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Diversity of Crabs in the Intertidal Zone at Sundak Beach, Gunungkidul, Indonesia

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Abstract. Crabs are members of the subphylum Crustacea that can be found in various habitats, such as in the intertidal zone at Sundak Beach. However, Sundak Beach is a popular tourist attraction with tremendous activities in the intertidal zone. This can cause habitat loss of crabs. Information on the diversity of crabs at Sundak Beach is still limited. Therefore, this study aims to conduct crabs inventory at Sundak Beach. Samples were collected at night in Aug 2016 and Jan 2017 using purposive sampling method. The results showed that 16 species from six families were found at Sundak Beach, including *Calappa gallus* (Calappidae); *Eriphia scabricula* (Eriphiidae); *Grapsus albolineatus* and *Percnon planissimum* (Grapsidae); *Tiarinia cornigera* (Majidae); *Charybdis annulata*, *Portunus granulatus*, *Portunus pubescens*, *Thalamita coeruleipes*, *Thalamita intermedia*, *Thalamita prymna*, and *Thalamita sima* (Portunidae); *Actaeodes tomentosus*, *Atergatis floridus*, *Ozius rugulosus*, and *Zosimus aeneus* (Xanthidae).

Keywords: crabs, purposive sampling, species richness, Sundak Beach

INTRODUCTION

Crabs are promising trade commodities. They can be used as food, animal feed, and even cosmetics. In addition, they also have an important role in the ecosystem as predators and detritivores [1]. Crabs have extensive living areas including freshwater, brackish water, and marine. In marine, their habitats are scattered in various zones, from intertidal to deep ocean. Sea crabs can be found almost in all continents, while freshwater crabs only live in warm climates [2]. In their habitat, movement of crabs to the upper habitat at night time, it helps them in evading predators like birds [3].

Intertidal crabs are exposed to fluctuated marine conditions during high tide and low tide. This typical stress will lead to specific adaptation. Intertidal crabs will keep their gills moist using articulating plates which are able to block the dry air entering the gills. They also choose a dark and moist place to hide. Most intertidal crabs are small in size. It is an advantage for them to avoid predators and big waves by entering coral crevice [4].

Gunungkidul, a region located in the D.I. Yogyakarta province has more than 60 beaches stretching as far as 70 km in the south part of Java Island [5]. Crabs are easily found on those beaches, but many are still not explored. Some tropical crab families are Portunidae, Majidae, Gelenidae, Dromidae, Calappidae, Ocypodidae, Grapsidae, Porcellanidae, Macropthalmidae, Xanthidae, and Pilumnidae [6]. Some beaches are not accessible for vacation, while others are visited by many tourists, e.g., Sundak beach. The number of tourists increases every year, causing massive activities like stepping on the intertidal zone cannot be avoided. It potentially damages the intertidal zone which is the habitat of most crabs [5, 7]. It is necessary to collect crabs species living on the beach as a primary or secondary data for advanced study in the future.

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MATERIALS AND METHODS

Main tools used in this research were hand net and tweezers to catch crabs. The headlamp was used because sampling was done at night. Bucket and labeled ziplock plastics were used as a sample container. Digital camera and millimeter block were used for documentation purpose. Alcohol 70 % and 10 % solution of formaldehyde in distilled water were used for preservation in a bottle.

Sampling was conducted on Aug 27th, 2016 and Jan 27th, 2017 at night because most crabs are nocturnal. This two different time of sampling were related to the season, i.e., August is mostly warm and dry while January is the rainy season. Sampling was done by purposive sampling method. This method is carried out by walking down the coast at the intertidal area in order to find crabs [8]. Each crab samples obtained were sorted and preserved with Alcohol 70 % for wet preservation and 10 % solution of formaldehyde for dry preservation. Small crabs were released. Identification was done using several books, i.e., *A guide to decapod crustaceans of the South Pacific* [9], *Marine Decapod Crustacea of Southern Australia: A Guide to Identification* [10] and *The Living Marine Resources of The Western Central Pacific VOLUME 2 Cephalopods, crustaceans, holothurians and sharks* [11].

RESULTS AND DISCUSSION

From the first sampling (Aug 27th, 2016), six species were found belonging to the Majidae, Portunidae, and Xanthidae families. From the second sampling (Jan 27th, 2017), 14 species were found belonging to the Calappidae, Eriphiidae, Grapsidae, Majidae, Portunidae and Xanthidae families.

TABLE 1. Crabs species found in Sundak beach from first and second sampling.

Family	Vernacular Name	Scientific Name	1*	2**
Calappidae	Yellow box crabs	*Calappa gallus* (Herbst, 1803)	-	+
Eriphiidae	Hairy rock crabs	*Eriphia scabricula* (Dana, 1852)	-	+
Grapsidae	Mottled lightfoot crabs	*Grapsus albolineatus* (Lamarck, 1818)	-	+
Grapsidae	Spray crabs	*Percnon planissimum* (Herbst, 1804)	-	+
Majidae	Spider crabs	*Tiarinia cornigera* (Latreille, 1825)	+	+
Portunidae	Banded-legged crabs	*Charybdis annulata* (De Haan, 1833)	+	+
Portunidae	Shore crabs	*Portunus granulatus* (Edwards, 1834)	-	+
Portunidae	Hairy swimming crabs	*Portunus pubescens* (Dana, 1852)	+	+
Portunidae	-	*Thalamita coeruleipes* (Jacquinot and Lucas, 1853)	-	+
Portunidae	Six-lobed sw. crabs	*Thalamita intermedia* (Miers, 1886)	+	-
Portunidae	Swimmer (sw.) crabs	*Thalamita prymna* (Herbst, 1803)	-	+
Portunidae	Four-lobed sw. crabs	*Thalamita sima* (Edwards, 1834)	+	-
Xanthidae	Hairy tank crabs	*Actaeodes tomentosus* (Edwards, 1834)	+	+
Xanthidae	Floral egg crabs	*Atergatis floridus* (De Haan, 1833)	-	+
Xanthidae	-	*Ozius rugulosus* (Stimpson, 1858)	-	+
Xanthidae	Reef crabs	*Zosimus aeneus* (Linnaeus, 1758)	-	+

*) First sampling (Aug 27th, 2016)

**) Second sampling (Jan 27th, 2017)

+ found; - not found

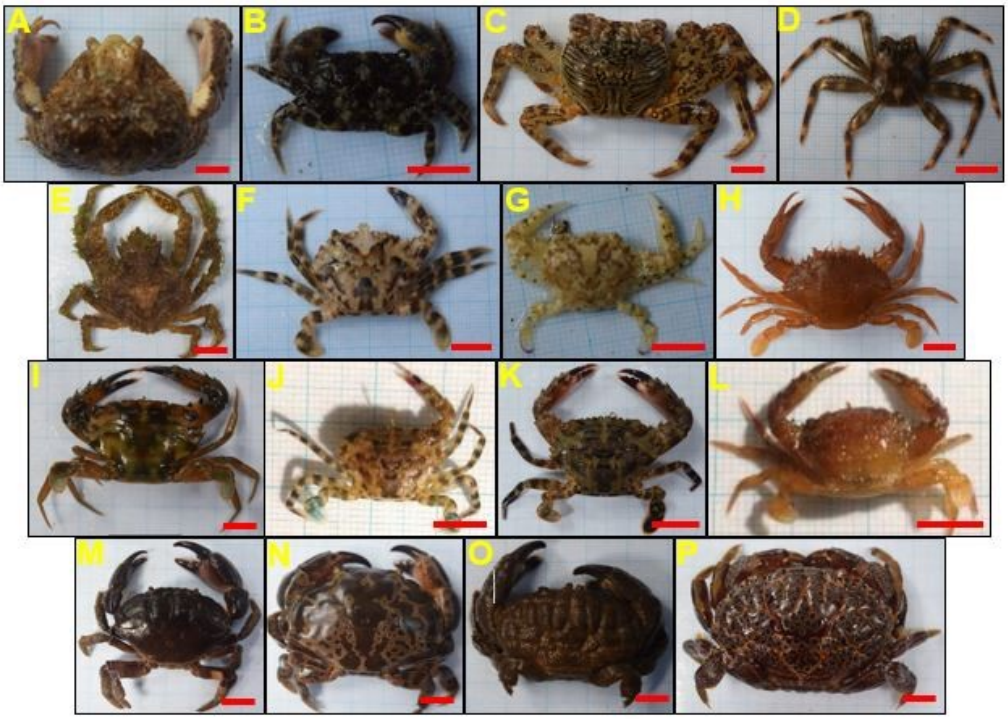

FIGURE 1. Dorsal view of crab samples from 1st and 2nd sampling in Sundak beach. Red line represents 1 cm. A–P, respectively: *C. gallus, E. scabricula, G. albolineatus, P. planissimum, T. cornigera, C. annulata, P. granulatus, P. pubescens, T. coeruleipes, T. intermedia, T. prymna, T. sima, O. rugulosus, A. floridus, A. tomentosus, Z. aeneus*

FIGURE 2. Sundak Beach intertidal zone consists of algae, white sand, and rocks

Calappidae. *Calappa gallus* (Herbst, 1803) – Solid subovate carapace resembles a shield with granules forming a bridge. It has flat chelae on lateral part. There are 5–7 serrations in the dorsal margin a basin-like form in the orbital region. The colors are generally orange to brown with red dots [9]. The sample has the characteristics, in addition, brownish-creams colored 2.9 cm width carapace, and have a rough surface. The habitat of Callapidae was soft and mud substrates, in this case, they were found in white sand [11].

Eriphiidae. *Eriphia scabricula* (Dana, 1852) – Carapace is oval, but relatively convex, with a hard protrusion equipped with 3–5 sharp anterolateral teeth, which is the sample has four. The frontal edge is smooth without denticula. Cheliped has a hard bulge, and its ambulatory leg has setae on the top and bottom region. The colors are generally brownish, slightly pale yellow, with relatively green eyes [9], which is similar to the sample. The habitat of Eriphiidae was benthic; in this case, they were found in rocks [11].

Grapsidae. *Grapsus albolineatus* (Lamarck, 1818) – Carapace is convex with low tubercles. It has a rounded outline with one anterior tooth, which also found in the sample. The front length is almost the same as the posterior margin length. The carapace is bluish-green with pale areas, while the sample is brown. The sample has lateral margin and white tubercle, brown legs and orange spot [9]. Other features found in the sample are stemmed eyes, brown spiky spines on the dactylus. *Percnon planissimum* (Herbst, 1804) – Anterolateral teeth have the same size. Chelae is more rounded, with no hairy formation, like in the sample. Every pereopod on the brachium section has sharp spikes. Black cornea and median green line on the carapace are also found in the sample [9]. The habitat of Grapsidae was swimming, climbing or terrestrial but the majority in intertidal, in this case, they were found at the rock when being climb [11].

Majidae. *Tiarinia cornigera* (Latreille, 1825) – Carapace has no spines on the dorsal and lateral parts. Rostral on the carapace is reduced or very short [12]. The sample was pyriform-shaped. The entire dorsal surface is covered with granules and tubercles in various sizes. The habitat of Majidae was, benthic; in this case, they were found at rock [11].

Portunidae. *Charybdis annulata* (De Haan, 1833) – The anterolateral border is divided into six teeth, the first two teeth are smaller and the next are larger, but the last tooth is small. This is also found in the sample. Both chelipeds have almost the same size and longer than the length of the carapace. The carpus has a strong internal thorn with three spines on the outside. Male pleopod is more robust and has a quarter-sized superior part of the total length [13]. Another feature found in the sample were blue dactylus, each pereopod is striped with white and brown color. *Portunus granulatus* (Edwards, 1834) – Sample has hexagon-shaped carapace, light yellow, irregular brown spots on the surface. The frontal part has four lobes. The lobes in supraorbital are similar to the sample, with other features such as two anterior lobes and six-pointed teeth on anterolateral margin. The last anterolateral spine is relatively prominent. The posterolateral junction is rounded. Maxilliped has three anteroexternal angles [10]. Other features found in the sample are karina (yellowish white spines on cheliped, pereopod, and pleopod) and flat transparent swimming leg. *Portunus pubescens* (Dana, 1852) – Carapace is 1.6 times wider than its length, which is 2.8 cm long and 3.7 cm wide on the sample. The anterior part of the carapace consists of four lobes with clear and firm nine anterolateral teeth, like in the sample. Outer cheliped has no ornament. Maxilliped has two anteroexternal angles, but not found in the lateral part. Colors, in general, are brownish, while the sample is brownish to orange [10]. *Thalamita coeruleipes* (Jacquinot and Lucas, 1853) – Carapace is about 20 mm × 29 mm to 40 mm × 56 mm. The carapace is also accompanied by six lobes in the anterior part and five spines in the anterolateral part, like in the sample. Other features are three lobes in supraorbital, ridge on the basal joints of the antenna has 2 to 3 sharp spines [9]. It also has karina; the swim legs are long, flat, and dark-colored surrounded by a thin membrane on the edge and accompanied a pointed tooth in the first leg; the right one is larger. *Thalamita intermedia* (Miers, 1886) – Carapace is solid and pilose-formed. The heart region is divided into two clear bumps, but the mesobranchial ridge is unclear. The anterior part of the carapace is divided into four lobes, the submedian is wider than the median, there are five anterolateral teeth and chelae have four spines [10]. The sample has 2,5 cm × 3 cm carapace with dark and light brown color. Dactylus is red. *Thalamita prymna* (Herbst, 1803) – The dorsal part is smooth and slightly shiny. There is no bulge behind the epibranchial. The front is straight and divided into six short lobes. The submedian is broad, occasionally fused into the median with five anterolateral teeth, the fourth one is not yet perfect. The sample has six lobes and five anterolateral teeth. Inner merus cheliped has a bearing with three sharp spines, but a smooth surface at the bottom. Chelae have a strong spine on the upper surface and there is a spiniform tubercle at the end proximal [10]. Another feature is stemmed eyes. *Thalamita sima* (Edwards, 1834) – Carapace on the dorsal part is pilose formed. Anterocarapace is divided into two lobes and has five anterolateral teeth. Cheliped on merus has three spines on its border, whereas in chelae, there are five spines on the top and bottom surfaces, like in the sample [10]. The dorsal part of the carapace is overgrown with blackish-colored hair and white spots. The ventral surface is bluish and the mouth is reddish. Portunidae are benthic to semipelagic with diverse habitat, in this case, they were found when swimming and trapped rocks [11].

Xanthidae. *Actaeodes tomentosus* (Edwards, 1834) – Carapace is longitudinal oval-shaped forming narrow pathways. All parts of the body are covered by rough bulge and covered by fine and short hair, including sternum and ventral parts of the crab. The anterolateral margin is divided into four non-protruding denticles. The cheliped is spoon type. The general color is brownish like the sample found [14]. *Atergatis floridus* (De Haan, 1833) – The carapace is smooth. The anterolateral margin forms a peak and is separated by a posterolateral margin of blunt teeth. Color is generally olive green or brownish with dark chelipeds, like in the sample [9]. *Ozius rugulosus* (Stimpson, 1858) – Carapace is relatively rough with the wrist, cheliped with wrinkles-like form and reticular. The branchial part is bypassed by two bulges located between the third and fourth anterolateral lobes. *Zosimus aeneus* (Linnaeus, 1758) –

Carapace has a wavy shape. The anterolateral margin is divided into three lobes having one triangular posterior tooth, like in the sample. Another feature is karina and irregular brown spotted carapace [9]. Xanthidae was benthic with diverse habitat, in this case, they were found in rocks [10].

CONCLUSIONS

In this study, we found 16 species from sampling on Aug 27th, 2016 and Jan 27th, 2017 which belong to Calappidae, Eriphiidae, Grapsidae, Majidae, Portunidae, and Xanthidae families, i.e. *Calappa gallus, Eriphia scabricula, Grapsus albolineatus, Percnon planissimum, Tiarinia cornigera, Charybdis annulata, Portunus granulatus, Portunus pubescens, Thalamita coeruleipes, Thalamita intermedia, Thalamita prymna, Thalamita sima, Ozius rugulosus, Atergatis floridus, Atergatis tomentosus, Zosimus aeneus.*

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