

## Species diversity of gastropods (Cypraeidae and Conidae) at Krakal Beach, Gunungkidul, Yogyakarta, Indonesia

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**Abstract.** Febiansi D, Rahmayanti F, Kurnia RN, Silmi MA, Dewi AK, Millaty NK, Prasetya TA, Roshitafandi DA, Sartika HW, Trijoko. 2018. Species diversity of gastropods (Cypraeidae and Conidae) at Krakal Beach, Gunungkidul, Yogyakarta, Indonesia. *Ocean Life* 2: 27-32. Krakal is a beach in Gunungkidul, Yogyakarta, Indonesia which has white sand and coral substrate in the intertidal zone. Cypraeidae and Conidae are families of gastropods found quite varied in the intertidal zone of Krakal Beach. The purpose of this research was to discover the diversity of Cypraeidae and Conidae families in the intertidal zone of Krakal Beach, Gunungkidul, Yogyakarta. The research was conducted on May 24, 2014 and May 25, 2017. The ecological parameters recorded were 26,5°C for temperature in 2014 and 26°C for temperature in 2017,  $\pm 3.35\%$  for salinity in 2014 and  $\pm 3.6\%$  for salinity in 2017, 7.7 for pH in 2014 and 7 for pH in 2017. The samples were collected using purposive sampling method, and specimens were identified by determining the morphological characteristics of the shell. This study found 5 species of Cypraeidae family in the intertidal zone of Krakal Beach, those are *Cypraea annulus*, *Cypraea bouteti*, *Cypraea moneta*, *Cypraea caputserpentis* and *Cypraea lynx*. While for family Conidae 5 species were found, those are *Conus coronatus*, *Conus ebraeus*, *Conus capitaneus*, *Conus botulinus*, and *Conus fergusonii*.

**Keywords:** Conidae, Cypraeidae, diversity, gastropod, Krakal

### INTRODUCTION

Indonesia is an archipelago. It can be estimated that the Indonesian archipelago comprises 17,840 islands. According to data published by PBB in 2008, Indonesia has the fourth longest coastline in the world and extends 95,181 km from the western end to the eastern tip of Indonesia (KKP 2009). Long coastlines support a wide range of marine flora and fauna species with high abundance and diversity (Pieter et al. 2013). One of the beaches that has potential for diversity is Krakal Beach located in Ngestirejo Village, Tanjungsari Sub-district, Gunungkidul Regency, Special Region of Yogyakarta. Krakal Beach is one of the white sand beaches that has become a famous tourist attraction. The beach is located at the coordinates of S8 ° 8'42.3 "E110 ° 36'8.9", the length of the coastline reaches over 700 meters with a gentle and wide surface. The coastal intertidal zone is quite extensive with a variety of substrates in the form of rocks, sandstone, and corals, which are overgrown with algae, seagrass, and sponge. The variety of these substrate causes this location to have a diverse community of biota. Various biota communities that can be found are algae communities, coral reefs, fish, and various other invertebrate organisms that include thermodynamics, molluscs, crustaceans, and meiofauna. The high potential of marine resources has begun to be disrupted by human activity. This is because the intertidal area of this beach has a lot of interaction with human activities, especially tourists. Coupled with the

activities of surrounding communities that often take marine biota for consumption, such as *Ulva* sp., sea urchins, and ornamental fish. The area will be submerged in sea water during tidal conditions and will become open areas when sea water recedes so the area becomes a place that is very easily exploited by tourists and the surrounding community. The habitat changes have a significant impact on the survival of flora and fauna from year to year (Satino 2003). One of the organisms that are sensitive to habitat changes is molluscs. Molluscs are a soft-bodied animal. Molluscs have three main parts of the body, i.e., legs, visceral mass, and mantle. Most molluscs secrete a strong protective pillar made of calcium carbonate. Molluscs mostly live in the sea, although some species inhabit fresh water, and some snails and bare snails live on land (Campbell et al. 2010). Molluscs play an important role in the formation of marine ecosystems (Arbi 2010). Changes in the structure of the molluscan community can serve as a bioindicator of the aquatic environment. Therefore, a study of the inventory of biodiversity and abundance of molluscs is required. The purpose of this research is to assess the diversity of mollusc species especially family Cypraeidae and Conidae located in the intertidal zone of Krakal Beach. The results of this study are expected to be used as additional information about the biodiversity of molluscs located in the intertidal zone of Krakal Beach. In addition, it can be used as a reference in determining coastal tourism management policy.

## MATERIALS AND METHODS

### Study area

The research was conducted on 24 May 2014 and 25 May 2017 at intertidal zone of Krakal Beach, Gunungkidul, Yogyakarta, Indonesia (S8°8'42.3" E110°36'8.9"). Materials that were used in this research included Gastropod sample particularly family Cypraeidae and Conidae, aquadest, 73% MgCl<sub>2</sub>, 70% alcohol. Tools that were used included zip lock plastic, laminated millimeter blocks, paper labels, and digital camera.

### Procedures

#### Sample collection

Sample collection was conducted using purposive sampling method. Sampling was done by surveying the coastal intertidal zone by walking from the eastern end to the western end of the beach. Along the way, the gastropod that was found was collected and then inserted into a zip lock plastic. The plastic is labeled using a label paper containing sampling site and sampling time. Substrates, where the specimen was found, were also noted for supporting data. Before preservation, several morphological characteristics were also observed.

#### Preservation

Sample preservation began by taking pictures of shell and aperture of the specimens. Preservation via dry and wet preserves using MgCl<sub>2</sub> 73% (relaxation), 96% alcohol (fixation), and 70% alcohol (wet incidence).

#### Identification

Identification of Gastropods was conducted using the following resources: The Living Marine Resources of The Western Central Pacific Volume 1 and 2 (Carpenter and Niem 1998), The Shell Book (Rogers 1908), Seashells of

the World (Abbott 1985), and Compendium of Seashells (Abbott and Dance 1998).

## RESULTS AND DISCUSSION

This study found 5 species of Cypraeidae family in the intertidal zone of Krakal Beach, namely *Cypraea annulus*, *Cypraea bouteti*, *Cypraea moneta*, *Cypraea caputserpentis* and *Cypraea lynx*. While, for family Conidae 5 species were found, those were *Conus coronatus*, *Conus ebraeus*, *Conus capitaneus*, *Conus botulinus*, and *Conus fergusonii*. *Cypraea* is a gastropod that has an oval-shaped, smoothly polished and often brightly colored shells, with a narrow aperture stretching along the whole shell length. Generally associated with coral reefs, *Cypraea* uses tentacles to sense and capture food. They feed mainly on algae or coral animals, also foraminifera, sponge and small crustaceans. The tentacles were distributed all over the mantle surface to achieve the maximum surface area to capture food. *Cypraea* move by using the muscular foot tissue. There are two ways for gastropods animal to attach, using the peristaltic muscle and the mucus to glide. The thick muscular foot tissue can produce mucus as lubricant when moving and reduce desiccation. Like most of the gastropods, *Cypraea* has a siphon to aid respiration. The siphon is a part of the mantle skirt and when needed it curls to form a tubular extension at the anterior. This allows the water current to feed oxygen towards its gills in the mantle cavity. Reproduction dioecious, the egg is generally spawned in coral caves, empty shells or similar dark places. Female gastropods do not leave the eggs after spawning in order to protect the eggs from predators until the eggs have hatched.

In general, species of molluscs found in coastal waters of Krakal, Gunungkidul, Yogyakarta can be classified as follows :



**Figure 1.** Map showing research location at Krakal Beach, Gunungkidul, Yogyakarta, Indonesia

***Cypraea annulus***

The gold ring cowry, is a marine gastropod in the Cowry family, Cypraeidae. This species is usually 1.5-2 cm in length and has a distinctive gold dorsal band on the glossy, cream shell. *C. annulus* is nocturnal and emerges to graze on plants and algae at night with its mottled, brown mantle fully extended over its shell. Habitat preferences include shallow water, tide pools, under stones or amongst seagrasses. Distribution in Indo-Pacific, tropical Indo-Pacific, also in Australia. *Cypraea annulus* live at 24°C-28°C, on salinity 33,67 PSU-35,42 PSU, and depth at 0,5 m – 8 m (Rosenberg 2011).

***Cypraea bouteti***

Creamy brown colored with lines across the back or upper side of the shell. Habitat in under stones or amongst seagrasses, intertidal zone. Distribution in Indo-Pacific (Moretzsohn 2012).

***Cypraea moneta***

Has a shell with knobby outline and raised dome. Colour creamy, yellowish or pale green, occasionally with three darker bands. Habitat in shallow seagrass. Distribution: Indo-Pacific, tropical Indo-Pacific. Depth 0m-70m, salinity 33,67 PSU-35,5PSU, and temperature 23-28°C (Rosenberg 2010).

***Cypraea caputserpentis***

Rather flattened shell with thickened margins, up to 4 cm. Dorsal surface brown with numerous cream spots. Lower sides and base dark chocolate-brown. Habitat intertidal zone in rocky or shallow seagrass. Distribution in the West Indian Ocean, tropical Indo-Pacific. *Cypraea caputserpentis* live at 23-28°C, and salinity 33.7 PSU-37.2 PSU (Rosenberg 2012).

***Cypraea lynx***

The dorsum surface of these smooth and shiny shells is generally pale brown, pale purple or grey, densely covered with small and large dark brown or purple dots. The large spots are extended to the edges. These cowries live in tropical shallow water, subtidal and intertidal, usually under rocks or corals up to about 10 meters. Distribution in the Indian Ocean, western Pacific Ocean, western and northern Australia, and tropical Indo-Pacific. *Cypraea lynx* lives in 25-28°C and salinity on 33.7 PSU-35.8 PSU (Rosenberg 2010).

***Conus coronatus***

Has distinctive features that distinguish it from other species. This species has a small, squat heavy shell, up to 4 cm; has aperture variably wider at base than at shoulder; and the sides of body whorl convex. Colour light, mottled pinkish-blue with brown dots and blotches. Various sized markings of brown, black or olive, spirally aligned on either side of subcentral band, either separate or fusing into 2 solid color bands. Variably spaced spiral rows of alternating white and dark dots or dashes from base to shoulder. Aperture purple-brown (Richmond 1997; Gmelin 1791). Environmental parameters of *Conus coronatus* are

26.8-28.5°C for water temperature, 1.0-2.88 µmol/L for water silicate concentration, 0.088-0.26 µmol/L for water phosphate concentration, 0.09-0.44 µmol/L for water nitrate concentration, and 4.35-4.67 mL/L for water dissolved O<sub>2</sub> concentration (Bouchet et al. 2015). Habitat in shallow water, often under boulders (Richmond 1997). Abundant in coral reef areas, in sand pockets among corals or exposed on rocks. Intertidal and shallow sublittoral zones to a depth of about 10 m. Sometimes present in local markets of the northern Philippines. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to Japan and Hawaii, and south to northern New South Wales (Carpenter and Niem 1998).

***Conus ebraeus***

Easily recognizable small, squat shell, up to 5 cm, with a rounded, short spire. Body whorl smooth, convex at top third, straight or slightly concave below, sculptured with weak spiral ribs on lower half. Patterned with four spiral bands of blackish squares on a white background, the lower band compressed at base. Aperture narrow with colored bands. Siphon and rostrum black, tipped with a narrow red margin (Richmond 1997; Kohn 1959; Beechey 2004). Environmental parameters of *Conus ebraeus* are 1-67 m for depth range, 23.160-28.394°C for water temperature, 0.983-7.726 µmol/L for water silicate concentration, 0.071-0.526 µmol/L for water phosphate concentration, 0.146-3.658 µmol/L for water nitrate concentration, 4.131 mL/L-4.700 mL/L for water dissolved O<sub>2</sub> concentration, and 33.721-35.125 PPS for salinity (Bouchet et al. 2015). This species is found in intertidal and subtidal habitats to about 3m, on sand, among or beneath dead corals and on coral reef and limestone platforms. It feeds on polychaetes (Rockel et al. 1995). The distribution is Indo-Pacific (Richmond 1997).

***Conus capitaneus***

Shell of moderate thickness; body whorl encircled by finely punctate striae on the basal half, the striae more distinct and separated by low ridges basally; aperture rather narrow, the sides parallel. Shoulder angular, smooth; spire rather low, obtuse, striate; apex pointed. Color of body whorl variable, yellow or olive yellow to orange-brown or olive brown, encircled by several dark brown dotted lines and two broad white bands, interrupted by dark brown blotches, at the shoulder and centrally on the body whorl. The white bands may also be crossed by closely spaced longitudinal wavy brown lines. Young individuals may lack the two white bands. Spire tessellated with alternate brown and white blotches, continuing to form band on body whorl at shoulder. Outer lip thin; aperture violet within (Beechey 2004). Environmental parameters of *Conus capitaneus* are 23.25-26.8 °C for water temperature, 1.0-1.25 µmol/L for water silicate concentration, 0.13-0.16 µmol/L for water phosphate concentration, 0.09-0.22 µmol/L for water nitrate concentration, and 4.67-4.82 mL/L for water dissolved O<sub>2</sub> concentration (Bouchet et al. 2015).

### *Conus betulinus*

Spire of low to moderate height, outline variably concave. Basal third of last whorl with variably broad spiral ribs. Ground color yellowish tan to orangish brown, less often cream white mottled with yellow or orange; occasionally, ground overlaid with grey. Last whorl generally with spiral rows of brown markings, varying from a great number of closely set rows to absence of rows. Markings vary from narrow spiral dashes to rectangular bars and from dots to round or squarish spots and axial flecks. Dark markings alternate regularly with white markings that are often absent from adapical two-thirds. Basal part of last whorl may be of darker color. Aperture white, sometimes pale yellow or violet; smaller shells often suffused with violet-brown deep within (Linnaeus 1758). Found in littoral and shallow sublittoral zones to a depth of about 20 m, in sheltered bays and on reefs, inhabiting sand pockets, sand flats, and muddy sand. Sand flats, especially in sheltered areas and near seagrasses. Widespread in the Indo-West Pacific, from East Africa to eastern Polynesia; north to southern Japan and south to Queensland and New Caledonia (Carpenter and Niem 1998).

### *Conus fergusonii*

Spire whorls slightly concave; large specimens white, small specimens yellow-orange, shells large (maximum length 153 mm) with widely spaced spiral rows of dark brown spots; spire lacking color pattern. Spire low to moderately elevated; spire outline concave in small specimens to nearly straight in large specimens; shoulder sharply angulate in small specimens, less angulate in large specimens. Aperture moderately broad. Color light yellow-orange, paler in medium-sized specimens, fading to white in large specimens; small specimens with a distinct lighter spiral band about the middle of the shell and usually a second light band at the shoulder; spire lacking color pattern; small specimens with spiral rows of dark brown dots on body whorl; aperture white within. Periostracum thin and light colored in small specimens, thick and dark brown in large specimens (McLean and Nybakken 1979). This species occurs at depths of 0 to 200 m on sandy and muddy substrates (Paredes et al. 2010; Tenorio et al. 2012).

**Respiratory System.** This animal respire only by branchiae, and have the head furnished with two tentacula, which bear the eyes near their summit. They have a narrow mantle, and a tube above the head, by which the water gains admittance to the respiratory organ. **Reproduction System,** sexes are separate in *Conus* and the male has an extendable penis (Kohn 1959).

**Digestive System.** Their venom is produced in the tubular venom duct and expelled into the proboscis by the contraction of a muscular bulb at the basal end of the venom duct. The proboscis also contains a radular tooth which is used as both a harpoon and disposable hypodermic needle through which the venom is delivered to the prey. Once the venom has been injected, the prey is immobilized almost instantaneously and engulfed by the cone snail (Halai and Craik 2009).



Figure 2. *Cypraea annulus*



Figure 3. *Cypraea bouteti*



Figure 4. *Cypraea moneta*



Figure 5. *Cypraea caputserpentis*



**Figure 6.** *Cypraea lynx*



**Figure 10.** *Conus betulinus*



**Figure 7.** *Conus coronatus*



**Figure 11.** *Conus fergusonii*



**Figure 8.** *Conus ebraeus*



**Figure 9.** *Conus capitaneus*

This research into the diversity of Mollusca at Krakal Beach found as many as 10 species consisting of 5 species of Cypraeidae members and 5 species of conidae members. Species found include *Cypraea annulus*, *Cypraea bouteti*, *Cypraea moneta*, *Cypraea caputserpentis*, and *Cypraea lynx*. Conidae 5 species, those are *Conus coronatus*, *Conus ebraeus*, *Conus capitaneus*, *Conus botulinus*, and *Conus fergusonii*. The abundance of gastropods in Krakal Beach is positively correlated with coastal substrate conditions in the form of rocks. In addition, gastropods have varied diets, some are herbivores, deposit feeders, Polychaeta eaters, scavengers, bivalve eaters, fellow gastropod eaters. Therefore, gastropods are more easily found in different habitats (Susetiono 2005).

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