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# *GROWTH PERFORMANCE AND ECONOMIC ANALYSIS OF SNAKEHEAD (CHANNA STRIATA) FISH FARMING SEMI INTENSIVE SYSTEM*

## *Kinerja Pertumbuhan Dan Analisis Ekonomi Budidaya Ikan Gabus (Channa striata) Sistem Semi Intensif*

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**ABSTRACT**

The high market demand for snakehead fish (*Channa striata*) makes aquaculture activities one of the solutions to declining production in nature and increasing production of snakehead fish. Various cultivation systems are used to increase productivity while still focusing on economic benefits. This study aims to determine growth performance, survival rate, and economic analysis of snakehead fish farming cultivated with a semi-intensive system. The research method consists of 2 stages, namely nursery and growthout phase. Artificial feed in the form of pellets is used during cultivation. The nursery phase uses seeds with a size ± 1 cm (0.4 g/fish), kept in a fiber tank with a density of 10 fish/liter for 30 days. Growthout phase using seeds of size 5 – 7 cm (18 g/fish) is maintained in an earthen pond with a density of 20 fish/$m^2$ for 150 days. The average daily growth and survival rate of snakehead fish at the nursery phase were 0.59 g/day and 87%, respectively, while at the growthout phase were 0.55 g/day and 90%. The feed conversion ratio at the growthout phase is 1.48. The percentage of feed costs in the growth out phase is the highest percentage of other costs, which is 48.8% of total operational costs. The profits obtained from snakehead nursery and growthout activities are Rp. 585,000 and Rp. 2,505,000, respectively. The results of this study show that semi-intensive snakehead fish farming shows good performance and is economically profitable so it can be developed as a solution to increase snakehead fish production.

**Keywords** : Aquaculture, Economic analysis, Growth performance, Semi-Intensive, Snakehead fish

**ABSTRAK**

Tingginya permintaan pasar ikan Gabus (*Channa striata*) menjadikan kegiatan budidaya sebagai salah satu solusi menurunnya produksi di alam serta meningkatkan produksi ikan Gabus. Berbagai sistem budidaya digunakan untuk meningkatkan produktivitas dengan tetap berfokus pada keuntungan secara ekonomi. Penelitian ini bertujuan untuk mengetahui kinerja pertumbuhan dan analisis ekonomi budidaya ikan Gabus yang dibudidayakan dengan sistem semi intensif. Metode penelitian terdiri dari 2 tahapan yaitu pendederan dan pembesaran ikan.

Pakan buatan berupa pellet digunakan selama budidaya. Pendederan ikan menggunakan benih berukuran ± 1 cm (0,4 g/ekor) dipelihara dalam bak fiber dengan kepadatan 10 ekor/liter selama 30 hari. Pembesaran ikan menggunakan benih ukuran 5 – 7 cm (18 gram/ekor) dipelihara dalam kolam tanah dengan kepadatan 20 ekor/$m^2$ selama 150 hari. Pertumbuhan rata-rata harian dan tingkat kehidupan ikan Gabus pada tahap pendederan masing – masing yaitu 0,59 gr/hari dan 87%, sedangkan pada tahap pembesaran yaitu 0,55 gr/hari dan 90%. Ratio konversi pakan yang dihasilkan pada tahap pembesaran yaitu 1,48. Persentase biaya pakan dalam tahap pembesaran merupakan persentasi tertinggi dari biaya lainnya yaitu 48,80% dari total biaya operasional. Keuntungan yang diperolah dari kegiatan pendederan dan pembesaran ikan Gabus per siklus masing – masing yaitu Rp. 585.000 dan Rp. 2.505.000. Hasil penelitian ini menunjukkan bahwa budidaya Ikan Gabus secara semi intensif menunjukkan kinerja yang baik serta menguntungkan secara ekonomi sehingga dapat dikembangkan sebagai upaya peningkatan produksi ikan Gabus.

**Kata Kunci** : Akuakultur, Analisis ekonomi, Ikan Gabus, Kinerja pertumbuhan, Semi intensif

## INTRODUCTION

Snakehead fish (*Channa striata*) is a type of fish that has high economic value and is widely used in people's lives. This fish has many benefits, such as for consumption and medicinal purposes, so demand for it in the market is increasing, both in small (seed) and large (consumption size). Snakehead fish is used as an ingredient for treatment because it contains albumin which is very good for the body, especially in accelerating the healing of cell tissue (Suriansyah *et al.,* 2023). Along with the increase in market demand for snakehead fish, the population of snakehead fish in nature is decreasing. According to Sirodiana & Irwan (2018), the decline in snakehead fish populations in nature is caused by several factors, including predators, pollution and overfishing. In line with this statement, the decline in snakehead fish production in nature is a result of exploitation carried out by fishing in nature and will gradually cause extinction (Merdekawati and Agam, 2021; Yulintine *et al.,* 2023).

Snakehead fish have several advantages both in biological and economic aspects. Biologically the snakehead fish is a very strong fish, this fish can live in aquatic environments with low acidity, besides that it can still survive in locations with little water because it has a breathing apparatus that can be used to take free oxygen directly from the air for breathing. (Augusta & Pernando, 2019; Muslim, 2019). Economically, this fish has a high selling price, grows quickly in nature, and is tolerant of high densities. With its superior biological and economic aspects, snakehead fish has great potential and is promising for aquaculture business activities (Saputra and Mahendra, 2019; Saputra *et al.,* 2020; Ansyari *et al.,* 2022).

Snakehead fish cultivation is one of the efforts that can be made to maintain the population and increase production of Snakehead fish to meet market needs, besides that it can be used as a business opportunity for fish farmers (Mulyani *et al.,* 2023). Some of the problems in cultivating snakehead fish include low survival rates during the cultivation period, limited seeds from hatcheries and slow growth due to relying on natural food. Various kinds of solutions have been implemented by cultivators to solve this problem, including using artificial feed in the form of pellets (Akbar and Iriadenta, 2021), using a closed system with aquaponic technology (Saputra, 2020; Mudlofar *et al.,* 2021), implementing a "water system green" or green water system (Saputra *et al.,* 2018a), administration of vitamin C and immunostimulants such as astaxanthin and garlic as antioxidants (Dwinanti *et al.,* 2018; Sasanti, 2019; Sofian *et al.,* 2019), biofloc system ( Pangaribuan and Sembiring, 2022), the use of probiotics and

synbiotics, namely a combination of probiotics and prebiotics (Saputra *et al.,* 2018b; Saputra *et al.,* 2022; Safitri *et al.,* 2024).

Semi-intensive cultivation is cultivation activities using fiber, plastic or concrete ponds with irrigation using pumps, feeding with a combination of artificial feed and natural feed, and applying fertilizers (fertilizer, lime, probiotics). Semi-intensive fish farming systems have been used for various types of fish such as cultivating Jantimbulan Tilapia (Oreochromis sp), goldfish (Cyprinus carpio), and milkfish (Rizky *et al.,* 2022; Yampu *et al.,* 2022; Tampubolon *et al.,* , 2023). This system is used to increase business productivity by increasing the growth and life of fish which will have an impact on business profits. For this reason, this research was conducted to determine the growth performance and economic analysis of snakehead fish (*Channa striata*) cultivated using a semi-intensive system.

## METHODS

### Time and Place of research

This research was carried out in May – December 2023 at the Fish Pest and Disease Laboratory, AUP Polytechnic of Lampung, which is located at Pantai Harapan Street, Way Gelang, Kotaagung District, Tanggumus Regency, Lampung Province.

### Tools and Materials

The tools used in this research are fiber tubs measuring 2 x 0.5 x 1 m for fish nurseries, 75 m2 earthen ponds for fish rearing, warings for pond fences and fiber tub covers, feed buckets and ladles for feeding, scales. for weighing fish and feed, scoops and buckets for catching and transferring fish. Meanwhile, the materials used are 1 cm snakehead fish seed, PF 500 size pellet feed (0.5 – 0.7 mm) for nursery, 2 – 3 mm size pellet feed for rearing, probiotics, lime and organic fertilizer.

### Research stages

Research activities were carried out using qualitative methods. This research consists of two stages, namely fish nursery and fish rearing. Fish nursery is carried out for 30 days while fish rearing is carried out for 150 days.

*Fish nursery*

Snakehead fish breeding uses seeds of uniform size, namely ± 1 cm with an average weight of 0.4 grams/head. Preparation for fish nursery is carried out in stages: (i) preparing a rearing container in the form of a tank with a volume of 1000 L which has been cleaned, (ii) filling the tank with water up to a volume of 300 L and leaving it for 3 days, (iii) stocking the fish seeds through an acclimatization process with a density of 10 fish/liter, (iv) cover the surface of the tub with waring so that the seeds do not jump. During rearing, fish seeds are fed artificial feed in the form of pellets (PF 500) with a minimum protein content of 39 – 41%. The frequency of feeding during the rearing process is done twice using the adlibitum method. Water changes are carried out every 3 days, by replacing 30% of the total water volume. Harvesting is carried out after raising the fish for 30 days. Harvesting is done by catching fish by removing all the water from the tank.

*Fish rearing*

The rearing of snakehead fish is carried out after harvesting the fish at the nursery stage. The stages of fish rearing are carried out in earthen ponds. Earthen ponds are prepared by drying the pond, liming at a dose of 200 grams/m2 and fertilizing with organic fertilizer at 200

grams/m2. Next, fill it with water as high as 50 cm and leave it for 3 days until the water turns brownish green, which indicates that the maintenance medium has grown plankton. Before the seeds are spread into the pond, the entire pond embankment is installed with a 10 cm high warping so that the fish do not jump out of the pond. The seeds used in snakehead fish rearing activities are seeds harvested from nursery activities, with an average size of 18 grams/head. Seeds are stocked at a stocking density of 20 individuals/m2 using an acclimatization process. During the rearing process the fish are given pellet feed (2 – 3 mm in size) with a protein content of 32 – 34%. The frequency of feeding is 2 times/day in the morning and evening with the amount of feed given being 3 – 5% of the total weight of the fish. The percentage of feed is adjusted to a percentage of 5% (≤ 50 days), 4% (51 – 100 days) and 3% (≥ 101 days until harvest). During the fish rearing process, probiotics are spread in the rearing media at a dose of 2 ml/m3. Probiotics should only be given if the pool water is dark green. Harvesting activities are carried out after the fish have been kept for 150 days by catching all the fish in the pond along with removing the water from the pond.

**Data Analysis**

Data analysis was carried out using Microsoft Excel. The data analyzed in this research includes data on average daily growth (ADG), survival rate (SR) and feed conversion ratio (FCR). However, FCR calculations are only carried out for fish rearing activities. Calculation of these data uses the following formula:

$$\text{Daily growth rate } \left(\frac{\text{gr}}{\text{day}}\right) = \frac{(\text{final fish weight - initial fish weight})}{\text{times}}$$

$$\text{Food convertion ratio} = \frac{\text{Food Total}}{\text{fish weight total}}$$

$$\text{Survival Rate (\%)} = \frac{\text{final amount of fish}}{\text{initial amount of fish}} \; x \; 100$$

## RESULT

Snakehead fish seeds that are reared for 30 days in the fish nursery produce an average fish weight of 18 grams/fish with a length of 5 – 7 cm. The average daily growth of Snakehead fish during the nursery period (0.59 gr/day) is higher compared to the growth of Snakehead fish during the rearing period (0.55 gr/day). Snakehead fish with an average weight of 18 grams/head produce an average weight of 100 grams/fish during a rearing period of 150 days. The life rate of snakehead fish during cultivation activities is 87 – 90%. The fish mortality rate at the fish rearing stage (10%) is lower than at the fish nursery stage (13%). The feed conversion produced during the semi-intensive system of snakehead fish rearing is 1.48. The growth performance of semi-intensive cultured snakehead fish is presented in Table 1.

**Table 1. Performance of semi-intensive snakehead fish**

| Parameter | Nursery | Rearing |
|---|---|---|
| Daily Growth Rate (gr/day) | 0,59 | 0,55 |
| Food convertion rasio | - | 1,48 |
| Survival rate (%) | 87 | 90 |

Operational costs and profits in growing snakehead fish in one cycle (30 days) are Rp. 720,000/cycle and Rp. 585,000/cycle, so the percentage of profit obtained is 81.25% of the

total operational costs. Meanwhile, operational costs and profits for raising snakehead fish in one cycle (150 days) are respectively Rp. 4,920,000/cycle and Rp. 2,505,000/cycle, so the profit percentage obtained is 50.9%. Analysis of semi-intensive snakehead fish cultivation businesses is presented in Table 2.

**Table 2. Analysis of semi-intensive/cyclical snakehead fish business**

| Parameter | Nursery (30 day) | Rearing (150 day) |
|---|---|---|
| Operasional Cost | | |
| Seed (Rp)[1] | 300.000 | 750.000 |
| Food (Rp)[2] | 60.000 | 2.400.000 |
| Saprotan (fertilizer, lime, probiotic) (Rp) | - | 150.000 |
| Depreciation of equipment and irrigation (Rp) | 60.000 | 120.000 |
| Labor (Rp) | 300.000 | 1.500.000 |
| Income[3] | 1.305.000 | 7.425.000 |
| Profit | 585.000 | 2.505.000 |

[1]The price of 1 cm seed is Rp. 100/head, price for 5-7 cm seeds Rp. 500/head
[2] Feed during nursery ± 5 kg; feed during rearing 200 kg; price Rp. 12,000/kg
[3] Selling price for 5-7 cm seeds Rp. 500/head, fish selling price 100 -125 gr/head (size 8 – 10) Rp. 55,000/kg

Feed costs are the highest operational costs used in fish rearing with a cost percentage of 48.80%. Meanwhile, the lowest costs are equipment costs with a cost percentage of 2.40% of total operational costs. The percentage of operational costs for semi-intensive snakehead fish rearing is presented in Figure 1.

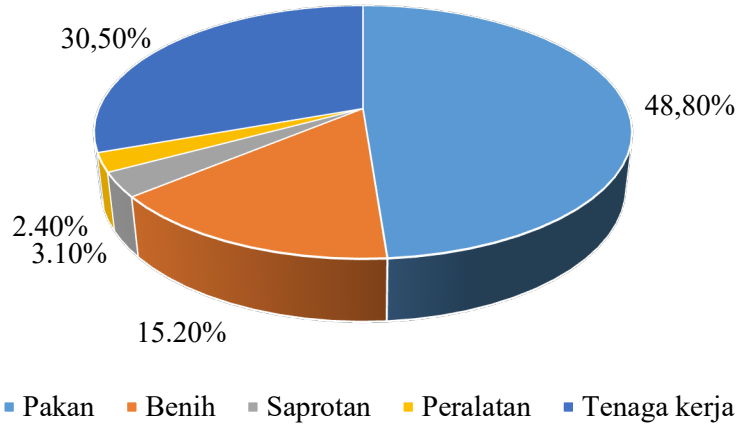


Figure 1. Percentage of operational costs for growing snakehead fish

## DISCUSSION

Fish growth during the cultivation period is generally determined by the amount of feed consumed, efficiency in digestion and absorption of feed nutrients during a certain rearing period. The average daily growth of snakehead fish cultivated using a semi-intensive system in this study was 0.55 - 0.59 grams/day. This result is higher when compared with research reported by Prakoso *et al.,* (2018), cultivating snakehead fish with fingerlings measuring 0.88 ± 0.05 g/fish for 21 days has an average daily growth of 0.021 – 0.025 g/day which is cultivated in 0, 5 and 10 ppt freshwater media. However, this result is lower when compared to research

conducted by Pangaribuan and Sembiring (2022), the average daily growth of snakehead fish cultured with a biofloc system is 0.97 grams/day. Another study reported that the use of silkworm feed for snakehead fish larvae resulted in an average growth of 0.25 grams/day (Yulintine *et al.,* 2023). Differences in snakehead fish growth are thought to be influenced by the cultivation system used, the maintenance period and the type of feed used during the cultivation period. In the semi-intensive cultivation system, the feed used is a combination of natural feed and artificial feed. In addition, the use of pellet feed with a protein content of 32 - 41% in this study is thought to be able to support the growth of snakehead fish well. This is because protein in feed can affect fish growth. Apart from the feed factor, semi-intensive cultivation also uses a stocking density that is not too high so that the cultivated fish can grow well.

In this research, the life rate of snakehead fish cultivated using a semi-intensive system was 87 – 90%. These results are the same as research conducted using a synbiotic system, namely by administering a combination of prebiotic honey and probiotic Lacticaseibacillus paracasei which was able to produce a survival rate of 85-95% (Djauhari *et al.,* 2022). However, the results of this research are higher when compared with the life level of snakehead fish cultivated using an aquaponics system using seeds measuring 8-10 cm with a rearing period of 165 days, namely only 86.5% (Mudlofar *et al.,* 2021). According to Augusta and Pernando (2019), the life rate of snakehead fish larvae is 89.6%, with the death rate of snakehead larvae being 10.3%. Another study reported that the average survival rate of snakehead fish larvae when given artificial feed in the form of Daphia, silk worms and artificial feed was 83.3% - 100% (Yulintine *et al.,* 2023). Snakehead fish cultivated using a green water system with natural food in the form of Chlorella sp have a survival rate of 93.4% -94.3% (Saputra *et al.,* 2018a). It is suspected that the method of adlibitum feeding of pellets during the nursery period and feeding with a feed percentage of 3 – 5% at the rearing stage is sufficient for the snakehead fish's feed needs so as to minimize the death rate caused by cannibalism. Snakehead fish cultivation using a semi-intensive system has the potential for good success with a high percentage of survival rate.

The feed conversion ratio for snakehead fish cultivated using a semi-intensive system in this study was 1.48. This result is higher than research conducted by (Ibrahim *et al.,* (2024), the feed conversion of snakehead fish cultivated using probiotics is 1.36. When compared with the results of research conducted by Iskandar *et al.,* 2023, this result shows the value better feed conversion because in the research conducted, the author reported that the feed conversion ratio obtained was 2.28. However, the feed conversion ratio in this study was higher compared to the results of research conducted by Muliati *et al.,* Snakehead fish fed pellets were able to produce a feed conversion ratio of 1.08. The semi-intensive system of Snakehead fish cultivation in this study also used probiotics which were applied to water media feed additives in the form of live microbes that can improve the balance and digestive function of fish, especially when new fish seeds are stocked in the pond. According to Safitri *et al.,* (2024), probiotics if given through feed or water can benefit the host by increasing disease resistance, health status, growth performance, increasing feed efficiency, reducing feed conversion ratio values, feed utilization, stress responses or providing energy that can be obtained through improving balance. host microbes or the microbial balance of the surrounding environment. Other research also reports that giving probiotics to snakehead fish cultivation produces a good feed conversion ratio, namely 2.08 (Lestari *et al.,* 2022) while Saputra *et al.,* (2020), reported that by applying the probiotics Lactobacillus casei and Saccharomyces cerevisiae through maintenance media in aquaponic technology the feed conversion rate obtained was 1.78 – 2.53.

Feed is a determining factor for growth and the largest expenditure of the total cultivation production costs, namely around 60-70%. In aquaculture business activities, feed

costs the highest when compared to other costs with a cost percentage of more than 50% of total production costs (Delgado *et al.,* 2021; Sánchez-Muros *et al.,* 2020; Ayisi *et al.,* 2017; Kumaran *et al.,* 2017; Van *et al.,* 2017). The percentage of feed costs in this study is 48.80% of operational costs. These results show that the cost of feed in semi-intensive cultivation is lower when compared to the percentage of feed costs which are generally used in cultivation businesses. The business profits generated in the semi-intensive system of snakehead fish cultivation in this study were IDR. 585,000/nursing cycle and Rp. 2,505,000/enlargement cycle. This result is lower when compared to the profits from the snakehead fish hatchery business produced in research conducted by Ansyari and Slamat (2022), namely IDR 3,412,500 in one business cycle (1 month). Another research conducted by Suriansyah *et al.,* (2023), shows that the profit from the business of cultivating potential parent and seed snakehead fish is IDR. 2,980,500/3 months, this shows that the profits are higher when compared to the semi-intensive system of snakehead fish rearing. This is thought to be because the two studies above did not include labor costs in the business analysis carried out, whereas in this study, business profits were calculated by including labor costs as one of the cultivation operational costs. In general, the semi-intensive system of snakehead fish nursery and rearing business activities is feasible and profitable.

## CONCLUSSION

Snakehead fish seeds measuring 1 cm (0.4 gram/fish) that are cultivated for 30 days will produce seeds measuring 5 – 7 cm (18 grams/fish). The semi-intensive system of snakehead fish cultivation produces an average daily growth of 0.55 – 0.59 grams/day, a fry survival rate of 87 – 90% and a feed conversion ratio of 1.48. Feed costs show the highest cost percentage with a percentage of 48.80% of total operational costs. The profit obtained from the nursery and rearing of snakehead fish each cycle is Rp. 585,000 and Rp. 2,505,000. Semi-intensive snakehead fish cultivation shows good growth performance and is economically profitable so it is worth developing as an effort to increase snakehead fish production.

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