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SPAWNING AND DEVELOPMENT OF DOG CONCH *Strombus* sp. LARVAE IN THE LABORATORY

PEMIJAHAN DAN PERKEMBANGAN LARVA SIPUT GONGGONG *Strombus* sp. *DI LABORATORIUM*

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ABSTRACT

An intensive exploitation of dog conch *Strombus* sp. in Tanjungpinang city coastal waters has occurred because the increasing number of fishermen, population growth and demand. In addition, the increasing activities of bauxite mining cause the declining in quality of waters around dog conch, thus providing ecological pressure that endangers sustainability of the dog conch. The purpose of this study was to observe the spawning and development of dog conch in the laboratory. Spawning was done in aquarium with 100 liters of seawater (salinity: 26±1 ppt), with stimulation of spawning performed by changing 90% water volume every day until the female issued the eggs. The female issued the eggs on the third and fourth days of stimulation. Eggs are attached to the wall of the aquarium. Egg cell division occurs after about 2 hours of the egg is released the mother, from one cell into two cells and a row into four cells, eight cells, the sixteen cells, thirty-two cells to multicellular. The embryo develops into a gastrula phase than trochophore phase. Larvae were reared in a tank containing 20 liters of seawater (salinity: 26±1 ppt). Veliger larvae occurred on the fifth day until the eleventh day. Veliger larvae are planktonic, and turn into benthic with a sedentary life in the bottom waters to begin the formation of a thin and transparent shell. The value of water quality parameters during maintenance category feasible: DO of 7.6 to 7.8 mg / L; pH of 8.13 to 8.33; turbidity of 1.97 to 3.90 NTU, salinity of 26.8 to 27.8 ppt; and temperature of 25.8-27.8°C-.

Keywords: development, dog conch, larvae, spawning, *Strombus* sp., Tanjungpinang City

ABSTRAK

Eksploitasi intensif telah terjadi terhadap siput gonggong Strombus sp. *di perairan laut Kota Tanjungpinang karena jumlah permintaan meningkat akibat pertambahan jumlah penduduk dan peminatnya. Mutu perairan laut di sekitar habitat gonggong menurun akibat tingginya aktivitas penambangan bauksit selama beberapa tahun terakhir, sehingga memberikan tekanan ekologis yang membahayakan kelestarian gonggong. Informasi dasar tentang pemijahan dan perkembangan larva gonggong diperlukan untuk budidaya atau pemulihan populasi di alam. Tujuan penelitian ini adalah untuk mengamati pemijahan dan perkembangan larva gongong di laboratorium. Pemijahan induk dilakukan di akuarium berisi 100 liter air laut dengan salinitas 26±1 ppt, dengan perangsangan pemijahan dilakukan melalui pergantian air 90% setiap hari sampai induk betina memijah. Pada penelitian ini diketahui bahwa induk betina memijah pada hari ketiga dan keempat pascastimulasi, dan menempelkan telurnya di dinding akuarium. Fase pembelahan sel telur terjadi sekitar 2 jam setelah pemijahan, dari satu sel menjadi dua sel, empat sel sampai multisel, kemudian berkembang menjadi fase gastrula dan trokofor. Larva dipelihara di akuarium berisi 20 liter air laut salinitas 26 ± 1 ppt. Fase larva veliger terjadi pada hari kelima sampai hari kesebelas. Larva veliger bersifat planktonik, kemudian berubah menjadi bentik hidup menetap di dasar perairan dengan mulai terbentuknya cangkang tipis dan transparan. Parameter kualitas air selama pemeliharaan berkategori layak, yaitu DO 7,6-7,8 mg/l; pH 8,13-8,33; kekeruhan 1,97-3,90 NTU, salinitas 26,8-27,8 ppt; suhu 25,8-27,8°C.*

Kata kunci: *kota Tanjungpinang, larva, pemijahan, perkembangan, siput gonggong,* Strombus sp.

I. INTRODUCTION

Tanjungpinang City is located in Bintan Island, Kepulauan Riau Province, has a wide variety of marine life. One of marine life that has been recognized and consumed because of its delicious taste is dog conch (*Strombus* sp.). Many restaurants provide dog conch as special menu for the visitors. Dog conch is a seafood culinary mascot of Tanjungpinang City. The government builds a monument of dog conch in the 1980s as tourism promotion. Economically, dog conch is a source of food and livelihoods in Tanjungpinang. Catching dog conch intensified because of the increasing of the population and demand. Because of the increasing bauxite mining in Tanjungpinang, the quality of waters become worse, thus endangering the preservation of snails barking (Muzahar, 2013), which is indicated by the size of the bark sold in the market is getting smaller and difficult to obtain (Dody, 2012).

The genus *Strombus* exist throughout the tropical regions of the world (Cob *et al*., 2009). Most gastropods is dioeciously with a gonad (ovary or testis) is located near the digestive tract in visceral mass. The Dog conch is a subc-class of Prosobranchia. Reproductive organs in some sub-class are contained on a separate sex (Suwignyo *et al*., 2005). Meanwhile the restoration effort of the presence of dog conch in nature until now has never been done by any party, so that the wild population is increasingly threatened, it is necessary to attempt cultivating snails barking. Basic information such as biology and ecology is needed in the utilization and management of fishery resources (Yusron, 2005; Widigdo *et al.*, 2017). The information becomes important because it can be used as an alternative input to fishery resource management planning (Welcomme, 2001). For the purposes of cultivating dog conch, basic information on reproductive biology are needed. Several studies on dog conch reproduction have been conducted in some aquatic sites (Kuwamura *et al.*, 1983; Appeldoorn, 1993; Stoner and Schwarte, 1994; Reed, 1995; Stoner *et al*., 1998; McCarthy *et al*., 2002; Aranda *et al.*, 2003; González *et al*., 2007; Siddik, 2011). Research on spawning and larval development dog conch in Tanjungpinang City has never been done. The purpose of this research was to study the life cycle of dog conch partially, through observation of spawning and development of larvae in the laboratory.

II. MATERIALS AND METHODS

2.1. Materials Research

The broodstock of dog conch was collected from Madong waters, Tanjungpinang City. Spawning and development larvae observation were conducted in January - March 2015. The observation was held at the Laboratory of Faculty of Marine Sciences and Fisheries, Raja Ali Haji Maritime University, Tanjungpinang.

2.2. Research Methods

2.2.1. Spawning

Spawning observations were performed on an aquarium scale. The aquarium used contains 100 liters of natural seawater with salinity 26±1 ppt, sandy mud substrate with a thickness of 8 cm, and 2 plant seagrass *Enhalus accoroides*. Several breeders inserted into the aquarium. Each breed has characteristics such as total shell length of > 7.0 cm, total weight of > 30 g, and outer lip of > 2.5 mm. Those breeds were maintained for 3-5 days (Dody, 2012; Muzahar and Viruly, 2013). The spawning behaviors were observed; physical and chemical parameters of waters were measured.

2.2.2. Eggs Cytology and Larvae Development

The observation of eggs and larvae development was conducted in aquarium scale. The aquarium used contains 20 liters of natural seawater with salinity of 26 ± 1 ppt. Before used, sea waters were filtered by net plankton with size of 40 µm. The egg colonies were carefully and immediately transferred to the other aquarium. The egg sample was taken and observed under a microscope. The process of cell division every egg stage were documented. The larvae were fed 0.5 liters *Nanocloropsis* sp. with density of 1.2 x 10^6 cells / ml and frequency once a day.

2.3. Water Quality Parameters

The measurement procedure of water quality parameter followed the Indonesian National Standard (SNI 06-2412-1991). The physical and chemical parameters of water during the larva rearing were measured daily on all aquariums. The parameters were DO, pH, turbidity, salinity, and temperature.

III. RESULT AND DISCUSSION

3.1. Spawning

Spawning observation had been conducted in 5 days. The first day, no activity indicated the occurrence of sexual activity. The second day, male and female approached each other and coincided, it was suspected to occur the copulation process. The eggs have been issued by the female on the third and fourth day. Spawning process and time interval was relatively same with *Strombus turturella* (Dody, 2012). The eggs stacked in the edges of aquarium. The eggs have pink color and shaped like a tangled yarn (Figure 1).

3.2. Eggs and Larvae Development

The eggs were observed under a microscope showed the arrangement of egg colonies neatly arranged and resemble a chain. Colony egg covered and protected by a capsule. Dog conch eggs form spherical with an average diameter size of 262.85 µm. Granules egg wrapped by a gel capsules containing solution with a thin membrane at the edges and colored brighter than eggs. Then the chain of capsule also wrapped by compact thin membrane that surrounded the egg with lengthwise resembles a long chain. Cell membrane contained adhesive substance which caused the colony eggs stick fairly closely to the glass aquarium and not easily to broke (Figure 2).

The first fission of egg cells were occurred two hours after being expelled with rate of cell fission relative simultaneously. Egg cells divided into two cells, then each egg was kept splitting into four, eight, sixteen and thirty-two cells and ultimately multi-cell (Figure 3).

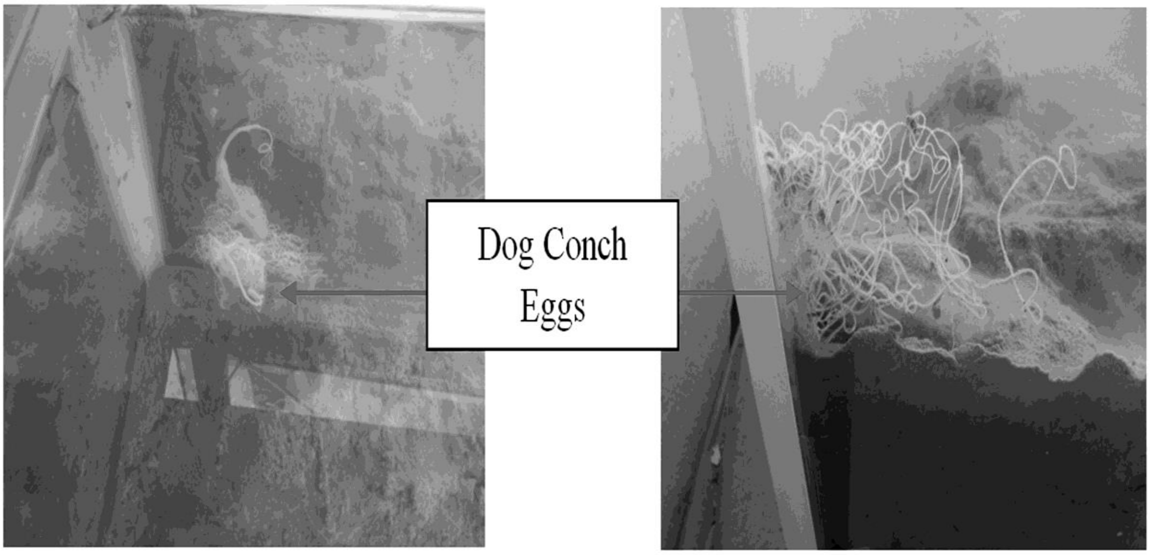

Figure 1. Eggs of dog conch in aquarium.

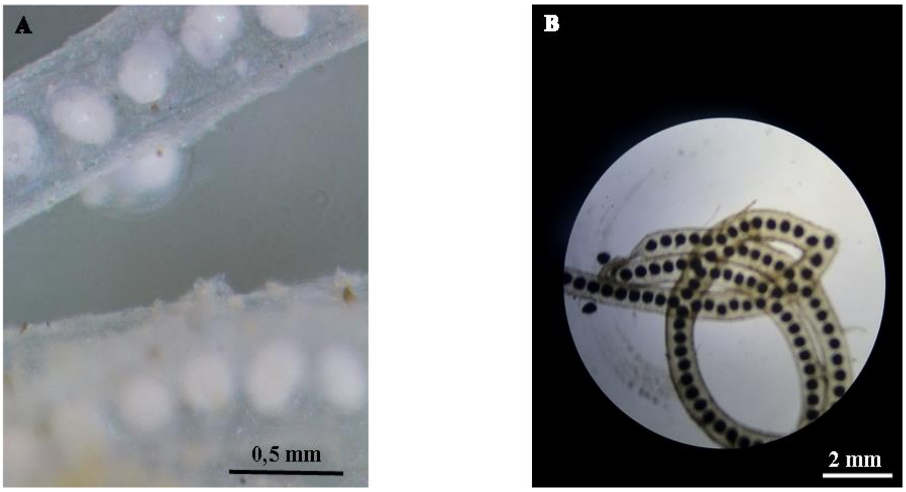

Figure 2. Egg forms (a) eggs of dog conch, (b) egg colonies.

At the eighty-one hours, embryo developed into gastrula phase that was characterized by formatted cilia. The active movement of cilia caused embryo looks circling both clockwise and counters. Furthermore, the embryo developed into trochophore larvae that increasingly and actively spin in capsule. The fifth day, trochophore larvae developed into veliger larvae and hatch out from egg capsules. There were two type of veliger larvae hatch out from capsule. Type one, veliger larvae pushed one side of capsule until forming a bulge on the banks, wrapping membrane rupture, and leaving scars of an empty space on a colony chain, then swim freely. Type two, egg and capsule separated from the colony wrapping membrane, then hatch out of capsule and active swimming in the water column (Figure 3b). The organs and body weight of veliger larvae continued to grow and gradually changing from planktonic into benthic by beginning to settle and visible formation of the shell (Figure 3d).

According to Dody (2012), the settled larvae faced threats and vulnerable to attack. The major predators were Copepoda and Polychaeta that could enter into the shell. Predator would come out of the shell to find new prey larvae when a shell was empty.

Cob *et al*. (2009) said that veliger larvae of *Strombus canarium* kept in the laboratory planktonic developed in four phases. There were stage I age 0-3 days, stage II age 4-8 days, stage III age 9-16 days, and stage IV after 17 days for metamorphosis process. The ending metamorphosis stage was characterized by velar lobber loss on larvae and emerging propodium from juvenile dog conch.

Larvae hatching in this study occurred from the fifth day, but Dody (2012) reported that *S. turturella* larvae hatching started from the fourth day. According Manzano *et al*. (2000), *S. pugilis* egg began cell fission into two cells after five hours and entered the fourth day. Upon entering the water, veliger larvae would be more active in various directions. Dody (2012) stated that veliger larvae phase was able to consume natural food (phytoplankton). In cultivation process, feeding of natural food with *Nanocloropsis* sp. was performed once daily in the morning.

On the eleventh day most of eggs hatched into larvae, so the egg incubation period was 5-11 days. Dody (2012) stated that hatching eggs of *S. turturella* had reached 99.9% entering the tenth day and the incubation period of one colony ranged from 4-10 days. The difference incubation period was alleged by two factors. First factor was temperature in aquarium (25.8 to 27.8°C) under optimal conditions (31°C) for hatching

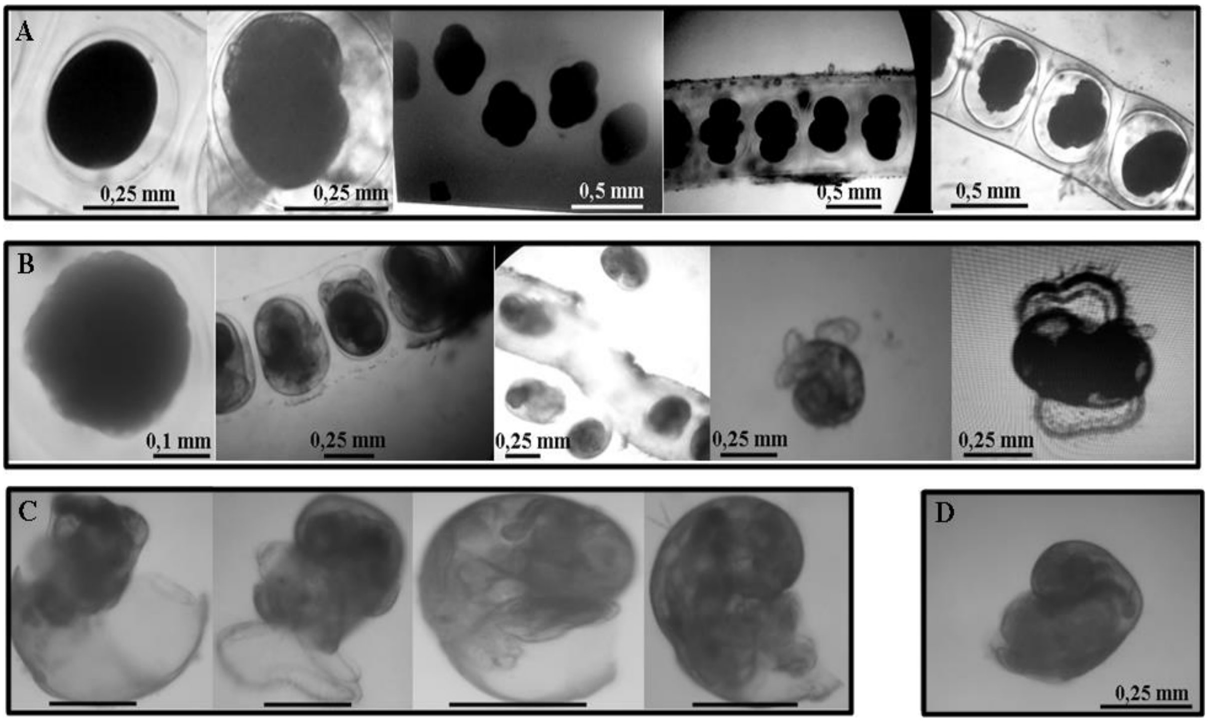

Figure 3. Eggs and larvae development; (a) cell division phase to multi-cell stage, (b) gastrula/trochophore phase; trochophore and capsule separate from the egg colony, (c) veliger larvae swim in the water, scale bar 0.25 mm; (d) larvae entered benthic phase (settled) in the bottom of aquarium.

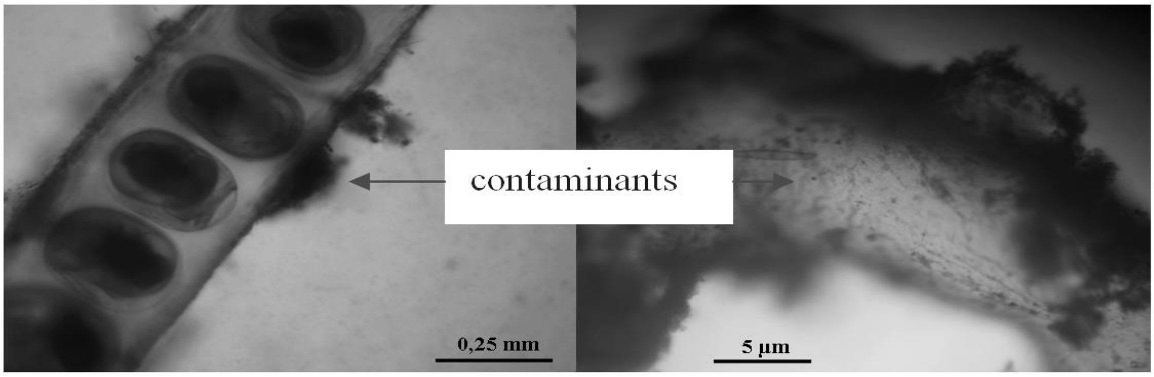

Figure 4. Phytoplankton contaminants around the colony eggs.

eggs. Second factor was many contaminants attached to capsule membrane of eggs during the incubation period. This condition was caused by water to maintain eggs until larvae only filtered by plankton net mesh size of 40 µm. The consequence was smaller plankton still in water and became a contaminant. Some types of phytoplankton seen attached to the egg capsules that rich with nutrients (Figure 4).

3.3. Water Quality

The physical and chemical parameters of water during the larva rearing were measured daily on all aquariums. The water quality parameters in spawning aquarium and larvae maintenance aquarium were showed in Table 1.

Table 1. Water quality in spawning aquarium and larvae maintenance aquarium.

Parameter	Spawning aquarium	Larvae maintenance aquarium	Water quality standard*
DO (mg/L)	4.40 - 5.90	7.60 - 7.80	≥ 5
pH	10.15 - 10.91	8.13 - 8.33	7 – 8.5
turbidity (NTU)	2.00 - 5.10	1.97 - 3.90	< 5
salinity (ppt)	26.5 - 31.1	26.8 - 27.8	≤ 34
Temperature (°C)	25.4 - 25.7	25.8 - 27.8	28 – 32

*Decree of the Minister of Life Environment No. 51 of 2004 on Marine Water Quality Standard for Marine Animal.

Water quality standard was made for all animals in marine habitat, not specific only for dog conch. Only salinity was appropriate with water quality standard in both aquariums. The results of this study were similar to other research measured on natural conditions (Utami, 2012; Khodijah and Anggraini, 2015; Rosady *et al.,* 2016). Dissolve oxygen (DO) only on spawning aquarium was below water quality standard, but the value was not significant difference. The reduction of dissolved oxygen has no significant effect because it can be used anaerobically metabolism (Setyobudiandi, 2000 *in* Utami, 2012).

Turbidity in both aquariums were safe range for aquatic organism. Research conducted by Utami (2012) and Rosady *et al.* (2016) showed the value of turbidity above 5, where the dog conch was still alive. The pH in aquarium spawning was greater than water quality standard whereas larvae maintenance aquarium appropriated with water quality standard. The majority of macrozoobenthos biota was sensitive affect by changing of pH and like in pH of 7.0-8.5 (Yonvitner, 2001). Hawkes (1979) added that gastropods (macrozoobenthos) have different pH ranges and are relatively narrow within the range of 7.5-8.4. Benthic diversity began to decline at pH of 6.0-6.5 (Effendi, 2003).

Temperature in this study was lower than water quality standard and dog conch habitat. Several studies in native habitat found an average temperature between 28.5-29.9°C (Dody, 2007), 28-31°C (Utami, 2012), 29.0-29.7°C (Siddik, 2011) in Bangka Belitung; and 26-30°C (Amini, 1986), 30.1-30.3°C (Khodijah and Anggraini, 2015), 30-32°C (Rosady *et al.*, 2016) in Riau Islands. Very low temperatures in this study were alleged to influence hatching eggs.

VI. CONCLUSIONS

Dog conch (*Stombus* sp.) can be cultivated on a laboratory using an aquarium. Egg cell division occurs after the first 2 hours of the eggs laid by the female parent in several stages so as to achieve multicellular. The eggs hatch into larvae are planktonic veliger ciliated started on the fifth day, and almost all of the eggs hatched on the eleventh day. The newly hatched larvae phase is a critical phase because it requires natural feed size is very small.

Based on the Decree of the Minister of Environment No. 51 of 2004 on Water Quality Standard for Marine Life, the range of values of water quality parameters DO, pH, and turbidity qualify but for salinity, temperature measured is below the range required for live biota sea.

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