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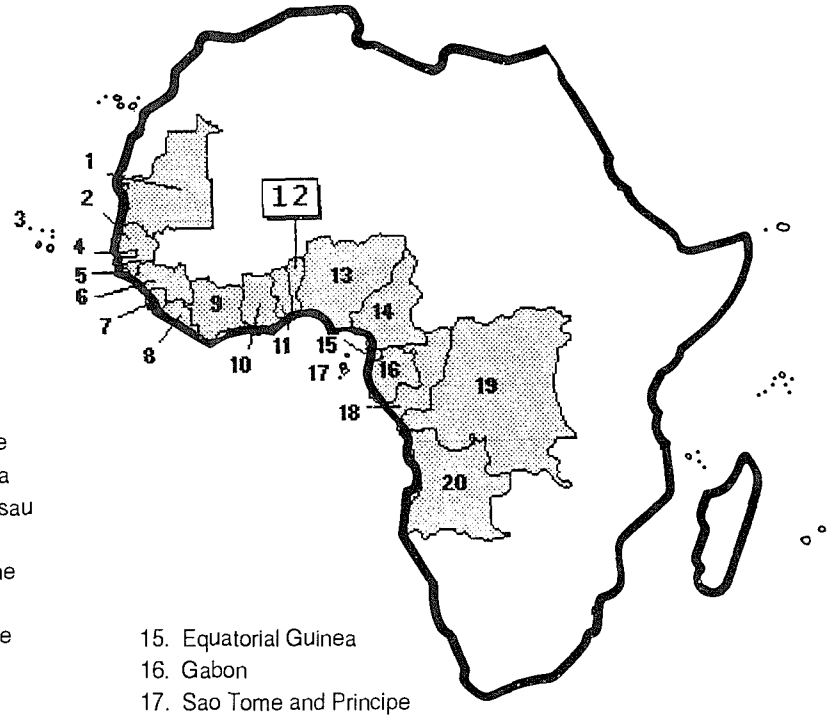
Technical Report N° 67 April 1995

A Cost and Earnings Study at Cotonou Harbour, Benin



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12. **Benin**
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DANIDA DEPARTMENT OF INTERNATIONAL DEVELOPMENT COOPERATION OF DENMARK

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Technical Report N° 67 April 1995

A Cost and Earnings Study at Cotonou Harbour, Benin

by

Bert Kamphorst
APO Socio-Economist

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Cotonou, April 1995.

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PREFACE

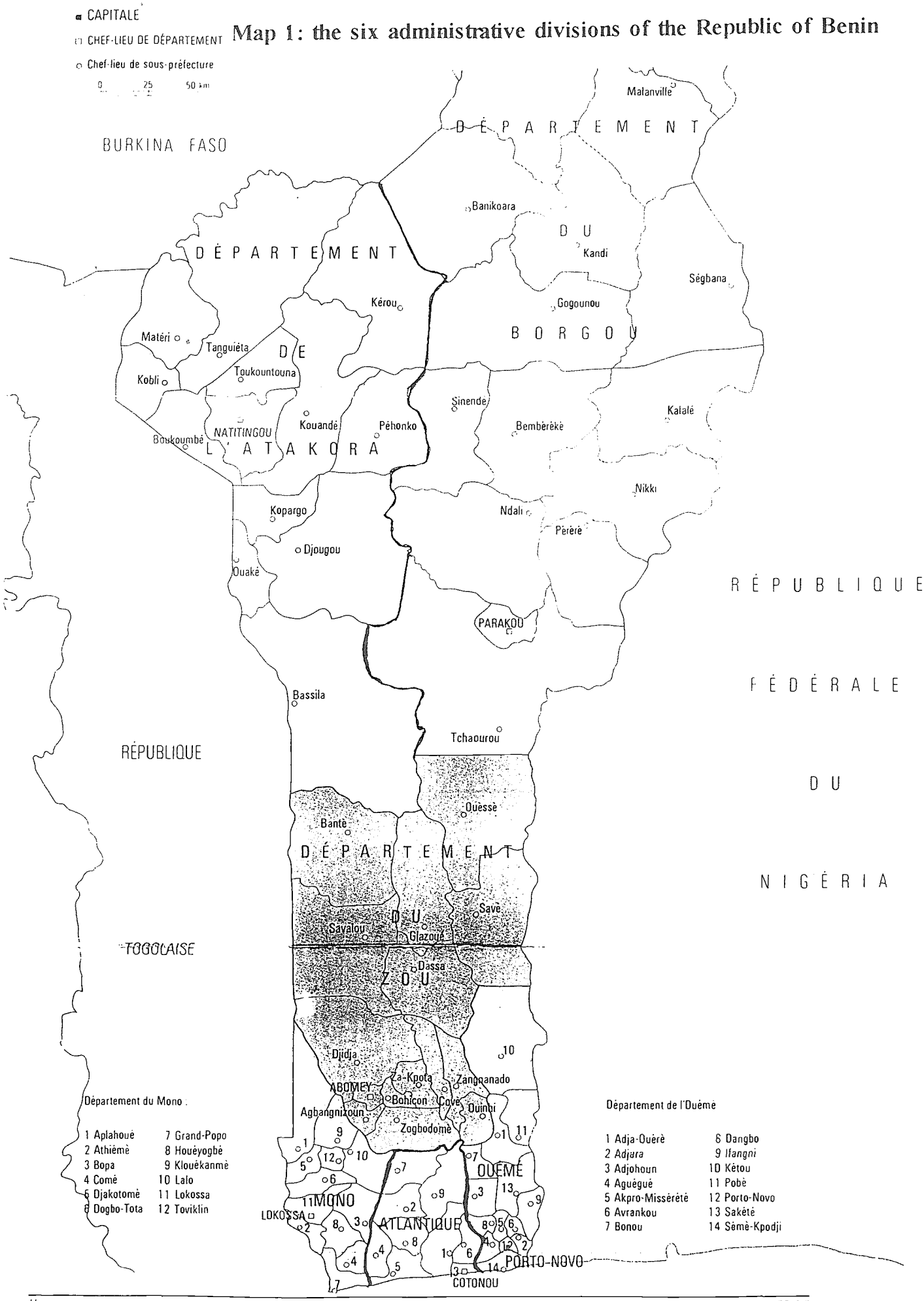
A clear assessment of costs, earnings and profitability of different combinations of gear and craft in a comparative framework is usually required to monitor trends in the development of artisanal fisheries within the context of a national fishery development plan. Information is also necessary to make recommendations to what technologies should be encouraged and those to be discouraged taking into account the available biological information. Most surveys in the sector have been limited to catch and effort.

The IDAF Programme believes that it is important to study closely the cost structure, the sharing system and profitability of artisanal operations. In general, the income from fishing contributes to the major part of a fishing household's total income and therefore influence their socio-economic conditions. Such detailed but global analysis for the simplicity is termed " Cost and Earnings Study (CES)".

The IDAF Programme would like to collaborate with Departments of Fisheries and research institutions to undertake "CES" in a number of countries over at least one year. The IDAF Programme intends to set up a network of national institutions. A "Working Group on Costs and Earnings of Artisanal Fisheries in West Africa" with regional experts on this subject will be constituted in June 1995. The exchange of views, experience and information will be an important objective of this regional network.

This report is the result of research carried out at Cotonou fishing harbour from September 1993 to December 1994, within the framework of elaborating and testing a simple methodology for monitoring fishing economic units on costs and earnings of their operations, which could be used in other associated IDAF countries.

I would like to thank the data collectors: Mr. A. Adodo, teacher and manager of fishing economic units and Mr. S. Fousseni, fisheries monitor for the Department of Fisheries; IDAF staff for the useful comments and assistance during the writing of the report; and last but not least the managers of the selected fishing economic units for their kind cooperation.


CAPITALE
CHEF-LIEU DE DÉPARTEMENT
Chef-lieu de sous-préfecture
0 25 50 km
Map 1: the six administrative divisions of the Republic of Benin
BURKINA FASO
DÉPARTEMENT DE L'ATAKORA
DÉPARTEMENT DU BORGOU
DÉPARTEMENT DU ZOU
DÉPARTEMENT DU MONO
DÉPARTEMENT DE L'ATLANTIQUE
DÉPARTEMENT DE L'OUÉMÉ
RÉPUBLIQUE FÉDÉRALE DU NIGÉRIA
RÉPUBLIQUE TOGOLAISE
Malanville
Banikoara
Kandi
Ségbana
Gogounou
Kérou
Matéri
Tanguiéta
Toukountouna
Kobli
Boukoumbé
NATITINGOU
Kouandé
Péhonko
Sinendé
Bembèrèkè
Kalalé
Nikki
Kopargo
Ndali
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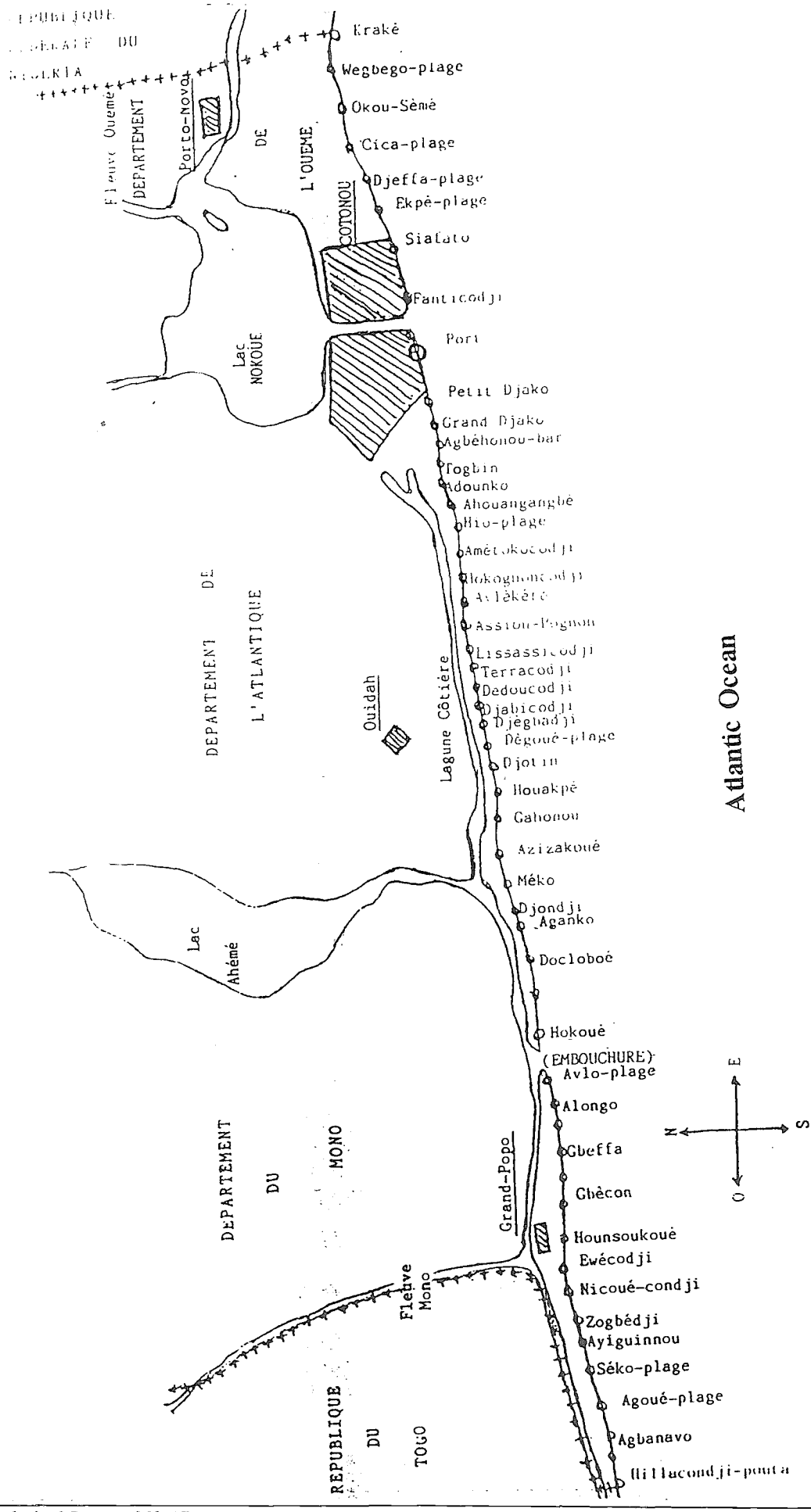
Djougou
Ouaké
PARAKOU
Bassila
Tchaourou
Ouessè
Bantè
Savè
Savalou
Glazoué
Dassa
Djidja
Za-Kpota
Zangnanado
ABOMEY
Bohicon
Covè
Ouinhi
Agbangnizoun
Zogbodomè
LOKOSSA
ATLANTIQUE
PORTO-NOVO
COTONOU
Département du Mono :
1 Aplahoué
2 Athiémè
3 Bopa
4 Comè
5 Djakotomè
6 Dogbo-Tota
7 Grand-Popo
8 Houéyogbé
9 Klouékanmè
10 Lalo
11 Lokossa
12 Toviklin
Département de l'Ouème
1 Adja-Ouèrè
2 Adjara
3 Adjohoun
4 Aguégué
5 Akpro-Missérété
6 Avrankou
7 Bonou
8 Dangbo
9 Ifangni
10 Kétou
11 Pobè
12 Porto-Novo
13 Sakété
14 Sémè-Kpodji

MAP 2: the landing sites in Benin



EXECUTIVE SUMMARY

The study was undertaken, in collaboration with the Beninese Department of Fisheries, at the Cotonou fishing harbour from September 1993 to December 1994. The most important objectives of this cost and earnings study were to elaborate and to test a simple methodology for monitoring the costs, earnings and profitability of different fishing economic units which can be also used in other associated IDAF countries.

The fishing economic units were divided into four main geartype groups; i.e. *sovi* (bottom gillnet), to*hounga/aviondo* (bottom gillnet/drift gillnet), *watcha* (purse seine) and hook & line, based on the situation in September 1993.

A total of 61 managers of fishing economic units, who correspond to 37% of the managers at Cotonou Harbour, were interviewed on the fixed costs of their "enterprises".

A selected number of respectively 4 bottom gillnet, 4 pure seine, 2 drift gillnet and 4 hook & line fishing economic units were monitored on landings and sales from January 1994 to December 1994

Based on the fixed costs survey, 60% of the managers are Ghanaians, 32% are Beninese and the remaining 8 % have the Togolese nationality.

Beninese managers belong mainly to Plah, Pedah, Mina and Goun ethnic groups. Adan and Fanti are the important Ghanaian ethnic groups.

Educational levels among all managers are rather low. Around 40% is illiterate.

22% of the Ghanaians managers have a piece of land in their home village in Ghana. The migration pattern of the Ghanaian ethnic groups are responsible for the fluctuations of canoes at Cotonou harbour, which can vary from 140 to 230, during a year.

The remuneration system of the fishing economic units at Cotonou harbour consists generally of three shares: 1.) the owner of the fishing equipment receives 40% of the net revenues as a remuneration of his capital; 2.) the owner also receives 20% of the catch as compensation for maintenance and repair of equipment and; 3.) the crew obtains the remaining 40% of the net revenues.

The net profit from capital of the owners is much lower than the share of the crew. The bottom gilnet owners are an exception. This means that labour is better remunerated than capital for the purse seine, drift gillnet and hook& line fishing economic units.

In Cotonou, the interest rate of a savings account is 5%. In this case the opportunity costs of capital for watcha owners is lower than their return on capital investment. The return on investment is high for sovi owners (77%) and reasonable (20%) for hook & line owners.

Except for sovi units, the common operating costs consume the greatest part of the income from sales, namely 38% for aviondo units, 44% for watcha units and 53% for hook & line units. Approximately 70% of the income from sales is used to common and fixed costs. The

remaining 30% is used for payments to crew members and for remuneration of capital. The net profit on capital for the owners is the smallest part of the income from sales and is even negative for aviondo owners.

The average annual landings of all sovi, watcha, aviondo and hook and line units at Cotonou harbour are roughly estimated at 2,200 metric tons which is approximately between 35%and 40% of the total Beninese marine artisanal landings.

A summary of 16 indicators used for monitoring fishing economic units on costs and earnings at Cotonou harbour in 1994:

	Sovi	*Watcha*	*Aviondo*	Hook & line
1. Investment costs	381,550	8,724,492	2,639,991	3,625,000
2. Av. catch/trip (kg)	42	242	116	160
3. Number of trips/year	225	163	88	51
4. Av. price/kilo (FCFA)	101	220	240	876
5. Sales (*1)	1,034,180	8,785,980	2,746,550	6,907,287
6. Number of months fishing in Benin	12	12	7	9
7. Common operating Costs	270,000	3,830,500	1,029,600	3,660,000
8. Divisible earnings/ net revenues	764,180	4,955,480	1,716,900	3,247,287
9. Share crew	305,789	1,982,192	686,760	1,298,915
10. Share owner	458,508	2,973,288	1,030,140	1,958,139
11. Depreciation costs and maintenance & repairs	162,207	2,240,937	1,099,858	1,245,000
12. Net profit of owner	296,301	732,351	-69,718	713,139
13. Crew size	3	15	8	12
15. Net income of fisherman	102,000	131,553	85,845	108,243
16 Returns on investment	**77%**	**8%**	-	**20%**

1: The sales are based on the figures in the annex 3-6.

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1. INTRODUCTION

1.1 Geographical setting

The Republic of Benin is situated in West Africa, located between the longitudes of 1° and 3°40' E and latitudes of 6°30' and 12°30' N. In the East, Benin is bordered by Nigeria, in the West by Togo, in the North by Niger and in the Northwest by Burkina Faso. In the South, the Republic has the Atlantic Ocean, more particulary the Gulf of Benin, as natural border. The total land area is about 112,622 km^2. Benin had a population of approximately 5.1 million in 1993, resulting in an average population density of 45 persons per km^2. The country has a population growth rate of 3%. The potential economic active population can be found in the age group 15-59 years, which corresponds to 47% of the population (Kolawolé et al. 1993). Benin has six administrative divisions, which are shown on map 1.

The Beninese coastline measures approximately 120 kms, from Kraké village at the Nigerian Border to Hilla-Condji at the Togolese border and covers parts of the three southern divisions, i.e. Mono, Atlantic and Ouémé. The total surface area of these three divisions is 11,720km^2 with a total population of 2.7 million; the average population density being 230 inhab./km^2. In other words, 55 % of the Beninese population live in the three southern divisions which cover only 10 % of the total surface area (Kolawolé id. 1993). The sea has three connections with the interior, i.e. the Nokoué and Ahémé Lakes and the Mono River. There are 82 fishing camps along the coast which are shown on map 2 (Gbaguidi et al. 1993). The shelf area, up to 200m deep and the exclusive economic 200 nautical miles zone are estimated at 3,100km^2 and 27,100km^2 respectively (Seki and Bonzon 1993).

1.2 The marine artisanal fisheries in Benin

The character of the marine artisanal fisheries in Benin is still highly traditional because all fishing methods are completely manual. The fishing methods can be divided into two groups, i.e. net fishing, which can be further specialized into active and passive methods; and luring with bait. The fishing techniques used by fishermen in the harbour of Cotonou are described in paragraph 2.3.

The importance of the marine fisheries sector to the Beninese economy lies concretely in its contribution to employment and to protein supply. Around 3,200 fishermen are engaged in marine fish production in Benin (Gbaguidi et al. 1993). The Ghanaians, 50 % of the fishermen in Benin, are fishing with their own craft or as crew members on Togolese and Beninese fishing units in Beninese territorial waters. The Beninese and Togolese marine fishermen in Benin are respectively estimated at 46% and 4% (Gbaguidi et al. 1993). Ghanaians have adopted a "transhumant mode of living" determined by seasonal movements of fish, prices of inputs and prices of fish products. Ghanaian fishermen with a contract from a fishing company or a "fishmama" lodge for that period in temporary camps or in dormitories.

Hundreds of people are finding employment in the "backward linkages"of fishery industries like boat constructors and repairers, net menders, mechanics, suppliers of fuel and ice and a few thousand are engaged in the "forward linkages" of fishery industries related to activities like fish processing, distribution and marketing which are mainly women's activities in Benin.

The marine fishing industry produced approximately 7,000 metric tons in 1992, while marine potential is estimated at 9,500mt. The continental and lagoon fisheries were responsible for respectively 2,000 and 26,000mt. Fish imports, especially frozen fish, were estimated at 13,000mt (Department of Fisheries 1992). Export of fish is negligible. Benin has a a per caput fish supply of 9.7 kg/year out of which 1.6 kg/year from artisanal maritime fisheries. It must be noted that fish is one of the lowest priced sources of animal protein and is acceptable to people of all groups and religions which are common in Benin.

1.3 Justification and specific objectives of the study

A fisheries cost and earnings study (CES) collects data on a regular basis (at least one year) at the basic level: the fishing economic unit (FEU). A FEU is defined as a particular combination of capital (fishing equipment such as gear, canoe and means of propulsion) labour and management. A CES collects grassroots level information on technical, social-economic and economic matters which are essential for planning, executing and assessing the impact of small-scale fisheries programmes. Remarks on returns on investment and the profitability of the gear types must be placed in the social-economic environment of the owner(s). The work and living environment influence the decisions of fishermen. It is important to have an accurate view of the needs and availability of capital, the cash flows generated by fishing units, the remuneration systems and the dependency relations of fishing units. This data is especially important when credit programmes are planned or new equipment is introduced to fishermen. A detailed CES has never been done in Benin.

The specific objectives of the study at the Cotonou fishing harbour were: (1) to elaborate a simple methodology for monitoring the fishing economic units, (2) to assess costs and earnings for different types of fishing economic units, (3) to analyse the rate of return on capital investment for different types of equipment owners, (4) to analyse the distribution of income from fishing in relation to the production factors: labour and capital and (5) to provide recommendations to the responsible authorities in order to improve the data collection system in Benin.

1.4 Description of the study area

The Cotonou fishing harbour is the most important landing site in Benin with 40% of the fishermen and 36% of the operational canoes. The importance of the Cotonou harbour for Beninese marine fisheries is shown in table 1.

Table 1: Geographical distribution of fishing gear in Benin

Gear type	% of this gear type used at Cotonou harbour	% of this gear type used outside Cotonou harbour
Aviondo	91	9
Hook and Lines	70	30
Nifan-Nifan	68	32
Watcha	61	39
Ali Foussa	47	53
Bottom gillnets	25	75

Source: Gbaguidi et al, 1993

Since the construction of the harbour, many Beninese fishermen moved to Cotonou harbour from their villages because it forms a much better base of operation. Canoes are able to enter and to leave the harbour regardless of beach surf conditions which hamper operations from villages. Fishermen working from Cotonou are also largely free of the compulsory rest days enforced according to traditional religious criteria in their villages (Satia 1993). In general, the fishermen operating from Cotonou harbour go roughly three times more to sea a month than their colleagues operating from the fishing villages.

Another important reason for selecting the Cotonou fishing harbour for this study is because almost all fish catches are sold or retailed in Cotonou. The fish prices in Cotonou are nearly two times higher than in rural areas and the fish is usually bought by the "fishmama's" with cash whereas in the villages it is more common for the women to buy on credit (Haakonsen 1987).

In December 1993 a total of 65 "fishmamas", mainly from the Plah ethnic group, operated with insulated boxes at two different places close to the port and sold frozen fish. Another 70 "fishmamas" were buying and selling fresh fish. They became fish smokers in the high season when supply was higher than demand. More than 200 old petrol barrels at Yénewa, located in Placondji, the fishermen's quarter of Cotonou, were being used as smoking ovens for sea fish. Roughly 300 women, mainly of the Pedah, Plah or Mina ethnic groups, were involved in the processing of fish.

During visits to Cotonou port the presence of six outboard engin mechanics; respectively two Ghanaians and four Beninese, and three Beninese hull repairers was observed. Two private companies were supplying ice-blocs and flakes, and one company supplied ice-flakes in small plastic crates to "fishmamas" and fishermen. Approximately 20 women were selling prepared meals to the fishermen and around 15 women had some petty retail activities. At least six persons were employed full-time in the supply of petrol to fishermen.

The infrastructural works at the port are rudimentary. Fishing port facilities such as a jetty or a sheltered auction/market place are lacking. Two fenced places at the port are created by and for fishermen to sell their fish. The Fisheries Department has a fishing material shop at the harbour.

The Beninese fishermen established in 1992 an association which has an office at the harbour. This office forms, together with the sheltered mending place and the storage rooms for fishing equipment, one complex which was constructed in 1989. The storage rooms have been damaged by fires in 1990 and 1991. At the time of writing this report they were being under repair. The fetish priestess has a shelter in the port.

1.5 Methodology

The methodology used to obtain data during the various stages of the study at the Cotonou fishing harbour is based on: literature review, talks with key persons, observations, a detailed questionnaire on fixed costs for 61 fishing units, monitoring of the landings for 14 fishing units and joining units on some trips to sea. In this paragraph the methods used during the various stages of the study and the organization of the study are described

A literature review on the subject and study area was carried out in July and August 1993. Observations and discussions with key persons took place at the harbour in August 1993.

The distribution pattern of fishermen at the harbour is determined by ethnic group and gear type. All the *sovi* fishermen belong to the Fanti, a Ghanaian ethnic group who are grouped together at the harbour, just as the Adan, another Ghanaian ethnic group, driftnet fishermen, the Adan handliners and the Fanti purse seine fishermen. The canoes of the Beninese bottom set gillnet are also clustered in the harbour. The Togolese and Beninese purse seine fishermen are spread all over the port.

A convenient sampling frame on fishing economic units, gear or craft did not exist. Each unit has its own specific remuneration system for the production factors. The crew can vary from two fishermen for a *sovi* unit to twenty for a *watcha* unit. A census of the total number of active fishing units, based on canoe-main gear combination, was made at the harbour on 2nd of September 1993. It must be noted that the individual Beninese *tohounga* fishermen who share a boat with six or seven other fishermen are under represented by this system of registration. *Tohounga* and *aviondo* are taken as one group because the *tohounga* units use the same type of boat and have similar investment costs to *aviondo* units. The list, prepared in September 1993, was used as a sampling frame for the study and is shown in table 2.

Table 2: Number of fishing units at Cotonou harbour in September 1993 and sample size

Fishing unit	Number of operational units	Sample size in number	Sample size in %
Sovi	91	20	22
Aviondo/Tohounga	46	13	28
Watcha	24	24	100
Hook & Line	4	4	100
Total	165	61	37

The fishing units are identifiable units. A simple random sample does not ensure a coverage of the four groups of fishing economic units. A stratified sample has to be used to cover the various types of fishing units. The variability and the sample size, needed to statistically represent the units accurately, must be estimated in cases of a huge number of units and especially when big differences are expected within the sub-group. After a pilot survey of one day, the standard questionnaire on personal details of the owners of fishing equipment and the fixed costs was completed. No big differences in the sub-groups were noted during the testing of the questionnaire. The survey started at the end of September 1993 and was completed by the beginning of December 1993. The *Zogbodo's*, the fisherman's fetish rest day each eighth day, were used for interviewing the owners of the equipment. The questionnaire is given as annex 1.

A survey on landings was carried out in cooperation with the Department of Fisheries and an owner of a *watcha* fishing unit during the period January to December 1994. It was not necessary to use all fishing economic units interviewed during the fixed costs survey, in the landings survey because the fishing effort of all the units, i.e. average number of fishing trips per month, is known. Two days per week, the data on the landings of 14 fishing units, i.e. 4 *sovi*, 4 hook & line, 4 *watcha* and 2 *aviondo* units respectively, were collected. The proposed monitoring of two Beninese *tohounga* fishermen was too difficult and was cancelled in April 1994. The *tohounga* fishermen operate in groups, together they rent a canoe and an engine. Each fisherman has his own nets. The composition of the groups changed during the year which means that there can be no question of a fishing unit but of a group of individuals. The landing sheet, used for the 14 units, is given as annex 2. In the questionnaire the days between the two data collecting days were described either as unit ashore or unit at sea. For obtaining detailed data on variable costs, fishing trips with a *sovi*, a *tohounga* and a *watcha* fishing unit took place in December 1993 and in March 1994 (because of the devaluation in January 1995, the results could not be compared).

The data on fixed costs were processed by computer, using Excel 4.0 and the data on variable costs and landings were processed by hand. The report was written in December 1994-February 1995.

1.6. Limitations of the study

The devaluation of the FCFA by 50%, effective on 12 January 1994 (from 50 to 100 for 1 FF, which means from 295 to 590 for 1 US $), brought some implications for the calculations of the present replacement costs of equipment. The replacement costs of equipment in the questionnaire were based on purchase prices of October 1993. After a rapid investigation at the market and shops in Cotonou in July 1994 it was noticed that purchase prices of canoes had increased roughly by 50%, gear by 80% and outboard engines by 100% compared to the price in October 1993. The price of fishing equipment in July 1994 has been used for the 1994 cost and earnings analysis of fishing units at the Cotonou harbour. Some equipment was bought in Lagos or Tema (Ghana). The unstable exchange rates of the Naira and the Cedi in relation to the FCFA made it difficult to calculate the real price in FCFA.

The method of estimating the weight of fish landed by the selected fishing economic units was done by eye. However, the fishermen have been consulted in many cases. The fishermen have a fairly good idea of how much they have caught. Any errors in estimates of weight of fish landed affect records of earnings. The assistants during this study, a *watcha* owner and a fishery monitor were capable to estimate the quantities of fish.

The aspect of migration of foreign artisanal fishermen makes it difficult to monitor the fishing economic unit for one year. Only the operation periods in Beninese territorial waters were recorded. Ghanaian *watcha* units react to weather and fish movements.

A more comprehensive analysis could be performed but the present study was because of time limitations linked to cost and earnings.

1.7 Catch and effort assessment system in Benin

The National Centre for Oceanography in Cotonou supervised a Catch and Effort Survey at three landing sites; i.e. Cotonou harbour, Ayiguinnou and Agoué. The responsible monitors count daily the number of canoes which went out for fishing and the number of canoes which returned. The monitors registrate the catch and efffort of different geartypes twice a week. The sample size for each geartype is between 10 and 30%. They have not fixed days for the survey. The days change weekly. They do not monitor the same units for a long period because the fishermen claim a compensation for monitoring their unit and CNO has not the financial means to pay fishermen for their collaboration. Based on the results of the three mentioned landing sites CNO makes an extrapolation for Benin which is possible if the the effort of all the other landing sites is known.

2. CRAFT AND GEAR AT COTONOU HARBOUR

2.1 Introduction to the devices for marine fishing

Marine fishing takes place in a risky environment. Gear can float away, sink or be torn. A small canoe can capsize in a storm and loose its mode of propulsion and fishing gear. Cases of destruction of gear (rocky bottoms and sharks or dolphins entering in the nets), the condition of the engine and boat, social obligations and stays ashore due to weather conditions determine the number of trips to sea. Fishing also takes place in an uncertain environment. This uncertainty not only stems from the insecurity of access to fish at the fishing grounds but also from the social environment of the fisherman, i.e. the uncertain actions and differences in equipment of the fishermen. The sea contains large numbers of species with different habits requiring different capture techniques. Many species are only periodically available. Catches and prices fluctuate, thus a good catch does not always mean a good day's income. Caught fish is a perishable commodity. This perishability can lead to post-harvest losses in money and protein.

Despite these characteristics of the marine fisheries, which distinguish the fishery sector from other natural resource industries, people are willing to invest money in fishing equipment to catch marine fish. In the case of a number of fishing techniques, the entry to this sector in relation to the equipment and technical skills required, can be described as relatively "easy".

Each type of gear requires a set of different operations that have to be carried out, simultaneously, necessitating a certain number of persons. The type and the size of gear determines the number of fishermen who are needed to technically operate it. The size of the canoe is adapted to the various types of fishing gear. In the next two paragraphs, the type of craft and gear used at the Cotonou harbour are described.

2.2 Craft

The number of canoes at the Cotonou fishing harbour fluctuated between 153 (mimimum) canoes in July 1994 and 226 (maximum) in December 1994. Due to this fluctuation the rate of motorization ranges from 41% in the lean season (April-August) to 60 % in the good season (September-March). The migration patterns of the fishermen of the Fanti and the Adan ethnic groups, and seasonal conditions in terms of availability of special fish types and weather are responsible for the annual fluctuations of craft at the harbour. The small-scale fishery at the harbour is operated essentially with (Ghanaian) dug-out canoes, improved with side-planks. The mounting bracket for the outboard engine is fixed to the side of the canoe. Fishermen use a long paddle as tiller. The canoes at Cotonou harbour can be divided into:

(i) small sized canoes, used by the Fanti fishermen to operate their bottom set gillnet. The length varies from 4 to 8.5m, the width from 66 to 104cm and the depth ranges from 38 - 49cm. These canoes are propelled by paddle and sail. A wooden mast and two bamboo sticks are used as a sail rig and this makes the craft very traditional. Only 10% of the Fanti *sovi* fishermen use canoes propelled outboard engines.

(ii) medium sized canoes, used by bottom set gillnet/*tohounga*, drift gillnet and by shark fishermen. They are 9-12.5m long and 106-150cm wide. The depth varies from 52 to 61cm. These canoes are motorized by a Yamaha outboard engine of 25 or 40HP.

(iii) large canoes, used by purse seine, encircling gillnet and hook and line fishermen. They are 12.8-16.2m long, 140-200cm wide.and 82-92cm deep. All are propelled by a Yamaha 40HP outboard engine.

2.3 Gear

The active nets used by fishermen at the Cotonou harbour are *watcha* and *ali mahounda dahassa* and the two drifting gillnets *aviondo* and *ali foussa*. The fixed bottom gillnets can be classified into *tohounga, sovi and nifan-nifan* nets. Another fishing method uses hooks and lines instead of nets.

(i) *Watcha*

Purse seines are characterized by the use of rings and a purse line at the bottom of the net which enables the net to be closed like a purse and thus retains most of the fish surrounded. This encircling net consists of parts with different small stretched meshes, from 3/4 to 2 inches. The sizes of the nets vary with a length between 400-750m and a depth varying of 35-50m. It is operated down to a depth of 40m from October until till May. The fishing operation, setting and hauling, of a purse net of 700m is a two hours work.

Species caught: *scomberomous tritor, caranx hippos, caranx senegallus, caranx crysos, sphyraena barracuda, strongylura crocrodila, euthynnus alleteratus*

(ii) *Ali Dahassa*

This encircling gillnet varies from 700 to 1000m in length and from 25-40m in depth. The stretched mesh size varies from 1.7/8 to 2 inches. The nets are operating in water with a depth of 30m. The fishing period is from June to October.

Species caught: *sardinella maderensis, sardinella aurita*

(iii) *Aviondo*

This is a very popular driftnet among the Adan fishermen. Its length varies from 180m to 360m and the depth is 1.8m. Nets are joined together and can form a length of 1800 to 4000m. It is operated at a depth of 20-40m from October until April during the night. The stretched mesh size is two inches.

Species caught: *exocoetus volitanus, Strongylura senegalensis, carenx, thonnus obesus*

(iv) *Ali Foussa*

This driftnet operates on the surface or at a certain distance below it. They drift freely with the current, often with the canoe to which they are attached. The net varies between 600 and 1000m in length and 30-40m in depth. It is operational during night at a depth of 10-40m depth. The net is set after sunset and hauled and set several times during the night. The stretched mesh size is two inches.

Species caught: *sardinella maderensis, sardinella aurita*

(v) *Sovi* and *Tohounga*

Both types are traditional set gillnets, which are fixed to the bottom by anchors or weights from cars. Gillnets are a broad generic name for nets which are wall-like in nature and in which fish get caught when their gills are entangled in the meshes. The length of a single net ranges between 200-360m and the depth is 1.8m. When several nets are combined the total length varies from 540m-1800m, depending on financial means and boat size. They are operated all year round and are set at dawn on smooth sandy/muddy bottoms at a depth between 10 and 25m.

The *tohounga* nets are hauled in after one and half hours. The fishermen who use this type of net are generally Beninese, who use outboard engines of 25 HP. The stretched mesh size of the net is 2 or 3 inches. The rope used is thicker than the rope used by the *sovi* fishermen.

The *savi* nets are hauled in every two hours. The stretched mesh size is 1.5 inches. The Fanti are specialized in this type of fishing. The fishermen use sails and paddles to reach the fishing grounds.

Species caught:

1.Tohounga: *pseudolithus spp, galeoides decadactylus, lutjanus, Pomadasys, Palinulirus regius, Psettodes belcheri, Menippe nodifrons*

2.Sovi: *ilisha africana, galeolides, decadactylus, pentanemus quincarius, pseudolitus spp*

(vi) *Nifan-Nifan*

There are two types of this shark net: *agla* as drift gillnet and *agla dodo* as set gillnet. The stretched mesh sizes vary from 6-12 inches. The length is normaly 15m by 1.5m. The operational season is between August and Octobe and in January.

Species caught: *isurus oxysinehus, sphyrna lewini, istiophorus albicans*

(vii) Hand-lining

Fish are attracted by natural bait placed on hooks fixed to lines. Hand-held line fishing in Cotonou is a speciality of the Adan fishermen. This type of fishing is operated upto a depth of 100m.

Species caught: *myeteroperca rubra, sparus coeruleostictus, lutjanus agennes, lutjanus fulgens, epinephelus aenus, elagatis bipinulata*

3. SOCIO-ECONOMIC DATA OF THE BOAT OWNERS

This chapter describes the various types of equipment owners (managers), the way they reduce uncertainty in earning a living from fishing and how they spread their risks.

3.1 Nationality and ethnicity

From the survey, 60% of the canoe owners are Ghanaians, 32% are Beninese and the remaining 8% have the Togolese nationality.

All owners of the units with *sovi* as main gear type, have the Ghanaian nationality and belong to the Fanti ethnic group.

The *aviondo* owners are Ghanaians who belong to the Adan/Ga group. 65 % of the *tohounga* owners with the *aviondo* as a minor net are Beninese of the Plah group. 25% belong to Beninese of the Mina group and the remaining 10% are Beninese of the Goun and Pedah group. Individual *tohounga* fishermen are usually Beninese fishermen of the Plah, Pedah, Mina and Goun group or Togolese of the Ewe and Mina groups.

The 24 owners of the *watcha* units can be divided into 9 Beninese of the Plah (88%) and Mina (12%) group, 8 Ghanaians of the Fanti (63%) and New Ningo (37%) group, 6 Togolese of the Ewe (83%) and Mina (17%) group and one Cameroonian.

The owners of handlining units are all Ghanaians who belong to the Adan/Ga group and have their base camp in old or new Ningo.

3.2 Age

The age of *sovi* managers ranges from 21 to 49 years, giving an average of 34 years. 12 of the 20 *sovi* manager/owners (60%) are younger than 34 years.

The age of *aviondo/tohounga* varies from 25 to 65 years with an average of 42 years. For the *watcha* manager it ranges from 31 to 65 years, giving an average of 49 years and for handline managers the age ranges from 30 to 40 years, giving an average of 36 years.

Some *sovi* managers are beginners and they will accumulate money to invest in a bigger canoe with engine and other types of gear like *tohounga* and *ali foussa*. A minority wish to become a crew member on a *watcha* fishing unit. 20% of the *sovi* managers are older than 45 years. They have worked in Ghana and later started fishing in Cotonou to obtain hard currency.

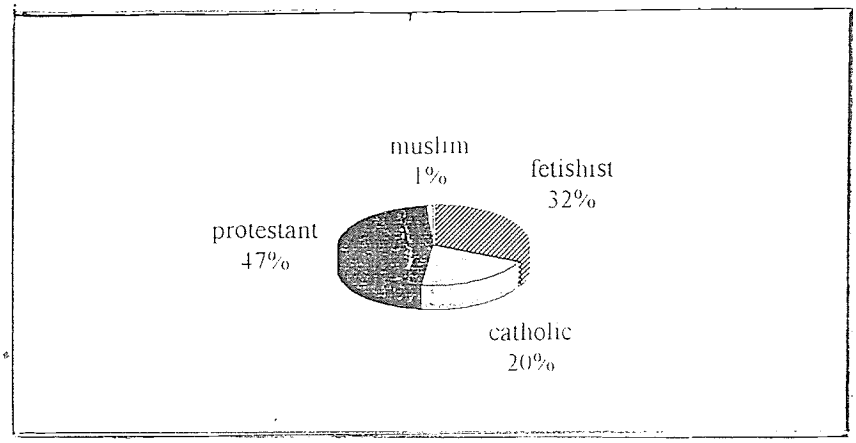
3.3 Marital status and migration pattern

Three *sovi* equipment owners are bachelors, thirteen are married to 1 wife and four to 2 wives. Three (23%) *aviondo/tohounga* managers are bachelors, three (23%) are married to 3 wives, six (46%) to 2 wives and two (8%) to 1 wife. Four (17%) *watcha* managers are married to 1 wife and the others (83%) to 2 or 3 wives. The wives of the *aviondo/tohounga* managers have on average four children. All hook and line managers are married. Two have 2 wives and two are married with 1 wife.

The Ghanaians migrate during the year. *Watcha* units go back to Ghana during the herring season (July-August). Hook and line units move easily to Nigeria in case of big landings in Lagos or cheaper fuel prices. *Aviondo* units relocate to Lomé in Togo or home village during March-August. Cultural festivals in their home villages in Ghana are also reasons for fishermen to leave Cotonou for a while. The *aviondo* and *watcha* owners have at least one wife living in Cotonou and one in their home town. When *watcha* fishing economic units have problems with their nets around Cotonou by big discharges of the Nokoué lake in the Atlantic Ocean, they go to Togo.

3.4 Religion

Figure 1: the religion of the boat owners/managers.

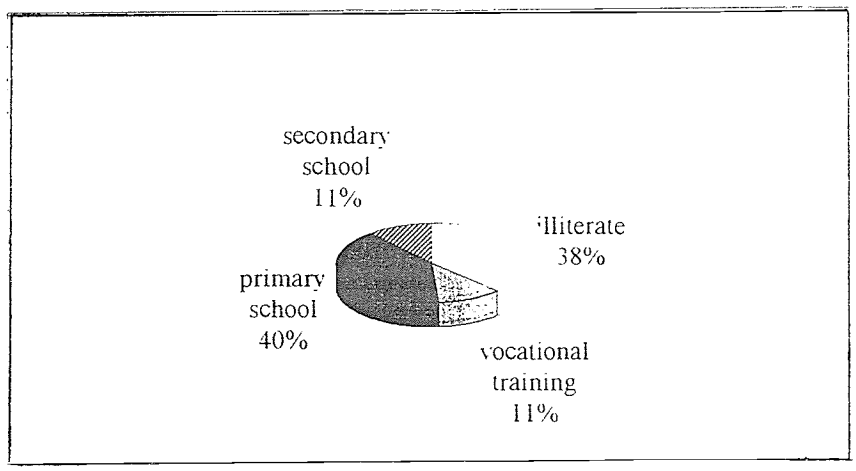


Only 32% of all owners/managers said that they are fetishists. 20% are catholics, 1% are muslims and 47 % belong to protestant/methodist churches. In fact, all fishermen are fetishists and give fish to the fetish priest and ask her assistance in bad times. Their fetish culture is nowadays mixed with one of the above religions.

3.5 Education

The educational level of owners is presented in figure 2.

Figure 2: Educational level of owners



Educational level among all managers is rather low. Ten (50%) of the *sovi* managers, 5 (37%) of the *aviondo/tohounga*, 7 (29%) of the *watcha*, and 2 (50%) of the handline managers are illiterate. Six (25%) of the *sovi* managers, 4 (31%) of the *aviondo/tohounga*, 13 (54%) of the *watcha* and 2 (50%) of the handline managers finished full primary school. Two (10%) of the *sovi* managers, 4 (31%) of the *aviondo/tohounga* and 1 (4%°) of the *watcha* managers completed the middle school. Only 3 (15%) of the *sovi* managers, 1 (8%) of the *aviondo/tohounga* and 3 (13%) of the *watcha* managers attended and completed a vocational training school.

3.6 Former job

Twelve (60%) of the *sovi* managers did not have a former job. They have always been engaged in fishing. Eight (40%) had other jobs before they became fishermen. They were respectively farmers at an estate (3), tailor, mechanic, carpenter, electrician and lorry driver

Seven (54%) of the *aviondo* managers have been engaged in fishing all their life. Five of them were farming and one was a tailor.

The *watcha* and hook & line managers had no former jobs.

It must be noted that all managers interviewed learned fishing from their fathers. All are sons of fishermen. If they had a former job, fishing was still a part of their life. They joined family and friends at sea in their spare time.

3.7 Additional job

Seven (35%) of the *sovi* managers are land owners in Ghana. Their wives cultivate the land. One manager works as a tailor sometimes.

Five (39%) of the *aviondo/tohounga* managers own land cultivated for food crops. One works as a tailor to earn an additional income.

Six (25%) of the (Beninese) *watcha* managers possess coconut trees. Among the Beninese, one is the owner of a welding company, two are teachers and one is a high ranking officer in the navy. In total, 10 (42%) of the *watcha* managers have an additional income.

All interviewed hook and line managers have a piece of land in their home village in Ghana.

Based on the survey respectively 22% of the Ghanaian owners have a piece of land in Ghana. Only 20% of the Beninese boat owners also possess land.

Additional activities are means of spreading risks. It compensates or replaces fishing income and generates a source of liquidity to invest in fishing equipment. The impression is that mainly Beninese owners/managers use income earned from outside the fishing sector to invest in fishing equipment.

3.8 Experience in marine fishing

The years of experience in fishing for *sovi* managers range from 4 to 32 years, giving an average of 16 years. The ranges and average years of experience for *aviondo/tohounga* and watcha managers are respectively 6-50 years with an average of 23 years and 10 to 53, giving an average of 33 years of fishing for *watcha* managers. Hook and line managers have 20 to 26 years experience, resulting in an average of 22 years.

4. INVESTMENT COSTS

The investment costs for the craft depend on the size, place of purchase of the canoe, gear type and the way by which the craft is propelled. The investment costs on gear depend on type, combination of fishing gear, size, material and country of sale. The economic life of fishing equipment is given in paragraph 6.1. All costs and prices are given in FCFA.

4.1 Craft

Table 3 shows the average investment costs in craft for the different gear types at Cotonou harbour. The hook & line managers invest around two millions of FCFA on their craft. Their big canoes are equipped with an echo-sounder, an ice-box and an engine of 40hp. The average crew for their fishing operations is 12 persons. They spend three nights at sea before they return. They have to preserve their fish with ice. *Watcha* managers need a big boat and strong engine for this type of fishing. For *sovi, tohounga/aviondo* units the investment costs are bigger than for their canoes.

Table 3: Average investment costs on craft July 1994 (*1).

Equipment\ Gear type	*Sovi* (n=20)	*Aviondo/Toh.* (n=13)	*Watcha* (n=24)	Hook & Line (n=4)
Canoe	156,000	900,000	1,500,000	1 500,000
Paddles	9,000	19,000	18,000	6,000
Sails from cotton	7,100	8,000	21,500 (*2)	
Sails from fert. bags	2,000			
Engine of 25 HP	1,000,000	997,145		
Engine of 40 HP		1,384,000	1,500,000	1,200,000
Ice-box				63,000
Echo-sounder				460,000
Average investment costs of craft for each gear type	192,100 and --- 1,192,100 for 25 HP and cotton sail users	1,924,145 for 25 HP users and --- 2,275,000 for 40 hp users	3,039,500	3,229,000

(*1) 1 US$ = 590 FCFA in July 1994
(*2) Sail used to cover mending place at the port

4.2 Gear

The prices of each specific gear type vary enormously. Most units are not dependent on one gear type. They use a combination of gear. Investment costs for gear of the four fishing categories are given in table 4.

Table 4: Prices of standard units of gear in FCFA in July 1994.

Gear type	Price per unit of net (bundle of 100 yards)	length of net, made from standard unit	Total price of gear (including: rope, threads, lead and floaters)
Sovi	36,000-45,000	360m	108,000- 360,000
Tohounga	45,000	360m	90,000
Aviondo	32,000- 45,000	270m	65,000-90,000
Watcha		600m	4,680,000
Ali Foussa		500m	720,000
Ali Dahassa		800m	1,440,000
Nifan - Nifan	540,000	500m - 800m	1,260,000 - 2,160,000
Lines	10 lines	230 m	360,000

The *sovi* fishermen use 1.5-5 bundles of this fishing net with a stretched mesh size of 1.5 inches. Their individual investment costs on gear range from FCFA 108,000 to 360,000, with an average expenditure on gear of FCFA 189,450.

The average investment costs on gear of *aviondo/tohounga* fishing units are given in table 5. Looking at the individual investment costs of *aviondo/tohounga* fishing units on gear the figures vary from FCFA 552,600 to 2,070,000 with an average of FCFA 715,846.

Table 5: Specification of *aviondo/tohounga* fishing units and their investment costs in July 1994

Combination of gear	Number of companies	Average costs per type of company
Aviondo	6	552,600
Aviondo and Tohounga	5	655,200
Tohounga and Ali Foussa	1	900,000
Aviondo– Tohounga and Ali Foussa	1	2,070,000

The 24 *watcha* units are fishing with the most expensive nets. Their combination of gear and investment costs are shown in table 6. Their individual investment costs on gear range from FCFA 3,600,000 to 10,980,000 giving an average of FCFA 5,684,992

Table 6: Investment cost on gear of *watcha* companies in July 1994

Combination of gear	Number of companies	average investment costs per combination of gear
Watcha only	2	3,600,000
Watcha + Tohounga	5	4,608,000
Watcha + Tohounga + Ali Foussa	1	4,860,000
Watcha + Ali Dahassa	2	5,220,000
Watcha + Tohoung + Ali Dahassa	8	6,052,500
Watcha + Nifan-Nifan	2	6,210,000
Watcha + Tohounga +Sovi + Ali Foussa	1	6,660,000
Watcha + Tohounga + Ali Dahassa + Aviondo + Nifan-Nifan	1	7,560,000
Watcha + Tohounga + Sovi + Ali Foussa + Ali Dahassa	1	10,980,000

The average investment costs on hooks and lines for the hand-lining units is around FCFA 396,000.

4.3 Investment costs on fishing equipment and capital intensity per type of fishing unit

Capital intensity expresses the investment per crew member on gear and craft. In general, a low capital intensity means a low labour productivity and a low income per crew member. On the other hand, the level of income is not exclusively determined by labour productivity, but can be influenced to some extent by the structure of ownership of the productive assets. The average figures for investment cost and capital intensity for the different gear types are shown in table 7 for October 1993 and July 1994.

Table 7: Investment cost and capital intensity of four types of fishing units in October 1993 and July 1994.

TYPE	*SOVI* NEU (n = 18) EU (n = 2)	*AVIONDO/ TOHOUNGA* (n=13)	*WATCHA* (n=24)	HOOK & LINE (n=4)
Average investment costs in October 1993	212,222 N.E.U. ---------- 783,500 E.U	1,617,462	4,931,167	2,096,500
Average investment cost in July1994	381,550 N.E.U	2,639,991	8,724,492	3,625,000
Increase of investment cost because of the devaluation in January 1994	+77%	+62%	+76%	+48%
Average number of crew members	3	7	15	12
Average capital intensity in October 1993	73,259 N.E.U. 225,876 E.U.	215,816	343,557	174,708
Average capital intensity in July 1994	127,183 N.E.U	377,142	581,633	302,083

*1) N.E.U. = NON-ENGINE USER
*2) E.U. = ENGINE USER

The investment costs per crew member of *watcha* units are two times higher than the investment costs per crew member of hook & line units and are four times higher than for a crew member of a *sovi* unit. The number of crew members on board of *watcha* units varies between 12 and 20 persons.

5. LANDINGS AND FISH PRICES

5.1 Landings

The catches from January to December 1994 were registrated on a sheet, given as annex 2. The number of trips and the average monthly landings and sales for selected *sovi, watcha, aviondo* and hook & line fishing units during January-December 1994 are shown in annexes 3-6. The average annual landings for the four types of fishing units are shown in table 8. Each unit always had at least one fishing day per week with hardly any catch because of problems with gear due to rocky bottoms, dolphins or sharks or heavy winds. The monthly trips of fishing economic units vary between 9 and 21. Weather conditions, social obligations, physical condition of the crew, *zogbodo*'s, routine maintenance and fuel price determined the number of trips. *Sovi* units made an average of 225 trips in 1994. The figures for *watcha, aviondo* and hook & line units were respectively 163, 88 and 51 trips a year. A trip for a hook & line unit lasts 4 days. The average annual landings of *watcha* were 4 times higher than the average annual landings of *sovi* and *aviondo* units in 1994.

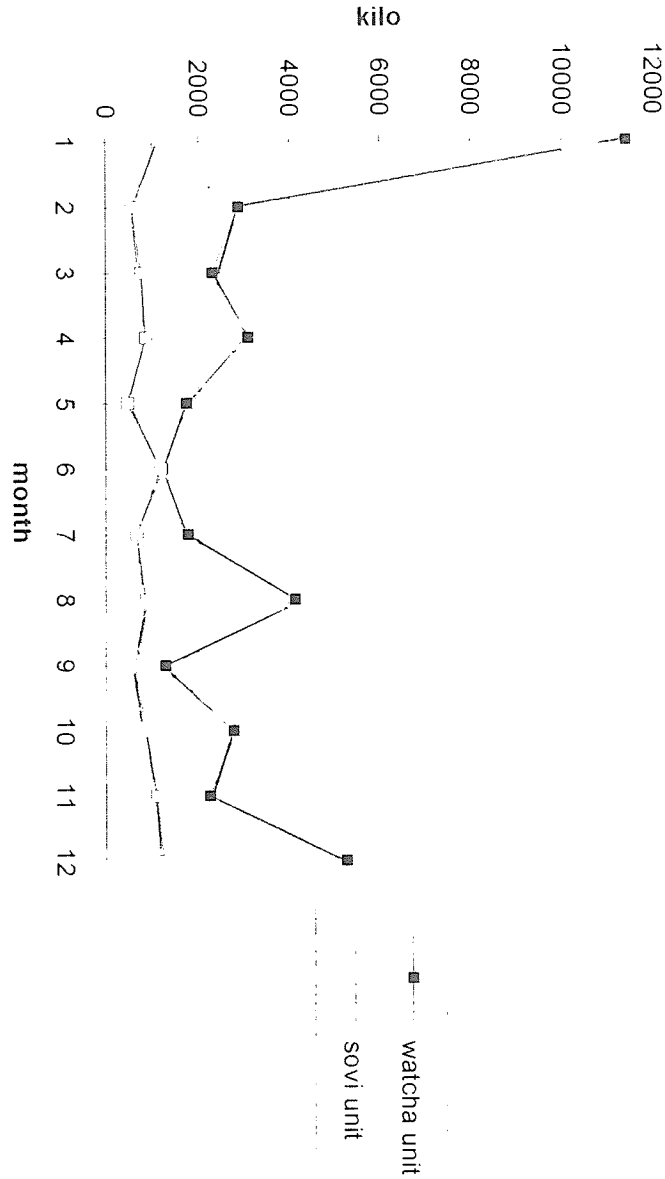
Table 8: Average catches, trips and sales for different FEU's in 1994

FEU	Av. catch/trip (A)	Av. trips/year (B)	Total av. catch/year (kg) (A) x (B)	Av.price/kg (fcfa) (C)	Total average sales. (A)x(B)x(C)
Sovi	42	225	9,450	101	954,450
Watcha	242	163	39,446	220	8,678,120
Aviondo	116	88	10,208	240	2,449,920
Hook & Line	160	51	8,160	876	7,148,160

Not surprisingly, *watcha* units caught the most in kilograms of fish per trip in 1994. *Aviondo* units only operate in Benin for 7 months which explains partly why the average annual landing of this gear type is so low. *Watcha* units caught roughly 2 times more in kilograms of fish per trip than *aviondo* units.

The average monthly landings for *sovi* and *watcha* units are shown in graphic 1.

Graphic 1:



5.2 Fish prices

The prices for 1993 and for 1994 are shown in annex 7. Prices should always be treated with caution. In general, prices received by fishermen are dependent on the size of the catch, its composition and quality, the season, the demand, access to and the relationships with the "fishmama's". For these reasons, prices can fluctuate enormously. This is illustrated in annexes 3-6. For example the *aviondo* units received high prices for the "first" exocet in the season, namely 113 FCFA per piece in October. Fish are sold per basin, basket, tray, per piece or per quantity of 40. The average price per kilo for the different gear types is given in table 8. Hook & line fishermen catch mainly species which are high priced. *Tohounga* units catch species with a relatively high price, i.e. around 520 per kilogramme. The lowest priced species are caught by the *sovi* units. In most cases the wife/wives of the fisherman sell their husband's landings. The fisherman is not involved in the trading of his fish or in the processing.

A graph showing the price fluctuation of specific fish species during a year can not be shown because the average price of the catch composition was taken. A specific fish like herring can varie in price because of weight and/or quality differences. To be very accurate it is necessary to weigh the caught species of monitored fishing units.

5.3 Incomes from sales.

Income from sales of fish for the fishing economic units depends on the composition of the catch species, given in paragraph 2.3, and the prices given for the different species of fish by the "fishmamas". In the former paragraph the price fluctuations are explained. The fluctuations of prices in FCFA and landings in kilograms are shown in the annexes 3-6. Table 8 shows that the average annual sale's income is the highest for *watcha* units. The income from sales for hook & line units is only calculated for a 9 months period. It will certainly reach the income from sales of the *watcha* units if the figures for the remaining 3 months of fishing, outside the Beninese waters, were available.

6. FIXED COSTS

The structure of costs includes both fixed and variable costs. In artisanal fisheries fixed costs are described as expenditure or allocations related to capital, such as interest on debts, depreciation of capital equipment, licence fees, harbour tax and other expenditure arising whether the productive assets are actively utilized or not.

6.1 Depreciation costs

Depreciation of equipment means that the fishing equipment decreases in value during the years. This "writing-off" of capital is an "unpaid" cost for the owner because there is no transaction of money. Depreciation is accounted in this paper by dividing the present price of new fishing assets of the same type by the lifespan of capital equipment in years. It is assumed that the residual value of the equipment is nil. Depreciation can therefore be considered as a provision for capital replacement. Table 9 shows the estimated average economic life of fishing equipment at the Cotonou harbour.

Table 9: Average economic life of capital equipment

Fishing equipment	Economic life in years
Canoe	10
Engine	3
Gear type:	
Sovi	2
Tohounga	3
Aviondo	2
Watcha	5
Nifan-Nifan	7
Ali Dahasa/Foussa	5

Table 10 gives the average costs for the four categories of fishing units. The fixed costs differ enormously. The annual fixed costs for *watcha* units are 1,5 times higher than for hook & line units, two times higher than for *aviondo/tohounga* units, 5 times higher than for *sovi* units with engines and 15 times than for *sovi* units without engines.

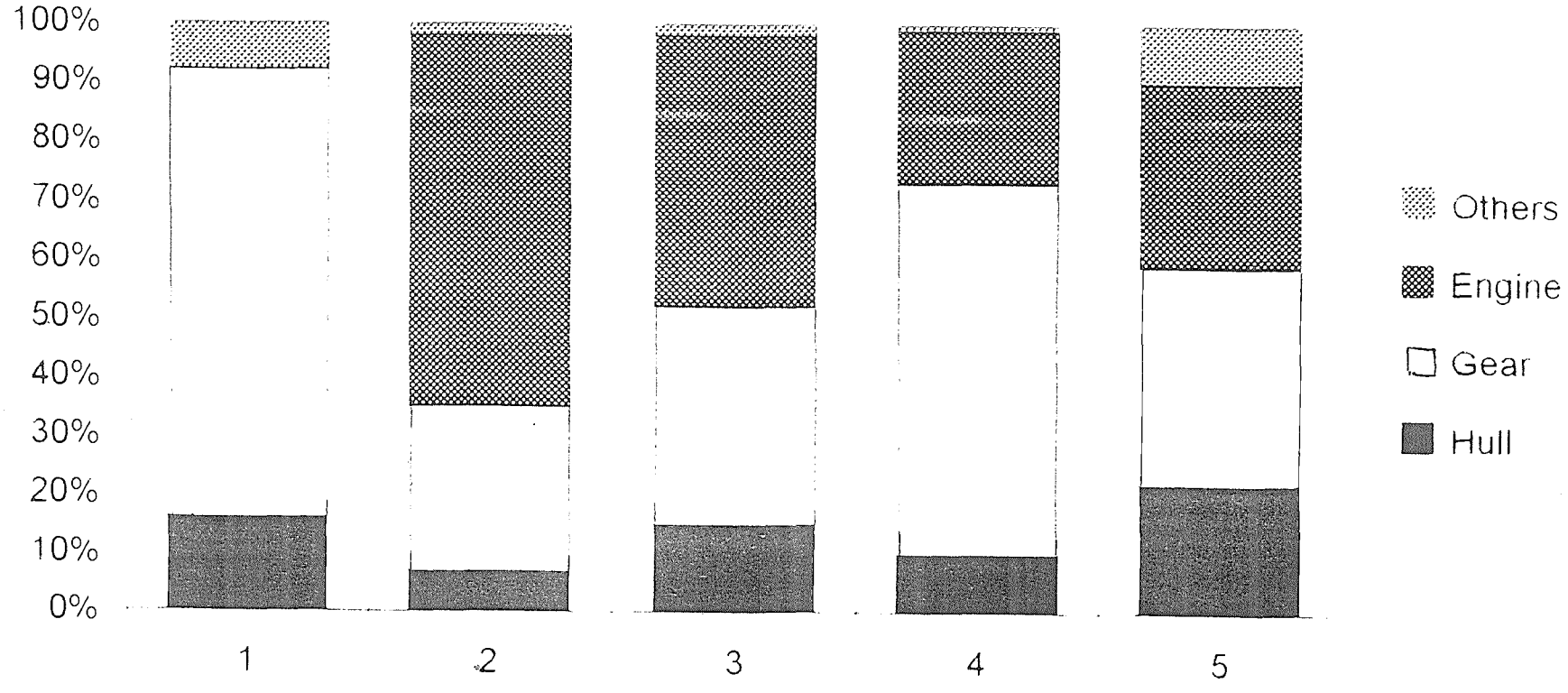
Table 10: Annual fixed costs for the four groups of fishing units in FCFA in July 1994

Type of fishing units	Average costs
Sovi	118,789
Sovi with engine	356,220
Tohounga/Aviondo	800,545
Watcha	1,790,937
Hook & Line	1,190,003

The importance of the depreciation cost of gear, hull and engine for the five groups are expressed as percentage of the total depreciation costs and are respectively shown in graphic 2. The annual depreciation cost of gear is the most important part of the total fixed costs for *sovi* units without engine (76%), *watcha* (63%) units and for hook & line units (36%). For *sovi* units with engines and for *aviondo/tohounga* units, the annual depreciation cost of the engine contributes most to their annual fixed costs.

Depreciation costs of other equipment like paddles, anchors, lamps, ice-box, compass, echo-sounder, etc. vary per gear type and range from 2 to 12 % for *sovi*, 2 to 3 % for *tohounga/aviondo*, 0.8 to 1.8 % for *watcha* and 10.6-14.1% for hook & line.

Graphic 2: depreciation of equipment as % of total depreciation for different fishing units



1= Sovi (NEU) 2= Sovi (EU) 3= Aviondo 4= Watcha 5= Hook & Line

6.2 Other fixed costs

Licence fees do not exist for artisanal Beninese fisheries. None of the equipment at the harbour is insured. The harbour tax is FCFA 5,000 and a bottle of rhum for foreigners who will use the harbour as fishing base.

Interest on debts is taken as a fixed cost. In case fishing units have debts to "fishmamas" who receive a preferential price for the landings as part of the repayment agreement, the debt is not taken as a fixed cost because it will be counted double. In this case the debt directly influences the income from sales. In general, the fixed costs in the harbours only consist of depreciation cost of capital equipment and are borne by equipment owners.

In cases of interest charges, it can be misleading to compare business of one equipment owner with another owner who has either or less equity. For example, two owners may have identical costs and returns but one owner has debts (fixed costs) and the other has inherited all the equipment from the grandfather of the owner. It appears that the debt-free owner has a better business because of lower fixed costs. For a true comparative analysis, it is better to ignore interest charges but a cost and earnings study looks to individual owners and has to take interest charges as a fixed cost for the owners.

7. VARIABLE COSTS

7.1 Introduction

The variable costs consist of expenditure incurred in the course of fishing operations. They depend on fishing effort which determines the operating costs like fuel, food, ice, bait, repairs...., and on the catch which influences the share of the crew members. The rent of equipment, especially canoe and engine, is often determined by a fixed percentage of the daily catch and is therefore a variable cost. *Tohounga* fishermen who have their own gear but rent a canoe and engine, give between five and eight fish per forty, which corresponds to 12,5%-20% of the catch, to the craft owner. In this chapter the variable costs consider only variable costs which are similar to operating costs and are split into two groups: A) operating costs paid by the owner and the crew and B) repair and maintenance cost paid by the owner only. The payment to crew is not considered as a cost but as a revenue which is described in chapter 8.

The important questions in a cost and earnings analysis are: who is bearing which costs and how is the sharing of divisible earnings organized. The answers must be known before starting any cost and earnings analysis. Divisible earnings plays a central role in the cost and earnings analysis. The sale's income (gross earnings or total revenues) from fishing less the common operation costs is defined as the divisible earnings in this report. Sale's income is calculated by the product of fish caught and its price paid by "fishmamas".

7.2 Common operating costs

Common costs are those directly incurred in the normal activity of fishing such as fuel, lubricants, labour, food on board, bait, material for small daily net mending and ice. Some operational costs are shared by crew and owner.

Table 11 shows the operating costs for the different fishing units and makes it clear that fuel is the most important part in the operational costs. The *watcha* fishing units have the highest daily operating costs. A litre pre-mixed fuel costs FCFA 200 in December 1993. A Yamaha 40 hp engine consumes 15 litre/h for a boat of 15m length which is enough to travel 9 miles/h. Therefore a fuel price increase will directly affect the operations of the fishing units. The small repairs consider the costs of material for usual daily mending activities of the crew members. Table 12 shows the average annual operating costs of the different fishing units. The common operating costs are than the fixed costs, borne by the owner, for all four types of fishing economic units.

Table 11: Average operating costs per trip in FCFA

Type	Fuel & Lubricant	Food	Ice	Bait	Small Repairs	Total
Sovi NEU		500			700	1,200
Sovi EU	3,000	1,000			700	4,200
Aviondo	10,000	1,000			700	11,700
Tohounga	5,000	1,000	4,000		700	10,700
Watcha	20,000	1,500			2,000	23,500
Hook & line	25,000	6,000	12,000	18,000	5,000	66,000

Table 12: Average annual operating costs for different gear types at Cotonou harbour

Type of fishing unit	Average operational costs per trip	Average number of trips in a year	Average annual operational costs
Sovi without engine	1,200	225	270,000
Sovi with engine	4,200	(*1)	
Aviondo	11,700	88(*2)	1,029,600
Tohounga	9,700	137 (*3)	1,328,900
Watcha	23,500	163	3,830,500
Hook & line	66,000	51 (*2)	3,366,000

*1) After March 1994, the two sovi units did not use engines because of technical problems.
*2) only 7 fishing months in Benin
*3)only 9 fishing months in Benin

7.3 Maintenance and repair

The costs for maintenance and repair of the canoe, gear and engine have been estimated at respectively 10%, 15% and 20% of their replacement value. It is sometimes difficult to separate investment and repair expenditure. The life span of gear is therefore used as the criteria to make the difference. Gear used longer than one year is taken as an investment cost and less than one year it is treated as an expenditure. Purse seine fishing units replace a part of their nets each year. This replacement cost is covered by the depreciation cost of gear. Costs for repair and maintenance are normally paid by the owner of the equipment. These annual costs are shown in table 13 for the different owners. In some cases it depends on the agreements and sharing system of the unit.

Table 13: Routine maintenance of hull and engine per year in FCFA for 1994

Gear type	Engine	Hull	Gear	Total
Sovi	no engine -------	15,000	28,418	43,418
	25hp 200,000	16,000	28,418	244,418
Aviondo/tohounga	25hp 200,000	90,000	107.737	397,737
	40hp 300,000	90,000	107,377	497,737
Watcha	40hp 300,000	150,000	-------	450,000
Hook & Line	40hp 240,000	150,000	60,000	450,000

8. EARNINGS AND PROFITABILITY

The decision to invest money in fishing equipment and to start a venture, with its own labour system based on family members, friends and/or contractors and sharing systems, is a fundamental economic one. It has wide-spread consequences for all involved. For most hook & line fishermen, the "fishmamas" finance the operational costs, while the managers and crew members with their families take the actual risks of the venture with their equipment.

8.1 Remuneration systems

In general, the system of sharing the divisible earnings of the *watcha*, *aviondo* and hook & line fishing economic units is based on certain notions which are accepted by crew and owners. Basically there are three shares:

1.) the owner of the fishing equipment (canoe, engine and gear) receives 40% of the (divisible) earnings as a remuneration of his capital.

2.) the owner also receives 20% of the catch as compensation for maintenance and repair of equipment.

3.) the crew obtains the remaining 40% of the divisible earnings which is called the return on labour. It is a fixed percentage of the earnings, which means that it does not change with the number of crew members.

For most *sovi*, there is no separation between enterprise and family household of the owner/operator. One or two sons operate with their father. The father receives income from sales and bears all costs. The sons do not receive any share. In this case 100% of the divisible earnings goes to the family. The fishing household fulfils the financing, organization of production and worker's function. The *sovi* fisherman's fishing economy has close structural analogies with a peasant economy. The difference is based on the nature of primary resources and not on the organization, the unit which is responsible for investment, employment and operational decisions.

Some family organized Ghanaian *watcha* fishing units have complex sharing systems which are based on expertise, experience and age.

The sharing system of *tohounga* fishermen who rent a canoe and an outboard engine, is already described in paragraph 7.1.

The remuneration of the earnings to owners has to be reduced with the depreciation costs of capital, interest charges and the costs for maintenance and repair, to calculate the owner's net profit from capital. The net profit from capital is shown in table 14. Except for *aviondo* owners, all owners have an economical surplus. It varies from nearly 300,000 FCFA for *sovi* owners to roughly 730,000 FCFA for *watcha* owners.

Table 14: Average annual net incomes in FCFA and net returns on investment at Cotonou harbour for 1994

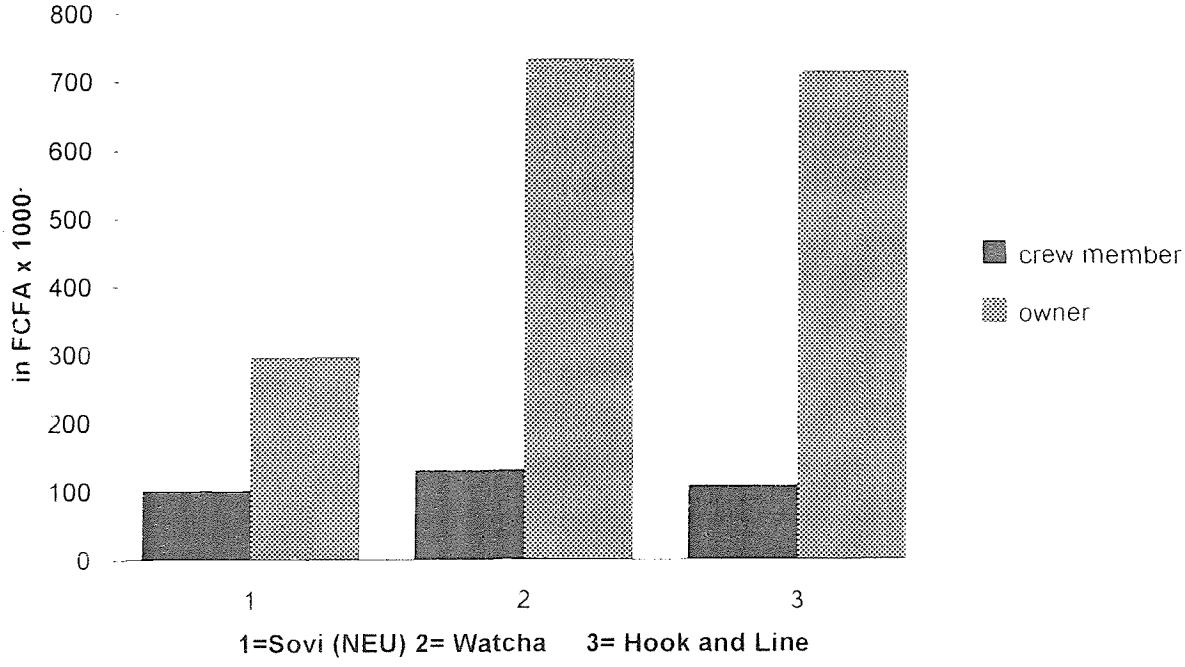
	Sovi	*Watcha*	*Aviondo*	Hook & line
1. Investment costs	381,550	8,724,492	2,639,991	3,625,000
2. Sales	1,034,180 [2]	8,785,980	2,746,550	6,907,287
3. Number of trips/year	225	163	88	51
4. Number of months fishing in Benin	12	12	7	9
5. Common operating Costs	270,000	3,830,500	1,029,600	3,660,000
6. Divisible earnings (DE)	764,180	4,955,480	1,716,900	3,247,287
7. Share crew (40% of DE)	305,789	1,982,192	686,760	1,298,915
8. Share owner	458,508	2,973,288	1,030,140	1,958,139
9. Depreciation costs and repairs	162,207	2,240,937	1,099,858	1,245,000
10. Net profit of owner	296,301	732,351	-69,718	713,139
11. Crew size	3	15	8	12
12. Net income of fisherman	102,000	131,553	85,845	108,243
13 Returns on investment in % (10:1 x 100%)	**77%**	**8%**		**20%**

The net profit from capital of the owners is much lower than the share of the crew. The *sovi* owners are an exception. This means that labour is better remunerated than capital for the *aviondo, watcha* and hook & line mentioned fishing economic units.

The earnings of the crew members depends on the catch, the common operationg costs and on the agreements of the share of the earnings between owner and crew. Concerning a financial analysis of the boat owner, wages are cost for the owner. The wages of crew members of the different fishing economic unit are shown in table 14. A crew member of a *watcha* fishing economic unit earned roughly 130,000 FCFA in 1994. An *aviondo* crew member got 85,000 FCFA for a seven months fishing period. Hook & line crew members earned more than the mentioned 110,000 FCFA because they also fish, above the 9 months of operating in Benin, outside Beninese territorial waters.

Graphic 3 gives the earnings of owners and crewmembers for the different FEU's.

Graphic 3:



8.2 Return on investment

A common measure of the private profitability is the return on investment which is calculated by dividing the net profit of owner by his capital investment per unit. The return on investment of the different fishing economic units is shown in table 14. The rate is very is low for the *watcha* owners (8%) because of high investment costs and even negative for *aviondo* owners because of the relatively high depreciation costs. The opportunity cost of capital is in this report defined as a certain percentage of the present value of the capital investment which an owner could have earned if he had the money on a savings account at a bank. In Cotonou, the interest rate of a savings account is 5%. In this case the opportunity cost of capital for *watcha* owners is lower than his return on capital investment. The rate of net return on investment is high for *sovi* owners (77%) and reasonable (20%) for hook & line owners.

8.3 Distribution of income

Income from sales can be global divided into 4 parts: a.) common operating costs, b.) fixed costs including maintenance and repair, c.) share of crew in the divisible earnings and d.) net profit of owners from capital. The figures for these four categories are given in in percentages of the sales in table 15.

Table 15: Incomes as Percentages of sales in 1994

	Sovi	Watcha	Aviondo	Hook & Ligne
Sales	100%	100%	100%	100%
Share to crew	30%	23%	25%	19%
Profit to owner	29%	8%	- 4%	10%
Common operational costs	26%	44%	38%	53%
Depreciation and R&M	15%	25%	41%	18%

Except for *sovi* units, the common operational costs consume the greatest part of the income from sales, namely 38% for *aviondo* units, 44% for *watcha* units and 53% for hook & line units. Approximately 70%of the income from sales is used to common and fixed costs. The remaining 30% is used for labour costs for crew and for remuneration of capital. The share of net profit from capital is the smallest part of the income from sales and is even negative for *aviondo* owners.

From the data collected during the study it is possible to make a extrapolation to get an idea of total landings, sales, incomes, employment and profit for four different fishing units at Cotonou harbour. The data is shown in table 16. The four types of fishing unit are responsible for 2,200 tons of fish landed in Cotonou, for employment of 937 crew members who are earning together more than 100 million FCFA/year, for a total profit of 50 million FCFA/year for equipment owners and for sales with a value of apprixmately 450 million FCFA/year.

Table 16: Extrapolation of some data for four different type of fishing units at Cotonou harbour in 1994.

	Sovi	*Watcha*	*Aviondo*	Hook & Line	Total
Number of units at C. harbour	91	24	20	12	147
Investment	34,721,050	209,387,808	52,799,820	43,500,000	340,408,678
Landings in kg	934,934	960,384	229,060	94,632	2,219,010
Sales	94,110,380	210,863,520	54,931,000	82,887,444	442,792,344
Profit to Owners	26,963,391	17,576,424		8,557,668	53,097,483
Income crew	27,846,000	47,359,080	13,735,200	15,586,992	104,527,272
Employment	273	360	160	144	937

9. RECOMMENDATIONS

Considerations of cost, time and manageability have indicated that 63 fishing economic units for the fixed costs survey and only 14 units for the variable, landings and fish prices survey have been selected at the Cotonou harbour. The selected units had similar investment cost and landings. The identification of the dominant gear types was based on the availability of craft-gear combinations at Cotonou harbour in September 1993. Some gear types like *nifan-nifan* net and *ali foussa* are not represented because these gear types were not operated in that time of identification. The "intra-harbour consistency" of fishing economic units should be improved by preparing a list of fishing economic units which operate at least one month from Cotonou harbour. The list should indicate gear types used per month by the units operating from Cotonou. This means that the migration pattern of the Ghanaian groups and the different fishing seasons should be known of all the units operating from Cotonou.

The sheets used for the registration of the landings and fish prices should indicate the dominant gear type and the gear type operated at the day of registration. For example, Beninese watcha owners also possess *ali dahassa* operated during herring season. Ghanaian *aviondo* units also operate *tohounga.*

The same fishing economic unit should be monitored. In some cases owners have two units operating the same gear type. The fishery monitor should be aware that the owner can mix the data on landings for these units in case the monitor could not observe the landings because the canoe returned late in the evening.

Fishermen have the intention to say that they went out because it is not nice to say that they stayed ashore. Some units only go out for three hours with hardly any costs to fish for own consumption. This is more or less a leisure activity and not a fishing operation. These leisure trips are recorded as going out to sea. The days should be classified into three groups: staying ashore, going out for fishing and leisure activity.

It is recommended that a cost and earnings study should be continued by the Centre National Océanographie (CNO) with logistical assistance from IDAF and with assistance from Department of Fisheries (DOF). The data collected should be processed and analysed at CNO. A monthly monitoring report on catches and fish prices of selected units at Cotonou harbour should be sent to Fisheries Department and to IDAF headquarters.

To calculate the fixed costs it is not necessary to ask the present replacement value of an outboard engine, a canoe or of a bale of net. This information should be obtained from shops, markets and constructors. For the remuneration to capital it is important to identify the real owner and the origin of funds with its lending conditions. Depreciation and interest charges are fixed costs borne by the owner of equipment.

The selected owners should benefit from a cost and earnings study. They are not interested and motivated to supply data if they do not see how it can improve their situation. At least they should be supplied with a booklet of daily report sheets which consists of a simple list of daily expenses, landings, fish prices and earnings. This means that for each gear-craft combination a few FEU's should be selected so that it is possible to discuss with all selected

FEU's their monthly financial results. Because of time limitations only 2 FEU's have benefitted from this study at Cotonou port. An other option is to explain only to a few fishing units the results and to increase the sample size of CES to the size of the Catch Assessment Survey which is possible when the data sheet includes questions on costs, fish prices and crew size and when a trained monitor with a computer is available to process the data of the fishing units, interviewed two/three times a week. An example of a daily data sheet is given in annex 8.

The relationship pattern of fishermen with their wives as fish mongers should be known. It is interesting to know how the cash flows from production and marketing are allocated within the fishing household. A fishing household survey should give relevant data on the mobilization of profits (economic surplus).

The registration of fish prices is not well-developed in Benin. Producer's price are known but the price of selling by the wife of the fisherman, wholesaler's price and retail price are not recorded. These prices, smoked, frozen and fresh) should be weekly recorded by CNO at the fish markets at port and Dantokpa. A standardization of the traded quantities of fish does not exist and makes it a little bit difficult to calculate prices in kilo. To weigh the catch of the monitored fishing units is time consuming but gives the most accurate figures.

ANNEX 1: Questionnaire Cost and earnings for fishing units

1. Information fondamentale de propriétaire et sur la pêche

1a. CODE PÊCHEUR	
1b. PRINCIPAL ENGIN DE PÊCHE	
1c. NUMERO D' ENQUETE	
1d. DATE D' ENQUETE	
1e. NOM DE L'ENQUÊTEUR	
NOM DE LA PIROQUE	
1f. NATIONALITE	
1g. TRIBU/ETHNIE	
1h. ÀGE	
1i. SITUATION DE FAMILLE	
1j. NOMBRE DE FAMILLE	
1k. NIVEAU D' EDUCATION	
1l. RELIGION	
1m. PÊCHEUR DEPUIS COMBIEN D'ANNEES	
1n. ANCIEN TRAVAIL	
1o. TRAVAIL SUPPLEMENTAIRE	
1p. GENRE D'ENTREPRISE	
1q. COMBIEN d'HEURES EN MER PAR SORTIE?	
1r. COMBIEN DE MILES NAUTIQUES FAITES-VOUS POUR ARRIVER à VOTRE LIEU DE PECHE?	
1s. PROFONDEUR D'EAU à VOTRE LIEU DE PECHE	
1t. COMBIEN DE MOIS PAR AN RESTEZ-VOUS à COTONOU	

2- 7. Coûts fixes annuels

COQUE D'EMBARCATION	
2a. Type	
2b. Longeur en metres	
2c. Largeur en mètres	
2d. Coûts de remplacement actuel en FCFA	
2e. Lieu d'achat	
2f. Nombre d'années d'utilisation	
2g. Origine des fonds	
2h. Amortissement en FCFA	

MOTEUR	
2i. Marque	.
2j. Puissance en CV	. .
2k. Sorte de carburant	.
2l. Coûts de remplacement actuels en FCFA	. . . . .
2m. Lieu d'achat	.
2n. Nombre d'années d'utilisation	.
2o. Origine des fonds	.
2p. Amortissement en FCFA	. . . . .
RAMES	
2q. Nombre	. .
2r. Coûts de remplacement actuels en FCFA	. . . . .
2s. Lieu d'achat	.
2t. Nombre d'années d'utilisation	.
2u. Origine des fonds	.
2v. Amortissement en FCFA	. . . . .
VOILE	
2w. Matériel	.
2x. Coûts de remplacement en FCFA	. . . .
2y. Lieu d'achat	.
2z. Nombre d'années d'utilisation	.
3a. Origine des fonds	.
3b. Amortissement en FCFA	. . . .
ANCRE	
3c. Coûts de remplacement	. . . .
3d. Nombre d'années d'utilisation	. .
3e. Lieu d'achat	.
3f. Origine des fonds	
3g. Amortissement en FCFA	.
COMPARTIMENT à GLACE	
3h. Matériel	.
3i. Capacité en litres	. .
3j. Coûts de remplacement en FCFA	. . . . .
3k. Lieu d'achat	.
3l. Nombre d'années d'utilisation	. .
3m. Origine des fonds	.

3n. Amortissement en FCFA	. . . . .
LAMPE	
3o. Combien de lamps utilisés	. .
3p. Coûts de remplacement en FCFA	. . . .
3r. Lieu d'achat	.
3s. Nombre d'années d'utilisation	. .
3t. Origine des fonds	.
3u. Amortissement en FCFA	. . . .
FLOTTEUR	
3v. Nombre	.
3w. Coûts de remplacement en FCFA	. . . .
3x. Lieu d'achat	.
3y. Origine des fonds	.
3z. Nombre d' années d'utilisation	. .
4a. Amortissement	. . . .
4b. AUTRE COÛTS ANNUELS	. . .
7d. COÛTS FIXES ANNUELS TOTAUX en FCFA	. . . . .

10. Coûts variables 1 (reparation et entretien pour ce mois)

Sorte d'équipment	Coûts en FCFA
coque d'embarcation(inclus peinture et main d'oeuvres de menusier)	10a . . . . .
moteur	10b . . . . .
filet (matériel)	10c . . . .
Compartiment à glace	10d . . . .
Autre	10e . . . .
	10f

:IN PRICIPAL

pe	longeur en mètres	profondeur en mètre	maillage en metrès	coûts de remplace-ment en FCFA	lieu d'achat	nombre d'années d' utilisation	origine des fonds	amortissementt
Watcha	4d	4e	4f	4g	4h	4i	4j	4k
Tohunga	4m	4n	4o	4p	4q	4r	4s	4t
Sovi	4v	4w	4x	4y	4z	5a	5b	5c
Filet rdinelle ussa	5e	5f	5g	5h	5i	5j	5k	5l
n Filet rdinelle ahassa	5n	5o	5p	5q	5r	5s	5t	5u
Filet Avion	5w	5x	5y	5z	6a	6b	6c	6d
Filet à equin	6f	6g	6h	6i	6j	6k	6l	6m
mbination Tohunga et et à renquin	6o	6p	6q	6r	6s	6t	6u	6v
La Ligne à ain		6x		6y	6z	7a	7b	7c

11 Coûts variables 2 (coûts de production par sortie en mer pour ce mois)

Coûts	Combien utilisé ce mois (litres ou unités)	prix de litre ou unité	valeur en FCFA
Essence pour moteur	11a	11b . . .	11c . . . . .
Huile pour moteur	11d . . .	11e . . .	11f . . . . .
Nourriture			11g . . . .
Blocs de glace ou boîte de glace	11h . . .	11i . . .	11j . . . . .
Kerosene pour les lampes	11k . . .	11l . . .	11m . . . . .
Appat	11n	11o . . .	11p . . . . .
Autre	11q	11r	11s
Equipage			11t cash et en nature . . . . .
Louer de piroque			11u . . . .

ANNEX 2: Catch assessment sheet

NOM PECHEUR: CODE PECHEUR: MOIS:
TYPE D'ENGIN: SORTIES EN MER:

DATE	ESPECES	UNITE D`ENCH.	NOMBRE	POIDS TOTAL EN KILC	PRICE DU KILO	VALEUR EN FCFA

ANNEX 3: Average landings and sale's income for *sovi* units (n=4) in January-December 1994

	Number of trips	Average landings in kg/trip	Sale's income/trip in FCFA	Av. total landings in kg	Av. total sale's income in FCFA	Average price per kilo
January	17	66	4,855	1,125	82,535	73
February	15	37	3,320	555	49,800	90
March	18	42	4,225	756	76,050	101
April	21	41	4,155	861	87,255	101
May	18	26	2,300	468	41,400	88
June	19	62	9,500	1,178	180,500	153
July	18	37	5,570	666	100,260	151
August	20	43	3,825	860	76,500	89
September	17	36	3,350	612	56,700	93
October	21	41	3,538	861	74,298	86
November	21	52	5,192	1,092	109,032	100
December	20	62	4,980	1,240	99,600	80
Total	225			10,274	1034,180	101

ANNEX 4: Average landings and sale's income for Hook & Line units (n=4) in January - December 1994

	Number of trips	Average landings in kg/trip	Sale's income/trip in FCFA	Av. total landings in kg	Av. total sale's income in FCFA	Average price per kilo
January	5	129	65,016	645	325,080	504
February	4 *	160	111,000	320	222,000	694
March	4 *	159	143,563	636	574,252	903
April	5	137	135,511	685	677,555	987
May	6	172	138,500	1,032	831,000	805
June	5	157	132,000	785	660,000	844
July	6	163	147,900	978	887,400	907
August	5	141	130,200	705	651,000	923
September	went to Ghana	for festivals				
October	" " "	" "				
November	6	170	186,000	1,020	1,116,000	1,094
December	5	216	192,615	1,080	963,000	892
Total	51			7,886	6,907,286	876

* In February and March each fishing unit made 4 trips to Nigeria. One trip lasts four days

ANNEX 5: Average landings and sale's income for *watcha* units (n=4) in January-December 1994

	Number of trips	Average landings in kg/trip	Sale's income/trip in FCFA	Av. total landings in kg	Av. total sale's income in FCFA	Average price per kilo
January	15	760*	171,329	11,400	2,569,929	225
February	9	319*	59,650	2,871	369,000	129
March	17	135	22,500	2,295	382,500	167
April	14	220	61,710	3,080	863,940	280
May	11	158	23,125	1,738	254,375	146
June	12	102	22,128	1,224	265,536	217
July	16	110	29,400	1,760	470,400	267
August	17	242	61,400	4,114	1,043,800	254
September	8	160	31,500	1,280	252,000	197
October	16	173	33,000	2,768	528,000	191
November	13	172	30,000	2,236	390,000	174
December	15	350*	93,100	5,250	1,396,500	266
Total	163*			40,016	8,785,980	220

* using *dahassa* nets

ANNEX 6: Average landings and sale's income for *Aviondo* units (n=2) in January-December 1994.

	Number of trips	Average landings in kg/trip	Sale's income/trip in FCFA	Av. total landings in kg	Av. total sale's income in FCFA	Average price per kilo
January	12	238	23,860	2,865	286,320	100
February	12	155	19,255	1,860	231,000	124
March -August	went to Ghana					
September	16	83	22,600	1,328	361,600	272
October	15	75	45,842	1,125	687,630	614*
November	17	117	31,770	1,989	540,000	272
December	16	143	40,000	2,286	640,000	280
Total	88			11,453	2,746,550	240

ANNEX 7: Fish prices for 1993 and 1994 at the fishing harbour market.

Noms	Prix in FCFA/Kilo	
	1993	1994
Gros bars **	425 - 700	900 - 1000
Bars moyens**	325 - 600	850 - 900
Petits bars**	275 - 300	750 - 800
Bars fritures**	240 - 250	400
Daurades roses*	520 - 700	1000
Daurades grises*	400 - 600	900
Carpes grises*	400 - 520	1000
Pageot fritures*	300 - 400	750
Gros mérous*	450 - 520	1000
Petits mérous*	520 - 700	1100
Grosses sôles	200 - 700	900
Petites sôles**	300	800
Gros faux capitaines**	260 - 400	600
Petits faux capitaines**	240 - 300	450 - 500
Grosses carengues	400 - 500	700
Petits carengues	200 - 350	600
Gros congres*	250	450
Petits congre*	250	400
Vrais guinées	250	400
Faux guinées	250	400
Gros plaplas	300 - 400	750 - 800
Petits plaplas	300 - 350	700 - 750
Disques St. Pierre**	400 - 500	600 - 700
Disques ordinaires**	200 - 250	350 - 400
Maquereau**	200 - 250	400 - 500
Raies ordinaires	150 - 200	200 - 250
Gros machoirons*	250 - 400	450 - 500
Petits machoirons*	175 - 250	400 - 450
Petis brochets	250 - 350	500 - 600
Petits requins**	300 - 400	400 - 500
Fritures à barbes**	250 - 300	400 - 450
Ethmalosa**	180 - 250	225 - 250
Ceintures**	120 - 180	150 - 200
Menu fretin	130 - 200	150 - 250
Lottes traités*	300 - 500	450 - 600
Chinchard*	200	200 - 300
Friture à écaille**	200	200 - 350
Raies éperviers*	250 - 300	400 - 500
Grosses raie ordinaires*	300	300 - 450
Gros brochet*	500 - 600	800 - 1000

* species caught by lines and shark nets
** most popular caught species in Benin

Source: Fishmamas at the Cotonou fishing harbour, interviewed in November1993 and in November1994

ANNEX 8: Data sheet for monitoring the cost and earnings of fishing economic units.

DAILY REPORT SHEET

TYPE AND QUANTITY OF GEAR USED: _____

DATE/TIME OUT: _____ DATE/TIME IN: _____

BEACH OR PORT: _____

CREW SIZE: Fishermen: _____ Apprentices: _____

EXPENSES:	Quantity:	Price/Unity*:	Total expenses:	Specify:
Fuel	_____	_____	_____	
Oil	_____	_____	_____	
Chop			_____	
Bait			_____	
Twine/hooks, etc...			_____	_____
Spare parts/ repairs			_____	_____
Other			_____	_____

INCOME :	Quantity of fish sold**	Price/Unity	Total value	Species
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____

Grd Total _____ = _____

* Liter or gallon. Specify!
** Cartons, crates, bassins, kilos or pieces. Specify!

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