Goals:

- To assess transport and chemical transformations of air pollutants over the East Asian continent and the western North Pacific
- To determine the deposition of primary and secondary pollutants in the East Asian region
- To estimate the effects of climate and atmospheric processes on marine biogeochemistry

Tasks:

- Emission inventory
- Intensive field programs
- Ground-surface monitoring network
- Shipboard measurements

Evaluation of carrying capacity in coastal waters

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The 20th century has been the age of the throwaway principle and competition. Consumption has been encouraged in pursuit of material wealth, and this has been supported by our increasing ability to produce industrially anything we want including food. This leads to an escalating demand of materials and energy for further production. On the contrary, little attention has been paid to thrown-away materials. Until quite recently, we did not recognize the cost for managing the waste product. By this, we have exerted huge impacts on the natural environment and its material cycling through extracting things from nature and depositing waste materials far beyond nature's renewing ability. Competition for profits at various levels accelerates this tendency. Now, we are in serious trilemma in many environmental issues among environments, population and resources viz., deterioration in environments, explosion in human population and exhaustion of resources. Recently, it became widely recognized that a proper environment is essential to sustain renewable resources, and that there are practical and moral reasons for placing values on the environment, including utilitarian, aesthetics, the rights of nonhuman life and our obligations to future generations. Moreover, benefits of natural environments are evaluated in terms of 1) goods such as food production, 2) ecosystem services such as material cycling and purging function, and 3) amenity.

Coastal waters have been utilized in various ways, and food production is the most important function. Coastal areas are nurseries for marine biota of which conservation is crucial for sustainability of fish stock. Changes in coastal environments due to reclamation, pollution and heavy eutrophication directly affect the fishery stock through reduced reproduction of organisms. Coastal waters are also intensively utilized for sea farming and aquaculture of fish, shellfish and macroalgae. Since cultured organisms are incorporated into natural material cycling within the coastal ecosystems, excessive aquaculture can lead to disturbance in the material cycling and marine life. In addition, various environmental issues are raised, being associated with habitat modification, wild seedstock reduction, biological pollution and formation of anoxic zone. Sustainable utilization of coastal waters including continued expansion of aquaculture requires healthy ecosystems because of dependence of fish production on natural ecosystems. Then, how much food production can we expect in a coastal area? To answer this question we have to evaluate the carrying capacity of the area through understandings of *in situ* material cycling. A research project on the carrying capacity of coastal waters is currently in progress in Sanriku area in northern Japan in order to establish adequate aquaculture potential for shellfish and macroalgae. Recent progress made in these areas will be reviewed.

Coastal ecology and marine pollution

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Humankind had regarded capacity of the hydrosphere as unlimited at the beginning of the 20th century because of its huge surface (two third of surface of the earth). During the 20th century, agriculture, fisheries, forestry, mining and industry are making rapid progress with accompanying pollution. The world population is expected to increase from 5.9 billion in 1998 to 8.0 billion by 2025. It is estimated that 75% of the global population lives on the coast or within 60 km of the coast by the year 2000 and the percentage is increasing. These population have direct or indirect impacts on environments of

the coastal waters. At the end of 20th century humankind consider that their impacts on the hydrosphere are greater than its capacity. In the 21st century, they must preserve the environment of hydrosphere from their industrial and agricultural activities and live together with the hydrosphere free from pollution for the healthful co-existence.

The word "pollution" generally means the environmental damage caused by wastes discharged into the hydrosphere, the occurrence of wastes in the hydrosphere or the wastes themselves. Therefore, it is necessary to define it correctly for scientific discussion. The "inputs" are used for wastes in the sea (hydrosphere), the "contamination" is for the occurrence of wastes in the sea and the "pollution" is for the damaging effects of the wastes.

Classification of pollution is very useful for understanding degree of impacts by the pollution. It can be classified into four categories on a basis of duration of impact according to Prof. A. Meinesz at the Univeristé de Nice-Sophia Antipolis.

- Short-term pollution that disappears after stopping causes. It corresponds to a period within ten years.
- Middle-term pollution that is caused by most of chemicals non-biodegradable and active on fauna and flora. It corresponds to a period from several decades. The author classifies non-biodegradable chemicals to irreversible pollution due to persistency in the hydrosphere.
- Long-term pollution that are related to ecosystem destruction which needs long time for its reconstruction. It corresponds to a period of a hundred years.
- Point of no return, irreversible pollution, that is definitive destruction of species or ecosystem. It corresponds to a period more than several centuries.

When the causes of pollution are not excluded, even short-term pollution continues as middle-term pollution. The concept is based on the duration after stopping or eliminating causes of pollution. Short-term to long-term pollution are reversible (non-conservative), and the other is irreversible (conservative) pollution. Irreversible pollution means that pollutants are accumulated and not decomposed for several hundred years or more. Prof. A. Meinesz proposed that reclamation is irreversible pollution because it is very difficult to recover reclaimed coast to original one and the reclaimed area exits quasi-perpetually. The irreversible pollution must be avoided for sustainable development. On the other hand, reversible pollution means that pollutants can be decomposed or diluted by natural force. A representative example is oil spill pollution. Pollution can disappear in ten or twenty years after the oil spill accident. This kind pollution can be controlled by appropriate policy such as removing source of inputs or improving treatment of discharged water. In our presentation, I introduce some examples of these classification.

To understand present situation of coastal waters, monitoring is important. Obtained knowledge serve to ameliorate its environment and predict future conditions. Since pollution is transboundary, monitoring must be conducted in international frames. Most of pollution is caused by human activities on land. Water and ecosystem quality in the hydrosphere depends on comprehensive management along course of water flow from precipitation to the sea through mountains, rivers and lakes. I present some results of monitoring coastal waters including seagrass beds which are very important for marine ecosystem and environments.

Contamination of organotin compounds and endocrine disruption in gastropods

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Imposex, a superimposition of male genital organs (penis and vas deferens) on female gastropods, occurs cause specific and at low concentrations of certain organotins such as tributyltin (TBT) and triphenyltin (TPhT) [1–6]. Reproductive failure is known at severely affected stages [7, 8]. Since the first report from Plymouth, England in 1969, imposex have been reported from all over the world involving more than 140 species [9–11]. Among them, the main cause of population declines in at least seven species is considered to be reproductive failure related to imposex [12]. In this paper, we will report the present status of imposex of gastropods and organotin pollution in Japan, together with endocrine disruption observed in abalones.

Imposex in the rock shell (*Thais clavigera*) and organotin pollution in Japan

Among rock shell samples collected between September 1996 and January 1999 from 93 locations along the Japanese coast, imposex were observed in 86 locations whereas no or rare cases were found in the remaining seven locations. The percentages occurrence of imposex were as high as or close to 100% at 73 locations. It is expected that spawning obstruction occurs in more than half the population of females when the Relative Penis Length (RPL) index exceeds 40, based on the relationships of RPL index, the Vas Deferens Sequence (VDS) index and the percentage occurrence of oviduct (vulva) blockage in females. Among the 93 locations, RPL index values exceeded 40 were found at 40 locations. Compared to the results of the survey conducted last time, the index values