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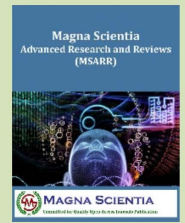


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Growth and survival of bronze featherback (*Notopterus notopterus*, Pallas 1769) reared on bucket

Muslim Muslim* and Wendy Julius Simanjuntak

Aquaculture Study Program, Department of Fisheries, Faculty of Agriculture, Universitas Sriwijaya, Indralaya, Indonesia.

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Abstract

The bronze featherback (*Notopterus notopterus*, Pallas 1769) is a freshwater fish species native to Indonesia. The population of *N. notopterus* has declined in the wild due to overexploitation and habitat destruction. The Indonesian government has listed *N. notopterus* as a protected species. The extinction of this species can be prevented by cultivation. Studies on the rearing of *N. notopterus* are limited. The aim of this study was to determine the survival and growth of *N. notopterus* reared in bucket and fed with different diets. The results showed that *N. notopterus* survived and grew in the bucket. The growth of *N. notopterus* fed with *Caradina* sp. was better than that fed with *Rasbora* sp. The results of this study provide initial information for the aquaculture of *N. notopterus* in the future.

Keywords: Aquaculture system; Fish farming; Fish feeding; Knifefish; Protected species

1. Introduction

Species belonging to the family Notopteridae are distributed in Indonesia, India, Malaysia, Thailand, Bangladesh, Pakistan, and Vietnam (Barby et al., 2018; Hilton & Lavoué, 2018; Kottelat, 2013; Mustafa et al., 2014; Naeem et al., 2010; Srivastava, Singh, & Pandey, 2012). Species belonging to the family Notopteridae are known by the common name knifefish, referring to their knife-like morphology. Ten species of knifefish are found in four genera (*Papyrocranus*, *Xenomystus*, *Chitala*, and *Notopterus*) (Barby et al., 2018). The ten species are *Papyrocranus congoensis*, *Papyrocranus afer*, *Xenomystus nigri*, *Chitala borneensis*, *Chitala blanci*, *Chitala chitala*, *Chitala lopis*, *Chitala hypselonotus*, *Chitala ornata*, and *Notopterus notopterus* (Hilton & Lavoué, 2018). They originate in India and Southeast Asia, as well as western and central Africa (Inoue et al., 2009). *C. ornata* is distributed in Thailand (Osathanunkul & Minamoto, 2020), Vietnam (Gam et al., 2018), and Philippines (Castro et al., 2018). *P. afer* and *X. nigri* in Nigeria (Oluwale & Ugwumba, 2019), *C. blanci* in Thailand (Maneechot et al., 2015), and *N. notopterus* in Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Pakistan, Philippines, Thailand, and Vietnam (Achakzai et al., 2015; Gupta et al., 2013; Kyaw et al., 2020; Mohanty & Samanta, 2016; Mustafa et al., 2014; Naeem et al., 2010; Winn et al., 2021). In Indonesia, fishes belonging to the Notopteridae family are distributed in Java Island, Sumatra Island, and Kalimantan Island (Kottelat, 2013; Kottelat et al., 1996). In Indonesia, the Notopteridae family consists of four species: *Chitala lopis*, *Chitala hypselonotus*, *Chitala borneensis*, and *Notopterus notopterus*.

Four species of fish in the family Notopteridae are known by the local Indonesian names "ikan belida" and "ikan putak". These fish are utilized by the community as food for daily side dishes and also as ornamental fish for display in aquariums. In addition, these fish are also used as raw materials to produce Palembang specialties, namely "pempek" (fish snacks) and "kerupuk-kemplang" (fish crackers). This species has potential to be cultivated (Muslim et al., 2020). The increasing demand for fish has led to increased exploitation of this species. This is one of the causes of the decline in the population of fish species in the Notopteridae family in nature. This species is categorized as critically endangered

* Corresponding author: Muslim Muslim

(Iskandar et al., 2020). To prevent the extinction of these species, the Government of the Republic of Indonesia, c.q the Ministry of Maritime Affairs and Fisheries, established the Decree of the Minister of Maritime Affairs and Fisheries Number 1 of 2021 regarding protected species. Four fish species belonging to the Notopteridae native to Indonesia, including *C. lopis*, *C. hypselonotus*, *C. borneensis*, and *N. notoapterus*, are all included in the list of protected fish species (Kepmen KP, 2021).

The bronze featherback (*Notopterus notoapterus*, Pallas 1769) is a freshwater fish species native to Indonesia. *N. notoapterus* has been found in Bangka Islands, South Sumatra, Lampung, Jambi, Riau, and Kalimantan (Mulyani & Budijono, 2014; Muslim & Lestari, 2005; Muslim & Syaifudin, 2022; Rapita et al., 2021; Wibowo et al., 2009). In South Sumatra, the population of *N. notoapterus* has declined dramatically. It is urgent to domesticate this species. The aim of this study was to adapt *N. notoapterus* in buckets as an early domestication. This study provides initial information on the rearing of *N. notoapterus* in buckets.

2. Material and methods

2.1. Time and Location

Fish collection was conducted in Kelekar River, Tanjung Pring Village, Indralaya District, Ogan Ilir Regency, South Sumatra, from May to June 2023. Fish rearing was conducted at UPR Batanghari Sembilan, Timbangan Village, North Indralaya District, Ogan Ilir Regency, South Sumatra. Fish rearing was conducted from June to August 2023.

2.2. Fish Collection

The collection of *N. notoapterus* in the Kelekar River was done in collaboration with local fishermen. *N. notoapterus* was caught using traditional fishing gear, namely pengilar (fish trap) and bubu (fish trap). The *N. notoapterus* was transported to UPR Batanghari Sembilan. The transportation system used is a wet system, where the fish is put into a plastic bag that has been filled with water, then input pure oxygen, after which the bag is tied with rubber and transported.

2.3. Preparation of Buckets

A total of 10 buckets were used to rear *N. notoapterus*. The specifications of the bucket used are made of polyethylene plastic, 80 liters in volume, 51 cm in diameter, 56 cm in height, light green in color. Each bucket was equipped with aeration and filter installation. The bucket cover is hollowed out using the holesaw kit set. Before use the buckets were washed with fresh water until clean. Then the tub was dried and filled with 60 liters of clean water. After the bucket is filled with water, the water is aerated for 24 hours. After that, the bucket was ready to be stocked with *N. notoapterus*.

2.4. Fish Rearing

A total of 20 *N. notoapterus* were used in this study. Body weights of *N. notoapterus* used ranged from 67 to 93 grams per individual, and total lengths ranged from 20 to 23.5 cm. The *N. notoapterus* used was caught in the Kelekar River. Two *N. notoapterus* were kept in each bucket. *N. notoapterus* was reared in a bucket for 30 days.

2.5. Fish Feeding

Two types of feed were used in this study, namely ikan seluang (*Rasbora* sp) (fish) and udang beras (*Caridina* sp) (shrimp). Feeding the fish was done twice per day, from 12:00 to 13:00 pm and 16:00 to 17:00 pm (Western Indonesian Time). The feeding rate was 2% of the fish biomass in each bucket.

2.6. Parameters Measurement

The absolute weight growth (*W*) is the body weight of the test fish at the end of the rearing (*W_t*) minus the body weight of the test fish at the beginning of the rearing (*W_o*). Calculation of *W* using the formula: $W \text{ (g)} = W_t \text{ (g)} - W_o \text{ (g)}$. The total length growth (*L*) is the total length of the test fish at the end of the rearing (*L_t*) minus the total length of the test fish at the beginning of the rearing (*L_o*). Calculation of *L* using the formula: $L \text{ (cm)} = L_t \text{ (cm)} - L_o \text{ (cm)}$. Specific growth rate (*SGR*) is a coefficient that measures the percentage increase in fish weight per day. *SGR* calculation using the formula:

$$SGR = \frac{(\ln W_t - \ln W_o)}{t \text{ (days)}} \times 100$$

Where W_0 is the body weight of the fish at the beginning of the rearing (g), W_t is the body weight of the fish at the end of the rearing (g), t is the number of days during the rearing, and \ln is the natural logarithm.

2.7. Data Analysis

Data collected in this study included growth in length, growth in weight, specific growth rate, survival rate, and water quality. Data analysis was done descriptively.

3. Results and discussion

This study has successfully reared *N. notopterus* in buckets. The results showed that *N. notopterus* survived in the bucket during the 30-day rearing period. In addition, *N. notopterus* was also able to utilize the feed provided. So that the fish reared on bucket increasing in size. The results of this study were presented in Table 1.

Table 1 Bronze featherback (*Notopterus notopterus*, Pallas 1769) reared on bucket fed different diets

Parameters	Fed with <i>Caridina</i> sp (AVG±STDV)	Fed with <i>Rasbora</i> sp (AVG±STDV)
Initial length (cm)	22.11±1.34	22.33±1.35
Final length (cm)	23.83±1.27	23.16±1.40
Growth in length (cm)	1.72±1.20	0.83±0.71
Initial weight (g)	83.78±11.57	84.04±11.78
Final weight (g)	92.39±11.02	91.39±11.42
Growth in weight (g)	8.61±2.55	7.35±2.81
Specific growth rate (%)	0.33±0.12	0.29±0.12
Survival rate (%)	100±0.00	100±0.00
Water quality:		
Temperature (°C)	27-28.5	27-28.6
Dissolved oxygen (mg/L)	6.0-7.2	6.0-7.4
pH (unit)	5.3-6.1	5.5-6.3
Ammonia (mg/L)	0.023-0.027	0.024-0.27

This study has successfully adapted *N. notopterus* to buckets. The survival rate of *N. notopterus* in buckets fed with *Caradina* sp. was 100%, as were those fed with *Rasbora* sp. These results show that the survival rate of *N. notopterus* is very good. During rearing, *N. notopterus* grows. Growth is a quantitative change, which is the increase in fish size, including length and weight. The results showed that *N. notopterus* reared in buckets increased in length and weight. Although the environmental parameters in the bucket were different from those in the wild, *N. notopterus* grew. This study shows that the water quality in the bucket is suitable for the life of *N. notopterus*. These results are similar to previous studies, where *N. notopterus* survived and grew in box containers and aquaria (Muslim et al., 2023). The growth of reared fish is affected by the quality and quantity of feed. In this study, the feed used was swamp shrimp (*Caradina* sp.) and seluang fish (*Rasbora* sp.). The feeding rate of the two feeds given was the same at 2%. Based on the results of this study, *N. notopterus* fed with *Caradina* sp. was better than *Rasbora* sp. The protein content of *Caridina* sp. is 30.21% while the protein content of *Rasbora* sp. is 15.23%. According to Sumokwo et al., (2018), the nutritional content of *Caridina nilotica*. namely protein 53.63%, fat 4.46%, ash 15.2%, and fibre 0.8%. The nutritional content of seluang fish (*Rasbora argyrotaenia*) is 10.39% protein and 2.38% fat (Utami et al., 2016). Proximate fresh meat of *N. notopterus* contains 18.31-21.70% protein, 0.97-2.58% fat, 0.81-1.58% ash, and 75.90-78.04% moisture.

4. Conclusion

This study has successfully reared *N. notopterus* in buckets. The results showed that *N. notopterus* has a good ability to survive. *N. notopterus*, reared in buckets, grew. The growth of *N. notopterus* fed with *Caradina* sp. was better than that

fed with *Rasbora* sp. The results of this study provide initial information for the aquaculture of *N. notopterus* in the future.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there are no conflicts of interest in this study.

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