

## DIFFERENCES BETWEEN LENGTH-FREQUENCY SAMPLES TAKEN IN PUERTO RICO AND OTHER SAMPLING SOURCES

*T. C. Foster, A. L. Coan*

## SUMMARY

Length-frequency distributions of yellowfin and bigeye tunas sampled in Puerto Rico from transshipments of Tema-based baitboats are compared to distributions generated from samples reported by ICCAT and taken in Tema, Ghana. Comparisons of the predicted proportions of fish less than 55 cm are also presented. Differences between the distributions indicate that some sorting of fish occurs before transshipment, or some biases in sampling exist.

## RESUME

Les distributions de fréquences de taille de l'albacore et du thon obèse échantillonnés à Puerto Rico sur des transits de canneurs basés à Tema, Ghana, sont comparées aux distributions issues des échantillons prélevés à Tema et transmises à l'ICCAT. Une comparaison de la proportion prévisible de poisson de moins de 55 cm est également présentée. Les différences de distribution indiquent qu'il se produit quelque tri du poisson avant transit, ou que l'échantillonnage présente quelque biais.

## RESUMEN

Se comparan las distribuciones de frecuencias de talla de rabil y patudo muestreado en Puerto Rico en transbordos de barcos de cebo con base en Tema, con distribuciones procedentes de muestras informadas por ICCAT y tomadas en Tema, Ghana. También se presentan las comparaciones de las proporciones predichas de peces de menos de 55 cm. Las diferencias entre las distribuciones indican que de alguna forma tiene lugar una selección de peces antes del transbordo, o bien que hay sesgo en el muestreo.

## INTRODUCTION

Sampling of transshipments of Tema-based baitboat catches of Atlantic tunas began in Puerto Rico in 1974. The program was designed to monitor the sizes of fish caught in the Atlantic, particularly from the Tema-based fleet, since no other monitoring of these fish was being done. Since that time, however, the International Commission for the Conservation of Atlantic Tunas (ICCAT) started its own sampling program in Tema, Ghana, and most countries participating in the fishery also started monitoring their own catches. At present, there may be at least three sources of data on sizes of fish being caught in this fishery, and the best data source to use in analyses has been uncertain.

Our analysis examines the coverage of fishing effort data from sampling by ICCAT in Ghana, compared to that from data provided by the participating countries. We then examine the length compositions generated from the ICCAT sampling program in Ghana and compare them to those from the Puerto Rico sampling program. The data collected from the 1980 Tema-based baitboat fleet is analyzed for the three participating countries, Japan, Korea, Panama, and Ghana (Korean and Panamanian statistics are combined, as explained below). The 1980 sampling year was chosen after looking at the data for 1979-1981 and determining that 1980 was representative of the period. Only length compositions of yellowfin and bigeye tunas are considered even though skipjack tuna are also measured. Skipjack tuna are not considered because their length distributions cover a small range with one significant mode and because there is very little difference between data from the various sampling sources (Foster, 1983, Gong et al., 1982, ICCAT, 1979).

## METHODS

Fishing effort data in our analysis are from Data Records 18 and 19 (ICCAT 1981a, 1982). The data are shown in Figures 1 through 3, by one-degree squares and quarter of the year.

Length-frequency data for ICCAT sampling in Ghana are from the ICCAT secretariat and are weighted by the tonnage represented by each sample, as are the U.S. length-frequency samples from the Puerto Rico program.

ICCAT sampling in Ghana combines data from Korean and Panamanian vessels, because some Panamanian flag vessels are owned and operated by Koreans. Wise (1983) indicates that data reported by the Korean government may also include Panamanian flag vessels. In this paper, Korean and Panamanian length-frequency data from the U.S. sampling program in Puerto Rico are also combined; references to the "Korean" fleet include Panamanian flag vessels owned and operated by Koreans.

## RESULTS

### Comparison of Fishing Effort Data

Sampling coverage obtained by ICCAT sampling in Ghana for fishing effort data on baitboats fishing in the Gulf of Guinea in 1980 is not as extensive as that reported by the corresponding national fisheries agencies (Figures 1 and 2). For example, effort is shown in eleven one-degree squares in the Korean fishing effort data from sampling by ICCAT for quarter 1, in comparison with fifty-five such squares in data reported by the Korean government (Figure 1). Similarly, effort is shown in eleven one-degree squares in the Japanese fishing effort from ICCAT sampling for quarter 1, in comparison with eighty-four such squares reported by the Japanese Far Seas Fisheries Research Laboratory (Figure 2). Other quarters show similar disparities. Fishing effort data for Ghanaian baitboats in 1980 from ICCAT sampling also show little coverage for the ten baitboats fishing (Figure 3).

An explanation for the fewer one-degree squares reported in ICCAT sampling can be found in an explanatory note in Statistical Series 8 (ICCAT, 1979). ICCAT does not collect logbooks; it obtains areas fished from its length sampling. These fishing areas may be assigned to one one-degree square for an entire trip. Therefore, the use of ICCAT fishing effort sampling in research would be questionable.

Although less area was covered by ICCAT fishing effort sampling for Korean baitboats in 1980, "days fishing" effort was greater than that reported in data from the Korean government. (It is possible that ICCAT sampling includes a greater number of Panamanian flag vessels with the Korean data, Figure 1.) ICCAT fishing effort sampling of Japanese baitboats in 1980 in

Ghana produced a higher estimate of days fishing effort for one quarter and lower for all others, when compared with data reported by Japan's Far Seas Fisheries Research Laboratory (FSFRL) (Figure 2). We would expect the FSFRL effort to be less than that reported by the ICCAT sampling, because the FSFRL reports only successful days fishing. The observed differences may be due to an extrapolation of fishing effort of a limited number of samples from a very small number of vessels by the ICCAT sampling effort in Ghana, compared to a greater number of samples and vessels sampled in data obtained by the Japanese and Korean governments.

#### Comparison of Length-Frequency Data

Weighted length-frequency distributions of yellowfin and bigeye tuna catches derived from samples taken in Puerto Rico in 1980 (from transshipments of the catches of Tema-based baitboats) are compared with those taken by ICCAT sampling of the landings of Tema-based baitboats during 1980.

Of the 12 Japanese, 13 Korean, and 10 Ghanaian baitboats fishing in the Eastern Atlantic in 1980 (ICCAT 1981b), transshipments of yellowfin tuna from 11 Japanese baitboats, 10 Korean baitboats, and 3 Ghanaian baitboats were sampled in Puerto Rico for length-frequency of catches made in 1980. Transshipments of bigeye tuna from 4 Japanese baitboats, 5 Korean baitboats, and 3 Ghanaian baitboats were sampled in Puerto Rico for length-frequency of catches made in 1980. (These figures are presented as an indication of coverage and may be misleading because not all of the thirty-five baitboats may have caught bigeye tuna, and not all of the vessel trips may have been transshipped.) Transshipment vessel manifests indicate that at least one length-frequency sample was taken from each of the fourteen transshipments originating in Tema.

In comparing yellowfin tuna length-frequency distributions from sampling by ICCAT with those from samples taken in Puerto Rico, the most obvious difference is in the Japanese baitboats (Figure 4). In the ICCAT length-frequency distribution the majority of yellowfin tuna are less than fifty-five centimeters. In the Puerto Rico length-frequency distribution, the majority of yellowfin tuna are greater than fifty-five centimeters.

Differences are less obvious between the two sampling sources for Korean baitboat-caught yellowfin tuna, but there is again a greater number of larger fish in the Puerto Rico samples. Many 30- to 40-centimeter fish occur in ICCAT samples taken in Ghana, but very few occur in samples taken in Puerto Rico. Little difference is apparent in the two samples taken of Ghanaian baitboats.

Comparisons of length-frequency distributions for the two sampling programs for baitboat-caught bigeye tuna in 1980 again show many more large fish in the Puerto Rico samples of transshipments of Japanese and Korean baitboats. For Ghanaian baitboats, the difference is less pronounced, but there is again a greater number of larger fish in the Puerto Rico samples (Figure 5).

These differences are also apparent in estimates of undersized fish taken in the Gulf of Guinea in 1980. Miyake and Nordstrom (1983), using ICCAT sampling data, estimate the percentage of undersized baitboat-caught yellowfin tuna at 68%, and the percentage of undersized baitboat-caught bigeye tuna at 80%. Using data from the Puerto Rico sampling program, Foster (1983) estimates 53% for yellowfin tuna and 59% for bigeye tuna.

#### CONCLUSIONS

Fishing effort data obtained by ICCAT sampling in Ghana report significantly fewer one-degree squares fished than fishing effort data reported by Japan's Far Seas Fisheries Research Laboratory and the Korean government. The discrepancy between estimated total days fishing is less than the discrepancy associated with area fished. Extrapolation of ICCAT's catch/effort data to represent the distribution of catches and effort of the entire fishery could be misleading, and should not be used in analyses.

Differences in the length-frequency distributions can be caused by differences in the sampling programs. The U.S. sampling program is adequate for determining the sizes of fish transshipped by the Tema-based fleet (Coan and Bartoo, SCRS/83/59). The adequacy of the ICCAT sampling should be analyzed in a similar manner. As shown in SCRS/83/59, increasing the number of vessel trips covered increases the accuracy of the sampling to a much greater extent than increasing the sample size per vessel. If the ICCAT

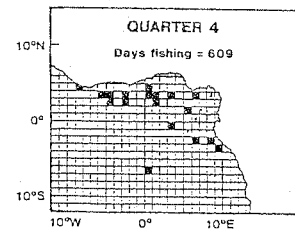
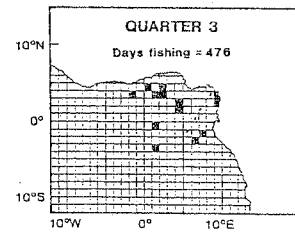
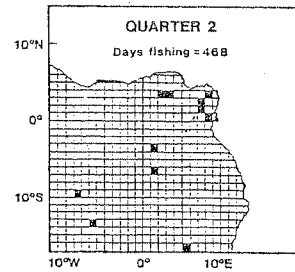
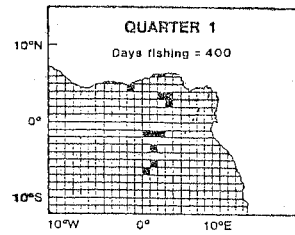
catch/effort sampling is an indication of the number of trips covered, then the accuracy of the length-frequency samples may be suspect.

Differences in the length-frequency distributions may also be caused by selective sorting of transshipments before shipment. If transshipments from the Tema-based fleet are selectively sorted to remove the small fish before shipment, then the U.S. samples should only be used to determine the sizes of fish transshipped to Puerto Rico. The ICCAT sampling in Ghana will then become the only source of data, and the question of how accurate the ICCAT sampling is becomes more critical.

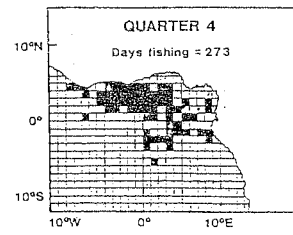
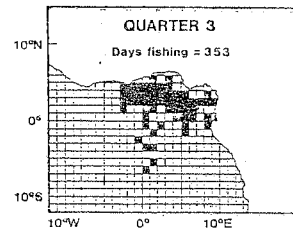
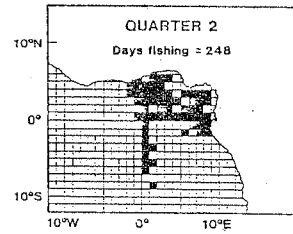
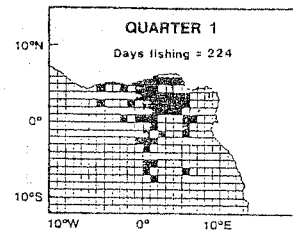
#### LITERATURE CITED

- Coan, A. L., Jr. and N. Bartoo. (Manuscript). Effects of sample size on the accuracy of length-frequency sampling of tunas transshipped to Puerto Rico. ICCAT, SCRS/83/59.
- Foster, T. C. 1983. Size and species composition of Atlantic tunas from imports landed in Puerto Rico during 1981. Col. Vol. Sci. Pap., Int. Comm. Cons. Atlan. Tunas, Madrid, Spain (SCRS-1982) 18(1):111-130.
- Gong, Y., J. U. Lee, and W. S. Yang. 1981. Review of the catch composition by species caught by the Korean baitboat fishery based in Tema for 1977-1979. Col. Vol. Sci. Pap., Int. Comm. Cons. Atlan. Tunas, Madrid, Spain (SCRS-1980) 15(1):20-25.
- ICCAT. 1979. Statistical Series, Vol.8. Int. Comm. Cons. Atlan. Tunas, Madrid, Spain.
- ICCAT. 1981a. Data Record, Vol. 18. Int. Comm. Cons. Atlan. Tunas, Madrid, Spain, 424 p.
- ICCAT. 1981b. Statistical Bulletin, Vol. 12. Int. Comm. Cons. Atlan. Tunas., Madrid, Spain.
- ICCAT. 1982. Data Record, Vol.19. Int. Comm. Cons. Atlan. Tunas, Madrid.
- Miyake, P. M. and V. Nordstrom. 1983. Estimation of undersized tropical tuna catches in the Atlantic for 1979 and 1980. Col. Vol. Sci. Pap. Int. Comm. Cons. Atlan. Tunas, Madrid., Spain (SCRS-1982) 18(1):131-167.
- Wise, J. P. 1983. (ISYP Manuscript). The baitboat fishery for skipjack in the Gulf of Guinea, 1969-1982. Int. Comm. Cons. Atlan. Tunas, Madrid, Spain.

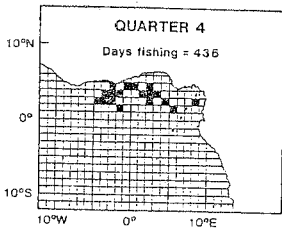
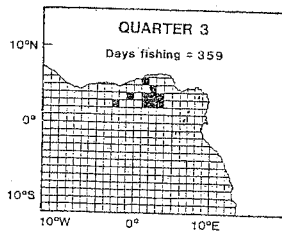
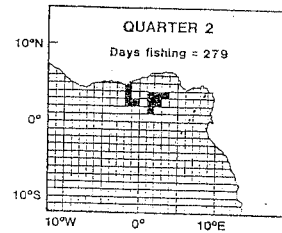
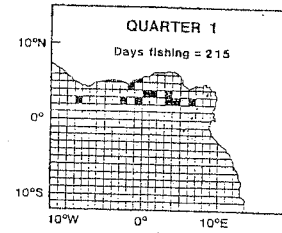
ICCAT Sampling in Ghana



Korean Government Sampling



ICCAT Sampling in Ghana



Japanese F.S.F.R.L. Sampling

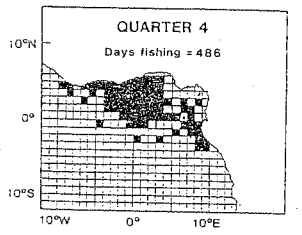
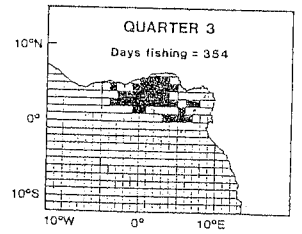
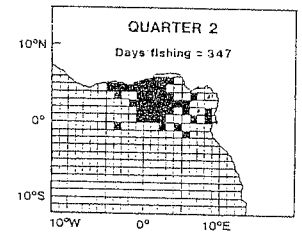
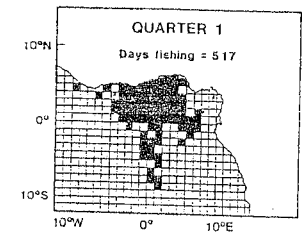


Figure 1. Fishing effort by Korean baitboats in 1980.

Figure 2. Fishing effort by Japanese baitboats in 1980.

ICCAT Sampling In Ghana

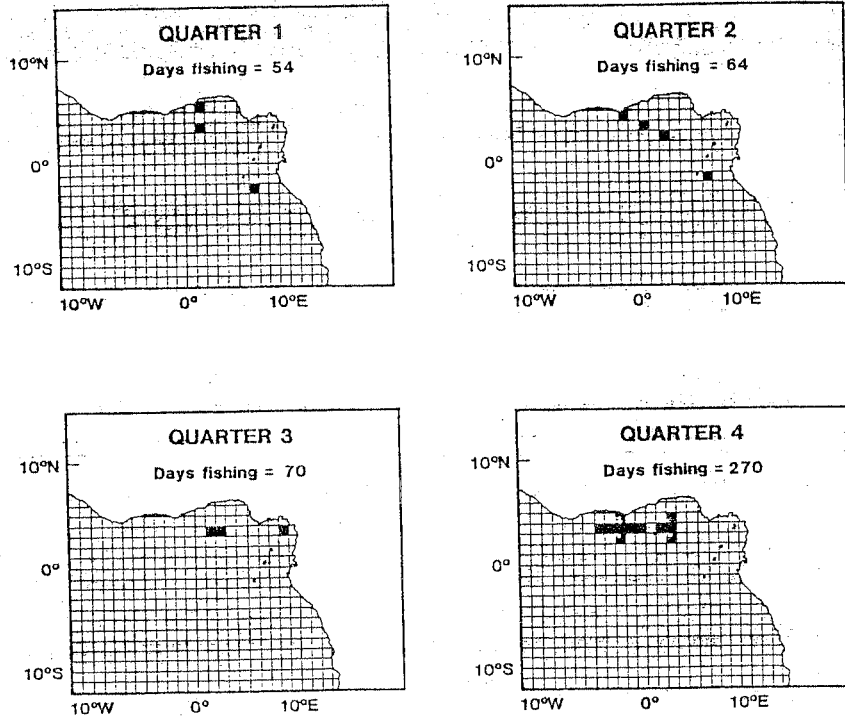
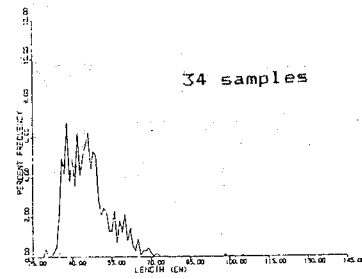
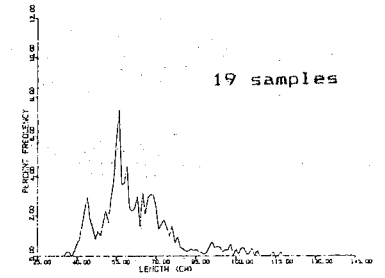


Figure 3. Fishing effort by Ghanaian baitboats in 1980.

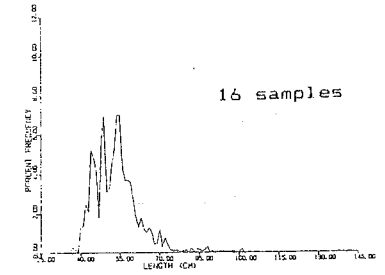
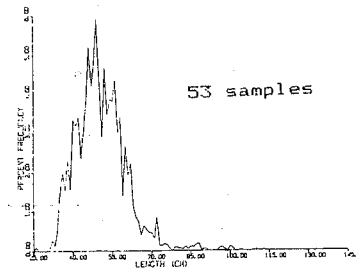
ICCAT Sampling in Ghana



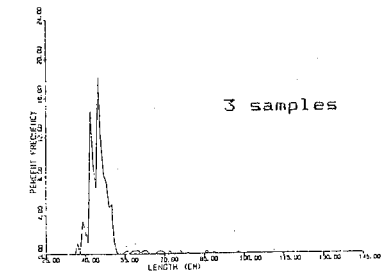
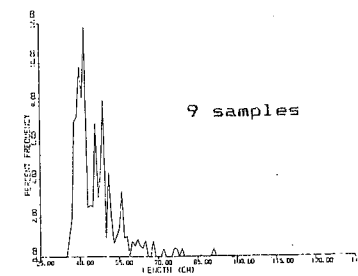
U.S. Sampling in Puerto Rico



Japan



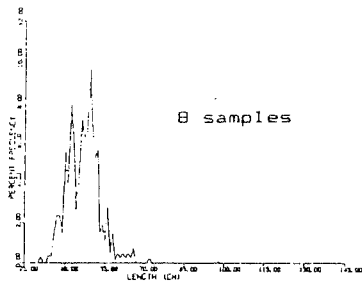
Korea



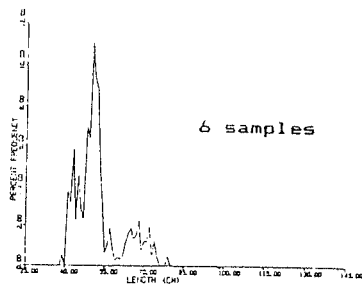
Ghana

Figure 4. Length-frequency distributions from sampling in Ghana and Puerto Rico for baitboat-caught yellowfin tuna in 1980.

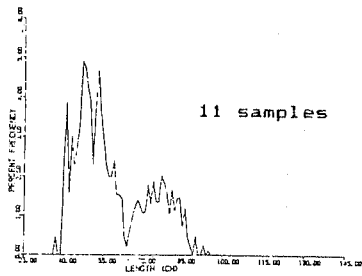
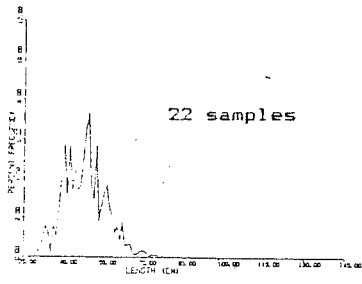
ICCAT Sampling in Ghana



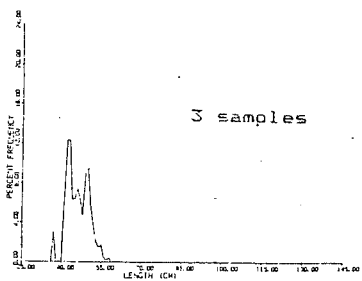
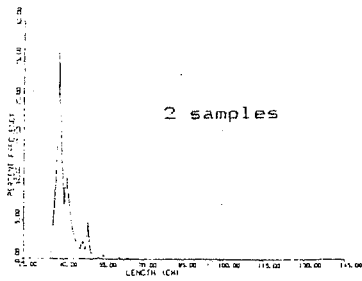
U.S. Sampling in Puerto Rico



Japan



Korea



Ghana

Figure 5. Length-frequency distributions from sampling in Ghana and Puerto Rico for baitboat-caught bigeye tuna in 1980.