Technical Manual for Artificial Propagation of the Indonesian Catfish, *Pangasius djambal*
Editors: Jacques Slembrouck, Oman Komarudin, Maskur, Marc Legendre
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Chapter VI

Larval Biology

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Techniques for larval rearing of farmed fish are specific and must be adapted to the particular behaviour and biological requirement of fish during their development. Based on our observations, the present chapter provides information on various aspects of development, requirements and specific characteristics of *P. djambal* larvae. Although more detailed investigations are required, these initial data allow a better understanding of the management of *P. djambal* larvae and fry during their two first weeks of life. The methods of larval rearing are detailed in Chapter VII.

LARVAL CHARACTERISTICS

Biological characteristics of *P. djambal* larvae and fry, from hatching to 15-day-old, are presented in Table VI.1.

Born from larger eggs, newly hatched larvae of *P. djambal* are bigger than those of *P. hypophthalmus*. They possess a large yolk reserve and usually present no cannibalistic behavior. However, in case of food shortage during the first days of life, some rare occurrence of cannibalism could be observed. Due to their initial difference in size, *P. djambal* larvae were also bigger (about 3 times) than those of *P. hypophthalmus* at the onset of exogenous feeding. As a consequence, larval rearing of the former species was easier and high growth and survival rates were regularly obtained (Legendre *et al.,* 2000).

Table VI.1.
Some characteristics of *P. djambal* larvae.

Characteristic	
Total length of larvae at hatching (mm)	4.7
Duration of yolk sac absorption at 28 – 29°C (days)	2.5
Total length of larvae at first feeding (mm)	8.6
Body weight at first feeding (mg)	4.5
Behavior of larvae	No cannibalism
Survival rate at 15 days of age (%)	70 – 94
Body weight at 15 days of age (mg)	190* – 380**

* in stagnant water
** in recycling water system

LARVAL DEVELOPMENT

As hatching of larvae is not synchronous but spread over a period of several hours, the age of a group of larvae refers to the moment at which 50% of larvae have hatched. In the example of hatching kinetics shown previously (Figure V.1), this "T_0" or hatching reference was reached after

about 37 – 38 h of egg incubation at a temperature of 29 – 30°C. The period between hatching and 24-h after hatching is considered as “day 0” and “day 1” starts 24-h after hatching.

Compared to *P. hypophthalmus*, *P. djambal* larvae developed an earlier dark pigmentation which even appeared on the embryos before hatching. During the first week, this pigmentation was restricted to the anterior half of the body. Eleven days after hatching, the fins were almost totally formed and the juveniles presented the general morphology of the adult (Plate VI.1.)

Supplementary observations were also made on the gut development of young fish from post hatching up to the age of 21-day. In *P. djambal*, the digestive tract was not subjected to a major anatomic evolution as is the case in *P. hypophthalmus*. In the relatively large-size post-hatched larvae of the former species, the stomach was visible since the first day. Only some minor morphological changes occurred during development and after 5-day of age the gut already presented the general morphology of that of a 21-day-old juvenile.

As *Artemia* nauplii represent a rather expensive feed, other types of feed were tested as possible substitutes during larval rearing of *P. djambal*. The time of first ingestion of each feed type by the larvae is presented in Table VI.2. It was shown that feed intake could be delayed by 4 to 6-h depending on the available type of feed.

The first feed intake of *P. djambal* larvae fed *Artemia* sp., or *Moina* sp. (49 h at 27 – 30°C) occurred before the yolk sac was totally absorbed (see Table VI.1).

Table VI.2.

First feed intake in *P. djambal* larvae fed with different types of feed.

Feed type	Time after hatching (hours)
Artemia sp.	49 h
Moina sp.	49 h
Daphnia sp.	53 h
40% protein dried diet	55 h

CHOICE OF FEED FOR LARVAL REARING

A comparison of growth and survival rates of larvae fed either *Artemia* sp., *Moina* sp*., Daphnia* sp., tubifex (blood worms) or a 40% protein dried diet was carried out until 11 days after hatching. Although, no differences in survival rates were found between larvae receiving the different types of feed, larvae fed *Artemia* nauplii showed 3 – 4 times faster growth.

Difference in growth rate between larvae receiving the different feeds could be explained at least partly by a faster and greater ingestion of *Artemia* nauplii from the first feeding (3 times) to the 8th day after hatching (20 times) in comparison with other feed types.

Although all feed type tested could be used for larval rearing of *P. djambal* in terms of survival, these results demonstrated that *Artemia* nauplii were clearly more efficient than other feeds. Similar observations were reported for *P. bocourti* (Hung *et al.,* 2002).

STOMACH EMPTYING

It has been shown for different fish species that the optimal frequency of feed distribution during larval rearing depends on age. Indeed, the speed of stomach emptying is related to stomach development and varies as a function of age. Some investigations previously done on *P. djambal* larvae showed also that the period of time between a meal and the total stomach emptying was about 4 – 5 hours until 5 days and increased up to 7 hours after 8 days. It is obvious that these biological changes have an influence on the feeding behavior and on routine work during larval rearing.

WEANING TIME

Previous studies have shown that larvae of *P. djambal* reared in recycling water system and fed with *Artemia* nauplii displayed optimal growth and survival rates. This optimal zootechnical performance was maintained when the larvae were weaned after 4 days only instead of a longer period of one week or more. As a consequence, *Artemia* substitution by an artificial diet from the 5th day of feeding allowed a significant decrease in operating cost of larval rearing.

WATER QUALITY

The parameters of water quality given in Table VI.3 correspond to those observed during various larval rearing of *P. djambal* carried out at JFADC or at RIFA stations. The list of parameters is not exhaustive and among them, only the tolerance to salinity was tested experimentally. Although the lethal limits of other parameters were unknown, respecting the ranges given in Table VI.3 could give good results in terms of growth, survival rates and health of *P. djambal* larvae.

During larval rearing particular attention should be paid to the dissolved oxygen concentration because the requirement of larvae is quite high.

Rearing them below an oxygen concentration of 3 mg.L^{-1} is risky. Besides, from the second day after hatching, *P. djambal* larvae like to swim against the current which keeps them in the most oxygenated part of the rearing tanks.

Table VI.3.
Environmental parameters for rearing *P. djambal* larvae.

Environmental parameter	Observed Range
Temperature (°C)	26 – 31
pH	6 – 8.9
Oxygen (mg.L^{-1})	> 3
Ammonia [NH3] (mg.L^{-1})	< 0.2
Nitrite [NO2] (mg.L^{-1})	< 0.1
Salinity (g.L^{-1})	0 – 4

This particular behavior could be used as a criterion to evaluating the level of oxygen available in the rearing structure. When the oxygen concentration was high enough, the larvae were well spread out in the tank. By contrast, when the concentration of oxygen was too low, the larvae were concentrated in the current resulting from aeration or water inlet.

In terms of temperature, good performance of larvae was obtained in the range tested (Table VI.3). However larvae reared below 28°C were subjected to higher risk of infection by parasites, such as *Ichthyophtirius multifiliis* (white spot disease). In this case, it is recommended to increase artificially temperature up to 28 – 30°C or to administer some preventive treatments (see Chapter VIII) for avoiding infection.

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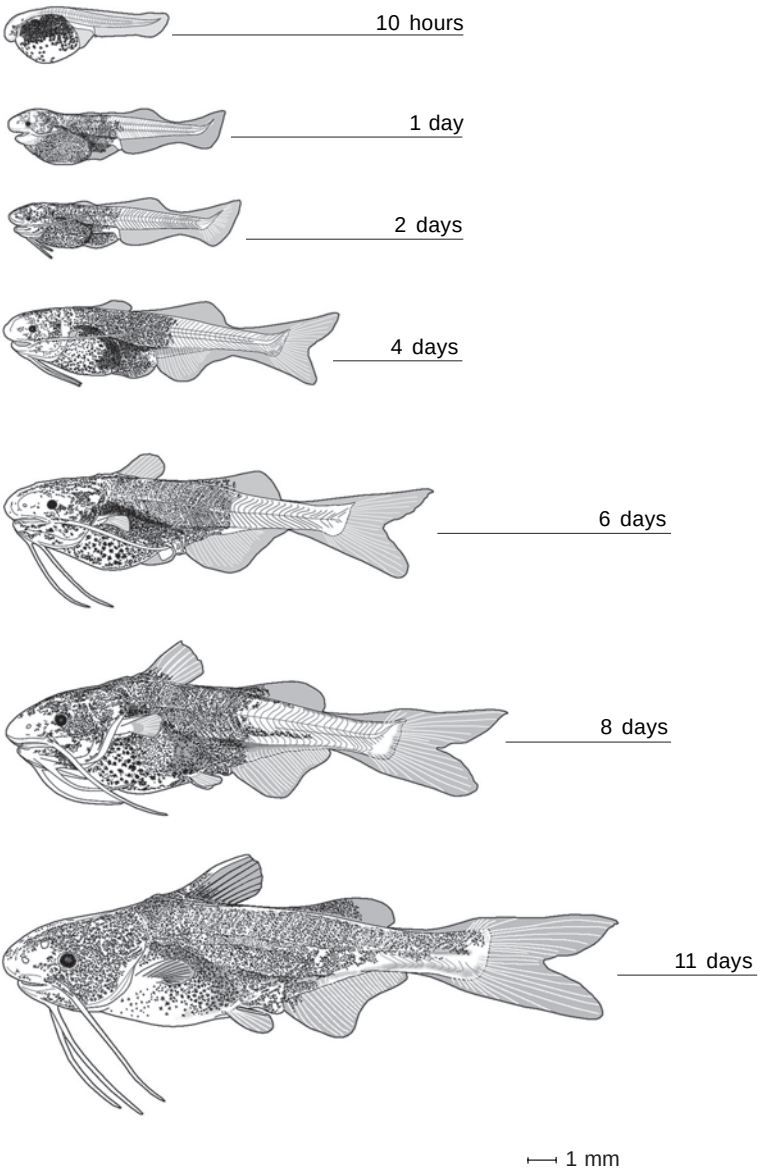

Plate VI.1.

Different stages in the early development of *P. djambal*.

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