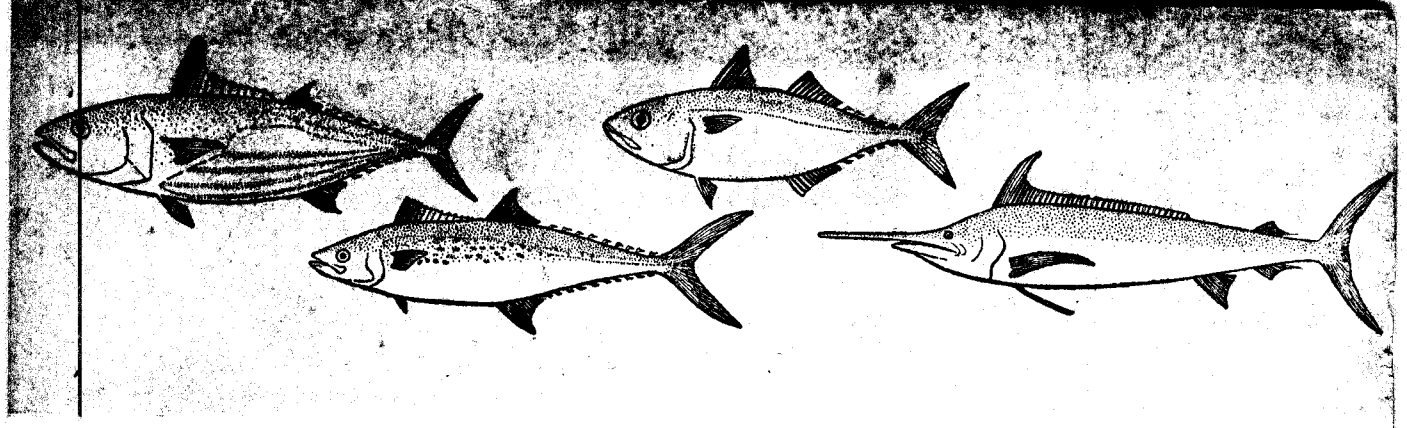
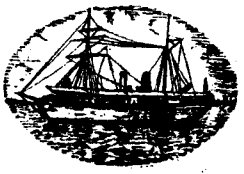


SYMPOSIUM ON

SCOMBROID FISHES

PART III



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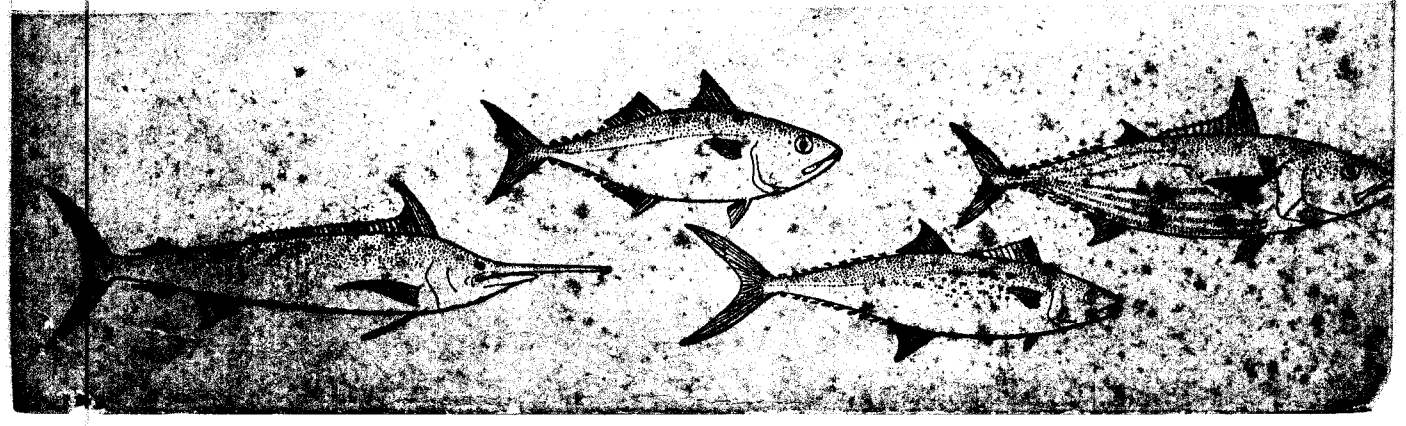
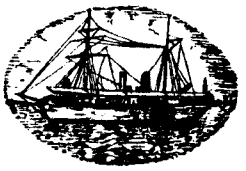


PROCEEDINGS OF THE

SYMPOSIUM
ON
SCOMBROID FISHES

HELD AT MANDAPAM CAMP FROM JAN. 12-15, 1962

PART III



SYMPOSIUM SERIES I

MARINE BIOLOGICAL ASSOCIATION OF INDIA

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CONSERVATION OF THE TUNA AND BILLFISH RESOURCES OF THE INDIAN OCEAN

S. JONES
Central Marine Fisheries Research Institute, Mandapam Camp, India

FISHING activity in the high seas has now been extended to the Indian Ocean also with the emergence of Japan in the post-war years as a premier fishing nation. With the exception of the intensive fishing carried out for the oceanic skipjack, *Katsuwonus pelamis* in the Maldive Islands and in the Minicoy Island in the Indian Ocean it is doubtful if any organised tuna fishery existed anywhere in this area before the last World War. In the regular commercial fisheries of various countries bordering the Indian Ocean tunas and occasionally billfishes form a part of the catches during certain seasons from the inshore areas. What little fishing is done specially for these fishes is mostly of an exploratory nature.

The object of any fishery management should be the regular maintenance of maximum sustainable catches, minimising, if possible, fluctuations. It could naturally be expected that the success of the Japanese in the Indian Ocean will tend to attract other nations also in the field and

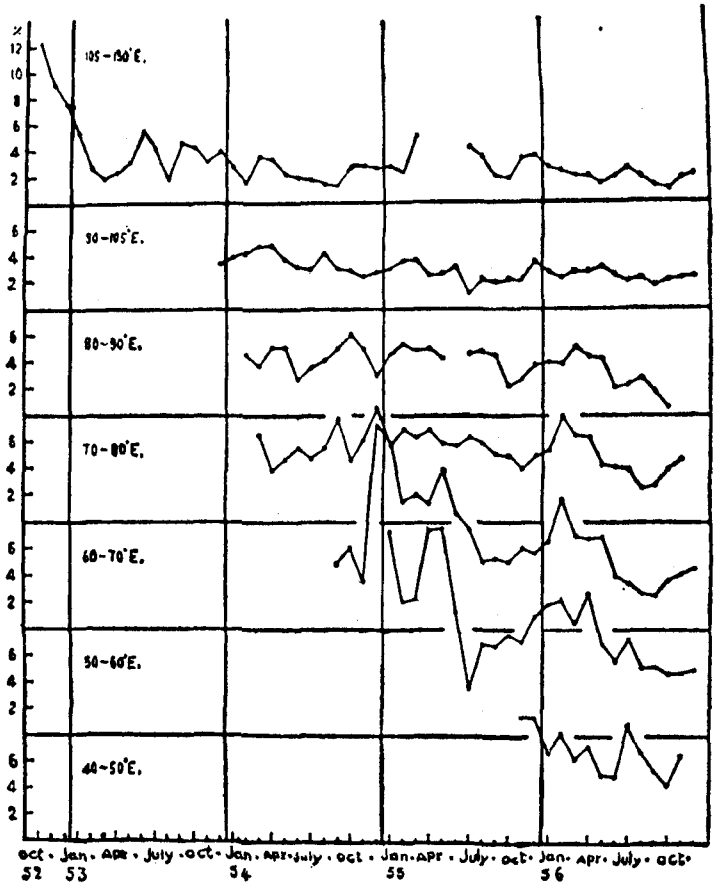

Fig. 1.—Monthly change of the mean hooked-ratio in each sea area (5°-13° S.) (Reproduced from Mimura, 1958).

absence of any concerted action might lead to indiscriminate fishing resulting ultimately in overfishing and depletion. Our marine resources are renewable but could no more be considered as inexhaustible. We harvest from the high seas without sowing and what is called for is judicious management. To carry out this effectively in international waters is no easy matter without the goodwill and co-operation of all concerned. It might be asked whether a situation has arisen to warrant steps towards conservation measures under international auspices. But should we wait till then? Would it not be more rational if the problem could be tackled even before depletion takes place? Investigations could be organised even before exploitation reaches the optimum limits as was done by the Inter-American Tropical Tuna Commission soon after the last war. Initiation of investigations therefore without waiting further would enable determination of the maximum yield and the level of fishing at which the catch curve tends to show a downward trend.

Reverting now to the condition of the tuna fisheries of the Indian Ocean it is evident from the statements of Japanese workers that the warning sign is already up. The yellowfin tuna, *Neothunnus macropterus* which is commercially the most important species in this region has been studied in fair detail by them. It is reported by the Nankai Regional Fisheries Research Laboratory* that in the Indian Ocean '(*a*) The hooked-rate is the highest in the year when the ground was first exploited, and it drops gradually year by year' and '(*b*) the bimodal size of the principal catch becomes smaller year after year.'

The above are indicated in Figures 1 and 2.

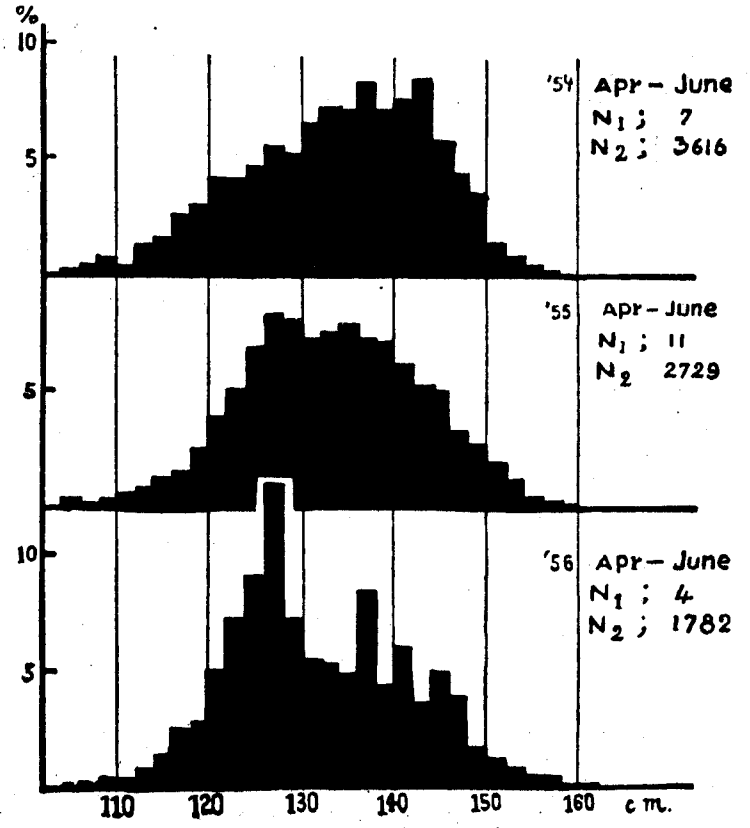

Fig. 2.—Annual length frequency distributions (percentage) of yellowfin tuna, taken in Bengal Bay (north of 0°, 80-100°E.).
N_1 ; Number of ship investigated. N_2 ; Total number of fish measured.
(Reproduced from Mimura, 1958).

* Mimura, Koya 1958. *Report. Nankai Reg. Fish. Res. Lab., No.* 7 : 59-71.

Similarly the work done by the Japanese fisheries training ship *Shuntotsu-Maru** shows that 'in the Indian Ocean the body length of the yellowfin tuna decreased year by year and its range shifted from 130-150 cm. to 110-140 cm. in the years of 1954 to 1959. The fishing conditions also became worse year by year, and except for the Western coast of Sumatra Island, the angling rate showed the reduction above 60%, especially in the western part of the Indian Ocean and in the district adjacent to the Lesser Sunda Island this tendency was remarkable.' It is also stated that the ' stock of yellowfin tuna in the Indian Ocean shows a tendency to decrease from year to year'. The areas referred to are shown in the figure reproduced below (fig. 3).

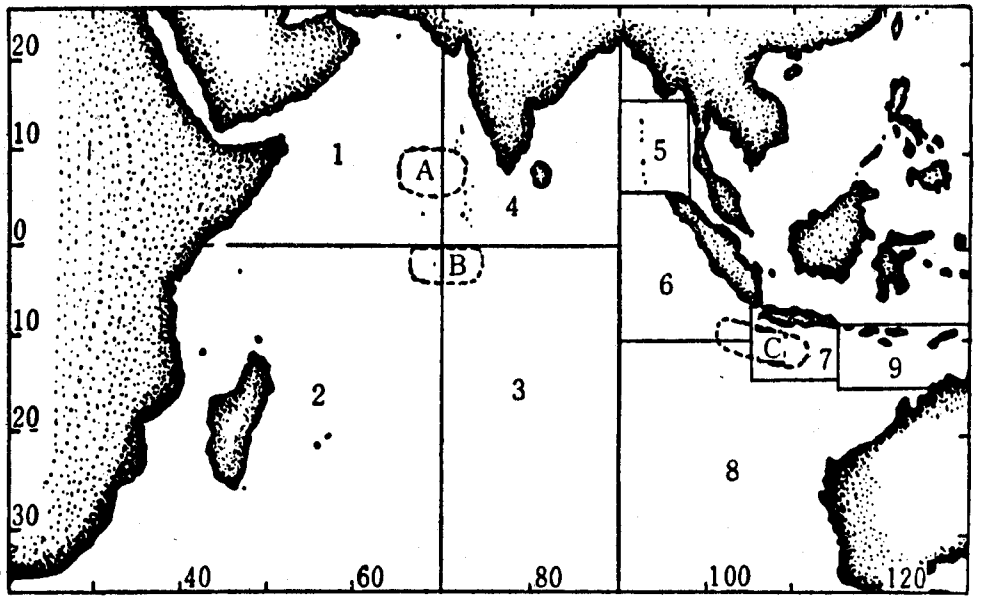

Fig. 3.—Division of fishing area of the Indian Ocean. (Reproduced from Tsuruta and Tsunoda, 1960).
A.....A area. B.....B area. C.....C area.
1. Arabian Sea area, 2. Western part of the Indian Ocean area, 3. Middle part of the Indian Ocean area, 4. Ceylon Island area, 5. Andaman Is. and Nicobar Is. area, 6. Western coast of Sumatra Island area, 7. Southern coast of Java Island area, 8. Western coast of Australia area, 9. Southern coast of Lesser Sunda Is. and Timor Island area.

More or less similar inferences have been drawn as a result of the observations made at the Kanagawa Prefecture Fisheries Experimental Station † on the yellowfin tuna in the Arabian Sea and Bay of Bengal.

Though the above statements relate to the yellowfin tuna, several other species of tunas as well as billfishes are also caught from the high seas and with intensive fishing the fate of their fisheries also will more or less tend to become the same in due course.

In any step taken towards conservation the most essential prerequisite is full data on total catch, catch-per-unit-of-effort and size-composition. Based on these only the behaviour of a fishery could be explained and ways and means could be devised for its regulation. With pelagic fishes like the tunas and marlins, which are very widely distributed and are capable of long range migrations this is a very complex problem, and unless the projection of a complete picture in the

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* Tsuruta, Saburo and Seiichi, Tsunoda, 1960. *J. Shimonoseki Coll. Fish.*, **10** (1) : 5 & 6.
† Nakagome, June 1959. *Japanese Soc. Sci. Fish.*, **25** (3) : 186-188 and *Ibid.*, **25** (6) : 417-420.

pattern of a mosaic could be achieved for the whole region it would be impossible to do anything tangible. What is required is not merely gross statistics but biological statistics with information on the catch-per-unit-of-effort and this calls for in its wake considerable background knowledge based on work of a fundamental nature. Information on the species concerned, their distribution, population relationship, the ecological system in which they exist, etc., is most essential. Several species are involved and each will have its own pattern of distribution and behaviour. Proper catch statistics with the requisite biological data would help to measure the effects of fishing on the abundance and yield of the tuna resources and would provide the scientific basis of maintaining the fishing level at the optimum sustainable yield.

With regard to the species occurring in the Indian Ocean, not only our knowledge about them is meagre but there appears to be certain amount of confusion in the identity of some which grow to a large size. In any attempt at management it is most essential that we should know the ultimate biological entity of the fish we are dealing with. Even in the same species we have to see whether they constitute a natural biological unit or are constituted by different populations or sub-populations. These will have to be studied with the help of comparative morphometric data followed by tagging experiments, blood-typing studies, analysis of the size composition of catches and maturity and spawning studies. The extent to which the different populations and sub-population if any within the same mix, their relative movements with reference to space and time and the factors responsible for the hydrographical containment if any of the populations have to be investigated. Tunas are known to congregate in areas of high organic productivity and react very much to temperature and other environmental conditions. Attention therefore has to be given to the study of the general oceanographical conditions with special reference to currents in relation to the behaviour of the fish. A study of the environment in all its various aspects viz., physical, chemical and biological is very essential. Migration studies would require a common tagging programme and since fishing in the high seas is carried out on an organised scale a fair degree of recovery could be expected. Standardised uniform techniques may have to be adopted for biological investigations. Many of the studies will be essentially of a long range nature.

Since the Pacific and Indian Oceans are contiguous bodies of water and do not have the same degree of isolation that the Atlantic has, a good amount of mixing of stocks might be taking place at least along the region of the Indo-Australian Archipelago. Areas in the immediate south of this in the neighbourhood of Christmas Island, Cocos Keeling etc., are reported to be rich tuna fishing grounds and the effect if any of intensive fishing in south-western part of the Pacific on the tuna stocks in the adjacent areas of the Indian Ocean and *vice versa* require to be studied.

Some of the tunas are caught with bait fishes and as such the degree of success of their fisheries is intimately connected with the proper utilization of the bait fish resources. Though the latter apparently looks like an ancillary problem it is actually an integral one and requires equal attention. Large scale damage to hooked tunas and marlins by sharks is common in some areas and the adverse effect this has on the fishery also requires investigation.

As stated already the existing information on the biology of tunas and related fishes in the Indian Ocean is rather meagre and mostly is of a desultory and preliminary nature. It is obvious that the symposium that is being held now on the biology and fishery of scombroid fishes has helped to bring together all the available information and it is hoped that this would contribute in no small measure to stimulate work on this interesting and important group of fishes. The problem of the conservation of the living resources of the sea has already begun to receive the attention of international bodies and the need for co-ordinated action has been agreed to in principle by all nations. In this connection the organisation of the World Tuna Meeting that is proposed to be conducted this year under the auspices of the FAO is a sign of the special attention that tunas and related fishes have begun to receive on a global basis.

COMMENT OF M. B. SCHAEFER ON PAPER BY S. JONES

As noted by Dr. Jones, and also in my paper for this symposium, publications by various Japanese scientists on the catch-per-unit-of-effort and on size-composition of yellowfin tuna in the Indian Ocean indicate clearly that the fishery for that species has become sufficiently intense to have a marked effect on the population size. A decrease in catch-per-unit-of-effort and in average size of the fish in the catch is, however, the inevitable result of effective exploitation of a fish population. By themselves, such data cannot yield any conclusions as to where the fishery stands in relation to the maximum average sustainable yield. For the latter purpose, there are also required statistics of total catch.

Unfortunately, as far as I have been able to ascertain, there are no data available on total catch of yellowfin tuna from the Indian Ocean, either by geographical subdivisions or the ocean as a whole. It would appear to be highly important that such data be collected for past years from records of companies having operated vessels here, if they exist, and, at least, to ensure that such records are compiled in the future.

This is an outstanding case of need for international co-operation in collection of scientific data to make possible the management of the living resources of the high seas for the benefit of mankind. Paragraph 2 of Article 1 of the Convention on Fishing and Conservation of the Living Resources of the High Seas, adopted by the International Conference on the Law of the Sea in Geneva in 1958 provides : ' All States have the duty to adopt, or to co-operate with other States in adopting, such measures for their respective nationals as may be necessary for the conservation of the living resources of the high seas.' In order to determine when conservation measures are needed, and what type of measures are appropriate, there must be adequate scientific data, including proper information on total catch and catch-per-unit-of-effort. By implication, then, it is the duty of every nation whose nationals engage in fishing on the high seas to collect adequate statistical information for scientific purposes, and to make them generally available for research on the condition of the fish stocks.

ADDENDUM

Since the presentation of the above paper at the Symposium I had the occasion to see the paper (in Russian) entitled " On the productivity and prospects of fishing in waters of the Indian Ocean " by V. G. Bogorov and T. S. Rass (*Oceanology*, 1961, **1** (1) : 107-109) summarising the results of the 31st cruise of the Russian Research Ship *VITIAZ* in the Indian Ocean. Relevant extracts of translation of the above are given below :

" Ichthyological works included observations on tuna and other pelagic fishes (swordfishes, sailfishes), and also simultaneous collection of information concerning the fishing in the Indian Ocean."

* * * *

" According to present literature data, Japanese catches of tuna in the central part of the Indian Ocean are larger than those in all other regions of the World Ocean : on the average 10 tunas 130-140 cm. long, per 100 hooks of a longline."

* * * *

" A great number of findings indicates the existence of far numerous spawning schools of the above stated fishes than those given for the Pacific and the Atlantic Oceans."

* * * *

" There is evidence of significant fishing resources in open parts of the Indian Ocean, first of all in waters of the Arabian Sea. The complex investigations of the Indian Ocean which were started during the 31st cruise of the R/S *VITIAZ* should be continued and developed in future. The route from the Soviet Black Sea ports (Kherson, Odessa, Kerch) to the Arabian Sea is no larger than 4-4.5 thousand miles, and the possibilities of developing our fisheries here are undoubtedly of practical interest."

No comments are made except that the last para offers the most significant reading.

S. JONES.