equipment support.

RESOURCE ASSESSMENT AND DEVELOPMENT

ADF provides technical cooperation in the evaluation and development of physical, social and financial resources available for the execution of specific projects. Evaluation of marine resources includes: exploratory fishing programs; analysis of the magnitude and optimum sustainable yields of available fisheries stocks; assessment of fisheries product processing, storage and marketing facilities; and environmental studies. ADF directly participates in marine fisheries operations on a joint venture basis. Special technical studies are conducted in the evaluation and development of aquaculture activities to improve intensive farming of marine and freshwater resources including special fish species, shrimp, conch, oyster and other aquatic crops. Special support is given to small-scale systems which can appropriately be utilized by poor artisanal fishermen.

UTILIZATION OF UNDEREXPLOITED MARINE SPECIES

In a world confronted with food shortages and serious over exploitation in some regions of several traditional commercial fish stocks, a number of important fish species remain underutilized. Many species such as sharks and trigger fish represent potentially important resources for increased fisheries production. Therefore, ADF actively promotes and develops projects aimed at the most economic exploitation of such species. Specific activities include the establishment of appropriate fishing operations and processing facilities for such fisheries and assistance in the international marketing of the non-traditional fisheries products.

DEVELOPMENT OF FUEL EFFICIENT VESSEL DESIGNS AND SAIL TECHNOLOGY

With the significant increase in the cost of fuel for motor vessels, fuel has become a major overhead cost for commercial fishing, marine research and other marine related activities. Therefore, ADF promotes and offers technical and material assistance regarding the low cost use of sailpower and fuel efficient hulls for commercial fishing, research and transport activities. Specific ADF activities in this area include: research and development of optimum hull designs and propulsion systems for specific use patterns, sea conditions and socioeconomic needs of beneficiary peoples; and utilization of sail for primary or auxiliary power.

TRAINING AND EDUCATIONAL SERVICES

One of ADF's main objectives is to improve local, national and international capabilities in marine and aquaculture activities. Therefore, it provides training and educational services to transfer available technologies and develop new productive capabilities. ADF offers a number of practical training courses and educational services, some in cooperation with other national and international institutions, in the following areas: commercial fishing techniques; oceanographic and marine biology research; aquaculture technology and marine fisheries management; sail training; seamanship and vessel operations; piloting and navigation; marine and fishing gear equipment operations; and vessel and equipment maintenance.

VESSEL AND MARINE EQUIPMENT SUPPORT

ADF utilizes various kinds of vessels and marine equipment in support of its national and international scientific research, educational and economic development activities. Its activities require many types of commercial fishing vessels and other motor and sail vessels for training, oceanographic research, transport and specific projects including actual commercial fishing operations. There is a similar need for equipment and supplies for use in the Foundation's marine and aquaculture projects. Such vessels and marine equipment, which are used in projects serving the most needy artisanal fishermen, are acquired by ADF through contributions from the private and public sector.

AMERICA'S DEVELOPMENT FOUNDATION— RESOURCES AND SUPPORT

America's Development Foundation is governed by a Board of Directors that is dedicated to the public service objectives of the institution. The Foundation's multilingual staff consists of U.S. and internationally recruited scientists and other qualified professionals with extensive experience in marine resources and aquaculture development.

ADF's technical cooperation includes preparation, implementation and evaluation of development projects as well as feasibility studies and formulation of specific project proposals. ADF's cooperation includes securing private and public sector support for projects at the local, national and international levels as well as participating in joint venture projects.

ADF is a U.S. non-profit, publicly supported charitable institution: it is not a private foundation. The Foundation is a tax exempt 501(c)(3) charitable corporation which as described in Section 170(c) of the U.S. Internal Revenue Code is qualified to receive tax deductible contributions. ADF's program activities rely upon the support of contributions, loans and grants of financial, material and technical resources from individuals, corporations, foundations, governments and international agencies.

Appendix II

MEETINGS HELD WITH
INDIVIDUALS IN PRIVATE AND PUBLIC SECTORS

SENEGAL

1.	Dr. Diokh	Director of Fisheries
2.	Dr. Demba Kane	Deputy Director of Fisheries, Fisheries Department
3.	B. Chuun	Chef de Service, DOPM
4.	Demba Diop	Ministry of Plans and Cooperation
5.	George Everitt	Program Leader, CECAF
6.	Michael Ansa Emin	Deputy, CECAF
7.	M.A. Robinson	Senior Fishery Economist, CECAF
8.	Abdoulaye NDiaye	Societe des Pecheries Senegalaises du Thun
9.	Ibrahima Diagne	SURGEL
10.	Mathar NDiaye	S.N.C.D.S.
11.	A. D. Thiam	AFRISEN
12.	Michael Langlois	Amerge Casamance
13.	Jacqueline Lopez	Director, Oceanographic Research Center, (CRODT), Dakar
14.	Jacques Weber	Oceanographic Research Center (CRODT)
15.	Andre Peuvion	SOFISEDIT
16.	Carol Tyson	Deputy Director, USAID
17.	Abe Houdrouge	Commercial Section, USAID
18.	Ed Auchter	Commercial Section, USAID
19.	Papa Samba	SODIPROMER

THE GAMBIA

1.	Ousman Sallah	Minister for Water Resources and the Environment
2.	I. Joof	Minister of Fisheries
3.	Austin Joko Jones	Fisheries Officer
4.	O. B. Conateh	President, National Partnership Enterprises
5.	Ismaila Ceesay	National Partnership Enterprises
6.	Kawsu Ceesay	National Partnership Enterprises
7.	Gabriel Samdou	National Partnership Enterprises
8.	B.M. Sousseh	Kumera Amina & Co.
9.	Byron Bahl	U.S. AID, Director
10.	Quincy Benbow	USAID Agricultural Development Officer

GUINEA BISSAU

1.	Flavio Proenca	Secretary of Fisheries
2.	Eduardo Fernandez	Ministry of Commerce
3.	George Pimental	Director, PESCARTE
4.	Henrique Paralta	E.R. Paralta
5.	Suleimane Djassi	Secretary of Fisheries
6.	Jim Anderson	U.S. AID Mission Director

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Appendix IV

BALI
1981

FAO SPECIES IDENTIFICATION SHEETS

FISHING AREAS
34, 47 (in part)
(E.C. Atlantic)

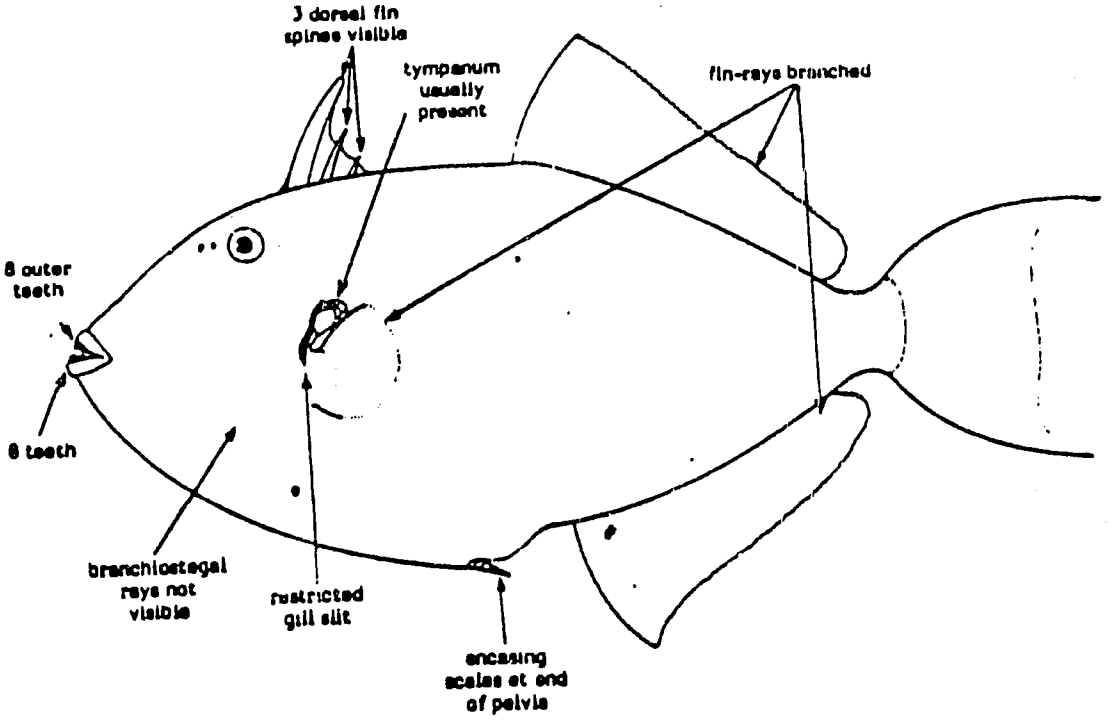
BALISTIDAE

(excluding the Monacanthidae e Aluteridae of some authors)

Triggerfishes and durgons

Small or medium-sized fishes, usually less than 40 cm in length, with deep, moderately compressed bodies encased with very thick, tough skin with large rectilinear scale plates easily discernible as individual units; scales above pectoral fin base usually enlarged and slightly separated, forming a flexible tympanum. Gill opening a relatively short vertical to oblique slit in front of the pectoral fin base, branchiostegal rays hidden beneath the skin; mouth small and usually more or less terminal; teeth heavy, 8 in an outer series in the upper jaw and 8 in the lower jaw. Three dorsal fin spines, the second spine more than one-half the length of the first; the first spine capable of being locked in an upright position of erection by the second; most dorsal, anal and pectoral fin rays branched; pelvic fins and spines rudimentary or absent, represented by a series of 4 pairs of enlarged scales encasing the end of pelvis. Lateral line inconspicuous.

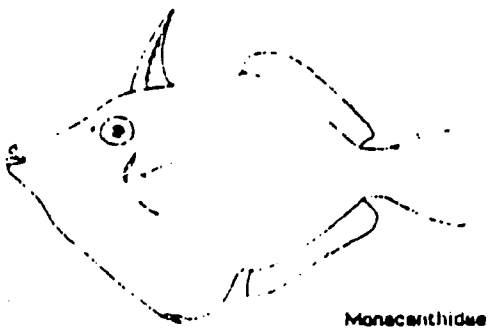
Colours variable, sometimes black or drab brown, grey or greenish, but often with strikingly marked and vivid patterns.



Triggerfishes are usually solitary, ranging in depth from the coastline to about 90 m, with some species being found primarily in pelagic open water and others primarily benthic around rocky and coral reefs. They feed on bottom invertebrates, often hard-shelled species, or zooplankton, with their small mouths typically armed with large and relative heavy incisor-like teeth. Highly valued as food in many handline fisheries, and also taken as bycatch in commercial bottom trawls; on rare occasions the flesh has been considered toxic. Some species, such as Balistes capriscus and B. punctatus are very abundant and of growing commercial importance in some countries. The catch of unsorted triggerfishes reported from the area in 1978 totalled almost 10 000 t.

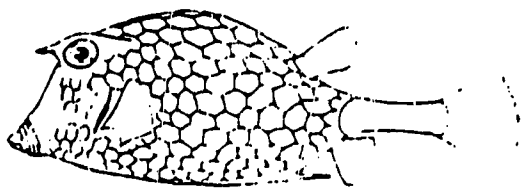
SIMILAR FAMILIES OCCURRING IN THE AREA:

Monacanthidae: two dorsal fin spines, only the first of which is especially large and prominent; body more laterally compressed; fewer and less massive teeth in jaws; scales shagreen-like, with the individual basal plates small and not readily distinguishable from one another to the unaided eye.



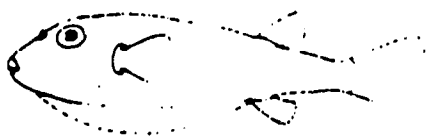
Monacanthidae

Ostraciidae: no spiny dorsal fin; teeth more conical; scales in the form of enlarged, exceptionally thick, usually hexagonal plates sutured together to form a box-like encasement of the body.



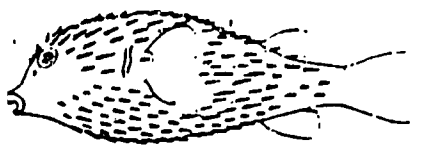
Ostraciidae

Tetraodontidae, Diodontidae, Molidae: no spiny dorsal fin; no pelvic fin of any kind; teeth incorporated into, or indistinguishably fused with the jaw bones to form a parrot-like beak, with or without a division in the midline into two equal halves in each jaw; skin either rough with scales modified as prickles and long quill-like spines or scales sometimes absent and the skin smooth.



Tetraodontidae

Molidae



Diodontidae

KEY TO GENERA OCCURRING IN THE AREA:

1 a. Scales above pectoral fin base and just behind gill slit much enlarged and partially separated, forming a flexible tympanum (Fig. 1)

2 a. Caudal peduncle depressed, wider than deep ..... Abalistes

2 b. Caudal peduncle compressed, deeper than wide

3 a. Teeth notched, uneven, of distinctly increasing length toward the middle teeth (Fig. 2); scales of posterior body without keels forming longitudinal ridges; body greyish to bluish-green, but never distinctly black, and no pale stripe along the bases of the soft dorsal and anal fins ..... Balistes

3 b. Teeth not notched, at least in larger juveniles and adults, with relatively even distal edges, not of distinctly increasing length toward the middle teeth (Fig. 3); scales of posterior body with keels at the centre forming longitudinal ridges; body blackish with a pale bluish stripe along the bases of the soft dorsal and anal fins ..... Melichthys

1 b. Scales above pectoral fin base and just behind gill slit not enlarged and not especially well separated, not forming a flexible tympanum

4 a. Cheek with about 3 prominent naked longitudinal grooves, darker in colour than the surrounding skin; mouth slightly, but distinctly, supraterminal (Fig. 4) ..... Xanthichthys

4 b. Cheek evenly scaled, without prominent naked longitudinal grooves; mouth terminal (Fig. 5) ..... Canthidermis

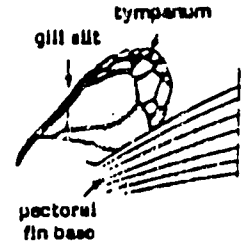
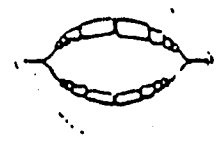


Fig. 1

Balistes sp. Fig. 2

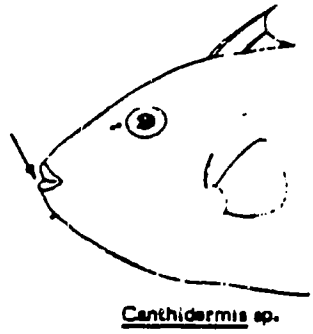
teeth



Melichthys sp. Fig. 3

teeth

Xanthichthys sp. Fig. 4



Canthidermis sp. Fig. 5

LIST OF SPECIES OCCURRING IN THE AREA:

Code numbers are given for those species for which Identification Sheets are included

Abalistes stellatus (Lacepède, 1798)	
Balistes capriscus Gmelin, 1788	BALI Bali 1
Balistes punctatus Gmelin, 1788	BALI Bali 3
Balistes vetula Linnaeus, 1758	BALI Bali 2
Canthidermis maculatus (Bloch, 1786)	
Melichthys niger (Bloch, 1786)	
Xanthichthys ringens (Linnaeus, 1758)	

Prepared by R. Winterbottom, Department of Ichthyology and Herpetology, Royal Ontario Museum, Toronto, Canada, and James C. Tyler, Program for Biological Research Resources, Division of Environmental Biology, National Science Foundation, Washington, D.C. 20550, U.S.A.

GACI Bull 1
1981

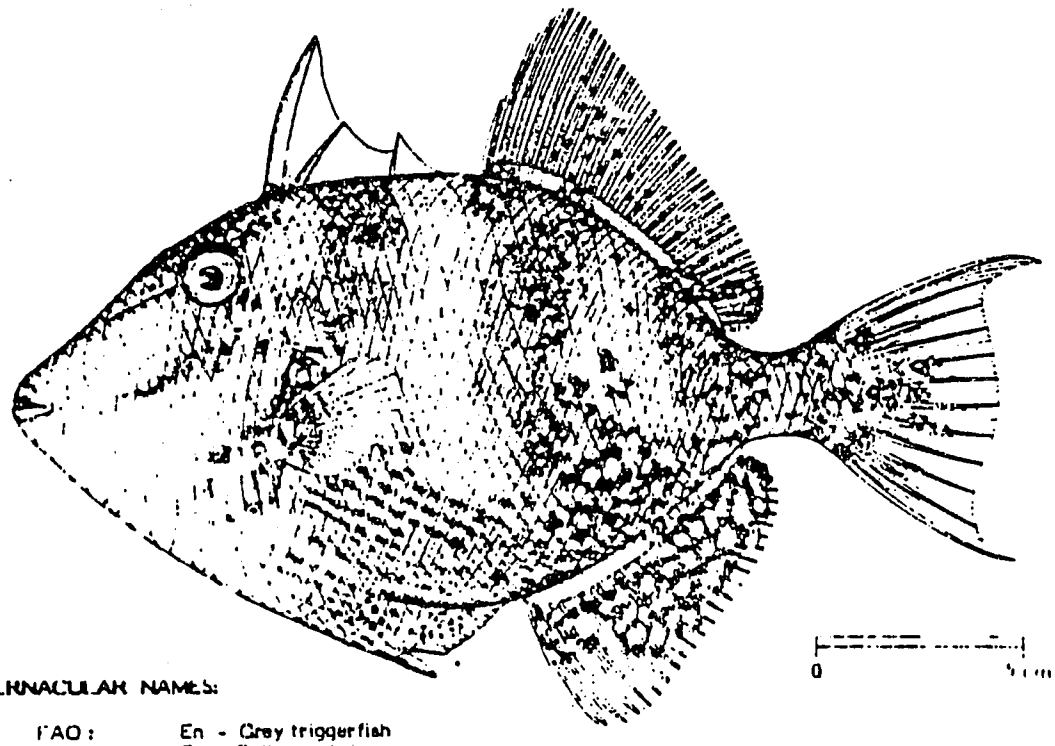
FAO SPECIES IDENTIFICATION SHEETS

FAMILY : BALISTIDAE

FISHING AREAS
34, 47 (in part)
(E.C. Atlantic)

Balistes capriscus Gmelin, 1788

OTHER SCIENTIFIC NAMES STILL IN USE : Balistes carolinensis Gmelin, 1788
Balistes forcipatus Gmelin, 1788



VERNACULAR NAMES:

FAO : En - Grey triggerfish
Fr - Baliste cabri
Sp - Pejepuerco blanco (= Pez ballesta)

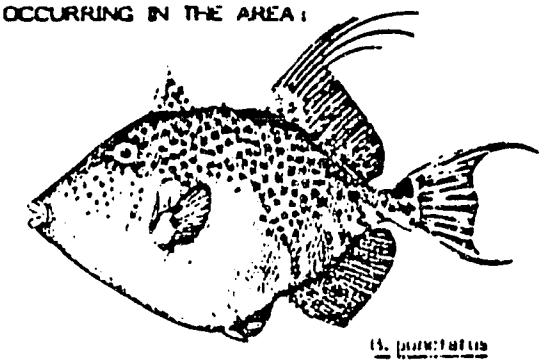
NATIONAL :

DISTINCTIVE CHARACTERS :

Body deep and laterally compressed, with the large rectilinear scale plates of the thick skin forming regular rows, and the scales of the cheek in an even, relatively complete covering. Scales enlarged above the pectoral fin base and just behind the gill slit to form a flexible tympanum; scales of body without prominent keels, not forming longitudinal ridges. A small groove in the skin from in front of the eye to below the low nasal apparatus. Mouth terminal; teeth notched. All 3 dorsal fin spines readily apparent, the first spine capable of being locked erect by the second; most soft dorsal, anal and pectoral fin rays branched; caudal fin rays slightly prolonged above and below; caudal peduncle compressed, deeper than wide.

Colour: generally greyish with green overtones and about 3 darker blotches or irregular bars across the back; chin lighter; small bluish to purplish spots on the upper body, with lighter spots on lower body, sometimes larger and forming short irregular lines; soft dorsal and anal fins with spots, tending to form rows.

DISTINGUISHING CHARACTERS OF SIMILAR SPECIES OCCURRING IN THE AREA:



B. punctatus

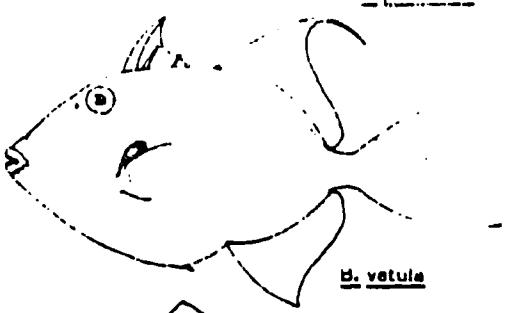
Balistes punctatus: body grey with numerous round blue or dark spots over most of body, posterior to eyes; 3 or 4 anterior rays of second (soft) dorsal fin filamentous and free of membrane in adults.

Balistes vetula: 2 broad blue lines on cheek from above mouth to below the region in front of pectoral fin base; caudal fin in adults greatly prolonged both above and below.

Melichthys niger: body blackish, with a pale bluish stripe along bases of soft dorsal and anal fins; scales of posterior body with keels at the centre forming longitudinal ridges; teeth of adults not notched and not distinctly increasing in length toward the middle teeth; third dorsal fin spine scarcely visible.

Abalistes species: caudal peduncle depressed, wider than deep.

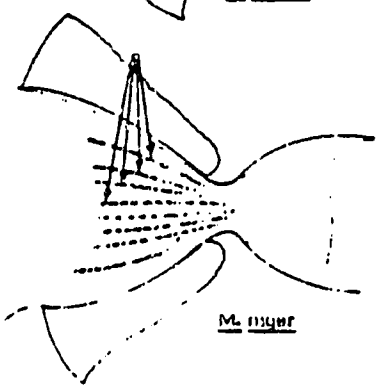
Canthidermis and Xanthichthys species: scales above pectoral fin base and just behind gill slit not enlarged, not forming a flexible tympanum.



B. vetula

SIZE:

Maximum: at least 45 cm, but unconfirmed reports quote 60 cm; common to 20 cm.



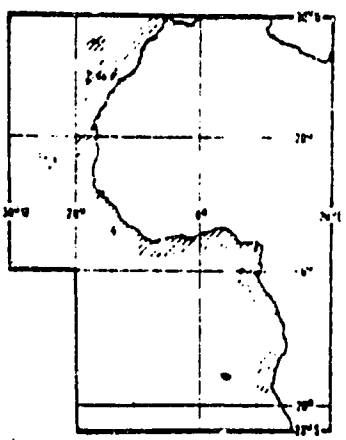
M. niger

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOUR:

In the area, from the Straits of Gibraltar to Moçamedes, Angola including Madeira and the Canary and Cape Verde Islands; northward extending into the Mediterranean and along the Atlantic coasts of Europe up to England. Elsewhere, in the Western Atlantic from Nova Scotia to Argentina.

Found in shallow water down to about 50 m. Nothing definite is known about the areas occupied by this species, but like B. vetula, it seems to occur mainly in shallow sandy or grassy areas as well as rocky bottoms.

Feeds on bottom-living invertebrates.



PRESENT FISHING GROUNDS:

Caught throughout its range, very abundant, and becoming of increasing commercial importance in several African countries.

CATCHES, FISHING GEAR AND FORMS OF UTILIZATION:

Separate statistics are not reported for this species. The catch of unsorted triggerfishes reported from the area in 1978 totalled about 10 000 t.

Taken in bottoms trawls, traps, beach seines and on handlines.

Consumed mostly fresh, smoked and dried salted. The flesh is of excellent quality. Also reduced to fishmeal by offshore trawlers.

XN-AAQ-232-A
ISN: 24915

AMERICA'S DEVELOPMENT FOUNDATION

600 SOUTH LEE STREET, OLD TOWN, ALEXANDRIA, VIRGINIA 22314, TELEPHONE (703) 836-2717

EXECUTIVE SUMMARY OF

A PRE INVESTMENT STUDY IN WEST AFRICA

FOR THE HARVESTING, PROCESSING, AND MARKETING OF TRIGGERFISH

IN THE GAMBIA, GUINEA BISSAU, AND SENEGAL

May 1983

WASHINGTON, D.C. • ALEXANDRIA, VA.

7113

In September 1982, the U.S. Agency for International Development approved a $46,500 grant to America's Development Foundation for its project proposal to conduct a feasibility study in West Africa designed to evaluate the opportunities for private sector investment in Senegal, the Gambia and Guinea Bissau to catch, process and market the underutilized plentiful Balistes resource (also known at Triggerfish) as minced fish products for domestic, regional and international food markets.

The objective of the feasibility study was to help identify private sector investment opportunities in fisheries development which could add to food supplies in the region and generate employment opportunities, income and foreign exchange. America's Development Foundation had been requested by private and public sector officials in West Africa to help identify how the underutilized Balistes fisheries resource could be productively utilized. Mr. Michael Miller and Dr. John Sainsbury, conducted the study through on-site visits, meetings and consultations with members of the private and public sectors in Senegal, the Gambia and Guinea Bissau.

Data obtained from a fisheries resource survey conducted in 1981 by the Norwegian research vessel "Dr. Fridtjof Nansen", in collaboration with the United Nations Food and Agricultural Organization (FAO), indicated that the biomass of Balistes resources in the Gulf of Guinea region had increased rapidly over ten years from a few tons in 1970 to a total biomass of some one and a half million tons in 1981. However, almost throughout the region, the abundant Balistes resources were not being utilized due to local consumer resistance because of the fish's tough skin, bony scale and small size. The Balistes which are caught by commercial vessels were being discarded at sea. On the other hand, consumers in some countries who had become familiar with the flesh of the fish enjoy it for its excellent flavor, whiteness and texture.

A major objective of America's Development Foundation study was to consider the utilization of minced fish technology to transform the Balistes into acceptable food products for local African markets and for export. This technology is based on the production of minced fish by utilizing equipment for the mechanical separation of bone, skin, and scales from the flesh of the fish. The product thus obtained from a mechanical fish separator is raw material suitable for the manufacture of a variety of food products to supply the needs of a range of consumers in urban and rural areas. Furthermore, the waste generated by this processing technology can be utilized to produce various animal feeds.

The utilization of minced fish technology was considered appropriate for fish species such as Balistes, which, owing to its form and size, had little market value. The advantage of the processing technique is that the fish loses its original identity. It can be mixed with other food ingredients and, the product's properties and appearance can be adapted to suit the taste of markets and consumers. Also, the utilization of minced fish allows the addition of anti-oxidants and other ingredients to improve product preservation and avoid the significant problems existing throughout Africa of fish losses due to handling, climatic conditions and insect infestation. It is possible for some dried minced fish products to have an almost indefinite shelf life.

An analysis of the Guinean (Western) Balistes resources indicated that it appears feasible to annually harvest between 262,500 tons and 367,500 tons of that stock (i.e., 25% - 35% of a 1,050,000 tons biomass). Only the Soviet Union's vessels fishing in Guinea Bissau waters are commercially exploiting the Balistes resources in the region. In 1982, the Soviets caught about 95,000 tons of Balistes which was transported out of the region.

The resource, therefore, appears adequate to provide for an on-going Balistes fishery based on any or all of the countries under consideration; e.g., if the average catch of a vessel were 3,000 tons per year, then a fleet of some thirty to forty vessels might be supported without affecting the resource or requiring a reduction in existing foreign fishing effort. In order to estimate the landed raw material cost of Balistes for onward processing into the various products, an economic analysis was made of the potential for a targeted Balistes fishing operation for each of the three countries.

On the basis of product development activities and relevant experience of others, an industrial plant design was developed for the processing of Balistes with an integrated production system into the following products: dried minced fish products for national and regional export markets in Africa to meet nutritional food needs; production of frozen fish blocks for export principally to industrial countries to generate foreign exchange earnings; and production of fish silage for animal feed in the local market. The plant design, incorporating such production capacities, was selected for its capability to initially serve potential local, regional and international markets.

For each country in the study, i.e., Senegal, the Gambia, and Guinea Bissau, a financial model for an integrated directed Balistes fisheries and processing plant operation was developed. Financial estimates on investment capital requirements, operating costs and projected income from product sales indicated it was profitable to establish an integrated directed Balistes fisheries and processing plant operation in each country.

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The feasibility of private sector involvement in development of Balistes fisheries and processing operations was reviewed in light of existing enterprises and conditions in each country and resulted in the following conclusions.

Guinea Bissau

1. There exists abundant Balistes resources together with traditional high value food fish within Guinea Bissau fisheries limits which are greatly underutilized. There is a potential catch of an additional 125,000 tons of Balistes from the western stock. Also, of the approximately 50,000 tons of the annual fish catch available on the continental shelf only some 3,500 tons are landed at Bissau.

2. There exists a major need for supplies of fresh and cured fish for Bissau and the markets throughout the country to meet the nutritional food needs of the population. It has been estimated that annual per capita fish consumption in Guinea Bissau is around 7.4 kg as compared with 44 kg for Senegal.

3. There exists one private enterprise company, E.R. Peralta, which is most interested in pursuing fisheries development activities of the type of project under consideration by using a step level approach. E.R. Peralta is capable of participating in such a venture and welcomes the opportunity to participate in a joint venture with other investors to undertake further fisheries development activities. The strengthening and support of an indegenous private enterprise, as E.R. Peralta, will allow it to respond to profitable opportunities which will generate nutritional food production, jobs and foreign exchange. Also, the activities of E.R. Peralta will serve as a model to encourage development of the private sector with management and technical skills responsive to the economic needs of the country.

4. There exists significant government support for private sector fisheries development activities involving E.R. Peralta Company and overseas investors. Such government support for private enterprise development represents a major breakthrough in the orientation of the public sector.

5. In light of existing conditions and the expressed interests of E.R. Peralta, it is suggested that a phased step by step level approach toward increased fisheries production for local export markets be pursued. The harvesting of Balistes could be undertaken

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in conjunction with production of traditional food fish for known markets. With experience and data gained from such expanded fishing operations, a targeted fisheries for Balistes could be developed for the processing and production of non-traditional products for local and export markets.

6. As a first step, local and international development institutions, supportive of private sector initiative, such as USAID, should be responsive to the plan being developed by E.R. Peralta to initially acquire a trawler to expand his fishing operations. Upon the financial strengthening of his enterprise, E.R. Peralta will be prepared, as will foreign investors, to then organize financing for development of the opportunities identified in the integrated Balistes fisheries and processing plant model presented on Guinea Bissau.

The Gambia

1. There exists adequate Balistes resources together with underutilized high value fisheries resources within the Gambia's fisheries limits. There is a potential catch of an additional 125,000 tons of Balistes from the western stocks. Also, at the present time, there are no significant landings of demersal fish by industrial vessels in the Gambia. The offshore Gambia resources remain virtually unharvested by Gambian nationals.

2. There exists a major need to develop Gambia's demersal fisheries to provide for the country's local markets and for export. There exists a special need for increased supplies of cured fish of improved quality to serve the needs of the rural inland population areas of the country.

3. There exists only one indigenous private enterprise company, National Partnership Enterprises, Ltd., having the financial and management strength to undertake fisheries development activities of the type of project under consideration. NPE has indicated that once it has progressed in its traditional fisheries development activities, it would like to undertake development of an enterprise with an integrated Balistes fisheries and processing plant operation.

4. There exists strong government support for a private sector fisheries development project involving National Partnership Enterprises and foreign private investors.

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5. In order for NPE to meet existing financial commitments and better develop a solid financial base of operations, it is considered important that NPE be supported in its ongoing efforts to acquire an additional trawler vessel to provide additional supply of high value fish to fully utilize existing plant capacity of NPE's new processing complex. At the same time, with the production of high value food fish for existing markets, experimental harvesting of Balistes could be conducted. Such an experience would provide NPE with a financial base and experience to take advantage of opportunities to catch Balistes and produce non traditional fish products for local and export markets.

6. Local and international financial institutions should be responsive to the interests of NPE to purchase a larger trawler to engage in catching and processing of high value marine species of fish. As NPE gains financial strength from the profitable operations of such a venture, it will then be prepared, as will other interested investors, to develop a joint venture to develop the opportunities identified in the integrated Balistes fisheries and processing plant model for the Gambia.

Senegal

1. There exists adequate Balistes resources within the waters of Senegal for the development of a directed fisheries operation, principally to the south of Dakar and in the Casamance region.

2. There exists a significant amount of potential Balistes raw material resources from the Balistes by-catch of the existing trawler and purse seiner fisheries fleet that is presently being discarded at sea but which could be encouraged to be landed for a processing facility by appropriate financial incentives.

3. There does exist a need for increased supplies of cured fish products to meet the food and nutritional needs especially of the rural inland population.

4. The existing fisheries companies are principally interested in the production of high value fish for export markets. There was no evidence of any local interests in developing a processing operation to

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produce Balistes products. Therefore, it would be necessary to identify other local sources of capital to establish such a processing facility.

5. There exists strong government support for private sector activities to develop Senegalese fisheries including the utilization of Balistes. There was especially strong interest in development of fisheries processing technology to produce cured fish products that have extended shelf life to meet the food and nutritional needs of the rural inland population.

6. The investment opportunities for the industrial processing of fish into dried fish products, produced with high value whole fish and utilizing minced fish technology for underutilized species for the African market, needs to be brought to the attention of potential local and foreign investors through investment opportunity seminars and other communications.