IMPORTANCE OF *ENHALUS ACOROIDES* AND IDENTIFICATION OF ITS ASSOCIATED INVERTEBRATE FAUNA

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Abstract

Enhalus acoroides is a seagrass of family Hydrocharitaceae subject to factors that can inhibit its growth and reproduction. The protection and conservation was a need since there is an alarming rate on its abundance considering that invertebrate fauna were foraging and living adjacent to them. It aimed to explore the ecological and economic importance of *E.* acoroides and to identify its associated invertebrate fauna in one of the coastline barangays of Tacloban City. This was identified and recommended by Bureau of Fisheries and Aquatic Resources (BFAR) to have greater abundance of *E. acoroides* within Tacloban City. The period of observation and collection lasted for three consecutive days during the high tide and low tide and one survey schedule was done for its importance. Invertebrate fauna was collected and identified by the expert. The results suggested that the ecological and economic importance of *E. acoroides* as viewed by the community were categorized as shelter, source of food, nest to lay the eggs of other sea creatures, and there were no known uses of *E. acoroides* economically. There were eight species of invertebrate fauna that were collected and identified in three study stations namely: five species of Bivalvia, one species of Gastropoda, one species of Malacostraca and one species of Polychaeta. The study also revealed that the largest species to be found were the species from Class Bivalvia which persisted despite the presence of garbage in the study stations.

Keywords: Conservation, *Enhalus Acoroides*, Invertebrate Fauna, Protection, Seagrass

Introduction

Enhalus acoroides species belongs to the monotypic marine genus *Enhalus* in the family Hydrocharitaceae**,** a perennial, marine, submerged, dioecious, rhizomatous, coarse, glabrous herb. Enhalus has the lengthy leaves found on the shores. The strap-like leaves are 1-2cm wide and can be 1.5m long. The leaves edged are rolled. Itis located in the subtidal

zone and is slow to produce new shoots but produces high biomass, being a very large seagrass (Suvaluck, 2011). The leaves have air channels in them. This seagrass has thick rhizomes (underground stems) that are thickly enclosed with the stiff black fibrous strands. This rhizome also has much cord- like, hairless roots. The roots also have wide air-channels (Hemminga& Duarte, 2000)

E. acoroides communities play a key role worldwide in the marine ecology ofcoastal and estuarine areas. *E. acoroides* is thought to be among the main food of many marine organisms (e.g., Dugong (*Dugong dugon*). And believed to be eaten by traditional people living on the coasts of many countries and its durable fiber is useful for fishing nets.

Major losses have usually occurred due to eutrophication or turbidity from industry, dredging or catchment runoff, mariculture activities, backfilling (reclamation), transportation, overfishing as well as natural disturbances. It is especially endangered by the establishment of fish pens/farming found in the embayment (Mahatma, 2011). The species is said to be vulnerable to shallow-net trawling and eutrophication. It is frequently troubled by vessels and anchorage considering that the species is primarily found in estuaries, shallow lagoons, and muddy bays and inside basins. The species under study is located in a narrow depth range. Therefore, this species is exceptionally susceptible sensitive to disturbances, as well as global climate change, such as sea-level rise.

E. acoroides with its major losses can affect the associated invertebrate fauna. Inthe study of Suvaluck, et. al., 2011, bivalves showed a significant abundance correlation with the species under study followed by gastroprod and polychaetes. These invertebrates are significant communities of different biotic components of seagrass ecosystems.

It is deemed that the said species under study is at risk with different factors that can inhibit its growth and reproduction. The need to conserve, protect and preserve the species under study is quite alarming because there are invertebrate fauna foraging and living just adjacent to *E.acoroides*(Mahatma, 2011).Such invertebrate fauna can also be threatened and endanger its growth and reproduction once the *E.acoroides* will be out of the picture. Thus, it is necessary for researchers to investigate and identify the invertebrate fauna associated with *E.*acoroides as this might give answers to unanswered questions to the ecological role, economic importance and global crisis of the seagrass ecosystem and conservation.

There were compelling studies on the preservation and conservation of *E.acoroides* against its surrounding major threats. But the problem remains that the threat of the *E. acoroides* can also be the risk of the invertebrate fauna and other species associated with it.

Thus, the identification and investigation of the *E. acoroides* are necessary. Through this study, it provide inputs for on the importance of*E. Acoroides* and the identification of its associated invertebrate fauna. Thus, the global crisis of the sea grass ecosystem and conservation gives us the idea that the threat and problem of one can affect the others as well.

Materials and Methods

Research Design

The descriptive research design was used in this study to describe the behavior and identify the invertebrate fauna associated with seagrass, *E. acoroides* as it occurs in the environment.

Research Locale

One of the barangays of Tacloban City is Barangay 88 Fisherman's Village, San Jose. The barangay is near the coast, and it is located far from the national highway. Consequently, thesource for living of the residents is fishing. The said setting is abundant in the seagrass-*E.acoroides*, which can be seen during low tides from the seaboard. The study site could be observed with plastics, feces, and other waste materials that could reach the sea at the time of high tide. The drainage system of the place was flowing directly to the sea, and some residents use the sea as bathrooms. The water was observed dark in color and oil can be seen in direct contact.

The site above was identified by Bureau of Fisheries and Aquatic Resources (BFAR) rich in *E. acoroides*. The three stations will be selected based on some factors that include: the appropriateness of the aims of the research, the abundance of *E. acoroides* and the proximity to other stations. The setting is located at East, 100m, and 300ft. Southeast from the location is the office of Bangko Sentral ng Pilipinas alongside is the school of Leyte Colleges.

Research Instruments

A survey questionnaire was used by the researchers. This is designed to collect relevant data that will help the researchers in the examination of the ecological and economic importance of *E. acoroides* as viewed by the community in the study. The questionnaire is a researcher-made that had undergone pilot testing. It had fifteen items and partitioned into two parts: the first one deal with the demographic profile of the respondents; and the second one seeks to explore the respondent's subjective perception of the mentioned species under study.

Data Gathering Procedure

One set of data were gathered to address the problem presented in this study. The first problem is concerned as to what are the ecological and economic importance of *E.acoroides*as viewed by the residents. The second problem is in to the identification of invertebrate fauna associated with *E. acoroides*. In order to gather the necessary data to address and analyze the problems, the researchers administered one survey schedule for selected respondents in Brgy. 88 Fisherman's Village, San Jose, Tacloban City. To ensure uniformity of data, the topics of the questionnaire and follow up interview conducted by the researchers were of the same theme and content for each respondents. The respondents were coded as P_1, P_2, and so on.

The second problem is concerned with the identification of invertebrate fauna associated with *E. acoroides.* The researchers used quadrat method. Quadrats (Baxter, 2014) are efficient tools to determine abundance/ condition of the assessed habitat regarding the percentage cover observe. And percentage cover of the assessed habitat will be determined through actual observations using the habitat rating criteria. A quadrat measures 1 m x 1 m. It is with smaller grids inside and bamboo poles tied together. A 1 m x 1 m quadrat is divided into four subsquares for easy percentage cover estimation of the assessed coral or seagrass habitat. It is recommended that a suitable number of quadrats be used to serve as samples of the assessed habitats (see Appendix B).

Three consecutive days and nights was allotted for the observation and collection of invertebrate fauna associated with *E. acoroides* every high tide and low tide of the day. Distances of sampling will depend on the presence of seagrasses distributed in the study site. The researchers had three stations in Brgy. 88 Fisherman's Village, San Jose, Tacloban City. Purposive sampling was done with a quadrat of 0.25 m^2 at each stations. The collection was done hand-picked. All samples of different species were preserved in a glass container with 10% formalin and 90% seawater solution. The preserved samples were submitted for identification. As for the identification, the expert used the FAO Marine Species Identification Guide, Shells of the Philippines by Springsteen and Leobrera, Indo-Pacific Coral Reef Guide by Allen and Steene, and the WoRMS (World Register of Marine Species) Database Website.

Table 1. *Observation Period of the Study*

TIDE	January 3	January 4	January 5
Low Tide	3:15 AM	4:04 AM	4:50AM
High Tide	7:26 AM	8:18 AM	9:10 AM

It can be gleaned from Table 1 that the observation period of the study lasts for three consecutive days, from January 3-5, 2018. The collection and observation of invertebrate fauna was done for every high tide and low tide of each day. This was performed as recommended by Suvaluck et al., 2011 to include the tides of each day for other animals such as grazers that can only be seen during high tide.

Results and Discussions

This research contributes to the identification of invertebrate fauna associated with *E. acoroides* literature. One set of data were gathered to address the problem presented inthis study. The first problem is concerned as to what are the ecological and economic importance of *E. acoroides* as viewed by the residents. The second problem is in to the identification of invertebrate fauna associated with *E. acoroides*.

The respondents were residents in Brgy. 88 Fisherman's Village San Jose, Tacloban City. The locality was chosen because it was identified by the Bureau of Fisheries and Aquatic Resources (BFAR), a place where we can find a greater abundance of *E. acoroides* compared to other areas in Tacloban City. There were 40 respondents and were selected through purposive sampling in terms of their job. Majority of them were fishermen with 55% followed by self-employed with 25%, and 15% goes to the housewives. The least percentage of 5 was for public employee. The range of age of the respondents was 30-40. Among the respondents living in Brgy. 88 Fisherman's Village, San Jose, Tacloban City, there was 70% who are aware of the seagrass, *E. acoroides* and 30% said no in knowing the *E. acoroides.*

Ecological Importance of *E. acoroides* as viewed by the Residents

The ecological and economic importance of *E. acoroides* is discussed. The ecological importance of *E. acoroides* is discuss in four categories: as shelter, as food, as nesting place and the imposition of harm to humans and followed by the discussion of economic importance of *E. acoroides*.

It can be gleaned from Table 4 that there is 61% said that *E. acoroides* serves as shelter of the fish, followed by 8% saying that serves as nesting place of other sea animals

and 2% serves as food of other sea animals. But 1% that *E. acoroides* can inflict harm to humans and can leave cut on your skin.

As shelter

E. acoroides with its long leaves and abundance in the study site can serve asshelter and protection from other sea animals. There is 61% out of 100% agreed its importance as shelter to fish. That is why there is a great number of fish in the place. Though it cannot be used in other things, in contrast it can increased the number of fish. Furthermore, *E. acoroides* because of its longer leaves can have a wider range for protection and shelter of fish and other sea animals. The mat of rhizomes also provides shelter for many small animals.

As nesting place

There is 29% of the residents answered that *E. acoroides* serves as nesting place of fish. The growth of their number in the sea grass can only mean that there is a reproduction happening. This increased the number of fish which was a relief for fisherman for they will not run out of food. Moreover, *E. acoroides* has no direct benefits given to the residents but they are helping the residents, especially those who do not have well jobs.

As food

There were7% who answered that *E. acoroides* serves as food to other sea animals. The seeds are thought to serve as food like crabs. One respondent stated that during low tide, there was a crab eating on the leaves of *E. acoroides*.

The residents are observant enough to witness such events. Moreover, *E.acoroides* blade grows a wide variety of tiny encrusting animals like green gum dropascidians and seagrass hydroids and egg capsules. Tiny algae often grow on the leaves of this seagrass, providing food for grazing creatures such snails. Study showed the species to be high in kilocalorie content, with high content of phenols in the leaves and rhizomes. *E.acoroides* yielded 68.82 kcal/g, the highest values among the seagrass tested. It alsoyielded maximum values in leaf and rhizomes. The calorific contents of the species were equivalent to Bengal gram, peas, potato and sweet potatoes (Pradheeba, et al., 2011). It was suggested that *E. acoroides* can be considered as feed or food.

Harmful Effects to Humans

Out of 100%, 3% answered that the leaves can leave cut on the skin once rubbed. *E. acoroides'* leaves compare to other seagrass is longer that during low tide can beevidently seen from the shore. Since the long and numerous leaves of this species tended to

overshadow the entire area, it was hard for the fisherman to park their boats. The results suggested that though sea animals receive benefits from the species under study. It is way of growing and increasing numbers but can impose harm to the residents and serves as barrier from the waves.

The residents near the coast observed that during the rage of storms, areas with absence of the species has higher and steeper waves while the waves slow down as it reaches the shore, in their presence. Thus, invoking that other than the mentioned harmful effects of *E. acoroides*, there is yet to discover its ecological importance to humans.

Economic Importance of *E. acoroides*as viewed by the Residents

From the literature cited, *E. acoroides* seeds are eaten by traditional people living on the coasts of Australia and the Philippines. Eaten raw, they are said to taste like water chestnuts. A durable fiber useful for fishing nets is also made from it. This species has a variety of uses, it is harvested for food, for animal medicine, fiber and construction materials, and for handicrafts. It is also used as fertilizer in India. In Brgy. 88 Fisherman's Village, San Jose, Tacloban City, there were no known economic uses of *E. acoroides*. A total of 100% answered that the residents don't use the seagrass to make baskets, nets or as herbal medicine. But according to one informant, we do not use *E. acoroides* to make anything. But according to other people, it has a seed and that seed serves as an herbal medicine. The residents only knew what the uses according to other elders, but the residents do not use the *E. acoroides* in practice. This statement also suggests that not all of the residents know all about the *E. acoroides* parts, functions and uses. Another informant answered, we do not use it to make basket and mats because its leaves are easily cut. It's okay for the fish as their shelter. But for us, it can leave wounds or cuts.

The residents were assured that the leaves are not suitable for making baskets and mats. But had never tried it once in making baskets and mats. The residents defended that the *E. acoroides* are only important for sea animals and not for them.

The Identified Invertebrate Fauna Associated with *E. acoroides*

There were 8 species of invertebrate fauna that were collected and identified in three stations in Brgy. 88 Fisherman's Village San Jose, Tacloban City. Five species were Bivalvia, one species of Gastropoda one species of Malacostraca and one species of Polychaeta composed in the study area. The two classes, Malacostraca and Polychaeta was identified up to order only. As for the identification, the expert used the FAO Marine Species Identification Guide, Shells of the Philippines by Springsteen and Leobrera, Indo-Pacific

Coral Reef Guide by Allen and Steene, and the WoRMS (World Register of Marine Species) Database Website. Moreover, the collection took three consecutive days and nights every high tide and low tide. This was performed as recommended by Suvaluck et al., 2011 to include the tides of each day for other animals such as grazers that can only be seen during high tide.

The identified fauna has the same result with the fauna associated with *E.acoroides*in the study of Suvalack, et al., 2011. Class Bivalvia, Class Gastropoda, andClass Polychaeta. The results suggest that there were more species in Class Bivalvia associated to the seagrass, the same data showed a significant correlation to *E. acoroides* in the study of Suvaluck, et al., 2011. But in comparison to the results presented, the results gathered in Brgy. 88 Fisherman's Village San Jose, Tacloban City had an additional Class Malacostraca.

It can be gleaned from Table 3, the presence and absence of invertebrate fauna associated with *E. acoroides*. There were three stations made according to the abundance of seagrass and the proximity to other stations. The observation and collection was done for three consecutive days during the high and low tide. The abundance of seagrass stands for the percentage it covers in the quadrat and the proximity to other stations was 30 meters away from one quadrat to another. It was observed from Table 3 that *Tellinatimorensis, Modiolus philippinarum,* and *Ostrea sp.*were found in all three stations. There were five, six, and four species observed in station 1, station 2 and station 3, respectively.

In station 1, there were 5 species observed- *Laternula spengleri, Tellina timorensis,Modiolus philippinarum, Amphipoda* and *Ostrea sp*. The four species belong to the ClassBivalvia. Only the *Amphipoda* belongs to the Class Malacostraca. All identified species belonging to Class Bivalvia are seen for three days of observation. During the period of observation, *Amphipoda* was only seen once in high tide of the first day of observation. This was because the *Amphiphoda* was much more mobile compared to other species present. *Amphiphoda* tends to search food from one seagrass to another. Once its supply of food runs-out, *Amphipoda* will transfer to another seagrass (Green and Short, 2003).

In station 2, it includes the following species, *Laternula spengleri, Tellinatimorensis, Modiolus philippinarum, Orbiniida, Ostrea sp.* and *Spondylus echinatus*.Station 2 has the highest species diversity having six species. All the species belongs to Class Bivalvia whereas *Orbiniida* is under the class of Polychaeta. The data suggests that *Orbiniida* was observed twice on low tide and once on high tide. In the study of Suvalucket al., 2011, Class Polychaeta has a lesser significant correlation with *E. acoroides* with a percentage of 27.

Moreover, *Orbiniida* is a mobile organism, with its segmental appendages and free-living way of life. Same data gathered in Station 1 that all identified species belonging to Class Bivalvia are seen for three days of observation.

In station 3, the species observed are *Tellina timorensis, Modiolus philippinarum,Ostrea sp.* and *Pomacea caniculata*. This station had the least species found. Three species belong to the Class Bivalvia while *P. caniculata* is under the Class Gastropoda. Unlike any other class seen on the two stations other than Class Bivalvia, *P. caniculata* occurs for three consecutive days both high tide and low tide together with the Class Bivalvia species present.

The data gathered suggests that among the stations, the researchers observed Class Bivalvia occurs in high tide and low tide for three consecutive days. The data gathered was strengthened with its even result of Suvaluck et al., 2011 study.

Conclusion

The ecological and economic importance of *E. acoroides* as viewed by the community in the study site because it serves as a shelter, source of food and nest to lay the eggs of other sea creatures. There were no known uses of *E. acoroides* economically. A total of 8 species of invertebrate fauna associated with *E. acoroides* were collected and identified within three stations in Brgy. 88 Fisherman's Village San Jose, Tacloban City. The study has shown four classes of invertebrate fauna. Class Bivalvia includes *Laternulaspengleri, Tellina timorensis, Modiolus philippinarum, Spondylus echinatus*and *Ostrea sp.*Whereas Class Polychaeta and Class Malacostraca were identified up to Order Orbiniida and Order Amphiphoda only. Lastly, Class Gastropoda includes *Pomacea canaliculata*. Among the three stations, station 2 has the highest diversity. Similarly, the most abundant invertebrate fauna belongs to Class Bivalvia which can be seen for three consecutive days during high and low tide. Furtheremore, Class Bivalvia has the significant correlation to the biomass of *E. acoroides*.

Recommendation(s)

In light of the results and discussion of the study, the following recommendations are suggested:

1. Further studies should be done regarding on how Class Bivalvia survive in an environment surrounded with wastes and plastics of Brgy. 88 Fisherman's Village San Jose, Tacloban City. It is recommended to collect species under Class Bivalvia and examine its physiologic and adaptations strategies. Thus, wider ranges of species are needed. It is also suggested to study fauna other than invertebrates only.

2. Moreover, it is likewise recommended to have more sampling stations to consolidate gathered data for time and location comparison of information.
3. Lastly, it is advised to perform testing its physic-chemical parameters of environmental water on site to prevent inconsistency in results.

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Tables and Charts

Table 1. *Observation Period of the Study*

TIDE	January 3	January 4	January 5
Low Tide	3:15 AM	4:04 AM	4:50AM
High Tide	7:26 AM	8:18 AM	9:10 AM

Table 2. *The Ecological Importance of E. Acoroides*

TIDE	f	%
E. acoroides serves as shelter of fish	17	61%
E. acoroides is where the fish lays their eggs	8	29%
E. acoroides serves as food of other sea animals	2	7%
E. acoroides can leave cut on your skin	1	3%
Total	**28**	**100%**

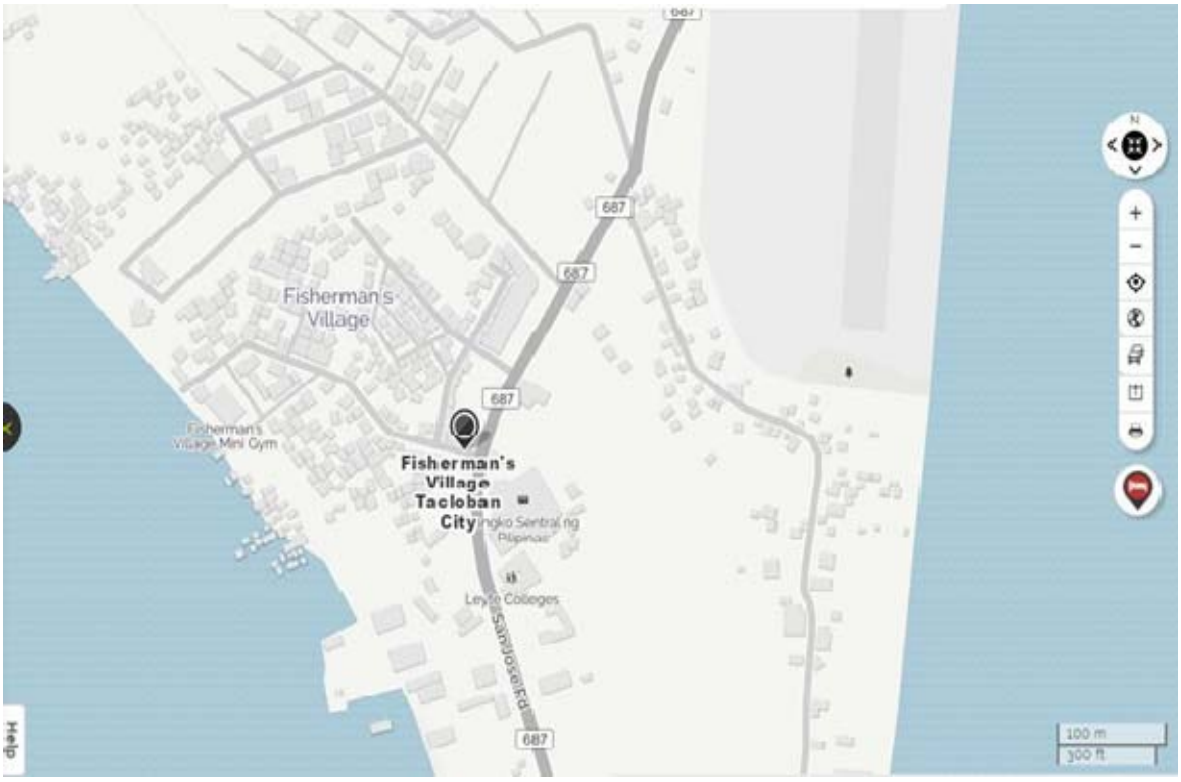
Table 3. *Presence and Absence of Invertebrate Fauna*

Station	Invertebrate Species	January 3		January 4		January 5	
		HIGH	LOW	HIGH	LOW	HIGH	LOW
1	*Laternula spengleri*	P	P	P	P	P	A
	Tellina timorensis	P	P	P	P	P	P
	Modiolus philippinarum	P	P	P	P	P	P
	Amphipoda	P	A	A	A	A	A
	Ostrea sp.	P	P	P	P	A	A
	Laternula spengleri	P	P	P	P	P	P

2	*Tellina timorensis*	P	P	P	P	P	P
	Modiolus philippinarum	P	P	P	P	P	P
	Orbiniida	P	P	A	P	A	A
	Ostrea sp.	P	P	P	P	P	P
	Spondylu sechinatus	P	P	P	P	P	P
3	*Tellina timorensis*	P	P	P	P	P	P
	Modiolus philippinarum	P	P	P	P	P	P
	Ostrea sp.	P	P	P	P	P	P
	Pomacea canaliculata	P	P	P	P	P	P

Legend:
**P stands for the presence of the invertebrate fauna*
**A stand for the absence of the invertebrate fauna*

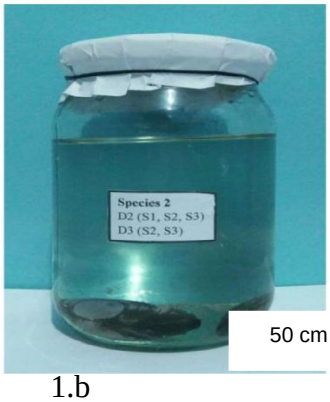
Figure/Graph/Map/Layout/Outline



The Identified Invertebrate Fauna Associated with *E. acoroides*

Class Bivalvia

1.a



1.b

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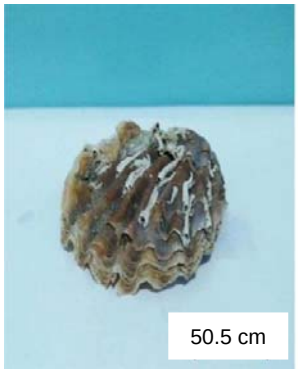

1. d

1.e

Class GastropodaClass Malacostraca

1.f

1. g

1.h

Figure 2. Identified Invertebrate Fauna.Class Bivalvia 1a *Laternula spengleri*, 1b *Tellina timorensis*, 1c *Modiolis philippinarum*, 1d *Spondylus echinatus* and 1e *Ostrea sp.* Class Gastropoda 1f *Pomacea caniculata*. Class Malacostraca,1g Order *Amphiphoda*. And Class Polychaeta, 1h Order *Orbiniida*.