been fished for sport for half a century and commercially for half that time, knowledge of their biology is remarkably sparse and even their identification has been uncertain until very recent times.

Between 1964 and 1967 the East African Marine Fisheries Research Organization at Zanzibar conducted a survey of the tuna and billfishes in the equatorial western Indian Ocean, and as a result considerable advances in knowledge of the fisheries potential of the area were made. A study by N. R. Merrett (*J. Zool. Lond.*, **163**, 351 ; 1971) on aspects of the biology of billfishes from the area concentrates more on the biology of these fish than on fisheries aspects. One interesting result of this study shows that the five species caught in this area, the sailfish *Istiophorus platypterus*, the spearfishes *Tetrapterus audax* and *T. angustirostris*, and the marlins *Makaira indica* and *M. nigricans*, all seem to be conspecific with Pacific Ocean forms, a fundamental element if data from the better known Pacific populations are to be extrapolated to the Indian Ocean stocks. Only the *Tetrapterus* species show morphometric differences which can be interpreted as indicating population differences.

Merrett also examines growth rates so far as his material, and the difficulty of working with large fish at sea, would allow. Thus, for *Tetrapterus audax*, he found four year classes in his catches, and although it was not possible to establish the absolute age of the fish, during the four years they were available to the fishery they grew between 20 and 15 cm each year, with an approximate weight increment of between 27 and 21 lb. Length and weight frequencies were plotted for the other spearfish and the marlins and it was discovered that in the marlins the larger specimens are all females.

Estimates of the fecundity of the two *Tetrapterus* species and of *Istiophorus platypterus* showed that within each species there is considerable variation which seems to be linked with the size of the fish. Thus the ovaries of four specimens of sailfish showed a fecundity varying between 1.9 and 19.5 million ova, and two specimens of *T. angustirostris* had fecundities of 2.1 and 6.2 million. Clearly, many more observations will have to be made on the fecundity of billfishes before any final conclusions can be reached, but Merrett's figures seem to be the only firm data available and as such are of considerable value.

The migratory habits of these fish are well known and off the East African coast they seem to be related to monsoon periods. Thus Merrett found that *I. platypterus*, *T. audax*, and *M. indica* became more abundant during the north-east monsoon, whereas *T. angustirostris* and *M. nigricans* appeared in greater numbers during the south-east monsoon. The two *Tetrapterus* species were most common offshore, and although like the other billfishes they are surface dwellers, they seem to prefer the open sea with depths of at least 250 fathoms. The marlins (*Makaira* spp.), however, were most abundant inshore over depths of up to 500 fathoms, and *M. nigricans* seems to prefer still shallower water of up to 250 fathoms. This distribution according to monsoon conditions and bathymetric range is similar to that observed elsewhere for these billfishes. These and the other observations by Merrett add considerably to knowledge of these valuable commercial and sportfish in the East African coastal area and confirm observations made in the Pacific by American and Japanese workers.

Filaments or Ribbons in Mammalian Smooth Muscle?

THE controversy concerning the organization *in vivo* of the myosin in mammalian smooth muscle is brought to the forefront again by a pair of papers (Rice *et al.* and Somlyo *et al.*) appearing in *Nature New Biology* next Wednesday. Although electron microscopy and X-ray diffraction have clearly demonstrated the presence of ordered arrays of actin filaments in these muscles, the evidence concerning myosin filaments has long been ambiguous. It was only last year that Lowy and co-workers (*Nature*, **225**, 1053 ; 1970) first observed characteristic myosin reflexions in the X-ray patterns of both relaxed and contracting *Taenia coli* muscles. They also produced electron micrographs of the relaxed muscle showing ribbon-like structures, size 80 Å by 200–1100 Å in transverse section, which they suggested were the myosin-containing structures (*Nature*, **227**, 46 ; 1970). Many other workers, however, have observed thick filaments similar to those in striated muscle, and usually of diameter 150–200 Å. These have been observed in rigor and contracted muscle and in some non-physiological conditions, but only rarely in relaxed muscle.

Because different preparative methods have been used by the different groups of workers, the crucial point in evaluating the contrasting observations is to determine which of the methods does, in fact, preserve the structure of mammalian muscle *in vivo*. Rice and co-workers now report further electron microscope observations using their own techniques, and also examinations of the techniques used by Lowy and co-workers. Rice *et al.* fixed their muscles while they were bathed in an oxygenated Krebs–Ringer solution, in which procaine was sometimes added to ensure relaxation. Fixation was with 4 per cent formaldehyde ; there was no indication of any tension increase. Several different mammalian muscles were examined in this relaxed condition and, contrary to their previous work, thick filaments were seen. Furthermore, in the rabbit portal–anterior mesenteric vein (MV) muscle, and also occasionally in *Taenia coli* (TC) muscle, these filaments were observed in fairly regular arrays. There was an indication of square packing, and electron micrograph and optical diffraction measurements gave an interfilament separation of about 700 Å. Arrays of actin filaments were always observed. Similar features, but with many more thick filaments, were seen when muscles were fixed at 1.6 times their excised length. Garamvolgyi *et al.* (*J. Ultrastruct. Res.*, **34**, 135 ; 1971) also observed that thick filaments were considerably more numerous in stretched preparations.

The techniques used by Lowy *et al.* to observe the myosin X-ray pattern and the ribbon-like structures in the electron microscope have been criticized as being non-physiological. The muscles were allowed to equilibrate at 0° C in an oxygenated Krebs solution supporting a 10 g weight for 3–4 h before X-ray diffraction analysis or fixation for electron microscopy. This procedure produced a 3–10 per cent extension. Somlyo *et al.* have now examined both TC and MV muscles stretched to lengths up to 2.6 times the excised length, and/or in hypertonic solutions. Under these conditions they do observe ribbon-like structures, and these are more plentiful the greater the length and the more hypertonic the solution. They conclude that these conditions which abnormally reduce the interfilament spacing are responsible for the formation of the ribbon-like structures, and that the normal structure *in vivo* is represented by the arrays of thick filaments, which they observe. They also suggest that the width of the 144 Å meridional myosin reflexion in the X-ray diffraction pattern can be as readily accounted for by their observations of arrays of thick filaments, diameter ~180 Å, as by Lowy *et al.*'s observations of random distributions of ribbon-like structures. But because slight stretching increases the number of thick filaments visible, and more extensive stretching produces ribbons, it still seems a debatable question to what extent either of these structures is present *in vivo* in the relaxed unstretched muscle.