

Apparent characteristics and taxonomic study of macroalgae in Pattani Bay

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Abstracts

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A survey on macroalgae in Pattani Bay was carried out to build up a database resource for the management of algae in the area. From February 2004 to March 2005, samples of macroalgae from 10 sites were randomly collected monthly. Macroalgae were found at 4 sites in the north of the bay, namely Laem Tachi, Lighthouse, Ban Bu Di and Ban Ta Lo Samilae; 3 sites in the east, namely Ban Da To, the Yaring River Mouth and Ban Bang Pu and only one site in the south at Ban Tanyong Lu Lo. Twelve species of 3 divisions of macroalgae were detected. They were Division Cyanophyta, *Lyngbya majuscula* (Dillwyn) Harvey ex Gomont; Division Chlorophyta; *Ulva intestinalis* Linnaeus, *U. pertusa* Kjellman and *U. reticulata* Forsskal, *Rhizoclonium riparium* (Roth) Harvey, *R. tortuosum* Kutzing, *Chaetomorpha crassa* (C. Agardh) Kutzing and *Cladophora* sp.; and Division Rhodophyta, namely *Gracilaria tenuistipitata* Chang et Xia, *G. fisheri* (Xia et Abbott) Abbott, Zhang et Xia, *Hypnea spinella* (C. Agardh) Kutzing and *Acanthophora spicifera* (Vahl) BØrgesen. Among them, four species were new recordings at Pattani Bay: *Lyngbya majuscula*, *Rhizoclonium riparium*, *R. tortuosum* and *Acanthophora spicifera*. Most of these seaweeds were found at the east sites in

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the dry season from February to September 2004 and from January to March 2005. Only a few species could be found in the wet season from November to December 2004.

Key words : Pattani Bay, macroalgae, seaweed

บทคัดย่อ

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ลักษณะการปรากฏและการศึกษานุกรมวิธานของสาหร่ายทะเลขนาดใหญ่ในอ่าวปัตตานี

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การสำรวจสาหร่ายทะเลขนาดใหญ่ในอ่าวปัตตานี เพื่อใช้เป็นฐานข้อมูลเพิ่มเติมในการจัดการทรัพยากรสาหร่ายทะเลของอ่าวปัตตานี โดยทำการสุ่มตัวอย่างสาหร่ายทะเลทุกเดือนรอบอ่าวจำนวน 10 สถานี ระหว่างเดือนกุมภาพันธ์ 2547 ถึงเดือนมีนาคม 2548 พบสาหร่ายทะเลแพร่กระจายที่สถานีทางด้านทิศเหนือของอ่าว 4 สถานี ได้แก่ สถานีแหลมตาชี กระโจมไฟ บ้านบูดี และบ้านตะโล๊ะสะมิแล ที่สถานีด้านทิศตะวันออก 3 สถานี คือ บ้านคาโต๊ะ ปากแม่น้ำยะหริ่ง และ บ้านบางปู และทางด้านทิศใต้ เพียงสถานีเดียวที่บ้านต้นหยงลูโ๊ะ พบสาหร่ายจำนวน 3 ดิวิชัน 12 ชนิด คือ ดิวิชัน Cyanophyta 1 ชนิด ได้แก่ *Lyngbya majuscula* (Dillwyn) Harvey ex Gomont ดิวิชัน Chlorophyta 7 ชนิด ได้แก่ *Ulva intestinalis* Linnaeus, *U. pertusa* Kjellman, *U. reticulata* Forsskal, *Chaetomorpha crassa* (C. Agardh) Kutzing, *Cladophora* sp., *Rhizoclonium riparium* (Roth) Harvey และ *R. tortuosum* Kutzing และดิวิชัน Rhodophyta 4 ชนิด ได้แก่ *Gracilaria fisheri* (Xia et Abbott) Abbott, Zhang et Xia, *Gracilaria tenuistipitata* Chang et Xia, *Hypnea spinella* (C. Agardh) Kutzing และ *Acanthophora spicifera* (Vahl) Børgesen โดยพบสาหร่ายที่เป็นการรายงานครั้งแรกของอ่าวปัตตานี จำนวน 4 ชนิด คือ *Lyngbya majuscula*, *Rhizoclonium riparium*, *R. tortuosum* และ *Acanthophora spicifera* สาหร่ายส่วนใหญ่พบที่สถานีด้านตะวันออกของอ่าวในช่วงฤดูแล้ง ระหว่างกุมภาพันธ์ถึงกันยายน 2547 และมกราคมถึงมีนาคม 2548 ส่วนในช่วงฤดูฝน ระหว่างพฤศจิกายนถึงธันวาคม 2547 พบสาหร่ายน้อยชนิด

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Pattani Bay is a semi-enclosed reservoir which connects to the Yaring River and its branches and the Gulf of Thailand. It is one of the important water bodies in southern Thailand which supply natural resources. Seaweed is one of the important natural resources in the bay. A few important seaweed species in the bay such as *Gracilaria* spp. are used as food for local communities and exported to other areas nearby. *Ulva* spp. causes a blooming green tide in the bay resulting in many problems to the fisheries (Viriyanon *et al.*, 1999). There have been several researches on the algal flora of the Pattani Bay. Butharatana and Luangthuvapranit (1992) reported that there were 3 divisions, 7

genera of macroalgae, and *Gracilaria tenuistipitata* is the dominant species at Ban Bang Pu. Runngchuay and Luangthuvapranit (1999) recently reported that 3 divisions, 8 species of seaweeds were found in Pattani Bay. The environmental factors of the bay such as temperature, salinity, depth, sediment, and water direction fluctuate throughout the year (Viriyanon *et al.*, 1992, Viriyanon *et al.*, 1999). These physical parameters can affect macroalgae distribution in the bay. The present study aimed to investigate macroalgae species and the frequency of their occurrence in Pattani Bay and to compile this information to build up a database for resource management.

Materials and Methods

Study sites

Samples of macroalgae were collected monthly from 10 sites surrounding Pattani Bay. The north sites of the bay were at Laem Tachi (6N56.30/101E15.42), Lighthouse (6N56.40/E 101E17.15), Ban Bu Di (6N55.55/101E18.04), Ban Ta Lo Samilae (6N55.55/101E19.08). The east sites of the bay were Ban Da To (6N54.46/101E19.85), the Yaring River Mouth (6N52.79/101E20.08) and Ban Bang Pu (6N52.50/101E19.64). The south sites of the bay were Ban Tanyong Lu Lo (6N53.07/101E18.75), Ban Ba Na (6N52.77/101E17.45) and Ban Laem Nok (6N54.03/101E16.18). The north sites were located on the leeside of the curved protruding area of Laem Tachi. The east sites were located at the estuary of the Yaring River and its branches near a mangrove forest. The south sites were near the mainland while the west of the bay opened to the Gulf of Thailand. These locations are indicated in Figure 1.

Sampling

Samplings were collected monthly from February 2004 to March 2005. The seaweeds at

each site were collected by hand at every 10 meters of line transects faced into the sea. The samples were taken from quadrates of 50 x 50 cm² and carried to the laboratory in plastic bags. Some water quality parameters were measured at the sites of plant collections.

Identification

The samples were cleaned and weighed. Then, some were dried in a hot oven of 60°C and weighed. Some were observed under a light microscope and some were preserved in 10% formalin seawater for anatomical examination. These samples were classified according to the system used in the taxonomic publications of Taylor, 1960; Abbott and Hollenberg, 1976; Humm, 1979; Tseng, 1984; Lewmanomont, 1994; Lewmanomont and Ogawa, 1995; Ohno *et al.*, 1997; Trono, 1997 and Hayden *et al.*, 2003.

Results and Discussions

Water quality

The temperature of surface water at all sites was more or less the same at a given time. It fluctuated from 25.0 to 33.5°C during the research

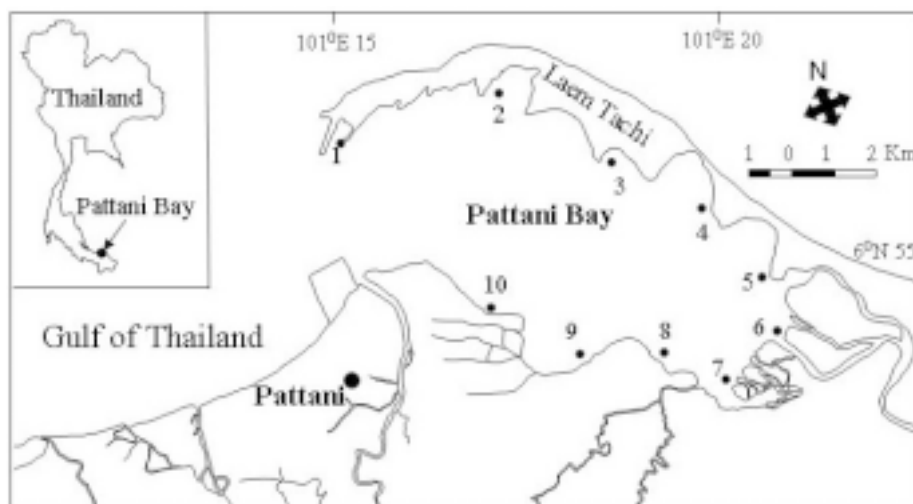


Figure 1. Location of survey areas (● sampling site); Laem Tachi (1) Lighthouse (2) Ban Bu Di (3), Ban Ta Lo Smilae (4), Ban Da To (5), Yaring River Mouth (6), Ban Bang Pu (7), Ban Tanyong Lu Lo (8), Ban Ba Na (9) and Laem Nok (10)

period of 14 months. The average lowest of all sites was in January 2005 ($26.0 \pm 1.0^\circ\text{C}$) and the average highest of all sites in May 2004 ($32.0 \pm 1.5^\circ\text{C}$). A salinity range of 8.0-33.0 psu showed similarity by site but showed difference by month. The average lowest of all sites occurred in September and October 2004 (13.3 ± 5.7 and 13.3 ± 6.5 psu, respectively) and the average highest of all sites occurred in April 2004 (30.7 ± 0.6 psu). Water transparency range was 10-87 cm. Nitrate-nitrogen in the water fluctuated from 0.007-0.053 $\text{mg}\cdot\text{l}^{-1}$, showing the average highest by month in December 2004 (0.048 ± 0.029 $\text{mg}\cdot\text{l}^{-1}$) and average highest by site at the Ban Da To (0.031 ± 0.022 $\text{mg}\cdot\text{l}^{-1}$). Phosphate phosphorous in the water was 0-0.025 $\text{mg}\cdot\text{l}^{-1}$, showing similarity by sites but showing the highest (0.248 ± 0.528 $\text{mg}\cdot\text{l}^{-1}$) in October 2004. Most of these factors fluctuated by season. However, the range of these water quality parameters were similar to those found in the previous studies of Viriyanon *et al.* (1992) and Viriyanon *et al.* (1999).

Apparent Characteristics

Twelve species of macroalgae in 3 Divisions were found at 8 sites in the north, the east, and the south of the bay: Laem Tachi, Lighthouse, Ban Bu Di, Ban Ta Lo Samilae, Ban Da To, the Yaring River Mouth, Ban Bang Pu and Ban Tanyong Lu Lo. At the south sites, only a few species of macroalgae were detected at Ban Tanyong Lu Lo while none was detected at Ban Ba Na and Ban Laem Nok sites, because of accumulated sediments at these sites (Viriyanon *et al.*, 1999). The specimens included Division Cyanophyta, *Lyngbya majuscula* (Dillwyn) Harvey ex Gomont; Division Chlorophyta, *Ulva intestinalis* Linnaeus, *U. pertusa* Kjellman, *U. reticulata* Forsskal, *Rhizoclonium riparium* (Roth) Harvey, *R. tortuosum* Kutzing, *Chaetomorpha crassa* (C. Agardh) Kutzing, and *Cladophora* sp.; and Division Rhodophyta, *Gracilaria tenuistipitata* Chang et Xia, *G. fisheri* (Xia et Abbott) Abbott, Zhang et Xia, *Hypnea spinella* (C. Agardh) Kutzing, and *Acanthophora spicifera* (Vahl) BØrgesen.

Table 1. List of species of macrolagae found (*) at each station in Pattani Bay during February 2004 to March 2005

Divisions and species	Stations									
	1	2	3	4	5	6	7	8	9	10
Cyanophyta										
<i>Lyngbya majuscula</i>	*	*	*	*			*			
Chlorophyta										
<i>Ulvaintestinalis</i>				*		*	*	*		
<i>Ulva pertusa</i>	*	*	*	*	*					
<i>Ulva reticulata</i>				*						
<i>Rhizoclonium riparium</i>						*	*			
<i>Rhizoclonium tortuosum</i>					*	*	*			
<i>Chaetomorpha crassa</i>	*	*	*	*	*	*	*			
<i>Cladophora</i> sp.				*	*	*	*			
Rhodophyta										
<i>Gracilaria tenuistipitata</i>		*		*	*		*	*		
<i>Hypnea spinella</i>		*	*	*	*					
<i>Acanthophora spicifera</i>			*	*						

Note: (1) Laem Tachi, (2) Lighthouse (3) Ban Bu Di, (4) Ban Ta Lo Samilae, (5) Ban Da To, (6) Yaring River Mouth, (7) Ban Bang Pu and (8) Ban Tanyong Lu Lo, (9) Ban Ba Na and (10) Leam Nok

The seaweeds were found in the dry seasons of February to October 2004 and January to March 2005 only. Therefore, the presence of these seaweeds seemed to be related to the salinity in the surface water. *Chaetomorpha crassa* and *Gracilaria tenuistipitata* always predominated other seaweeds while *Ulva reticulata* and *Acanthophora spicifera* were seldom and scarcely found. Although Viriyanon et al. (1999) mentioned harvesting of *Gracilaria* spp. from Pattani Bay, this study found *Gracilaria fisheri* in a low density. The seaweed bloom in March was not related to nitrate-nitrogen or phosphate-phosphorous in water because the concentration of these nutrients had a normal value then. The degrees of abundance of the seaweeds are shown in Table 2.

While the morphology and distribution of the eight species (*Ulva intestinalis*, *U. pertusa*, *U. reticulata*, *Chaetomorpha crassa*, *Cladophora* sp., *Gracilaria tenuistipitata*, *G. fisheri* and *Hypnea spinella*) in this study agreed with those in the studies of Butharatana and Luangthuvapranit (1992) and Ruangchuay and Luangthuvapranit

(1999), 4 species were found for the first time. They were *Lyngbya majuscula*, *Rhizoclonium riparium*, *R. tortuosum*, and *Acanthophora spicifera*. This discovery might be due to the fact that the present study collected samplings every month while the previous researches did it every three months and therefore might have missed the short blooming period of the seaweeds. However, while this study did not find *Padina* sp. Butharatana and Luangthuvapranit (1992) and Ruangchuay and Luangthuvapranit (1999) found it at Laem Tachi. It might be due to the fact that their researches included the outer part of the cape while the present research limited itself to its inner part.

Systematic Account

Division Cyanophyta

Class Myxophyceae

Order Homogonales

Family Oscillatoriaceae

Genus *Lyngbya* Agardh

Lyngbya majuscula (Dillwyn) Harvey ex Gomont (Figure 2)

Table 2. Species and densities of macrolagae found at each month in Pattani Bay during February 2004 to March 2005

Divisions and species	Months													
	Feb 04	Mar 04	Apr 04	May 04	Jun 04	Jul 04	Aug 04	Sep 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05
Cyanophyta														
<i>Lyngbya majuscula</i>	-	-	-	+	-	+++	+++	+	-	-	-	-	++	++
Chlorophyta														
<i>Ulva intestinalis</i>	-	+++	++	++	-	-	-	-	-	-	-	++	+++	+++
<i>Ulva pertusa</i>	++	++	++	++	++	++	+	-	-	-	-	-	+++	+++
<i>Ulva reticulata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	+
<i>Rhizoclonium riparium</i>	-	-	-	-	+	-	-	+	-	-	-	-	-	-
<i>Rhizoclonium tortuosum</i>	-	+	-	-	-	-	-	-	-	-	-	-	-	+++
<i>Chaetomorpha crassa</i>	+++	+++	++	++	++	+++	+++	++	++			++	+++	+
<i>Cladophora</i> sp.	-	+++		++	+	-	+	-	-	-	-	+	+	+++
Rhodophyta														
<i>Gracilaria tenuistipitata</i>	+++	+++	++	++	+++	++	++	++	+	-	-	+	+	+
<i>Gracilaria fisheri</i>		+	++	+	+	+	+	+	+	-	-	-	+++	++
<i>Hypnea spinella</i>	+	+		+	-	-	-	-	-	-	-	-	+++	++
<i>Acanthophora spicifera</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	++

Note: "+" indicate presence of the seaweed less than 1 g dry wt. m⁻², "++" presence of the seaweed 1-10 g dry wt. m⁻², "+++ present of the seaweed more than 10 g dry wt. m⁻² and "-" absence of the seaweed

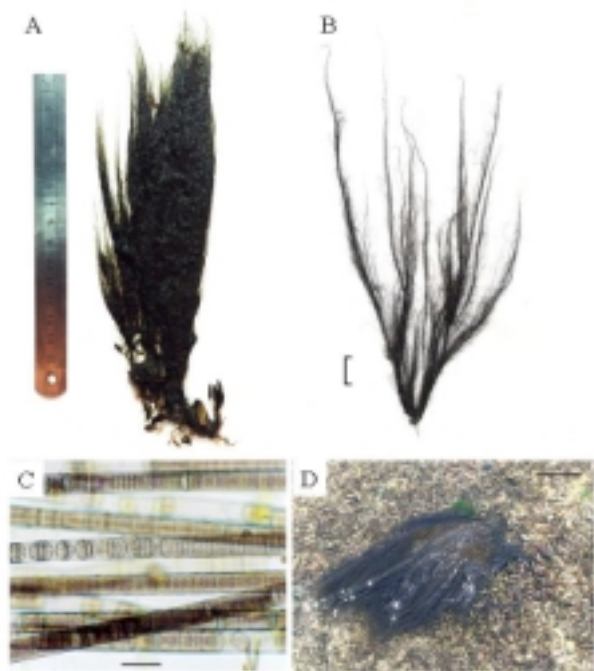


Figure 2. *Lyngbya majuscula* A. Wet specimen, B. Herbarium specimen (scale bar = 2 cm), C. Enlarged filaments (scale bar = 20 μ m), D. Natural habitat (scale bar = 10 cm)

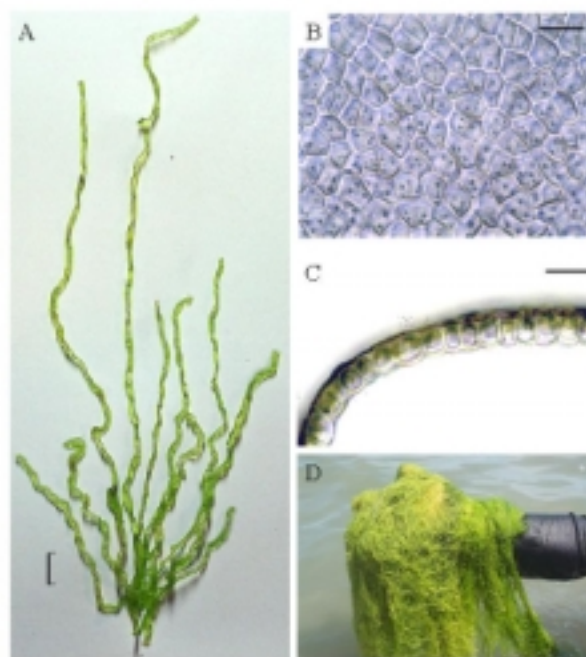


Figure 3. *Ulva intestinalis* A. Wet specimen (scale bar = 2 cm), B. Surface view of blade (scale bar = 20 μ m), C. Cross section view of blade (scale bar = 0 μ m), D. Natural turf

(Color figure can be viewed in the electronic version)

Tseng, 1984, p.17 fig. 4; Lewmanomont and Ogawa, 1995, p. 17

Thalli forming hair like filaments, rough to the touch, dark brown or reddish brown in color, straight or slightly flexuous trichomes, 10-25 cm long, and 19-23 μ m in diameter; sheath hyaline, very thin; cells width 20-25 μ m, length much shorter than width (5.0-12.5 μ m), constricted at septa; apex obtuse or conical, without calyptra.

Remarks: This species was found between February and September 2004. It was conspicuously brown. It was found at the bottom of the sea. Filaments attached to pebbles, sand or other materials such as shells and, at Ban Bang Pu, entangled with *Gracilaria tenuistipitata*.

This specimen was a new recording at the Pattani Bay. Its sheath was very thin while that of the specimen found by Tseng (1984) was 11 μ m.

Division Chlorophyta

Class Chlorophyceae

Order Ulvales

Family Ulvaceae

Genus *Ulva* Linnaeus

Ulva intestinalis Linnaeus (Figure 3)

Taylor, 1960; p.62; Abbott and Hollenberg, 1976, p.76; Humm, 1979, p. 205; Tseng, 1984, p. 254, pl.126, fig. 4; Lewmanomont and Ogawa 1995, p. 50; Stegenga et al., 1997 p. 86; Hayden et al., 2003.

Thalli bright green or yellowish green, usually in groups; the blade flat and easy to tear, cylindrical in shape and slightly compressed, width 1-1.5 mm, height 12-60 cm or more; thalli crumpled; cells in surface view arranged irregularly and polygonal, 12.5-20 μ m in diameter; thalli thickness 22-25 μ m; cell round to oblong in shape,



Figure 4. *Ulva. pertusa* A. Herbarium specimen (scale bar = 3 cm), B. Surface view of blade (scale bar = 20 μm), C. Cross section view of blade (scale bar = 20 μm), D. Habitat (scale bar = 5 cm), E. Natural blade

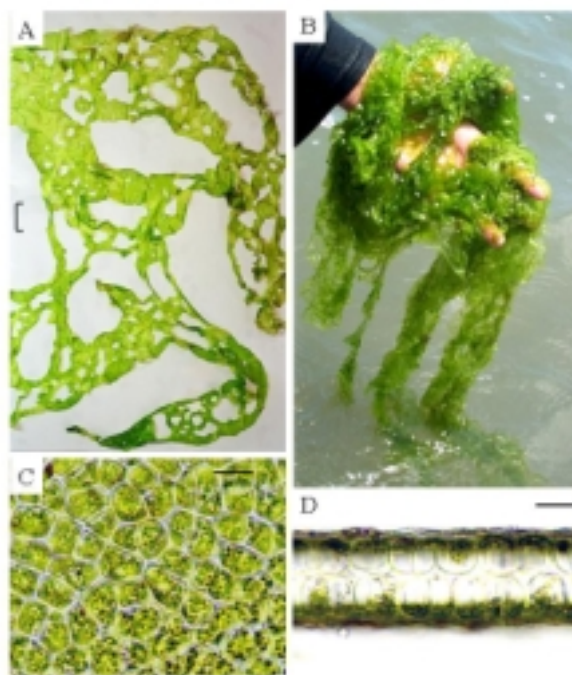


Figure 5. *Ulva reticulata* A. Wet specimen (scale bar = 3 cm), B. Natural turf, C. Surface view of blade (scale bar = 20 μm), D. Cross section view of blade (scale bar = 20 μm)

(Color figure can be viewed in the electronic version)

2-4 pyrenoids.

Remarks: This species was found between February and September 2004. Thalli usually drifted in mass at the Yaring River Mouth and Ban Bu Di while entangled with other seaweeds at other sites.

This alga appeared in different forms such as an attached form (Tseng, 1984), an attached form at first and floating form later (Taylor, 1960) or with rhizoid (Stegenga *et al.*, 1997). This study found it drifting in mass without rhizoid. It might be the cause of a green tide.

Ulva pertusa Kjellman (Figure 4)

Tseng, 1984, p.258, pl. 128, fig. 2; Trono, 1997, p. 13, fig. 5

Blade bright green to grass green, shiny;

blade irregular in size and shape, height 7-36 cm; thalli surface mostly wrinkled and dull; surface usually perforated in large round or irregular shapes; margin undulated; surface cells mostly polygonal in the middle region, 15-18 μm in diameter; thalli thickness ranges 60-100 μm in the middle with two layers of cells. These cells have a cup shape with chloroplast filling half of them.

Remarks: This species was found between February to August 2004 and between February to March 2005. The plant was mostly free floating and rarely found attached to the bottom of the sea.

This species was found in the inner part of the bay. It also caused a green tide (Ruangchuay and Luangthuvipranit, 2004). This alga is similar to *U. lactuca*, which is known virtually worldwide. *U. pertusa* was crisp but not glossy (Trono,

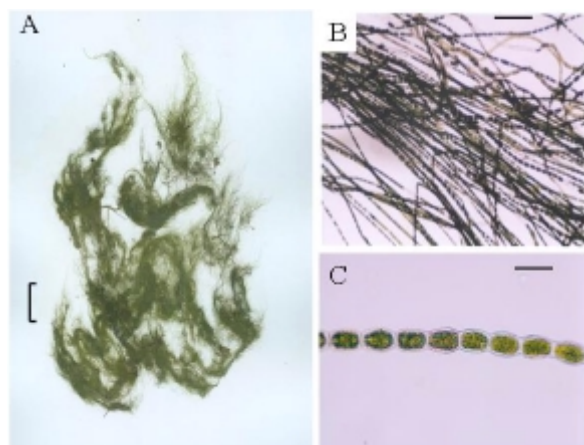


Figure 6. *Rhizoclonium riparium* A. Herbarium specimen (scale bar = 2 cm), B. Filaments (scale bar = 300 μm), C. Enlarged filament (scale bar = 50 μm),

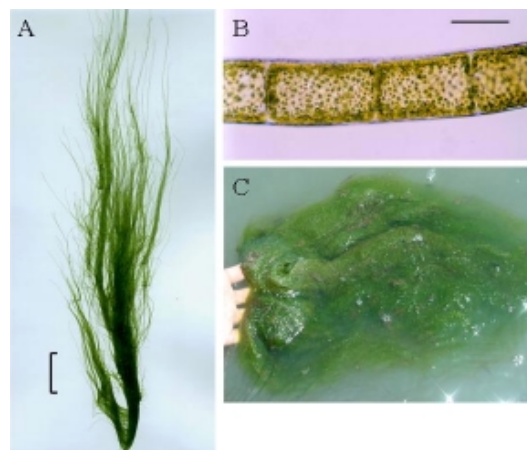


Figure 7. *Rhizoclonium tortuosum* A. Herbarium specimen (scale bar = 2 cm), B. Portion of filament (scale bar = 100 μm), C. Natural turf

(Color figure can be viewed in the electronic version)

1997). The thickness of the specimens found in the present study was different from that of the specimens of previous studies but the same as that of *U. lactuca*.

Ulva reticulata Forsskal (Figure 5)

Lewmanomont, 1995, p. 50; Trono, 1997, pp. 14-15, fig. 2

Thalli irregular in blade shape with holes of various sizes some of which were so large that parts of this alga looked like stripes; bright green or grass green in color; thalli surface slightly wrinkled or smooth; blade margin serrated; thickness 60-90 μm with two layers of cells; cup shaped chloroplast concentration close to the surface of blade.

Remarks: This species generally occurred in the outer part of the bay (Butharatana and Luangthuvapranit, 1992) and also caused a green tide in the area (Ruangchuay and Luangthuvipranit, 2004). However, this study also found it in the inner bay at Ban Bu Di in March 2005. Probably it was caught in fishermen's nets and thrown back into the water when they returned to the dock.

Order Cladophorales

Family Cladophoraceae

Genus *Rhizoclonium* Kutzing

Rhizoclonium riparium (Roth) Harvey (Figure 6)

Taylor, 1960, p.76; Abbott and Hollenberg, 1976, p. 92; Humm, 1979, p 222, fig. 98; Tseng, 1984, p.264, pl. 131 fig. 3; Stegenca *et al.*, 1997, p. 113, pl. 24, fig. 5-9

Thalli appeared as patches or soft flowing unbranched filaments, dark green, 22-40 μm in diameter, slightly constricted at the cross walls; cells cylindrical or barrel-like in shape, cell width 12.5-22.0 μm, cell length 1-1.5 times of width, no rhizoid.

Remarks: This species was found sometimes in July 2004 and from September to October 2005. It was occasionally found as patches on *Gracilaria tenuistipitata*.

This species was a new recording at Pattani Bay. It contaminated the *Gracilaria tenuistipitata* production. It was different from that found by Taylor (1960), Tseng, (1984) and Stegenca *et al.*, (1997) in having no rhizoid.

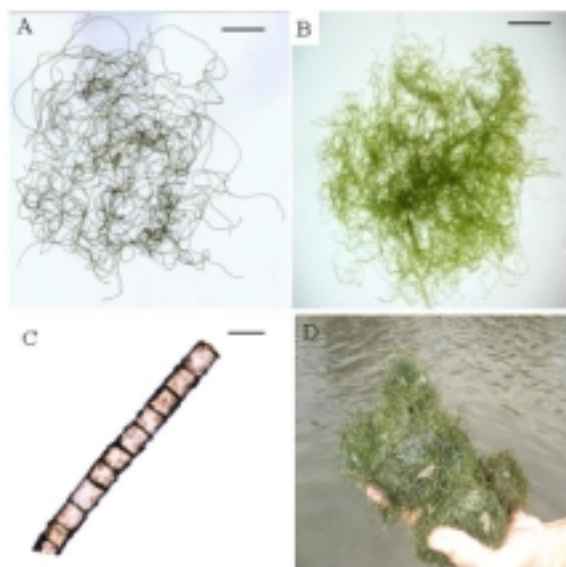


Figure 8. *Chaetomorpha crassa* A. Herbarium specimen (scale bar = 3 cm), B. Wet specimens (scale bar = 5 cm), C. Portion of filament (scale bar = 500 μm), D. Natural turf

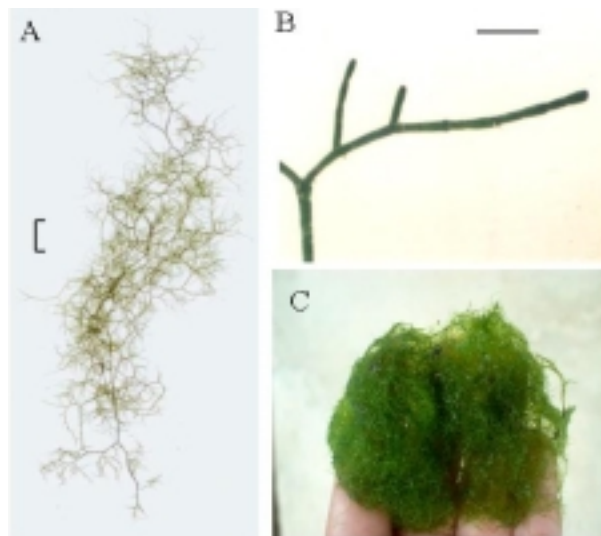


Figure 9. *Cladophora* sp. A. Herbarium specimen (scale bar = 0.5 mm), B. Branches (scale bar = 200 μm), C. Natural turf

(Color figure can be viewed in the electronic version)

Rhizoclonium tortuosum Kutzing (Figure 7) Taylor, 1960, p. 76; Humm, 1979, p. 223, fig. 99

Thalli flowing soft, group of unbranched filaments, green to yellow green in color, 50-80 μm in diameter; cells cylindrical or barrel-like in shape but unstricted at nodes, parietal chloroplast and 2-3 pyrenoids; cell width 12.5-22.4 μm, cell length 1-3 times of width, no rhizoid.

Remarks: This species was found in March 2005. It was free floating or entangled with other seaweeds.

This was a new recording at Pattani Bay. It drifted in a mass without rhizoid. This specimen might be of late phase of blooming. It also caused a green tide. While this specimen did not have rhizoid, those found by Taylor (1960) and Humm (1979) did.

Genus *Chaetomorpha* Kutzing
Chaetomorpha crassa (C. Agardh) Kutzing (Figure 8)

Taylor, 1960, p. 72; Trono, 1997, p. 18, fig. 8; Lewmanomont and Ogawa, 1995, p. 42

Thalli often loosely entangled, rough to the touch, grass green to dark green in color; filaments unbranched and contorted; cells cylindrical, 300-650 μm in diameter, slightly constricted at the nodes, cell width 190-300 μm, cell length 2.0-2.5 times of width.

Remarks: This species was found almost throughout the year except from November to December 2004 and January 2005. The plant was sometimes entangled with other seaweeds or drifting seagrasses. Occasionally, it was found attached to bivalve bed.

Thalli of the present study were grass green or dark green which were different from the light green described in Trono (1997) and Lewmanomont and Ogawa (1995).

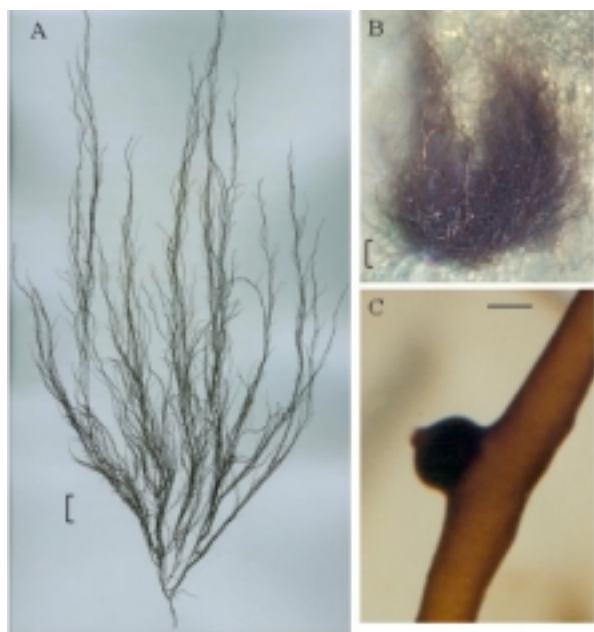


Figure 10. *Gracilaria tenuistipitata* A. Herbarium specimen (scale bar = 2 cm) B. Habitat (scale bar = 4 cm), C. Portion of branch with cystocarp (scale bar = 1 mm)

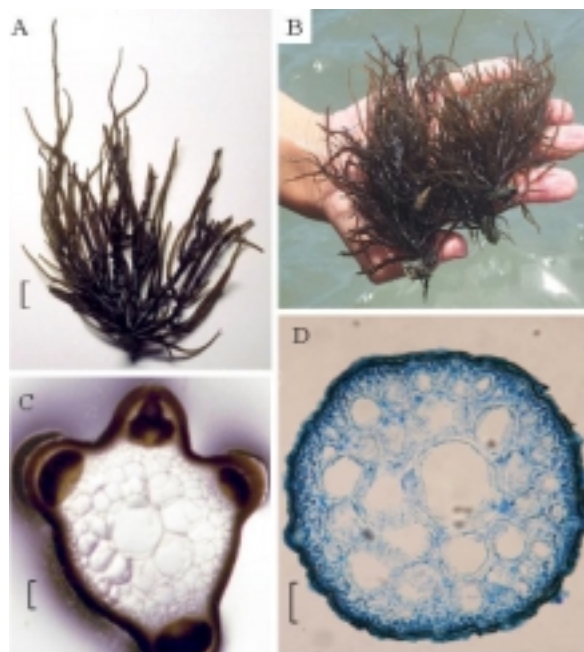


Figure 11. *Gracilaria fisheri* A. Wet specimen (scale bar = 2 cm), B. Natural thalli C. Cross section of thallus with cystocarps (scale bar = 0.5 mm), D. Cross section of thallus and stain (scale bar = 0.5 mm),

(Color figure can be viewed in the electronic version)

Genus *Cladophora* Kützing

***Cladophora* sp.** (Figure 9)

Abbott and Hollenberg, 1976, p. 106, fig. 65

Thalli forming tufts, green to yellowish green, soft and silky, height 4-8 cm; branching at low portions of the main axis was mostly dichotomous, cylindrical or constricted at the nodes; branches shorter toward apex of axis, tapering slightly with obtuse tip; cells width at mid-portions 61-18 µm in diameter, cell length 2.9-4.6 times of width.

Remarks: This species was found in March 2004, from May to June 2004, August 2004 and from February to March 2005. Occasionally, it was found attached to other seaweeds (especially *Gracilaria* spp. and *Chaetomorpha crassa*).

Unlike *Cladophora microcladioides* Collins described by Abbott and Hollenberg (1976), this

species had regular branching arrangement, tapering towards its apex.

Division Rhodophyta

Class Rhodophyceae

Order Gigartinales

Family Gracilariaceae

Genus *Gracilaria* Greville

***Gracilaria tenuistipitata* Chang et Xia** (Figure 10)

Lewmanomont, 1994, pp.144-145, fig. 13-14; Lewmanomont and Ogawa, 1995, p.117; Ohno et al., 1995, p. 109, figs. 10 a-c

Thalli bushy, reddish brown to dark brown in color and black when dry, height 5.0-32.5 cm, branching irregularly 3-4 orders; main axis thin and slender with 0.9-1.1 mm in diameter; branches 0.33-0.83 mm in diameter; cortex one layer;

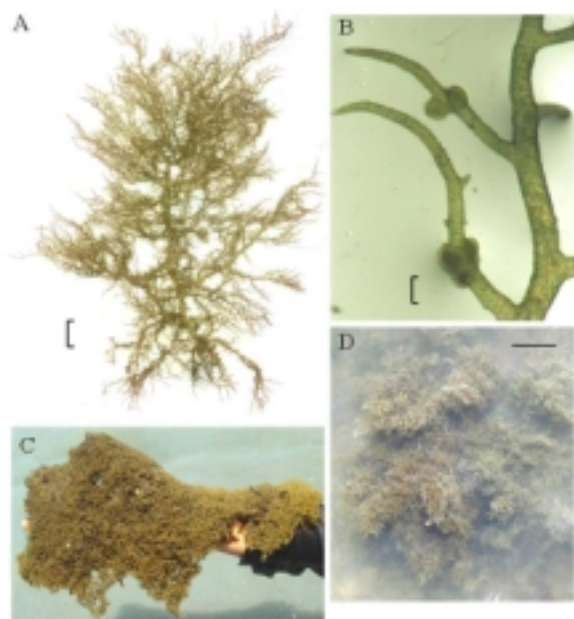


Figure 12. *Hypnea spinella* A. Herbarium specimen (scale bar = 2 cm), B. Branches (scale bar = 1 mm), C. Natural turf, D. Habitat (scale bar = 3 cm),

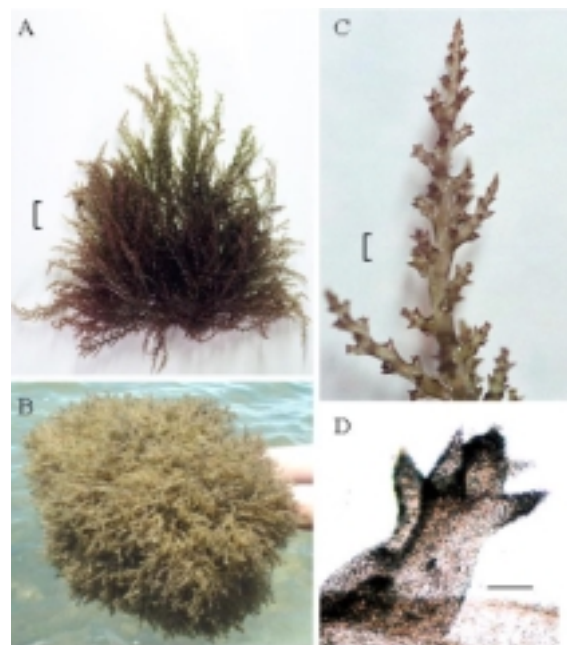


Figure 13. *Acanthophora spicifera* A. Wet specimen (scale bar = 2 cm), B. Natural turf C. Branches (scale bar = 1 mm), D. Branchlet (scale bar = 150 μm)

(Color figure can be viewed in the electronic version)

medulla 3-4 layers, 800-1000 μm in diameter; lateral branchlets delicate; cystocarp 0.5-1.0 mm in diameter with 7-8 cell layers of pericarp.

Remarks: This species was found in March 2004, from May to June 2004, August 2004 and from February to March 2005. It bloomed in February 2005 at Ban Bang Pu.

Thalli found in the present study were taller than those described by Lewmanomont (1994), Lewmanomont and Ogawa (1995) and Ohno *et al.* (1995). This was an alga of economic value. Fishermen harvested this alga between February and March 2004 and in February 2005 to dry it and sell for consumption or agar extraction.

Gracilaria fisheri (Xia et Abbott) Abbott, Zhang et Xia (Figure 11)

Lewmanomont, 1994, pp.140-141, fig. 9; Lewmanomont and Ogawa, 1995, p.111; Ohno *et*

al., 1995, p. 107, fig. 7

Thalli bushy, brown to dark brown in color, height 12-20 cm; branching irregularly 2-3 orders, branches cylindrical, somewhat constricted at base and tapering toward the apex, main axis branch 1.1-1.5 mm in diameter, base 1.7-2.2 mm in diameter; medulla 0.4-1.1 mm in diameter; cortex 3-4 layers; cystocarp conical shape, 0.5-0.7 mm in diameter.

Remarks: This species was found from March to October 2004. It was usually found growing on snails. The tips of some branches of the thalli were bitten off.

This was also an alga of economic value. The specimen of the present study was shorter than that described by Lewmanomont, (1994), Lewmanomont and Ogawa, (1995) and Ohno *et al.* (1995).

Family Hypneaceae**Genus *Hypnea* Lamouroux**

Hypnea spinella (C. Agardh) Kutzing (Figure 12)

Taylor, 1960, p. 466, pl. 73, fig. 2; Trono, 1997, p. 239

Thalli dense, depressed turf, brittle, yellowish brown or light brown or reddish brown; branching irregular; main axis obtuse and 4-10 cm in height; branches curved, tapering to the tip, length 0.5-4 cm; cystocarps globular on branches; tetrasporangial stichidia at middle or tip of branchlets.

Remarks: This species was found from March to May 2004, in July 2004 and in March 2005. This alga grew as a dense tuft at the bottom of the sea. Some tufts were found with other seaweeds.

The present study found this alga in luxuriant growth in the northern area of the bay during the dry season. This alga had been found at Laem Tachi and the Yaring River Mouth (Ruangchuay and Luangthuvapranit, 1999). However, the present study found it at Lighthouse, Ban Bu Di, Ban Ta Lo Samilae and Ban Da To.

Family Rhodomelaceae**Genus *Acanthophora* Lamouroux**

Acanthophora spicifera (Vahl) Børgesen (Figure 13)

Taylor, 1960, p. 619, pl. 71, fig. 3 and pl. 72, figs 1-2; Tseng, 1984, p. 142, pl. 74, fig. 1; Lewmanomont and Ogawa, 1995, p. 90; Trono, 1997, p. 255. Fig. 159

Thalli erect, succulent, spreading, easily broken when fresh, light to dark brown, pink in reduced light, height 13 cm; main axis 1.2-2.4 mm in diameter; short and long branches alternate on the axis, 0.65-0.84 mm in diameter; branchlets bearing short spines.

Remarks: This species was found in February 2004 and March 2005. It usually grew in a bushy form at the bottom of the sea. Its fragments mixed with other seaweeds.

This was a new recording at Pattani Bay. Compared to the species reported by Tseng (1984)

and Trono (1997), this *A. spicifera* grew in sandstone or coral areas. It was amazing how this species could grow in the inner bay.

Acknowledgements

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