

# Biological Assessment of Ecologically Important Areas for the Algae Taxonomic Group of Yellow Sea Ecoregion

## Korea Part

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### Ecological sub-regions

#### Definition and description of sub-regions

##### Sub-region: East coast of the Yellow Sea

The east coast of the Yellow Sea is defined as to include Jeju Island, the south and west coasts of the Korean peninsula and all islands within this area.

Seaweed distribution is dependant on sea temperature and, in terms of the composition as a subtropical species, has been suggested to occupy two sub-regions: the west coast sub-region and Jeju Island, and the south coast sub-region (Sohn, 1998). However many seaweed species live in both of the two sub-regions since the Yellow Sea Warm Current flows into the area. Thus, we shall use only one region: the Yellow Sea region.

#### Common Criteria for defining Ecologically Important Areas of the Yellow Sea Ecoregion

The Algae Taxonomic Group has adopted the following common criteria to identify Ecologically Important Areas in the Yellow Sea Ecoregion (YSE) (Table 1).

**Table 1. List of Common Criteria for Algae Taxonomic Group**

Adopted Common Criteria	Selected Indicator Species/ Species Groups	Definition of Indicator Species	Definition of Ecologically Important Areas
Criterion 1: representative species/habitat types	<i>Caulerpha okamurae</i> , <i>Ulva pertusa</i> , <i>Hizikia fusiformis</i> , <i>Ishige okamurae</i> , <i>Laminaria japonica</i> , <i>Sargassum confusum</i> , <i>Sargassum thunbergii</i> , <i>Undaria pinnatifida</i> , <i>Corallina pilulifera</i> , <i>Gloiopeltis furcata</i> , <i>Gracilaria lemaneiformis</i> , <i>Porphyra yezoensis</i>	Abundant species	Major area of distribution
Criterion 2: endemism and unique species assemblages	<i>Hizikia fusiformis</i> , <i>Ishige okamurae</i> , <i>Silvetia siliquosa</i> , <i>Gracilariopsis chorda</i>	Species endemic to the south and west coast of Korea	Area of distribution is South-western coast of the Korean Peninsula
Criterion 3: species richness	<i>Not adopted</i>	Not adopted	Not adopted

Adopted Common Criteria	Selected Indicator Species/ Species Groups	Definition of Indicator Species	Definition of Ecologically Important Areas
Criterion 4: species of special concern 1 (threatened species)	<i>Silvetia siliquosa</i>	The population of this species has significantly decreased due to increasing water pollution. It is observed just in the offshore islands.	Islands in the open sea
Criterion 5-A: commercially important (Volume)	<i>Hizikia fusiformis</i> , <i>Laminaria japonica</i> , <i>Undaria pinnatifida</i> , <i>Porphyra yezoensis</i> , <i>Gloiopeltis furcata</i> , <i>Gracilariopsis chorda</i>	High yield species of important economical value	Cultivated areas along the coast
Criterion 5-B: commercially important (Value)	<i>Caulerpha okamurae</i> , <i>Hizikia fusiformis</i> , <i>Laminaria japonica</i> , <i>Undaria pinnatifida</i> , <i>Chondrus ocellatus</i> , <i>Gelidium amansii</i> , <i>Porphyra tenera</i> , <i>Porphyra yezoensis</i>	Species of high commercial value.	South and west coasts of the Korean Peninsula
Criterion 6: intact habitat/ecological processes	Not adopted	Not adopted	Not adopted

**Selected Indicator Species under Criterion 1: Representative species/ habitat types**

Note: Common names are in Korean unless otherwise specified.

**Definition of Indicator Species under Criterion 1:**

Representative species and/or habitat types are those that are highly abundant in the YSE.

**Selected Indicator Species:**

**1) [*Caulerpha okamurae*] [옥덩굴, Okdeonggul] (No information on English name)**

It is widely distributed along the south and south west coasts of Korea in the YSE.

**2) [*Ulva pertusa*] [구멍갈파래, Gumeonggalparae] [孔石莼, あなあおさ] (No information on English name)**

*Ulva pertusa* is widely distributed in the YSE and is considered to be one of the most abundant species in the YSE due to its rapid growth and strong adaptability to the eutrophic sea water.

**3) [*Hizikia fusiformis*] [뜻, Tot] (No information on English name)**

Is widely distributed and abundant on the south coast of Korea in the YSE.

**4) [*Ishige okamurae*] [패, Pae] (No information on English name)**

Is widely distributed from south to west coasts (Taeon Bay) of Korea and abundant in the YSE.

**5) [Japanese kelp] [*Laminaria japonica*] [다시마, Dasima] [海帶, Haidai] [まこんぶ, Makonbu]**

It is distributed from the low intertidal zone to the sub-tidal zone of the YSE and is also one of the most important commercial algae. It is one of the dominant species because of its abundance, huge thallus and large coverage.

**6) [*Sargassum confusum*] [알쏭이 모자반, Alssongi-mojaban] [海蒿子] [ふしすじもく, Husisuzimoku] (No information on English name)**

*Sargassum confusum* is very abundant in the low intertidal zone to sub-tidal zone of the YSE.

**7) [*Sargassum thunbergii*] [지충이, Jichungi] [鼠尾藻] [うみとらのお, Umitoranoo] (No information on English name)**

*Sargassum thunbergii* is very abundant from the intertidal zone to sub-tidal zone of the YSE.

**8) [Sea mustard] [*Undaria pinnatifida*] [미역, Miyeok] [裙帶菜] [わかめ, Wakame]**

It is one of the dominant species in the YSE because of its abundance and large thallus. It is also a commercially important algal species that is cultivated in China and Korea.

**9) [*Corallina pilulifera*] [작은구슬산호말, Jageunguseul-sanhomal] (No information on English name)**

This species is abundant in the mid intertidal zone of the Korean coast in the YSE.

**10) [*Gloiopeltis furcata*] [불등풀가사리, Buldeungpulgasari] [ふくろふのり, Hukuronori] (No information on English name)**

*Gloiopeltis furcata* is very abundant in the upper intertidal zone of the YSE and is edible.

**11) [Sea string] [*Gracilaria lemaneiformis*(=*G. verrucosa*)] [꼬시래기, Ggosiraegi] [せいようおごのり, Seiyuogonori]**

*Gracilaria lemaneiformis* is a common seaweed species in the intertidal zone of the YSE and is also a commercial seaweed.

**12) [*Porphyra yezoensis*] [방사무늬김, Bangsamunikim] [紫菜] [すさびのり, Susabinori] (No information on English name)**

This species is widely found in winter in the upper intertidal zone of the YSE. It is also one of the most important commercial species cultivated in the seas around Korea.

**Definition of Ecologically Important Areas for the Selected Indicator Species:**

Major areas of distribution of the species are the south and southern west coasts of Korea (e.g., Wan Island, Namhae Island etc.).

**Selected Indicator Species under Criterion 2: Endemism and unique species assemblages**

**Definition of Indicator Species under Criterion 2:**

Endemic species of algae that are found or reported only in the YSE.

**Selected Indicator Species:**

**1) [*Hizikia fusiformis*] [뜻, Tot] (No information on English name)**

It is widely distributed and abundant in the southern coast of Korea in the YSE.

**2) [*Ishige okamurae*] [파, Pae] (No information on English name)**

This species is abundant in the YSE with wide distribution from the south to the west coasts (Taeon) of Korea.

**3) [*Silvetia siliquosa*(=*Pelvetia siliquosa*)] [뜸부기, Ddeumbugi] (No information on English name)**

This species is only reported in the YSE.

**4) [*Gracilariopsis chorda*] [미역, Gae-ggosiraegi] (No information on English name)**

The distribution of *Gracilaria chorda* is confined to subtidal zones along the southwest coast of Korea.

**Definition of Ecologically Important Areas:**

Areas of distribution of selected indicator species such as the west coast of Korea and, in particular, offshore islands.

**Selected Indicator Species under Criterion 4: Species of Special Concern**

**Selected Indicator Species:**

**1) [*Silvetia siliquosa* (= *Pelvetia siliquosa*)] [뜸부기, Ddeumbugi] (No information on English name)**

This species is edible but is becoming less abundant in the YSE because of water pollution.

**Selected Indicator Species Under Criterion 5: Commercial Importance**

**Selected Indicator Species:**

**1) [*Caulerpha okamurae*] [옥덩굴, Okdeonggul] (No information on English name)**

This species is widely distributed from the south to the south west coast of Korea in the YSE and is particularly abundant along the southern coast.

**2) [*Hizikia fusiformis*] [뚝, Tot] (No information on English name)**

This species is common and widely distributed along the southern coast of Korea in the YSE.

**3) [Japanese kelp] [*Laminaria japonica*] [다시마, Dasima] [海帶, haidai] [まこんぶ, Makonbu]**

This species is distributed from low intertidal zones to sub-tidal zones of the YSE and is also one of the most important commercial algae. It is one of the most abundant species due to the fact that it is cultured in large amounts and has huge thallus and coverage.

**4) [Sea mustard] [*Undaria pinnatifida*] [미역, Miyeok] [わかめ, Wakame]**

This species is abundant in the YSE and is one of the dominant species because of its large thallus. It is also an important algal species that is cultivated in China and Korea.

**5) [Rock moss/Curly moss] [*Chondrus ocellatus*] [진두발, Jindubal]**

This species is abundant from mid intertidal to lower intertidal zones on the south coast of Korea in the YSE and is used to extract carragenan.

**6) [*Gelidium amansii*] [우뚝가사리, Umutgasari] (No information on English name)**

This species occurs in the lower intertidal zone and is abundant on the south coast of Korea where it is an important agarophyte.

**7) [*Gloiopeltis furcata*] [불등풀가사리, Buldeungpulgasari] [ふくろふのり, Hukuronori] (No information on English name)**

*Gloiopeltis furcata* is very abundant in the upper intertidal zone of the YSE and is edible. This alga is also used to extract carragenan.

**8) [*Gracilariopsis chorda*] 개꼬시래기, Gae-ggosiraegi] (No information on English name)**

*Gracilaria chorda* is a common seaweed in the intertidal zones of the YSE and is also commercially important.

**9) [Laver] [*Porphyra tenera*] [참김, Chamkim]**

This species is widely found in winter in the upper intertidal zones of the YSE. It is also one of the most important commercial species cultivated in the seas around Korea.

**10) [*Porphyra yezoensis*] [방사무늬김, Bangsamunikim] [すさびのり, Susabinori] (No information on English name)**

It is widely found in winter in the upper intertidal zone of the YSE. It is also one of the most important commercial species cultivated in the seas around Korea.

**Definition of Ecologically Important Areas for the Selected Indicator Species:**

Cultivation areas along the coast such as the south coast of Korea, in particular Gyeongsangnam-do and Jeollanam-do (ex. Namhae Island, Wan Island and Jangheung)

**Table 2: List of selected Indicator Species**

Selected Indicator Species	Criterion 1 Representative species/ habitat types	Criterion 2 Endemism and unique species assemblages	Criterion 4 Species of Special Concern	Criterion 5 Commercially important
<i>Caulerpha okamurae</i>	X			X
<i>Ulva pertusa</i>	X			
<i>Hizikia fusiformis</i>	X	X		X
<i>Ishige okamurae</i>	X	X		
<i>Laminaria japonica</i>	X			X
<i>Sargassum confusum</i>	X			
<i>Sargassum thunbergii</i>	X			
<i>Silvetia siliquosa</i> (= <i>Pelvetia siliquosa</i> )		X	X	
<i>Undaria pinnatifida</i>	X			X
<i>Chondrus ocellatus</i>				X
<i>Corallina pilulifera</i>	X			
<i>Gelidium amansii</i>				X
<i>Gloiopeltis furcata</i>	X			X
<i>Gracilariopsis chorda</i>		X		X
<i>G. lemaneiformis</i>	X			
<i>Porphyra tenera</i>				X
<i>Porphyra yezoensis</i>	X			X

Note: X indicates that the species was selected under the corresponding criterion.

**Maps and Description of Ecologically Important Areas for the Algae Taxonomic Group****Table 3. List of Maps and Area Names for Algae Ecologically Important Areas**

Map No.	Indicator Species	Area Names for Algae Ecologically Important Areas					
		Seogwipo	Tongyeong, Yokji Island	Busan	Wan Island	Buan	Taeon
Map 1	<i>Caulerpha okamurae</i>						
Map 2	<i>Ulva pertusa</i>					Buan	Taeon
Map 3	<i>Hizikia fusiformis</i>						
Map 4	<i>Ishige okamurae</i>					Buan	Taeon
Map 5	<i>Laminaria japonica</i>					Buan	Taeon
Map 6	<i>Sargassum confusum</i>					Buan	Taeon
Map 7	<i>Sargassum thunbergii</i>					Buan	Taeon
Map 8	<i>Silvetia siliquosa</i>					Buan	
Map 9	<i>Undaria pinnatifida</i>					Buan	Taeon
Map 10	<i>Chondrus ocellatus</i>						
Map 11	<i>Corallina pilulifera</i>					Buan	Taeon
Map 12	<i>Gelidium amansii</i>						
Map 13	<i>Gloiopeltis furcata</i>					Buan	Taeon
Map 14	<i>Gracilaria chorda</i>					Buan	
Map 15	<i>Gracilaria lemneiformis</i>					Buan	Taeon
Map 16	<i>Porphyra tenera</i>						
Map 17	<i>Porphyra yezoensis</i>					Buan	Taeon

**1) Area Name: Seogwipo**

Location: Seogwipo City, Jeju Island, 33° 13' N, 126° 29' E

Area Description: Seogwipo, Jeju Island is an Ecologically Important Area because all of the indicator species grow in the area of this island.

Knowledge gaps and specific studies needed:

Past studies on the marine benthic algae have focused on the intertidal zone in the area and periodic surveys have been made at study sites.

**(2) Area Name: Tongyeong, Yokji Island**

Location: Tongyeong City, Gyeongnam Province, 34° 49' N, 128° 26' E

Area Description: Tongyeong and Yokji Island are Ecologically Important Area on the south coast of the Korean Peninsula. The seawater is clear and substrata are well developed.

Knowledge gaps and specific studies needed:

Seasonal algal flora and abundance intertidal and subtidal zones have not been studied.

**(3) Area Name: Busan**

Location: Busan City, 35° 05' N, 129° 05' E

Area Description: The coast of Busan and its islands are Ecologically Important Areas because of some cultivated algae such as *Undaria pinnatifida* and *Laminaria japonica*. The rocks are well developed and the seawater around the islands is very clear.

Knowledge gaps and specific studies needed:

Most research works on algal flora were performed only once for intertidal zone and the study areas were limited. Some biological and environmental factors need to be explored further to increase the quantity and quality of the products grown.

**(4) Area Name: Wan Island**

Location: Wan Island County, Jeonnam Province, 34° 17' N, 126° 43' E

Area Description: Wan Island is important because various seaweeds grow in the area and *Undaria pinnatifida*, *Laminaria japonica*, *Porphyra yezoensis* and *Hizikia fusiformis* are cultivated here. In addition, their populations are in well-developed, natural habitats.

Knowledge gaps and specific studies needed:

Studies on the marine benthic algae have focused on intertidal zone and periodic surveys have only been made at study sites.

**(5) Area Name: Buan**

Location: Buan County, Jeonnam Province, 35° 37' N, 126° 29' E

Area Description: Buan is on the west coasts of the Korean Peninsula. The seawater is too turbid for algal growth but the substrata are well developed.

Knowledge gaps and specific studies needed:

Seasonal algal flora and abundance were not studied for both the intertidal and sub-tidal zones.

**(6) Area Name: Taeon**

Location: Taeon County, Chungnam Province, 36° 35' N, 126° 43' E

Area Description: Coasts of Taeon and its islands are Ecologically Important Areas and natural rocks are well developed.

Knowledge gaps and specific studies needed:

Most research on algal flora was performed only once for intertidal zone and study areas were very limited. Some biological and environmental factors need to be further explored.

Algae Ecologically Important Area (AEIA) for *Caulerpha okamurae* (Map 1)

Area Name: Seogwipo

Area Name: Tongyeong, Yokji Island

Area Name: Busan

Area Name: Wan Island

Algae Ecologically Important Area (AEIA) for *Ulva pertusa* (Map 2)

Area Name: Seogwipo

Area Name: Tongyeong, Yokji Island

Area Name: Busan

Area Name: Wan Island

Area Name: Buan

Area Name: Taeon

Algae Ecologically Important Area (AEIA) for *Hizikia fusiformis* (Map 3)

Area Name: Seogwipo

Area Name: Tongyeong, Yokji Island

Area Name: Busan  
Area Name: Wan Island

Algae Ecologically Important Area (AEIA) for *Ishige okamurae* (Map 4)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Wan Island  
Area Name: Buan  
Area Name: Taean

Algae Ecologically Important Area (AEIA) for *Laminaria japonica* (Map 5)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island  
Area Name: Buan  
Area Name: Taean

Algae Ecologically Important Area (AEIA) for *Sargassum confusum* (Map 6)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island  
Area Name: Buan  
Area Name: Taean

Algae Ecologically Important Area (AEIA) for *Sargassum thunbergii* (Map 7)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island  
Area Name: Buan  
Area Name: Taean

Algae Ecologically Important Area (AEIA) for *Silvetia siliquosa* (Map 8)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island  
Area Name: Buan

Algae Ecologically Important Area (AEIA) for *Undaria pinnatifida* (Map 9)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island  
Area Name: Buan  
Area Name: Taean

Algae Ecologically Important Area (AEIA) for *Chondrus ocellatus* (Map 10)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island

Algae Ecologically Important Area (AEIA) for *Corallina pilulifera* (Map 11)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan

Area Name: Wan Island  
Area Name: Buan  
Area Name: Taeon

Algae Ecologically Important Area (AEIA) for *Gelidium amansii* (Map 12)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island

Algae Ecologically Important Area (AEIA) for *Gloiopeltis furcata* (Map 13)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island  
Area Name: Buan  
Area Name: Taeon

Algae Ecologically Important Area (AEIA) for *Gracilaria chorda* (Map 14)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Wan Island  
Area Name: Buan

Algae Ecologically Important Area (AEIA) for *Gracilaria lemaneiformis* (Map 15)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island  
Area Name: Buan  
Area Name: Taeon

Algae Ecologically Important Area (AEIA) for *Porphyra tenera* (Map 16)

Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island

Algae Ecologically Important Area (AEIA) for *Porphyra yezoensis* (Map 17)

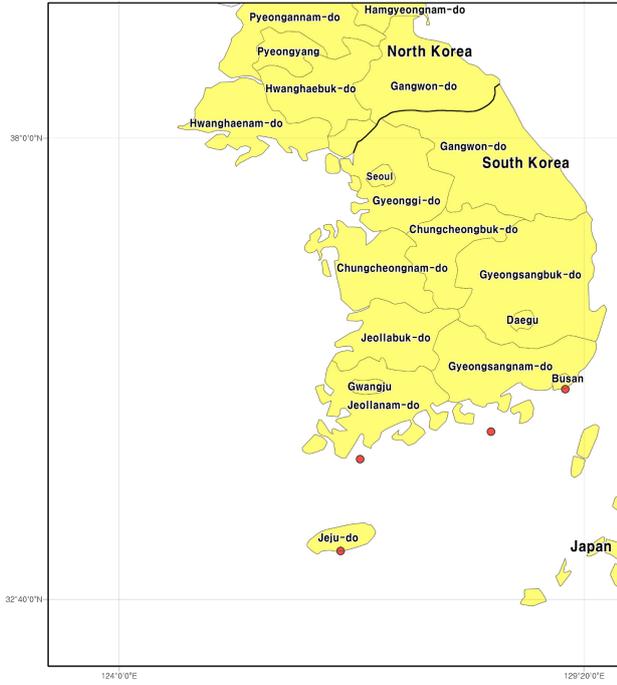
Area Name: Seogwipo  
Area Name: Tongyeong, Yokji Island  
Area Name: Busan  
Area Name: Wan Island  
Area Name: Buan

### **Knowledge Gaps and specific studies needed for Algae**

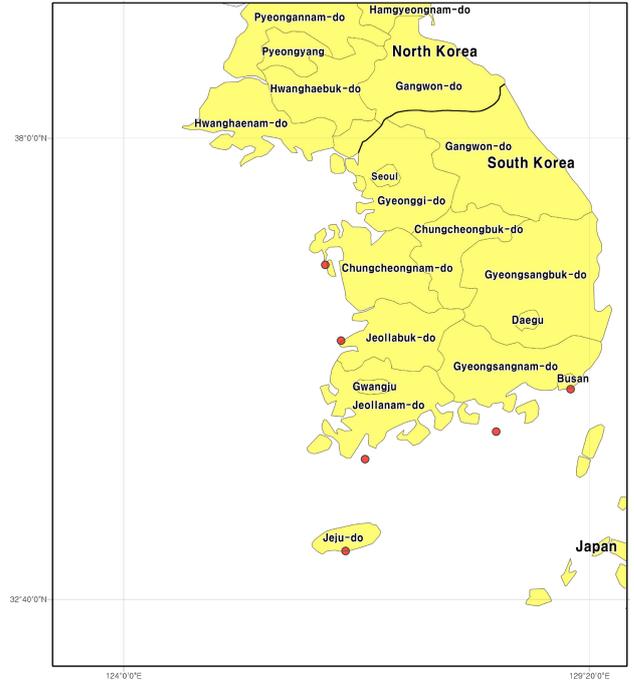
Seasonal studies on algal flora and abundance have not been studied for years. In addition, algal flora and community or succession patterns in the intertidal and sub-tidal zones have not been examined at study sites.

### **References**

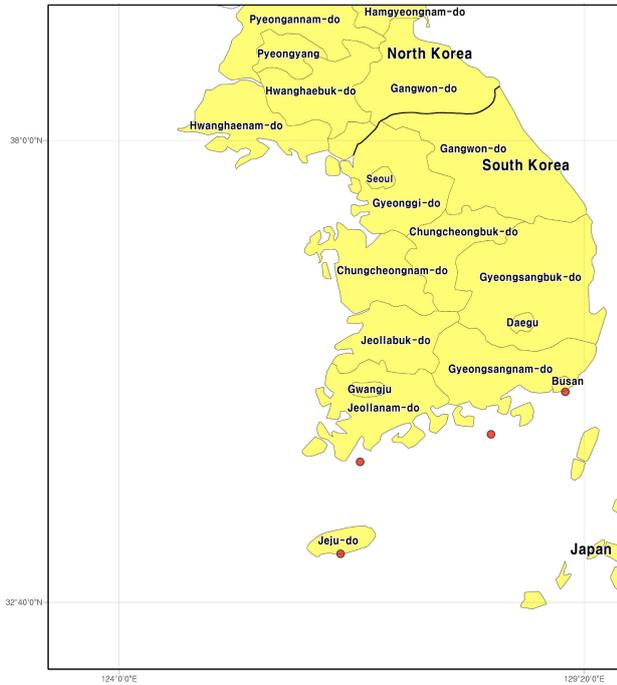
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- Sohn CH. 1998. The seaweed resources of Korea. In: Critchley A.T. and Ohno M. (eds.), Seaweed Resources of the World. Japan International Cooperation Agency, Yokosuka, pp. 15-31.



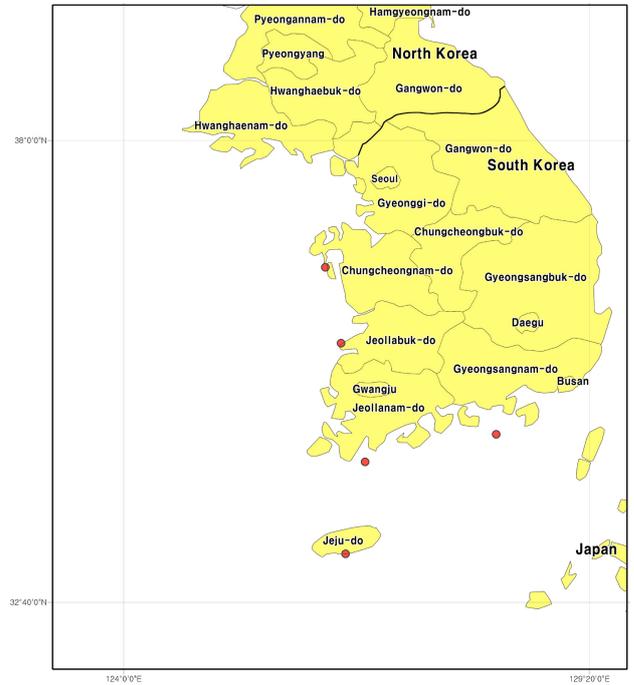
Map 1 *Caulerpa okamurae*



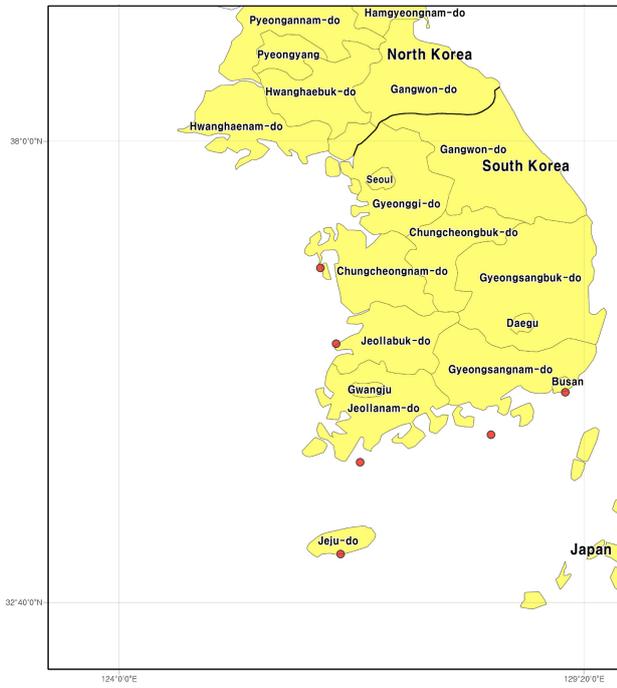
Map 2 *Ulva pertusa*



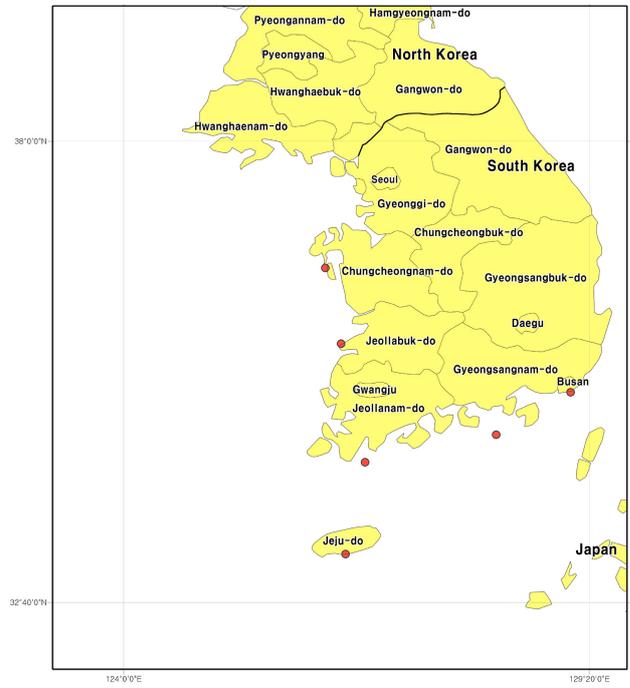
Map 3 *Hizikia fusiformis*



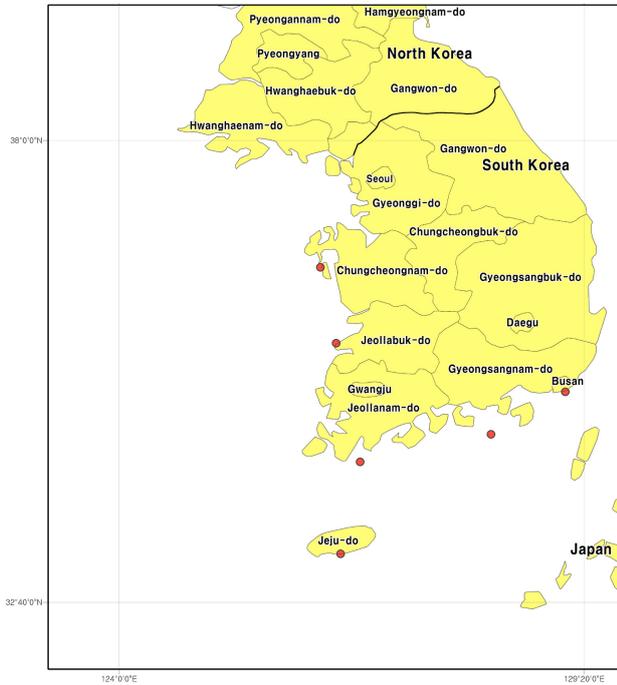
Map 4 *Ishige okamurae*



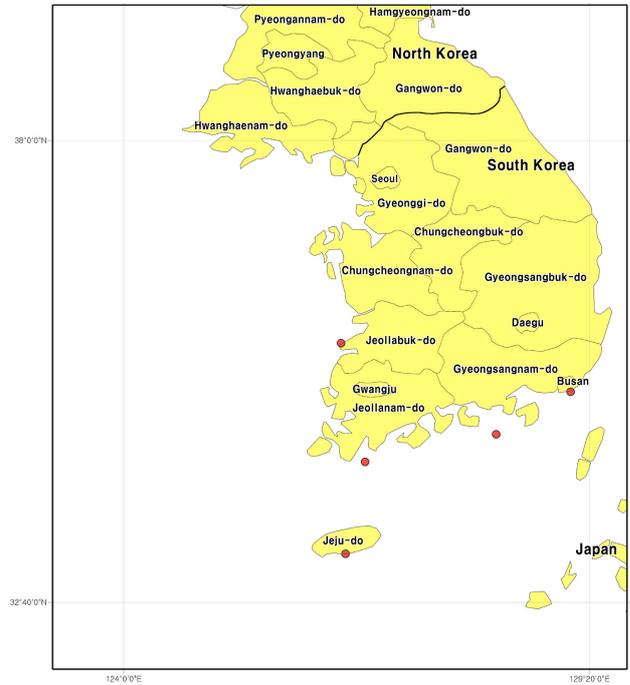
Map 5 *Laminaria japonica*



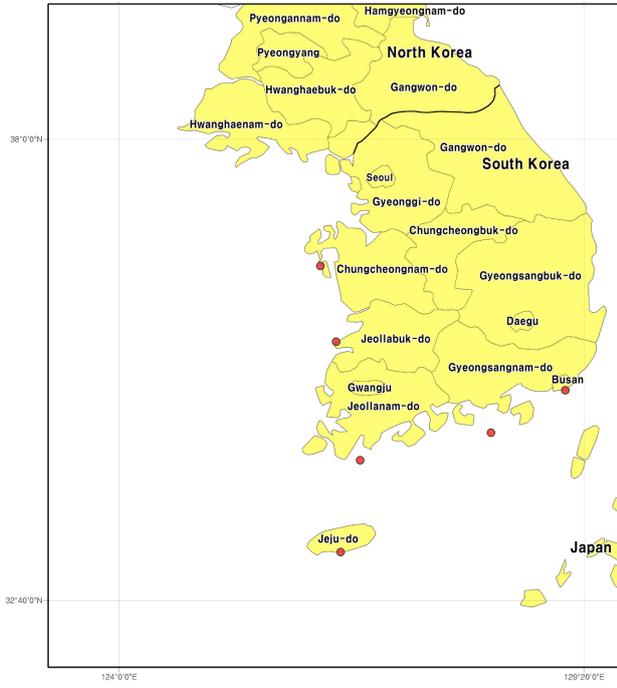
Map 6 *Sargassum confusum*



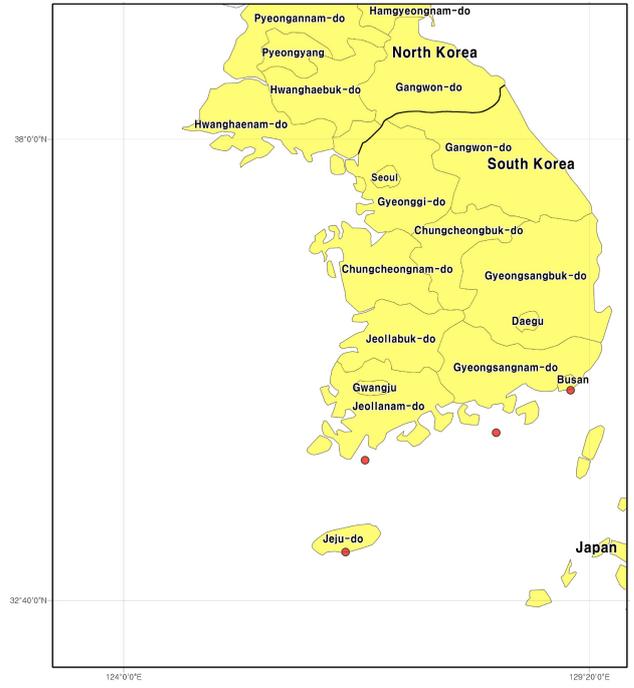
Map 7 *Sargassum thunbergii*



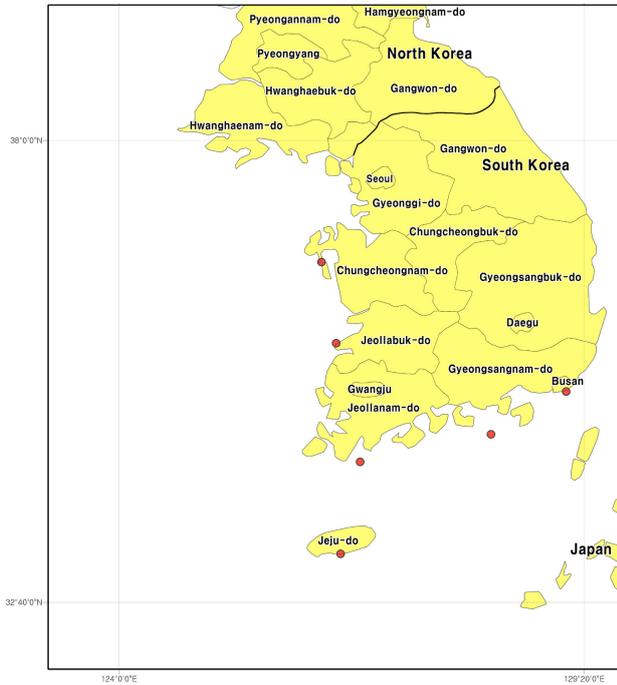
Map 8 *Silvetia siliquosa*



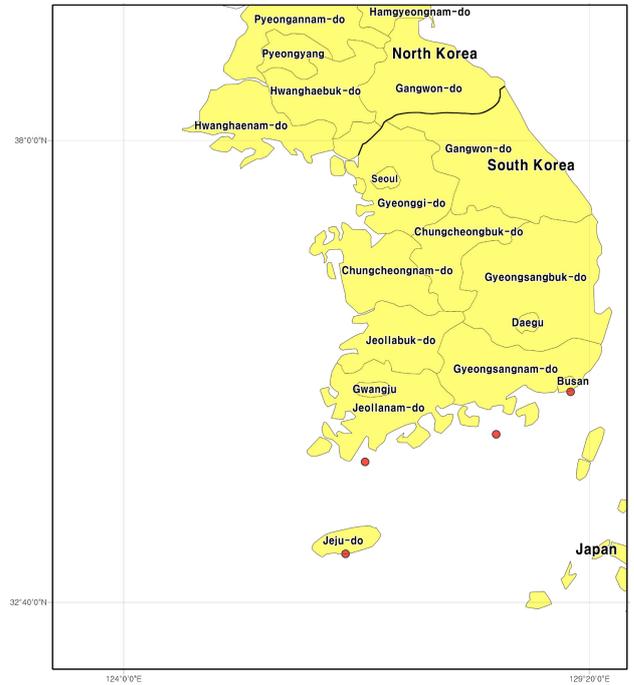
Map 9 *Undaria pinnatifida*



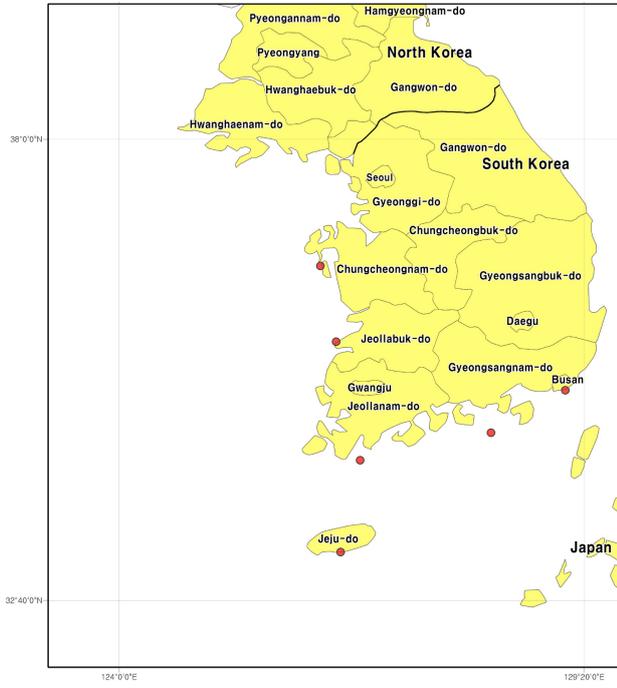
Map 10 *Chondrus ocellatus*



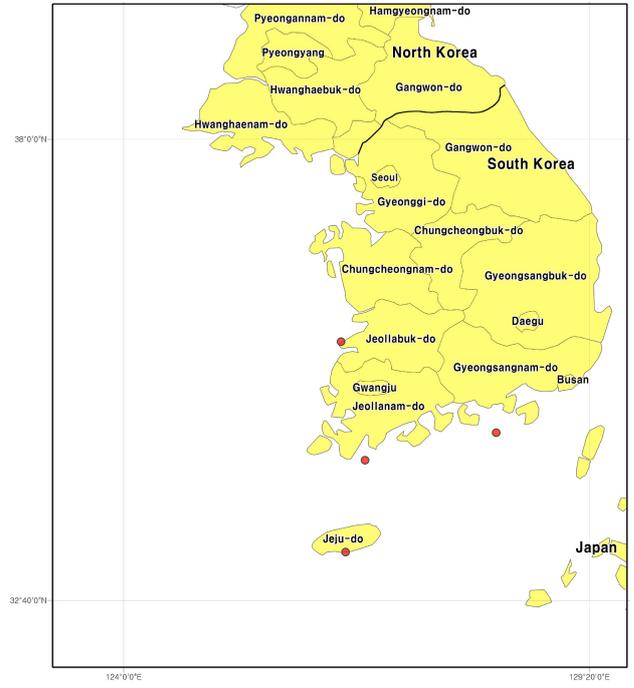
Map 11 *Corallina pilulifera*



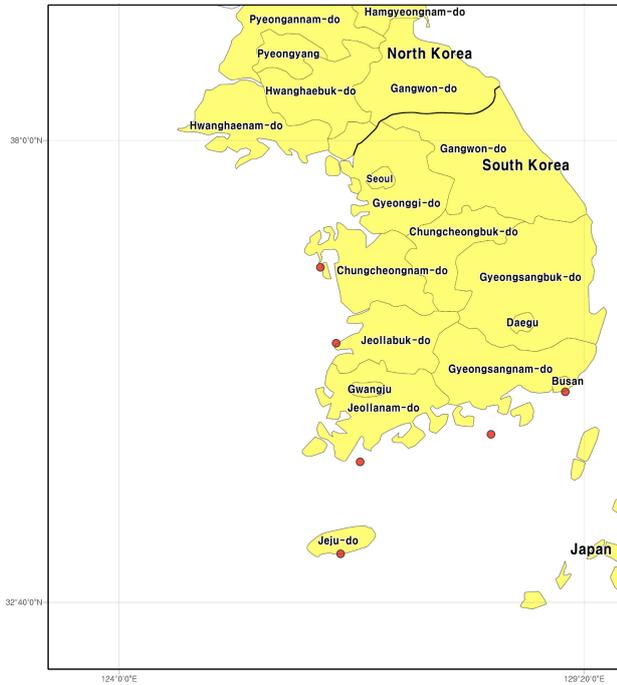
Map 12 *Gelidium amansii*



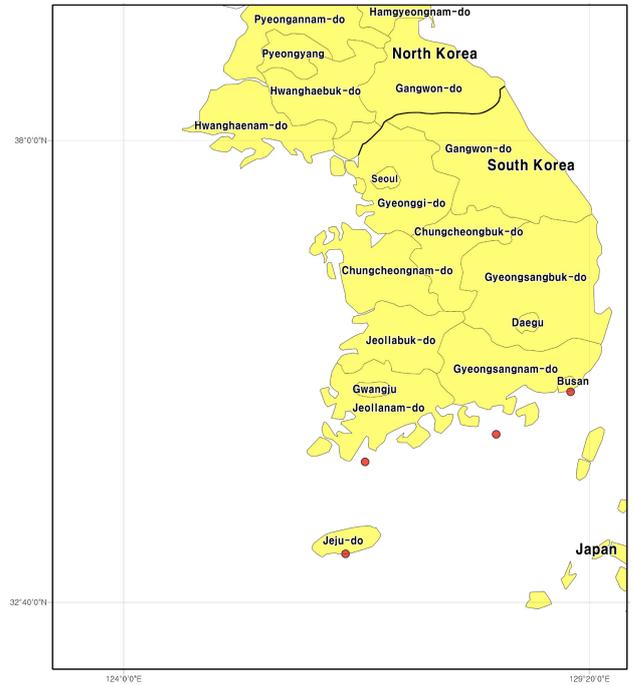
Map 13 *Gloiopeltis furcata*



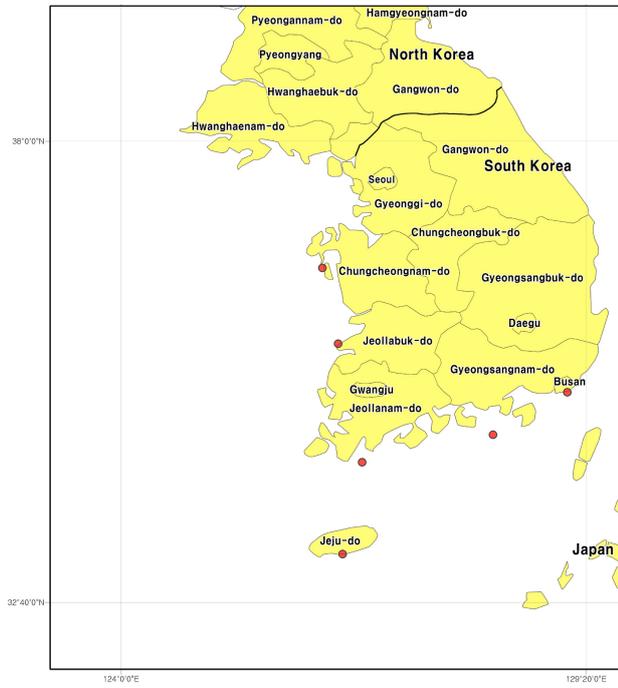
Map 14 *Gracilaria chorda*



Map 15 *Gracilaria lemaneiformis*



Map 16 *Porphyra tenera*



Map 17 *Porphyra yezoensis*