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Discovery of habitat preferences and community structure of echinoderms in Kri, Raja Ampat, Indonesia

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Abstract. *Siburian RHS, Tapilatu JR, Tapilatu ME. 2023. Discovery of habitat preferences and community structure of echinoderms in Kri, Raja Ampat, Indonesia. Biodiversitas 24: 3968-3976.* Raja Ampat, located in Papua, Indonesia, is home to one of the most diverse coral reef ecosystems and is a component of the Coral Triangle. The coral in Raja Ampat is still considered to be in good health. Although the marine fauna in Raja Ampat District, Southwest Papua, Indonesia is pristine and diverse, there have still only been a few studies in this region. The scientific research on the echinoderms in Raja Ampat is limited, particularly as a primary input for data research. In this study, we present Echinoderm's habitat and community structure in the Kri coastal area at Mansuar Island based on the data collected at field sampling. From January to February 2023, data were collected intensively during morning and afternoon low tide for three repetitions each, at 5-10 m depths. We conducted morphological species identification. Asteroidea, Holothuroidea, Echinoidea, and Crinoidea were found to be the four major classes of Echinodermata that dominated the sampling area, with a total of 20 species and 180 individuals. Each Echinodermata species has its preferred Kri coastal habitat based on its food supply, unique behavior, and body structure. In addition, the result indicates that this region has a moderate diversity level, with low dominance and moderate to high uniformity. This research provides new information on the ecology of echinoderms in eastern Indonesia, particularly in Raja Ampat.

Keywords: Diversity, dominance, habitat, invertebrates, uniformity

INTRODUCTION

Raja Ampat is one of the Indonesian archipelago areas located in the epicenter of the world's coral triangle area, which supports the highest level of marine biodiversity (Becking et al. 2015). There are about 1320 species of reef fish (Allen and Erdmann 2009) and 533 species of scleractinian coral (DeVantier et al. 2009) can be found in this area, which is around 75% of the world's total (Grantham et al. 2013). Raja Ampat's abundant marine resources make it an appealing spot for economic development, encompassing commercial fishing, tourism, mariculture, oil and gas, mineral, mining, and logs (Grantham et al. 2013). With a growing economy that relies on healthy ecosystems, this area was designated as a Regional Marine Protected Area (RMPA), covering an area of 1,185,940 hectares in 2009 (Cox and Bright 2017). MPAs aim to protect and maintain ecological values and species in response to growing marine activities and changes in the global environment that damage marine resources (Atmodjo et al. 2017).

Mansuar Island is one of the islands in Raja Ampat District, Indonesia. Mansuar Island is rich in biodiversity, with different vegetation such as plantation land, coral reefs, seagrass beds, and mangrove forests. Mansuar is also known for its significant tropical marine biodiversity, and these conditions benefit both nature and the local society (Tafalas 2010). One of the most popular sites in this island is the Kri coastal area. The Kri area (1300 40' E; 00 45' S) is geographically located in the eastern part of Mansuar Island, across the Dampier Strait (Kompajne and Moeliker 2001). Ahsin et al. (2022) mentioned that the high level of marine biodiversity in this area attracts tourists and researchers making it a popular destination. Tourist attractions in Raja Ampat encompass everything from the coral reef SCUBA diving and snorkeling to kayaking and scenery sightseeing. The abundance of biodiversity is linked to the various ecological supports provided by coral reef vegetation, seagrass beds, and mangrove forests. Various habitats provide optimum support for the development and survival of various organisms (Mayor et al. 2017). According to Tapilatu et al. (2021), the complexity of a coastal ecosystem can support a wide range of living organisms, including elasmobranchs, reptiles, marine mammals, and various types of invertebrates.

Echinodermata are a particular kind of animal that can be found in Kri, Mansuar. In general, Echinodermata is one of the largest phyla in the group of invertebrates that includes starfish (Asteroidea), sea lilies (Crinoidea), brittle stars, sea urchins, basket stars (Ophiuroidea), sand dollars (Echinoidea), and sea cucumbers (Holothuroidea)

(Espinoza-Rodríguez et al. 2021). The Echinoderm (in Greek, *echino* means hedgehog inhabiting them, and *derma* means skin) diversity comprises animals with a thorny skeleton and radial and pentameral symmetry (Arnone et al. 2015). Echinoderms inhabit diverse benthic habitats, ranging from intertidal to deep sea (Reich et al. 2015). Echinoderms populations appear regionally distinct, and there is evidence that economic activities induced declines in several isolated subpopulations (Rahman et al. 2014). The presence of habitat preferences is inextricably linked to the morphological form of each species in a given ecosystem (Espinoza-Rodríguez et al. 2021). The relationship is regarded as a type of adaptive response that is possessed to maintain its existence, with distinctions in morphological features indicating different habitat selections (Blake 1990). As herbivores, Echinoidea plays a significant role in regulating the algal cover on rigid substrates. As bioturbators (or their foraging behavior), they may play a crucial role in limiting reef growth (Setyastuti et al. 2018).

This field has yielded several study discoveries (Tafalas 2010; Mayor et al. 2017; Subhan et al. 2020). However, more is needed to know about the organism habitat preferences or community structure of echinoderms in this location. Knowing Echinodermata's habitat preference and community structure is important since this biota has the ecological significance of balancing the ecosystem in the oceans. Therefore, this research was conducted to identify Echinodermata species, habitat preferences, and community structure. Given the importance of the Echinodermata group in the balance of coastal ecosystems, this study's findings and the data obtained would contribute to the management and conservation of Echinodermata in the area.

MATERIALS AND METHODS

Data collection

Echinodermata sampling was carried out in January 2023 and February 2023 in the Kri coastal area, Mansuar Island, Raja Ampat District, Southwest Papua Province, Indonesia (Figure 1). It is strategically located along the Dampier Strait, surrounded by the Cape Kri. The area has a narrow bay with a width of only 7-10 km; the bottom of the shelf is irregular and decreases abruptly towards the Cape Kri. This research was conducted during these months because it corresponds to the end of the western Monsoon in Raja Ampat, when the SST level is at its highest and has the potential to have a significant impact on the condition of the biodiversity and habitat in this region (Mangubhai et al. 2012; Nugraha et al. 2018).

Sampling was conducted at low tide for a better perspective while inventorizing the Echinoderm benthic ecosystem. This study used the road sampling technique for Echinoderm observation described by Bookhout (1994), Schultz (2015), and Ryanskiy (2020). The transects were located parallel to the coast, with each transect of 100 m at three different research stations by snorkeling in the intertidal areas. Each station represents a different type of ecosystem, such as Station 1 in Sorido Bay Resort, Station 2 in marine patrol post a coral reef ecosystem, and Station 3 in Kri Eco Resort a seagrass ecosystem. The majority of the specimens were photographed using an underwater camera while still alive in situ. The same individual performed all census sampling. Furthermore, identification to the level of species refers to Clark and Rowe's identification book guidelines (1971). Systematics and nomenclature adhere to the World Register of Marine Species (WoRMS 2022).

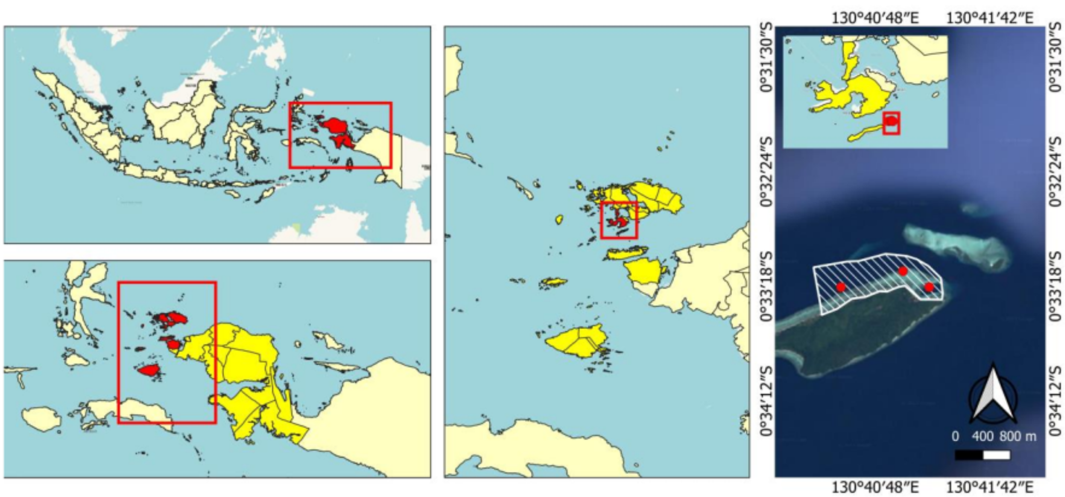


Figure 1. Research location of Echinodermata habitat structure and preferences in the Kri area, Raja Ampat District, Southwest Papua, Indonesia

In addition to the above, this study also examined the parameter conditions of the surrounding waters to learn more about the state of the area at each station that promotes Echinodermata life, with the sorts of factors examined, including pH, salinity, and temperature. We used water quality instruments to measure temperature (Shenzhen Yage Electronic Technology Co., Ltd, China), pH (Fisher Scientific, USA), and salinity (ATAGO Co., Ltd). Data collection comprised biota samples, and water measurements were carried out during morning and afternoon low tide for three repetitions each, at 5-10 m depths.

Data analysis

All the data were analyzed by various statistical methods such as the Shannon-Wiener Index of diversity (H'), Simpson's Dominance Index (C), and frequency of the presence of echinoderms in each different ecosystem's stations.

Diversity index

The diversity index used in this study in accordance to Shannon-Wiener (Muzaki et al. 2019):

$$H' = -\sum \rho\iota \ln \rho\iota$$

Where:
H': Shannon-Wiener Diversity Index
Pi : Ratio ni/N
ni : Number of individuals of species i
N : Total number of individuals

Dominance Index

The Dominance index in this study uses the following equation (Simpson 1949), which was computed per transect level for use in comparing stations:

$$C = \sum (\rho\iota)^2$$

Where:
C : Dominance Index
pi : The number of individuals of the i-th species

Uniformity Index

The uniformity index referred to here is the balance and individual composition of each species found in a community. We used the Evenness formula in this study for the uniformity index as follows (Ulfah et al. 2019):

$$E = \frac{H'}{lnS}$$

Where:
E : Uniformity Index
H': Diversity Index
S : Number of species

We compared models that differed only in combinations of habitat types and species. The obtained data were grouped into 3 natural habitat types (coral reef, rubble/sand, and seagrass) and 1 artificial habitat (jetty wood). The frequency (% of sample sites where a species appeared) correlated with the quantity of each species. It is represented in a stacked bar diagram, with species categorized depending on habitat occurrence (Keinath et al. 2017). Stacked charts are an extremely effective tool for comparing total numbers across categories (Streit and Gehlenborg 2014).

RESULTS AND DISCUSSION

Characteristics of the Kri coastal area habitat

The presence of Echinodermata groups in an area can provide an overview and comprehension of the complexity and health of coastal ecosystems (Smith et al. 2018). The habitat traits and water quality are conducive to supporting echinoderms' survival in coastal waters (Cleary et al. 2016). Water quality is one of the key components to identify in an area, because it is one of the primary factors affecting the survival of aquatic life (Gaol et al. 2017). Table 4 shows several types of habitats and the state of the water quality mentioned from each station.

Based on the result, each station generally exhibits the typical circumstances of the bottom of the seas, which are sloping and tipped with a cliff. Each station has its own habitat characteristics, where every section capable of meeting the diverse needs of Echinodermata for survival. This is reinforced by remarks by Tapilatu et al. (2022) and Hasim (2021), who indicate that the characteristics of waters with flat topographical areas that are sloping and densely packed with coral reef and seagrass ecosystems can support the existence of a variety of creatures in the area.

Table 1. Benchmark value of Diversity Index (Sumekar and Widayat 2021)

Diversity Index	Criteria
H' < 1.0	Low diversity and very low productivity, unstable ecosystem
1.0 < H' < 3.322	Moderate diversity, moderate productivity, balanced ecosystem
H > 3.322	High diversity, high productivity, stable ecosystem

Table 2. Benchmark value of Dominance Index (Sumekar and Widayat 2021)

Dominance Index	Criteria
0 < C < 0.5	There is no dominant species
0.5 < C < 1	There is a dominant species

Table 3. Benchmark value of Uniformity Index (Sumekar and Widayat 2021)

Uniformity Index	Criteria
E < 0.4	Low uniformity
0.4 < E < 0.6	Moderate uniformity
E > 0.6	High uniformity

Table 4. Habitat characteristics

Station	Habitat type	Temperature (°C)	Salinity (‰)	pH
1	Sandy bottom and rubble	29.6±0.7	34±0.5	8.16±0.02
2	Coral reef and jetty wood	29.4±0.8	35±0.2	8.14±0.03
3	Seagrass and algae bed	29.5±0.0.5	34±0.3	8.12±0.04

Table 5. List of Echinodermata species found (individuals) in the Kri coastal area, Raja Ampat District, West Papua, Indonesia

Classes	Species	Station 1	Station 2	Station 3
Asteroidea	*Linckia laevigata* (Linnaeus 1758)	16	50	3
	Linckia multifora (Lamarck 1816)		1	
	Echinaster luzonicus (Gray 1840)		9	
	Fromia nodosa (A.M. Clark 1967)		1	
	Ophidiaster granifer (Lütken 1871)	1		
	Culcita novaeguineae (Müller and Troschel 1842)	1		
Holothuroidea	*Holothuria atra* (Jaeger 1833)	25		3
	Holothuria leucospilota (Brandt 1835)	5		1
	Holothuria edulis (Lesson 1830)	2		
Echinoidea	*Diadema antillarum* (Philippi 1845)		3	
	Echinothrix calamaris (Pallas 1774)		2	
	Echinostrephus aciculatus (A. Agassiz 1863)		7	
Crinoidea	*Comanthus parvicirrus* (Müller 1841)		4	
	Comanthus suavia (Rowe, Hoggett, Birtles and Vail 1986)		10	
	Basilometra boschmai (AH Clark 1936)		3	
	Anneissia bennetti (Müller 1841)		24	
	Comaster schlegelii (Carpenter 1881)		2	
	Himerometra robustipinna (Carpenter 1881)		2	
	Cenometra bella (Hartlaub 1890)		4	
	Comaster multifidus (Müller 1841)		1	
Total		50	123	7

The results showed that station 1 was dominated by sand bottom and rubble. This habitat may benefit certain Echinodermata species due to the abundance of algae and debris that can support their diets (Hartati et al. 2020). In contrast, the conditions at Station 2 are dominated by coral reef habitats. Many species of Echinodermata, particularly those of the Asteroidea, Crinoid, and Echinoidea, are supported by ecological factors that provide a favorable environment for protection and food supply (Chandra and Raghunathan 2018). Station 2 also provided artificial habitat for invertebrates in jetty wood. Reid et al. (2014) and Spinuzzi (2013) mentioned that jetty wood in neighboring habitats could sustain food webs and be a physical structure in coastal zones. Station 3 was dominated by seagrass and algae. The presence of sufficient food supplies and protection from sunlight also predators, can support many lives of species in this area, including Echinodermata (Ziegenhorn 2017).

In addition, this research assesses environmental supporting data by collecting water quality data at three stations to determine the habitat's ecological support for the species' growth (Khuram et al. 2022). Good water quality for marine organisms has temperature tolerances of 26 to 30°C, salinity tolerances of 15 to 35, and pH tolerances of 7.9 to 8.4 (Al Rashdi et al. 2012; Cleary et al. 2016). The pH values measured at each location showed no significant variation across the three observation stations regarding the average temperature, salinity, and pH value. According to the results, the temperature, salinity levels, and pH also meet quality standards and are conducive to the survival of Echinodermata.

Identification of Echinodermata species on the Kri coastal area

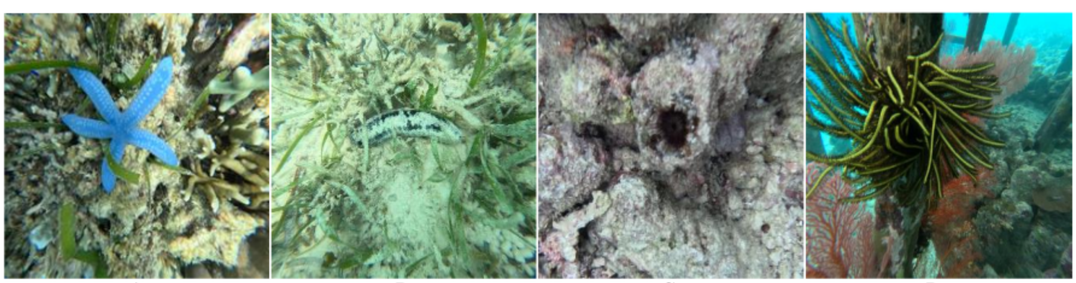
The phylum Echinodermata is divided into five main groups namely sea cucumbers (Holothuroidea), starfish (Asteroidea), star snakes (Ophiuroidea), sea urchins (Echinoidea), and sea lilies (Crinoidea). According to the findings of three study stations, 180 individuals, 20 species, and four classes of echinoderms were discovered in the coastal area of Kri, Mansuar Island (Table 5).

Variations in the number of individuals and species at each station show that each Echinodermata group has a preferred environment. Thus, environmental factors support the life of the biota within the Kri coastal area. Four groups of echinoderms were identified at research stations (Figure 2), composed of Asteroidea, Holothuroidea, Echinoidea, and Crinoidea.

The results indicate a significant difference between the quantity of species and class at these three stations. Some of these differences can be attributed to the availability of sustenance and protection that each habitat offers and the larval distribution range of each species (Williams and Benzie 1993). Station 1, where its area is mostly covered with sandy bottom and rubble, has provided a great habitat for several species of echinoderms. The study shows that this area is dominated by the class of Holothuroidea, with a total of 32 individuals consisting of species: *Holothuria atra* (Jaeger 1833), *H. leucospilota*, and *H. edulis*. This group is morphologically distinct due to its spherical and long body form, with oral and aboral lines as the axis connecting the anterior-posterior body regions (Alvarado and Solís-Marín 2014). According to Zhou and Shirley (1996), sea cucumbers favor areas with a coarser-grained physical structure, such as debris and boulder, because it provides the necessary interstitial spaces and protection. In addition, their peculiar behavior of burying themselves in dunes to avoid drought and sunlight may be a significant factor in their habitat preference (Battaglene et al. 1999). Despite this, 18 individuals and 3 species of Asteroidea, including *L. laevigata, O. granifer,* and *C. novaeguineae*, prefer the habitat located at station 1.

In contrast, station 2, which is dominated by coral reefs and a small portion of jetty wood, is habitat to a greater number of echinoderms belonging to various classes and species than station 1. One of these reasons is that coral reefs provide the species with exceptional protection and a plentiful supply of nutrients (James 1982; Espinoza-Rodríguez et al. 2021). More than half of the echinoderms in this research were collected from this habitat, which contained 3 classes, 15 species, and 123 individuals. This area is dominated by a group of starfish, which consists of four species and 61 individuals. The tube feet, which are a multiplicity of small, attachable appendages, are one of the essential morphological characteristics (Hennebert et al. 2014) that aid in identification. The enormous number of individual starfish in this area, according to James (1982), is related to the high amount of habitat production that can support their growth. They spend the most of their early growth in places between coral reefs. Based on the result, *L. laevigata, L. multifora, E. luzonicus,* and *F. nodosa* are the starfish species that can be found in this area. Sea urchins are the next group to be discovered in this station location. In this research, just a few sea urchins were found, including: *D. antillarum*, *E. calamaris*, and *E. aciculatus*. This species' spherical, solid, and covered spiny plate shells make it easy to identify its presence in a habitat (Grossmann and Nebelsick 2013). The existence of this species in an environment is easily identified by its spherical, firm, and coated spiny plate shells (Grossmann and Nebelsick 2013). The presence of sea urchins in this location is supported by the presence of algae layers on numerous portions of the coral reef surface, which serve as one of the main food sources for these creatures. In addition to using coral reefs as a habitat, sea urchins play important roles as apex predators and benthic grazers, contributing to bioerosion processes and energy transfer in these marine ecosystems (Hermosillo-Nez 2020). In addition to coral reefs, station 2 offers jetty wood as an alternative preferable habitat for echinoderms like sea lilies. In this instance, this area has served as a habitat for eight species of sea lilies, including: *C. parvicirrus*, *C. suavia*, *B. boschmai*, *A. bennetti*, *C. schlegelii*, *H. robustipinna*, *C. bella*, and *C. multifidus*. The morphology of lilies, with their limbs enclosing the mouth facing upward away from the lily-shaped substrate, and their propensity to adhere to rough substrates such as jetty wood make this area suitable for their survival (Arnone et al. 2015).

Station 3 is the last observed station in this study. Based on its characteristics, this station is dominated by the presence of seagrass beds and algae in this area. According to Wicaksono et al. (2012), seagrass beds is one of invertebrate's most preferable habitat due to their ecological function as a spawning ground and feeding ground. However, the study shows the opposite condition, where the echinoderms inhabiting this location have the least amount compared to the other stations. This station is comprised of 2 classes, 3 species, and 7 individuals, where *L. laevigata* being the only species of starfish found in the area, also *H. atra* and *H. leucospilota* are both the species of sea cucumbers that can be found in this area. The contrasted disparity in abundance and lack of echinoderms in this area is assumed to be owing to a preference for coral reef habitats or rubble in other areas nearby (Nybakken 1982) to station 3, notably the areas of stations 1 and 2. The findings of this station are also consistent with a recent study on the structure of the Echinodermata community in the seagrass environment in the Karimunjawa region of Jepara, Central Java, Indonesia, conducted by Fatima et al. (2020).



A B C D

Figure 2. Four Class of Echinodermata at research stations in Kri, Raja Ampat District, West Papua, Indonesia: A. Asteroidea (*Linckia laevigata)*, B. Holothuroidea (*Holothuria atra*), C. Echinoidea (*Echinostrephus aciculatus*), D. Crinoidea (*Anneissia bennetti*)

Habitat preference

The existence of an organism in a specific habitat has a significant ecological meaning for both the survival of the animals that inhabit it and the area it inhabits. Environmental conditions also might significantly influence marine species distribution, feeding habitats, annual recruitment levels, and reproductive traits (Vayghan and Lee 2022). Habitat conditions can create reciprocal relationships critical for the ecosystem's balance (Douglas 2020). The density and richness of echinoderms were related to the complexity of habitats (Satyam and Thiruchitrambalam 2018). Each species has its habitat preference and can be seen in any of the four types of habitats found in the Kri coastal area (Figure 3).

Several species of Echinodermata consist of different classes and species such as: Asteroidea (*L. laevigata*, *E. luzonicus*, and *O. granifer*), Echinoidea (*D. antillarum*, *E. calamaris*, and *E. aciculatus*), and Crinoidea (*C. parvicirrus*, *C. suavia*, *B. boschmai*, and *C. bella*). Some species settle upon coral reefs as a preferred habitat due to their characteristics which can function as protection and good places to feed. According to Caballes and Pratchett (2014), species such as starfish spend most of their young growth phase in areas between coral reefs due to the high level of habitat production which support their growth. The submerged topography is another component that might be considered for habitat association. Sea lilies and other echinoderms can exist on coral reefs extending from the intertidal zone to the water's edge because of the many physical factors that affect them (Tay and Low 2016). The preference conjunction for invertebrate habitats helps species that occupy certain regions and provides positive feedback to the areas inhabited, in addition to the individuals that reside in this environment. One example of a reciprocal relationship is the interaction of sea urchins in coral reef environments. The existence of sea urchins in coral reef areas as herbivorous organisms that actively eat algae is essential for reducing the number of algae available on the surface of the environment, where this relationship has given reciprocity for sea urchins and the ecosystem they inhabit (Chu et al. 2023).

According to research and analysis, nine distinct Echinoderm species favor pulverized rubble/sand habitat. Asteroidea (*L. laevigata*, *L. multifora*, *E. luzonicus*, *F. nodosa*, and *C. novaeguineae*) and Holothuroidea (*H. atra*, *H. leucospilota*, and *H. edulis*) dominated this habitat. The sea cucumber group inclines coral rubble and sand as reference environments. This is thought whereas they burrow into the sand to protect themselves from drought and sunlight (Tomatala et al. 2018). Apart from sea cucumbers, starfish species prefer sand and coral rubble habitats because of the abundance of detritus and the effects of decay of benthic sessile biota prevalent in this area (Ringvold and Andersen 2016; Suryanti 2019).

Seagrass beds are one of the ecosystems that serve numerous ecological functions to heterogeneous species, including the phylum Echinodermata. The study found quite a few groups of Echinodermata in the seagrass environment. Based on the study, some Echinodermata that prefer this habitat are *L. laevigata, H. atra,* and *H. leucospilota*. Pitogo et al. (2018) also found similar things in Sarangani Bay. Most invertebrates like to live in seagrass beds because they provide a place to live, find food, and find protection.

On the other hand, coarse imitation substrates, such as wooden bridges or shipwrecks, are significant in providing shelter for numerous species of invertebrates. The study discovered eight Krinoid species preferred wood as a substrate, namely *C. parvicirrus, C. suavia, B. boschmai, A. bennetti, C. schlegelii, H. robustipinna, C bella,* and *C. multifidus*. Despite this, sea lilies, including the species *B. boschmai*, can adhere to hard surfaces such as coral reefs. The substrates' location on the outskirts of Station 2 has added a strategic component that can improve habitat conditions through the influence of physical and chemical elements. This condition is also in line with Abdelhady and Fürsich (2014) research, where mostly crinoids choose the characteristics of a rigid substrate habitat in the coastal area to maintain their body position from being hit by sea waves.

Community structure

A study of the community structure of Echinodermata in the Kri coastal area was obtained using analysis of diversity, dominance, and diversity index calculations at three stations, as shown in Table 4.

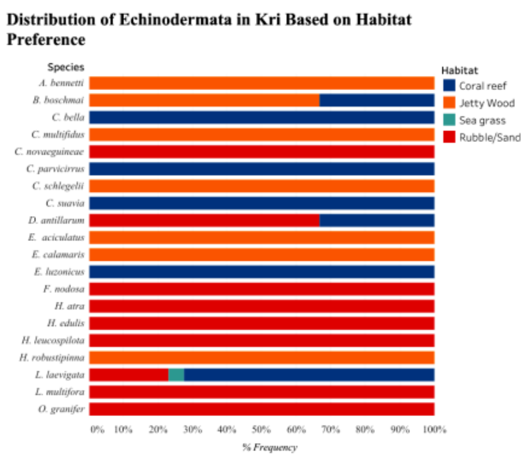


Figure 3. Distribution of Echinodermata in Kri, Raja Ampat District, West Papua, Indonesia based on habitat preference

Table 4. Diversity Index (H'), Uniformity Index (E), and Dominance Index (C) values

Station	H'	Category	C	Category	E	Category
1	1.198961136	Moderate	0.3656	Low	0.409478188	Moderate
2	1.952948009	Moderate	0.228058193	Low	0.656112444	High
3	1.277034259	Moderate	0.306122449	Low	0.426284508	Moderate

The study of diversity (H') data, which agreed with the benchmark 1 < H' < 3.322 (Krebs 1999), revealed that the species variety in the Kri coastal area was all at a moderate level, with values between 1.227-1.953. Station 2 has the highest diversity value, with a value of 1.952. This indicates that more species of Echinodermata can be found in this area. The great diversity and number of species in this area are assumed to be related to the station's habitat having more variance than other stations. According to Whitfield (2017), the diversity of marine environments promotes the amount of diversity of species living in them by providing ecological functions such as shelter, foraging, and growth. Nonetheless, the diversity of echinoderms in the Kri region is greater than in many other aquatic locations, including Gili Meno in North Lombok (Ghafari et al. 2019) and Osi Island in West Seram (Yusron and Edward 2019).

The results of the domination index study at the three stations are then expressed in the Samson Dominance Index as a concentration value. The closer the value is to 1, the higher the domination structure. The dominance of the Kri coastal area as a whole is included in the low group with a value between 0.223-0.306. The low level of dominance in this area is assumed to result from a high diversity and competition between species, which does not allow for high dominance of a certain species (Muzaki et al. 2019).

Furthermore, according to Ulfah et al. (2019), the results of the uniformity analysis (E) based on the criteria E < 0.4 indicated that it had a moderate to large uniformity. The Kri coastal area has a uniformity value that ranges from 0.409-0.656. According to Syukur et al. (2020), a community is considered stable if its value is close to one, and less stable if its value is close to zero. Because one species is more common than the others, one of them can change the uniformity value. In relation to this, the starfish *L. laevigata* predominates among the three locations.

In conclusion, according to the findings of this study on the preferences of the Echinodermata habitat in Kri, the habitat characteristics and water quality in the Kri coastal area are ideal for supporting the growth and survival of the Echinodermata population. In addition, 180 echinoderms, 20 species, and four classes were discovered in the Kri coastline area. Diverse habitat alternatives, such as coral reefs, coral debris and sand, seagrass meadows, and a wooden jetty, have supported an area of shelter, feeding, and spawning for Echinodermata in this area. Though the Kri coastal area provides many ecological variations, each class of Echinodermata has its habitat preference, which is based in its supply of food, unique habit, and body structure. According to the findings, the Asteroidea class is one of the most adaptable Echinodermata, with habitat preferences that include coral reefs, rubble and sand, and seagrass. The Holothuroidea class has multiple environmental preferences, including rubble and seagrass habitat. Class Echinoidea is found on coral reefs, and Crinoidea can be found on hard substrates like jetty wood and coral reefs.

Furthermore, this study also gives an outline of the Echinodermata community structure in Kri, Raja Ampat. From the study, we found that the value of diversity in this area is with a value range of 1.227-1.953 and in the level of moderate. In part of that, the dominance index for the Kri coastal area as a whole is low, ranging from 0.223-0.306. The value is reflected by the fact of high diversity and competition of this area. Last, the moderate to high value of uniformity in this location ranging from 0.409-0.656. From the study, it can be concluded that preferences and community structure of Echinodermata in the Kri coastal area are strongly influenced by the morphological forms of the animals and the ecological role of the habitat which functions to provide food, shelter, and growth for Echinodermata animals.

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