International Journal of Oceans and Oceanography
ISSN 0973-2667 Volume 14, Number 2 (2020), pp. 285-294

https://www.ripublication.com/ijoo.htm

# Cultivation of Selais Fish (*Kryptopterus lais*) in Floating Net Cages in Kayangan Lake Pekanbaru

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**Abstract**

Kayangan Lake has an area of 1,164,000,000 $m^2$. The volume of reservoir puddle in this area is ± 1,623,780 $m^3$ and the average total water discharge from the waters is 0.5 $m^3$/second. Related to these data, Kayangan Lake has the potential to be used as an aquaculture area; one kind of fish mostly favored by the community is selais fish (*Kryptopterus lais*) since it has a high economic value. This study aimed to analyze the conditions of selais fish farming and to determine the carrying capacity of the waters for the development of aquaculture. The method of this study was divided into 2 stages: aquaculture conditions and an experimental method by applying a completely randomized design (CRD) with three levels of treatment, namely: stocking density as much as 20 fish/$m^3$, 30 fish/$m^3$, and 40 fish/$m^3$. Moreover, the carrying capacity was determined by using the total Phosphate method at four different locations. Selais fish used as the object of this study was 6.00 ± 1.00 cm in size, which were raised in floating net cages for 90 days. Results of this study revealed that different stocking densities affected the growth rate of selais fish. It was found that the stocking density as much as 40 fish/$m^3$ was optimal for the growth of selais fish in floating net cages. Then, this stocking density resulted in the best growth rate. The absolute weight was 13.10 g, LPS was 2.53%/day, the absolute length was 8.82 cm, FCR was 1.61, the feed efficiency was 55.69%, and the percentage of survival was 100%. The carrying capacity of the four measurement locations ranged from 0.1744 – 0.3666 mg/L. After that, the number of existing cages was 25 cages. Finally, the results of the carrying capacity obtained by the number of floating cages allowed were 496 cages.

**Keywords:** *Kryptopterus lais*, Growth, Stocking Density, Water Carrying Capacity.

## INTRODUCTION

Selais fish (*Kryptopterus lais*) is a common water fish that is popular among the community and has a high economic value. Selais fish is both fish as food and ornamental fish, so it is one of the most popular fish and is sought after by fishermen (Simanjuntak et al., 2006). Selais fish can be found in several areas in Riau province, such as the waters in Bulu Cina Village, Kampar (Thamrin et al., 2020), the waters in Tasik Giam Siak Kecil, Bengkalis (Suman et al., 2020), and Kumu River, Rokan Hulu (Purnama and Yolanda, 2016).

To date, the fulfillment of the needs of selais fish comes from natural catches, so fish farming activities need to be carried out. Fish farmers have recently carried out more rapid farming activities, especially for the enlargement, and the density of stocking has continued to be increased. Unsuitable stocking density often causes death which will affect the production. Stocking density affects competition in oxygen demands, the space to move, the feed needed, and the metabolic activity.

One of the artificial lakes located in Pekanbaru, Riau, is Kayangan Lake. As a tourist attraction located in Kelurahan Lembah Sari, Kecamatan Rumbai Pesisir, the existence of Kayangan Lake ecosystem provides beneficial functions for human life such as for household needs, industries, fisheries, and agriculture. Fish farming activities in floating net cages at Kayangan Lake have been started since 2003 until now. These cage activities always experience problems due to fish mortality, which is caused by a decrease in waters' quality, not only physically, but also chemically and biologically. The existence of a fish farming management system and the accumulation of organic materials as pollutants result in the mismatch of waters for aquaculture activities and other activities that utilize waters either directly or indirectly (Asmawi in Azizah, 2009).

A study on fish farming and enlarging selais fish was successfully conducted by providing artificial feed as much as 5% of the biomass weight, resulting in a feed efficiency for as much as 52% (Tang, 2008). Then, to increase the growth rate of the fish, a study was conducted by giving artificial feed which was added by the Growth Hormone (T3) by Tang (2012). Besides, a study was also conducted about the use of recombinant growth hormone (Sawitri et al., 2018). Moreover, (Gunawan et al., 2019) also found that a temperature manipulation as much as 29°C provided the best growth rate for selais fish, which was 7.12 g/day. After that, according to Debath et al. (2019), the protein content of 30% could increase the growth rate of selais fish.

However, research on the enlargement of the fish in ponds or cages had not been widely reported. Based on these problems, it was necessary to conduct research on the impact of preserving selais fish with different stocking densities in Kayangan Lake to affect the growth rate.

This study aimed to analyze the conditions of selais fish farming and to determine the carrying capacity of the waters for the development of aquaculture.

## MATERIALS AND METHODS

This research was conducted form February to July 2019, in the waters in Kayangan Lake, Kelurahan Lembah Sari, Kecamatan Rumbai Pesisir, Pekanbaru, Riau. Selais fish used as the object of this study were 5 – 6 cm in size from the results of spawning using ovaprim. The pisciculture tested was carried out for 90 days. The feed was given three times a day, at 08.00, 13.00, and 18.00 WIB as much as 5% of the body weight of the fish (Nugroho et al., 2018). The method used in this study was an experimental research by applying a completely randomized design (CRD) with three levels of treatments, namely stocking density of 20 fish/m$^3$, 30 fish/m$^3$, and 40 fish/m$^3$.

The specific growth rate was calculated by using the formula: (Zonneveld et al., 1991)

$$LPS = \frac{Ln\,Wt - Ln\,Wo}{t} \times 100$$

Notes:

$LPS$ = Daily growth rate (% /day)

$Wt$ = Larvae weight at the end of the study (g)

$Wo$ = Larvae weight at the beginning of the study (g)

$t$ = Length of the study (day)

Then, the feed efficiency was calculated by formula (Hasan, 2012)

$$EP = \frac{(Bt + Bm) - Bo}{F} \times 100$$

Notes:

$EP$ = Feed Efficiency

$\Sigma F$ = The amount of feed given (g)

$Bt$ = Biomass of the fish at the end (g)

$Bm$ = Biomass of the dead fish (g)

$Bo$ = Biomass of the fish at the beginning (g)

After that, the survival rate was calculated by using the formula (Effendie: 2002), as follows:

$$SR = \frac{Nt}{No} \times 100\%$$

Notes:

$SR$ = Survival Rate (%)

$Nt$ = Number of fish at the end of the study

$No$ = Number of fish at the beginning of the study

The research parameters were analyzed by using ANOVA and if there was an effect of the treatment, the Student Newman Keuls advanced test was carried out with the 95% confidence level. The statistical test was carried out by using SPSS software version 22.

## RESULTS AND DISCUSSION RESULTS

*The Growth Rate of Selais Fish*

The measurement results of the specific growth rates, the feed efficiency, and the fish survival during the study can be seen in the following table.

**Table 1.** Measurement results of the growth rate of selais fish during the study

| Parameter | Stocking density (fish/$m^3$) | | |
|---|---|---|---|
| | 20 | 30 | 40 |
| LPS (%/day) | 2,07±0,03[a] | 2,20±0,04[b] | 2,53±0,03[c] |
| Feed efficiency (%) | 38,04±1,00[a] | 41,74±0,76[b] | 55,69±0,41[c] |
| Survival (%) | 100 | 100 | 100 |

Note: Superscript on the same line shows significant differences ($p < 0.05$).

The pisciculture of selais fish with different stocking densities had an effect on the absolute length ($p < 0.05$). The highest absolute length in the stocking density treatment was 40 fish/$m^3$, which was as much as 8.82 cm while the lowest stocking density was 20 fish/$m^3$. The growth rate of the absolute length increased during the study. To be clearer, it can be seen in Figure 2.

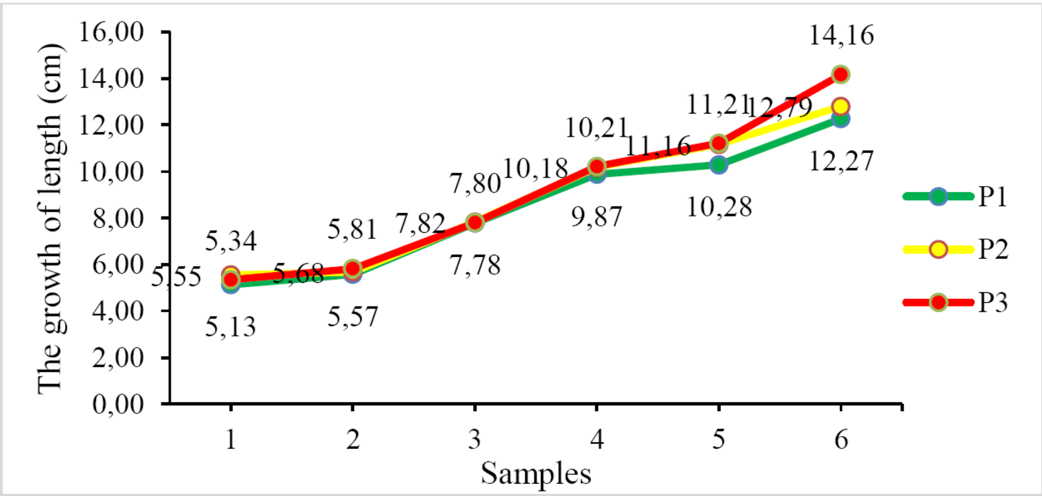


**Figure 2.** The Growth of length of selais fish during pisciculture

*Notes: P1 (stocking density = 20 fish/ $m^3$), P2 (30 fish/ $m^3$), P3 (40 fish/ $m^3$)*

*The Quality of Waters in Kayangan Lake Lake Waters*

Several physico-chemical parameters measured in Danau Bandar Kayangan were temperature, pH, dissolved oxygen, and phosphate. The measurements results of the quality parameters of waters in Kayangan Lake were (a) the temperatures was ranging from 29-33°C; (b) pH was ranging from 5-8.4; (c) dissolved oxygen was ranging from 1-11 mg/L; and (d) phosphate was ranging from 0.1744-0.3666 mg/L. More clearly, it can be seen in Table 2.

**Table 2.** The measurement of waters quality in Kayangan Lake

| Parameter of water | Units | Beginning | The end |
|---|---|---|---|
| Temperature | °C | 30,6-31 | 30,6-31 |
| pH | - | 6,8-7,2 | 6,8-7,2 |
| Dissolved oxygen | mg/L | 5,5-11 | 1-9 |
| Phosphate | mg/L | 0,1744-0,2013 | 0,1744-0,2013 |

## DISCUSSION

Based on the results of measurements, the total phosphate at the four measurement locations ranged from 0.1744 – 0.2013 mg/L. According to PP 82 Year 2001, the phosphate value at several station points at Kayangan Lake is above the quality standard, which is 0.2 mg/L.

Baharsyah (2014) asserts that Phosphorus is a mineral needed by fish because it is very important for the growth and the formation of bones. The phosphorus deficiency in the fish body can cause low growth rates, abnormal body shape, low feed efficiency, and accumulation of body fat.

The increase in the number of floating net cages resulted in an increase in the amount of feeding and also had an impact on increasing sediment deposits in the bottom of the waters which results in silting. Phosphate levels in the form of high total phosphorus in water exceeding the normal needs of organisms resulted in plankton to develop in abundance. Then, it experienced mass death. The mass death of plankton caused dissolved oxygen to decrease drastically and such conditions would be dangerous for farmed fish (Siagian, 2010).

Moreover, according to Arbianti et al. (2017), phosphate is not yet a limiting factor for phytoplankton growth.

Tatangindatu et al. (2013) revealed that phosphate was also produced from wasted pellet feed residue. Not all of the pellets given to fish were eaten by fish. Some were washed away by the stream and the water turbulence caused by the movement of the fish while fighting for food. The crushed pellets were usually involved at the time of feeding and the small crushed pieces were not caught by the fish and carried away by the stream.

Morse et al. (2002) assert that the sources of phosphorus were 10% derived from natural processes in the water environment itself (background source), 7% from industry, 11% from detergents, 17% from agricultural fertilizers, 23% from human waste, and the largest, 32%, from livestock waste including fisheries. Fish meal used in fish feed contained phosphorus levels for as much as 2.6 – 5.3% which increased eutrophication in the aquaculture system and the surrounding area. This initiated the high phosphate value in the lake.

Kayangan Lake has an area of 1,164,000,000 $m^2$ with the volume of reservoir puddle of ± 1,623,780 $m^3$ and an average total water discharge from the waters is 0.5 $m^3$/s (Mudjiatko et al., 2015). The total phosphate at the four measurement locations is ranged from 0.1744 – 0.3666 mg/L. From these conditions, based on the calculation of the carrying capacity by using the Phosphorus method, it is known that the optimal number of floating net cages that can operate is 496 plots while the optimal number in the current research location is 25 plots.

The real condition found in the field was that the number of floating net cages was 25 compartments of cages. Meanwhile, the calculation results showed that the allowed floating net cages were 496 compartments of cages. Based on the current condition during the research, the number of the existed floating net cages could be increased according to the carrying capacity of the waters in Kayangan Lake.

However, it is very necessary to manage optimal water quality in order that the waters in Kayangan Lake are not severly polluted if the development of floating net cages cultivation is not maximized, such as the water that can no longer be used for the daily needs of local residents or the mass death of fish.

The estimation of the number of floating net cages that could fulfill the carrying capacity of the waters in Kayangan Lake was based on parameters of initial P concentration and one that could be tolerated by the waters, P level in pellets, the level of P retention, FCR, average depth, surface area, total volume of outlet water, and the lake volume. This estimation was calculated based on the Pulatsu method with CADS_TOOL. Based on these estimates, it could be seen that the optimal number of cages that can be developed for fish farming by using floating net cages in Limbungan Artificial Lake were 496 units/year (Azizah, 2009).

*The Growth Rate of Selais Fish*

The stocking density as much as 40 fish/$m^3$ provided the highest average growth of the absolute weight, which as 13.10 g. This revealed that the stocking density was still optimal for the pisciculture because it also affected the behavior of the fish, supported by findings that the fish were more active to move so that it increased dissolved oxygen and stimulated the fish appetite.

The specific growth rate at the stocking density of 40 fish/$m^3$ was the highest due to the efficient feeding and the appropriate stocking density. As a result, the nutrient needed for fish were fulfilled. The more efficient the feeding, the higher the protein absorbed by the fish body for the growth process. Based on the opinion of Amarwati et al. (2015), the feed with optimal protein content can increase the maximum growth.

Moreover, the stocking density of 40 fish/m$^3$ provided the highest average of specific growth rate for as much as 2.53%. This implies that the stocking density of 40 fish/m$^3$ gave a good response to the growth rate of the fish. In addition, there were several factors that affect the growth, such as protein, fat, and carbohydrates. The more protein absorbed by the fish, the more protein will affect the growth of the fish due to the increasing weight (Munisa et al., 2015). Furthermore, Ipa et al. (2019) added that the growth of fish occurred because of the use of feed consumed by the fish.

The amount of feed consumed gave a direct effect on the fish growth. Besides, the relative growth of fish was also influenced by the energy entering the fish body. Fish would grow optimally if there was a number of nutritional intake received and absorbed by the body (Kurniawan et al., 2020). The stocking density of 40 fish/m$^3$ resulted in a feed conversion ratio for as much as 1.61. This indicates that the stocking density of 40 fish/m$^3$ is more efficient in utilizing the feed than the lower stocking density, presumably due to the clustering nature of the fish which increases the fish eating habits.

According to Debnath et al. (2019), feed conversion of selais fish fed with protein content of 30% is ranging from 2.1 – 2.4. The value of feed efficiency is inversely proportional to feed conversion and is directly proportional to the increase in body weight of the fish. The higher the feed efficiency value, the lower the feed conversion value. The value of feed efficiency is related to the ability of the fish to digest the feed given and shows whether or not the feed is good.

In addition, the highest feed efficiency value at the stocking density of 40 fish/m$^3$ was 55.69%. It was influenced by the high stocking density of the fish; as a result, the feed given was not wasted. The efficiency of feeding would be directly proportional to the increase in body weight of the fish. Consequently, the higher the digestibility value of the feed, the greater the nutrients that will be converted into energy utiized by the fish to live, to grow, and to replace damaged tissue in order that the value of feed efficiency would be high. This implies that the more efficient the fish use the feed consumed for its growth (Labh et al., 2017).

The survival rate of selais fish which were raised with different stocking densities reached 100%. It is assumed that the stocking density is still suitable for the fish. In addition, the quality of water that fulfills the requirements affects the survival of selais fish during pisciculture. According to Munisa et al. (2015), the survival can be influenced by biotic and abiotic factors. Biotic factors consist of the age and ability of the fish to adapt to the environment while abiotic factors include food availability and the quality of living media.

*Parameters of the Waters Quality in Kayangan Lake*

Temperature measurements conducted at Kayangan Lake were quite varied, ranging from 30.6 – 31°C. Basically, a quite high temperature variation can have a big impact or influence on various metabolic activities of fish. According to Vahl (1979), the optimum temperature causes the performance of digestive enzymes in the digestive tract to reach a maximum point to digest the food consumed. As a result, the stomach is empty (the fish are hungry) and the fish will re-consume the feed. In addition, high temperatures can reduce dissolved oxygen and fish appetite. When the temperature rises, the growth of the fish will be disrupted, both in terms of weight and length of the fish (Gunawan et al., 2019).

The dissolved oxygen at the beginning of the study ranged from 5.5 to 11 mg/L, but at the end of the study, it was decreased in the range of 1 – 9 mg/L. It was found that the dissolved oxygen content in the waters also affected the appetite and activities of the fish. Low dissolved oxygen was due to the decomposition of organic materials, especially the feed residue and fish metabolism residue (Effendi et al., 2012).

Generaly, the dissolved oxygen concentration in water changes every day due to the consumption or production of oxygen by aquatic organisms, diffusion, and the influence of seasons (Ministry of Environment of Government of British Columbia, 2009).

## CONCLUSION

The results of this study revealed that the stocking density of 40 fish/$m^3$ was optimal for the growth of selais fish in floating net cages. The stocking density of 40 fish/$m^3$ produced the best growth rate, that was the absolute weight for 13.10g, LPS for 2.53%/day, absolute length for 8.82cm, FCR for 1.61, feed efficiency for 55.69%, and 100% survival.

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