

BLUEFIN FISHERIES AND STOCKS IN THE ATLANTIC, 1970-81*Z. Suzuki*

SUMMARY

An attempt was made to assess the status of the stock qualitatively, using catch, CPUE and other information obtained from the fisheries for the years 1970-1981, during which period the cohort analyses failed to provide reliable results.

RESUME

On a effectué une tentative d'évaluation quantitative de l'état du stock en utilisant la prise, la CPUE et d'autres renseignements obtenus sur les pêcheries au cours de la période 1970-1981, durant laquelle les analyses de cohortes n'ont fourni aucun résultat fiable.

RESUMEN

Se intentó evaluar en forma cualitativa la situación del stock, en base a las capturas, CPUE y otros datos obtenidos de las pesquerías respecto al periodo 1970-1981. Durante este periodo, los análisis de cohorte no dieron resultados fiables.

Introduction

Bluefin tuna changes habitats in accordance with the development during the long life history. The fish appear in the coastal waters at some developmental stages, whereas migrating across the ocean at the others. Various types of fishing gears have been developed for capturing the fish at diverse stages, thus differing in the ecology. It is very difficult, therefore, to obtain a common measure of fishing intensity generated by all the fishing gears. Furthermore, the species often shows remarkable variation of year class strength. Under such conditions, the cohort analysis has been widely employed for assessing the stocks, since this method is able to separate the historical catch data into cohorts exploited in the years under consideration. However, the available data, especially these required for age-length conversion, were considered insufficient (Hester 1983). Indeed, hurried application of the method without sufficient examination of the assumptions and data bases resulted in confusion of the stock assessment and then the management schemes in the Atlantic Ocean (ICCAT 1983). Biologists dealing with the stock assessment of bluefin tuna recently agreed on conducting several examinations of available data to proceed the computation of cohort analysis (ICCAT in press). Furthermore, a review of two papers presented at the 1982 SCRS Meeting, Powers et al. (1983) and Suzuki and Hisada (1983), shows that the two series of computations were found in coincidence with each other for the early years before 1970, but not for the later years. This indicates the advantage and fault of the cohort analysis, i.e. the estimates of stock size converge for the early years due to improvement of reliability with cumulation of annual fishing mortality coefficients, but the estimates for later years are not highly reliable. Since it is required to find out measures of recent stock sizes independent from the cohort analysis, and since there remains concern

to the decline of stocks, here is attempted to review the catch and effort statistics, cpue and size composition data for providing preliminary evaluation of status of the stock.

Materials and definitions

Task I data base of ICCAT provides the amount of catch of bluefin tuna classified by area, country, gear and size category for years from 1950 to 1981. The present study is mainly based on the Task I statistics for the recent 12 years from 1970. The size category, however, is used only for the explanation of Figs.1 and 6, because it solely bases on type of fishery, all the Japanese longliner's catch was classified into the large-sized fish, in spite of occurrence of small- or medium-sized fish in the catch from Canadian and U.S. coastal waters. The present description refers to three size categories proposed by Rivas (1979), small-sized fish of less than 130 cm in body length*, medium of 130 to 200 cm, and large over 200 cm, taking information on size composition of catch into account. The age and body weight approximates to 4 years or younger and below 45 kg for small, 5 to 9 years and 45 to 165 kg for medium, and 10 years or older and over 165 kg for large.

In spite of possible intermixture between two stocks originating in the western Atlantic Ocean and in the eastern Atlantic and Mediterranean Sea, the present description is given for two areas divided by around Long. 25 W to 45 W as defined by Parrack (1982), taking the convenience of description into consideration.

Due to diversity in the fishing methods, the calculation of cpue needs knowledges on the behaviour of fisheries as well as of fishes. The present author did not attempt to handle the statistics, but only cited series of calculations involved in available publications.

Results

Western Atlantic Ocean

Total landings declined from 7,000 tons in 1971 to only 3,700 tons in 1972, having stayed around that level until 1974, recovering to about 6,700 tons in 1977, and then stayed around 6,000 tons until

*In this paper, body length refers to fork length.

1981 (Fig. 1). Thus the catch stayed fairly constant in the western Atlantic compared to the fluctuating nature found in other parts of the world. The catch by fisheries mainly aiming at large-sized fish increased since 1976. Consistent decline of other gears might have, at least partly, ascribed to the intensified size regulation.

Sakagawa and Coan (1974) first noted steady increase of mean body weight of large-sized bluefin tuna in the western Atlantic, which was regarded exemplifying lack of recruitment. The tendency was again noted by Hurley and Iles (1982) for the Canadian sport fishery with rod and reel (Fig. 2). A close examination of Fig. 2 suggests termination of such rise of body weight toward end of the 1970's. Furthermore, cpue in the Canadian recreational fishery has become stable in 1978 to 1980 after a sharp decline in the preceding three years (Fig. 3). Since the fishery depends on 11 years and older fish, these observations imply that the 1969 year class might have been a bit stronger than the preceding cohorts. Or, taking possible error involved in age-length conversion into account, it might be also possible to consider that the strong cohorts have occurred in 1971 to 1973 as suggested by previous analyses and observations.

Japanese longliners have continuously caught large-sized fish of 10 years and older in the Gulf of Mexico for seven years from 1975 to 1981. These cohorts have been only slightly represented in the catch as 7 to 11 ages of medium- and large-sized fish in the preceding years. No sharp decline of cpue appeared for the seven years (Fig. 4).

Medium-sized fish once experienced significant exploitation in the early 1960's by handline, harpoon and trap fisheries along North America. Measurable harvest of them occurred again in 1979 to 1981 there when Japanese longline fleet harvested the 1970 to 1973 cohorts. These year classes were already exploited by Canadian and U.S. purse seiners at ages of one to four in 1972 to 1976 as shown in Table 1 of Powers et al. (1983). Furthermore, in 1980, occurrence of medium-sized fish was also reported in trap fishery in the St. Margaret Bay (Hurley and Iles 1982). Thus it is inferred that these year classes were still abundant in the latest three years.

Currently no fishery is permitted to harvest sizable amount of small-sized bluefin tuna in the western Atlantic Ocean. However, incidentally caught young fish of 3 to 5 ages appeared fairly abundant in Japanese longline fishery in 1981 (Fig. 5).

Eastern Atlantic Ocean and Mediterranean Sea

Total catch was once increased from around 10,000 tons in 1970 to 1973, to 21,000 to 22,000 tons in 1975 and 1976, and then dropped to 12,000 tons in 1979 to 1981. Rise of catch in the middle 1970's occurred coincidentally for both large-fish and small-fish fisheries (Fig. 6). Farrugio (1980) mentioned that the long history of fisheries in the eastern Atlantic Ocean and Mediterranean Sea experienced quite a large fluctuation in the abundance of the bluefin tuna stocks (Fig. 7) in the last twelve years under discussion, most of biologists did not notice it necessary to pay serious concern upon the decline of abundance. Cort and Rey (1983) described that cpue of young fish of 1 to 4 ages in the Spanish pole and-line fishery in the Bay of Biscay appeared to be on the rise in spite of decline of amounts of catch and fishing effort (Fig. 8). Japanese longline data also shows that cpue of bluefin tuna fluctuated around a certain level, rather than any monotonous decline (Fig. 9). This agrees to stable recruitment of 1-age fish since 1975 as estimated by Kume and Suzuki (1983).

Conclusion

Concern was expressed for fatal decline of the Atlantic bluefin tuna in the last decade. This was based on the monotonous increase of body weight of large-sized fish, and disappearance of medium-sized fish in the western Atlantic fisheries. This phenomenon was interpreted as the evidence for that the stocks were severely harvested at young stages, blocking the fish to attain the sexual maturation, and then decreasing the size of recruitment in the following years.

There is some indication, however, for that the continuous increase of size of fish reflects merely existence of very strong year classes that might have supported fisheries for some duration of years, and that disappeared not due to over-exploitation but due to natural fluctuation as exhibited in the stocks in the eastern Atlantic Ocean (Tiews 1980) and in the Pacific Ocean (Uda 1952, Nakamura 1969). Hisada (pers. comm.) is examining year-to-year change of body weight composition of bluefin tuna taken by purse seiners off eastern Japan. The results show shift of modal weight of dominant year classes for several years (Fig. 10). It is noted that the amount of catch often rose coincidentally with entrance of dominant year classes to the fishery. The inference of possible dominance of strong year classes

is supported by unusual increase of large-sized fish in the catch from the early 1960's when the stock was lightly harvested to the 1970's of significant exploitation, which could be explained by assuming occurrence of dominant year classes that might have continuously supported the fisheries for about ten years, even though there is a possibility that insufficient sampling of size data in 1960's stressed such observation. Further examination of catch at age and cpue in 1970's gives another observation that 1970-73 cohorts seem to be still relatively abundant even in 1981 and onward, nevertheless they experienced heavy exploitation in younger ages. If this holds, the spawning stocks in the Gulf of Mexico might have increased in 1982 and 1983 seasons.

In summary, rather stable catch in the recent decade implies that the western Atlantic bluefin tuna stock would not have been lowered to the level as seriously as once concerned. Recent bluefin workshop pointed out inadequacy involved in the previous cohort analysis (ICCAT in press). It is also understandable to maintain the fishing activities at least at current level until more reliable assessment is obtained through joint effort of ICCAT scientists for wise utilization of the stocks. However, currently experiencing shortage of data requires that it is necessary to reconsider a monitoring scheme designed to secure enough amount of data from the various sectors of the stock to conduct the rational appraisal.

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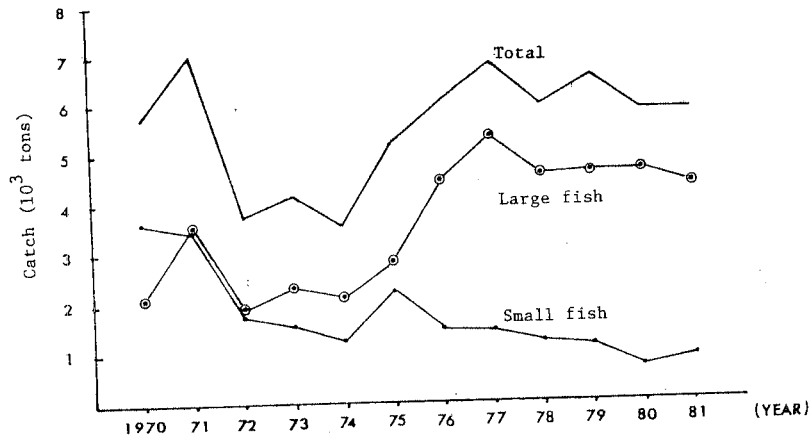


Fig. 1. Amount of catch of bluefin tuna in the West Atlantic Ocean, 1970-1981.

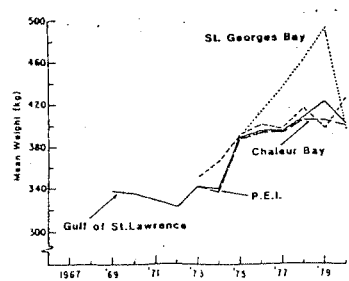


Fig. 2. Annual mean of body weight of bluefin tuna taken by Canadian rod and reel fishery, 1967-1980.

After Hurley and Iles (1982).

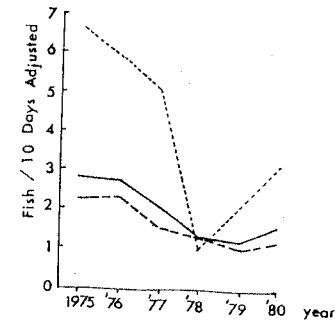


Fig. 3. Adjusted catch-per-unit-effort of bluefin tuna exploited by Canadian rod and reel fishery, 1975-1980.

After Hurley and Iles (1982).

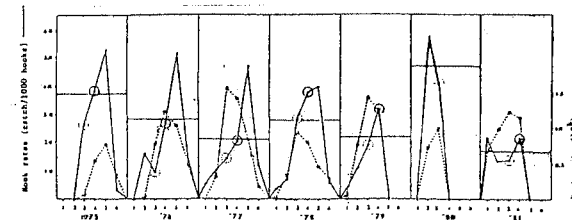


Fig. 4. Number of hooks employed by Japanese longliners and hook rates of bluefin tuna in the Gulf of Mexico, 1975-1981.

— hook rates over the entire season
 ○ hook rates in March
 □ hook rates in April

After Hisada and Suzuki (1982).

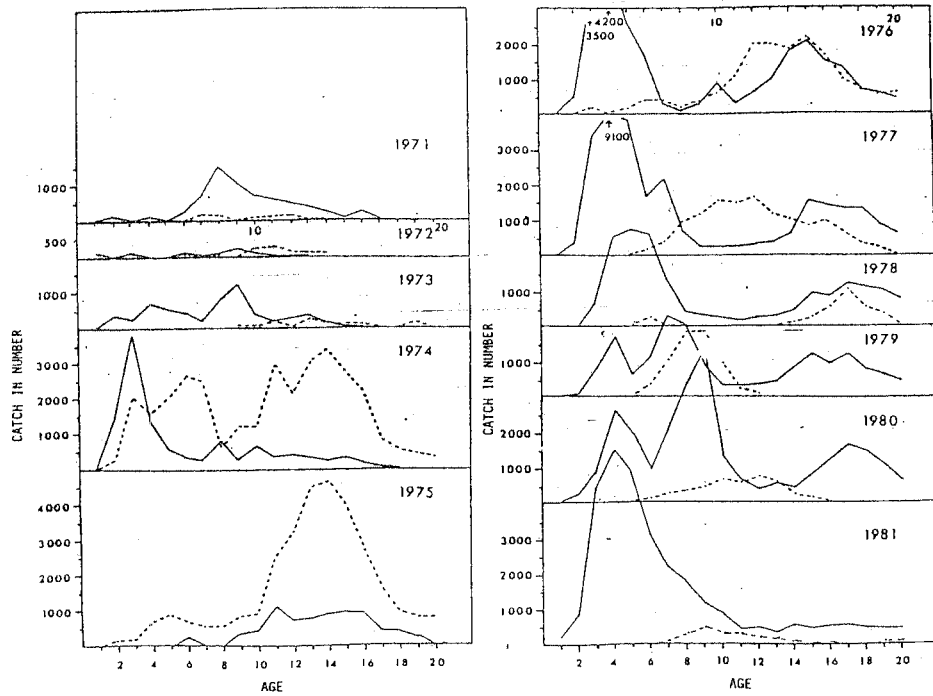


Fig. 5. Catch-at-age in number of bluefin tuna from the Atlantic Ocean, 1971-1981.

Solid and dotted lines denote catch from the West and East Atlantic Ocean, 1971-1981.

After Suzuki and Hisada (1983).

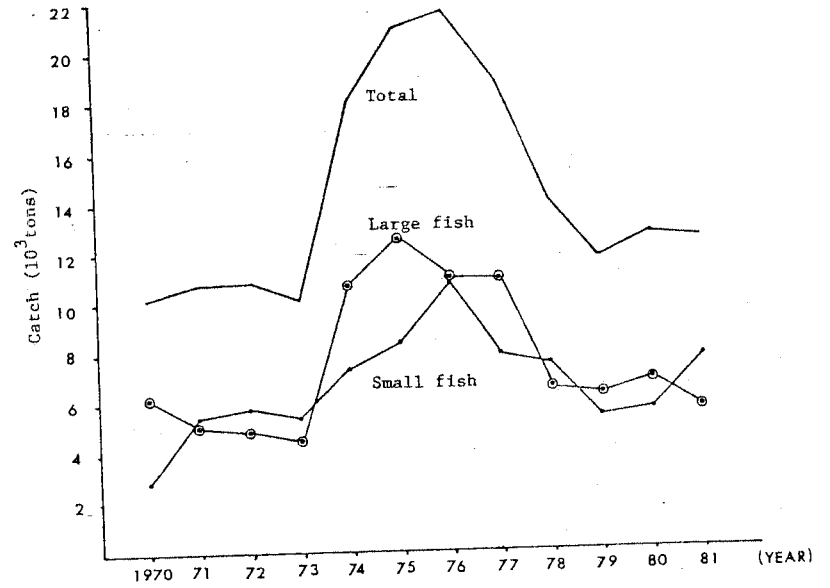


Fig. 6. Amount of catch of bluefin tuna in the East Atlantic Ocean, 1970-1971.

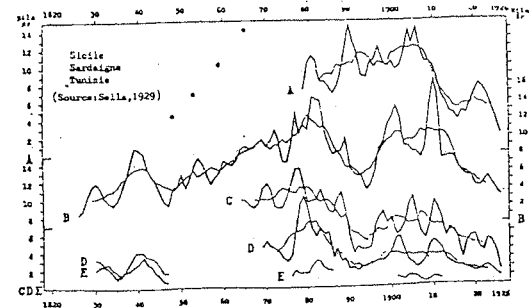


Fig. 7. Examples of chronological catch record of bluefin tuna in several Mediterranean areas, 1820-1926.

After Farrugio (1980).

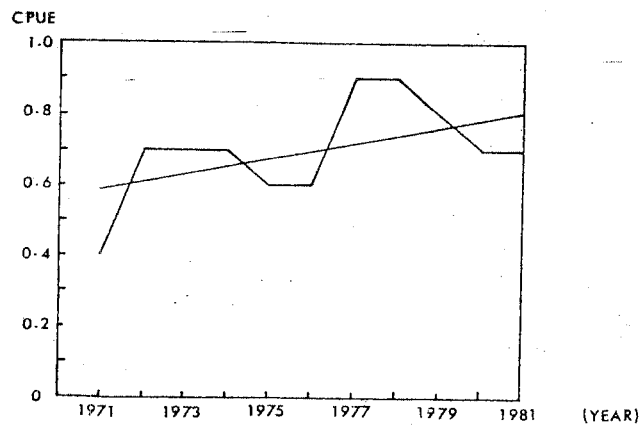


Fig. 8. Catch-per-unit-effort of bluefin tuna exploited by Spanish pole-and-line fishery in the Bay of Biscay, 1971-1981.

After Cort and Rey (1983).

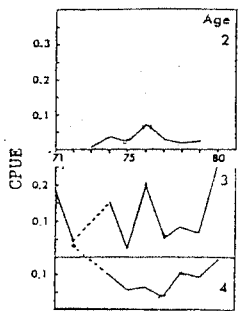


Fig. 9. Catch-per-unit-effort of young bluefin tuna exploited by Japanese longliners in the East Atlantic Ocean, 1971-1980.

After Suzuki (1983).

Fig. 10. Body weight composition of bluefin tuna caught by purse seiners off eastern coast of Honshu, 1951-1980.
After Hisada (personal communication).

