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Structure of echinoderm community in Nirwana Beach, used as learning media on the beach ecosystem

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Abstract. This study aims to determine the structure of the Echinoderms Community in the Coastal Area of Nirwana Beach, Baubau City, which is used as a media for the distribution of coastal ecosystems. The method used in this study is a survey method. Data were taken using purposive sampling technique and analyzed in quantitative descriptive. Calculations are used in quantitative data processing using the Shanon-Weaver Diversity formula, Simpson dominance and Darrell's abundance. Vodopich is the number of individuals per unit area. Environmental factors measured are temperature, salinity, and pH. The results showed that at the two research sites namely on the Nirwana beach of Baubau City, Echinoderms found consisted of 4 classes, namely *Holothuroidea, Ophiuroidea, Echinoidea* dan kelas *Asteroidea*. The diversity index of Echinoderms found in the two research sites shows differences and if based on the diversity index benchmark values, both locations are in the low diversity category (H < 1,0) which means that productivity is very low as an indication of heavy pressure and an unstable ecosystem. The dominance value of Echinoderms indicates that at the Nirwana beach location no one has dominated. While the abundance value of each class in Echinoderms shows that at the beach location is still very low. This is caused by excessive community activities.

1. Introduction

Nirvana Beach, located in the City of Baubau has a very amazing sea beauty with various types of biota in it such as coral reefs, fish, molluscs, crustaceans, echinoderms and other biota and white sand stretches that are the main attraction of this beach, so economically and economically and ecologically useful. Nirvana beach is a paradise for people who like to go to the beach and enjoy the beautiful sea. All parts of this beach have a type of rocky beach, sandy, seagrass. The existence of the beach is a living community of biota. Komunitas merupakan sistem kehidupan bersama dari sekelompok populasi organisme yang saling berhubungan karena ada interaksi antara satu dengan yang lainnya dan berkaitan pula dengan lingkungan hidupnya [1]. In a community, living organisms interact or interact functionally. In a community, there are differences in the types of composers vertically, such as differences in life forms and levels. Horizontally there are groups of types of organisms making up them, and there are also links between types that live together [2].

In their activities, residents often throw trash and do other activities such as fishing, trawling, and archery. Garbage in the form of organic or inorganic. This situation can affect the life of marine organisms and the food chain system that is inside. There are several marine animals that are included in organic waste-eating animals, one of which is an Echinodermata.

Echinodermata comes from Greek Echinos means thorn, derma means skin [3]. In general, Echinoderms means animals with thorn skin. This animal has the ability to autotomy and regenerate parts of the body that are lost, broken or damaged. All animals included in this class are radially symmetrical and most have an endoskeleton from lime with bulges in the form of thorns. The main group of Echinoderms consists of five classes, namely the Asteroidea class [3,4], example: *Archaster typicus*, Ophiuroidea Class example: *Amphiodia urtica*, kelas Echinoidea example: *Diadem a setosium*, Crinoidea Class example: *Antedon rosacea*, and Holothurodea Class (Tripang Laut) example: *Holothuria scabra* [3,5].

Echinoderms are very important animals in the marine ecosystem and are useful as a component in the food chain [3,6]. states that "Types *Echinoderms* can be seston-eaters or destritus-eaters, so that their role in an ecosystem is to overhaul the remnants of organic material that are not used by other species but can be utilized by several types *Echinoderms*". In addition *Echinoderms* contain chemical elements that have high value in the fields of food, medicine and are often used as beautiful decorative collection items [2].

The existence of organic waste originating from the community, as well as unspoiled coral reefs is one of the many causes of Echinoderms in this area because of the availability of food they need and a place to hide themselves from prey.

The underlying factor for the research is that there is no data that reveals the amount and distribution of marine biota (*Echinoderms*) in Nirwana beach, therefore it is very important to do research, so that it can be used as a data guide for local government in making policies so that its sustainability is maintained and protected [7].

In addition, *Echinoderms* are also included as marine biological resources that have important ecological value for the environment because they are used as biomonitoring ecosystems to maintain environmental stability [5,8].

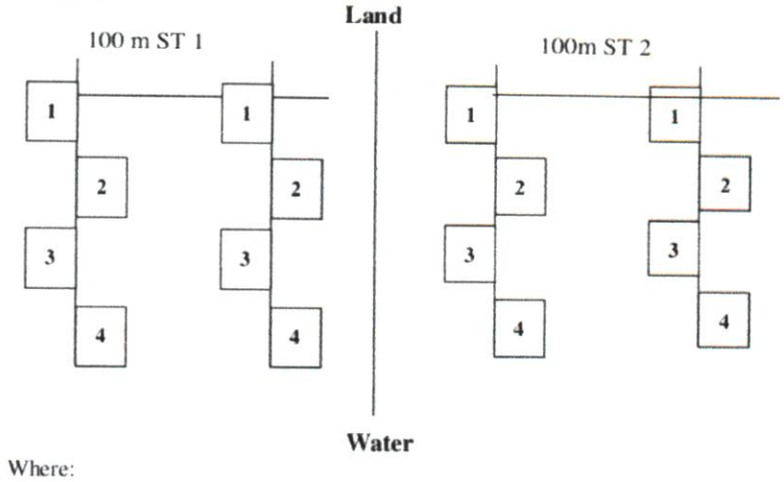
2. Methods

This research was conducted for two months, from March to June 2019. It can be seen in the map in figure 1 that the location of sampling points is divided into two stations. Station one in the southern part is usually used as a place of recreation and station two in the north

Figure 1. Location of Echinodermata Nirwana Beach sampling.

2.1.Sampling method

The method used in this study is a survey method at 2 stations that have been determined using GPS. For sampling, 1 transect line was made, measuring 100 meters. Transect lines are made using role meters. Transects consist of 4 plots / quadrants with the size of each plot / quadrant 20 x 20 meters and the distance between plots / quadrants 5 meters, the following is the Layout used in field sampling.



Where:

= Plot

1-4 = Number of plots per Transect

——— = Transect Line

Figure 2. Transect schema and placement plots for echinoderms collection

2.2. Data analysis

The data obtained were analyzed descriptively quantitatively. The data is processed using the community structural formula namely Dominance Index (ID), Diversity Index (H '), Index and Abundance (J').

2.3. Dominance index

To calculate the dominance index (ID), Simpson's formula is used:

$$ID = \sum_{i=1}^{S} \frac{(n_i\ (n_i - 1))}{(N(N-1)} \qquad (1)$$

Where :

n_i = the number of individuals of the i-th species

N = total number of individuals

2.4. Abundance index

$$J^I=H^I/H^I_{Max} \quad (2)$$

Where :

J^I = abundance or presence
H^I = shanon-weaver diversity index
H^I_{Max} = Lon s, where, s = number of families found [9]

2.5. Diversity index

To calculate the diversity index the Shannon-Weaver formula is used :

$$H = -\sum_{i=1}^{s}(Pi\ lon\ Pi) \quad (3)$$

Where:

Pi = Number of individuals each species i (i=1,2,3.....)
s = Number of species
H = Estimator of Population Diversity

Table 1. Diversity index benchmark value

Diversity Index Value	Criteria
H < 1,0	Diversity is small, productivity is very low as an indication of heavy pressure and an unstable ecosystem.
1,0 < H < 3,322	Medium diversity, sufficient productivity, fairly balanced ecosystem conditions, moderate ecological pressure.
H > 3,322	High diversity, stable ecosystem stability, high productivity, resistant to ecological stress

3. Results and discussion

a. Echinoderms at the research site

Based on the identification results shown in Table 2, the Echinoderms phylum found at the study site, namely on the southern coast located near the residential areas and the north coast located at the crossing port, consists of 4 classes, 5 orders, 5 families, 5 genera and 5 species. In accordance with the results of the observations all of them are scattered on various substrates that exist in both study sites. Furthermore Echinoderms classification found at the study site can be seen in the following table 2:

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Table 2. *Echinoderms* at the Research Site

Kingdom	Phylum	Class	Ordo	Family	Genus	Species
Animalia	*Echinodermata*	Asteroidea	Valvatidae	Ophidiasteridae	Linckia	*Linckia laevigata*
			Forcipulatida	Asteridae	Asterias	
		Echinoidea	Cidaroidea	Diadematidae	Diadema	*Diadema setosu*
		Ophiuroidea	Ophiurida	Ohpiocamidae	Opichoma	*Opichoma p.*
		Holothuroidea	Aspidochirotida	Holothuridae	Holothuria	*Holothuria i.*

Echinoderms of phylum diversity index

Based on the results of research conducted in the Nirwana coastal area, Baubau City, the Echinoderms diversity index at station 1 and station 2 has a different diversity index value at each station. For more details, see figure 3.

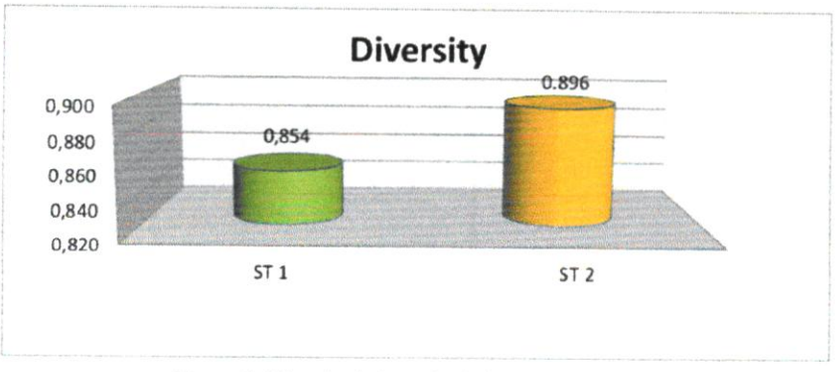

Figure 3. Diversity index calculation diagram

Seen in figure 2 shows that the average diversity index of Echinoderms at station 1 is 0.854 from the results shown at station 1 if based on the category of diversity index benchmark values indicate that diversity is low, productivity is lacking, ecosystem conditions are unbalanced, ecological stress is not stable (H < 1,0). Whereas for station 2 it has an average value of Echinoderms diversity index at station 2 of 0.896.

Indeks dominansi filum echinodermata

Based on the results of research conducted in the Nirwana coastal area, Baubau City, the Echinoderms dominance index at station 1 and station 2 has a different dominance index value at each station. For more details, see figure 4.

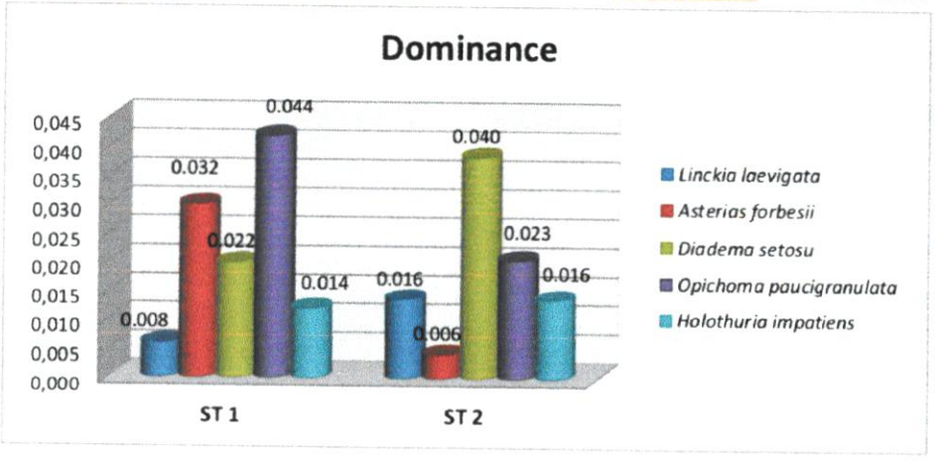

Figure 4. Dominance index calculation diagram

Echinoderms at station 1, namely Asteroidea class with Linckia laevigata species with a dominance index of 0.008 Indv / m2, with 3 Individuals, Asterias forbesii with a dominance index of 0.032 Indv / m2, with 6 individuals. Echinoidea class with Diadema species setosu dominance index 0.022 Indv / m2, as many as 5 individuals. Ophiroidea with Opichoma paucigranulata species with a dominance index of 0.044 Indv / m2, as many as 7 individuals. and Holothuroidea class with Holothuria impatiens species dominance index 0.014 Indv / m2. as many as 4 individuals. While the dominance index at station 2 is Asteroidea class with Linckia laevigata species with a dominance index of 0.016 Indv / m2, as many as 5 Individuals, Asterias forbesii with a dominance index of 0.006 Indv / m2, as many as 3 individuals. Echinoidea class with Diadema species setosu dominance index 0.040 Indv / m2, as many as 8 individuals. Ophiroidea with Opichoma paucigranulata species with a dominance index of 0.023 Indv / m2, as many as 6 individuals. and Holothuroidea class with Holothuria impatiens species dominance index 0.016 Indv / m2. as many as 5 individuals.

From the values above it can be concluded that the location is more dominated by the Echinoidea class. Echinoderms are most commonly found in intertidal areas that have good coral reefs. Echinoderms are solely marine animals and are among marine animals in general, with a wide distribution, found in all seas from the intertidal zone to the very deep sea [8,2].

The existence of Echinoderms in this location greatly influences the coastal ecological system [2]. But when you see the Dominance Index from the two observation stations, the Simpson Dominance Index, with a krikteria ($D \approx 0$) which means there are no species that dominate other species. This is made possible by differences in physical and chemical environmental factors such as temperature, salinity, pH.

Echinoderms abundance index

Based on the results of research conducted in the Nirwana beach area, Sulaa Village, Betoambari District, Baubau City, shows the abundance index of Echinoderms at station 1 and station 2 has different abundance index values at each station. At station 1 the class that has the highest abundance index value is the Ophiroidea class of 0.044 Indv / m2, and the one with the lowest abundance index value is believed to be the Asteroidea class of 0.008 Indv / m2. Whereas station 2 class which has the highest abundance index value is Echinoidea class at 0.026 Indv / m2 and class which has the lowest abundance index value, namely Asteroidea class 0.004 Indv / m2. For more details can be seen in figure 5.

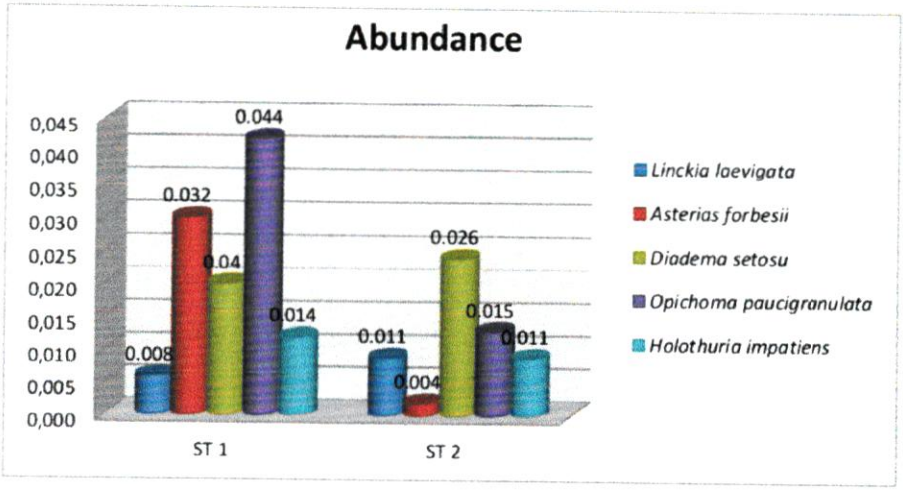

Figure 5. Abundance index calculation diagram

Based on the values in figure 5 it can be seen that the abundance index of Echinoderms found on the Nirvana coast is in the less abundant category. This is based on the level of diversity of echinoderms obtained by the number of individuals in a class.

e. Environmental factors measured at research locations

The results of the measurement of environmental factors at the Nirwana City Baubau beach location are shown in the diagram contained in figure 6.

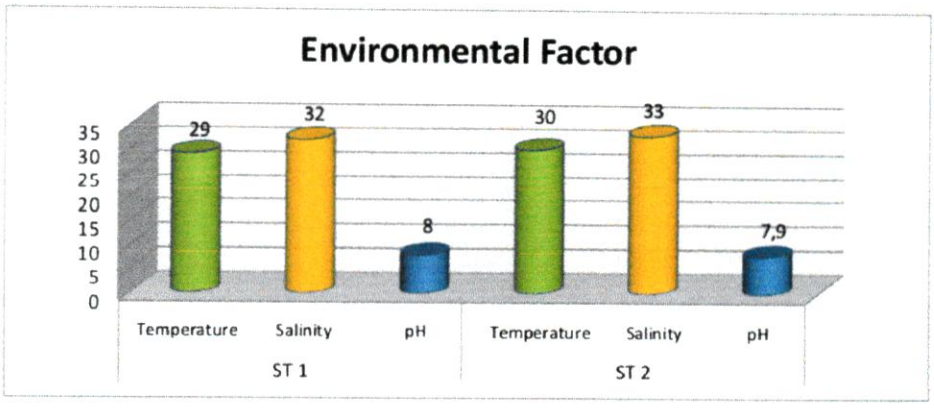

Figure 6. Diagram of the Measurement of Environmental Factors at Nirwana Beach Location

Based on figure 5, above it can be seen that environmental factors at the study site both at station 1 and station 2 have environmental temperatures ranging from 29-30°C, with a salinity of 32-33‰ (ppt), and for water pH between 7.8 - 8.2 pH. Furthermore, for the measurement of environmental factors at the Nirwana beach location, it can be seen in the diagram contained in figure 6.

Based on the results of the research that has been described previously, it can be seen that the research location located on the Nirwana beach has a low diversity index and if it is based on the diversity benchmark val it can be concluded that the value of echinoderm diversity on the Nirwana beach is relatively low. A community is said to have high diversity if the community is composed of many species with an abundance of species that are the same and almost the same. Conversely, if a

community is composed of few species and if only a few species are dominant, species diversity is low.

Diversity is identical to the stability of an ecosystem, that is, if the diversity of an ecosystem is high, then the condition of that ecosystem tends to be stable [1].

High, medium and low diversity can be caused by several factors namely the age of a community, the level of environmental stability, time, heterogeneity of space, competition, installation, productivity and adjustment of each individual to physical and biological factors in the community. [5,1]. This can be interpreted that the location is resistant to ecological pressure. On the other hand, even though the location on the Nirwana beach visually still looks like natural, it cannot guarantee that the diversity of Echinoderms in it is in good condition, because the ecological pressure referred to above may originate from the existence of community activities, utilize a portion of Echinoderms into food. A community is said to have a high diversity of species if the community is composed of many species with an abundance of the same or almost the same species [1]. Conversely, if the community is composed of very few species and only a handful of dominant species, the species diversity is low. The high diversity of species shows that the community has a high complexity, because in the community there is a high species interaction. So in a community that has a high diversity of species there will be species interactions involving energy transfer (food chains), competition and niche distribution which is theoretically more complex. With a community that is far more complex, the community will be far more stable [10,1]. Stable communities according to show that an ecological niche cannot be occupied simultaneously and perfectly by stable populations of more than one species [1].

For the dominance value of Echinoderms in the Nirwana coast, no one has dominated. As is well known that Echinoderms phylum is an animal that has an important role in an ecosystem, one of which is as detritus. On the abundance value of each echinodermata, it is seen that the Nirwana beach is already in a bad condition, because the echinoderms in the Nirwana beach area have a low abundance or presence value, with the level of diversity which is one of the benchmarks for determining the abundance of an abundance. species.

Another factor that causes differences in the structure of the Echinodermata phylum community between stations 1 and 2 is environmental conditions, in Table 5 shows that station 1 has a temperature of 29^{0}C station 2, the average temperature is 30^{0}C. At station 1 the temperature is lower than at station 2, because at station 1 it has more water depth. Tropical coastal waters usually have a temperature range between 27-29^{0}C but can be high with reduced depth of water ". Echinoderms can live with temperatures of 22^{0}C - 35^{0}C, if the temperature is above 40^{0}C, then Echinoderms will dwell under the reef, immerse themselves in sand or take refuge in seagrass plants [11,8,2].

The average salinity at station 1 is 32‰, this is because the sampling is done on seagrass beds and rocky corals which can reduce evaporation. Station 2 has a high salinity. 33‰, because the condition of the beach is a rocky beach and rocky coral so that evaporation is high. The range of salinity that is still able to support the life of aquatic organisms, especially the invertebrate fauna is 15-35‰ [12,2]. The degree of acidity produced at station 1 is 8.0 pH and station 2 is 7.9 pH, this pH is optimal. Good pH supports the life of Echinoderms ranging from 7-8.

4. Conclussion

Echinoderms phylum found on Nirvana beach consists of 4 classes namely Holothuroidea, Ophiuroidea, Echinoidea and Asteroidea class. Echinoderms that are found at Nirwana beach at stations 1 and 2 have a low average Diversity Index where D '<1.0. Echinoderms found in Nirwana beach at stations 1 and 2 have an average low Dominance Index where D ≈ 0. Based on the abundance value of each type of Echinodermata it can be seen that the Nirwana beach location has a low abundance value. When viewed from the condition of the beach which has a rock is a preferred place by animals that are included in the phylum Echinodermata.

The range of environmental factors, temperature, salinity and pH found in both stations shows a range of tolerance that can support the life of Echinoderms, although on the other hand there is an ecological pressure on the life of Echinoderms in both stations. If seen from the regional conditions the abundance should be high but the abundance obtained from the analysis results is low. This is due to the existence of community activities that utilize echinoderms that have exceeded the limits of the management and use of natural resources. Based on the results of the discussion, it can be concluded that the structure of the Echinoderms community in the Nirwana coastal area is still in the low category, because seen from several indicators of the structure of the community structure itself including diversity, dominance, and abundance. This situation needs to be renewed in order to maintain and always preserve the coastal ecosystem for the future survival of our children and grandchildren.

References

[1] Fauna S, Satyam K and Thiruchitrambalam G 2018 *Habitat Ecology and Diversity* (Elsevier Inc.)
[2] Turra A, Checon H H, Fernandez W S, Majer A P, Delboni C G, Denadai M R and Dias G M 2019 The importance of embayed coastal areas for the life cycle of two sympatric starfish species (Echinodermata, Asteroidea) *Estuar. Coast. Shelf Sci.* **219** 128–38
[3] Clark, A. M. and F W E R 1971 *Monograph Of Shallow-Water Indo-West Pacific Echinoderms* (London)
[4] Linchangco G V., Foltz D W, Reid R, Williams J, Nodzak C, Kerr A M, Miller A K, Hunter R, Wilson N G, Nielsen W J, Mah C L, Rouse G W, Wray G A and Janies D A 2017 The phylogeny of extant starfish (Asteroidea: Echinodermata) including Xyloplax, based on comparative transcriptomics *Mol. Phylogenet. Evol.* **115** 161–70
[5] Carney R S and Carey A G 1982 Distribution and diversity of holothuroids (Echinodermata) in Cascadia Basin and on Tufts Abyssal Plain Carney, R.S. and A.G. Carey Jr., 1982. Deep-Sea Res., 29(5A):597–607. Dept. of Invert. Zool., Smithsonian Inst., Washington, D.C. 20560, USA *Deep Sea Res. Part B. Oceanogr. Lit. Rev.* **29** 796
[6] Miller A K, Kerr A M, Paulay G, Reich M, Wilson N G, Carvajal J I and Rouse G W 2017 Molecular phylogeny of extant Holothuroidea (Echinodermata) *Mol. Phylogenet. Evol.* **111** 110–31
[7] Suratissa D M and Rathnayake U S 2016 Diversity and distribution of fauna of the Nasese Shore, Suva, Fiji Islands with reference to existing threats to the biota *J. Asia-Pacific Biodivers.* **9** 11–6
[8] Ringvold H and Andersen T 2016 Starfish (Asteroidea, Echinodermata) from the Faroe Islands; spatial distribution and abundance *Deep. Res. Part I Oceanogr. Res. Pap.* **107** 22–30
[9] Darrell S V 2010 *Ecology Laboratory Manual* (New York)
[10] Solís-Marín F A, Laguarda-Figueras A and Honey-Escandón M 2014 Biodiversidad de equinodermos (Echinodermata) en México *Rev. Mex. Biodivers.* **85** 441–9
[11] Jin S, Wang Y, Xia J, Xiao N, Zhang J and Xiong Z 2015 Decline in the species richness contribution of Echinodermata to the macrobenthos in the shelf seas of China *Phys. Chem. Earth* **87–88** 43–9
[12] Elmasry E, Omar H A, Abdel Razek F A and El-Magd M A 2013 Preliminary studies on habitat and diversity of some sea urchin species (Echinodermata: Echinoidea) on the southern Levantine basin of Egypt *Egypt. J. Aquat. Res.* **39** 303–11

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