

Species Diversity of Aquatic Fauna in Seagrass at Rockgarden Village, Rayong Province

Chanate Wanna^{1*}, Chaloepon Phongpha²

¹Faculty of Science and Technology, Suan Sunandha Rajabhat University

¹U-thong Nok Road, Dusit, Bangkok 10300, Thailand

Corresponding author E-mail: *chanate.wa@ssru.ac.th

Abstract: The diversity of aquatic fauna such as fish, shrimp and crab behind Rockgarden Village in Kleang District, Rayong Province by surveying and collecting samples were in two stations of different habitat types i.e. inside and outside seagrass. The collection sampling of aquatic fauna using small beach embankment carried out 3 times in November 2016, January and March 2017 and three replications in each time. The samples were collected by dragging net with 2 mm mesh size at 1 - 1.2 m of a depth level. The total faunal species comprised 24 species from 20 families, 5 orders and 2 classes as Actinopterygii in fish group with 4 orders i.e. Perciformes (13 families, 17 genera and 16 species), Syngnathiformes (1 family, 1 genera and 1 species), Atheriniformes (1 family, 1 genera and 1 species) and Tetraodontiformes (2 families, 2 genera and 2 species) and Malacostraca in crab and shrimp with 1 order as Decapoda (3 families, 4 genera and 4 species). The 22 species (18 fish species, 3 crab species and 1 shrimp species) were found inside seagrass while 15 species (11 fish species, 3 crab species and 1 shrimp species) were found outside seagrass. The fish group was the most abundance and then was the crab and shrimp group. Family of fish which is the most abundance in this area was Siganidae. The diversity index of aquatic fauna was inside seagrass as 1.042 and outside seagrass as 0.188. This survey indicated that the inside seagrass area was more abundant aquatic fauna than the outside seagrass area and was important in habitat, nursery ground and food source of aquatic fauna.

Keywords: species diversity; aquatic fauna; seagrass; Rockgarden Village

1. Introduction

Seagrasses are plants that spread along the coast and can grow well in shallow water with sunlight. Scientists believed that the indigenous plants which originate from single-celled organisms called diatoms that live in the sea. The evolution of land plants such as mosses, ferns and cycads, which are very high in the evolution of dinosaurs decreased. Land plants developed the most advanced angiosperms (flowering plants) several million years ago. A group of flowering plants, seagrass special group only developed down to the sea. Seagrass species widely distributed in shallow, coastal waters worldwide in tropical and subtropical region. They can reproduce by rhizome and sexual reproduction with flowers. When the female flowers were fertilized, they will be developed as fruits which are within the seeds and spread on other area (Department of Marine and Coastal Resources, 2017).

Rockgarden Village in Kleang District, Rayong Province is a village with seagrass area behind the village is a large 3 in Rayong. The total area is about 1,029,375.874 square meters or approximately 643 acres (Department of Marine and Coastal Resources, 2017). Seagrass ecosystems are vital to the coast because there are so many living creatures, including the grass itself. The creatures have adapted well in water that has been up and down all the time (Kritsana, 1999; Wararin *et al.*, 2008). They are a role as a source of refuge and feeding habitat for aquatic species to spawning and larvae of fish to strength before heading out to sea or coral reef, especially fish, shrimp, crab and shell, including rare sea creatures like turtles and dugongs (Dollar, 1991; Tipamas, 2005; Chanate and Pattaraporn, 2017). Moreover, seagrass also helps to filter water and improves water quality. The root system of seagrass allows the adhesive to prevent the soil erosion, so they are the important ecosystem. The seagrass in the area tends to

deteriorate and declines by human activity, in particular, the construction of the jetty, fishing in the seagrass, business travel and littering or wastewater discharge into the sea lead to sedimentation causes damage to seagrass, so seagrass ecosystems were imbalance. In addition, impacts to the bay from increasing population and industrial development of the Tampa Bay area resulted in large seagrass reduction (Johansson and Greening, 2000).

From the above mentioned problems, causing pollution of the environment affects to changes in coastal seagrass beds impact on diversity and abundance of aquatic life. This research studied in seagrass area around Rockgarden Village in Rayong Province for the study of aquatic biodiversity and abundance to know the status of aquatic fauna in the seagrass and impact to make everyone aware of the importance of seagrasses in terms of the habitats of aquatic larvae, hidden sources of aquatic fauna which lead to the restoration plan and sustainable solutions in the future.

2. Materials and methods

2.1 The survey and sampling of aquatic fauna

Survey samples were collected from the second station is inside and outside of seagrasses behind Rockgarden Village in Kleang District, Rayong Province, including all three times in November 2016, January and March 2017 because this time period changes the season between winter to summer, three replications for 10 min in each replication at 1 - 1.2 m of a depth level by dragging net over a small embankment. Each net size of 5 m width, 1.5 m height, 7 m length and 2 mm mesh size (modified from Wararin *et al.*, 2008). The Kuicheai seagrass (*Halodule uninervis*) is the dominant seagrass species in the survey area. Using satellite maps compared to the actual location. Then explore the area on a map as well as Geocoding and maintain a living example by freezing to be identified in the laboratory.

2.2 Identification of aquatic fauna species

Samples were stored under the classification taxonomy according to the manual classification of aquatic fauna species in the Andaman seagrass (Wararin, 2006), Invertebrates in the Songkhla Lake Basin (Pattamaporn and Sakanun, 2009), Fish in the Songkala Lake Basin (Pattamaporn and Sakanun, 2009) and www.marinespecies.org (World Register

of Marine Species, 2014). This is based on external morphological characteristics of shape, pattern classification by fish and other landmarks. The group classified by the shape of a crab carapace and shapes and classified shrimp with green shrimp, a sort of articulate and rudders.



Figure 1. Aquatic fauna surveying area behind Rockgarden Village in Kleang District, Rayong Province; green pin is inside seagrass area and black pin is outside seagrass area. (Google Earth, 2016)

2.3 Data analysis

2.3.1 Species diversity index

Used to calculate the Shannon-Weiner Diversity Index according to Washington (1984), calculated using the following formula

$$H = -\sum_{i=1}^S [p_i * (\ln p_i)]$$

H = Species diversity index of Shannon-Weiner Diversity Index

p_i = The proportion of individual and total samples

S = Species number found in each station

2.3.2 Species evenness index

A value indicating the spread of the species and season each station if the survey station is high shows that season and explore it includes species that are in line and a similar distribution by way of Pielou's index (Clarke and Warwick, 2001), using the following formula

$$E = H / \ln S$$

E = Species evenness index of Pielou's index

S = Species number found in each station

H = Species diversity index

2.3.3 Species richness index

A value that indicates the diversity of aquatic fauna in each station, and if the season is very valuable survey shows that there are more species diversity, based on the calculation of the number of species found according to the method of Margalef index (Clarke and Warwick, 2001), using the following formula

$$R = (S-1)/\ln N$$

R = Species richness index of Margalef index

N = Total individual number found

S = Species number found in each station

2.3.4 Relative abundance (RA)

Shows the frequency of aquatic fauna found during the study which describes the distribution of marine spatial (Clarke and Warwick, 2001), using the following formula

$$RA = \frac{\text{Abundance of each species}}{\text{Total of all species}} \times 100$$

3. Results

3.1 Taxonomy of aquatic fauna

The survey of species diversity of aquatic fauna inside and outside of seagrass behind Rockgarden Village in Kleang District, Rayong Province found that 15 species inside seagrass and 3 species outside seagrass in November, 16 species inside seagrass and 13 species outside seagrass in January and 15 species inside seagrass and 11 species outside seagrass. All 20 families, 24 species are divided into groups of fish 1 class 4 orders 17 families 18 genus and 20 species, the crab 1 class 1 order 2 families 3 genus and 3 species and shrimp 1 class 1 family 1 genus and 1 species as shown in Table 1 of appendix.

3.2 Biological diversity of aquatic fauna inside and outside seagrass

When analyzing a variety of animals in each survey area that are all aquatic fauna 22 and 15 species, 10,378 and 460 individuals, species diversity of 1.042 and 0.188, species evenness of 0.377 and 0.069 and species richness of 2.260 and 1.506 inside and outside seagrass, respectively (Table 2) indicating that inside seagrass has a variety of aquatic fauna more than outside seagrass.

Table 2. The Ecological index of aquatic fauna in each survey area

Ecological index	Survey area	
	Inside seagrass	Outside seagrass
Total species	22	15
Total individuals	10,378	460
Species diversity (H)	1.042	0.188
Species evenness (E)	0.337	0.069
Species richness (R)	2.260	1.506

3.3 Evaluation of aquatic fauna relative abundance inside and outside seagrass

The species diversity of aquatic fauna behind Rockgarden Village in Kleang District, Rayong Province, including all three times in November 2016, January and March 2017 found 18 families, 22 species and 10,378 individuals inside seagrass. The aquatic fauna which was high relative abundance found 5 species such as *Siganus javus* 72.56%, *Terapon puta* 13.75%, *Siganus canaliculatus* 5.12%, *Lethrinus lentjun* 1.64% and *Penaeus semisulcatus* 1.83% and was low relative abundance found 3 species such as *Chelonodon patoca* 0.019%, *Scatrophagus argus* 0.009% and *Matuta victor* 0.009%. The aquatic fauna outside seagrass found 13 families, 14 species and 460 individuals which was high relative abundance such as *Siganus canaliculatus* 54.78%, *Lethrinus lantjun* 14.57%, *Aerherinomorus duodecimalis* 10.87%, *Sillago Aeolus* 3.70% and *Terapon puta* 3.04% and was low relative abundance such as *Monacanthus chinensis* 0.43%, *Thalamita crenata* 0.22% and *Matuta victor* 0.22% shown in Table 3 of appendix. Assessing the relative abundance of aquatic fauna status in this study was different in surveyed frequency of each species between inside and outside seagrass to serve about the abundance and conservation status of aquatic fauna outside seagrass.

4. Discussion

Siganidae are fish group which is the most abundance inside seagrass area around Rockgarden such as *Siganus javus* and *Siganus canaliculatus* corresponds to Wararin *et al.* (2008) studied aquatic fauna inside seagrass at Phuket Island that Siganidae are the most abundant species include the marine fish found Siganidae by the white supremacy. We found that different fish *Siganus javus* over *Siganus canaliculatus*, which shows that a group of fish species are abundant inside seagrass both the Andaman Sea and the Gulf of Thailand. Coast island also has an abundance of crab (*Portunus pelagicus*) the highest, followed by *Portunus sanguinolentus*

and *Thalamita* spp., respectively, to explore inside seagrass around Rockgarden area found abundance of *Portunus pelagicus* and *Thalamita crenata*, indicating that abundance of aquatic fauna inside seagrass between Rockgarden and Phuket Island nearby. But the seagrass of Rockgarden didn't find *Portunus sanguinolentus* due to the environment of different species of seagrass which is used as a food source and habitat of *Portunus sanguinolentus*.

Supaporn (2014) reported that the Taled Gulf, Nakhonsithammarat Province found that there are *Siganus javus* very abundant of 44.66%, followed by *Secutor ruconius* of 10.57%, *Leiognathus splendens* 9.72%, *Leiognathus decorus* of 6.79%, *Ambassis kopsi* of 3.59%, *Metapenaeus lysianassa* of 2.31% and *Terapon puta* of 1.77% which *Siganus javus* as the fish were abundant only local resources seagrass are consistent this survey. It shows that *Siganus javus* found in seagrass pointed out that the seagrass habitat and food sources for *Siganus javus*. Pinto and Punchihewa (1996) studied the useful of fish inside seagrass around Nagumbo Estuary Sri Lanka found that Gobies and Siganid take advantage of seagrass in finding food and refuge fish include a lot of *Siganus javus* in seagrass. Jeerapong (2004) conducted a survey of aquatic fauna inside Baan Tha-Lane seagrass, Krabi Province collected total 4,543 individuals of fish which the family Siganidae is the most abundant include *Siganus canaliculatus* of 66.15% and *Siganus javus* of 9.44% which is different from this survey found *Siganus javus* of 72.55% and *Siganus canaliculatus* of 5.11%. Ukkrit and Suree (2005) were examined the stomach contents of fish in the Eastern side of seagrass, Phuket Province found that 84% of gastric banding *Siganus javus* as seagrass and algae. This indicates that *Siganus javus* into the seagrass along the food supply for itself. This shows that the prevalence Siganidae in the seagrass, whether it is the Gulf of Thailand or the Andaman Sea.

Baan Tha-Lane has species diversity index of aquatic fauna as 1.51, species evenness of 0.39 which is consistent with a variety of fish over space exploration in the grass near the Rock Garden Village. The Baan Laem Som, Phangnga Province found a total of 4,937 fish were the highest abundance in the area such as *Siganus canaliculatus* of 41.72%, *Lethrinus lentjun* of 4.23% and *Siganus javus* of 1.96% and species diversity index equal to 2.04 and species evenness of 0.54, which is very high compared to seagrass beds of Rockgarden Village.

Because Baan Lane seagrass found all eight species of seagrass such as *Enhalus acoroides*, *Thalassia hemprichii*, *Cymodocea rotundata*,

Cymodocea serrulata, *Halophila minor*, *Halophila ovalis*, *Halodule pinifolia* and *Halodule uninervis*. Dominant seagrass species is *Halophila ovalis* which covers about 80% of the total area. Baan Laem Som seagrass, Phangnga Province with an area of approximately 0.8 square kilometers of sea grass found 8 species of seagrass similar to Baan Lane seagrass, Krabi Province. The dominant seagrass species, including grass-covered area along the seagrass *Enhalus acoroides* 70% unlike Rockgarden seagrass which was the dominant seagrass *Halodule uninervis* and probably found only one seagrass in this area as a result, the diversity of aquatic fauna in Rockgarden seagrass.

Tipamas (2005) surveyed crustaceans group in the mangroves and seagrass beds, Phuket Province found *Penaeus semisulcatus* in small amounts and only seagrass and its abundance of shrimp difference with Rockgarden seagrass in Rayong, which surveyed shrimp dominant. Additionally, animals in seagrass ecosystem will have to share the use of space by time. During the daytime meet the most diverse group of fish and during the night to find the most shrimp (Supasit, 2008), including the appearance of seagrass in the area will affect the amount and type of aquatic faunas found. The phylum arthropoda to find the maximum area of short leaves seagrass and phylum chordata in the core area, typically long leaves seagrass. It shows that the survey found the type and abundance of aquatic fauna are specific to the type and characteristics of seagrass in various areas (Weerachat *et al.*, 2008).

5. Conclusions

A survey of aquatic fauna using small beach seine inside and outside of seagrass behind Rockgarden Village in Kleang District, Rayong Province found that the fish group are the most diversity of 20 species, followed by the crab 3 species and shrimp 1 species. The station which was the most diversity has 22 species of inside seagrass with species diversity of 1.042, species richness of 2.260 and species evenness of 0.337. The high abundance inside seagrass found 5 species such as *Siganus javus*, *Terapon puta*, *Siganus canaliculatus*, *Penaeus semisulcatus* and *Gerres oyena*. The outside seagrass found 14 species has species diversity of 0.188, species richness of 1.506 and species evenness of 0.069 and high abundance 5 species such as *Siganus canaliculatus*, *Lethrinus lentjun*, *Aerihinomorus duodecimalis* and *Sillago aeolus*. These indicated that the inside seagrass area has species diversity index higher than outside seagrass. The database of the aquatic fauna diversity

is the necessary information to be studied further and a guideline for the sustainable conservation of aquatic fauna.

Acknowledgements

The author would like to thank the Suan Sunandha Rajabhat University and Eastern Gulf Fisheries Research and Development Center (Rayong) for providing all the necessary support and is grateful to the referees for their valuable comments, which have enhanced the quality and presentation of this paper.

References

- Chanate, W. and Pattaraporn, D. (2017). Species diversity of amphibians, reptiles and mammals in Suan Sunandha Rajabhat University Samut Songkhram Campus and around area. *New Trends and Issues Proceedings on Humanities and Social Sciences*, 4(1) : 202-10. doi: - 10.18844/prosoc. v4i1.2256.
- Clarke, K.R. and Warwick, R.M. (2001). *Change in marine communities: An approach to statistical analysis and interpretation*. 2nd edition. Plymouth Marine Laboratory. Plymouth, UK. 176 pp.
- Department of Marine and Coastal Resources. Importance, type and area of seagrass in Rayong. Available source: <http://www.dmcg.go.th/home.php>, February 17, 2017.
- Dollar, M.I.I. (1991). A survey of the fish and crustacean fauna of the seagrass bed in North Bais Bay, Negros Oriental, Philippines, 367-77. In Alcalá, A.C. (ed). *Proceedings of the Regional Symposium on Living Resources in Coastal Areas*. Marine Science Institutes, University of the Philippines.
- Google Earth. (2016). Google map. Available Source: www.google.com/earth, February 18, 2017.
- Jeerapong, J. (2004). *Species diversity and distribution of pre-reproductive fish in two different seagrass of Andaman Sea*. Master of Science Dissertation, Field of Ecology, Prince of Songkhla University. 139 pp.
- Johansson, J.O.R. and Greening, H.S. (2000). Seagrass restoration in Tampa Bay: A resource-based approach to estuarine management. In: Bortone, S.A. (ed.) *Seagrasses: Monitoring, Ecology, Physiology and Management*. 279-93.
- Kritsana, I. (1999). *Distribution and diversity of seasonal marine fauna in seagrasses of Pattanee Bay*. Master of Science Dissertation. Chulalongkorn University. 148 pp.
- Pattamaporn, M. and Sakanun, P. (2009). *Fish in Songkhla Lake Basin*. 1st edition. i-design publisher, Songkhla. 315 pp.
- Pattamaporn, M. and Sakanun, P. (2009). *Invertebrates in Songkhla Lake Basin*. 1st edition. i-design publisher, Songkhla. 293 pp.
- Pinto, L. and Punchihewa, N.N. (1996). Utilisation of mangroves and seagrasses by fishes in the Negumbo Estuary, Sri Lanka. *Marine Biology*, 126(2): 333-45.
- Supaporn, O. (2014). *Species and distribution of aquatic fauna in Taled Gulf, Nakhonsithammarat Province*. Second Report of Marine and Coastal Resources Research & Development Institute, Department of Marine and Coastal Resources. 36 pp.
- Supasit, B. (2008). *Aquatic fauna in seagrass around Tungkhien Gulf, Phuket Island*. Marine and Coastal Resources Research & Development Institute, Department of Marine and Coastal Resources.
- Tipamas, U. (2005). *Distribution and abundance of crustaceans around seagrasses and mangroves of Andaman*. Eleventh Report of Marine and Coastal Resources Research & Development Institute, Department of Marine and Coastal Resources. 35 pp.
- Ukkrit, S. and Suree, S. (2008). *Food and eating habit of fish in seagrass around Eastern of Phuket Island*. Sixteenth Report of Marine and Coastal Resources Research & Development Institute, Department of Marine and Coastal Resources. 51 pp.
- Wararin, W., Vichai, S. and Sutarat, C. (2008). *Study on aquatic fauna resources in seagrass by rawa instrument*. First report, Marine and Coastal Resources Research & Development Institute, Department of Marine and Coastal Resources. 42 pp.
- Wararin W. (2006). *Manual of fauna in seagrass of Andaman*. Marine and Coastal Resources Research & Development Institute, Department of Marine and Coastal Resources. 96 pp.
- Washington, H.G. (1984). Diversity, biotic and similarity indices: A review with special relevance to aquatic ecosystems. *Water Research*, 18(6): 653-94.
- Weerachat, P., Tipamas, U., Janewit, S., Somying, P., Mongkol, K. and Hatairat, S. (2008). Effect of seagrass distribution boundary on aquatic fauna. In Marine Science Conference, August 25-27, 2008. The Metropole Hotel Phuket. 127-42.
- World Register of Marine Species. (2014). WoRMS taxon detail. Available Source: www.marinespecies.org, March 15, 2017.

Appendix

Table 1. Taxonomy of aquatic fauna

Phylum	Class	Order	Family	Genus	Species
Fish group	Actinopterygii	Perciformes	Gerreidea	<i>Gerres</i>	<i>Gerres oyena</i>
Chordata			Terapontidae	<i>Terapon</i>	<i>Terapon puta</i>
				<i>Pelates</i>	<i>Pelates quadrineatus</i>
			Siganidae	<i>Siganus</i>	<i>Siganus javus</i>
					<i>Siganus canaliculatus</i>
			Lujanidae	<i>Lutjanus</i>	<i>Lutjanus russelli</i>
					<i>Lutjanus fulviflamma</i>
			Mulidae	<i>Upeneus</i>	<i>Upeneus tragula</i>
			Lethrinidae	<i>Lethrinus</i>	<i>Lethrinus lentjun</i>
			Gobidae	<i>Favonigobius</i>	<i>Favonigobius reichei</i>
			Chealotodontidae	<i>Parachealotodon</i>	<i>Parachealotodon ocellatus</i>
			Scatophagidae	<i>Scatophagus</i>	<i>Scatophagus argus</i>
			Labridae	<i>Halichoeres</i>	<i>Halichoeres bicolor</i>
			Sphyraenidae	<i>Sphyraena</i>	<i>Sphyraena barracuda</i>
			Leiognathidae	<i>Leiognathus</i>	<i>Leiognathus</i> spp.
			Sillaginidae	<i>Sillago</i>	<i>Sillago aeolus</i>
		Syngnathiiformes	Syngnathidae	<i>Hippichthys</i>	<i>Hippichthys cyanospilos</i>
		Atheriniiformes	Atherinidae	<i>Aerherimomorus</i>	<i>Aerherimomorus duodecimalis</i>
		Tetraodontiformes	Monacanthidae	<i>Monacanthus</i>	<i>Monacanthus chinensis</i>
			Tetraodontidae	<i>Chelonodon</i>	<i>Chelonodon patoca</i>
Shrimp and crab group	Malacostraca	Decapoda	Portunidae	<i>Portunus</i>	<i>Portunus pelagicus</i>
Arthropoda				<i>Thalamita</i>	<i>Thalamita crenata</i>
			Matutidae	<i>Matuta</i>	<i>Matuta victor</i>
			Peneidae	<i>Peneaus</i>	<i>Peneaus semisulcatus</i>

Table 3. The abundance of aquatic fauna inside and outside seagrasses

aquatic fauna species inside seagrass	F	N	A	aquatic fauna species outside seagrass	F	N	A
1. <i>Gerres oyena</i>	1	148	1.426	1. <i>Terapon puta</i>	2	14	3.043
2. <i>Terapon puta</i>	3	1427	13.750	2. <i>Siganus javus</i>	2	32	6.956
3. <i>Pelates quadrilineatus</i>	2	44	0.423	3. <i>Siganus canaliculatus</i>	2	252	54.782
4. <i>Siganus javus</i>	3	7530	72.557	4. <i>Lethrinus lentjun</i>	2	67	14.565
5. <i>Siganus canaliculatus</i>	2	531	5.116	5. <i>Favonigobius reichei</i>	3	4	0.869
6. <i>Lutjanus russelli</i>	3	24	0.231	6. <i>Paracheatodon ocellatus</i>	2	9	1.956
7. <i>Lutjanus fulviflamma</i>	1	5	0.048	7. <i>Leiognathus spp.</i>	1	5	1.086
8. <i>Upeneus tragula</i>	1	4	0.038	8. <i>Sillago aeolus</i>	1	17	3.695
9. <i>Lethrinus lentjun</i>	3	170	1.638	9. <i>Hippchthys cyanospilos</i>	1	3	0.652
10. <i>Favonigobius reichei</i>	3	32	0.308	10. <i>Aerherimomorus</i>	3	50	10.869
11. <i>Paracheatodon ocellatus</i>	3	101	0.973	<i>duodecimalis</i>			
12. <i>Scatophagus argus</i>	1	1	0.009	11. <i>Monacanthus chinensis</i>	1	2	0.434
13. <i>Halichoeres bicolor</i>	2	3	0.028	12. <i>Thalamita crenata</i>	1	1	0.217
14. <i>Sphyraena barracuda</i>	1	6	0.057	13. <i>Matuta victor</i>	1	1	0.217
15. <i>Hippchthys cyanospilos</i>	3	50	0.481	14. <i>Penaeus semisulcatus</i>	2	3	0.652
16. <i>Aerherimomorus duodecimalis</i>	1	5	0.048				
17. <i>Monacanthus chinensis</i>	2	5	0.048				
18. <i>Chelonodon patoca</i>	1	2	0.019				
19. <i>Thalamita crenata</i>	3	42	0.404				
20. <i>Portunus pelagicus</i>	3	57	0.549				
21. <i>Matuta victor</i>	1	1	0.009				
22. <i>Penaeus semisulcatus</i>	3	190	1.830				

Remark: F = Surveyed frequency N = Total individual number found A = Relative abundance