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Short communication

Determination of larvae development stages in rainbow trout (*oncorhynchusmykiss walbaum*, 1792) based upon morphologic observations, pigment distribution patterns, and fin development patterns

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ABSTRACT

Our knowledge about fish biology couldn't be completed without our awareness of bio- history of larvae. The study of fish's bio- history can provide information about fish larvae actions and reactions in its first life stages. This general description can represent the anatomical, physiological, behavioral and ecological changes in development stages of fishes. In this research, we study the larvae development stages on 30 larvae of rainbow trout based on morphological observation, pigment scattering pattern and fins development pattern. From the viewpoint of pigments pattern, in general, the highest pigments were concentrated on the rear of head and between eyes and the lowest was on fins bud and their abdomen. The morphological observations in larvae stage indicated that larvae in first stage has different shape than its puberty and its appearance will change in parallel to its development during the time, so that at the end of stage, it is so like an adult fish. In same researches on larvae of other salmon species, there are relative similarities due to pigment scattering pattern but there are significant differences in morphological observation and also the pattern of fins development.

1. Introduction

Rainbow trout (Oncorhynchusmykiss Walbaum, 1792) of Salmonidae is one of the most important commercial fish species which is mainly found in Caspian Sea, Dejleh, Karoon, and Zayandehrood. It plays very important role in commercial and sport fishing and renders a high influence on economy of Iran (Barimani, 1977). Fish farming in Iran commenced in 1960 with farming rainbow trout. Considering palatability and consumptive potentials of this species, it has been given an accelerated attention to be farmed. Despite ever-increasing production rate for this species, there has been a considerable difference between larvae production and final product (Vosoughi & Mostajir, 2009). Studying fish roe and larvae is regarded as one of novel branches of ichthyology (Rabbaniha, 2007). Determination of biologic history of fish provides precious information on the changes occurring during this stage. Such investigations may be very applicable of which fish biology and systematic (Helfman et al., 2005), fish population dynamics (Rabbania, 2007), and fisheries stock assessment and management (Urho, 1996) can be named. Jafari et al. (2009) studied larvae stages in Caspian kutum (Rutilusfrisiikutum) in terms of morphologic characteristics. They divided larvae stage into 3 sections and 18 subsections and described morphologic traits of the larva. Their results showed that the highest variations occur during changing from internal feeding to external feeding. In a study on fetus and larvae stages in Asian stinging catfish (Heteropneustesfossilis), Puansuari et al. (2009) found results about roes hatching time, onset of larvae period, end of this period, and variations in these stages. Gisberi et al. (2002) investigated morphologic changes and larvae growth pattern in halibut (Hippoglossushippoglossus). Their results pointed to the highest transformations during larvae internal feeding, early, and mid larvae period, such as evolution of sensory receptors, evolution of digestive system, respiration, and progress in swimming. Considering the importance of rainbow trout and necessity of attention to its growth and development, especially in larval period, determination of growth and development of rainbow trout larvae seems to be of high importance.

2. Materials and methods

Rainbow trout larvae were purchased from Rainbow Trout Breeding and Farming Center of Gorgan (longitude: 53° 45' 45.32"; latitude: 36° 49' 26.35") in 2012. The larvae were kept in 42.5×42.5×20 m troughs at 8.5°C.They were fixated in formalin 4% in different sizes and were transferred to lab for biometry. Biometry was performed on 30 larvae by use of micrometer M6C-10-equipped loop with accuracy of 0.5 mm as well as a caliper. Imaging, also, was executed by means of a SZX12 loop (micron-measured). The pattern proposed by Nikolsky (1963) was adopted in order to determine larvae period. The pattern determines larvae period from yolk sac reduction to evolution of fin rays, countable plates, and elimination of larval traits. Furthermore, to achieve a better insight into this period, pigment pattern (form and distribution), morphologic observations (morphologic variations during larval period), and fin development pattern (fins formation time and process) were determined. In order to facilitate determination, larval period was divided into pre-larval (early to mid) and post-larval (mid to late) stages and the results were reported on this basis.

3. Results

3.1. Pigment pattern

Pigments were distributed as tiny spots on whole body of larvae (especially under lateral line) in pre-larval stage. In macroscopic observations of pigments in primary sized of pre-larval stage, a blackish gray cloud can be detected on larvae body where pigment cannot be detected separately. The pigments in larval period are melanophores. The pigmentsgradually develop as the larvae grow up so that their distribution can be macroscopically seen. One of the prominent morphologic characteristics of rainbow trout is its big black spots spread as a line on both sides of body from head to the beginning of caudal fin. Formed as a result of pigmentation, these spots are invisible in the early pre-larval stage. The spots get more detectable as larvae grow up. There is another black spot in the back of larvae head. There is black line from this spot to the beginning of caudal fin which can be seen from yolk sac reduction to end of pre-larval period. The black spot in the back of larvae head starts to be divided from the middle part of body so that it can be seen as two distinct spots at the end of the period. Pigments in pre-larval period are mostly distributed on the head, between eyes, on snout, and on

nostrils and operculum. In the case of fins, pigments may only be seen on dorsal fin as well as on the beginning rays of fins which become more evident as larvae grow. Other fins lack pigments toward the late larval stage. Pelvic area of larvae body lacks pigment in the whole stage.

In post-larval stage, the highest number of pigments can be seen in dorsal and lateral sides, respectively and like pre-larval stage, pelvic area lacks pigment in this stage, as well. Body spots become more detectable in post-larval stage; a few tiny spots, formerly undetectable in pre-larval stage, may be seen in this stage where can be vividly seen in the late post-larval stage and they can be counted macroscopically. These spot are small and black. The black spot in the back of larvae head is clearly divided so that two rather separate spots can be detected in final sizes. The black line in the back of body can be seen in the whole period. The highest distribution of pigments in post-larval stage is above the lateral line, back of the head, nostrils, and between eyes, respectively.

3.2. Morphologic observations and fins development pattern

Larvae body is slender and long from the early pre-larval stage to middle sizes; however, after that and as the larvae grow, their body turns to be fusiform. In the early sizes, larvae head has a low incline and it gets steeper gradually. Steeper head helps larvae have a more fusiform body leading to the capability of swimming with higher speed. Eyes size is also very big compared to head so that they are easy detected in morphologic observations. At this stage, nose is very low and it will remain in this form toward the end of this stage. Body height is an important trait in morphologic observations. In the beginning of this stage, body height is very low so that head and trunk are in a same level. Body height gradually increases in the middle sizes which is very effective to have a fusiform body in larvae. Fin buds are seen from the beginning of pre-larval stage. In primary sizes, the longest fins are caudal, dorsal, pectoral, anal, and ventral fins, respectively. Fin length increasing rate is in anal, ventral, dorsal, and pectoral fins, respectively.

In the beginning of pre-larval stage, larvae body is nearly fusiform. At the end of this stage, the body is totally fusiform and it looks more like a juvenile or adult fish. Increasing body height is the most important factor at this stage. Like previous stage, eyes size at this stage is big in terms of head size indicating to high applicability of this organ for rainbow trout. Mouth is more complete than the previous stage and it is more similar to the mouth of a juvenile or adult fish; this corresponds to requiring specialized predation in the mentioned stages. Like previous stage, nose is low, but, the head is steeper. At the end of this stage, all larval traits vanish. The larvae are very similar to juvenile and adult fish and they are capable of being introduced to juvenile period. End of larval stage and entering juvenile period may be assigned by countable plates growing in caudal peduncle.

What mentioned hitherto point to high susceptibility of larvae at pre-larval stage (onset of changes and organs growth and development) as well as high importance of post-larval stage (evolution and acquiring necessary skills for entering juvenile period).

4. Discussion

The present study was formulated in order to determine some morphologic traits, pigments distribution pattern, and fins development pattern in rainbow trout larvae with total length of 20-53 mm. Larval development is a continuous phenomenon (Helfman et al., 2005) and occurs in all organs and systems for transformation from larval stage to juvenile stage (Urho, 1996). Oncorhynchus species have a short lifetime and they are not as fertile as other marine fish; however, they have big roes (King &Mcfarlane, 2003). The average ovule diameter for rainbow trout is 5.1 mm which is bigger than that of brown trout (Salmotrutta) (3.51 and 3.78 mm) (Demir et al., 2010). Melanophores cells are detectable from the beginning of rainbow trout's larval life. Pigments are distributed as tiny spot on the whole body of larvae in the pre-larval stage with more pigments as larvae grow. On the contrary, Gholamhoseinian et al. (2010) reported regular and black pigments (presumably melanophores) under head and trunk epidermis in the mid days of the first larval week; they also reported further and more regular cromatophores after the second week on while melanophores are spread on yolk and head in the beginning of larval stage in coral trout (Plectropomusleopardus) (Masuma et al., 1993).Appearance of melanophores on different parts of body may be adopted as a factor for recognizing species as well as differentiating different stages in the species.

Fins buds are detectable in larvae from the beginning of pre-larval stage in rainbow trout where the longest fins are caudal, dorsal, pectoral, anal, and ventral fins, respectively. The first structures formed in Ohrid trout (Salmoletnica) in the first larval stages are pectoral girdle and caudal fin (Ristovska et al., 2008); nevertheless,

coral trout larvae witness only dorsal fin buds in the eraly larval stages (Masuma et al., 1993). Larval growth and development is affected by species, water quality, habitat, and duration of being in the habitat (Okumus et al., 1999; Uysal&Alpbaz, 2002 a,b). Okumus et al. (1999) showed that Brook trout (Salvelinusfontinalis) and rainbow trout have better growth rates than brown trout in the same wild and farming status (Okumus et al., 1999).

5. Conclusion

In conclusion, it seems in investigations on different larval stages that the difference in larval growth and development in different species of trout should be given more attention so as to recognize larvae and management and dynamics of their population.

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