

# 21 Sea of Japan

## Overview

The Sea of Japan is a marginal sea located along the edge of the Eurasian continent and partially separated from the open ocean by the Japanese Archipelago and Korean Peninsula. It is connected to the open Pacific Ocean through 4 straits which are the Tsushima, Tsugaru, Soya and Mamiya Straits.

## Location

### Basic information<sup>13</sup>

Surface area : 978,000 km<sup>2</sup>

Volume : 1,713,456 km<sup>3</sup>

Average depth : 1,752 m

Maximum depth : 3,742 m

## Nature

### < Background >

The Sea of Japan is bordered by the Japanese Archipelago along the east and south, and the Eurasian continent along the north and west. It is an international sea with 4 bordering countries - Japan, Russia, North Korea and South Korea.

It is connected to the Pacific Ocean through 4 straits, all of which are narrow and shallow. These straits enhance the closed nature of the water as well as limiting seawater exchange compared to other marginal seas. The widely known name 'Sea of Japan' probably stems from the geographic features of the Japanese Archipelago that visually separate the water from the northern Pacific Ocean.



### Climate

Located along the eastern edge of the Eurasian continent in the mid-latitude area, the Sea of Japan has a cool to warm climate. There are, however, 2 distinct types of climates - a cool and wet continental climate dominates the continental area from Khabarovsk in Russia, along the North Korean coastline to the Hokkaido area in northern Japan, and a warm monsoon climate dominates over Japan (except Hokkaido) and South Korea. The former has a wide range of air temperatures and is characterized by having a short hot summer and a long cold winter. The latter has 4 distinctive seasons, with a hot humid summer and a cool winter with little precipitation.

A mirage is a phenomenon where distant scenery becomes stretched or inverted as an optical illusion due to the refracted light caused by temperature differences in the atmosphere. It is thought to be caused by the inflow of air warmed on land during the day on top of the layer of low temperature air above the sea. Mirages can be observed in Toyama Bay from the end of March to the beginning of the June.<sup>1</sup>



Mirage in Uozu City<sup>1</sup>

### Topography

Two large banks, the Yamato and Kita-Yamato Banks forming the Yamato Ridge, are found in the central part of the Sea of Japan. The Yamato Ridge is surrounded by deep basins - the Japan Basin in the north (over 3,000 m deep), the Yamato Basin (2,500-3,000 m deep) in the southeast, and the Tsushima Basin (1,500-2,500 m deep) in the southwest. South of the Yamato and Tsushima basins, along the Tsushima Strait, lies a shallow continental shelf approximately 120 m deep.

### Hydrology

Two strong currents exist in the Sea of Japan - the warm Tsushima Current that enters from Tsushima Strait and heads northeast, and the cold Liman Current that runs along the Eurasian continent from north to south. The Tsushima Current is the main current and is a branch of the larger Kuroshio Current.

The Tsushima Current splits into 3 smaller branches upon entering the Sea of Japan. Although all of the branches head toward the north, the first branch goes along the coastline of the Japanese archipelago, the second along the Korean Peninsula, and the third cuts across the center of the Sea of Japan. Eventually, the majority of these currents flow into the Pacific Ocean or the Sea of Okhotsk, through either the Tsugaru or Soya Straits.

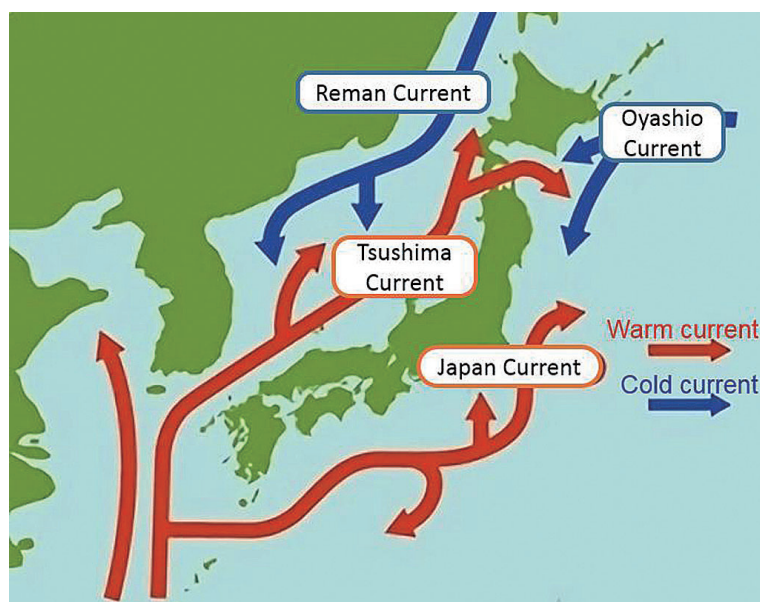
According to past records, the whole process of water entering through the Tsushima Strait and exiting through the

Tsugaru Strait into the Pacific Ocean is estimated to take approximately 2 months. Some of the remaining current continues to travel northward. In the meantime, the water is slowly cooled and finally released into the open ocean through the Mamiya Strait. Due to the shallowness of the strait, part of this current turns around at the mouth of the Strait and becomes the Liman Current, which then heads south along the Eurasian continent.

The tidal range is small, with a maximum range of 20 to 30 cm. The tidal cycle is slightly irregular, and diurnal rather than semi-diurnal tides are occasionally observed.

In waters of approximately 300 m and deeper, there is nearly homogeneous water of salinity about 34.1 ppt and of water temperature about 0-1 °C. This is called "Japan Sea Proper Water (JSPW)". The deepest part of the Sea of Japan has about 3,800 m water depth. On the other hand, water depths of straits leading to the adjacent waters are shallow at about 50-140 m.

The water body that is cooled by cold winter breezes increases its water density and causes sinking to the bottom of the sea. Since the water exchange is limited in the surface layer, this denser water body remains at the bottom of the sea. The value of dissolved oxygen content in the JSPW is obviously high compared with the adjacent northern Pacific Ocean seawater. This shows that the JSPW has been formed by the sinking of oxygen-rich surface sea water to the deep layer.<sup>3</sup>



Ocean Currents in the Sea of Japan

### < Surrounding environment >

#### Biota

The region's different climates enable the establishment of a 'wildlife transition zone' that accommodates plants and animals from both north and south. In addition, due to the simultaneous occurrence of the warm Tsushima and cold Liman currents, a polar front is formed where the currents mix, with the temperature difference providing an ideal environment for fisheries.



Amur Leopard (*Panthera pardus orientalis*)<sup>4</sup>

A leopard subspecies found around the southern part of the Russian coastal area. It is now under the threat of extinction mainly due to decreases of habitat forests.



Amur Tiger (*Panthera tigris altaica*)

Amur Tigers have been found in the habitats of Amur Leopards, and there is concern for their competition.

### History and Culture

#### < Formation of Sea of Japan >

The Sea of Japan is considered to have been formed sometime between 10 and 20 million years ago, following large scale crustal movement.

Twenty-five million years ago, a large lateral fault developed at the eastern edge of the Asian Continent, creating numerous rift valleys and lakes. Between 14 and 19 million years ago, these rift valleys and lakes drifted farther from the Asian Continent, and eventually created the deep Japan Basin. Large sea basins were also formed south of the Japan Basin, although they are occasionally interrupted by some ridges and plateaus, such as the Yamato Ridge and Korean Plateau. Due to these tectonic movements, the current form of the Sea of Japan is thought to be created around 14.5 million years ago.

### < Cultures surrounding the Sea of Japan >

Being compact in size, the Sea of Japan boasts a long record of supporting cultural exchange between bordering countries, such that the history of countries can not be told without addressing the significance of the Sea. In ancient times, the continent introduced rice-paddy agriculture, Buddhism and writing to Japan. Simultaneously, Japan tried to communicate and catch up with international affairs, culture and academics by sending official diplomats to continental countries, such as during the Sui, Tang and Bo Hai Dynasties in China, and the Silla Kingdom in Korea.



Restored envoy vessel <sup>5</sup>

During the period between 630 and 838 AD, 16 envoy missions were sent to China, composed of government officials, students, doctors and others, usually totaling 100 to 250 people and in some cases including over 500 people. These envoy missions helped Japan to learn about the advanced cultural and political systems of the Tang Dynasty in China.

## Social Environment

### < Population >

Approximately 200 million people live on the Korean Peninsula and the Japanese Archipelago, in the southern area of the Sea. In contrast, only 4 million people live in the northern area, in the 3 areas (coastal provinces, Khabarovsk Krai, Sakhalin Oblast) along the coast of Russia.

### < Land Use >

Forest covers almost 70% of the total land area of the Russian and Japanese coastlines. These forests provide valuable nutrients to the Sea but are threatened by factors such as development, clear cutting, accidental fire and damage caused by insects.

### < Industry >

The main industries in far-eastern Russia are iron working, food processing (mainly seafood), electricity generation, oil and machinery production and metal mining. This industrial structure is highly dependent on the area's rich natural resources and abundant energy sources. A serious problem in this area is that a large portion of land is covered by forests and permafrost, making agricultural development challenging. In contrast, the service industry is expanding in Japan and South Korea, further diversifying the industrial structure of their countries.

#### Fisheries

The Sea of Japan has maintained its rich biodiversity and high biological productivity. It has contributed to the development of fisheries in all bordering countries. However, due to recent economic growth and rapid urbanization, nutrient loads are increasing and many shallow sea areas are being reclaimed, leading to the deterioration of many marine habitats. Consequently, fish landings have decreased.

In recent years, increases in sea temperature has caused fish species that prefer low water temperature to no longer move south to the sea area around Japan, while fish species that prefer high water temperatures are expanding their habitats and migratory ranges northward.<sup>6</sup>

## Environmental Problems

### < Water and sediment quality >

Concern over water quality in the Sea of Japan is increasing as economic and industrial development is taking place along coastlines. In particular, Russia, North Korea, and South Korea have a serious problem with industrial effluent, agricultural runoff and untreated sewage entering inlets and rivers in inland areas or coastal zones that are connected to the Sea.

Highly contaminated marine life is found around Vladivostok, Russia, many of them exceeding acceptable levels for both consumption and industrial processes. Frequent red tides along the southern coasts of South Korea have also affected the fishing industry of this region greatly.



Number of red tides recorded along the South Korean coast and economic loss of fisheries<sup>7</sup>

Year	1999	2000	2001	2002	2003
Number of Red Tides	75	69	56	59	45
Economic Loss of Fisheries (Million US Dollars)	0.2	0.2	7	4	18.6

**< Pollution source >**

Since the Sea of Japan is an international water body bordered by 4 countries, not just one country is accountable for its water pollution. Concern about this situation in the bordering countries is growing as pollutant loads increase with population and economic growth.

Old and inadequately equipped factories, and slow development of environmental infrastructure, including sewage treatment plants, result in the release of industrial effluents into the environment without proper treatment. This continuously exposes the Sea to water and sediment pollution. Other threats exist as well, such as runoff of sediments and byproducts from mining, flowing into rivers and the ocean.

The major rivers that flow into the Sea from the Eurasian continent are the Tumen River running across the borders of China, Russia and North Korea, and the Rakuto Zen Tsu river in South Korea. The Ishikari, Shinano, and Agano rivers flow into the Sea from the Japanese Archipelago.

Changes in gross domestic product in coastal countries around the Sea of Japan<sup>8</sup>

Unit: 1 billion US dollars

Year	Japan	China	South Korea	Russia
2000	4,730	1,192	533	259
2012	5,935	8,358	1,129	2,029

**< Other Environmental Problems >****Influence of global warming**

Global warming causes adverse effects to the sea such as increases in sea water temperature and sea acidification. It is reported that the sea surface temperature rises faster in the Sea of Japan than in other sea areas, and this temperature rise may change flows of sea water and distribution of marine organisms.<sup>8</sup>

**Marine litter**

A large amount of waste such as large plastic containers, medical wastes and specific fishing gears is cast ashore in the coastal area of the Sea of Japan. Not only does the waste greatly worsen the visual aesthetic of the shore, but it is also expected to negatively affect economic activities such as fishery and human health due to waste residues.<sup>9,10</sup>

**Radioactive pollution and oil spill**

Disposal of radioactive waste, which dates back to the former USSR era, as well as oil spills from tanker accidents, are becoming a big environmental threat in the Sea. This disposal is a long-term issue, the impacts of which will be a concern far into the future.

**< Environmental Protection Measures >**

Ongoing environmental protection measures, in and around the Sea area, are as follows.

**Northwest Pacific Action Plan (NOWPAP)**

NOWPAP is one of the Regional Seas Programmes initiated by UNEP (United Nations Environment Programme), and its aim is to protect the environments of highly-enclosed international waters. Adopted in 1994 by Japan, China, South Korea and Russia, NOWPAP implements various projects targeted towards the Sea of Japan and Yellow Sea, in compliance with the intergovernmental meetings that are held occasionally.

**NOWPAP projects**

NOWPAP/1: development of marine environment protection database and information management system for target ocean regions

NOWPAP/2: Study into laws related to marine environment protection in related nations

NOWPAP/3: Production of environmental monitoring programs for target ocean regions

NOWPAP/4: Regional cooperation on ocean pollution (action in case of oil pollution incidents etc.)

NOWPAP/5: Designation of regional activity centers to become centers of activity in respective areas

NOWPAP/6: Public awareness raising on the marine, coastal and associated freshwater environment

NOWPAP/7: Assessment and management of land-based activities

### Coastal marine litter survey

In 1996, the local government of Toyama prefecture in Japan and the Northwest Pacific Region Environmental Cooperation Center started a "Survey on Buried and Washed up Marine Litter on the Coasts along the Sea of Japan and the Yellow Sea" in order to establish the partnership with local government along the coastline and to clarify the actual status of sea pollution caused by the washed up driftage. Since 2010, the survey has been carried out as an international joint survey named "NEAR Project Survey on Washed up Marine Litter on the Coasts along the Sea of Japan" that local governments, from Japan, China, South Korea and Russia, has participated in.<sup>11</sup> This activity initially began by cooperation with only 10 Japanese local governments along the coastline. However, by 2013, 18 local governments, from Japan (13), South Korea (3) and Russia (2), and a total 1,898 people participated in the project in 48 coasts through collaboration and cooperation with local governments and NGOs /NPOs.<sup>12</sup>

### Related organizations and NGOs

- Northwest Pacific Region Environmental Cooperation Center (NPEC) <<http://www.npec.or.jp>>
- The Economic Research Institute for Northeast Asia (ERINA) <<http://www.erina.or.jp/>>
- Japan Seaology Promotion Organization <<http://www.nihonkaigaku.org/index.html>>
- Ocean Energy of Japan Sea Governments <<http://www.nihonkairengou.jp/>>
- The Association of North East Asia Regional Governments (NEAR) <<http://www.neargov.org/jp/>>
- Association for Northeast Asia Regional Studies <<http://anears.net/index.html>>

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