

MARINE ALGAE IN THE VICINITY OF BIOLOGICAL INSTITUTE ON KUROSHIO, KOCHI PREFECTURE, JAPAN

by

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Abstract

A preliminary examination of benthic marine seaweeds in the vicinity of Biological Institute on Kuroshio at Otsuki-cho, Kochi Prefecture, Japan records 12 Chlorophyta (green algae), 34 Rhodophyta (red algae), and 16 Phaeophyta (brown algae) species. The characteristic algal genera in the area are the brown alga *Sargassum* and the red algae *Galaxaura*, *Laurencia*, *Prionitis*. The dominant macro algae were *Sargassum* spp. that grew abundantly on the rocky subtidal zone as well as on the ropes of pearl oyster culture floating facilities.

Introduction

The Biological Institute on Kuroshio is situated in Cape Ashizuri, which is located towards the south-western margin of Kochi Prefecture in Shikoku Island, south-western Japan. The area has a subtropical climate, and its marine waters receive enrichment from the Kuroshio Current. In 1942, the late Prof. Yukio Yamada described some *Sargassum* species from Kashiwajima Is. near Cape Ashizuri which have drawn attention to the rich marine

flora present in south-western Shikoku Is. Since the 1970s, some ecological studies on seaweeds in Tosa Bay had been conducted by Prof. Ohno of Kochi University; however inventory of the seaweeds resources in the area has not been reported yet. This author had the opportunity to be invited by the Biological Institute on Kuroshio, and surveyed the marine benthic seaweeds in the nearby coastal area. This paper is

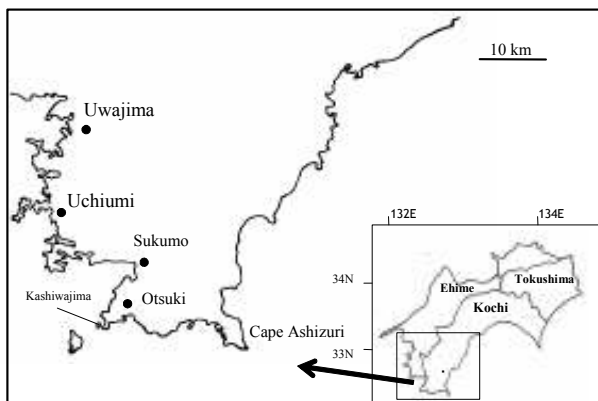


Fig. 1. Map of south-west part of Shikoku Is., Japan.

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the preliminary report of the marine seaweeds distributed near the institute.

Materials and Methods

Seaweeds were collected by skin diving at Uchinoura, Sukumo-shi and Biological Institute on Kuroshio at Otsuki-cho, Kochi Prefecture (Fig. 1) on April 14, 2002. Some seaweed attached to the ropes of pearl oyster farming facilities at Uchiumi-mura, Ehime Prefecture was also collected on April 13. The collected seaweeds were preserved in 10% formalin-seawater before being mounted on herbarium sheets. The specimens are deposited at the Phycological Herbarium of Faculty of Fisheries, Kagoshima University.

Results and Discussion

The present report lists 62 species of marine algae, which is composed of 12 Chlorophyta (green algae), 34 Rhodophyta (red algae) and 16 Phaeophyta (brown algae) species (Tables 1 and 2). Five figures in Plate 1 illustrate the characteristics of the coastal area and habitat of the seaweeds. Some photographs of the herbarium dry specimens are shown in Plates 2-4.

Most of the species are common subtropical benthic marine algae already known from Shikoku Is. and Southern Kyushu, Japan. In the green algae, genera *Caulerpa* and *Codium* were common in the area. On the other hand, other common subtropical small green algae, such as *Acetabularia* were not collected in this trip.

Laurencia and *Galaxaura*, attached to rocks, were the prominent genera of the red algae in the area. Further, these rhodophytes and other many crustose and articulated coralline algae covered the surface of rocks in the sea. Interestingly, other benthic small red algae such as *Gelidium* were observed growing on the crustose coralline algae.

Among the brown algae, *Dictyota* and *Sargassum* spp. were abundant in the area. *Sargassum piluliferum* is the one of the common *Sargassum* in Japan. This species is plentiful and widely distributed along the stretch of the shallow and calm bay from Uchiumi to Otsuki, thus making a large *Sargassum* bed. In such *Sargassum* bed, many juvenile marine organisms like fish and shellfish take refuge and feed on a variety of food organisms attached to the surface of the seaweeds.

Many *Sargassum piluliferum*, "mametawara" in Japanese, were observed attached to and entangled with the floating buoys and cages of the pearl farms in Uchiumi. Probably, a large amount of *Sargassum* was drifted from a nearby *Sargassum* bed along the coastal area. Moreover, dissolved nutrients from the pearl oysters farms and nutrients brought by the Kuroshio Current might have contributed to the luxuriant proliferation of "mametawara" in this area.

According to old fishermen in the area, before the 1970s, other subtropical *Sargassum* species were distributed in Kashiwajima Is. near the Institute. In fact in 1942, Yamada reported some new species of *Sargassum* in this vicinity. However, this author did not observe other *Sargassum* species during his field survey. There is a possibility that certain environmental conditions have changed through the years, which become very favorable to the life cycle and growth of "mametawara". Further investigations on this matter are recommended.

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Table 1. List of algae distributed in Biological Institute on Kuroshio and its vicinity.

Division	Species [Japanese name]	Uchiumi	Uchinoura	Otsuki
		Ehime May/13/2002	Sukumo,Kochi May/14/2002	Kochi May/14/2002
Chlorophyta	<i>Caulerpa brachypus</i> Harvey [Heraiwazuta]			+
	<i>C. racemosa</i> var. <i>clarifera</i> f. <i>macrophysa</i> Weber van Bosse [Sennarizuta]			+
	<i>C. racemosa</i> var. <i>laete-virens</i> W.v.Bosse [Surikogizuta]			+
	<i>Chaetomorpha spiralis</i> Okamura [Futojyuzumo]		+	
	<i>Codium cylindricum</i> Holmes [Nagamiru]		+	
	<i>C. intricatum</i> Ok. [Motsuremiru]			+
	<i>C. fragile</i> Hariot [Miru]		+	+
	<i>C. spongiosum</i> Harvey [Kobushimiru]			+
	<i>Pachydietyon coriaceum</i> Ok. [Sanadagusa]		+	
	<i>Ulva conglobata</i> Kjellman [Botanaosa]		+	
	<i>U. pertusa</i> Kj. [Anaaosa]		+	
	<i>Valonia aegagropila</i> C. Agardh [Tamabaronia]			+
Rhodophyta	<i>Ahnfeltiopsis flagelliformis</i> Masuda [Okitsunori]		+	+
	<i>Callophyllis okamurae</i> Silva [Kinuhada]		+	+
	<i>Carpopeltis affinis</i> Ok. [Matsunori]		+	
	<i>C. prolifera</i> Kawaguchi et Masuda [Komenori]		+	+
	<i>Chondrococcus hornemanii</i> Schmits [Hosobanaminohana]			+
	<i>Corallina pilulifera</i> Postels et Ruprecht [Pirihiba]			+
	<i>Delisea fimbriata</i> sensu Segawa [Tamaitadaki]			+
	<i>Galaxaura fastigiata</i> Decaisne [Garagara]			+
	<i>Gelidium elegans</i> Kuetzing [Makusa]		+	+
	<i>G. japonicum</i> Ok. [Onikusa]			+
	<i>Gigartina tenella</i> Hommersand [Suginori]			+
	<i>Gracilaria chorda</i> Holmes [Tsurushiramo]		+	
	<i>G. gigas</i> Harvey [Ooogonori]		+	
	<i>G. incurvata</i> Ok. [Mizoogonori]		+	
	<i>G. vermiculophylla</i> Papenfuss [Ogonori]		+	
	<i>Grateloupia fulicina</i> C. Ag. [Mukadenori]		+	
	<i>G. livida</i> Yamada [Mukadenori]		+	
	<i>Hypnea charoides</i> Lamouroux [Ibaranori]		+	+
	<i>H. japonica</i> Tanaka [Kagiibaranori]			+

Table 2. List of algae distributed at Biological Institute on Kuroshio and its vicinity. (continued)

Division	Species [Japanese name]	Uchiumi	Uchinoura	Otsuki
		Ehime May/13/2002	Sukumo,Kochi May/14/2002	Kochi May/14/2002
Rhodophyta	<i>Laurencia composita</i> Yamada [Kikusozo]			+
	<i>L. intermedia</i> Yam. [Kurosozo]		+	
	<i>L. majuscula</i> Lucas [Akasoza]			+
	<i>L. okamurae</i> Yam. [Mitsudesozo]		+	
	<i>L. undulata</i> Yam. [Kobusoza]			+
	<i>Lomentaria catenata</i> Harvey [Fushitsunagi]		+	
	<i>Meristotheca populosa</i> J.Ag. [Tosakanori]			+
	<i>Plocamium telfairiae</i> Harvey [Yukari]			+
	<i>Prionitis cornea</i> Dawson [Tsunomukade]			+
	<i>P. crispata</i> Kawaguchi [Tosakamatsu]		+	+
	<i>P. divaricata</i> Kawa. [Hitotsumatsu]			+
	<i>P. patens</i> Ok. [Hirakintoki]		+	
	<i>P. ramosissima</i> Kawa. [Sujimukade]		+	
	<i>Scinaia okamurae</i> Huisman [Nisefusanori]		+	+
	<i>Tricleocarpa cylindrica</i> Huismann et Borowitzka [Garagara]			+
Phaeophyta	<i>Dictyopteris proloifera</i> Ok. [Herayahazu]			+
	<i>D. undulata</i> Holmes [Shiwayahazu]			+
	<i>Dictyota spinulosa</i> Harvey [Hariamijigusa]		+	
	<i>D. dichotoma</i> Lamouroux [Amijigusa]		+	+
	<i>Padina arborescens</i> Holmes [Umiuchiwa]			+
	<i>P. crassa</i> Yamada [Konaumiuchiwa]		+	
	<i>Sargassum alternato-pinnatum</i> Yam. [Kirebamoku]			+
	<i>S. cristaefolium</i> C. Ag. [Tosakamoku]	+	+	
	<i>S. duplicatum</i> Bory [Futaemoku]			+
	<i>S. fusiforme</i> Yoshida [Hijiki]	+		
	<i>S. hemiphyllum</i> C.Ag. [Isomoku]	+	+	
	<i>S. nipponicum</i> Yendo [Tamanashimoku]			+
	<i>S. piluliferum</i> C.Ag. [Mametawara]	+	+	
	<i>S. siliquastrum</i> C.Ag. [Yoremoku]	+		
	<i>S. thunbergii</i> Kuenze [Umitoranowo]	+		
<i>Zonaria diesingiana</i> J.Ag. [Shimaooigi]			+	

+: present

EXPLANATION OF PLATES

PLATE 1

- Fig. 1. Pearl oyster farming at Uchiumi-mura, Ehime Prefecture.
- Fig. 2. Brown alga, *Sargassum piluriferum*, attached on the ropes of pearl oyster farming facilities at Uchiumi-mura.
- Fig. 3. Plenty of *Sargassum*, harvested from ropes of pearl oyster farming facilities at Uchiumi-mura.
- Fig. 4. Natural *Sargassum* vegetation at Uchiumi-mura, Ehime Prefecture.
- Fig. 5. Brown alga *Sargassum duplicatum* growing on intertidal rocks at Otsuki-cho, Kochi Prefecture.

PLATE 2

- 1: *Caulerpa brachypus*
- 2: *Codium cylindricum*
- 3: *Codium fragile*
- 4: *Dictyopteris undulata*
- 5: *Dictyota dichotoma*
- 6: *Sargassum duplicatum*

PLATE 3

- 7: *Hypnea charoides*
- 8: *Laurencia okamuræ*
- 9: *Callophyllis okamuræ*
- 10: *Delisea fimbriata*
- 11: *Galaxaura fastigiata*
- 12: *Grateloupia filicina*

PLATE 4

- 13: *Hypnea charoides*
- 14: *Laurencia okamuræ*
- 15: *Laurencia undulata*
- 16: *Scinaia okamuræ*
- 17: *Prionitis cornea*



Fig. 1. Pearl oyster farming at Uchiumi-mura, Ehime Prefecture.



Fig. 2. Brown alga, *Sargassum piluriferum*, attached on the ropes of pearl oyster farming facilities at Uchiumi-mura.



Fig. 3. Plenty of *Sargassum*, harvested from ropes of pearl oyster farming facilities at Uchiumi-mura.



Fig. 4. Natural *Sargassum* vegetation at Uchiumi-mura, Ehime Prefecture.



Fig. 5. The brown alga *Sargassum duplicatum* growing on intertidal rocks at Otsuki-cho, Kochi Prefecture.



1cm

1. *Caulerpa brachypus*



2cm

2. *Codium cylindricum*



2cm

3. *Codium fragile*



2cm

4. *Dictyopterus undulata*



2cm

5. *Dictyota dichotoma*



2cm

6. *Sargassum duplicatum*



7. *Hypnea charoides*



8. *Laurencia okamurai*



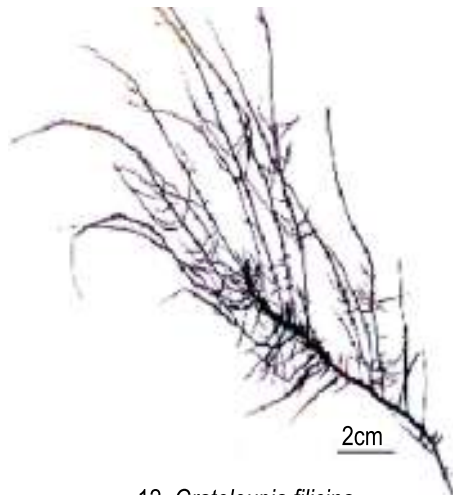
9. *Callophyllis okamurai*



10. *Delisea fimbriata*



11. *Galaxaura fastigiata*



12. *Grateloupia filicina*

PLATE 4



1cm

13. *Hypnea charoides*



1cm

14. *Laurencia okamurae*



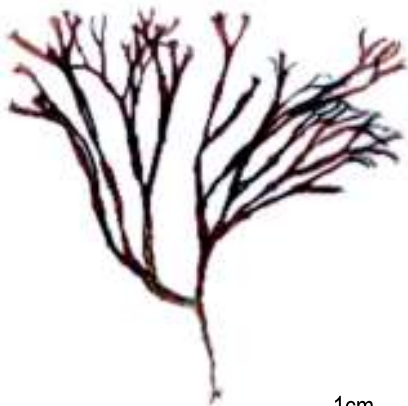
2cm

15. *Laurencia undulata*



2cm

16. *Scinaia okamurae*



1cm

17. *Prionitis cornea*