and the workshop participants.

On December 8, all the participants paid a courtesy visit to Mr. Hiroya Masuda, the Governor of the Iwate Prefecture, and made a brief report on the activities of the workshop. He appreciated the efforts made by the workshop participants to discuss issues that are important to the fishery communities in the Iwate Prefecture and to assist in raising public awareness on these issues, particularly with the younger audience.

The organizing committee appreciates the excellent presentations and contributions made by all the participants during the workshop. Thanks are also due to the staff members of UNU and OMRC for their kind assistance in arrangements for this workshop. On the whole, this workshop could not have been successful without the strong contributions and cooperation of all involved.

Ocean, man and environment: A message from dolphins and seals

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Marine pollution by organochlorine compounds has become a vital issue everywhere on earth. Since the latter half of 1960s, mass deaths of marine mammals have been often observed for the grey seal (*Halichoerus grypus*) and the harbor seal (*Phoca vitulina*) in the Baltic Sea and the North Sea. Similar events were found in Baikal seals (*Phoca sibirica*) of Lake Baikal in 1987–88, in Caspian seals (*Phoca caspica*) of Caspian Sea in 1997, and in the striped dolphin (*Stenella coeruleoalba*) in the Mediterranean Sea in 1990–91. The causative mechanism is not yet completely understood. However, organochlorine compounds such as PCBs (polychlorinated biphenyls) and DDTs must be the major factors in creating this tragedy. Seals have found to be suffering from uterine occlusion, which has resulted in decrease of reproductive rates. Meanwhile, it is likely that aquatic animals are losing their immunity against viruses. Reduction in the testosterone levels by DDE was also observed in Dall's porpoises (*Phocoenoides dalli*) from the western North Pacific.

Why are seals and dolphins vulnerable to artificial chemical substances? Since they normally have long lives and are at the top of the oceanic food chain, they accumulate a high intensity of chemical substances in their body. In the striped dolphins from the western North Pacific the accumulative concentration of organochlorine compounds in their bodies is one to ten million times higher than that found in the water. These accumulated compounds, which are soluble in fat, are passed on to calf through mother's milk. Approximately 75–90% of the accumulated chemicals are transferred to calf. Unfortunately, seals and dolphins pass the contaminants on from generation to generation once they have been polluted because they are not capable of metabolizing them. This tragedy is now spreading throughout the world's oceans. Most of the organochlorine compounds used in the tropical areas move into the air and eventually spread over the earth. Such pollution has actually been observed even in the Antarctic Ocean. More than ten million kinds of chemical substances have been produced so far and most of them are being discharged onto the land and into the seas. We should realize that actual damage, including pollution by organochlorine compounds, is extremely severe.

In recent decades we also faced another problem of butyltin contamination. It is much more serious in the coastal areas of the developed countries compared with those of the developing ones in the Northern Hemisphere. We need to establish an effective strategy on the present marine environment issues.

From ancient times, most of people have been dependent on resources from the ocean such as fish, cuttlefish, shellfish, seaweed, and other marine organisms. What we should do right way is to recognize what is happening on our earth and to promote the conservation of the ocean. Otherwise we cannot guarantee the future for the next generation. Our priority is to launch research to monitor marine pollution and to send out the latest information to the world.

Wildlife and birds as sentinels of ecosystem pollution

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Seabirds and songbirds are very sensitive indicators of environmental contamination. Agriculture and urban pesticide use in the United States has caused declines in bird populations in several localized regions, indicating pollution by chemicals which are persistent in the environment. In this talk I will introduce the process of environmental monitoring of wildlife, and how studies of wildlife and bird populations have identified specific pollution problems. Eggshell thinning in seabirds and birds of prey signaled the increasing ecosystem pollution by DDT, and eventually led to new laws, such as the Endangered Species Act, to protect wildlife populations. Other examples of coastal pollution, such as disposal of plastics into coastal oceans have led to international agreements on disposal of plastics at sea, and have reduced injury to albatrosses and their chicks.

Wildlife injury to both fish and birds resulted in the public demand to clean up the U.S. Great Lakes, to make fish safe to eat, and to allow recovery of the contaminated birds. Strict laws on disposal of PCBs, other industrial chemicals, and pesticides into rivers and lakes have allowed recovery of these areas, and recovery of fish and wildlife populations. Disasters such as the Exxon Valdez oil spill led to changes in safety procedures and better monitoring to safeguard seabirds and marine mammals.

Endocrine disrupting chemicals have been discovered in rivers and lakes in the US and Europe, causing reproductive injury to fish, birds and alligators, and signaling possible dangers to human populations. Each of these examples has shown that monitoring of fish and wildlife can identify pollution problems, and lead to improved regulations to keep the environment clean. Fish and wildlife are indicators which must be watched carefully to insure ecosystem problems will not impact human populations.

Atmospheric transport of anthropogenic substances to the surrounding marine environment: A view from biogeochemical cycles

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The East Asian continental rim region is characterized by anthropogenic emissions that are already high in many locals and that are rapidly growing throughout much of the region. Within two decades, emission from eastern Asia could account for roughly half of the sulfur and nitrogen and a third of the carbon emitted from all anthropogenic sources worldwide. The Asia/western Pacific region has a unique mixture of aerosols and trace gases because of these distinctive patterns of emissions in combination with the particular meteorological conditions affecting the region. Anthropogenic materials in the atmosphere can also influence regional and global climate by altering the Earth's radiative balance. Continental outflow affects biogeochmical cycles of the North Pacific, and associated effects on marine biology and chemistry could also have climate implications. The following goals and tasks are the focus of our future research:

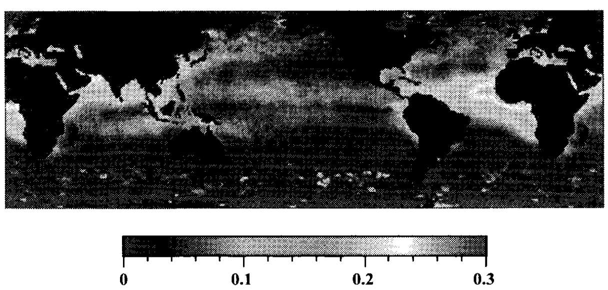

Figure. Annual composite image of aerosol optical thickness in 1993 obtained by NOAA AVHRR sensor. High aerosol concentration was observed along east coast of the Asian continent. However, satellite images cannot tell us the chemical composition of aerosols. It is possible to identify the aerosols are emitted from natural or anthropogenic sources and its transport pattern by chemical analysis.

Table. Source strength, atmospheric burden and residence time of various types of aerosol particles.

Source	Flux (10^{12} g yr^{-1})	Global mean Column burden (10^{-3} g m^{-2})	Residence time (day)
Natural			
Primary			
Soil dust (mineral aerosol)	1500	32.2	4.0
Sea salt	1300	7.0	1.0
Volcanic dust	33	0.7	3.9
Biological debris	50	1.1	4.1
Secondary			
Sulphates from natural precursors, as $(NH_4)_2SO_4$	102	2.8	5.1
Organic matter from biogenic VOC	55	2.1	7.1
Nitrates from NO_x	22	0.5	4.2
Anthropogenic			
Primary			
Industrial dust, etc.	100	2.1	3.9
Soot (elemental carbon) from fossil fuels	8	0.2	4.7
Soot from biomass combustion	5	0.1	3.7
Secondary			
Sulphates fropm SO_2 as $(NH_4)_2SO_4$	140	3.8	5.1
Biomass burning	80	3.4	7.9
Nitrates from NO_x	36	0.8	4.1

IPCC '95 (1996)