Rock Seaweeds Diversity at Coast of Nakhon Si Thammarat, Thailand

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Abstract

Diversity of Seaweed at rocky shores of Si-chon and Kha-nom district, Nakhon Si Thammarat Province, Southern of Thailand were investigated during dry (March-April 2007) and rainy seasons(August-September 2007 and December 2007-January 2008). Specimens were collected in a quadrat of 110 x 110 cm^2 in area. Measurement of temperature, salinity and pH of seawater were also done during sampling period. Thirty-six taxa of seaweeds distributed into 26 genera was identified, comprising 2 Cyanophyta, 11 Chlorophyta, 13 Phaeophyta and 10 Rhodophyta. Of the identified species, the brown seaweed, *Chnoospora* and *Sargassum polycystum* were mostly distributed and the most abundance species. A greater abundance of seaweed was found during the dry season at all sites. This suggest that the variation could be influenced by light intensity, temperature as well as the accumulation of nutrient. However, cloud be adapted to maintain their population throughout the years.

Keywords : Seaweeds, Coast, Diversity
Nakhon Si Thammarat

1. Introduction

Rocky shore is one of the coastal ecosystem. Besides the role as the sheltering, spawning, nursing and feeding, rocky shore also accommodates the particular marine lives, such as barnacles, mollusks and seaweeds. Seaweeds, in particular are known as the primary producers for other herbivores as well as human beings. For human food, seaweeds are served in many ways, viz., fresh meal, cooked or boiled products, spiced salad (traditional Thai cuisine). They are also utilized as animal food, fertilizers, natural foods for economic aquaculture species and the industrial phycocolloids.

Diversification, distribution and abundance of seaweeds are usually known to be influenced by both physical and biological factors (Lobban and Harrison)[1]. Biological factor, grazing, is the major factor controlling the structure of seaweeds communities. The previous work has been taken at Sa-mui Island (west of Gulf of Thailand) by Mayakun and Prathep[2]. They have reported the patterns of seasonal distribution and abundance of seaweeds were influenced by various abiotic factors, light intensity, tidal system, nutrient levels, substrate stability and desiccation.

Kha-nom and Si-chon are two districts of Nakhon Si Thammarat Province, locate at the east coast of South Thailand. Although these areas are adjacent to Sa-mui Island, there was still no record about the seaweeds, thus far. This might be the complicate sites due to steep cleft and difficult to enter.

The purpose of this study is to document the diversity and abundance of the seaweed at rocky shores, Nakhon Si Thammarat Province, Thailand. The results could be used for data base and reference sources for further study of seaweed in Thailand and Southeast Asian countries.

2. Materials and Methods

1. Study sites

Rocky shores in Kha-nom and Si-chon districts, Nakhon Si Thammarat Province, Southern of Thailand were intentionally set as collection sites. These areas were told in having the most species richness in Nakhon Si Thammarat Province (interviewing: unpublished data).

Four collection sites were selected as shown below.

1. Thong Node (9°16'46.14"N, 99°50'43.26"E): Tumbon Thong Nean, Kha-Nom District: Sandy beach with rocky shore in both opposite sides (Figure 1).

2. Nai Phlao, Tumbon Nai Phlao, Kha-Nom District (9°7'33.12"N, 99°53'25.14"E): sandy beach alternately with rocky shore.

3. Khao Phlai Dum, Tumbon Thong Sai, Si-chon district (9°8'16.14"N, 99°52'38.52"E): Old cleft and rocky shore.

4. Plai Thon, Tumbon Si-chon, Si-chon district (8°59'59.46 "N, 99°55'9.78" E): New cleft with rocky shore.

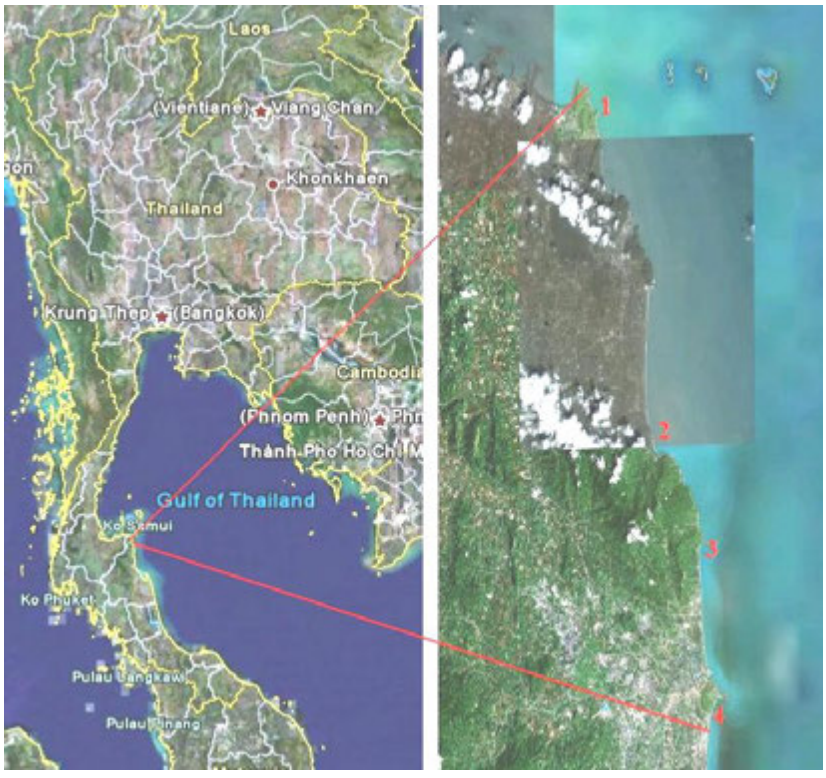

Figure 1. The study sites, along the coast of rocky shores of Kha-nom and Si-chon district, Nakhon Si Thammarat Province, Thailand.

3. Collection procedure

Four sampling sites along the shoreline were chosen on the basis of the highest diversity of seaweeds. The investigation included both sight observation and quadrat technique in the period of low tide since the seaweeds would clearly appear. Three transect lines, and five plots of quadrat space (110 cm ×110 cm) were sampled randomly at 5 m-intervals. Covering percentages of seaweeds was estimated using the mean of % cover in the quadrat. Seaweeds covering percentages were visually estimated by giving the score 1-5 as followed:

Mean of the covering percentage:

Not found	=	-
1 - 20 % of quadrat	=	1
21- 40 % of quadrat	=	2

41- 60 % of quadrat = 3
61- 80 % of quadrat = 4
81-100 % of quadrat = 5

The sampling were assigned for two seasons in one year, dry season (March and April 2007) and two periods of wet season, SW Monsoon (August and September 2007) and NE Monsoon (December 2007 and January 2008). Covering percentage and substratum of seaweeds were visually estimated and recorded in situ, water quality such as temperature, pH, salinity and nutrient contents were also determined (APHA, AWWA and WEF [3] and Strickland and Parsons [4].

The collected seaweeds were brought to the laboratory for identification using various taxonomical identification guides, e.g. Abbott and Hollenberg [5], Abbott and Dawson [6], Humm [7], Tseng [8], Lewmanomont and Ogawa [9], Graham [10] Litter and Litter [11], Noiraksa *et al*., [12].

All specimens were sorted out and hand sections were made to identify specimens and then pressed following standard herbarium procedures and deposited at the Faculty of Agriculture, Rajamangala University of Technology Srivijaya. Nakhon Si Thammarat Campus.

4. Results

1. Diversity of seaweed

There were 36 species of seaweeds from 27 genera and four divisions were identified. They were Cyanophyta (2 spp.), Chlorophyta (11 spp.), Phaeophyta (13 spp.) and Rhodophyta (10 spp.) (Table 1). Among the 36 species found, the brown seaweeds, *Chnoospora* sp. and *Sargassum polycystum* were considerably the most dominant species. *Padina*, *Sargassum* and *Turbinaria* had the highest number of taxa (three species each). *Chnoospora* sp., *Padina australis* , *Sargassum polycystum* and *Sargassum swartzii* had the greatest distant distribution. *Chnooospora* sp., *Sargassum* sp.1 and *Sargassum polycystum* had greater abundance and found in all four sites studied. Contrarily, some species were found only particular sites, for instance, *Brachytrichia quoyi* and *Acetabularia major* occurred only at Nai Phlao, *Rhiphidosiphon javensis* occurred only at Plai Thon, *Cheilosporum* sp. occurred only at Khao Phlai Dum, *Struvea anastomosans*, *Centroceras clavulatum*, *Gracilaria* sp.1, *Gracilaria salicornia* and *Hypnea pennosa* occurred only at Thong Node (Table 1).

2. Seasonal variations

Table 1 showed that there were differences in diversity between sites and seasons. Of the four sites studied three sites had the similar species composition. The great numbers of seaweed species were noticeably observed in the period of dry season, 22 spp. from Khao Phlai Dum, 21 spp. from Nai Phlao and 20 spp. from Thong Node, respectively. Whilst the least diversity (4 species) occurred during the wet season (NE monsoon) at Nai Phlao and Thong Node. Nevertheless, the species richness occurred in SW monsoon was comparatively twice as that of NE monsoon, while that of NE monsoon was three times higher than that of the dry season(Figure 2). There were only 14 species found in dry season, *Brachytrichia quoyi*, *Acetabularia major*, *Bryosis pentata*, *Caulerpa microphysa, C. taxifolia*, *Dictyosphaeria cavernosa, Rhiphidosiphon javensis*, *Struvea anastomosans*, *Turbinaria decurrens*, *T. ornata*, *Amphiroa foliacea, Cheilosporum* sp., *Hypnea pennosa* and *Peyssonnelia rubra*. However, no seaweed species occurred only in both wet seasons (NE and SW monsoons).

Table 1. Covering percentage of seaweeds at rocky shores of Kha-Nom and Si-chon districts, Nakhon Si Thammarat Province, Thailand.

Species	Study sites											
	Thong-Node			Nai Phlao			Khao Phlai dum			Plai Thon		
	D	W_1	W_2	D	W_1	W_2	D	W_1	W_2	D	W_1	W_2
DIVISION CYANOPHYTA												
Brachytrichia quoyi (C. Agardh)Bornet & Flahault	-	-	-	2	-	-	-	-	-	-	-	-
Lyngbya majuscule (Dillwyn) Harvey ex Gomont	2	-	-	-	1	2	-	-	-	4	2	1
DIVISION CHLOROPHYTA												
Acetabularia major Martens	-	-	-	1	-	-	-	-	-	-	-	-
Bryosis pentata Lamouroux	-	-	-	1	-	-	2	-	-	-	-	-
Caulerpa microphysa (Weber-VanBossse) J. Feldmann	-	-	-	1	-	-	1	-	-	-	-	-
Caulerpa taxifolia (Vahl) C. Agardh	-	-	-	-	-	2	1	-	-	-	-	-
Chaetomorpha sp.	3	3	2	-	-	-	3	2	3	-	-	-
Cladophora porlifera (Roth) Kutzing	5	2	1	-	-	-	3	1	-	2	1	
Dictyosphaeria cavernosa (Forsskål) Børgesen	-	-	-	2	-	-	-	-	-	-	-	-
Enteromorpha clathrata (Roth) Greville	-	-	-	-	4	-	-	4	-	2	-	
Rhiphidosiphon javensis Montagne	-	-	-	-	-	-	-	-	-	2	-	-
Struvea anastomosans(Harvey) Piccone & Grunow ex Piccone	2	-	-	-	-	-	-	-	-	-	-	-
Valonia aegagropila C. Agardh	3	1	-	2	-	-	-	-	-	-	-	-
DIVISION PHAEOPHYTA												
Chnooospora sp.	3	4	5	2	4	4	2	5	4	2	5	4
Dictyota bartayresiana Lamouroux	-	-	-	4	2	-	1	-	-	-	-	-
Hormophysa cuneiformis	-	-	-	2	4	-	1	3	-	-	2	-
Lobophora variegate (Lamourous) Womersley	-	-	-	-	-	-	3	1	-	4	1	-
Padina australis Hauck	3	2	1	3	1	-	3	-	-	2	1	1
Padina japonica Yamada	-	-	-	2	2	-	-	-	-	2	-	-
Padina tetrastromatica Hauck	4	-	-	4	-	-	3	-	-	2	1	-
Sargassum sp. 1	2	2	-	3	4	-	3	4	-	3	4	-
Sargassum polycystum C. Agardh	3	2	-	3	5	-	4	5	-	4	5	-
Sargassum swartzii (Turn) C. Ag	1	1	-	1	3	-	-	2	-	1	1	-
Turbinaria conoides (J. Agardh) Kutzing	-	-	-	-	-	-	2	1	1	2	-	-
Turbinaria decurrens Bory de Asint-Vincent	-	-	-	2	-	-	1	-	-	-	-	-
Turbinaria ornata (Turner) J. Agardh	-	-	-	-	-	-	1	-	-	4	-	-
DIVISION RHODOPHYTA												
Acanthophora spicifera (Vahl) Borgesen	2	-	-	3	1	1	4	1	1	-	-	-
Amphiroa fragilissima (Linnaeus) Lamouroux	3	-	-	4	1	1	4	1	1	-	-	-
Amphiroa foliacea Lamouroux	1	-	-	2	-	-	2	-	-	-	-	-
Centroceras clavulatum (C. Agardh) Montagne	4	1	-	-	-	-	-	-	-	-	-	-
Cheilosporum sp.	-	-	-	-	-	-	3	-	-	-	-	-
Gelidiella acerosa(Forsskål)Feldmann & G.Hamel	3	1	-	3	1	-	4	-	1	2	-	-
Gracilaria sp. 1	3	1	-	-	-	-	-	-		-	-	-
Gracilaria salicornia (C. Agardh) Dawson	4	1	-	-	-	-	-	-	-	-	-	-
Hypnea pennosa J. Agardh	3	-	-	-	-	-	-	-	-	-	-	-
Peyssonnelia rubra (Greville) J. Agardh	1	-	-	1	-	-	2	-	-	-	-	-
Total	**20**	**12**	**4**	**21**	**12**	**4**	**22**	**12**	**5**	**14**	**10**	**3**

D = dry season , W_1 = wet season (SW-monsoon) and W_2 = wet season (NE-monsoon)

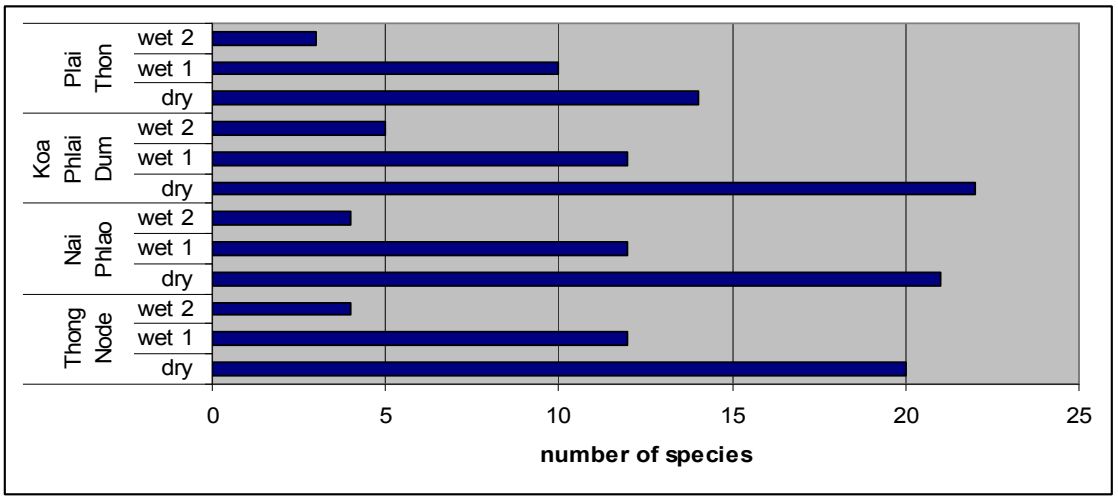

Figure 2. Number of Species of seaweed for each sampling site.
D = dry season, W_1 = wet season (SW-monsoon) and W_2 = wet season (NE-monsoon)

5. Discussion

Table 1 shows that there was not clearly different between four sites studied, however Plai Thon had lower species than other sites because of more turbidity and less surface areas (small-sized rocks).

Chnoospora sp. was regarded as the unique species which once found in Sa-mui Island (Lewmanomont & Ogawa, [9]. Despite the works have recently been done at coastal shore of Chumporn Province [13], Ang –Thong Island National Park, Surat Thani Province [14], Samui Island, Surat Thani Province (Mayakun & Prathep) [2], Kram Island and adjacent islands [15] and the coast of Samaesan, Chonburi Province [16], and Koh Tean, Had Khanom-Mu Koh Thale Tai National Park, Nakhon Si Thammarat Province [17], no seaweed of genus *Chnoospora* was reported, thus far, *Sargassum* spp. was only brown seaweed which was regarded as the common genus found in all above mentioned areas. However, *Chnoospora* sp. could be distributed around tropical and subtropical Indian, Pacific and western Atlantic oceans (Nelson & Duffy)[18].

In case of *Chnoospora*, it was found that the covering percentage was highest in the wet season (NE Monsoon). This might be caused by increasing of the sea level as well as nutrient contents(Table 2). This suggested that *Chnoospora* and *Sargassum* had the widest distribution both in terms of spatial and temporal.

The highest number of seaweeds observed in the dry season could be due to the greater light intensity, resulting more photosynthesis. In addition, nutrient run off during the rainy season especially, in NE Monsoon, might influence growth and abundance of seaweed.

The results indicated that the rocky shore of Nakhon Si Thammarat Province, Thailand had high diversity and abundance of seaweed. This implied that coastal zone of Nakhon Si Thammarat Province is still virgin for seaweeds and other marine organisms. Utilizing intelligently could maintain the balancing ecosystem.

Conclusion

Thirty-six taxa of seaweeds distributed into 26 genera, *Chnoospora* and *Sargassum polycystum* were mostly distributed. A greater abundance of seaweed was found during the dry season.

Table 2 Some water quality at study sites from March 2007 to January 2008. (mean ± SD)

Parameter	Study sites											
	Thong-Node			Nai Phlao			Khao Phlai Dum			Plai Thon		
	D	W_1	W_2	D	W_1	W_2	D	W_1	W_2	D	W_1	W_2
Temperature (° C)	32.18 ±0.14	29.45 ±0.22	28.44 ±0.42	32.54± 0.11	29.34 ±0.12	28.56± 0.47	32.11 ±0.24	28.99 ±0.22	28.12 ±0.14	32.82± 0.54	29.44 ±0.55	28.21 ±0.24
pH	8.24± 0.14	8.28± 0.21	7.84± 0.15	8.34±0. 11	8.28± 0.17	7.84±0. 15	8.24± 0.16	8.28± 0.15	7.84± 0.18	8.24±0. 14	8.28± 0.21	7.84± 0.08
Salinity (ppt)	34.00 ±0.11	33.50 ±0.14	29.00 ±0.18	34.00± 0.14	33.50 ±0.18	29.0±0. 14	34.00 ±0.18	33.0 ±0.15	29.00 ±0.14	34.00± 0.14	33.50 ±0.17	29.00 ±0.16
NH_3-N (mg/L)	0.16± 0.02	0.25± 0.01	0.36± 0.04	0.16±0. 03	0.25± 0.01	0.36±0. 01	0.17± 0.03	0.25± 0.04	0.36± 0.01	0.16±0. 01	0.25± 0.01	0.36± 0.02
NO^-_3-N (mg/L)	0.01± 0.00	0.00	0.02± 0.00	0.01±0. 00	0.00	0.02±0. 00	0.01± 0.00	0.00	0.02± 0.00	0.01±0. 00	0.00	0.02± 0.00
PO^{-3}_4-P (mg/L)	0.00	0.00	0.05± 0.01	0.00	0.00	0.06±0. 01	0.00	0.00	0.04± 0.04	0.00	0.00	0.02± 0.00

D = dry season , W_1 = wet season (SW-monsoon) and W_2 = wet season (NE-monsoon)

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