Human Activities on Land and Coastal Zone Environments

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The sea is the source of life on Earth. Even now, it is the basic presence that supports the energy circulation and substance circulation in the global environment that support complex and diverse ecosystems, made up of not only life in the ocean but all life on land, and create the climatic conditions that enable life to survive. Human activity on Earth has expanded explosively, as symbolized by the fact that the population of the earth doubled in the last 50 years of the previous century. As a result, we have exceeded the stable limits of the planet in several aspects. One typical example is the diverse changes in coastal zones, particularly those in enclosed coastal seas. We need to view the state of such coastal environments as one of the keys to finding a way to preserve proper coexistence between the natural environment and human activity.
High-density human activity is concentrated in many seacoast areas and river basins, and the environmental loads produced by the economic activity and lifestyle patterns seen in these areas vary in terms of both quantity and quality. So the question is how to assess the size of human activity that is affecting the oceans. Human activity in river regions consists of many overlapping activities: agriculture, forestry and livestock industry activities, industrial activities and projects, daily living activities and so on. Efforts are needed to assess the environmental load that is produced from the extent of the human activity in these basin zones.

In addition, the mountains and forests that are further removed from coastal zones and the sphere of human activities store a portion of the rainfall and discharge it downstream as a more stable river flow, at the same time functioning to provide silt, nutrient salts, minerals, polymeric organic substances and so on to ocean regions. Moreover, these hinterlands that should be rich in natural resources are also being greatly affected by and changed by warming and other climate change, as well as enormous levels of development by human beings.

There is also endless variety in the characteristics of the ocean regions that are the ultimate recipient of this load. The ocean provides ecological services to the residents living in the vicinity of each ocean region, in the form of the value provided by marine products, the value of the living environments provided by weather and scenery and so on. Through the long course of history, they have created the cultural value that is unique to each region.

It was in the period of rapid economic growth following the end of the Second World War that the changes in coastal zones that are affected in various ways by increased human activity became particularly notable, ultimately taking the form of deterioration of the environment and fishing industry in coastal areas. Looking at the Seto Inland Sea as one example, frequent “red tides” and other damage to fishing industry operations occurred at the same time as the period of high-level economic growth in the 1960s. Around 1970, pollution-related laws were enacted in Japan, and thorough effluent regulations were instituted in accordance with the Water Pollution Prevention Law. Attention focused on the nutrient salt inflow from land as the primary cause of “red tides,” and total emission controls of nitrogen, phosphorus and the like are currently in place. Although the occurrence of “red tides” has decreased as a result of these controls, however, the truth is that the fishing catch in the Seto Inland Sea has been diminishing as a result of their occurrence. Moreover, there are more than 600 islands in the Seto Inland Sea, and these form a highly intricate coastline. As a result, the tidal flows in the interior are complex and it is difficult to make predictions regarding substance circulation. In addition, traditional knowledge that had been accumulated has also been lost in many cases.

There are 21 locations around the world that have been identified by EMECS as large-scale enclosed coastal seas. In terms of small-scale enclosed coastal seas, however, 88 locations have been designated in Japan alone. As boundary zones between human beings and nature, the countless diverse enclosed coastal seas around the world face a variety of problems, and a variety of efforts are needed to determine what kind of management is needed to create healthy environments in these ocean regions.

Review of Coastal Management Policy and Future in Japan

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Japan experienced serious water pollution during the period of rapid economic growth in the 1960s. In addition, the concentration of population and industry caused large quantities of chemical substances, organic matter, nutrients and so on to flow into the ocean from land areas. This had an adverse impact on the living environment and the fishing industry in the form of health hazards and the occurrence of red tide. Various efforts have been promoted to improve the situation, such as the imposition of legal restrictions through relevant legislation, the construction of sewer systems and the installation of factory wastewater treatment facilities.

One of these efforts is the Total Pollutant Load Control System (TPLCS), put in place to ensure water quality based on the Water Pollution Control Law and the Law Concerning Special Measures for Conservation of the Environment of the Seto Inland Sea. The purpose of this system is to reduce the total pollutant load of chemical oxygen demand (COD), total nitrogen and total phosphorus flowing into the ocean in Tokyo Bay, Ise Bay and the Seto Inland Sea. Efforts have been conducted over a period of 40 years to reduce the total pollutant load and so on in the Seto Inland Sea, the largest enclosed coastal sea in Japan. The benefits from these efforts include the fact that water quality environmental standards for total nitrogen and total phosphorus have got achieved in almost all the regions in the Seto Inland Sea.

The first half of my presentation will discuss the mechanism of the TPLCS that has been implemented in Japan up to now, as well as the results of these efforts.

The Basic Plan for Conservation of the Environment of the Seto Inland Sea — formulated by the government in accordance with the Law Concerning Special Measures for Conservation of the Environment of the Seto Inland Sea — has been revised for the first time in approximately 14 years. More than ten years had passed since the previous changes made in December 2000, and it was necessary to deal with new issues such as the need to increase biodiversity. Accordingly, beginning in July of 2013, a review of changes was conducted by the Committee for the Environmental Conservation of the Seto Inland Sea (under the Water Environment Division of the Central Environment Council).
After receiving public comment and the views of the 13 relevant prefectural governments and so on, the changes to the Basic Plan were approved by the Cabinet on February 27, 2015. The Ministry of the Environment is also promoting Sato-umi creation activities nationwide, and in FY 2015 the Ministry began conducting surveys and studies aimed at preserving “the beautiful and bountiful sea.”

In the second half of my presentation, I will present an overview of the Basic Plan and talk about the latest efforts being pursued by the Ministry of the Environment to promote and give concrete form to the new objectives contained therein, such as “conservation, recovery and creation of coastal zone environments” and “conserving and managing water quality.”

Sustainable management of estuaries in North-Western Europe in response to climate change.

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Estuaries are important areas for the ecological functioning of coastal environments. They are widely used by people who benefit from biogeochemical cycles and biological processes found in these ecosystems. They contribute to the development of many economic activities (fishing, transport, industry, leisure ...) However, in general, coastal environments are today under increasing pressure due to economic growth. Locally, in megatidal estuaries of the English Channel - North Sea in North-Western Europe, port and industrial activities intensify in parallel to global change which indirectly affects coastal habitats. Such disturbances impinge on goods and services provided by estuaries.

Managing an estuary requires a vision on a global scale, with ecological goals understandable, acceptable and applicable to all stakeholders. Scientists have proposed various methods for calculating ecological criteria that provide services. They suggested to calculate the area of specific habitats necessary to deliver good productivity and healthy food webs. In particular, they suggested that hydrological and geomorphological conditions are essential to understand in relation to the ecological functioning of an estuary. Primary productivity and fish community structure have been shown to be good indicators of environmental health.

This paper presents strategies to maintain and restore environmental quality in some industrialized estuaries over recent decades in North-Western Europe. It then compares certain practices developed to rehabilitate damaged habitats and methods used to restore lost estuarine ecological functions. Sites selected for this intercomparison include the Seine in France, the Humber in England, the Scheldt in Belgium and the Netherlands and the Elbe and the Weser in Germany. The paper briefly reviews the morphological and ecological changes that have taken place in these estuaries during the last century. It highlights the actions that have been successful in improving their ecological functioning.

Based on rigorous scientific analysis, the conclusion offers a synthetic approach to ecological management, while discussing it as a concept sometime misinterpreted.

South to North Water Diversion Project of China: Feasibility and Challenge

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Water resources are unevenly distributed in China. Southern China owns rich water resources, but northern China remains in thirsty. This retards significantly the socio-economical development of the region. The Chinagjiang River of southern China has an annual runoff of ca. 9500 $x10^8m^3$ (35% of the total), which irrigates ca. 25% of the arable land of China. In contrast, the annual runoff of northern China takes only ca 17% of the total, while caring ca. 62% of the total arable land. The total runoff of the major rivers (the Yellow, Huai and Hai river) of northern China is 1573 x 10 x^8m^3 (6％ of the total). However it needs to irrigate ca. 40％ of the arable land of China. In particular, the Haihe River's annual runoff is 26 x 410^8m^3 (<1％ of the total), but it irrigates ca. 12％ of the total. In comparison, the water resource of the Changjiang is 10 times of the Haihe River (17 times per capita). Also, drought-out has happened quite often in northern China and over-irrigation has occurred in the upper Yellow River. Given the situation, it seems a reason that the South-North Water transfer is practical, which diverts water from the Changjiang River to northern China, via 3 routes, i.e. the west-, middle- and east-route.

The water being diverted via the west-route starts from the upper Changjiang to the upper Yellow River via geo-engineering. The average annual water diversion is 145-195 x 10^8m^3. This water supply covers 6 provinces of northwestern China. The main goal is to complement the water shortage of the Yellower River basin, where over-irrigation occurs. The water being diverted via the middle-route is basically from the Danjiangkou reservoirs (a tributary of the middle Changjiang) to supply the major cities along the man-made-canal. This totals an annual water of $130x10^8m^3$. The main goal is to release the pressure from the domestic water use for >20 cities, including Beijing and Tianjin and, eco-water usage as well. The water being diverted via the east-route is to help the eastern coast of northern China. The annual water diversion is $278.6x10^8m^3$. The main purpose of this diversion is to solve the issues resulting from the water shortage in the areas in the Lower Yellow River basin.

Significant issues arise from the water diversion. Here are two major examples. The water being diverted from the middle Changjiang reaches ca. 24% of the total incoming water sources, annually. This threatens local water sources, especially during the dry season. In the year of drought-out 2011, there was 83.93 $x10^8m^3$ discharge in the Danjiangkou reservoir, ca. 3.8% less than the normal year. Also, water diversion is to aggravate the saltwater intrusion in the Changjiang River mouth. It appears that the saltwater intrusion has occurred earlier in the winter season than before, and duration becomes longer. Many side-effects due to the water diversion arrive in terms of environmental conservation, although the diversion alleviates the northern China from water shortage. An integrated water study needs to urgently carry out.

The Significance of EMECS 11 in St. Petersburg
For environmental management of Baltic Sea

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The 11th International Conference on the Environmental Management of Enclosed Coastal Seas (EMECS 11) is scheduled to be held in the city of St. Petersburg, Russia in August 2016. This will be the first EMECS conference to be held on the Baltic coast since EMECS 3, which was held in August 1997 in Stockholm, Sweden.

St. Petersburg was founded in 1703 in a lowland marsh delta region on the easternmost edge of the Baltic Sea, at the point where the Neva River flows into the Gulf of Finland. The city now has a population of some five million people and is the second largest city in Russia after Moscow. Since the city was founded, it has suffered from flooding of the lowland marsh delta region by storm surges from the Baltic Sea, caused by strong winds and low barometric pressure. Flooding occurred 249 times between 1703 and 1979, a ratio of approximately once per year. Between 1980 and 2002, however, flooding occurred 46 times, an increase to approximately twice per year. This has been pointed out as an indication of the impact of climate change.
The idea of constructing a dam to prevent flooding in St. Petersburg has been studied since 1980. In 2011, a dam across the Neva River estuary that extends for a total length of approximately 25 km was completed (at a total cost of approximately US$3 billion). The construction of this dam has definitely produced enormous benefits by making it possible to avoid destruction of social infrastructure (buildings, roads, bridges and subway systems) and sewer system overflow as well as loss of economic activity in St. Petersburg.

At the same time, however, there are many metal factories, mining companies, chemical factories, meat industry businesses and sewage treatment plants in St. Petersburg, and large quantities of industrial effluent and household sewage flow via the Neva River into the Gulf of Finland. High concentrations of zinc, lead, cadmium and copper have been detected in core samples of bottom sediment. In addition, high concentrations of nitrogen and phosphorus flowed via the Neva River into the Gulf of Finland in the past, but with the improved sewage treatment capability in St. Petersburg in recent years, the nitrogen and phosphorus load has decreased. However, there is little seawater exchange between the Baltic Sea and the outside ocean, and oxygen-depleted water masses have been produced in the deep bottom layers in the center of the Baltic where pollutants accumulated over many years are present. Due to the nutrient salt load resulting from elution of nutrient salts from the bottom sediment, it is anticipated that an extremely long period of time will be needed to improve the water quality in the Baltic Sea overall. There are also concerns regarding the possibility of environmental degradation due to the increased closure of Neva Bay as a result of the dam construction.

More than 60% of the world's population lives in coastal zones, which will be most directly affected by the rising ocean levels accompanying global climate change. In these coastal zones, dam construction is one of the measures being studied by many countries as one option for adapting to climate change. I think there is much that we can learn from the experience of St. Petersburg with regard to dam construction, in terms of issues such as adaptive technologies, effectiveness of adaptation, environmental impact, environmental management policy, economic benefit, financial burden and so on.

MANAGING RISKS TO COASTAL REGIONS AND COMMUNITIES IN A CHANGING WORLD

R.D.Kosyan, G.G.Gogoberidze

The title of our presentation coincides with the name of the next joint conference of the International Center for Environmental Management of Enclosed Coastal Seas (International EMECS Center) and «Sea Coasts» Working Group of the RAS Council on World Ocean. From the point of view of SPC EMECS, this title fits nowadays problems of enclosed seas very correctly.

International EMECS Center was established on 1994 in Kobe, Japan. Its objectives shall be to construct an organized network linking governments, researchers, private companies, citizens etc. in order to promote academic exchanges on an international level and conduct research, conferences, seminars, educational programs for conserving enclosed coastal sea environments, re-constructing new ones and promoting sustainable society.

The Working Group «Sea coasts» is social civic organization, created at Russian Academy of Sciences for concentration and coordination of the efforts of Russian coast researches. It was founded in 1952 and during half a century it raised high a prestige of the Russian scientists and experts in the world. The last 10 conferences began to be international.

The Joint Conference EMECS'11-SeaCoasts'26 will take place in August 22-27, 2016 in St. Petersburg, the cultural capital of Russian Federation. This Conference will be the 11th in the list of EMECS conferences and the 26th in the list of the Russian group «Sea coasts».

Local organizers of the future Conference are Russian State Hydrometeorological University (RSHU), P.P. Shirshov Institute of Oceanology of the RAS (SIO RAS) and A.P. Karpinsky Russian Geological Research Institute (VSEGEI).

Main topics of the Conference are planning as:

- Coastal systems and their dynamics (from coast to water and from water to coast);
- Coastal erosion and dynamical processes in the nearshore zone;
- Climate change in changing world. Coastal adaptation to climate change;
- Construction and exploitation of hydraulic engineering structures and dredging in the coastal areas;
- Approaches to and issues modeling and monitoring of processes in the coastal areas;
- Interactions between coastal zone and the open sea: impact on the coastal and the marine ecosystems;
- Ecological sensitivity of coastal area: anthropogenic loads and natural disasters;
- ICZM – case study and new experience;
- GIS & marine spatial planning;
- Sustainable use and development of coastal resources: effective management and approaches.

The Joint Conference "Managing risks to coastal regions and communities in a changing world" in Russia will involve the leading experts of the World Ocean and its coastal zones, the representatives of the coastal regions governance structures and the world business community. It will be an important step for strengthen of trans-border, trans-economic and scientific cooperation of all marine states.

Welcome to St.-Petersburg in August of 2016.

Development of Coastal Management Method to Realize the Sustainable Coastal Sea

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The Ministry of Environment, Japan has begun the new research project "Development of Coastal Management Method to Realize the Sustainable Coastal Sea" (2014-2018, PI: T.Yanagi) in 2014. This project aims to propose the suitable ICM (Integrated Coastal Management) for realizing the sustainable coastal community. Three research fields (Seto Inland Sea as semi-enclosed coastal sea, Sanriku coastal seas for open character coastal sea and Japan Sea's coastal sea where the international management is necessary) are selected to clarify their natural characteristics from the viewpoint of physical, chemical and biological oceanography. Social and human scientists are also included to this multi-disciplinary project in order to clarify the economic and cultural aspects of the coastal community. We will develop the integrated numerical model which is useful for the policy decision in the coastal areas.