Sea urchin identification in Kodingareng Lompo waters, Spermonde Archipelago

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Abstract. Sea urchin, belongs to Phylum Echinoderm, Class Echinoidea. It is categorized as benthic marine invertebrates, and could be found in several ecosystem from shallow water to abyssal depth. Despite the high potential, there is no detail information of this organism in Indonesia, especially in Spermonde Archipelago, South Sulawesi Region. This study aim to identify the sea urchin species found in Kodingareng Lompo Island, Spermonde Archipelago. Kodingareng Lompo is one of the islands belong to Sangkarang Regency, Makassar city. Sampling was done during July 2020. Samples were collected randomly in seagrass bed and transition area. The morphological identification was conducted at the main island. The morphological traits of sea urchin samples collections were observed, noted, and compared with some literatures for identification. There three kind of sea urchin found in this waters: Diadema setosum, Mespilia globulus and Tripneustes gratilla.

1. Introduction

Sea urchin is one of marine invertebrate, belong to Phylum Echinoderm, Class Echinoidea or Echinoid. Echinoids known as benthic fauna, and could be found from shallow water to abyssal depth, mostly all around the world. Echinoids can be found in many marine environments, start from seagrass bed, rubble until coral reef ecosystem [1]. It could live solitary or in group. Some species are live with burrowing habit, and some are immersing itself into sand. Echinoids are mostly herbivore, consuming algae and seagrass. However, some species found to be omnivore, especially in unfavorable conditions. Number of species found in the world was reported about 800 species, and in Indonesia the number of species are 84 species from 48 genera [2, 3].

Echinoids includes sea urchin, heart urchin and sand dollars. Sea urchin categorized as regular Echinoids, meanwhile heart urchin and sand dollars categorized as irregular Echinoids. The common characteristics of the adult regular echinoid are globular and penta-radial symmetry. The skeleton commonly known as ‘test’. It is made from calcareous plates, round and rigid. Test size could vary from 3 to 10 cm. Mouth located near substrate, downwards, known as oral side. Meanwhile its anus located at the opposite part of its body (aboral side). There is jaw apparatus, called Aristoteles’s lantern, inside its mouth. Aristoteles’s lantern is very complex apparatus with many parts and moved with assistance of almost 60 muscles, which could cut not only the sea plants, but also shells of some fauna. Area around the mouth called ‘peristome’. Plates around anus called ‘periproct’. At periproct, there is genital pore, and madreporite. Extend from mouth (oral) to the upper body (aboral), near anus, there are regions along sea urchin body, called ambulacral groove or ambulacral area, and it is alternate with region called inter-ambulacral. Ambulacral groove are commonly found in other class of Echinoderm. However, in Echinoids the grooves are closed [1, 4, 5]. Echinoids also known for its spines. Some species have long, needle-like, some have short spines. The spines size varies from 1 to 30 cm in length, depends on the species. The spines are flexibles and used for locomotion. It is also
function as passive self-defense and to trap the food. It also has tube feet, which function to move, catch prey, and attach to substrate [1, 4].

Sea urchin are valuable, ecologically and economically. Ecologically, sea urchin is in food web, eat the seagrass, algae, mollusks. It also consumed by sea star, crab, and several kinds of fishes. Economically, sea urchin is widely known for its gonad. Sea urchin gonad, common term is ‘roe’ or ‘uni’ in Japanese, famous as delicacies in several countries, particularly in Asia, Mediterranean, Polynesia and Chile. The number one country consumes sea urchin gonad as delicacies is Japan, which took about 80% of the sea urchin gonad world production. The second consumer country is France. Several species that most consume are Strongylocentrotus intermedius, S. nudus, Hemicentrotus pulcherrimus, Pseudocentotus depressus, Abthocidaris crassispina, and Tripneustes gratilla [6]. In Indonesia, sea urchin is also consumed, but only in several areas or communities. From 84 species, 6 species are commonly consumed by people in Tomia Island, Southeast Sulawesi Region: T. gratilla, Diadema setosum, Echinothrix calamaris, Toxopneustes pileolus, Mespilia globus dan Echiometra sp. In North Maluku, Talibu Island, T. gratilla, D. setosum, Echinothrix calamaris are processed and consume by local. Furthermore, T. gratilla is the most consume in Bali [7]. In South Sulawesi region, sea urchin is not commonly consumed.

Sea urchin is one of marine invertebrate with high potential. Its gonad not only consumed, but some researches are applied for its antimicrobe and antibacterial. Furthermore, it is not only the gonad, live sea urchins are used for aquarium, and the test are processed to become souvenirs. Many researches have been applied, considering the potentials of this organism. Nevertheless, no detail information about sea urchin in each area of Indonesia. Since it is important to have the basic data for sea urchin in each area, this research was conducted.

2. Materials and Method

2.1. Field work
Sampling was conducted in Kodingareng Lompo, Sangkarang District, Spermonde Archipelago, South Sulawesi. Geographically, it is located on 119° 16‘00 BT dan 05° 08’54 LS. This island could be reach about one hour by regular ship from the mainland, Makassar City, or about 30 minutes by speedboat. Wide area of seagrass bed located at the western part of this island, extend to about 600 meters. Sampling was done several times on July and August 2020. Sampling was done randomly, in seagrass bed, rubble and coral area, from the shore to 100 meters. Samples were collected and several pictures were taken during the sampling. Collected samples were preserved in formalin to keep the test structure. Identification were done for morphology characteristic. Identification were done on the mainland.

2.2. Sea urchin identification
Identification conducted in this research was based on its morphology. The identification was done by categorized the samples based on their general and specialized features for the sea urchin and compare them to the several identification books or articles.

3. Result and Discussion
Samples collected in this study are regular Echinoid. This confirmed by the round shape, with anus in aboral, within apical system, and mouth in the centre of the oral surface. Mouth downward, facing the substrate. There are three genera of sea urchin found in Kodingareng Lompo waters based on their morphological characteristic. The three genera of sea urchin are Diadema sp., Mespilia sp., and Tripneustes sp.

3.1. Diadema
Diadema species are belong to Order Diadematoida, Family Diadematidae. It is mention that the characteristic for Diadematidae are primary tubercules perforate and often also crenulate. Spines
usually hollow, long, cylindrical and very slender and breakable [5]. Other genus belong to this family are Astropyga and Echinotrix. Diadema apical system are similar with Echinotrix which genital plates not longer than wide. Meanwhile genus Astropyga have apical system with genital plates conspicuously elongated (Figure 1). Spines are used to differentiate Diadema and Echinotrix genus. However, it is difficult to differentiate the spines visually with bare eyes. Nevertheless, based on other characteristics, the samples from this study are belong to Diadema genus.

Diadema found in this research shows morphological characteristic of *D. setosum* species. It was confirmed by the orange ring color on anal ring cone that can be seen clearly during the sampling (Figure 1 and 2). At aboral area, white spots and blue iridophores were also found (Figure 2) [8, 9, 10]. These morphological traits are very similar to *D. clarki*. However, in Chow et al. 2016 the characteristic of *D. clarki* explain with white or other color streaks and not white spot. Other characteristic mentioned was white-streak like remnant can be seen on the dried specimen of *D. clarki* [9]. This characteristic is nowhere to be found in this study samples (Figure 1).

There are, at least, three species of Diadema found in Spermonde Area [10]. However, there are not so many specific and detail researches done for sea urchin identification. Chow et al. [8, 9] mention in his publication that *D. clarki* cannot be found in Indonesia waters. Therefore, more detail morphology identifications are required for sea urchin in Spermonde area.

Figure 1. (A) Apical system of Diadema samples in this study (area inside red circle), (B) Apical system of Diadema and Echinothrix from an identification book [5], (C) Apical system of Astropyga from an identification book [5]

Figure 2. (A) Underwater photo of *Diadema sp* shows orange ring anal and white spot at the aboral side. (B) Close up photo of *Diadema sp*. shows white spot (red arrows) and blue iridophores
One unique characteristic found in this study is the different color of the spines: some samples have black spines and some samples have stripes spines (Figure 2A and Figure 3). Nonetheless, there are no previous study explain about this in detail. It could be one species with different genetic variance. This unique fact will require further study with genetic tools identification.

![Figure 3. The variation of Diadema spines color (A) with stripes, (B) all black](image)

3.2. *Mespilia*
Genus *Mespilia* is belong to Ordo Camarodonta, Family Temnopleuridae. *Mespilia* sp. also known as tuxedo pincushion sea urchin. It describes as five broad-coloured bands alternate with five usually blue or black darker bands [11]. The samples that we took show this color (dark blue). However, after taken to the main land, the test color changed to darker side (Figure 4). This species is usually not big, the diameter only up to 6-8 cm. It can be found only in tropical waters [11].

![Figure 4. *Mespilia* sp.](image)

3.3. *Tripneustes*
Tripneustes genus belong to Ordo Camarodonta, Toxopneustida family. Characteristic of Toxopneustidae are gill silts sharp and deep; test pentagonal or circular as viewed from above. Meanwhile for Tripneustes, the globiferous pedicellaria small, inconspicuous; only 1 in 3 or 4 ambulacral plates with a primary tubercle; test high, almost globular, pore-pairs in horizontal arcs and spaced to form 3 distinct vertical series.

There are three species of Tripneustes, with non-overlapping distribution: *T. ventricossus*, *T. gratilla* and *T. depressus*. *T. ventricossus*, known as white sea urchin, found on both sides of the
Atlantic ocean. *T. gratilla*, found in the central and western Pacific Ocean as well as the Indian Ocean. *T. depressus*, known as brown sea urchin, found in the eastern Pacific Ocean only. Morphologically, the three species are very similar, though *T. depressus* spines mostly are brown to purple in color, and *T. ventricosus* spines are white [12].

*T. gratilla* describe as “Round sea urchin, slightly flattened. Spines very short, solid; usually white but may be orange or nearly black. Test also highly variable in colour, with shades of white, pink, purple and sometimes green.” [13]. The color variation of *T. gratilla* was associated to the habitat and environment [14].

![Color variation of *Tripneustes gratilla*](image)

**Figure 5.** Color variation of *Tripneustes gratilla* found in this study

4. Conclusion
There are three genera from two different family of sea urchin found in Kondigareng Lompo waters in Spermonde. The three species from the three genera of sea urchin are *Diadema setosum*, *Tripneustes gratilla* and *Mespilia globulus*.

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