Preliminary Survey of Sea Stars *(Asteroidea spp)* in Passig Islet, Brgy Bato, Sta. Cruz, Davao Del Sur, Philippines

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ABSTRACT

Sea stars often known as starfish are marine invertebrates that belong to Kingdom Animalia, Phylum Echinodermata, and Class Asteroidea. Sea stars are important in marine ecology and are regarded as keystone species. In Mindanao, there are 2,357 species belonging to the family Astropectinidae, Ophidiasteridae, Oreasteridae, and Acanthasteridae that are already documented. The purpose of this study is to identify sea star species present in certain unexplored places in the region such as Passig Islet, Barangay Bato, Sta. Cruz, Davao del Sur, Philippines and produce an infographic (e.g., Poster). Actual specimen collection of *Asteroidea* species followed the procedure stated in Scott et al. (1994) Visual Encounter Survey (VES). Then, a photograph of the collected specimens was submitted to the Bureau of Fisheries and Aquatic Resources, Region XI (BFAR) for identification and verification. Results revealed that there are three (3) families of Sea Stars in Passig Islet namely; Archasteridae, Oreasteridae and Ophidiasteridae. In terms of species, there is only one (1) species - *Archaster typicus* under family Archasteridae, three (3) species namely: *Pentaster obtusatus, Protoreaster nodosus,* and *Culcita novaeguineae* under family Oreasteridae and lastly, one (1) species -*Linckia laevigata* under family Ophidiasteridae. As a marine protected area, policy reviews specifically, re-drafting of the existing zoning maps and activity guidelines that involve biodiversity conservation are highly recommended. Restoration efforts and assessment of marine biodiversity should not only focus on mangrove forest and sea grasses, but also include the sea stars. Lastly, the locals must be involved in strengthening environmental stewardship and tourism development in the islet.

Keywords: Asteroidea, Passig Islet, Preliminary, Survey, Philippines

INTRODUCTION

Sea stars, often known as starfish, are marine invertebrates that belong to the Kingdom of Animalia, Phylum Echinodermata, and Class *Asteroidea*. According to [10], they have five (5) arms on average and a central disc. Though some sea stars have more arms and can grow up to one meter (m) long, the majority are much smaller. Sea stars can be red, blue, or various colors. Furthermore, these marine species are found in a diverse natural habitat, including bottom areas of bays, tidal pools and lagoons, kelp forests, along surf grass and sea grass beds, on the rough coastline, and familiar locations on coral reefs [17]. Sea stars are ecologically important because they are predators and most likely the shallow ecosystem's most essential predators [18]. [5] they are called keystone species because they contribute to the entire marine ecosystem by regulating mussel and barnacle populations. In addition, sea stars also contribute to the health of seaweed populations and the communities that feed on them. Thus, without its keystone species, the ecosystem would either no longer exist or would change significantly [1].

The results of this study will be beneficial to the Bureau of Fisheries and Aquatic Resources (BFAR) because it will serve as baseline date in their future studies on sea stars. Consequently, Passig Islet will be given the utmost priority in BFAR conservation programs. Presently, Passig Islet is becoming a popular tourist destination in the region not only because of the natural beauty of the place but because of the diversity of sea stars in the area. Lastly, this study will provide baseline data for future researchers of marine species such as *Asteroidea* sp.

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LITERATURE REVIEW

In terms of distribution, class *Asteroidea* has approximately 2,000 species of sea stars living in all the world's oceans [8]. In a study conducted in a disturbed tropical seagrass meadow in Southeast Asia like in Malaysia, seven species were observed, with Merambong Shoal having the highest diversity and Sungai Duku and Tanjung Bin having the lowest. Notably, *Astropecten vappa* was recorded for the first time in the area. Combining with previous research, the total number of sea star species in this region now stands at eight [6]. In another study about sea stars conducted in Indonesia, particularly in Baluran Nation Park Bilik Intertidal Zone, two (2) starfish species (*Asteroidea*) were identified including *Linckia laevigata* and *Archaster typicus* [13]. Meanwhile, in the Philippines, nine (9) families are documented: Family Pterasteridae, Archasteridae, Ophidiasteridae, Mithrodiidae, Echinasteridae, Acanthasteridae, Astropectinidae, Oreasteridae, and Goniasteridae ([15]-[16]). In Mindanao, there are 2,357 identified individuals of sea stars, classified into eight (8) genera and four (4) families. The distribution among families was 1842 species of Astropectinidae, 484 species of Ophidiasteridae, 30 species of Oreasteridae, and 1 species of Acanthasteridae [10]. Moreover, sea star species such as *Protoreaster nodosus, Linckia laevigata, Culcita novaeguineae, Archaster typicus,* and *Pentaster obtusatus,* was also documented in the study of [3] and [10] in Davao Gulf, [7] in Samal Island Davao Del Norte Philippines and [12] in Babanlagan, Talisay and Misamis Oriental, Philippines. [10] conducted a study about sea stars in ten (10) selected intertidal zones of the Davao Gulf, including Binugao, Dumoy, Agdao, Bago Aplaya, Punta Dumalag, Bucana, Pampanga, Sasa, Tibungco and Bunawan. The presence of seven (7) genera, including Astropecten, Protoreaster, Linckia, Acanthaster, Choriaster, Nordoa, and Culcita, and four (4) families, including Astropectinidae, Ophidiasteridae, Oreasteridae, and Acanthasterida were documented. Additionally, in a study conducted in Samal Island where most echinoderms encountered were from Class Asteroidea (sea stars), nine (9) species were identified [7]. Locally, there are documented studies when it comes to the assessment of mangrove forest diversity and sea grasses in Passig Islet but no studies have been conducted yet to document the diversity of sea stars in the marine protected area.

MATERIALS AND METHODS

Study Area

The Passig Islet in Barangay Bato, Davao del Sur, is a little island with an area of 750 square meters of white sand that is home to a variety of marine life species, including seaweeds, sea urchins, sea stars, clown fish, and other exotic aquatic critters that may be found at the Municipality of Sta. Cruz, Davao del Sur, Philippines (6.7868°N, 125.3951° E). Bounded in the Northeast is Davao City and on the East side is the Davao Gulf (Figure 1).

Fig. 1 Map of Passig Islet, Brgy. Bato, Sta. Cruz, Davao del Sur, Philippines

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Sampling, Collection, and Identification

The number of sea stars encountered was recorded while habitats were examined along a transect or in a plot. The duration of time, the intensity of the search, the search area boundaries, and the search pattern was determined ahead of time. The specific study site is situated in the littoral zone of Passig Islet (Figure 3). The total area of the islet ranges from 95.7 hectares, with a total area of approximately 750 square meters for Passig Islet Island only and 3 hectares around the marine protected area [2]. Each of the two (2) sampling areas for specimen collection is about 400 meters (distance in the shore) in length and 350 meters (distance in the shore) in width (Figure 2). This study used the method of [4]. In this method, a randomized-walk design is employed during sampling wherein the researchers choose at random specific sampling areas during low tide. The researchers also followed the Visual Encounter Survey (VES) proposed by [19]. The VES is an appropriate technique for both inventory and monitoring studies. This method includes the following: VES survey sheet, transect sampling, random walk design, hand-collecting, boat transect, and photo documentation of the aboral and oral view of each species. The collected species were all returned to their natural habitat after the photo-documentation. Lastly, for further identification and verification, the photographs of each species species were submitted to certain marine experts from the University of Science and Technology of Southern Philippines (USTP), and to the Bureau of Fisheries and Aquatic Resources, Region XI (BFAR).

Fig. 2 Aerial View of Passig Islet, Brgy. Bato, Sta.

Cruz, Davao del Sur, Philippines

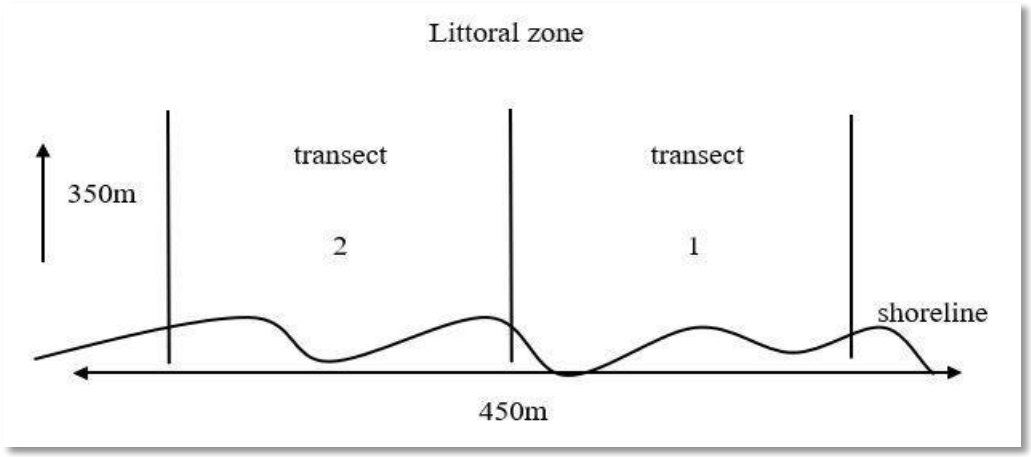

Fig.3 The layout of Littoral Zone Sampling Areas in Passig Islet

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RESULTS AND DISCUSSION

Table 2 presents the results on the preliminary survey of Sea Stars *(Asteroidea spp.)* in Passig Islet, Brgy. Bato, Sta. Cruz, Davao Del Sur, Philippines.

Table 2: Sea Star Families Identified in the Sampling Areas.

Sampling Area	Family	Genus	Species	Species Observed
1	Archasteridae	*Archaster*	*typicus*	*Archaster typicus*
2	Oreasteridae	*Proteaster*	*noduosus*	*Proteaster noduosus*
	Oreasteridae	*Proteaster*	*noduosus*	*Proteaster noduosus*
		Culcita	*novaeguineae*	*Culcita novaeguineae*
		Pentaster	*obtusatus*	*Pentaster obtusatus*
	Ophidiasteridae	*Linckia*	*laevigata*	*Linkia laevigata*

The three families of sea stars identified in the two (2) sampling areas in Passig Islet, Brgy. Bato, Sta. Cruz, Davao Del Sur, Philippines are Family Archasteridae, Family Oreasteridae, and Family Ophidiasteridae.

Family Archasteridae is a family of sea stars found in shallow water areas in Passig Islet. This family lives in sandy bottoms with loose, unconsolidated sediment and can dig and hide beneath the sand or sediment [15]. In this study, only one (1) species was identified, namely; *Archaster typicus.*

The Genus *Archaster* has a five-limbed star with long, slightly tapering arms with pointed tips [15]. It is common to encounter three, four, or even six-armed individuals. This starfish is adapted to living on the sandy seafloor, burrowing itself in the sediment during high tide and moving across the sediment surface during low tide. The general color is grey or brownish, with darker and lighter patches that form a chevron pattern at times (See Figures 4A and 4B). The only species under Genus *Archaster* that was identified in Passig Islet is typicus. [14] the species *A. typicus* is common in the Indo-West Pacific region. In the Philippines this species can be found in Davao Gulf Philippines ([3]-[10]), in Samal Island Davao Del Norte Philippines [7], and in Babanlagan, Talisay and Misamis Oriental Philippines [12].

Fig. 4A Actual Photo of *Archaster typicus* (Aboral view)

Fig. 4B Actual Photo of *Archaster typicus* (Oral view)

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Meanwhile, the family Oreasteridae was also predominantly observed to be present in Passig Islet. [1] species in the family are large, heavy, and slow, with distinctive spines or other ornamentation. The majority feed on microalgae. This family contains species of regular starfishes with five (5) arms typically surrounding a stiff, convex, and often brightly colored body. In this study, there are three (3) species that were identified, namely, *Protoreaster nodosus, Culcita novaeguineae,* and *Pentaster obtusatus.*

The Genus Protoreaster has no spines on the animal's edge and is frequently encountered in shallow waters near mangroves and on sandy bottoms. They eat microalgae and other organic nutrients found in the sediment. Color in living animals varies greatly (See Figures 5A and 5B) [14]. In this study, only one (1) species, namely nodosus under Genus Protoreaster, was identified in Passig Islet. This particular species was also documented in the study of [3] and [10] in Davao Gulf, [7] in Samal Island Davao Del Norte Philippines, and [12] in Babanlagan, Talisay and Misamis Oriental, Philippines.

The Genus *Protoreaster* has no spines on the animal's edge and is frequently encountered in shallow waters near mangroves and on sandy bottoms. They eat microalgae and other organic nutrients found in the sediment. Color in living animals varies greatly (See Figures 5A and 5B) [14]. In this study, only one (1) species, namely *nodosus* under Genus *Protoreaster*, was identified in Passig Islet. This particular species was also documented in the study of [3] and [10] in Davao Gulf, [7] in Samal Island Davao Del Norte Philippines, and [12] in Babanlagan, Talisay and Misamis Oriental, Philippines.

Fig.5B Actual Photo of *Protoreaster nodosus* (Oral view)

Fig. 5A Actual Photo of Protoreaster *nodosus* (Aboral view)

On the other hand, Genus *Culcita* has a wide range of colors and an incredibly diverse appearance. Some have more spines, while others have more granules. *Culcita* species are coral predators, but they are not known to eat as many corals as the Crown of Thorns *(Ancanthaster planci)*. They are essential to the ecosystem because the species they eat likely help control the structure of a coral reef found in Passig Islet (See Figures 6A and 6B) [15].

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In this study, only one (1) species, namely *novaeguineae* belonging to Genus *Culcita,* was identified in Passig Islet. This particular species was also documented in the study of [3] and [10] in Davao Gulf, [7] in Samal Island Davao Del Norte Philippines, and [12] in Babanlagan, Talisay and Misamis Oriental, Philippines.

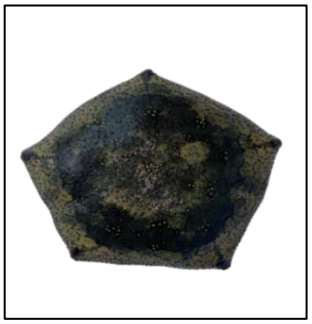

Fig. 6A Actual Photo of *Culcita novaeguineae* (Aboral view)

Fig. 6B Actual Photo of *Culcita novaeguineae* (Oral view)

Lastly, shown in Figures 7A and 7B, is the Genus *Pentaster* which is another widespread species commonly found in Passig Islet. According to [15], there are no spines or prominent tubercles on the surface of these species. Also, the species has a speckled appearance with many small and low tubercles.

Species *obtusatus* was the only species under Genus *Pentaster* identified in Passig Islet. This particular species was also documented in the study of [3] and [10] in Davao Gulf, [7] in Samal Island Davao Del Norte Philippines, and [12] in Babanlagan, Talisay and Misamis Oriental, Philippines.

Fig. 7A Actual Photo of *Pentaster obtusatus* (Aboral view)

Fig. 7B Actual Photo of *Pentaster obtusatus* (Oral view)

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Finally, another family of sea stars identified in Passig Islet is Ophidiasteridae. Species belonging to this family have long arms and small disks. They are found in Passig Islet, both in coral reefs and seagrass beds. As cited by ([13]-[14]), the genera in this family have brilliant colors and patterns, which can be attributed to aposematism and crypsis as a defense mechanism against predators. In this study, only one (1) species was identified: *Linckia laevigata.*

The Genus *Linckia,* also known as the Blue Linckia or "finger starfish," is found in the shallow-water reef at Passig Islet. These species are typically firm in texture, with slightly tubular, elongated arms and short, yellowish tube feet [14]. In this study, only (1) species, namely *laevigata* under Genus *Linckia,* was identified in Passig Islet (see Figure 8A and 8B).

The species *laevigata* also thrives in Babanlagan, Talisay, and Misamis Oriental Philippines, as cited in the study of [12] and Davao Gulf Philippines as also mentioned in the study of [3] and [10] (See Figure 8A and 8B).

Fig. 8A Actual Photo of *Linckia laevigata* (Aboral view)

Fig. 8B Actual Photo of *Linckia laevigata* (Oral view)

CONCLUSION AND RECOMMENDATIONS

The results revealed that there are three (3) families of Sea Stars in Passig Islet, namely, Archasteridae, Oreasteridae, and Ophidiasteridae. In terms of species, there is only one (1) species - *Archaster typicus* under the family Archasteridae, and three (3) species, namely: *Pentaster obtusatus, Protoreaster nodosus,* and *Culcita novaeguineae,* under the family Oreasteridae, and lastly, one (1) species -*Linckia laevigata* under family Ophidiasteridae.

Based on the findings of the study, it is recommended that through the Bureau of Fisheries and Aquatic Resources (BFAR) in the region, policy reviews specifically, re-drafting of the existing zoning maps and activity guidelines that involve biodiversity conservation in Passig Islet are highly recommended. Restoration efforts and assessment of marine biodiversity in the islet should not only focus on mangrove forest, corals, and sea grasses, but also include the sea stars. Lastly, the locals play a key role in long term environmental

stewardship and tourism development. They must be involved in planning, decision-making, and implementation of marine conservation programs.

Conflict Of Interest

No conflict of interest exists.

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