Proc. ICCAT Intl. Skipjack Yr. Prog. 1 : 118-121 (1986)

Catch Per Unit of Effort of Tema-based Bait Boats and Length Frequency of Skipjack

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The landing statistics of all Tema-based baitboats were used in this study, which was aimed at determining catch per unit of effort for the baitboats and length frequency distribution of the skipjack catch. The number of days absent from port was used as the unit of effort.

It was observed that the larger the gross tonnage of the boats, the larger the catch per unit effort and that no matter the size of the boats, the catch per unit effort remained the same for all flags (nations).

For the seven years, 1976 to 1982, the patterns of the length-frequency distributions were similar with skipjack of 41-49 cm being dominant. There were differences in the length frequencies between years except between 1978 and 1979, which were similar.

Cette étude, qui utilise les statistiques de débarquement de tous les canneurs basés à Téma, a pour but la définition de la capture par unité d'effort des canneurs et de la distribution des fréquences de taille dans la prise de listao. Le nombre de jours hors du port a servi d'unité d'effort.

On a pu observer que la capture par unité d'effort était d'autant plus importante que le tonnage brut des bateaux était élevé, et que, quelle que soit la taille des bateaux, la prise par unité d'effort demeure la même pour tous les pavillons (pays).

Les modes de distribution des fréquences de taille ont été similaires pendant les sept années de 1976 à 1982, avec une prédominance des listaos de 41-49 cm. Les fréquences de taille présentent des différences d'une année sur l'autre, sauf pour 1978 et 1979 qui sont de même ordre.

En este estudio se utilizaron estadísticas de desembarque de todos los barcos de cebo con base en Tema, con el propósito de determinar la captura por unidad de esfuerzo de dichas unidades y la distribución de frecuencias de talla en las capturas de listado. Como unidad de esfuerzo se utilizó el numero de días ausentes de puerto.

Se observó que cuanto mayor el tonelaje bruto, más importante era la captura por unidad de esfuerzo, y que independiente del tamaño de los barcos, la captura por unidad de esfuerzo permanecía igual para todas las banderas (países).

Para los siete años comprendidos entre 1976 y 1982, las distribuciones talla-frequencia fueron similares cuando dominaba el listado de 41-49 cm. Se detectaron diferencias en las frecuencias de talla entre años, excepto entre 1978 y 1979, que fueron similares.

1. Introduction

Over the past twenty-two years, the boats that have fished from Ghana have been predominantly baitboats, which use chumming (throwing live bait to the school of tuna). Purse seiners were used for only a brief period after a resource survey of tuna off the coast of Ghana, and recently when a Ghanaian company acquired five seiners. Bait fishing has been made possible by the year-round availability of anchovy (*Engraulis engrasiolus*) and the young of *Sardinella aurita* off the Ghana coast (Choo and Kim 1976). The tuna fishery, however, has extended beyond the coastal jurisdiction of Ghana to as far south as Annobon and sometimes as far north as Sierra Leone (Figure 1). Skipjack (*Katsuwonus pelamis*) have comprised around seventy six percent of the total landings.

The fleet has been composed primarily of Japanese and Korean registered baitboats of different gross tonnages. Even though the sizes of these boats have not changed over the years, some characteristics, especially the proportions between the oriental and the Ghanaian crew, have changed considerably. With these changes have come new and more incentive-oriented contracts for the crew. As a result, vessels which hitherto have performed marginally have recently improved their catches.

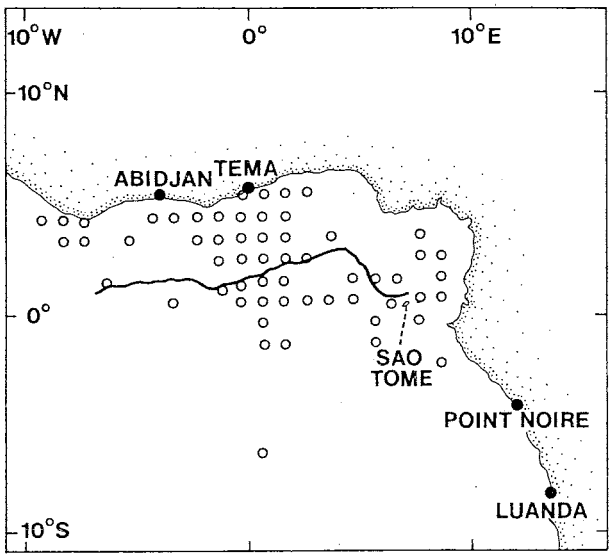

Figure 1. Circles identify 1° squares used by Tema-based baitboats, 1976-1982.

This study is therefore aimed at examining the relation between the Catch Per Unit of Effort (CPUE) of the vessels and the size of the boats, over time. Calculation of CPUE in the baitboat fishery has been neither easy nor satisfactory (Kume 1977a; Gong et al. 1980). For the purpose of this study, however, the

number of days the boat was absent from port is used as the unit of effort. We also examine the length-frequencies of skipjack in recent years.

2. Materials and Methods

The catch and effort statistics of every baitboat were obtained through the courtesy of the captain as each boat returned to port. The number of days at sea was copied from log-books and used to compute the CPUE, and these were compiled for a period of seven years (1976 to 1982, inclusive) according to the nationality and size of the boats. Fork-lengths of fifty skipjack were measured aboard each vessel from a randomly selected sample, using a meter rule calibrated in millimeters. The mean, variance, and standard deviation of samples were calculated, and significance of differences between years was tested with Student's t-test.

3. Results and Discussion

The highest landings of skipjack, 35,700 metric tons, occurred in 1979, the lowest, 21,000 metric tons, in 1976 (Fig. 2). This parallels the total catches in the East Atlantic, of which the landings in Ghana comprise about 30% (see ICCAT Statistical Bulletins).

The analysis of CPUE and vessel size (Fig. 3) showed that the larger the gross tonnage of the boat, the higher the CPUE. This increase in CPUE with increasing gross registered tonnage (grt) can be explained on the grounds that the bigger the vessel the more hands to hook fish.

For a given vessel size, the CPUE did not vary between years, except for size categories 401-450 and 451-500 grt between the years 1979 and 1980 (Table 1). The increase in CPUE for vessels over 400 grt between 1979 and 1980 arose because of increased incentives to the crews, resulting in improved efficiency, and because of changes in management and improved conditions of service for the crew. These changes have obviously increased the fishing efficiency of these vessels. (Gulland 1964; Pope 1975).

Our measure of fishing effort, which combines the time steaming to baiting grounds and time steaming to and from fishing grounds, as well as time spent searching and fishing, may not be proportional to the

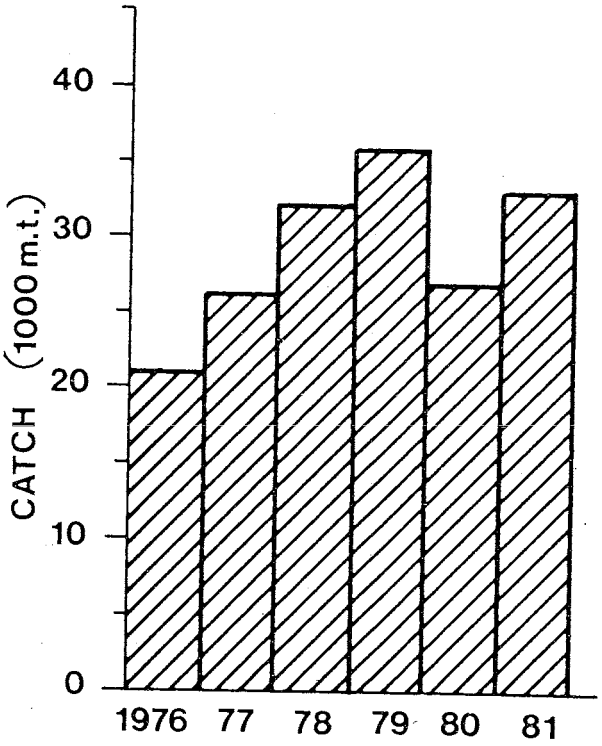

Figure 2. Annual landings of skipjack in Ghana, 1976-81.

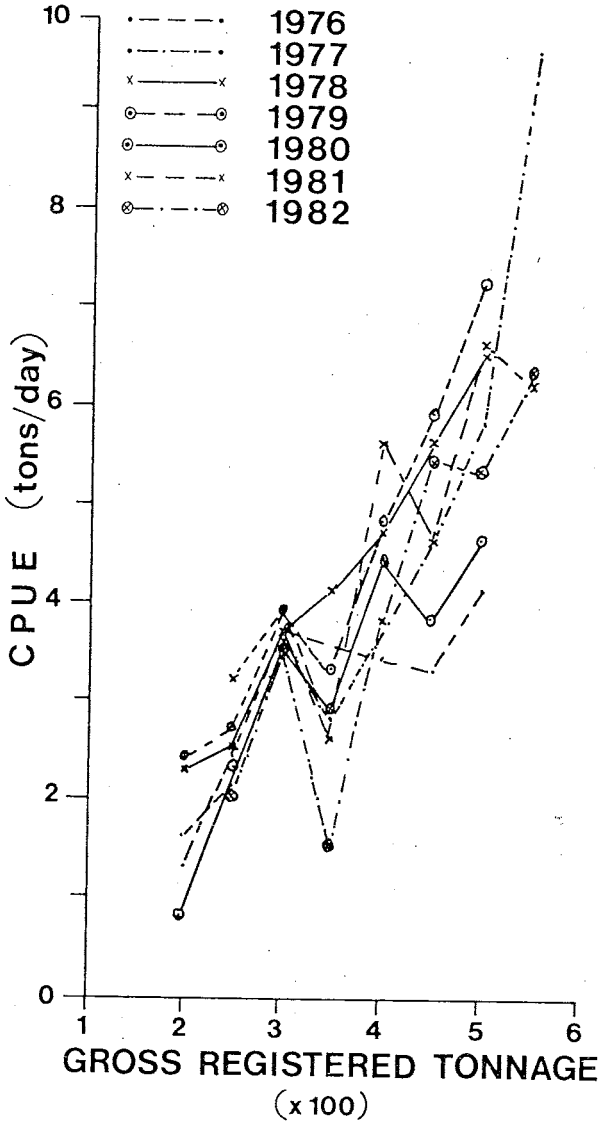

Figure 3. Catch per unit effort of skipjack landed in Ghana by baitboat size categories, 1976-1982.

Table 1. Student's t (t/df) of differences between years in catch per unit effort by gross registered tonnage of boat (GRT).

	Between years					
GRT	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82
151-200	0.88/1	0.700/0	0.100/0	1.600/0	—	—
	NS	NS	NS	NS	—	—
201-250	0.572/5	0.989/7	0.368/7	0.422/4	0.317/3	0.576/3
	NS	NS	NS	NS	NS	NS
251-300	0.076/45	0.000/49	0.591/48	1.070/44	0.930/39	0.702/37
	NS	NS	NS	NS	NS	NS
301-350	—	—	0.523/1	0.262/1	0.376/1	1.379/1
	—	—	NS	NS	NS	NS
351-400	—	—	0.082/2	0.328/2	0.902/2	0.977/2
	—	—	NS	NS	NS	NS
401-450	0.966/5	1.621/12	0.504/16	3.697/16	1.573/21	1.752/25
	NS	NS	NS	**	NS	NS
451-500	0.972/2	0.664/5	0.810/6	3.257/5	2.171/3	1.152/2
	NS	NS	NS	**	NS	NS

NS — not significant; ** — highly significant.

Table 2. Differences between boat performance by country of registry, 1978-81 and 1978-82.

				Student's		
1978-81	Mean	Variance	N	t	df	Signif.
Ghana	0.5040	0.0579	5	0.692	29	NS
Japan	0.4645	0.0457	11	0.479	35	NS
Korea	0.3440	0.0459	10	0.977	34	NS
All countries	0.4258	0.0486	26	—	—	—
1978-82						
Ghana	1.6363	4.2155	8	1.470	38	NS
Japan	0.5838	0.1229	13	0.694	43	NS
Korea	0.4891	0.2728	11	0.885	41	NS
All countries	0.8144	1.3217	32	—	—	—

NS — not significant; there were no significant differences.

resulting fishing mortality. We concede that the number of days used to designate the effort could result in apparent increased fishing efficiency as the stock decreases (Gulland 1977).

Though some boats appeared to out-perform all others, regardless of their size, comparison of differences in performance of all boats using Student's t-test (Table 2) showed that the catch per boat per day was not significantly different between nations. The number of crew members on boats of different nationalities, which varied between 23 and 30, did not appear to influence the performance of the boats.

Length-frequency distributions (Fig. 4) showed that 41-49 cm fish were dominant through the years of this study. In 1977 and 1978, skipjack of 48-53 cm fork-length, referred to as 'jumbo' size, were more common than in other years. Though the differences in mean lengths of skipjack in consecutive years (Table 3) were of little practical importance, they were statistically significant at the 5% and 1% confidence levels except between 1978-1979 (Table 4).

Overfishing in a fishery is accompanied, amongst other things, by a reduction in the sizes of fish. The length-frequency data from skipjack show that the sizes of the fish caught have remained relatively constant (Fig. 4). Fishing pressure, also, has remained

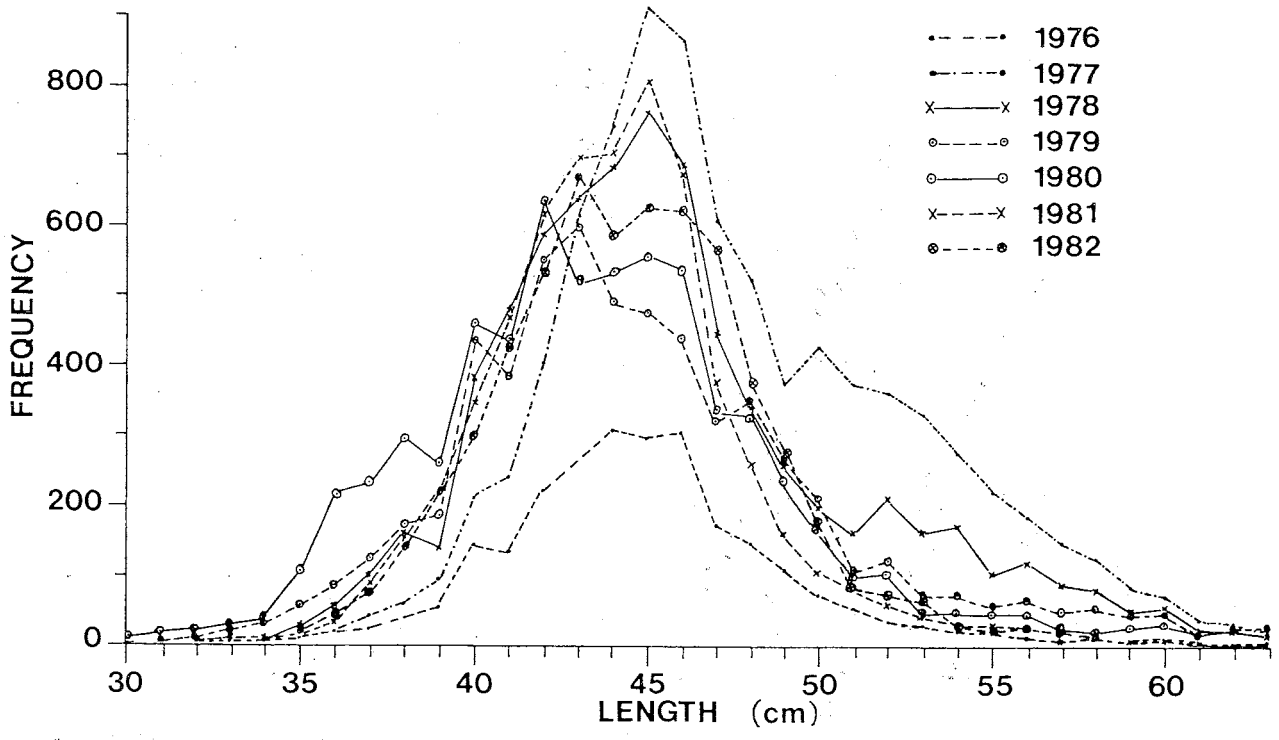

Figure 4. Length frequency distribution of skipjack landings in Ghana, 1976-1982

Table 3. Results of length-frequency analysis of skipjack.

Year	Mean Length	Variance	Std. Dev.	Sample size (n)
1976	44.924 cm	16.3166	4.039	2,500
1977	47.790 cm	29.2951	5.413	8,450
1978	44.814 cm	68.6226	8.284	7,200
1979	44.970 cm	30.4330	5.517	5,929
1980	43.856 cm	18.3855	4.288	6,508
1981	44.112 cm	14.3484	3.788	5,989
1982	44.611 cm	15.1593	3.893	5,955

Table 4. Between-year differences for skipjack length frequencies.

Years	Similar	Different	Levels of Significance	Std. Dev.
1976-77		+	5% & 1%	9.997×10^{-2}
1977-78		+	5% & 1%	1.140×10^{-1}
1978-79	+			$1\!\!/\!_8.210 \times 10^{-1}$
1979-80		+	5% & 1%	8.920×10^{-1}
1980-81		+	5% x 1%	7.200×10^{-2}
1981-82		+	5% x 1%	1.016×10^{-1}

reasonably constant with respect to number of vessels (Table 5), and no new techniques have been introduced. There is no reason, from these data at least, to suggest that skipjack are yet being overfished.

4. Conclusions

1. The larger the gross tonnage of the boats, the larger the CPUE.

Table 5. Total number of baitboats (all nations) that operated from Ghana, 1976-82.

Year	No. of baitboats
1976	41
1977	41
1978	46
1979	46
1980	39
1981	44
1982	44

2. The CPUE has not varied significantly between 1976 and 1982.

3. Although the differences in mean lengths of skipjack were significant between all consective years except 1978-1979, these differences were sufficiently small to be of little or no practical importance.

4. The 41-49 cm fork length were most dominant for all years.

5. 'Jumbo' sizes (48-53 cm fork length) were well represented in 1977 and 1978.

Acknowledgements

We are grateful to A.N.K. Badoo of the Fishery Research Unit for conducting the statistical analyses for this report. We also thank T.A. Borkety and J.K. Yeboah for painstakingly collecting the statistical data from the boats.