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MANAGEMENT OF A NEW FLEET FOR EXPANSION OF FISHERIES IN THE CAPE VERDE ISLANDS: A FEASIBILITY STUDY

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ABSTRACT

A new fleet has been acquired by the Government of Cape Verde with the objective of taking advantage of the unexploited harvest potential of fish stock in the Cape Verde EEZ. The status of available fish stocks in Cape Verdean waters and the catching potential are analysed in this study. Available data indicates that there is expanding scope only for tuna. Different possible operating scenarios are then inventoried and the status of available fish stocks to Cape Verdean fisheries and their expansion potential are studied. The results indicate that there is substantial scope for expanding fishing for small pelagic species in Senegal and for small pelagic and demersal species in the Angolan EEZ, where free fishing licenses are available to Cape Verdean fisheries. To see how the profitability of the fishing operation may change, sensitivity analyses are conducted by using different catch, sale prices, value of crew share and fuel price (main consumption). A loan amortization schedule is made to show how the loan will be repaid. The results are discussed and recommendations concerning the way of running the fleet are made to the government.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

The archipelago of Cape Verde is located 600 km off the coast of Senegal, West Africa (Figure1). There are 10 islands of which nine are inhabited and eight islets. The total population is 430,000. The islands are positioned between latitude 14^{o} 50'-17 ^{o} 20' N and longitude 17 ^{o} 20' – 22 ^{o} 40' W. They are divided into two groups according to the trade winds that reach them from the African continent: windward and leeward. The total land area of Cape Verde is 4,033 km^2 and the shoreline of the islands is approximately 2,000 km. The continental shelf is irregular and narrow. The area of the shelf down to 200 m is 5,394 km^2. The shelf plus slope extends down to 500 m, and constitutes an area of 7,650 km^2 (Almada 1992).

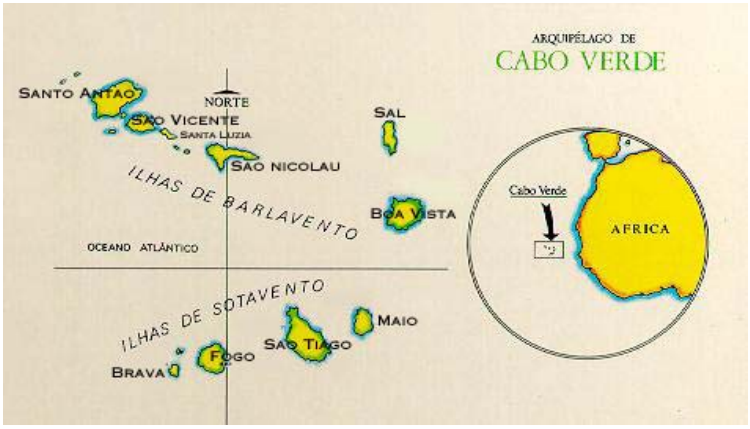

Figure 1: Cape Verde archipelago. Of the ten main islands only the smallest one, Santa Luzia is not inhabited (Portal de Cabo Verde 2002).

In 2002 the Government of Cape Verde acquired, through the Integrated Fisheries Development Project, co-financed by the African Development Bank and the Arabic Bank for African Economic Development, 10 new 26 m fishing vessels made of glass reinforced plastic. By operating this fleet in a profitable way the government expects to increase the contribution of fisheries to the Gross Domestic Production (GDP), to increase the level of employment, improve exports and increase the balance of payment. Originally it was planned that these vessels should be sold to private Cape Verdean entrepreneurs.

Due to the cost of the investment and the low financial and technical capacity of the national entrepreneurs, the government decided to establish a fishing company to manage the new fleet. This company will be created with national and external capital in order to protect national interests and acquire the external know-how and financial capacity.

The new fishing company is meant to fulfil the following objectives set by the government (Lopes 2002):

- To increase catches and landings;
- To better utilize the production capacity of the processing plants, through the furnishing of sufficient quantities of raw material; and
- To improve the social and economic conditions on the islands.

To fulfil these objectives it is clear that the operation of this fleet needs to be profitable in the long run. Profitability requirements in Cape Verde are normally considered to be 15%.

Due to the seasonal nature of the Cape Verdean fisheries such a fleet would have to target different species during different seasons if it is to operate throughout the year. This may, however, not be enough to ensure profitability. The fisheries potential within the Cape Verdean EEZ is limited and such an operation is likely to affect the profitability of the artisan and semi-industrial fleets, which are of high social importance.

Profitability of the investment will depend on the status of exploitation of the fish stocks, available markets, price and the operation and strategy. There are several options other than increasing fish pressure on local stocks.

Fishing agreements exist among countries in the sub-region and between Cape Verde and the other African Portuguese Speaking Countries (PALOP). Free fishing licenses are available for the Cape Verdean fleet in Senegal, Gambia, Guinea Bissau, Guinea Conakry, Sao Tome, Angola and Mozambique.

In this study an inventory is made of the different operating scenarios for the fleet. Their potential profitability is analysed and recommendations are made to the government concerning optimal operation of the fishing company. This includes:

- Looking at fishing in Cape Verde EEZ and the potential there.
- Looking at fishing in other EEZs and the potential there.
- Looking at potential markets near fishing grounds.
- Constructing different scenarios, using assumptions based on the present study.

2 THE FISHERIES SECTOR IN THE CAPE VERDE ISLANDS

The importance of an economic activity is usually measured by its contribution to the GDP of the country. In Cape Verde the relative contribution of fisheries to GDP has been decreasing and is now less than 4% (Governo de Cabo Verde 2001) but it employs directly and indirectly around 20,000 people (Cadima 1996).

Fisheries exports (Table1) are very important for the equilibrium of the balance of payment. Fish and fish products constitute the main animal protein source in Cape Verde and are the staple food for a large part of the population. Finally the fisheries sector has cultural value, is of recreational importance and attracts tourism.

Table 1: Export of fishing products in volume and in value1992-2000 (INDP 2002, INE 2002).

Year	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Fish Exp. (tonnes)	2,274	994	1,974	1,289	2,636	3,115	2,448	1,236	344
Fish Exp.(Th.US$)	205	184	196	160	171	178	203	190	100
Tot. Exp. (Th.US$)		312	408	687	1,046	1,295	1,016	1,170	
% from fish exports		58.9	48	23.3	16.3	13.7	19.9	16.3	

The value of fish export in the last nine years has varied from 160–205 thousand US$. In 2000 there was a decrease in fish export due to an embargo set by the EU. It is still in force and although official export figures for 2001 and 2002 are not available, it is likely that they would show a further contraction.

Commercial species are grouped into large pelagic, small pelagic, demersal species and lobsters and they are all caught in both the artisanal and industrial sub sectors.

The artisanal sub sector's fleet (Table 2) is composed of around 1,400 wooden open deck boats 4–8 m long, with 5-25 HP out-board engines and 2-4 crew (INDP 2000). These boats operate in coastal areas, using mostly hand line, purse seines up to 250 x 25 m, gill nets and beach seines 50–90 x 3-8 m (INDP 2000). The catches are rarely preserved in ice and usually landed in small fishing ports for local consumption.

Table 2: Summary of catches, effort, no. of boats, fishermen and engines in the artisanal sub sector 1986-2000 (INDP 2000).

Year	Catch/ tonnes	Effort/ trips	Number of boats	No. of Engines	No. of fishermen	Catch		
						Kg/trip	Ton/boat	Ton/fisher
1986	4,764	119,851	1,276	550	3,821	40	3.7	1.2
1987	4,005	135,478	1,327	536	4,003	30	3	1.0
1988	4,092	116,663	1,387	573	4,182	35	3	1.0
1989	6,391	154,368	1,404	599	4,258	41	4.6	1.5
1990	4,935	137,998	1,363	634	4,392	36	3.6	1.1
1991	4,884	138,534	1,376	628	4,576	35	3.5	1.1
1992	4,308	112,737	1,328	675	4,143	38	3.2	1.0
1993	4,829	123,016	1,354	881	4,388	39	3.6	1.1
1994	5,347	134,699	1,455	1,000	5,481	40	3.7	1.0
1995	4,547	128,732	1,476	1,012	5,538	35	3.1	0.8
1996	4,912	134,667	1,424	986	5,406	36	3.4	0.9
1997	4,920	140,404	1,400	986	5,675	35	3.5	0.9
1998	5,242	148,158	1,400	986	5,724	35	3.7	0.9
1999	5,968	155,009	1,267	920	4,283	39	4.7	1.4
2000	6,977	173,856	1,267	920	4,283	40	5.5	1.6

The industrial sub sector (Table 3) operates around 60 10–26 m long wooden, plastic or steel vessels with in-board engines (up to 625 HP) targeting small pelagic and demersal species, tuna and lobsters. The production is always preserved in ice mainly for export and processing plants.

Up to 1992, tuna and tuna like species and lobsters constituted the main target species for the industrial vessels.

In 1992-1999 there was a good market for horse mackerel. A long-line fleet based at the Canary Islands paid good prices, making these fisheries more profitable than the pole and line fisheries for skipjack tuna. This explains the relatively low level of catches of tuna in 1992-1998 and the corresponding increase in the small pelagics (Table 3). Since 1999 the development of the tuna fishery has been hampered by lack of live bait and an import embargo set by the EU in 2000. To date the embargo is still in effect.

The activity of the industrial fleet is regulated by licenses issued by the General Directorate of Fisheries at the Ministry of Agriculture and Fisheries.

Table 3: Total industrial catches (tonnes) in Cape Verde 1991-2000 (INDP 2000).

Year	Tunidae	S. Pelagic	Demersal	Lobsters	Diverse	Total
1986	2,215	327		36		**2,578**
1987	3,007	216	33	51		**3,307**
1988	1,840	221	209	25		**2,295**
1989	1,860	210	121	30	2	**2,223**
1990	1,351	244	16	30	3	**1,644**
1991	2,105	309	2	70	8	**2,494**
1992	967	1,179	2	106	11	**2,265**
1993	832	1,193	20	76	50	**2,171**
1994	940	1,823	58	68	20	**2,909**
1995	1,737	1,990	126	60	35	**3,948**
1996	1,640	2,230	240	29	104	**4,243**
1997	1,233	3,230	137	25	82	**4,707**
1998	1,188	2,734	156	27	113	**4,218**
1999	2,065	2,003	164	35	136	**4,403**
2000	1,742	1,892	90	29	91	**3,844**

2.1 Government policy for fisheries development

Until 1992 the government was active in commercial fisheries. It then sold its fishing company. The private sector has not managed to fill the gap left by the government company, forcing the government to revise its policies. Buying 10 new fishing vessels is an attempt to re-vitalise the industry.

The government policy for fisheries development is presented in "Programa do Governo 2001-2005" and can be summarised as follows:

- To reconsider the state as an investor in the sector.
- To promote external investment in the fisheries sector.
- To create incentives for savings as a way to built financial capacities for the investment and writing off old debts.
- To motivate the private enterprise initiatives.
- To institute sanitary and quality control in order to meet the requirements of the domestic and external markets.
- To adjust the legislation of the sector to the new national and international requirements, in substance of exploitation and preservation of the resources.
- To monitor and regulate foreign fleet activity for the evaluation of its global impact in order to identify the strategies that maximise the economic and social benefits of this activity.
- To update information on the state of the resources in order to be able to furnish global and specific recommendations for the sustainable exploitation of the resources.
- To emphasise environmental education and strengthen preservation of biodiversity.

3 STATUS OF FISH STOCKS AVAILABLE TO CAPE VERDEAN FISHERIES

3.1 Cape Verdean EEZ

Over-fishing is a threat to the future of many people who depend on the resources of the sea, either for their employment and income or their nutrition. About 70% of the commercial species worldwide are already fully exploited or depleted (FAO 2000). The historical evolution of the catches and the results from marine research show that although Cape Verde has a large EEZ, it has limited fish resources (Table 4). Demersal stock is relatively small. They have a low regenerating capacity and are very sensitive to fishing pressure.

Table 4: Fishing potential (tonnes) and exploitation status of the main resources in Cape Verde EEZ (INDP 1999).

Resources	Estimated TAC	Average catch	Expansion potential
Thunidae	25,000 – 30,000	7,500	17,500
Small pelagic	10,000 – 12,000	4,500	5,500 – 7,500
Demersal	3,000 – 5,000	900	2,100 – 4,100
Lobster	50 - 70	47	Fully exploited

3.1.1 Small pelagic species

In Cape Verde the main pelagic species are horse mackerel, *Decapterus macarellus* (Cuvier 1833) with an estimated potential of 10,000-2,000 tonnes (INDP 1997) and bigeye scad, *Selar crumenophthalmus*, (Bloch 1793) estimated at 1,000–1,500 tonnes (Carvalho and Caramelo 1996). Like most short lined pelagic species their abundance tends to fluctuate with fluctuations in environmental conditions. The catches of horse mackerel increased until 1997 because of the demands for frozen bait for the Canary based long lining tuna fleet and decreased again after this period.

Juveniles of both species constitute the main bait for tuna fishing with pole and line and they are frequently caught for human consumption.
According to INDP's management issues no more purse seiners can be licensed.

3.1.2 Tuna and tuna like species

The archipelago of Cape Verde is located in a productive zone for tropical tuna and tuna like species. The estimated TAC for coastal and deep-sea waters is 25,000 tonnes (Hallier 1996) and they are considered moderately exploited (INDP 1996).

The tuna and tuna like species are exploited by national and foreign fleets, with different fishing gears. The total catches of both fleets are below the estimated potential yield. The catches of the foreign fleet appear to be underestimated but they have never exceeded 3,000 tonnes. The low exploitation level in Cape Verde has been attributed to lack of bait. Although this is partly true it's not the main reason. There are external factors, such as low and decreasing prices for skipjack tuna in the international market, which hinder its traditional fishing (Hallier 1996). In the Cape Verde waters the most important species are: yellowfin tuna *(Thunnus albacares)* (Bonnaterre 1788), bigeye tuna *(Thunnus obesus)* (Lowe 1839) and skipjack tuna

(*Katsuwonus pelamis)* (Linnaeus 1758). They are mainly caught by hand line or with pole and line. To catch skipjack live bait is essential and therefore all pole and line vessels are equipped with purse seines. Yellowfin and bigeye can be caught with long line using dead bait, frozen or fresh.

A pole and line vessel catches annually around 250-450 tonnes, the average specific catch composition from August to November is: 70% skipjack, 25% yellowfin and 5% bigeye. From April to August and from October to December it changes to 70% yellowfin, 10% bigeye and 20% skipjack.

INDP recommends maximising the catches of the national fleet.

3.1.3 Demersal species

Although the catches have been increasing slowly, it seems that stocks are intensively exploited in certain areas. They are made up of very small populations, with limited genetic diversity and slow individual growth. They are very sensitive to fishing effort. Generally it is difficult to increase the catches of rocky bottom demersal species (Monteiro 1998).

The sandy bottom demersal species are under-exploited and their potential is estimated at 700-2,800 tonnes/year (Thorsteinsson *et al*. 1995).

The species living below 200 m are slightly exploited but recent studies show that they are not abundant and therefore they will not support high fishing effort (Menezes *et al*. 2001).

INDP recommends preserving the demersal species for the national fleet and banning the use of gillnets and trawsl on the rocky bottom and sea mountains.

3.1.4 Lobsters

Four species of lobster are caught on the continental shelf of Cape Verde, the pink, green and brown spiny lobsters and slipper lobster. They are very sensitive resources with slow population growth and relatively sedentary.

The pink spiny lobster (*Palinurus charlestoni*) is an endemic species in Cape Verdean waters. It lives in depths between 100-450 m, the largest density around 200 m (Almada Dias 1995). They are caught in baited traps that are placed on the seafloor linked to a buoy. Usually traps are set in the afternoon and hauled in the morning.

Until 1992 different potential estimations have considered the annual catch potential to be around 1,000 tonnes for all four species (Postel 1966, Fouéré 1981).

In 1992 M. E. Carvalho and D. Latrouite estimated the pink spiny lobster’s potential to be between 100 and 150 tonnes and Almada (1992) estimated it to be around 70 tonnes for males and 34 tonnes for females.

Demersal surveys from 1995 to 1999 show that the CPUE tends to decrease and this trend has continued since then (INDP 2002).

Evaluation shows that they are economically over-exploited (Eide *et al.* 1996) and at the present time only four vessels are operating for spiny lobster. INDP recommends extending the closed season by two months from July to November and maintaining the actual fishing effort (number of boats and traps).

The green spiny lobster (*Panulirus regius)* (De Brito Capello 1864), is distributed from southern Morocco to northern Tanzania. In Cape Verde it lives on rocky bottoms around all the islands at depths up to 50 metres.

Brown spiny lobster (*Panulirus echinatus)* (Smith 1869), is found along the Brazilian coast, Canary Islands, Saint Helene, Assumption and Cape Verde Islands. It prefers rocky and coral bottoms located between 0 and 50 m depths.

Slipper spiny lobster (*Scyllarides latus)* (Latreille 1803), present around the Mediterranean Sea and Atlantic Ocean from south Portugal to south Senegal and around the Canary and Cape Verde Islands at depths of up to 100 m..

The coastal lobsters are caught by diving with autonomic diving-dress from small boats.

With regard to the coastal lobsters, INDP recommends replacing the diving technique for traps to preserve this resource for the artisanal sector and to extend the closed season, which is at present from July-September to November.

3.2 Status of stocks outside the CV EEZ available to Cape Verdean fisheries

Although most of the fish stocks are considered under-exploited (Monteiro 1998), this study will consider only the extension potential for tuna (Table 4). According to INDP's recommendations, in order to protect the resources and to avoid social conflicts, demersal and small pelagic species should be reserved for the already existing fishing fleets.

This study proposes to analyse different possible operating scenarios out of Cape Verdean waters. Cape Verde has a reciprocal fishing agreement with the sub-region countries and the PALOP.

In the past the Cape Verdean public fishing company operated in Senegal and Angola for many years. Now revising its policy for the development of the fishing sector the government has acquired a new fleet and intends to operate it out of the Cape Verde EEZ in order to take advantage of the fishing agreements signed with different countries.

Senegal has a better fishing market than Cape Verde and it is close to the most important southwest African markets for tuna and small pelagics such as Abidjan and Thema.

Angola is also an attractive market and it has high expansion potential for small pelagic and demersal species. In addition, important Cape Verdean communities live

in these two countries, which constitute potential investors in the company and manpower.

3.2.1 The Senegalese EEZ

In Senegal, fisheries resources represent important economic and social interests. In fact, in 1999 more than a quarter of foreign exchange earnings (US$ 2.83 billion) came from sea products and fisheries contributed 2.4% of the GDP (World Information 2002).

Over the last few years the fisheries sector has become Senegal's primary economic sector, ahead of both peanuts and phosphate. The annual mean fisheries production in the 1980s has been around 250,000 tonnes, but reached 350,000 tonnes as of 1993.

The exploitation of these resources by both artisan and commercial fleets is very important economically and socially. The fisheries sector directly employs 57,000 fishermen, of which 47,000 are in the artisanal sector. The fisheries sector also creates more than 150,000 jobs indirectly, including a large marketing sector consisting mainly of women. In all, it is estimated that 15% of Senegal's labour force is linked to the fishery sector.

The two fisheries industry components, artisanal and commercial, are often complimentary but can also conflict. Therefore, their development must be based on careful decisions guaranteeing the equilibrium of all components of the fisheries systems, including the preservation of the resource and the maximisation of revenues by both the public and private sectors. It is therefore deemed necessary to support research, which allows continuous surveillance of the state of fisheries resources and their levels of exploitation.

Although the figures of actual catches are not presented, in Senegal the large pelagic are fully exploited and demersal species are slightly over-exploited. There is only potential for increasing small pelagic fisheries (Table 5).

Table 5: TAC and exploitation status of fish species in Senegal (FAO 1997).

Resources	**Total allowed catch**	**Status**
Large pelagic	15,000 – 20,000	Fully exploited
Small pelagic	200,000 – 450,000	Moderately exploited
Demersal	130,000	Slightly over-exploited

3.2.2 Angolan EEZ

The continental shelf is roughly divided in two parts: the northern area with relatively warm waters (Angola current) and the southern area, narrower, with cold waters (Benguela current). The influence of these currents varies according to the season. The diverging currents create strong up-welling leading to high primary production.

Over-fishing and hydroclimatic conditions have strongly reduced the potential of fisheries, which is now estimated to be about 360,000 t/y. Of this potential,

285,000 tonnes are small pelagic species like horse mackerel and pilchard, 55,000 tonnes are various demersal species and 20,000 tonnes are deep-water crustaceans and molluscs (Table 6).

Table 6: Status of fish stocks in Angola (SADC 2002).

Resources	Potential	Status
Small pelagics	285,000	Under exploited
Demersal	55,000	Under exploited
Large pelagics	20,000	Under exploited

The actual total catches of the Angolan fisheries were just over 200,000 tonnes in 1999, absolutely identical as in 1998. 170,000 t are fished by the national fleet, including 31,000 t from the artisanal sector, and 32,000 tonnes are caught by foreign vessels. This last figure illustrates a sharp decline of foreign activity that was over 100,000 tonnes in 1997. The state owned fleet is also in constant decline, with only 1,000 tonnes fished in 1999, and is largely compensated by the rapid growth of catch from the private sector that has doubled in the last five years (SADC 2002).

Purse-seiners targeting the small pelagic species, are largely dominant, with 80,000 tonnes, followed by the trawlers that showed recently a steady growth, up to 43,000 tonnes in 1999.

In total 171,000 tonnes are caught by industrial, or semi-industrial vessels (the industrial registered fleet is about 200 vessels) and 31,000 tonnes are from the artisanal sector (Table 7). The latter is apparently relatively stagnant compared to the industrial sector.

Table 7: Summary of the fisheries sector in Angola (SADC 2002).

Fleet	Nr. of vessels	Nr. of fishermen	Catches (tonnes)
Artesanal	3,740	21,500	30,954
Industrial	214	13,500	139,064
Foreign vessels	91	-	32,000
Total	4,045	35,000	202,018

The actual catch of the artisanal sector has been estimated at only 30-50,000 tonnes in recent years. This sector employs most of the fishermen (21,500 of 35,000 in total). Artisanal boats are over 3,700 units but only 14% are engine powered. It appears that all the groups of species are under-exploited (Table 6).

4 THE NEW FLEET

The fleet is composed of 10 vessels well equipped for navigation and fish detection and capture with pole and line, long line and purse seine. They are all equipped with an extra mobile live bait tank that can be removed when using purse seines or long line. The main characteristics of the vessels are specified in Table 8.The fish hold and the fixed bait tank are insulated and refrigerated to 1^{o} C.

Demersal and small pelagic species are preserved in ice respectively in boxes and directly in the fish hold while tuna species are first showered with refrigerated seawater at 1^{o} C.

Table 8: Technical specifications of the 10 new vessels acquired by the Cape Verde government (Lopes 2000).

Length overall	26.00 m
Breadth	6.50 m
Draught	3.50 m
Hull	GRP – Glass Reinforced Plastic
Crew	17
Fish hold capacity	116.00 m^3
Live bait tank	58.00 m^3
Fuel capacity	44.00 m^3
Water capacity	17.00 m^3
Autonomy	23 days
Speed	10.5 knots
Main engine	Caterpillar: 600 HP; 1,800 rpm
Auxiliary engine	Cummins Leroy Summer: 2 x 100 KVA
Ice making machine	3.0 tonnes / 24 hours
Water desalinisation	2.00 m^3 / 24 hours

The fishing capacity of the fleet will depend on the available resource and its storage capacity. With such characteristics each vessel would be able to store per trip 75.4 tonnes of small pelagic, 40.6 tonnes of demersal species, 52.2 tonnes of tuna and 1.7–1.9 tonnes of live bait (Table 9).

Table 9: Fish and bait storage system and capacity.

Species	**Preserving system**	**Storage capacity**
Small pelagic	In ice free in the fish hold	116 m^3 x 650 kg
Demersal	In ice in plastic tubs in the fish hold	116 m^3 x 350 kg
Tuna	In ice free in the fish hold after being showered in refrigerated sea water	116 m^3 x 450 kg
Bait	Live in bait tank	58 m^3 x (30-50) kg

For tuna and tuna like species the fishing capacity will depend also on available live bait. One ton of live bait is needed to catch 10-30 tonnes of tuna (FAO 1990).

4.1 Exploitation scenarios

The effective deployment of an industrial fishing fleet must be guided according to the productivity of the operating zones and to the attractiveness of the markets (Lopes 2002).

The fleet opens new horizons and facilitates the use of diverse exploitation scenarios what will assure the profitability of the fleet. In this perspective, the fleet will be able to operate in the EEZ of Cape Verde, Senegal and Angola, where free fishing licenses are issued to Cape Verdean vessels.

The fleet will operate on the basis of two fundamental parameters: the TAC (expansion potential) and value of the catches. Therefore this study analyses the potentialities of each different EEZ and the nearest available markets.

In order to maximise the profitability the landings and the commercialisation of the catch as well as the vessel's provisions will be effectuated in the country the fleet is operating in.

Each type of fishing is characterised by its specificity defined basically by the fishing gear used. Therefore the fishing of small pelagic with purse seines, according to the abundance of species, can be organised in highly productive short trips.

This particularity can change the foreseen scenarios because each trip may become shorter and will increase the probability of higher catches and profits.

For each scenario unforeseen lost days are predicted.

4.1.1 Cape Verde scenario

According to the status of fish stocks in Cape Verde (Table 4) the study considers the hypothesis of fishing only tuna and tuna like species not only to prevent social conflicts with the artisanal sector and the already existing industrial fleet, but also to protect the small pelagic, demersal and lobster resources.

The fleet will operate from March to December because in January and February the weather conditions are very bad. During these 10 months each vessel will make 24 trips of 11 days each and four effective fishing days (Table 10). To get the necessary live bait to catch tuna each vessel will be sailing to Senegal and back for six days per month. In the Cape Verde EEZ the fish is caught mostly around the sea mountains.

Table 10: The fleet operating in the EEZ of Cape Verde catching tuna from March – December.

ACTIVITIES	NO. DAYS
Searching and fishing bait	3
Searching fish	0.5
Fishing	4
Sailing towards landing site	0.5
Landing	2
Crew resting	1
Total days per trip	11
Number of months	10
Number of trips	24
Number of days at sea	192
Number of days in the port	72
Unforeseen lost days	36
Total operation days	300

4.1.2 Senegal scenario

In this scenario the fleet will operate from February – December (Table 11). During this period 36 trips of eight days duration and four effective fishing days each are made. The predicted catch for the whole fleet is 13,700 tonnes of horse mackerel and pilchard.

In this EEZ, fish is abundantly found in open sea and therefore only four days per month are predicted for sailing and fish searching.

Table 11: The fleet operating in the EEZ of Senegal catching small pelagic from February – December.

ACTIVITIES	NO. DAYS
Searching fish	0.5
Fishing	5
Sailing towards landing site	0.25
Landing	1
Crew resting	1
Total days per trip	8
Number of months	11
Number of trips	36
Number of days at sea	216
Number of days in the port	72
Unforeseen lost days	42
Total operation days	330

4.1.3 Angola scenario

In this scenario the fleet will operate for 11 months, each vessel realising 42 trips of seven days each and three of effective fishing (Table 12). According to the potential of the EEZ of Angola (Table 6) the whole activity will be addressed to small pelagic and demersal species.

Due to the relative widespread abundance of this species, mainly small pelagic, only days per month are predicted for sailing and bait searching and the catches can be landed in the main fishing ports of Luanda, Lobito, Namibe and Matadi.

Table 12: The fleet operating in the EEZ of Angola catching small pelagic and demersal species from February – December.

ACTIVITIES	NO. DAYS
Searching and fishing bait	0.25
Searching fish	0.5
Fishing	3
Sailing towards landing site	0.25
Landing	2
Crew resting	1
Total days per trip	7
Number of months	11
Number of trips	42
Number of days at sea	167
Number of days in the port	126
Unforeseen lost days	37
Total operation days	330

4.2 Fleet operation cost

The main cost in Cape Verde is fuel. Each vessel is equipped with a 600 HP main engine that consumes 96.4 litres and a 2 x 125 HP auxiliary engine consuming 20.1 litres/hour. The calculations for fuel and lubricants are made according to the scenario activity plan and using the formula C= 0.75 x P max x S/d x t x 1/1000 recommended by FAO (FAO 1990). For each scenario I will consider the price in the respective country in the EEZ which the vessels are operating in.

For the profitability study variable costs are calculated according to predicted catch or fishing days (Table 13 and Appendix 2, 3 and 4).

Table 13: Variable costs in USD.

Scenarios	**CAPE VERDE**			**SENEGAL**		**ANGOLA**	
Variable costs / species	**YFT**	**BET**	**SJT**	**H.mack.**	**Pilchard**	**H.mack.**	**Demersal**
Crew share per ton sales	71	108	41	32	45	30	144
Ice per tonnes catch	22.7	22.7	22.7	10.2	10.2	10.2	10.2
Fuel per sailing day	952			644		644	
Fuel per fishing day	624			422		422	
Lubricant per sailing day	143			87		87	
Lubricant per fishing day	90			55		55	
Food per month	1,851			1,851		1,851	
Fishing gear % of revenue	1%			1%		1%	
Water per month	160			150		150	
Salary per month	34,120			34,120		34,120	
Agency per fishing month	1,800			1,800		1,800	
Communic. per fishing month	1,310			1,310		1,310	

Food and water consumption are calculated according to estimates by the Cape Verdean Commercial Navy.

The main fishing gears are acquired with the vessels and considered initial investment. One percent of revenue per year is used for supplies and maintenance of fishing gear.

Maintenance of vessels and equipments is 3% of revenue per year.

For insurance the study considers the best proposal received in Cape Verde.

The salary is calculated according to current wages in Cape Verde. It consists of a fixed part paid to the permanent employees and a variable one paid to the seasonal crew members as fishermen and cooks.

A crew share is paid at the end of the year for all the crew members as a percentage of the total revenue. For tuna small pelagic and demersal species the study considers 10% of the revenue as the crew's share.

5 AVAILABLE MARKETS

Industrial fishing for pelagic species is a dynamic economic activity, characterised by a high level of competitiveness. In the production sector these dynamics and competitiveness are responsible for the needs of improving the efficiency of the vessels by using sophisticated (new) catching methods and new fish finding equipment to locate areas to maximise the fishing effort. There is always a gap between demand and supply of raw material that imposes rules and influences the price of canned products increasing the competitiveness among the different actors of this fishery.

It is very important to know the rules of the market in order to take the most advantage in commercial transactions, mainly in what refers to raw material for canneries where, very often, the buying and selling process is concluded before landing the product.

In the west coast of Africa the most important pelagic markets for canneries are located in Dakar (Senegal), Abidjan (Ivory Coast) and Thema (Ghana).

At present, Dakar is one of the Atlantic Ocean's major tuna fishing zones with a fleet of line fishing boats made up of French and Spanish Basques. The three tuna processing plants in Dakar have a total capacity of 50,000 tonnes per year. These three plants depend largely on long liners for their supply of tuna as the fleet of line fishing tuna boats based in Dakar is only made up of some 10 units with an average age of 30 years.

This lack of supply of fish as a raw material is in fact a major concern for the three tuna processing plants.

Tuna prices are generally 10% higher in Dakar than on the international market, among other reasons, because of the competition among the canneries to purchase raw materials (CDI-Partnership 2002).

In recent years the Cape Verdean canneries have processed very low quantities due to lack of raw material. The catches landed by the artisanal and the old industrial fleet are sold for local consumption at high prices that can't be afforded by the canneries. The main markets for Cape Verdean canned fish before the EU's embargo were France, Germany and Italy.

In December 2001 Frescomar, a Cape Verdean – Portuguese fish processing company became the first Cape Verdean company to be certified by the U.S. Food and Drug Administration and has changed its export strategy to focus on sales to the U.S. market under the African Growth and Opportunity Act (AGOA). It presently processes 16 tonnes of fish (25-30,000 cans) per day in one shift (FDA 2002).

All together the Cape Verdean canneries have a processing capacity of about 7 – 8,000 tonnes per year and they employ about 400 persons.

In Angola the national fleets land all their catches mainly for national consumption. Foreign fleets land 21,000 tonnes, e.g. 2/3 of their catches. Thus, about 94% of the fish captured is landed in Angola. Most of the fish caught is sold on the national market, as per capita demand of fish is high and not fully satisfied.

Fish consumption is on average 16 kg per person per annum: 40 kg in coastal areas, down to 10 kg or less in inland areas. The distribution of fish to the population has been strongly affected by the civil war.

Most of the fish is sold fresh. Some 41,000 tonnes (25%) are deep frozen, mainly in Luanda; 6,000 tonnes are dried/salted (Benguela); 4,000 tonnes are processed as fishmeal, and 2,500 tonnes as fish oil (Namibe/Tombua). Less than 1,000 tonnes are canned.

Export of fish represents only 5% of total landings (Table 14) and the main item is deep-water shrimp sold to Spain.

Table 14: Fish exports from Angola (million USD) 1995-1999 (SADC 2002).

Years	**1995**	**1996**	**1997**	**1998**	**1999**
Exports	24.0	20.3	16.5	20.0	23.8

Some high quality frozen fish and lobsters from the artisanal fishery are processed and exported. For these products marketing and trade are hampered by both war and lack of consistent quality control. There is a recent growing trend for fishmeal and oil exports. The total export value averaged 24 million USD in 1999.

Some progress was achieved in 1999 with the publication of the official documents related to quality control requirements. Nevertheless, the last visit by EU inspectors in January 2000 concluded that the competent authority was not sufficiently trained and equipped to comply with the EU quality control requirements. Thus, the exports from

the national sector are limited to whole or gutted frozen products. This situation will be maintained for a while considering the limited progress that has been made.
The contribution of fisheries products to the Gross Domestic Product (GDP) was 4% in 1999 (SADC 2002).

5.1 Market price

According to the government objectives the catches effectuated in Cape Verde and Senegal‘s EEZ should be sold to the national canneries in order to provide them with the raw material they need to continue to be able to guarantee job posts.

The catches will be sold immediately after catching in the nearest market at best price.

The best price for tuna and tuna like species is offered in Abidjan but for quantities of over 300 tonnes (Table 15). Sailing from Cape Verde or Senegal to land in Abidjan would imply extra costs that would not be covered by the difference in price between Senegal and Abidjan. So all the fish caught in Cape Verde and Senegal or Angola should be preserved in ice and sold in Dakar and Angola respectively for canning and local consumption.

Table 15: Price / ton in Euros for different species in different markets (INDP 2002).

SPECIES	**Tuna and tunalike**			**Small pelagic**		**Demersal Species**
MARKETS	**Yellowfin**	**Bigeye**	**Skipjack**	**H. Mackerel**	**Pilchard**	
CAPE VERDE	680	636	345	230	450	1,360
DAKAR	710	1,080	410	320	450	-
ANGOLA	-	-	-	320	-	1,450
ABIDJAN	1,418	890	749	-	-	-

6 PROFITABILITY OF THE DIFFERENT SCENARIOS

The profitability of the fishing operation depends on the income and total costs. The operation costs are divided into fixed and variable costs.

The conditions of the investment are presented in Table 16.

For each scenario the income is calculated according to the number of fishing days and the catch value per month in euros (Appendix 2, 3 and 4). The prices per ton are estimated as averages from recent years.

Table 16: Conditions of investment.

Total Investment	12,370,000 euros
Loan – 60%	7,422,000 euros
Interest rate	7%
Equity – 40%	4,948,000 euros
Expected rate of return	15%
Weighted average cost of capital (WACC)	10.2%

The net profit is calculated as the difference between the contribution margin and fixed cost before interest and tax for the whole fleet (Appendix 2, 3 and 4).

Net profit before tax increases at the end of the considered period by selling the fleet for 20% of initial value. Net profit after interest increases throughout the period. The net present value is the difference between the total present value and the initial investment (Table 17 and Appendixes 5, 6 and 7).

The present value is the value today of a future payment or series of payments discounted at the appropriate discount rate. It is calculated according to the following equation:

$$\mathbf{PV = NP / (1 + IRR).^{N}}$$

Where: PV is the present value, NP is net profit after interest and tax; IRR is the internal rate of return and N is the number of years.

Table 17: Operating profit and present value.

	CAPE VERDE (in euros)	**SENEGAL (in euros)**	**ANGOLA (in euros)**
Operating profit before interest	1,048,451	2,339,242	3,590,572
Initial investment	12,380,000	12,380,000	12,380,000
Net present value	17,350,606	24,632,388	41,465,157
IRR	4.6%	22.8%	33.4%
IRR of equity	1%	46%	72%

6.1 Loan amortization schedule

This schedule shows how the loan will be repaid. It gives the required payment each year and a breakdown of the payment showing how much the interest is and the repayment of principal (Table 18).

Table 18: Loan amortization schedule.

Year	**Loan amount (in euros)**	**Payment**	**Interest**	**Repayment of principal (in euros)**	**Remaining balance (in euros)**
1	7,422,000	814,896	519,540	295,356	7,126,644
2	7,126,644	814,896	498,865	316,031	6,810,614
3	6,810,614	814,896	476,743	338,153	6,472,461
4	6,472,461	814,896	453,072	361,823	6,110,638
5	6,110,638	814,896	427,745	387,151	5,723,486
6	5,723,486	814,896	400,644	414,252	5,309,235
7	5,309,235	814,896	371,646	443,249	4,865,986
8	4,865,986	814,896	340,619	474,277	4,391,709
9	4,391,709	814,896	307,420	507,476	3,884,233
10	3,884,233	814,896	271,896	542,999	3,341,233
11	3,341,233	814,896	233,886	581,009	2,760,224
12	2,760,224	814,896	193,216	621,680	2,138,544
13	2,138,544	814,896	149,698	665,198	1,473,346
14	1,473,346	814,896	103,134	711,761	761,585
15	761,585	814,896	53,311	761,585	0
Total		**8,148,957**	**4,068,190**	**4,080,767**	

The interest rate is 7% for a loan on 60% of the investment to be paid in 15 years.

The compound interest decreases as the remaining balance of the loan goes down.

The repayment of the principal equals the payment less interest. The remaining balance is the difference between the beginning amount and the repayment of principal.

6.2 Sensitivity analysis

To see how the profitability of the fishing operations changes for different assumptions in costs and income for the different scenarios, a sensitivity analysis was undertaken. It is made by maintaining the same fishing days and changing some variable costs like fuel consumption, total catch, crew share and the fish price (Table 19).

Table 19: Sensitivity analyses of the profitability of fishing operations (in euros).

Var. cost	Change %	CAPE VERDE		SENEGAL		ANGOLA	
		Op.cost	IRR	Op.cost	IRR	Op.cost	IRR
Fuel	15	850,466	2.2%	2,773,326	21.4%	3,980,499	31.8%
	10	916,464	3.0%	2,824,633	21.9%	4,022,523	32.1%
	5	982,462	3.8%	2,875,941	22.3%	4,064,547	32.5%
	0	**1,048,451**	**4.6%**	**2,339,242**	**22.8%**	**4,178,572**	**33.4%**
	-5	1,114,457	5.3%	2,981,935	23.2%	4,220,596	33.8%
	-10	1,880,455	6.1%	3,029,865	23.7%	4,262,620	34.1%
	-15	1,246,453	6.8%	3,081,173	24.1%	4,304,644	34.5%
Price	15	1,662,240	11.1%	3,807,413	30.3%	5,139,788	41.4%
	10	1,457,647	9.0%	3,514,025	27.8%	4,819,383	38.7%
	5	1,253,053	6.9%	3,220,637	25.3%	4,498,978	36.1%
	0	**1,048,451**	**4.6%**	**2,339,242**	**22.8%**	**3,590,572**	**32.8%**
	-5	843,866	2.2%	2,633,861	20.2%	3,858,167	30.7%
	-10	639,272	0.4%	2,340,473	17.5%	3,537,762	28.0%
	-15	434,679	-3.3%	2,047,085	14.8%	3,217,356	25.3%
Catch	15	1,598,197	10.4%	3,716,437	29.5%	5,169,018	41.6%
	10	1,414,951	8.6%	3,453,374	27.3%	4,847,762	39.0%
	5	1,231,705	6.6%	3,190,312	25.1%	4,526,507	36.3%
	0	**1,048,451**	**4.6%**	**2,339,242**	**22.8%**	**3,590,572**	**32.8%**
	-5	865,214	2.4%	2,664,187	20.5%	3,883,998	31.0%
	-10	681,168	0.1%	2,401,125	18.1%	3,562,741	28.2%
	-15	498,722	-2.4%	2,138,062	15.7%	3,241,485	25.5%
Fuel	-10						
C. Share	10	1,633,121	10.8%	3,750,692	29.8%	5,139,583	41.4%
Catch	15						
C. Share	10						
Catch	15	1,550,665	10.0%	3,648,076	29.0%	5,055,535	40.7%
Fuel	-10						
Price	10	3,665,981	8.7%	3,616,641	28.7%	4,975,432	40.0%

In some cases the fishing operation is profitable and in other cases it is not. The profitability depends on the operational conditions.

Profitability is most affected by the catch and price of the catch. Since both are likely to fluctuate, it is important that the foundation of the company is solid so it can ride out periods of unfavourable conditions.

Although fuel is the main consumption in it doesn't affect the profitability much even in Cape Verde, where fuel prices are higher, except when associated with the fish price.

According to Table 19, the fleet operation in the Cape Verde scenario, as described in Appendix 2 is unprofitable. If fuel price goes down 10% and crew share is increased by 10% as an incentive to improve catch to 15%, the IRR is improved to 10.8%.

In the Senegal and Angola scenarios (Appendix 3 and 4) the fishing operation is profitable. The profitability improves when the fish price and catch rise or fuel price decreases.

In the Senegal scenario if the price increases by 15% the IRR will rise by 33%.

In the Angola scenario the fishing operation is still profitable even if the fuel price goes up by 15% or if the catch or price goes down 15%.

7 DISCUSSION

Three different operation scenarios for the new fleet in Cape Verde have been considered: fishing for tuna in Cape Verde, small pelagic in Senegal or small pelagic and demersal species in Angola.

The profitability of the Senegal and Angola scenarios is higher because the operating costs are lower and the catches are priced higher. This is mainly due to local fishing conditions and the demand for fish in the markets. At present, Dakar has three tuna processing plants with a total capacity of 50,000 tonnes per year. The lack of supply of fish is a major concern for these plants.

On the west coast of Africa the most important pelagic markets for canneries are in Dakar (Senegal), Abidjan (Ivory Coast) and Tema (Ghana). Tuna prices are generally 10% higher in Dakar than on the international market, mainly because of the competition among the canneries to purchase raw materials (CDI-Partnership 2002).

Most of the landings are for national consumption. Foreign fleets land 2/3 of their catches. Thus, about 94% of the fish captured is landed in Angola. Most of the fish caught is sold on the national market, as demand for fish is high and not fully satisfied (SADC 2002).

In these scenarios the profitability can be improved by reducing the lost days in port resulting in more fishing days and higher catches.

Fishing for tuna in Cape Verde is unprofitable mainly because expected catches are low, costs are high, lack of bait, inadequate fish handling and preservation and because of the natural conditions around the islands. The profitability depends mostly on the catch and price of fish at the market. When the price goes down by 10% the IRR is reduced by 91% and it increases by 87% when the catch is increased 10%.

Educating and motivating the crew can improve profitability. Increasing the crew's share should result in higher catches or and upgrading the quality of the fish landed will lead to higher price at the market. The latter should also end the E.U.'s embargo.

As an incentive to increase supplies in the Abidjan market, companies give a higher price for landings of over 300 tonnes of tuna.

8 CONCLUSION / RECOMMENDATION

It is clear from the results of this study that it will be difficult for the government to fulfil its objectives by operating this new fleet and in the Cape Verde EEZ. The study shows that the most profitable scenario is to fish and land the fish in Angola where the IRR 33.4%. This is due to factors like better markets, lower cost and higher catches. Similarly, in the Senegal scenario the IRR is 22.8%, higher than in the Cape Verde scenario.

On the other hand the study shows that the Cape Verde scenario is under the profitability requirements of 15% put forward in the introduction chapter. This can be traced to factors like high operating cost, low catches and low market price.

The objectives put forward by the governments by operating these vessels were:

- To increase catches and landings.
- To better utilise the production capacity of the processing plants, through the furnishing of sufficient quantities of raw material.
- To improve the social and economic conditions on the islands.

With unchanged conditions it is clear that these objectives will not be fulfilled. Hence it is clear that the government needs to change the conditions of operating the vessels or put less demand on the profitability of the vessel.

It is clear that in the long run the government cannot encourage the fishing industry to operate a fishing fleet in an unprofitable way so the only real option for the government is to either in some way make the operation of the fleet profitable or operate it somewhere else and abandon the original objectives.

Improvements in profitability can be made in the Cape Verde scenario by changing the actual fishing conditions thus increasing the landings and selling at a higher price.

The best market for Cape Verdean fisheries is West Africa

Due to these conclusions the study would recommend operating the new fleet in Angola.

However, taking into account the objectives of improving the social and economic conditions on the islands and furnishing sufficient quantities of raw material to the processing plants set by the government, it should be recommended to operate the fleet in Cape Verde under the following conditions to overcome the actual situation:

- To change the compensation system by using incentives to encourage higher catches up to 20%.
- To improve fish handling and processing in order to end the E.U.´s embargo and so have better marketing options and get prices at least 15% higher.

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APPENDIX

Appendix 1: Variable cost and sale price for the different scenarios (in Euro)

CAPE VERDE	YFT	BET	SJT
Crew share per ton sales in Senegal	71	108	41
Salary per month	34.120		
Fuel per sailing day	952		
Fuel per fishing day	624		
Lubricant per sailing day	143		
Lubricant per fishing day	90		
Food per month	1.851		
Fishing gear % of revenue	1%		
Water per month	160		
Ice per tonnes catch	22,7	22,7	22,7
Agency per fishing month	1.800		
Communication per fishing month	1.310		
Sale price per ton in Cape Verde	680	636	345
Expected sale price per ton in Senegal	710	1.080	406

SENAGAL	Horse mackerel	Pilchard
Crew share per ton sales in Senegal	32	45
Salary per month	34.120	
Fuel per sailing day	644	
Fuel per fishing day	422	
Lubricant per sailing day	87	
Lubricant per fishing day	55	
Food per month	1.851	
Fishing gear % of revenue	1%	
Water per month	150	
Ice per tonnes catch	10,2	10,2
Agency per fishing month	1.800	
Communication per fishing month	1.310	
Expected sale price per ton in Senegal	317	446

ANGOLA	Horse mackerel	Pilchard
Crew share per ton sales in Angola.	30	144
Salary per month	34.120	
Fuel per sailing day	644	
Fuel per fishing day	422	
Lubricant per sailing day	87	
Lubricant per fishing day	55	
Food per month	1.851	
Fishing gear % of revenue	1%	
Water per month	150	
Ice per tonnes catch	10,2	10,2
Agency per fishing month	1.800	
Communication per fishing month	1.310	
Expected sale price per ton in Angola	301	1.436

Apendix 2:Income, operation cost and profit in Cape Verde scenario in Euro

Revenue Catch	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Tot.annual
Yellowfin tons	0	0	24	24	24	30	30	21	27	33	42	24	279
Bigeye tons	0	0	12	12	12	15	15	7	9	11	21	12	126
Skipjack tons	0	0	4	4	4	5	5	42	54	66	7	4	195
Fishing days	0	0	12	12	12	12	12	12	12	12	12	12	120
Sailing days	0	0	6	6	6	6	6	6	6	6	6	6	60
Catch per vessel	0	0	40	40	40	50	50	70	90	110	70	40	**600**
Income per vessel	0	0	31.624	31.624	31.624	39.530	39.530	39.518	50.809	62.099	55.341	31.624	413.321
Total revenue	0	0	316.236	316.236	316.236	395.295	395.295	395.178	508.086	620.994	553.413	316.236	**4.133.205**
Variable costs													
Crew share pr. ton	0	0	31.624	31.624	31.624	39.530	39.530	39.518	50.809	62.099	55.341	31.624	413.321
Salary pr. month of fishing	0	0	34.120	34.120	34.120	34.120	34.120	34.120	34.120	34.120	34.120	34.120	341.200
Fuel pr. day sailing	0	0	57.136	57.136	57.136	57.136	57.136	57.136	57.136	57.136	57.136	57.136	571.362
Fuel pr. day fishing	0	0	74.860	74.860	74.860	74.860	74.860	74.860	74.860	74.860	74.860	74.860	748.596
Lubricant pr day sailing	0	0	8.554	8.554	8.554	8.554	8.554	8.554	8.554	8.554	8.554	8.554	85.536
Lubricant pr. day fishing	0	0	5.423	5.423	5.423	5.423	5.423	5.423	5.423	5.423	5.423	5.423	54.234
Food pr. month fishing	0	0	1.851	1.851	1.851	1.851	1.851	1.851	1.851	1.851	1.851	1.851	18.510
Fishing gear 1% of revenue	0	0	3.162	3.162	3.162	3.953	3.953	3.952	5.081	6.210	5.534	3.162	41.332
Water pr. month fishing	0	0	160	160	160	160	160	160	160	160	160	160	1.600
Ice pr. Tons of catch	0	0	909	909	909	1.136	1.136	1.591	2.045	2.500	1.591	909	13.635
Agency pr. month fishing	0	0	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	18.000
Comm. pr. month fishing	0	0	1.310	1.310	1.310	1.310	1.310	1.310	1.310	1.310	1.310	1.310	13.100
Total Variable cost	0	0	220.909	220.909	220.909	229.833	229.833	230.274	243.149	256.023	247.680	220.909	**2.320.426**
Contribution margin	**0**	**0**	**95.327**	**95.327**	**95.327**	**165.463**	**165.463**	**164.904**	**264.937**	**364.971**	**305.733**	**95.327**	**1.812.779**
Fixed cost													
Fixed cost													764.320
Depreciation vessels													569.000
Depreciation other													19.000
Total fixed cost													**1.352.320**
Total operation cost													**3.672.746**
Operating profit													**460.459**

Appendix3:Income, operation cost and profit in Senegal scenario in Euro

Revenue Catch	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Tot.annual
Horse mackerel	0	11	11	11	13	13	14	14	14	13	12	11	137
Pilchard	0	99	99	99	117	117	126	126	126	117	108	99	1.233
Fishing days	0	16	16	16	16	16	16	16	16	16	16	16	176
Sailing days	0	4	4	4	4	4	4	4	4	4	4	4	44
Catch per vessel	0	110	110	110	130	130	140	140	140	130	120	110	**1.370**
Income per vessel	0	47.589	47.589	47.589	56.242	56.242	60.568	60.568	60.568	56.242	51.916	47.589	592.703
Total revenue	0	475.893	475.893	475.893	562.419	562.419	605.682	605.682	605.682	562.419	519.156	475.893	**5.927.031**
Variable costs													
Crew share pr. ton	0	47.589	47.589	47.589	56.242	56.242	60.568	60.568	60.568	56.242	51.916	47.589	592.703
Salary pr. month of fishing	0	34.120	34.120	34.120	34.120	34.120	34.120	34.120	34.120	34.120	34.120	34.120	375.320
Fuel pr. day sailing	0	25.767	25.767	25.767	25.767	25.767	25.767	25.767	25.767	25.767	25.767	25.767	283.439
Fuel pr. day fishing	0	67.520	67.520	67.520	67.520	67.520	67.520	67.520	67.520	67.520	67.520	67.520	675.200
Lubricant pr day sailing	0	3.485	3.485	3.485	3.485	3.485	3.485	3.485	3.485	3.485	3.485	3.485	31.363
Lubricant pr. day fishing	0	2.210	2.210	2.210	2.210	2.210	2.210	2.210	2.210	2.210	2.210	2.210	24.306
Food pr. month fishing	0	1.851	1.851	1.851	1.851	1.851	1.851	1.851	1.851	1.851	1.851	1.851	20.361
Fishing gear 1% of revenue	0	4.759	4.759	4.759	5.624	5.624	6.057	6.057	6.057	5.624	5.192	4.759	59.270
Water pr. month fishing	0	150	150	150	150	150	150	150	150	150	150	150	1.650
Ice pr. Tons of catch	0	1.109	1.109	1.109	1.310	1.310	1.411	1.411	1.411	1.310	1.210	1.109	13.810
Agency pr. month fishing	0	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	1.800	19.800
Comm. pr. month fishing	0	1.310	1.310	1.310	1.310	1.310	1.310	1.310	1.310	1.310	1.310	1.310	14.410
Total Variable cost	0	191.670	191.670	191.670	201.389	201.389	206.249	206.249	206.249	201.389	196.529	191.670	**2.186.122**
Contribution margin	**0**	**284.223**	**284.223**	**284.223**	**361.030**	**361.030**	**399.433**	**399.433**	**399.433**	**361.030**	**322.627**	**284.223**	**3.740.909**
Fixed cost													
Fixed cost													813.660
Depreciation vessels													569.000
Depreciation other													19.000
Total fixed cost													**1.401.660**
Total operation cost													**3.587.782**
Operating profit													**2.339.249**

Appendix 4:Income, operation cost and profit in Angola scenario in Euro

Revenue Catch	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Tot.annual
Horse mackerel	60	60	55	50	50	45	0	40	45	55	60	60	580
Demersal	40	40	35	30	30	30	0	30	35	35	35	40	380
Fishing days	12	12	12	12	12	12	0	12	12	12	12	12	132
Sailing days	4	4	4	4	4	4	0	4	4	4	4	4	44
Catch per vessel	100	100	90	80	80	75	0	70	80	90	95	100	**960**
Income per vessel	75.474	75.474	66.792	58.110	58.110	56.606	0	55.101	63.783	66.792	68.297	75.474	720.012
Total revenue	754.740	754.740	667.920	581.100	581.100	566.055	0	551.010	637.830	667.920	682.965	754.740	**7.200.120**
Variable costs													
Crew share pr. ton	83.021	83.021	73.471	63.921	63.921	62.266	0	60.611	70.161	73.471	75.126	83.021	792.013
Salary pr. month of fishing	34.120	34.120	34.120	34.120	34.120	34.120	0	34.120	34.120	34.120	34.120	34.120	375.320
Fuel pr. day sailing	25.767	25.767	25.767	25.767	25.767	25.767	0	25.767	25.767	25.767	25.767	25.767	283.439
Fuel pr. day fishing	50.640	50.640	50.640	50.640	50.640	50.640	0	50.640	50.640	50.640	50.640	50.640	506.400
Lubricant pr day sailing	3.485	3.485	3.485	3.485	3.485	3.485	0	3.485	3.485	3.485	3.485	3.485	31.363
Lubricant pr. day fishing	6.629	2.210	2.210	2.210	2.210	2.210	0	2.210	2.210	2.210	2.210	2.210	28.725
Food pr. month fishing	1.851	1.851	1.851	1.851	1.851	1.851	0	1.851	1.851	1.851	1.851	1.851	20.361
Fishing gear 1% of revenue	7.547	7.547	6.679	5.811	5.811	5.661	0	5.510	6.378	6.679	6.830	7.547	72.001
Water pr. month fishing	150	150	150	150	150	150	0	150	150	150	150	150	1.650
Ice pr. Tons of catch	1.008	1.008	907	806	806	756	0	706	806	907	958	1.008	9.677
Agency pr. month fishing	1.800	1.800	1.800	1.800	1.800	1.800	0	1.800	1.800	1.800	1.800	1.800	19.800
Comm. pr. month fishing	1.310	1.310	1.310	1.310	1.310	1.310	0	1.310	1.310	1.310	1.310	1.310	14.410
Total Variable cost	217.329	212.909	202.390	191.871	191.871	190.015	0	188.159	198.679	202.390	204.246	212.909	**2.212.769**
Contribution margin	**537.411**	**541.831**	**465.530**	**389.229**	**389.229**	**376.040**	**0**	**362.851**	**439.151**	**465.530**	**478.719**	**541.831**	**4.987.351**
Fixed cost													
Fixed cost													880.780
Depreciation vessels													569.000
Depreciation other													19.000
Total fixed cost													**1.468.780**
Total operation cost													**3.681.549**
Operating profit													**3.518.571**

Appendix 5: Operating profit and present value for the scenario Cape Verde

Year	Operating profit before interest	Interest	Operating profit after interest	Present value
1	1.048.459	519.540	528.919	505.802
2	1.048.459	498.865	549.594	502.603
3	1.048.459	476.743	571.716	499.983
4	1.048.459	453.072	595.387	497.927
5	1.048.459	427.745	620.714	496.421
6	1.048.459	400.644	647.815	495.451
7	1.048.459	371.646	676.813	495.005
8	1.048.459	340.619	707.840	495.072
9	1.048.459	307.420	741.039	495.640
10	1.048.459	271.896	776.563	496.699
11	1.048.459	233.886	814.573	498.239
12	1.048.459	193.216	855.243	500.253
13	1.048.459	149.698	898.761	502.731
14	1.048.459	103.134	945.325	505.666
15	3.324.459	53.311	3.271.148	1.673.304
Total	18.002.885			4.980.603
Initial investment				-12.370.000
Net present value				17.350.603
IRR	5%			
IRR EQ	1%			

Appendix 6: Operating profit and present value for the scenario Senegal

Year	Operating profit before interest	Interest	Operating profit after interest	Present value
1	2.339.249	519.540	1.819.709	1.525.322
2	2.339.249	498.865	1.840.384	1.293.086
3	2.339.249	476.743	1.862.506	1.096.924
4	2.339.249	453.072	1.886.177	931.152
5	2.339.249	427.745	1.911.504	790.994
6	2.339.249	400.644	1.938.605	672.429
7	2.339.249	371.646	1.967.603	572.077
8	2.339.249	340.619	1.998.630	487.090
9	2.339.249	307.420	2.031.829	415.072
10	2.339.249	271.896	2.067.353	354.006
11	2.339.249	233.886	2.105.363	302.191
12	2.339.249	193.216	2.146.033	258.197
13	2.339.249	149.698	2.189.551	220.815
14	2.339.249	103.134	2.236.115	189.029
15	4.615.249	53.311	4.561.938	323.253
Total	37.364.735			9.431.636
Initial investment				-12.370.000
Net present value				21.801.636
IRR	18%			
IRR EQ	33%			

Appendix 7 : Operating profit, present value and IRR – Angola scenario

Year	**Operating profit before interest**	**Interest**	**Operating profit after interest**	**Present value**
1	3.590.572	519.540	3.071.032	2.936.811
2	3.590.572	498.865	3.091.707	2.827.363
3	3.590.572	476.743	3.113.829	2.723.138
4	3.590.572	453.072	3.137.500	2.623.918
5	3.590.572	427.745	3.162.827	2.529.494
6	3.590.572	400.644	3.189.928	2.439.668
7	3.590.572	371.646	3.218.926	2.354.249
8	3.590.572	340.619	3.249.953	2.273.056
9	3.590.572	307.420	3.283.152	2.195.916
10	3.590.572	271.896	3.318.676	2.122.664
11	3.590.572	233.886	3.356.686	2.053.141
12	3.590.572	193.216	3.397.356	1.987.196
13	3.590.572	149.698	3.440.874	1.924.687
14	3.590.572	103.134	3.487.438	1.865.475
15	5.866.572	53.311	5.813.261	2.973.682
Total	56.134.580			25.026.279
Initial investment				-12.370.000
Net present value				37.396.279
IRR	28%			
IRR EQ	61%			