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# New Evidences on the Distribution of Predatory Pelagic Sharks in the Tuna grounds of the Indian Ocean*

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## INTRODUCTION

Since the commencement of the exploitation of oceanic tuna resources of the Indian Ocean seventeen years ago, the hooked rates for the tuna species have declined in many areas of the Ocean but there are no evidences of such a trend in the case of the sharks. As a result, the percentage composition of sharks in the longline catches and the percentage of the tuna catch damaged by sharks show an increase. Hence there is an urgent need for innovation of the existing longline gear in order to increase the fishing efficiency for hooking the tuna species with a corresponding reduction in its efficiency for hooking sharks.

At the beginning of this fishery, hooked sharks were discarded at sea, at a later stage the liver and fins were taken and the carcass discarded and presently the sharks are also brought along with the tuna catch. Though the shark meat has a very low market value it is brought in order to cover up for the declining tuna catches. Thus it has become very necessary to increase the demand for shark meat by developing products or by-products utilizing shark meat and ensuring the successful continuity of the tuna longline fishery.

The pattern of distribution of shark species in the tuna fishing grounds of the Pacific, Indian and Atlantic Oceans and also the predation of hooked tunas by sharks were discussed earlier (Sivasubramaniam 1963, 1964 and 1966). Some contribution to these studies is made in this paper based on new data that have become available.

### Date and Method of Analysis

Earlier studies on this subject were limited to the latitudinal range 10°N to 30° S in the Indian Ocean. Data of longline operations conducted by research vessels during the International Indian Ocean Expedition and the exploratory cruises of the Fishery Agency of Japan, have made it possible to extend this investigation to cover the latitudes 10°–20°N and 30°S–45°S. In addition observations were also made on the tuna longline catches of the 3·5 ton, 11 ton and 250gr. ton classes of vessels operated by Ceylon.

The processing of the data and the methods used in the analyses were the same as those applied during the earlier studies and which were reported in the preceeding papers.

### Species Composition and Distribution

Figure I illustrates the percentage species composition of the longline catches made in the latitudinal ranges covered by the earlier studies as well as those covered by the new data. It is evident that the pattern of distribution of tuna and shark species, arrived at earlier, has been followed. There is a noticeable decline in the number of species of sharks and other undesirable

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varieties, in the catches made in the fishing grounds south of 30°S. The number of shark species appearing in the long line catches is large in the equatorial region and declines towards the higher latitudes of the south and north.

It is also noticeable that in the fishing grounds south of 40°S, both yellowfin tuna (*T. albacares*) and Carcharhinus species of sharks are absent in the catches and similarly in the area north of 10°N albacore (*T. alalunga*) and the great blue shark (*Prionace glauca*) were absent in the catches. These are in accordance with the distribution trends discussed earlier (Sivasubramaniam 1963). The mackerel shark (*Lamna ditropis* (Hubbs et Follet)) appear in the catches from grounds south of 30°S. The lancet fish (*Alepisaurus borealis*) appears in the longline catches from all latitudinal ranges but probably more frequently in the latitudes of the south.

Of about twenty-one species of elasmobranchs caught during tuna longline operations in the Indian Ocean, ten species belong to the genus Carcharhinus. Earlier evidences indicated that the appearance of the Carcharhinids, especially *C. longimanus* (Poey), in the longline catches became noticeable from about 30°S latitude and its density of distribution increased northwards to become the most dominant shark group in the equatorial and north-equatorial waters. New evidences show that north of the equator *C. falciformis* has a density of distribution equal to or even higher than that of *C. longimanus*. In the central part of the north-equatorial region *C. falciformis* has the highest density of distribution for any shark species in the tuna grounds of the Indian Ocean. In fact this species forms 75–80% of the pelagic sharks caught from the in-shore and off-shore waters of Ceylon.

In the tuna fishing grounds of the Indian Ocean, the genus Isurus shows a relatively higher percentage composition of the species hooked on the longline, for areas north of the equator than for those south of the equator. *Isurus oxyrhincus* (M & H) is one of the very common species caught during longlining for tunas. Even in the in-shore and off-shore waters west of Ceylon, very good catches are made between January and March when big eyed tuna (*T. obesus*) also appears commonly in the catches.

Two species of the Alopidae have been observed in the longline catches from the Indian Ocean. Though *A. vulpinus* (common thresher) is the species often described for the main Indian Ocean, tuna longline catches indicate that the big eyed thresher (*A. superciliosus*) is more abundant than the former species. Both species are met with in the coastal waters of Ceylon and here too *A. superciliosus* is more frequently caught than *A. vulpinus*. The sex ratios and the length frequencies for the two species from the northern part of the central-equatorial waters is given in figure 3.

Though the taxonomic investigation of these predatory pelagic sharks is outside the scope of the present study, it must be stressed here that there is an urgent need for such an investigation in the Indian Ocean. A tentative list of such sharks which get caught on the tuna longline in the tuna fishing grounds of the Indian Ocean is given below :—

| | | |
|---|---|---|
| *Carcharhinus faclciformis (M & H) | — | Silky shark |
| C. longimanus (Poey) | — | White tipped shark |
| Prionace glauca (Linn) | — | Great blue shark |
| *Sphyrna zygaena (Linn) | — | |
| *Sphyrna blochi (Cuvier) | — | Hammer head shark |
| *Sphyrna tudes (Val) | — | |
| *C. melanopterus (Q et G) | — | Black tipped shark |
| *Isurus oxyrhincus (M & H) | — | Bonito shark |
| *C. albimarginatus (R) | — | |
| C. lamia | — | |
| *C. limbatus (Val) | — | Grey shark |
| C. brachyurus (G) | — | Cub shark |
| *Galeocerd cuvieri (P & L) | — | Tiger shark |
| *Alopias superciliosus (Lowe) | — | Big eyed thresher |

| | | |
|---|---|---|
| *A. vulpinus (Bonnaterre) | — | Thresher shark |
| C. dussumieri | — | |
| C. menisorrah (M & H) | — | |
| C. gengiticus (M & H) | — | |
| Dasyatus violace | — | Pelagic sting ray |
| *Mobula sp. | — | Devil ray |
| Carcharias komaharii (Matsubara) | — | |
| Lamna ditropis (Hubbs et Follet) | — | Mackerel shark |
| Heptranchias perlo | — | Sevengill shark |

Those with an asterisk are commonly caught in the coastal waters of Ceylon too.

## PREDATION OF TUNA CATCHES BY SHARKS

The degree of damage to the tuna catches is dependent mainly on the abundance of the pelagic Carcharhinid sharks present in the fishing ground. Figure 4 shows the proportions of the main groups of sharks in the longline catches from different latitudinal ranges and also the percentage of the tuna catches damaged by sharks in the respective ranges. Though there is only a small difference in the percentage of Carcharhinids in the catches made in the ranges 0°–10°N and 0°–10°S, there is a very significant difference in the extent of the damages from these two ranges because of the large difference in the hooked rates of sharks for the respective ranges (Table I).

TABLE I

HOOKED RATES FOR SHARKS AND THE PERCENTAGE OF TUNA CATCH DAMAGED BY SHARKS, IN THE VARIOUS LATITUDINAL RANGES, IN THE INDIAN OCEAN

| *Latitude* | *Hooked Rate* | *Percentage of catch damaged* |
|---|---|---|
| 20°N–10°N .. | 1·5 .. | 19·4 |
| 10°N–0° .. | 1·4 .. | 18·9 |
| 0°–10°S .. | 0·8 .. | 10·1 |
| 10°S–20°S .. | 0·4 .. | 5·2 |
| 20°S–30°S .. | 0·2 .. | 5·1 |
| 30°S–40°S .. | 0·05 .. | 1·2 |
| 40°S–45°S .. | 0·50 .. | 0 |

Considering the distribution pattern of the tuna species and that of the shark species (Fig. 1) in the Indian Ocean, it may be said that the loss caused by shark predation is high in the tuna grounds north of 10°S, between 10°S and 30°S latitudes the damage is not heavy, and below 30°S it is very negligible or almost nil.

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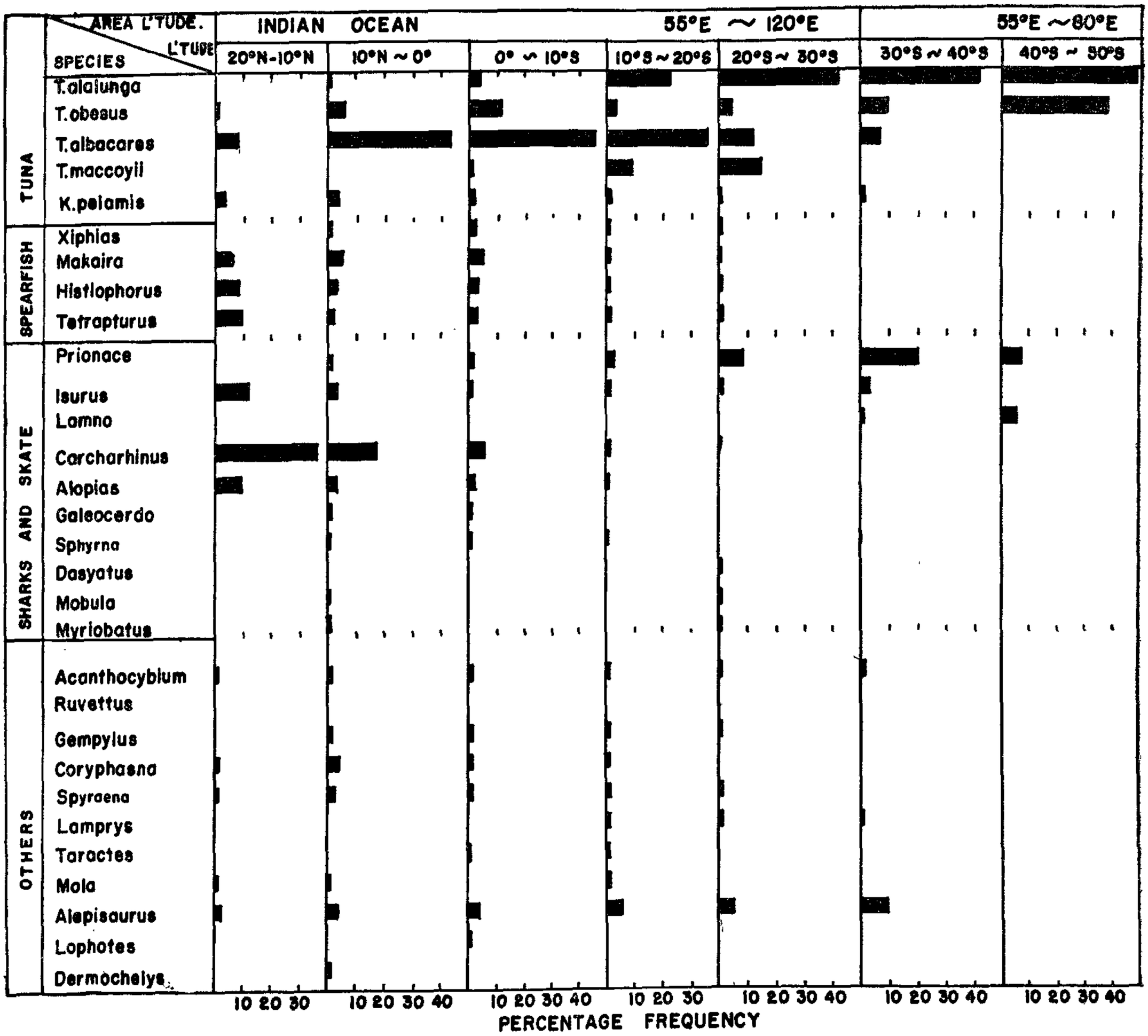


Fig. 1. Species composition of tuna longline catches from the Indian Ocean.

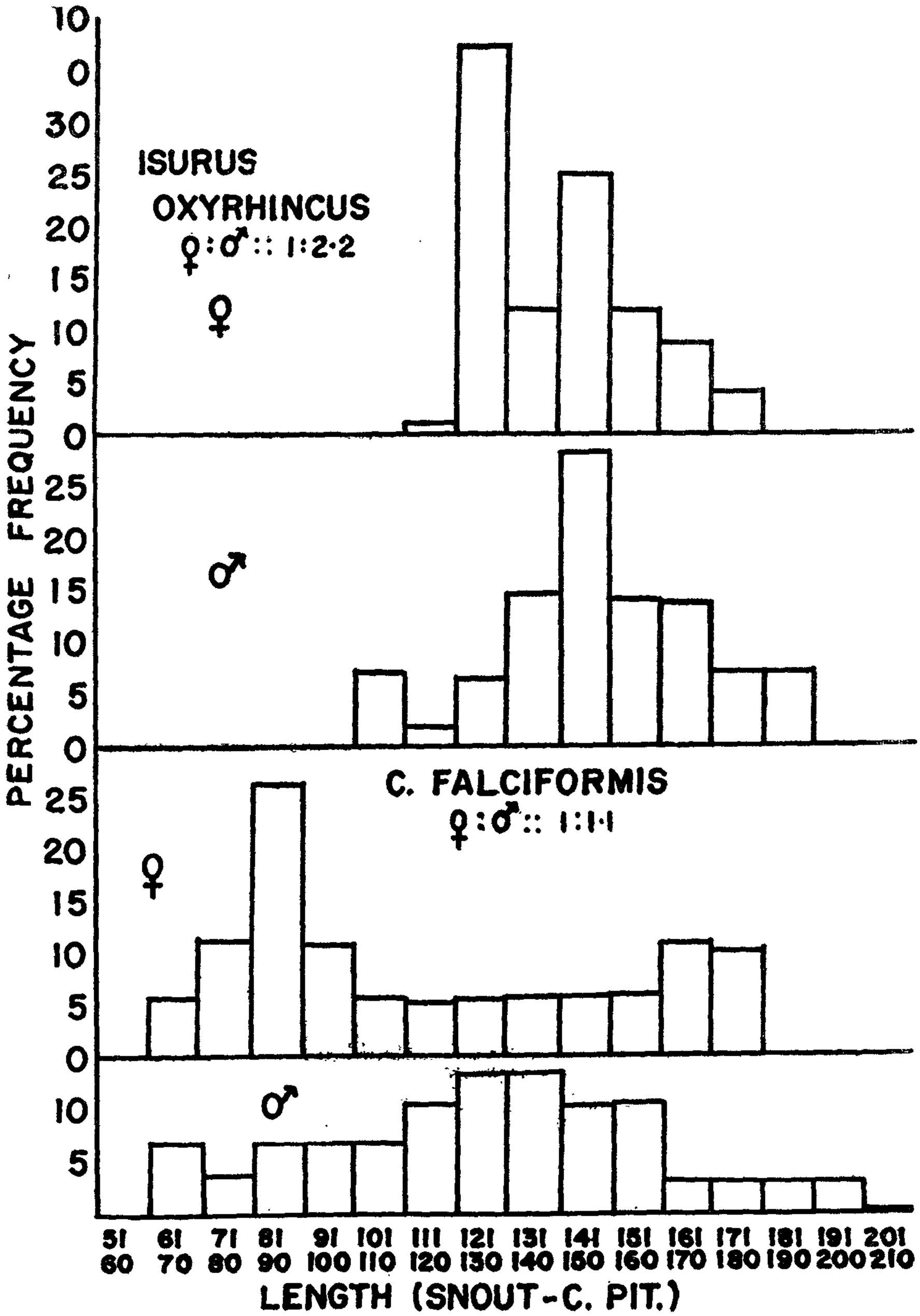


Fig. 2. Length-frequency distribution for *Isurus oxyrhinous* and *C. falciformis* from the North-central Indian Ocean.

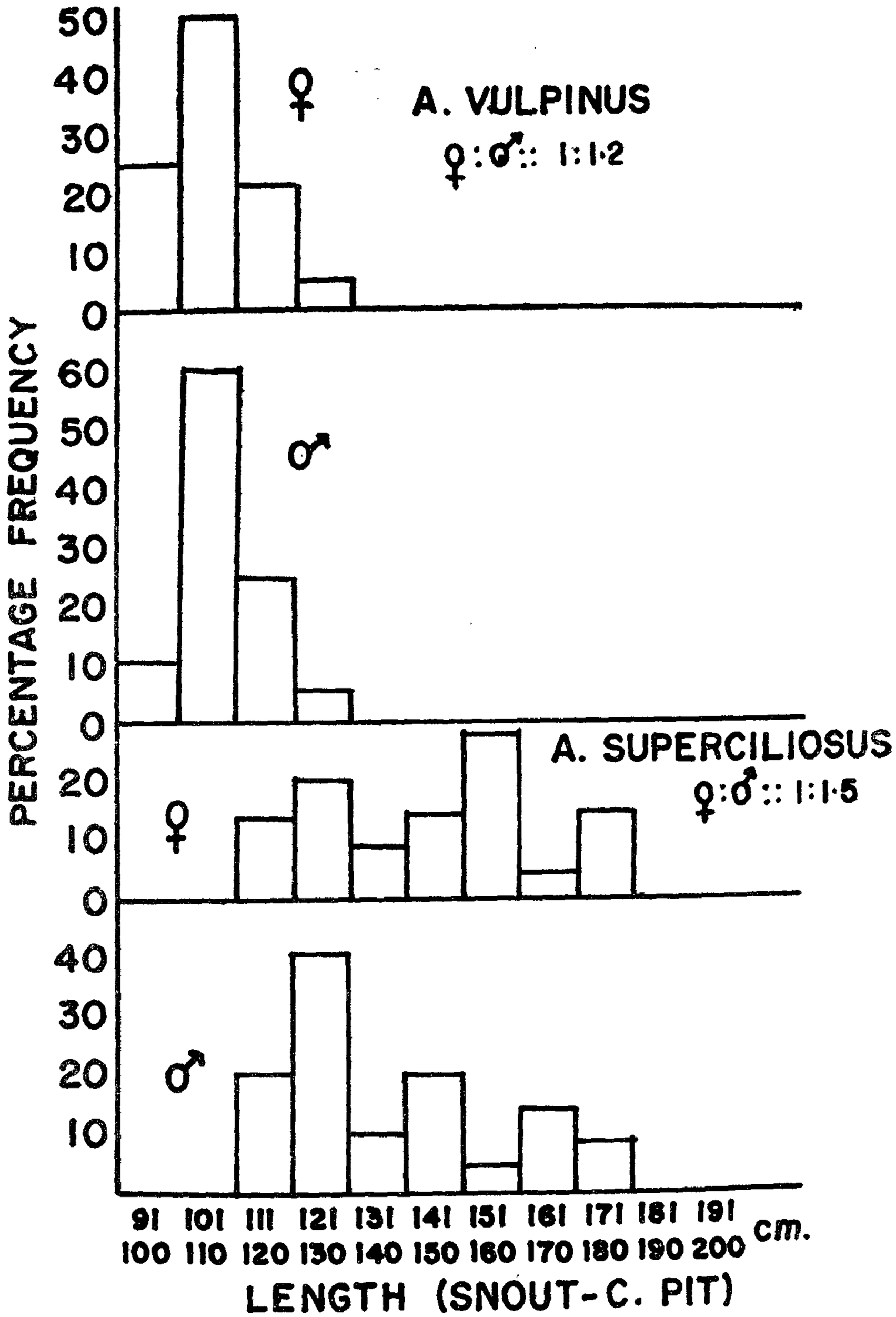


Fig. 3. Length-frequency distribution for the two species of thresher sharks from the North-central Indian Ocean.

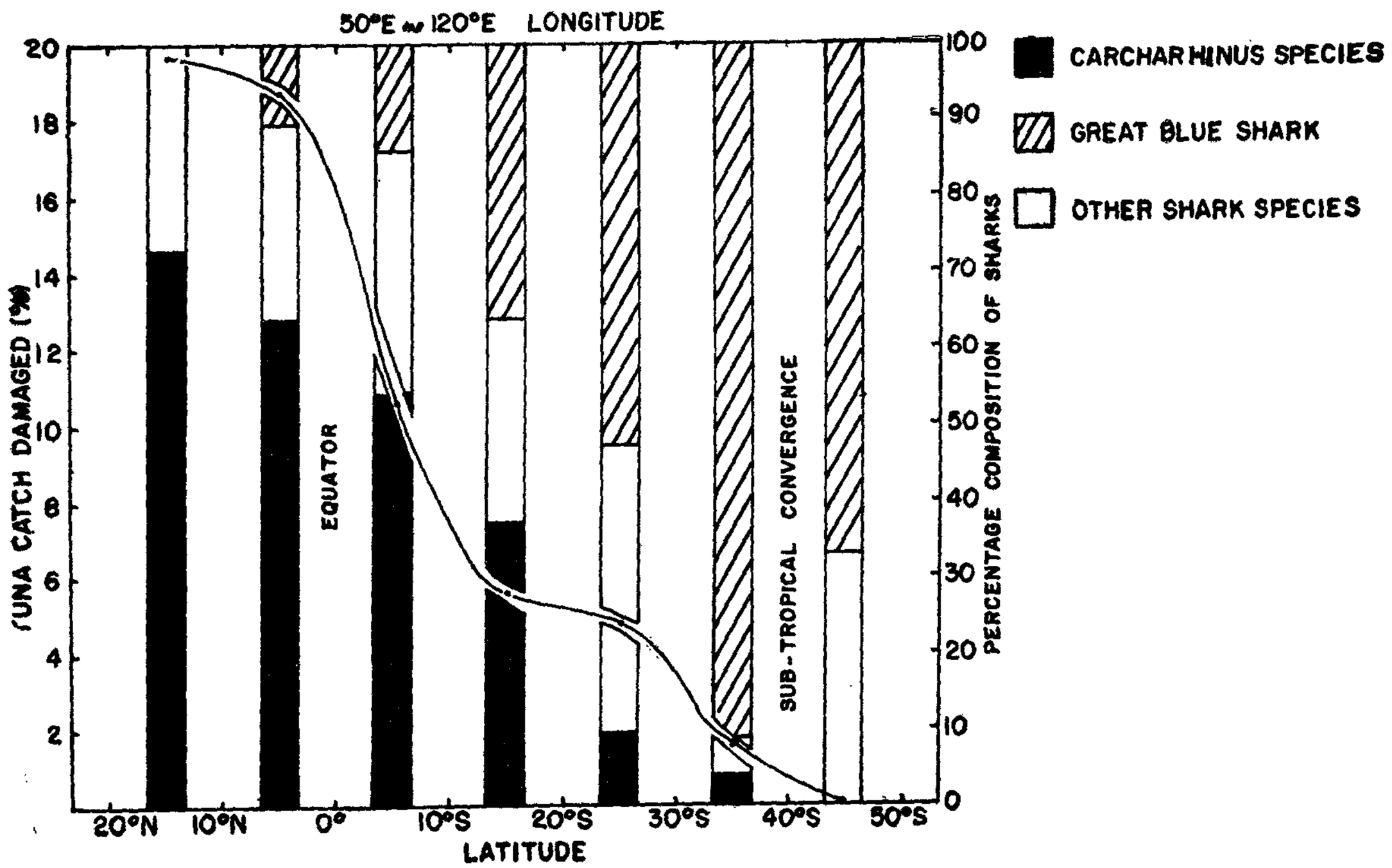


Fig. 4. Latitudinal changes in the percentage composition of the main shark groups and the percentage of tuna catch damaged by sharks.