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SEX REVERSAL IN THE SPARID FISH *CHRYSOBLEPHUS LATICEPS*

by

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Abstract – Protogynous hermaphroditism is reported in the sparid fish *Chrysoblephus laticeps*. It appears that there is a factor in their genetic make-up making it possible for various degrees of hermaphroditism to develop.

Introduction

Cases of protogynous hermaphroditism in fish have been recorded from widely scattered localities, and from several well separated families, but no cases have hitherto been reported from South Africa.

During a biological study of inshore sparid fishes occurring in the region of False Bay and in the waters of the Tsitsikama Coastal National Park it became apparent that at least one species, *Chrysoblephus laticeps*, had a male : female ratio far removed from what could be expected in a normal heterosexual species. In a sample of 474 fish, taken in the two collecting areas during December 1968 to January 1969, the ratio was found to be 35,5 males : 64,5 females or almost exactly 1 : 2. When the sample was further analysed, however (Fig. 1), there was very clear evidence that sexual reversal was taking place as a normal part of the species life cycle. All other samples (a total of about 3 000 fish) showed the same pattern, but the period selected as an example is during the breeding season of the species. This period was chosen because the likelihood of missexing the ripe gonads while handling large numbers in the field is greatly reduced.

It can be seen from Figure 1 that all the smaller, younger fish are females; over the size range 270-330 (all lengths given as fork lengths) there is an overlap, which I believe to be due to differential growth rates rather than to a variation in the age at which sexual change occurs. Above 330 mm all fish are functional males. During the breeding season female fish were either ripe and in some cases running when caught or recently spawned, but with some eggs still present. Male fish all contained sperm. During the off season period all gonads diminished greatly in size; a few fish were found where from a macroscopic examination it was possible to tell that the gonad was in a transformation stage, but no histological work was undertaken.

No external sexual dimorphism could be detected in *Chrysoblephus*

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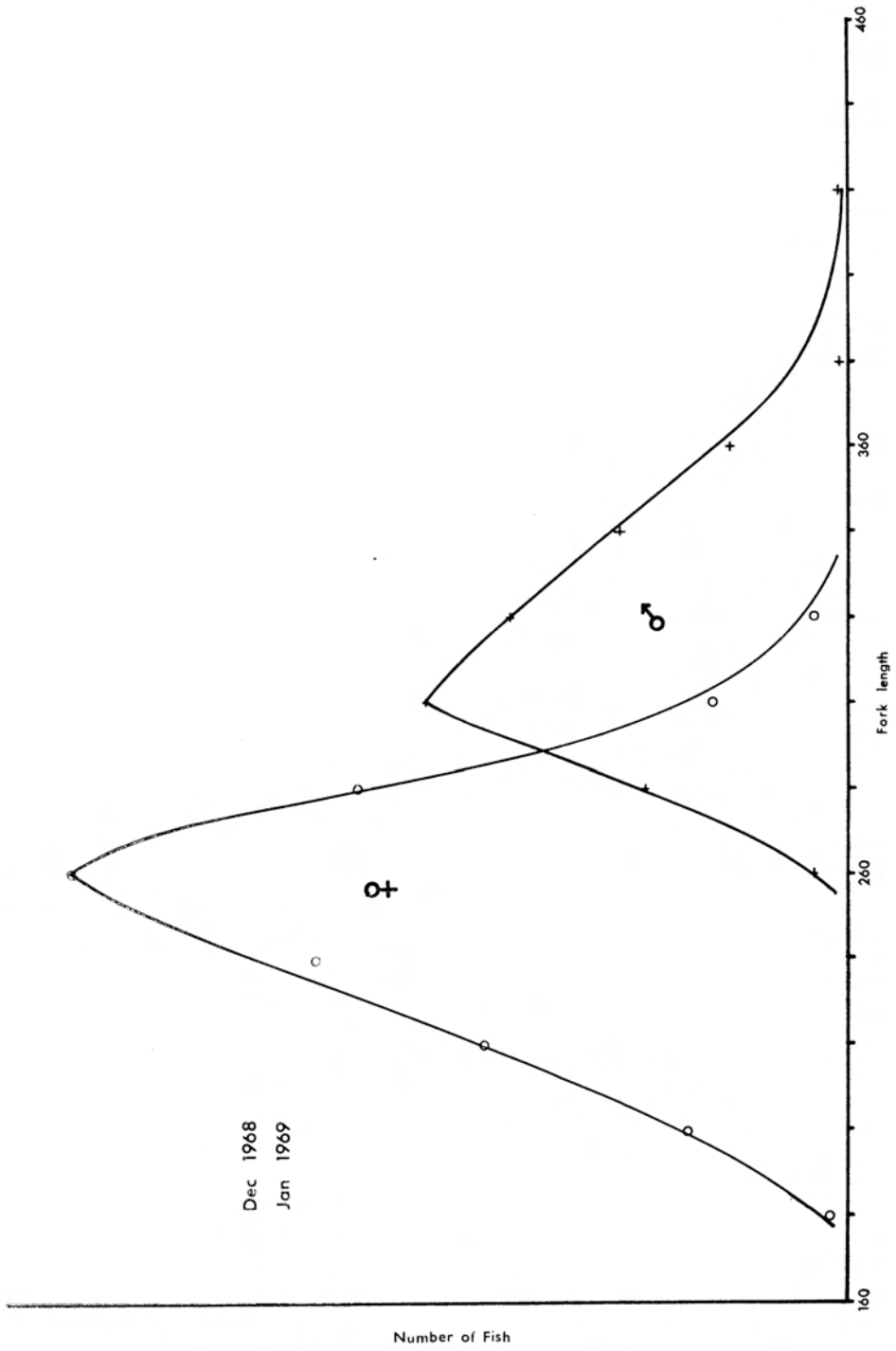

Fig. 1. Sex distribution with size (fork length) of 474 Roman from Storms River and Gansbaai.

laticeps other than size. There is, however, a marked difference in behaviour of the two sexes, the females being found swimming over the reef in small groups of 3-6 fish, and the males by contrast lying up in a cave or other shelter in the reef (Penrith, *in press*).

Sexual reversal does not occur in the related red stumpnose, *Chrysoblephus gibbiceps*. A third member of this genus, the dageraad, *C. cristiceps*, also forms an important part of the commercial catch, but unfortunately my samples consist almost entirely of young fish (under 350 mm fork length, whereas the species grows to at least 580 mm fork length). There is a suggestion that sexual reversal may take place but more samples of larger fish are needed to confirm the supposition.

Of the other sparid species in the commercial catch, normal bisexual development definitely occurs in the following: *Boopsoidea inornata* (Frans madame), *Spondyliosoma emarginatum* (steentjie), *Petrus rupestris* (red steenbras), *Pterogymnus laniarius* (panga), *Pachymetopon grande* (Natal hottentot), *Diplodus sargus* (dassie), *Polysteganus undulosus* (seventy-four), and *Rhabdosargus globiceps* (white stumpnose).

Discussion

Absolute protogynous hermaphroditism in fish was first reported by Liu (1944) in the synaphobranchid eel *Monopterus*, but later work on this family (Chan & Phillips, 1967; Liem, 1963) has suggested that there are both primary males and secondary males, only the latter arising from the sexual reversal of formerly functional females. A similar condition has been found in certain labrids (Reinboth, 1962). In the Centracantidae (Zei, 1950), however, a situation similar to that found in the roman apparently occurs.

Chrysoblephus laticeps is interesting because at least most of the species related to it in South African waters do not exhibit sexual reversal. The following points are worth recording as theoretical considerations of why it may have occurred in *C. laticeps*, but no attempt is made to suggest means.

C. laticeps is a reef-dwelling species, with its main area of abundance between Cape Point and Algoa Bay (a distance of about 1 200 km). Over this same area the Cape fur seal, *Arctocephalus pusillus*, is common, and before the advent of Europeans must have been abundant. Unlike the other sparids in this area, *C. laticeps* is a rather weak swimmer and as it increases in size it becomes hydrodynamically even poorer, with a large heavy head, a flabby body, and a soft, only slightly concave caudal fin. Catch statistics show a very rapid fall-off of catch rates for the larger specimens, a more rapid fall-off than would be expected from normal mortality rates (fig. 2). Large specimens are almost invariably found in caves or some type of rock shelter (Penrith, *in press*), and it is doubtful if large specimens lacking a shelter have the speed and manoeuvrability to avoid seals and sharks. The availability of shelters is naturally limited on

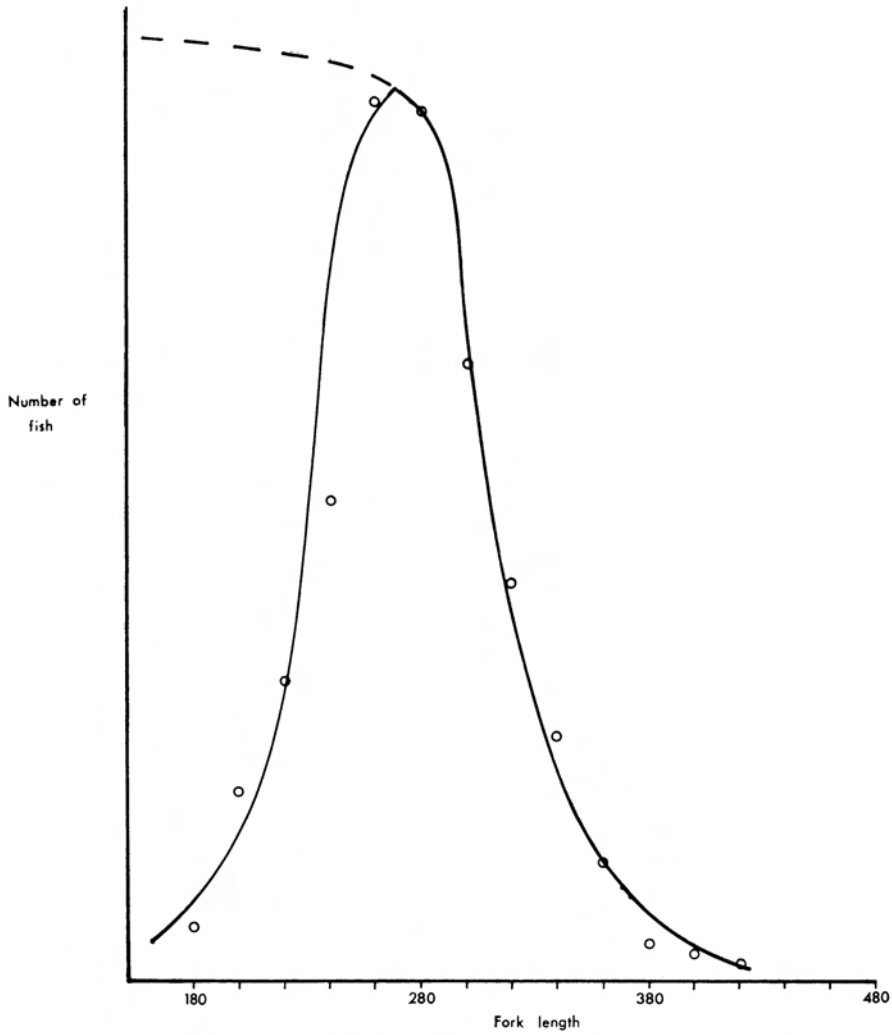

Fig. 2. Size composition of Roman population in southern Cape, based on hand-line catch. The almost vertical drop to the left is due solely to sampling error; the marked fall off to the right of the peak is exceptional, as no sampling error is involved.

the reefs, and it is known that fish occupying a shelter are very territorial and show aggression to other romans coming close to the entrance. Finally, in any externally fertilizing species where there is no pair attachment, a large male, with correspondingly large testes, can be expected to have the potential to fertilize several females, especially if the females are small.

In the roman, therefore, unlike the other sparid species of the southern Cape coast, we have a species where the younger fish have sufficient speed and manoeuvrability to avoid the normal predators but the larger fish do

not. To survive, the large fish require a retreat in the rocky reef, but these shelters are naturally limited in number in any given area. Without basic morphological changes in the entire form of the fish, evolutionary pressures would be expected to result in a species with a considerably smaller maximum size. The sparids, however, apparently have a factor in their genetic makeup making it possible for various degrees of hermaphroditism to develop. It is suggested that this factor has enabled gonad evolution to proceed to the point where the still mobile size range is composed of functional females and the hydrodynamically poor larger size range are functional males, whose size enables the relatively low number of males which survive by virtue of using the available shelters, to fertilize a number of females.

Acknowledgements

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