The Nippon Foundation

OPRF

Ship & Ocean Newsletter

Selected Papers

No.13
October 2010

Ocean Policy Research Foundation

Director's Message

As mankind moves into the 21st century, integrated policies of ocean governance are necessary for the sustainable development and use of our oceans and their resources and the protection of the marine environment.

Towards this end, the Ocean Policy Research Foundation (formerly: Ship & Ocean Foundation) has started an "Ocean Policy Research", with the mission statement "Living in Harmony with the Oceans".

The Ocean Policy Research Foundation aims to conduct cross-sectoral research in ocean related issues in order to initiate debate on marine topics and formulate both domestic and international policy proposals.

We publish a Japanese-language newsletter called the "Ship & Ocean Newsletter" twice a month. The "Ship & Ocean Newsletter" seeks to provide people of diverse viewpoints and backgrounds with a forum for discussion and to contribute to the formulation of maritime policies to achieve coexistence between mankind and the ocean.

Our Foundation believes that the Newsletter can expand effective communication on these issues through its function as editor, publishing timely research and welcoming responses from readers, which might then be published in turn.

"Ship & Ocean Newsletter Selected Papers No.13" contains English-language versions of papers from the Japanese Newsletter edition, published from No.211(2009.5.20) to No.230(2010.3.5).

It is our sincere hope that these Selected Papers will provide useful insights on policy debate in Japan and help to foster global policy dialogue on various issues.

Hiroshi TERASHIMA
Executive Director

■Publisher

Hiroshi TERASHIMA
Executive Director, Ocean Policy Research Foundation

Ocean Policy Research Foundation
Kaiyo Senpaku Building, 1-15-16 Toranomon, Minato-ku, Tokyo, JAPAN 105-0001
Tel. 81-3-3502-1828/Fax. 81-3-3502-2127
URL. http://www.sof.or.jp/en/index.php

Contents

Ship & Ocean Newsletter
Selected Papers No.13
October 2010

●The affiliation of the author and the contents of the article are exactly as they appear in the Ship & Ocean Newsletter.

Need for a Deep Sea Investigation System for Marine Accidents

[KEYWORDS] Japan Coast Guard / JAMSTEC / risk management

Shizuo HOSHIBA
Project Professor, The University of Tokyo GCOE Project
(Ship & Ocean Newsletter No.214 July 5, 2009)

For a seafaring country like Japan, deep sea research capabilities are important, and some critical issues have been resolved by the advanced research capabilities of deep-sea researchers. On the other hand, Japan's capabilities to search the deep sea for marine accidents are insufficient. Therefore, a deep sea crisis management system suitable for Japan should be developed that gives sufficient deep-sea research abilities to the Japan Coast Guard, in cooperation with research institutes and the private sector.

Introduction

Whenever we hear news that something special has sunk in the ocean, the same questions are brought up. Is somebody going to look for it ? How can it be found ? Is it going to be pulled up in the end ?

Here I would like to express my concerns about the fact that although Japan possesses very highly-developed deep-sea research capacities, it does not have a sufficient system in place in terms of national crisis management, and I also would like to propose resolutions for the issues involved.

Past case studies and an exploration system for the deep sea

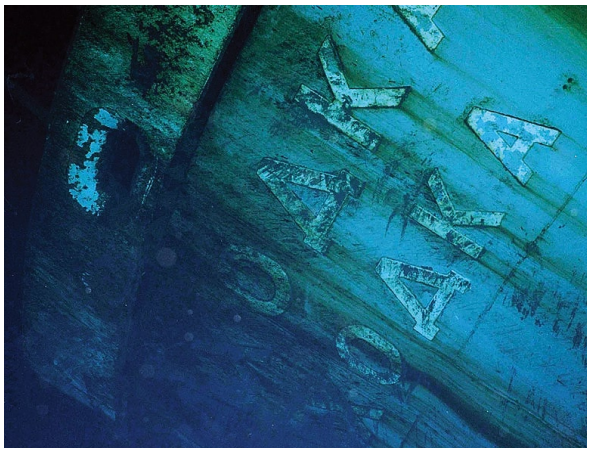
(1) Who found the Titanic and how ?

It seems that worldwide it is mainly research organizations which possess the ability to investigate the deep sea. There are many issues involved, such as raising treasures from shipwrecks, but most of that takes place in shallow seas. Doing the same in the deep sea is technically difficult and requires significant funds for exploration as well as for salvage operations, and this is difficult for the private sector.

It is known throughout the world that the passenger ship Titanic (length 269 m, gross tonnage of about 46,000 t) sank 3,800 meters to the bottom of the Atlantic, but was found in 1985 by Dr. Robert Ballard of the Woods Hole Oceanographic Institution in the U.S. in collaboration with the French Ocean Research Institute. Recently, I have heard that Dr. Ballard himself has remarked that he has been involved in a search requested by the U.S. Navy to explore for a sunken atomic submarine. Given this fact, one can assume that the U.S. Navy does not possess exploration capabilities greater than that of top research institutions.

(2) How was the sunken tanker "Nakhodka" found ?

During the winter of 1997, on January 2, the Russian-flagged tanker "Nakhodka" sank in the Sea of Japan (length 177 m, displacement of about 13,000 t, loaded with 19,000 kℓ of heavy oil). The ship had broken in two and the bow was washed ashore in Fukui prefecture amidst cold winter winds, while the ship body sank to the bottom to a depth of 2,500 meters. Fanned by the stormy weather, the load of heavy oil was washed ashore widely along the coast facing the Sea of Japan. Many local people and volunteers were engaged in removing the oil, with the winter cold and fatigue even causing the death of some people.



The stern section of the sunken ship "Nakhodka"(Photo: JAMSTEC)

On the other hand, no one could dispel concerns that large amounts of oil were further pouring out from the body of the sunken ship and floating towards the coast. Therefore, there were calls insisting on the need to investigate the state of the hull of the "Nakhodka" and the possibility that a great amount of heavy oil was leaking out.

The sinking of the "Nakhodka" was a so-called marine incident. At that time, I was working in the Japan Marine Science and Technology Center (JAMSTEC, the current Japan Agency for Marine-Earth Science and Technology), where I learned that the Japan Coast Guard could only investigate in shallow waters. The deep sea could only be investigated by research institutions that possessed the necessary exploration capabilities, although I had thought that investigation and countermeasure of marine incident was obviously the task of the Coast Guard. Within JAMSTEC there was a sudden stir, with some people saying "Why our center ?" or "This is going to be a disaster if we fail." But led by a group of deep-sea researchers familiar with the situation in the deep sea, JAMSTEC considered its role as

a member of the government which was push into a corner and judged that it was first and foremost their responsibility.

For a day and a night we prepared the unmanned deep-sea probe vehicle and its mother vessel, which had been receiving a periodic inspection at the time, and then headed for the Sea of Japan. As a result, in cooperation with the Japan Coast Guard, which had made a preliminary survey of the area, we succeeded in finding the sunken wreck and in determining the status of the hull, including the oil leak. This helped alleviate public anxiety and was a proper role for us to play as a government institution. However, as a member of a research institution, I somehow did not feel comfortable about it all.

(3) Is it possible to find a grain of sand in the ocean ?

JAMSTEC once searched for an H-II Rocket (flight 8) after a failed launch by the National Space Development Agency of Japan (now Japan Aerospace Exploration Agency). At that time the submarine struggled very hard to find the rocket engine, much smaller than a ship (the center part being about one meter in diameter), which had sunk to a depth of about 3000 meters in the Pacific Ocean (the search started on November 19, 1999, and succeed in recovering the engine in January 2000). The successful finding of the engine was a great achievement, as it was discovered that the cause for the accident was different from what had been assumed, which contributed significantly to the subsequent improvement of the engine. This work was due to the cooperation between research institutions and it was featured in NHK's television program "Project X - Challengers" (22nd episode, September 2000), which made the outstanding technical achievements of the deep-sea researchers widely known.

The Coast Guard should be equipped with deep-sea explorative functions to deal with marine accidents

I realized that Japan has only one organization possessing the capability to freely search the deep sea. However, explorations like the "Nakhodka" case are national emergencies and therefore an issue of crisis management. Should the coastal crisis management really be depending on the "chivarius spirit of sailors" of research organizations such as JAMSTEC ?

Article 2 of The Coast Guard Establishment Act stipulates that the Coast Guard "... by carrying out operations such as salvages, marine pollution prevention measures, ... makes it its mission to ensure maritime safety and security," while Article 4 stipulates the capabilities of the ships and aircraft it should be provided with as "structures, facilities and capabilities that are adequate to protect human life and property during a marine accident." This means the deep sea is not necessarily excluded.

The Japan Coast Guard possesses some excellent marine research capabilities such as the Hydrographic and Oceanographic Department (formerly the Hydrographic Department). The research capabilities are not limited to coastal waters, as vessels like the survey vessel "Shoyo" have the ability to examine any depth of the exclusive economic zone (EEZ). There are places in Japan's EEZ which are 6,000 meters deep, and the survey of these deep regions is important for the securing and conservation of national territory.

When we investigated the "Nakhodka," a large Coast Guard survey vessel narrowed down the most probable point by using the latest sonar despite the extremely poor conditions of the Japan Sea in winter, then we succeeded to find the point in a relatively short time. But although the agency currently has a towing vehicle, it still does not have an unmanned deep-sea probe vehicle with a propulsion engine. Therefore, I would like to propose that the Coast Guard should obtain and operate an unmanned deep-sea probe vehicle with a propulsion engine.

The operation of such probe vehicle needs both personnel and funds, but unlike manned vehicles, unmanned deep-sea probe vehicles are not that expensive. In regards to personnel, JAMSTEC relies heavily on experts from the ocean-related private sector. As this is not about maritime security action, there is no reason not to put a seafarer from the private sector in charge of the operation of a Japan Coast Guard survey vessel and the operation of a probe vehicle. If JAMSTEC and the Japan Coast Guard, respectively, were in possession of the necessary deep-sea probe vehicles and cooperated with each other in operational aspects through the use of the private sector, Japan's capacity for deep-sea crisis management would increase dramatically. This would also lead to maintaining and improving the manufacturing technology of unmanned deep-sea probe vehicles in the shipbuilding sector.

The Ministry of Land, Infrastructure, Transport and Tourism to which the Coast Guard belongs has built a ship for the recovery of heavy oil in preparation for tanker accidents, but the development of unmanned deep-sea probe vehicles is also a task that should be accomplished before the next accident happens. ■

On the Promotion of Ocean Education

[KEYWORDS] ocean education / school education / recommendations

Manabu SATO
Professor, Graduate School of Education, The University of Tokyo / President of the Japanese Educational Research Association
(Ship & Ocean Newsletter No.215 July 20, 2009)

The Basic Act on Ocean Policy stipulates the promotion of ocean education in schools. To realize this aim, last year the "Recommendations for Promoting the Spread of Ocean Education in Elementary Schools" was compiled.Creating an ocean education program as soon as possible is desirable, but as is the case with all good education, I think ocean education should be promoted based on the rich experiences one has when becoming familiar with the sea, enjoys the sea, and interacts with the sea.

Becoming familiar with the sea

I would like to start with my own personal recollections. I spent two years on a remote island in the Seto Inland Sea when I was in junior high school. I led a life in which my school was located next to the coast and my home was also near the coast. One half of the year, I lived a life enjoying the sea. After coming back from school, I would set my bag down at the door, take off my school uniform and shirt, and jump into the sea behind our house. I learned how to deep-sea fish, catch fish while snorkeling, as well as how to row a boat from the fishermen in the neighborhood. I was taught how to operate a motorboat and sea ski from the president of a shipping company who was an acquaintance of my father. I learned oil painting techniques from painting the landscape of the fishing port at sunset and sunrise from my art teacher in junior high school, and my music teacher taught me the joy of choral singing while watching the sunrise at the tip of the cape. I was fascinated by the sea, and even in class I continued to interact with the sea through the windows of the classroom. The sea was always talking to me. I was able to evoke the memories of cells born from the sea deep inside my body, and I imagined the day when all of my body cells would blend into the sea one day.

"When I graduate from junior high school I want to go to a merchant marine school to be a sailor." This dream was put on hold by the persuasion of my parents and teachers who encouraged me to go to college, and after graduating from junior high school I left the island and went to high school on Japan's main island, but the memories of the days I spent surrounded by the ocean for two years is still clear and fresh in my mind even now.

The Seto Inland Sea (Photo: Mihara City, Hiroshima Prefecture)

Two years ago, when I was asked by the Ocean Policy Research Foundation to become a member of the Committee for Promotion of Ocean Education in Primary Education, I immediately agreed to take on the job. This was because my vivid memories of the sea, which I thought had been forgotten, came vividly back to mind. After having accepted the offer, however, I regretted somewhat my over eagerness. My specialization is in the study of school curriculums, and I am virtually ignorant of oceanography and ocean education. The more I realized the gravity of the mission of ocean education, the more I was ashamed of the irresponsibility I had shown in so readily consenting to join the committee. Even now, a year later, I have the same feeling. However, among education researchers, who number in the tens of thousands, there are none specializing in ocean education. Given this state of affairs, I felt that even though I was virtually ignorant of the field, having direct experience of the necessity and importance of ocean education, it might be meaningful for me to be part of its creation and promotion. Telling myself this, I took up my appointment as a committee member.

More than a year later, after repeated meetings of the committee, we are now in the process of drafting our ocean education proposal, and I once again feel certain that, as in all good education, ocean education should also be promoted based on the rich experiences that come with familiarity, with enjoying the sea, and interacting with it. This is all the more true if the learners are elementary and junior high school students.

Learning from the sea

Our committee last year put together and publicized the Recommendations for Promoting the Spread of Ocean Education in Primary Schools [1]. These are the recommen-

dations that embody the spirit of Article 28 of the Basic Act on Ocean Policy (the promotion of public understanding of the ocean). In these recommendations, we established the following definition of ocean education.

"Humanity significantly benefits from the ocean and has considerable impact on the marine environment, making the ocean and human coexistence a national priority. Ocean education aims to not only deepen national understanding of human and ocean relations but also foster human resources with knowledge, skills, the ability to think, the power of judgment, and the expressive power to enable peaceful and sustainable development and use of the oceans based on international understanding while trying to protect the marine environment. To achieve this goal, ocean education has to promote learning to make people familiar with the sea, to know the sea, to protect the sea and to use the sea."

This definition is a very long one, but the main purpose is in the last passage. "Make people familiar with the sea," "know the sea," "protect the sea," and "use the sea" are proposals for four ways of study.

Promotion of ocean education does not mean setting up oceans as a new academic subject. Even if the ocean education curriculum were presented in the same systematic fashion as the educational guidelines for other subjects, it would be impossible to directly implement the curriculum in the current school curriculum. In reality, the contents of ocean education form a part of Integrated Studies classes and are already partially included in the contents of various other subjects. If we are to make a proposal in line with existing circumstances, we must present a clearer definition of ocean education and make explicit its contents, connect the ocean education related contents being taught in Integrated Study classes and other school subjects with this concept of ocean education, raise awareness of the conceptual structure, and creatively expand the educational practice of the ocean education genre. With this hope in mind, we have presented in these recommendations a schematic concept of ocean education, consisting of the four areas of becoming familiar with the sea, knowing the sea, protecting the sea, and using the sea, as well as a list of educational contents to be used as source material.

"Grand Design for Ocean Education in the 21st Century (edition for primary schools)"
http://www.sof.or.jp/jp/topics/09_06.php

The key to promotion

Fortunately, our recommendations drew a greater than expected reaction from educators, maritime officials, and the press. From here we would like to make an effort to deliver these recommendations into the hands of school teachers nationwide. The key to promotion is to build centers of ocean education. Although the government is still considering the proposal, we would like to establish educational research centers as hubs for promoting ocean education in several places nationwide. These centers would connect universities with schools, schools with various maritime-related organizations, and make efforts to support systematic and ongoing activities related to ocean education. Through these activities, it is hoped that professional marine researchers would be fostered. Harboring this dream, this year we have started to make recommendations for ocean education in secondary education.

After our recommendations were made public, I heard through word of mouth that the junior high school on the island I graduated from had been closed down. I wonder if junior high school students that have become familiar with the sea and lived with the sea, like I did, will disappear from the island. The possibility that the recommendations I had been preparing this year for ocean education at junior high schools could be put into practice on that island have been lost. This is truly regrettable. However, I think I would like to utilize the experience of being familiar with the sea and enjoying the sea, which my body cells are still remembering, for the process of making future recommendations. ■

1) http://www.sof.or.jp/jp/topics/08_03.php

Iron Fertilization in the Oceans — Results of Field Experiments and the International Situation

[KEYWORDS] Phytoplankton / carbon dioxide / global warming

Shigenobu TAKEDA
Associate Professor, Graduate School of Agricultural and Life Sciences, The University of Tokyo
(Ship & Ocean Newsletter No.216 August 5, 2009)

Since the possibility of reducing global warming by spraying iron into the Antarctic Ocean was proposed, iron-spraying experiments have been conducted 13 times in these marine areas, and the scientific verification of the hypothesis of iron limitations in the production of marine phytoplankton has made progress.Many of the results obtained suggest that the CO_2 absorption effect in the oceans due to the spraying of iron is less than first expected, but there are plans by venture companies to spray iron and the building of an international management system is underway.

Biological activity in the oceans and CO_2 absorption

The oceans have the ability to absorb CO_2, which is increasing in the atmosphere due to human activities, and to mitigate the rapid progress of global warming. This ability depends on the physical ocean water circulation and the bio-geochemical material cycle involving phytoplankton, and these cycles, through mutual interaction, are driving the global carbon cycle.

In order to achieve a smooth photosynthesis of phytoplankton, which is the origin of the marine biological carbon cycle, the supply of light and nutrient salts has to be sufficient. The nutrient salts N and P are often lacking in the surface waters of the open oceans, but in the offshore regions of the Antarctic Ocean, despite a high enough concentration of nitrate and phosphate in surface waters, phytoplankton biomass has been suppressed all the year round, a phenomenon which is said to be one of the mysteries of oceanography. As causes for this, the U.S. marine chemist John Martin found low concentrations of dissolved iron in surface waters and presented the hypothesis that phytoplankton growth is limited by the lack of the micronutrient iron. These kinds of waters are called high nutrient low chlorophyll (HNLC) marine areas, which spread to the equatorial Pacific Ocean and the subarctic Pacific Ocean, amounting to nearly 20 percent of the world's oceans.

Martin's discovery of a measure to curb global warming, caused by CO_2 deriving from human activity, caused much discussion. In other words, the idea that if one could facilitate the photosynthesis of phytoplankton by artificially providing iron in HNLC areas, the oceans' CO_2 absorption capacity would increase, has received attention as a low-cost measure to fix large amounts of CO_2.

Sprinkling iron into the oceans

To verify the hypothesis concerning the control of marine biological production and CO_2 absorption due to iron, it is essential to examine the response of the plankton ecosystem as a whole, including changes to the physical environment and impact on the food chain. Therefore, a new open-air experiment was proposed, where iron would actually be sprayed in an area of 50 to 300 km^2 of natural waters.

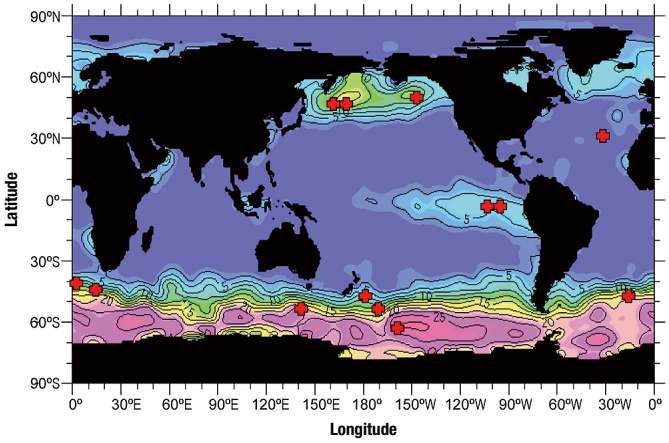
During the iron-spraying experiment, iron sulfate is dissolved in several thousands of liters of acid seawater, and, together with ocean water containing chemical tracers, (sulfur hexafluoride) is released via tubes and pumps from the stern of a moving survey ship into the target marine area. Then, while tracing the whereabouts of the water mass where the iron has been sprayed, using the concentration of chemical tracers as indicators, the differences in growth responses of plankton communities and changes in chemical composition within and outside these water masses are examined.

In HNLC waters these iron-spreading experiments have been conducted 12 times since 1993, as shown in the chart. Of these, SEEDS [1] and SEEDS-II took place in the western subarctic Pacific Ocean region and were mainly conducted by Japanese researchers. In addition, experiments were conducted in the subtropical oligotrophic waters of the Atlantic Ocean, where iron and phosphorus were sprayed simultaneously (FeEP, 2004).

What the iron-spraying experiments revealed

In many experiments a large phytoplankton growth based on diatoms and a marked decrease of nutrient salts and CO_2 concentration in surface waters could be observed, as well as an increase in the sedimentation of organic matter. In other words, it was confirmed as a response of the ecosystem on a scale of several weeks that in HNLC waters, due to the small supply of iron, the primary production and transport of carbon to the deep layers of the ocean had been restricted. However, it also became clear that because a large proportion of the organic matter produced by phytoplankton was dissolving near the surface, the contribution of the oceans toward CO_2-absorption was lower than originally expected. At the same time, results were obtained that showed that if iron was sprayed during the same season in the same area, there were cases where the composition of

■The distribution of Nitrate concentrations in ocean surface layers (μM) and the marine areas where iron-spraying experiments have been conducted



Eastern equatorial region of the Pacific Ocean (IronEx-I, in 1993; IronEx-II, 1995),
Australian district of the Antarctic Ocean (SOIREE, 1999; SAGE, 2004),
Atlantic Ocean district (EisenEx, 2000; EIFEX, 2004; LOHAFEX, 2009),
Pacific Ocean district (SOFEX-North, 2002; SOFEX-South, 2002),
Western subarctic region of the Pacific Ocean (SEEDS, 2001; SEEDS-II, 2004),
Eastern subarctic region (SERIES, 2002),
Oligotrophic waters of the subtropical regions of the North Atlantic Ocean (FeEP, 2004),
a total of 13 experiments.

biological communities and the scale of the response differed depending on the year, and that the biomass of phytoplankton almost did not increase if the surface mixed layers were deep, and therefore it can be said that with an increasing number of trials the complex aspects of the marine ecosystem have emerged.

The results of iron-spraying experiments conducted in 2004 were published as a review in the international magazine Science, in 2008. It was compiled mainly by the Surface Ocean - Lower Atmosphere Study (SOLAS) Project, a core project of the International Geosphere-Biosphere Programme (IGBP) sponsored by the International Council for Science (ICSU). Currently, a working group of the Scientific Committee on Oceanic Research (SCOR) is building a database of the iron-spraying experiments, and is constructing physical-biological models reflecting these results. However, as it is problematic to directly apply the short-term results from these iron-spraying experiments to a larger spatial and temporal scale, such as the entire Antarctic Ocean, complementary studies have to be conducted, and recently observations of the long-term responses of the marine ecosystem toward the phenomenon of a natural iron supply from yellow sand drops, small islands, and ocean plateaus have attracted attention.

Prohibition of commercial ocean fertilization

Apart from this kind of scientific research, several U.S. venture firms are obtaining patents for CO_2 absorption and fixation into the ocean by iron-spraying, and they are studying the treatment of carbon credits for the fixated carbon. Marine scientists express great concern about the difficulty in estimating the amount of absorbed and fixated CO_2 due to iron fertilization CO_2 and the uncertain impact on the ecosystem when carrying out iron spraying on a large scale, but there are signs venture companies are planning iron-spraying experiments for commercial purposes.

Under these circumstances, in a meeting of the Parties to the London Protocol, the need was recognized to manage ocean fertilization as a whole, as well as the spraying of iron, and the prohibition of commercial ocean fertilization and the proper management of scientific research on ocean fertilization was also considered. As an immediate conclusion, a resolution was adopted in 2008 stating that ocean fertilization for legitimate scientific research purposes would be determined case by case, in line with the evaluation framework that is currently in place, and that other acts of fertilization (excluding the artificial breeding of reefs) are contrary to the London Convention and the objectives of the 1996 Protocol of the London Convention and are not acceptable according to current findings. At the same time there have also been discussions under way to revise Annex I of the 1996 Protocol stipulating the objects for ocean dumping.

In addition, the Conference of the Parties to the Convention on Biological Diversity in 2008 made the decision that all kinds of ocean fertilization should be banned, except for small-scale scientific research in coastal areas, until sufficient scientific knowledge about risk assessment and control mechanisms have been obtained.

In any case, it will be necessary to closely follow future trends in the international community, as hasty regulations on experimental studies for scientific purposes are undesirable in consideration of the important scientific findings iron-spraying experiments have provided for the understanding of a phenomenon on the scale of an oceanic ecosystem. At the same time, we have to be acutely aware of the impact that a geo-engineering approach such as ocean fertilization may have on the earth's systems and that we live in an era when scientists more than ever before are required to provide information. ■

1) SEEDS(Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study) http://www.seeds-exp.jp/

Toward to Avoiding Collisions between Super High-speed Vessels and Whales

[KEYWORDS] whales / collision avoidance / super high-speed vessels

Hidehiro KATO
Professor, Faculty of Marine Science, Tokyo University of Marine Science and Technology
(Ship & Ocean Newsletter No.217 August 20, 2009)

In recent years a series of collisions between large marine life and high-speed hydrofoil boats have occurred and have continued to trouble transport officials.The laboratory for cetacean (whales and dolphins) biology at the Tokyo University of Marine Science and Technology, based on the working group of the Committee for considering safety measures for super high-speed vessels, which was established by the Ministry of Land, Infrastructure, Transport and Tourism, conducts research for avoiding collisions by seeking the cooperation of shipbuilding, maintenance, and operating companies.

Background

Although the situation has improved somewhat recently, in recent years a series of collisions between hydrofoil-type super high-speed vessels ("super high-speed vessels," Figure 1) and large marine life have occurred and continue to trouble transport officials. The number of domestic incidents in the past six years has reached 19, and an incident outside the port of Busan, Korea occurred in April 2007, causing 1 death and 102 injuries. These disasters often become the target of marine accident inquiries, and the factors causing them have been expressed in a very careful manner, but by and large it would be fair to say that large marine life in most cases refers to whales (see Figure 2).

With regards to collisions between whales and ships, from around the year 2000 in Europe at ASCOBAN [1] and/or ACCOBAMS, based on the UNEP/CMS (Bonn Convention on the Conservation of Migratory Species of Wild Animals), concerns about collisions between whales and ships started to be pointed out, and in tandem with that discussions at the IWC (International Whaling Commission), which is the main organization for whaling issues, were begun. In 2008, at the 60th IWC annual meeting held in Santiago, Chile, cooperation with the IMO (International Maritime Organization) was strengthened, as proposed by the Netherlands, and this line was also promoted at the 61st meeting held in June 2009 at Madeira, Portugal.

■Figure 1. Hydrofoil type high-speed vessel. Employed on important high speed routes linking remote islands with the mainland.

■Figure 2. Sperm whale, a whale species with a high collision risk. Their population has increased in recent years.

Why is the avoidance project necessary?

IWC, ASCOBAN/ACCOBAMS and IMO have regarded collisions between large cetaceans and super high-speed vessels as one of the threats to the survival of whales, and the main focus has been placed on deterring them. Their strategy is quite simple, and the issue was worked out by having super high-speed vessels settle on the ocean surface and slow down whenever whales appear. However, this will not solve the problem ... this is my view and also the reason why a research project is necessary. Japan, which is surrounded on all four sides by the sea, is currently the home of nearly 130 million people. However, even in regional areas, the population is concentrated in urban areas, while in the suburbs and mountainous areas extreme depopulation is in progress. The devastation of local communities destroys mountain villages existing in harmony with the environment, and mid-sized cities where urban development plans have failed and been abandoned halfway through are waiting for an even more miserable end. The islands are no exception; the depopulation of the once well-developed islands will devastate them, leading to environmental damage and disturbances to the coastline, and these disturbances will eventually penetrate the offshore areas. The super high-speed vessel services prevent the depopulation of the islands and with certainty shorten the travel

time between islands and the mainland. Through the traffic of people who feel that distances have been shortened by the high speed vessels, appropriate awareness education and environmental administration will be undertaken and environmentally harmonious home islands built, which will in the end work to protect the marine environment. We want to find a solution for the risks posed by collisions with whales from the viewpoint of the super high-speed vessels ... this is the opinion of the author.

Research project by Tokyo University of Marine Science and Technology on avoiding collisions between super high-speed vessels and whales

The Maritime Bureau of the Ministry of Land, Infrastructure, Transport and Tourism established the Commission for considering safety measures for super high-speed vessels in April 2006, the turning point being the crash of the super high-speed vessel Toppy off Cape Sata (April 2006). As there were great concerns that the cause of the collision might have been a collision with a whale, I was invited to participate as an academic expert (a formal final report was published in April 2009.)

The laboratory for cetacean biology at Tokyo University of Marine Science and Technology, based on the working group established by the above-mentioned committee, is conducting research on collision avoidance by seeking the cooperation of Kawasaki Shipbuilding Corporation, a maker of Jetfoils ("JF"), the main type of hydrofoil-type high-speed vessels, KHI JPS Co., Ltd., which is in charge of maintenance, and Sado Kisen Co., Ltd, and Tokai Kisen Co., Ltd., which are operating JF services. In the following, I would like to outline the projects for which we are responsible.

The current super high-speed vessels of the JF-type are equipped with UWS (Under Water Speakers), which emit sound waves with the aim of repelling the whales. However, whales (87 species in total, with 14 species of the suborder Mysticeti and 73 species of the suborder Odontoceti, recognized by the Society for Marine Mammalogy in 2010) are very different in terms of their acoustic characteristics, depending on the species, with a big difference especially between the baleen whales, which are highly adapted to the ocean, and the toothed whales, which retain a strong legacy from their terrestrial mammal ancestry (Figure 3). Questions therefore remain about the usefulness of the current UWS. It is not clear what kind of sound each whale species can hear, especially the large whale species, which are difficult to keep in captivity. However, in the meantime, working on the assumption that the whales can hear the calls of their fellow whales, we would like to try to identify the hearing range of high collision risk whale species in a different way.

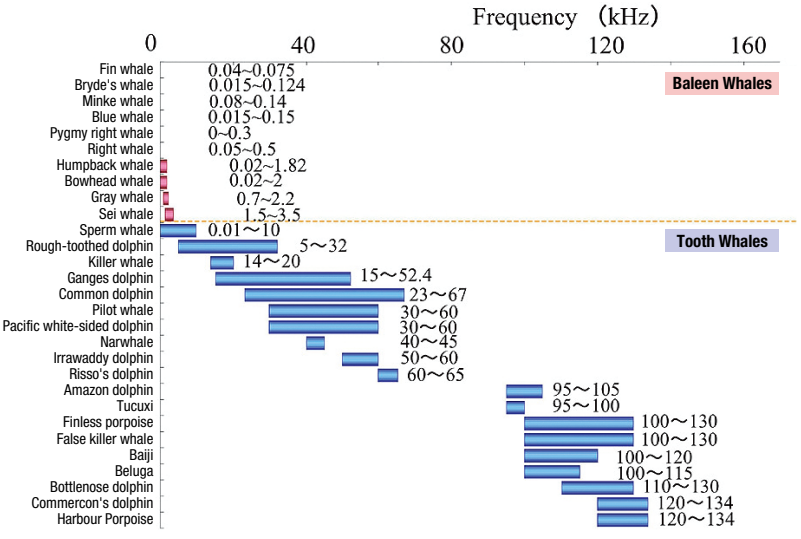
For this, the following two sub-projects have been set up under the following themes.

(1) Clarify which whale species are near the shipping routes and their seasonal variations, identify the whale species that have a high collision risk, and reflect their unique acoustic characteristics in the UWS. To achieve this task we have set up the following sub-projects.

i. Analysis of the normal visual data collected by ships in service, ii. Visual surveys specializing in whale species by whale probing experts, iii. Improvement in the accuracy of normal visual data by visual training to identify whale species, iv. Improvement in the identification accuracy of whale species and detection ability through the introduction of high-definition cameras, v. Identify whale species with a high collision risk based on a survey of the whale's body size and the above research results and improve the sounds generated by the UWS for each route and season.

(2) Conduct acoustic surveys using new ideas with the aim of estimating the audible range of whale species with a high collision risk: i. Estimate using an anatomical approach of the inner ear, ii. Estimate from correlations with their vocal characteristics, iii. Further improvement of the sounds generated by the UWS based on the above.

■Figure 3. Differences in the sonant frequency bands of whale species



Cited literature on sonant frequencies: Baleen whales, David K et al., 2002, Tooth whales, Backus and Schevill et al., 1966

With regards to the above-mentioned sub-project (1), significant progress has been made and reported to the above-mentioned committee, and the results have been compiled in master's theses at the University's Graduate School of Marine Science and Technology (academic year 2007 Aya ODAGAWA, academic, year 2008 Kentaro SHAKATA), In the academic year 2009 we aim to expand our studies into maritime areas around Kyushu and other areas. Moreover, with regards to sub-project (2), we are expecting to make progress from the year 2009 onwards after the feasibility study conducted in 2008. The positions of the manufacturers and the operating companies regarding this issue is very positive, the improvement of safety belts has already been finished, and further efforts are being made in the pursuit for greater safety.

Future challenges and expectations

In the course of the investigations and research for the improvement of the UWS, specific challenges for future research have been highlighted. As mentioned earlier, we have tried to introduce high-definition cameras to improve the accuracy of identifying whale species, but a new technique for obtaining high-quality images has also emerged, which might contribute to the early detection of whale bodies as well as the identification of whale species by. In one application of this, we are thinking of building a system that recognizes a whale's unique blow in an image, capturing the approach of high collision risk whale species at an early stage and sounding an alarm. Although things do not always proceed as planned, taking into consideration the user friendliness of the current JF and the high ability of crew members to steer ships, we believe that if an approach is predicted in advance to some extent, collisions with whales can be avoided. ■

1) ASCOBAN : Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas, 1991

Passage of the "Law on Punishment of and Measures against Acts of Piracy"

[KEYWORDS] pirates / anti-piracy law / UNCLOS

Yasuhiro OKANISHI
Cabinet Counselor, Secretariat of the Headquarters for Ocean Policy of the Cabinet Secretariat
(Ship & Ocean Newsletter No.218 September 5, 2009)

In this article I will discuss the outline of "The Law on Punishment of and Measures against Acts of Piracy," the anti-piracy law which took effect on July 24, the issuing of anti-piracy action orders, and future efforts.
Acts of piracy have occurred frequently in the waters off Somalia in recent years and have become a serious threat not only for Japan, but also for the international community, and therefore must be addressed with urgency.
The above-mentioned law addresses this situation by making systematic stipulations based on UNCLOS (United Nations Convention on the Law of the Sea) about the punishment of piracy on the high seas, and therefore the legislation can be called advanced, even by global standards.

Introduction

For Japan's economy and society and for the global economy as a whole, foreign trade is of high importance and so the safety of ships operating on the high seas is essential. The frequent acts of piracy off the Somali coast in recent years therefore represent a serious threat for the international community, requiring an urgent response. UNCLOS stipulates that all states should cooperate against acts of piracy through international cooperation, and the policing of pirate ships should be undertaken regardless of their nationality by applying their respective national laws. This is the only exception to the basic principle of the freedom of the oceans, the "principle of the flag state."

Given these occurrences of acts of piracy and UNCLOS, "The Law on Punishment of and Measures against Acts of Piracy" was passed on June 19 after 50 hours of deliberation by the Lower and the Upper House of the Diet and took effect on July 24, enabling Japan to take appropriate measures against acts of piracy as its national right. On the same day, orders for anti-piracy measures based on the law were issued and through these measures it will be possible to more adequately secure maritime safety, which is essential for the development of Japan.

The Gulf of Aden off the Somalia coast is an important sea-lane linking Asia and Europe via the Suez Canal, but because of the frequent occurrence of piracy acts, there is also the belief that ships would rather travel via the Cape of Good Hope. However, it is not acceptable that civilian vessels, innocent of any wrongdoing themselves and in international waters where the principle of free movement applies, should have to make a detour due to criminal acts such as piracy. Everyone should be aware that the safety of maritime traffic, which is literally the infrastructure of international trade, is something sought worldwide. The UN Security Council has adopted four resolutions calling on countries to send warships to deter pirates, and more than 20 countries have already sent war ships, etc., and have implemented activities such as patrols.

Japan's response

The Japanese government, after vigorous debate within the ruling parties, made a Cabinet decision on the anti-piracy law proposal on March 13. In addition, as an emergency measure until the law took effect, the government decided to dispatch Self-Defense Force vessels on maritime patrols. Maritime patrols face certain limitations, as the framework of the existing laws is being used. Firstly, the vessels to be escorted are limited to those that are related to the "lives and properties of Japan." Secondly, if one takes into account the actual conditions of piracy, the current provisions concerning the use of weapons might not be sufficient, since acts of piracy usually take place in vast maritime areas and present a serious danger to the life of crew members once their ships have been taken over by pirates, making a recovery extremely difficult. For example, it was reported that on April 4, a Self-Defense Force vessel received a report from an unescorted ship that suspicious boats were approaching it; in response, the SDF vessel used a large directional sound-producing apparatus, which stopped the approach of the suspicious boats. As a result, it was able to deter the suspicious boats using a non-forceful method, but this was a borderline measure, as no further measures could have been taken under the current law if the suspicious boats had not heeded the warning.

Overview of the anti-piracy law

(1) Significance and nature

The anti-piracy law stipulates measures to deal with pirates, such as dispatching the Self-Defense Force, as well as sanctions. By declaring acts of piracy on the high seas crimes against our nation, it is made clear that ensuring the safety of ships on the so-called high seas falls under maintaining the public order in Japan, and that measures against pirates are nothing other than an act of law enforcement

against crime. As a result, anti-piracy measures are based on international cooperation, but the ultimate intent of the law is the maintenance of public order in Japan.

(2) Definition of acts of piracy (Article 2)

Given the acts of piracy in recent years and taking into account the integrity of the criminal law and punishment in view of this, acts such as the takeover of ships on the high seas were determined to fall within the range of "acts of piracy" according to UNCLOS. Under UNCLOS, the jurisdiction that is ordinarily only accorded to the flag state is accorded to all countries in the case of pirates. Japan also will exercise its jurisdiction over all pirates, regardless of their flag state. Keeping in mind that the exercise of jurisdiction over pirates is an exception beyond the rest of the exceptions to the freedom of the high seas, acts of piracy have been defined in this anti-piracy law as typical acts attributed to pirates internationally. In addition, the nationality of the ship to be protected has not been restricted, but when it comes to actual measures a judgment will be made whether to take measures or not based on the impact on the Japanese economy and society, among other factors. In the case where such an act occurs in the territorial waters of a foreign state, this law does not apply, as it is common practice that the littoral country carries out law enforcement based on its sovereign rights.

(3) Measures by the Japan Coast Guard to deal with acts of piracy (Article 5 & Article 6)

It has been made clear that anti-piracy measures are to be primarily conducted by the Coast Guard, which has responsibility for protecting property and life at sea and for maintaining public order. Regarding the use of weapons, provisions for firing weapons to stop a ship were added. As it is extremely difficult to restore security after pirates have boarded a civilian vessel, the use of weapons to stop a pirate ship approaching a civilian vessel have been stipulated as a supplement to Article 7 of the Police Duties Execution Law.

(4) Measures by the Self-Defense Force to deal with acts of piracy (Article 7 & Article 8)

If the Coast Guard cannot deal with acts of piracy on its own, because of issues related to equipment, etc., the Prime Minister has given approval for the Self-Defense Force to take measures against acts of piracy. In order to receive the approval of the Prime Minister, the Defense Minister has to submit a plan of measures describing their necessity, location, size of units, period, etc., to the Prime Minister. Furthermore, the Prime Minister has to make reports to parliament at the time of approval and once the measures have ended. These procedures were decided upon in order to establish more effective control over Self-Defense Force activities, as it is expected that their foreign dispatches will often be for long periods. As according to the anti-piracy law the actions of the Self-Defense Force are law enforcement measures that Japan takes against crimes, the provisions for Coast Guard officers regarding the use of weapons will apply as usual. As the law enforcement operations conducted by the Self-Defense Force are limited to administrative policing, they cannot conduct judicial policing such as crime investigations, and are therefore similar to maritime patrols.

Issuing anti-piracy action orders and future efforts

On July 24th, the day the law took effect, the defense minister issued an anti-piracy action order. With this action the safety of maritime transport, which is essential for the development of our country's economy and society, can be more effectively secured than ever before. Applying this anti-piracy law will make it possible for Japan to properly deal with the frequent acts of piracy off the coast of Somalia. As vessels from any country can now be protected, it can also be expected that cooperation with other countries will progress smoothly. However, it is the stance of Japan that other middle and long-term efforts are also required, such as the strengthening of law enforcement by coastal states and the stabilization of the situation in Somalia.

Finally, as the law represents systematic anti-piracy legislation, including punishments, and has been introduced as an advanced case to the IMO-Council, I want to conclude with the hope that it might become a model for the rest of the world. ■

On March 14th of this year, Prime Minister Taro Aso sees off escort ships leaving port. (Photo: from the Ministry of Defense homepage)

Characteristics and Issues of Japanese-style Marine Protected Areas

[KEYWORDS] marine protected area / commons / Basic Plan on Ocean Policy

Nobuyuki YAGI
Associate Professor, Graduate School of Agricultural and Life Sciences, The University of Tokyo
(Ship & Ocean Newsletter No.219 September 20, 2009)

The debate over marine protected areas (MPA) is mounting globally. Locations that could be called MPAs exist in the hundreds in Japan. These MPAs have different characteristics from the type found in the West, but include elements which can serve as an example for an Asian type of marine protected area. It is vital to make efforts to win broad recognition by the international community in regards to this issue.

The Situation of Marine Protected Area

The debate over marine protected areas (MPA) has attracted great interest around the world.

At the World Summit on Sustainable Development in 2002 (WSSD), a resolution was passed to set up MPAs and a representative network by 2012 and also at the Evian summit (G8) in 2003 it was agreed that a regional network of marine and coastal protected areas would be created by 2012. Furthermore, the COP7 Convention on Biological Diversity in 2004 also passed a resolution to build a network of marine and coastal protected areas by 2012. In addition, the decision by the 26th Fisheries Commission of the UN Food and Agriculture Organization (FAO) in 2005 to establish technical guidelines concerning MPAs at the FAO and the several resolutions adopted at the UN General Assembly (A/RES/63/112, etc.), have encouraged this development.

Moreover, the designation system for PSSA (Particularly Sensitive Sea Areas) of the International Maritime Organization (IMO) also exists, but in Japan it has not yet been established.

In Japan, the Basic Plan on Ocean Policy passed by the government in a Cabinet decision in 2008 stipulates that "as a means for ensuring biodiversity and sustainable use of marine resources, based on the Convention on Biological Diversity and other international agreements, and under the cooperation of relevant ministries and agencies, we will clarify ways to set up marine protected areas in Japan and will promote their establishment in an appropriate manner."

Given this situation, there can be no doubt that clarifying how MPAs should be set up in Japan has become one of the challenges for Japan's ocean policy.

Hundreds of locations which could be called MPAs exist in Japan

A single definition for MPA does not exist which has been internationally agreed upon. The definition of IUCN (International Union for Conservation of Nature and Natural Resources) is commonly used, which defines it as a "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." In addition, the COP7 Convention on Biological Diversity notes " marine and Coastal Protected Area' means any confined area within or adjacent to the marine environment, together with its overlying waters and associated flora, fauna, and historical and cultural features, which has been reserved by legislation or other effective means, including custom, with the effect that its marine and/or coastal biodiversity enjoy/

■Table 1 MPA classification and the approximate number of each class

Name	Approx. No.
Undersea park areas under the Natural Parks Law	69
Undersea special districts based on the Natural Environmental Protection Laws	1
Protected water surfaces based on the Fisheries Resource Protection Law (only the surface of the sea)	About 55
No-fishing areas within the framework of the Fisheries Act (including autonomous management by fishermen)	Over 280

(estimated by the author as of 2009)

■Table 2 Differences between Japan and the United States with regards to the characteristics of MPAs

	Marine national monument in the Mariana marine area of the United States	No-fishing areas and protected areas of the coast of Japan
Scale	Extremely large scale (one area is several hundred miles)	Small scale (one area has a scale of several hundred meters, etc.)
Process of establishment	Top-down from the President's office	Many of them are bottom-up by coastal fishermen
Purpose	Protection of undersea mountains, protection of the ecosystems of coral reefs	Protection of fishery resources, protection of coastal ecosystems
Involvement of stakeholders	Unknown (not tampering with nature is the basic thought)	Aspects of implementation can be secured through active involvement. Also, direct involvement with the natural environment can include the release of young fish and clean-up activities.

enjoys a higher level of protection than its surroundings." Taking this into account, one can understand that various forms of marine protected areas exist and that even if entering an area is not forbidden, it can be considered an MPA if it is a marine area where limitations on harvesting plants and catching animals are being implemented.

To what extent do such marine areas exist in Japan?

Although there are no official statistics, the following places can be considered as candidates: (1) Marine park areas under the Natural Parks Law, (2) Marine special areas based on the Nature Conservation Law, (3) Protected waters based on the Act on the Protection on Fisheries Resources, (4) No-take zones which have been set up independently by fishermen within the framework of the Fisheries Act or have been set up by adjustment rules. If one adds up (1) to (4), this would mean that hundreds of MPA exist nationwide (see Table 1).

Characteristics of Japanese-style MPA and their future

In any case, looking at the situation described above, it can be said that the characteristics of the marine protected areas in Japan (or conservation activities) are as follows: firstly, in many cases the stakeholders (interested parties), coastal fishermen, voluntarily set them up from the bottom-up, in addition to the ones set up in a top-down fashion by the central government; secondly, rather than protection for the sake of protection, the nature of many is to conserve resources for future use; thirdly, activities where humans actively shape nature are being recognized as legitimate activities.

This looks very different from the Western type of MPA. For example, the United States set up large protected areas (marine national monuments) in the Pacific Islands, such as the Mariana marine area in January 2009, but as shown in Table 2, there are clear differences in the method of setting the area up and its scale between Japan and the United States.

Conclusion

As has been shown above, Japanese-type MPAs have different characteristics from their Western counterparts. The comparative merits and demerits of both will not be discussed here due to limitations of space, but I would like to clarify the future potential of the Japanese type of MPA.

Unlike Western countries, Japan has a history of depending on marine resources for its food. Even now, while in the West animal protein in the daily diet comes mainly from meat, in Japan it is mainly from fish and other seafood. Under these circumstances active involvement in the environment has developed distinct patterns, such as coastal areas being made into local commons for the sake of production, the establishment of protected areas through bottom-up local initiatives, and movements for ocean conservation through citizen participation or the release of young fish.

Asia is similar to Japan in that, unlike Europe and North America, many areas seek food resources from the sea and a large number of stakeholders exist in densely populated coastal areas. It would be better if the Japanese type of MPA became a model for Asia rather than the MPA of the West. For this reason, it is a key responsibility of Japan to communicate their Japanese-style protected areas to the international community and for them to have active discussions about the definition of MPAs.

Meanwhile, in Japan, even if hundreds of places exist which can be called MPAs, there is no justification for being complacent about the current situation. The current protected areas are set up on the basis of different laws and the jurisdiction over them also spans multiple ministries and agencies. Coordinating these different management environments is an important issue in itself. Also, despite the fact that nearly 40% of areas such as seaweed beds and tidal flats have been lost in the past several decades, there exist places which do not have sufficient institutional protection. Measures for solving this problem should also be examined. ■

Current Trends in "Bio-logging Science"

[KEYWORDS] bio-logging / marine animals / camera logger

Nobuyuki MIYAZAKI
Professor, Ocean Research Institute, The University of Tokyo
(Ship & Ocean Newsletter No.223 November 20, 2009)

In past research on bio-logging, we attached Argos transmitters to large marine animals and studied their migratory and diving behaviors, but now our research group has successfully developed a new high-performance energy-saving small data logger, a camera logger and even a small automatic detaching device.Fascinating research on all types of marine animals is being conducted based on this technology.

Background of the research

Researchers around the world have been attaching Argos transmitters to large marine animals to study their migratory and diving behaviors. TOPP (Tagging Of Pacific Predators) has been implemented in the United States since 2000, and they have so far received information about the behavior and environment of more than 22 species and 2,000 individual animals, which has advanced understanding of the earth's ecosystems. However, the transmission speed of the Argos transmitter is only 4,800 bps, so in order to further understand the behavior of marine animals and their habitats the emergence of a new system capable of collecting large amounts of accurate information has been eagerly awaited.

Our research team has successfully developed a separate system from the Argos transmitter, a new high-performance energy-saving small data logger and a camera logger, and even a small automatic detaching device. With this technology, it has become possible to attach the device to a greater variety of marine animals, including not only whales, seals, manatees, sea turtles and other large animals, but even small animals like the streaked shearwater, penguins, grunts, and eels, resulting in an abundance of fascinating research. In this paper, I introduce the content of bio-logging science activities in Japan.

Development of the devices and research results

Our research team has developed a system of data loggers, camera loggers and automatic detaching devices and conducted research based on our own ideas in order to develop bio-logging science internationally. The following is a brief description of these devices.

Data logger:

Digitizing the device has made it possible to obtain large amounts of high-quality data. At present, various models are used depending on the purpose of their application. In particular with the 3MPD3GT (ø27 mm, L: 190 mm, W: 125 g), which can record 3-D geomagnetism, speed, depth,


Photo 1


Photo 2

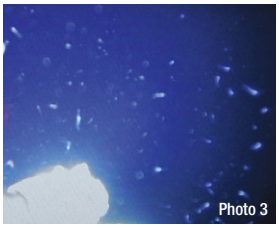


Photo 3


Photo 4

Photo 1) Weddell seal pup swimming after its mother (useful for the estimation of parent-offspring activities) Sato et al. (2003) Mar. Mammal Sci., 19: 136-147.
Photo 2) Underwater swimming behavior of an Adelie penguin group (useful for explaining group actions) Takahashi et al. (2004) Pro. Royal Soc. Lond. B., 271: 281-282.
Photo 3) Small organisms living in the deep sea (useful for the estimation of their relative density) Watanabe et al. (2003) Mar. Ecol. Prog. Ser., 252: 283-288.
Photo 4) A predatory scene of a Weddell seal observed at a depth of 314 m in the Antarctic sea (useful for the verification of predatory behavior) Sato et al. (2002) Polar Biology, 25: 696-702.

3-D gravity and temperature data in one second intervals, it has become possible not only to obtain information on the behavior and the environment of marine animals, but also information on the characteristics of their environmental preferences. Also, because the three-axis acceleration data is obtained from 16-64 Hz, three-dimensional behavioral trajectories of marine animals underwater and body postures and changes in body postures can be understood, as well as their underwater activities, such as the number of strokes. For example, we can grasp their foraging and resting behavior, as well as the complex changes in body posture of sperm whales and the Weddell seals during these activities. In addition, by analyzing the data in detail, we are able to obtain knowledge about systems of buoyancy compensation.

We developed the D2GT (ø15 mm, L: 53 mm, W: 16 g) for use with small animals in order to develop a device that reduces the burden on sea birds and fish. This device can measure not only water temperature and depth, but also 2-axis acceleration, and has proved effective for the investigation of not only diving behavior, but also the buoyancy compensation system of the Chinese sturgeon. By estimating more exactly the posture of a grunt while it is swimming, it has been possible to improve accuracy in estimating the population size using the images of a fishing detector. We have also been able to estimate predatory events from the subtle movements of the lower jaw of a seal by attaching the device to its lower jaw, which has attracted international attention. In this way, many different methods of using the devices depending on purpose have become possible. We are also currently focusing our efforts on developing the world's smallest data logger, and are highly optimistic as to the further progress of our research.

Camera logger:

In order to verify the characteristics of diving behavior and environmental preferences of marine animals obtained through the data logger, it was essential to develop the camera logger DSL2,000m (ø31 mm, L: 230 mm, W: 73 g). As this model can capture 2,000 images in a 30-second interval, it is useful in getting direct information about the predatory behavior of wild animals, relative prey density, social behavior, relationships with other organisms in the ecosystem and the way they use their habitat (Photo 1-4). As for the Weddell seal, the relative prey density, predatory scenes, and groups of invertebrates forming underneath 150-m thick ice have become clear. Likewise, we can now see how the Adelie penguins interact with krill, how the Shag uses its habitat, how the chum salmon selects its environment, and in the case of the Giant mottled eel, its environment in Lake Poso (Indonesia, Central Sulawesi) is now more clearly understood. Currently, the new camera logger DSL-II 2000m (ø31 mm, L: 230 mm, W: 73 g, minimum shooting interval: 4 images/s, number of recorded images: 8,000-10,000 frames), has been developed and it is now possible to visually capture the interactions between the Adelie penguins and krill in Antarctica.

Automatic detaching device:

For the kinds of animals where it is difficult to recover the logger, we developed an "automatic detaching device" with which it is possible to detach the data logger and camera logger from the animal at a scheduled time with the help of a timer. As this device is extremely precise, it has proven useful for animals such as the Baikal seal, Hooded seal, Chinese sturgeon, Loggerhead sea turtle, the Giant mottled eel, and the black bass, to name a few examples of its current wide use around the world.

The above model was developed independently in Japan and because it can be used many times by replacing the batteries, it has acquired an international reputation as an extremely efficient system. By using these systems, it is possible to obtain a wealth of fascinating findings, and demands for collaborative research not only domestically, but with researchers from around the world have risen sharply.

Future prospects

As we have seen, Japanese researchers have developed devices based on their own creative ideas as pioneers in this field and they have accomplished outstanding research achievements. To "Explain the mysteries of the sea from the perspective of the animals," is a viewpoint useful not only in clarifying relationships between the diving behavior of animals and their environment, it can also play an important role in the rational management and use of marine life resources and for the challenges which have currently become pressing issues, such as the protection of biodiversity, environmental protection, and global climate change. In the future, through the participation of young researchers and graduate students, we want to develop the science of bio-logging even further, and with the support and cooperation of stakeholders and the general public, disseminate this new science to the world. ■

Submarine Groundwater

[KEYWORDS] groundwater linking land and sea / material load to the ocean / coastal ecosystem

Makoto TANIGUCHI
Professor, Research Institute for Humanity and Nature
(Ship & Ocean Newsletter No.224 December 5, 2009)

Submarine groundwater discharges have drawn attention as hidden water linking the land to the ocean, as an important part of the material load to the ocean, and as a factor influencing coastal ecosystems.Their existence has been known since Roman times, but quantitative evaluation of submarine groundwater has now begun as an international interdisciplinary collaborative research project. I will introduce the unknown connections linking the land and the ocean.

What is submarine groundwater?

The coast and beach are in many ways a kind of border. They are the boundary between the land and the ocean, and the boundary between freshwater and seawater. Likewise, the research of coastal waters is the boundary between oceanography, which sees inland waters flowing into the ocean, and limnology and hydrogeology, which see inland waters as flowing out to the ocean. In the past, each discipline was literally looking in a different direction, and conducted their research separately. More recently, however, it was reported that a certain amount of nutrient, which could not be explained by the material load due to the inflow of river water, was flowing from the land into the ocean. The inflow of submarine groundwater into the ocean, the load on the sea of materials containing nutrient, and evaluation of this impact on the coastal ecosystem have all been taken up as an international interdisciplinary collaborative research project.

Most rainwater, once it infiltrate into the ground, becomes groundwater. Then most of the water flows from groundwater into rivers. Science has shown that the water which increases in rivers after it rains is not in fact the rain itself but the groundwater which had been stored in the ground before the rainfall and was then pushed into the river by the rain. However, what happens if this groundwater directly went to the ocean instead of flowing into a river. "Submarine groundwater discharge" is a phenomenon where this groundwater flows directly into the ocean.

The amount of submarine groundwater flow

There are various factors that determine the amount of submarine groundwater discharges. One is the driving force that moves groundwater from land to sea, and another is the permeability of the aquifer containing the groundwater. The driving force that moves groundwater is controlled by the amount of groundwater recharge and the hydraulic gradient, mainly determined by the slope of the terrain. In addition, the permeability of the aquifer is determined primarily by the permeability coefficient of the aquifer. In addition to these, the scale of the rivers also controls the amount of submarine groundwater flows. In other words, in areas where no large rivers exist, such as on islands, the proportion of groundwater discharges becomes larger.

■Table 1 Percentage of direct groundwater flowing into the sea (Taniguchi, 2005)

Author,	Percentage of groundwater flows,	Method
Berner and Berner [a]	6 % of the total water flux	Literature,
Church [b]	0.01 ~ 10 % of surface runoff	Literature
COSODII [c]	0.3 % of surface runoff	Hydrological assumption
Garrels and MacKenzie [d]	10 % of surface runoff	Water balance
Lvovich [e]	31 % of the total water flux	Water balance
Nace [f]	1 % of surface runoff	Water assumption
Zektser et al. [g]	10 % of surface runoff	Water balance
Zektser and Loaiciga [h]	6 % of the total water flux	Hydrograph Separation

So, how much groundwater around the world is leaking into the ocean as submarine groundwater discharge? Table 1 shows the percentage of submarine groundwater discharges that constitutes all the water flowing into the seas (Taniguchi, 2005). The estimated percentage of the influx of submarine groundwater flows of the total influx into the ocean differs greatly from 0.01% to 31%, but seen as a whole, 1 to 10 percent of the whole discharge is the part that can be attributed to the direct influx of groundwater (submarine groundwater discharges). These quantitative evaluations have just gotten started, and the international research organizations IAHS (International Association of Hydrological Sciences) and IAPSO (International Association for the Physical Sciences of the Oceans), and the SCOR (Scientific Committee on Oceanic Research) and LOICZ (Land-Ocean Interactions in the Coastal Zone), IOC, IHP, IAEA and IUGG (International Union of Geodesy and Geophysics) have organized joint research groups and have been carrying out international collaborative research after establishing three tasks based on research methods and the scale of the research objects.

As mentioned above, in terms of water balance, the amount of direct groundwater flows into the ocean is less than 10% of the total amount of flows, but with regard to material transport (amount of load) caused by Submarine groundwater, the dissolved concentrations of groundwater are usually greater than those of river water, and therefore, in terms of the impact on the geochemical and ecological balance it can be said that this is more important than the amount itself. With regards to the transport of substances

through groundwater to the ocean, the amount of salt the groundwater brings to the sea is estimated to be about 50% of the amount brought by river water.

The important role of the material cycle

Science has gradually shown that as hidden links in the water cycle, submarine groundwater discharges also play an important role in the material cycle, but how is this submarine groundwater affecting the surrounding environment after it has flowed into coastal areas? One of the characteristics of submarine groundwater discharges is their constant temperature. There are many creatures which can exist in the coastal ecosystem only when there is this constant temperature and brackish water mixed with just enough fresh water.

As an example, let's look at the ecology of submarine groundwater discharges and oysters (Crassostreanippona) at the base of Mt. Chokai. At the Research Institute for Humanity and Nature of the National Institute for the Humanities, an impact assessment on the effects of submarine groundwater discharges on the coastal ecosystem is being conducted as the collaborative research project "People and Water" (Head: Tomoya Akimichi) (Taniguchi, 2009). At Kamaiso, Mega, Kisakata, etc., on the submontane coast of Mt. Chokai, oysters have a different size and shape depending on the bay. Where does this difference come from? Is it the physical environment, such as temperature, or the chemical environment, such as nutrients, or are there other unrelated factors? As clues to investigate this difference, we consider factors such as whether the fresh water portion of brackish groundwater comes from river water or from groundwater (submarine groundwater discharges), and research is also being done on how temperature environments and flows of nutrients into the ocean vary. The temperature of groundwater is more constant and stable than the temperature of river water. This is because groundwater has a longer residence time and flow relatively slow, the water is mixed with daily variations and seasonal fluctuations and therefore becomes constant, whereas river water has a residence time that is short and flows fast. With regard to nutrient loads, the concentration of dissolved substances in river water and groundwater is different, and it is conceivable that these differences have an effect on the coastal ecosystems, including the oysters. In addition, when sandfish spawn on the coast of Mt. Chokai, they also lay eggs in bays where no rivers exist. For recurrent freshwater fish such as sandfish, there is no problem if the freshwater that is part of brackish water comes from groundwater rather than a river.

Submarine groundwater discharges in Kamaiso, the submontane coast of Mt. Chokai

Research on coastal areas where water, humans and living things are intertwined with each other in various ways

Submarine groundwater discharges are usually an invisible phenomenon. However, the fishermen of Suruga Bay found out about submarine groundwater discharges because white bait were gathering there, and in Saijyo, Ehime there is a well in the sea which supplied fresh water to fishing boats carrying fish that stopped along the way. From there, fresh groundwater was discharging. Furthermore, in Shiranui there is a well that shows its face only during low tide, from which submarine groundwater (fresh water) is discharged and used by the local people in their daily lives. All of this shows that the regional water cycle is connected through groundwater, and it is the coastal areas where water, humans, and living things are connected. The link between forests and the sea, centered on beech forests, has received much attention lately, but "the forest as lover of the sea," is not necessarily made up only by rivers. Submarine groundwater discharges are a phenomenon in which the land is directly connected with the sea through groundwater.

Coastal areas where water, humans and living things are intertwined in various ways are perfect places to create integrated knowledge through research, not only for the disciplines of oceanography, hydrogeology and limnology, but also for interdisciplinary research. Research into the coastal areas where diverse things clash with each other at their boundaries is a field we should promote further. ■

International Trade and Resource Management of Precious Coral

[KEYWORDS] precious coral / CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora)/ marine resource management

Hiroshi HASEGAWA
Associate Professor, Institute of Science and Engineering, Faculty of Chemistry, Kanazawa University
(Ship & Ocean Newsletter No.224 December 5, 2009)

Precious coral is one of the few natural resources for which Japan is a major producing country. Currently it is being discussed at the conference of the parties to CITES, whether precious coral should be included in CITES (international trade regulations) in terms of the protection and conservation of precious coral as a marine resource. I am putting my hopes into efforts that can be proposed to the international community, because it is Japan that has nurtured a culture of living in coexistence with the sea and precious coral.

What is precious coral?

Precious corals are different from reef-building corals, which are distributed in the shallow seas of tropical and subtropical areas, in that they grow slowly over years in depths of water that receive little sunlight. Both are organisms belonging to Cnidarian Anthozoa and possess skeletons whose main component is calcium carbonate, but whereas the skeleton of reef-building coral has many gaps, precious coral form a densely packed dendrite skeleton (see photo). The skeleton of precious coral is a bright peach red color and is very hard, and because of its beautiful appearance it is traded at very high prices for jewelry or accessories.

Although this fact is generally not well known, precious coral is one of the few natural resources for which Japan is a major producing country. The production areas of precious coral are limited to certain regions of the world (see map). Well known regions overseas are the Mediterranean, the Western North Pacific, and the area around Midway, Hawaii. In Japan, Kagoshima and Kochi, Okinawa, the Goto Islands, and the area off the Ogasawara Islands are the main coral fishing areas, and it has been reported that in the five years from 2001 to 2005 1 to 2.5 tons of coral have been caught (according to materials from the Division for the Management of Fisheries of the Kochi Prefectural Government). Red coral, peach-colored coral and white coral, which can be caught in the waters near Japan, are also exported to foreign countries.

Developments related to the CITES

Recently, in terms of the protection and conservation of marine resources, the issue of precious coral has been taken up at the Convention on International Trade in Endangered Species of Wild Fauna and Flora (commonly known as the Washington Treaty, or CITES). At the 14th Conference of the Parties to CITES, which was held in June 2007, the United States proposed listing precious coral in Appendix II of the CITES (international trade regulations). This proposal was approved by the First Committee, but rejected by the General Assembly for such reasons as a lack of scientific data showing a decrease in the amount of resources, and the discussion has been carried over to COP 15 to be held in 2009. The United States has already announced in the Official Gazette of July this year that it plans to again propose listing precious coral in Appendix II. China also listed four species of precious coral in Appendix III in 2008, meaning that it requests cooperation from other countries in order to protect resources within its country (in this case China).

In the case of Appendix II, which is the list that is currently being discussed as the document where precious coral should be put, the target coral would be, "species not necessarily threatened by extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival." If a species is listed in Appendix II, it becomes necessary for the exporting country to issue permits which proves that the trade does not threaten the survival of the species due to international trade and that the individual

Precious coral (left) and the carbonate skeletons of a reef-building coral (right) (From Sango no Bunkashi, Coral Culture Magazine)

specimens have been caught legally. In Japan, the law regulating the implementation of CITES, the Law for the Conservation of Endangered Species of Wild Fauna and Flora (commonly known as the Endangered Species Act) has been enacted, and for the species regulated by the CITES, a permit is required at the time of a transaction, even for processed products where only part of the species is used, as is the case for precious coral. Currently, the domestic precious coral industry is in an economic situation which cannot be called good, and there are fears that listing the coral in the CITES Appendix II would likely accelerate the economic slowdown, making it a issue of the most consequences. In addition, there is also the possibility that in the future this could lead to a listing in Appendix I (ban on all international trade).

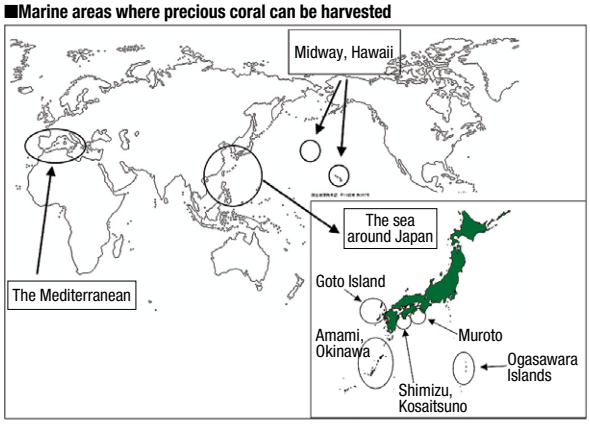
It is not the case that the precious coral industry in Japan is overexploiting the resources, but rather the opposite. The collection of precious coral must be authorized by the local government, and there are limitations on the areas, duration of operations, as well as the method of fishing to prevent overfishing. The precious coral union has also implemented voluntary regulations, saying that precious coral smaller than a certain size will not be collected. However, globally overfishing of precious coral is a real problem, and in the waters around Japan in particular poaching by Taiwanese trawlers has become apparent. If effective measures are not taken globally, the decline in precious coral resources can probably not be avoided.

Strategies and expectations for the future of precious coral

The two big powers between which Japan is caught are perhaps trying to address the conservation of precious coral from different perspectives. The United States has embarked on the protection of marine life, based on what one could call the universal principle of preventing the extinction of wildlife species. Meanwhile, China has not made its purpose clear, but taking into account the recent moves relating to rare metals, China could be considered to have the intention of using precious coral for its resource diplomacy. There exists the possibility that precious coral could be treated as a national strategic resource, as is the case with pandas. The Japanese government's response to this seems to rest on the opposition to a listing in the CITES Appendix II in order to protect Japan's domestic industry. The Fisheries Agency adopted a policy of opposition at the 15th Conference of the Parties, expressing doubts about whether there is enough scientific data on which regulations could be based.

In fact, scientific data on precious coral is remarkably sparse. In order to determine the amount of resources of precious coral, extensive scientific knowledge is essential,

■Marine areas where precious coral can be harvested



but academic studies on reef-building corals outnumber those for precious coral by a hundred to one. Knowledge about species in Japanese waters is especially insufficient and species not described or that have not been scientifically identified are even now being distributed in international transactions. Faced with these circumstances, my group has been working for several years on a research project targeting precious coral from around Japan, and we have conducted a survey on the distribution and stock of precious coral. For the sustainable use of precious coral resources, knowledge about the individual species, the distribution and the growth rate of precious coral is fundamental. At this stage, even this fundamental scientific data is lacking. Also, if international trade were regulated, technology would be required to identify the species and production areas. In this case, a detailed analysis of the precious coral produced in Japan would be necessary in order to clarify the difference between domestic and foreign products, and to define a high-quality brand image.

For Japan, which relies heavily on international trade, it will be important in the short term to consider measures that can be taken to facilitate international trade in order to acquire adequate marine resources. In the long term, it seems it is necessary to establish a uniquely Japanese philosophy toward marine resources as well as a strategy that one can be proud of internationally and that is based on solid scientific knowledge. Japan is an island surrounded by the sea where the life and culture of the Japanese has been deeply involved with the sea, and this is not limited to precious coral. There exists a culture of daily life that cannot be reduced to the narrow sense of environmental protection and the hoarding of natural resources. In order to pass on the current culture to future generations, we must tackle the issue of protecting marine resources head on. I hope that we will accumulate strategies, a philosophy and the scientific knowledge for leading the discussion on the issue of precious coral in the international community. ■

Japan's Ocean Policy for the Future

[KEYWORDS] ocean state /ocean policy / management of the sea

Seiji MAEHARA
Minister of Land, Infrastructure, Transportation and Tourism (also Minister for Ocean Policy)
(Ship & Ocean Newsletter No.226 January 5, 2010)

It can be said that promoting long-term ocean policy is a top national priority. We have already accomplished, in bipartisan fashion, major marine policy objectives such as the enactment of the Basic Act on Ocean Policy in 2007, the establishment within the Cabinet of the Headquarters for Ocean Policy, and the formulation of the Basic Plan on Ocean Policy in 2008. I believe that gathering together the wisdom of Japan and promoting the use and development of the vast frontier of the ocean will be a new driving force for Japan in terms of industry, technology, and science.

Introduction

Having been appointed the Minister for Land, Infrastructure, Transportation and Tourism, I also serve as the Minister for Ocean Policy, and am thus entrusted with the critical mission of securing the country's marine interests. When I think about the fact that Venice, located in a small lagoon and with only a small population, prospered as a seafaring country for a thousand years, it seems natural to think that Japan, a small country territorially and with an aging and declining population, must establish a secure foundation as an ocean state if it would continue to thrive.

In his policy speech at the 173rd Diet, which was the extraordinary session and was first convoked after the change of government, Prime Minister Hatoyama spoke of "moving from an insular island to an open ocean state." Needless to say, Japan is one of the world's leading ocean states. It is an island state, surrounded on all sides by the sea, and has a vast exclusive economic zone (about 4.47 million km^2; the world's sixth largest) compared to the size of its land territory (about 0.38 million km^2). The promotion of an ocean policy with a long-term perspective is therefore one of the most important issues for the Japanese government.

Reflecting the growing significance of ocean policy, we the Diet members have pressed forward in a bipartisan way which successfully led to the results such as the enactment of the Basic Act on Ocean Policy and the establishment within the Cabinet of the Headquarters for Ocean Policy in 2007, and the formulation of the Basic Plan on Ocean Policy in 2008.I myself have been deeply involved with the above work as a politician and have served as the facilitator and co-chairman of the "Follow-up Study Group on the Basic Act on Ocean Policy", consisting of politicians from various parties and experts, until last summer. With my recent appointment as the Minister, I have resigned from the post of co-chairman, but will continue to work on ocean policy more actively than ever before as a facilitator of the group and as the Minister in charge.

At the 8th meeting of the Follow-up Study Group on the Basic Act on Ocean Policy (October 29, 2009 in Tokyo)

Our Ocean Policy for the Future

Looking at the situation the world is facing, with the growing world population and significant economic development in emerging countries, a medium-term tightening in the supply and demand of resources and energy and price increases are to be expected. In such circumstances, I believe from the standpoint of resources and energy security, the importance of untapped resources in the sea will increase even more for Japan's future. The waters surrounding Japan can be regarded as a gold mine for resources and energy, as they contain polymetallic sulphides containing precious metals as well as methane hydrate, which is showing great promise as a future energy resource with less CO_2 emissions. In order for Japan, which is usually thought of as a country with few natural resources, to become a natural resource superpower, it will be extremely important to establish a system that secures its marine interests, combined with the certain realization of commercialization in 10 years time through the acceleration of research and development relating to ocean resources. Furthermore, we must put forth our efforts with respect to the natural energy of the oceans (ocean-based wind power, wave power, tidal power, etc.), which has the possibility of becoming a future source of energy, and also in terms of global warming counter-measures.

Under the provisions of the United Nations Convention on the Law of the Sea, coastal states can extend the continental shelf beyond 200 nautical miles (about 370 km) if certain conditions are met. States have sovereign rights over the continental shelf to exploit submarine natural resources. Japan has submitted relevant information and data in November 2008 to the Commission on the Limits of the Continental Shelf of the United Nations in order to extend

its continental shelf. The examination of the case in the subcommittee of the Commission began in September 2009 and is expected to take two or three years to conclude. It is important for Japan to exercise its rights under the Convention and to secure its marine interests at the United Nations, and the Japanese government intends to promote this policy with a concerted effort.

Furthermore, in terms of management of the sea, we hope to establish a mechanism to preserve and manage the remote islands that dotting our country. Needless to say, not only Japan's vast exclusive economic zone above-mentioned, but also the continental shelf which we submitted to the said Commission, owe their basis to a large number of remote islands, from which the maritime zone is measured. On the understanding that the remote islands provide the basis for our exclusive economic zone and continental shelf and their preservation and management are essential for securing Japan's marine interests, the government on December 1st, 2009, formulated the "Basic Policy concerning Preservation and Management of Islands for Management of the sea" based on the Basic Act on Ocean Policy. In particular, as Okinotorishima, located at Japan's southernmost tip, and Minamitorishima, at Japan's easternmost tip, each of the islands has exclusive economic zone of more than 0.4 million km^2, which is larger than Japan's land area. We therefore are hoping to expand concrete measures for the effective utilization of these islands and surrounding ocean areas.

Also, with regards to global environmental problems such as the urgent issue of global warming, the oceans, which cover 70% of the Earth's surface, are not only playing a crucial role in regulating the Earth's temperature, but as they also are an absorption point for a large amount of carbon dioxide we believe that this role will become increasingly important. We must therefore strengthen investigations, research, and development to more accurately understand the relationship between the oceans and global climate change and to improve our responses to these issues.

With regard to research and development, work to formulate the 4th Basic Plan for Science and Technology by the end of FY2010 has begun in a concerted effort by the whole government, and we are thinking of firmly positioning research and development concerning the oceans, including the relationship between global environmental issues, within this plan. Moreover, by the end of this fiscal year we aim to establish a clearing-house for information related to the oceans within the Ministry of Land, Infrastructure, Transportation and Tourism (Japan Coast Guard). At present, the information gathering process is currently spread among various organizations, so we expect this new clearinghouse will streamline and revitalize marine investigations and research.

The ocean is also very important for our supply of food. Japan's food self-sufficiency ratio on a calorie basis is currently only 40%, while the self-sufficiency ratio of marine products, that is living marine resources, is relatively high, about 60%. Further efforts are, however, needed to improve our work in the areas of fisheries, where efforts of ocean policy traditionally have been promoted.

Also, we should recall that Japan's marine industry, which first came onto the world stage during the Meiji era, has been rapidly fading in recent years in the face of neighboring Asian countries' rapid development. I would like to establish a growth strategy for marine industries, including the provision of world-class port services, by this summer.

In addition, as you can see by the fact that "Tsunami (a seismic sea wave)" has entered the English vocabulary, Japan boasts world-class research and measures relating to disasters deriving from the ocean, such as earthquakes, tsunami, and tidal waves. We need to make far greater efforts to utilize these technologies, of which we can be justly proud, along with our high-speed railways and other technologies, in order to make a contribution to international cooperation and the world as a whole.

Looking toward Japan's future

Although Japan has long benefited and been protected by the sea, given our declining birthrate and aging society it is important to be more active in the search for sources of wealth in the oceans in order to maintain our prosperity in the 21st century. I believe that bringing together the wisdom of the Japanese people and promoting the use and development of the vast frontier of the ocean will be a new driving force for Japan in terms of industry, technology, and scientific research.

As Minister for Ocean Policy, and as a politician, in order to secure Japan's path into the future I intend to continue my efforts to tap the vast frontiers of the ocean, and for this I would like to ask for everyone's cooperation. ■

New Developments regarding the Marine Litter Problem — On Occasion of the Enactment of the Law for the Promotion of Marine Litter Disposal

[KEYWORDS] marine litter problem / network-type co-creation / community development

Naohiro GO
Associate Professor, Tohoku University of Community Service and Science
(Ship & Ocean Newsletter No.230 March 5, 2010)

With the establishment of the Law for the Promotion of Marine Litter Disposal, Japan has formulated its basic policy on measures against marine litter. According to this law, the government will now take financial measures based on the regional plans of the prefectures, but there are fears that important cross-regional aspects of the problem will be overlooked. I hope that there will be more active efforts for community development and integrative management of coastal areas while working with each other in a multilayered way on multiple levels such as regional, national, and international levels.

The significance of the Law for the Promotion of Marine Litter Disposal and its challenges

For the past 10 years, efforts to solve the marine litter problem have become more active, interlinking in a multilayered way at various levels, including the regional, national, and international levels. With this as the background, a new chapter was begun when the long-sought Law for the Promotion of Marine Litter Disposal was enacted by parliament with legislation supported across party lines on July 8, 2009.

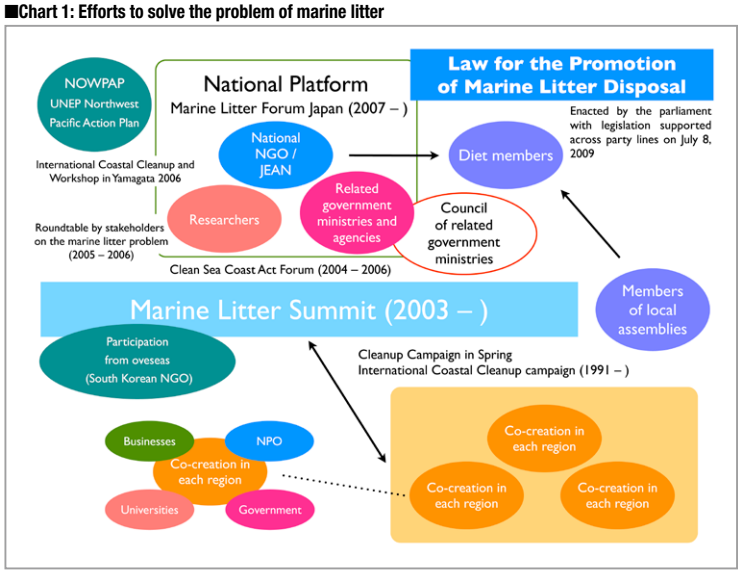
The landmark points of this law are its contents and the enactment process. First, the most important point is that it is the first comprehensive law on measures for marine litter in Japan (but it is limited to litter washed ashore). The law clarifies the disposal responsibilities of the coastal administrators and others (prefectures, etc.) as well as the obligations of the municipalities to cooperate, and the law states that the government will take financial measures based on its national basic policy and the regional plans of prefectures. The following six points are given as basic principles: (1) considerations for landscape preservation and biodiversity conservation, (2) clarification of the responsibilities of coastal administrators and other related parties and promotion of smooth disposal of litter, (3) efforts to suppress the generation of such litter, (4) conservation of the marine environment by the entire nation, (5) securing the appropriate sharing of roles and the cooperation of diverse entities, and (6) promotion of international cooperation. Incidentally, this law is formally, "In order to Protect the Beautiful and Rich Nature, and Pertaining to the Protection of a Good Coastal Landscape and Environment, Law for the Promotion of Marine Litter Disposal, etc." The meaning that the disposal of marine litter is the whole nation's problem and not only that of the coastal areas was included into the first part of the title of the law.

As for the tasks ahead, there are concerns that important aspects of this cross-regional problem will be overlooked, since the drafting of plans will be left to each prefecture. It would be desirable that the national government coordinate between local governments, but at this point it is weak in this function. In particular, effective collection at coasts that should have priority (about 75% of the litter is concentrated at 10% of the nation's coasts) is desirable, and this requires overall coordination by the national government. Also, for the time being, government spending will come from the regional Green New Deal funds (expected to total 6 billion yen over three years), but in measures taken before drafting of local plans, budgets not based on local plans and not considering regional differences have been created. Now in each prefecture, as a parent organization for the promotion of regional planning, the establishment of a council for the promotion of measures for coastal drift material has become obligatory. In Yamagata Prefecture, "Yamagata's Beautiful Sea Platform" was launched in 2008 and was a pioneer for the rest of the country. The members are residents groups, businesses, and agriculture and forestry organizations. The government, NPOs and universities have been operating a joint secretariat for the platform. The purpose of the platform includes the sharing of information on marine litter, raising public awareness, and policy advocacy, and this platform became a model for the idea the above-mentioned council, which was specified in the new law on marine litter disposal. However, the platform has remained a coastal network so far, and it will be a difficult process for it to become a place for creating and promoting plans involving the whole prefecture.

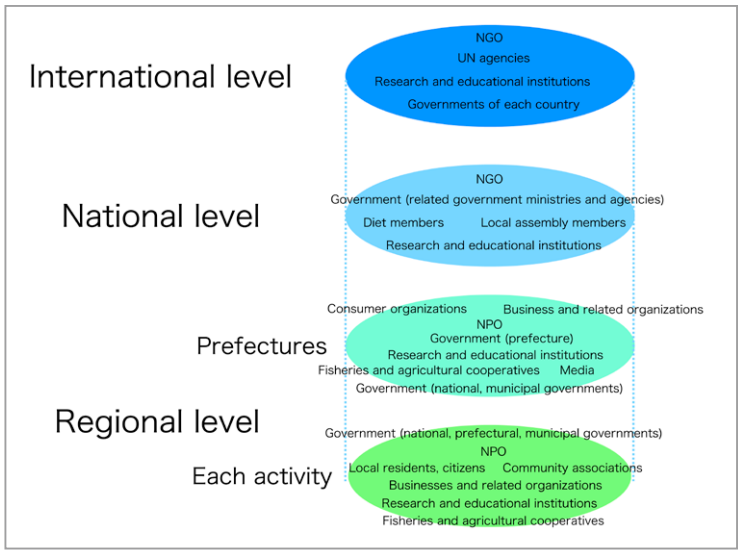
Problem solving model based on multilayered network-type co-creation

It is particularly noteworthy that the enactment of the law was based on the recommendations NGOs had made for many years, included the involvement of local assembly members, and was drafted by diet members across party lines (Chart 1). In this respect, the Marine Litter Summit that was held first in Tobishima, Yamagata Prefecture in 2003, and has continued annually, has played a prominent role. Regional areas and NGOs manage this summit. Regional governments and NPOs facing the same prob-

■Chart 1: Efforts to solve the problem of marine litter



■Chart 2: Problem-solving model based on multilayered network-type co-creation at regional, national and international levels



lems, as well as related national ministries and agencies, researchers, and participants from overseas are brought together and share the challenges from the field by working and sweating together to collect the litter washed ashore. In this way, the summit has played an important role as a place for deepening common awareness in order to discuss solutions to the national marine litter problem.

In addition, the law calls for the promotion of international cooperation, and it will be an advantage for Japan to attempt international coordination after correcting itself by promoting waste recovery and suppressing the generation of domestic waste. I call such a problem solving method a "problem solving model based on multilayered network-type co-creation at regional, national, and international levels" (Chart 2).

Since the past, litter has washed ashore, but in recent years there has been an increase in plastic waste that does not decompose in nature and illegal dumping of garbage, and this has made the problem more serious. Regarding these new challenges, it was unclear who had the responsibility for measures under the existing legal system. In addition, due to lack of manpower, high processing costs, and the difficulties of natural and geographical conditions such as remote islands, there are limits to the extent local residents can become the main bearers. In this way, there is no one to bear the responsibility, but in order to tackle this important challenge, first, "public-minded citizens" who recognize the importance of the issue and have the sense of being a concerned party need to come forward, and "network-type co-creation" initiatives by government, NPOs, educational and research institutions, and industry groups, who prepare the stage for the activities of these citizens, must arise in each region.

At the national level, JEAN (Japan Environmental Action Network / Cleanup National Secretariat) created a network of local governments and citizen movements around the country, and by cooperating with relevant government ministries and agencies to propose the recognition of common issues and a path toward solutions, JEAN has been fulfilling its role of connecting to reforming systems of the national government. It can be said that such a problem-solving method based on "multi-layered network-type co-creation", which has been building up at the local, national and the international levels, has significant potential as a model for solving a variety of problems in the future, and not only the marine litter problem.

Weaving the revival of pristine regions and nature

I hope that the growing interest in the sea at the regional level arising from this marine litter problem will become a model for community development and a way of integrated coastal zone management. For example, the Tobishima Cleanup Operation (the 10th annual cleanup was held in 2010), in which the author is involved, has triggered activities of support groups for island revitalization from

outside the island, and these activities are very vigorous. The islanders have always felt that the coast of Tobishima was divided into the coasts of three different villages, but with the involvement of outsiders, recognition of the coast of Tobishima as a whole arose among the islanders for the first time. In addition, conservation activities for Tobishima Kanzo flowers, which aim to restore the original landscape of the island, have gathered momentum and become a symbolic activity of spontaneous regional development.

Furthermore, the fifth Marine Litter Summit (the summit held in Sado in 2007) created the opportunity for the annual "Three-island Exchange", where islanders learn from each other about sustainable regional development drawing on natural resources. The islands involved are Sado and Awashima (both of Niigata Prefecture) and Tobishima. Following this trend, occasional ferry service between these three islands has been achieved, cleanup activities in Awashima sharing the expertise from Tobishima have begun, and exchanges and cases of learning with each other through marine routes are flourishing.

Coastal areas continue to be full of life because they are inherently a dynamic place where a variety of things come and go via the sea. The initiative to tackle the marine litter problem and regional development will progress in a mutually complementary way.

I think the most important thing now is to have a vision of recovering the formerly pristine nature and natural landscapes, and the beautiful ocean and coasts, and further, recovering the original splendor of living creatures and community ties, while implementing these activities. ■