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Domestication of *Osteochilus spilurus*: survival and growth in recirculated water

A Kurniawan^{1,2}, M Azhari³ and E Prasetyono²

¹Doctoral Student of Fisheries and Marine Science Faculty, Universitas Brawijaya, Malang, Indonesia

²Aquaculture Department, University of Bangka Belitung, Bangka, Indonesia

³Graduated of Aquaculture Department, University of Bangka Belitung

E-mail: ardian_turen@yahoo.co.id

Abstract. *Osteochilus spilurus* is one of freshwater fish in the river of Bangka and Belitung Island. This fish became an important economically fish in East Belitung. The problem of *Osteochilus spilurus* is the season of fishing and trading which may contribute to reduce its natural population. Nowadays, *Osteochilus spilurus* is still at the first level of domestication. Adaptation using recirculation of water in an artificial container needs to test to pass the first level of the domestication process. Different debit of water recirculation affects survival rate but does not at the growth of *Osteochilus spilurus*. The best treatment was with water debit of 0.11 liters/minute, resulted in a survival rate of $88.33 \pm 0.03\%$, length growth of 0.31 ± 0.06 cm and weight growth of 0.93 ± 0.04 g for 30 days of cultivation. Aggressiveness and sensitivity of *Osteochilus spilurus* decrease after 7 days of cultivation. The researcher can use water circulation in the next level of *Osteochilus spilurus* domestication.

1. Introduction

The wealth of river biodiversity on the islands of Bangka and Belitung, Indonesia is a source of community livelihood. Although tin mining activities that dominate the economy on both islands, it affects the physical and chemical characteristics of the environment [1], utilisation of local freshwater fish continuously done. One of the river commodities with prominent uses is small fish with silvery colors and black dots at the base of the tail. Bangka people call Kapaet for this fish, Cempedik in Belitung community, and *Osteochilus spilurus* in the taxonomy.

Osteochilus spilurus was also identified in rivers on the islands of Sumatra, Kalimantan, and the Malay Peninsula, but the publication was limited to identifying the existence of this species with another ichthyofauna in certain regions. Meanwhile, *Osteochilus spilurus* research on the islands of Bangka and Belitung has included potential aspects of development [2], ethnozoology of fishing [3], morphological and genetic similarity, food habit and maturity [4], phytoplankton as natural feed [5], and domestication experiments [6]. The progress of *Osteochilus spilurus* research on the both islands is based on the trade and economic value of the fish.

Especially in East Belitung, *Osteochilus spilurus* becomes an economically important fish with most of the catching and trading was carried out during the rainy season. Meanwhile, most of *Osteochilus spilurus* are in the level 4 ripe gonad conditions in the rainy season [4]. The exploitation



of *Osteochilus spilurus* in the mature condition is possible to reduce its natural population due to the breakdown of the breeding cycle.

Nowadays, *Osteochilus spilurus* has not been cultivated yet by either the community or research centers. Domestication provides solutions to *Osteochilus spilurus* availability without depending on natural catches. *Osteochilus spilurus* is still at the first level domestication research, namely the first trial of acclimatization to the cultural environment [7]. Adaptation test of *Osteochilus spilurus* on the stagnant water in the treatment of temperature results 3 - 35% survival rate (SR) [6] and algae feeding results 0-14% SR [4] after 30 days of cultivation. We must be to found the methods of keeping *Osteochilus spilurus* survive in the artificial containers to pass the first level of domestication. Adaptation using recirculation of water in an artificial container needs to test on *Osteochilus spilurus* to go through the first level in the domestication process.

2. Method

Research of *Osteochilus spilurus* domestication using water recirculation treatment was done in May until June 2017 at the Hatchery of Aquaculture department, Bangka Belitung University. The *Osteochilus spilurus* samples were got from Lebak River, Bangka Regency at measuring 5-6.5cm. The fish cultivating uses plastic containers with a measure of 40 x 30 x 32 cm. This research used a Completely Randomized Design (CRD) with 4 treatment and 3 repetitions. CRD used as follows:

Treatment A : without recirculation

Treatment B : recirculation treatment with a water flow of 0.05 liter/minute

Treatment C : recirculation treatment with a water flow of 0.08 liter/minute

Treatment D : recirculation treatment with a water flow of 0.11 liter/minute

The fish experiment was conducted for 30 days with a stocking density of 20 fish/containers. Feeding of fish using silkworm (*Tubifex* sp) as much as 5% per day. The fish observation was done every day for survival and behavior, and every seven days for the growth measurement. Survival rate (SR) is the percentage of organisms that live at the end of a certain time. Survival rate was calculated using equation 1 to compare the number of fish at the end and the early of the experiment [8].

$$SR = \frac{N_t}{N_o} \times 100\% \quad (1)$$

Where N_t is the number of fish at the end of experiment and, N_o is number of fish early experiment.

The growth rate of fish on weight and length are calculated by comparing the beginning and end of cultivation size. The calculation of the formula of growth rate is to find the difference in the length or weight of fish between the end and the early of the experiment [9] following equation 2.

$$G = M_t - M_o \quad (2)$$

Where, M_o is length or weight of at the beginning cultivation and, M_t is the final length or weight.

Water quality analysis measured during the study was temperature, pH and DO (dissolved oxygen). Data were analysed by variance to see the real effect between treatments. ANOVA variance test is used to see whether there is an effect of the treatment given.

3. Results and Discussion

Catching and handling of fish sample play an important role in the domestication's success. The process of catching, handling fish, transportation, and density affect the stress level of the fish before being kept in a new and different environment from its natural habitat. *Osteochilus spilurus* as a sample fish was got from fishing using a net. Sample fish transportation from the Lebak river to an aquaculture hatchery at the Bangka Belitung University was done at a density of 20-30 fish per

oxygenated plastic bag and packed in an insulated box with the addition of ice. The cold condition at the transportation box can minimize the stress of fish. The fish sample prepared from Lebak river is shown in Figure 1.



Figure 1. Catching *Osteochilus spilurus* in Lebak river, Bangka Regency.

After keeping the fish for 30 days, there are differences in survival rates were obtained for different water circulation treatments. The treatment of water circulation provides a higher survival rate than maintenance in stagnant water. The higher water recirculation flow shows more fish survive as in Table 1. The higher flow of recirculated water gives an effect on water quality to secure a good growth and a low food conversion ratio [10]. There is no different water quality that can affect the survival rate. Water quality during fish domestication is optimum for aquaculture, specifically the temperature of 26-28°C, the pH of 6.4 - 7.6, and dissolved oxygen of 3.2 - 4.7 mg / l for all treatment.

Table 1. Survival rate of *Osteochilus spilurus* with water recirculation.

Treatment	Averageof survival rate (%)
A	73.33±0.07 ^a
B	76.67±0.06 ^b
C	76.67±0.03 ^b
D	88.33±0.03 ^c

Note: the different superscript letter behind the number says it is significantly

The treatment of 0.11 liter/minute water debit found the highest average survival rate (88.33%). Natural fish habits may cause the survival rate achieved in the highest water debit. *Osteochilus spilurus* is identified in rivers with the slow flow [11]. Schooling of *Osteochilus spilurus* prefers to be in the riverbed with low water flow and moves between plants on the riverbank when rain causes strong stream [4].

20% of fish mortality occurs from the first day to the 10th day of cultivation. Fish mortality is shown as possible due to aggressiveness and sensitivity in seven days of cultivation. However, this achievement is quite successful and better than other first-level domestications. Domestication of manggabai fish (*Glossogobius giuris*) was obtained survival at 87% in floating net cage at the natural environment, and in the pool was only 74% [12].

Recirculation of water does not have a significant effect on fish growth in 30 days cultivation. The growth of *Osteochilus spilurus* on weight and length, which showed in Table 2, is not significant in the different water debit treatment. 30 days is not enough to monitor fish growth in the domestication process because it reduced by the time of adaptation. Fish adaptation to the artificial environment occurred in the first 14 days of cultivation. Fish have aggressive swimming and sensitive to light behavior when starting cultivation. Aggressiveness and sensitivity decrease after 7 days of cultivation. The fish color was darkened at the beginning of treatment and turns bright after 14 days of cultivation. Aggressiveness, light sensitivity and color change are characteristics of stress in fish. The use of energy

for growth is lower during stressful conditions [13]. The decrease in aggressiveness in fish behavior has an effect on the survival rate and growth. The most extreme response to a stressor is death, whereby homeostasis cannot be maintained [14]. The first generation of domestication improved fish growth performance but at this early stage do not change behavioral responses to repeated acute stress exposure [15].

Table 2. Growth of *Osteochilus spilurus* with recirculation.

Treatment	Weight Growth (g)	Length Growth (cm)
A	0.91 ± 0.41^a	0.4 ± 0.303^a
B	0.8 ± 0.13^a	0.25 ± 0.12^a
C	0.94 ± 0.38^a	0.33 ± 0.17^a
D	0.93 ± 0.04^a	0.31 ± 0.06^a

Note: the same superscript letter behind the number says it is not significantly different

The condition of *Osteochilus spilurus* that has been able to live in an artificial container makes it past the first level of domestication. The first level of the domestication is the first trials of acclimatization to the culture environment. It can increase the domestication to the second level. Description of second-level domestication is the part of the life cycle being completed in captivity [7]. The success of the domestication process of *Osteochilus spilurus* is expected to be beneficial for the development of Indonesian freshwater aquaculture and conservation of river environments on the islands of Bangka and Belitung.

4. Conclusion

Different debit of water recirculation affects survival rate but does not at the growth of *Osteochilus spilurus*. The best water debit at 0.11 liters/minute with a survival rate of $88.33 \pm 0.03\%$, length growth of 0.31 ± 0.06 cm and weight growth of 0.93 ± 0.04 g for 30 days of cultivation. Aggressiveness and sensitivity of *Osteochilus spilurus* decrease after 7 days of cultivation. The next level of *Osteochilus spilurus* domestication can use the treatment of water circulation.

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