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Survival Rate Lemon Fish (*Rachycentron canadum*) Larvae in Lampung Marine Aquaculture Center

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Abstract

Cobia fish (*Rachycentron canadum*) is one of the marine carnivorous fish that is relatively new and has the potential to be cultuvited. This study aims to determine the effectiveness of larval rearing and nursery cobia fish found in the Center for Marine Aquaculture (BBPBL) Lampung. Held 20 January to 19 February 2021. The mature fish were mated in a 2x2x1 m concrete tank filled with 4,000 L of water. The eggs produced were harvested using an egg collector, counted and hatched in a 0.8x0.6x0.5 m aquarium. After hatching, the larvae were moved into nursery tanks with a density of 5-7 fish/L. Larvae were reared until they were 25 days old and fed naturally with *Branchionus* sp, *Nannochloropsis* sp, and artemia. The larvae were then counted, weighed, measured, graded and their growth analyzed. The results of this study showed that not all of these cobia eggs were fertilized by male cobia sperm at the time of spawning. Spawning was carried out on January 16, 2022. Total eggs was 648,000, total fertilized eggs was 480,000 and fertilization rate was 74.04 %. The results of the initial larval count were 75,000, 17,040 were harvested with a survival rate of 22.72%. Water quality (pH, DO, temperature, salinity, nitrite and ammonia) during the research was still normal.

1. Introduction

The cobia fish (*Rachycentron canadum*) is known by the names ling, lemonfish, crebeater and cobio (Figure 1). This fish is a pelagic fish that lives in tropical and sub-tropical waters. This fish is found in the Pacific, Atlantic and southwestern Mexico (Shaffer & Nakamura, 2012), and in the southern United States of the Atlantic Coast and the Northern Gulf of Mexico (Ditty & Shaw, 1992), (Franks *et al.*, 2001). It is a relatively new carnivore in aquaculture and has a high potential for mass production (Liao & Leano, 2005). Including the euryhaline and eurythermal groups (Resley *et al.*, 2006), so they are able to adapt to cultivation conditions both in floating net cages and in controlled tanks.

Cobia grows relatively fast, and has a good response to artificial feed (Priyono *et al.*, 2010). Cobia is also one of the fish species that attracts the attention of the aquaculture community both in the research and commercial fields for cultivation, because cobia has a good growth rate that can reach 4-6 kg in 1 year, has a high survival rate (SR) of 90 %, and has a good feed conversion ratio (FCR) ranging from 1.6 to 1.8 (Chou *et al.*, 2001). In addition, cobia are easy to adapt to cage maintenance and are resistant to disease (Sun *et al.*, *in* Saputra *et al.*, 2010).

Cobia is gaining popularity in Indonesia, marked by the large demand for eggs, seeds and consumption sizes from Jakarta, Bandung, Bali, Pulau Seribu and Kalimantan. Cobia has delicious meat and high quality, so it has a high selling value for marine fish commodities (Franks *et al., in* Chen, 2001), especially in raw fish as the basic ingredient of sashimi (Chou *et al.*, 2001). Cobia fish has a good taste with a dense meat texture, besides that cobia fish also has a high nutritional content, especially omega 3, EPA, and DHA (Pazos *et al.*, 2005).

Cultivation of these fish larvae still relies on natural food for phytoplankton (*Nannochloropis*) and zooplankton (rotifers and copepods) as well as *Artemia naupli*. Fish rely on temperature for larval growth, where temperature is one of the environmental factors. Fish larvae are one of the main facilities that must be available in every fish farming business. Therefore, in an effort to develop fish farming, the provision of larvae should not be omitted and must receive special attention and handling (Musthofa *et al*., 2010).

At the end of 2009, the Lampung Marine Aquaculture Center (BBPBL) has succeeded in naturally spawning cobia broodstock (F1) which have been bred since 2007. The success of spawning cobia broodstock is also followed by the success of larval rearing with survival rates of 4-10%. This study aims to determine the effectiveness of larval rearing and nursery cobia fish found in the Center for Marine Aquaculture (BBPBL) Lampung.

Figure 1. Cobia fish (*Rachycentron canadum*)

2. Methodology

2.1. Time, Place and Materials

This research was conducted at the Center for Marine Aquaculture (BBPBL) Lampung, Indonesia, from January 20 to February 19, 2021.

2.2. Larva Container Preparation

Preparation of the cobia larval rearing container is done by sterilizing the larval rearing container along with other equipment such as aeration hoses, aeration stones and plastic covers. This larval container was previously cleaned by brushing and rinsing with sea water. Then soaked using chlorine for 1 x 24 hours.

The larval container used is made of concrete which is in a 5x2x1 m container with a water volume of up to 10,000 L. Before use, the container is cleaned and disinfected to prevent disease during maintenance. The container is cleaned by brushing and dousing with water first, then dousing with 200 ppm chlorine and settling for 24 hours. Containers that have been cleaned are then installed with 16-20 points of aeration with a distance of 50-60 cm each and the distance of the aeration stone to the bottom between 5-10 cm. Furthermore, the 8 m^3 maintenance media was filled using seawater which was flowed through the provided pipe and filtered using a filter bag. This larval rearing container after being fed will be siphoned, after siphoning the outlet is opened so that the water in the larval container can be replaced with new water.

2.3. Egg Hatching

Handling the eggs was carried out by taking the eggs trapped in the egg collector in the brood container and the eggs are directly put into the aquarium to be counted. After that, the eggs were separated between the fertilized and the unfertilized by siphoning and then counting the eggs.

2.4. Larvae Maintenance

Larval stocking was carried out 18 hours after egg harvesting. These larvae are stocked according to their density. Larval distribution was carried out using a basin from the aquarium to the larval rearing container. Larval distribution was carried out in the afternoon in 3 rearing containers with a stocking density of 75,000 fish/container, which is about 5-7

fish/liter. Before stocking, the rearing media was given probiotics at a dose of 1 ppm to inhibit the growth of pathogenic containers so that the water quality in the larval rearing containers was maintained. Two drops of fish oil were added daily 7 days as additional nutrient.

Rotifera or *Branchionus* sp. is a type of zooplankton that is used as natural food for the rearing of cobia fish larvae. The provision of rotifers started from 2-day-old larvae to 8-day-old with a density of 2-7 fish/mL on day 2 gradually up to 5-7 fish/ml on day 8. Larvae were also fed with phytoplankton type *Nannochloropsis* sp. with a density of 300,000-500,000 cells/ml, namely as feed for rotifers and also as a water quality stabilizer. Nannochloropsis sp. in the cobia module is produced and distributed through pipes resulting from the culture process. Artemia is a zooplankton used as feed for cobia larvae aged 9 days to 25 days with a density of 2-5 fish/mL. Fish pellets were given to larvae aged 10 days until harvest. Artificial feeding was carried out 2-4 times, namely at 07.30-10.00 AM and at 13.30-15.00 PM. They were fed by spreading the feed on the surface of the rearing media.

On the 10th day, the larvae were fed with Love Larva (LL) 1 according to the size of the larva's mouth opening. On the 15th day the larvae were fed LL2, on the 20th day the larvae were fed LL3 and on the 23rd day the larger larvae were fed LL4 until at harvest the larger larvae could be fed with a larger size with LL5.

2.5. Larvae Harvesting

Harvesting of larvae was done when the larvae are 25 days old. These larvae will be transferred to a new container that has been previously cleaned and the number of stockings will be different from before. Next, a sorting/grading process is carried out to group the larvae into the same size.

2.6. Nursery

The container used for nursery cobia fish was a fiber or concrete container with a capacity of about 2-3 m^3. The commonly used container shapes are round and square. The containers were equipped with seawater inlet and outlet as well as aeration equipment (hose, ballast and aeration stone). The seawater outlet pipe were made with holes measuring ±1-2 cm and lined with nets. The purpose of giving the layer is so that the seeds do not drift along with the flow and the size of the mesh used must pay attention to the smooth disposal of water, so that there is no blockage by dirt.

Healthy and good fries were selected and adapted to the new rearing container. Fries distribution is carried out immediately after harvesting the seeds from the larval rearing container (20-25 days old). The density of seeds when transplanting is attempted not to be too dense and to use a dark colored container. The harvested seeds are put into hapa-hapa for grading. In the hapa oxygen is given through the aeration hose. Next, the grading is done manually. Grading is done by separating the seeds into 3 sizes, namely small (< 2 cm), medium (2 < x < 3 cm) and large (> 3 cm). The graded seeds are then stocked in prepared containers with a density of 0.5-1 head/L.

Seed grading is carried out continuously along with the seed maintenance period to uniform size and reduce the rate of cannibalism. Seed maintenance can be done with a circulation system (running water) and open recirculation (30-50% water change / day). Cobia seed nursery feed is pelleted, because its availability does not depend on natural conditions, feed conditions are clean and do not carry disease seeds (containers, parasites and fungi) and cobia seeds are easy to adapt to pelleted feed.

Feeding pellets for cobia seeds, adjusted to the size of the seeds. When the new seeds were transferred from the larval rearing container to the nursery container, the small size seeds (< 2 cm) were still fed with artemia feed and trained with artificial feed (LL 1), for approximately 3 days in a row until the seeds smoothly received pellet feed. This is done to reduce seed mortality. Feeding the seeds is made to ensure that no feed is wasted. To maintain the quality of maintenance water, siphoning is carried out 2 times a day, in the morning and evening.

2.7. Water Quality Measurement

During the research, water quality (pH, DO, temperature, salinity, nitrite, and ammonia) was measured to ensure that the water conditions met the requirements for rearing these fish.

2.8. Data Analysis

The data obtained from this study were collected and tabulated for further descriptive analysis based on the related literature

3. Result

3.1. Rearing of Larvae

Harvesting of eggs is done after the parent cobia fish spawned. Spawning eggs are collected using a running water system equipped with aeration, this is because spawning is done in a controlled container. The diameter of the cobia eggs is between 1000-1300, the eggs are harvested from the egg collection container which is located between the parent container, namely a concrete container with a thickness of 10 cm and dimensions of 2m x 2m x 1m, can accommodate up to 4000 L of water and inside there is an egg collector so that the eggs that come out of The drain pipe is accommodated in the egg collector with dimensions of 0.8m x 0.6m x 0.5m and a 2-inch pipe, then filtered using a 200-400 plankton net, then the eggs are stocked in the aquarium to count the total eggs and the number of fertilized eggs.

The fertilized cobia eggs will float and the unfertilized ones will settle. The results of this study indicate that not all cobia eggs are fertilized by male cobia sperm during spawning. The male parent usually releases the sperm first so it cannot fertilize the egg from the female parent. In the parent container, the number of male parents is more than the number of female parents, with a ratio of 2 males and 1 female. Spawning was carried out on January 16, 2022. Total eggs was 648,000, total fertilized eggs was 480,000 and fertilization rate was 74.04 %.

3.2. Growth of Larvae

Measurement of larval growth was carried out in 3 larval containers, namely Container 1, Container 2 and Container 3. To determine the growth rate of cobia larvae, sampling was carried out every 5 days starting from the 5th day to the 25th day. For Container 1, the average length of larvae on days 5, 10 and 15 were 0.5, 1.0 and 1.6 cm, respectively. Growth on the 20th and 25th day was not carried out again, because the larvae in Container 1 were all dead. Container 2, the average length of larvae on days 5, 10, 15, 20 and 25 were 0.5, 1.3 and 1.9, 3.4 and 5.5 cm, respectively. Container 3, the average length of larvae on days 5, 10, 15, and 20 were 0.5, 1.2 and 1.8, and 2.8 cm, respectively.

The length growth of cobia fish larvae from day 5 to day 25, where the growth of the larvae is classified as very rapid seen from the increase in length of 1-2 cm every 5 days. This figure was obtained from the measurement of larval length sampling in container 7. In containers 2 and 8, larval growth was disrupted because both containers were attacked by parasites so that the larvae died gradually starting from the 18th day to the 25th day.

3.3. Harvesting Larvae

Cobia fish larvae were harvested at the age of 25 days and then reared at the nursery stage. The larvae are transferred slowly so that the larvae do not experience stress, by taking them slowly using a spoon and then putting them into a basin to be transferred from the rearing container to the nursery location. Furthermore, grading activities are carried out in containers that have been provided with rombongs to separate small, medium and large seeds. The results of the initial larvae count were 75,000, 17,040 were harvested with a survival rate of 22.72%.

3.4. Nursery

The containers used in nursery activities are round fiber containers with a diameter of 1.8 m, 0.8 m high and have a volume of 2000 L. The containers in the nursery are 20 pieces but the containers used in the maintenance of newly harvested cobia seeds only 13 pieces. Before use, the container is cleaned first by means of the container being emptied of the remaining water from the previous maintenance. Then the container is brushed to clean it from moss and dirt attached, then watered again with seawater. After that, the container is soaked using chlorine and allowed to stand for 1 x 24 hours and then rinsed again until clean. Furthermore, the container is filled with seawater, equipped with aerators and outlets to support seed maintenance activities during the nursery stage.

3.5. Introducing the Fries to Nursery Container

Seeds that are kept in nursery activities are healthy seeds (free from viruses, containers and parasites) and have high growth. The characteristic of cobia fish seeds that can be transferred to nursery containers is that there is a white line on the dorsal side. Seeds that will be maintained, previously carried out grading which aims to determine the desired size, also get healthy seeds and no defects. Initial grading of seeds is done at the age of 25 days. Seeds

that have been captured are then put into the hopper to be separated according to the size carried out in the rearing container.

3.6. Fish Feeding

In newly reared seeds, was fed gradually with different feed diameter sizes depending on the size of the mouth opening in the seeds. The type of pellet feed used was Love Larva (LL) pellet feed which was adjusted to the mouth opening and seed size. The frequency of feeding pellets is 4 times a day by giving it little by little until full or by ad satiation. Cobia fish seeds have characteristics when they have consumed food and are full, namely in the stomach it will bulge. The time of feeding the seeds is at 07.30-08.30, 10.00-11.00 am, 13.30-14.30 and 15.00-16.00 pm.

Pellets were provided according to body size and mouth opening on the first day of rearing, namely small sizes were fed LL3, medium LL4, and large LL5. When the seeds were 32 days old, the size of the feed diameter increased, namely small seeds were given pellets in the form of LL5, while LL6 and large ones had started to be fed pelleted feed in the form of GR (Marugami GR) no 1.

3.7. Water Quality

The water used in the maintenance period is water from Hurun Bay that has been previously filtered. The following is data on water quality for cobia fish rearing in controlled containers in nursery activities, which are presented in the following Table 1.

Table 1. Nursery water quality parameters.

No.	Parameters	Unit	Level	Standards
1.	pH	-	7,81	7-8,5*
2.	DO	mg/L	4,79	>4
3.	Temperature	^{o}C	29,1	28-34
4.	Salinity	Psu	32	30-34*
5.	Nitrite	mg/L	0,077	0,05**
6.	Ammonia	mg/L	0,152	0,3*

4. Discussion

4.1. Rearing of Larvae

Fertilized eggs will hatch in about 21 - 37 hours at a temperature of 22 - 31^{o}C (Liao *et al.*, 2004). Cobia fish eggs look transparent, slightly yellowish in color and mixed with melanin pigment. The diameter of cobia fish eggs ranges from 1.2 -1.3 mm with an average of 1.29 mm. The diameter of the oil grains is between 0.25-0.32 mm with an average volume of 0.151 mm3 (Priyono *et al.*, 2005). Cobia fish larvae are actively receiving food from the outside (exogenous feeding) at the age of 3 days, with mouth opening sizes between 200-250. The size of the rotifer feed is around 140-200 (Aslianti *et al.*, 2008), so it can be ascertained that the rotifer feed can enter the stomach of the larvae.

Feeding cobia fish larvae become seeds is usually given natural food. The role of natural feed has not been fully replaced by artificial feed considering that at the beginning of its development the larvae are more interested in moving feed and require an easily digestible feed composition that cannot be fulfilled by artificial feed, so the presence of natural feed is absolutely necessary and cannot be replaced by artificial feed. Sururi (2014). Natural feed *Nannochloropsis* sp. has an important role in providing a source of protein and nutrition for larvae. The use of natural feed in hatcheries needs to be limited in time and its role needs to be replaced with artificial feed whose nutrient composition is adjusted to the needs of the larvae.

Based on microscopic observations made by Priyono (2012) that cobia fish larvae until the age of 1 day their digestive tract is still a straight channel located in the dorsal yolk sac and has not been differentiated. Changes in the morphology of the digestive tract only occurred on day 1 to day 4, post hatch with a total length of 3-4 mm when the larvae began to eat food from outside the body (exogenous feeding). This is in accordance with the statement of Faulk *et al.* (2007) which states that cobia fish larvae are relatively undifferentiated, so that the larvae have not been able to fully digest and absorb artificial feed and still utilize natural food contained in the rearing media water.

Cobia fish larvae are cannibalistic and have a fast digestive process. Food reserves in the larval body are in the form of endogenous egg yolk feed which can last up to 3 days after the larvae hatch (Effendi, 2004), it is necessary to give natural food from outside the body that contains a lot of protein and fat, one of which is Rotifera sp. or Branchionus plicatilis, this type of natural feed has a high nutritional value of 52% protein and 13% fat, these nutrients are needed in the larval phase because protein is a very important element in fish growth (Sutrisno *et al.*, 2004).

Techniques to maintain good water quality, among others: siphoning, management

(plankton, live feed, and artificial bait), water replacement and provision of hygienic container water sources. In addition to siphoning, it is also important to avoid excessive feeding of plankton, artificial feed and plankton that has started to enter the death phase, which is given during the larval rearing period, although the phytoplankton still looks green and brown. Also note the remaining fertilizer content, in the conventional way through the aroma of phytoplankton, namely by smelling the smell of plankton. Phytoplankton that still contains fertilizer elements will have a direct impact on larvae and cause sudden larval death (Ari *et al*., 2009).

The problem experienced during research on the maintenance of cobia larvae is the presence of parasites that attack the larvae in container 2 and container 8 so that many larvae die and both containers are given chlorine to be sterilized so as not to spread to other containers. The characteristics of the diseased larvae are that the larvae experience slow growth due to loss of appetite and slow swimming. As shown in Table 7, larvae that were successfully transferred to nursery containers had a low survival rate of 27.2%. This is caused by parasites that attack the larvae so that only 1 container of larvae can be harvested out of a total of 3 maintenance containers.

4.2. Rearing of the Fries

After the larval rearing activities were carried out for 25 days, then the cobia fish were reared in the first nursery stage for 30 days, followed by the second nursery for 30 days and followed by the rounding stage for 45 days. Water quality is one of the factors that influence the success of nursery. Water quality management is carried out to maintain good water conditions during nursery. It must be carried out in accordance with the required range of water quality parameters. To maintain good water quality, siphoning is carried out 2 times a day in the morning and evening every 15 minutes of feeding. When siphoning, aeration is turned off so that the dirt settles at the bottom of the container. The siphon tool used is a pipe that is modified in such a way that it makes it easier to clean the maintenance container, at the base of the pipe it is connected to a hose. To clean the bottom of the container every 2 days, water changes are carried out starting with cleaning the bottom of the container and continuing by reducing the water by 70-80% from its original height (Agustian, 2013).

5. Conclusion

The results of this study indicated that not all cobia eggs are fertilized by male cobia sperm during spawning. Spawning was carried out on January 16, 2022. Total eggs was 648,000, total fertilized eggs was 480,000 and fertilization rate was 74.04 %. The results of the initial larvae count were 75,000, 17,040 were harvested with a survival rate of 22.72%. Water quality; pH, DO, temperature, salinity, nitrite and ammonia were still within normal limits

REFERENCES

Agustian. (2013). *Telaah Kualitas Air Bagi Pengelolaan Sumberdaya dan Lingkungan Perairan*. Kanisius. Yogyakarta. 246 hlm

Aslianti, T., K. Suwirya., Asmanik. (2008). Teknologi Pemeliharaan Larva Kerapu Sunu (*Plectropomus leopardus*) secara massal. *Jurnal Riset Akuakultur* 3(1): 1-11.

Chou, R.L., M.S. Su., H.Y. Chen. (2001). Optimal dietary protein and lipid levels for juvenile cobia (Rachycentron canadum). *Aquaculture*, 193: 81–89.

Ditty, J.G., & R.F. Show. (1992). Larval development, distribution, and ecology of cobia, Rachycentron canadum (Family: Rachycentridae), in the nortern gulf of Mexico. *Fish. Bull.* 90: 668-677.

Effendi, I. (2004). *Pengantar Akuakultur*. PT. Penebar Swadaya, Jakarta.

Faulk, C.K., A.D. Benninghof, G.J. Holt. (2007). Ontogeny of the Gastrointestinal Tract and Selected Digestive Enzymes in Cobia (*Rachcentron canadum*) (L.). *Journal of Fish Biology*, 70(2): 567-583.

Kepmen Lingkungan Hidup No.51 Tahun 2004 Tentang Containeru Mutu Air Laut

Liao, C.I.H. Ting-Shih., T. Wann-Sheng., H. Cheng-Ming., C. Su-Lean., L.M. Eduardo. (2004). Cobia Culture in Taiwan: Current Status and Problem. *Aquaculture*, 237(1-4): 155-165.

Liao, C.I., & E.M. Leano. (2005). Cobia Aquaculture in Taiwan. *Journal of the World Aquaculture*. 36(1): 4.

Musthofa, S.Z., T. Afifah, Aslianti., A. Priyono. (2010). Pengaruh penambahan

probiotik komersial terhadap pertumbuhan dan kelangsungan hidup larva bandeng, Chanos chanos Forsskal. Kumpulan Makalah Seminar Nasional Biodiversitas III. Departemen Biologi. Fakultas Sains dan Teknologi, Universitas Airlangga. Hlm. 96-99.

Pazos, M., J.M. Gallardo., J.L. Torres, I. Medina. (2005). Activity of Grape Polyphones as Inhibitors of the Oxidation of Fish Lipids and FrozenFish Muscle. *Food Chemistry*, 92: 547-557.

Peraturan Pemerintah No.24 Tahun 1991 Tentang Pengendalian Pencemaran Lingkungan Laut. Kementerian Dalam Negeri Republik Indonesia. Jakarta.

Priyono, A., B. Slamet., Asmanik. (2005). Pengamatan Pemijahan Alami di Container Pemeliharaan, Perkembangan Embrio dan Awal Larva Ikan Cobia (*Rachycentron canadum*). *Prosiding: Konferensi Nasional Akuakultur. Masyarakat Akuakultur Indonesia. Semarang: Universitas Diponegoro*. Page: 268-274.

Priyono, A.S., Zuhriyah., Afifah. (2010). Penggunaan probiotik komersial pada pemeliharaan larva Cobia (*Rachycentron canadum*) skala hatchery. Prosiding Forum Inovasi Teknologi Akuakultur: 373.

Priyono. A., T. Aslianti, S.Z. Musthofa. (2012). Respons Pakan Buatan pada Pemeliharaan Larva Ikan Cobia (*Rachycentron canadum*). Prosiding Forum Inovasi Teknologi Akuakultur : 721-726.

Resley, M.J., K.A. Webb., G.J. Holt. (2006). Growth and survival of juvenile cobia, *Rachycentron canadumi*, at different salinities in a recirculating aquaqulture system. *Aquaculture*, 253: 398-407.

Saputra, S., H. Minjoyo., L.N. Marzuki. (2010). Budidaya cobia (*Rachycentron canadum*) komoditas unggulan yang belum banyak dikenal. Prosiding Forum Inovasi Teknologi Akuakultur. Balai Besar Pengembangan Budidaya Laut.

Shaffer, R.V., & E.L. Nakamura. (2012). Synopsis of biological data on the cobia, *Rachycentron canadum* (Pisces: Rachycentridae). NOAA Technical report NMFS 82, FAO fisheries synopsis 153. 21p.

Sururi, A. (2014). *Budidaya Ikan Hias Clown. Program Pengembangan Sumberdaya Perikanan*. Balai Perikanan Budidaya Laut: Ambon.