

# Enclosed Coastal Seas in the World

— *Current Status & New Direction* —



International EMECS Center

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## The Seto Inland Sea

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### *A Profile of Nature's Kaleidoscope*

The Seto Inland Sea is surrounded by the Japanese islands of Honshu, Shikoku and Kyushu, and is located roughly in the middle of the islands that constitute the nation's territory. Almost 1,000 large and small islands, with their intricate coastlines amounting to some 7,230km in length, form the beautiful, distinct scenery of the region. A total of 643 different river water sources feed the Sea from the surrounding mountainous watershed, with fifty billion cubic meters flowing into the Sea each year. The region has a mild temperate climate and relatively little rainfall throughout the year compared to other regions of Japan. Typically, the average temperature is 15 ~ 16°C, with rainfall of 1,000 ~ 1,900mm.



The Seto Inland Sea and its watershed area

### *1. Major enclosed coastal seas around Japan*

The Japanese Archipelago is composed of four major islands - Hokkaido, Honshu, Shikoku and Kyushu, accompanied by numerous smaller islands, forming an intricate topography. In other words, there are many "enclosed coastal seas", combined with inlets and bays.

In Japan, there are 88 officially designated "enclosed coastal seas", which are defined as 'an enclosed geographical area encompassing more than 5km<sup>2</sup>', such as Tokyo Bay, Ise Bay and the Seto Inland Sea.

### *2. The Seto Inland Sea: an overview*

The Seto Inland Sea is the largest enclosed coastal sea in Japan and covers an area of 23,000km<sup>2</sup>. It can hold 880 billion cubic meters of water and is a shallow sea with an average depth of 38 meters. The Seto Inland Sea is connected to the outer ocean via the Kii Strait between Honshu and Shikoku, the Bungo Channel between Shikoku and Kyushu, and the Kanmon Strait between Honshu and Kyushu.

The coastal basin within its watershed is home to some 30 million people, or around 24% of Japan's total

population of 127 million. These people are crowded into an area of 47,000km<sup>2</sup> – a mere 12% of the entire land area of Japan (380,000km<sup>2</sup>).

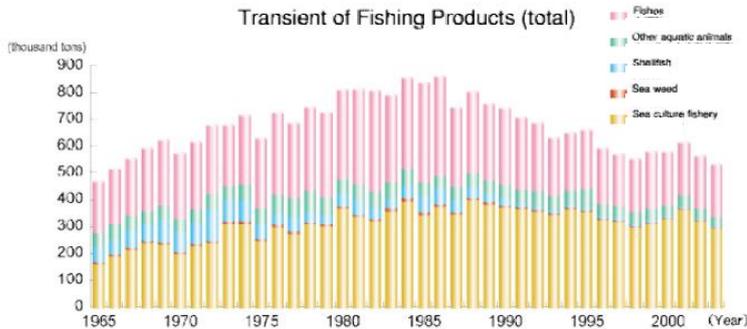
In terms of its working resources, climate and geographical features, the Seto Inland Sea is suitable as a location for heavy and chemical industries, particularly steel and petrochemicals, and the region played a leading role in Japan's period of explosive economic growth in the 1960s. The volume of products shipped from the area nowadays exceeds 16 times that of forty years ago. Even today, the coastal area of the Seto Inland Sea accounts for approximately 46% of the domestic share of steel industry products, 35% of the petrochemical industry, and 30% of the pulp/paper industry.

However, in comparing each of these industries, we find that primary industries (agriculture, forestry and fisheries) and secondary industries (mining, construction and manufacturing) are declining while tertiary industries (transport and logistics, wholesale and retail business, finance and insurance, and the service industry, etc.) are gaining ground.

Since ancient times, the Seto Inland Sea has depended on maritime transport. Even now, about 43% of all goods shipped domestically pass through the Seto Inland Sea carried by large cargo vessels, and many of them can be seen passing back and forth through the

narrow sea route.

The Seto Inland Sea is also a major fishing area, with a yearly catch of 233,000 tons and a yearly aquaculture of 298,000 tons. However, compared with the 1980s, the size of the fish catch has decreased by around 30%. It should be also noted that, as reclamation for the construction of industrial land has reduced the number of biological habitats, fishing areas, the quantity of clams and other marine products have fallen dramatically from their former levels.



### 3. Water Quality in the Seto Inland Sea

In recent times, COD (Chemical Oxygen Demand) concentration as an index of organic pollution has stopped rising at the specific level in local areas of the Sea, though there has been some degree of improvement compared with the previous critical condition known as “the dying sea” of the mid-1960s. Further, the concentration of total nitrogen (TN) and total phosphorus (TP) as causes of eutrophication, has tended to decrease more than in the case of COD, though differences exist between local areas of the sea. It should be noted that the occurrence of oxygen depleted bottom water is apt to destroy the benthos ecosystem in some areas, particularly during the summer.

### 4. Environmental problems in the Seto Inland Sea

During Japan’s period of rapid economic growth in the mid-1960s to mid-1970s, industrialization of the coastal area, the increase in the number of factories, and expansion of landfills in waterfront areas caused a rapid increase in water pollution, with a reduction in shallow water areas and destruction of the marine environment in the Seto Inland Sea. In fact, “red tides” occurred more frequently and, due to the depletion of oxygen, many fish and shellfish - especially fish - were annihilated.

This dealt a serious blow to the fisheries industry. It was not only the decline caused by industrialization,

but also the resulting rapid reduction of natural seashore areas, especially sandy beaches, by landfills and water pollution - places where local residents could come in contact with nature, for example by taking their families to the beach, going swimming, just basking in the sun, digging for clams and so on. Formerly, the sea was an integral part of the lives of local residents. However, nowadays, factories built on reclaimed land are located very close to each other and prevent people from actually going to the sea. Other concerns that have been raised include the effect of sea sand mining done from the bottom of the sea, the amount of marine litter due to people disposing of garbage, and the problem of chemically harmful effluent from various facilities.

#### (1) “Red tides”

The frequency of so-called “red tides” in the Seto Inland Sea recently declined in number to around 100 occurrences a year from a peak of around 300 in 1976. Most occurrences of “red tides” are in the summer time, and are the cause of immense damage to the fishing industry. Individual records of the enormous damage include 14 million cultured yellowtail that perished in July, 1972, resulting in a loss of 7.1 billion yen; 3.3 million in August, 1977, causing losses of 3 billion yen; 2.8 million in July, 1978, with a loss of 3.3 billion yen; and 1.35 million in August, 1987, resulting in 16 billion yen in losses.

Of particular note is the fact that damage to fisheries in the mid-1960s developed into a major social problem, and local fishing cooperatives eventually took the national government and companies along the coastal areas to court. Eventually, however, it resulted in an amicable settlement.

In addition, considerable damage occurred in August, 1998, which annihilated the cultured oyster industry and resulted in a loss of 3.9 billion yen.

#### (2) Reduction of shallow water areas

##### a. Seaweed beds and tidal flats

Seaweed beds are generally an important habitat for fish and other aquatic animals. Tidal flats are also important as habitat for aquatic animal, migratory birds and, furthermore, play a leading role in purifying water quality in the region. Both of these important areas have been disappearing. In the 12 years from 1978 to 1991, 800 hectares of seaweed beds and 800 hectares of tidal flats were lost. Of these, 40% of the seaweed beds and 70% of the tide flats were lost due to reclamation, dredging or modification of the coastal area.

##### b. Natural coastlines

Since ancient times, shallow areas of the Seto Inland

Sea have been changed from natural seashore to farmland and/or salt farms. From the mid-1950s, expansion of urban areas and/or industrial locations took priority over the natural environment, to such an extent that only 37% of the natural coast line, now remains.

In order to preserve the natural seaside environment for recreational purposes such as sea bathing resorts, 91 points have been designated by the each of the prefecture governments under the municipal law.

## 5. Environmental Conservation of the Seto Inland Sea

In the period between 1965 and 1975, water pollution in the Seto Inland Sea increased dramatically, and pushed it to the brink of becoming a dying sea. To conserve the environment of the region, the Law on Temporary Measures for the Environment Conservation of the Seto Inland Sea was enacted in 1973. In 1978, this law was made permanent as the Law on Special Measures for the Environment Conservation of the Seto Inland Sea (“The Seto Inland Sea Law”), with new measures added to deal with the damage caused by "red tides" and the like, including measures to cope with eutrophication. The following measures have been taken based on these laws:

### (1) Basic Program for Conservation of the Environment of the Seto Inland Sea

To promote long-term policies relating to the environmental management of the Seto Inland Sea in a comprehensive and systematic manner, the national government enacted the Basic Program for the Environment Management of the Seto Inland Sea based on “The Seto Inland Sea Law”. Individual prefectures located around the Sea established their own prefectural plans for environmental management of the Seto Inland Sea based on the Basic Program of the government. In 2000, the Basic Program established in 1978 was greatly revised. The revised Program established upgraded conservation policies as well as policies to restore lost environments and promote wide-ranging cooperation and participation among the national government, local public organizations, private citizens, companies and other entities.

### (2) Policies to preserve water quality and protect natural scenery, etc.

To promote the conservation of water quality in the Seto Inland Sea, a variety of restrictions have been implemented based on the Water Pollution Control

Law and “The Seto Inland Sea Law”. As objectives of water quality administration, environmental quality standards for chemical oxygen demand (COD), total nitrogen (TN) and total phosphorous (TP) concentration in sea water have been established as desirable standards needed to achieve and maintain the quality of water in public waters.

In addition, effluent standards have been established for waste water from factories and workplaces, and restrictions have been implemented prohibiting the discharge of specific pollutants into rivers and the ocean. Moreover, in the Seto Inland Sea, permission from the local prefectural governor, etc. is needed in order to set up specified facilities that discharge such polluted water. A total pollutant load control (TPLC) of COD, TN and TP has also been established for the Seto Inland Sea.

Measures have been taken to designate core regions of natural scenery in the Seto Inland Sea as National Parks and the like, to ensure that their outstanding natural scenic beauty is not lost. Moreover, as the greenery on islands and in coastal zones is a crucial component of the scenery in the Seto Inland Sea, efforts are actively being made to protect and manage green spaces.

The basic policy for reclamation was established in accordance with “The Seto Inland Sea Law”, and reclamation has been strictly limited, though not entirely banned. Mining sand from the sea floor, which had become an issue in the area, became subject to prohibition measures on the part of relevant local prefectures, so as to reduce the environmental impact of such activities.

## 6. New Directions in Management Policies

More recently, 2013 saw the 40th anniversary of the enactment of “The Seto Inland Sea Law”, while 2014 saw the 80th anniversary of the designation of the Setonaikai National Park. Moreover, 2015 turned out to be the year for a particularly important change of direction for the Seto Inland Sea. At the end of February 2015, a major revision of the national government’s Basic Program for the Conservation of the Environment of the Seto Inland Sea was approved by the Cabinet. In addition, at the end of September, a revised version of “The Seto Inland Sea Law” was enacted to support the content of these major revisions.

### The Law Concerning Special Measures for Conservation of the Environment of the Seto Inland Sea

#### <Key Points of the Amendment>

- Conservation/restoration of seaweed beds/tidal flats
- Adaptive management initiatives, including efforts to conform with the Act such as nutrient management at sewage facilities
- Investigation/research into appropriate management of nutritives
- Releasing aquatic animals’ seeds and seedlings
- Adopting eco-friendly structures, etc.

Concerned prefectures and cities will, by responding to the actual situation of their bays and seas, take on initiatives in a systematic manner.

The combination of unparalleled major revisions to both the law and the Basic Program resulted in a major change to the management system for the Seto Inland Sea. If you wanted to sum up the changes to the system in a single phrase, it would be a major shift from working to achieve a “clean sea” to working to achieve an “abundant sea.”

“The Seto Inland Sea Law” was enacted in the days of significant environmental pollution. Since that time, efforts over many years have been dedicated to cleaning up the polluted sea. As a result, the total pollutant load from land-based sources has been reduced, which, to a significant degree, achieved the goal of creating a “clean sea” in terms of water quality. Meanwhile, however, natural beaches, seaweed beds and tidal flats have decreased, and the fish catch has also declined, and so the loss of the original abundance of the Seto Inland Sea remains unchanged. These revisions mark a major pivotal change from the previous focus on conserving water quality through restrictions to an active effort to secure fishery resources - and to not only conserve but also restore the environment. This approach is clearly stated in the basic philosophy of the revised law, namely, to turn the Seto Inland Sea into “a sea of abundance whose multifaceted value and functions are maximized.”

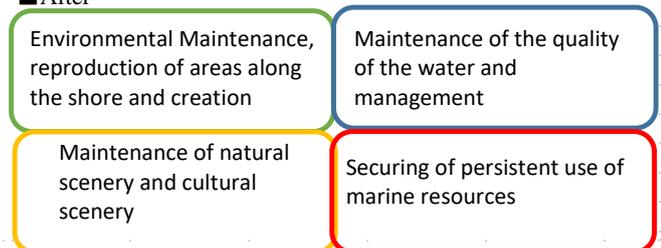
## Basic Program for the Conservation of the Environment of the Seto Inland Sea

### < Concept of Revision >

#### ■ Before



#### ■ After



Most areas in the Seto Inland Sea have already achieved their water quality environmental standards, and the Sea is now entering a “post-total pollutant load control (TPLC) age.” The Seto Inland Sea has also been called an “experimental area” for marine environmental management in Japan. From now on, it also needs to play the role of an “experimental area” for the entire world as it deepens its exchanges with other enclosed coastal seas around the world.

A new direction in management policies was established based on the history of the Seto Inland Sea after WWII in which the first major target of such management was hazardous water pollution, including toxic substances. Following this, the target turned to red tides due to eutrophication. More recently, the main targets have been changing to lowered biological productivity and biodiversity due to oligotrophication and deteriorated habitat. Therefore, the main approaches in the management policy have also changed from water quality control to restoration and the creation of new habitats and fishing grounds, not only as a result of restrictions but by the promotion of participatory creative activities. This new direction is also supported by the concept of *Satoumi*, which includes restoration of biodiversity, biological productivity, habitat and a well-balanced nutrient cycle by means of the intervention of positive human activities.

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