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Maturity Level and Somatic Index of Gonado at Dwarf Snake-head (*Channa gachua*) during January to December 2009

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ABSTRACT

This research was conducted in the Experimental Station of Fresh Water Plantation (Stasiun Percobaan Budidaya Air Tawar), Faculty of Fisheries and Marine Science, University of Brawijaya, in Sumber Pasir village, Pakis district, Malang, East Java on January to December 2009. The aim of this research was either to know gonado maturity stage or gonado somatic index on dwarf snakehead (*Channa gachua*). The method used in the research was descriptive method. Based on the research result, the gonado somatic index (GSI) which was injected on female fish has average value of 5,63% highest on November, while those which weren't injected of female fish has the GSI value of 5,31% highest on November. The relation between length and weight of body dwarf snakehead body fish indicate the type of growth is positive allometric. The water quality during research: temperature 25.05-25.42^{o}C, pH 5.37-6.12 and dissolved oxygen (DO) 6.85-7.15. The rain fall and daylight duration in January until December 2009 gane little influence on GSI only influence its breeding process.
KEYWORDS: gonado maturity stage, gonado somatic index, dwarfs snakehead (*Channa gachua*).

INTRODUCTION

Sneak-head fish (*Channa gachua*) has a high economic value. Wild sneak-head which caught from rivers, lakes and swamps in Sumatra and Kalimantan, often marinated before traded between islands. Sneak-head is one of salted dried fish is quite expensive. In addition, the fresh sneak-head mostly sold in a state of life, is an important protein source for the community village , especially those adjacent to the marshy areas or rivers. The fish is very rich in albumin , a type of protein is important. Human body needs albumin every day, especially in the process of healing the wounds. The given sneak-head or extracts of its protein, has been employed to increase the level of albumin in the blood and help cure some diseases. Sneak-head containing 6.2% albumin and 0.001741% zinc with essential amino acids are threonine, valine, methionine, isoleucine, leucine, phenylalanine, lysine, histidine, and arginine, as well as non-essential amino acids such as aspartic acid, serine, acid glutamate, glycine, alanine, cysteine, thyroxine, hidroksilisin, ammonia, hidroprolin and proline. The content of albumin sneak-head male is about 6.7% compared to sneak-head female that reached 8.2% [1].
The culture of local sneak-head *(Channa gachua)* is still not well developed. This is because the technology of fish reproduction is still not well controlled. This could be due to inadequate availability of seed has not been good in terms of number or quality. According to Fujaya [2], reproduction is the ability of individuals to produce offspring in an attempt to preserve the type-species or groups.

In the process of reproduction, before spawning, most of the body's metabolism is intended for gonad development. The heavier gonads followed by increased size, including egg diameter in the ovaries. Ovary weight will reach the maximum as the fish will spawn, and then decreased rapidly during the spawning until the completion of spawning. Changes of gonad condition were stated by gonad maturity level. Gonadal maturation of fish needed to know the comparison among fishes which are not yet mature gonad of existing stock in the waters. Besides gonad, changes are also expressed in the gonads Gonad Maturity Index (GMI), which is also called *Maturity Index* or *Gonado Somatic Index* (GSI) [3]. To know at what time when the local sneak-head mature fish gonads, the research on levels of gonadal maturation and gonadal maturation index should be done.
Local sneak-head fish *(Channa gachua)* are used mostly for public consumption which is still much to rely on the natural capture. Results from these catch will reduce the potential of biodiversity found in nature. To preserve local fish from natural waters, it is necessary cultivate those fishes.

Before starting the initial process of cultivation must be known in advance the exact mechanism of reproductive technology. One of the ways to get these reproductive technologies is to know in advance when the fish will spawn. Spawning fish will be associated with knowledge about the levels of gonadal maturation and gonadal maturation index of local sneak-head-fish.

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Therefore, to determine the reproductive potential of local sneak-head fish and to know the time when the local sneak-head fish *(Channa gachua)* mature gonads it is necessary to do research about the level of gonadal maturation in fish local sneak-head in January-December 2009.

The objective of this study was to determine the level of gonad maturity and gonad maturation index on the local sneak-head fish *(Channa gachua)* in January through December. This research is expected to assist and facilitate in determining the level of gonad maturity and gonad maturation index on the local sneak-head fish *(Channa gachua)* in these months, so it can be used for research on artificial spawning of fish. The study was conducted in January through December 2009, at the Freshwater Aquaculture Experiment Station, Faculty of Fisheries and Marine Sciences UB village of Sand Resources, District Pakis, Malang regency, East Java Province.

MATERIALS AND METHODS

Materials and equipment

The tools used at the time of the study was a circular concrete tanks with diameter of 4 m and height 90 cm, aquarium size 200 cm x 40 cm x 25 cm, equipment aeration (aerator, hose, aeration stone), digital scales, a ruler 30 cm, bath plastic, tray, cloth, 0.5 ml syringe, microscope, glass objects, sectio set Thermometer, pH meter and DO meter.

The materials used in this study include ova prim, local sneak-head fish *(Channa gachua)* size of 10-20 cm from the Dinoyo District, Physiological Na Cl solution, alcohol, nets and screens.

Research methods

This research used was descriptive method which a descriptive investigation of trying to find solutions through the analysis of causal relationship, namely that examine certain factors relating to situations or phenomena are investigated and compared with other single factor, is the investigations that are comparative [4]. The data used are primary data, ie data obtained from the source, observed and recorded for the first time. The data was collected for 10 times in January-December 2009 (every 2 weeks) and each data collection using the fish as much as 10 cows. Total fish used during the study was total of 100 individuals.

Research procedure

Circular concrete pool is cleaned (drained), then given the mud and water filled to a height of 25 cm. on its surface given the water plant (water hyacinth) as shelter.

Aquarium cleaning (drained), then dried (dried). Aquarium filled with water to a height of 25 cm and provided with aeration for oxygen is well maintained. Aquarium covered with nets for when the fish put into it not out. Aquarium divider is insulated as much as 5 per bulkhead filled a fish tail for ease in observation as well as treatment at the time of hormone injections ova prim.

Fish sneak-head is used that is sized 10-20 cm obtained from the local District Dinoyo chatter. Before observations, fish were domestificated sneak-head for ± 30 days in advance in concrete tanks, and then adapted for 24 hours at the aquarium in Freshwater Aquaculture Experiment Station Sand Resources prior to observation. During the domestication of fish fed with small fish and silk worms (*Tubifex* sp) adlibitum.

In this study conducted several activities, among others:

- Procurement of fish obtained from local sneak-head Dinoyo, District chatter, Malang.
- Fish sneak-head adapted to the new environment for one month
- Measurement of water quality ponds, which formed as a measurement of temperature, pH and dissolved oxygen.
- Sneak-head fish sampling at least 10 cows every two weeks.
- Selection of male and female catfish.
- Measuring the length and initial weight
- ova prim hormone injection at a dose of 0.5 ml / kg weight of fish.
- left for 48 hours.
- Measuring the length and weight of the final after treatment.
- Determination of GML: Perform surgery on each fish sample. Surgery begins from the front of the anus to the caudal direction and passes through the genital opening, and then leads into the body cavity along the dorsal extent of vertebrates. Surgery continued to limit the operculum and turned into the pectoral. After the sex organs of sight, the next step is to perform the provisions of GML.
- Determination GSI: After doing the surgery, take the fish gonad carefully by using tweezers. Gonad which has taken place at a small paper that has already cut the weight. Furthermore, the gonads of fish weighing one-one by using a scale with a precision of 1 gr. The next step is to calculate the value of GSI fish by using the formula [5]:

$$GSI = Gw / Bw \times 100\%$$

Note

GSI = Gonado Somatic Index
Gw = Gonad Weight (g)
Bw = fish body weight (g)

- Observation of weather (rainfall and sunshine) and water quality from January to December.

Test Parametres

Main parameters

The main test parameter in this study is:

a. Gonad Maturity Level (GML)

Observation of gonad maturity level is done by the parent observing the gonads of male and female fish, sneak-head and adjusted (scoring) based on the distribution of gonad maturity level according to Kesteven [5].

b. Gonado Somatic Index (GSI)

Gonad somatic index calculation can be done by calculating the value Gonado Somatic Index (GSI) with the following formula:

$$GSI = Gw / Bw \times 100\%$$

Note:

GSI = Gonado Somatic Index
Gw = Gonad Weight (g)
Bw = Body Weight of fish (g)

Supporting parameters

Parameter support in this research is the measurement of water quality (temperature, pH, DO) of maintenance medium and observation of rainfall and solar radiation from the Meteorology and Geophysics Coral Climatology Ploso, air base station Abdul Rahman Saleh, Malang, which will be connected with the GSI and GML in graphical form.

Table 1 GML sneak-head injected fish in January and December

Month	Male	Female
January	Progress 2	Spawning
February	Progress 2	Pregnent
March	Virgin	Spawning
April	Virgin	Progress 2
May	Progress 2	Pregnant
June	Virgin	Spawning
July	Dara Developing	Spwning
August	Virgin	Spawning
September	Dara Developing	Progress 2
October	Dara Developing	Spawning
November	Development 2	Spawning
December	Adult	Spawning

RESULTS AND DISCUSSION

Gonad Maturity Level (GML)

The study of gonad maturity level is using the classification of Kesteven [6]. For the average yield data GML in January and December are in Table 1 below.

Table 1 shows the peak level of gonad maturity there in December for males of the parent fish had reached mature sneak-head compared with other months. But for female fish from sneak-head samples obtained each month mijah phase, this could be due to the influence of seasonal factors is uncertain. Fish local sneak-head gonad observed in this study had experienced some ripe gonads. It can be seen with the presence of gonads which entered phase I development at the local sneak-head male fish and the development phase I to phase mijah on the local sneak-head female fish. It is suspected in certain months there is increased rainfall that stimulates the development of local sneak-head fish gonads.

To condition the level of gonadal maturation in fish that are not injected can be seen in Table 2 below.

Table 2 GML sneak-head fish that are injected in the month of January to December

Moon	Male	Female
January	Adolescent	Spawning
February	Progress 2	Pregnant
March	Progress 2	Spawning
April	Development of a	Progress 2
May	Progress 2	Adolescent
June	Virgin	Pregnant
July	Dara Developing	Pregnant
August	Virgin	Pregnant
September	Development of a	Pregnant
October	Progress 2	Pregnant
November	Adolescent	Spawning
December	Spawning	Spawning

Based on the table it can be seen that for sneak-head male fish that are not injected can experience peak spawning is in December which is in phase Spawning sneak-head as well as in female fish. So in December the sneak-head to spawning fish without assistance of another hormone, but must be supported by other environmental factors.

If seen the condition of the gonad maturation of the samples taken, there is still a phase even though virgin, but there are also pregnant phase. This can be said in that month entered the early spawning period *(pre Spawning)* toward the spawning period (Spawning). Differences gonadal maturation condition of sample injected and not injected is injected in the fish gonad maturation phase mijah this can happen because of the influence of hormone injections ova prim. For fish that are not injected there is no phase mijah, highest maturation was pregnant phase, this can happen because there is no encouragement of hormones to stimulate ovulation. According Rustidja and Richter [7], environmental factors such as rainfall, temperature, light, the plants and male fish, may stimulate maturation, ovulation and oocyte yellow Spawning of eggs.

For fish that are not injected, ovulation may occur if there is one factor above. According to Effendi [8], ovulation in fish is influenced by hormones secreted by glands hypofisa of gonadotropins. Hormones *neurohypofisa* accused of direct involvement of spawning behavior. From the seduction of male stimulates the female fish so that when the issue neurohypofisa lymph glands had already reached a certain level result in expenditure by the fish eggs.

Gonado Somatic Index (GSI=IKG)

From the main research results obtained ovaprim injected with Gonado somatic index value (GSI), the highest female fish occurred in December with the highest value of 2.02% GSI (spawning) and the lowest at 0.38% (virgin / immature gonads) on April. At the local sneak-head male fish gonad maturity index value (GSI), the highest being in mijah phase of 2.1% in November and the lowest 0.08% in May.

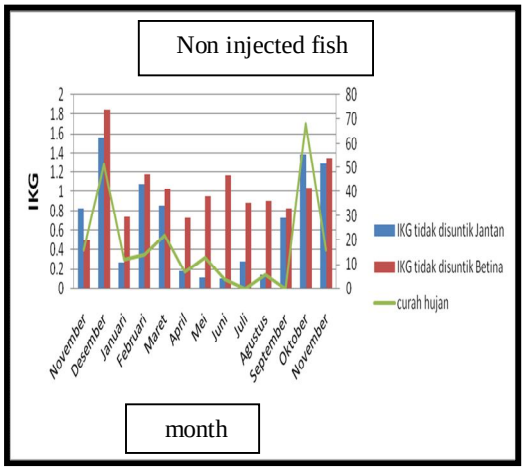

Figure 1 Graph of GSI (IKG) on non injected fish

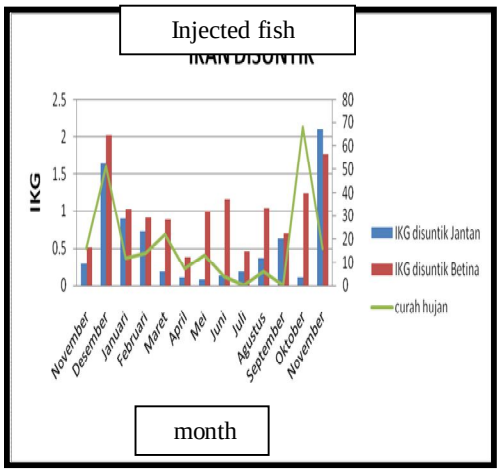

Figure 2 Aerage of GSI (IKG) on injected fish

Based on the chart as above, the index of gonadal maturation in female fish injected local sneak-head increased from April to June, decreased in July and increased again in August, declined in September, in October rose until early November, late November had decreased and increased again in December last decline

continues until April. For gonadal maturation index on the local sneak-head male fish injected decreased from December until May, then rose until September, declined again in October and rose to the highest value in November. In November is the peak spawning too rapidly so that decline.

From the research, the parent who does not get injected with ovaprim Gonado somatic index value (GSI), the highest female fish occurred in December with the highest value of 1.85% GSI (spawning) and the lowest at 0.73% (virgin / immature gonads) in April. At the local sneak-head male fish gonad maturity index value (GSI), the highest being in phase mijah of 1.57% in November and the lowest 0.12% in May.

From the graph above shows that the GSI increased in December, declined in January, rose again in February, dropped back until April, rose again until June, declined again in July and rose until November. This can happen because there is an unstable rainfall which also can affect the GSI. The external stimulus causes an increase and decrease in value of fish GSI local cork.

Relationship of ength and weight

The number of local sneak-head fish used during the study was total of 100 individuals, with males and females were 21 tail as much as 79 tails. After doing the calculations on the value of the whole fish plumpness local sneak-head either injected or not, most of the obtained value of b> 3 with the number of 98 fish tail, while the remaining values obtained b <3. It can be concluded that most of the local sneak-head fish used in this study are *allometrik positive* growth is growth in weight is greater than the added length. This can occur because the food intake of fish obtained by the local sneak-head during maintenance can be fulfilled so that your metabolism can work well.

Relationship between Gonado Somatic Index (GSI) and Water Quality

Relationship between GSI and water temperature

Changes in water temperature can affect the speed of metabolism in fish. Regional sub-tropical and cold water temperature is closely related to solar radiation so that both factors influence the biological processes of fish such as gonad maturation, spawning and hatching eggs in fish hatcheries. The range of temperatures required in the hatchery fish are 25-30 ^{o} C.

Changes in water temperature that is too extreme would be an adverse impact on fish that are kept. As a result, fish become stressed, and when fish are stressed then the fish will be susceptible to disease. Temperature will affect the growth rate of fish when the temperature is too low then growth will slow reared fish grow, because if the temperature is low then the process will be slow metabolism of fish and fish appetite will decrease. The temperature must be exactly the optimum range of 25-30 $^{\circ}$ C [9]. During the study the average water temperature sneak-head pisci culture local media ranged from 25.05 to 25.38 ^{o} C, so the effect of temperature on the GSI was not so great

Relationship between GSI and Degrees Acidity (pH) Water

High or low pH is influenced by the high and low O_2 or CO_2. When O_2 is high then high pH, whereas when O_2 is low pH, but otherwise when CO_2 rises, the pH decreased due to chemical changes [10]. According to Asmawi [9], pH value affects the plants and animals so that water is often used as a guide which states the good and bad state of water as the environment.

The pH during the study is still in the normal point of local sneak-head fish life of 6.85 to 7.15, so that your metabolism is still running normally. Therefore the pH does not significantly affect gonad development of fish local cork. According to Courtenay and William [11], this fish can tolerate a wide pH range with 100% survival rate for 72 hours at pH 3.1 to 9.6. This fish also has a great tolerance to temperature extremes, from 13^{o}C to 36,5°C.

Relationship between GSI and Dissolved Oxygen (DO)

Fish need oxygen to burn fuel (food) to produce an event, such as swimming activity, growth, reproduction, or vice versa. Therefore, it seems clear that the availability of oxygen for the fish to determine the circle of fish activity. Conversion of food, as well as growth rate, depends on oxygen, with the stipulation that as long as factors other Events optimum [9].

The increase and decrease in dissolved oxygen in the research is not so big, so it can be said of dissolved oxygen during the study were normal at this stage for local sneak-head fish life. According Nevertheless and Pethiyagoda [11], sneak-head fish can live in stagnant waters with low oxygen conditions and turbid waters.

Relationship between GSI and Rainfall GSI

Overall there was no association between rainfall rate against local sneak-head GSI fish for fish, especially on the local sneak-head female. The relationship is a relationship in which the mixture when rainfall increased in April to May, the GSI value increases, while during the months of May-June when rainfall

increased GSI remain high. In July when rainfall decreases, the value GSI also decreased, and increased again in August accompanied by the increase in value GSI.

GSI relationships with rainfall in the local sneak-head injected fish are not much different in the injected fish. This can occur because of increased rainfall stimulated the fish to spawn. According Rustidja [12], the presence of male fish gives stimuli on female fish to spawn, since male fish are known to release certain substances called pheromones that are species specific.

According Rustidja and Richter [7], environmental changes affect fish senses such as skin, eye and olfactory tools. The information environment by the means of five senses transmitted to the brain, and from here transmitted through nerves to the hypothalamus, located at bottom center of the brain. The hypothalamus produces hormones that drive realizing hypofysa (pituitary) to release a hormone gonadotropin (GTH), where the hormone is then released in the vascular system of hypofysa. In this way, flow through the blood of hypofysa gonadotropins to the ovary. Gonadotropin stimulates production of sex steroids. These hormones are a direct mediator for spawning.

Fujaya [2] added in some species, males are interested to integrate with the females through smell. Sex steroids are one of the chemicals (pheromones), which spontaneously generates electrical affinity olfactory organ.

Relationship between GSI and Radiation Solar GSI

Average solar radiation is reduced for male fish will decrease its value GSI and for the female fish will increase its value GSI. This relationship is not so tightly between the GSI and sunshine. This could be due to that this sun shines, the indirect effect on fish, but on the medium water temperature first. Both serve as producers of oxygen in the process of photosynthesis, or decrease or increase in water temperature due to such radiation.

Maitra *et all* [13], examines the influence of photoperiod on gonad development. Photoperiod would affect the endocrine system by producing *melatonin. Melatonin* functions control the timing of reproduction by stimulating the final stages of sexual maturation by connecting on oocyte maturation time for spawning to take place optimally. Most fish produce less *melatonin* is on the condition of light or at night.

Another study by Srivastava and Singh [14], with a short photoperiod with a combination of high temperatures (30 ^{o} C) will stimulate the development of gonadal *Channa punctatus* both males and females. The signal environment will affect gonadotropin hormone production cycle which will directly increase the activity of sex steroids in the testes which produce testosterone and progesterone in the ovaries which will affect the ripening process and ovulation in fish.

Rustidja and Richter [7] had held a trial on the effect of temperature and light on ovarian growth of *Clarias* sp., and the results are treated ovaries temperature> 25^{o}C has the oocyte vitello-genesis and oocyte yellow eggs are heavier than the experiments performed in ordinary water temperature (15.5^{o}C - 17^{o}C), which only has a vitello-genic oocyte. So, the temperature is > 25 $^{\circ}$ C, both for beginners' vitello-genesis than a lower temperature (15.5-17^{o}C) by ignoring the photoperiod.

CONCLUSION

Based on data from studies of gonad maturity level studies on the local sneak-head fish *(Channa gachua)* in January - December 2009 can be deduced as follows:

1. Gonado somatic index (GSI) values during the study showed an increase and decrease the still stable and that is the culmination of spawning fish in November on the local sneak-head female
2. Fish gonad maturity level of local sneak-head is also experienced variations of each month, may have increased or decreased.
3. Length relationship of fish weight during the study showed that sneak-head local fish are covered by the *positive allometrik* growth (b> 3)
4. Relationship with gonadal maturation index does not significantly affect water quality because water quality values obtained are still within the normal range for the lives of local sneak-head fish is the temperature from 25.05 to 25.42 ^{o} C, pH ranged from 5.37 to 6.12 and the dropout rate of 6 0.85 to 7, 15
5. Value GSI injected fish or reach the highest peak is in November for males with GSI value of 2.95% and for females with a value of 5.63% GSI
6. GSI value fish that are not injected or reach the highest peak is in December for males with GSI value of 4.46% and in November for the females with a value of 5.31% GSI

SUGGESTION

Based on this research results, it can be suggested as follows:

1. The existence of research on the maturation of the gonads of male fish local cork, because its population is in nature that very little

2. The existence of special techniques for handling local sneak-head caught from the wild, so that the fish at the time were investigated in normal conditions
3. The existence of research on naturally spawning fish local sneak-head to save fish stocks in order to continue sustainable natural

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