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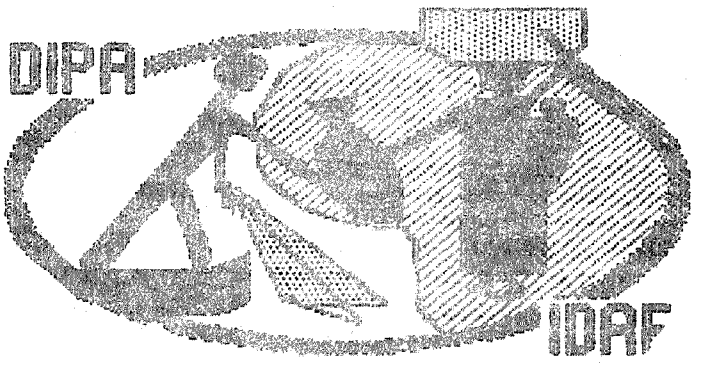

F A O / D A N I D A / N O R W A Y

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DEVELOPMENT PLANNING FOR SMALL-SCALE FISHERIES IN WEST AFRICA : PRACTICAL TECHNICAL AND SOCIO-ECONOMIC ASPECTS OF FISH PRODUCTION AND PROCESSING

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Development of Artisanal
Fisheries in West Africa
GCP/RAF/192/DEN-GCP/RAF/198/DEN
GCP/RAF/197/NOR

With financial assistance from Denmark and Norway, and in collaboration with the Peoples Republic of Benin, the Fisheries Department of FAO is implementing in West Africa a programme of small scale fisheries development, commonly called the IDAF Project. This programme is based upon an integrated approach, involving production, processing and marketing of fish, and related activities ; it also involves, in particular, an active and full participation of the target fishing communities.

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1. GENERAL CONTEXT OF SMALL-SCALE FISHERIES

The advent of the new international Law of the Sea, which extended the EEZ 200 miles from the coast, has reawakened general interest in the development of small-scale fisheries, particularly among the countries of West Africa. These countries have seen in the new Law a chance to exploit available fishery resources with national fleets, in response to a basic governmental policy objective, as stated by all countries of the region, affirming their determination to achieve food self-sufficiency. This issue has become a major concern in Africa - where famine is becoming endemic - the population having more than doubled over the last 20 years. It will double again by the year 2000 because the rate of population growth is still very high.

It is quite natural for West Africa coastal countries to look to the sea to meet their animal protein requirements. In addition, the other possible sources of animal protein (small and large scale livestock production) are now grappling with weather, health, and nutrition problems, and therefore offer little hope for rapid development. The general consumer trend is to eat fewer products of animal origin, as these become increasingly scarce. This being the situation, almost all countries of West Africa are basing their fisheries development policies on the following general principles:

(i) increase the production of fish and other marine resources to meet the local demand for cheap proteins ; thus achieve food self-sufficiency.

(ii) raise the living standards of fisherfolk : modernize the small-scale fisheries industry by wider use of motorized canoes and improved catch techniques.

(iii) right the unfavourable balance of payments : export high-value luxury fish and crustaceans, thus ensuring a good inflow of strong currencies.

(iv) set up the necessary infrastructures.

But it is not an easy thing to move from the expression of a lolicy to practical effective action ; the parameters to be taken into consideration are highly complex. From the socio-economic standpoint, a major parameter is to establish the boundary between small-scale and industrial fisheries, and where conflicts of

interest arise when these two fisheries are competing for the same fishing grounds. The classic example is shrimp trawling and fishing for numerous high-value deepwater fish species over sandy mud and seashell sand bottoms over the shelf, such stocks being concentrated between 5 and 30 isobaths, the problem is that the same fishing grounds are the favourite territory of the traditional small-scale fisheries sector.

For reasons of simplicity, rapidity and urgency in food security, the dynamic, immediate highyield, industrial fisheries sector wins priority over the improved small-scale fisheries, which, though often the topic of political sermons, are much slower to take off. But both solutions will always conflict directly with the small-scale canoe fishery. From the social standpoint, a compromise solution must be found which can offer the directly affected small-scale fishermen another alternative, such as access to line fishing and crustaceans such as crab or rock lobster over rocky bottoms unsuitable for trawling. Another possibility for this sector is to fish the small pelagic species associated with the continental shelf.

All in all, since the technical and economic boom of the fifties (during which the use of nylon gear became common) and the sixties (when outboard motors for canoes came into widespread use), small-scale fisheries have made little progress of note. The exceptions are countries such as Senegal and Ghana where the introduction of the purse seine for sardinella was a major step forward. However, the investment and operating costs for this technique are high. It is only economically viable where stocks are particularly abundand. Both Ghana and Nigeria have developed an improved small-scale trawl fishery (9-13 m craft), but the industry is now tottering due to lack of equipment and maintenance. Excepting these two instances, small-scale fisheries can be described as going through a stagnant period when, in theory, the sector should be in full expansion. There are a number of explanations for this situation but we will mention only those which bear most directly on the small-scale fisheries context.

1.1 The small-scale fisherman and his environment

Field staff are well aware that the small-scale fisherman is nearly always, for a number of reasons, short of money :

- the highly specialized nature of the marine fisherman's work (the fisherman/canoe/gear economic unit of production). He usually proactises a single fishing technique

directly connected to his social status, i.e., his technical and economic capacities. There is a well established hierarchy among small-scale fishermen.

- restricted as he is to one fishing technique, the small-scale fisherman is often dependent on a very short fishing season. This is further compounded by the random nature of a fishery in which violent winds in the dry season, hurricanes in the rainy season, and the luck of the sea (such as a few trips so unsoccessful as not to even pay for the fuel ; capsizing at the wrong time entailing heavy repair costs for the canoe and the motor - for which parts are often hard to find - and so forth). Other problems are the initial funds needed at the start of the fishing season, which always seem to be borrowed as the fisherman is completely broke during the closed season, and which cannot be paie back. So the fisherman again has to go into debt, running the same risks every year, and consequently his financial situation is permanently precarious.

- when by chance the fishing goes well, he has no assurance that he will be able to sell his catch at a fair price which pay him for his trouble, as everything here depends on the market potential. Fish may be plentiful so prices drop. Fishmongers may fail to appear when the catch is landed and the fisherman must then process his fish, often by drying and smoking, for later sale.

- in addition to this, when the traditional fisherman has made a sale, the proceeds tend to be frittered away in prestige purchases, or frequently for drink. The rate of alcoholism among these still illiterate people is particularly high. The fisherman's behaviour is a direct consequence of the instability and insecurity of the rough life he leads.

- This way of life, typical of small-scale fishing communities, is economically dependent either on the family (the women process and sell the fish) or on people outside the family circle, such as regular fishmongers (who generally agree to "advances on production"), or well-off local merchants or private individuals who lend money to finance the purchase or renovation of the canoe, motor and gear. These loans are paid back out of shares of the catch after each fishing trip.

Need we add that most traditional fishermen today still live in marginal coastal fishing communities, isolated if not actually enclaves. Only rarely do they have access to such items of social progress as education, hygiene, health, communications and so forth. They are

accordingly considerably behind with respect to the evolution of the more land-oriented rural sector. Government initiatives are greeted with great suspicion and reticence by these closed-in fishing communities. This is why it is so difficult to earn the trust of this social milieu, and why successful actions require such a long consolidation period (5-10 years) to achieve a positive and lasting impact.

Thus the small-scale fisherman within his immediate environment. Planners will have to take into account this specific socio-economic context if they wish to do useful work in an approach targeted at promoting the development and improving the existing structures of the small-scale sector. On this point, the official trend up to now has been to modernize the sector through the introduction of "imported" systems which are heavy, rigid and constricting, which upset the socio-economic links within the milieu and sow confusion, and which at the same time fail to provide the "services and connections" provided by the established, traditional system.

1.2 Access to resources

Over the last 30 years, intensive and rather anarchical industrial fisheries have developed nearly everywhere in the world. Demersal and pelagic stocks have been overfished. Marine fisheries production in West Africa soared from 300 000 tons in 1950 to 3 000 000 tons in 1980. For some years now, however, the unmistakable signs of overfishing are backed up by a general dwindling of the catch, despite a continual increase in effort. In most West African ports now, one can see vessels which no longer pay for their keep, rusting in the docks, inactive, in confirmation of this sad fact.

In fact, the countries of the region have inherited a critical situation just at a time where the new Law of the Sea seemed destined to offer them a vast opportunity to expand. In actual fact, most if not all of these countries are ill-prepared, technically, financially and phisically to handle thise new prospects straight off.

In practice, the more appropriate thing would be for the governments responsible to take adequate measures for resource management, limit the industrial fisheries effort, and take steps to rationalize the small-scale fisheries sector. Considering the various interests at stake, such political and administrative measures are always highly complex.

Government policy options in the industrial fisheries sector are, however, only partially responsible

for this situation, given the technical capabilities of the small-scale fisheries sector here and now. There are obvious reasons why industrial fisheries need to be maintained, but there is also a need to enact and enforce measures to protect small-scale fisheries. Industrial vessels, for example, such as trawlers and purse seiners should be relegated to the offshore area and coastal fisheries be reserved for canoes and improved small-scale fishing. Planners should take these elements into account.

1.3 Foreign aid

In most cases, international, technical and financial aid to small-scale fisheries has been poorly utilized. So far, the main feature has been unprofitable over-investment. Many countries of West Africa have been provided with grandiose centres for the development of small-scale fisheries which include ice factories, cold storage rooms, landing piers, individual storage sheds for fishermen, refrigerated vehicles, storage for gear and tackle, fish processing facilities, machine shops, administrative and management offices, and so forth.

In the main, these infrastructures have proven far in excess of the real needs of small-scale fisheries and their technical capacity for production. They are, in fact, "prestige" investments, (often desired by donors or money-lenders), which governments are reluctant to refuse. Once they become operational, however, it is soon noted that these infrastructures far exceed the technical and economic capacity for absorption of small-scale fisheries. They are operating far below their profitability thresholds and can only be maintained in operation by continuous and heavy subsidies, usually far in excess of what governments can afford. The only alternative is then to abandon the installations, which is what usually happens, or to request external aid on a continuing basis.

There have been far too many repetition of this kind of intervention ; the recipient countries fall into the habit of having everything given to them. In the final analysis, this kind of aid behaviour has only succeeded in developing a welfare mentality among the governments and small-scale fishermen alike.

During the four years from 1978 to 1981, aid to small-scale fisheries in West Africa rose to US $ 180 000 000. The current rate of foreign interventions holds steady at roughly US $ 50 000 000 per year, as can be seen in the table.

Planners still have a great deal to do in the small-scale fisheries sector in terms of drawing up more balanced, realistic and pragmatic plans, corresponding to the real needs of the small-scale fisheries sector.

Table 1

SOME EXAMPLES OF FOREIGN AID IN WEST AFRICA

BENIN :	(1979-84)-UNDP: US$ 1 338 000 - IF: US$ 2 912 000 - EEC: 2 746 000 ECU.
CAMEROON :	(1979-85) - USAID: US$ 1 500 000 - CIDA: US$ 7 900 000 - IBRD: US$ 25 000 000 (port) - Bilateral: US$ 2 200 000 - EEC: US$ 2 100 000.
CAPE VERDE :	(1980-85) - UNDP: US$ 1 600 000 - Bilateral: +/- US$ 5 000 000 - EEC: US$ 12 000 000 (Port of Mindelo).
CONGO :	(1984) - UNDP: US$ 550 000 - Bilateral: US$ 18 000 000 (Pointe Noire Port)
EQU. GUINEA :	(1981) - EEC: US$ 1 045 000
GABON :	(1981) - EEC: 2 450 000 ECU (OWENDO Small-scale Fisheries Centre)
GAMBIA :	(1982-83) - UNDP: US$ 1 000 000 - EEC: US$ 3 000 000
GHANA :	(1981) - EEC: US$ 3 600 000 - Bilateral US$ 2 000 000
GUINEA BISSAU :	(1980-85) - EEC: US$ 800 000 - USAID: US$ 500 000 - Swedish bilateral aid: US$ 3 200 000
GUINEA	(1977-85) - ADB: US$ 6 000 000 - EEC: US$ 2 000 000 (Fisheries School) - ADB/ADF: US$ 25 000 000 (Small-scale Fisheries)
IVORY COAST:	(1979-83) - UNDP: US$ 1 700 000 - CCCE: US$ 9 000 000
LIBERIA :	N.A.
MAURITANIA :	(1981-84) - UNDP: US$ 1 462 000 - Bilateral US$ 31 000 000 EEC: 700 000 ECU
NIGERIA :	(1982-83) - UNDP: US$ 2 821 500
SAO TOME & PRINCIPE :	EEC: 500 000 ECU - IFAD: US$ 2 100 000
SENEGAL :	(1978-84) - CIDA: US$ 17 450 000 - Bilateral: US$ 15 000 000 - Banks: US$ 22 000 000 (Industrial Fisheries) - Italy: US$ 12 500 000
SIERRA LEONE :	(1980-83) - GTZ: US$ 2 900 000 - Japan: US$ 2 500 000 - EEC: US$ 900 000
TOGO :	N.A.
ZAIRE :	(1981-84) - UNDP: US$ 1 549 999 (maritime small-scale Fisheries)

Source : FAO

Table 2

TOTAL FOREIGN AID TO THE FISHERIES SECTOR
IN AFRICA IN THOUSANDS OF US$
(exclusive of regional projects)

	1978	1979	1980	1981
. Technical assistance - Total	15.479	24.253	25.537	26.541
. Breakdown - multilateral aid	7.885	11.174	10.757	9.058
EEC	322	539	643	2.143
OPEC	100	108	108	108
. Bilateral aid	7.172	12.432	14.029	15.232
. Total financial assistance	35.017	49.176	54.312	70.458
. Breakdown - multilateral aid	5.748	9.986	9.525	9.425
EEC	1.126	3.259	5.664	5.664
OPEC	2.600	2.600	1.999	1.799
. Bilateral aid	25.543	33.331	37.124	55.369
GRAND TOTAL FOR AFRICA	50.496	73.429	79.849	98.798
Received by West Africa				
. Technical assistance	6.441 1.149 1.321	7.711 1.801 5.197	8.516 1.621 5.738	10.016 1.318 6.254
SUB-TOTAL	8.911	14.709	15.875	17.588
. Financial assistance	17.888 1.460 1.323	27.667 4.347 2.433	29.203 1.969 3.355	25.035 3.518 5.845
SUB-TOTAL	20.671	34.447	34.527	34.398
GRAND TOTAL WEST AFRICA	29.582	49.156	50.402	51.986

Source: FAO.

1.4 Government policy options

1.4.1 Organizing fishermen

Small-scale fisheries are paralysed rather than developed by poorly chosen government policies regarding the organization of traditional canoe fishermen. The usual option is to impose cooperatives by means of unwieldy, authoritarian, restrictive measures and procedures. This near-universal choice has prevailed and perpetuated itself for decades without producing any tangible result of lasting impact. Likewise, all official forms of credit, the access to which is reserved for cooperatives, have proven completely inappropriate to the specific socio-economic context of small-scale fisheries and failed resoundingly everywhere.

Governments have shown a total lack of imagination in this domain, applying imported systems without considering that these imported systems have not worked anywhere in the world except in specific cases involving sheer economic survival on the part of the fishing communities involved. The cooperative movement is not a system which should be imposed, even directly, by political fiat. It can only succeed if it is the product of a spontaneous, grass-roots decision in response to a serious problem confronted by the community. Even now, there are hardly any production cooperatives anywhere but there are a good many service and consumer cooperatives.

In Africa, it seems, the solution lies at the level of the traditional fishing communities, which ought really to be organized as a unit instead of focussing solely on a few isolated elements of these communities, as usually happens with cooperatives.

The best strategy for organizing fishermen is undoubtedly the one used by the Integrated Development Programme for Small-scale Fisheries in West Africa, from which planners would do well to draw inspiration. This new approach is based on a few fundamental principles. One is to enlist the active, permanent participation of small-scale fishing communities in self-development leading to self management. This involves: identification of needs; establishment of priorities; selection of options; decision-making based on the community's technical and socio-economic capacity to absorb; action plan; mobilization of local resources; and execution with the active participation of the assisted community. This gradual training in how to assume responsibilities produces a situation where the communities organized themselves as and when they establish the structures best adapted to their particular context.

1.4.2 Support services for small-scale fisheries: providing equipment

There has been an erosion of the sytems to equip and gear small-scale fisheries, as well as of the basic support services. The main culprits are the oil crisis and the skyrocketing prices it engendered. The limited turnover in the sale of fishing equipment plus rising costs have led private businesses to take fewer risks and cut back on imports. The small-scale fisheries sector, with its limited funds, has tried to find a partial solution to needed equipment replacements on parallel markets benefitting from favourable exchange rates.

In addition, the fundamental facts of the supply issue have been regularly thrown into a false light by substantial donations of fishing equipment and thousands of outboard motors to the countries of the region offered to the governments in support of small-scale fisheries as bilateral or multilateral assistance. This had discouraged the best intentions of private initiative. The governments receiving the fishing equipment have tried to offset the apparent relative gaps in private initiative by setting up their own supply structures from supplies received from donors. These State systems, however, have proven incapable of providing a satisfactory service of this kind. Nowhere has a cash reserve been reconstituted, thus making it possible to replace equipment. Chapter 2.3 below suggests a compromise solution, which appears the best choice at hand.

1.4.3 Field services for small-scale fisheries

The general tendency to concentrate services heavily in the capital cities under the Departments of Fisheries or Fisheries Services and skimp on technical field services (by definition highly decentralized) has virtually cut off all dialogue between the Fisheries Administrations and the small-scale fishing communities, most of which remain isolated and abandoned to their own devices.

The lack of field logistical and technical support is unquestionably one of the main causes of the failure of most small-scale fisheries development projects which do not receive adequate follow-up.

The best way to fill this gap is to set up fishery development units made up of experienced practising technical people living in the field on a permanent basis among the communities they serve. This would include fisheries technologists, engine specialists, carpenters, fish technologies, experts in women's activities, and so forth. Planners should note that what is being suggested here is a "technical" and not an "administrative" decentralization of the Departments of Fisheries.

1.5 Conclusion

The general marine fisheries situation described is not catastrophic, but it does require the greatest attention from the governments involved. A firm fisheries resource management and administration policy implies the right measures in the industrial fisheries sector and in the small-scale fisheries sector.

Certainly, one of the major regional problems is the collapse of the Sardinella stocks and their replacement by a substantial increase in Balistes (several million tons) unutilized because unfamiliar to the great mass of the African people. Marine fisheries can only be rationalized by the implementation of global sectorial, long-term master plans for development. This is the only kind of plan which can ensure continuity in government resource management and administration policies. Such master plans would also make for better orientation and coordination and more effective use of foreign aid.

In practical terms, the development of small-scale fisheries is contingent upon good technical field services. These in turn require heavily decentralized Departments of Fisheries. Development also means setting up the necessary support services and structures at all stages of the harvesting/processing/marketing process.

2. PRESENT STATUS OF SMALL-SCALE FISHERIES: PLANNING REQUIREMENTS

Table 3 lists the best presently available information on the small-scale fisheries fleet and yields in West Africa. The data prompted the following comments:

- with the exception of Cape Verde (which has the most exact data), Benin, Ghana and Senegal, apparently no other country of the region has undertaken a frame survey for many years. The frame surveys which do exist are not at all complete.

- the number of canoes and fishermen is usually taken from the older estimates and there may have been substantial changes.

- no country in the region has been able to set up or maintain a statistical monitoring and control of fishing effort. Monitors are not followed up, and the yield figures put forth are quite untrustworthy. The countries of the region normally make no distinction between canoe fishing and improved small-scale fisheries (small trawlers and purse seiners). Or they count marine fisheries together with lagoon fisheries and the upshot is that confusion is more prevalent than clarity. Obviously, this is a very awkward situation for planners.

Be that as it may, even these inexact statistics do provide a relative order of magnitude concerning the equipment and support services essential to operations in the small-scale sector. As one indication, the planner can drew on the following regional estimates:

- the working life of a canoe (5 to 10 years) means that approximately 5 000 to 7 500 new canoes are needed each year.

- the average working life of an outboard motor rarely exceeds three years and so about 5 000 to 6 000 motors need to be replaced every year, including full sets of spare parts.

- assuming a maximum working life of 4 to 5 fives for fishing gear, i.e., annual replacement of 20 to 25 percent of the netting, 10 000 new gear with all accessories, exclusive of fishing lines and hooks, would be necessary.

TABLE 3

SITUATION OF THE SMALL-SCALE FISHERIES CANOE FLEET IN WEST AFRICA IN 1985

Country	Total number of canoes (*1)	Rate of motorization	Number of fishermen (*1)	(*2) Estimated yield in tons Source RAF/192/DEN	Source CECAF
Mauritania	300 - 400	50%	1 750	3 000 - 4 000	21 000
Senegal	8 256	60%	40 500	90 000 - 120 000	194 000
Gambia	1 204	30%	2 800	11 000	11 000
Cape Verde	1 173	30%	2 306	5 300	8 000
Guinea-Bissau	(50)650?	25%	3 000	1 000	1 000
Guinea	1 700	20%	5 000	15 000	18 000
Sierra Leone	7 090	10%	17 965	32 500	32 300
Liberia	1 020	20%	4 200	5 000	5 000
Ivory Coast	2 800	-	10 000	15 000	21 000
Ghana	8 500	50%	40 000	50 000 - 90 000	142 000
Togo	462	70%	3 000	4 000	5 000
Benin	350 - 450	50%	2 595	2 000 - 3 000	4 000
Nigeria	10 000	-	50 000	50 000	95 000
Cameroon	4 450	-	15 000	20 000	20 000
Sao Tome and Principe	(1 400)?	-	1 500	1 500	1 500
Equatorial Guinea	-	-	-	-	-
Gabon	1 150	-	4 000	5 000	5 000
Congo	460	25%	2 000	6 000	6 500
Zaire	200	-	-	2 000	2 000
	+/-50 000		+/-200 000	+/-350 000	592 000

(*1) Only Cape Verde has conducted a recent census of all vessels and fishermen

(*2) No country of the region has a valid monitoring and control system for fishing effort
- the CECAF figures reflect official yield statistics submitted to FAO by countries
- the figures submitted by RAF/191/DEN are backed by more realistic yield estimated and experience, and are related to canoe size: 6-7 m = 1 to 2 t: 9-12 m = 3 - 5 t: 13-15 m = 7 - 15t

TABLE 4

TRENDS IN THE SMALL-SCALE CANOE FISHERY IN WEST AFRICA 1965-1985

Country	Estimated Number of Canoes				Estimated Yield in Tons			
	1965	1975	1980	1985	1965	1975	1980	1985
Mauritius	100	300	300	300-400	800	7 000	21 000	3 000- 4 000
Senegal (*2)	5 118	6 100	4 104	8 526	83 300	150 000	194 000	90 000-120 000
Gambia	241	350	1 044	1 204	3 200	8 000	11 000	11 000
Cape Verde	-	800	980	1 173	-	7 000	8 000	5 300
Guinea Bissau	-	300	(50)650	(50)650	-	5 000	1 000	1 000
Guinea	1 300	1 300	1 700	1 700	4 000	7 000	18 000	15 000
Sierra Leone (*3)	2 264	6 287	3 000	7 090	18 000	62 000*	32 500	32 500
Liberia (*4)	1 700	3 000	800	1 020	5 000	20 000*	5 000	5 000
Ivory Coast	2 124	2 800	3 000	2 800	15 000	24 000	21 000	15 000
Ghana	10 212	8 238	7 000	8 500	43 200	154 300	142 000	50 000- 90 000
Togo	463	603	235	462	4 000	9 400	5 000	4 000
Benin	566	500	339	350-450	3 500	3 000	4 000	2 000- 3 000
Nigeria (*1)	10 000	69 627/*	...		32 000/	293 900*	...	...
	-	(10 000)	10 000	10 000		(45 000)	95 000	50 000
Cameroon	4 445	5 900	3 500	4 450	15 400	34 000	20 000	20 000
Gabon	850	600	1 150	1 150	1 000	2 600	5 000	5 000
Sao Tome and Principe	-	-	(1 400)	(1 400)	-	-	1 500	1 500
Equatorial Guinea	-	-	-	-	-	-	-	-
Congo	460	500	600	460	1 700	3 700	6 500	6 000
Zaire	200	200	-	200	200	2 000	...	2 000
Total	+/-40 000	+/-104 000 45 000	+/-40 000	+/-50 000	+/-230 000	+/-790 000	+/-590 000	+/-350 000

(*1) Nigeria 1975 - Abherrant figures, canoes and yields also include dozens of little 3-6 m canoes fishing in lagoons and estuaries.

(*2) Senegal - 1975 and 1980 yield including canoe yield plus advanced small-scale fisheries (purse seiners and small trawlers)

(*3) Sierra Leone - 1975 yield - abherrant figure Sources: 1965 - Haling Report FAO, 1975-80 - CECAF, 1985 - RAF/192/DEN

(*5) 1985 estimate brought down to the standards for canoes according to size.

N.B. 1965 estimates highly realistic, 1985 numbers of canoes increased by 20%, yield by 50%

While it is relatively easy to evaluate the overall equipment requirements of the region, parcelling them out and distributing them along 9 000 to 10 000 km of coastline (the Cape Verde Islands alone have 3 000 km of coastline), shared by 19 countries, 12 with a different and non-convertible monetary system, raises every possible kind of problem. This is why it is so hard to supply these fishing communities with the necessary equipment.

Table 5

SOME DETAILS OF THE CANOE FLEET

- CAMEROON	2 650 3-6 m canoes 1 800 7-13 m canoes
- GAMBIA	942 canoes under 7 m 185 7-10 m canoes 77 canoes over 10 m
- LIBERIA	771 Kru canoes under 6 m 249 7-12 m Fanti canoes
- SIERRA LEONE	355 Kru canoes under 6 m 5 025 6-10 m canoes 1 326 10-15 m canoes 384 14-18 m canoes
- SENEGAL	3 325 canoes with sail 5 300 canoes with motors

These problems concerning the provision of supplies and support services to small-scale fisheries are not new. They have been the constant concern of the authorities involved for some decades now and have given rise to a number of assistance projects to the small-scale sector. A review of efforts in this domain may indicate what action should be undertaken in development planning of this sector of production. We shall look at canoes, motors and fishing gear.

2.1 Canoes are the basic component of small-scale marine fisheries. Each canoe represents one fishing unit or basic economic production unit.

So far the countries of the region have used their own forests for the wood to build their dugout canoes. The most popular species for dugouts is Triplochiton scleroxylon, which provides three of the most representative types of canoes, according to tree height:

- small 6-7 m canoes, used by 1 or 2 fishermen;
- medium-sized 9-12 m canoes, used by 4 to 8 fishermen;
- long 13-15 m canoes used by 10 to 15 fishermen.

Frame surveys enumerating the numbers of fishermen, as well as planners, need to note these differences. Each size of canoe has its own special techniques and annual yields: 1-2 t for small canoes (not motorizable); 3-5 t for medium-sized canoes and 7-15 t for long canoes.

Ghana was and is unquestionably the greatest producer and supplier of canoes within the region. The spread of these canoes to Liberia, Sierra Leone, Ivory Coast, Togo, Benin, Nigeria, etc. was facilitated by seasonal migrations of fishermen out of Ghana. In recent years, however, canoe production in Ghana has fallen off considerably due to internal difficulties. Ghana does still have forest reserves, though it is not sure that these will be renewed by reforestation, but in the long term the country will probably not be able to continue supplying the sub-region with canoes.

Senegal, the most dynamic small-scale fishery in the region, has had no wood for a long time now. To meet the needs of fishermen, Senegal has developed a kind of craft which is a compromise between a dugout and a plank boat. The result is astonishing: the Senegalese canoe is found throughout the northern sub-region. It is one of the rare countries, along with Sierra Leone and Ghana, where a shipbuilding tradition has developed. The Cape Verde Islands also have solid experience, inherited from Portugal, of the manufacture of plank boats.

The idea of replacing traditional canoes by other sturdier types of craft, more spacious, more seaworthy, and better for marine fisheries, has attracted the attention of national and international authorities for some 25 years now. Their interest coincides with the introduction of outboard motors in small-scale fisheries.

But the problem of replacing canoes is highly complex. It involves a number of parameters, mainly:

Technical parameters: size, shape and weight of the craft, which depend on:

- the type of fishery for which the craft is intended, with or without motor, with or without sail.

- working conditions at sea:

i) Is the craft intended for use out of a port, a sheltered creek, a lagoon opening or a river estuary? This is the simplest case and any well-constructed type of craft will do.

ii) Will the craft be used off a low coast, much of which is out of the water at low tide? This is the case of certain coastal areas in Gambia, Sierra Leone, Guinea and so forth where tidal height varies greatly and craft must be pulled up above the high-tide mark rather than left at anchor beyond the low-tide mark for obvious reasons of safety, particularly motorized craft. Such a coast demands flat-bottomed beachable craft which can easily be pulled out of the water at high tide. This is not a very difficult problem to solve. Sierra Leone appears to be developing a plank canoe model which meets this requirement, but the construction technique still requires a great deal of improvement.

iii) Is the craft intended for use off a hard coast with heavy surf? This demands a surf-crossing craft which has to be beached at each trip. In this case, the craft needs to have a certain form, size and weight in order to cross the surf and so that it can be beached. There is a certain size and weight limit beyond which it becomes impossible to haul the craft up above the high-tide line.
This is definitely the most complex instance and the hardest one to solve. Unfortunately it occurs very frequently among the coastal countries of West Africa, particularly the Benin Gulf countries. It should be examined in detail.

..... during the sixties people began to look at the Doris solution, a motorized marine plywood craft. It was about 6 m long and was tested in Dahomey (present-day Benin). One solution to the problem of hauling the boats would have been to winch them but the projects at the time were very short (being virtually confined to a simple demonstration), whereas the method, to be well assimilated, would have required follow-up for a rather longer time. In any case, the main handicap of this kind of craft was the mediocre quality of African "marine" plywood, which was not resistant to seawater. The boat was also not the right shape and was too short.

During the seventies, some unsuccessful experiments were made with small ferro-cement boats, particularly in Togo. In any case, they could only have been used out of a port, not off a coast.

Meanwhile, the promoter countries, Senegal and Ghana, with the introduction of the purse seine for Sardinella and also to use longlines, had to shift to a longer canoe (15-16 m). These local carpenter/sailors were certainly able to find highly effective stopgap solutions to the problem. But long canoes cannot be beached. They are left at anchor beyond the breakers and the catch is landed with the aid of little, beach-crossing canoes.

Beginning in 1975, Japan began to introduce little FRP boats in Africa. They were offered to a number of countries of the continent, as were large quantities of outboard motors.

Nowhere except in Mauritania were these boats worked off hard coasts, where they appear to have been used right off the beach, and therefore no conclusions can be drawn from this experiment.

The Japanese measures did, however, reawaken interest in the "canoe" question, especially inasmuch as a new Senegalese prototype fibreglass canoe had been launched, of as yet unknown performance. Private firms in Nigeria and Gabon (just to name two) began in the early eighties to build little RFG or FRP boats, first pleasure boats and then canoes. Canoes in Gabon were used primarily for river transport. Some, however, began to be used for estuary fishing (no surf). Beachable boats in FRP were built in Nigeria but no data is available on these.

In the early eighties, France launched a new supercanoe prototype, inspired by the Ghanaian canoe but with better proportions and a more streamlined shape, made out of a new material, glued and laminated wood. Some test models were demonstrated in Cape Verde, Ivory Coast, Madagascar, and so forth. The boat was used to transport fish in Cape Verde, whereas it was used in Ivory Coast for distant-water longline fishing out of Port San Pedro. Hull problems developed after two or three working years. On-site repairs proved difficult, if not impossible. The model was then used as a "mould" for identical hulls in fibreglass. The fibreglass model was tested under the worst possible surf conditions and, while it undeniably has a number of qualities, it does have a few weak points (not the shape but the way it is built) which could be corrected.

This appears to be the best if not the only progress in improvements to beachable canoes in Africa.

More recently (late 1984), FAO built two prototype canoes in Senegal out of 15 m planks for advanced small-scale fisheries (the distant-water longline Sardinella fishery). These have pull-up inboard motors and can be beached. A craft of this type is probably perfect for high-yielding small-scale fisheries in countries with good coastal access and no surf.

Even though 25 years of intermittent trials do not seem to have produced any very concrete results, these attempts to improve canoes do lead to some very interesting conclusions regarding the future, at least as far as the technical aspects are concerned. The fact is that size, shape and weight problems are well-researched now and can easily be solved. Marine plywood (African), glued and laminated wood, ferro-cement and iron can be ruled out in canoe construction. The only valid remaining construction materials are wood (planks), FRP (highly inflammable however) and aluminium (riveted, not soldered).

The biggest handicap to the extension of improved canoes is still their cost price which far exceeds that of traditional canoes, as the Table 6 shows.

As can be seen, the FRP 10 m supercanoe is equal in volume (19 m^3) to the Ghanaian 30 m dugout canoe, but it costs nearly three times as much.

From the socio-economic standpoint, as long as traditional canoes are available, small-scale fishermen will definitely continue to prefer them. First, because their quality is excellent despite their shortcomings and mostly because no other material can begin to compete with them. Another major social component is the firmly established traditional canoe market, which is certainly not going to be replaced by some external solution, especially an "official" one. The traditional canoe has been shown to adapt very smoothly to even the new, unwieldy purse seines, which were thought to require the introduction of a new model of seiner. Where the planning of fishing craft is concerned, one must proceed very cautiously: price will always be the key to purchase.

Table 6

	1984 Price	Traditional Canoe		FRP Canoe (in US dollars)		
	6-7 m	11-13 m	14-16 m	8.50 m	10 m	12 m
Ghana	-	1 400/2 000	3 000/6 000	-	-	-
Senegal	-	-	3 600	-	-	-
Sierra Leone	100	1 200	1 800	-	-	-
Liberia	500	2 000	4 000	-	-	-
Togo-Benin	-	2 500	-	-	-	-
Gabon	1 000	1 800	-	3 000	-	6 000
Ivory Coast	-	-	-	-	6 000	-

An extension trial for the FRP supercanoe is now under way in Ivory Coast under the hire purchase system. It is aided by a loan from the Caisse Centrale de Cooperation Economique, and a government subsidy covering 30 percent of the cost of the canoe. This superpirogue is the only present example with some chance of success. This is due to the very special context of the operation. It involves concerned migrant Senegalese fishermen (not Ivory Coast fishfolk); an isolated sector, very far from any market; adequate support services guaranteed -- ice, fuel, spare parts, maintenance, marketing; reasonable rate of loan repayment with respect to income.

2.2 Motors: Outboard motors, introduced nearly three decades ago, have today become a necessary, indeed essential, component of all large and most medium-sized canoes. An estimated 30 to 40 percent of present craft are now motorized. Nor should we forget that many of the small ones simply cannot be motorized.

The introduction of the 2-stroke oil/gasoline mixture outboard motor was a Senegalese initiative of the fifties. The innovation was taken up in short order by Ghana. The motors in use at the time were 10-15 hp Johnson and Evinrude outboard motors, well-represented by the Compagnie Francaise de l'Afrique Occidentale (CFAO).

The motorization craze hit almost all the countries of West Africa during the sixties, spurred by a number of bi- or multilateral assistance projects (particularly the FFHC). Virtually all development projects designed thereafter included a "canoe motorization" component.

An odd thing, however, is that this costly trend in canoe utilization was not matched by systematic, socio-economic and technical surveys on the part of any of the countries or agencies involved. Today we are faced with a particularly regrettable gap. It is not at all obvious in many cases that this innovation helped improve living standards of fisherfolk. Meanwhile, fishermen have virtually lost the ability to use sail, the reintroduction of which is now being attempted today at great expense.

During the seventies, Yamaha motors replaced the former brands, which have now virtually disappeared. Yamaha motors were introduced en masse in the form of Japanese assistance to West Africa. At present Japan has a virtual monopoly on the market for outboard motors and spare parts in Afica. A certain standardization of outboard motors is certainly desirable but it is unfortunate that the models change so often, as this makes maintenance and upkeep nearly impossible.

Motorization followed somewhat the same evolution as canoes. Canoes ranged further afield in search of new fishing grounds, particularly longline grounds, Senegal, Ivory Coast, Ghana, etc. were typical of this trend. Another example is the use of new techniques such as the purse seine, a very heavy piece of gear which demands a larger crew of 12 to 15 men and therefore a more powerful motor. Today, for example, most canoes use 25 and 40 hp outboard motors (oil/gasoline mixture). For day fishing, the average fuel consumption is roughly 60 litres. For distant-water fishing (3 to 5 days at sea) the canoes load on as much as 400 litres of oil/gasoline. Given the present cost of fuel, such high consumption levels should give planners food for thought!

There is general consensus at present that the outboard motor has definitely become a necessity in some cases. But its inordinate use does leave one with the impression that an outboard motor often has more to do with prestige than with cost-effectiveness (the fisherman wants a more powerful motor to go faster).

Certainly, canoe motorization has become a necessity, but the system is completely anarchical. There is no planning, and most of all no technical and economic study, in particular, on the relationship between canoe models, fishing technique and horse power. Worse yet, outboard motor manufacturers change model constantly, making the maintenance problem, in terms of spare parts, virtually unsolvable. The rate at which motors are produced is evidence of the consumer society demands, characteristic of the western lifestyle in the second half of the twentieth century, which is not at all valid for African fishing communities.

Concerning the Support Services, there are usually machine workshops at headquarters level in the Departments of Fisheries, sometimes with branches in the field or in development projects. These support structures, along with the equipment donations received, are managed by the "administration". Unfortunately, the management of "bureaucratized" machine workshops is fairly inefficient. Most frequently, once the first stock has been used up (motors and spare parts), stock renewal orders lay far behind demand because the necessary permits have not been issued, or for lack of forward planning or initiative, or because of spare part specification problems because the models have changed, and so forth.

Generally speaking, motorization keeps going thanks to the initiative of certain private firms, but most of all as a result of "successive waves of equipment donations" which more and more tend to form the basis of external aid. In countries with convertible currencies, the motors/spare parts situation is fairly satisfactory, but it is catastrophic in most West African countries lacking convertible currencies. This situation (some term it a privilege and others a disaster), has prompted the development of a runaway parallel market in currency, equipment and consumer goods, making any notion of economy completely irrelevant.

The most recent trend in canoe motorization is the use of kerosene-fueled outboard motors and the introduction of the diesel outboard and inboard motors. In West Africa, the use of the kerosene fueled outboard motor has spread widely in recent years (1983-84) in Gabon, stimulated by three private firms: Yamaha, Mariner and Suzuki. This twin carburettor motor starts with gasoline and when a certain engine speed is attained the kerosene intake switch takes over. To stop the motor, the process is reversed. Kerosene and gasoline consumption are near identical, but the enormous advantage lies in the overall fuel cost, at least when the gasoline/kerosene price difference is big enough.

Government price policy on the different fuels therefore has to be known prior to selection of an outboard motor. The utilization of outboard motors also requires practical training of the canoe fishermen who will run the motor: a technical/economic aspect often overlooked.

The diesel outboard motor and pull-up diesel inboard motor were simultaneously introduced only in late 1984 in Senegal. It is worth noting, however, that several attempts to use a diesel inboard motor failed in the past (see Table 7).

Eight and 12 hp outboard Ruggerini prototype diesel motors, supplied to Senegal under Italian bilateral aid to small-scale fisheries, underwent comparative trials. The trials showed that a 12 hp diesel motor performs as well as a 25 hp gasoline motor and consumes four to six times less fuel. An outboard diesel motor, on the other hand, is 100 percent heavier, an obvious problem of maintenance and transport at the end of the trip, as the motors cannot be left on board. After several months of use (1985), salt deposits formed on the engine block (the engine hood not providing adequate protection), allowing entry to seawater. The builder is now studying the details of this problem.

Three Deutz diesel motors, 12 and 15 hp, were installed on a 15-16 m Senegalese canoe and on two plank canoes. These were the new 15 m FAO-designed prototype canoes. One was used in Senegal and the other in Guinea-Bissau.

The design inspiration was taken from the Indian system of a pull-up inboard motor inside a virtually waterproof case resting on two axles fixed to the inner sides of the canoe, allowing the motor to swing up and down. The motor is air cooled and there is also a water-cooled version. The watertight case has a movable cover which can be taken off once the boat is at sea, and put back when the craft is beached or put into water, i.e., at critical moments when the craft may be submerged or even overturned by wave action.

With an assembly of this sort, the transmission shaft fixed to the motor can safely be moved up when the boat reaches shore and is beached. This sytem is far superior to the one used up to now with the Doris, where the motor is fixed in place and the transmission/propeller attached to the motor by a movable Cardan shaft. The weak point here is that the propeller shaft soon wears out and must be replaced every few months -- just the sort of problem to avoid in Africa.

Table 7 lists the various trials in Africa during the last 29 years with beachable diesel-fueled boats.

Such are the latest initiatives in this field. It seems premature at this point in time to draw any final conclusions. Predictably, however, the inboard diesel motor, pull-up or fixed (according to the conditions of use), does represent the future solution for distant-water, large and medium-sized canoes. For medium-sized canoes, one possible solution is an outboard diesel motor, should these new motors be proved reliable. For day trips in canoes, a fresh look should be taken at the whole question of hp and motor type (gasoline, kerosene or diesel) in the light of the too often overlooked or forgotten possibility of using sail.

In conclusion, the major constraints to canoe motorization are:

- The models used are changed too frequently, entailing a serious problem of spare parts.
- A general lack of organization of the field services for engine repair and upkeep. Underskilled mechanics in fishing communities keep canoes inactive for long periods of time when motors break down.
- Lack of basic training of canoe fishermen in engine use and maintenance: such training would cut the frequency of breakdowns.
- The lack of support structures to supply fuel to fishing communities scattered along the coasts; fishing activities paralysed by lack of fuel.

These are the basic factors which administrators should keep in mind in planning small-scale fisheries development.

2.3 Fishing gear

In this sector, also, there is a deplorable, near-total lack of frame surveys, depriving the planner of the data base essential to development planning and the rationalization of fisheries. Frame surveys are likewise of capital importance in equipment supply systems, and qualitative and quantitative equipment specifications.

We do, however, have some notion of the most frequently used kinds of gear:

- beach seine
- purse seine (Sardinella)
- drift gillnet (Sardinella, shad)
- bottom and surface gillnets
- bottom and surface shark net
- longline
- trolling line
- floating and bottom longline

TABLE 7

Trials from 1965-1985 with beachable diesel motor craft

Country	Type of boat	Coastal operation with "surf"	Coastal operation without "surf"	Dimensions in m. Overall length	Volume m³	Construction material	Motor type and HP	Cooling system Air	Cooling system Water	Trial results
Senegal	Doris		X	8.1 x 2.3 x 0.7	13	Plywood-Okoumé	Diesel 18HP		X	Halted motor blocked - cooling system defective
Senegal	Yamaha BLC - 30		X	9.1 x 1.7 x 0.7	10	FRP	Diesel 11HP		X	Halted motor problems - lack of spare parts
Senegal	Yamaha BLC - 40		X	12.8 x 2 x 0.9	23	FRP	Diesel 23HP		X	Halted motor problesm - lack of spare parts
Senegal	Traditional canoe		X	17. x 1.5 x 1	26	Wooden planks	Diesel 23HP		X	Trial halted - motor flooded
Senegal	Senegal 1 FAO canoe		X	14.8 x 2.5 x 0.9	34	Wooden planks	Diesel 14HP	X	-	Trial began February 1985
Guinea-Bissau	Senegal 1 FAO canoe		X	14.8 x 2.5 x 0.9	34	Wooden planks	Diesel 24HP		X	Trial began February 1985
Sierra Leone	Traditional canoe		X	18. x 2.3 x 1	42	Wooden planks	Diesel 24HP		X	Too light construction an caulking - motor flooded
Sierra Leone	V bottomed		X	7.6 x 2.4 x 1.1	20	Wooden planks	Diesel 12HP	X	-	Construction and caulking too light- motor flooded
Ivory Coast	Traditional canoe		X	12.9 x 1.7 x 1	25	Wooden dugout	Diesel 25HP		X	Motor flooded by rainwate and canoe highly porous
Ivory Coast	Super canoe		X	9.7 x 1.9 x 1	19	Laminated plywood glued FRP	Diesel 18HP		X	Motor problems - diesel fuel impure - no spare part
Ivory Coast	Super canoe	X	X	9.7 x 1.9 x 1	19	FRP	HB 25 HP Gasoline			Fishermen very satisfied with canoe but gasoline consumption high
Benin	Doris	X		7.5 x 1.8 x 0.8	11	Plywood Okoumé	HB 18 HP gasoline			Operation 3 years. Then stopped after Okumé plywood unglued - rotten.

N.B.: The FRP super canoe (Ivory Coast) was surf-tested.
Source: FAO - GULBRANDSEN Report 1985, Consultant GCP/RAF/192/DEN.

and all their accessories: strengthening ropes, leads, floaters, rope gear, thread for mending -assembly, hooks, etc.

Each gear has different characteristics and its own specifications, perhaps not in each country but doubtless from one sub-region of West Africa to the next.

In Africa, not a producer of nylon line (the dominant material in line fishing), private initiative is very limited. The basic commodity has to be imported and therefore small-scale fisheries are entirely dependent on foreign trade for their supply of nylon line.

Nigeria did have a nylon factory which was operational for several years, producing line and mesh, but the quality was rather mediocre and the factory has gone out of business. There is a net factory in Senegal, which gets its raw material supplies from France. The factory is working in the red and is trying to expand its market. Its looms are limited to certain kinds of mesh, particularly trawl and purse seine mesh for the industrial fisheries sector, which does not necessarily correspond to the characteristics of small-scale fishing gear. Very high final cost (and sale) price means the product cannot compete with high-quality imports from Asia.

The requirements of small-scale fisheries and those of industrial fisheries are so different that they virtually cannot be put together. Moreover, industrial fisheries usually have their own external sources of supply. A fishing net industry therefore has little chance of financial success in West Africa.

Such private enterprises as the Compagnie Francaise de l'Afrique de l'Ouest (CFAO) in particular, whose branch offices are found virtually throughout the region, supply limited quantities of some of the commonest types of mesh netting such as that used to make drift gillnets and small bottom gillnets. This is nearly the only possibility for supplying small-scale fisheries. Sometimes private firms also import netting when there are reliable orders from fishermen who have a reputation for financial solvency. Here again, and for the same reasons, a parallel market in fishing equipment has become a fixture in the countries with convertible currencies and those not so favoured. This market is made easier by the porous nature of national boundaries.

Given this obvious lack of resources, the countries of the region have included supplies of equipment as a component of their small-scale fisheries development projects. These proposals are usually accepted by foreign aid. The guiding concept, as for motors, was to constitute a working capital out of these original contributions which would allow the fishing equipment to be renewed as needed.

A very recent study made in early 1985 on the initiative of the Regional Programme for the Integrated Development of Small-Scale Fisheries in West Africa did, in fact, make an analysis of how State and private systems to supply fishing gear and equipment work in certain selected countries of the region. The results of this survey are fairly edifying and give useful indications for planning supply systems. They maybe summarized as follows:

- In convertible currency countries (the CFA franc zone) the supply of fishing equipment and accessory gear (likewise the supply of outboard motors and spare parts) is generally fairly satisfactory when it comes from private enterprise. However, running out of stock is a fairly common occurrence.

- The major handicap of the private sector is its lack of information on the requirements of the small-scale fisheries sector, for lack of data on the subject. Another handicap is the lack of the technical background essential to writing orders including exact specifications for gear and accessories. The result is that the equipment available does not always correspond to the specific norms peculiar to each fishing gear.

- Another, and so far unsuspected, handicap is the relative marginalization of the trade in fishing and accessory gear which has a very limited turnover. This means that the sale of fishing gear cannot be the prime economic activity but must be peripheral to the sale of other more popular consumer goods. This explains why the profit margins are still fairly high and there is virtually no competition.

- In the countries with non-convertible currencies (the English- and Portuguese-speaking countries of the region) the situation is crucial due to the lack of foreign exchange for imports, such funds obviously being earmarked for other priorities. Fisherfolk in these countries are usually reduced to getting their supplies on the parallel market, which is made much easier by the porous nature of national boundaries, but they pay exorbitant prices, given the prevailing rates of exchange.

Generally speaking, the official state (Department of Fisheries) or para-statal (state firms - cooperative, etc..) supply systems set up by many countries of the region, based on an initial contribution from external aid, have met with fairly resounding failure. This is mainly due to the inability of the Civil Service to assume tasks totally foreign to it, tasks normally performed by private initiative.

We know of no case in which it has been possible to reconstitute the working capital, as often the money recovered on sales of fishing gear is used for other administrative expenses.

Furthermore, the storage and sales structures mobilize an army of personnel -- generally overpaid, as often happens in the state firms -- most of whom are a real financial burden on the income from sales. Under these conditions, even where there are no taxes to pay, the prices at which equipment is sold to fishermen are not generally lower than equipment sale prices in private commerce.

Another frequent occurrence is that the staff is not sufficiently familiar with the technical specifications of gear and so write out orders which are not exact. This occasions a long, slow back and forth correspondence with suppliers. This, added to the fact that the orders are not renewed in time and that the delivery time is not taken into account, creates a situation where these systems are frequently short of stock for long periods of time, during which the small-scale fisheries remain paralysed. During this time, the meagre income is eaten up in salaries, accelerating the exhaustion of the ill-fated working capital.

It seems obvious that rigid, heavy official procedures lack the proper flexibility. State or para-statal staff do not have the experience, competence, motivation, spirit of initiative and decisiveness, i.e., the management capabilities, essential to the success of such activities.

As a result the most effective aid which the governments of the region could contribute to the development of small-scale fisheries would simply be to encourage and stimulate private initiative to ensure the supply of the necessary fishing equipment and accessory gear, by the application of the following measures:

- The remission of taxes on all gear and accessories (likewise motors and spare parts under 40 HP) in use at sea.
- Deriving from the above measure (considered as a subsidy), reduction of the authorized profit margin.
- Issuing the necessary import licences to cover small-scale fisheries requirements, with supervision over quality, origin and prices.

For their part, the National Departments of Fisheries should be in a position to provide traders/importers with all detailed specifications as well as the necessary quantities for each category of equipment and accessories to be ordered.

These arrangements imply that frame surveys be conducted beforehand. These surveys should be conducted responsibly by properly trained staff.

These reflections on development planning were inspired by an analysis of the components of the production sector of small-scale fisheries.

3. FISH PROCESSING

3.1 Socio-economic context of fish processing

Fish processing and marketing is the near-exclusive privilege of women in West Africa who have mastered both the traditional fish processing techniques and the markets.

Profits from the purchase and sale of fish allow them to constitute and regenerate capital, of which a part is generally used to renew the equipment of the fishermen, who are thereby economically dependent on the women. In addition, within the household the fisherman's budget and that of his wife or wives are completely separate. Economically, the women master the whole "fish chain" system, and they also assure the stability and viability of the family, their traditional responsibility at the same time.

In this context, which planners should bear in mind, it is easy to see that "official-parallel" interventions, where they clash with such traditions, are doomed in advance to fail.

The comparatively more independent urban fishermen land their catch directly in ports or on beaches in the large coastal cities, the city markets absorbing virtually the entire daily production (surpluses are processed in various ways by the fishmongers). But most small-scale fishermen land their catches in their fishing camps where they also live and where solidly established family and socio-economic traditions intervene in the destination of the fish brought ashore.

Generally, the fisherman's wife or wives (or, failing that, his moneylender) have priority in the purchase of the landings of which they agree on the price. But, if collector fishmongers appear, the fisherman then divides the fish into piles for sale. If the offering price is good he sells. Otherwise the catch goes as agreed to the family group. The women then arrange to sell part of the catch fresh if a local market is accessible or else process the fish - the only way to preserve it - for later sale.

Thus, over the generations, a still vigorous small-scale family fish-processing industry developed. Its characteristic features are: very low investments; no machines and no automation, all work manual; simple techniques and little or no management; great flexibility in adapting to fluctuating yields ranging from nothing or little one day to a huge catch the next (the women can spontaneously mobilize a large local labour force).

Like the production sector, the fish processing sector lacks an economic survey of adequate scope. It is therefore impossible to make any realistic estimate of the cost/benefit (or losses) ratio of these women fish processors. This gap must be bridged as soon as possible. It is virtually impossible without this data base to evaluate the economic impact of recommended or implemented technological advancement.

3.2 The technical context

In tropical and equatorial countries, fish loses its freshness and spoils from six to 12 hours after it is landed on shore, depending on the fish species and local climate, including temperature, humidity, sunlight, winds, etc. All in all, the product landed by small-scale day-trip fishermen can be considered fresh, these being active fisheries where the fish is hauled live out of the water (beach seine, surface gillnet, purse seine, line fishing, etc.).

However, the small-scale fishing communities strung along the coasts do not have ice, storage facilities or cold trucks to either store their catch or send it off directly to distant markets. Nor can facilities of this sort be profitable unless there is a rapid turnover in stocks stored and transported and unless the fish bring in a good price. Only luxury fish can bear the costs, as shown by the success of private sales of fish from the Senegalese small-scale line fishery. These fishmongers collect the catch at the large producer centres, ice the fish, and deliver it to markets in Dakar and inside Senegal.

Most of the small-scale fisheries catch, however, is pelagic species of little commercial value intended for the mass of rural and urban consumers of little means. The small-scale fishing communities scattered along the coasts usually have no choice but to process fish before marketing.

There are a number of methods of processng fish; techniques vary from country to country and from region to region. The overriding concern is that of preserving the fish. Particular consideration is given to consumer tastes from the standpoint of presentation, colour, texture and flavour, the "quality criteria", which cannot be compared to "western standards". Many attempts to improve fish processing have met with failure merely because they overlooked the above points.

The commonest fish processing products in West Africa are:

- dried fish
- dried and salted fish
- fermented dried fish
- dried and smoked fish.

3.3 Dried fish

This is the simplest and easiest preservation technique. It uses only natural elements: sun and wind. It is particularly suitable and is usually applied to small pelagic species like the Anchoviella, which are intensively fished on a seasonal basis in the early morning with beach seines or even fine-mesh purse seines.

The fish are scattered to dry on the sandy beaches near the fishing camps or compounds. The women turn them at least once during the day, picking them up in the later afternoon. The fish is stored in a sheltered area for the night. According to how dry it is, the following day it is laid out to dry on the sand on mats or racks, usually in the fisherman's own compound. By this time the product is dry enough to be stored and taken to market, packed in large baskets or in burlap bags.

In the humid, equatorial climate, coastal countries around the Gulf of Guinea this type of product is harder to preserve and does not keep as long as do dried fish in the more tropical climates such as Senegal and Mauritania. The fish rapidly re-absorbs moisture, develops mould and is attacked by mites, scaveneger beetles and Dermestes.

If commercial reasons such as lack of transport, price speculation and so forth mean the dried fish has to be stored for a long time, the product has to be re-exposed to sunlight every week for two days to eliminate mould and insect larvae.

Dried fish is highly prized all over and appears, though irregularly, even in the most remote rural centres inland. This widespread trade in dried fish is facilitated by the warm dry climate of the Sahelian zone and by the very small size of the fish which can be retailed in very small quantities.

3.3.1 Improvements

Certain technical improvements of fish processing have been tested, particularly the construction of cement-drying areas, but these small pelagic fish have lost almost all of their thin layer of scales in the fishing process and therefore adhere to the concrete and break or tear when removed, which lowers their commercial value. Such initiatives should be ruled out. In contrast, there have other, more effective, more appropriate interventions, such as:

- Setting up drying areas made of gravel or beach pebbles, where these are found locally. The fishing communities are perfectly capable of laying out such areas themselves if they have been made aware of the problem and shown how to proceed by extension workers.

- The most common improvement is to set up fine-mesh imported drying racks in an open, sunny, well-ventilated area. The racks are set on wooden or concrete supports about 90-100 cm off the ground. This much more complicated techniques does have the advantage of making better use of the wind-sun combination. From the hygiene standpoint, the fish is not in contact with the ground which is often unclean and harbours mites. Should it rain suddenly, the fish can be instantly protected by a plastic (polyethylene) sheet spread over the racks.

This kind of installation, it should be noted, can be made from local (much cheaper) products such as wood, braided mats, bamboo lattice-work, etc.., which would also stimulate the development of a small-scale rural industry to produce the frames.

From the standpoint of small-scale natural fish drying, there is little room to innovate. An exception is the polyethylene tent solar drier, technically valid but yet to prove cost-effective. An artificial drying process using energy, such as fuel or electricity, to run the warm air vents would in all likelihood produce a better-quality fish product. But it would exceed the capacity for financial absorption and management of the fishing communities involved, and above all the cost would be excessive compared to the purchasing power of the mass of consumers.

3.3.2 Recommendations

Before drying:

- Throughly clear the drying area and vicinity of anything which could attract and provide breeding grounds for flies and pests.

- Rinse the fish in seawater (or drinking water) especially if it has become dirty during the fishing operation (particularly beach seining). Get it as soon as possible onto the drying area. If put into woven baskets (not basins), it drains during transport.

- The best drying hours are from 09.00 to 16.00 hours.

During the drying process:

- Turn the fish over at least once during the day between 13.00 and 14.00 hours.

- Keep pests away.

- Protect the fish from rain.

After drying:

- Store fish in bulk or baskets or burlap bags in a dry sheltered place protected against flies and pests.

- Set the fish out to dry again once a week when the weather is good. In this instance the best technique is probably to use plastic solar tents to raise the temperature and eliminate mould and insect larvae (20 hours of sunshine at 45°C are necessary, but only 40 minutes at a temperature of 70°C).

3.4 Salted and dried fish

The custom of eating salted and dried fish was given a boost in Africa between 1940 and 1960 as the the major inland lake and river fisheries developed. Massive imports of dried and salted cod (stockfish) from the Nordic countries was another factor. Nigeria, Cameroon and Ghana are examples of countries where salted dried fish are widely consumed.

During the seventies, however, and up to now, imports of dried and salted fish have been replaced by imported fresh frozen fish, which is landed in thousands of tons in all coastal ports by the industrial fishing fleets exploiting West Africa's marine resources. Dried and salted fish is probably the seafood product now least appreciated by the mass of consumers. Despite this, it is still in demand (used primarily as a condiment) and also because it keeps well in hot dry areas.

Small-scale fisherfolk communities use this technique to process the surplus from successful fishing expeditions or large fish which have remained unsold (West African croakers, drumfish, etc.) or else to meet certain specific demands for which there is a traditional limited market, as for shark.

The major handicap with this technique is precisely the salt component. Salt is not always available and prices remain high because it often has to be imported. If manufactured locally on a small-scale basis, it tends to be mediocre in quality and contain impurities, bacteria and the like.

The usual process is to scale large and medium-sized fish. Rarely are they headed, but are instead split in two down the spine from head to tail. The belly acts as a hinge, the fish are gutted and the gills removed. The dorsal fin of large fish is removed and deep cross-cuts made in the muscles. These operations are often performed on the ground (sometimes on a mat). The fish is then rinsed in a basin of seawater (usually without changing the water). The fish are next piled up in baskets, basins, trays or cement basins, or other recipients, and then each layer is covered with rock salt and the next layer of fish is added (dry salting at a rate of roughly 20 percent of the weight). The fish is pressed by placing a plank over the pile of fish and weighting it down with a large rock. The fish is kept in the salt mixture and pressed for three to four days, then rinsed lightly in seawater and set out to drain and sun-dry on mats or lattices resting on supports 50-100 cm off the ground. Sometimes the fish is merely laid out to sun-dry on the thatched roofs of the fishermen's houses.

The drying operation lasts three to five days. The weighted piles of fish are brought in during the evening and put out again the following morning. The final product is sold as soon as possible. If it is to be stored, like dried fish, it needs to be re-exposed to the sun long enough to eliminate insect larvae and mould.

3.4.1 Improvements

Very few technical improvements have been introduced at the level of the women fish processors and these primarily concern hygiene. Occasionally, cooperatives do facilitate the supply of salt. Demonstrations have also been given before cooperatives on improved fish preparation; the technique of salting and drying in fish in piles pressed down with weights; salting in concentrated brine, etc. These demonstrations have rarely led to any lasting practical results, for such methods over-dry the fish without giving it the flavour desired by consumers, who prefer lightly salted, fermented fish.

The objective of some of the interventions was to build modern fish-drying and salting centres for fishing communities and/or cooperatives. None is operating, however, due to political, administrative, socio-economic and management constraints.

The lukewarm reaction of fishermen and women fish processors to this approach to fish processing should encourage a more prudent, pragmatic approach among planners in this sector. Such an approach would probably be better applied to real industrial fish processing (drumfish in Mauritania, Balistes in Guinea and Ghana, and so forth). But experience has shown that the technique has little scope in the small-scale fish-processing sector.

3.4.2 Recommendations

Before salting:

- Process fish as fresh as possible.
- Prepare the fish with clean tools, on a clean working table, and collect waste portions in garbage pails for disposal (proliferation of flies).
- Rinse the fish in clean water and throw out rinse water.

During the salting process:

- Use cement trays or basins and high-quality salt.
- Ensure that the pressing weight for the fish is sufficiently heavy.

During the drying process:

- Turn the fish over at least once a day (fish on racks).
- Cover the fish with a plastic tarp in case of rain.
- Take the fish in for the night and, preferably, keep it stacked and pressed.

After drying:

- Store the fish in a dry place, protected from flies.
- Sun-dry the fish again once a week as per the regular drying process.

3.5 Fermented dried fish

This small-scale fisheries product has been known for a long time in Africa and it is accordingly widespread. It is mainly used as a condiment, having a very special flavour which people much prefer to the flavour of dried and salted fish.

Quite a few fish species are suitable for drying and fermenting: croakers, threadfins, mackerel, shark, Balistes, Cymbium (mollusc), etc.

The products normally used for this process are fish which remain unsold at the fishmongers, as well as fish landed after a long trip at sea, which has begun to spoil, and fish from bottom-set nets which is no longer fresh. This is in fact a means of recovering such fish.

There are several different ways of preparing dried fermented fish, but they all consist in striking the right balance between putrification and preservation. The product is first fermented, i.e.:

- by immersion in light brine for 24 hours, or simply in a basin of seawater, whole fish, rarely gutted, followed by trimming prior to sun-drying;
- by open-air (aerobic) fermentation, during a very hot period when the pre-trimmed fish dries as quickly as it "spoils";
- by anaerobic fermentation, burying whole fish underground wrapped in burlap or plastic for 12 to 36 hours depending on how hot it is, followed by trimming and drying.

After fermentation, the fish are scaled, gutted, gills removed but not headed (except catfish) and washed, then sun-dried for three to six days on racks, mats, lattices, etc., even on the thatched roofs of the fishermen's houses. The fish are turned once a day and every evening stacked in a sheltered place, belly side up and sprinkled with salt, then covered with a plastic tarp.

This product loses 40 to 60 percent of its weight. Consumer tastes demand a fairly heavy fish, with a wet appearance, springy texture and strong aroma.

Some fish such as sharks are cut or filleted before fermentation. Others such as Balistes are skinned. Cymbium (a gastropod) is first shelled (by cracking with an iron bar) and the mollusc is quartered. It then undergoes anaerobic fermentation in a closed jar, and is then either put in a basin of seawater covered with a tarp or buried underground wrapped in burlap or plastic sacks. After fermentation, the Cymbium is washed and sun-dried for a few days. This is a very common preparation in Senegal and Gambia.

3.5.1 Improvements

There have been very few direct interventions from external aid for this particular technology. The Institute of Food Technology in Senegal is the only one to have examined the subject. Their objective was to get more information on physical and chemical reactions during the fermentation process (bacteria, enzymes).

3.5.2 Recommendations

In all instances of handling and pre-processing fish, the question of hygiene and cleanliness, including the supply of clean water, throwing out rinse water and wastes, is still of prime importance.

Consequently, planners should reject the (habitual) prestige investments in favour of practical, more useful and more appropriate areas for action in small-scale fisherfolk communities such as:

- sinking a drinking water well in the fish camps;
- utensils and tools used in processing;
- storage area for and storage of high-quality salt;
- preparing drying areas and surroundings;
- developing a small-scale industry for the production of racks, mats, lattices, baskets, recovery grates, etc.;
- product storage shelters, etc.

3.6 Smoked and dried fish

Smoked and dried fish definitely ranks right after fresh fish as the most popular and highly prized fish product throughout Africa. Though a great many species are smoked and dried, a real small-scale smoking and drying industry has grown up around the Sardinella and bonga shad fisheries (and presently even Balistes). These are pelagic species which were harvested in increasingly large numbers after the motorization of canoes, introduction of nylon nets, and particularly such high-performance gear as the purse seine. Most small-scale fisherfolk community activities revolve around these seasonal coastal pelagic species. The considerable amounts of fish landed cannot be absorbed by the coastal markets, which now have reached the saturation point in fresh fish. Smoking and drying is the best way to preserve these species. The technique is technically and economically accessible to the women fish processors. The product can be marketed over long distances. Moreover, it is ideally suited to the temperature and rainfall conditions of the region.

The scenario is near-identical for thousands of kilometres along the coast. The catch is unloaded from the canoes into baskets or basins and dumped onto the (often dirty and polluted) sandy beaches. The fishermen rapidly count their catch, usually into piles of about 400 fish, and the sale price is then bartered with the women fish processors.

Once the price has been decided upon, the women carry the fish off to the rows of smokers set up in the fishermen's compounds, and start the long job of smoking the fish, which often goes on far into the night.

The fish is first rinsed in seawater (or water from a nearby pond or well) to wash the sand off the scales (the rinse water is usually used over again). It is then spread out on round, square or rectangular racks, according to the type of stove used. Chicken wire is the material most commonly used for the racks, but bamboo and similar materials are often used. Sardinella and bonga shad are never scaled or gutted (the skin is removed from the very thick-skinned Balistes).

The average weight of a bonga shad is 200 to 400 grams. They are always processed in a single layer (one rack). The much lighter Sardinella (75-200 grams) are dried and smoked in superimposed layers on smokers which contain six to 12 racks.

In the countries of West Africa, the traditional smokers have been designed in different shapes to meet the specific capacity needs for processing the catch. The smokers are usually built in clay for round smokers, adobe bricks made out of clay and roughcast with wet cement for square or rectangular smokers. The smokers are usually built in adjacent rows of 6 to 8 m long, 1.25/1.50 cm wide and 0.80 to 1 m high. Usually several banks of smokers are grouped together under a roofed area where the processors can work out of the sun and rain. The fuel also varies from place to place depending on what is available; coconut husks, mangrove wood, palm leaf mid-ribs (cocoa palm), groundnut shells, fuel-wood from the savanna and forest. Heavy population pressures and galloping urbanization along the entire coast of West Africa are causing a very serious reduction of fuel-wood. In some countries the fuel-wood needed to smoke the fish now has to be trucked in, which entails an unrealistic burden of additional costs for a supposedly cheap commodity.

The smoking technique is fairly simple. It consists of drying and hot smoking, with an initially fairly high hardwood fire. This lasts for four to six hours, during which the fish is virtually cooked and fairly well dehydrated on the outside. This hot treatment at over 70°C is necessary to block the action of enzymes and micro-organisms (putrefication), protect the fish from flies and larvae, and dry the inner meat, including penetration by the preserving, protective elements in the smoke.

Drying and smoking then continue at a low, slower fire to which green wood is added (cocoa husks, wet sawdust, sugar-cane wastes, etc.). This brings the heat down to 40-45°C and gives off a continuous thick smoke which adds the goldish tinge desired in the final product. During the operation the smokers are covered with a sheet or piece of sacking to keep the heat and smoke from escaping. Round smokers are capped with a cone of thatch. This second phase of the processing varies from one to several days depending on the extent of dehydration required, which is often determined by market conditions. A properly dried and smoked fish loses about 70 percent of its weight. During the course of processing, the racks are rotated several times, from top to bottom, and the fish are turned over to get a fairly standard final product.

Depending on the custom, the amount processed and market conditions, the fish is either stored in baskets in a storage area off the fisherman's hut, or just left on racks piled up 15 to 20 deep on a bank of smokers and completely covered with a plastic tarp. This is a very convenient system as the product can be re-dried and smoked at will, completely eliminating mould, flies and larvae (40 minutes at 70°C are enough to eliminate all larvae). The only problem with this method is that the fish becomes overdried, brittle, breaks easily and must be very carefully packed and transported.

3.6.1 Improvements

The most active external interventions have been and still are in fish smoking and drying techniques. Virtually all ongoing small-scale fishery development projects include a "fish processing improvement" component involving smoking and drying.

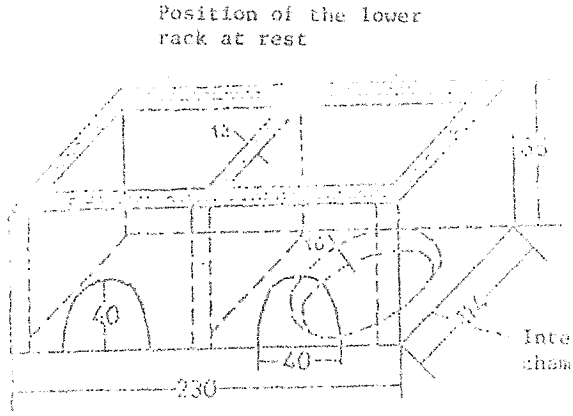
For nearly a quarter of a century now, a great many fish technologists have examined the problem. They have tried to introduce various types of smokers, according to their school of thought. The following are the principal examples:

(i) In the early sixties, the so-called "Ivory Coast type" improved smoker was developed by Christiansen (FAO). Admittedly, no one has done anything really better since.

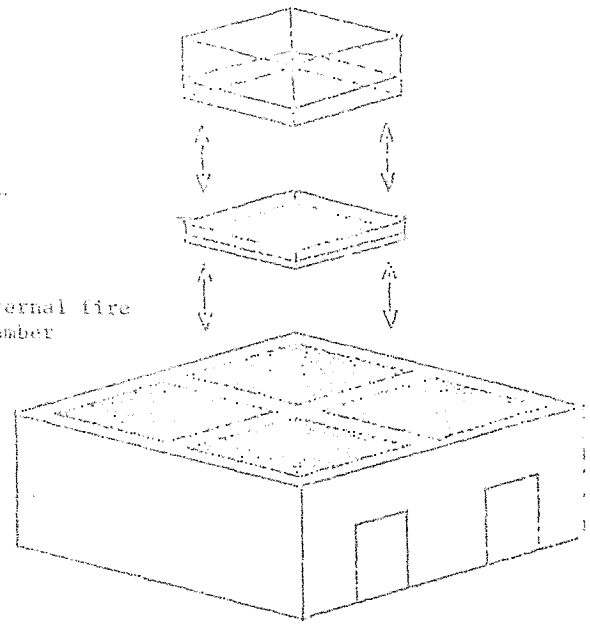
This was a square smoker built of adobe bricks or scrap metal sheets (metal sheet flattened from old fuel drums) equipped with heat vents regulated by dampers and sheet metal heat spreader with large perforations hung over the fire. Using racks of lightweight grille on wooden frames, several superimposed layers (racks) of fish could be smoked and dried at the same time, the last being covered with a dampened hessian cloth. Indeed these were merely practical improvements of traditional individual smokers, which were immediately adopted by the women fish processors as they in no way modified established socio-economic structures. The extension services did an excellent job with this system in the Ivory Coast where the development of Sardinella smoking and drying was in full swing. Entire coastal villages have now specialized in fish smoking, using this method. With time, of course, the heat spreaders disappeared, but the women processors had learned by experience to master the flow of heat, and the products were no longer charred.

At the time, the same type of smoker was introduced on a demonstration basis to a number of other coastal countries of the region, but without getting to the extension stage, doubtless due to the high cost of these smokers built for the occasion from new imported sheet metal, angle iron, and so forth. In all likelihood the very clever small-scale fisherfolk communities in Ghana drew on this model to develop their "Chorkor smoker".

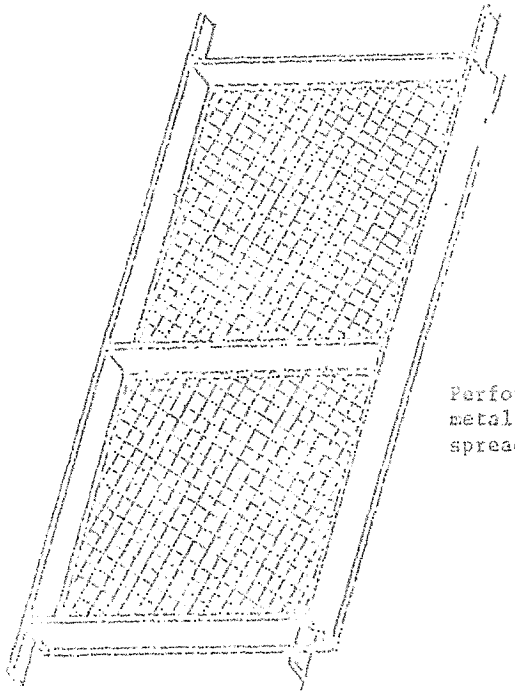
(ii) During the same period, another FAO project carried out in Nigeria by Platek introduced a completely different type of improved smoker called the "Altona smoker", with excellent technical performance. The (reduced) attached sketch is self-explanatory. The Altona smoker, with its excessively high cost price, cannot be extended in the field even today because its metal construction makes it too sophisticated, and mostly because the fish processors cannot afford it. In addition to this, any sheet metal fixture rusts at the seaside. It is too short-lived to pay for itself and is therefore not appropriate.



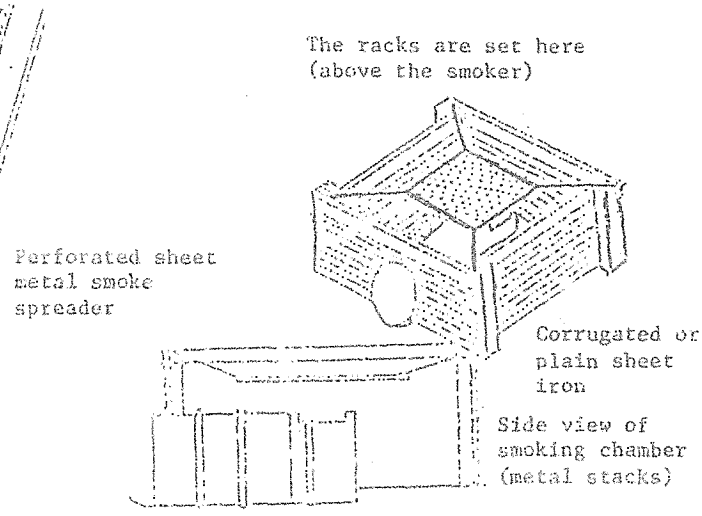
Improved Chorkor smoker (Ghana)



A set of 4 adjacent smokers



Smoking rack
This rack is for a 230 x 114 cm smoker (outside dimensions) with 14 cm thick walls

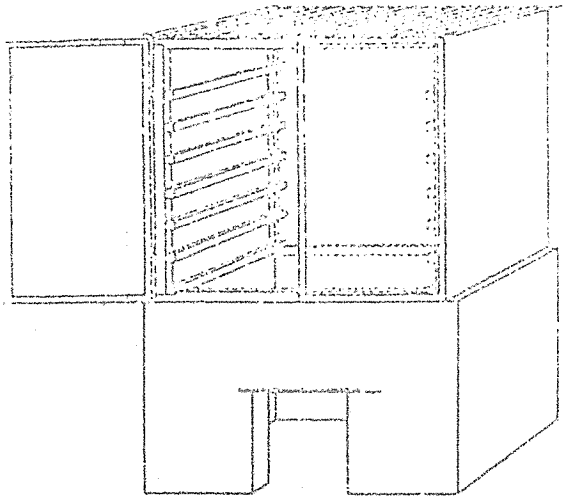


Improved smoker (Ivory Coast)

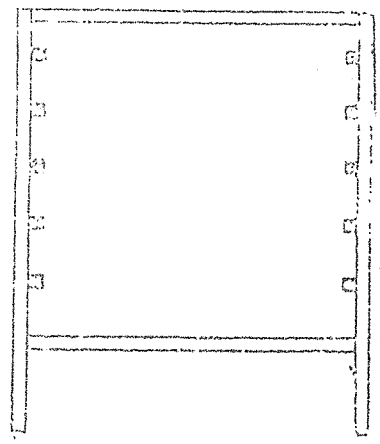
Improved smokers in Ghana

Source: Study N.S. Diouf, Consultant, FAO/CECAF DP/INT/81/014, November 1983

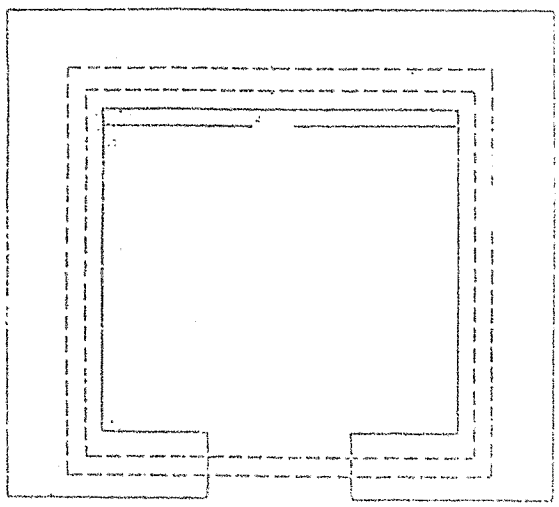
Simplified version of the interior hearth Altona smoker



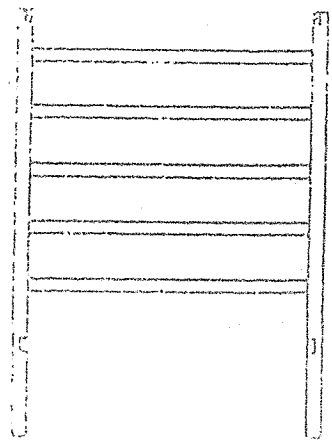
General view of half-open smoker



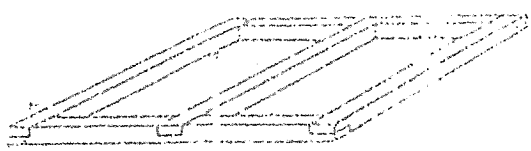
view rack holder



Section of hearth



Side view rack holder



Smoking rack

Source: Study N.S. Diouf, Consultant, FAO/CECAF DP/INT/81/014, November 1983

(iii) Again, during the sixties, bilateral aid introduced, without success, an Altona-type smoker in masonry, cement and (imported) fire-proof bricks. The model was inspired by conventional small-scale installations used in Europe to prepare luxury products such as mackerel, smoked mackerel, trout and eel. Twenty years later, bilateral and multilateral aid set up some Centres collectifs de Developpement des Peches Artisanales, reintroducing the Altona smokers in sheet metal and the massive masonry smokers lined with fire-proof brick. The racks, with thick metal grilles and heavy angle iron frames, demand a herculean effort to handle when loaded with fish, quite beyond the scope of the "weaker sex".

There was even a wheeled, one-piece interior assembly shelf arrangement which could be rolled in and out of the smoker at will. This was both designed and implemented. Here the layers of fish could neither be reversed nor turned over. The lowest layers were processed long before the upper layers, and the results was far from uniform.

In practice, these collective installations owe more to prestige than to efficiency. So far they have had no impact on the fishing communities who remain indifferent to them, as they do more to perturb than to promote social harmony in these communities.

(iv) As part of the Decade of Women, special attention was paid to aspects of women's work in the small-scale fishermen's communities, particularly fish-smoking and drying techniques.

The dialogue between the technical people and the social groups directly involved (the women) had as their outcome the improved traditional Ghanaian oven, called the "Chorkor smoker". Practically speaking, this is a repeat of the Christiansen smoker (Ivory Coast type) of the sixties. The highly explicit attached drawing represents at the present time the model of smoker which best corresponds to the technical and financial possibilities of the women who process the fish. The chances for extending the Chorkor smoker throughout the region are excellent. This is an individual smoker, which can be built in rows, making the maximum use of locally available materials, and most of all it is ideally suited to the conditions and socio-economic structures of this social environment.

3.6.2 Recommendations

Drying and smoking fish, particularly Sardinella and shad (probably soon to be joined by Balistes), will long remain the fish preservation technique best adapted to the technical and socio-economic context of Africa. The only possible (but highly improbable) competition would be from fresh, iced or frozen fish. For this to become a reality, vast networks of cold storage and transport systems would have to be set up. This is the solution often recommended by experts representing the commercial side of the venture. These networks would be extended by the use of home refrigerators among the rural masses which is obviously economically unfeasible.

In designing small-scale fisheries development programmes or projects, planners must keep the following factors in mind if they wish to achieve positive, lasting results:

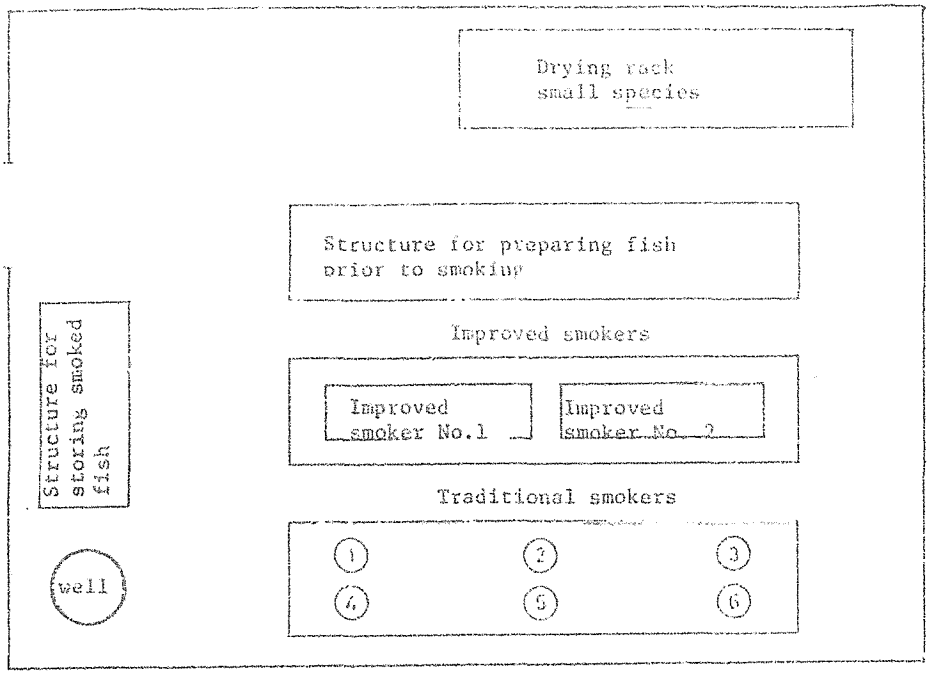
(i) Any improvement in smoking and drying facilities must remain within the technical, financial and managerial capacities of the small-scale fisheries community. The people in the community should be consulted on the projects which concern them. They must also participate financially or otherwise in the implementation of such projects.

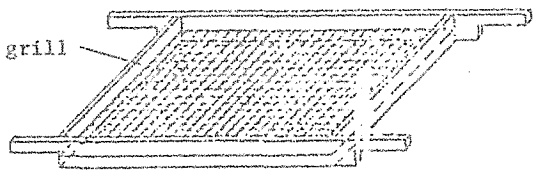
(ii) The main improvements, and the ones which should receive top priority, are those which have to do with hygiene. Planners should, for example, include in their plans the construction of a drinking water well in all fishing camps. Training should also be provided in these communities in techniques of drying, smoking, storage, packing processed fish, principles of basic bodily and environmental hygiene. Experienced women would be trained who would then monitor the work of the rest.

(iii) Processed fish for market should remain as cheap as possible, i.e., within the financial reach of a consumer with low purchasing power.

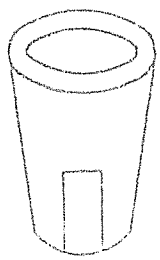
In the small-scale sector, there is only one way to really keep cost prices down. This is to respect long-established traditions of fish processing by individual families, a system in which the work done by family members is not remunerated. All methods of group processing (processing shops) in which the labour force has to be paid have so far proved non-viable, as shown by a number of fruitless attempts to do so.

Improved fish smoking workshop in Benin

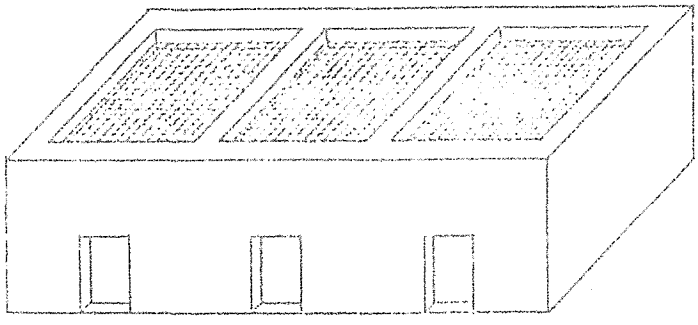




A smoking rack



Clay oven



A set of 3 smokers in clay

Source: Study N.S. Diouf, Consultant, FAO/CECAF DP/INT/81/014, November 1983

(iv) The smoking facilities should involve minimum expenses, both to build and to operate, whilst at the same time providing a product of acceptable quality. This principle implies tapping any and all local materials before resorting, as is most often done, to high-cost imports.

Abobe brick walls rough-cast in cement, which are every bit as valid as cement block walls, are preferable to expensive, short-lived, imported sheet metal, given the salty-heavy coastal environment. Imported metal grill racks could be replaced by racks made from the tyre wires of discarded tyres, thus promoting the development of a local craft.

The question of saving fuel is primarily a question of teaching the women processors how to best use fire, more than a question of what materials are used. It seems ridiculous to import fireproof bricks which could only be justified by the preparation of luxury products.

Before smoking/drying:

- The fish should reach the family processing centres as soon as possible after landing. This transfer is always much delayed by the fisherman having to count his fish, and the bargaining over the fish by the women fish processors.

- The women processors should have enough drinking quality water to wash the fish properly before processing. Water used for rinsing should be thrown out away from the working areas so as to avoid attracting masses of flies.

- A single rack should hold only fish of the same size, not mixing sizes, so that the products will be uniformly processed.

During the drying and smoking process:

- The women fish processors should receive more intensive training in how to use fire at the various stages of the drying/smoking process (so as to avoid charring the fish, as well as the obvious waste of fuel and calories), as well as how to achieve a better distribution of heat within the oven (for uniform internal heat, always rather a problem in square or rectangular smokers).

- Improvement of the technique of rotating fish racks and turning the fish during the drying/smoking process, taking into account the size of the fish and the different racks, in particular, as well as how near the product is to completion.

After drying/smoking:

- Improved storage techniques, involving a dry storage area, free of parasites and protected from flies and such predators as rats, cats, pigs, chickens, etc..

- A properly designed storage area would include:

  a cement floor;

  shelf racks for storing the fish in bulk covered with plastic sheeting or in baskets lined with brown wrapping paper or plastic, or in burlap bags. The product should not be in direct contact with the floor;

  one or two external heat vents, depending on how large the storage space is, with a flue for heat and smoke right in the centre of the storage area so that the stored product can be re-dried and re-smoked at will. Light smoking is enough to keep flies away, and 70 ^{0}C heat for 40 minutes is enough to eliminate fish-eating larvae;

  the use of insecticides should be forbidden.

- One very simple, low-cost alternative is to store the processed fish directly on 15 to 20 tiers of racks over a bank of smokers, the whole covered by a plastic hood. This practice is common when the smokers are installed in sheds within the fisherman's own compound where surveillance is not a problem.

- The surroundings of the fish processing and storage site should meet high standards of hygiene. Used rinse water, household wastes, waste and garbage, human and animal excrement should be properly disposed of, thus avoiding meat flies, scavenger beetles, Dermestes infestation, rats, etc..

- Last of all, packing the processed product for transport to market. The main items of use here are the high-quality baskets in different shapes and sizes woven by local craftsmen.

Dried and smoked fish is fairly fragile and crumbles easily. The baskets are quite strong and the women are remarkably skilful in the way they pack the baskets with fish. This is a delicate operation and it is hard to see how it could be further improved. The baskets are lined inside with wrapping paper, burlap or plastic, and the top is generally covered by a hessian cloth sewed to the top of the basket.

The only real handicap of the systems is the risk of piling baskets one on the other for transporting large batches of fish without having taken the elementary precaution of separating the layers by a good row of planks, the only way to avoid crushing and crumbling of much of the processed product. From this standpoint, it would be better to pack the fish in crates, but they would cost a great deal more.

In closing, it can be seen that planners will have to cope with a great many technical, social and economic problems. The choice of any one approach over another should be objective, realistic and pragmatic. The participation of the fishing community should be enlisted; they should be part of the decision-making process. The lack of progress in the development of this sector, which has remained at a standstill for the last 20 years, is one result of planners having ignored this principle.

Let us hope that a new generation of planners will be wise enough to learn this lesson.

LISTE DES RAPPORTS DIPA - LIST OF IDAF REPORTS

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De Graauw, M. A., Etude de préfactibilité technique de l'aménagement d'abris
1985 pour la pêche maritime artisanale au Bénin. Cotonou, Projet DIPA. 55p., DIPA/WP/1.

Black-Michaud, M. J., Mission d'identification des communautés littorales de
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