

9 Bohai Sea

Overview

The Bohai Sea is a semi-enclosed inland sea located at the northernmost end of eastern Chinese mainland between 37°07' ~ 41°N and 117°35' ~ 122°15' E. The Sea extends 480 km north to south and 346 km east to west. The Bohai Sea is surrounded by the Liaoning, Hebei and Shandong provinces and is connected with the Yellow Sea on the east via the Bohai Strait. The line linking Laotieshan of the Liaoning Peninsula and the Cape of Penglai on the north coast of the Shandong Peninsula is the boundary between the Bohai and Yellow seas. Encompassed by the Liaoning and Shandong peninsulas, like two outstretched arms, the Bohai Sea functions as an offshore gateway to the capital city of Beijing.

< <http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm> >

Location



Basic information

Surface area : 7,284 km²

Volume : 131 km³

Average depth : 18 m

Maximum depth : 85 m

Nature

Nature

< Background >

The Bohai sea has a catchment area of 1.4 million km² and a population size of 445 million.^{1,2} The littoral area boasts a network of 50 rivers, big and small. Of these rivers, 19 are on the coast of Laizhou Bay, 16 are on the coast of Bohai Bay and 15 are on the coast of Liaodong Bay, such that three major freshwater systems and three major bay ecosystems are along the coast of the Bohai Sea. These rivers deposit huge amounts of sediment into the three bays, forming extensive delta wetlands at the mouths of the Liaohe, Yellow and Haihe rivers. These shallow areas are increasing annually by a total of 20 km².

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

Climate

Located in the northern temperate zone, the Bohai Sea is neither extremely hot in summer nor severely cold in winter. Generally, the average temperature is around 11 °C with an annual precipitation of between 500 and 600 mm.

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

Topography

With an average water depth of 18 m, half of the sea area is shallower than 20 m. The maximum depth is 85 m.

The bottom of the Bohai Sea is shaped like a bottle lying in the northeast to southwest direction. The Liaodong Bay is located at the top end and the Laizhou and Bohai bays are located at the bottom end.

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

Hydrology

A recent three-dimensional modeling study described tidal, wind and other processes that transport seawater in the Bohai Sea. It is summarized as follows. The vertical and horizontal profiles of temperature, salinity and density show that a weak stratification develops in the center of the Bohai Sea from solar heating. In winter, the stratification disappears due to wind-induced vertical mixing. The south and north winds change the residual current system dynamically. For example, a clockwise circulation is induced by south wind, primarily during the summer, and an anticlockwise circulation is induced by north wind, primarily during the winter. The change in flow structure affects the water exchange of the Bohai Sea; south wind decreases the water exchange whereas north wind increases the water exchange.³

< Surrounding environment >

Wetlands and Shallow Estuarine

The Bohai Sea has three major ecosystems - estuarine delta wetlands, a river estuary and the central Bohai deep-water zone.

1) Estuarine delta wetlands

The wetlands in the Bohai Sea are rich in a variety of organisms, including plants, such as reed, cord grass, salt marsh hay and algae, and more than 150 species of birds. The Liaohe River estuarine delta wetland and the Haihe River estuarine delta wetland are China's main areas of reed production, providing large quantities of high-quality raw materials for the paper industry in China.

2) River estuary

The littoral shallow estuarine area of the Bohai Sea is rich in nutrients and a variety of bait organisms, making the area an ideal spawning and nursery ground for commercial fish, shrimp and crab.

3) Central Bohai deep-water zone

The central deep-water zone of the Bohai Sea functions as the wintering ground for many of the commercial and endemic species of the Sea's fish, shrimp and crab.

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

History and Culture

< Ancient Bohai State and Japan >

The ancient Bohai State was established 1,300 years ago and was much larger than the present Bohai region. It continued for about 200 years as a sophisticated cultural center in East Asia. The State sent over 30 missions to Japan for economical and cultural exchanges during its 200-year rule. In response, Japan sent 15 missions to the Bohai state. According to most Japanese history text books, these official Japanese missions to ancient China (Zui and To) are not well known.

To research and publish these poorly-known close international relations of the ancient age, Togi Town, in Japan's Ishikawa Prefecture, established the Bohai State Relation Research Center and began its activities in 1996. Togi Town's Fukuura Port was one of the most frequently used Japanese ports in the ancient age, due to its special guest house that had repair and maintenance facilities for the mission boats. The people in Togi Town are proud that ancient international communications with Bohai State was even more active than the Japanese official missions to ancient China.

The Bohai State Relation Research Center has organized Bohai-style cooking meetings three times and has plans for Bohai-style cooking contests.

<http://www.town.togi.ishikawa.jp/sfd_menu.php?id=61> (in Japanese)

Social Environment

< Population >

The coastal cities of the Bohai Sea (Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia, Liaoning and Shandong) had a total population of 275 million in 1999.⁴ The whole catchment area of the Bohai Sea, the population is estimated to be 445 million.^{1,2}

< Land use >

In the coastal area, land resources are limited and land use is not well planned. Many factories and mines have been abandoned and many villages are now left uninhabited. The agricultural area per capita in the coastal area (Beijing, Tianjin, Shanxi, Liaoning and Shandong) is lower than the national average. Land use will be reorganized by optimizing the limited land area, through the systematic integration of rice paddies, waters, roads, woods and villages, and by the restoration of abandoned factories and mines.

< Industry >

Fisheries, ports, petroleum, tourism and sea salt production and manufacturing are the six major industries of the Bohai Sea.

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

Fisheries

The Bohai Sea is fertile, with high concentrations of nutrients and abundant bait organisms. The annual production of phytoplankton is about 140 million tons and the annual fish catch is about 0.49 million tons. The coastal area of the Bohai Sea acts as the cradle of the Huanghai (Yellow Sea) and Bohai Sea fisheries and is a favorable place for breeding and growing various fish, shrimp, crabs and shellfish. Hence, the area has been known as the "treasure bowl". Prawn, shrimp, small yellow croaker and hairtail are the most important commercial species in the Bohai Sea.

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

Ports

Many large-scale seaports are distributed in the Bohai Sea, and these ports support the developing economy of the Sea's coastal area. The Bohai Sea is an important maritime passageway for foreign trade in North China. At present, there are over 100 sites where seaports have been completed or proposed.

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

Petroleum

The Bohai Sea is rich in offshore oil and gas. Due to the offshore oil fields and the coastal oil fields of Shengli, Dagang and Liaohe, the Bohai Sea is now the second-largest oil producing area in China, next to Daqing.

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

Tourism

With beautiful natural scenery and multitudes of famous historic and cultural sites, the Bohai Sea has become a major tourist destination.

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

Salt production

The Bohai Sea is the largest salt-producing base in China due to its favorable bottom and climatic conditions. Three of the four major sea-salt producing areas in China - Changlu, Liaodong Bay and Laizhou Bay - are

located on the coast of the Bohai Sea. The littoral area of Laizhou Bay has rich reserves of underground brine, amounting to 7.6 billion m³ or over 800 million tons of salt. These underground brine reservoirs are easily exploited due to their shallow depth and high concentrations.

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

Manufacturing

The abundant resources of the Bohai Sea, such as fish, petroleum and sea salt, and its pleasant natural environmental conditions have imbued extensive vitality into the economic development of the Bohai Sea region. Vigorous development of the primary industry has promoted the development of secondary industries, such as the chemical, shipbuilding and repair, aquatic-products processing, petrochemical and textile industries, as well as tertiary industries. In addition, the Bohai Sea has a broad-tidal flat covering an area of 5,100 km², which increases annually by 20 km². The tidal-flat areas provide vast space for solving the conflict between a large population and limited land in the coastal zone.

<<http://www.pemsea-bohai.net.cn/hjzy/hyqy01e.htm>>

Environmental Problems

< Background >

The self-purification capacity of the Bohai Sea is limited due to the long turnaround time of water exchange, which ranges from 40 to 200 years. Wastewater flowing into the Bohai Sea amounts to 2.8 billion tons per year, which is 32 % of the entire discharge amount from China. Solid wastes into the Bohai Sea amounts to 0.7 million tons per year, which is 48 % of the entire solid wastes from China. Some experts even describe the Bohai Sea as a garbage dump.

Pollution in the Bohai Sea seriously affects human health in the area, through consumption of contaminated fish and shellfish. Fishermen's hair has been contaminated by lead, mercury, and arsenic above the normal level, and fishermen's cancer rate has increased. Fishermen's death rate due to malignant tumor has become higher than farmers.

Water Quality

According to the China Water Resource News, the most polluted coastal area in China in 2002, was observed in the Bohai Sea and in the East China Sea.⁵ About 40 % of the Bohai Sea area (32,000 km²) exceeded the target water quality called "clean marine standard of the Bohai Sea". The exceeded area increased by 16 % compared to the previous year.

Pollution by heavy metals are most serious. Especially, lead and mercury exceeded the water quality standard at 95% and 94% of the monitoring points, respectively. Oil and grease exceeded the standard in half of the monitoring points. Dissolved oxygen exceeded the standard at 10 %, and other parameters at 40 % of the monitoring points.

The highest mercury concentration in China was observed in the Bohai Sea, with value of 1.26 μg/L. The value at the standard monitoring station increased to 0.44 μg/L, which is close to 0.5 μg/L, the Class 4 (Port/harbor area and the other development/construction area) environmental standard.

<<http://search.envir.com.cn/info/2003/1/113561.htm>> (in Chinese)

< Other Environmental Problems >

Red Tides

Red tides have been frequent in the Bohai Sea since the end of 1970, and their frequency and area have increased recently. In the summer of 1988, a large-scale red tide occurred in Liaodong Wan (Gulf of Liaotung). In 2002, 79 red tides were recorded in China, of which 13 were in the Bohai Sea.

<<http://www.coi.gov.cn/hyzh/ccao/work802.htm>> (in Chinese)

Oil Spills

The Bohai Sea area is surrounded by major oil fields and heavy industrial and port areas. Numerous tankers transport oil and mineral resources. Once an oil spill occurs, it causes serious damage to the vulnerable marine ecosystem and fisheries of the Bohai Sea. In 2002, three oil spills occurred in the Bohai Sea.

<<http://www.coi.gov.cn/bohai/zhxx/2002/gongbao.htm>>

Damage to Ecology

Since the Chinese government's commitment to open economic policy, pollution loads to the Bohai Sea have increased, resulting in the deterioration of the ecosystem, loss in biodiversity and the extinction of some endangered species. Exotic species have also been disturbing the ecosystem. Illegal activities that destroy the marine ecosystem have not yet been effectively controlled.

< Environmental Protection Measures >

Blue Sea Action Plan for the Bohai Sea

The State Environmental Protection Administration has drawn up the Blue Sea Action Plan for the Bohai Sea that is aimed at controlling land-based pollution. The government will implement the comprehensive plan in the Bohai Sea area with a budget of about US\$6.7 billion over 15 years. The aims of the plan are that:

- 1) By 2005, impacts on the ecosystem will be reduced by having more than a 10 per cent reduction in land-based COD loads, and more than a 20 per cent reduction in land-based phosphate, inorganic nitrogen and oil, relative to 2000 levels
- 2) By 2010, the marine environment will improve by having more than a 10 per cent reduction in land-based COD loads, more than a 15 per cent reduction in land-based phosphate and inorganic nitrogen, and more than a 20 per cent reduction in oil, relative to 2005 levels
- 3) By 2015, the marine environment and ecosystem will be improved and restored.

The numbers and budget of the projects planned in the Blue Sea Action Plan for the Bohai Sea are listed as below by project type.

Projects Planned in the "Blue Sea Action Plan for the Bohai Sea"

Project Type	Number of Projects	Budget (billion US\$)
Waste Treatment	169	2.58
Rehabilitation	102	2.50
Improvement of Manufacturing Processes	156	1.51
Planning (environmental management, monitoring and scientific research)	-	0.07
Total	427	6.66

<<http://gemini.html.533.net/xyhbzs/2hyhjbh.htm>> (in Chinese)

Bohai Declaration on Environmental Protection

The 7th Meeting of the Steering Committee of the GEF/UNDP/IMO Regional Programme on Building Partnerships for Environmental Protection and Management of the Seas of East Asia was held in Dalian, July 26-19, 2000. At the meeting, the State Oceanic Administration, the Bohai coastal provinces of Liaoning, Shandong and Hebei and the municipality of Tianjin agreed to cooperate on various measures against pollution in the Bohai Sea, acknowledging the severity of marine pollution and resource depletion.

<<http://www.coi.gov.cn/bohai/lxwj/xuanyane.htm>>

References

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3. Nakatsuji, K., Yamanaka, R., Liang, S., and Sun, Z., 2003. Seasonal change of baroclinic circulation and water exchange in the Bohai Sea. 8th International Conference on Estuarine and Coastal Modeling. <http://ecm.thewisdomgroup.net/abstract_listing.php>
4. National Bureau of Statistics, People's Republic of China, 2000. China Statistical Year Book. China Statistical Press, 888 pp. (in Chinese)
5. China Water Resource News, 13 Jan. 2003. <<http://www.chinawater.com.cn/newspaper/>> (in Chinese)