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COSTS AND EARNINGS OF THE INDUSTRIAL SARDINELLA FISHERIES IN THREE WEST AFRICAN COUNTRIES IN 1983

by

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FOREWORD

This study aims at providing a better understanding of the costs and earnings of small industrial purse seine vessels in West Africa. Although this fishery is relatively small, it is important in that it provides, in certain countries, relatively cheap fish for the general public. Senegal, Côte d'Ivoire and Ghana all have such a fishery, competing with each other at different levels. For example, Ghana and Côte d'Ivoire are competing for the same stock, while the fleet of Dakar competes with the one from Côte d'Ivoire for the same market in Côte d'Ivoire.

The data used in this study were collected during the second half of 1984, and refer to the average situation in 1983. Data collection in Ghana was carried out by Dr. E.O. Tetteyy who prepared a first draft of the chapter on Ghana. He also assisted with the data collection in Côte d'Ivoire. Dr. D. Greboval, Fishery Planning Analyst, FAO Rome provided useful comments on early drafts. However, all responsibility for this study, including the presentation and interpretation of the data, rests with the author.

EXCHANGE RATES:

¢	Cedi	1 US $ = 50 ¢ in January 1984
CFAF	CFA Franc	1 US $ = 381 CFAF in January 1984

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1. INTRODUCTION

The fishing sector is of increasing importance for the countries in the CECAF area, which includes all coastal States from Morocco to Zaire. The total volume of fish caught in the territorial waters of these countries has fluctuated around three million tons during the last ten years (with an increase between 1972 and 1977, and a decrease after that, due to the extension of national jurisdiction).

The African coastal countries increased their share from 37 % in 1973 to 42 % (by volume) in 1983. It is estimated that the share of the coastal States in the catch (by value) has increased from 28 % in earlier years, to 45 % in 1983. The total landed value of fish caught in these waters has been estimated around US $ 1 400 million for 1983 (this represents one percent of the combined national products of these countries). Around 45 % of the catches (by volume) is landed by the artisanal sector (which in some countries, includes the semi-industrial sector).

With the introduction of the Exclusive Economic Zones (EEZ) in most coastal States in recent years, governments have been confronted with the problems of rationally exploiting the living and non-living resources in their waters. The development and management problems in fisheries are many and complex. For the artisanal sector, the problems often centre around the question of how to increase production, how to increase fishermen's incomes and how to protect them from the direct physical and economic competition with the industrial sector. Questions often arising in the industrial sector include how to develop a national fleet, to replace foreign fleets currently operating in the area and how to manage them at a bioeconomic optimal level.

The body of knowledge on many aspects of West African fisheries has known a steady growth over the last ten years, especially with regard to stock assessment, fishery statistics and regional trade information. More recently, it has become clear that information on costs and earnings in the fishery sector are of utmost importance to enable development and management measures to be taken. However, the simple question "what do fishermen (vessel owners) actually earn" has not been asked often enough in West Africa. While it is suspected that in many countries some studies have been undertaken in this respect, most of the results have remained unpublished.

This study brings together three separate enquiries on costs and earnings. They have, as far as possible, been made comparable although due to the different problems encountered in obtaining data from the various countries some inconsistencies remain. Nevertheless, the accounts of income and expenditure of "typical" vessels can be used to evaluate the fisheries and draw certain conclusions.

The study deals with small pelagic species notably Sardinella spp. These species are fished both by the industrial sector (small purse seine vessels, and large mid-water trawlers) and the artisanal sector. The stocks of sardinella have as their main characteristic that they are migratory and highly unstable. This means that any fishery for this species is exposed to high risks of over-investment and big losses (Garcia, 1984). The primary aim here is to present information on the inshore industrial fisheries for sardinella in three different countries and compare them.

All tables are presented at the back of the report, Table numbers refer to the relevant chapters. The quality of the data presented is variable, depending on the quality of the statistical system in the countries concerned, and the sources of the data (interviews). All conclusions drawn from these data should therefore be treated with care. This report is a provisional study and it is hoped that it will encourage further work in this field in West Africa.

2. GHANA

2.1 Introduction

The Ghanaian sardinella fishery has received considerable attention in recent years, mainly from biologists (Ansa-Kwamim, 1968 and 1973; FAO, 1979 and 1980). The fishery itself underwent marked changes during the seventies, as a result of changing operational circumstances and severe economic conditions. One of the most importance changes is the conversion of purse seiners to trawlers in order to fish species at greater depths, particularly outside the sardinella season.

The difficult economic circumstances in Ghana make an evaluation of the fishery complicated. The country has an acute shortage of foreign exchange resulting in a parallel market for nearly all goods. The Ghanaian cedi (¢) has fallen in value from 1.15 ¢/US $ in 1983 to 50 ¢ in 1984. However, foreign currencies are scarce and parallel market rates might have been as high as 120-150 ¢/US $ in 1983. The normal operations of the fishing vessels have been affected by frequent shortage of fuel, supplies and spare parts. Investment in new vessels virtually came to a halt in recent years and most of the fleet had become old and inefficient.

2.2 Description of the fishery

2.2.1 Background

A rapid expansion of the industrial fleet was observed between the mid 1950s and the early part of the 1970s. This was mainly due to the introduction in 1953 of the charter party loan scheme. This scheme enabled fishermen to rent vessels at low and attractive rates and eventually own them after several years (Lawson and Kwei, 1974).

Since 1974 there was a marked decline in investment in fishing vessels particularly within the inshore fleet. Nevertheless, following certain restrictions placed on the operation of foreign fishing vessels from Ghanaian ports the number of tuna vessels under Ghanaian ownership increased from four in 1975 to 33 in 1983.

The serviceability of the fleet (the ratio of the number of vessels operating to the number of vessels registered) declined from 82.4 % in 1970 to a low of 53.8 % in 1975). More than one third of the fleet was idle since then. Of the vessels that do operate, the majority can only do so during a few months of the year due to the lack of fuel and spare parts.

The Ghana canoe fleet is the country's major supplier of fish with a share of over 70 % of the total landings in 1982 (Table 2.2). The share of Sardinella spp. in the total catch for both inshore industrial and canoe fisheries has been variable over the last twelve years (Table 2.3).

2.2.2 The sardinella fishery

The poli net is now the most widely used and most productive technique in the artisanal fishery for sardinella. This is a modified form of the traditional ali net made more effective by the fitting of purse rings. Poli fishing has accounted for more than two thirds of the entire sardinella catch since 1972 with the exception of 1974 and 1977 when greater quantities were taken by beach seines (Table 2.4).

Two types of industrial vessels are used for the exploitation of sardinella. Those less than 12 meters long and others between 12 and 22 meters long. The small vessels (12 m) are multipurpose and depending on the season operate both the trawl net for demersal species and the small purse seine for pelagic species. The small purse seine net, usually referred to as "ringnet" in Ghana, measures about 400 m long and 40 m deep and has average mesh size of about 25 mm. These small vessels operate at depths ranging from 18 to 50 m.

Most of the medium sized vessels are also multipurpose trawlers/purse seiners. The purse seine net used by this fleet is about 700 to 800 m long and about 70 m deep. This fleet operates at depths ranging from 20 to 50 m.

The seasonal character of the sardinella fishery is quite marked in Ghana. The greatest abundance of fish occurs between July and September during the upwelling season. Between 1973 and 1982, 85 % of the industrial sardinella catch was taken during that season. Between November and June catches are negligible (Table 2.5). The seasonal character is less marked with the canoe fishery, with 56 % of the total catch during the upwelling. The main reason for the difference between the two types of fisheries is the fact that the industrial fishery switches to other target species outside the upwelling season.

2.3 Costs and earnings

2.3.1 Method

The financial data for the vessels upon which the study is based have been obtained from Mankoadze Fisheries, Ohuorwe Fisheries and the Tema Boatowners Association. In all, 32 vessels representing a little over 10 % of the fleet reportedly operating in 1983 were studied. The sample vessels are grouped into the different size classes : 0-9.9 m, 10.0-18.3 m and 18.4-30.5 m, with 7, 14 and 11 vessels in each respective size class. The price paid for a representative vessel in each class is estimated from cost data collected from the Tema Boatyard Company, fishing companies and the Inshore Boatowners Association.

2.3.2 Description of costs and earnings items

Revenues

The three vessel sizes have annual catches of 173, 208 and 236 tons of small pelagics respectively. Based on prices obtained and official price developments over the last few years, an average price of 9 500 ¢/ton is used in the analysis.

Variable costs:

(i) Fuel and lubrication

A breakdown of the number of trips for each vessel size is not available. Therefore, an overall average of 46 trips per year for all sizes is used. The average trip length is around four days. This means that vessels are at sea for 184 days per year (including trawling activities), a low figure that can be explained by the operational problems encountered.

Fuel consumption per trip is estimated at 350, 400 and 550 gallons for small, medium and large vessels respectively. The average price of fuel was ¢ 25 per gallon in 1983. Total annual costs were ¢ 402 500, ¢ 460 000 and ¢ 632 500 respectively. Ten percent is added for lubrication.

(ii) Salaries and crew share

Crew share and payroll taxes are dependent on the catch. A standardized wage rate for crew was not employed by the respondents. Various agreements have been established between vessel owners and crew with regard to the crew remuneration. The most popular remuneration is one third of the difference between revenues on the one hand and fuel lubrication and ice on the other hand. Under this agreement each crew member has to provide his own food and water while at sea. These food items do not constitute a cost to the fishery and are not included in supplies. Payroll taxes were 7.5 percent.

(iii) Ice

Per trip of four days, vessels use respectively 250, 300 and 400 blocks of ice. In 1983 the price was ¢ 15 per block. Total annual costs therefore were respectively ¢ 172 500, ¢ 207 000 and ¢ 276 000.

(iv) Repairs and maintenance

The Ghanaian industrial fishing fleet was not properly maintained over the last decade and the situation deteriorated even further over the past three years. Repairs activities have been minimal and vessels have been left idle at dockside over extended periods, due to lack of spare parts. In effect, costs associated with repairs and maintenance are found to be relatively low compared with other fisheries. This means of course that boats owners are consuming their invested capital. Amounts shown under this heading are averages from the vessels in the sample.

(v) Supplies

These include usual items such as netting material, ropes and tools, but exclude food and water. The amounts are averages from the vessels in the sample.

Fixed costs

(i) Depreciation

In calculating depreciation costs for the three vessels, the straight line pattern is employed. As mentioned above, repairs and maintenance were substandard. Therefore, the usual salvage value of 35 percent of the original cost (Griffen et al., 1976; Tetley et al., 1984) is lowered to 15 percent. Vessel owners stated a useful life of 15 years for the three vessel sizes, with an investment value of ¢ 2 357 500, ¢ 2 936 250, and ¢ 3 283 750 for the three size classes. Annual depreciation is ¢ 133 592, ¢ 166 388, and ¢ 186 079 respectively.

(ii) Insurance

Lending institutions and agents expect fishermen to insure their vessels but very few vessel owners comply with this regulation. Records and information from respondents indicate that among vessel owners insuring their vessels very few actually meet their premium obligations.

The pattern is changing however with the lending institutions applying stricter regulations and fishermen acknowledging the need for insurance. An estimated rate of four percent of the replacement value, one percentage point lower than the State insurance company's rate, is believed to best describe the situation in 1983.

(iii) Interest

The Agricultural Development Bank is the major source of loans for vessel purchases. The terms of these loans have been changing with time. Interest charges are calculated from an average of 67 percent debt financing at a rate of 6.5 percent.

(iv) Overheads

They include licence fees, dry dock charges and harbour taxes.

(v) Opportunity costs of management

Costs of management reflect the foregone opportunity by the vessel owner who manages his own business. Based on related ventures in the economy, a cost of five percent of the gross revenue is used (Griffen et al., 1974).

2.3.1 Results

The costs and earnings of the fishery in 1983 are summarized in Table 2.6. The gross returns and the return to investment are the highest for medium sized vessels. It should be noted that as a result of the way in which crew shares are calculated, the crew share for the large vessel is smaller while it can be assumed that the large employ more crew. Whether this is realistic remains to be researched.

The cost structure of the fishery is shown in Table 2.7. Around three quarters of the total costs are variable, a result which applies to many other fisheries. Fuel is around 30 percent of total costs, with the medium size vessels being the relatively more efficient. Spectacular differences between the various sized vessels do not exist. Selected results are presented in Table 2.8.

Overall, the largest vessels are the least profitable, a difference of 13.5 percent in revenues compared with medium size is offset by a difference of 19.6 percent in total costs. The difference between small and medium sized vessels is not large in terms of profitability but the medium size vessel is probably a better investment because one can assume that they have more possibilities and a wider range when they operate as a trawler outside the upwelling season.

3. COTE D'IVOIRE

3.1 Introduction

Since the early 1960s more than half of the total Ivorian fish landings have been attributed to the industrial fleet based in Abidjan (FAO, 1976; Robinson & Crispoldi, 1984). The industrial vessels account for 68 percent of the total marine catch in 1980, 59 percent in 1983.

Four different types of industrial fisheries exist, of which the sardinella fishery is the most important in terms of weight, accounting for 51 percent of the industrial landings in 1983. The tuna fishery is the most important in terms of value, accounting for 50 percent of the total landed value in 1983. The other two fisheries are the trawl fishery (mainly demersals) and the shrimp fishery.

The development of the sardinella fishery goes back to the early sixties and traditionally, fishing grounds have stretched from Senegal to Ghana. In recent years, no agreements with other countries have been obtained and, currently, the fleet is restricted to operating in Ivorian waters. Given the highly fluctuating nature of the resource, this situation can be expected to put heavy pressure on the continuation of the fishery.

3.2 Description of the fishery

3.2.1 Background

Côte d'Ivoire with its narrow continental shelf, relies for an important part on fish imports to satisfy domestic demand. In 1980, 60 percent of the total domestic supply came from imports. That share dropped to 49 percent in 1983 due to a sharp decrease in imports as a result of difficult economic conditions. This, combined with a fast growing population (including immigrants from other countries), resulted in a drop in the supply of fish per capita by 26 percent between 1979 and 1983 (Frielink, unpublished).

Of the 73 700 tons of frozen fish imported in 1983, ten percent was Sardinella spp. Ten percent was mackerel and 80 percent was "other species". Fifty-one percent of the sardinella came from Senegal and 49 percent from Mauritania.

Purse seine vessels land their catches at the quay in the Abidjan fishing harbour which, at the same time, serves as auction hall. Fish are sold on the spot at negotiated prices to traders. Most fish are then brought to smoke houses for smoking and subsequent sale in the interior of the country. This system creates a near-perfect market structure at quay-side with prices and quantities landed, moving in opposite directions on a day-to-day basis. Vessel owners have set a maximum number of vessels which can land fish on any one day in order to avoid very low prices. Recent price developments are shown in Table 3.1. The drop in prices in 1983 reflects the relative good catch during that year.

3.2.2 The sardinella fishery

Description of the fleet

Sixteen purse seiners ranging from 18.4 to 28.8 meters in overall length operated in the Ivorian inshore fishery in 1983. Data are available for 15 vessels. The vessels are grouped into two classes, according to installed engine power (Table 3.2).

The vessels were all built in Abidjan, from wood and equipped with power blocks. No vessel had a refrigeration system, ice was used. The vessels in general were well maintained and operated on a regular basis. Fishing is practised year round, except in June when nearly all activities halt due to heavy rains.

A total of 1 821 trips were made in 1983 with catches of 23 392 tons for an average ex-vessel price of 115 CFAF/kg (Table 3.3). Differences in catch per vessel are large but, excluding the vessel Balmer, the differences in catch per trip are relatively small. Differences in average ex-vessel price are due to :

(i) difference in catch composition (on average 90 percent of the catch consists of Sardinella pp), and

(ii) differences in average size of individual fish.

Landings and seasonality

While between 1975 and 1983 the number of vessels operating decreased slowly, the total catches showed a big decline between 1976 and 1980, although recently, there have been some recovery. Effort, expressed as number of trips, showed a steady increase since 1979.

Catches per trip showed an even bigger decline and, in 1983, were 42 percent below the 1977 level. This decline is only partially compensated for by the increase in ex-vessel prices and consequently, the value of the catch per trip decreased by 30 percent between 1978 and 1983. Especially, 1982 and 1983 were relatively difficult years with an apparent collapse of the sardinella stock.

The period of the upwelling from July to November is important, with 61 percent of the total catches in 1983 (Table 3.4). May and June were the poorest months, with absolute lows in catches per trip. Activities virtually came to a standstill in June due to bad wheather. As a result of the open market structure, ex-vessel prices showed a movement alternate to the quantities landed. The value of the catch therefore was much evenly spread over the year. Obvious exceptions were May and June. November was the top month with nearly 13 percent of the annual earnings. Catches per trip were high then, while prices were up, due to the pre-Christmas demand.

3.3 Costs and earnings

3.3.1 Method

The vessels of which the technical data are shown, are divided into two classes according to engine size. One group, "small", has on average an engine of 240 hp; the other group, "large", an engine of 450 hp. As the performance of the individual vessels in each group shows large differences, an average vessel within each group has been used rather than a "typical" vessel. The results thus apply to the average of the whole group but will not reflect actual results for any individual vessel of that group.

The 16 vessels in operation in 1983 belonged to eight vessel owners, one of whom owned seven vessels. Five of the owners (or their representatives) were interviewed. This represents 13 vessels (or 81 percent of the fleet). One vessel of which no details are known, performed very badly in 1983 and was excluded from the calculations.

The small vessel has an historical investment cost of 35.5 million CFAF (1969) and a replacement value of 180 million CFAF (1983). For the large one, this is respectively 67 (1973) and 240 million (1983). An average length of 20 meters for the large vessel is used. Small vessels employ 18 to 20 persons, large vessels 24.

3.3.2 Description of costs and earnings items

The total number of trips in 1983 is 110 and 122 respectively, with total landings of 1 425 tons and 1 223 tons. Earnings are 161 055 000 CFAF and 195 778 000 CFAF.

Variable costs

(i) Fuel and lubrication

The average number of days per month at sea for both vessels is 23 and 20 respectively. Assumed horsepower utilization is 80 percent and engine use 0.2 l/hp per hour.

For the small vessel the monthly fuel consumption is 0.8 x 23 x 24 x 0.2 x 240 = 21 197 litres at 108.1 CFAF per litre giving 2 291 396 CFAF per month or 27 496 752 CFAF per year. For the large vessel this is 20 x 0.8 x 24 x 0.2 x 450 = 34 560 litres at 108.1 CFAF giving 3 735 936 CFAF per month, or 44 831 232 CFAF per year. These results are in the same order as the figures given by the respondents.

Adding 10 percent for lubrication, the total annual costs become 30 246 427 and 49 314 355 CFAF respectively.

(ii) Salaries

Total monthly wage bills including taxes and social security charges and premiums are estimated to be 2 million CFAF for small vessels and 2 500 000 CFAF for large vessels. For each function there is an official minimum wage which adds up to about 1 400 000 CFAF. The difference is assumed to be premiums and extras.

Annual wage bills are then 24 million CFAF and 20 million CFAF for small and large vessels respectively.

(iii) Repairs and maintenance

Detailed figures on the drydock charges were obtained for 1983. However, no detailed figures were available on repairs and maintenance, though some respondents were able to give some estimates. For repairs and maintenance a figure of ten percent of the replacement value is used, giving costs which are of the same order as those given by the respondents.

(iv) Supplies

Ice costs 12 000 CFAF per ton. On average 10 tons per trip were used, which gives 1 100 tons for small vessels and 1 220 tons for large vessels, or 13 200 000 CFAF and 14 640 000 CFAF respectively. Other supplies, such as netting material and the like are evaluated at one million CFAF/month for both vessels.

(iv) Unloading costs

Unloading costs are 200 000 CFAF/month/vessel.

Fixed costs:

(i) Insurance

Insurance costs are 3.5 percent of the replacement values. It should be noted that some vessels appeared to be under-insured. Annual insurance costs are 6 300 000 CFAF for small vessels and 8 400 000 CFAF for large vessels.

(ii) Depreciation

It is assumed that the life of the vessels is 15 years and that at the end of that period, the salvage value is 30 percent of the current cost. Depreciation is 8 400 000 CFAF and 11 200 000 CFAF respectively.

(iii) Interest payments

No information on actual interest payments is available. The interest rate paid to commercial banks for loans on fishing vessels is 18 percent. Interest payments are estimated to be 6 400 000 CFAF and 12 060 000 CFAF annually for small and large vessels respectively.

(iv) Port taxes

Port taxes are 7 000 CFAF/month per meter of vessel length. On annual basis this is 1 680 000 CFAF and 2 184 000 CFAF for small and large vessels respectively.

(v) Overheads

Overheads are estimated at 2 million CFAF per vessel for both sizes annually.

(vi) Opportunity costs of management

In line with other studies (Griffen et al., 1974) this is estimated to be five percent of the gross revenues, or CFAF 8 052 750 for the small vessels and CFAF 9 788 900 for the large vessels.

3.3.3 Results

Table 3.5 summarizes the costs and earnings of the fishery in 1983. Overall, the fleet made a profit of 403 million CFAF on sales of 2 589 million CFAF. The average small vessel has a profit of 30 400 000 CFAF on sales of 161 million CFAF, and the average large vessel a profit of 19.9 million CFAF on sales of 195 800 000 CFAF.

Small vessels average 1 425 tons in landings against 1 723 tons for large vessels, a difference of 21 percent. While the difference in revenue is 18 percent, the difference in total costs between the two vessel types is 35 percent resulting in a profit which is 35 percent lower for the larger vessels.

This difference is attributable both to variable costs (33 percent) and to fixed costs (41 percent). Within the variable costs, fuel and lubrication (63 percent), repairs and maintenance (33 percent) and salaries (25 percent) are higher for the large vessels. For fixed costs the important items are interest (88 percent higher) and depreciation (33 percent).

As in many other fisheries, variable costs are about three quarters of total costs (Table 3.6). The largest single cost items are fuel and lubrication, accounting for 24 percent and 29 percent for small and large vessels respectively. No large differences in the cost structure are observed between small and large vessels, with the exception of fuel and lubrication, and interest. Large vessels spend relatively much more money on fuel and lubrication. Because of the higher investment costs, interest payments are substantially higher. Average historical costs of large vessels (67 million CFAF) are nearly twice as much as for small vessels (35 500 000 CFAF). Reasons for this are :

(a) small vessels are on average older than the larger ones;
(b) one large vessel has been bought recently at a high cost.

Some selected results are presented in Table 3.7. Both the production per fisherman and the revenues per fisherman are 10 percent lower for the large vessels than for the small ones, indicating the familiar decline in productivity with the increase in engine power. Despite this, the value added per vessel is higher for large vessels. This is mainly attributed to the higher interest charges. The value added per fisherman again is lower for large vessels than for small ones.

The return on investment is an acceptable 16 percent for small vessels, higher than the return on a bank deposit. This is also true for the return on large vessels, though 7.4 percent is too low with respect to the risks involved. The fishery as a whole has a reasonable return on investment, considering 1983 is a below average year.

4. SENEGAL

4.1 Introduction

Over the last decade, the fishery sector of Senegal has grown fast and the country now has one of the most important fisheries in West Africa. Estimated total landings in 1983 were 190 000 tons, of which 90 000 tons were small pelagics. Total estimated value of the landings in 1983 was US $ 92 million (Everett, 1984). Of these totals, 60 percent by weight and 35 percent by value were landed by the canoe fishery. The industrial purse seine fishery for small pelagics is only a small part of the total industrial activity, with seven percent of the number of vessels in the fleet and 19 percent of the landings by weight. Recent developments are presented in Table 4.1.

In 1962, a small purse seiner from Côte d'Ivoire started fishing for Sardinella spp. in Senegalese waters. During the first six years the fleet was small but catches were increasing quickly, with the catch per unit of effort rising from seven tons per trip to 31 tons per trip. After a small decline in catch rates and a levelling off of the number of vessels to four or five during the early seventies, the fleet started to expand rapidly to attain a maximum of 19 vessels in 1982. Catch rates however kept declining steadily and dropped to an absolute low in 1982/1983, making the fishery economically unattractive. Many vessels stopped fishing in early 1984.

Of the catches by the purse seine fleet, around 70 percent is bought by the domestic fish traders, while 30 percent goes to the factories for freezing and export (mainly to Côte d'Ivoire). This means that the fishery under study here competes directly with the important canoe fishery for the same species. As the vessels are small and old (with frequent breakdowns), they do not go beyond the fishing grounds exploited by the canoe fishery. Thus, they cannot exploit larger sardinella species further offshore.

4.2 Description of the fishery

4.2.1 The fleet

The purse seine fleet of Dakar consists of many different types and sizes of vessels. Sizes range from 27 GRT to 256 GRT and engines from 110 hp to 600 hp (Table 4.2). Some vessels are old wooden ones, others are relatively new and constructed from fibre-glass. There is one converted trawler with a refrigerated seawater system. All other vessels use ice for preservation of the catch. Powerblocks are installed on all vessels.

While the fleet size increased gradually to five in 1972, there was a big increase in 1973-74 to 16 vessels, and the number of vessels has been fluctuating around that level since (Table 4.3). Effort, however, has been gradually increasing since 1973 in response to the decline in the catch per trip, which went from 21 tons in 1972 down to six tons in 1983.

The development of the fleet has been very unbalanced and, as a result very uneconomical. Each year has seen vessels leaving and entering the fishery while other vessels have only been partly used due to poor maintenance or financial problems. The result is that more than 50 percent of the landings were made only by five vessels between 1975 and 1983 (Table 4.4). The same applies to effort although with the increase in the number of vessels, effort has become somewhat more evenly spread. In 1983, 43 percent of the total effort is attributable to five vessels. This percentage is high and means that the fishery as a whole is unheathly.

Differences between vessels were also evident in 1983. Only eight vessels were active during all months of the year. The average number of trips per active month ranged from 9.7 to 21.9, the catch per trip from 1.1 to 14.1 tons (Table 4.2).

4.2.2 Landings and seasonality

Landings by the purse seine fleet reached a maximum of around 33 000 tons in 1974 and fluctuated greatly after that. The increase in effort in recent years however has only partially compensated for the decrease in catch per trip. Landings reached an absolute low of 18 000 tons in 1983 (Table 4.3).

The seasonal variation in catches is pronounced, with 59 percent of the catches occurring in the period from March to July (Table 4.5). The catch per unit of effort is above average (index 100) in May to July and in November. The seasonal pattern of catches per trip in 1983 is similar to the average pattern between 1969 and 1983 (last column of Table 4.5).

Information on the development of ex-vessel prices in the course of the year is not available. The average ex-vessel price over the whole year has been estimated on the basis of recorded FOB prices.

4.3 Costs and earnings

4.3.1 Method

The vessels of the Dakar purse seine fleet show wide differences in characteristics and performance, making it difficult to select either a "typical" or an "average" vessel. While some vessel owners manage to keep their vessel(s) in operation most of the year, others were only operating part of the year and the vessels were idle the rest of the time. Some ran their business while trying to aim for a "going concern" with proper maintenance standards, others operated at the margin. Part of the fleet was very old and not kept in proper working order.

For the purpose of this study, the vessels have been grouped into four classes. The characteristics and performance of each of the classes is a mixture of the observed averages for 1983 and what seems to be typical for that class. Thus, obvious exceptional cases like a vessel only operating for three months or vessels with extremely low catch rates have been excluded from the averages (Table 4.6).

As many operators work at the margin, without proper standards and bookkeeping systems, it is very difficult to obtain information through interviews. Others were not willing to give information. Most of the information presented here came from secondary sources or are estimates. The quality of the information therefore might not be as good as in other cases, but it is believed that it is sufficient for purposes of comparison and for certain conclusions on the profitability of the fishery. Because of the wide differences in performance between vessels, it is not possible to extend the results to the whole fleet.

4.3.2 Description of costs and earnings items

Revenues

An average price of 54 CFAF/kg is used together with the basic information from Table 4.6.

Variable costs

(i) Fuel and lubrication

The price of marine diesel for fishing vessels in 1983 was 81 CFAF/l. The average length of a trip was ten hours. Because the trips were relatively short, the assumed horse power utilization is 100 percent, while fuelconsumption is 0.2 l/hp/h. Lubrication was 10 percent of the fuel costs.

Table I : Fuel and oil consumption by vessel type

Vessel classes	C1	C2	C3	C4
Litre/trip.....	220	480	600	1 200
Litre/year.....	30 800	119 520	114 000	240 000
CFAF/year.....	2 494 800	9 681 120	9 234 000	19 440 000
Inc. 10 % lub..	2 744 280	10 157 400	10 157 400	21 384 000

(ii) Salaries

Salary rates and premiums are fixed by convention between vessel owners and unions. Some of the premiums depend on the owners. Estimated monthly costs, including premiums, in 1983 are given in the table below.

Table II : Monthly salary costs by vessel type (in CFAF)

Vessel classes	C1	C2	C3	C4
Matelot.....	6 x 40 000	12 x 40 000	16 x 50 000	20 x 50 000
Bosco.....	1 x 50 000	1 x 50 000	1 x 60 000	1 x 60 000
Graisseur.....	1 x 50 000	1 x 50 000	1 x 60 000	1 x 60 000
Mécanicien.....	1 x 90 000	1 x 90 000	1 x110 000	1 x110 000
Patron.....	1 x 110 000	1 x110 000	1 x140 000	1 x140 000
	360 000	780 000	1 170 000	1 370 000

Social security costs are 17 percent of this.

(iii) Repairs and maintenance

Detailed figures are not available. The fleet is much less well maintained than the Abidjan fleet, so a figure of 7.5 percent of the replacement value is used instead of 10 percent.

(iv) Ice

The price of ice was 12 000 CFAF/tons. The ice/fish ratio generally was 1.2. The annual amounts of ice used were 191 tons, 685 tons, 580 tons, and 1 100 tons respectively for the four vessel classes.

(v) Supplies

Food is included in the salary. Water was 10 CFAF/person/trip. Other supplies, like netting material and small tools are evaluated at 1 000 000 CFAF, 2 500 000 CFAF, 3 000 000 CFAF and 5 000 000 CFAF/year respectively.

(vi) Unloading costs

The unloading costs were 1 000 CFAF/ton.

(vii) Taxes

Taxes for loading and unloading were 1 832 CFAF/ton.

Fixed costs:

(i) Insurance

Insurance premiums were 4.5 percent of the insured value, which is estimated at 50 percent of the replacement costs. This is based on a similar study of the Dakar shrimp fleet (Chhun, 1984; personal communication).

(ii) Interest

In line with Chhun (1984), this is assumed to be five percent for the first year over the new value of the vessel, with 80 percent debt financing.

(iii) Depreciation

A straight line depreciation is assumed over 15 years, with a salvage value of zero.

(iv) Overheads

Overheads are estimated at three percent of the gross revenues.

(v) Licence fees

The licence fees were 5 000 CFAF/GRT.

4.3.3 Results

Table 4.7 summarizes the costs and earnings in 1983 for the four vessel types. Only C2 vessels operated profitably in 1983; the others recorded losses — which were substantial in the case of C3 vessels. The main reason for the profitability of C2 vessels, in relation to the other vessel types, seems to be the higher number of trips attained, thus ensuring reasonably high revenues. The C4 vessels recorded losses despite their high catches. The main reason for this seems to be high depreciation charges. Whether this is realistic is not clear as the vessels are very old and might be regarded as written off. Furthermore, at present catch rates, owners will not have the intention of replacing the vessels. Vessels C3 are very uneconomical to run ; they have slightly higher catch rates than the others while they only operate 190 days per year.

The structure of the costs (Table 4.8) is slightly different from that of other fisheries. The total variable cost as percentage of total costs is lower than is usually the case (around 75 percent). The main reason for this is the fact that effort is unusually low. Vessels should operate 250 to 280 days per year. Also, because of the short trips, the fuel costs as percentage of total costs range from 11 to 18 percent instead of 25-30 percent. Salaries were relatively high. This was a result of the fact that part of the salaries was fixed (the base). Selected results are presented in Table 4.9.

It can be concluded that the fishery under study was making big losses in 1983, although revenues are still high enough to cover operating expenses. The exceptions were the three fiberglass vessels and the wooden one, with 240 hp engines (class C2). The other wooden vessels were old and not well maintained and were making big losses. However, should circumstances change and catch rates of pre-1980 return, then the fishery can be a profitable venture.

5. COMPARISON OF THE THREE FISHERIES

5.1 Introduction

In sections 2, 3 and 4, data concerning three similar purse seine fisheries in three different countries are presented. The development of the fisheries, and their current performance, shows differences between the countries concerned, depending on general economic circumstances, resource availability as specific factors such as availability of spare parts, and the market situation.

In Côte d'Ivoire, the available resources have been relatively small after the collapse of the fishery in 1972. This is also true in Ghana. The fleets are generally restricted to operate in their own EEZs. Senegal, on the other hand, has much larger resources of small pelagics, although of course it also suffers from the unstable nature of the resource. Côte d'Ivoire and Ghana are relatively densely populated countries with a high demand for fish which cannot be met by national production alone. Senegal is a large exporter of fish as it is relatively sparsely populated. This results in ex-vessel prices which are respectively 128 percent and 107 percent higher in Ghana and Côte d'Ivoire.

5.2 Exchange rate considerations

In order to make the three fisheries comparable with each other and with other fisheries in the region, values have to be converted to a common denominator. The currency most commonly used for international trade, and an accepted standard for comparing international values is the US dollar ($US) The disavantage of using the dollar is that its value in terms of other currencies has fluctuated considerably during the last few years.

For this study, which makes a comparison on the basis of the average for 1983, the changes in the dollar value are thought to be of no major drawback. It must be emphasized, however, that the results are only valid for 1983 and not for any other year, due to differences in inflation and changes in the dollar value of the currencies.

Both Côte d'Ivoire and Senegal are in the CFA zone (member countries are: Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Gabon, Mali, Niger, Senegal and Togo), which means that the currency (CFA franc) is guaranteed by the Central Bank of France. There is a fixed exchange rate of 50 CFAF to 1 FF. For the conversion of CFAF to the dollar, the average interbank rate of 381.07 CFAF to the dollar has been used (IMF 1983).

The situation for Ghana is more complicated. Due to difficult economic and political circumstances, the Cedi has lost much of its value over the years. A continuous shortage of foreign exchange and the existence of a parallel market for the dollar have forced the Government to devalue the Cedi several times over the last years. In 1975, the exchange rate of the Cedi is 1.16 to the dollar; in February 1985 this is 50 ¢/$ while it is reported that the parallel market rate is in the order of 120 to 150 ¢/$.

From January to September 1983 the official rate was 2.75 ¢/$; in October 1983 it devalued by 91 percent to 30 ¢/$. Thus the average exchange rate in 1983 was 3.45 ¢/$ (IMF 1983). It is thought to be realistic to use this average for 1983. The currency was enormously overvalued. Because further data on the parallel market in 1983 is lacking, the value of 30 ¢/$ is used as a conservative estimate of its market value.

Costs and earnings information expressed in dollars is presented in Table 5.1.

5.3 Selected indicators

The performance of the different fisheries can be best compared using specific indicators (table 5.2). Catches per trip, expressed in kilogramme, are by far the highest in Côte d'Ivoire and the lowest in Ghana. Catches per crew member (in kg) are also very low in Ghana. In Senegal there are large differences between the different vessel classes but, contrary to Ghana, the largest vessels have the highest catches per crew member. The ex-vessel price of fish, expressed in dollars, is highest in Ghana but close to the Abidjan price. The low price in Senegal is an

expression of the direct competition with the important canoe fishery for the same species. Gross earnings per trip and per crew member are highest in Côte d'Ivoire, as are operating costs. However, the value of the catch as ratio of operating costs is similar in the three countries, with the obvious exception of the C4 class vessels in Senegal. This ratio is the inverse of operating costs as percentage of total costs.

Investment performance shows big variations. The net return on investment varies from negative in Senegal to 15.8 percent in Côte d'Ivoire. The Ghana fishery is the most labour intensive while Côte d'Ivoire and Senegal are about equally capital intensive. Gross earnings per unit of investment are lowest in Senegal.

The contributions of the fisheries to these countries economies, as measured by Gross Value Added, also show large variations. C1 and C3 vessels in Senegal hardly made any contribution; in Côte d'Ivoire the GVA was high. The GVA as ratio of gross earnings and as ratio of total investment seems to be at acceptable levels in Côte d'IVoire and Ghana and only for C2 vessels in Senegal.

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Table 2.1 : FLEET COMPOSITION OF GHANA, 1970 - 1983

Year	INSHORE VESSELS			Distant water vessels above 30.5m	Tuna vessels	Total number of vessels operating	Vessels operating as % of number of vessels registered	Number of canoes
	0-9.9 m	10.0-18.3 m	18.4-30.5 m					
1970	210	131	25	32	-	389	82.4	8,728
1971	200	119	27	14	-	380	84.1	8,727
1972	168	95	21	27	-	311	61.8	8,238
1973	204	128	29	22	-	383	87.4	8,238
1974	144	100	35	35	-	314	72.3	8,238
1975	130	95	24	25	4	278	63.2	8,238
1976	107	100	26	28	4	265	61.1	8,238
1977	126	98	18	16	4	262	60.4	8,472
1978	109	94	17	12	6	238	53.8	8,472
1979	122	90	23	10	8	258	56.7	8,472
1980	115	85	33	10	12	255	58.6	8,472
1981	120	93	27	14	22	276	63.2	6,938
1982	123	90	30	12	31	286	64.8	6,938
1983	126	94	25	12	33	290	64.3	6,938

Source : Ministry of Agriculture, Fisheries Department, Accra.

Table 2.2 : ANNUAL TOTAL DOMESTIC CATCHES IN GHANA

(quantities in mt)

Year	CANOE FLEET		INSHORE VESSELS		DISTANT WATER AND TUNA VESSELS		Total domestic catch
	Catch	% total catch	Catch	% total catch	Catch	% total catch	
1972	153,691	61.7	30,082	12.1	65,255	26.2	249,028
1973	73,007	47.0	16,648	10.7	65,660	42.3	155,315
1974	108,883	60.1	15,800	8.7	57,398	31.2	182,081
1975	134,395	63.2	17,226	8.1	61,057	28.7	212,678
1976	118,455	60.5	17,026	8.7	60,269	30.8	195,750
1977	151,391	66.9	20,069	8.9	54,752	24.2	226,212
1978	176,010	79.3	18,925	8.5	27,154	12.2	222,089
1979	139,960	74.5	21,577	11.5	26,422	14.0	187,959
1980	141,822	77.0	15,603	8.5	26,696	14.5	184,121
1981	149,823	74.8	16,857	8.4	33,745	16.8	200,425
1982	140,890	70.8	16,357	8.2	41,872	21.0	199,119
1983							

Source : Ministry of Agriculture, Fisheries Department, Accra.

Table 2.3 : ANNUAL LANDINGS OF SARDINELLA spp IN GHANA

(quantities in mt)

Year	CANOE		% of total	INSHORE VESSELS		% of total
	Total canoe catch	Sardinella catch		Total inshore catch	Sardinella catch	
1972	153,691	76,926	50.1	30,082	15,403	51.2
1973	73,307	15,606	21.4	16,648	1,443	8.7
1974	108,883	17,523	16.1	15,800	1,299	8.2
1975	134,395	19,728	14.7	17,022	1,049	6.1
1976	118,455	29,481	24.9	17,026	3,033	17.8
1977	151,391	24,278	16.0	20,069	4,048	20.2
1978	176,010	51,327	29.2	18,925	7,497	39.6
1979	139,960	23,545	16.8	21,577	5,199	24.1
1980	141,822	30,436	21.5	15,603	3,362	21.5
1981	149,823	22,512	15.0	16,857	5,594	33.2
1982	140,890	26,966	19.1	16,357	6,557	40.1
1983		43,967			4,392	

Source : Ministry of Agriculture, Fishery Research Unit, Tema

Table 2.4 : ANNUAL LANDINGS OF SARDINELLA spp OF THE CANOE FISHERY IN GHANA

Year	Poli	% of total	Beach seine	% of total	Set net	Set net	TOTAL
1972	74,269	96.5	2,129	2.8	528	0.7	76,926
1973	10,612	68.0	3,458	22.2	1,536	9.8	15,606
1974	6,732	38.4	9,844	56.2	944	5.4	17,520
1975	14,217	72.1	5,511	27.9	0*	0	19,728
1976	21,552	73.1	7,322	24.8	607	2.1	29,481
1977	11,979	49.3	10,990	45.3	1,309	5.4	24,278
1978	44,507	86.7	6,300	12.3	520	1.0	51,327
1979	17,678	75.1	2,000	8.5	3,867	16.4	23,545
1980	27,021	91.7	1,393	4.6	1,122	3.7	30,436
1981	19,748	87.7	1,195	5.3	1,569	7.0	22,512

* Less than 1 metric ton.

Source : Ministry of Agriculture, Fishery Research Unit, Tema

Table 2.5 : AVERAGE CATCH PER MONTH BETWEEN 1973 AND 1982 OF SARDINELLA spp IN GHANA

Month	CANOE		INSHORE VESSELS	
	Catch (mt)	% of total	Catch (mt)	% of total
January	557	4.3	50	2.5
February	423	3.2	43	2.1
March	336	2.6	19	1.0
April	652	5.0	9	0.5
May	540	4.1	17	0.8
June	542	4.1	34	1.7
July	2,588	19.8	652	32.5
August	2,800	21.4	710	35.3
September	1,945	14.9	344	17.1
October	944	7.2	80	4.0
November	630	4.8	12	0.6
December	1,121	8.6	39	1.9
TOTAL	13,078	100	2,009	100

Source : Ministry of Agriculture, Fishery Research Unit, Tema

Table 2.6 : SUMMARY OF ANNUAL COST AND EARNINGS IN GHANA, 1983

Amounts in Cedi	Small vessels	Medium vessels	Large vessels
Gross revenues	1,691,000	1,976,000	2,242,000
Fuel and lubrication	441,750	506,000	695,751
Ice	172,500	207,000	276,000
Crew share	233,864	267,474	351,818
Payroll tax	17,465	20,061	19,961
Repairs	161,000	184,000	207,000
Supplies	69,000	92,000	115,000
Variables costs	1,095,579	1,276,535	1,565,529
Depreciation	139,592	166,368	186,079
Insurance	94,300	117,450	131,350
Interest	99,510	123,939	138,607
Overheads	49,755	52,800	55,760
Fixed costs	377,157	460,577	511,796
Total costs	1,472,736	1,737,112	2,077,325
Gross returns	218,264	238,888	164,675
Opportunity cost of management	84,550	98,800	112,100
Return to investment	133,714	140,088	52,575
Invested value	2,357,500	2,936,250	3,283,750
Rate of return to investment	5.67 %	4.77 %	1.6 %

Table 2.7 : COST STRUCTURE OF THE FISHERY IN GHANA

	SMALL VESSELS		MEDIUM VESSELS		LARGE VESSELS	
	% in group	% of total	% in group	% of total	% in group	% of total
Total costs		100		100		100
Variable costs.....	100	74.4	100	73.5	100	75.4
Fuel and lubrication..	40.4	30.1	39.6	29.1	44.4	33.5
Ice.....	15.8	11.7	16.2	11.9	17.6	13.3
Crew share.....	21.2	15.8	21.0	15.4	16.2	12.2
Payroll tax.....	1.6	1.2	1.6	1.2	1.2	0.9
Repairs.....	14.7	10.9	14.4	10.6	13.2	10.0
Supplies.....	6.3	4.7	7.2	5.3	7.4	5.5
Fixed costs.....	100	25.6	100	26.5	100	24.6
Depreciation.....	35.4	9.1	36.1	9.6	36.3	9.0
Insurance.....	25.0	6.4	25.5	6.8	25.7	6.3
Interest.....	26.4	6.7	26.9	7.1	27.1	6.6
Overheads.....	13.2	3.4	11.5	3.0	10.9	2.7

Table 2.8 : SELECTED RESULTS : GHANA

(all values in Cedi)

	Small	Medium	Large	Total/average
Number of vessels.....	126	94	25	245
Catch per vessel (mt	178	208	236	195
Total number of trips.....	12,222	10,810	3,275	26,307
Total output (mt	22,428	19,552	5,910	47,881
Number of fishermen.....	1,260	1,504	500	3,264
Output per fisherman (mt.....	17.8	13.0	11.8	14.7
Revenue per fisherman.....	169,100	123,500	112,100	139,357
Total investment.....	297,045,000	276,007,500	82,093,750	655,146,250
Profit.....	16,847,064	13,168,272	1,314,375	31,330,611
Return on investment (%).....	5.7	4.8	1.6	4.8
Profit.....	16,847,964	13,168,272	1,314,375	31,330,611
= Salaries.....	29,340,864	25,142,556	6,320,450	60,803,870
Taxes.....	2,20[illegible]590	1,885,734	474,025	4,560,349
Interest.....	12,538,260	11,650,266	3,465,175	27,653,701
Value Added.....	60,927,678	51,846,828	11,574,025	125,348,531
Value Added per vessel.....	483,553	551,562	462,961	511,626

Table 3.1 : TRENDS IN THE SARDINELLA FISHERY IN COTE D'IVOIRE

Year	Number of vessels	Total catch (mt)	Number of trips	Average ex-vessel price (CFA/Kg)	Catch per vessel (mt)	Catch per trip (mt)	Value of catch per trip (thousand CFA)
1975	21	28,786	...	49	1,371	...	...
1976	20	35,592	...	45	1,780	...	...
1977	20	31,283	1,560	63	1,564	20.1	1,266
1978	21	24,642	1,102	95	1,173	22.4	2,128
1979	19	19,152	994	100	1,008	19.3	1,930
1980	18	16,392	1,035	115	911	15.8	1,817
1981	17	22,345	1,324	116	1,314	16.9	1,960
1982	16	20,963	1,795	124	1,310	11.7	1,450
1983	16	23,392	1,819	115	1,462	12.9	1,483

Table 3.2 : VESSEL CHARACTERISTICS OF ABIDJAN PURSE SEINE FLEET

Vessel name	Year built	Length (meters)	Gross tonnage	Horse power
SMALL				
Tabou	1969	18.40	57	200
Jackville	1967	18.95	56	240
Assinie	1969	19.00	57	240
Cocody	1969	19.40	59	240
Hypocamp	1965	19.68	54	240
Lahou	1966	22.00	76	240
Cassandra	1969	22.00	57	240
Azuretti	1966	22.10	67	240
Fraternité	1969	22.10	67	240
Cressus	1979	22.50	61	286
LARGE				
San Pedro	1970	23.20	80	450
Man	1970	23.20	128	530
Port Bouet	1970	26.50	104	430
Quezzin	1973	28.80	130	440
Cap Palmas	1972	28.80	114	430
Balmer	?	?	?	?

Table 3.3 : VESSEL PERFORMANCE IN 1983 IN ABIDJAN

Name	Number of trips	Catch (mt)	Value (million CFA)	Average price (CFA/Kg)	Average catch/trip (mt)	Average earnings/trip (thousand CFA)
Tabou	104	1,398	129	93	13.4	1,240
Jackville	140	1,774	185	105	12.7	1,321
Assinie	126	1,517	168	111	12.0	1,333
Cocody	100	1,215	174	144	12.2	1,740
Hypocamp	82	872	106	123	10.6	1,500
Labou	120	1,434	154	108	12.0	1,283
Sassandra	123	1,706	178	105	13.9	1,447
Azuretti	100	1,529	172	113	15.3	1,720
Fraternité	85	1,102	138	126	13.0	1,624
Cressus	120	1,710	200	117	14.3	1,667
San Pedro	126	1,547	181	117	12.3	1,437
Man	120	1,379	147	107	12.3	1,437
Port Bouet	117	2,150	245	114	18.4	2,094
Quezzin	122	1,710	195	115	14.0	1,598
Cap Palmas	123	1,831	208	114	14.9	1,691
Balmer	113	520	73	142	4.6	646
TOTAL	1,821	23,392	2,687			
AVERAGE				115	12.9	1,457

Table 3.4 : MONTHLY DISTRIBUTION OF CATCHES OF PURSE SEINE FLEET, 1983, IN ABIDJAN

Month	Total catch (mt)	%	Values of catch (million CFA)	%	Number of trips	%	Catch/trip (mt)	Value of catch/trip (million CFA)
January	1,799	7.7	221	8.2	106	5.8	17.0	2.1
February	1,666	7.1	247	9.2	128	7.0	13.0	1.9
March	1,688	7.2	244	9.1	153	8.4	11.0	1.6
April	1,547	6.6	236	8.8	144	7.9	10.7	1.6
May	529	2.3	105	3.9	211	11.6	2.5	0.5
June	56	0.2	11	0.4	17	0.9	3.3	0.6
July	2,676	11.4	240	8.9	249	13.7	10.7	1.0
August	2,496	10.7	225	8.4	216	11.9	11.5	1.0
September	3.315	14.2	282	10.5	180	9.9	18.4	1.6
October	2,949	12.6	226	8.4	155	8.5	19.0	1.5
November	2,871	12.3	344	12.8	143	7.9	20.0	2.4
December	1,800	7.7	305	11.4	117	6.4	15.4	2.6
TOTAL	23,392	100	2,686	100	1,819	100		

Table 3.5 : SUMMARY OF COSTS AND EARNINGS IN ABIDJAN

(Amounts in CFA)

	Small Vessel	Large Vessel	Whole fleet(*)
Gross revenues.....	161,055,000	195,778,000	2,589,440,000
Variable costs			
Fuel and lubrication.....	30,246,427	49,314,355	549,036,045
Salaries.....	24,000,000	30,000,000	390,000,000
Repairs, maintenance.....	18,000,000	24,000,000	300,000,000
Ice.....	13,200,000	14,640,000	205,200,000
Other supplies.....	12,000,000	12,000,000	180,000,000
Unloading costs.....	2,400,000	2,400,000	36,000,000
	99,846,427	132,354,355	1,660,236,000
Fixed costs			
Insurance.....	6,300,000	8,400,000	105,000,000
Interest.....	6,400,000	12,060,000	124,300,000
Depreciation.....	8,400,000	11,200,000	140,000,000
Port taxes.....	1,680,000	2,184,000	27,720,000
Overheads.....	2,000,000	2,000,000	30,000,000
	24,780,000	35,844,000	427,020,000
Total costs.....	124,626,427	168,198,355	2,087,256,045
Gross return.....	36,428,573	27,579,645	502,193,955
Opportunity costs of management...	8,052,750	9,788,900	129,472,000
Return to investment.....	28,375,823	17,790,745	372,711,955
Invested value	180,000,000	240,000,000	3,000,000,000
Rate of return to investment (%)..	15.8	7.4	12.4

(*) Note : Excluding 1 vessel, of which no details are known

Table 3.6 : COST STRUCTURE OF THE FISHERY IN COTE D'IVOIRE

	SMALL VESSEL		LARGE VESSEL		WHOLE FLEET	
	% in group	% of total	% in group	% of total	% in group	% of total
Total costs.....		100		100		100
Variable costs.....	100	80.1	100	78.7	100	79.5
Fuel and lubrication..	30.3	24.3	37.3	29.3	33.1	26.3
Salaries.....	24.0	19.3	22.7	17.8	23.5	18.7
Repairs.....	18.0	14.4	18.1	14.3	18.1	14.4
Ice.....	13.2	10.6	11.1	8.7	12.4	9.9
Supplies.....	12.0	9.6	9.1	7.1	10.9	8.6
Unloading.....	2.4	1.9	1.8	1.4	2.2	1.7
Fixed costs.....	100	19.9	100	21.3	100	20.5
Insurance.....	25.4	5.1	23.4	5.0	24.6	5.0
Interest.....	25.8	5.1	33.6	7.2	29.1	6.0
Depreciation.....	33.9	6.7	31.3	6.7	32.8	6.7
Port taxes.....	6.9	1.4	6.1	1.3	6.5	1.3
Overheads.....	8.1	1.6	5.6	1.2	7.0	1.4

Table 3.7 : SELECTED RESULTS OF THE ABIDJAN FLEET

	Small vessel	Large vessel	Total/average
Number of vessels	10	5	15
Catch per vessel (mt)	1,425	1,823	1,524
Number of trips	1,100	610	1,710
Number of fishermen	180	120	300
Total output (mt)	14,250	8,615	22,865
output per fisherman (mt)	79	72	76
Revenu/fisherman (CFA)	8,947,500	8,157,417	8,631,467
Total investment	1,800,000,000	1,200,000,000	3,000,000,000
Profit	283,758,230	88,953,725	372,711,955
Return on investment (%)	15.8	7.4	12.4
Profit	283,758,230	88,953,725	372,711,955
Salaries	240,000,000	150,000,000	390,000,000
Port taxes	16,800,000	10,920,000	27,720,000
Interest	64,000,000	60,300,000	124,300,000
Value added	604,558,230	310,173,725	914,731,955
Value added per vessel	60,455,823	62,034,745	60,982,130
Value added per fisherman	3,358,657	2,584,781	3,049,187

Table 4.1 : TRENDS IN SENEGALESE FISHERIES

Year	Number of vessels			TOTAL	Landings in mt			TOTAL
	Sardine seiners	Trawlers	Tuna boats		Sardine seiners	Trawlers	Tuna boats	
1975	11	90	42	143	31,054	15,601	12,656	59,401
1976	13	80	42	135	31,786	19,100	10,986	61,872
1977	12	168	32	212	27,477	77,483	11,902	116,862
1978	10	183	34	227	22,016	66,392	15,032	103,440
1979	15	184	32	231	26,357	74,700	9,115	110,172
1980	18	192	55	265	28,416	121,766	24,407	174,589
1981	15	175	67	257	31,853	42,895	19,469	94,217
1982	19	186	46	251	25,581	52,965	26,158	104,704
1983	17	187*	45*	249*	17,984	55,000*	20,000*	92,984

* Estimated

Source : CRODT, DOPM

Table 4.2 : DAKAR PURSE SEINE FISHERY, 1983

Name	Construction material	Year built	GRT	HP.	Catch 1983 (mt)	Number of trips	Catch per trip	Number of months active in 1983	Average of trips per months
THIAROYE	Fiber	1979	22.3	110	439	147	2.99	10	10.7
NGAZOBIL	Fiber	1979	22.3	110	362	124	2.92	8	15.5
BIGNONA	Fiber	1979	22.3	110	389	149	2.61	11	13.6
FUNELA	Fiber	1979	22.3	110	95	29	3.28	3	9.7
VENUS	Wood	1958	113.1	150	1,407	196	7.18	11	17.8
AMADY DIOUM	Fiber	1977	41.1	240	1,130	238	4.75	12	19.8
IBRAHIMA BA	Fiber	1977	41.1	240	1,036	247	4.19	12	20.6
BABACAR DIOP	Fiber	1978	41.1	240	1,710	263	6.50	12	21.9
FILS DE LA VIERGE	Wood	1957	95.9	240	1,672	253	6.61	12	21.1
BOUGHADARY	Wood	1965	56.2	270	795	142	5.60	7	20.3
AITA RAMUNTCH	Wood	1963	97.6	300	1,156	245	4.72	12	20.4
BOUSSOYE FOUTA	Wood	1957	108.4	360	1,077	229	4.76	12	19.1
FANAYE TORO	Wood	1958	123.1	400	1,151	144	7.99	7	20.6
NENE	Steel	1957	122.8	600	2,459	208	11.82	12	17.3
MAMAGUEDJ	Steel	1965	235.5	600	1,071	76	14.09	7	10.9
GUET NDAR	Wood	1956	256.3	600	2,024	255	7.94	12	21.3
SINE SALOUM	?	?	.....	...	12	11	1.09	1	11.0

Source : DOPM/CRODT

Table 4.3 : DEVELOPMENT OF THE PURSE SEINE FLEET IN DAKAR

Year	Number of vessels	Catch (mt)	Number of trips	Average ex-vessel price (CFA/Kg)	Revenue per vessel (million)	Catch per trip (mt)	Revenue per trip (thousand CFA)
1975	11	31,054	1,882	20	56.5	16.5	327.3
1976	13	31,786	1,961	22	53.8	16.2	356.7
1977	12	27,477	1,834	24	54.9	15.0	359.2
1978	10	22,016	1,530	27	59.4	14.4	388.2
1979	15	26,357	1,873	32	56.2	14.1	450.1
1980	18	28,416	2,283	34	53.7	12.4	423.4
1981	15	31,853	2,613	41	87.1	12.2	500.0
1982	19	25,581	3,054	47	63.3	8.4	393.8
1983	17	17,985	2,814	54	57.1	6.4	345.0

Source : CRODT/DOPM

Table 4.4 : EFFORT AND CATCH DISTRIBUTION OF PURSE SEINE FLEET IN DAKAR

Cumulative catches by the top 5 vessels, percentage of total catch

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Top 1	14	17	16	21	16	14	14	14	14
Top 2	28	28	31	36	30	27	28	25	25
Top 3	41	38	43	48	42	39	40	35	35
Top 4	52	48	54	60	52	51	51	44	44
Top 5	62	57	64	71	61	59	59	53	52

Cumulative number of trips by the top 5 vessels, percentage of total number of trips

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Top 1	14	14	13	15	12	11	11	10	9
Top 2	27	26	26	30	24	22	22	19	18
Top 3	39	37	38	44	36	32	32	28	27
Top 4	50	47	49	56	47	42	42	36	35
Top 5	61	56	59	68	58	51	51	43	43

Source : CRODT

Table 4.5 : SEASONAL DISTRIBUTION OF CATCHES IN SENEGAL, 1983

Month	Number of vessels	Catch (mt)	%	Number of trips	%	Catch per trip (mt)	Seasonal index catch per trip	Seasonal index average catch per trip(1969/83)
January	16	1,046	5.8	206	7.3	5.[illegible]	80	80
February	15	1,085	6.0	225	8.0	4.8	75	92
March	16	1,930	10.7	306	10.9	6.3	99	99
April	14	1,446	8.0	290	10.3	5.0	78	92
May	15	2,965	16.5	284	10.1	10.4	163	112
June	15	1,811	10.1	186	6.6	9.7	152	142
July	14	2,512	14.0	281	10.0	8.9	139	132
August	13	1,104	6.1	235	8.4	4.7	73	93
September	12	730	4.1	234	8.3	3.1	48	80
October	13	953	5.3	204	7.3	4.7	73	96
November	9	1,192	6.6	158	5.6	7.6	119	101
December	10	1,211	6.7	205	7.3	5.9	92	97

Note : The seasonal index is calculated by taking the average catch per trip as 100. The catch per trip on February for exemple, is 75 % of the average catch in 1983, in July this was 39 % above the average.

Table 4.6 : CLASSIFICATION OF DAKAR PURSE SEINE FLEET

Class	Construction material	Year built	GRT	HP.	Catch 1983 (mt)	Number of trips	Catch per trip (mt)	Number of crew	Historical cost x 10^6 CFA	Replacement cost x 10^6 CFA
C1	Fiber	1979	22	110	392	140	3	10	38	60
C2	Fiber	1977	31	240	1,370	249	5.5	16	83	110
C3	Wood	1960	100	300	1,159	190	6.1	20	15	200
C4	Wood/Steel	1960	200	600	2,200	200	11.0	24	18	240

Table 4.7 : SUMMARY OF COSTS AND EARNINGS OF DAKAR FLEET IN 1983

(Values in CFA)

Vessel type	C1	C2	C3	C4
Gross revenues	21, 168,000	73,980,000	62,586,000	118,800,000
Variable costs				
Fuel and lubrication	2,744,280	10,649,232	10,157,400	21,384,000
Salaries	5,054,400	10,951,200	16,426,800	19,234,800
Repairs and maintenance	4,500,000	8,250,000	15,000,000	18,000,000
Ice	2,292,000	8,220,000	6,960,000	13,200,000
Supplies	1,000,000	2,500,000	3,000,000	5,000,000
Unloading costs	392,000	1,370,000	1,159,000	2,200,000
Taxes	718,144	2,590,840	2,123,288	4,030,400
	16,700,824	44,450,272	54,826,488	83,049,200
Fixed costs				
Insurance	1,350,000	2,475,000	4,500,000	5,400,000
Interest	2,400,000	4,400,000	8,000,000	9,600,000
Depreciation	4,000,000	2,300,000	13,300,000	16,000,000
Port taxes	100,000	100,000	300,000	300,000
Licence fees	110,000	155,000	500,000	1,000,000
Overheads	635,340	2,219,400	1,877,580	3,564,000
	8,595,040	16,649,400	28,477,580	34,864,000
TOTAL COSTS	25,295,864	61,099,672	83,304,068	118,913,200
Returns	-4,127,864	12,880,328	-20,718,068	-113,200
Opportunity costs of management	1,058,400	3,699,000	3,129,300	5,940,000
Return to investment	-5,186,264	9,181,328	-23,847,368	-6,053,200
as %	n.a	8.4	n.a	n.a

Table 4.8 : COST STRUCTURE OF THE FISHERY IN SENEGAL

	C1		C2		C3		C4	
	% in group	% of total	% in group	% of total	% in group	% of total	% in group	% of total
TOTAL COSTS.....		100		100		100		100
Variable costs.....	100	66.0	100	72.8	100	65.8	100	69.8
Fuel and lubrication.....	16.4	10.8	24.0	17.4	18.5	12.2	25.8	18.0
Salaries.....	30.2	20.0	24.6	17.9	30.0	19.7	23.2	16.2
Repairs.....	26.9	17.8	18.6	13.5	27.4	18.0	21.7	15.1
Ice.....	13.7	9.1	18.5	13.5	12.7	8.4	15.9	11.1
Supplies.....	6.0	4.0	5.6	4.1	5.5	3.6	6.0	4.2
Unloading.....	2.4	1.6	3.1	2.2	2.1	1.4	2.6	1.9
Taxes.....	4.3	2.8	5.7	4.1	3.9	2.6	4.9	3.4
Fixed costs.....	100	34.0	100	27.2	100	34.2	100	30.2
Insurance.....	15.7	5.3	14.9	4.1	15.8	5.4	15.1	4.5
Interest.....	27.9	9.5	26.4	7.2	28.1	9.6	26.8	8.1
Depreciation.....	46.5	15.8	43.9	11.9	46.7	16.0	44.6	13.5
Port taxes.....	1.2	0.4	0.6	0.2	1.1	0.4	0.8	0.3
Licence fees.....	1.3	0.4	0.9	0.3	1.8	0.6	2.8	0.8
Overheads.....	7.4	2.5	13.3	3.6	6.6	2.3	9.9	3.0

Table 4.9 : SELECTED RESULTS : SENEGAL

(All values in CFA)

	C1	C2	C3	C4	Total/Average
Number of vessels.....	4	4	3	3	14
Catch per vessel (mt)....	392	1,370	1,159	2,200	1,223
Total number of trips....	560	996	570	600	2,726
Total output (mt).....	1,568	5,480	3,477	6,600	17,125
Number of fishermen.....	40	64	60	72	236
Output per fisherman (mt)	39.2	85.6	58.0	91.7	72.6
Revenue per fisherman....	2,116,800	4,623,750	3,129,300	4,950,000	3,918,432
Total investment.....	240,000,000	440,000,000	600,000,000	720,000,000	2,000,000,000
Profit/Loss.....	-20,745,056	35,725,312	-71,542,104	-18,159,600	-73,721,448
Return on investment (%).	-	8.4	-	-	-
Profit/Loss.....	-20,745,056	35,725,312	-71,542,104	-18,159,600	-73,721,448
Salaries.....	20,217,600	43,804,800	49,280,400	57,704,400	171,007,200
Taxes.....	3,272,576	10,763,360	7,269,864	12,991,200	23,533,640
Fees.....	440,000	620,000	1,500,000	3,000,000	5,560,000
Interest.....	9,600,000	17,600,000	24,000,000	28,800,000	80,000,000
Value added.....	12,600,000	109,513,472	10,508,160	84,336,000	217,142,752
Value added per vessel..	3,196,280	27,378,368	3,502,720	28,112,000	15,510,196

Table 5.1 : COSTS AND EARNINGS IN THREE SMALL PURSE SEINE FISHERIES IN 1983

(All amounts in U.S. dollars)

Vessel type(*)	COTE D'IVOIRE		SENEGAL				GHANA		
	Small	Large	C1	C2	C3	C4	Small	Medium	Large
GROSS REVENUES	422,639	513,759	55,549	194,138	164,327	311,754	56,285	65,791	74,647
Fuel and lubrication	79,372	129,410	7,202	27,945	26,655	56,116	14,741	16,847	23,165
Salaries	62,981	78,726	13,264	28,738	43,107	50,474	7,759	8,906	8,417
Repairs and maintenance	47,235	62,981	11,809	21,649	39,363	47,235	5,361	6,126	6,892
Ice	34,639	38,418	6,015	21,570	18,264	34,639	5,743	6,892	9,189
Supplies	31,490	31,490	2,624	6,560	7,873	13,121	2,297	3,063	3,829
Unloading	6,298	6,198	1,028	3,595	3,041	5,773	-	-	-
Taxes	-	-	1,884	6,799	5,572	10,576	581	668	631
VARIABLE COSTS	262,015	347,322	43,826	116,646	143,875	217,934	35,896	42,502	52,124
Insurance	16,552	22,043	3,543	6,405	11,809	14,170	3,140	3,910	4,373
Interest	16,795	31,648	6,298	11,546	20,993	25,192	3,313	4,126	4,615
Depreciation	22,043	29,391	10,497	19,156	34,922	41,987	4,448	5,540	6,195
Port taxes	4,409	5,731	262	262	787	787	-	-	-
Licence fees	-	-	289	407	1,312	2,624	-	-	-
Overheads	5,248	5,248	1,667	5,824	4,927	9,352	1,657	1,758	1,856
FIXED COSTS	65,027	94,061	22,556	43,690	74,730	94,112	12,557	15,336	17,040
TOTAL COSTS	327,042	441,383	66,382	160,336	218,605	312,046	48,453	57,838	69,164
GROSS RETURNS	95,597	72,376	-10,833	33,802	-54,368	-292	7,832	7,953	5,483
Opportunity costs management	21,132	25,688	2,776	9,707	8,212	15,588	2,815	3,289	3,732
RETURN TO INVESTMENT	74,465	46,688	-13,609	24,095	-62,580	-15,880	5,017	4,663	1,751
Invested capital	472,354	629,805	157,450	288,660	524,838	629,805	78,493	97,762	109,259
RETURN AS % OF INVESTMENT	15.8	7.4	-	8.4	-	-	5.7	4.8	1.6

(*) For vessel sizes, see respective chapters

Table 5.2 : SUMMARY OF THREE PURSE SEINE FITHERIES

Vessel type	COTE D'IVOIRE		SENEGAL				GHANA		
	Small	Large	C1	C2	C3	C4	Small	Medium	Large
1. Number of fishing units	10	5	4	4	3	3	126	94	25
2. Average number of crew per unit	20	24	10	16	20	24	10	16	20
3. Average number of trips per year	110	122	140	249	190	200	97	115	131
4. Catch per trip in kilograms	12,954	14,123	3,000	5,500	6,100	11,000	1,800	1,800	1,800
5. Catch per unit per annum (mt)	1,425	1,723	392	1,370	1,569	2,200	178	208	236
6. Catch per crewmember (mt)	71	72	39	86	58	92	18	13	12
7. Ex-vessel price of fish, $	0.29	0.29	0.14	0.14	0.14	0.14	0.32	0.32	0.32
8. Gross earnings per unit per annum, $	422,639	513,759	55,549	194,138	154,138	311,754	56,285	65,791	74,547
9. Gross earnings per trip, $	3,757	4,096	420	770	854	1,540	580	572	570
10. Gross earnings per crewmember, $	20,590	20,980	5,460	12,040	11,200	12,880	5,760	4,160	3,840
11. Operating costs per trip, $	2,382	2,847	313	468	757	1,090	370	396	398
12. Catch per $ operating costs in weight (Kg)	5.4	5.0	9.6	11.7	8.1	10.1	5.0	4.6	4.5
13. CAtch per $ operating costs in value ($)	1.6	1.5	1.3	1.6	1.1	1.4	1.6	1.5	1.4
14. Investment per fishing unit, $	472,354	629,805	157,450	288,660	524,838	629,805	78,493	97,762	109,259
15. Net return on investment, %	15.6	7.4	-	6.4	-	-	5.7	4.8	1.6
16. Invested capital per crew, $	23,618	26,242	15,745	18,041	26,242	26,242	7,849	6,110	5,463
17. Gross earnings per unit of investment, $	0.89	0.82	0.35	0.67	0.31	0.50	0.71	0.67	0.68
18. Gross value added per unit, $	158,650	162,973	8,099	71,440	7,879	70,362	16,664	18,363	15,414
19. Gross value added as ratio of gross earnings.	0.37	0.32	0.15	0.37	0.05	0.23	0.30	0.28	0.21
20. Gross value added as ratio of total investment.	0.33	0.26	0.05	0.25	0.01	0.11	0.21	0.19	0.14

Note : The exchange rate used for Ivory Coast and Senegal, is the average for 1983 (IMF Financial Statistical Yearbook) of 381.07 CFA to the Dollar. For Ghana, the end of 1983 exchange rate used (30 Cedi to the Dollar), because it is thought to reflect the situation better than the average for that year (3.45 Cedi to the Dollar).

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