Journal of the Indian Fisheries Association
18, 1988, 299-306

ON THE IDENTIFICATION OF THE EARLY DEVELOPMENTAL STAGES OF CLUPEIFORM FISHES FROM INDIAN WATERS

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ABSTRACT

Among about 65 species of clupeiform fishes present in the seas around India, most are distributed along both the east and west coasts and have similar spawning seasons and spawning grounds. The most difficult problem experienced with regard to the identification of their early developmental stages is the overlapping sets of diagnostic features among many species within the same genus as well as among species belonging to two or more genera. From studies carried out recently, the present paper cites a few instances wherein certain subtle characters have been used for distinguishing the early developmental stages of a few allied species. These include differences in the developmental sequences of comparable sizes and stages, the size and stage at which a certain fin is formed and differences in the disposition of myomeres in species with the same myomere complement.

INTRODUCTION

The Order Clupeiformes is one of the most important groups of commercial fishes in Indian waters,, responsible for about 23% of the annual marine fish production in recent years. Whitehead (1972) has reported about 65 species from India and many of these are caught in large quantities all along the east and west coasts. There are various reasons for the lack of adequate progress on egg and larval surveys of the various species of this group in India, the most important being the imperfect knowledge on the diagnostic features of the various developmental stages. The present paper examines some of the difficulties

experienced in this regard, cites a few instances wherein certain subtle characters have been used for distinguishing the early developmental stages based on recent work and suggests the need for adopting such methods for their identification.

The author is indebted to Drs. S.Z. Qasim and P.S.B.R. James, the former and present Directors of the Central Marine Fisheries Research Institute and to Dr. R. Natarajan, then Director of the Centre of Advanced Study in Marine Biology, for the encouragement afforded in the course of his work under them.

DIFFICULTIES EXPERIENCED

The various difficulties experienced in the identification of the early developmental stages of Clupeiformes in Indian Waters may be considered under the following heads.

Multiplicity of genera and species : Unlike in temperate countries, in a tropical region like India, the Clupeiformes are represented by many genera such as *Sardinella*, *Dussumieria*, *Escualosa*, *Hilsa*, *Ilisha*, *Opisthopterus*, *Raconda*, *Stolephorus*, *Thryssina*, *Thryssa*, *Setipinna* and *Coilia*. In many instances each genus has many species, with overlapping characteristic features. For example, the genus *Sardinella* is represented by 12 species in India, *S. longiceps*, *melanura*, *dayi*, *jussieu*, *brachysoma*, *albella*, *fimbriata*, *gibbosa*, *sindensis*, *sirm*, *clupeoides* and *leiogaster*, vide Whitehead (1972). The genera *Stolephorus*, *Thryssa* and *Coilia* have 10, 8 and 5 species respectively; and *Setipinna*, *Hilsa* and *Ilisha* have 3 each. Thus in many instances groups of congeneric species as well as species of many genera contribute to a fishery.

Areas and seasons of occurrence and spawning : A perusal of literature shows that most species of Indian Clupeiformes are available all along the Indian coasts and that in most localities the number of species recorded varies from 15 to 35. Rao (1962) has observed 32 species in Godavari estuary and Ramaiyan (1978) has found a similar number in the sea off Porto Novo. In the course of observations carried out during 1961 - 1988 at Cannanore, (southwest coast), Tuticorin and Mandapam (southeast coast), 30, 33 and 41 species have been collected with varying degrees of abundance, from 10 to 50% of the commercial catches.

Besides, many of the species are observed to spawn in the same area and at the same time. It was found in Cannanore during 1961-64 that from August to the following January, *Sardinella longiceps*, *S. fimbriata*, *S. gibbosa*, *Opisthopterus*

tardoore, Escualosa thoracata, Anodontostoma chacunda, Dussumieria acuta and many species of *Stolephorus* as well as *Thryssa* have spawned. At Tuticorin during 1965 - 77 and at Porto Novo during 1977 - 79, *Sardinella dayi, S. albella, S. fimbriata, Escualosa thoracata, Anodontostoma chacunda, Nematalosa nasus* and many species of *Stolephorus* and of *Thryssa* have spawned. Literature on the occurrence of eggs. larvae, postlarvae and juveniles such as Bal and Pradhan (1945, 1946, 1951), Gopinath (1946), Bapat and Bal (1950) also indicates protracted spawning in many clupeiform fishes. And, as drawn attention to by Qasim (1973), spawning in most marine fishes of India is protracted, beginning usually at the onset of the monsoon rains, the southwest monsoon along the west coast and the northeastt monson along the east coast.

Overlapping diagnostic characters : The most baffling problem encountered in the identification of clupeiform eggs and larvae in Indian waters is the overlapping of their diagnostic characters. It is true that in some species the diagnostic features are distinct enough for identification of the eggs and larvae, vide Delsman (1926 b, 1929 b, 1930, 1932 a, 1932 b, 1933 a), Jones and Menon (1950, 1952), Bensam (1968, 1971). But in most cases the overlapping characters have forced most workers to rely very much on circumstantial evidence only, such as neritic - pelagic distribution of adult fish and occurrence of eggs and larvae, coincident occurrence of eggs and larvae in the locality of capture of prespawners, spawners and postspawners and similar considerations. Delsman (1922, 1925, 1926 a, b, 1929 a, b, 1931, 1932 a, b) has generally followed such a method, although in some cases he has advanced cogent reasons of diagnostic value in arriving at his conclusions.

A representative case of overlapping sets of characters may be found in the genus *Sardinella*, the eggs and larvae of which have been under investigations for quite some time (Delsman, 1926 a; John, 1951; Nair, 1960; Bensam, 1972, 1973, 1984, 1986). Among the species in this genus, the eggs of *S. leiogaster* and *S. sirm* may be distinguished from those of the others in the absence of an oilglobule and the larvae hatching out of them have 42 - 43 myomeres. The eggs of *S. fimbriata* and *S. longiceps* have the same range of overall egg diameters and they possess an oilglobule of the same size range. Besides, the number of myomeres in the above two species as well as in the larvae of *S. gibbosa* and *S. dayi* is within a range of 45 - 47, viz., 45 in *S. gibbosa*, 46 in *S. dayi*, 45 - 46 in *S. fimbriata* and 45 - 47 in *S. longiceps*. Under such a condition it has become difficult to segregate the eggs and / or larvae based on such characters alone.

In addition to the overlapping number of myomeres among species within a genus, there are instances where the larvae of one genus have a range of myomere numbers similar to that of one or more of other genera. Thus, the larvae of *Stolephorus indicus, heterolobus* and *zollingeri* are likely to be confused with not only the larvae of *Sardinella leiogaster, sirm, clupeoides* etc., but also with those of *Hilsa kanagurta* and *toli* as well as with those of *Thryssa kammalensis* and *Thrissina baelama* (Delsman, 1926 a, 1929 a, 1931, 1933 b). If the spawners, eggs and larvae of two or more of these species occur in the same locality and at the same time, as is usually the case, their identification and segregation is difficult and meristic characters such as the number of myomeres alone may not be of much value.

SUGGESTIONS FOR A MORE EFFECTIVE APPROACH

In view of the above difficulties, it is essential to develop a more effective method to identify clupeiform eggs and larvae in Indian waters. A basic requirement in this connection is a thorough study of the ichthyofauna of the locality and a sound identity of all of the species present there, in relation to space and time. Also, an adequate knowledge on the biology of the species, especially regarding their spawning habits, seasons and grounds is an essential prerequisite. Apart from this background information, for an accurate identification of plaktonic eggs in their early stages of development, a sound knowledge of the characteristic features of the ripe ovarian ova is necessary. But, a perusal of literature shows that in India only in a few species of fishes the characteristic features of the ripe ovarian ova are available. This is chiefly due to the fact that spawning and oozing female fishes are different to collect, as is observed even in temperate countries exemplified by the Pacific sardine reported by Miller (1952). Hence, more survey and research work has to be undertaken in order to delineate the spawning grounds and to collect ripe ovarian ova of the target species for identification of their planktonic eggs.

With regard to larvae and postlarvae of clupeiform fishes from Indian waters, one aspect which has not received enough attention in India is the differences in the developmental sequences in comparable sizes and stages of allied species. The fact that such differences are useful for identification may be seen from studies undertaken recently on the larvae of *Sardinella gibbosa, dayi* and *fimbriata* by the present writer (Bensam, 1972, 1973, 1984, 1986), which have the same range of myomere numbers. These have revealed that the 5.5 mm larva of *S. fimbriata* (Delsman

1926 a) is distinctly less advanced than the 5.36 mm larva of *S. gibbosa* (Bensam, 1972) in that the former has a prominent larval finfold, much less developed caudal and anal fin regions, no indication of anal fin and more preanal myomeres than in the latter. Among postlarvae, the 7.7 mm stage of *S. fimbriata* lacks bifurcation of caudal fin, has more preanal myomeres and more pigmentation than 7.77 mm stage of *S. gibbosa*.

Difference in the disposition of myomeres in early developmental stages of specieswith a similar number of myomeres is found to be another character of diagnostic value. For instance, in having a total of 43 myomeres, the postlarvae of *Ilisha melastoma* (Bensam, 1984, 1987) resemble those of *Sardinella clupeoides* (Bensam, 1984, 1986). But, the 12.7 and 14.7 mm postlarvae of *I. melastoma* when compared with the 13.1 mm stage of *S. clupeoides* shows only 31 myomeres in its preanal region, as against 35 in the latter species, obviously related to a more rapid forward movement of the vent in *I. melastoma* than in *S. clupeoides*. And, in the 13.4 and 14.1 mm postlarvae of *S. sirm* the position of the vent is below the 28 th myomere, pointing out that the forward movement of the vent in *S. sirm* is the quickest one among these three species in relation to their sizes.

Similarly, the appearance of ventral fin in relation to the length of the postlarvae and their developmental stage in the case of *S. fimbriata* and *S. dayi* (Bensam, 1973, 1984, 1986) has been found to be diagnostic. In *S. fimbriata* the ventral fin has developed in an advanced postlarval stage of 21.5 mm which has almost reached juvenile condition. But, in *S. dayi* the ventral fin has developed even in a postlarvael stage of 18.7 mm which is only in the same stage of development as the 12.3 and 13.4 mm postlarvae of *S. fimbriata*.

REMARKS

It may be seen from the foregoing that for valid identification of the early developmental stages of Clupeiformes from Indian Waters, a much more in-depth study is required than at present. The subtle character differences as exemplified would go a long way for better identification and documentation of these stages. It becomes imperative to discover many more of such subtle characters as well as to standardise and define vital developmental stages in the lines proposed by Ahlstorm and Counts (1955), Moser and Ahlstorm (1970) and others. It is time that the attention of workers in the Indian region is focussed on a review and reappraisal of the existing procedures

as well as to adopt more valid approaches wherever necessary.

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