

Biological Assessment of Ecologically Important Areas for the Coastal Plant Taxonomic Group of the Yellow Sea Ecoregion

China Part

Author: LUO Yan

Position/affiliation: School of Life Sciences, Ocean University of China

Mailing address: Yushan Road 5, Qingdao, Shandong 266003, People's Republic of China

Email address: luoyan@ouc.edu.cn

1. Ecological sub-regions

Based on the floristic delineation of East Asian plants (Wu & Wu, 1996), the Eastern Asiatic Region (basically the area of east Asia) can be divided into two subregions: Sino-Himalayan and Sino-Japanese.

The Sino-Japanese Subregion can be further divided into four components, namely Central China; East China; South China; and the Yunnan, Guizhou & Guangxi area. The Yellow Sea Ecoregion (YSE) is a component of East China.

Within the YSE, there are no significant differences between coastal flora of different areas. Hence, as far as coastal plant is concerned as an indicator, the YSE cannot be divided into further into ecological sub-regions.

2. Definition of Coastal Plants

The coastal plants in this report includes both the halophytes and plants living on sand dunes.

Common Criteria for identification of Ecologically Important Areas of the Yellow Sea Ecoregion

The Coastal plant Taxonomic Group adopted the following common criteria to identify Ecologically Important Areas for Coastal Plants in the Yellow Sea Ecoregion (Table 1).

Table 1 List of Adopted Common Criteria for Coastal plant Taxonomic Group

Adopted Common Criteria	Selected Indicator Species/ Species Groups	Definition of Indicator Species	Definition of Ecologically Important Areas	Major References	Major Knowledge Gaps
Criterion 1-A: representative species of sea grass beds	<i>Zostera marina</i> <i>Ruppia maritima</i>	Dominant species or those with coverage of over 50%	Subtidal area	Zhao and Li, 1999; Zhao et al. 2002	The causes of sea grass decline are poorly known.
Criterion 1-B: Representative species of salt marshes	<i>Suaeda salsa</i> , <i>Salicornia europaea</i> , <i>Phragmites communis</i> , <i>Aeluropus litoralis</i> var. <i>sinensis</i> , <i>Scirpus triquetus</i> , <i>Scirpus mariqueter</i> , <i>Carex scabrifolia</i> , <i>Tamarix chinensis</i>	Dominant species or those with coverage of over 50%	Intertidal wetland, estuary	Chen et al., 1992, 1997; He, 1991; Jiangsu Institute of Botany, 1983; Li, 1991; Zhao and Li, 1999; Zhao et al., 2002	There are few studies about wetland vegetation in some important wetlands in China such as Laizhou Bay and Jiaozhou Bay.
Criterion 1-C: Representative species of sandy beaches	<i>Zoysia sinica</i> , <i>Carex kobomugi</i> , <i>Vitex trifolia</i> var. <i>simplicifolia</i>	Dominant species or those with coverage of over 50%	Sandy beaches	Chen et al., 1992, 1997; He, 1991; Jiangsu Institute of Botany, 1983; Li, 1991; Zhao and Li, 1999; Zhao et al., 2002	Studies about psammophytic vegetation on the coast of Liaoning Province are not available.
Criterion 2: endemism and unique species and assemblages (endemic to the Bohai/Yellow Sea/East China Sea)	<i>Scirpus mariqueter</i>	Endemic to China, commonly distributed in the Yangtze River Estuary and Hangzhou Bay	The Yangtze River Estuary	Zhang and Yong, 1992	Studies on the ecological conditions of <i>S. mariqueter</i> are needed.
Criterion 3: species richness	Not adopted	Not adopted	Not adopted		
Criterion 4: Species of special concern (threatened and/or protected species)	<i>Glycine soja</i> , <i>Glehnia littoralis</i> , <i>Rosa rugosa</i> , <i>Zoysia sinica</i>	Protected species listed in "The Red List of Chinese Plants".	Wetlands and sandy lands on the coast of the Yellow Sea	Fu, 1991	
Criterion 5-A: commercially important (Volume)	<i>Suaeda salsa</i> , <i>Phragmites communis</i>	Wide distribution, high yield	Saltmarsh on the coast of the Yellow Sea	Chen, 1999; Compiling Group of Economic Plants in Shandong, 1978; Zhao and Li, 1999; Zhao et al. 2002	Detailed statistical data of volume and economic value are not available.
Criterion 5-B: commercially important (Value)	<i>Suaeda salsa</i> , <i>Phragmites communis</i>	High economic value	Saltmarshes in the coast of the Yellow Sea	Chen, 1999; Compiling Group of Economic Plants in Shandong, 1978; Zhao and Li, 1999; Zhao et al., 2002	Detailed statistical data of volume and economic value are not available.

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

Definition of Indicator Species under Criterion 1:

Species that are dominant at different habitats on the coast of the Yellow Sea Ecoregion.

Proposed Indicator Species:

[Eelgrass] *Zostera marina* [大叶藻, Dayezao]

Reason for Selection:

The eelgrass, one of the most common sea grasses in the Yellow Sea and a representative species of submerged halophytic vegetation. It plays an important role in the shallow sea ecosystem. This plant has a wide but patchy distribution on the coast of Shandong, Hebei and Liaoning in China. It often grows in sheltered waters such as shallow inlets, bays, estuaries and saline lagoons. Eelgrass provides refuge for many species of fish and nursery areas for some marine species. Intertidal and probably shallow subtidal *Z. marina* beds provide a source of food for a variety of wildfowl, such as whooper Swan (*Cygnus cygnus*) in Shandong.

[Widgeon grass] *Ruppia maritime* [川蔓藻, Chuanmanzao]

Reason for Selection:

This species is also commonly found in the inshore areas. It is widely distributed in the shallow sea of coastal regions of China.

[Common seepweed] *Suaeda salsa* [盐地碱蓬, Yandijianpeng]

Reason for Selection:

Suaeda salsa is widely distributed in China and is an indicator plant adapted in saline soil. This species is a pioneer plant and forms single-species community in saline meadows that have 2% salinity. The *S. salsa* community is one of the breeding habitats for Saunders's gull (*Larus saundersi*) in Yancheng Nature Reserve of Jiangsu province in China (Jiang, 2002).

[Glasswort] *Salicornia europaea* [海蓬子, Haipengzi]

Reason for Selection:

Glasswort is common in salt marshes, beach dunes, and salt flats along the north coast of China. This typical saltmarsh plant is not shade-tolerant and requires dry or moist soil. It can tolerate maritime exposure.

[China Aeluropus] *Aeluropus littoralis* var. *sinensis* [獐茅 Zhangmao]

Reason for Selection:

Aeluropus littoralis var. *sinensis* is a dominant species in halophytic meadows (Zhao et al., 2002). It is adapted to saline soil with relatively lower salinity (0.6%-1.0%). The *A. littoralis* var. *sinensis* community is one of breeding habitats for Saunders's Gull (*Larus saundersi*) in Yancheng Nature Reserve of Jiangsu province in China (Jiang, 2002).

[Common reed] *Phragmites communis* [芦苇, Luwei]

Reason for Selection:

The common reed is widely distributed in fresh and brackish marshes and ditches. *Phragmites* is a colonial plant; it can be spread by rhizomes (underground stems) and is capable of forming large stands or colonies through one or a few seeds or individuals. The species often forms monospecific (one species) strands in brackish water and disturbed areas. The common reed plays an important role in ecosystems by being able to clear water from pollutants including heavy metals and sewage-related wastes.

[Tamarisk] *Tamarix chinensis* [柽柳, Chengliu]

Reason for Selection:

Although it occasionally grows with a defined trunk as a tree, tamarisk generally grows as a multiple-stemmed shrub. It is a dominant species in halophytic scrub in northern China. Tamarisk grows in generally moist sites at streams, sandy floodplains and along riverbanks. It can tolerate saline soils and also contributes to the salinization of the soils in which it grows. Tamarisk forms dense strands in the Yellow River Delta.

[Common bulrush] *Scirpus triqueter* [三棱藨草, Sanlengbiaocao]

Reason for Selection:

Scirpus triqueter is dominant in tidal mudflats. Habitats where *S. triqueter* is dominant or relatively important are estuarine intertidal zones and emergent wetlands. The species is important as a food source of waterfowl and other wildlife.

[Sea-bulrush] *Scirpus mariqueter* [海三棱藨草, Haisanlengbiaocao]

Reason for Selection:

Scirpus mariqueter is a pioneer plant growing in brackish shallow waters with low elevations from the mouth of Yangtze River to Hangzhou Bay. The species often forms dense pure stands. It has a high capacity for tolerating tidal disturbances and produces relatively large achenes and carbohydrate-rich corms, which are well-known waterfowl foods. *Scirpus* marshes are valued as nurseries for juvenile fish and shellfish; the marshes also help to purify water. Other functions of the marshes include shoreline stabilization and accumulation of sediments.

[Scabrous-leafed sedge] *Carex scabrifolia* [糙叶苔草, Caoyetaicao]

Reason for Selection:

Carex scabrifolia is widely distributed in brackish marshes and ditches. It is a dominant salt marsh plant inhabiting beaches and coastal areas often in company with *Phragmites* community.

[China lawngrass] *Zoysia sinica* [中华结缕草, Zhonghuajielucao]

Reason for Selection:

Zoysia sinica mainly grows in saline fields along the coast. As a kind of lawn grass with the characteristic of salt tolerance, the species is commonly used as lawn grass in coastal cities. Its communities are mainly distributed in coastal areas with altitudes ranging from 2 to 40 m and its degree of coverage is between 60-90 percent.

***Carex kobomugi* [砂钻苔草, Shazuantaiacao]**

Reason for Selection:

Carex kobomugi is a species characteristic of sand dunes all around China. It grows in coastal regions, mostly in fixed and semi-fixed dunes. Its aerial shoots grow up to about 10 inches in height and arise from a horizontal rhizome, which can spread over considerable distances below the surface of the sand. This plant can help bind loose sand.

[Simple-leafed shrub chastetree] *Vitex trifolia* var. *simplicifolia* [单叶蔓荆, Danyemanjing]

Reason for Selection:

Simple-leafed shrub chastetree is a tree vine shrub that grows in coastal sand dunes. It is a dominant species in psammophytic vegetation. This plant can withstand a moderate amount of salt and windblast. Due to its sprawling growth habit and sand-binding ability, *Vitex trifolia* is a useful sand-stabilizing species.

Definition of EIAS for this species:

Major distribution areas of these species are ecologically important areas.

Selected Indicator Species under Criterion 2: Endemism and unique species assemblages (endemic to Bohai/ Yellow Sea / East China Sea)

Definition of Indicator Species under Criterion 2:

Species that are endemic to the Bohai, Yellow, and East China Seas were selected as indicator species.

Proposed Indicator Species:

[Sea-bulrush] *Scirpus mariqueter* [海三稜蘆草, Haisanlengbiaocao]

Reason for Selection:

Scirpus mariqueter only exists in China and is mainly distributed in the Yangtze River Estuary and the north bank of Hangzhou Bay (Zhang and Yong, 1992; Yuan et al., 2002). It is one of the most common plants in tidal wetlands and is a primary colonizer.

Definition of EIAS for this species:

Major distribution areas of these species are ecologically important areas.

Selected Indicator Species under Criterion 4: Species of Special concern (threatened and/or protected spp.)

Definition of Indicator Species under Criterion 4:

Species that significantly decreased in population number and size, and are listed in "The Red List of Chinese Plants" were selected as Indicator Species.

Proposed Indicator Species:

[Coralgreens] *Glehnia littoralis* [珊瑚菜, Shanhucai]

Reason for Selection:

Glehnia littoralis grows on sandy beaches and is distributed mainly in Liaoning, Shandong and Jiangsu provinces of China but is also found in Japan and Korea. The root of this species is used to treat cough and other throat ailments. It is very important for sand fixation along the coast and the amelioration of saline-alkali soil. The natural populations are very small and vulnerable to disturbances. It has been over-collected in China for medicinal use. It was a dominant species in sandy beaches of China in the past, but is now only found in a few sandy beaches on the coast of the Yellow Sea. Both the number of natural populations and the size of the distribution area of this species are decreasing, and it is likely to become endangered or even extinct unless appropriate protective measures are taken. Its level of danger is second in the Chinese Red Book.

[Wild soybean] *Glycine soja* [野大豆, Yedadou]

Reason for Selection:

Wild soybean is regarded as the wild progenitor of the domesticated soybean (*Glycine. max*). It is mainly distributed in north China and adjacent countries and regions. This plant often grows in wetlands along rivers. Since it is a highly nutritious forage crop, it is a favorite of cattle, sheep and horses. It has been seriously threatened by habitat changes caused by intensive agriculture. It is a second level endangered species in the Chinese Red Book.

[Rose] *Rosa rugosa* [玫瑰, Meigui]

Reason for Selection:

Rose is of great horticultural interest for its large, elegant and fragrant flowers. Native populations mainly grow in sand dunes along the coast of Liaoning and Shandong provinces in China and are valued as a gene-pool for developing new varieties. The essential oil drawn from the flower is of medicinal value for the treatment of stasis. However, most wild plants have disappeared due to habitat destruction by local inhabitants. The populations of this species have been dwindling and the area of

distribution has been continuously shrinking. It is a second level endangered species in the Chinese Red Book.

Selected Indicator Species under Criterion 5: Species of commercial importance

Definition of Indicator Species under Criterion 5:

Species that have economic value or potential value as food, fodder and oil are selected as Indicator Species.

Proposed Indicator Species:

[Common seepweed] *Suaeda salsa* [盐地碱蓬, Yandijianpeng]

Reason for Selection:

Suaeda salsa grows in alkaline soil. It has high ecological and commercial value. Studies have shown that Conjugated Linoleic Acid (CLA), an ingredient of its seed oil, is a potent antioxidant, anti-carcinogen and anti-catabolite as well as a powerful immune system enhancer. In the late spring, local people collect this plant for self-consumption and trade purposes. Recent research indicates that this plant could continue to gain popularity in the market as a health food (Compiling Group of Economic Plants in Shandong, 1978; Chen et al. 1999; Zhao, 2004).

[Common reed] *Phragmites communis* [芦苇, Luwei]

Reason for Selection:

The common reed is used in many ways all over the world. In China today and in the past, *Phragmites* has been harvested for making houses, thatched roofs, boats and paper. In the household, it could be seen in the forms of mats, baskets and curtains. It is also collected as food and medicine (Compiling Group of Economic Plants in Shandong, 1978; Chen et al. 1999).

Table 2. List of Selected Indicator Species

Adopted Common Criteria Selected Indicator Species	Criterion 1: Representative species/ habitat types	Criterion 2: Endemism and unique species assemblages (endemic to Bohai/ Yellow Sea / East China Sea)	Criterion 4: Species of special concern (threatened and/or protected species)	Criterion 5: commercial importance
<i>Zostera marina</i>	X			
<i>Ruppia maritime</i>	X			
<i>Suaeda salsa</i>	X			X
<i>Salicornia europaea</i>	X			
<i>Aeluropus littoralis</i> var. <i>sinensis</i>	X			
<i>Phragmites communis</i>	X			X
<i>Tamarix chinensis</i>	X			
<i>Scirpus triqueter</i>	X			
<i>Scirpus mariqueter</i>	X	X		
<i>Carex scabrifolia</i>	X			
<i>Zoysia sinica</i>	X		X	
<i>Carex kobomugi</i>	X			
<i>Vitex trifolia</i> var. <i>simplicifolia</i>	X			
<i>Glehnia littoralis</i>			X	
<i>Glycine soja</i>			X	
<i>Rosa rugosa</i>			X	

Maps and Description of Ecologically Important Areas for Coastal Plants Taxonomic Group

Table 3. List of Maps and Area Names for Coastal Plants Ecologically Important Areas

Map Number	Indicator Species	Coastal Plant Ecologically Important Areas				
Map 1	<i>Zostera marina</i> , <i>Ruppia maritima</i>	Laizhou Bay	Rongcheng Beach			
Map 2	<i>Suaeda salsa</i>	The Mouth of the Yalujiang River	The Liaohe River Delta	The Yellow River Delta	Beach areas in Yancheng City	
Map 3	<i>Salicornia europaea</i>	The Yellow River Delta	Beach areas in Yancheng City			
Map 4	<i>Aeluropus littoralis</i> var. <i>sinensis</i>	The Liaohe River Delta	The Yellow River Delta	Beach areas in Yancheng City		
Map 5	<i>Phragmites communis</i>	The Mouth of the Yalujiang River	The Liaohe River Delta	Nadagang Marsh Area	The Yellow River Delta	Beach areas in Yancheng City
Map 6	<i>Tamarix chinensis</i>	The Liaohe River Delta	The Yellow River Delta			
Map 7	<i>Scirpus triquetra</i>	The Yellow River Delta	Beach areas in Yancheng City	The Yangtze River Estuary		
Map 8	<i>Scirpus mariquetra</i>	The Yangtze River Estuary				
Map 9	<i>Carex scabrifolia</i>	The Mouth of the Yalujiang River	The Yellow River Delta	Beach areas in Yancheng City	The Yangtze River Estuary	
Map 10	<i>Zoysia sinica</i>	The Liaohe River Delta	Jiaozhou Bay			
Map 11	<i>Carex kobomugi</i>	Sand Beaches in Qinhuangdao City	The east coast of Laizhou Bay	Haizhou Bay		
Map 12	<i>Vitex trifolia</i> var. <i>simplicifolia</i>	Sand Beaches in Qinhuangdao City	The east coast of Laizhou Bay	Haizhou Bay		
Map 13	<i>Glehnia littoralis</i>	Sand Beaches in Qinhuangdao City	The east coast of Laizhou Bay	Haizhou Bay		
Map 14	<i>Glycine soja</i>	The Liaohe River Delta	The Yellow River Delta	Beach areas in Yancheng City		
Map 15	<i>Rosa rugosa</i>	The Mouth of the Yalujiang River	The Changhai Islands	Coasts of the Jiaodong Peninsula		

Plants Ecologically Important Area (PEIA) by Species

PEIA for *Zostera marina* [eelgrass] and *Ruppia maritima* [Widgeon grass] (Map 1)

Area Name: Laizhou Bay and Rongcheng Beach

Laizhou Bay

Location (city, province, country nearest to the area, geographical coordinates):
Weifang City and Yantai City, Shandong Province, China, 37°39'-37°41'N, 119°16'-120°13'E

Rongcheng Beach

Location (city, province, country nearest to the area, geographical coordinates):
Rongcheng County, Shandong Province, China, 37°25'N, 122°20'-122°40'E

Description of Area:

Laizhou Bay and Rongcheng Beach are Important Areas because they are where eelgrass is distributed. Eelgrass has been on the decline since 1940 and more than one third of the original eelgrass beds around the Yellow Sea have been lost (Zhao and Li, 1999; Zhao et al. 2002). There are some small natural populations of eelgrass distributed in Laizhou Bay and Rongcheng Beach.

Knowledge gaps and specific studies needed: The importance of eelgrass to coastal ecosystems has been neglected in China. The cause of the decline of eelgrass is poorly known.

PEIA for *Suaeda salsa* [common seepweed] (Map 2)

Area Name: The Mouth of the Yalujiang River, the Liaohe River Delta, the Yellow River Delta and Beaches in Yancheng City

The Mouth of the Yalujiang River

Location (city, province, country nearest to the area, geographical coordinates):
Donggang City, Liaoning Province, China, 39°40'N, 123°10'E

The Liaohe River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Jinzhou City, Panjin City and Yingkou City, Liaoning Province, China, 40°52'N, 121°1'35'E

The Yellow River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Dongying City, Shandong Province, China, 37°35'-38°12'N, 118°33'-119°20'E

Beaches in Yancheng City

Location (city, province, country nearest to the area, geographical coordinates):
Yancheng City, Jiangsu Province, China, 32°20'-34°37'N, 119°29'-121°1'16'E

Description of Area: The Mouth of the Yalujiang River, the Liaohe River Delta, the Yellow River Delta and Beaches in Yancheng City are important because there are large numbers of *S. salsa* communities with little human disturbance distributed in these places (Li, 1993; Li et al., 1998; Yang et al., 1998; Yu, 1999).

Knowledge gaps and specific studies needed: detailed statistical data of volume and economic value are not available. Strategy on sustainable exploitation is needed.

PEIA for *Salicornia europaea* [Glasswort] (Map 3)

Area Name: The Yellow River Delta and Beaches in Yancheng City

The Yellow River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Dongying City, Shandong Province, 37°35'-38°12'N, 118°33'-119°20'E

Beaches in Yancheng City

Location (city, province, country nearest to the area, geographical coordinates):
Yancheng City, Jiangsu Province, China, 32°20'-34°37'N, 119°29'-121°16'E

Description of Area: The Yellow River Delta and Beaches in Yancheng City are important because there are large numbers of *S. europaea* communities with little human disturbance distributed in these places (Li, 1993; Tang et al., 1997; Li et al. 1998; Shao et al., 2002).

Knowledge gaps and specific studies needed: Detailed statistical data on volume and economic value are not available. Strategy on sustainable exploitation is needed.

PEIA for *Aeluropus littoralis* var. *sinensis* [China *Aeluropus*] (Map 4)

Area Name: The Liaohe River Delta, the Yellow River Delta and Beaches in Yancheng City

The Liaohe River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Jinzhou City, Panjin City and Yingkou City, Liaoning Province, China, 40°52'N, 121°135'E

The Yellow River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Dongying City, Shandong Province, China, 37°35'-38°12'N, 118°33'-119°20'E

Beaches in Yancheng City

Location (city, province, country nearest to the area, geographical coordinates):
Yancheng City, Jiangsu Province, China, 32°20'-34°37'N, 119°29'-121°16'E

Description of Area: The Liaohe River Delta, the Yellow River Delta and Beaches in Yancheng City are important because there are large numbers of *A. littoralis* var. *sinensis* communities with little human disturbance distributed in these places (Li, 1993; Dong et al., 1995; Li et al., 1998; Yang et al., 1998).

Knowledge gaps and specific studies needed: There are few studies on wetland vegetation in some important wetlands in China, such as Laizhou Bay, Jiaozhou Bay.

PEIA for *Phragmites communis* [common reed] (Map 5)

Area Name: The Mouth of the Yalujiang River, the Liaohe River Delta, Nandagang Marsh Area, the Yellow River Delta and Beaches in Yancheng City

The mouth of the Yalujiang River

Location (city, province, country nearest to the area, geographical coordinates):
Donggang City, Liaoning Province, China, 39°40'N, 123°10'E

The Liaohe River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Jinzhou City, Panjin City and Yingkou City, Liaoning Province, China, 40°52'N, 121°35'E

Nandagang Marsh Area

Location (city, province, country nearest to the area, geographical coordinates):
Cangzhou City, Hebei Province, China, 38°30'N, 117°30'E

The Yellow River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Dongying City, Shandong Province, China, 37°35'-38°12'N, 118°33'-119°20'E

Beaches in Yancheng City

Location (city, province, country nearest to the area, geographical coordinates):
Yancheng City, Jiangsu Province, 32°20'-34°37'N, 119°29'-121°16'E

Description of Area: The mouth of the Yalujiang River, the Liaohe River Delta, Nandagang Marsh Area, the Yellow River Delta and Beaches in Yancheng City are important because there are large numbers of *Phragmites communis* communities with 80-90% coverage distributed in these places (Li, 1993; Dong et al., 1995; Li et al., 1998; Tang et al., 1997; Yang et al., 1998; Yu et al., 1999; Shao et al., 2002; Yuan et al., 2002; Zhao et al., 2003). The 100,000 ha reed marsh in Panjing City along the Liaohe River is the second largest of its kind in the world (Dong et al., 1995).

PEIA for *Tamarix chinensis* [Tamarisk] (Map 6)

Area Name: The Liaohe River Delta and the Yellow River Delta

The Liaohe River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Jinzhou City, Panjin City and Yingkou City, Liaoning Province, 40°52'N, 121°35'E

The Yellow River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Dongying City, Shandong Province, China, 37°35'-38°12'N, 118°33'-119°20'E

Description of Area: The Liaohe River Delta and the Yellow River Delta are important because there are large numbers of *T. chinensis* communities distributed in these places (Li, 1993; Dong et al., 1995; Yang et al., 1998; Shao et al., 2002).

Knowledge gaps and specific studies needed: Studies about ecological and physiological adaptations of *T. chinensis* community are needed.

PEIA for *Scirpus triqueter* [common bulrush] (Map 7)

Area Name: The Yellow River Delta, Beaches in Yancheng City, and the Yangtze River Estuary

The Yellow River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Dongying City, Shandong Province, China, 37°35'-38°12'N, 118°33'-119°20'E

Beaches in Yancheng City

Location (city, province, country nearest to the area, geographical coordinates):
Yancheng City, Jiangsu Province, China, 32°20'-34°37'N, 119°29'-121°16'E

The Yangtze River Estuary

Location (city, province, country nearest to the area, geographical coordinates):
Shanghai City, China, 31°05'-31°30'N, 121°45'-122°00'E

Description of Area: The Yellow River Delta, Beaches in Yancheng City and the Yangtze River Estuary are important because there are large numbers of *S. triqueter* communities with little human disturbance distributed in these places (Li, 1993; Tang et al., 1997; You, 1997; Li et al., 1998; Shao et al., 2002; Yuan et al., 2002; Zuo et al., 2003).

Knowledge gaps and specific studies needed: Studies about the ecological function of the *S. triqueter* community are needed.

PEIA for *Scirpus mariqueter* (Map 8)

Area Name: The Yangtze River Estuary

Location (city, province, country nearest to the area, geographical coordinates):
Shanghai City, China, 31°05'-31°30'N, 121°45'-122°00'E

Description of Area: The Yangtze River Estuary is an Ecologically Important Area because there are large numbers of *S. mariqueter* communities with little human disturbance distributed in this place (Zhang and Yong,

1992; Yuan et al., 2002).

PEIA for *Carex scabrifolia* (Map 9)

Area Name: The Mouth of the Yalujiang River, the Yellow River Delta, Beaches in Yancheng City, and the Yangtze River Estuary

The Yalujiang River

Location (city, province, country nearest to the area, geographical coordinates):
Donggang City, Liaoning Province, China, 39°40'N, 123°10'E

The Yellow River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Dongying City, Shandong Province, China, 37°35'-38°12'N, 118°33'-119°20'E

Beaches in Yancheng City

Location (city, province, country nearest to the area, geographical coordinates):
Yancheng City, Jiangsu Province, China, 32°20'-34°37'N, 119°29'-121°16'E

The Yangtze River Estuary

Location (city, province, country nearest to the area, geographical coordinates):
Shanghai City, China, 31°05'-31°30'N, 121°45'-122°00'E

Description of Area: The Mouth of the Yalujiang River, the Yellow River Delta, Beaches in Yancheng City, and the Yangtze River Estuary are important because there are large numbers of *C. scabrifolia* communities with little human disturbance distributed in these places (Li, 1993; Tang et al., 1997; You, 1997; Li et al., 1998; Yu et al., 1999; Shao et al., 2002; Yuan et al., 2002; Zuo et al., 2003).

Knowledge gaps and specific studies needed: Studies on ecological function of *C. scabrifolia* community are needed.

PEIA for *Zoysia sinica* [China lawngrass] (Map 10)

Area Name: The Liaohe River Delta and Jiaozhou Bay

The Liaohe River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Jinzhou City, Panjin City and Yingkou City, Liaoning Province, China, 40°52'N, 121°35'E

Jiaozhou Bay

Qingdao City, Shandong Province, China, 36°00'-36°02'N, 120°16'-120°17'E

Description of Area: The Liaohe River Delta and Jiaozhou Bay, are Ecologically Important Areas because there are some natural *Z. sinica* communities distributed in these places (Li, 1991; Chen et al., 1992; Wang, 2001).

Knowledge gaps and specific studies needed: Studies about the natural community inhabited by *Zoysia sinica* are needed.

PEIA for *Carex kobomugi* (Map 11)

Area Name: Sand Beaches in Qinhuangdao City, The east coast of Laizhou Bay, and Haizhou Bay

Sand Beaches in Qinhuangdao City

Location (city, province, country nearest to the area, geographical coordinates):
Qinhuangdao City, Hebei Province, China, 39°32'-40°37'N, 119°37'E

The East Coast of Laizhou Bay

Location (city, province, country nearest to the area, geographical coordinates):

Yantai City, Shandong Province, China, 37°26'-38°23'N, 119°34'-121°09'E

Haizhou Bay

Location (city, province, country nearest to the area, geographical coordinates):

Rizhao City, Shandong Province and Lianyungang City, Jiangsu Province, China, 35°05'-35°45'N, 119°21'-119°29'E

Description of Area: Sand Beaches in Qinhuangdao City, The east coast of Laizhou Bay and Haizhou Bay are important because there are large numbers of *C. kobomugi* communities distributed in these places (Hou, 1953; Xu, 1991; Liu, 1992).

Knowledge gaps and specific studies needed: Studies about psammophytic vegetations on coasts of Liaoning Province are not available.

PEIA for *Vitex trifolia* var. *simplicifolia* [simple-leafed shrub chastetree] (Map 12)

Area Name: Sandy Beaches in Qinhuangdao City, The east coast of Laizhou Bay, and Haizhou Bay

Qinhuangdao City

Location (city, province, country nearest to the area, geographical coordinates):

Qinhuangdao City, Hebei Province, China, 39°32'-40°37'N, 119°37'E

The east coast of Laizhou Bay Location (city, province, country nearest to the area, geographical coordinates):

Yantai City, Shandong Province, China, 37°26'-38°23'N, 119°34'-121°09'E

Haizhou Bay

Location (city, province, country nearest to the area, geographical coordinates):

Rizhao City, Shandong Province, China, 35°05'-35°45'N, 119°21'-119°29'E

Description of Area: Sand Beaches in Qinhuangdao City, the east coast of Laizhou Bay and Haizhou Bay are Ecologically Important Areas because there are large numbers of *V. trifolia* var. *simplicifolia* communities distributed in these places (Hou, 1953; Xu, 1991; Liu, 1992).

Knowledge gaps and specific studies needed: Studies about psammophytic vegetations on coasts of Liaoning Province are not available.

Coastal Plants Ecologically Important Area for *Glehnia littoralis* [Coralgreens] (Map 13)

Area Name: Sand Beaches in Qinhuangdao City, the East Coast of Laizhou Bay, and Haizhou Bay

Qinhuangdao City

Location (city, province, country nearest to the area, geographical coordinates):

Qinhuangdao City, Hebei Province, China, 39°32'-40°37'N, 119°37'E

The east coast of Laizhou Bay

Location (city, province, country nearest to the area, geographical coordinates):

Yantai City, Shandong Province, China, 37°26'-38°23'N, 119°34'-121°09'E

Haizhou Bay

Location (city, province, country nearest to the area, geographical coordinates):

Rizhao City, Shandong Province and Lianyungang City, Jiangsu Province, China, 35°05'-35°45'N, 119°21'-119°29'E

Description of Area: Sand Beaches in Qinhuangdao City, the east coast of Laizhou Bay and Haizhou Bay are important because there are large numbers of *Glehnia littoralis* communities distributed here (Hou, 1953; Xu, 1991; Liu, 1992).

Knowledge gaps and specific studies needed: The importance of *G. littoralis* to coastal ecosystems has

been neglected in China. An effective strategy to protect this plant should be provided.

PEIA for *Glycine soja* (wild soybean) (Map 14)

Area Name: The Liaohe River Delta, the Yellow River Delta, and Beaches in Yancheng City

The Liaohe River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Jinzhou City, Panjin City and Yingkou City, Liaoning Province, China, 40°52'N, 121°35'E

The Yellow River Delta

Location (city, province, country nearest to the area, geographical coordinates):
Dongying City, Shandong Province, China, 37°35'-38°12'N, 118°33'-119°20'E

Beaches in Yancheng City

Location (city, province, country nearest to the area, geographical coordinates):
Yancheng City, Jiangsu Province, China, 32°20'-34°37'N, 119°29'-121°16'E

Description of Area: The Liaohe River Delta, the Yellow River Delta, and Beaches in Yancheng City are important because there are large numbers of *Glycine soja* with little human disturbance distributed in these places (Li, 1993; Dong et al., 1995; Li et al., 1998; Yang et al., 1998).

PEIA for *Rosa rugosa* (rose) (Map 15)

Area Name: The mouth of the Yalujiang River, the Changhai Islands and the Coasts of the Jiaodong Peninsula

The mouth of the Yalujiang River

Location (city, province, country nearest to the area, geographical coordinates):
Donggang City, Liaoning Province, China, 39°40'N, 123°10'E

The Changhai Islands

Location (city, province, country nearest to the area, geographical coordinates):
Changhai County, Liaoning Province, China, 39°07'-39°52'N, 122°07'-123°17'E

Location (city, province, country nearest to the area, geographical coordinates):
Yantai and Weihai City, Shandong Province, China, 37°29'-37°38'N, 120°15'-121°11'E

Description of Area: The Mouth of the Yalujiang River, the Changhai Islands, and the Coasts of Jiaodong Peninsula are important because there are large numbers of wild *R. rugosa* communities with little human disturbance distributed in these places (Qin et al., 1994).

Knowledge Gaps and specific studies needed for Coastal Plants.

In addition to the knowledge gaps specific to indicator species, there is a knowledge gap about the importance of coastal plants to coastal ecosystems at the ecosystem level. Regulations on biodiversity and protection of coastal vegetation should be enforced.

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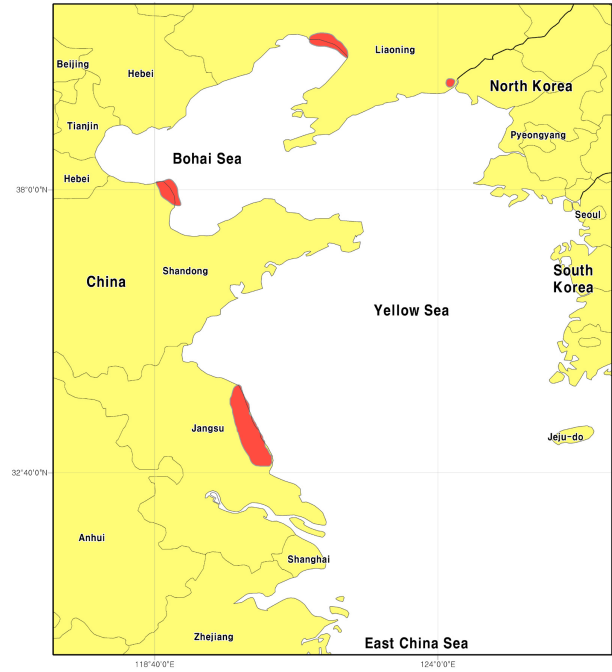
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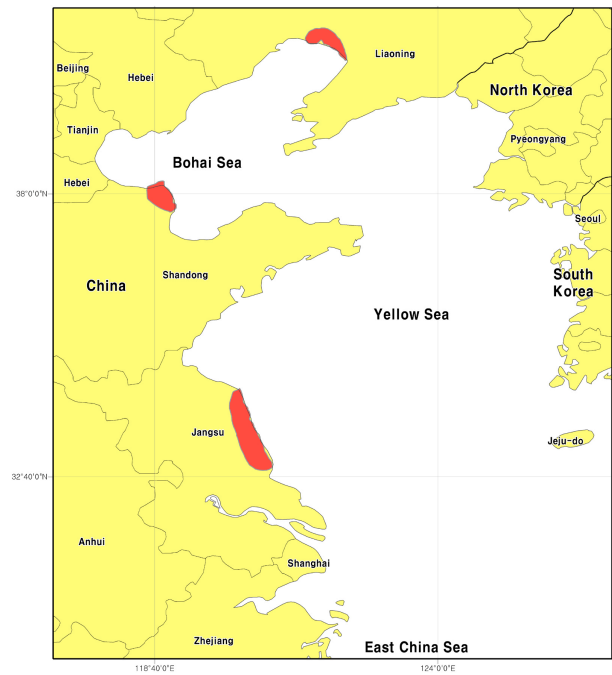
Map 1 *Zostera marina*, *Ruppia maritima*



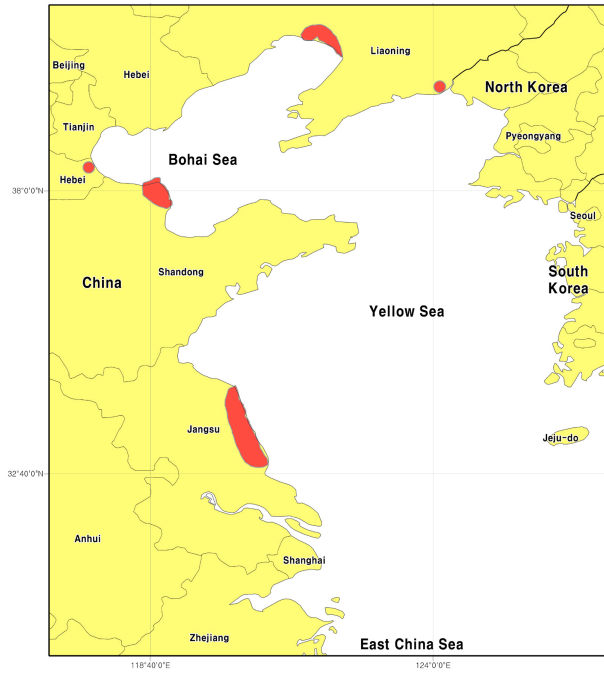
Map 2 *Suaeda salsa*



Map 3 *Salicornia europaea*



Map 4 *Aeluropus littoralis* var. *sinensis*



Map 5 *Phragmites communis*



Map 6 *Tamarix chinensis*



Map 7 *Scirpus triqueter*



Map 8 *Scirpus mariqueter*



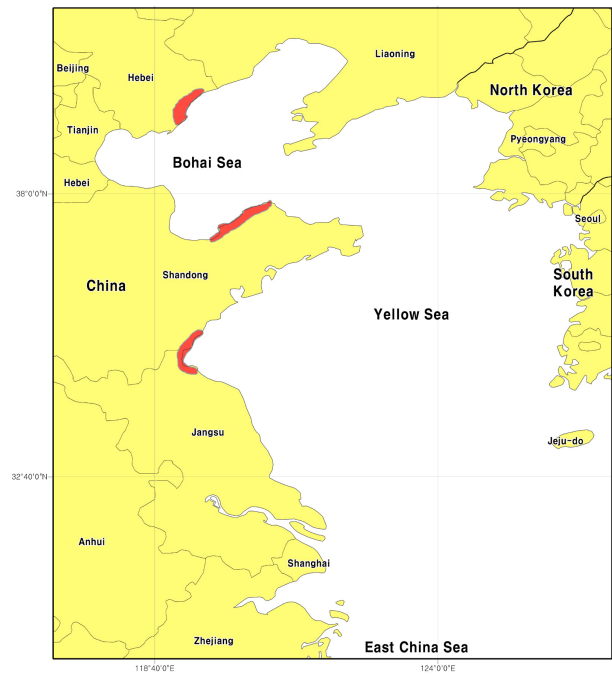
Map 9 *Carex scabrifolia*



Map 10 *Zoysia sinica*



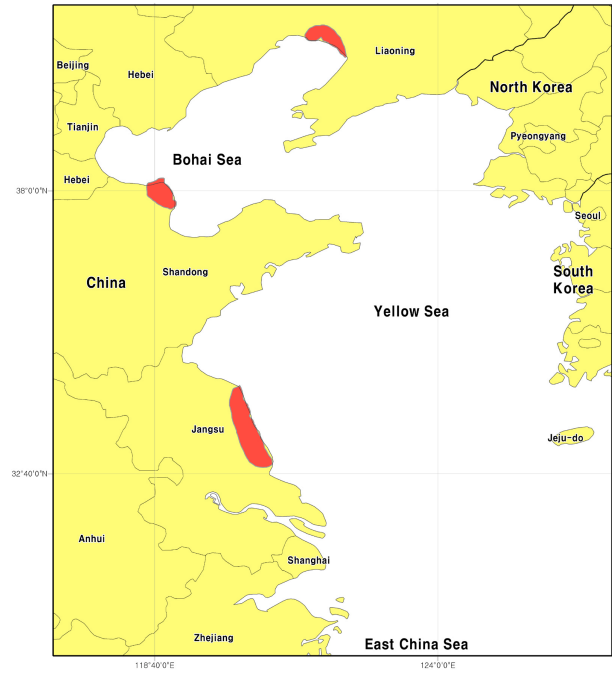
Map 11 *Carex kobomugi*



Map 12 *Vitex trifolia* var. *simplicifolia*



Map 13 *Glehnia littoralis*



Map 14 *Glycine soja*



Map 15 *Rosa rugosa*