Biology, Ecology and Aquaculture potential of *Osteochilus spilurus* (Bleeker 1851) in East Belitung, Indonesia

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**Abstract.** *Osteochilus spilurus* is one of the freshwater fish species in the Cyprinidae family which is found in the ancient river region of Sunda shelf which empties toward the North Natuna Sea. This article explores the biological, ecological, and potential characteristics of fish called Cempedik (local name in Belitung Island) as an aquaculture species. Research results and literature showed about feeding habits, reproduction, habitat, and aquaculture potential. It is abundant and well suited for culture in an established market insure, especially Belitung Island, but reproductive biology is not well understood. It can be preserved in an artificial environment, and it is possible to become an aquaculture species as well as other osteochilus genera.

1. Introduction
Domestication of wild local fish into an aquaculture commodity is needed to reduce the pressure of human consumption on its natural population. Although introduced fish is cultivated to fulfill the freshwater fish market, Indonesian people still regularly catch and trade freshwater fish from natural habitat. Especially in local fish. It makes fish catches from inland water in Indonesia is increased in the last ten years [1]. It's the potential to reduce fish populations in their habitats. Fish protection is needed to prevent fish from becoming extinct. When the fish is difficult to find in nature, domestication is too late to begin.

At present, *Osteochilus spilurus* has not been rated as an extinct category of fish. But it might happen if exploited continuously. The economic value of local fish poses a threat to its natural population. *Osteochilus spilurus* trade as consumption fish is found in Belitung Island. There are no trading reports of this fish trade except on Belitung Island. Majority citizens in East Belitung recognize and consume these fish from trade. But the trading was limited in the rainy season [2]. Large numbers of catches are carried out in local rivers to meet market demand, but there is no tonnage data annually [3]. At the moment, Belitung Island has developed into a geopark tourism
destination and places the fish with the local name Cempedik as one of the geo-products. On the one hand, it makes *O. spilurus* more known and on the other hand, increases market demand, which impacts its natural catches.

Domestication of *O. spilurus* has passed the first level [4]. Nevertheless, if the process stops at this level, it corresponds only to taming, i.e., to the modification of the behavior of a wild animal during its lifetime. Most farmed fish species are at an early stage of domestication (levels 2 or 3). Once the entire life cycle is controlled, but there are still wild inputs into the restricted stocks [1]. The process to reach this stage requires biological and ecological information. Market potential of product is also needed in the conversion of wild fish into aquaculture products.

2. Method

The study was conducted in December 2016 to September 2017. *Osteochilus spilurus* samples using specimens collected from fishermen's catches in East Belitung, Indonesia (02°55'09.7" LS - 108°06'35.3" BT). Biological observations focused on feed habits and the level of gonad maturity in the catching season in 36 randomly selected fish samples.

Feed habit of fish samples was observed the contents of the stomach using a microscope. The result were compared with the Jense identification book [5]. The frequency of diets can be calculated following the formula [6]:

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\text{Frequency of diets (\%)} = \frac{\text{Number of occurrences of a type of diet}}{\text{Number of stomach containing diet}} \times 100
\]

Observation of the fish gonads using physical condition. Determine gonad maturity level refers to the histological characteristics of the modified *Osteochilus vittatus* gonad according to Omar [7]. Male fish at level III have milky white gonads which fill half of the abdominal space, while level IV gonads fill most of the abdominal area. Female level III fish are characterized by an ovary containing a bright yellow-grained egg that fills half of the abdominal space, and reaches level IV when filling most of the abdominal area.

The habitat ecology of *O. spilurus* is visually observed at the location of its capture and information from fishers. The potential of aquaculture was assessed based on the domestication literature and the results of a consumption survey and the Belitung Island society's preference for *O. spilurus* products.

3. Result and Discussion

The results of the analysis of the stomach contents found five types of food, namely, Microcystis, Fragilaria, *Aphanothece stagnina, Navicula* sp, and *Pinnularia* spp. The frequency of occurrence of phytoplankton types is presented in Figure 1. Microcystis (Cyanophyceae) and Fragilaria (Bacillariophyceae) became the predominant phytoplankton with a percentage of more than 25%. The occurrence frequency of fish food more than 25% can be stated as the primary food, while less than 25% is an additional food or fish supplement food [5].
Figure 1. Diagram of frequency of occurrence of each type of food

The types of food found are possible according to availability in nature. The availability of phytoplankton in the Lenggang River matches the type of food that dominates. Bacillariophyceae became the dominant phytoplankton in the Lenggang River by 37% and Cyanophyceae 15% [8]. Similar conditions are exposed to species of the genus Osteochilus. *Osteochilus melanopleura* is reported to be substantial quantities of green algae and phytoplankton, so it is assessed to be predominantly herbivores [9]. The genus Osteochilus as part of Cyprinidae refers to herbivorous properties. However, *Osteochilus vitatus* and *O. hasselti* are dominated by algae in gut content [10]. Information about *O. spilurus* natural feed in its natural habitat can underlie the selection of the type of feed given in the domestication effort.

The results of observations of gonad maturity showed male fish with maturity level III was 67%, and level IV was 33%. Observations on female fish samples showed level III maturity data of 70% and level IV of 30%. The maturity diagram is shown in Figure 2, the appearance of a mature gonad osteochilus in figure 3. Maturity conditions indicate that male and female Cempedik fish are entering the spawning season when sampling is done in December. That month was also the rainy season in Indonesia and became the abundant fishing season with the highest trade volume in East Belitung.

Figure 2. Percentage of maturity level for female (right) and male.

Figure 3. Male (left) and female (right) maturity level IV of Osteochilus spilurus
Catching of fish in the mature condition of gonad has the potential to break the fish's reproductive cycle naturally. Thousands or even millions of prospective new fish individuals in nature have failed to bring up a new generation. However, this species is not yet known whether it is a spawning type once or many times throughout the year. Other species in the Osteochilus genus, O. hasselti, can spawn throughout the year [11]. O. vittatus is a partial spawner, i.e., the species of fish that do not remove mature eggs at once at the time of spawning, spawning in the river has been linked to high water levels due to rain or flood [12].

O. spilurus in rivers live in groups and move in schooling. When schooling together with other fish species, namely Rasbora sp, Puntius lineatus, Beta sp, Osteochilus wandersii, Puntius binotatus, and Cyclocheilichthys apogon, O. spilurus is at the bottom of schooling. O. spilurus is benthopelagic (living between surfaces and areas in water) in rivers with heavy currents in deeper channels and slow flow [13]. The flow waters have become the habitat of this fish, even though the area with a weak current is the choice to move actively. Body size ranging from 49.43 ± 2.21 mm affects the ability of fish to deal with strong currents.

Schooling of O. spilurus is the target of arrest using the passive fishing gear. The placement of fishing gear on the edge of a river that grows Pandanus sp shows that the fish choose to move on the side of a river that has a slower current. Plants that live on the edge become one of the characteristics of O. spilurus river habitat on Belitung Island. Water plant resistance decreases the strength of the current so that it becomes the preferred water flow.

Water flow has an essential role in O. spilurus. This is reflected in the domestication process, most of which remain alive and decrease the indication of stress when maintained in running water. Aggressivity, light sensitivity, and color change, i.e., characteristics of stress in fish, decrease after seven until 14 days of cultivation in water flow treatment [4]. This achievement at the first level of domestication provides an opportunity to continue efforts towards commodity aquaculture at the 3rd or 4th level.

O. spilurus trade is based on the consumption of this fish by the people of East Belitung. More than 80% of respondents from the society in the Districts of Gantung and Manggar, East Belitung who know the fish said that they consume and like it [2]. There are at least more than 94 thousand East Belitung residents aged over 14 years become a market of O. spilurus cultivation if it has been successfully domesticated. The development of Belitung as a geopark tourism destination will increase the demand for exclusive local products base on O. spilurus. If each individual consumes one kilogram of fish per week, more than 3 tons of O. spilurus production is needed.

Maybe the opportunity is not a big market compared to aquaculture products that have been developed. But as a product that originates from local wisdom, its development into an aquaculture commodity is still needed to reduce natural population pressure and meet the needs of the local market and tourism.

4. Conclusion

The natural feed of Osteochilus spilurus based on gut analysis shows phytoplankton as the primary food. More than 67% of fish caught enter maturity level IV during the rainy season, so it is predicted to be spawning time. As with other Osteochilus genera, the spawning type may be partial spawner. These fish are caught in freshwater waters with slow flow and shelter in riverbank plants during heavy currents. O. spilurus prospect for aquaculture because now day it passed the first level of domestication. More than 80% of the population of East Belitung consuming and liking it becomes a potential local market.

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