

ON THE TERMINOLOGY FOR PHASES AND STAGES IN THE LIFE HISTORY OF TELEOSTEAN FISHES

S. JONES

*Central Marine Fisheries Research Institute,
Mandapam Camp, Madras*

ABSTRACT

The terminology generally used for describing the different stages of the life history of teleostean fishes is discussed and suggestions are given for categorizing it under phases and stages. Four phases, *viz*, embryonic, larval, juvenile and adult are recognized. Of these, the embryonic phase is divided into precleavage, cleavage, shield and postshield stages, and the larval phase is divided into prolarval and postlarval stages. Juveniles and adult phases are not subdivided but the latter could be grouped under different year classes.

INTRODUCTION

In a previous note, the author (Jones, 1950) gave the terminology for the early developmental stages of fishes based mainly on the recommendations made by Hubbs (1943), and discussed some of the popular terms current in fishery literature and pisciculture in this country. Subsequently it came to his notice that Rass (1946), independent of the recommendations of Hubbs (1943), made a detailed analysis of the terminology used by a large number of workers on the subject and gave suggestions which were complementary as well as supplementary to those proposed by Hubbs (1943) and Jones (1950). In the present communication, the recommendations of the above-named authors are discussed and a modified terminology is suggested.

TERMINOLOGY ALREADY USED

Hubbs' (1943) terminology has already been discussed and quoted (Jones, 1950) and needs no repetition here. Rass (1946) has established categories of gradation in the development, *viz*, phases and stages, the former to denote distinct periods in the life history and the latter to denote the subdivisions of the former. The phases and stages as given by him are summarized below as many may not have easy access to his paper.

1. EGG PHASE: The unfertilized ovum and the embryonic stages up to the time of hatching with the following stages:

(a) O-STAGE: Undeveloped, dead or unfertilized egg.

- (b) CLEAVAGE STAGE: From the time of the cleavage stage up to the formation of the germinal disc.
 - (c) EMBRYONIC SHIELD STAGE: From the germinal disc stage up to the formation of the tail-bud.
 - (d) EARLY EMBRYO STAGE: From the formation of the tail-bud up to the encirclement of the yolk by the embryo.
 - (e) LATE EMBRYO STAGE: From the encirclement of the yolk by the embryo to the hatching of the prelarva.
2. PRELARVAL PHASE: The larva with the yolk-sac.
 3. LARVAL PHASE: The larva after the absorption of the yolk and till the attainment of juvenile features. This is divided into the following two stages:
 - (a) PROPTERYGIOLARVAL STAGE OR EARLY LARVAL STAGE: Characterized by the presence of embryonic fin-fold devoid of fin-rays.
 - (b) PTERYGIOLARVAL STAGE: Characterized by the presence of rays in the unpaired fins.
 4. JUVENILE OR YOUNG FISH PHASE: From the completion of the larval phase to the attainment of sexual maturity. In some, a transitory 'prejuvenile' stage between the late larva and the young fish is also recognized. The juvenile stage is subdivided into year classes.

DISCUSSION

Though the above classification has some distinct advantages over all the previous ones, the ontogenesis or the actual development of the individual commences only with fertilization and as such it may not be relevant to group the unfertilized ova within the first phase. Therefore, the recognition of a O-stage representing undeveloped, dead or unfertilized egg is not considered necessary. The embryonic phase is generally distinctly different from the rest of the life history phases of the fish, while between all other phases there are transitory stages making clear lines of demarcation sometimes difficult. Another point is that all the embryonic stages classified under the 'egg phase' by Rass may not fit in well with the pattern of development seen in many fishes in the tropics. In most of the marine and freshwater fishes of India hatching takes place within 24 hours after fertilization and the time lapse between the early embryo and the hatching time is so little that there is hardly any scope for a further subdivision of the embryonic phase. Moreover, in a number of cases yolk is not encircled by the embryo and hatching takes place soon after the tail-bud gets differentiated and before it encircles the yolk-sac. It is also difficult to reconcile with the recognition of the two phases, *viz*, the prelarval and the larval, before the juvenile phase and it is considered desirable to combine them under only one phase, *viz*, the larval phase.

Based on the available information the following divisions are suggested in

the life history of a typical teleostean for consideration, *viz*, embryonic phase, larval phase, juvenile phase and adult phase.

1. EMBRYONIC PHASE: This will cover the period of development within the egg-membrane from the time of fertilization to the time of hatching. The single-celled precleavage stage with the germinal protoplasm collected at one pole immediately after the fusion of the gametes would mark the beginning of the life of the individual. The embryonic phase in the ontogeny commences with fertilization and ends with hatching. This phase may be divided into the following stages:

- (a) PRECLEAVAGE STAGE: This is the initial and perhaps the most transient stage. This commences with the fusion of gametes and the streaming of the protoplasm towards the nuclear pole to form a cap and ends with the first division into two cells. It might even be contended by some that it is rather too early to call it an embryo but could be considered only as a fertilized egg.
- (b) CLEAVAGE STAGE: Same as defined by Rass (1946). This would commence from the first cell-division and end with the formation of the germinal disc.
- (c) SHIELD STAGE: Same as defined by Rass (1946). This would commence from the formation of the germinal disc and end with the formation of the tail-bud. The germinal layer at this stage completely envelops the yolk.
- (d) POSTSHIELD STAGE: This commences from the formation of the tail-bud and ends with the hatching out of the prolarva.

2. LARVAL PHASE: This covers the period from the moment of hatching to the formation of the juvenile characters. This includes the prelarval and larval phases of Rass (1946) and the prolarval and postlarval stages as defined by Hubbs (1943) and Jones (1950). For the sake of convenience division of this phase into prolarval and postlarval stages as suggested by the latter authors is recommended.

In some of the comparatively heavily yolked larvae, like those of the salmonids, the prolarva gets directly transformed into the juvenile. Such larva is known as alevin. A similar condition exists in some of the catfishes with heavily yolked eggs.

- (a) PROLARVAL STAGE: This is the larva with the yolk-sac from the time of hatching to the absorption of the yolk. It is the same as the prolarval stage as defined by both Hubbs (1943) and Jones (1950) and the prelarval phase as defined by Rass (1946).
- (b) POSTLARVAL STAGE: This covers the period from the absorption of the yolk to the development of juvenile characters and is the same as defined both by Hubbs (1943) and Jones (1950) and similar to the larval phase defined by Rass (1946) which he has divided into two stages, *viz*, proto-

pterygiolarval and pterygiolarval stages. If, however, a further division of the postlarval stage is warranted, it could perhaps be categorized into propterygiolarva and pterygiolarva as suggested by Rass (1946). The former will be devoid of fin-rays in the median fins, whereas the latter will bear fin-rays in the median fins. The transitional stage being a protracted one, in many cases a sharp distinction between the above two stages is difficult. The terms 'early postlarva' and 'late postlarva' will also convey the same meaning. It may be mentioned in this connexion that in a few instances with a protracted embryonic stage, rays begin to develop even before hatching takes place.

In the eels the larval stage is followed by the leptocephalus and elver stages before transformation into the juvenile eel.

3. JUVENILE PHASE: Same as the juvenile or young fish stage as defined by both Hubbs (1943) and Jones (1950) and the juvenile phase referred to by Rass (1946). The essential external distinguishing features of the adult are attained and the term is applicable up to the attainment of first maturity. Further grouping, if any, is done according to age.

4. ADULT PHASE: This final phase is attained by the first maturity of the fish. They are further classified under year-groups.

As already stated, in most cases a very clear line of demarcation between the different stages may not always be possible and hence during the transitional period precise assignment to one stage or the other would rather be difficult. The distinctions made out in this note, therefore, only broadly cover the main phases and stages in the life history of teleostean fishes.

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Accepted 9 October 1966. Read 27 April 1967.

Communicated by Dr A. K. Mondal