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Growout of Striped Snakehead (*Channa Striata*) in Swamp Water System Using Fences and Cages

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Abstract. Striped Snakehead (*Channa striata*) is a local species with biological characteristics adapted to swamp water and have a potential to culture in swamp water system. This research was to find out a suitable stocking rate and feeding management in culture system to reach high growth rate of striped Snakehead. Experiment on grow out of striped Snakeheads was conducted in swamp area of Sekayu village, South Sumatra Province, Indonesia using three fences of 6x4 m^2 each and six bamboo cages of 2x1.5x1.5 m^2 each. In fence system the fish were stocked at density of 10 fish/m^2 gave three different feeds i.e, trash fish, pelleted feed, and both trash fish and pelleted feed. In cages the fish were stocked in three different rates i.e, 50, 100, and 150 fish/m^2, fed with pelleted feed at a rate of 3% of total biomass. The results show that in fence system the different fed could give different growth rate due to behaviour feeding, and trash fish treatment was gave higher production/m^2. While in cages, the higher stocking density gave lower final weight but higher production/m^2.

Keywords: *Channa striata*, swamp, fences culture, cages culture

1. Introduction

Swamps are a half-way world between terrestrial and aquatic ecosystems and exhibit some of the characteristics of each. Swamps are valuable as sources, sinks, and transformers of a multitude of chemical, biological, and genetic materials, and also for fish and wildlife protection [1]. Utilization of freshwater swamp ecosystem for fisheries dominated by capture activities with yields tend to decreases. Fish culture is an alternative to increase fish production in swamp water system.

Striped Snakehead (*Channa striata*) is a native species of Indonesian freshwater especially in Sumatra, Kalimantan and Java. The fish are able to breathe atmospheric air by virtue of an accessory organ in the upper of the gill chamber. This reportedly enables the species to travel over land during drought to find larger and more permanent bodies water. They are ambush predators [2].

According to [3] mentioned that *Channa striata* is the most common Snakehead species found in the swamp area. The species is carnivorous, air breathing and able to migrate over wet ground. It is thus well adapted to life in swamp area with pattern of seasonal and temporary aquatic. Snakehead is a voracious carnivorous feeding mainly on live animals. In nature Snakehead can attain a length of one meter. Size of 60 - 70 cm are very common. This fish is very economic important on both cultures and captures throughout southern and southeastern Asia. The maximal total length published is 100 cm or maximal weight 3,000 g, but commonly found 60 cm [4]

Grow out of striped Snakeheads already practices in any region such as Thailand, Cambodia and India using fish fingerling from natural water (*capture based aquaculture*) [4]. In Indonesia another species of Channa i.e. Giant Snakeheads (*Channa micropeltes*) also cultured in Sumatra and Kalimantan.

In South Sumatra striped Snakehead become more valuable species due to higher need for fish flesh not only for table fish but also as raw material for fish ball, crackers, salted and smoked fish.

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The research conducted in swamp area of Musi Banyuasin in order to find out a suitable stocking rate and feeding management in culture system to reach high growth rate of striped Snakehead.

2. Material and Method

Research is conducted in grow out experiment in swamp area of Sekayu sub district, Musi Banyuasin Regency, South Sumatra Province, Indonesia from June to September 2012 by using six bamboo cages with size 2 x 1.5 x 1.5 m, and three net fish fences of 6 x 4 m size. The cages and fences were stocked with snakehead fingerling from swamp area. Cage culture experiment was arranged to evaluate fish growth in different stocking rate (50, 100, and 150 fish/m^2), fed with pelleted feed containing 38% protein. Experiment in fence system was arranged to evaluate fish growth in different feed treatmants (pellet, trash fish, and pellet + trash fish) with stocking rate 10 fish/m^2.

Observation on fish weight and length was carried out in every four weeks, water quality parameters such as pH, Dissolved Oxygen (DO), free CO_2, Hardness and Alkalinity also measured in every four weeks.

3. Results and Discussion

3.1. Grow Out in Fence System

Growth performance of striped Snakehead (*Channa striata*) reared in fence was showed in Table 1. The highest growth was found in fence fed by trashfish from average weight of 2.69 g, after twelve weeks of rearing period gave average final weight of 58.25 g, while the lowest was found in fish fed by pelleting feed gave average final weight only 38.20 g.

Tabel 1: Average length and weight of striped Snakehead during twelve weeks growout experiment in fence

Treatment Feed	Initial Weight (g)	Initial Length (cm)	Final Weight (g)	Final Length (cm)	Production (g/m^2)
Pellet	2.69	6.21	38.20	16.26	1719.0
Trash Fish	2.69	6.21	58.25	18.42	2621.3
Mixed (Pellet+Trash)	2.69	6.21	44.30	17.09	1993.5

The first generation (F1) of snakehead fish in Cambodia are being grown from larvae to adult fish by feeding them with formulated pelleted diets [5]. The result show that different fed could give different growth rate due to behaviour feeding. It may cause by the fish behaviour as carnivorous which is need higher protein level. Trash fish treatment was gave higher production per m^2. Snakehead culture in Thailand fed mainly on trashfish. Under culture, Snakehead matures in one year, measuring about 21 cm in total length [6].

In Cambodia, [7] reported that snakehead aquaculture production represented more than 75% of total freshwater cage aquaculture production. It is entirely dependent on wild fish both as seed and feed. Feed represents more than 70% of the total operational cost and the main type of feed for wild snakehead culture is small-sized or small fish, including juvenile of commercially important fish species, which represent 60 to 100% of the total feed used depending on feeding strategies adopted by different farmers. During the dry season (October to May), the most important source of feed is freshwater small-sized fish, while more marine small-sized or low value fish species are used during the rainy season (June to September) [8].

3.2. Grow Out in Bamboo Cages

Growth performance of striped Snakehead (*Channa striata*) reared in cages was showed in Table 2. The highest growth was found in cages with stocking density 50 fish/m^2 from average weight of 2.18 g, after twelve weeks of rearing period gave average final weight of 45.42 g, while the lowest was found in cages with stocking density 150 fish/m^2 gave average final weight only 29.35 g.

The highest weight gain was found in cages with stoking density of 50 fish/ m^2. The result show that higher stocking density could reduce growth rate due to crowded behaviour may cause competition for food, oxygen and space. [9] found higher growth of *Channa striata* cultured in ponds with stocking density (30 -50 fish/m2), the fish commonly attain 300 – 500 g in nine months and 500–800 g in eleven months, and [10]

found production of snakehead reared in ponds of 9-15.6 kg/m^2 during 7 – 10 months with stocking rate 75-460 fish/m^2, and fed trash fish and rice brand.

Table 2: Average Length and Weight of Striped Snakehead during twelve weeks grow out experiment in cages

Treatment Stocking density	Initial Weight (g)	Initial Length (cm)	Final Weight (g)	Final Length (cm)	Production (g/m^2)
50 fish /m^2	2.18	6.2	48.25	16.32	2412.5
50 fish /m^2	2.18	6.2	42.59	15.68	2129.5
100 fish /m^2	2.18	6.2	37.54	15.05	3754.0
100 fish /m^2	2.18	6.2	44.68	16.44	4468.0
150 fish /m^2	2.18	6.2	35.77	15.00	5365.5
150 fish /m^2	2.18	6.2	22.92	13.29	3438.0

Reported from [11] that in Lao PDR, snakehead cultured in bamboo cage of 18 m^2 size, stocking rate 56 fish/m^2, fed by small dry fish during 7 months of culture period fingerling 10 cm reaching harvest size of 500 gram with, survival rate 97% and FCR 3.5.

In this experiment was found that higher stocking density gave lower final weight but higher production per m^2. Stated from [12] that cage fish culture have several benefits such as easy to manage for feed and harvest, and suitable in running water. Normally fish production increases with the increase in the number of fish stocked per unit area to a maximum and then starts decreasing when no supplementary feeding is provided and the total crop is dependent only on the naturally generated feed. If supplementary feeding is given we can increase the fish production further but again up to a certain extent only. After that the production decreases. In other words we cannot increase the number of fish stocked beyond certain number and there is always an optimum stocking rate beyond which there will be decrease in production.

3.3. Water Quality

Water quality as monitored during the experiment were ranging in suitable quality for fish life as showed in Table 3.

Table 3: Water quality of swamp in research location

No.	Parameter	Bamboo Cages	Fence System
1.	Ph	7.0	7.3
2.	DO (mg/l)	5.7	7.2
3.	CO_2 (mg/l)	11.0	10.0
4.	Alkalinity (mg $CaCO_3$/l)	9.0	36.0
5.	Hardness (mg $CaCO_3$/l)	21.0	45.0
6.	Temperature (^oC)	28 – 32	28 – 32

With air breathing apparatus, the Snakehead is tolerant of water lacking in dissolved oxygen and can survive without water for a number of months as long as the skin and breathing apparatus are kept moist. The fish can live in water having pH values of 4–5, with desirable range of 6.5–8.5. Positive growth occurs between water temperatures 28–35 ℃ where as optimum temperature is 30–32 ℃ [13].

According to [14] for warm water fish, the level of 24-30^{o}C is the best temperature for fish reproduction and larval development. Dissolved oxygen strongly affects on fish metabolism. Very high oxygen concentration had negative effects on fish growth because of gas bubble disease causing block on blood vessel lead to death.

4. Conclusion

1. In fence system the fish grow from average weight of 2.69 grams after twelve weeks reach average weight of 58.25 grams. The different fed could give different growth rate due to behaviour feeding, and trash fish treatment was gave higher production per m^2.
2. In cages, the highest weight gain was found with stoking density of 50 fish/m^2, the fish grow from average weight of 2.18 grams after twelve weeks reach average weight of 48.25 grams, but gave lowest production per m^2. The higher stocking density although gave lower final weight but gave higher production per m^2.

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