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# THE EFFECT OF THE INTRODUCTION OF NEW DEVICES (FAD) AND BIRD RADARS IN THE BAITBOAT FISHERY OF TUNA IN GHANA

*Kwei, E. A., P. Bannerman*
*Fishery Research Unit, Tema, Ghana*

## SUMMARY

A two-year study was carried out to assess the impact on newly-introduced fishing devices aimed at enhancing the performance/efficiency of tuna vessels (baitboats) in terms of their catches. Data on records of fishing activities of three selected vessels employing none, one, or both devices were compared. Biological sampling relating to length measurements was also carried out. Observations reveal that with the use of the new devices in the fishery, notably bird radar and rafts simultaneously, significant yields are recorded. Modal classes of species caught tend to remain constant.

## RESUME

Une étude a été menée sur deux années pour évaluer l'impact d'équipements introduits récemment dans la pêcherie, et qui visent à accroître la performance/efficacité des thoniers (canneurs) en termes du taux de capture.

Les données sur les registres des activités de pêche de trois bateaux retenus, et qui utilisaient, soit aucun, soit un, soit deux de ces équipements, ont été comparées.

L'échantillonnage biologique associé aux mensurations de taille a également été mené.

Les observations révèlent qu'en utilisant les nouveaux équipements dans la pêcherie, en particulier par l'emploi simultané du radar à oiseaux et des épaves, des ponctions significatives sont enregistrées.

La classe modale des espèces capturées tend à demeurer contante.

## RESUMEN

Se llevó a cabo un estudio de dos años de duración para evaluar el impacto de los dispositivos de pesca recientemente introducidos, con el fin de incrementar el rendimiento/eficacia de los barcos atuneros (cebo) en términos de tasas de captura.

Se comparan los datos en los registros de las actividades pesqueras de tres barcos seleccionados, que utilizaron ninguno, uno, o ambos dispositivos.

También se llevaron a cabo actividades de muestreo biológico relativo a las mediciones de talla.

Las observaciones revelan que con el uso de los nuevos dispositivos en la pesquería, se han obtenido importantes rendimientos, principalmente con el radar de pájaros y las balsas, simultáneamente.

## 1. Introduction

*The Bait boat tuna fishery in Ghana has been based on the chumming method over the years (Kwei and Mensah, 1979). Search for schools has relied, by and large, on the visual observation of a congregation of birds fluttering over the disturbance created on the surface by schooling fish.*

*When a shoal has been sighted, the captain attempts to intercept it. Once the head of the shoal is reached, sea-water sprays are turned on and the chummer scatters live-bait into the water. The fishermen, begin fishing off the stern by mainly flipping aboard the tuna, with a flexible pole and hook until further fishing is not worthwhile due to the reduction in the fish numbers or bait supply is being exhausted.*

*This method of flipping, (the pole and line fishery) introduced into Ghana in the late 1960's, is known to have an advantage over the grasping and unhooking method (Uchida, 1967). If chumming is unsuccessful, the school is abandoned and scouting is resumed.*
*However, during the periods of haziness brought about by rain or harmattan dust thus limiting visibility, fishing is poor.*

*In the recent past, there has been improvement of the situation by the introduction of the bird radar, which, improves the search for schools of fish. To supplement the use of the bird radar has been the introduction of rafts or payaols, fitted with radio buoys, which act as aggregating devices for the tuna to be caught.*

*The real effect or impact of the introduction of these two devices in the fishery has not been fully assessed. In this paper, the authors have assembled data to assess the effect on the yield, size composition of the fish caught, and the likely effect on the stocks*

## 2. Materials and Methods

*Daily information on vessels collecting baits as well as fishing for tuna are recorded in log books while these vessels are out at sea. These vessels then radio this information to their companies ashore for processing and analysis of the fleets' activities. These enable management to ascertain the performance of the vessels and roughly estimate the time a vessel is most likely to return to port, and also for arranging a carrier vessel by the purchasing agents.*

*Estimates on catch and effort were made based on the observation of the landings from three active vessels, (bait-boats), employing various strategies in the fishery. Data on the days' estimates were pooled to obtain estimates for the trip per vessel.*

*Estimates for all the trips in the year were combined to get the annual estimates.*

*From the data obtained, the following were computed, among others, to assess the performance of these vessels.*

1 - *Days at sea (Absence from port - DAS)*
2 - *Days searching (D.S)*
3 - *Days Baiting (D.B.)*
4 - *Duration of Fishing (D.F.)*
5 - *Tonnage of tuna Landed (in metric tons)*
6 - *Catch per unit of Effort (Effort in days Fishing)*

*Analyses of the data collected were carried out mainly on two aspects.*

*A. Annual performance of vessel (1990 - 1991)*

*B. Performance of individual vessels, taking into account their fishing strategies.*

*Vessel A was representative of vessels which did not use any of the devices. Vessel B employed only the bird radar while C employed both devices (bird radar and rafts) respectively in 1991.*

*From data on the catch per unit of effort (in days fishing) a statistical test was conducted to find out whether there was any significant differences in catches per day fishing, in relation to the different strategies employed by vessels in the fishery.*

*Data from biological sampling conducted by technicians from the Fisheries Department, were extracted from log books of the bait boats and used in this study, to obtain estimates of size distribution and species composition. The most abundant species of tuna, namely the yellowfin (Thunnus albacores), bigeye (Thunnus obesus) and skipjack (Katsuwonus pelamis) were used in this study.*

*Data, from log books on positions (by fishing area) were inadequate to make any meaningful analysis on the size composition of species caught.*

## *3. Results*

*Specifications on vessels A, B and C indicate that they all fall within the same category in terms of their length and gross tonnages, hence their assumed efficiencies. Since the number of days each vessel fished per trip varied, the catch per day fishing was selected and used as the nominal effort in determining their performance Table 1.*

*From the figures, there were increases in days baiting, and catch rates in 1991 as compared with 1990's. However the mean number of days vessels were absent from port, fishing and also searching time (days) dropped in 1991, from higher values in 1990.*

*Individual vessel performances in terms of their effective catch per trip are shown in Table 2.*

*CPUE (Y-axis) were plotted against trips (X-axis) are illustrated in Fig 1.*

*The graphs generally show fluctuations throughout the period 1990 to 1991. However, a clearly remarkable rise in performance of vessel C is seen in the year 1991.*

*Vessel A performed quite creditably having, on an average, a catch of 9 mt per day fishing in 1991, improving upon her performance of 8 mt in 1990. Mean C.P.U.E values for vessel B, rose from 9 mt per day fishing in 1990 to 13 mt in 1991. Vessel C (using both the bird radar and rafts fitted with radio buoys) had exceptionally good catches per day fishing, rising to an average of 36 mt in 1991, from 9 mt in 1990.*

*Since these vessels (notably B and C) started using these aids for fishing in 1991, there has been an improvement in their catch rates. Also it can be deduced from their mean C.P.U.E. values in Table 2 and Fig 2, that there is an overall increase in these (C.P.U.E) values from 1990 to 1991 for all the three vessels.*

*An analysis of variance (statistical test) steel and torrie, 1981 was conducted to examine the significance of the differences in catch rates (Table 3 and 4).*

*From table one cannot reject the null hypothesis (Ho) that there is no significant difference at the 5% probability level between the three methods (ie catch per day fishing) in 1990,*

*However, with the introduction of the new devices (assuming same hypothesis) considerable difference in catches per day fishing is observed in 1991 as shown in table 4.*

*Diagrams on the length frequency distribution of the various tuna species caught in 1990 and 1991, are shown in Fig 3.*

*From Figure 3, more smaller fish are caught in 1991 for all three species as compared to that of 1990. Modal classes of the bigeye tuna rose by 1 cm in 1991 from 48 cm in 1990, and that of the skipjack tuna dropped by a centimetre from 46 cm in 1990. For the yellowfin, the modal class remained about the same ( at 48 cm) in both years.*

*The maximum length of fish measured in 1990 was 65 cm with 30 cm being the lowest length sampled in 1991). Catches of the Bigeye specie was the lowest (in terms of numbers) and that, catches of this species in the past decade has been the lowest among the three main tuna species exploited by the bait-boats based in Tema, Ghana (Mensah and Koranteng 1986)*

*4. Discussion*

*The use of the three vessels in this study is a matter of choice hence result, should be taken as tentative. In any case, results from other vessels which fall within the same category employing the same devices would probably not be very different.*

*On trip basis, tuna vessels steam off from port to catch bait before moving off to locate tuna schools mainly off the shelf, where they can make catches within the area. The size and quality of tuna caught depends on the location of fishing and season, while the quantity of tunas caught by and large rest with the expertise of crew and strategy adopted at exploiting fish stocks.*

*From a careful examination of the results, it can be deduced at the end of the 2 (two) year study period, that there was an increase in baiting days of approximately 33% while searching time (days) dropped by 100% from the previous years. This increase in baiting time presupposes that the bait (anchovy) may have been caught in smaller quantities per haul. More likely it maybe due to poor sea conditions, but most probably due to reduction in the stocks, thus filling up bait-wells in a much longer period. Also the remarkable decrease in searching time (days) in 1991 may be due to very good weather conditions (ie no haziness nor harmattan condition) making it extremely easy to spot the birds whose fluttering presence indicate fish schools.*

*However considering these facts, it is more likely that with the introduction of the new devices, the sea bird radar employed by vessels B and C in the fishery in 1991, spotting the birds and hence locating the tuna has been made much easier.*

*Climatic and environmental factors have been known to affect the catch per unit of effort (Cushing, 1982).*

*Though the mean CPUE value for 1991 was approximately twice that of 1990, total catches in both years were rather similar. It took vessels less days fishing in 1991 than 1990, hence it is deemed reasonable to attribute the high CPUE value in 1991 to the new fishing aids introduced. This is somewhat confirmed in that with the bird radar, there was an increase of 48% in catches per day fishing between 1990 and 1991. Also with the use of both devices (ie bird radar and rafts together), catch per day fishing rose by about 200% in 1991.*

*While it is observed that catches improved significantly with the introduction of the new devices it is difficult to fully interprete closely the cause of the slight changes in size composition (ie more small-sized fish) which may be partly explained in the usage of rafts. This device left floating on the surface of the sea, seems to "trap" or "attract" more juvenile fish. There is, hence, a need to further study the use and effect of these devices (rafts or payaols) as means of influencing fish aggregation and abundance over a longer period.*

*Though this change may appear insignificant. Gulland (1974) reiterated that other factors, notably morphological and edaphic (depth in relation to position of rafts), also could influence fish aggregation and abundance.*

## 5. Conclusion

*From the study conducted, it is evident that fishing aids enhance the performance of fishing vessels. This study though short, has proved that with the right kind of equipment/fishing aid, not withstanding obvious natural effects that may arise, significant catches can be recorded, thus making fishing trips economical.*

*Since tuna contributes approximately 13% to the overall marine landings in Ghana, (Mensah and Koranteng ,1986) and also an export commodity, which brings in foreign exchange, its importance cannot be underestimated. There is hence the need to study ways and means to enhance the fishery, with the new devices introduced for its rational exploitation.*

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*Many thanks to other colleagues who helped in various ways.*

| | 1990 | 1991 |
|---|---|---|
| Mean Number of Days at Sea(DAS) | 206 | 143 |
| " " " " Baiting(DB) | 43 | 57 |
| " " " " Searching(DS) | 9 | 0 |
| " " " " Fishing(D.F) | 154 | 86 |
| " Catch per unit effort (CPUE) | 8.71 | 19.77 |

**Table 1 the overall performance of the vessels (bait-boats)**

| Vsl | Year | C.P.U.E. Values | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| A | 1990<br>1991 | 3.355<br>11.542 | 11.65<br>7.435 | 7.423<br>9.63 | 7.65 | 9.8 | 6.9 | | | | |
| B | 1990<br>1991 | 12.667<br>27 | 8.462<br>10.87 | 7.6<br>9.2 | 9.2<br>18.2 | 10.89<br>14.1 | 9.42<br>20.6 | 8.8<br>8.6 | 5.88<br>7.9 | 8.3 | 10 |
| C | 1990<br>1991 | 6.571<br>10.5 | 10.22<br>39.3 | 7.49<br>77.5 | 11<br>24.9 | 7.16<br>29.3 | 10.78 | 12.1 | 10.7 | 5.03 | |

**Table 2 Vessel performance in terms of catch per trip.**



| Source of Variation | df | Sum of squares | Mean sum of Sq. | F |
|---|---|---|---|---|
| Among Method | 2 | 8.53 | 4.27 | 0.77 tabular 3.49 |
| Within Method | 20 | 111.30 | 5.57 | |
| Total | 22 | 119.83 | | |

Table 3.

| Source of Variation | df | Sum of Squares | Mean sum of Sq. | F |
|---|---|---|---|---|
| Among Method | 2 | 2069.44 | 1034.72 | 7.76 tabular 3.68 |
| Within Method | 15 | 2933.62 | 133.35 | |
| Total | 17 | 5003.06 | | |

Table 4 Analysis of variance of CPUE.

FIG.1A PERFORMANCE OF VESSEL A
C.P.U.E.(M/T) DAYS FISHING

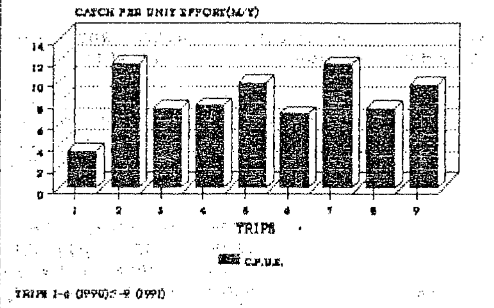


FIG.1B PERFORMANCE OF VESSEL B
C.P.U.E.(M/T) DAYS FISHING

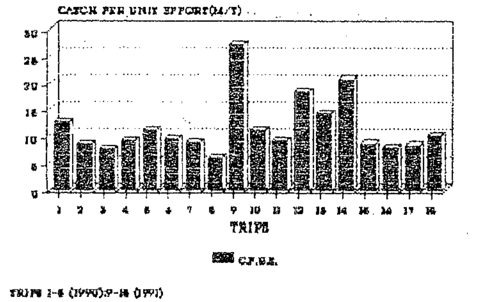


FIG.1C PERFORMANCE OF VESSEL C
C.P.U.E.(M/T) DAYS FISHING

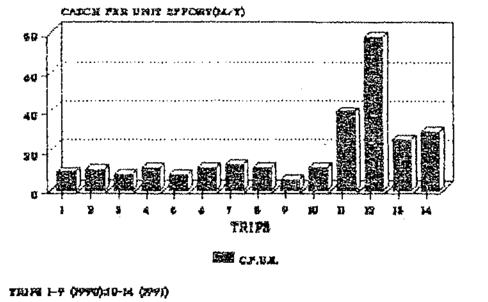


FIG.2 MEAN PERFORMANCE OF VESSEL
C.P.U.E. (DAYS FISHING)

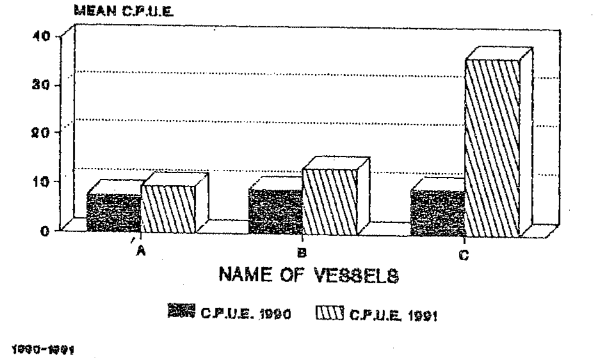


FIG.3A LENGTH FREQUENCY DISTRIBUTION
SKIPJACK

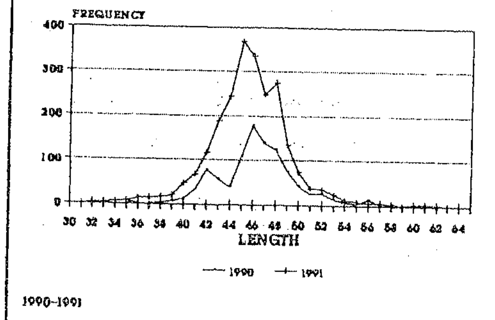


FIG.3B LENGTH FREQUENCY DISTRIBUTION
YELLOWFIN

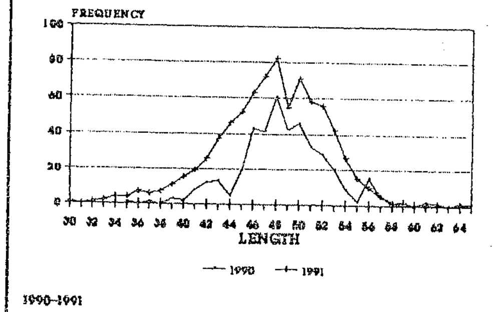


FIG.3C LENGTH FREQUENCY DISTRIBUTION
BIGEYE