Marine Biodiversity Conservation Strategy

March 2011

Ministry of the Environment

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Outline of the Marine Biodiversity Conservation Strategy in Japan

1. Background

Ocean is an essential component to sustain lives on the Earth. Humans survive on various blessings from diverse organisms and ecosystems in the ocean.

In recent years, there is a strong indication that marine biodiversity has been deteriorating at both domestic and international levels, and the Japanese people also take more interests in the conservation of marine biodiversity.

This Conservation Strategy was formulated by the Ministry of the Environment in Japan on the basis of the "National Biodiversity Strategy (approved by the Cabinet in March 2010)" under the "Basic Act on Biodiversity (enacted in May 2008)." It is in line with international targets under the Convention on Biological Diversity, and with the "Basic Act on Ocean Policy (enacted in April 2007)" and the "Basic Plan on Ocean Policy (approved by the Cabinet in March 2008)" in Japan.

2. Objectives

This Conservation Strategy aims to conserve the biodiversity which supports the sound structure and function of marine ecosystems, and to utilize ecological services of the ocean, or the blessings from the ocean, in a sustainable manner.

The Strategy, therefore, mainly addresses areas within the exclusive economic zone of Japan, or areas under its jurisdiction, and provides basic perspectives and direction of measures for conservation and sustainable use of marine biodiversity.

3. Biodiversity in the ocean and its ecosystem services

Complex topography with drastically changing depths, various ocean currents such as the Kuroshio Current and the Oyashio Current, and the lengthy Japanese Archipelago extending from south to north create rich variety of environments in waters around Japan to allow diverse marine organisms to live.

Biodiversity could be referred to as "characteristics" and "interrelations" of life created through the long history of evolution. Biodiversity provides human beings with the foundation for their survival, and human beings benefit from various supports, or ecological services, from ecosystems with interactions among various organisms.

In this way, human beings depend on various blessings from marine organisms and ecosystems, but there is a concern over deterioration of marine biodiversity by their activities in recent years.

4. Basic perspectives

(1) Recognition of the importance of marine biodiversity

It is important to recognize marine biodiversity and its various blessings. Long-term and continuous utilization of the ecosystems services requires maintenance of sound ecosystems. In addition, for continuous promotion of their conservation and sustainable utilization, it is essential to properly assess the importance of marine biodiversity for our economic activities and social life, to accept its conservation as worthwhile.

(2) Integrated management of the sea

- **Importance of its linkage with the land in coastal areas:** It is necessary to manage a coastal area considering the linkage between the land and the sea. Approaches to perceive a whole watershed as an integral part are among such management.
- **Importance of extensive perspectives on the open ocean:** Considering the continuity of the ocean and the extensive migration of marine organisms, international cooperation, such as cooperation with neighboring countries, is important for the open ocean.

(3) Measures appropriate for the characteristics of marine areas around Japan

Characteristics of ecosystems and the major influencing factors differ between coastal water and the open ocean. Marine environment also varies significantly with latitude, ocean current and bottom topography. It is important to implement measures for their conservation and sustainable utilization, taking characteristics of individual marine areas into consideration.

(4) Effective measures that utilize local knowledge and technology

It is important to respect activities of local communities for conservation and management on the basis of their long history and traditional wisdom. Participation of various local actors and facilitation of coordination among them are also important.

(5) Summary of the concept of Marine Protected Areas

Marine Protected Areas:

- Marine areas designated and managed by law or other effective means, in consideration of use modalities, aimed at the conservation of marine biodiversity supporting the sound structure and function of marine ecosystems and ensuring the sustainable use of marine ecosystem services.
- **Current status of Marine Protected Areas in Japan and their challenges**: In Japan, areas that would fall under Marine Protected Areas have been designated in various forms such as National Parks. From now on, it is necessary to consider a concept of efficient Marine Protected Areas through their improvement by application of the existing systems and

effective combinations of these. Continuous review for appropriate measures or systems is also required, considering accumulation of knowledge and changes of the social situation.

5. Development of measures

(1) Improvement of baseline information

Methods and systems for the effective and efficient collection and utilization of information at the national level will be considered for systematic accumulation of information and knowledge regarding marine biodiversity. Marine areas of particular importance for conserving biodiversity will be identified on the basis of scientific knowledge.

(2) Identification of factors influencing marine biodiversity and implementation of measures to reduce them

To promote conservation of marine biodiversity and its sustainable use appropriately, causes of the problems and those responsible for actions to reduce their impacts will be identified. Measures will be conducted with methods and procedures suitable to solve these problems, under cooperation among relevant parties.

(3) Implementation of measures appropriate for characteristics of individual marine areas

Measures for conservation and sustainable use of marine biodiversity will be implemented in accordance with characteristics of individual marine area, such as differences in the ecosystems and major influencing factors between costal water and the open ocean.

(4) Improvement of Marine Protected Areas and enhancement of their networking

Designation Marine Protected Areas will be promoted appropriately using the existing systems such as National Parks, and management of Marine Protected Areas will be improved and enhanced. For conservation and sustainable use of biodiversity, a concept of effective networking of Marine Protected Areas will be considered, and if required, a new system will be considered as well.

(5) Facilitation of public acceptance and involvement of various actors

Scientific information and knowledge regarding the current status of marine biodiversity, various values associated with it, and the necessity for its conservation will be distributed for publicity among the public. To establish a network of Marine Protected Areas, cooperation and coordination among various relevant actors will be enhanced, and awareness of conservation and sustainable use of marine biodiversity in social activities will be raised.

Preamble

Ocean covers approximately 70% of the Earth's surface, or 360 million km^2. It is estimated to have around 97% of water volume on the Earth. Its average depth is about 3,800m, and 55% of the planet's surface, or approximately 77% of the ocean, is deep sea of more than 3,000m in depth[1].

The extensive ocean plays an important role in circulation of water, heat, organic and inorganic materials on the planet. In addition, the ocean significantly affects local climate/weather around the globe. The ocean is, thus, essential to support various terrestrial and aquatic organisms on the Earth. The fact that the ocean around the world is indispensable component to sustain lives on the Earth was clearly stated in Agenda 21 adopted at the United Nations Conference on Environment and Development (UNCED, Earth Summit) in 1992, and also in the "Basic Act on Ocean Policy" enacted in April 2007 for the comprehensive and integrated progress of Japan's policies on the ocean.

In addition, the ancient ocean is thought to be where the first forms of life were created 4 billion years ago. And today, humans survive on various blessings from diverse organisms and ecosystems of the ocean. For the survival of human beings while continuously enjoying such blessings from the ocean, promotion of the conservation and sustainable use of marine biodiversity is a prerequisite.

Chapter 1 Background

Internationally, to provide a basis for promotion of the biodiversity and sustainable use of the ocean, "United Nations Convention on the Law of the Sea (UNCLOS)" was adopted in 1982, and came into force in 1994. After preparation of relevant domestic policies, Japan became its 94th ratifier, and the Convention was nationally put into effect on July 20 (original "Ocean Day" of national holiday) in 1996.

This Convention, also referred to as a "Constitution for the Oceans", recognizes that "the problems of ocean space are closely interrelated and need to be considered as a whole" in its preamble. The Convention aims to facilitate international communication and promote the peaceful uses of the seas and oceans, the equitable and efficient utilization of their resources, the conservation of their living resources, and the study, protection and preservation of the marine environment.

UNCLOS is composed of 17 parts, 320 articles and 9 annexes. Its Part 12 entitled "Protection and Preservation of the Marine Environment" declares in the opening article that "States have the obligation to protect and preserve the marine environment" (Article 192), to confirms that it is a common obligation for states to protect the marine environment including those within their

[1] Ministry of the Environment (1999) Interim report of the round-table conference on the future of marine environment conservation

exclusive economic zone, and this Part provides detailed regulations for protection and preservation of the marine environment. From the perspective of biodiversity conservation, Paragraph 5 of Article 194 states that measures to prevent, reduce and control pollution of the marine environment shall include measures "necessary to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life". Specific measures, however, are not provided in this paragraph, and they are left in the hands of each state.

In the 1980's, there increased a sense of crisis over the global-scale extinction of species and the loss of biological resources essential for the survival of human beings, and this lead to adoption of the "Convention on Biological Diversity" at the United Nations Conference on Environment and Development (Earth Summit) in 1992. Objectives of this Convention are "conservation of biological diversity," "sustainable use of its components" and "fair and equitable sharing of the benefits arising out of the utilization of genetic resources." In May 1993, Japan ratified the Convention as its 18th ratifier, and the Convention came into force in December of that year.

In 2002, parties agreed to "achieve, by 2010, a significant reduction of the current rate of biodiversity loss" (2010 Biodiversity Target) at the 6th Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD-COP6). However, this could not be accomplished, and new targets were set for years after 2011 (Strategic Plan 2011-2020 (Aichi Biodiversity Targets)) at the 10th Meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD-COP10) hosted by Japan in 2010, to clearly present a future roadmap. Strategic Plan 2011-2020 (Aichi Biodiversity Targets) consists of 20 individual targets, many of which are relevant to marine biodiversity, such as the sustainable management and harvest of all fish and invertebrate stocks and aquatic plants (Target 6); the minimization of multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification (Target 10); and conservation of at least 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures (Target 11).

At the Conference of the Parties to the Convention on Biological Diversity, discussions have been made on various issues relevant to the biodiversity in the ocean, as one of the categories of interest, since the decision on "Conservation and Sustainable use of Marine and Coastal Biological Diversity" (Decision II/10; known as "Jakarta Mandate") was adopted at the 2nd Conference of the Parties (COP 2) in 1995. At the 10th Conference of the Parties, decisions were made under the agenda for "marine and coastal biodiversity" for better understanding of application of "scientific criteria for the identification of Ecologically or Biologically Significant Areas (EBSA) in need of protection", promotion of efforts to accomplish a plan to "establish networks of marine protected areas by 2012" as stated in the "Johannesburg Plan of Implementation" adopted at the "World

Summit on Sustainable Development (WSSD)" in 2002, scientific advice for conservation of the biodiversity in waters beyond national jurisdictions, cooperation with relevant organizations to assess impacts of unsustainable fishing, and assessment of impacts of the marine acidification associated with the climate change[2].

In Japan, in response to increasing public interests in the coastal environment, Coast Act was amended in 1999 to include "establishment and protection of good coastal environment" as one of its objectives. With increasing general interests in environment, Port and Harbor Act was also amended in the following year (2000) to include "consideration for environmental protection" among its objectives. In such ways, concept of environmental protection was incorporated into individual acts relevant to the sea.

In addition, with increasing public awareness for integrated management of the ocean, Basic Act on Ocean Policy was enacted in April 2007. This Act was formulated under the recognition that it is "important to realize a new oceanic State in harmonization of the peaceful and positive development and use of the oceans with the conservation of the marine environment, under the international cooperation" Article 18 on the Conservation of Marine Environment, etc. clearly requires "securing the biodiversity in the oceans " along with reduction of the pollution load caused by water flow into the oceans, prevention of the discharge of waste materials to the oceans. "Basic Plan on Ocean Policy" decided by the Cabinet in March 2008 under this Act also clearly lists efforts to secure the biodiversity among the measures to be taken by the government.

In May 2008, with increasing national and international concern on biodiversity, "Basic Act on Biodiversity" was enacted. This act aims to promote policies for conservation and sustainable use of biodiversity in a comprehensive and planned manner, thereby conserving rich biodiversity, and to aim at realizing a society in coexistence with nature where human beings can continue enjoying benefits therefrom in the future and to contribute to conserving the global environment.

In May 2009, Natural Park Act and Nature Conservation Act were also amended (effective since April 2010) to clearly provide "contributions to security of the biodiversity" as their objective.

With the establishment of the Basic Act on Biodiversity, "National Biodiversity Strategy of Japan 2010" was decided by the Cabinet in May 2010. This is the 4th one since the first National Biodiversity Strategy was established in 1995 on the basis of the Convention of Biological Diversity, and its reference to the marine environment has been extended.

National Biodiversity Strategy of Japan 2010 describes various measures by the government for conservation and sustainable uses of the coastal and marine biodiversity. However, at the same time, this strategy clearly states that the effective conservation and restoration of extensive coastal and marine areas require characterization of ecosystems there and systematic implementation of regulations and conservation measures.

[2] UNEP/CBD/COP/DEC/X/29

This Marine Biodiversity Conservation Strategy reflects such international and national actions and summarizes the basic principles to promote general protection of marine biodiversity in line with the Strategic Plan 2011-2020 (Aichi Biodiversity Targets) and the National Biodiversity Strategy of Japan 2010.

Chapter 2 Objectives

This Conservation Strategy, based on the National Biodiversity Strategy 2010, was scrutinised and formulated by the Ministry of the Environment through the "Expert Working Group on Marine Biodiversity Conservation Strategy" organized by the Ministry. It is in line with the international objectives under the Convention on Biological Diversity and with Japan's Basic Act on Ocean Policy and Basic Plan on Ocean Policy.

This Conservation Strategy aims to conserve the biodiversity which supports the sound structure and function of marine ecosystems, and to utilize ecological services[3] of the ocean (blessings from the ocean) in a sustainable manner.

This Conservation Strategy, therefore, addresses mainly areas under the jurisdiction of Japan (territorial sea and exclusive economic zone, up to 200 nautical miles from the shore). This strategy provides Japan's basic perspectives for conservation and sustainable use of marine biodiversity and the direction of measures to be implemented.

Measures described in this Conservation Strategy will be considered appropriately in the next revision of the National Biodiversity Strategy. This will facilitate the government as a whole to make efforts for conservation and sustainable use of the biodiversity in the ocean.

Furthermore, efforts will be made in public relations so that this Conservation Strategy contributes to implementation of measures by local governments on the biodiversity, such as consideration of local strategies on the biodiversity and enhancement of public understanding and actions on marine biodiversity.

Chapter 3 Biodiversity in the ocean and its ecosystem service

In this chapter, functions of the ocean and the current status of the marine biodiversity at the global level and for water around Japan will be identified and summarized to provide prerequisites for preparation of the basic concepts for conservation and sustainable use of marine biodiversity.

1. What are the biodiversity and the ecosystem service?

Ever since beginning of its primitive form, life has repeated adaptation, evolution and extinction

[3] Refer to Chapter 3 "1. What are the biodiversity and the ecosystem service?"

in response to various changes of environment on the Earth, to create the present diversity of as many as 30 million species[4] and their associations. “Biodiversity” could be referred to as the “character” and “interconnection” of life created through the long history of evolution. Human being is one of the species which constitute the biodiversity, and the biodiversity provides foundation for its survival.

In the Convention on Biological Diversity, “biodiversity” is defined as the variability among all organisms. Included are not only “species diversity” which is occurrence of various species of fauna and flora, but also “intra-species (genetic) diversity” which is variation in a single species according to localities, etc., and “ecosystem diversity” which refers to the variety of ecosystems such as forests, rivers, tidal flats and coral reefs, which are composed of the interrelation between various fauna and flora.

The blessings people can obtain from such ecosystems where various organisms interact are called “ecosystem services.” They include “provisioning services” of resources such as seafood and the genetic resources for medicine, “regulating services” for stable climate and clean water, “cultural services” to provide recreational and mental benefits such as sea bathing, and “supporting services” such as nutrient circulation and photosynthesis[5].

Facilitation of the objectives of the Convention on Biological Diversity, or conservation and sustainable use of the biodiversity requires understanding of the fact that there are multiple levels of the biodiversity as mentioned above, and it is important to address all levels rather than any single level.

2. Functions of the ocean and characteristics of its ecosystems

(1) Physical functions and blessings from the ocean

Ocean covers an extensive part of the Earth, and large-scale horizontal and vertical circulations occur there. Evaporation of water from the ocean plays a major role in sustaining the atmosphere-to-land circulation of water. Along with water, the ocean transports heat, it mitigates drastic changes of the climate through its interactions with the atmosphere, and maintains the temperature within the acceptable range for occurrence and growth of organisms. The ocean is deeply involved in the weather around the world and the climate kinetics. There occur and grow a variety of organisms in the ocean, and diverse ecosystems are established there.

In recent years, there is increasing attention on relationship between the ocean and the climate change. The ocean has not only a lot of water but also a plenty of carbon as a “carbon reservoir”. Annual net primary production of marine phytoplankton would be around 50 billion tons of carbon equivalent. This would be almost equal to that of terrestrial plants, and the ocean is very important as

[4] Millennium Ecosystem Assessment (2005) Ecosystem and Human Well-being Vol.1.
[5] Field, C. B., M. J. Behrenfeld, J. T. Randerson and P. Falkowski (1998) Primary production of the biosphere: Integrating terrestrial and oceanic components. Science 281: 237-240.

a sink for carbon dioxide.

Human life has been closely related to the ocean with multi-functions ever since the ancient times. As the quantity and quality of human activities increase, there occurs more utilization of the ocean.

Direct blessings from the ocean to human beings include means for transportation, supply of food, water, mineral and energy, and space for recreation and mental stability. In particular, unexploited energy and mineral resources have been recently identified in the ocean through various surveys and researches on the ocean. When such resources are utilized, efforts have to be made to accomplish their sustainable development, and to establish and maintain an international order on the use of energy and mineral resources.

(2) Characteristics of marine ecosystems

Important in consideration on the marine environment and the ecosystems there is the existence of an extensive water body. In the ocean, there are layers with different water flow at different depths, and organisms and ecosystems distribute three-dimensionally. Plants with photosynthesis as primary producers occur in photic zones down to about 200m from the water surface, and on sea bottoms of the shallow coastal water. There occur completely different ecosystems in the deep sea.

In the ocean, many organisms migrate for a long distance during their life history. In addition, water, or where they occur and grow, also moves around. These lead to very high mobility of organisms. In other words, there is a highly continuous space from the polar region to the tropics, and complex interactions among organisms exist over a wide area.

Microscopic phytoplankton is the major primary producer in the ocean, and this is quite different from the terrestrial ecosystem where large plants such as trees are the major producer. In the ocean, turnover of the primary production occurs quickly and the material circulation rate through the grazing food chain and microbial food chain is high. Materials, therefore, do not stay for a long time in the form of the primary producers as on land.

For example, at transition regions where different ocean currents or water bodies are in contact, cold seawater with rich nutrients mixes with warm surface water to stimulate productions of phytoplankton and attract many organisms of higher trophic levels in the food web. However, one must keep in mind that the status of ecosystems changes drastically with changes of physicochemical conditions. For instance, environmental changes due to the global-scale climate change, such as the regime shift with intervals of several decades and El Niño and La Niña, significantly alter productions and distributions of organisms.

Approximately 230 thousand species[6] have been identified for marine organisms, but our knowledge on marine species is limited compared to terrestrial ones. Many new species are still discovered even in shallow waters, and it is expected that there are many unknown species. As for

[6] Fujikura et al, (2010) Marine Biodiversity in Japanese Waters. PLoS ONE

higher taxa, among all of the 35 animal phyla[7], 34 of them include species occurring in the ocean, and 16 phyla are found only in the ocean. It could be said that there are more morphological variations among marine organisms than terrestrial ones.

(3) Characteristics of the marine environment and ecosystems around Japan

Japan is surrounded on its four sides by the Pacific Ocean, the East China Sea, the Sea of Japan and the Sea of Okhotsk. Consisting of approximately 6,000 islands including Hokkaido, Honshu, Shikoku, Kyushu and Okinawa, Japan has one of the world's widest closed sea and exclusive economic zone of approximately 4.47 million km^2 around it.

Approximately a half of the world's ocean is ocean flats, or flat bottoms. However, four plates collide to each other in marine areas around the Japanese Archipelago on the eastern edge of the Eurasian Continent, and their submersions have created marine trenches and the diverse and complex bottom topography with drastic changes in water depth. It is characteristic to Japan that the majority of its exclusive economic zone is deep water, with limited shallow water over the continental shelf and within the inland sea and bay.

As for the average water depth around Japan, the East China Sea is shallow and around 300m deep, but the Sea of Japan and the Sea of Okhotsk are about 1700m deep, and the Pacific Ocean is around 4200m deep[8]. A relatively gentle continental shelf of 0 to 200m deep extends out from the continent in the East China Sea southwest to the line between the Korean Peninsula and the Noto Peninsula and in water west to Hokkaido and coastal water of the Sea of Okhotsk. On the Pacific side, there are very steep bottom topographies down to the depth of 4,000 to 6,000m, such as the Japan Trench and the Izu-Ogasawara Trench running south from Honshu and the Nansei Islands Trench (Ryukyu Trench) from Kyushu to Okinawa. There are also a series of seamounts such as the Nansei Islands Ridge (Ryukyu Ridge) and the Izu-Ogasawara Ridge on the Pacific side. There are relatively wide undersea basins at the depth of about 2,000m, such as the Japan Basin in the Sea of Japan and the Kuril Basin in the Sea of Okhotsk.

Diverse environment is created in Japanese water due to many warm and cold currents such as the Kuroshio Current (warm current) and the Oyashio Current (cold current) flowing along Japan, and the Japanese Archipelago of numerous islands extending from the south to north with a wide range of climate zones from subarctic to tropical ones. In the north, drift ice covers the Sea of Okhotsk in winter, and unique habitat and environment are created by sea ice. In the south, various organisms are transported from the south by the Kuroshio Current. Under influences of the Kuroshio Current, or the world's largest warm current, Japanese water is warm even at the high latitude, and this allows the world's northernmost distribution of coral reefs and provides many marine organisms with their

[7] According to the classification by The Union of the Japanese Societies for Systematic Biology
[8] National Institutes of Natural Sciences, National Astronomical Observatory of Japan (2009) Chronological Scientific Tables 2010

spawning and feeding grounds and the larvae and juveniles of fish with their nursing grounds. In addition, there are many fish and good fishing grounds in the transition region where the Kuroshio Current contacts the Oyashio Current. The Tsushima Warm Current flows in the surface layer of around 200m, and below is a water body with low temperature and relatively high dissolved oxygen content called the "Japan Sea Proper Water".

Unique fauna and flora occur along the long and complex coastline of approximately 35,000km in total length, depending on local topographies such as sand dunes and cliffs. Distributed in the shallow coastal water, where land, inland water and sea join, are seaweed beds[9], tidal flats and coral reefs, and diverse habitats and environment are provided to marine organisms for their reproduction, growth and feeding. In the vast ocean on the Pacific side, there are remote islands, such as the Izu-Ogasawara Islands, Okinotori Island, Minamitori Island and the Daito Islands, and seamounts, and water shallower than its surrounding induces the upwelling current to provide habitats for various organisms.

Coastal water is closely linked with its adjoining land, and nutrient salts are supplied from rivers and the springs on the sea bottom. Ecotone, or a transitional zone from the land to its adjoining water beyond the shoreline, is rich in biodiversity. For example, the "intertidal zone" between the high tide and low tide lines repeatedly emerges and submerges with the tidal rhythm. Duration of time under seawater varies depending on the height to produce differences in environmental factors such as dryness, temperature, and salinity, and multiple species adapted to each environment are thriving there. In brackish water at the river mouth, where seawater mixes with freshwater, many organisms with resistance to changes in salinity occur, and mangrove forests are established in the tropical and subtropical zones. A unique ecosystem develops at each environment. On sandy beaches, landing of sea turtles and breeding of little terns are observed. Enormous numbers of species and biomass of benthic organisms occur on tidal flats in the inland bay to provide food to many migrating birds such as sandpipers and plovers, and they fly to these tidal flats for food and rest. Seaweed beds are called the "cradle in the sea", and they have an important role as a place for spawning and growth of organisms. In coastal ecosystems such as tidal flats and seaweed beds, organic matters in municipal effluents from the land are removed through decomposition by bacteria and meiobenthos and the filtration by shellfish, and nitrogen and phosphate are also taken away as parts of organic matters by their storage in seaweeds and removal by birds and fish, to produce clean water. Through their function to produce clean water, coastal ecosystems maintain habitats and environment for organisms, and they contribute significantly to the protection of biodiversity.

Under unique environments such as the deep sea and the hydrothermal vent, there occur organisms completely different from those in coastal and surface water.

[9] In this Strategy, "seaweed beds" refer to areas where communities of large size benthic plants (seaweed and sea grass) are established.

In water around Japan, such diverse environments allow occurrences of 50 out of 127 species of marine mammals in the world (40 species of whales and dolphins, 8 species of seals and sea lions, sea otters and dugongs)[10], 122[11] out of about 300 species of sea birds in the world, and around 3,700[12] out of about 15,000 species, or about 25% of marine fish in the world, to produce a rich species diversity. Surveys on marine organisms occurring in our exclusive economic zone, or water under our jurisdiction, reported around 34,000 species[13], which account for about 15% of around 230 thousand species known in the world. Among these, about 1,900 species are identified as endemic to Japan. As for marine organisms, it should be noticed that except for certain taxa, their taxonomy is still under development, with many organisms yet to be discovered.

3. The current status of marine biodiversity

(1) Global marine biodiversity outlook

Various measures have been taken on both international and national scales to assess the variety and complexity of biodiversity. We gradually understand the loss of marine biodiversity.

"Millennium Ecosystem Assessment" (MA) was the first large-scale action to assess the biodiversity and ecosystem at the global scale, and 1,360 experts from 95 countries were involved from 2001 to 2005.

The Millennium Ecosystem Assessment has revealed that human beings have significantly altered the structure of terrestrial ecosystems. We have accelerated the rate of species extinction by approximately 1,000 times in the past few hundred years, and we are changing the fundamental biodiversity on the Earth. For the ocean, it has been pointed out that coastal ecosystems rich in biodiversity have been significantly affected by human activities and threatened for loss. For example, about 20% of coral reefs in the world have been lost during the last few decades of the 20th century, and in countries with available data, around 35% of mangrove forests have also disappeared in the last 20 years. As for marine fishery resources, global demands on them are on the rise. However, the same assessment reported that a quarter of species targeted for the scientific resource assessment were depleted by overfishing. Stock of fish species, especially those in higher trophic levels in the food chain (large fish-eating fish such as certain species of tunas and Atlantic cods) is declining, and losses of marine biodiversity have been revealed.

Secretariat of the Convention on Biological Diversity edited and published the "Global Biodiversity Outlook (GBO)" in 2001, 2006, and 2010. Its third edition (GBO3) published in May

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[10] Jefferson et al, (2008) Marine mammals of the world. & Ohdachi et al, (2009) The wild mammals of Japan.

[11] Peter Harrison (1985) Seabirds: An Identification Guide.
& The Ornithological Society of Japan ed. (2000) Check-List of Japanese Birds (6th ed.).

[12] Taki et al, (2005) Colored Fish Guide (New ed.).
& Ueno and Sakamoto (2009) Fish Classification Guide (New ed.)

[13] Result of the research under the international joint research network "Census of Marine Life (CoML)", done by Fujikura et al. (2010).

2010, evaluates the status of achievements of the objectives agreed by the Parties for 2010, and points out that on the global scale, none of these 21 individual objectives has been met. As for the status of coastal and marine ecosystems, it is reported that the mangrove forests and coral reefs are declining continuously, and 80% of marine fishery resources in the world have been exploited to the limit or even overexploited.

Recently, a global-scale research entitled “Census of Marine Life” (CoML) had been conducted since 2000 as a 10-year project to study the biodiversities, distributions and populations of marine organisms in the world for the past, present and future. Researchers from more than 80 countries including Japan participated in this Census, and data were registered and accumulated on the global-scale Ocean Biogeographic Information System (OBIS).

(2) Status of the marine biodiversity in Japan

For assessment on the status of the biodiversity in Japan, the Ministry of the Environment established the Japan Biodiversity Outlook Science Committee, and with contributions by 208 experts, released the “Comprehensive Assessment of Biodiversity in Japan” (JBO: Japan Biodiversity Outlook) in May 2010. Japan Biodiversity Outlook states that developments and alterations, especially those during the high economic growth period, significantly diminished tidal flats and natural coastlines. Although demands for developments and alterations are decreasing now, coastal erosions, invasions of alien species and impacts of the global warming are listed as new concerns.

Specifically, the Outlook identifies followings as indicators to represent the status of biodiversity losses in the coastal and marine ecosystems: (1) size and quality of the coastal ecosystems; (2) number of individuals and distributions for species in shallow water; and (3) status of valuable fish stocks. All of these indicators trend to decrease.

As for (1) size and quality of the coastal ecosystems, the Outlook points out that coastal ecosystems such as tidal flats, seaweed beds, coral reefs, and sandy beaches have shrank in size due to the developments and alternations of lands, such as dredging and reclamation, sea gravel extraction, and creation of artificial shorelines during the high economic growth period after the war. Especially, tidal flats tend to be in inner bays, and it is easy to develop them. Tidal flats shrank drastically during the high economic growth period, and around 40% of sandy beaches had disappeared in 50 years since 1945. More than 50% of natural coastlines have also disappeared along the main island. Shore erosions on sandy beaches are getting worse under the reduced supply of sediments due to gravel extractions from rivers and the sea and the river development projects in the upstream, and under influences by structures on coastlines to change the sand drift system. In addition, various changes in the ecosystems, such as rocky-shore denudation, and coral bleaching are observed. Rocky-shore denudation is a critical decline of dense sea jungles with large seaweeds.

Changes or degradations of corals, sea grasses and seaweeds are attributed to increases of the seawater temperature, and there is a concern over impacts of the global warming.

As for (2) number of individuals and distributions for species in shallow water, numbers of individuals of birds like snipes and plovers and the shellfish like short-necked clams and hard clams, with a part of their life history in shallow water, are decreasing due to deterioration of the environment, water pollution and less tidal flats and sandy beaches.

For (3) status of valuable fish stocks, about 40% of the fishery resources already evaluated are at low levels now.

While the Comprehensive Biodiversity Evaluation reports that relationship between the biodiversity and ecosystem service is yet to be studied, the loss of biodiversity in Japan is suggested to have impacts on the supply of ecosystem services. In the Seto Inland Sea, decreases in sand eel stock level is attributed to the loss of sandbanks by actions such as dredging of the sea sand, and this is suggested to have resulted in less loons, or winter birds there. Decreases of clams lead to not only less food supplies but also less cultural services, or opportunities for recreational shellfish gathering.

In recent years, changes in the marine ecosystem and their impacts on ecosystem services including fishery have been observed. For example, outbreaks of Nomura's jellyfish occurred frequently in the Sea of Japan.

4. Impacts of human activities on marine biodiversity

For effective and efficient conservation and sustainable use of marine biodiversity, it is important to systematically and comprehensively understand problems in the target water.

(1) Factors affecting marine biodiversity

Major anthropogenic factors that affect or may affect the biodiversity in Japan are (1) physical alterations that reduce habitats for organisms, (2) pollution of marine environment that deteriorates the quality of ecosystems, including releases of effluent, waste material, oil and chemical substances, (3) excessive harvests (including those of non-target species, or their bycatch), (4) introduction of alien species that may disturb ecosystems, and (5) impacts of the climate change that may affect the physicochemical environment or system of the ocean. Human activities are intensive especially in coastal water, and these factors are involved intricately.

1) Physical alterations to reduce habitats for organisms

Physical alterations of inland areas, such as river basins, coastal areas and sea bottoms may have impacts on habitats of marine organisms depending on where and how they occur.

Development projects in river basins may increase the influx of sediments and nutrients into rivers excessively due to the runoff of surface soil. This may increase turbidity in the estuary and coastal water, or it may lead to changes in the marine environment, such as eutrophication. Alterations to

prevent the river flow may divide a habitat of migratory (diadromous) fish between the river and sea, to pose a problem against their reproduction and reduce their population size. Such alterations may also facilitate erosions on the sandy beach due to the reduced supply of sediments.

Development projects in the coastal area usually involve physical alterations of the coastline to lead to changes in topography of the coastal area, losses of ecosystems in shallow water, and changes in the flow regime. Losses of seaweed beds, tidal flats, coral reefs and sandy beaches will not only deprive marine organisms of their habitats, but also contribute to eutrophication through reduction of the function of ecosystems to clean water. As for thermal effluents from power plants, there are growing concerns about impacts of changes in the temperature on marine organisms. Depending on their siting, bird strikes at wind power stations would be concerns about migratory birds.

Exploitations of energy and mineral resources on the sea bottom may also deprive organisms in the unique chemosynthetic ecosystem thriving without solar energy in the deep sea of their habitats through physical alterations.

2) Pollution of the marine environment that deteriorates the quality of ecosystems

i. Pollution from land-based sources and activities

Influx of pollution loads, such as the hazardous substances and nutrient salts in the industrial and municipal effluents generated by the industrial activity and daily life of human beings, increased especially during the high economic growth period, and caused problems such as accumulations of sludge, or deposits of polluted soft mud on the sea bottom, and outbreaks of red tides associated with eutrophication, to produce significant adverse impacts on the occurrences and habitats of organisms especially in coastal water. It is also among concerns that chemical substances with unknown hazard may have impacts on ecosystems.

ii. Pollution from marine based sources and activities

Among the pollution loads on the marine environment from activities on the sea surface, such as navigation, are marine pollution by spills of oil and chemical substances from ships, discharge of the wastes and contaminated water generated from activities within ships, and pollution by oil from boating disasters. Adverse impacts by ship-bottom antifouling paints with organotin compounds such as tributyltin (TBT) on marine organisms have posed problems since late 1980s.

In April 2010, an oil spill accident occurred at the oil drilling facility in the Bay of Mexico, and tons of crude oil was released over the whole bay from the underwater oilfield. Causes of the accident are presently under investigation, but oil was released at deep water and the pressure of crude oil to blow out was extremely strong, so that the oil spill could not be stopped easily and extensive damages were made.

3) Fishery-related problems

Fishery is an environment-dependent industry and it is based on rich blessings from the sea. It is necessary to maintain sound ecosystems to support its productivity, and it is essential to protect the biodiversity for this. On the other hand, if fishery or aquaculture is managed improperly, it may pose a threat of significant impacts on the marine ecosystem. Excessive harvests of fish and shellfish (including their bycatch) will not only reduce the population size of fisheries resources but also change the species composition of their preys and predators, and even balance in the whole food web. In addition to these, it is also required to pay attentions to impacts of actions such as the dumping of harvested organisms and the ghost fishing, or entanglements of organisms in abandoned fishing gears, on the ecosystem. Aquacultures could provide indirect effects to recover fisheries resources through reductions of the dependency on them. However, majority of juveniles for the aquaculture of Japanese eels and bluefin tunas are supplied from natural resources, and there is a concern over impacts on the resources of such species. Aquacultures may also lead to marine pollution if the rearing density and feed dosage are not properly managed, and their impacts on the genetic biodiversity need to be considered.

Fishers living in the coastal communities are conducting environmental conservation activities for stable supply of the safe and quality products. However, in recent years, depopulation in coastal fishing communities and advanced aging are posing concerns over declines in such conservation activities.

4) Disturbance of ecosystems by alien species

Alien species are introduced intentionally or unintentionally through human actions from abroad or the other areas of Japan beyond the natural potential for migration of wildlife. Alien species may feed on indigenous organisms to damage fishery, eliminate indigenous organisms through competition with them, damage ecosystems through genetic contaminations by their crossing with indigenous organisms, and harm the human body and life through their biting and poison. Countermeasures against such alien species are required. In our ocean and coastal water, 76 species which did not occur in Japan originally are known to occur, and it is recognized that about 20 species have been introduced apparently from abroad while they distribute naturally in Japan. More than 100 species would have been introduced from the other parts of Japan. For example, organisms such as Mediterranean green crabs are confirmed to have settled in water around Japan, and there is a concern on their impacts.

As pathways for introduction of alien species, recent studies have clarified that entrainment of organisms in the ballast water of ships or their attachment to the body of ships allows their transportation to water far away, and upon discharges of the ballast water, they will settle there to disrupt the local ecosystem, for example through reduction of indigenous species, and damage the local fishery.

Species which has not been occurring at the site may be introduced for its aquaculture, but potential impacts on the local ecosystem in the case of its escape are also concerns. Furthermore, in addition to impacts by the introduced species, outbreaks of organisms coming along with it or its parasites at new habitats may also be concerns. For example, *Sakigurotamatsumeta* snails that feed on molluscs used to occur only in limited parts of Japan, such as the Sea of Ariake. Recently, however, it has been reported that snails of foreign origin came to marine areas new to them together with imported clams and reproduced themselves there to feed on bivalves, such as short-neck clam, and damage their aquafarming and shellfish gathering[14].

5) Effect of the climate change

In recent years, there are growing concerns on impacts of the climate change for both coastal water and the open sea. In coastal water, there would be impacts on the coastal ecosystem through the sea level rise, stronger tropical cyclone and frequent high tides. Coral reefs are suggested to be vulnerable to the climate change, and their large-scale bleaching by the increased seawater temperature has been observed frequently in recent years around the world. Furthermore, increasing ambient concentrations of carbon dioxide will lead to more carbon dioxide dissolved into seawater and subsequent aggravation of its acidification. Acidification of seawater will then suppress calcification to produce calcium carbonate for the skeleton of corals and the shell of plankton. Some species may not be able to form its skeleton or shell, and balance of the ecosystem may be lost due to changes in the species composition.

Recent studies have revealed decreases in the production of phytoplankton, or the major producer in the open ocean, and it is suggested that the reduced supply of nutrient salts to the euphotic zone due to more stratification in the ocean by the global warming is responsible for this[15].

In the north-western part of the Sea of Okhotsk, formation of sea ice produces dense cold seawater with high salinity to sink and flow out of the continental shelf and carry iron from the Amur River to the southern part of the Sea of Okhotsk and the North Pacific Ocean. It is suggested that the seawater circulation triggered by chilled sea surface in winter allows this iron to go up again to the surface layer, lead to growth of phytoplankton, and support the marine and terrestrial ecosystems. If the formation of sea ice is reduced due to the global warming, there would be extensive impacts on biological production of the associated marine ecosystems.

As for fishery, extension of the distribution of target species to the north may change their fishing grounds and seasons. Surveys on sea urchins catches around Hokkaido since 1985 revealed that *Kitamurasakiuni* sea urchins which used to be harvested in substantial volumes at the southern part of Hokkaido, are now caught also in substantial volumes at further north along Soya region. Longheaded eagle rays, which used to distribute in coastal water in the subtropical and tropical

[14] The Plankton Society of Japan, Japanese Association of Benthology ed. (2009) Alien species in the sea - The Earth's oceans disturbed by human beings.
[15] Gregg et al, (2005) Global Chlorophyll-a Trends During 1998-2003: Geophys. Res. Lett.

zones, are now occurring in large numbers in Ariake Sea and the Seto Inland Sea, and damages on the fishery of short-neck clams and pen shells caused by the rays have been reported. Extension to the north of the distribution of organisms with adverse impacts on fisheries is suggested.

(2) Impact factors in each type of water

In order to understand impact factors, it is necessary to treat "coastal water" and "open ocean" differently. Coastal water is closely related to land, and there are unique ecosystems such as those where the primary producers like algae occur. Open ocean receives less influence from land, and there are different ecosystems from those in coastal water.

While coastal water is usually rich in nutrient salts from land, it is subject to impacts by human activities. In terms of ecosystems, coastal water is not clearly separated from the open ocean, and both are closely related to each other. However, in this Conservation Strategy, coastal water is defined as "water from the intertidal zone to the continental shelf of less than 200m in depth, to be subject to significant impacts by human activities", and the other water as the open ocean.

1) Coastal water subject to significant impacts by human activities

In coastal areas, there have been formed many flat lands suitable for the agriculture. They have been densely populated since the ancient times, and major cities have developed there. During the economic growth after the war, industries also had concentrated on the coastal areas, such as the pacific belt zone, for better access to imported material and water resources. In Japan, flat coastal areas with populations and industries are often subject to heavy environmental loads. Coastal areas adjacent to shorelines have been under pressures of human activities, such as reclamations, creations of artificial coastline and dredging to collect sea sand, and the habitats for marine organisms and coastal vegetations, such as seaweed beds, tidelands, coral reefs, sandy beaches and sandbanks, have decreased, environmental conditions have been deteriorated, and links between the land and sea have been destructed there. There is less daily involvement with the sea. In recent years, drastic development does not occur as it used to do, and coastal areas reclaimed in a year remain no more than around 800ha. New development projects, however, are still under way. In coastal water, apart from the development projects, its recreational uses, such as diving, could disrupt ecosystems if proper consideration is not taken for the marine ecosystem.

Not only physical alterations of the coast, but also discharges of various substances from daily life and industrial activities have impacts on ecosystems by their pollution of seawater through rivers and groundwater. In the past (1950's), the Minamata disease, or a toxic neurological disorder, occurred through intakes of fish and shellfish contaminated with organic mercury discharged into water, and became a serious social problem as one of the four major pollution diseases in Japan. With aggravation of the water pollution by industrial and municipal effluents, dissolved oxygen contents in water decreased, and more water became unsuitable for the organisms that used to occur there. In

recent years, serious pollution has been improved, but water mass with low oxygen contents and red tides are still observed especially in the enclosed water, and there occur problems such as decreases in fish and shellfish and subsequent impacts on fishery. Sediment discharges not only from natural disasters but also from farmlands, devastated forestlands and construction sites have been also reported to have impacts on coastal ecosystems such as coral reefs and seaweed beds.

Large volumes of debris are drifting out from Japan and the countries and regions around it to have washed up to beaches including those along the Sea of Japan, and damages such as deterioration of the coastal environment including ecosystems there, losses of scenic beaches with "white sand and green pines", reduced functions as the coast, and impacts on fishery have been reported. Drifting debris on the sea, such as plastic wastes from human activities, are washed up to beaches or accumulated on the sea floor. Apart from adverse impacts on scenery and fishery, turtles and sea birds may swallow them, and life of organisms would be threatened.

Fishery utilizes biological resources in the ocean, and if it is not properly managed, it will have impacts on the marine ecosystem by overfishing or bycatch. Among 84 populations of 52 fish species under the stock assessment of individual fish species and subpopulation, 40% of them are evaluated to be at low level. Apart from impacts of changes in the marine environment, excessive fishing on certain species overwhelming their ability to recover, in addition to reductions of the seaweed beds and tidal flats as the spawning and nursery grounds in the coastal water, is suggested to be responsible for this. Aquaculture is also conducted in coastal water, and attentions for its appropriate management is required as mentioned above. It is a concern that alien species intentionally introduced in recent years for food supply may have impacts on the original ecosystem.

2) Human pressure on the open ocean

When compared with coastal water, the open ocean is less likely to be subject to direct impacts of human activities. Currently, the open ocean is used mainly for navigation, fishing and ocean dumping of wastes. Its new development and utilization, such as exploitation of ocean bottom resources and the development of natural energy including wave power and tidal power, are envisaged for future.

Among impacts on the ocean by vessels are discharges of oil and hazardous substances, and especially oil spills at the time of an accident have significant impacts on the marine ecosystem. After the war, Japan has developed economically through trades with many countries around the world. Today, Japan relies almost all of its international trade and about 40% of its internal transport on the marine transport. Along with globalization and the global scale economic development, volumes of the marine transport in the world are increasing, growing with and Japan is involved in around one-seventh of such volumes.

As for fishery, even in the open ocean, significant reductions in size of particular species or population, for example by overfishing would pose a threat of impacts on populations of the

organisms associated with such species, or balance of the whole food web. Bycatch and ghost fishing are also concerns.

Wastes and pollutants released to the sea from human activities in coastal water or the open ocean are transported extensively by ocean currents, atmospheric circulations and the movements of organisms, and it is observed that they are accumulated in the body of organisms even in the open ocean. It is known that floating debris in the North Pacific is accumulated to particular water by ocean currents[16]. Debris from Japan has been reported to have washed up to beaches of the Midway Islands. Marine environment monitoring by the Ministry of the Environment[17] has clarified that floating plastics distribute extensively even in the open ocean of around 4,000m deep. Deep-sea surveys have identified plastic debris even on the deep-sea bottom as well. Once released to the environment, plastics are not easily decomposed, and there is a concern that they may have impacts on organisms for a long time.

Chapter 4 Basic perspectives on conservation and sustainable use of marine biodiversity

The National Strategy on Biological Diversity 2010 states the following five basic perspectives as the essential common bases to implement measures intended to conserve and sustainably use biodiversity: (1) achieving scientific recognition and having a preventive or adaptive attitude, (2) having a community-oriented attitude and broad view, (3) having coordination and collaboration, (4) using socioeconomic systems, and (5) having an integrated and long-term viewpoint. All of these perspectives are also crucial in implementing measures related to marine biodiversity. However, in addition to these, another five basic perspectives should be recognized especially when considering marine biodiversity, and these are given below.

1. Recognition of the importance of marine biodiversity

Because the ocean is extensive and difficult to access, it is difficult to recognize the biodiversity there in our daily lives. However, the ocean's ecosystem is highly diverse. For example, the existence of an ecosystem independent of solar energy (chemosynthetic ecosystem) was discovered in the deep sea, where no light reaches, with the development of deep sea research.

In addition, it is important to recognize that marine biodiversity does not only supply resources that can be used directly, such as seafood and genetic resources for medicine. Through services such as climate moderation and water purification, marine biodiversity supports systems which support

[16] M. Kubota (1994) A mechanism for the accumulation of floating marine debris North of Hawaii. Journal of Physical Oceanography. 24, : 1059-1064.

[17] The Ministry of the Environment (2009) Present Status of Marine Pollution in the Sea around Japan - as based on data from Marine Environment Monitoring Survey results (Fiscal Years 1998 - 2007). (http://www.env.go.jp/press/press.php?serial=11688)

the lives of human beings. For example, seaweed beds, tidal flats and coral reefs provide a living space for numerous marine organisms; seaweed beds and tidal flats purify water flowing in from land; and coral reefs stop the rough sea waves from reaching islands and protect the humans and organisms living there.

The objectives of the Convention on Biological Diversity are to conserve biological diversity, sustainably use its components, and fairly and equitably share the benefits arising out of the utilization of genetic resources. Each of these objectives could also be reworded as objectives for changing the current state of nature, our economies, and societies to sustainable ones.

Upon utilising ecosystems, the public must consider the long-term and continuous benefits society could receive from them and realize the need to sustainably manage a sound ecosystem. Continuous progress in conservation and sustainable use of natural resources is unachievable without appropriately evaluating the importance of marine biodiversity in economic activities and social life, and we must realize that environmental conservation is a valuable activity.

2. Integrated management of the sea

The Basic Plan on Ocean Policy states that "Comprehensive governance of the sea" is one of the basic aims of ocean-related policies. The Plan clearly states that it is important to have an integrated perspective when managing the ocean, and the following must be achieved: appropriate use of rights and jurisdiction; fulfilment of obligations; and international cooperation in line with international rules including the United Nations Convention on the Law of the Sea.

The National Strategy on Biological Diversity also follows the concept of the Ecosystem Approach, which aims for integrated management of the entire ecosystem and thus clearly states the importance of implementing preventive and adaptive management and use based on scientific knowledge. The strategy also states the importance of sharing information among all the relevant actors and states that society should decide on the manner of managing and using ecosystems.

In such ways, having an integrated perspective is crucial for conserving and sustainably using marine biodiversity.

(1) Importance of its integration with land in coastal areas

The land and the sea are connected through water systems including rivers and groundwater. Downstream transportation of sediments creates tidal flats and beaches in coastal areas, and the nutrients provided from land nurture organisms such as fish in rivers and seas, creating rich ecosystems. Marine nutrients are also transported to upstream forests by anadromous salmon. In such ways, the land and the sea are closely connected. Many organisms living in coastal areas such as land crabs, coconut crabs, gobies, *Ayu* sweet fish, and Japanese sea perch are migratory and change their habitats at different stages of their lives. Thus, it is important to perceive these

come-and-go routes and habitats as a network. Some organisms like common freshwater clams inhabit estuaries where freshwater and seawater mix. Thus, coastal areas require comprehensive management that, with a broad perspective, perceives the watershed as a whole considering the connection between the land and the sea. In addition, the habitat and nursing grounds of inner bay organisms are connected by ocean currents in coastal inner bays. Thus, in promoting coastal area management and the protection or restoration of suitable habitats and nursing grounds, such networks must also be considered.

To implement protective measures that consider ecosystem networks for marine biodiversity, the life history and migratory pattern of the target marine organisms must be considered and systematic measures that embrace such features must be established.

In addition, it is important to encourage various actors relevant to the water bodies which comprise ecosystem network to share information, to widely participate and cooperate, and to establish systematic conservation measures that consider the region's features.

(2) Importance of extensive perspectives on open ocean

Considering the continuity of the ocean, the existence of ocean currents, atmospheric input of pollutants, and extensive migration of marine organisms, problems related to marine biodiversity cannot be solved within a single country. Each country has an obligation to maintain a sound environment in the marine areas within its jurisdiction; however, cooperation with neighboring countries is essential when such environment is the open ocean. To implement conservation measures in highly enclosed waters such as the Sea of Japan, cooperation with the relevant countries is necessary, and measures for conserving marine biodiversity must be implemented under international cooperation. In addition, it is necessary to recognize that marine areas have a strong relationship with continental land, just as the Amur River and Yangtze River (two large continental rivers) supply the Sea of Okhotsk and the western part of the East China Sea, respectively, with nutrients and foster rich ecosystems.

Japan stretches a long way from north to south on the western rim of the vast northern Pacific Ocean, and it is connected to many countries via the Pacific Ocean. Therefore, international cooperation is essential for Japan. For example, organisms such as migratory birds, sea turtles, diadromous fish and marine mammals including whales, migrate long distances over national boundaries and use the Japanese coastline. To conserve and protect such organisms, it is important to have a broader international point of view in collaborating and cooperating with the relevant countries to implement measures to conserve their habitats. Such cooperation is also required to prevent pollution including marine debris.

Of the countries in the Organization for Economic Cooperation and Development (OECD), Japan consumes the largest amount of fisheries products of all the developed countries. Thus, Japan

plays an internationally important role in promoting the sustainable use of fishery resources and conservation of marine biodiversity.

In addition, negative impacts from global warming and global dispersion of chemical substances are also causing concerns. To face such problems, measures must be taken with international cooperation. Collaborative research on the global distribution of hazardous substances, effect of climate change upon marine ecosystems, and effective measures to mitigate such impact must also be promoted.

Internationally, under the United Nations Environmental Programme (UNEP), the establishment of "Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services" (IPBES) had been conferred, and in June 2010, the attending parties came to a basic agreement on its establishment.

To establish IPBES as an efficient and effective framework that provides a scientific basis for policymaking, we must be actively involved in and positively contribute to discussions on the framework of IPBES. And through this kind of framework, utilization of scientific bases in making policies relating to marine biodiversity and ecosystem services must be promoted as well.

3. Measures appropriate to the characteristics of marine areas around Japan

The characteristics of the ecosystem and major factors that affect them differ between coastal areas and open oceans. The marine environment also varies significantly with latitude, ocean current and bottom topography. Thus it is important to promote measures for conservation and sustainable use of marine resources that take into account the characteristics of the particular marine area. When implementing such measures, it is essential to realize the need to understand and maintain the structure and function of the ecosystem in the target marine area.

Upon conserving marine biodiversity, it is important to systematically and comprehensively identify the factors that affect it and threaten the biodiversity of the marine area. It is also crucial to promote effective conservation measures and consideration in utilization.

In terrestrial areas, ecosystems can be generally depicted by the distribution of vegetation (an indicator of regional biological characteristics) as basic information. However, in the sea such ecosystems with a stable base are limited to coastal areas such as seaweed beds. The distribution of fauna in the ocean is regulated by physiochemical factors such as topography, matrix and ocean currents. Thus, to understand marine ecosystems, the types of physiochemical environment factors must be classified.

Coastal waters could be divided into "enclosed areas", which from a topographical point of view are highly enclosed seas such as inland seas and inland bays like the Seto Inland Sea; and "open areas" connected to the ocean. Coastal areas could also be classified according to their vegetation such as seaweeds and sea grasses, similar to the way land is classified. In such cases, the water

temperature largely determines the vegetation that can grow there.

Open ocean areas could be divided into layers according to the depth of the water mass (water columns) and sediment layers (Figure 1).

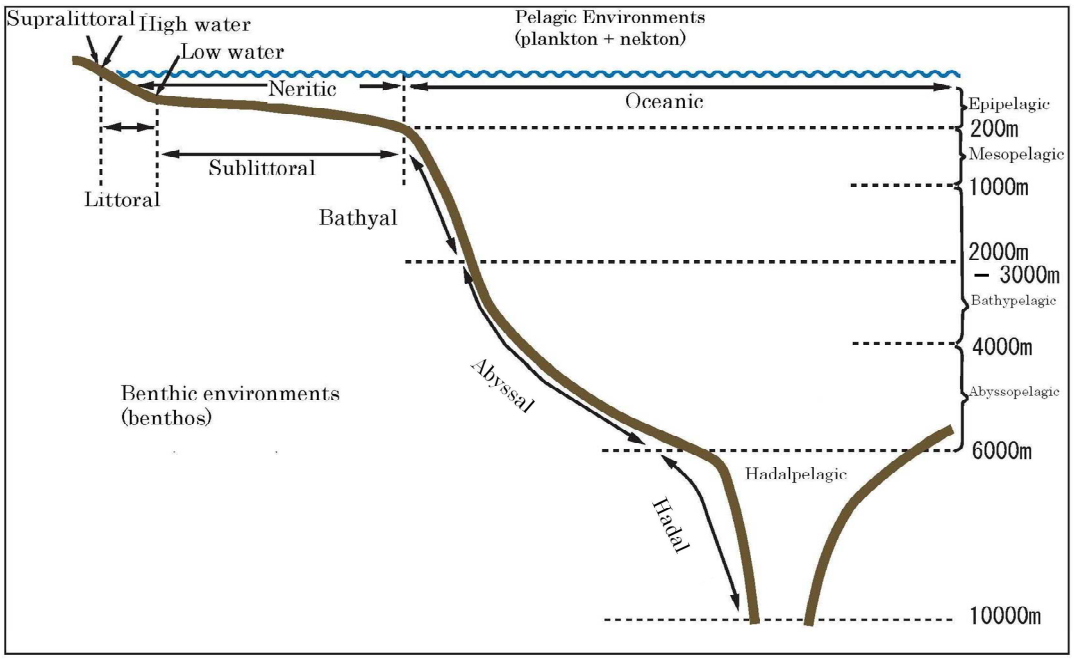

Figure 1: Ecological divisions of the ocean

Modified from "Biological Oceanography - an Introduction" (2nd ed., 2009) translated by Takeshi Naganuma and edited by Fumitake Seki.

Marine Ecoregions of the World (MEOW)[18] is a system that classifies the marine areas of the world shallower than 200m into 232 ecoregions. There are other national and international classification systems, but the sea surrounding Japan could be classified into 6 major marine zones according to topographical characteristics and oceanographic conditions including the distribution of ocean currents: (1) the Kuroshio Current and subtropical zone; (2) Eastern Honshu mixed water region; (3) Oyashio Current and subarctic zone; (4) Sea of Okhotsk; (5) Sea of Japan; and (6) East China Sea.[19]

[18] Mark, D.S. et al. (2007) Marine Ecoregions of the World: a bioregionalization of coastal and shelf areas., Bioscience. 57(7): 573-583

[19] Incorporated Association of Research Institute for Ocean Economics (2002) Research report on establishment of marine management network in our nation's 200 nautical miles of marine area.

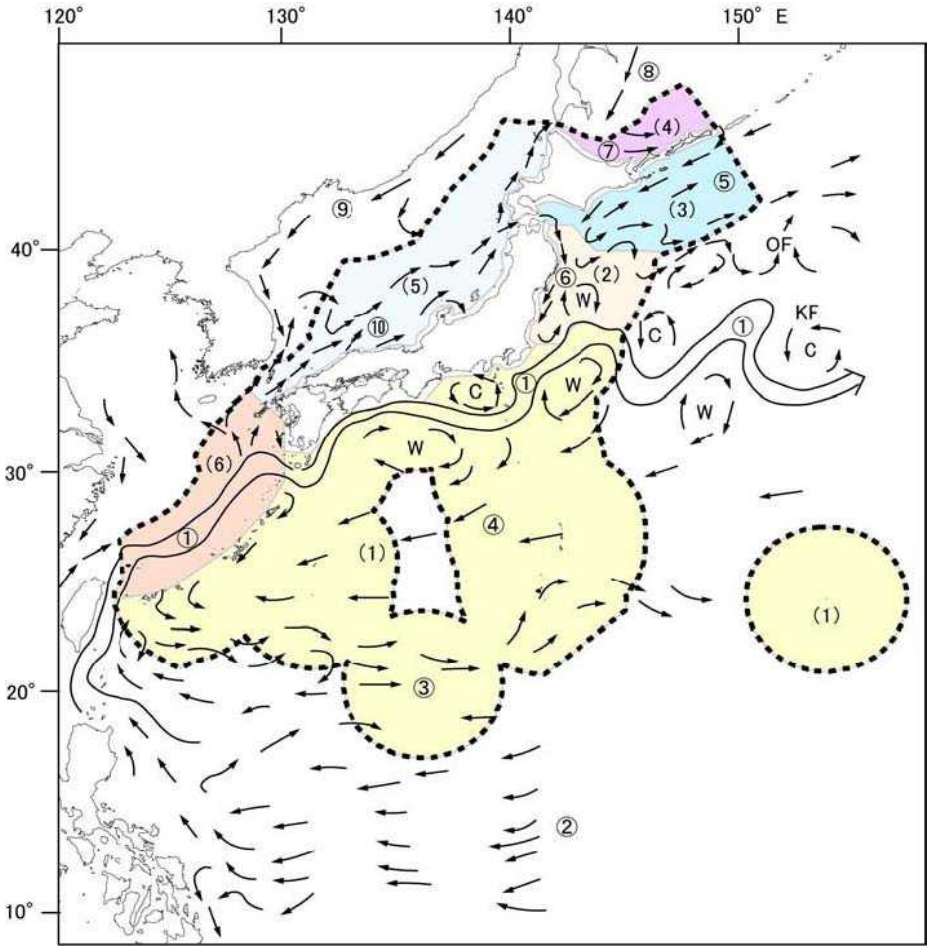

Figure 2: Marine zones of Exclusive Economic Zone of Japan according to characteristics of oceanographic conditions

Modified from "Research report on establishment of marine management network of our nation's 200 nautical miles of marine areas" Incorporated Association of Research Institute for Ocean Economics.

Table 1: Marine Zones and their Characteristics

Marine Zones	Characteristics of geography and topography	Characteristics of climate, ocean currents etc.	Characteristics of ecosystem, biological resource etc.
(1) Kuroshio Current and Subtropical Zone	• It is a vast area on the pacific side of the country, from Nansei Island to the offshore area of the Boso Peninsula in the eastern shore of Honshu, including the Ogasawara Islands. • The Philippine Sea Plate, the Pacific Plate and the Eurasian Plate collide in the area. Steep and deep sea trenches such as the Nansei Island Trench, Izu-Ogasawara Trench, Nankai Trough and Ogasawara Trough can be seen here.	• Okinotori Island is the only Japanese land in a tropical zone. The Nansei Islands lie in a subtropical zone and the coasts of Honshu lie in a temperate zone. • One of the largest Kuroshio currents of the world flows north along the Nansei Islands and the Eastern Coast of Honshu. The mesopelagic zone of the Kuroshio disperses at the relatively shallow Izu-Mariana Trench. The Kuroshio Countercurrent flows southwest offshore of Shikoku. • Offshore at Boso, the Kuroshio Current heads east and becomes the Kuroshio Extension, which flows to the west coast of North America.	• This marine area is connected to the "Coral Triangle," the most biologically diverse sea in the world, by the Kuroshio Current. Thus this area could be considered to be one of the world's most biologically diverse marine areas. • Low latitude marine areas are in subtropical marine environment, and diverse ecosystems such as mangroves, coral reefs, seaweeds, and sea grasses could be seen on the coast. • The coasts of Honshu are temperate, allowing some species that are distributed mainly in subtropical zones to coexist with species unique to temperate zones. The majority of sea grasses seen in this marine area are eelgrasses, and mangroves are rare. Brown algae such as *Arame*, *Kajime*, and sargassum are found in abundance on rocky shores. • The Kuroshio Current is a highly saline, warm and oligotrophic surface current. Its primary production in the open ocean is supported by small phytoplanktons. • Due to the Kuroshio Current, warm water biotas are seen. And a complex grazing food web consisting of microbial food chains, small zooplanktons, mesopelagic fish and squids, small epipelagic fish, large migratory fish, seabirds and whales is created. • Spawning sites for fish lie in the inner Kuroshio regions from Satsunan to Boso (for sardine and mackerel) and offshore south of extension areas (for Pacific saury and neon flying squid). • Subtropical areas are the spawning areas for large fish such as tuna, and are the migratory route of highly migratory fish. • Loggerhead turtle (North Pacific stock) and green turtle lay their eggs mainly on the sand dune coasts of southern Japan. Ogasawara is the largest spawning site for green turtle. • Drifting seaweeds consisting of sargassum are used as spawning sites and juvenile and larval fish are transported offshore. • Approximately 30% of all whale species in the world inhabit areas around the Ogasawara Islands. In addition, albatross breed on some of the islands. • Hydrothermal ecosystems are observed in the Izu-Ogasawara, Mariana and Nansei Island region. • Cold seep ecosystems are observed in some areas like the Sagami Bay.
	• The Seto Inland Sea, surrounded by Honshu, Kyushu and Shikoku, is the largest enclosed water in Japan. The sea has many islands and the water is shallow.	• In the Seto Inland Sea, spacious sea with a calm flow called "nada" and narrow sea with fast tidal current called "seto" exists alternately.	• The Seto Inland Sea has many complex coastlines. Thus, there are various marine environments and diverse organisms, especially those of inner bays, inhabit and grow abundantly there. • Being an inland sea, the effect of warm currents is limited. Therefore compared with the Pacific coasts, subtropical species are scarce and most are temperate species. • Primary production of the Seto Inland Sea is relatively high and fish that feed on plankton such as Japanese sardine, Japanese anchovy, whitebait and sand lance are abundant. • The coasts of the Seto Inland Sea are dotted with shallow areas such as tidelands and eelgrass beds that are habitats for benthic organisms and breeding grounds for horseshoe crabs. In addition, sandbanks exist in various places and serve as a habitat for species such as lancelet and sand lance, attracting the migration of black finless porpoise and loons which feed mainly on sand lance.

(2) Eastern Honshu mixed water region	• It is an area where the North American plate and Pacific plate collide offshore of Sanriku. The Japan Trench stretches north to south. • The coast of Sanriku has a developed rias coast.	From summer to autumn, Kuroshio-Oyashio transition region (mixed water region) spreads in the northern area offshore of the Kuroshio Extension and a complex front structure with warm and cold water eddies develop. The Kuroshio Current, Oyashio Current and also the Tsugaru Current flow into the Sanriku coasts establishing a mixed water region and a very complex marine environment.	• Temperate and subarctic species coexist, creating a unique biota. Subtropical species that are seen along the Kuroshio Current are scarce. • Eelgrass beds and seaweed beds develop well in inner bays. • Many areas with a spacious sublittoral zone exist, and echinoderms and the like dominate. • The Kuroshio-Oyashio transition region offshore serves as foraging and growing area for epipelagic fish and squids such as Pacific saury, mackerels and sardines, and large migrating fish such as tunas and skipjacks. • Both cold and warm current fish biotas are observed, and cold current fish and Japanese sardines prevail in the cold regime, while warm current fish prevail in the warm regime. • From spring to early summer, the coasts of Sanriku are abundant with krill and become important foraging area for baleen whales that feed upon the krill and for shearwaters that have crossed the equator heading north. • In the marine trenches, cold seep ecosystems are observed.
(3) Oyashio Current and subarctic zone	• It is the marine area north of the eastern coast of Hokkaido and surrounded by the Kurile Islands. • It is the area where the North American plate and the Pacific plate collide. The Kuril and Kamchatka trenches stretch north to south.	• It is the area that contains the Oyashio Current, with a flow rate almost equivalent to the Kuroshio Current. • The Oyashio Current originates from the Sea of Okhotsk, the surface water of the western subarctic circulation, and flows southward in a tongue-like shape. • The Oyashio Current is divided into three portions. The first, the Oyashio Current Branch, flows south from Erimo. The coastal Oyashio current branches off from the first and flows along the Hokkaido and Tohoku Coasts. The second Oyashio current branch flows offshore.	• The Oyashio Current is a cold, low-salinity surface current, rich in nutrient. The primary production of the open ocean is supported by the spring bloom of large phytoplanktons (diatoms). • In the coast, cold water biota develops. Generally, the ecosystem has a large biological mass but the number of species is small compared to subtropical marine areas. • Large zooplanktons such as krill and copepods, and mesopelagic fish and squids are abundant. It is foraging area for organisms such as valuable fish species (salmons, cods and flatfish), seabirds, pinnipeds and whales that feed upon them. • From summer to autumn, mackerels, sardines and squids migrate north and the Oyashio Current transition region becomes an important feeding and growing area for them. • In autumn, salmon (chum salmon) that grew in northern seas migrate to the coastal area and rivers to breed. • Large brown algae (such as kelps) flourish on coastal rocky shore areas and the areas function as important spawning sites for Pacific herring and other organisms. Also, valuable benthic organisms such as abalones and sea urchins inhabit there abundantly. • Eelgrass beds spread over the sandy beach regions. • The eastern coast of Hokkaido serves as a habitat for harbor seals (the only land-breeding seal in Japan) and a breeding place for rare seabirds such as tufted puffins.
(4) Sea of Okhotsk	• Highly enclosed sea surrounded by the Kamchatka Peninsula, Kuril Islands, Sakhalin and Hokkaido.	• It is the world's lowest latitude marine area with seasonal sea ice formation. It is Japan's only frozen marine area. The Sakhalin cold current flows southward along the eastern coast of Sakhalin. • The Soya warm current, derived from the Tsushima warm current, flows from the Soya Channel along the Sea of Okhotsk side of Hokkaido, reaching the Shiretoko Peninsula. • With the formation of seasonal sea ice at the Northern Sea of Okhotsk, cold, high-salinity, and nutrition rich seawater sinks, and the Sea of Okhotsk intermediate cold water is created.	• The Sea of Okhotsk intermediate cold water spreads from the Sea of Okhotsk to northwest of the northern Pacific Ocean as nutrient-rich water mass. This supports rich biological production such as a bloom of phytoplankton in spring. • Diatoms (ice algae) attach to the bottom of the seasonal sea ice where they flourish and then sink, feeding benthic communities (especially filter feeders). • Drift ice strands to the coasts, and special biota originating from drift ice can be seen. • Environmental characteristics such as water temperature are similar to those of the Oyashio Current area, and similar biota is observed: abundant biomass but limited species. • Similar to the Oyashio Current area, large zooplanktons such as krill and copepod are abundant and it becomes foraging area for valuable fish species (cods, flatfish and crabs), sea birds, pinnipeds and whales that feed upon them. • From spring to early summer, southern Sea of

			Okhotsk is the area where salmon fry and larva from the rivers of Tohoku and Hokkaido grow. In autumn, salmon and pink salmon that matured in the northern Pacific Ocean migrate to the coast and rivers to breed. • From winter to spring, cold water marine organisms (bottom fish including codfish, sea eagles and seals breeding on ice) similar to those found in arctic ice edge ecosystems prevail, but from summer to autumn, warm current migratory epipelagic fish also arrive.
(5) Sea of Japan	• Highly enclosed sea surrounded by the Tsushima Channel, Soya Channel and Mamiya Channel with a deep-sea-basin-like feature. • A shoal called the Yamatotai exists in the centre of the Sea of Japan. • It has a vast, shallow and rather flat topography (due to the continental shelf).	• The Tsushima Current, a mixture of the Kuroshio Current and Chinese coastal water flows northward. This current includes a current that flows along the eastern coast of the Korean Peninsula, and another current that flows along the Sea of Japan side of the coast of Honshu. It creates complex warm and cold water eddies and fronts with the Liman Current that flows southward along the continental coast. • The 300m deep surface water layer is composed of the Tsushima warm current, and the bottom layer is composed of the Sea of Japan proper water below 1 degree Celsius. This proper water originates from the cold, high-salinity water that sinks with the winter seasonal wind at the Russian coast.	• With the winter seasonal wind, vertical mixing occurs in the Sea of Japan, transporting nutrients in the middle-to-bottom part to the surface layer. With the increase in sunlight and water temperature, phytoplankton proliferates from spring. • The Tsushima warm current is a surface current with warm, high-salinity, low nutrient water, but at the complex front area with the Liman Current, highly productive primary production similar to that of the Oyashio-Kuroshio transition region occurs. • Warm current fish that lay eggs mainly in the South China Sea (ex., bluefin tuna, yellowtail, horse mackerel) and Japanese common squid migrate northward along the Tsushima warm current and migrates back southward before winter to their egg laying area at the Sanin-South China Sea. • On the continental shelf and slope areas, there are many warm current species in the south, and cold current species in the north. A large number of snow crabs inhabit the baythal zone. • Not long has passed since the formation of the Sea of Japan. Thus in general, the area has lower biodiversity compared with other areas but the production is high. • Due to the lack of tidal changes, tideland ecosystems do not develop. • Benthic biota on the coastal area is a part of the biota of the Kuroshio Current area. However, due to the effect of the Tsushima warm current, warm current species are distributed in higher latitudes than on the Pacific side of Japan. • Mesopelagic areas are affected by the Sea of Japan proper water and only a limited number of species are distributed. Fish such as *Maurolicus japonicus* and Porous-head eelpout dominate and other organisms such as firefly squid are distributed.
(6) East China Sea	• Located west of the Nansei Islands, 70% of the area consists of a continental shelf shallower than 200m. However, in the southeast portion of the East China Sea, the continental slope along the Ryukyu Islands is steep and depths reach beyond 1000m. • The continental shelf is covered with thick layers of sand and silt sediments affected by land water from areas such as the Yangtze River.	• The top layer of the Kuroshio Current flows through a narrow channel of eastern Taiwan, into the East China Sea, and once again out to the Pacific through the Tokara Channel. • On the upper layer of the inner side of the coastal slope, the Kuroshio Current and China cold water (originating from China's continental coast) mix and form surface-mixing water that flows counter clockwise along the coast of Kyushu becoming an eddy. A portion of this water flows into the Sea of Japan as the Tsushima Warm Current.	• In the continental shelf and slope of the Chinese continent, vertical mixing from the winter seasonal winds and the increase in sunlight and water temperature in spring cause phytoplankton to proliferate, as in the Sea of Japan. • It is the spawning and nursing ground for many epipelagic fish (ex., yellowtails, horse mackerels and mackerels) and winter stocks of Japanese common squid that migrate north along the Tsushima warm current of Sea of Japan and Kuroshio Current of North Pacific Ocean. • Due to abundant supply from the continent, there is a substantial biomass in the ocean and continental shelves. • The coastal area is environmentally the same as those of the Kuroshio Current subtropical area, and there is no difference in biota as well. Thus, it is one of the world's most biologically diverse bodies of water. • Many hydrothermal ecosystems are distributed around the Nansei Islands.

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4. Effective measures to utilize local knowledge and technology

Surrounded entirely by the sea, Japan has actively used the ocean throughout its history. It has been used as a place for transporting products and humans, necessary for the formation and development of industry in each area, and as a place for harvesting marine resources which are an important component of the diet of the country.

From such a historical background, especially in the coastal areas, various actors utilize and manage the sea. Thus it is important to promote effective conservation and sustainable use of marine biodiversity by incorporating such various measures taken by social bodies utilising or managing the sea. The simultaneous conservation and utilization of marine biodiversity in a sustainable manner is the responsibility of any user of the sea.

The history of fishery in coastal regions goes back an exceptionally long way in Japan. By the Edo period, fishing gear and methods had been developed, and an order related to rights on exclusive use of fishing grounds, which could be suggested to be a primitive form of the current fishery right and piscary, was created. Coastal fishing villages were allowed the right to monopolize the use of site water surface. A system where the management of coastal area was left to the responsibility of the local fishers and the village was established. This background has led to the strict local management of fishery resources in Japan today. For example, conserving the environment of fishing grounds, setting fish shelters, establishing no-take areas and limiting operation waters are the major types of autonomous fishery management done by entities such as fisheries cooperative associations[20].

Shiretoko was registered as a World Natural Heritage site because of its unique marine ecosystem affected by the formation of sea ice and the distinguished interaction between terrestrial and marine ecosystems. In 2007, Shiretoko developed The Multiple Use Integrated Marine Management Plan, and under the idea of adaptive management, is aiming to conserve the biodiversity of the marine area while sustaining fishing resources by the legal restrictions as well as the local fishers' autonomous regulations.

[20] According to the 2008 Fishery census, 1,738 organizations are conducting voluntary fishery management in Japan.

Such autonomous measures taken by the local people may become a more effective measure in conserving and managing biodiversity than regulations based on laws, because flexible and detailed management by the related entities can be expected. Coastal areas are places where human life and nature are closely related. Seas that show high productivity and maintain rich biodiversity by the assistance of human activity that harmonizes with natural ecosystems have recently come to be gradually recognized as "Sato-umi (village seas)". Thus, it is important to progress with their appropriate conservation and use by utilising locally cultivated knowledge, technology and systems on the relationships between people and the sea.

Extensive and diverse actors are involved with the ocean. To maintain the biodiversity of such, we need to have further cooperation among the relevant actors and to establish systems for coordination. Among the measures taken by the Shiretoko World Natural Heritage Site described before, it is important to note that a cooperation system was created in the related scientific committees and regional liaison meetings that involve various actors such as local citizens, industries, intellectuals and governments.

Such cooperation system is also important to continue with long-term monitoring and conservation, regeneration and adaptive management of coastal areas based on the results of the monitoring.

5. Summary of the concept of Marine Protected Areas

(1) Defining Marine Protected Areas

Movements to promote conservation by establishing protected areas in marine areas (Marine Protected Area: MPA) have become globally active. This is against the backdrop of increased global interest about ecosystems and the conservation of biodiversity, and the accumulation of relevant scientific knowledge. In response to such movements, the Seventh Ordinary Meeting of the Conference of the Parties to the Convention on Biological Diversity defined a Marine and Coastal Protected Area as the following after a long discussion:

"A marine and coastal protected area means any defined area within or adjacent to a 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 customs, with the effect that its marine and/or coastal biodiversity enjoys a higher level of protection than its surroundings."

The International Union for Conservation of Nature and Natural Resources (IUCN), which had been working on this problem for a long time, revised the definition of marine protected areas established in the late 1980s. In 2008, the IUCN issued a definition of protected areas (applied to both terrestrial and marine areas) as follows and also produced some detailed guidelines.

"A protected area is 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."

There is no uniformly effective "marine protected area" for all marine areas. The importance lies in establishing protected areas in appropriate locations considering the target marine areas and the way they are used. Thus, in addition to the above definition, the IUCN has created "Protected Area Management Categories" (Table 2) and requests that protected areas be set up in a balanced way after clarifying the objective of managing them.

Table 2: IUCN Protected Area Management Categories

Category of protected areas		**Main objectives of managing areas**
Ia	Strict nature reserve	Strict protection (mainly for scientific research)
Ib	Wilderness area	Strict protection (mainly for preservation of wilderness)
II	National park	Ecosystem conservation and protection
III	Natural monument or feature	Conservation of natural features
IV	Habitat and species management area	Conservation through active management
V	Protected landscape and seascape	Landscape and seascape conservation and recreation
VI	Protected Area with sustainable use of natural resources	Sustainable use of natural resources

* "Protected Area" in this table refers to both land and marine areas.

Reference: Dudley ed. (2008) Guidelines for Applying Protected Area Management Categories

In addition, there is an emerging idea of creating networks of marine protected areas, so that the individual protected areas would effectively conserve biodiversity or ecosystems as a whole.

Therefore, internationally recommended marine protected areas today could be seen as an effectively set and clearly defined protected area in specified marine areas with the main objective of conserving marine biodiversity or ecosystems. Measures for such protection are decided flexibly according to their objectives, and include non-legislative measures such as local customs. Also the sustainable use of ecosystem services cannot be separated from the conservation of biodiversity, and is achieved by conserving biodiversity. Thus, aiming for the sustainable use of any of the ecosystem services could also be regarded as marine protected areas.

Considering the above, in this conservation strategy, the marine protected areas that Japan must promote from now on are defined as the following; however, this definition will be revised as necessary in accordance with the progress of the measures:

"Marine areas designated and managed by law or other effective means, in consideration of use modalities, aimed at the conservation of marine biodiversity supporting the sound structure and function of marine ecosystems and ensuring the sustainable use of marine ecosystem services."

(2) Current status of Marine Protected Areas in Japan and their challenges

Japan has been designating marine areas that would fall under Marine Protected Areas through the ages in various ways. These areas include: (1) Natural Parks and Natural Seashore Conservation Areas that aim to protect the natural landscape and the like; (2) Nature Conservation Areas, Wildlife Protection Areas, Natural Habitat Conservation Areas and designated areas for natural monuments that aim to conserve the natural environment or the habitat or nursery ground of organisms; and (3) Protected Water Surface that aim to conserve and cultivate aquatic fauna and flora, coastal marine resource development areas, and many other various specified areas designated by different entities such as prefectural governments and fishing groups. Thus, a great many Marine Protected Areas already exist.

The coastal Ramsar site based on the Ramsar Convention and marine areas of Shiretoko inscribed as natural properties of the World Heritage List based on the Convention for the Protection of the World Cultural and Natural Heritage could also be seen as protected areas that are designated in marine areas. Continuous protection of the site by any of the domestic systems listed above is required once they are added to these international lists.

In these already existing protection areas, the target of each conservation measure corresponding to each objective is made clear. However, because of this, there are cases where the target of conservation is limited to the unique landscape, academic value or specific species. This is in contrast to the trend of marine protected areas recommended in earlier mentioned international contexts, and the perspective of this Conservation Strategy, which aims for the conservation of biodiversity that supports a sound structure and function of ecosystems, and the sustainable use of ecosystem services.

The Basic Plan on Ocean Policy (decided by the Cabinet in March 2008) clearly states that in accordance with the Convention on Biological Diversity and other international agreements, as one means to ensure biodiversity and realize sustainable use of fishery resources, the government should clarify how to establish Marine Protected Areas in Japan. This should be done with coordination among the related ministries. In this way, Japan should appropriately promote the establishment of such marine conservation. The definition of Marine Protected Areas in this conservation strategy

includes various factors, but the important point is that it clearly states the conservation of biodiversity and sustainable use of ecosystem services as the objective. From now on, upon promoting designation of Marine Protected Areas in necessary marine areas, the establishment of effective Marine Protected Areas by appropriately expanding and improving the existing systems, and the effective combination and coordination of such systems should be considered from the perspective of biodiversity and ecosystem services as shown in the objective in the definition. It is also important to improve the management of currently protected areas by reviewing the current situation and revising the management plan, strengthening the regulations as required, taking measures to restore degraded nature, and taking measures such as the previously mentioned Sato-umi. At the same time, it is necessary to continue discussing appropriate measures and systems, considering the enhancement of ocean-related knowledge and changes in the social situation.

It is noteworthy that the change of marine ecosystems such as migration of organisms is large compared to the land. Thus, in addition to establishing a spatial protection area, a flexible management such as change of regulations and management according to the season or a period is important considering the temporal factors.

Chapter 5 Development of measures for conservation and sustainable use of marine biodiversity

This chapter describes the direction in which measures will be developed for the conservation and sustainable use of marine biodiversity. Unless otherwise stated, the measures described in this chapter will target marine areas under the jurisdiction of Japan.

1. Improvement of baseline information

(1) Improvement of scientific information and knowledge

To effectively implement measures for conservation and sustainable use of marine biodiversity, it is important to appropriately assess the current state of marine biodiversity and grasp the problems that may possibly occur in the future. For such continuous assessment, constant observation of changes in the marine environment must be done as the basis, and scientific data on biodiversity must be improved. From the observed data, basic research on taxonomy and ecology should be enhanced, and scientific data on marine ecosystems should be accumulated. It is desirable for such scientific knowledge to be shared widely among all the relevant entities in the country. In addition, based on this knowledge, the direction of management and use of natural resources should be decided as a social choice. Such scientific acknowledgement and adaptive management is also the basis of the ecosystem approach that was agreed upon as a strategy for integrated management of biological resources at the Convention of Biological Diversity. It is internationally important for

such scientific knowledge to be shared and utilized in decision making.

In Japan, various marine surveys are implemented by different governmental organizations to serve their political objectives. The Basic Plan on Ocean Policy, therefore, aims for the steady and effective implementation of each marine survey and the unified management and provision of each data source. Upon organizing such management and provision system, the Plan intends to make maximum use of already existing measures such as those carried out by the Japan Oceanographic Data Centre (JODC), which functions as the Japan branch for the International Oceanographic Data and Information Exchange (IODE). To this end, relevant government agencies, research organizations and the like are now working to share the information obtained in their own marine survey and at the same time improving the registered information to promote the use of the Marine Information Clearing House.

As an international scientific cooperation, the Convention for a North Pacific Marine Science Organization (PICES) was established in March 1992 to promote marine research and collection of relevant information in North Pacific seas. The present members consist of Japan, the United States, Canada, China, South Korea and Russia, and the collection and exchange of scientific information among the experts of the relevant organizations is being promoted.

To supplement scientific data on biodiversity in Japan, the Fisheries Research Agency and prefectural governments have been making elaborate marine observations or fish stock surveys in the marine areas surrounding Japan. They have acquired much knowledge, especially on the major fishing species (52 species, 84 communal groups) from reports such as the stock evaluation results that are released annually. Other than this, a certain amount of data has been accumulated on seaweed beds, tidal flats, coral reefs, sea turtles and sea birds from various surveys. They include the “National Survey on the Natural Environment” and “Monitoring Sites 1000” (which constantly follows the changes in representative ecosystems) led by the Ministry of the Environment for many years. The release of existing information related to marine natural environment is under way as well.

Concerning information on marine biodiversity, the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) is building a database which will serve as the Japan base of the Ocean Biogeographic Information System (OBIS), one of world’s largest database systems that provides information on the diversity and occurrence of marine organisms.

On the other hand, most of the information on marine organisms and ecosystems is accumulated in places such as research organizations of local governments and experimental fishery stations. It is important to continuously accumulate information at these local levels. However, from such various pieces of information, discussions must be held to establish a method to efficiently collect and share or utilize the necessary information that should be known at the national level. This should be done from the perspective of conserving and sustainably using marine biodiversity. From these

discussions, efforts will be made to collect the necessary types of information by receiving cooperation from the relevant governmental agencies, researchers, citizen groups and so on.

When compared with land species, information on marine species is limited. However, the information on rare marine species must also be organized, and this will be done by utilising the information that has been accumulated on marine organisms. Thus, via cooperation with the relevant organizations, measures will be promoted. These measures will include a discussion on methods to evaluate the scarcity of marine organisms and the target species that will be apt for such evaluation.

Surveys and research necessary for measures will be promoted. These will include further systematic understanding of the function and change in the divisions of the sea in the open ocean ecosystems as explained in the previous chapter. There is a need to promote research that elucidates topics such as the function of various organisms and ecosystems, the interrelationships between organisms and their surrounding environments, and the connection between biodiversity and the evolution of organisms. To achieve this, it is important to improve the knowledge on distinctive ecosystems and search for organisms in areas about which there is still particularly limited information. These areas include the sea below the mesopelagic zone, the hydrothermal sea floor, the deep ocean floor, and the undersea crusts. Furthermore, studies should also be done on factors that affect marine environments and that have unclear effects, such as the effect of artificial noise on marine organisms.

To implement the measures necessary for marine biodiversity such as conservation, to check the effects of those measures and to react adaptively, changes in marine ecosystems must be observed, and monitoring must be encouraged. Through survey programs such as Monitoring Sites 1000, data on the natural environment such as data on biota of shallow water ecosystems (seaweed beds, tidal flats, coral reefs, etc.) will be improved continuously. At the same time, data on sea turtles, sea birds, marine mammals and so on will be collected and organized. In addition, the marine environment will be continually monitored to evaluate the state of marine pollution.

Furthermore, if information that has not been collected continuously turns out to be important in detecting changes in marine biodiversity, a method to monitor such information will be examined, and efforts will be made to accumulate it. And to monitor the extensive ocean in an effective and efficient manner, an effective mode of cooperation involving various social entities such as local public organizations, fishermen, local citizens, and NGOs will be considered, in addition to cooperation among governmental agencies.

(2) Identification of marine areas of particular importance for conserving biodiversity

Effective conservation measures must be taken as necessary from the viewpoint of preventing damage to ecosystems, especially in high-priority marine areas for conservation of biodiversity. It is therefore essential to clearly identify the marine areas of particular importance for conserving

biodiversity in the seas surrounding Japan.

Thus, marine areas that are important in terms of conserving biodiversity will be identified according to the ideas such as the "scientific criteria for the identification of ecologically or biologically significant marine areas in need of protection" stated in the decision of the 9th Meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD-COP9) and the "Vulnerable Marine Ecosystem" by the Food and Agriculture Organization of the United Nations (FAO).

In the process, efforts will be made so that the ecosystems that are typical of each body of water will be selected without omission. This will be done by making maximum use of current scientific knowledge and taking into account the zoning and characteristics of the previously mentioned ecological and marine zones around Japan. It is important to keep in mind that many things are still unknown about marine organisms and ecosystems, and identifying all the highly important marine areas is difficult. In the future, it will be important to check the identified marine areas as necessary, as scientific knowledge on marine biodiversity improves further.

Many marine organisms are dependent on specific or multiple ecosystems, habitats and nursery grounds. Thus, upon identifying Marine Protected Areas, it is effective to focus on such ecosystems. The utilization of potential index species will also be considered. As described previously, coastal and shallow water zones including land especially form a complex ecotone (transition zone) with the terrestrial area, and sandy beaches, seaweed beds, tidal flats, and coral reefs are important as spawning grounds and habitats for fries. Also upon identification, the continuity between land and coastal or shallow waters should be considered.

In the open ocean, shallow waters such as seamounts are important habitats and growing places for organisms. Although not much is known about the organisms that live in the deep sea, it contains places with unique ecosystems such as the chemosynthetic ecosystem at hydrothermal vents and cold seeps, cold water coral communities, deepwater sponge communities, and deepwater bryozoan communities. As for water bodies, plankton flourish at transitional regions where two ocean currents meet or at upwelling currents where lower currents rise, and they serve as an important feeding area for fish and sea birds. However, the flow and strength of ocean currents change with changes in the global climate. Thus the size and location of such transitional areas change, and it may be difficult to grasp them as a marine area. However, their functions should be recognized.

2. Identification of factors influencing marine biodiversity and implementation of measures to reduce them

To appropriately progress with the conservation of marine biodiversity, the cause of specific problems and the related entities who shall take charge of conservation must be identified. While improving the cooperation between the relevant parties, the best method and process to solve the

problems must be found, and policies must be executed to realize them.

(1) Balanced development and conservation of the sea

Upon implementing development projects, the "Environment Impact Assessment Act" requires the effects on the environment (including those that occur after the development) to be researched, predicted and assessed beforehand. The results must be used with appropriate care to ensure environmental conservation. Also, as described in the Basic Act on Biodiversity, it is important for ecosystems to be considered at earlier stages of conservation (such as the formulation of upper layer plans) prior to implementing individual projects and making policies.

In recent years, various measures have been taken to balance both the environment and development. Water environment improvement projects include effective utilization of dredged gravel from channel maintenance for regenerating and creating tidal flats, and modifying seafloor pits, a cause of blue tides. Fishways, habitats and nursery environments for organisms have been provided or improved to secure the upstream and downstream continuity of rivers. Managing sediment by promoting the creation of artificial slits in sediment trap dams, conserving and restoring coastal environments including sandy beaches, and using methods to limit the spread of thermal discharges from power plants and the like are among other measures. The technologies that have been accumulated through such measures must continuously be used. Furthermore from now on, it is important to develop new technologies including the effective utilization of natural functions such as the ability of nature to clean itself.

Also, there would to be new developments and technologies, like the development of sea bottom resources and the utilization of natural energy sources such as wave power and tidal power. The impacts these will have on the environment must be assessed beforehand and technology to minimize the impact must be developed along with appropriate planning.

For marine areas that are important for conserving biodiversity and require protection, it is also effective to set regulations by establishing protected areas and promote nature restoration measures to restore lost ecosystems.

(2) Reducing marine environment pollutants that degrade quality of ecosystems

1) Pollution from land-based sources and activities

To prevent pollution in public water areas including coastal waters, regulations such as the effluent standard targeted at specified facilities, the total pollutant load control in designated water areas, and countermeasures for municipal effluent are prescribed based on the "Water Pollution Control Act" (established in December 1970). In addition, local public governments have set additional and expanded regulatory standards on effluent by setting ordinances that suit the situation of the local area, and this has been a large factor in encouraging countermeasures. Also to treat municipal and industrial effluents appropriately, wastewater treatment plants such as sewer systems

and septic tanks are being installed and maintained.

From the perspective of biodiversity, among the various environmental standards established based on the Basic Environment Act, the "water environment standard related to the conservation of aquatic organisms" is described as a desirable objective to be maintained to conserve aquatic organisms, a component of the "living environment" (which includes flora and fauna and their habitat that are deeply related to human life). From now on, adoption of new indicators including the perspective of objectives such as the "amenity of the area for organisms" and the "diversity of aquatic organisms" will be considered for water environment standards, in addition to the current indicators indicating good water quality or the state of water quality pollution.

Also efforts will be made not only to reduce the inflow of pollutions, but also in measures such as those to preserve or restore tidal flats which have high purification capacities.

Further, a system with a perspective that considers the effects that chemical substances have on the ecosystem is introduced in the "Act on the Evaluation of Chemical Substances and Regulation of Their Manufacture, etc." (established in October 1973). For the future, it is important to progress with a comprehensive program against chemical substances. This program includes appropriate research and assessment on the effects on ecosystems and the management of chemical substances from this perspective. Efforts will be made to improve scientific knowledge and collect information, and necessary regulations will be implemented reflecting the results of risk assessment.

2) Pollution from marine based sources and activities

To prevent marine pollution, the disposal of ship oils, hazardous chemicals and waste, and the ocean dumping of waste have been regulated by the "Act on Prevention of Marine Pollution and Maritime Disaster" (enacted in December 1972). This law incorporates international laws such as the "1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumpling of Wastes and Other Matter, 1972 (London Convention)," "International Convention for the Prevention of Marine Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78)," and "International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)." In addition, measures have been taken based on the "National Emergency Plan for Preparedness for and Response to Oil Pollution Accidents" which was made to meet the requirements of the OPRC. This includes the organization of a system and preparation for countering pollution accidents, creation and update of information maps that include information on coastlines that are most vulnerable to being severely affected by pollution accidents. Considering the negative effects on marine organisms by ship bottom paints that contain organic tin compounds such as tributyltin (TBT), the need for global regulations on the use of such paints has been recognized in the IMO with the leadership of countries including Japan. The "International Convention on the Control of Harmful Anti-Fouling Systems on Ships" (AFS) was adopted in 2001 and came into effect in 2008. Based on this

convention, paints that do not comply with this convention are banned on every foreign ship that enters any port of Japan. Appropriate regulations will be implemented hereby with these conventions and laws.

Considering the difficulty in operating deepwater development, countermeasures against possible accidents that may cause pollution are extremely crucial and the method of implementing them should be established beforehand.

(3) Appropriate management of fishery resources

Various regulations and management measures have been taken to conserve and manage fishery resources appropriately. For major fish species, regulations on items including fishing gear, methods, areas, periods and Total Allowable Catch (TAC) have been made under national laws such as the "Fisheries Basic Act" (enacted June 2001), "Fishery Act" (enacted in December 1949), "Act on the Protection of Fishery Resources" (enacted in December 1951) and "Act on Preservation and Control of Living Marine Resources" (enacted in June 1996). Fishers have also been implementing measures for conservation and management autonomously. Measures aiming for the sustainable use of fishery resources have been taken by fishers in autonomous agreements of various forms nationwide. For species that require urgent stock recovery, Stock Recovery Plan with comprehensive measures including reduced fishing effort, conservation of fishing grounds and active cultivation of resources have been conducted. Some of such autonomous measures may be considered as Marine Protected Areas, and it is important to promote the further development of these measures. In addition, the active release of juvenile organisms and creation of fish reefs and breeding grounds have been conducted for many fishery species to sustain and recover their resources, and enable their sustainable use. Bearing in mind matters such as genetic diversity and effects on non-targeted species, it is crucial to aim for the restoration of resources by promoting such resource management in a comprehensive way. It is also effective to establish a cultivation method that combines fish and shellfish cultivation and seaweed cultivation together. This is because it stabilizes the material cycle of carbon, nitrogen and the like. To achieve both sustainable fishery and conservation of marine wildlife, it is important to promote adaptive management based on scientific knowledge and limit the damage done to fisheries while sustaining the organism population.

In coastal areas, a reduction in the environment's ability to produces fishery resources is becoming a problem. This is caused by a decrease in and degradation of the quality of ecosystems such as seaweed beds, tidal flats, coral reefs, and sand banks. To realize a sustainable fishery system, it is necessary to produce, protect, restore, and create fishing environments including seaweed beds and tidal flats. The depopulation and aging of fishers weakens the structure of fishery production and also adversely affects the management of coastal environments. Thus, the revival of fisheries, especially in geographically disadvantaged areas such as isolated islands and peninsulas, is a crucial

task.

Also for the open ocean and high seas, it is important to enable appropriate conservation and sustainable usage of fishery resources based on scientific evidence through frameworks such as regional fisheries management organizations implemented by the relevant countries.

(4) Eradication and control of alien species that trigger disturbance of ecosystems

As a countermeasure against alien species, the "Invasive Alien Species Act" was enacted in 2004 and the Invasive Alien Species covered by this law have been regulated and controled. Also, some alien species that are naturalized in the wild, including some edible shellfish, are listed as requiring caution, without legal regulation. People's understanding and cooperation toward appropriate handling of such species (based on the three principles for preventing damages caused by alien species) have been called upon widely in the public. Indigenous species may also cause adverse effects on the ecosystem, just as an alien species will when, for example, it is released in places other than its original habitat. Careful consideration is also required in considering methods to increase fishery resources. It is important to consider the effects on genetic diversity and stock community upon formulating a release plan, producing juveniles, and actually releasing them. Disseminating the various existing guidelines is also an effective means to control the release and transplant of organisms.

To prevent alien species that are transferred in ship ballast water from disturbing the marine ecosystem, the "International Convention for the control and management of Ships' Ballast Water and Sediments" was adopted in 2004 at the International Maritime Organization (IMO). Japan is actively participating in discussions for the enactment of this convention, and national discussions will continue to meet the requirements. Japan will also continue to be actively involved in international discussions to minimize problems caused by the invasion of alien species attached to ships.

(5) Countermeasures and adaption against climate change

The impacts on ecosystems and biological resources from global warming (rise in seawater temperatures and levels, and changes in ocean currents), ocean acidification, and deliberate manipulation of the global environment (geo-engineering), done as a countermeasure against global warming, still remain unknown. Thus the progress of international research and development to elucidate their mechanisms is urged.

Furthermore, it is of utmost importance for countries around the world to cooperate in promoting measures to reduce emissions of greenhouse gases (measures to mitigate global warming) under international frameworks such as the Framework Convention on Climate Change. However, upon implementing these mitigation measures, the possible impact on ecosystems and biological resources

must be considered as well.

In addition to the measures to mitigate global warming, adaptation toward the projected effects from global warming must be considered. Coastal and island ecosystems such as coral reefs are suggested to be highly vulnerable to climate change. Thus it is important to promote effective and adaptive conservation management including the identification of especially important marine areas with consideration paid to nature's ability to cope with environmental changes, and reducing other anthropogenic stress to the area.

3. Implementation of measures appropriate for characteristics of individual marine areas

(1) Coastal area

Being areas most strongly linked with human activity, coastal areas have traditionally been the main subject of conservation measures. The importance of these areas shall not change hereafter and such measures should be further improved. Relationships among multiple affecting factors should be considered and thus the establishment of cooperation among various relative parties such as the state, local public organizations, businesses, fishermen, citizens, research organizations, and academic experts is important. In addition, coastal areas are strongly related with terrestrial areas by features such as rivers, and especially in estuaries, where the water is brackish and a unique ecosystem is found. Thus it is important to implement an integrated conservation approach by expanding the perspective to the whole watershed.

In Japanese coastal areas, fishery activities such as shellfish gathering and the collection of seaweeds have taken place since ancient times. And even today, fishery is an important mode of living for humans to acquire the rich blessings of nature (ecosystem services) from the ocean. Stable fishery production requires rich ecosystems that produce the fishery resources continuously. Therefore, comprehensive management is important to both conserve the ecosystem and to sustainably use the biological resources for the area. It is also important to create rules upon the use of coastal and shallow waters including coastlines for recreational use.

Considering the connection with terrestrial areas, artificial countermeasures for rivers with perspectives solely on disaster prevention will enhance safety. However, the countermeasures may reduce the supply of nutrients and sediments to coastal ecosystems, which may lead to the reduction of tidal flats and sand beaches. Thus the effects in downstream areas must be considered for measures targeting river areas. Independent of their size, wetlands in shallow water areas including seaweed beds, tidal flats and coral reefs sometimes play an important role in transferring and dispersing shellfish and crustacean larvae and juvenile fish. Therefore, the mechanisms and interrelationships among such wetlands must be acknowledged based on scientific knowledge. And with this knowledge, it is necessary to protect the remaining seaweed beds, tidal flats and coral reefs and reconstruct, remediate or create habitats that strengthen the interrelationships among the

organisms. The current state of pollution by chemical substances must be grasped and the inhabiting and growing situation of organisms in area that has been under development must be checked. In addition, the threshold value of organisms that represent the ecosystem for resistance against major chemical substances must be obtained, and, to support the functions of habitat and growing grounds that had been lost in the past, measures must be implemented including reconstruction, remediation, and creation.

As for floating and washed up debris, the situation of severely polluted areas and nationwide status, elucidation of the cause, and collection and treatment methods and countermeasures that suit the local need have been considered through various types of research. On July 2009, the "Act for the Promotion of the Clearing of Coastal Drifting Debris" was enacted. Based on this act, various entities are now collaborating to implement comprehensive and effective countermeasures against coastal debris. The knowledge and other data compiled from past experience will be used actively and measures that are necessary for the smooth treatment of debris and effective prevention of it will be implemented under cooperation with the relevant parties.

In enclosed waters, exchange of seawater with the open ocean is generally limited because of the physical shape of such areas, allowing pollutants to accumulate there easily. Therefore, once polluted, enclosed waters require a long time to recover. Enclosed waters are also the place where human activities are concentrated, in areas including ports, fishing ports, fishing grounds, aquaculture grounds, places to collect industrial water, and beaches for sea bathing. Also in some areas, especially on the Pacific coasts, the land is heavily populated by people and contains a lot of industry. So far, enclosed waters have been covered by the Water Pollution Control Act and Interim Law for Conservation of the Environment of the Seto Inland Sea, and numerous measures including the Total Pollutant Load Reduction and countermeasures for eutrophication have been applied. With the help of such measures, severe pollution has decreased today. However, the achievement rate for meeting these environmental standards has levelled out at 70%-80% in recent years. In some marine areas, an anoxic water mass has been observed and it is hindering the use of industrial water and affecting the survival and growth of aquatic organisms. Also the habitats for organisms have deteriorated by eliminating tidal flats and seaweed beds, and in some areas, ecosystems including fishery resources have deteriorated. Thus, it is important to have integrated management of pollutant sources and adjustments in the water area usage that include the concept of Sato-umi (achieving high productivity and conservation of biodiversity with human interaction while harmonizing with natural ecosystems) and a smooth material cycle in local areas.

(2) Open ocean

For activities that utilize the open ocean such as ship navigation, ocean dumping, offshore fishing, and energy and resource development, appropriate management and environmental

consideration is important. Care must be taken to protect marine areas that are important for the protection of biodiversity. The majority of regulations concerning ocean dumping from ships, fishing, and the like are established under international frameworks. Thus cooperation with the relevant countries and international organization is also essential.

The Sea of Japan and East China Sea are heavily affected by land activities. The two seas are important supplying grounds of fishery resources for Japan. On the other hand, marine debris and pollutants from various countries tend to accumulate there, making collaboration and cooperation among the regional countries crucial. Examples of such frameworks include the "The Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region" (NOWPAP) by the United Nations Environment Programme (UNEP), and the "Partnerships in Environmental Management for the Seas of East Asia" (PEMSEA) by the United Nations Development Programme (UNDP). These cooperation frameworks are important in protecting and sustainably using the marine environment beyond national boundaries and also as an aim to coordinate measures among the relevant parties.

4. Improvement of Marine Protected Areas and enhancement of their networking

Setting up a Marine Protected Area is an effective protective measure that implements some kind of regulation or management in marine areas that are important for securing marine biodiversity and ecosystem services from a precautionary point of view.

Target 11[21] of the Strategic Plan for Biodiversity 2011–2020 (Aichi Targets), which was decided in CBD-COP10, states that by 2020, at least 10% of coastal and marine areas shall be conserved through systems of protected areas and other effective area-based conservation measures. To achieve this target, those marine areas of particular importance must be identified based on the reasoning stated before. Then, Marine Protected Areas must be established appropriately after consideration of the goals and actual need for establishment and management. In the process, understanding among the stakeholders must be deepened by providing sufficient information and ensuring discussion. Under the cooperation of the relevant entities, Marine Protected Areas should be established and managed by the appropriate entities and systems that meet the goals of such protection.

Furthermore, considering international goals, other than identifying a marine area of particular importance for conserving biodiversity, and clarifying the need to protect and manage such marine areas, it is important to consider setting numerical targets as necessary.

(1) Promotion of establishment and enhancement of management

[21] Strategic Plan for Biodiversity 2011–2020 (Aichi Targets) Target 11: By 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, shall be conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes.

In Japan, the establishment of areas, regulations and management to maintain marine organisms, ecosystems, or relevant ecosystem services has been done for each individual objective, and various measures have been implemented. Therefore, the actual form of these Marine Protected Areas must first be grasped and then the system must be applied in a more appropriate manner from the viewpoint of biological diversity. In doing so, as is described in the IUCN's Protected Area Management Categories, the ecosystem, usage patterns, and other characteristics of the target area must be considered, and a system appropriate for the protected area must be applied according to the individual goals of management. In addition, effective conservation and sustainable use of biodiversity by appropriately zoning the target area is effective as well.

Precautionary conservation by setting up Marine Protected Areas is especially effective for ecosystems in coastal and shallow waters including land areas. Such ecosystems including sandy beaches, brackish waters, seaweed beds, tidal flats, and coral reefs provide various important functions such as acting as spawning and growing grounds for various organisms, and production grounds for rich fishery resources; cleaning water; and providing places for people to come into contact with nature. These areas are important in conserving biodiversity; however, at the same time they are subject to high human pressure.

Currently 40 to 50% of seaweed beds and coral reefs are designated as protected areas, mainly as National Parks and Quasi-National Parks. However, the majority belong to "Ordinary Zones in National and Quasi-National Parks" where regulations are loose. In addition, only up to 10% of tidal flats are designated as protected areas. Thus, there is a need to expand protected areas, review zoning within the existing protected areas, and establish areas with stronger regulations as required. From such need, the Natural Parks Act and Nature Conservation Law were revised in 2009, and the system for Marine Park Area and Marine Special Zone was formulated. From now on, areas such as National and Quasi-National Parks and Nature Conservation Areas will be designated and re-allocated according to their importance, and those such as Marine Park Areas and Marine Special Zones will be further designated. Especially for Marine Park Areas in National Parks, the goal is to double the size of those areas from the current 2,359 ha (in 2009) to around 4,700 ha by the end of 2012.

Also to identify areas where there is to be sustainable use of fishery resources, and to strike a balance between their use and conservation, detailed zoning based on the life history of the target species must be done. In doing so, along with scientific advice from academic experts, knowledge, techniques, and systems on relationships between the sea and humans that have been cultivated in the area should also be used.

In addition, identifying a Marine Protected Area itself does not solve the problem, and the actual implementation of effective measures must be secured. In any Marine Protected Area, continuous monitoring for adaptive management and revision of measures based on their review is

extremely crucial and the framework for such system must be established. In addition, the way this system is overseen must be reviewed and discussed for appropriate management.

Also for effective management, collaboration and cooperation among the various relevant actors is essential. Such actors include the relevant governmental agencies, local residents, fishery and recreational users, and those whose activities on land could affect the marine areas. It is effective to promote measures such as nature restoration and management as Sato-umi within such cooperation.

To enhance conservation and sustainable use of biodiversity in cooperation with various relevant actors, it is desirable to set up a cooperation system that suits the individual areas. Examples include creating management plans to share the management policy and methods, creating a cooperation system by the relevant local actors to implement and oversee adaptive management, and forming an open system for scientific reviews. To this end, especially for Marine Park Areas in National Parks, the coordination of a consultative body consisting of relevant actors for cooperation is being promoted.

In addition to enhancing the identification and management of Marine Protected Areas, from the point of view of biodiversity, it is important to discuss the criteria and method used to evaluate the effects of such Marine Protected Areas for adaptive management. Thus research must be promoted.

(2) Enhancement of networking

At the 2002 World Summit on Sustainable Development (WSSD), the "establishment of representative networks of marine protected areas by 2012" was adopted in the Johannesburg Plan of Implementation. However, the decision adopted in CBD-COP10 relevant to "Marine and coastal biodiversity" indicated the need for further efforts to achieve the goals of the plan. Also, Target 11 of the Strategic Plan for Biodiversity 2011–2020 (Aichi Targets) calls for 10% of coastal and marine areas to be conserved through "ecologically representative and well-connected systems of protected areas" and other measures.

The IUCN describes a "Marine Protected Area Network" as "A collection of individual marine protected areas or reserves operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels that are designed to meet objectives that a single reserve cannot achieve." Also in CBD-COP9 the "scientific guidance for selecting areas to establish such representative network of marine protected areas" was adopted as an Annex[22]. Five properties and components were identified as being required for a network: they must be ecologically and biologically important areas; have representativity; have connectivity; have replicated ecological features; and be adequate and viable sites.

As already mentioned, upon designating Marine Protected Areas, Japan should consider, from a

[22] UNEP/CBD/COP/DEC/IX/20 Annex II

broader point of view, developing a system for effective ecosystem networks. This can be done mainly by utilizing suitable existing systems, and combining and effectively locating Marine Protected Areas that suit the objective and target of protection.

For example, in a designated area, combining different protected areas set for various management reasons under a single management plan or several but sufficiently harmonized management plans could be distinguished as one form of network. At the Shiretoko World Natural Heritage Site, National Parks were expanded to secure the conservation of marine ecosystems. In addition, to allow both conservation and stable operation of fisheries through sustainable fishery resource use, the management plan was made to include resource management such as the establishment of no-take areas by local fishers and fisher groups. In Japan, the party in charge of management is made clear in frameworks such as the fishery right system, and such voluntary measures by fishers and others are effective. Thus, it is important to combine such voluntary measures with conservation measures taken on the scientific basis of ecological or biological integrity.

Furthermore, on a larger scale, it is important to effectively locate Marine Protected Areas by applying suitable systems. Along with identifying marine areas of particular importance, the distribution of current protected areas will be grasped, and the form of the network will be discussed and created. For example, for migratory birds, appropriate conservation of multiple habitats that are used along the migratory route is important, and the viewpoint for a network of protected areas is necessary. Also, along with the development of such measures, the system of Marine Protected Areas should be discussed continuously from the perspective of conserving biodiversity that supports the structure and function of a sound ecosystem, so as to utilize ecosystem services in a sustainable manner. If necessary, the revision of already existing systems and establishment of new systems shall be considered.

On the other hand, the Programme of Work on Protected Areas (PoWPA)[23] identified that a network of protected areas provides social connection between parties with the collaboration of others. This collaboration includes an exchange of ideas and experiences, scientific and technical cooperation, capacity building, and cooperative action. Thus, both at governmental and non-governmental levels, it is important to establish and maintain a collaborative system to manage protected areas at various levels.

Internationally from the point of view of social cooperation, utilizing the frameworks such as “International Coral Reef Initiative” (ICRI), “Partnership for the East Asian-Australasian Flyway,” “Conventions and Agreements for Protection of Migratory Birds” and “Ramsar Convention,” Japan will take the lead in areas such as conserving coral reefs based on the ICRI East Asia Regional Strategy on MPA networks, wetlands including seaweed beds and tidal flats, and migratory birds.

[23] UNEP/CBD/COP/DEC/VII/28

5. Facilitation of public acceptance and involvement of various actors

The Basic Act on Biodiversity and Basic Act on Ocean Policy clarify the responsibility of local governments, business operators and citizens[24] along with the responsibility of the State. In detail, local governments are required to implement policies according to the natural and social condition of their area, while citizens are required to recognize the importance of biodiversity and the blessing from the oceans and make voluntary efforts for conservation and sustainable use of biodiversity. These various actors should endeavour to conserve and sustainably use biodiversity according to their duties.

To ensure society is aware of the importance of conservation and sustainable use of biodiversity, and to urge various actors to take voluntary actions, activities such as active enhancement of public promotion and environmental education are necessary. In implementing this, this should not be limited to a simple transfer of knowledge, for interaction with nature is essential. Opportunities must be created for citizens to experience for themselves and participate in conservation measures. For biodiversity in the ocean, efforts will be made in public relations and opportunities will be created for citizens to learn the current situation regarding marine biodiversity and the various values it has along with the need for its conservation. This will be done by communicating scientific information, scientific knowledge, and examples that could be used for conservation with the cooperation of the related actors. Such actors include academic experts, fishers, people in the education field, NGOs, and shipping agents who have knowledge and experience. Organizing information about marine areas of particular importance for conserving biodiversity, rare marine species and the like is also effective in making the public aware of the importance of biodiversity.

In addition, it is important for the various relevant parties to collaborate with each other and voluntarily implement measures for conservation and sustainable use. Various measures are being implemented. They include a civilian survey where academic experts and NGOs who are knowledgeable about the local nature become the core and are joined by citizens who are interested in the local conservation of biodiversity. Promoting such measures is important. Also by using and publicizing the results widely, this may lead to a greater understanding of biodiversity. Therefore, efforts will be made to support such actions by means of formulating supporting centres based on the "Act for the Promotion of Biodiversity Conservation Activities" (formulated in December 2010) so that local activities that may conserve biodiversity will be continued or expanded. In addition, fishers are knowledgeable and experienced about the sea and marine organisms. Based on this wisdom, resources are managed from a mid- to long-term perspective by not using some resources now to avoid a drastic drop in aquatic resources and degradation of the environment. Such traditional

[24] The Basic Act on Biodiversity states this as the "Responsibility of Citizens and Private Bodies" (Article 7)

knowledge and experience of fishers should be respected. Then, a system that heightens the understanding and induces cooperation among all the relevant parties must be created for the conservation and sustainable use of marine biodiversity. To enhance the management of Marine Protected Areas and networking, collaboration and cooperation among the various relevant actors will be promoted by organizing a place for local meetings and so on.

In addition, it is important to create a system that allows not only governments but also businesses and citizens to include measures for conserving and sustainably using biodiversity in their social activities, and allow cooperation and active participation by those stakeholders. The certification system for environmentally friendly products is one effective method that utilizes an economic system. In the field of agriculture, forestry and fishery, a project to add value to the products that had been made with consideration on the lives of organisms has started. For example, for aquatic resources, the Marine Stewardship Council (MSC) and Marine Eco-Label (MEL) are certification systems that are led by private organizations to promote the market distribution of aquatic products produced from sustainable fisheries. To ensure the value of biodiversity is appropriately evaluated in economic activities and social life, and to trigger actions in the local area responsible for conservation, such certification systems that appropriately reflect the value of biodiversity in the products must be promoted. At the same time, the producers must participate in this system. In addition, measures to produce brands that add value to local environmentally friendly products and ecotourism that sustainably use the local resources are also essential. Furthermore, it is important for consumers to be able to select such products while understanding the meaning behind them. Thus, publically promoting such products and systems is important as well.

Closing remarks

As the country with the 6th largest marine area under its jurisdiction, securing the biodiversity (which supports the structure and function of the marine ecosystem in Japan) and the continuous sustainable use of the blessings are essential for the future of Japan. They are also essential for the country's international role to secure the world's marine biodiversity.

This Strategy, formulated through the "Expert Meeting on Marine Biodiversity Conservation Strategy," has considered the importance of biodiversity and ecosystem services of the ocean. It has clearly depicted the current status and features of the seas surrounding Japan, including richness in biodiversity that cannot be seen in any other part of the world. This Strategy has shown the direction of measures to be implemented, with consideration to the features of the ocean and the effects of impacts from factors like alien species, climate change, and direct impacts from human activity. As for Marine Protected Areas, which are attracting international interest as one conservation measure, a clear definition has not been made nationally. Thus, the definition and idea behind these areas in

Japan were made clear in this Strategy. With this basic idea, the Strategy regards the following measures based on scientific knowledge as important to meet international objectives: the expansion of protected areas by utilizing already existing systems such as National Parks; enhancement of management in protected areas; promotion of networking the protected areas; and if necessary, the amendment of already existing systems and consideration of establishing new systems. The strategy also states the essential need to improve scientific knowledge and have cooperation with local societies, and has stated measures to achieve the above.

By actively utilizing this strategy, Japan will promote the conservation and sustainable use of marine biodiversity by cooperating with every relevant level and stakeholder. In this way, Japan will hand down its rich marine ecosystem to the next generation, and contribute to the sustainable development of society.