

# Preliminary Study On Gonad Maturity Stages of the Sea Cucumber *Paracaudina australis* from Kenjeran Water, Surabaya, Indonesia

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**Abstract.** The holothurian *Paracaudina australis* is belong to family Caudinidae, ordo Molpadida and class Holothuroidea. This species is among the most common holothurian widely distributed in the tropical water. The purpose of this reseach is to do preliminary study on maturity stages of sea cucumber *Paracaudina australis* from Kenjeran Water, Surabaya, Indonesia. This research was conducted on April 2016. Samples were collected randomly on the Kenjeran Water, Surabaya. The result showed that there are five stages of gonad maturity. At the stage of maturity 1, the gonad was not clearly distinguished, there were unbranched small tubule. At the stage of maturity 2, there were small branched of tubules. At this stage, gonad can be differentiated between male and female. At the stage of maturity 3, tubule can be branched not only for male but also female. At the stage of maturity 4, the gonad was good mature, there were clearly branched tubule. At the stage of mature 5, there were generally had empty tubule except for a few relict unreleased spermatozoa. At female gonad, there were shrunken tubule and relict oocytes were presented in the lumen of the tubule.

**Keyword:** *Sea cucumber, Paracaudina australis, Stage of maturity*

## 1. Introduction

The demand for sea cucumber consumption is increasing with the high demand of the world and it makes the stock population of sea cucumbers in the tropical and surrounding areas decreases. This necessarily requires the cultivation of sea cucumbers, restoration of stock population of sea cucumbers in nature by enhancing the cultivation of sea cucumber [1] and [2]. Artificial breeding techniques in sea cucumbers have been developed for some species. Juvenile production techniques in the *Holothuria scabra* species have well developed in several tropical and subtropical countries such as Indonesia, China, Japan and India [3]. However, several species such as *Holothuria scabra* [4] and

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*Paracaudina australis* poorly known about reproduction organ system which including stage of gonad maturity and maturity index of gonad [5].

The high demand for cracker materials and snacks from *P. australis* from Kenjeran waters is increasing and this will result in a decreasing in *P. australis* population stock in the Madura Strait water. There is highly demand for sea cucumber commodities in Indonesia because some types of sea cucumbers have good nutritional value such as fatty acids, amino acids, fats, proteins, phosphorus, calcium, sodium and minerals [6] dan [7]. Sea cucumbers of this species (*Phyllophorus* sp and *P. australis*) also have potential as immunostimulant material against bacterial infections *Escherichia coli* [8].

Teripang *P. australis* is one of the many exploited sea cucumbers in the Eastern Coastal Waters of Surabaya, especially the waters of Kenjeran, Madura Strait. Based on the study of sea cucumbers population were found in Madura Strait waters, there were 7 species namely *Paracaudina australis*, *Phyllophorus* sp, *Colochirus quadrangularis*, *Holothuria sanctori*, *H. forskali*, *H. turriscelsa* and *Holothuria* sp. [5]. Sediments where the living sea cucumber population has the characteristics of sand mud and clay type of sediment [9].

Based on the observation in the field, sea cucumbers *P. australis* have been captured in large quantity. The over exploitation of sea cucumber could be reduced stock population in waters around Kenjeran, Madura Strait. So it is necessary to increase the stock of population in nature. This is certainly not separated from some reproductive studies on sea cucumbers *P. australis* such as maturity level of gonad and gonad maturity index and stock population of sea cucumbers in these waters [5].

The histology study of gonad development for the determination of stages of gonad maturity of sea cucumber *P. australis* has been done for three months in February, March and April, 2012 [5]. This observation will certainly support the study of the determination of pattern and reproduction cycle of sea cucumber *P. australis*. A macro observational study on male and female gonads was performed to supplement data on histology studies of gonad development of *P. australis*. So hopefully study about pattern and cycle of reproduction of *P. australis* in Kenjeran Waters, Madura Strait East Coast Surabaya can support data of population of sea cucumber *P. australis*. The recorded data were reproduction study on the type of sea cucumber *H. scabra* [4], sea cucumber (*H. vagabunda*) [10], fission reproduction of Stichopudidae from Karimun Jawa Island [11].

## 2. Materials and Methods

The material used in this research is the *P. australis* sea cucumber collected from the waters of Kenjeran Madura Strait (Surabaya East Waters) with geographical location between 07 ° 14'12.3 " to 07 ° 13'52.4" south latitude and between 112 ° 48'58.2 "to 112 ° 49'28.8" east longitude. The sampling of 50 sea cucumbers was conducted on the second week of April 2016. Seacucumber *P. australis* was directly taken from a depth of 3 meters with the help of divers by using hands. The observation of the stage of gonad maturity refers to [1], [4], [5] and [7], which consists of stage 1 (gametogenesis), stage 2 (maturation), stage 3 (spawning), stage 4 (early post spawning) and stage 5 (late post spawning). Whereas according to Perezrul et al.,[12], the stage of gonad maturity consist of stage 1 (immature stage), stage 2 (maturing stage), stage 3 (ripe stage) and stage 4 (spent stage). In this study stage of gonad maturity consists of stage 1 (immature stage), stage 2 (gametogenesis), stage 3 (maturation ), stage 4 (spawning) and stage 5 ( post spawning).

### 3. Results and Discussion

#### 3.1. Morphology Gonad *P. australis*

According to this research, there are clearly differences morphological in male and female gonad. In Females, the gonads look more yellow to orange for stages of gonad maturity 1, 2 and 3, whereas in the stage of gonad maturity 4 and 5, the gonad looks more pink (Figure 1 and 2). Tubular branching in female stage of gonad maturity 1 has not been clearly visible, whereas tubules have short branching for stage of maturity gonad 2. Furthermore, for female, tubules have been seen filled in stage of gonad maturity 3 and the number of tubular branching were more numerous. Similarly, in female of stage of gonad maturity 4 have seen a full tubule. Whereas in female for stage of maturity gonad 5 has already seen partially empty tubules (Figure 2). According this research, in the immature stage, tubules had short branched, thick, yellow-white in colour. Furthermore maturing stage had characteristic tubules long, thick and branched ovary pale red, and for the ripe stage had characteristic tubules thick, branched and red colour. Although different species in gonad maturity level, but for maturity level, ripe stage and spawning stage for *Holothuria spinifera* [2] *Isostichopus fuscus* [11], *Holothuria atra* [12], *Holothuria fuscocinerea* [13] *Bohadschia vitiensis* [14] is similar with *Paracaudina australis*.

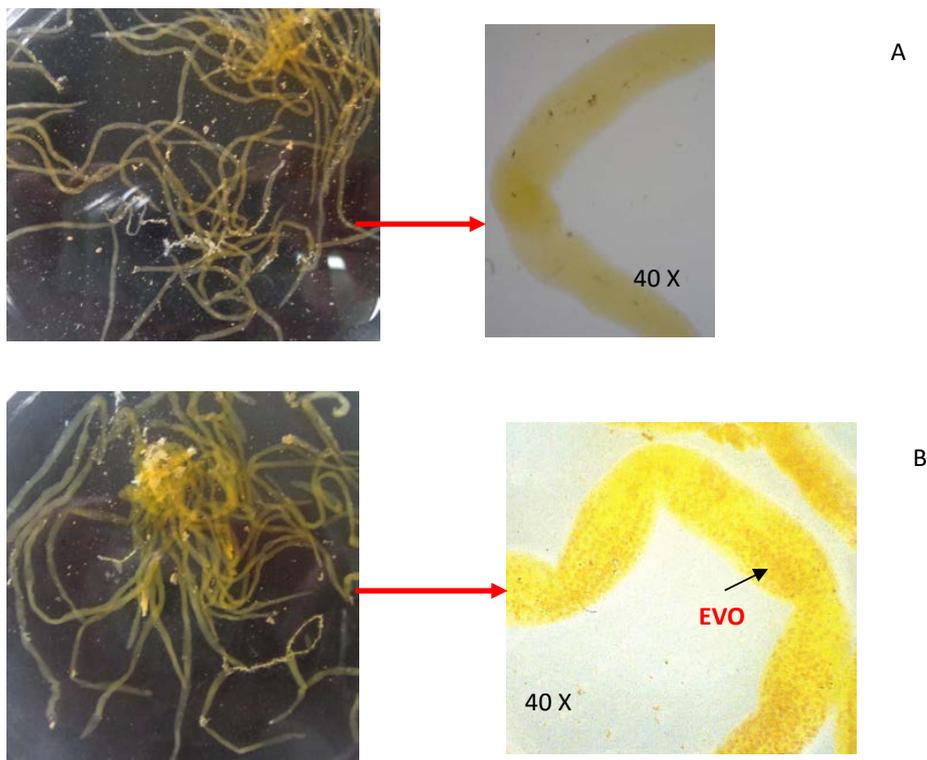


Figure 1. Macroscopic and microscopic of Stage of gonad maturity at female sea cucumber *P. australis*. (A) SGM 1; (B) SGM 2; EVO (Early Vitellogenic Oocytes)

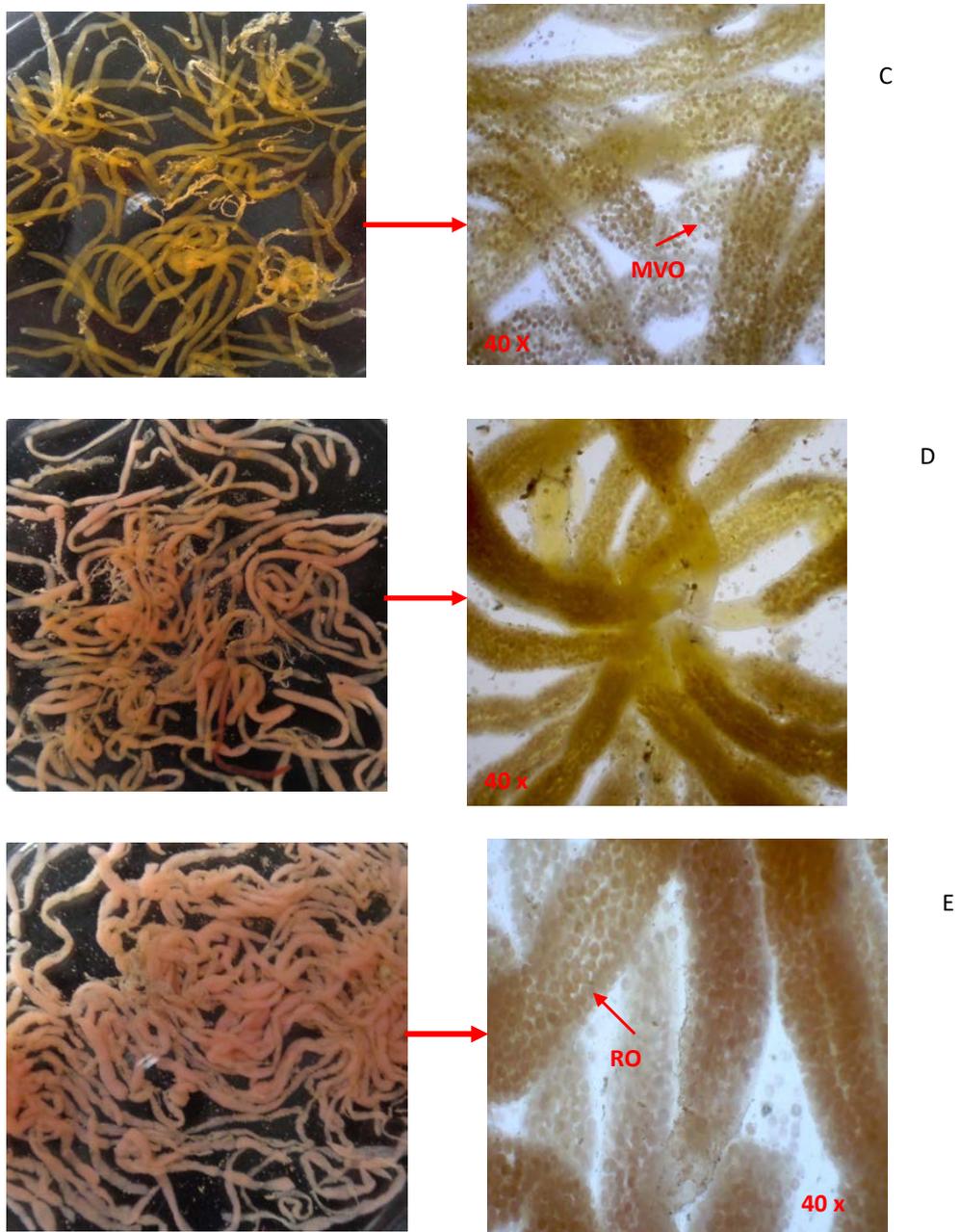


Figure 2. Macroscopic and microscopic at stage of gonad maturity (SGM) for female *P. australis*. (C) SGM 3; (D) SGM ; (E) SGM 5; MVO ( mid Vitellogenic Oocytes); RO (Relict Oocytes)

Based on morphological observations on male individuals, the colour of gonads tends to be pale yellow at stage of gonad maturity 1, 2 and 3, whereas in stage of gonad maturity 4 and 5 were white ivory (Figure 3 and 4). At the maturity level of gonad 1 in male individuals, tubular branching has not been seen clearly and tubules are still small and unfilled with spermatozoa. Furthermore, at the stage of TKG 2 has seen a branching in the tubule and after entering TKG 3 tubules have started to fill with spermatozoa. Spermatozoa removal in tubule is getting fuller on TKG 4 has a lot of branching. While at the 5th stage where it has entered the spawning stage (spawning) has seen the tubules that have started empty. (Figure 3.). It is also in accordance with the opinion of [12], that at the final stage of gonad maturity, the tubules in the *Holothuria atra* have been partially empty while the 2nd and 3rd stages are the maturity stage.

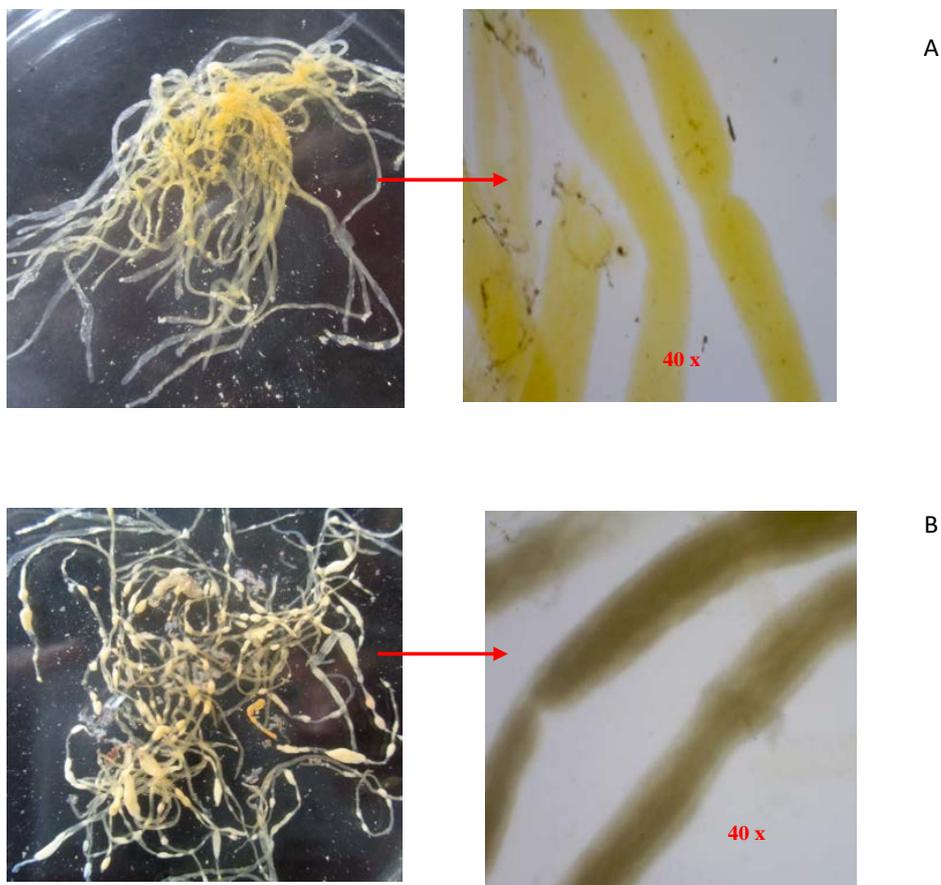


Figure 3. Macroscopis and microscopis Stage of Gonad Maturity (SGM) Tingkat on male of *P. australis*. (A) SGM 1; B) SGM 2.

In the observation of individual female sea cucumbers *P. australis* for stages 1 and 2 had a slightly different colour (orange colour) while in stages 3, 4 and 5 the colour becomes pink (Figure 3 and 4). It also appears in the *Holothuria atra*, where the colour of the tubules at stage of gonad maturity 2 and 3 were pink [2] [12]. The morphology structure of maturity level of gonad sea cucumber *P. australis* almost equal to the condition of sea cucumber *Holothuria vagabunda* [7], *Holothuria scabra* [4], *H. fuscocinerea* [14].

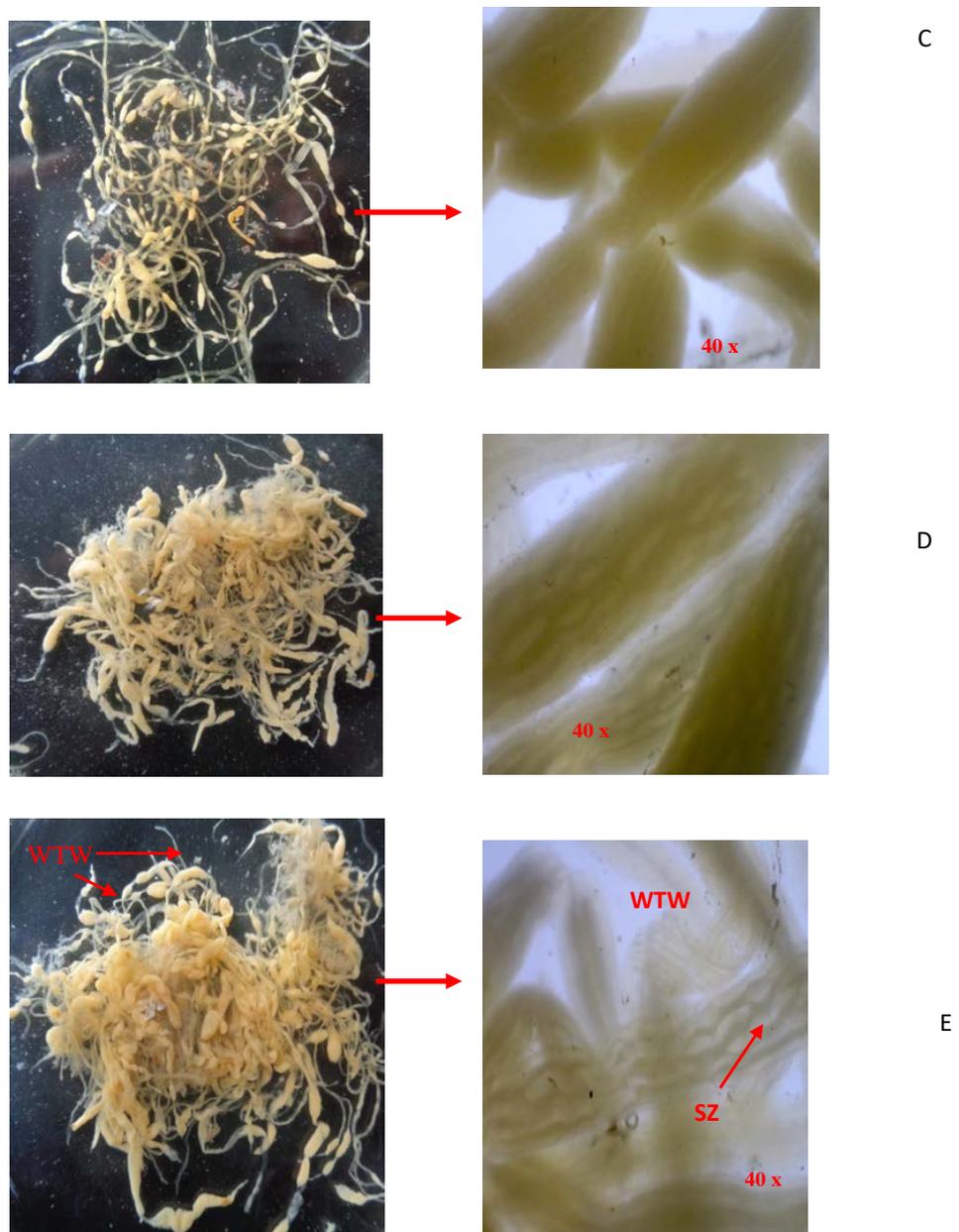


Figure 4. Macroscopic and microscopic Stage of Gonad Maturity (SGM) Tingkat on male of *P. australis*; C) SGM 3, D) SGM 4 ; E) SGM 5; WTW (wrinkled tubule wall); SZ (Spermatozoa)

In both male and female organism, the tubule at the first stage of gonad maturity are not yet clearly visible branching forms. While in the second stage has been formed branching followed by the filling of tubules with spermatozoa in males and oocytes in females. The maturation stage is usually called the third stage. While in the stage of gonad maturity 4 in tubules both in males and females already appear fully filled. Then in the fifth stage has begun to see the partially empty tubules where both the female and male individuals have spawning in natural.

According to the observation on the maturity level of gonads both in males and females, sea cucumbers *P. australis* is differenced between characteristic every stage gonad maturity not only for female but also for male. The characteristic gonad of *P. australis* is not similar with the other species of such as *Isostichopus fuscus* [11], *Holothuria atra* [12], *Holothuria fuscocinerea* [13] *Bohadschia vitiensis* [14], *Cucumaria frondosa* [15], *H. sanctori* [16] .

### Conclusion

At low stage of gonad maturity in females showed that tubules with short branches in light yellow. While the higher stage of gonad showed that tubules have been long branches with pink to red in females. At low stage of gonad maturity levels for the males showed that tubules have been short branches in light yellow. While the higher stage of gonad maturity showed that indicate tubules with long branches with ivory colour up to white.

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