

Fisheries Co-Management Project ICLARM-IFM-NARS/Project for the Development  
Artisanal Fisheries on Aby lagoon (Côte d'Ivoire)

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**Co-management in Aby lagoon (Côte d'Ivoire): Preliminary results**

by

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## ABSTRACT

Since 1995, an experiment of co-management is carried in the lagoon Aby (Côte d'Ivoire) for the management of the fishery. The process is based on a consensual definition of the rules of management and the setting up of organisational structures (fishing committees) ready to work with the governmental agencies to achieve the common goals of management. The preliminary results show that the fishermen are conscious of their duties. They are available to involve themselves in an active and efficient cooperation. The structure of exchange (communication) created on this purpose permits to ensure a satisfying participation of all. The bio-economic impacts of the co-management can already be perceived. Though these positive results are benefic to the whole fishery, there happens that some fishermen (the owners of beach seines) pay heavy taxes, and that leads to their opposition to the innovation. The process of co-management has favoured the supervision of the resources rather than their management in an extensive way. Consequently, women are not consulted in the decision making whereas they undergo the effects of that management. The appropriation of the process by the users which goes on slowly, to be perpetuated, must formalize the intitutional instruments (laws, status of committees etc.).

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## Introduction

On Aby lagoon, some works have been undertaken by the Oceanographic Research Center (CRO) in order to gather the necessary informations to answer the questions asked by the managers, decision-makers, planners and money-lenders, concerned with fishery development. The only subject of these researches was the halieutic biology, precisely the biology of the species, the evaluation of the resource. The fisheries management has been achieved by taking into account the resource only. One must recognise that this way of dealing with the problems of fishery management did not give entirely satisfying results. The repeated crisis of the over-exploitation of 1983 and 1987 and the open conflict (1990) between the Aby lagoon populations and the Project for the Development of Artisanal Fishery are the illustrations. The fishery management based only on the resource seemed therefore to have contributed to the relegation of the social aspect to a status of independent variable (Y. Brteon and C.M. Diaw, 1992).

Generally, the strong involvement of the authorities (strongly centralised administration) in the process of development seems to give an opposite effect, since very often, the beneficiaries of the development are isolated. On the one hand, when the technical services having in charge the promotion of the fishery have enough financial resources, they impose their own policy of fishery management. On the other hand, the users unilaterally impose their own way of management. In 1990, a radical break put an end to that practice, and for two years (1990-1992), the Aby lagoon populations and the Project for the Development of Artisanal Fishery had no contact with each other, especially with the interruption of the Project's activities.

In 1992, the analysis of the situation permitted to set up new strategies to deal with the fisheries management, this time, taking into account the social aspect. That new approach imposed by the circumstances (repeated crisis, frequent conflicts) on Aby lagoon, aimed at searching for a real participation of the fishermen in the management of the halieutic resource. Even if the setting-up of this strategy went on slowly, it responded to the goal of the national policy of decentralisation and devolution.

In 1995, the participative management was initiated on Aby lagoon in a context of a nearly systematic rejection of the fisheries administration by the users (Kponhassia and Konan, 1996). Despite the resistance of the beginning, the approach kept on going on. The present study aims at doing a first evaluation. The document consists of four parts:

- the first part deals with the demographic and physical geography of the Aby lagoon complex;
- the second part deals with the fishery on Aby lagoon and the economic characteristics;
- the third part accounts for the actions undertaken in the co-management and the most relevant bio-economic results;
- the fourth part deals with the durability of the system.

## 1. Material and method

Three main complementary tools permitted to gather the qualitative and quantitative data.

## **1.1. Bibliography**

The Aby lagoon is one of the most documented Ivorian lagoons. The Oceanographic Research Center (CRO) has been making researches on it since 1980. The Project for the Development of Artisanal Fishery on Aby lagoon made many reports and accounts and made also studies on it. All this documentation taken together has been used to help in the present study.

## **1.2. Semi-structured interviews**

The semi-structured interviews have been organised with three social groups: the cantonal fishery committee on Aby lagoon, three village committees and three groups of women fish smokers-sellers in three villages.

The three villages have been chosen for the following reasons:

- Etuéboué: very involved in the co-management because it is the cantonal district and it is recognised as the main instigator of the 1990's events. Before the beginning of the present co-operation, two tendencies could be distinguished, the youths were totally hostile to the restarting of the activities of the Fisheries Office whereas the elders were favourable to a reconciliation through a conditioned co-operation (Kponhassia, 1994).

- Epleman: fishermen in this village have very often been victims of the application of the seminar's resolutions. The inhabitants feel oppressed by the rest of the populations. It has been noticed that because of that situation, the village fishery committee is very laxist.

- Assomlan: the committee of this village has been renewed and works hard. Their bay which was very degraded has regained its vitality with a rapid reconstitution of the resource within six months. There were immediate financial outcomes for the village.

The choice of the social groups is based on the recognition by the village community of their role played in the process of co-management. However, the women who are very isolated in the present process have been met separately from the men. It is worth mentioning that 63 people have been met.

## **1.3. Enquiries**

The advantages of the semi-structured interviews is very often to sort out the tendencies of the dominant groups since in the societies of the lagoon populations, the social structures are based on very strong hierarchical system and the gerontocratic power counts much. On the contrary, the individual interviews favour a popular expression and are therefore very democratic. They took place in the twelve main villages of Aby lagoon (*sensu stricto*). In each village, three types of people have been interviewed:

- The fishermen: they consist of two groups, those who directly take part in the management of the committees (5 fishermen) representing 20%, those who are not committee staff members (10 fishermen) representing 40%.

- The notables: five (5) notables representing (20%) including the village chief, have been interviewed;

- the transformers: five (5) women fish-smokers representing (20%) have been interviewed per village.

Thus three hundred (300) questionnaires have been received and treated with computer program "ACCESS".

## **2. The Aby lagoon**

The Aby lagoon (fig 1) is one of the three lagoon complex (Ebrié, Grand-Lahou and Aby) which cover 300 km of the coast line. Each is in contact with the sea. They are connected to each other with channels (Durand and Chantraine, 1992).

The Aby lagoon (fig.2) is located in the far east of the littoral. Its median part forms a natural border between Côte d'Ivoire and Ghana. It covers 30 km of the coastal line and extends over an area of 424 square kilometres. The Aby lagoon is between the longitude 2°51' and 3°21' on the one hand and the latitude 5°01' and 5°22' on the other hand (Chantraine, 1980).

The Aby lagoon (*sensu stricto*), whose name has been given to the complex, is the most extended and covers 305 square kilometres, it penetrates (enters) the earth with about 24.5 km with a maximum width of 15.5 km.

- The Tendo lagoon which is the median part of the complex, is more stretched. Its length is 22 km with a width varying between 1.5 and 3.5 km. Its surface is 74 square kilometres.

- The Ehy lagoon, more eastern, has a basin form and a surface of 45 square kilometres.

### **2.1. Hydrology**

The Aby lagoon is supplied with fresh water by the rivers Bia in the north-west and Tanoé in the east. The regime of these two main coastal rivers depend on the rainfall of the southern forrester region. Both the marine and fresh waters have a common influence on some physical and chemical parametres, the salinity included. This salinity depends on the importance of the water supply which varies according to the season. During the dry season, the marine influence is maximal and the salinity at the surface is higher with an average of 14‰. That number decreases according to a south-north gradient to become very weak, even inexistent at the level of the channel.

The southern part of Aby lagoon is always salted because of the direct influence of the sea. The northern area of Aby lagoon is freed of salt, even fresh at the level of its encounter with the Bia river.

The Tendo area has a salinity which is permanently weak, between 0 and 2‰.

In Ehy area, under the strong influence of the Tanoé river, the waters remain fresh all over the year.

The degrees of salinity are low from August to december, high from January to April with a peak in March-April followed by a second one less important in August.

That spatial variation of salinity permits to explain the distribution of the fish species, especially that of *Ethmalosa fimbriata*

## 2.2. Ichthyofauna

The ichthyofaunal population of the Aby lagoon has been estimated to around sixty species (Daget and Iltis, 1965), 33 have been selected (N'Goran, 1995) among which the *Ethmalosa fimbriata* is far the most represented. It constitutes 60 to 80% of the catch on Aby lagoon (sensu stricto). The Aby lagoon complex presents a great and specific diversity. That rich content is due to its extent (424 square kilometres), its constant exchange with the sea and with the important fresh water supply by the Bia and Tanoé rivers (N'goran, 1995).

Three groups can be distinguished (Albaret, 1990)

- The fundamentally lagoon species group

That group consists of three types of species:

\*the exclusively estuarian species whose cycle takes place in lagoon (ex: *Tilapia guineensis*);

\*the estuarian species with marine origin which are adapted to the lagoon environment (ex: *Ethmalosa fimbriata*, *Trachinotus teraia*);

\* the estuarian species with continental origin (ex: *Chrysichthys* spp)

- The group of species with marine affinity

That group consists of three types

\* the estuarian marine species; they do not breed in lagoon but come to maturity in it (ex: *Elops lacerta*);

\* the accessory marine species whose presence is restricted to the lagoon (ex: *sardinella aurita*)

\* the occasional marine species, very rare and caught in the channel of Assinie (ex: *Dentex canariensis*);

The group of species with strong continental affinity

That group consists of two species.

\* the continental species with estuarian affinity bearing salinities inferior to 5‰ (ex: *Hepsetus odoe*)

\* the occasional continental species whose presence is restricted to the lagoon (ex: *Hemichromis fasciatus*).

The crustaceans consist of crabs (*Callinectes amnicola*) and shrimps (*Penaeus duorarum*) which are more and more important in the landings.

The Aby lagoon is characterised by seasonal variations of its physical and chemical parameters, by a spatial heterogeneity of its hydraulic climate and by a specific great richness which permit the lagoon populations to maintain an active fishing.

## **2.3 Lagoon populations**

The populations of the Aby lagoon complex Aby-tendo Ehy are classified into four distinct cantons. The cantons Adjouan, Adouvlai,, Ehotilé and Essouma, all of them settled according to the following:

- Aby lagoon: Canton Adjouan and Ehotilé;
- Tendo-Ehy lagoons : canton Adouvlai
- deltaic area canton Essouma.

The social and political organisation of the Aby lagoon populations is identical in its major components, because the populations concerned belong to the same Akan/Ashanti cultural group. In these societies, kinship is the framework which maintains relationships between individuals, via a matrilineal system (Kponhassia, 1995)

With regard to social organisation, there is a distinct division of labour according to sex. Women generally deal with the actual processing and marketing of agricultural and fishery products, while men are engaged in income earning or food-producing agriculture, as well as fishing. Furthermore, apart from their personal economic activities, the "youth" (from 15 to 35-40 years) are obliged to take an active part in the achievement of community interest works. As for fishing, the youth are asked, for instance, to undertake the surveillance and control of fishing activities within the village territory.

As far as political organisation is concerned, these traditional societies belong to the categories of societies where chieftancies hold a central power recognised and respected by all. At district level, a chief of district, sometimes under the authority of a king, holds the power of decision-making over all questions concerning the whole district. At village level, the village chief, surrounded by his notables, takes decisions concerning the village, after consultations with representatives of his people. After appointment at the local level, the chieftancies are then recognised by the territorial administration on the orders of the "Prefet" (Government-appointed Divisional Administrator). It is important to note that discussion is the tool largely used to resolve the conflicts which can sometimes break out between different social groups.

-Other individuals, natives of the village and who conduct their professional activities outside the village (administration or private enterprise executives), are very much involved at different levels of the decision-making process.

Due to the evolution of modern societies, in terms of modernisation, education, demographic pressure and attachment of monetary value to transactions, a certain, degree of erosion in the traditional social order is being observed with contradictions, disputes and sometimes power conflicts arising between the elders and the young. But this does not mean that these structures have lost their effective role in the shaping of local development policies and especially in the lagoon management.

## **3. Fishing on Aby lagoon**

The Aby lagoon covers 25% of the divisional territory of Adiaké whose surface is 1,860 square kilometres. At economic level (income and employment), fishing plays a very important role. The results of the enquiry framework (Konan, Kouakou and Kouakou, 1997) given in the present study permit to have very recent data.

### 3.1 Fishermen

There are 3,260 fishermen distributed as follows: 1,100 fishermen (33.7%) working with collective gears (beach seines and union seines) and 2,160 fishermen working with individual gears (gillnets, cast nets crab pots etc)

**Table 1:** Distribution of fishermen using collective gears per stratum

	Aby	Tendo-Ehy	Deltaic Area	Total
Number of fishermen	704	308	88	1,100
Percentage	64%	28%	8%	100%

At the level of individual gears, the fishermen are distributed on two types of dominating gears:

**Table 2:** Distribution of fishermen using individual gears per stratum

	Aby	Tendo-Ehy	Deltaic area	Total
Number of fishermen	1.172	98	290	1.100
Percentage	82%	4.5%	13.5%	100

The fishermen work with helpers.

**Table 3:** Distribution of individual fishermen per gear types

	owners	helpers	Total
Tilapia gillnets	512	508	1020
Ethmalosa gillnets	465	453	918
crab pots	122		122
shrimp nets	50	50	100

### 3.2. Typology of a fisherman

**Age of the fishermen:** the average age of the fishermen is 38 years. The average time of experience or seniority of service is about 10 years. It is important to note that 31 %, 36% and 33% of the fishermen have been doing that activity for respectively 3, 7 and 21 years.

**Table 4:** Percentage of the fishermen per age interval (year)

Age intervals	10 to 19	20 to 39	40 to 59	60 to 80

Percentage	7%	56%	25%	12%
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**Level of literacy** : the fishermen are classified into four categories of literacy level:

- the illiterate persons: it is the category of fishermen who do not know how to read nor how to write. They represent 42.10 %;
- primary school level: those who reached between Form 1 to Form 6 level, represent 37.10 %;
- secondary school first cycle (Form 1 to Form 4): they represent 16.10%;
- and finally, secondary school second cycle: they are weakly represented : 4.35%;

The people who stopped their studies for different reasons and became fishermen represent 28.4%, whereas those who converted to fishermen because of a first employment lost represent 32%.

**Gear property**: on Aby lagoon (sensu stricto) and in deltaic area (Assinie), the collective gears belong all to Ivorians. However, they employ foreigner fishermen.

At the level of the individual gears, 89% of the fishermen with Tilapia nets are the owners of their work tools against 84 % for ethmalosa gillnets. It has been noted that the fishermen who are regularly absent entrust their tools to employed fishermen. Their proportion varies to 11% for Tilapia nets and to 16% for etmalosa nets.

On Tendo-Ehy lagoon, 88% of the collective beach seines are owned by ghanaiian fishermen who negotiate the fishing areas with the traditionnal authorities of the lagoon villages.

**The alternative jobs**: the fishermen try to vary their activities for two reasons :

- \* to generate additional incomes;
- \* to secure their incomes during bad periods of fishing,

thus, they lessen the precariousness of their incomes. They are active in three sectors.

- food crops (plantains, cassava etc): 22 %
- perennial crops (coffee, cocoa, palm-trees etc ): 23 %
- trade (lagoonal transport, shops etc ): 7 %

It is worth noting that about half of the fishermen (48%) get their incomes exclusively from fishing. The other 52 % vary their sources of income, this has no effects upon the professional characteristics of their activity.

### **3.3. Women fish -smokers**

The transformation of the fish, particularly the smoking, is exclusively done by women. They are 2,284.

The Ivorians represent 79 % of the transformers. The non-Ivorians (21%) are largely dominated by the Ghanaians (97%). Each woman works with an average of one helper who is very often a relative since the percentage of helpers having a close relationship with the tool owners (smoking-rooms for fish) is 92 %;

**Table 5:** Distribution of fish smokers per stratum

	Aby	Tendo-Ehy	Deltaic area	Total
Owners	905	180	61	1,146
Helpers	897	180	61	1,138
Total	1,802	360	122	2,284

The smokers have in average 4 children, 79% among them are traditionally married against 20.3% of singles.

79.7 % of the women transformers are uneducated, 17.9 % have been to primary school, 2.2% have been to secondary school and 0.1% have attended upper studies.

### **3.4. Women sellers of fresh fish**

The number of women having the fresh fish trade as a main activity is relatively weak, about 136 people. 79.4% are Ivoirians and 20.6% are foreigners. Their helpers are often relatives (96.24%). Most of them are (traditionally) married (62%). The singles represent 38.34%. They have 3 children in average.

More than half of the fresh fish sellers are illiterate (59.56%). However, this type of activity seems to attract more young girls who interrupted their studies, 31.6% have primary school level, 6.6 % have secondary school first cycle level and 2.2% have secondary second cycle level.

### **3.5. Fish smokers/ sellers of fresh fish**

There is a group of women who sell fresh fish and smoke fish at the same time. They are 195. In fact, it is a group of women less specialised or rather "opportunists" who seem to take profit of any occasion they can get.

There seems consequently that the transformation and the marketing of the fishing products respect a kind of division of works even of specialisation.

The fishing is characterised by a vertical economic integration.

### **3.6. Means of production**

On Aby lagoon, many types of gear are used. They can be gathered into two categories:: collective gears and individual gears.

### 3.6.1. Collective gears

Most of the collective gears are concentrated on Aby lagoon (sensu stricto), about 71% of the whole of the collective gears with 66% of beach seines.

**Table 6:** Distribution of collective gears per stratum

Stratum	Beach seines (BS)	Union seines (US)	Total	%
Aby	33	9	42	71
Tendo-Ehy	13		13	22
Assinie	4		4	7
Total	50	9	59	100

Due to its particular hydrology and to a relative abundance of *Ethmalosa fimbriata*, the union seines which replace the gillnets are only found on Aby lagoon.

### 3.6.2. Individual gears

They are many and varied

**Table 7:** Distribution of individual gears per stratum

Stratum	TG	EG	TrG	SN	CP	LI	EP	CN	BAM
Aby	1,086	3,062	1,082	128	6,039	330	585	135	15,803
Tendo-Ehy	756	185	1	0	60	63	1,036	60	64,183
Assinie	121	145	3	73	36	4	80	27	0
Total	1,963	3,392	1,086	201	6,135	397	1,701	222	79,986

TG: Tilapia gillnets

SN: Shrimp nets

EP: Eel pot (Tilapia)

EG: ethmalosa gillnets CP: Crab pots

CN: Cast nets

TrG: Trachinotus gillnets

LI: Longlines

BAM: Bamboo

Each stratum presents one or many dominating gears. However, the Aby lagoon (sensu stricto) because of the number and the variety of gears in use, seem to be the most dynamic stratum. Three types of gillnets are dominant there; 55% of Tilapia nets, 90% of ethmalosa nets and 99% of Trachinotus nets are found on it.

### 3.6.3. Canoes

Two types of canoes are found on the Aby lagoon complex: dugout and planked canoes. The dugout canoes, all sizes taken together are 803 and represent 78% against 225 planked canoes (22%) being the canoes in use.

**Table 8:** Types of canoes on the Aby lagoon complex

	BDC	MDC	SCD	BPC	MPC	SPC	Total
Number	124	200	479	66	68	91	1,028
Percentage	12	19.5	46.6	6.4	6.6	8.9	100

**BDC:** Big Dugout Canoes**BPC:** Big Planked Canoes**MDC:** Medium size Dugout Canoes**MPC:** Medium size Planked Canoes**SDC:** Small Dugout Canoes**SPC:** Small Planked Canoes

### 3.6.4. Smoking-rooms

The smoking activity is very important on Aby lagoon. More than 98% of the ethmalosa landed is smoked and sold. The transformation process is achieved through two steps to take into account the fact that the market is held weekly around the lagoon.

Thus, the fish goes through a first step of smoking on either small smoking rooms made with 200-litres empty barrels or on small smoking-rooms made with baked clay with a barrel shape. After this step, the fish is stocked on smoking rooms of bigger capacity which are also used for conservation with a soft fire waiting for the market day.

**Table 9:** Different types of smoking-rooms

	BBS	BSC	SMS	SSC	Total
Number	1,065	1,241	3,759	581	6,646
Percentage	16	18.7	56.6	8.7	100

**BBS:** Big Barrel-shaped Smoking-rooms**SMS:** Small Barrel-shaped Smoking-rooms**BSC:** Big Smoking-rooms made with baked clay **SSC:** Small Smoking-rooms made with baked clay

It can be noticed that for the first step of smoking, the small 200 -litres empty barrels are more used by the women- smokers for they represent 56.6% of the selected smoking-rooms. The bigger smoking-rooms to the contrary, are more accepted when they are made with baked clay rather than with empty barrels.

## 3.7. Marketing

The post-fishing activities are generally done by women

### 3.7.1 Fish supply

In general, the fish are landed in villages where 94 % of the women transformers make their purchase, whereas 16% of the fresh fish retailers (secondhand sellers) go in canoes to buy the fish with the fishermen on the lagoon. They go either in hired canoes (77%), in their own canoes (20%), or in borrowed canoes (3%). That way of having access to the "raw material"

concerns the women of the areas where there are no fishery units with beach seines. That is the case of the women smokers and fresh fish sellers of the town of Adiaké.

Though 58% of them get their supplies from any fisherman, an important number of the transformers and retailers remain attached to some fishermen to secure their supplies. In the fishermen-sellers relationship, the family links can be helpful. Those links are more determinant for the supply of the women-smokers coming from the villages to which belong the fishing teams (the fish are first sold to the family members), and less for the fresh fish sellers, only 28 % of their providers are relatives.

### 3.7.2 Cession mode

- the purchase: the cash payment dominates the relationships between the fishermen and the women. However, the number of women who buy on credit with some fishermen seems to express a satisfying level of confidence.

**Table 10:** Fish cession mode to women

	Fish-smokers	Fresh fish sellers	Fish smokers/Fresh fish sellers
Cash payment	57%	72%	70%
Credit Payment	43%	28%	30%

The percentage of women who get their supply on credit is higher with the smokers (42%) than with the fresh fish sellers. That trend seems to confirm that in the villages, the family links contribute to the consolidation of the confidence between the fishing teams and the transformers.

The sale : the selling of the fish is determined by the nature of the product.

\* Fresh fish are sold everyday of the week except generally on wednesdays (fishing forbidden on tuesday) because the smoked fish dominate on that day. 90% of the interviewed affirm that they sell or retail the fish everyday to any buyer without any distinction of family link with only 9% of the buyers considered faithful. The sale is done with cash payment mode (90%) against only 10% on credit.

\* The smoked fish: the transformer is also a fish seller; 81% of the smokers sell their products at the weekly market. The fish are sold to any buyer without any distinction (82%). The percentage of the regular buyers is relatively weak (14%) as well as the preferences for relatives (3%) and partners (0.8%). Very few smokers sell their fish on credit (7%) because most of them sell on cash payment mode (93%).

**Table 11:** Selling mode of the fishing products

	Fish smokers	Fresh fish sellers	Fish smokers/Fresh fish sellers
Everyday	19%	90%	75%
Weekly market	81%	10%	25%

### 3.7.3. Selling of the smoked fish

The most important weekly market around the Aby lagoon complex is that of Adiaké. It is followed by Tiapoum market then those of Eboué and Mowa. The typology of the buyers (they are people who do not dwell at the place of production, but buy the fish to retail them inside the country) will be analysed using the enquiries made on Adiaké market. Women dominate the sector with 117 regular traders, that is 89% against 11% of men. The number of retailers has decreased of 19% from 1997 to 1998.

The most representative age interval is between 31 and 55 years, that is 86 women (74%) and 11 men (73%).

**Table 12:** Distribution of the retailers per sex and age.

Age interval	1996		1997		1998	
	Women	Men	Women	Men	Women	Men
16 to 30	18 (18%)	1 (11%)	21 (13.8%)	2 (20%)	14 (11%)	1 (7%)
31 to 55	72 (72%)	7 (89%)	115 (75.6%)	7 (70%)	86 (74%)	11 (73%)
56 to 75	10 (10%)	1 (11%)	16 (10.5%)	1 (10%)	17 (15%)	3 (20%)
Total	100(91.7%)	9 (8.3%)	152 (94%)	10 (6%)	117 (89%)	15 (11%)
Total	109		162		132	

It is an atom-like market where many sellers and buyers meet each other, marked by the scattering of the places of exchange around the lagoon (6 markets days per week around the lagoon).

### 3.8. Economic considerations

In 1996, the team of the Project for the Development of Artisanal Fishery in Aby lagoon achieved a study on the costs and incomes of the fishery units. Three fishery units (beach seines units, union seines units and ethmalose nets) are compared.

**Table 13:** Economic indicators of three fisheries units.

in US \$*	Beach Seines	Union seines	Ethmalosa gillnets
Investment	20,000	7,000	420
Turnover (TO)	23,300	8,793	3,255
Intermediary consumption			
- Care	540	54	99
- auto consumption	2,330	169	221
-Total intermediary consumption	2,870	223	320
Amortization (equipment)	2,000	416	144
Net Added-Value (NAV)	18,443	7,877	2650

Opportunity Cost of job	8,433	1,067	800
Opportunity Cost of Capital	3,428	1,179	538
Rent	6,581	5,631	1312
NAV/TO	79%	90%	81%
NAV/fisheram	802	1,969	1325
Rent/TO	28%	64%	40%

\$ US = 600 f cfa

#### **- Investments**

Of the three fishing gears, the beach seine requires the highest capital with an initial level of \$ 20,000 US, followed by the union seine \$ 7,000 US and the ethmalosa net \$ 400 US. The craftsmen provide their own funds.

#### **- Benefits**

The rate of profitability (net product/ invested capital) is around 20.7% for beach seines, 52.2% for union seines and 334% for ethalosa nets. The individual minor fishing with a low level of investment presents the highest rate of benefit, explaining thus the economic rationality of the individual fisherman who gives up the less profitable gears and reacts with much dexterity to the variations of the economic and ecologic environment.

#### **-Employments**

The collective fishing employs 1,100 fishermen against 2,160 fishermen for the individual fishing. The cost of an employment creation in collective fishing is four times higher than in individual fishing.

#### **- Wealth creation**

The value-added rate that we retain as a relevant criterion of evaluation of the resources creation is around 90% for beach seines. It is followed by the fishing units with ethmalosa nets which have a value-added rate of 81%, equal to the one recorded by union seines. It is worth noting that for unauqual investments, the fishing units relatively create the same level of wealth.

#### **- Rent**

The rent corresponds to the benefits acquired once the work and the capital have been paid at their relative costs. It can be noticed that the fishing units with beach seines get a low rate of rent (28%) contrarily to the union seines with a rate relatively important (64%) and the ethmalosa nets with (40%).

In a word, fishing on Aby lagoon is characerised by its diversity. It has very quickly evolved (since the 1980s) from subsistence level fishing to commercial fishing marked by a low level of auto-consummation, a relatively high cost of investment and exploitation strategies turned towards the research of benefits.

**Table 14:** Auto-consumption per type of fishing gears

	Beach seine	Union seine	Ethmalosa gillnet
Auto-consumption (% of catches consumed by the fisherman and his family)	4%	2%	4%

What will become of the economy of the fishing on Aby lagoon when the recommendations of the seminar held in Grand-Bassam will be applied in the case of the strategy of a co-management?

#### **4. Co-managment and bio-economic impacts**

The search for the populations participation in the management of the halieutic resources on Aby lagoon has always been the concern of the Aby lagoon complex managers. But the lack of a clear strategy and a strong will did not permit to reach the expected goals. The ongoing test capitalises the past experience and relies on the will of the population to safeguard their patrimony.

##### **4.1. History of the fisheries management**

From the 1950s onward, the fishing techniques began changing with the substitution of the nets made from natural fibres with nets made with cotton reels, then with nylon, and finally with industrially made yarns. These new gear types enabled them to increase their catch, and as the fishing effort developed, changed the distribution of fisheries wealth to the benefit of seine owners.

During the 1960s and the 1970s, the fisheries sector generated more and more important capitals. That development of the fishery went on in an Ivoirian socio-economic context characterised by a strong economic growth which favoured the emergence of investors, and an attraction of the youths towards cities and agriculture. The rural exodus phenomenon is expressed through an increased engaging of the Ghanian fishermen for the collective fishing with beach seines. In the late 1970s, a more and more pronounced division between two types of fishing was observed on the Aby lagoon:

- modern collective fishing (beach seines, purse seines), targeting profitability-oriented production;
- Individual traditional fishing (gillnets, cast nets, longlines) gradually becoming a subsistence fishing.

The outcome of this division was a weakening of traditional fisheries management systems, which relied on a control of the fishing effort through the reception of access rights

The end of the 1970s and the beginning of the 1980s represent the first cycle in the recent evolution of fisheries on Aby lagoon. This period coincides with an unfavourable economic climate in Côte d'Ivoire. The degradation of the macro-economic indicators is evidence of a crisis in the agricultural sector (falls in the price of raw materials (coffee, cocoa), low agricultural production, and the destruction of many plantations following drought and bush fires). All this undoubtedly increased fishing pressure around Aby lagoon.

During this period, a new fisheries development policy evolved within a global framework aimed at achieving food self-sufficiency. This policy was based on the promotion of the associative movement, and especially Co-operative Oriented Groups (GVCs). Thus, from 1979 to 1980 the National Bureau of Rural Promotion (ONPR), in collaboration with the National Bank for Agricultural Development (BNDA), initiated a loan programme for Aby lagoon GVC fishermen to enable them to acquire motorised purse seines. The ONPR worked with the fisheries project office set up in Adiaké since 1966. The first cycle of the programme coincided with an exceptional year at the halieutic resource level, the programme was accelerated and twenty GVCs were equipped within two years.

In 1979, the first institutional tool for fisheries management on Aby lagoon was established, with the implementation of a follow-up programme for compiling catch statistics by the Oceanographic Research Center (CRO) in collaboration with the Fisheries Office.

At the beginning of the 1980s, the dynamism of fishing on the lagoon was characterised by debt-ridden artisanal fisheries which needed to increase their fishing effort to cover not only important fixed cost, but also intermediary consumptions more and more expensive like the fuel. There was a gradual bio-economic fall of fisheries with social drawbacks on the whole lagoon.

The period from 1982 to 1984: some events occurred and led to a low production, 1980(6,030 t), 1981 (3,630 t) 1982 (2,130 t), evidently showing the limits of a traditional system of fishing effort regulation and conflicts solving in the lagoon area. The fishermen were the first to ask for state assistance of their fisheries management. In 1982, all the actors met at a general concertation. They agreed on the following:

- closing of fishing for six months;
- institution of a fishing licence;
- reduction of seine length from 1,200 metres to 600 metres;
- enlargement of the mesh size from 28 mm to 60mm;

The measures application rapidly shows the limits:

- the mesh reduction concerns only the pocket, a measure quickly avoided by the fishermen;
- the minimum mesh size is reduced to 50 mm instead of 60 mm decided but not applied;
- the nets length remain unchanged (1,200m);
- the fishing licence system is maintained but hardly applied.

In 1985, the Project for Artisanal Fishery under FIDA financing executed by the African Bank for the Development, started its activities. Its targets were oriented towards the organisation and development of the fisheries. In 1986, signs of the resource over-exploitation were recorded again, 1986 (6,090t), 1987 (1,190t) (fall of the ethmalosa and the main species abundance) recalling the period that preceded the stocks fall in 1981. A new closing of the fishing was decided in 1987. It was a total closing that concerned all the gear types.

The 1988-1990 period: it marked the break between the administration and the fishermen. On opening the fishing, a notable change in the Aby lagoon fishery form was noticed.

- The fishing for all the seines had been commonly decided. That decision was respected;
- It had been decided to forbid the fishing for all the seines. That decision was respected for motorised seines which were economically no longer profitable. The fishermen partly changed for purse seines and gillnets. Under the pressure of Etuéboué and Erokoan fishermen, the Project is obliged to tolerate some beach seines whose number increased until April 1988.
- The influence of the traditional authorities was reinforced as far as the fishing rights attribution to the foreigners is concerned. Malian fishermen were forbidden fishing and Ghanian fishermen were expelled from Etuéboué.
- the Project tried to become more actively involved in fisheries management by requesting the assistance of the CRO to examine strategies for fishery regulation through a combination of closed season, controlling effort in terms of gear types and numbers, and stipulating a minimum mesh size to maximise catches and economic rents. But the situation gradually worsened until 1990 when deplorable events came to mark the end of a decade during which the administration attempted to organise fisheries through the fishing effort regulation in collaboration with the traditional authorities.

In July 1990, a group of young natives of the lagoon villages led many attacks against the foreign fishermen (Ghanaians, Beninese and Togolese) destroying any sorts of material goods. On the 25th of July, the fisheries Fisheries Office was destroyed by night; the equipments and a car were burnt and the staff was physically threatened.

The reasons could hardly be known. However, the movements were the results of many endogenous and exogenous factors. The principal responsables were young natives (students and young dwellers) from the different villages.

**Exogenous factors:** the school-year (1990) was disturbed, young people went back to their villages having graduations with no real chances of employment, new political environment (creation of many political parties), claims of the young natives for a better social future, generation conflict, on the one hand the elders were favourable to the stay of the many foreigners who provided incomes to the villages, and, on the other hand, the youths wanted a significant part of the economic rent drawn from the lagoon exploitation.

**Endogenous factors:** presence of an important foreigner communities monopolizing access to fisheries on the lagoon, the Project accused for being favourable to their presence, taxes imposition on native fishermen, deficiency of communication between the Project and the populations beneficiaries of the actions of the Project, loans destined to fishermen not funded.

After these events, the Project stopped its activities from July 1990 to september 1992. It was in that environment of suspicion and distrust that the Project resumed its activities.

This diagnose is an evidence that there have been attempts in the past time to encourage the association of the lagoon communities for fisheries management. The results were relatively acceptable. In 1993, the government showed a more active will to found the Aby lagoon fisheries management not by consulting, nor by associating the lagoon populations, but with their effective participation.

#### **4.1.2. Attempts of co-management definition**

According to Black-Michaud and Johnson (1984) any person who collaborates with other people to reach a commonly-decided target "participates". So, participation is a co-management tool defined by Pomeroy and Willians (1994) as "the sharing of responsibility

and/ or authority between the Government and the local users of a resource in order to manage a resource". Participation and co-management suppose that the local users be ready to associate themselves to participate on the basis of conventional rules and that the Government be ready to share its responsibilities and illimited authority with the structured local users.

#### **4.1.3. Rules**

The co-management is based on rules consensually determined by all the partners. The rules are essentially based on the recommendations of Grand-Bassam seminar (1995).which permitted to set up a framework organisation of the Aby lagoon fishery. The concern of the lagoon populations is broadly taken into account in the search for a balance between modern and traditionnal rules. The seminar recommendations are :

##### **- Mesh size:**

\* for collective gears (beach seines and union seines) the adoption of 40 mm mesh size for the whole body net;

\* for ethmalosa nets, the adoption of a minimal mesh size of 40 mm;

\* for Tilapia nets, the adoption of 70 mm mesh size;

\* for cast nets, the adoption of 35 mm mesh size.

##### **- Seine length**

The beach seines length should not exceed 1,600 m on Aby lagoon and 1,000 m on Tendo-Ehy lagoon;

##### **- Bays (reserves)**

Due to their significant contribution to the renewal of lagoon resources through their functions of spawning , refuges and nurseries, the ten bays : Etuessika, Mélékoukro, Assomlan, N'Guiémé, Akounougbe, Eboinda, Ebobo, Tiapoum, Mama and Adiaké are declared reserves:

\* commercial fishing is forbidden in these bays;

\* the villages beside these bays have the duty to look after them.

For the specific case of Etuessika bay, the senimary retained the principle of trusting the prefectoral administration whose task would consist in reconciling both communities to permit them to draw equal benefits from the bay exploitation. To this purpose, the constitution of an ad'hoc committee was recommended to definitely resolve the conflict.

Apart from these bays, fishing is authorised on the whole lagoon surface with regard to the respect of the text regulating the attribution of fishing licences. However, it had been announced at this seminar that some villages unilaterally delimited some lagoon areas they considered their own reserves. To this purpose, the seminar asked the administrative authority and the technical services to order the concerned villages to free these areas in order to reintegrate them to the whole lagoon body and make them accessible to all. Exceptionally, the

districts having no natural bays have been permitted to create some. Their technical characteristics would be defined by the technical services.

#### **- Deep water fishing**

With regard to the prohibition of fishing in deep waters, which is in fact a tacit agreement between all the lagoon villages, the seminar took note of these measure and suggested that the application of this regulation be subjected to customary norms until the implementation of the new management dispositions.

#### **- The fishing season**

Taking into account the reproduction cycles of lagoon species, the lack of selectivity of fishing gears (beach and collective beach seines) and the specific hydrology of each large fishing area, the seminar recommended a closed fishing period of four months minimum each year for collective nets, starting from May with the option of changing this period each year.

#### **- Fight against fishing with poisonous products;**

Considering that fishing with the use poisonous products represents a real danger not only for lagoon stocks but also to human health, the seminar recommended :

- \* to vigorously fight this practice;
- \* to take actions to sensitise and inform the fishermen;
- \* to set up surveillance brigades equipped with appropriate means;
- \*to take immediate dissuasive sanctions againts offenders through rapid process.
- \* The populations to mobilise to eradicate this plague;

#### **- Promotion of the Ivorian fishermen**

\* Initiate actions (formation, equipment, organisation etc) to favour the insertion of the youths in the fishing.

#### **-Fishing licences**

- \* The administration would bear the cost of printing the licences for the fishing practice.

#### **- Environment**

- \* to scientifically follow the evolution of Assinie channel;
- \* to fight against floating aquatic plants;
- \* to scientifically follow the growth of the periodic algae.

One must note that the recommendations of the seminar related to the lagoon exploitation express well the transitory period in the mode of the lagoon management. In fact, the seminar explicitly recognised the existence of some points of management which exclusively fall within the competence of the traditional authorities, notably the management of the areas called "deep water". In this perspective, the strategy of the co-management seemed first to tacitely or

explicitely recognise the areas of influence and/or competence of the different partners so that through concerned strategies, the integration and/or the renewal be done to reach the stage of shared responsibility.

#### **4.1.4. Organisational structures**

After the approval of the rules, organisational structures had to be set up for the application and evaluation of these rules. The Project favoured the creation of village and cantonal committees.

##### **4.1.4.1. Village committees**

Following the recommendations of the seminar, 26 village committees have been set up on the whole lagoon complex (Aby-Tendo-Ehy).

The committee is animated by a staff whose head is elected at the level of each village by the villagers at a public meeting and under the authority of the village chief. The committee works with a staff which consists of :

- a president
- a vice president
- a secretary general
- a secretary assistant
- a treasurer general
- a treasurer assistant
- 4 members.

There are 10 people in average per committee. It is admitted in the village that for interventions on the lagoon, any fisherman can be required.

The duties of the committee :

- assure the surveillance of the water surface;
- control the mesh-size and the nets used by the fishermen ;
- retire any net from water if it does not respect the regulating dispositions and entrust it to the village chief;
- participate with the Fisheries Office team in the checking of the mesh-size of the collective gears and make sure that the programme for the change of the mesh-size is respected;
- do the surveillance of the bays declared reserves, favourite habitats of the fish (refuges, spawning and nurseries) where commercial fishing is forbidden,
- make the closed periods be respected;
- care for the non use of toxic products as means of the catch;

- propose relevant management measures;
- represent the interests of the users;
- and finally, represent the users at any meeting related to fishing or lagoon management, and constitute a first level of conflicts resolution..

#### **4.1.4.2. Ccantonal committee**

The cantonal committee has been set up in January 1998 with the expressed will of the lagoon populations. It comprises all the chiefs of the villages-centres of the two cantons (Adjouan, and Ehotilé) along Aby lagoon (sensu stricto) (Fig.3). The head is elected by his partners. He sets up his staff. His mission is:

- assure the interventions for surveillance and control that go beyond the limits of a village;
- to resolve conflicts which oppose more than one village in fishery matters;
- propose relevant management measures;
- represent the interests of the users.

The leading staff of the cantonal committee on Aby lagoon comprises:

**Table 15:** Leading staff of a cantonal committee

Role	Village	canton
President	Etuéboué	Ehotilé
1st Vice-President	Adjouan	Adjouan
2nd Vice-President	Assomlan	Ehotilé
Secretary General	Aby	Adjouan
Secretary General Assistant	Abiaty	Ehotilé
Treasurer General	Akounougbe	Ehotilé
Treasurer General Assistant	Eboué	Adjouan
Auditor	Etuéssika et Mélékoukro	Ehotilé
Members	M'Bratty et Eplemlan	Ehotilé

To make the structures functional, a concertation framework has been created.

#### **4.1.4.3. Concertation framework**

The concertation framework is defined as a means whereby different partners in the management periodically meet to discuss and evaluate the programmes in application. It consists of four meetings held each year:

- two meetings of evaluation: one to value the periodic opening of fishing (in May of each year) and the other -(in September of each year) to value the periodic closing of fishing;
- One public meeting for closing and opening of fishing presided over by the administration authority (Sous-Préfet or Préfet) and a public meeting for opening of fishing.

The two meetings of evaluation: they gather the Fisheries Office, the staff of the cantonal committee (so all the village chiefs) and the head of the village committee with his secretary. These meetings precede either the closing of fishing or its opening. It is a forum during which the Fisheries Office makes an evaluation of the agreed actions relatively to the application of the seminar recommendations and to the state of the production statistics. The decisions taken take into account the observed evolution.

For example, during the meeting of evaluation of the opening of fishing in May 1997, the committee revealed that the resource in ethmalosa was so abundant that the fishermen were inclined to set out with an excessive number of gillnets that they were unfortunately unable to haul. So they left the nets in the water to let the fish decay. Then, they just had to shake the nets and take them out of water. This practice spoils the resource. Therefore, the fishermen recommended that the number of ethmalosa gillnets used per fisherman be fixed at ten. The meeting approved that. The decision was publically communicated and applied.

The second example: at the meeting of evaluation of the closing of 1998, during which the change of mesh-size of collective beach seines began knowing a decisive application, the meeting decided:

- the cost of the transportation of the Fisheries Office staff be in charge of the owner of the gear. He must provide the fuel;
- the owner must pay \$ 4.US to the committee of the village where the net must be measured and \$ 8 US to the committee coming from another village.

In fact, the beach seines with an average length of 1,200 m must from now on use a mesh-size of 40 mm to replace the 28 mm bar mesh. The programme will last three years (1997, 1998 and 1999) with a change of third of the length per year.

It has been noticed that the committees were mobilised and actively involved in the mesh-size checking.

#### ***4.1.4.4. Institutional structures of co-management***

To assure the participation of all in the setting up of the organisation framework, an informal institutional structure of co-management has been set up (it has no administrative basis). It comprises:

- village committees, a basic committee set up in each lagoon village whose role is to apply at the basis (in the village) the rules and measures of co-management;
- the cantonal committee, it gathers all the lagoon village chiefs. It has a functional relationship with the village committees. It orders very important actions for the whole lagoon.

Both structures have no formal existence. They are tolerated.

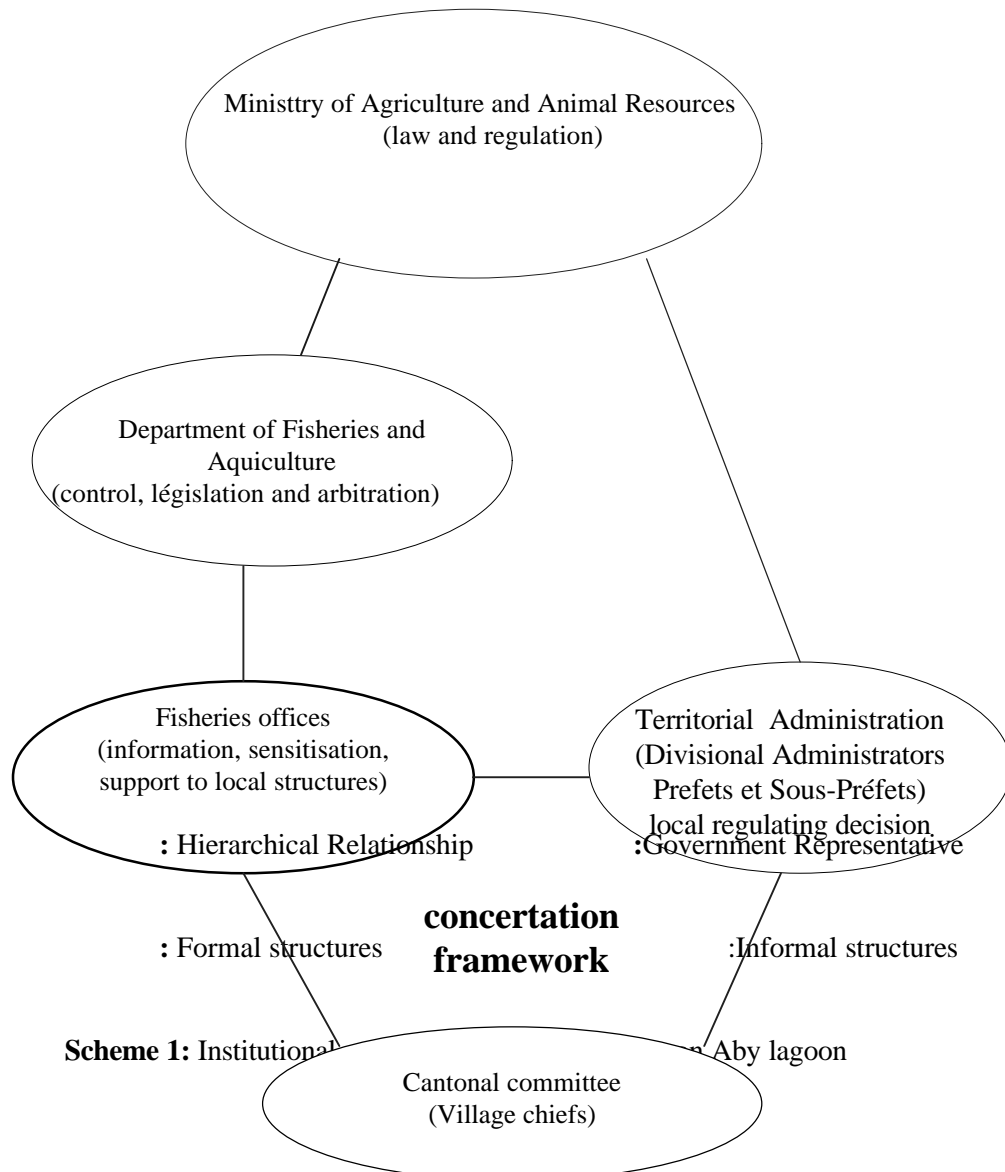
- the Fisheries Office: it is the technical representative (official) of the Ministry of Agriculture and Animal Resources;

- the Department of Fisheries and Aquiculture: it is the central Department which puts into practice the governmental policy in matters of hydrography management;

- the Ministry of Agriculture and Animal Resources : it defines the national policy for the development of agriculture and animal production (fisheries and aquiculture included);

- the local representatives of the Government (Sous-Préfectures, Préfecture). Their role is to take local administrative acts in the application of the regulations decided by the Government.

The institutional structure (scheme 1) seems to be functional. It assures the participation of the users in the decision-making and in their application. However, it is very precarious because of its informal status. In fact, the actions on the ground have out-distanced the administrative practice. For the time being, no legal dispositions permit the formal recognition of the existence of representative structures of users. The passing of that bill will contribute to the improvement of the situation on Aby lagoon and reinforce the ongoing process.



**4.2. Preliminary results of the bio-economic impacts**

After three years of experimental approach, what are the most relevant results which have been re

**4.2.1 Mesh-size**

The application of a strict regulation related to the mesh-size of all the gears used all over the Aby-Tendo-Ehy lagoon complex is absolutely necessary to restore the halieutic resource.

**4.2.1.1 Collective gears**

- Beach seines: the decision to widen the mesh-size of beach seines from 28 mm to 60mm was taken in 1982 after the first crisis of over-exploitation. It had not been applied. In 1995, the same decision was reaffirmed. Its application gave the following results.

**Table 16 :** Evaluation of the changes of the mesh-size of beach seines

	number of nets	1997	1998	% of achievement
		change of one third	change of two third	
Assinie	4	0	2	50
Tendo-Ehy	15*	8	8	100
Lagune Aby	40	34	35	87.5

\*There were 15 nets at the beginning, as soon as the application started, 7 nets were withdrawn;

The programme first started on Tendo-Ehy since 1996, then on Aby Lagoon (sensu stricto) in 1997 and in the deltaic area in 1998. That organisation in the time permitted the Fisheries Office to master the process in each sector and to draw lessons to better succeed the operation in the other sectors.

The owner whose net is ready receives the visit of an official of the Fisheries Office accompanied by two or three members of the fishery committee of the village and of the nearest neighbouring committee. The net is measured along all its length. Sometimes, the owner reduces the proportion of his net mesh-size to make his gear conform to the regulation. At the end of the visit, the fishing team receives a document authorizing it to fish. This document which is not paid is necessary before inserting the net into the water.

- On Tendo-Ehy lagoon: most of the nets belong to Ghanaians. Since the beginning of the measure application, the number of nets in activity fell from 15 to 8, a reduction of 7 nets. That is the reduction of the nominal fishing effort of 46.6%. All the nets changed their total length in mesh-size of 40 mm.

\* On Aby lagoon (sensu stricto): 40 beach seines have been selected. The rate of the programme achievement is 87.5%, representing 35 nets (1998). The five other nets which did not change their mesh-size received no authorisation to fish for the season 1998-1999.

- In deltaic area: two nets out of four were permitted to fish.

The populations through the village committees largely contributed and permitted to reach this target with a satisfying level of the programme achievement.

Purse seines: they present a particular case. In fact, their case had not explicitly been mentioned during the seminar. Furthermore, their fishing season nearly lasts four months (from October to January). The fishing units are confronted with a problem of profitability. Besides, they defend a sort of specificity. They exclusively fish *ethmalosa*. It is apparently an active fishing. Despite their mesh-size (28 mm), the teams pretend to be capable of avoiding the "small" fish and therefore not catch them. They believe that it is not necessary to change their mesh-size since they practise a selective fishing. That argument conquered the sympathy of the committee members and even that of the cantonal committee which organised a meeting with the Fisheries Office to study the question. Finally, in order to convince everyone, it has been decided to make a test of selectivity with the 40 mm mesh-size to check the arguments mentioned. These tests are to be achieved with the owners of this kind of gear and the Fisheries Office. The conclusions will determine the decision to take.

#### **4.2.1.2 Individual gears**

The individual gears concern the gillnets and cast nets. The village committees caught and destroyed many non prescribed nets. But the lack of statistics does not permit to quantify the extent of the phenomenon. It is worth noting that the committees efficiently contributed to the application of the measures.

#### **4.2.2. Seines length.**

The seine length has been imposed by itself through the financial efforts necessary to the change of the mesh-size.

The initial average length of the nets was 1,200 m. In 1997, it fell to 908 m, about 24.3% of reduction; in 1998, the average length was 842 m, a reduction of 66 m representing 7% of the average of the nets.

Because of the high cost of the net, the change of the mesh-size contributes to appreciably reduce the average length of the nets and consequently to reduce the nominal fishing effort.

One must note that from a year to another, the owners made less effort in 1998 than in 1997. In 1997, in average, 338 m of net length have been changed per team. In 1998, the effort concerned 230 m, that is a difference of 108 m.

#### **4.2.3 Bays**

Since 1990, the will of the populations to change certain bays on Aby lagoon into reserves where fishing would strictly be regulated to their benefits, has increased. The use of these reserves is so important for the populations that each village wants to possess one. Studies permitted to put in evidence that bays constitute appropriate habitats for the fish (refuges, spawning and nurseries). There exist 11 (after the seminar of 1995, the bay of Etueboué has been created).

In 1998, a workshop organised on bays management with the committees and the village chiefs permitted to determine rules for the bays exploitation:

- they are closed all over the year;
- commercial fishing is forbidden in bays;
- the village committees have the responsibility for the surveillance of the bays;
- fishing in bays is submitted to a previous authorisation delivered by the Fisheries Office;
- after fishing, part of the incomes must be given to the village committees to permit them to work.

These measures aim at protecting the bays and controlling their exploitation rate. The applications for authorisation of fishing formulated by the village show the respect of these dispositions.

#### **4.2.4. Fishing in deep water**

The area of the Aby lagoon called "deep waters", where the fishing activities of beach seines are forbidden, is a relatively limited area whose particular hydrology (channel of Bia river and the lagoon) participates in the fertilisation of the lagoon and consequently increases

its productivity. This area plays a role of spawning and nurseries. It must imperatively be preserved.

Exclusive competence has been recognised to committees to resolve problems related to the management of the area called "deep water" However, the technical service must bring the necessary help for a better comprehension of the stakes. The workshop organised in August 1998 permitted to specify the form of management wished by the fishermen. Fishing is not totally forbidden there. It is regulated. Thus, fishing is authorised for beach seines but with the condition for the team to stay at the bank to pull the nets. It is fishing in full water which is forbidden. The present practice, introduced by Ghanaians, consists in fishing in full water and the net is pulled from the canoe.

The non respect of these dispositions by the beach seines owners exposes them to heavy taxes (the cantonal committee organises patrols and receives the taxes).

#### **4.2.5 Fishing seasons**

The fishing seasons:

- the closing lasts 4 months on Aby lagoon and in deltaic area, and 6 months on Tendo-Ehy.

-the opening lasts 8 months on Aby lagoon and in deltaic area, and 6 months on Tendo-Ehy.

##### **4.2.5.1 Closing of fishing**

The closing of fishing does concern only beach seines. It is not a total closing. The individual gears more selective fish all over the year. The closing periods are determined according to the dominant species in each area.

- Aby lagoon and deltaic area: the dominant species which is *Ethmalosa fimbriata* breeds in March-April. The recruiting is done in August. The closing aims at protecting the small ones. Fishing is closed from the 1st of June to the 30th of September. The public meeting presided over either by the "Sous-Préfet" or the "Préfet" is held in May of every year but with the participation of the fishermen, committees and the Fisheries Office.

During the closing, it has been decided together with the village chiefs and the committees a process of getting an exceptional authorisation for fishing to respond to some needs of common interest. For that, the village which is concerned (village chief and committee) informs the president of the cantonal committee. The latter formulates a request to the Fisheries Office. This one delivers the authorisation and chooses the committees having in charge its application. This process has been respected by all the villages which were in need. Thus, 8 authorisations with 6 on Aby lagoon (Aby (2), Aboisso (1), Etuéboué (1), Assomlan (1), Etuassika (1), and 2 for Assinie were delivered during the closing of 1998.

- Tendo-Ehy: the dominant species have a continental affinity. So they breed during the rainy seasons. The spawnings and breeders must be protected. Furthermore, this period is chosen by the fishermen because of the rainfall to temporarily stop their activities. The combination of the fishing habits and the species biology permitted to "settle" the closing period from June 1st to November 30th of each year. The public meeting for the closing is held in May of every year, presided over by the "Sous-Préfet". To avoid possible frauds, it has been decided that the Ghanaian nets working in Côte d'Ivoire must keep their gears in their home village. The villages resolutely decided not to host any team which would carry its equipment.

Since the beginning of the measures application in 1996 and with the vigilance of the village chiefs and committees who patrol on their own initiative, the closing is actively respected.

#### ***4.2.5.2 Opening of fishing***

- Aby lagoon and deltaic area: the public meeting of opening is held in September presided over by the "Préfet".

- Tendo-Ehy: the public meeting of opening is held in November of each year and is presided over by the "Sous-Préfet" of Tiapoum.

#### **4.2.6 Fight against fishing with toxic products**

The use of poisonous products as means to catch the fish on Aby lagoon is a plague that must actively be fought. Though it is difficult to establish statistics to follow its evolution, there seems to be a reduction. Thanks to committees actions, four (4) offenders have been caught and were imprisoned for two months.

During the patrols, if the equipment of the offenders is abandoned at the fishing place and traces of toxic products are found in the canoe by the committee members, the canoe is destroyed and the nets as well.

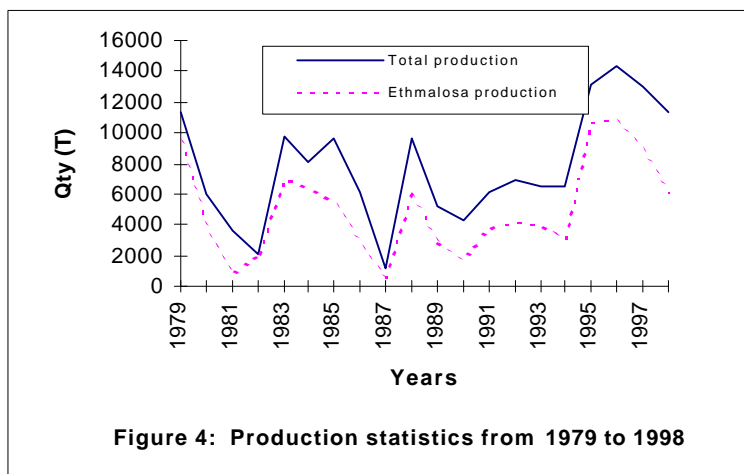
The resolutions of the 1995 seminar, which constitute the framework of fisheries organisation on Aby lagoon know a beginning of application. It is worth pointing out that the resolutions points whose application required the involvement of the populations seem to give the most convincing results. Whereas the points related to the promotion of national fishermen, the environment and the fishing licences which depend on the government have hardly started their achievement. The state hastily enters into engagements but does not always fulfil them. That often discredits them before the populations.

#### **4.2.7 Bio-economic impacts of the co-management**

The actions undertaken in terms of shared responsibility (public authorities and users) can durably motivate only if the social and bio-economic effects are perceived by the different partners.

##### ***4.2.7.1 Production***

Since 1979, the production is characterised by crisis of over-exploitation (1981, 1982, 1987). That of 1990 was more a social crisis than a crisis of production. Since 1991, we have been witnessing a period of stability and even of improvement of the level of landings. The production has even doubled since 1995 (fig 4) whereas the methods and the basis of data treatment did not change.



- The *Ethmalosa fimbriata* remains the dominant species. Five other species contribute to the production with levels of contribution that vary from one year to another.

**Table 17:** Commercial species of the Aby lagoon

	ethmalosa	Elops lacerta	Tilapia spp	Chrysichthys spp	Crabs	Shrimps
1994	46%	14%	14%	8%	7%	-
1995	82%	4%	5%	3%	1%	-
1996	76%	1.6%	5.1%	5.7%	3.5%	-
1997	68%	4%	2%	5%	5%	2%
1998	53%	4%	2%	5%	5%	2%

The levels of production recorded since 1995 seem to be close to the expectations of production which are 10,000 tons of Doucet and Al (1985). These authors relying on a lineary predictive model of ethmalosa production show that:

- the variation of the Bia flow explains for 46.4% the production (positive r);
- the activities of beach seines explain for 38.44% the variation of the production (negative r);
- the activities of the purse seines explain for 6.25% the variation of the production (negative r).

The modelling makes the climate effect appear on the resource and permits to conclude that if the correlation is a cause and effect relationship, one can think that the continental supply would contribute to the success of the pre-recruiting by improving the primary level of production. The fluctuation due to the flow variation would be superior to the ones generated by the variations of the fishing effort.

This observation seems very pertinent to us. In fact, two hydro-electric dams are built up the Aby lagoon and on the Bia river. The Bia flow which influences the lagoon is no longer linked to the climate but to the functioning rythm of turbines. So there is a regulating effect of flow which is added to the climate effect. It is generally admitted that when the recruiting decreases because of climatic conditions, the resistance of the fishery stock is reduced. Many pelagic stocks, and the most important among them disappeared due to the combined actions of unfavourable climatic conditions and an excessive fishing.

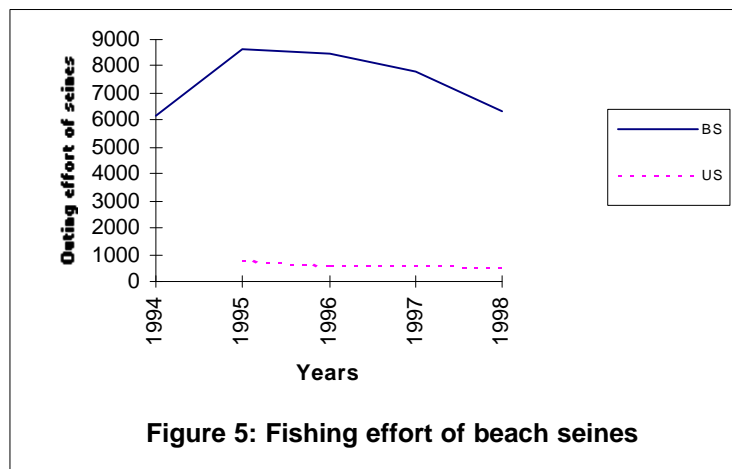
In 1998, the decrease in *Ethmalosa* landings reached 30%. The drought of 1997 and 1998 had probably had an influence on the production.

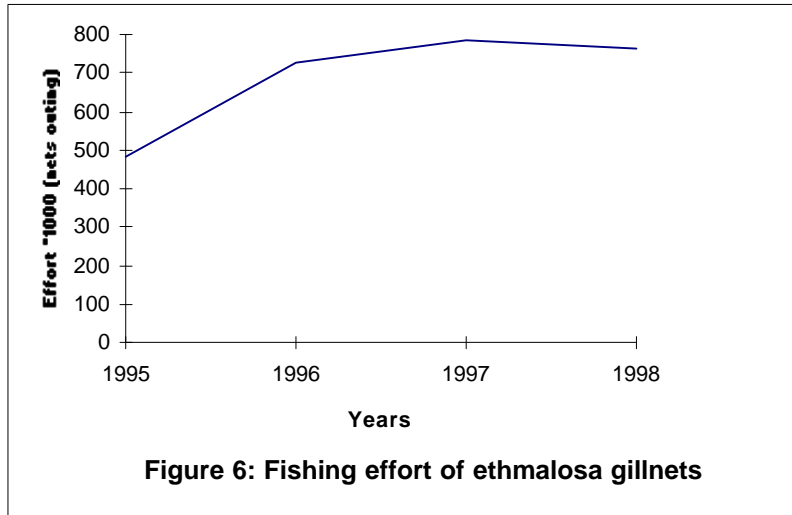
#### 4.2.7.2. Fishing effort

The fishing effort is defined as the total number of gears taken out. For beach seines, it is a daily use of the fishing unit. For gillnets, it is the number of nets taken out every day per fishing unit.

If 1996 is considered a year of reference for the closing of fishing, we can note that the fishing effort of beach seines decreased of 27% (fig.5), that of purse seines went stabilizing whereas that of gillnets increased of 57.6% (fig.6).

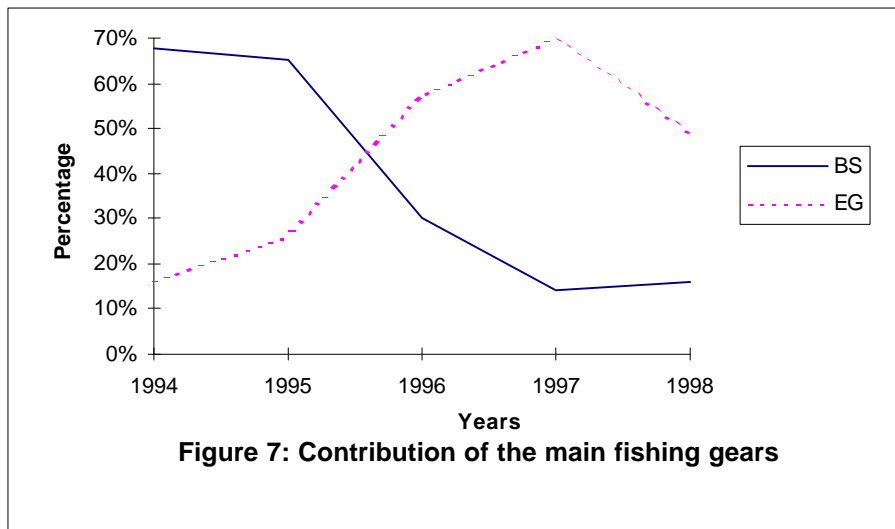
The closing of fishing favours individual gears but does not with collective gears.





This new distribution of the fishing effort has repercussion on the contribution of each type of landing gear.

Beach seines which were the main gears of production until 1996 lost their leadership in favour of the ethmalosa gillnets (fig.7). Charles-Dominique (1989) noted a sharp increase in the number of nets taken out per gillnets team in 1986, when in 1985, the landings reached a level of 9,630 tons. This explains a more important capacity of adaptation of individual fishermen to the environment. But later on, a kind of balance between both types of gears may occur for as we mentioned far above, both types of gear tend to catch fish of the same size. The beach seines may improve their productivity.

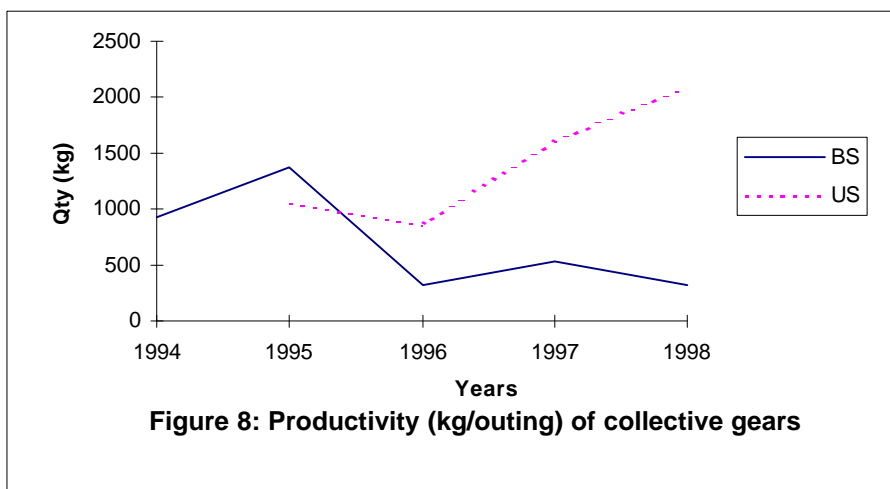


**4.2.7.3. Productivity**

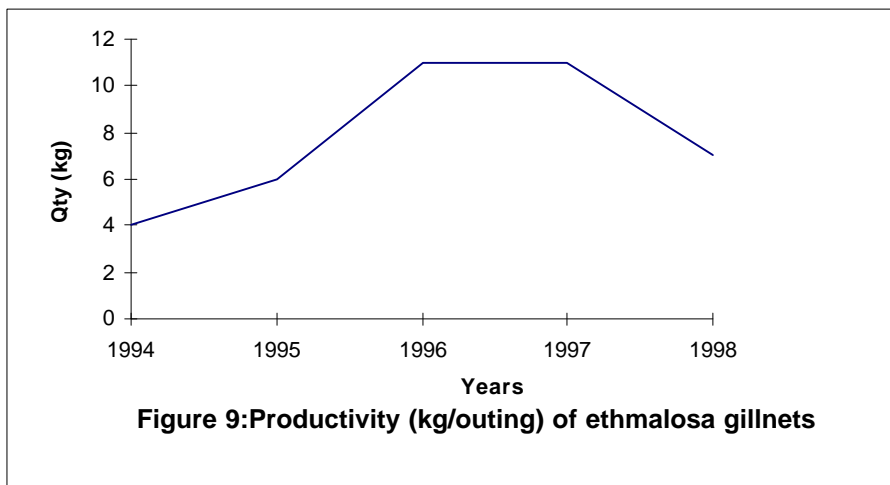
The measures of closing and change of the beach seines mesh-size have had immediate effects on the gears productivity. The productivity is defined as the quantity of fish caught per outgoing for beach seines. For gillnets, it is the quantity of fish landed per nets taken out.

Beach seines: The productivity which was relatively high in 1994 (936 tons) and 1995 (1,370 tons) gradually decreased to reach 624 tons (1996), 538 tons (1997) and 314 tons (1998).The seines lost 77% of their productivity (fig.8) comparatively to their level in 1995. In fact, the change of the mesh-size led to the reduction of the net size, to the increase in escape ,so of the seine selectivity.

Purse seines; Their productivity was regular and even improved to reach 2,081 tons (fig.8). It is an active fishing which is practised openly. These gears are functional only during the period of important concentration of ethmalosa (October to January).



Ethmalosa gillnets: their productivity improved much in 1996 and 1997 with 83% of earning comparatively to 1995 (fig.9). In 1998, the productivity considerably decreased probably because of the decrease in the relative abundance of ethmalosa.

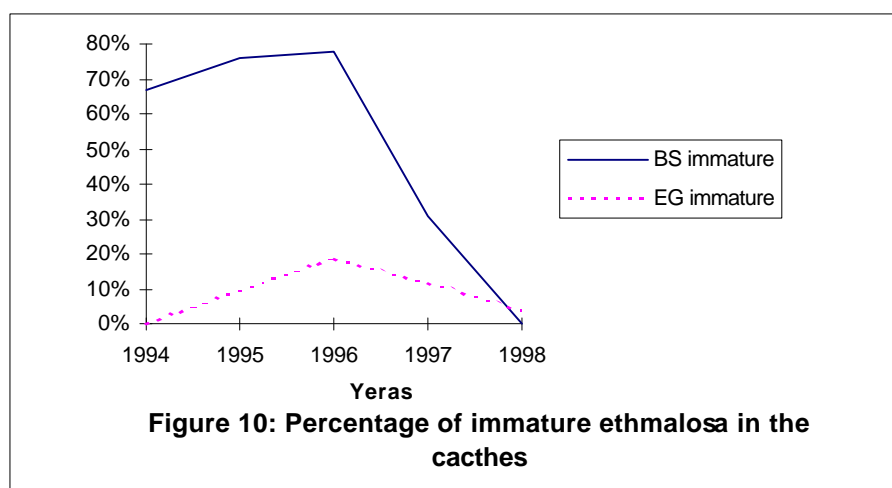


#### 4.2.7.4. Size of the fish caught

The combined effect of the closing and the adoption of new mesh-sizes for all the gears had an impact on the size of the fish caught. The size of the ethmalosa at its first sexual maturity (50% of the catch during the period of reproduction are mature at this size) is 10.7 cm for the female and 10 cm for the male (N'Goran, 1995). One must know that the fish whose size is below 11 cm are immature and the others are mature.

- On beach seines: from 1994 to 1996 the proportion of ethmalosa with a size inferior to 11 cm strongly dominated the landing with a maximum of 78% in 1996. This proportion fell to 31% in 1997 and became nought in 1998 when the seines started catching the ethmalosa from 11 cm size (fig.10).

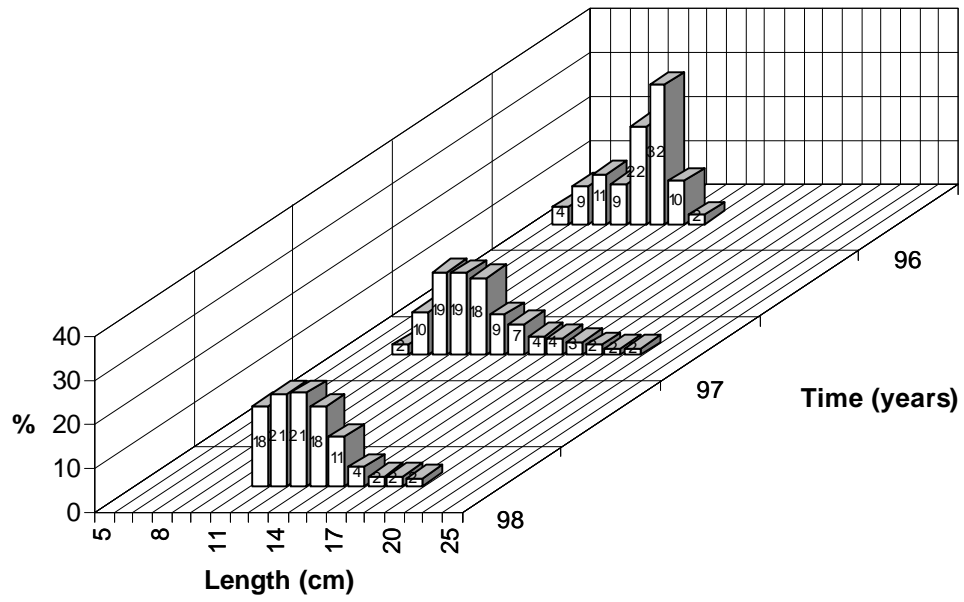
- On ethmalosa gillnets: the proportion of immature fish is relatively low. Its highest level was 19% (1996). In 1998, it was reduced to 4% (fig.10). These results apparently show the acute vigilance of the village committees to reduce the mesh-size of the irregular nets and the consciouness of users to respect the regulation.



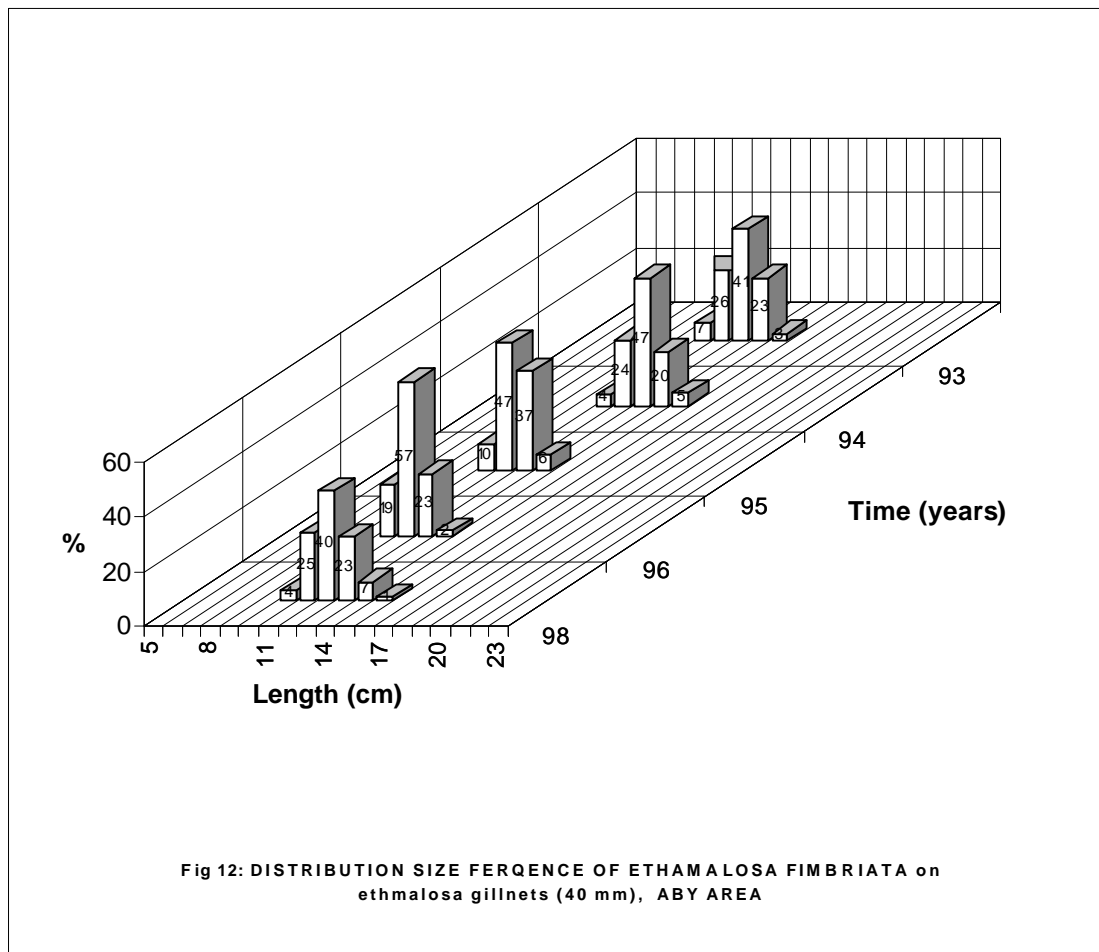
The recruiting is the process whereby the youngest part of the fish population integrates for the first time the group of "accessible" fish (Laurec and Le Guen, 19981). Charles-Dominique (1993) and N'Goran (1995) inform that the recruiting of ethmalosa on beach seines (28 mm mesh-size) starts between 6 and 7 cm.

The remarks made since 1996 on the distribution of the size frequencies of the *Ethmalosa fimbriata* on beach seines (mixed mesh-size 28 and 40 mm) show an evolution of the recruiting size (fig.11) which moves from 6 cm(1996) to 11 cm (1998).

On ethmalosa gillnets, the recruiting size is relatively stable and is fixed at 10 cm (fig.12).



**Fig 11: Distribution of size frequency of *Ethmalosa fimbriata* on beach seine**



The evolution of the size structures of the fish caught has an effect upon the prices and the value of production.

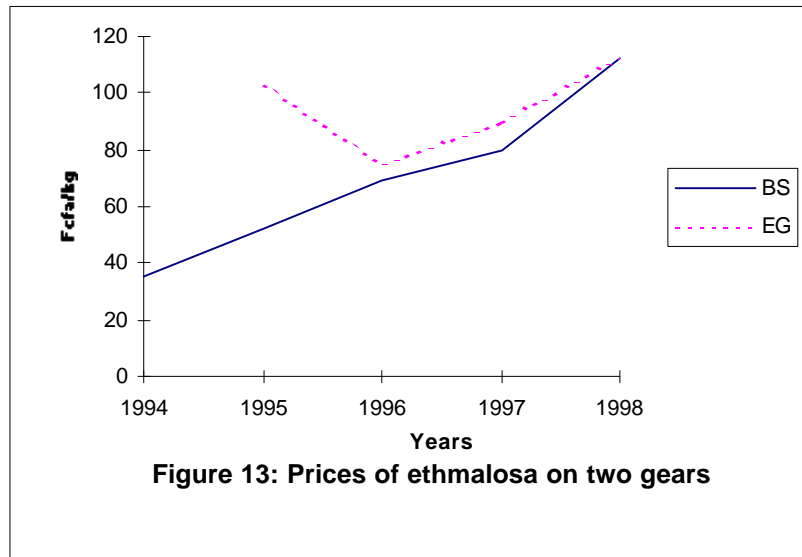
#### 4.2.7.5. Value of the production

The collection of information related to the production, the fishing effort and the size of the fish caught, is doubled with the rise of prices, permitting thus to estimate the economic value of the production.

##### 4.2.7.5.1. Prices of fish

We will base our observations about the fish prices on the evolution of the kilogramme prices of the ethmalosa on beach seines and on ethmalosa gillnets.

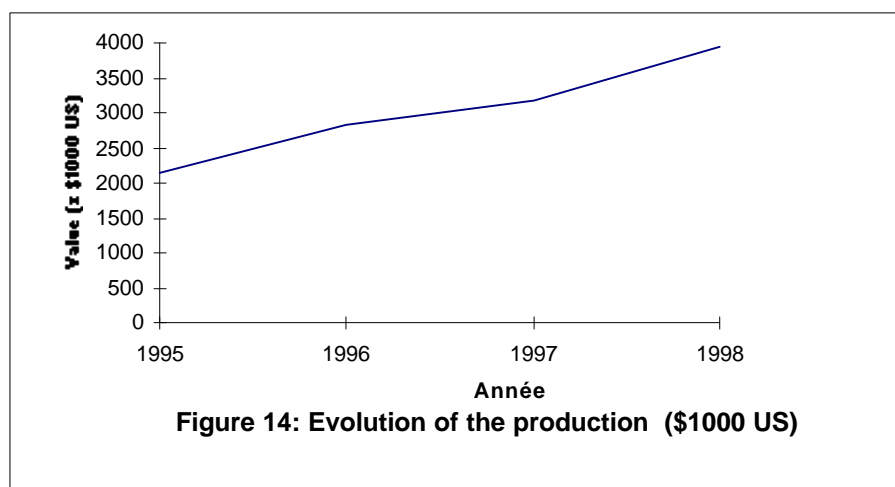
The prices practised on gillnets have always been superior to those of beach seines because of the mesh-size. The beach seines which catch fish of small size have known prices relatively low. Since 1996, their prices have tended to reach that of the gillnet (fig.13). In the long run, both types of gear catching the same size would propose equivalent prices valueing more the resource.



#### 4.2.7.5.2. Global value of the resource

It is noticeable from 1994 to 1998 that the production is more and more valued:

- The devaluation of the Franc cfa (Fcfa, currency used in Côte d'Ivoire) in 1994 permitted the national halieutic resource to become competitive because of the increase in price of the imported fish. This fact has had repercussion upon the prices of fish on Aby lagoon. The value of the production moved from \$ 2,148,000 US in 1995 to \$ 2,815,000 in 1996, that is a rise of 31%. Between 1997 and 1998, the growth reached 25% (fig.14).



- Though *ethmalosa* remains the dominant species, other species like crabs, with a high commercial value (30 cent /kg in 1998) ,whose catch is practised by young people and shrimps (\$ 1.02 US /kg in 1998) are more and more taken into account in the estimate of the incomes generated by fishing.

- Despite the interannual variations of the production, the improvement of the landed fish size notably contributes to the valorisation of the resource.

In 1998, the value per species was dominated by *ethmalosa* (30%), shrimps (21%) crabs(12%) *Tilapia* (12% and the *Chrysichthys* spp (10%).

The co-management permitted to record some results at organisational level and brought benefic effects to fishery for all. However, it must be noted that the process is new. And one can wonder if it can be integrated in the time?

## **5. The system durability**

To inscribe the process in the time, one must make sure that a minimum appropriation aptitude by users of the system which is being set up is taking form. All the elements which constitute the reference of users must therefore be analysed to appreciate it. The fundamental question which must be answered is: to whom does the lagoon belong? Are the organisational structures sufficiently implanted in the area? What views do users have of the impacts and their actions?

### **5.1. Lagoon status**

According to the prevailing regulations, the lagoon is part of the public property. It is the property of the State of Côte d'Ivoire. Fishermen exert only a right of usufruct. This disposition has always been hardly accepted by the lagoon populations who have always claimed the property of the lagoon, thus conferring them the right to take any management measures excluding the State. This view partly explains the misunderstandings which have always characterised the relationship between the populations and the administration. Since the starting of the participation process, this feeling seems to have been improved. In fact, 69% of the people interviewed say that the lagoon is at the same time property of the State and the populations. However, an important minority (31%) keep on thinking that the lagoon belongs to the populations. This improvement explained the participation of users to the programme. For, it is difficult to care for "something" which does not belong to you. It is noted that 75% of the lagoon populations are convinced that the lagoon management is the common duty of the State (Fishery Office, Sous-Préfet and Préfet) and users. However, it can be noted that 13% of the people interviewed keep on thinking that only the populations must impose the management rules against 8% who are for an exclusive and authoritative intervention of the State.

The local projects for the development strongly mobilise. The populations (100%) are available to come together and take the destiny of their village in hand and 98% are available to come together to resolve the problems specific to fisheries. In fact, around the Aby lagoon (*sensu stricto*), each of the 12 villages interviewed has a primary school, eight among them have electricity, one village has a generating set and eight have medical centers. these basic facilities acquired by the village communities themselves, are the results of their solidarity. This solidarity is extended to the committees.

## **5.2. Survey of the organisational structures**

The cantonal committee and the village committees seem to be sufficiently implanted on Aby lagoon. However, the village committees which carry out their mission in the immediate neighbourhood are more familiar to the populations, 94% of the interviewed are aware of their existence and are very well informed about their duties (88%), whereas the cantonal committee (with a more centralised power) is known to 63% of the users and only 57% of the populations are informed about their attributions. Nevertheless, the determination of the fishermen to work in these committees is strong, for 87% of the interviewed are ready to belong to the village committees and have a post of responsibility.

The committees are set up by referring to the traditional structures of the village. The responsables are chosen at a general meeting summoned by the village chief and the project for fishing service. The village inhabitants gather around the traditional authorities to choose the head of the committee. This way of choosing seems to meet the agreement of the users since 88% of them are satisfied.

## **5.3. Survey of the rules and measures**

At this stage of the co-management process, it is apparent that the users have a perfect knowledge of the measures and rules. It is noticed that 73% of the people interviewed know the period of the closing of fishing, 54% know the period of opening, 70% know the mesh-size applied to Tilapia gillnets. This satisfying level may be explained by their active involvement in the decision-making. In fact, 88% of the interviewed are convinced that the rules are determined by the Fisheries Office and the populations and 73% maintain that they apply the agreed decisions.

The information means used by the committees seem to be functional. They regularly hold meetings with the populations to inform them about meetings (Fisheries Office, Sous-préfet and Préfet) in which they participate, 60% of the interviewed confirmed to be informed through this way. However, it must be noted that the committees organise more meetings (48%) than the village chief does (12%). There are town criers in those villages. Unfortunately, this communication tool is not very much used, only 13% of the people interviewed remembered having been informed through this way.

Though the general level of information of the population is satisfying, the effort of formation and information must imperatively be pursued. For information is the backbone of success. A user who does not know the rules cannot apply them and contribute to the general effort.

## **5.4. Appreciation of the technical results**

The combined actions of the administration and the committees permitted to get measured bio-economic results with instruments unknown to the users. What is the opinion of the users?

The seminar held in 1995 permitted to start the co-management process; 94% of the interviewed believe that this meeting contributed much to it. It consensually set up the framework of the Aby lagoon management. The users (81%) say that since then, clear management rules are determined and the lagoon is better looked after. They (87%) say that the number of small mesh-size nets has considerably decreased. The populations (73%) recognise that the application of the measures notably contributed to the growth of the ethmalosa size and 91% among them affirm that the price of the fish basin has increased. The interviewed (90%) think that these are the results of the good management of the lagoon. Nevertheless, some

(56%) remark that the productivity has decreased, others (25%) believe that the level of productivity is stable. The rest (15%) are satisfied of the increase in the level of productivity. It must be noted that 95% of the users strongly believe that if the present management mode is kept on with the same determination, the lagoon halieutic resource will be restored. Furthermore, it will equally be distributed between the different fishery job holders.

The opinion that the users have about the results of the co-management is in harmony with the data mentioned above. At the level of the ethmalosa size, the fish price and the productivity, the comments of the users and the results of the Fisheries Office meet, expressing thus the relevance of the observations made by the users. It must be noted that the populations have no means of appreciation but their knowledge of the day to day realities and their experience permit to shape a far accurate opinion which must be taken into account in the analysis and decision-making.

### **5.5. Relationship users-committees-administration**

It is important to recall that the present process has been set up in an atmosphere characterised by a total lack of confidence between the different partners (Kponhassia, 1994). So the way used must be measured.

The interviewed users (90%) believe that what has been done has been possible thanks to the combined actions of committees and the Fisheries Office and 91% among them are so satisfied of the co-operation which now exists between the Fisheries Office and the population that 83% of the interviewed think that committees cannot work without the Fisheries Office. Yet, to reinforce the efficiency of committees, a number of conditions must imperatively be gathered:

- the formal recognition of the committees with an administrative order (prefectoral decision) delivered by the administrative authorities; 95% of the users say that the informal existence of committees is a serious handicap and could in the long run compromise the process;

- The committees wish they could have important means for interventions (boat, outboard motor etc.) for great actions of control all over the lagoon;

The formation (training) and the information of the committees is another obstacle. It is true that the meetings regularly held contribute to the formation and communication purposes but the administration in its mission of partner must be granted with adequate means for the formation of all.

in one word, the system durability should rely on:

- the adhesion of the population: on any lagoon, the co-management initiative has been taken by the administration. Therefore, the population must imperatively signify their adhesion to warrant the expected success. The results show the perfect availability of the populations to carry on the process and to own it.

- Communication: Generally, there are differences between the urban mind and the rural one; while one is characterised by rationality and vitality, the other bears the sign of religiosity and an acute sense of tradition. This perception of the supervisors (administrators and technicians) in the rural area sets a gap between them and the villagers they consider incapable to understand and assimilate the values dear to the educated people. So there is a social gap between the intellectuals living in cities and the villagers. This situation described by M;J.

Hilhorst, is frequently come across in rural areas where the supervisors have an intellectual behaviour, very often minimising the empiric knowledge of the rural people and not always considering them. In the co-management framework, an effort of humility must be made by the supervisors to set up a constructive dialogue between the different partners. Thus, each of the partners will have a better view of the goals to reach and will loyally involve himself.

- the mutual recognition: the partners must have the feeling that they take part in the decision-making and their setting up. The scheme 1 presenting the institutional structure of co-management on Aby lagoon makes the skeleton rely on the committees. The other components are formal administrative structures with a very centralised vision of the management of the public "property". In order to have a reliable institutional structure, each component must have a status that puts him in a position of a full partner. Yet, in the present situation, the administration is still hesitating to take an administrative decree (act, local decision) to change the committees into formal structures. The present internal dynamism will not sufficiently be kept on and produce a durable system if the latter is not based on the mutual recognition of the partners.

- Conflicts resolution: the unavowed goal of the Ivorian administration, by initiating the co-management, is to come to reduce the conflicts. It must be recalled that many conflicts on Aby lagoon disturbed the Ivoirian administration (namely the administration of fishery and territorial administration). This one has a very traditional vision of the conflicts. It believes that conflicts are the symptoms of a bad management. Conflicts are irrational and dangerous and must therefore be repressed. Unfortunately, since 1996, conflicts between users have multiplied (offence to the rules forbidding fishing in deep waters, in bays, fishing with toxic products, reglementary mesh-size non-respected). This situation shows that conflicts in communities and organisations are unavoidable. So the administration which is requested to arbitrate must develop a new vision of conflicts. These ones must neither be suppressed nor avoided, but resolved, for, the efficiency, the creativity and the innovation depend on them. It is admitted that conflicts lead to disorder but they set up the process of balance permitting the organisation to reach a better balance, to ensure its growth. It must be known that if the measures related to the change of the mesh-size of beach seines (a very expensive measure) has been applied, this is due to the potential existence of an optimal intensity of conflicts.

The owners were subjects to exclusion from the lagoon, not due to the action of the administration, but with the will of the populations.

To avoid frustrations generated by the conflict resolutions which can endanger the mechanism, all the partners must have an acute idea of their mission, and the rules must be determined with impartiality, equality and justice. The structures constituting respective levels of conflicts must sufficiently be responsabilised to resolve them.

The participation of women: one of the weaknesses of the fishery co-management on Aby lagoon is the weak participation of women. They are dominant at the transformation level but very less represented and even absent from the decisions instances. They are those who bear the social cost of the organisation of lagoon fisheries. During the four-months period of closing, their activities decrease of more than 75%. They have no alternative activities. At the present stage of the process which favours "police" aspects (surveillance, various controls etc.) of the lagoon fisheries organisation, it is rather difficult to perceive their role. The present mission of committees do not offer many possibilities of actions to women. This situation is regretted by the populations themselves and wish the entrance of women into the committees (promotion of alternative activities which can generate incomes, organisation of the women to improve the smoking, for the commercialisation and access to loan).

Unity on Aby lagoon is based on the consensus of the populations, but it may not resist against the dominating group interests if the latter organise themselves to create a contestation front. The break of the consensus could discredit the "informal actors" and compromise the general dynamism.

To limit the drawbacks of this approach, there must be a law to affirm with force the willing policy of support to the setting up of institutional mechanisms encouraging users to the resources organisation according to appropriate conditions. The second possibility is to have a decentralised power which can work at local level to determine regulating texts which are specific to the local situation as far as the natural resources management is concerned.

## **Conclusion-recommandations**

1. The experience of co-management which is dealt with in this document is very recent. It started in 1995. It is geographically restricted (the Aby lagoon, 424 square kilometers). The partners (administration, committees, fishermen women) seem to have a clear vision of the goals to reach.

2. At the level of the methodology, the performance measure (scale of performance) presented major difficulties which led to not to use it:

- the scale could be interpreted with difficulty for the interviewers and ununderstandable for the answerers;

- they could hardly comment the opinions given;

the answerers plan with difficulty the results over a long time because of the successive crisis experienced with the resources.

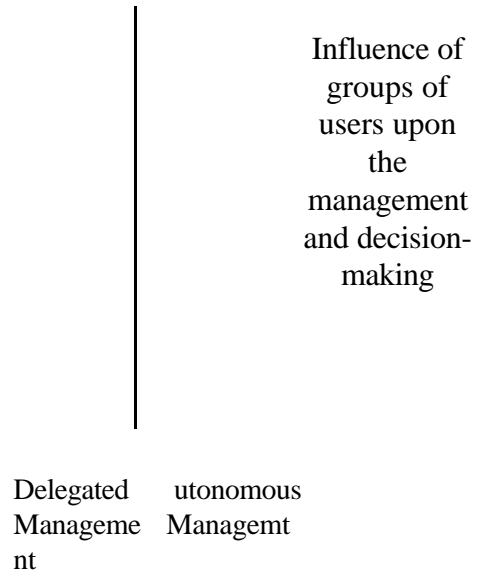
It is a measure whose application to the users requires a longer preparation than the one permitted by this study.

3. The co-management is not inherent. It is not obvious even if it is strongly wished. It is caused. Very often, it is the circumstances (conflicts, ethnic diversity, restricted space) which impose it. The administration is induced to take initiative to set up structures, make them reliable and work together to make them functional, no longer to respond to the goals of the administration but to achieve the well known expectations of users. There is a sharing of responsibilities between the users and mainly the administration. The policies of regionalization (decentralisation and devolution of the administration) constitute a chance to assure the participation of the local communities in the development, notably in the natural resources management. Nevertheless, it must be admitted that the process is slow. The practical actions advance very often the governmental initiatives.

4. On Aby lagoon, the present stage of the process can be qualified as a consultation-cooperation (scheme 2) comparatively to both poles which are the management exclusively controlled by the Government and the autonomous management. All the attempts for the lagoon resources management have experienced both poles. It seems that at the present stage, a real decision-making power has been given to committees. But, it should not be forgotten that the situation is very ambivalent because of the duality of the local decision-making structures. In fact, upon the traditional authority is superposed the administration and "modern" organisation. Co-management is a process. It is gradually set up in an environment in which tradition and modernism co-exist. It must take into account this "cultural" ambivalence to produce a

synthesis in which all the partners sufficiently feel considered (economical, social, cultural, environmental and political interests).

5. To reach the stage of delegated management supposes a notable improvement of the institutional environment (law, decrees and regulating texts which determine the framework of the partnary structures collaboration.



**Scheme 2 :** stage of co-management in Aby lagoon

6. The ideal co-mangement is the free participation of all in the common goal of management of the common patrimony by basically taking into account the collective interests of a long term. The combined effort of all should bring about the sharing of the generated profits. However, the diversity of the groups and their interests tend to divert the common will from this ideal. The existence of coercive means becomes therefore imperative. To be efficient, these means must come from the interior of the groups and use the traditional tools. that is why, in the process of co-management, repression which is sometimes unavoidable, must not exclusively be detained by the administration.

It must be shared in reasonable limits with the users. Consequently, committees must have means of coercion sufficiently dissuasive to attenuate the tendencies to fraud and have enough authority to resolve a certain number of problems at their level.

7. The management requires important efforts of formation (training) and information and of the system decision making which is the duty of the administration. But it can be noticed that the administrations which are supposed to be more conscious to bring the changes over a long term do not always show the expected interests (absence of a clear policy, insufficient fund, less-qualified staff etc.) to reinforce the benefits.

8. The experience seems to show that when the administration authorities recognise to the committees a sort of power and authority, the latter are mobilised and involve themselves with honesty and good will to put into practice their part of duty.

9. The co-management must be supported with a scientific support. At the beginning of the process, some management decisions and some rules of regulation are based upon a mixture of empiric knowledge and of the vision of users. As the process becomes more complex and some users see their interests threatened, contestations appear. To reinforce the consensus always looked for, the rules must be determined on objective basis, that is why it is necessary to have some (biology, statistics, socio-economic data etc.) reliable data provided either by the project or by the scientific research to make any decision-making clear.

10. The search for equity to warrant to all the same rights and duties (access to the resource, sharing of the benefits) must guide users and partners.

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