Globally Significant Algae in the Yellow Sea Ecoregion

A table of algae indicator species and their global significance

Indicator Species	Criteria for habitat and vulnerable species of global significance		
Scientific names	Criterion 1: Endemism	Criterion 2: Vulnerable Species	Criterion 3:Commercially Important Species
Laminaria japonica			C K
Sargassum qingdaoense	C		
Undaria pinnatifida			C K
Silvetia siliquosa (Pelvetia siliquosa)	C K	C K	
Hizikia fusiformis	K	C	K
Porphyra yezoensis			C K
Porphyra katadae var. hemiphylla	C		
Porphyra oligospermatangia	C		
Porphyra tenera		C	
Gracilaria lemaneiformis (Gracilaria verrucosa)			C
Gracilaria chorda	K		
Tsengiella spinulosa	C		
Tsengia nakamurae	C		
Solieria tenuis	C		
Caulerpa okamurae	K		Kva
Ishige okamurae	K		
Chondrus ocellatus			Kva
Gelidium amansii			Kva

Notes to the table

Each indicator species were assessed against Criterion 1, 2 and 3. When an indicator species meets Criterion 1 according to data available in China, then it is indicated by C (China).

Note 1 In Criterion 1,2 and 3 columns, C indicates that the criterion is applicable to the corresponding species according to data from China, K: South Korea.

Note 2 Kva indicates that the corresponding species is commercially important by value in South Korea

Note 3 From biodiversity conservation point of view, Laminaria japonica is NOT a globally significant species where it is an introduced species such as in China.

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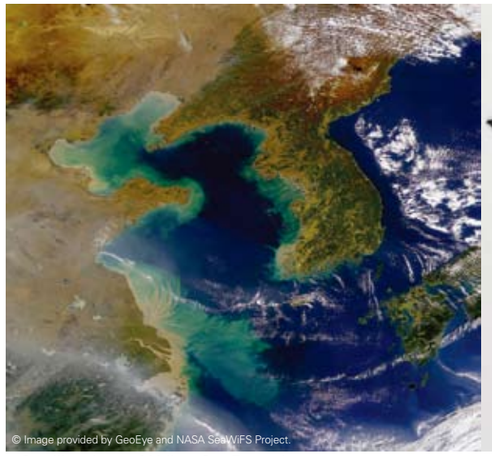
Laminaria japonica

Porphyra katadai var hemiphylla

Porphyra tenera

Undaria pinnatifida

Algae of the Yellow Sea Ecoregion and their habitats



Satellite photo of Yellow Sea Ecoregion

Silvetia siliquosa - a seaweed unique to the Yellow Sea Ecoregion

Algae and the Yellow Sea Ecoregion

About the area

The Yellow Sea Ecoregion is one of the world's largest areas of continental shelf. The Yellow Sea Ecoregion encompasses the Bohai Sea, the Yellow Sea and the East China Sea. It is a transboundary area, and extends from the coastlines of China, North Korea, and South Korea to a depth of 200m.

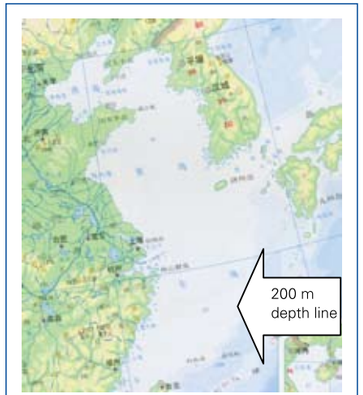
Valuable nutrients flow from the Yangtze and Yellow rivers and combine with sunlight and shallow waters to create an area that teems with abundant marine life.

Diversity of algae

Algae or seaweed are divided into a number of subgroups. Red algae, or Rhodophyta, are red or purple and most of the world's seaweeds belong to this group. The Brown algae (Phaeophyta) group also contains many familiar types of seaweed such as kelp. Green algae are the most advanced group. In addition, there are Dinoflagellata and Chrysophyta groups of algae that are mostly single-cell and small algae species.

In the tidal zone of the northern Shandong Peninsula in China, 42 species of red algae, 22 species of brown algae, and 11 species of green algae have been recorded. In the southern Yellow Sea, there are 84 algae species, including 15 species of green algae, 15 species of brown algae, and 28 species of red algae. Among phytoplankton (plant plankton) in the Bohai Sea and the Yellow Sea, Bacillariophyta group, which is a subgroup of Chrysophyta, is the largest group with 308 species.

In South Korea, a total of 395 species of algae have been identified, which consist of 43 species of blue-green algae, 45 species of green algae, 90 species of brown algae, and 217 species of red algae species. Among phytoplankton groups, Bacillariophyta had highest number of species (312 species).



Geography of Yellow Sea Ecoregion

What is an ecoregion?

Biodiversity is not spread evenly across the Earth but follows complex patterns determined by climate, geology and the evolutionary history of the planet. These patterns are called ecoregions. WWF defines an ecoregion as a large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions. The boundaries of an ecoregion are not fixed and sharp, but rather encompass an area within which important ecological and evolutionary processes most strongly interact.

Algae and People

There is a long history of using algae in the region. People collect algae for food and recently some species of seaweeds are being used for industrial and medicinal materials such alginates. Algae are harvested from natural habitat as well as from aquaculture.

Aquaculture of algae has become an economically important industry both in China and South Korea. In China, *Laminaria* (Japanese kelp) and *Porphyra* (Laver or Nori) are main cultured species and the production of these species account for about 66% of total algae production in China. In South Korea, *Sargassum*, *Porphyra* and *Undaria* (Wakame) species are important crops; the annual production of seaweeds in the Yellow Sea coast in South Korea had a value of US$ 165 million in 1996.

Seeweed aquaculture in South Korea

Threats to Algae

Some species such as *Silvetia siliquosa* has reduced its distribution due to water pollution. Construction of dams in estuaries has impacted culture of nori seaweed because of reduction in nitrogen and big changes in salinity. Over-harvesting has also affected some algae species.

The Yellow Sea Ecoregion - a Global Treasure, a Global Concern

Global Treasure

The Yellow Sea Ecoregion (203) has been selected by WWF as one of the Global 200 ecoregions, areas that are key to global biodiversity conservation. This marine ecosystem is also one of the Large Marine Ecosystems (LME) of the world.

Global Concern

The global importance of the Yellow Sea Ecoregion has been recognised by governments and the international community in recent years. Starting in 1992, the Chinese and South Korean governments together developed a transboundary approach to the management of the Yellow Sea area with the assistance of UNDP, UNEP, the World Bank, and NOAA. In 2005, a UNDP/GEF project, the Yellow Sea Large Marine Ecosystem project, was officially launched with participation of the Chinese and South Korean governments.

Meanwhile, in 2002, WWF and other research institutes in China, South Korea and Japan began an assessment of Yellow Sea Ecoregion biodiversity. The objective of this regional partnership was to prioritise conservation actions based on scientific data.

An urgent need: Identifying conservation priorities at a transboundary ecoregional scale

In order to conserve the full array of biodiversity and ensure the use of its services by people are sustainable, it is necessary to conduct assessments beyond political boundaries and at an ecoregional scale.

An ecoregional approach helps ensure that we do not overlook areas that are particularly unique or threatened, allowing for smarter trade-offs and greater positive impacts that are more likely to endure over time.

Yellow Sea Ecoregion (203)

LME #48 Yellow Sea Large Marine Ecosystem (red area)

UNDP/GEF Yellow Sea Project

WWF/KORDI/KEI Yellow Sea Ecoregion Planning Programme

Methodology for finding priority algae species and their Ecologically Important Areas

Cooperation among scientific experts from China and South Korea

Scientists from universities and ocedan research institutes in China and South Korea have worked together to review and identify priority algae species and their habitats of global significance. Together they have set a common methodology and reached an agreement on priorities.

Biological Assessment

Using a set of mutually agreed criteria that are key to biodiversity conservation -representative species (abundant species), endemism, threatened status, and commercial importance-experts selected the macroalgae species in the green algae, red algae, and brown algae groups as targets of assessment. According to these common criteria, each scientist analysed nationally available data to select appropriate indicator species and ecologically important areas and they compiled national Biological Assessment papers for China and South Korea.

Priority Area Analysis

Using a further set of criteria, experts then prioritised the previously selected indicator species and their habitat. Scientists adopted endemism, vulnerable species, and commercial importance as a set of criteria for the Priority Area Analysis. In identifying ecologically important areas for each Indicator Species of algae, some species had wide distribution and in such cases, scientists selected good reference areas for those species.

The scientists then overlaid important habitat areas of each indicator species, allowing scientists to visualise overlapping areas.

Results

Areas that are important for algae species are called Algae Ecologically Important Areas (AEIAs). 23 indicator species were assessed under the criteria to identify globally significant species and their habitat. Of these indicator species, 11 species met the endemism criterion, 3 species met Venerable Species criterion, and 8 species met Commercially Important Species criterion. Those indicator species that met any of these criteria were identified as globally significant species. Then habitat areas of these globally significant species, where those areas are critical for the survial of the species, were identified as indicator species ecologically important areas. In total, 13 AEIAs were identified.

The Yellow Sea Ecoregion Planning Programme will publish the full results of the biodiversity assessment and the priority area analysis, so that the results will be accessible by scientists and government agencies to use in the future.

Scientific experts from China, South Korea, Japan and other countries cooperated to analyse priority areas

Mapping data on common indicator species, Silvetia siliquosa and its ecologically important areas in China and South Korea

A Call to Action

The results provided key data for developing a regional conservation strategy and monitoring its successes. In particular, the results will help to:

1) Establish a network of representative marine protected areas at the ecoregional scale;

2) Evaluate effectiveness of existing protected areas;

3) Monitor the status of biodiversity.

In order to conserve algae biodiversity, in particular, these sets of globally significant species and their globally significant areas, various stakeholders need to take concerted actions. Community-based organisations, the scientific community, national and local government agencies, legislative bodies, non-government organisations including religious groups, the general public, the media, donor communities, industries, consumers, and youth groups all have important roles to play. For example, national and local government agencies can contribute by strengthening cross-sectoral coordination in the establishment and improvement of the management of marine protected areas (MPAs). Filling major knowledge gaps in ecology and human impacts on indicator species is also an important action to take.

Globally Siginificant Areas for Algae in Yellow Sea Ecoregion (China and South Korea)

- Yellow Sea Ecoregion Planning Programme -

Bathymetry

- Under 200m
- 200m - 100m
- 100m - 90m
- 90m - 70m
- 70m - 50m
- 50m - 30m
- 30m - 10m
- 10m - 0m

Algae EIA

No	Algae EIA	No	Algae EIA
1	Rizhao	8	Taean
2	Qingdao	9	Buan
3	Rongcheng	10	Wando
4	Weihai	11	TongYeong, Yokjido
5	Miaodao Qundao Islands	12	Busan
6	Qinhuangdao	13	Seogwipo
7	Changhai		