TUNA BAIT-BOAT BAITING TIME AND THE AVAILABILITY OF ANCHOVY IN GHANAIAN WATERS

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Abstract

The time used by tuna bait-boats in catching anchovies to be used as bait in their operations has been examined. The duration of baiting time has not significantly increased but the percentage of trip time spent at baiting increased between 1986 and 1992. Over the same period, the cpue of canoes exploiting anchovies have also steadily increased. There does not appear to be any change in the temporal and geographic distribution of anchovies in Ghanaian waters. Therefore it seems that the increasing percentage baiting time may be due to factors other than the availability of anchovy.

Résumé :

Ce document examine la durée des opérations de capture des anchois qui constituent l'appât vivant des thoniers canneurs ghanéens. La durée de ces opérations n'a pas augmenté significativement lors des années 1986-1992. Lors de la même période le rendement (cpue) des pirogues exploitant les anchois a nettement augmenté. Il ne semble pas qu'il y ait eu un changement dans la distribution spatio-temporelle des anchois dans les eaux côtières ghanéennes. En conséquence il semble que l'accroissement supposé du pourcentage de temps destiné a faire l'appât soit lié a d'autres facteurs que la disponibilité de l'anchois.

1. Introduction : Anchovy and tuna fishing

The commercial tuna fishery based at Tema in Ghana began in 1960 following a survey conducted in 1959-60 by the Star-Kist Foods of U.S.A. under an agreement between the company and the Government of Ghana (Hammond, 1977).

One of the major aims of the survey was to study the distribution and abundance of tuna and tuna bait fishes in the Gulf of Guinea. The results of the survey established, among others, that tuna species abound in the Gulf of Guinea of which Ghana is a part. Bait fishes, anchovy and young sardinellas, for tuna bait-boat operations were found to be readily available, especially in Ghanaian waters.

From the commencement of commercial tuna fishing, sardinellas and anchovies were used as live bait and the industry depended entirely on the availability of these small pelagic fish species. Since the early 1970"s when sardinella resources were drastically reduced in Ghanaian waters, anchovy has become the only fish species used as bait for tuna fishing. According to Choo and Kim (1976), the anchovy Engraulis encrasicolus (Linnaeus,1758) is more preferable than Sardinella as bait.

E. encrasicolus has also been found to be more reliable as bait partly because it is available almost throughout the year and also because it has been found to survive longer under artificial conditions (such as in bait-wells or tanks on tuna vessels) than sardinellas (Fisheries Department observation). E. encrasicolus is one of the most important marine fish species in Ghanaian waters, accounting for about 25% of marine fish landings in Ghana (Koranteng, 1993).

It is widely believed that, since the mid-1980s, tuna bait-boats are spending longer time now than before in obtaining sufficient bait to use in tuna fishing. Since the quantity of tuna caught is positively related to the quantity of bait available to the bait-boats, any reduction in biomass or abundance of anchovy will have an adverse effect on the performance of the bait-boats. The bait-boats will have to spend considerable proportions of their trip time looking for bait, instead of fishing for tunas. The tuna fishery in Ghana will thus suffer unless sardinellas or some other small pelagic fish could be used as bait. This could in turn have serious repercussions on sardinella resources in Ghanaian waters.

In this paper, the baiting time and the proportion of trip time used for baiting, have been examined. The results of the investigation have been related to the landings of anchovy by the Ghanaian artisanal fishing fleet.

2. Bait-Boat Operations and Baiting Time

When a tuna bait-boat sets off for fishing, it spends sometime looking for and catching the bait that will be used in attracting the tuna. The anchovy is encircled and caught with special purse-seine nets. The fish is taken alive with buckets and put into bait-wells located on the bait-boat.

The operation of bait collection ends when all the bait wells on the bait-boat are filled with live bait. The tuna bait-boat then moves to the expected fishing grounds which may be anywhere in the Gulf of Guinea, but may return to baiting grounds when the bait-wells are empty.

3. Materials and Methods

Records available in the log-books of six tuna bait-boats operating from Tema over the period 1986-1992 were examined. The log book information was obtained from the local office of Star-Kist International, the company through which the landings of the six vessels are marketed. These vessels were selected from about 30 tuna bait-boats that operated during the period. They operated more regularly than most of the other vessels and their log-books were available and contained very consistent information.

The vessels, each of them measuring between 39 and 55 metres and of 280 to 440 Gross Registered Tonnage, were as follows : AFKO 303, AFKO 305, GBESE 9, BIG JOHN, GHAKO 101 and GOSHEN 602.

The data extracted from the log-books (for every trip that each vessel made) were : -

1. NUMBER OF DAYS AT SEA (DAS) and
2. NUMBER OF DAYS AT BAITING (DB).

The number of days spent for tuna fishing is the difference between DAS and DB.

Each vessel made between 3 and 11 trips in each of the years under consideration. The duration of a trip usually varied between 6 and 47 days during which 1 and 14 days were used for bait fishing. The percentage (Pb) of trip time spent at baiting was calculated as:

$$Pb = \frac{DB}{DAS} \times 100.$$

The baiting time and calculated values of Pb for all trips made by each vessel are presented in tables 1 and 2.

A total of 328 trips were made by all six vessels in the period under study. The baiting time, and time used for tuna fishing were plotted (Figure 1). The percentage baiting time, Pb was also plotted (Figure 2.)

For each vessel, the baiting times, DB and percentage baiting times, Pb were grouped on quarterly basis. That is the operations in the months of January-March were put in the first quarter, April-June in the second quarter, July-September in the third and October-December in the fourth quarter. The regrouped data are presented in tables 3A and 3B which also give the annual mean values of DB and Pb. Combining all years under study, the average values of DB and Pb for each quarter of the year were plotted in figure 3.

Analysis of variance was performed on the quarterly values of DB and Pb to test the differences between years and quarters.

From the records of the Research and Utilization Branch of the Fisheries Department of Ghana, total landings and cpue of anchovy caught by the fleet of canoes using the artisanal purse seine net, called "poli", in each of the four maritime regions were obtained (Table 4.) An analysis of variance was performed on the quarterly values of cpue.

4. Result and Discussion

It is observed in figures 1-3 that the baiting and fishing times do not show any clear trend.

From figure 3, however, there appears to be an increasing trend in days baiting (DB) and percentage baiting time (Pb) from the first to the fourth quarters of the year. However, from the analysis of variance (appendix 1), the rising trends symbolising differences in DB and Pb were found to be statistically insignificant ($p=0.6724$) for DB and 0.6242 for Pb). This means that there were no real differences in both days baiting and percentage baiting among the four quarterly periods of the year. On the other hand, the inter-annual differences were found to be significant ($p=0.0462$) in Pb but insignificant in DB ($P=0.7432$).

From table 4 and figure 4, cpue values of anchovies caught with the poli net were highest in the Volta Region and lowest in the Western Region. This shows that anchovy is less available in the western than the eastern part of the country. However, from 1991 to 1992, there was a significant rise in cpue in the Western Region; coming second to the Volta Region. Central region also recorded a higher value than Greater Accra region. Except for this picture in 1992, there does not appear to be any changes in the temporal or geographic distribution of anchovy in Ghanaian waters. From the analysis of variance significant differences exist between quarters of the year ($p=0.0034$) and between years ($P=0.0424$).

On the whole, landings of the anchovy over the past seven years have fluctuated widely with a gradual decline observed from 1989 to 1991. Also within the same three year period, (1989-1991) it was observed that baiting time increased steadily. From 1991 to 1992, however, there is seen a slight rise in landings (Figure 5.)

Since 1991, the observation on increasing baiting time has resulted in some fears that there is a possible decline in the abundance of anchovy in Ghanaian coastal waters. Estimates of the biomass of anchovies have not been commensurate with catches made by canoes. For example in 1989, the combined biomass of the anchovy and sardinellas was estimated as 53,000 metric tons (Alvheim et al, 1989) but in the same year, over 76,000 mt of anchovy alone were caught.

It is evident that over the period under consideration, although the baiting time did not show any statistically significant rise, the percentage baiting time increased particularly since 1991, and the cpue of poli canoes did not decreased.

It is clear also on figure 6, that until 1991, the variation in percentage baiting time was generally in opposition of phase with variation in cpue of the poli canoes. One could therefore attribute the observed changes in baiting time and percentage baiting time to factors other than abundance or aivability of anchovy. However, there does not appear to be any cause for alarm with regard to the aivability of anchovy as tuna bait in the tuna bait-boat fishery in Ghanaian waters.

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CAPTIONS OF TABLES AND FIGURES

Table 1 : Baiting time for six selected Ghanaian tuna bait-boats 1986-1992

Table 2 : Mean percentage of baiting time for the six selected tuna bait-boats 1986-1992

Table 3 : A- Mean quaterly and annual baiting time for all six tuna bait-boats 1986-1992.
B- Mean percentage baiting time for all six tuna bait-boats 1986-1992

Table 4 : Catch and CPUE values of the anchovy
A- Total national catch and CPUE in each quarter of the year
B- Overall national and regional CPUE.

Figure 1: Compared baiting and fishing time of the six selected tuna bait-boats 1986-1992

Figure 2 : Percentage of the baiting time for the six selected tuna bait-boats 1986-1992

Figure 3 : Mean baiting time and percentage baiting time for all six bait-boats

Figure 4 : CPUE of poli nets in the four maritime regions of Ghana

Figure 5 : National catch and CPUE of anchovy

Figure 6 : Relation CPUE of anchovy versus percentage of baiting time, by quarters 1986-1992

TABLE 1.
BAITING TIME FOR SIX TUNA BAIT BOATS 1986 - 1992.

1986 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	6	6	7	7	3	5	2	7			
GBESE 9	4	3	9	5	2	5	2	4			
AFKO 303	6	4	5	6	5	4	8	6			
BIG JOHN	2	1	5	4	6	6	5	2	2	2	2
GHA.101	1	3	1	8	5	4	2	4	4		
GOS.602	NOT IN SERVICE										

1987 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	1	6	4	4	8	11					
GBESE 9	2	1	3	3	2	6	3	2	4	5	
AFKO 303	5	4	10	6	5	6	14	4	5		
BIG JOHN	3	2	10	5	7	1	14	5	6	5	
GHA.101	2	2	10	6	5	9	4	2	4		
GOS.602	NOT IN SERVICE										

1988 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	12	3	3	7	6	7	2	2	5		
GBESE 9	2	8	2	6	3	7	3	5			
AFKO 303	8	2	8	3	2	9	5	6	2	7	
BIG JOHN	5	4	5	6	7	7	3	2	2	10	
GHA.101	10	7	7	2	2	8	6	10			
GOS.602	3	1	3	5	7	3	6				

1989 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	2	3	4	5	9	6	5	10			
GBESE 9	5	4	1	2	7	5	6	4			
AFKO 303	8	4	3	3	4	3	8	10			
BIG JOHN	5	5	4	4	9	3	2	5			
GHA.101	3	2	5	4	4	3	8				
GOS.602	5	3	1	2	3	2	3	3	6		
1990 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	10	6	13	8	7	5	7	3			
GBESE 9	3	4	8	7	11	3					
AFKO 303	5	5	9	5	6	5	4	3	5	2	
BIG JOHN	2	4	4	7	9	5	5	2	4		
GHA.101	9	9	6	4	6	2	2	3	2		
GOS.602	8	7	10	6	2	6	4				
1991 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	11	4	8	10	7	6	8				
GBESE 9	5	11	8								
AFKO 303	6	6	10	4	3	6	7	2	5		
BIG JOHN	9	4	5	4	5	4	3				
GHA.101	2	5	6	2	9	5					
GOS.602	2	6	10	6	2	5	9	8	7	5	
1992 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	4	13	16	6	9	9	7				
GBESE 9	2	11	3	7	7	6					
AFKO 303	5	5	6	5	11	8	10	8	9	5	
BIG JOHN	3	4	3	2	7	2	5	5	7		
GHA.101	5	3	11	12	2	8	5	7			
GOS.602	7	3	7	3	4	4	4	5			

TABLE 2

MEAN PERCENTAGE BAITING TIME FOR SIX TUNA BAIT BOATS. 1986-1992.

1986 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	28.6	16.2	22.6	17.5	8.6	19.2	12.5	18.9			
GBESE 9	14.3	14.3	19.2	16.7	6.7	14.7	10.5	18.2			
AFKO 303	27.3	14.3	15.6	21.4	20.2	16.7	34.8	30.0			
BIG JOHN	18.2	2.4	16.7	12.9	28.1	17.1	16.1	10.5	10.5	13.3	6.5
GHA.101	4.4	9.4	12.5	17.0	16.1	12.1	9.5	19.1	15.4		
GOS.602	NOT IN SERVICE										

1987 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	2.5	14.6	14.3	16.7	22.2	29.7					
GBESE 91	5.4	3.3	12.5	35.7	20.0	7.9	14.3	16.0	20.8	25.0	
AFKO 303	22.7	12.9	29.4	35.3	33.3	15.8	51.9	17.9	29.4		
BIG JOHN	10.0	7.1	30.3	20.0	24.1	5.0	51.9	23.8	27.3	17.9	
GHA.101	9.1	7.7	26.3	20.0	20.8	26.5	25.0	33.3	12.5		
GOS.602	NOT IN SERVICE										

1988 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	26.6	9.1	10.0	21.9	16.6	24.1	20.0		14.3	33.3	
GBESE 9	6.5	19.5	6.3	23.1	15.8	16.3	17.6	35.7			
AFKO 303	25.8	5.1	25.8	15.0	11.1	31.0	23.8	35.3	14.3	21.2	
BIG JOHN	14.7	22.2	16.7	18.8	25.0	23.3	10.0	8.3	27.0	47.6	
GHA.101	26.3	22.6	18.4	7.4	13.3	25.0	20.7	36.3			
GOS.602	8.1	4.3	12.5	14.7	23.3	9.1	27.3				

1989 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	27.3	10.5	8.6	14.3	12.5	28.1	17.6	14.3			
GBESE 9	26.3	21.1	2.5	8.7	16.6	13.8	16.6	16.6			
AFKO 303	26.7	12.1	12.5	14.3	26.7	6.7	26.7	31.3			
BIG JOHN	15.6	17.2	18.2	12.5	20.9	18.8	7.1	13.5			
GHA.101	10.0	8.3	12.8	28.6	16.7	13.6	33.3				
GOS.602	20.8	18.8	3.8	10.0	8.6	16.6	10.0	10.7	19.4		

1990 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	33.3	27.7	20.7	35.1	26.7	22.6	14.7	24.1			
GBESE 9	8.1	15.4	21.6	29.2	35.5	25.0					
AFKO 303	23.8	27.8	26.5	16.1	26.1	20.0	16.0	14.3	25.0	9.5	
BIG JOHN	14.3	12.9	18.2	25.0	29.0	17.9	19.2	14.3	11.1		
GHA.101	22.2	26.5	28.1	17.1	16.7	13.9	10.0	15.4	15.8		
GOS.602	29.6	35.0	33.3	20.1	24.0	14.3	23.1				

1991 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	27.3	27.5	11.1	22.9	29.4	17.5	27.3				
GBESE 9	17.2	32.4	22.9								
AFKO 303	24.0	26.1	28.6	20.0	12.5	22.2	22.6	9.1	16.7		
BIG JOHN	28.1	14.3	16.1	16.0	16.6	14.8	16.7				
GHA.101	12.5	29.4	20.7	12.5	27.3	25.9					
GOS.602	6.9	27.3	33.3	37.5	13.3	35.7	31.0	26.6	28.0	20.8	

1992 TRIPS	1	2	3	4	5	6	7	8	9	10	11
AFKO 305	17.4	31.0	38.0	18.1	24.3	25.7	28.0				
GBESE 9	10.0	28.2	16.6	30.4	25.9	46.1					
AFKO 303	20.8	25.0	35.2	25.0	25.5	26.6	34.4	24.2	30.0	31.2	
BIG JOHN	18.8	22.2	14.2	8.0	33.3	13.3	20.8	19.2	25.0		
GHA.101	16.6	27.2	34.3	33.3	8.3	27.5	22.7	21.2			
GOS.602	21.8	20.0	35.0	17.6	30.7	9.0	17.3	22.7			

TABLE 3A

MEAN QUARTERLY AND ANNUAL BAITING TIME FOR ALL SIX TUNA BAITBOATS. 1986-1992

	QUARTER				
YEAR	1	2	3	4	ANNUAL
1986	8.4	10.4	10.4	8.8	9.5
1987	5.0	10.0	12.0	18.2	11.3
1988	10.3	12.0	11.8	10.2	11.1
1989	9.3	9.0	7.6	12.3	9.6
1990	12.6	15.3	10.8	7.8	11.7
1991	15.0	9.6	15.6	8.5	11.5
1992	8.4	17.0	13.0	13.0	12.9
MEAN	9.86	11.90	11.60	11.25	11.08

TABLE 3 B

MEAN PERCENTAGE BAITING TIME FOR ALL SIX TUNA BAITBOATS 1986-1992.

	QUARTER				
YEAR	1	2	3	4	ANNUAL
1986	15.3	18.1	16.0	17.0	16.6
1987	9.3	23.6	21.1	24.8	19.7
1988	18.3	13.9	16.9	22.6	17.9
1989	18.0	13.8	13.0	18.6	15.9
1990	23.0	22.9	22.6	16.1	21.2
1991	24.8	20.1	23.4	21.8	22.5
1992	21.1	25.1	23.6	27.8	24.4
MEAN	18.54	19.64	19.51	21.24	19.74

TABLE 4 CATCH AND CPUE VALUES OF THE ANCHOVY

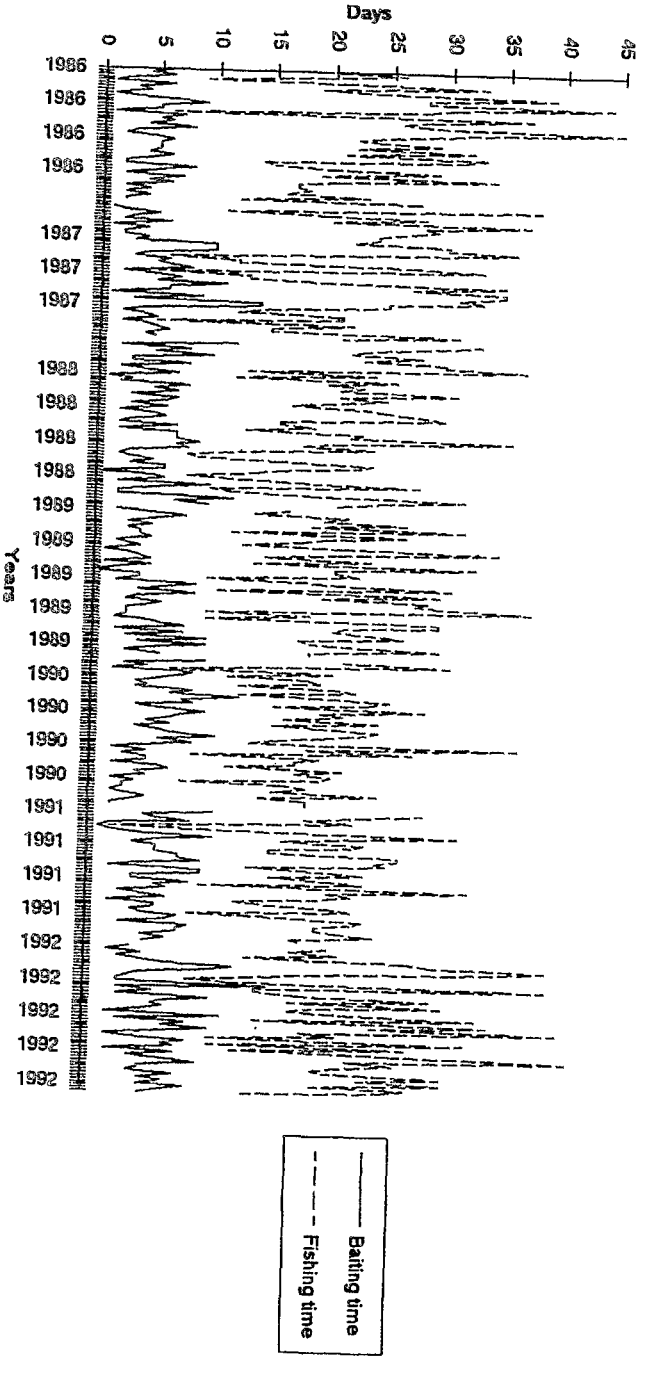
A : TOTAL NATIONAL CATCH AND CPUE IN EACH QUARTER OF THE YEAR

		CPUE PER QUARTER			
YEAR	CATCH	1	2	3	4
1986	15208	125.6	75.8	84.4	107.4
1987	87983	357.4	765.5	1105.5	506.9
1988	75908	395.4	251.4	976.8	480.2
1989	76348	251.6	209.2	1214.3	874.9
1990	74668	613.3	128.2	655.9	621.5
1991	65490	126.8	403.1	699.8	385.3
1992	85384	360.1	204.7	632.2	943.1

B : OVERALL NATIONAL AND REGIONAL CPUE

YEAR	WESTERN	CENTRAL	G/ACCRA	VOLTA	NATIONAL
1986	0.2	24.3	9.8	749	33.0
1987	40.6	185.8	281.7	902.2	191.9
1988	16	103.2	284.7	538.9	175.7
1989	44.4	200	273.2	588.4	451.2
1990	37.2	150.3	212.2	949.2	178.2
1991	9.8	57.3	185.6	731.7	102.9
1992	238	199.9	180.3	949.7	180.8

Figure 1 : Compared baiting and fishing times of tuna bait boats, 1986 - 1992



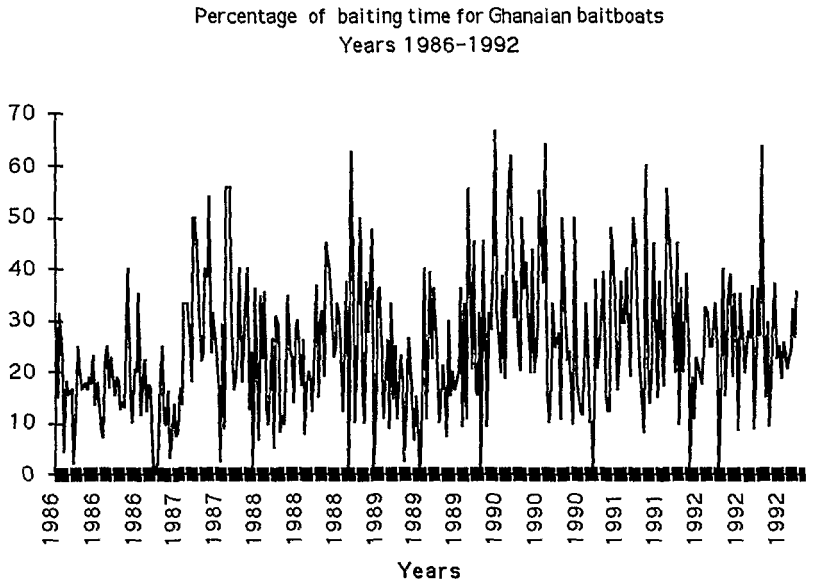


Figure 2 : Percentage baiting times for tuna boats 1986 - 1992

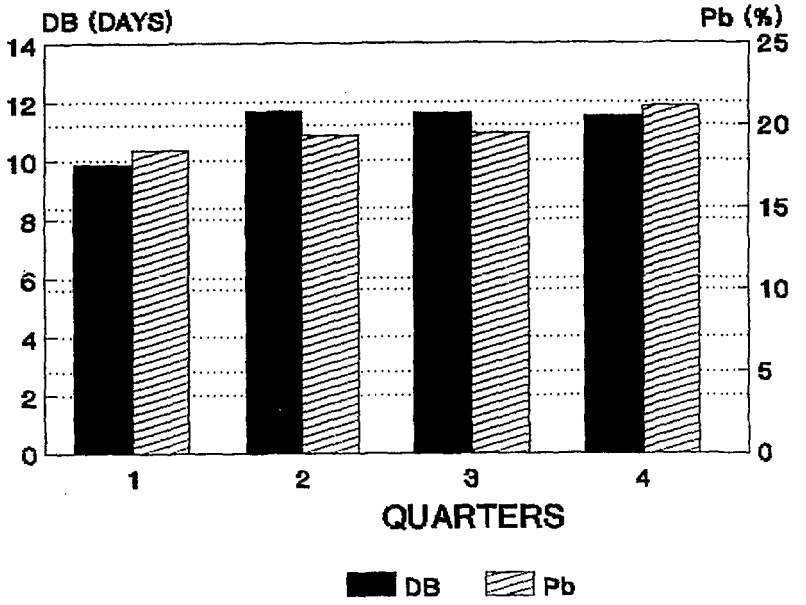


Figure 3 : MEAN BAITING TIME & PERCENTAGE BAITING TIME FOR ALL SIX BAITBOATS

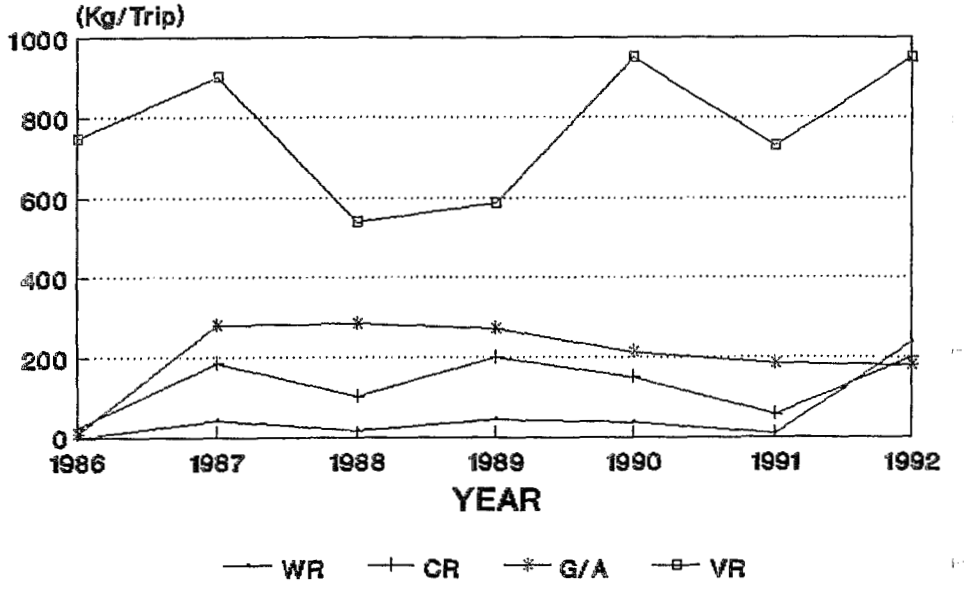


Figure 4 : CPUE OF POLI NETS IN THE FOUR MARITIME REGIONS OF GHANA

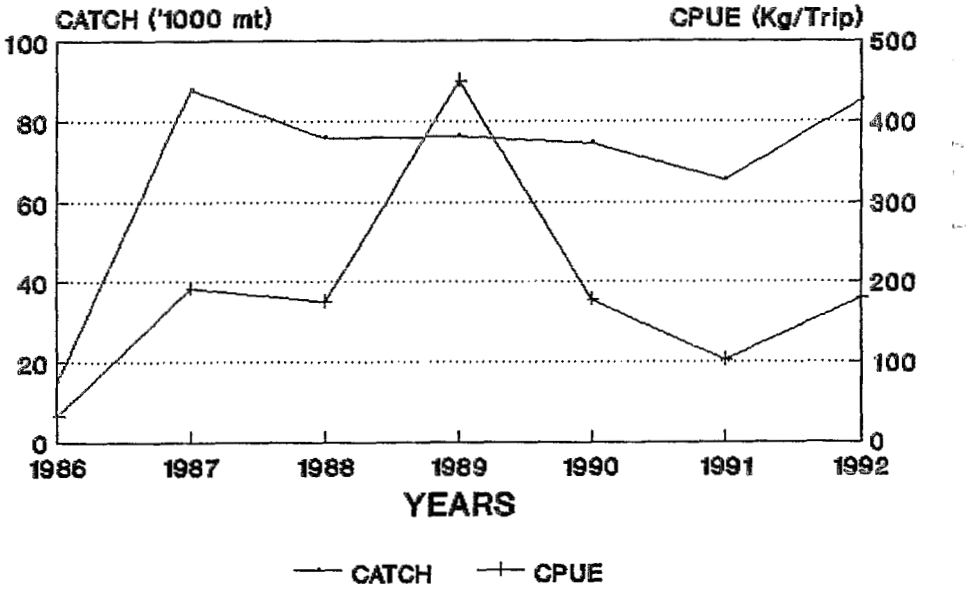


Figure 5 : NATIONAL CATCH AND CPUE OF ANCHOVY

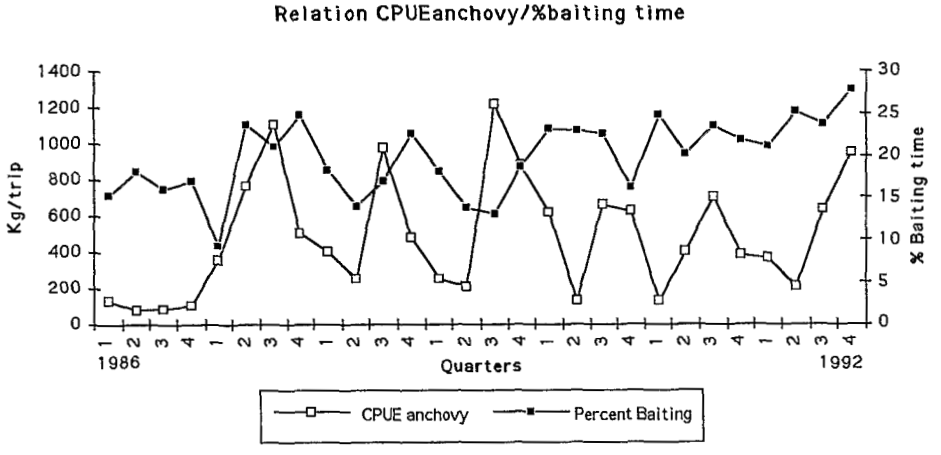


Figure 6 : Relation CPUE of anchovy versus percentage of baiting time, by quarters 1986-1992

APPENDIX 1. : ANALYSIS OF VARIANCE FOR DB.

SOURCE	DF	SS	MS	F	P
YEAR (A)	6	37.9071	6.31785	0.58	0.7432
QUARTER (B)	3	17.1353	5.71178	0.52	0.6724
RESIDUAL	18	196.827	10.9348		
TOTAL	27	251.869			

ANALYSIS OF VARIANCE FOR Pb.

SOURCE	DF	SS	MS	F	P
YEAR (A)	6	238.989	39.8315	2.72	0.0462
QUARTER (B)	3	26.2642	8.75476	0.60	0.6242
RESIDUAL	18	263.310	14.6283		
TOTAL	27	528.564			

ANALYSIS OF VARIANCE FOR CPUE.

SOURCE	DF	SS	MS	F	P
YEAR (A)	6	8.940E+05	1.490E+05	2.79	0.0424
QUARTER (B)	3	1.053E+06	3.509E+05	6.58	0.0034
RESIDUAL	18	9.607E+05	53369.6		
TOTAL	27	2.907E+06			