THE GHANAIAN FISHERY FOR SARDINELLAS

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Abstract :

The sardinella fishery is one of the most important economic activities in Ghana. The nature of the fishery and the behaviour, abundance and distribution of the fish have undergone some changes since the beginning of the fishery. Large variations in landings are experienced and in some years the fishery reached points of near collapse.

Résumé :

La pêcherie de Sardinelle du Ghana est des plus importante activité économique du pays. La nature de la pêcherie et le comportment, abondance et distribution des sardinelles a subi des changements depuis le début de la pêcherie. De grandes variations dans les apports ont été observées et en certaines années la pêcherie a atteint des niveaux proches d'un effondrement.

1. Introduction

The fishery for sardinellas is an extremely important economic activity in Ghana. Sardinella is a relatively cheap food resource and its fishery constitutes the livelihood of many fishers; fish processors and traders in coastal areas in Ghana depend on the sardinellas.

In years of good sardinella fishery, the species could constitute as much as 40% of total domestic marine fish production. Inter-annual differences in fish landings of Ghanaian fishing fleets are caused mainly by the quantities of sardinellas and anchovies caught in the years. High landings of these species

result in high total landings of fish for the year and poor landings result in low total landings for the year. The sardinellas are more important than anchovy as food fish and invariably a good fishing season means large quantities of sardinellas were landed in that season.

In the Ghanaian marine ecosystem, there are two sardinella species: the round sardinella (Sardinella aurita) and flat sardinella (Sardinella maderensis). These are the only sardinella species in the western Gulf of Guinea; that is, the area between Côte d'Ivoire and the Republic of Benin. These two sardinella species together with the european anchovy (Engraulis encrasicolus) and chub mackerel (Scomber japonicus) are the most important small pelagic fish species in Ghanaian waters and throughout the Western Gulf of Guinea. The round sardinella is more important than the flat sardinella in terms of total landings.

Sardinellas have in the past played an important role in the Ghanaian fishing industry. Thirty years ago, Hammond (1962) reported that the most important fishing season in Ghana was the period when sardinellas were caught. Kwei (1964) noted that the round sardinella was the most exploited fish in Ghanaian marine waters. In the early 1970"s, sardinella stocks were thought to be the greatest potential resources in the whole of the Gulf of Guinea (Ansa-Emmim, 1973).

The importance of sardinellas and chub mackerel to the Ghana fishing industry led to the setting up of a pilot cannery at Osu, Accra by the Fisheries Department soon after its establishment in 1946. This was followed by the proposition and/ or setting up of other fish processing plants with the main aim of canning sardinellas. These efforts by the Government of Ghana culminated in the establishment of the Fishery Research Unit (now the Research and Utilization Branch) of the Fisheries Department in 1962. This research outfit of the Department was charged, inter alia, with the responsibility of studying the biology and exploitation of sardinellas and the management of the sardinella fishery.

Women played a very significant role in the sardinella fishery in the past. They controlled the marketing of fresh fish, dominated the processing and distribution of sardinellas and even contributed to the acquisition of new fishing nets and canoes.

This paper assembles information on the sardinella fishery in Ghana, highlighting its history and nature. Statistics of catches and the response of artisanal fishers to changes in sardinella fishing situations are also elaborated.

2. The Sardinella Fishery in the Past

Since early times, the single most important fishery in Ghana has been that for sardinellas. The early artisanal fishers used fishing gears that were small in sizes and varied from village to village or even from fisher to fisher. Various sizes of gillnets, seine nets and trapnets were used. Sardinellas were caught mainly with beach seines and various types of gillnets the most important of which was the "ali" net. According to Lawson and Kwei(1974), the ali net which has been in use in Ghana since about 1850 was the most important of all the fishing gears

used in the sardinella fishery. Fishing for sardinellas was very localised; fishers did not fish far from their home bases.

As human population increased in Ghana, the demand for fish became greater and it became necessary for canoe fishers to increase catches and to compete with the motor fishing vessels that had entered the fishery. The fishers had realised that the traditional fishing grounds could no longer provide them with adequate fish and that even during the main fishing seasons large quantities of the sardinellas were not accessible to canoes using paddle or sails and small seine nets. The artisanal fishers, who were already conversant with the nature and pattern of migration of the Sardinella aurita began to follow the migrating fish by moving from village to village several times in the course of the major fishing season. By this practice they were able to practically extend the otherwise short sardinella fishing season.

A more efficient and easier means of propelling the traditional dug-out canoe was needed. The ali being a gillnet, was found to be less efficient than was required for catching schooling fish like sardinellas. It became necessary, therefore to use a more efficient fishing net in the sardinella fishery.

The fulfilment of these resquirements resulted in the change of the nature of artisanal fishing in general and sardinella fishing in particular.

3. Developments Leading to the Current Marine Fishing and the Sardinella Fishery in Ghana

According to Kwei (1961), Lawson and Kwei (1974) and Koranteng (in press), the significant changes in artisanal fisheries in Ghana included the following:

a. introduction of outboard engines as a means of propelling the canoes,
b. change from the use of natural to synthetic netting materials and
c. introduction of the purse seine net.

The demand for a more mobile and faster craft to go to distant fishing grounds and land fish in good condition led the Government's Fisheries Department to introduce motors as alternative means of propelling the canoes (Kwei, 1961). By using motors the fishers could engage the migrating shoals much longer and much further away from their home landing points where they would return to daily. Consequently, the fishers moved camp less frequently than before. The introduction of outboard motors therefore, changed the face of sardinella fishing in Ghana (then the Gold Coast) and even though artisanal fishers still undertake long or short term migrations, these are usually motivated by other reasons.

The introduction of synthetic materials in the manufacture of netting aided the search for better fishing gears. Bigger and more durable nets requiring less frequent mending were constructed. A surrounding net locally called «watsa» was developed. The watsa net was modified into a purse seine net (Doyi, 1984). It was developed further into a new seine net called «poli» which contains small-sized meshes made of thinner twine. According to Doyi (1984), whereas the

watsa net was constructed with only 50-60 mm mesh netting made of twine of 0.50 mm diameter, the poli net had mesh and twine sizes of 10-13 mm and 0.33 mm respectively.

The poli net became popular when stocks of the round sardinella (Sardinella aurita) in the western Gulf of Guinea were reduced drastically after the 1972 fishing season, during which large quantities of the fish were caught. The artisanal fishers, who could no longer find the traditional sardinella, increased the exploitation of anchovies and the poli net was found to be the most suitable gear for this fishery.

Catches of sardinellas increased significantly with the introduction of the purse seine net, especially the poli net. However, with its small meshes, the poli net was found to be a very destructive fishing gear.

In recent years, a new gear composed of a combination of the materials used in the ali, poli and watsa nets has been developed and is being used by artisanal fishers in pelagic fishing (Koranteng 1990; Doyi and Neequaye 1990). Doyi and Neequaye (1990) found that the poli/watsa combination was the most popular, and that the new net was, in fact, called «poli-watsa».

In addition, small-sized vessels with inboard engines were introduced into the marine fishing. These vessels which also exploit sardinellas are still being used in the industry.

Women continue to play significant roles in the sardinella fishery today which in turn plays an important role in the Ghanaian fishing industry.

4. The Present State of the Sardinella Fishery in Ghana

4. 1 Fishing fleets

Of the five principal fishing fleets operating in Ghanaian waters: artisanal, inshore, industrial trawlers, shrimpers and tuna fishing vessels, the artisanal and inshore purse seiners are the main harvestors of sardinellas.

Large dug-out canoes that are usually propelled by 40 horsepower outboard motors, use beach seine nets, purse seines and ali nets to catch sardinellas almost all year round. As large-sized hence heavier and more bulky fishing nets were constructed, it became necessary to carve larger canoes for the operation of these nets. There are about 4,200 such canoes (or 49% of the total canoe population) operating in Ghana (Koranteng, et al. 1993).

In the inshore fleet, locally-built trawler/purse seiners are used in the sardinella fishery. These vessels, ranging in sizes between 8 and 37m, and numbering about 160 fish for sardinellas only during the upwelling periods.

A few of the inshore vessels have echosounders, otherwise detection of sardinella schools is by sight and through years of experience.

4. 2 Fishing gears

Presently the ali, poli and poli-watsa are the main artisanal fishing nets used in the sardinella fishery in Ghana. The poli and poli-watsa nets are used when the fish are schooling and the ali net is used when the fish are scattered, normally at the beginning or towards the end of the sardinella season. The ali is also the main net used in catching Sardinella maderensis off the main sardinella seasons. The beach seine net which does not target sardinellas, also catches substantial quantities of sardinellas, especially young ones.

Purse seine nets, similar in construction to the poli nets are used by the inshore vessels. The sizes of the meshes and twines constitute the difference between the two nets. Whereas the poli net has 10mm stretched mesh, the inshore purse seine net has 25mm mesh made of thicker twine.

4. 3 The marine environment and sardinella fishing seasons

The fishery for sardinellas in the western Gulf of Guinea has been found to be affected by various environmental factors, prominent among them is the coastal upwelling. Relationships between the upwelling and the availability of sardinellas in the Ivoiro-Ghanaian ecosystem have been described by Oren and Ofori-Adu (1973), FRU/ORSTOM (1976), Cury and Roy (1987) and Roy (1992).

The sardinella fishery, especially of the round sardinella, is seasonal and coincides with the periods of upwelling period in Ghanaian coastal waters. The flat sardinella is caught in small quantities throughout the year.

Two periods of upwelling occur in the Ivoiro-Ghanaian marine ecosystem. These are the major upwelling in July-September each year and the minor upwelling of January/ February and in rare cases, March. Whereas the major upwelling lasts for about three months, the minor upwelling lasts for just about three weeks and sometimes longer. In Ghana, the upwelling is assumed to have started when the sea surface temperature drops to 26°C or less. The strength of the upwelling is measured in terms of an upwelling index which takes into consideration the time period within which the surface temperature was below 26 °C (FRU/ ORSTOM, 1976).

Until recently, the major upwelling was thought to be more important than the minor upwelling, apparently because more sardinellas are caught during the major upwelling period. Recent work (Koranteng, 1989; Pezennec and Bard, 1992; Pezennec, this series) have shown that the minor upwelling is as important as the major upwelling for the sustainance of sardinella resources in the Ivoiro-Ghanaian ecosystem.

In addition to the upwelling, the distribution and abundance of sardinellas in the western Gulf of Guinea have also been associated with rainfall (Ofori-Adu, 1975; Binet, 1982) and year-class strength (FRU/ORSTOM, 1976).

The sardinella season begins with the fall in sea surface temperatures and the breakdown or rise in depth of the thermocline when the sardinellas undertake a spawning and/or feeding migration. Usually, the bulk of the fish is first seen in the Western region of Ghana and moves eastwards, apparently following a

migration pattern proposed by Ansa-Emmim (1976). The eastwards movement continues into the Republic of Togo and to a lesser extent the Republic of Benin. Sardinella aurita is the main candidate in this migration which was known by the early fishers and which dictated their (fishers) movement.

There have been occasional departures from this general pattern of fishing (Koranteng, 1989), as the Greater Accra and Volta Regions often record smaller than usual proportions of the annual landings of Sardinella aurita. Pezennec and Bard (1992) and Pezennec (this series) have noted some of the changes in the upwelling, especially the minor upwelling, and the resultant effects on the distribution, abundance and fishery of sardinellas in the Ivoiro-Ghanaian ecosystem.

5. Catch, Effort and Performance of Fishing Fleets

The evolution of sardinella fishing efforts over the past two decades, is shown in figure 1. The rising trend in the efforts of the artisanal gears, ali/poli/watsa and beach seines is evident. Table 1 gives the total annual landings of Sardinella aurita and Sardinella maderensis caught by Ghanaian vessels in Ghanaian waters since 1963. Until about 1971, the two species were combined in the catch statistics of Ghana. The table also shows the landings made by each sector of the industry. The evolution of landings is presented in figures 2 and 3 and the catch per trip (cpue) of each fleet is given in table 2 and figures 4a-4c.

The monthly variation of catch/trip of Sardinella aurita and S. maderensis caught by the ali/poli/watsa and beach seine nets in each of the four regions of Ghana are given in FAO (1992). The variation and trend in catch/trip nationally, is shown in figures 5 and 6. Annual trend of catch per trip in each of the four regions appears in figure 7.

Like all pelagic fishery resources, the landings of sardinellas in Ghana have usually fluctuated from year to year. These fluctuations have sometimes given cause to fishers and fisheries managers to worry. For example in 1972, the fishery for Sardinella aurita recorded its highest yield since records of landings were kept in Ghana (Table 1; Figure 2). Landings in the three ensuing years were so low that the fishery was thought to have collapsed. Since the early 1980s there has been an increasing trend in the landings of sardinellas, especially of Sardinella aurita. These increases in landings have, however, not been commensurate with assessments of the biomass of the resource. For example in acoustic surveys coducted with RV Dr. Fridtjof Nansen (Stromme, 1983) and RV Cornide de Saavedra (Oliver et al, 1986), the combined biomass of the two sardinellas and anchovy in Ghanaian waters was put at 40,000 and 74,000 tonnes respectively. In the years during which the surveys were conducted, the total landings of sardinellas alone were nearly 30,000 and 70,000 for 1981 and 1986 respectively.

6. Prospects for the Future

The Ghanaian sardinella fishery of today is at its zenith in yields. The future of the fishery is always as unpredictable as the strength of the upwelling which is necessary for the success of the fishery. Looking back at the events that took place in the early 1970s, the recent high landings of sardinellas, epecially Sardinella aurita, are worrying as this could eventually lead to a drastic decline of the sardinella resources in the Ghana-Côte d'Ivoire marine ecosystem.

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CAPTIONS OF TABLES AND FIGURES

Table 1 : Total annual landings of Sardinellas in Ghana, 1963-1992 Note: Before 1972, the separation between S aurita and S maderensis was not registered.

Table 2 : Catch per trip (kg) of Sardinellas for different gears Note: APW: ali-poli-watsa nets, B/Seine: Beach seine, P/seine: Purse seine.

Figure 1 : Evolution of Sardinella fishing efforts (Thousand trips) Note: P.SEINES: Purse seine, B. SEINES: Beach seines, APW: Ali-Poli-Watsa.

Figure 2 : Total landings of Sardinellas in Ghana 1963-1992.

Figure 3 : Sardinella landing by the artisanal and inshore fleets.

Figure 4 A : CPUE of Sardinellas caught with ali-poli-watsa nets

Figure 4 B : CPUE of Sardinellas caught with beach seine nets

Figure 4 C : CPUE of Sardinellas caught with purse seine nets.

Figure 5 : Variation in monthly catch/trip of S. aurita caught by Ali-Poli-Watsa

Figure 6 : Variation in annual catch/trip of S. aurita caught by ali-poli-watsa, on national basis.

Figure 7 : Variation in annual catch/trip of S. aurita caught by ali-poli-watsa, by regions.

TABLE : 1 TOTAL ANNUAL LANDINGS OF SARDINELLAS IN GHANA 1963-1992

	S aurita			S. maderensis		
YEAR	Artisanal	Inshore	Total	Artisanal	Inshore	Total
1963	5500	1960	7460			
1964	22250	7180	29430			
1965	2350	1550	3900			
1966	4200	5800	10000			
1967	25200	11000	36200			
1968	2500	1800	4300			
1969	15900	6600	22500			
1970	14700	4800	19500			
1971	27492	3724	31216	4036	591	4627
1972	72350	14716	87066	4575	688	5263
1973	4701	4287	8988	10906	1676	12582
1974	1409	623	2032	16111	2511	18622
1975	1930	136	2066	19523	9949	29472
1976	12009	1794	13803	17962	1247	19209
1977	13611	2755	16366	14716	2016	16732
1978	40257	6117	46374	11070	1298	12368
1979	9247	3597	12844	14249	1608	15857
1980	19126	2768	21894	11310	645	11955
1981	10067	5529	15596	12445	859	13304
1982	14655	7330	21985	14007	870	14877
1983	36300	9024	45324	7667	612	8279
1984	34817	3398	38215	10077	1033	11110
1985	54072	9429	63501	22234	1826	24060
1986	45489	5509	50998	16633	2088	18721
1987	46338	1736	48074	25479	1698	27177
1988	75852	672	76524	10450	96	10546
1989	61159	4069	65228	14098	330	14428
1990	43167	2396	45563	14550	940	15490
1991	50447	2265	52712	8210	240	84501

Table 2 : Catch per trip (kg) of Sardinellas, 1972-1992 for Ghana

	S. aurita			S. maderensis		
Year	APW	B/seine	P/seine	APW	B/seine	
1972	408	12	766	15	19	47
1973	17	5	72	40	41	870
1974	7	1	21	28	112	206
1975	3	1	26	75	69	277
1976	51	11	241	42	124	274
1977	21	25	263	19	147	407
1978	129	43	505	22	69	273
1979	25	2	334	25	22	460
1980	48	3	438	28	18	174
1981	21	6	325	28	15	141
1982	35	2	502	35	21	164
1983	59	46	534	13	6	129
1984	47	7	324	19	5	265
1985	139	19	622	49	14	171
1986	53	177	238	26	52	173
1987	109	24	387	59	16	376
1988	156	45	92	20	10	15
1989	174	40	446	39	13	36
1990	95	38	438	30	23	172
1991	76	28	401	11	8	43
1992	235	79	814	22	46	22

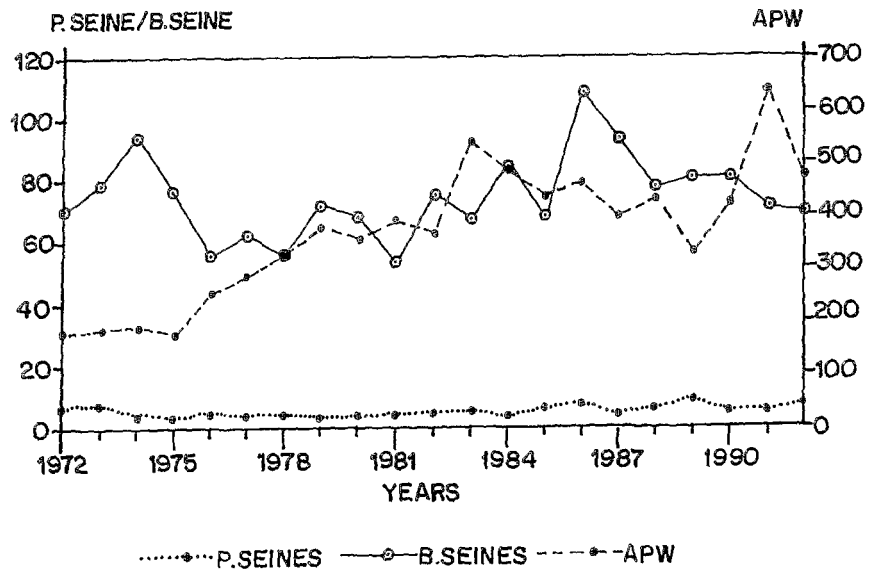

Figure 1: Evolution of Sardinella fishing efforts (Thousand trips) Note: P.SEINES: Purse seine, B. SEINES: Beach seines, APW: Ali-Poli-Watsa.

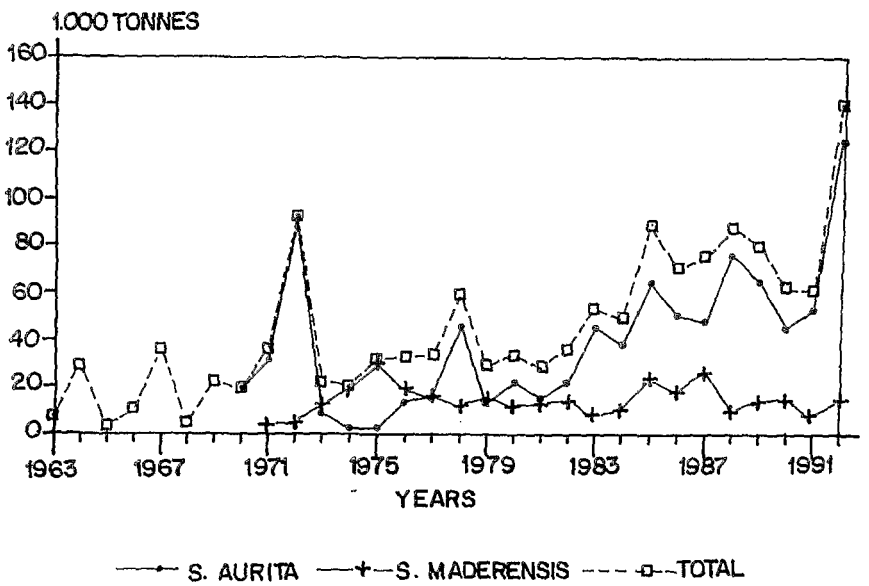

Figure 2 : Total landings of Sardinellas in Ghana 1963-1992.

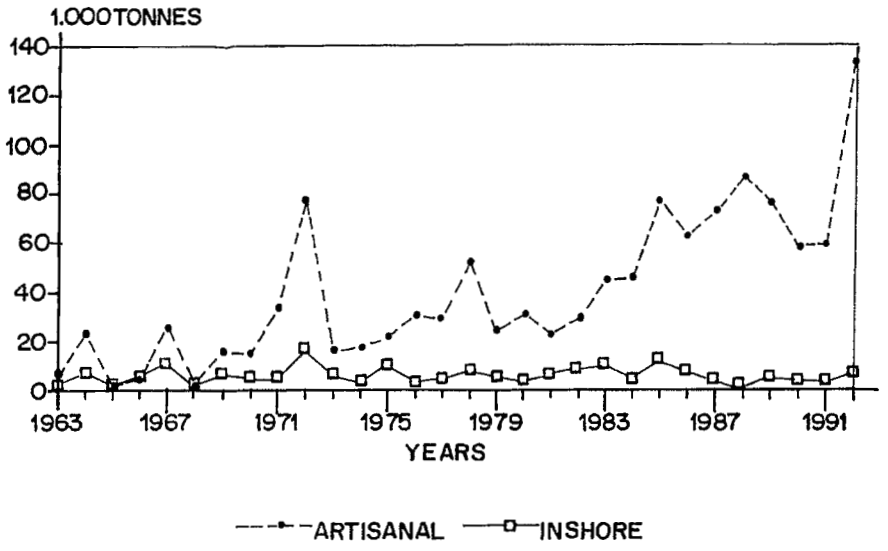

Figure 3 : Sardinella landing by the artisanal and inshore fleets.

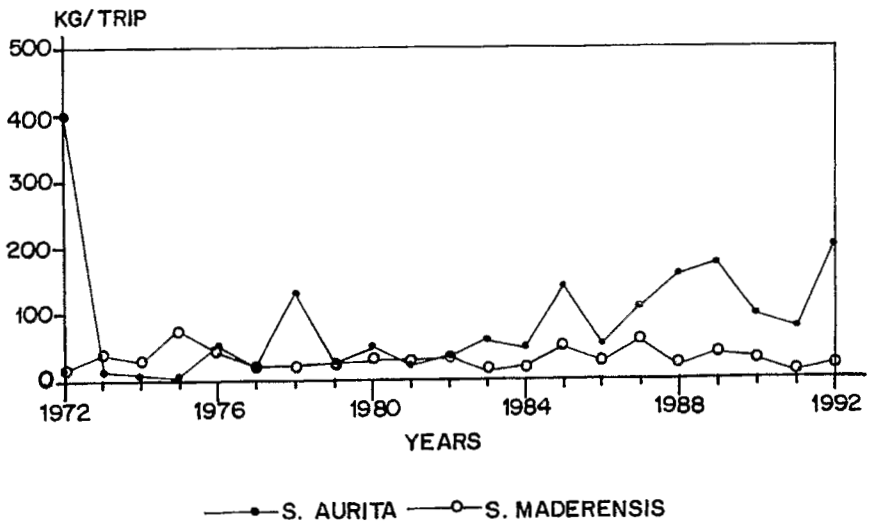

Figure 4 A : CPUE of Sardinellas caught with ali-poli-watsa nets

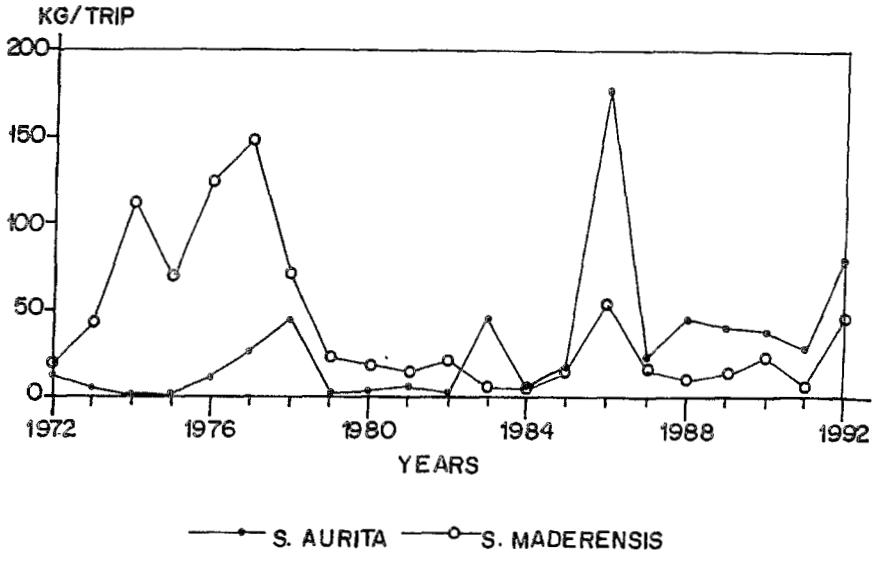

Figure 4 B : CPUE of Sardinellas caught with beach seine nets

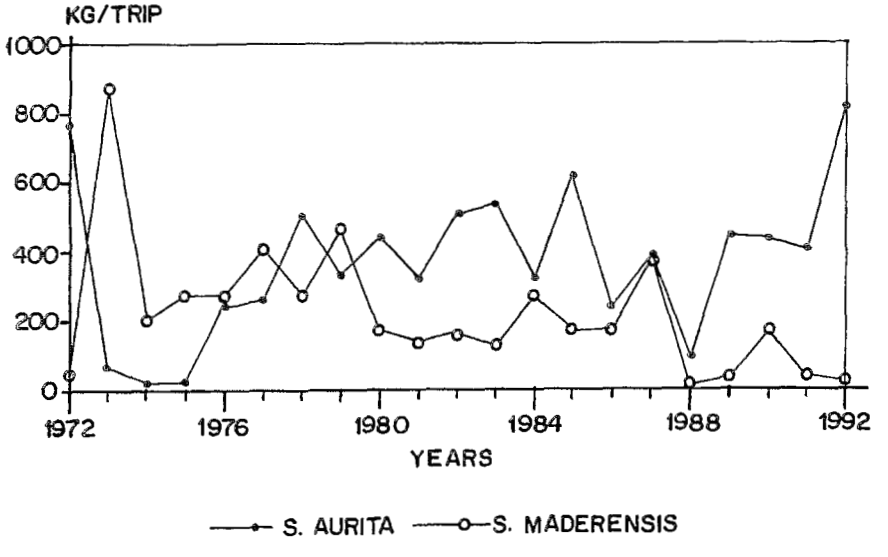

Figure 4C : CPUE of Sardinellas caught with purse seine nets.

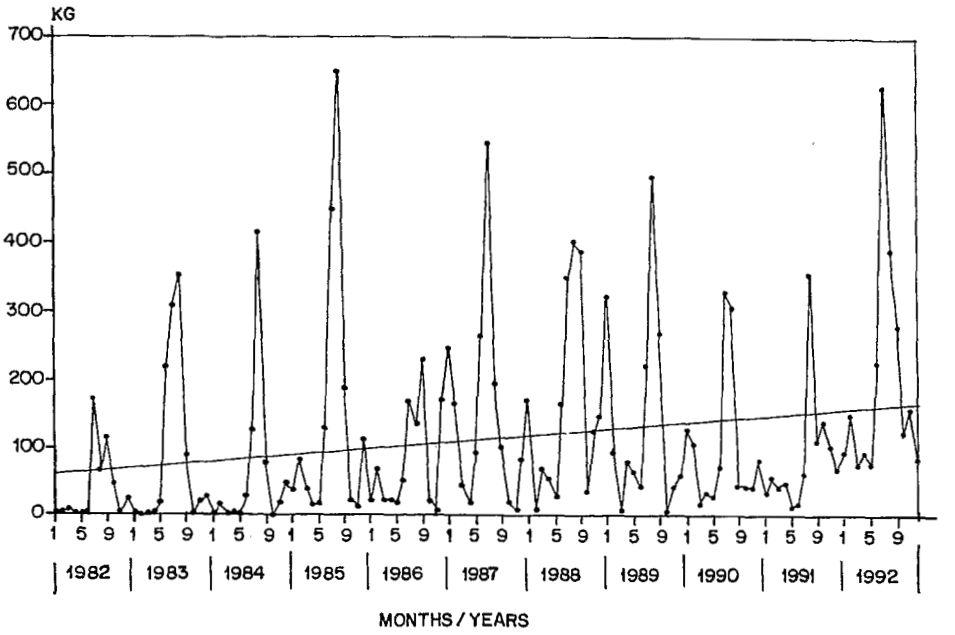

Figure 5 : Variation in monthly catch/trip of S. aurita caught by Ali-Poli-Watsa

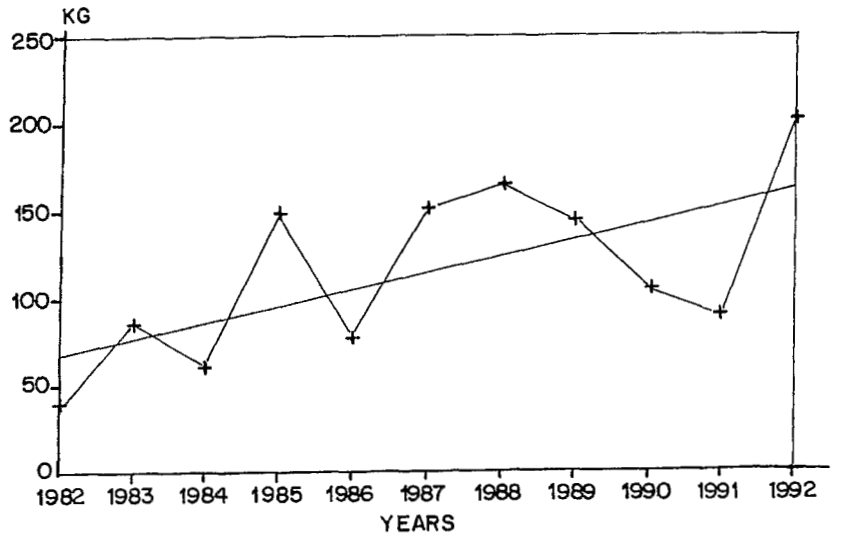

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Figure 6 : Variation in annual catch/trip of S. aurita caught by Ali-Poli-Watsa

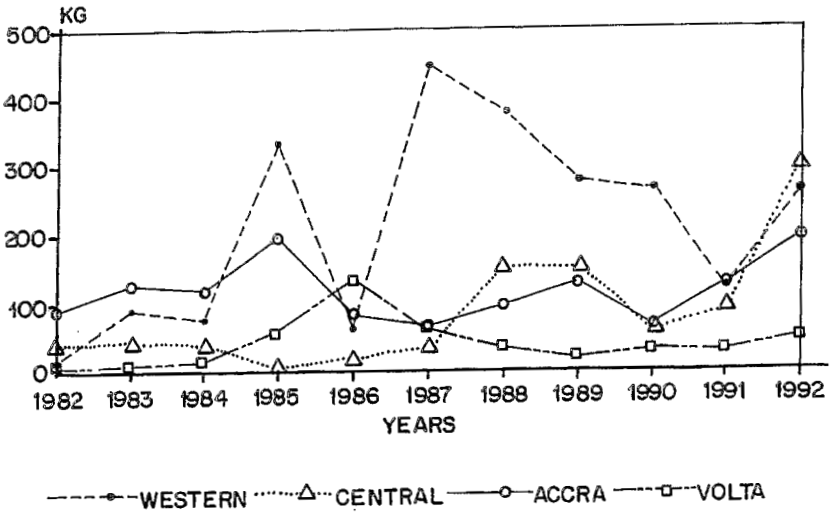

Figure 7 : Variation in annual catch/trip of S. aurita caught by ali-poli-watsa, by regions.