NEASPEC-NEAMPAN

# Management Plans and Strategies at Selected Sites of NEAMPAN in the Russian Federation

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## ABBREVIATIONS

| | |
|---|---|
| CBD | Convention on Biological Diversity |
| EBSMA | Ecologically and Biologically Significant Marine Areas of the CBD |
| FESMBR | Far-Eastern State Marine Biosphere Reserve |
| GEF | Global Environment Facility |
| IUCN | International Union for Conservation of Nature |
| MCSPAs | Marine and coastal specially protected areas |
| MNRE of Russia | Ministry of Natural Resources and Environment of the Russian Federation |
| MPAs | Marine protected areas |
| NEAMPAN | Subregional program for North-East Asia Marine Protected Areas |
| NEASPEC | Northeast Subregional Environment Cooperation Programme |
| SPAs | Specially protected natural areas |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environment Programme |
| UNEP MCS | UNEP Marine and Coastal Strategy |
| WWF | World Wildlife Fund |
| | |

# 1. Basic information of the target MPA

## Concept of MPA

The formulation of the objectives of marine protected areas is linked to the history of their formation.

IUCN proposed the following definition that take into account the specifics of the marine environment: “Any part of tidal or semi-tidal areas covered by water with their fauna and flora, as well as cultural objects that have been fully or partially declared protected in accordance with the law or other regulations” (IUCN General Assembly, 1994).

The Convention on Biological Diversity provides the following definition for the marine and coastal protected areas: “Marine and coastal protected area’ means any defined area within or adjacent to the marine environment, together with its overlying waters and associated flora, fauna, and historical and cultural features, which has been reserved by legislation or other effective means, including custom, with the effect that its marine and/or coastal biodiversity enjoys a higher level of protection than its surroundings” (Report of the AHTEG/CBD, Montreal, 2003).

The main goal of the MPAs is conservation and restoration of biodiversity of marine ecosystems, establishment of the conditions for restoration of natural state of marine ecosystems or maintaining the existing natural state.

Effective MPAs can ensure the long-term viability and genetic diversity of marine species. This is the result of the protection of rare and endangered species, conservation of habitats, as well as prevention of external activities that damage the marine environment.

MPAs can make a decisive contribution to the long-term support of marine and coastal ecosystems, provided that they are established based on representativeness, ecosystem approach and adequately reflect the size and interrelationship of individual zones and ensure the continuity of ecosystem processes.

It is generally recognized that the networked MPAs bring far more benefits (both in environmental-economic and socio-cultural aspects) than the ones operating independently from one another.

There is a system of criteria for the allocation of areas of the network of marine protected areas and determining their rank (naturalness, biogeographic criterion, environmental significance, the number and diversity of biotopes, habitats of rare or endangered species, water areas characterized by high biological diversity, economic value, social significance, scientific value).

The specifics of MPAs is also determined by their location in the ‘land – sea’ contact zone, what is reflected in the set of interrelated terrestrial and marine ecosystems. In this context, the main functions of the MPAs for the conservation of the environment depend on their area and the integrity of the nature conservation complex, which includes the marine environment, the land area bordering it with its surface waters, the associated flora and fauna, and the historical or cultural sites.

In some cases, MPAs are characterized by the merger of the coast and the rest of the territory in order to eliminate the fragmentation of the ranges of some rare and valuable species of plants and animals, reduce the risk of extinction of small "island" populations. (Mokievsky V.O., 2016)

### *Sustainable Development Goals*

The Goal 14 ("Conserve and sustainably use the oceans, seas and marine resources for sustainable development") of the UN 2030 Agenda for Sustainable Development (adopted by the UN General Assembly in 2015, resolution 70/1 "Transforming our world: the 2030 Agenda for sustainable development") provides for:

- "Enhance the conservation and sustainable use of oceans and their resources …" (14c);
- "... prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities…" (14.1);
- "… sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts…" (14.2).

### *Convention on Biological Diversity*

One of the objectives of the updated Strategic Plan for Biodiversity 2011-2020 (Nagoya, 2010) of the Convention on Biological Diversity (CBD) is to identify ways to establish environmentally representative and effectively managed marine and coastal protected areas under national jurisdiction.

The Strategic Plan is based on the application of the ecosystem approach to integrate protected areas into broader land and/or sea networks as the elements of general landscape. (Strategic Plan, Nagoya, 2010)

The Plan also recommends that countries undertake a valuation of marine and coastal biodiversity and ecosystem services and include them in national reporting systems to enhance sectoral integration, as well as the use of criteria for identification of ecologically or biologically significant areas. (CBD-CoP 2012, India, Decision 11/7)

For the MPAs, the Strategic Plan for Biodiversity 2011-2020 and the Biodiversity Targets adopted by the CBD in Aichi provide that "By 2020, at least … 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are 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 landscapes and seascapes" (Target 11 under the Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity). (Aichi Biodiversity Targets, 2010)

### *UNEP Marine and Coastal Strategy*

The objective of the **Marine and Coastal Strategy** (**UNEP MCS, 2010**) is conservation of the natural state of oceans and coasts, their productivity and sustainable resource use. Also, one of the main objectives is to develop an effective programme for managing marine and coastal ecosystems, including measures related to adaptation to climate change and monitoring the management/use of marine resources.

## Protected Areas in the Russian Federation

In the Russian Federation, marine and coastal protected areas are areas in the tidal or marine area, together with waters that cover them, and flora and fauna associated with them. These areas have historical and cultural features, the environment of which is subject to full or partial protection by law or other regulatory acts.

### *legislation of the Russian Federation of SPA*

Possible categories of specially protected areas (SPA) are determined by the legislation of the Russian Federation. The Federal law "On environmental protection" of 10 January 2002 № 7-FZ (as amended on 27.12.2009) is the basic umbrella law on the environment and is the basic political framework for protected areas, which defines environmental quality standards, grounds for the federal SPAs and activities banned on their territory.

The Water Code of the Russian Federation introduces the concept of "specially protected water bodies" and establishes its compliance with the legislation "on specially protected areas".

The "Law on specially protected areas" is the basic law in the field of SPAs, which establishes permanent federal ownership of the federal SPAs in Russia, SPA categories, the scope of authority of the federal and regional bodies. The law allows the establishment of natural reserves at the regional level.

These laws – common in their content – do not consider the specificity and complexity of MPAs management to ensure adequate conservation of marine biodiversity.

### *The main categories of SPAs*

The main categories of SPAs are: **reserves** (strict protection, the period of existence is not defined, the complete natural environment is under conservation, the level of management is federal), **national parks** (strict protection only at certain part – "core", functional areas with different anthropogenic load are allocated, period of existence is not defined, traditional nature use and ecotourism are allowed, federal level of management), **nature monuments** (strictness of protection depends on the object of protection, the level of management is federal, regional, local), **zakazniks** (are established for a specific time for the protection of certain ecosystems or species, certain types of economic activity are allowed, management level – federal, regional) (See Table 1 and **Figure *1***)

Major criteria for SPA categories – are strictness of protection, time frames of existing, goal of establishment, and level of management.

The state natural reserves, national parks, and state zakazniks are the key categories of SPAs, occupying the big area of around 55 mln. ha, and are located in 81 subjects of the Russian Federation. (See **Figure *1***).

### **The Russian legislation does not envisage individual category of MPA, nevertheless a number of SPAs have marine water areas as their parts**.

Thus, any **SPAs have marine water areas as their parts** in accordance with the Russian Federation legislation may be under one of these categories.

Pursuant to the **Russian legislation**, sea areas are under federal jurisdiction. Therefore, specially protected areas covering marine areas may only have the federal status. Their establishment and work are regulated by the Law of the Russian Federation "On specially protected areas". The SPAs of the regional significance, though could include marine areas, make a significant contribution to the conservation of the marine environment and ecosystems through the organization of protection of ecosystems in the contact zone "sea – land – continental water bodies" and key coastal habitats (bird markets, rookeries of sea animals).

The amendments were made to the Federal Law "**On specially protected areas**"[2] that clarify the legal status of specially protected areas (reserves and national parks; which introduce a ban on the change of the designated purpose of lands of reserves and a ban on the alienation of lands of federal protected areas from federal property).

In addition, the provisions on protective zones of reserves and national parks, the powers of the state inspectors exercising state supervision in the field of protection and use of SPAs have been clarified.

To improve the mechanisms of the state control (supervision) and strengthen the measures of responsibility for violations of the legislation in the field of environmental protection, the powers of the state inspectors engaged in the protection of specially protected areas were expanded, penalties for violation of the legislation on SPAs were increased, what contributed to improving the efficiency of the state supervision over compliance with environmental legislation on SPAs of the federal significance[3].

A number of legislative acts adopted are aimed at increasing the effectiveness of the state supervision (control) in the field of compliance with legislation on wildlife, fisheries and the preservation of aquatic biological resources.

Responsibility for illegal mining and trafficking of rare and endangered species has been strengthened. In particular, there was established only criminal liability for illegal extraction and trafficking of especially valuable wild animals and aquatic biological resources belonging to species listed in the Red Book of the Russian Federation and/or protected by the international treaties of the Russian Federation, such as sturgeon species etc.

To ensure biodiversity conservation in the Russian Federation, a whole series of contradictions between the Federal Law "On Specially Protected Natural Territories" and civil, land, and forest legislation have been eliminated. To improve the legal regulation of the establishment and operation of SPAs, the legal status of their administrations was determined, the procedure for establishing the protective zones of SPAs of various categories was established.

[2] Federal Law of 14.03.1995 № 33-FZ, as amended on 03.08.2018 No. 321-FZ.
[3] Resolution of the Government of the Russian Federation of 24.12. 2012 № 1391 with amendments of 28.06.2017 "On the state surveillance in the field of protection and use of specially protected areas of the federal significance".

Table 1 Main categories of SPAs.

| Main categories of SPAs | Major criteria for SPA categories - strictness of protection | Major criteria for SPA categories - time frames of existing | Major criteria for SPA categories goal of establishment | Major criteria for SPA categories - level of management |
|---|---|---|---|---|
| **Reserves** | strict protection, the complete natural environment is under conservation | the period of existence is not defined | the complete natural environment is under conservation | federal |
| **National parks** | strict protection only at certain part – "core", functional areas with different anthropogenic load are allocated | the period of existence is not defined | traditional nature use and ecotourism are allowed | federal, regional, local |
| **Nature monuments** | strictness of protection depends on the object of protection, | the period of existence is not defined | conservation of natural complexes | federal, regional, local |
| **Zakazniks** | economic activities are allowed | established for a specific time | protection of certain ecosystems or species, certain types of economic activity are allowed | federal, regional |

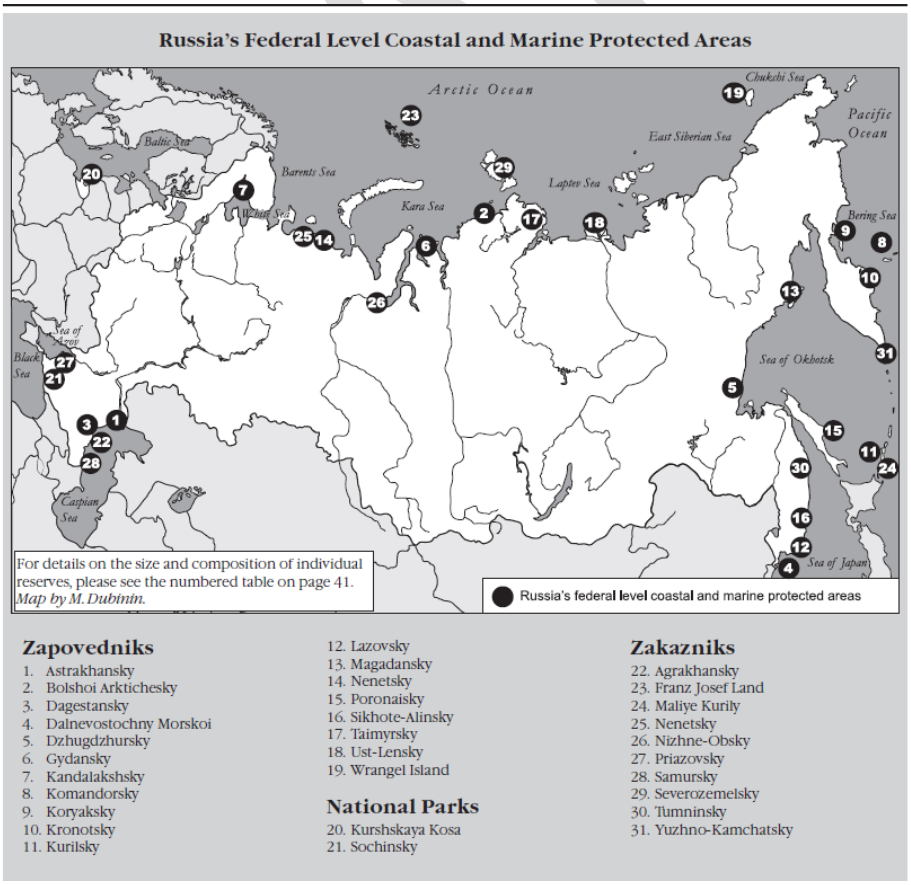


Figure 1. Coastal and marine protected areas of the federal level in the Russian Federation.
(NEAMPAN sites: № 4. Dalnevostochny Morskoi Zapovednik (Far Eastern Marine Reserve) and № 16 Sikhote-Alinsky.

## Assessing the representativeness of the existing network of Russian SPAs that have marine water areas as their parts

A modern tool for assessing the representativeness of the existing network of Russian SPAs that have marine water areas as their parts with regard to their role in the conservation of marine biodiversity is identification of the completeness and sufficiency of such a network, or gap-analysis.

According to WWF, MPAs (of the federal level) in Russia in the existing **SPAs** system are represented unevenly and unrepresentatively compared to their continental counterparts, which is one of the reasons for the relevance of the development and expansion of the MPA system in order to protect Russia's unique natural heritage and diversity of coastal and marine ecosystems.

For this, the MPA system should correspond to the actual landscape-ecological structure of land and water areas, cover areas that are key for preserving biological diversity sufficient to fulfill their functions, incorporate areas important for the reproduction and migration of rare and endangered species that need special protection, etc.

With regards to the protection of rare and endangered species listed in the Red Book of Russia, the existing system of marine and coastal reserves could be considered representative on formal grounds – the vast majority of these species are represented in protected marine areas, but the degree of contribution of protected marine areas for various species is different.
For many species, protected marine areas are transit biotopes that do not play an important role in the life cycle. On the other hand, many critically important biotopes for marine mammals and birds (rookeries, colonies etc.) are outside the reserve system (Current state, 2009).

A gap analysis carried out within the framework of the of the MNRE of Russia / GEF / UNDP project "Strengthening the Marine and Coastal Protected Areas of Russia" for identifying gaps in the biogeographic and ecosystem coverage of the MPA network and the protection of key species, has confirmed that the Russian SPA system, including the MPAs, in its present form, is intended to actively contribute to the conservation of biological diversity at all hierarchical levels (from population to biocenotic) and to the study of natural processes occurring under the minimal human impact. (IS 'SPAs of RF')

### *Institutional framework for SPAs, including the MPAs, policy and management*

The federal executive body responsible for the development of the state policy and legal regulation, including the development and implementation of the state policy and legal regulation in the field of specially protected areas, including wildlife and their habitats, state environmental monitoring (state ecological monitoring) is the Ministry of Natural Resources and Environment of the Russian Federation.

The MNRE of Russia maintains the state cadastre of specially protected areas of the federal significance, carries out the protection and reproduction of wildlife objects located in specially protected areas of the federal significance; protects aquatic biological resources located in specially protected natural areas of the federal significance; makes decisions on the establishment of protective zones of the state nature reserves, national parks and natural monuments of the federal significance and on the establishment of their boundaries.

The MNRE of Russia carries out its activities directly and through its subordinate organizations in cooperation with other federal executive authorities, executive authorities of the subjects of the Russian Federation, local authorities, public associations and other organizations.

Implementation of the basic powers in the field of protection and use of fauna and its habitat, and fishery is transferred to public authorities of the subjects of the Russian Federation.

The competence of the MNRE of Russia includes control of the legal regulation by the state authorities of the subjects of the Russian Federation on the implementation of the transferred powers to the subjects in the field of water relations, state ecological expertise, protection and use of wildlife and their habitat.

The MNRE of Russia coordinates and controls the activities of the Federal Service for Hydrometeorology and Environmental Monitoring, the Federal Service for Supervision of Natural Resources, the Federal Agency for Water Resources, the Federal Forestry Agency and the Federal Agency for Subsoil Use (Regulations on the MNRE of Russia, 2018[4]).

Scientific and information organizations subordinated to the MNRE of Russia, such as the All-Russian Scientific Research of Environmental Protection (VNII Ecology) and the Information-Analytical Center for Reserves Support (Roszapovedcenter), carry out activities on development of SPA system, increase of efficiency of work of the organizations performing management of SPAs of the federal significance, and also on methodical support of works on preparation of data of the state accounting, state cadastre and state monitoring of objects of fauna in the state nature reserves, national parks and the state natural sanctuaries of the federal significance.

Conservation and sustainable use of biodiversity, the operation **of SPAs, including MPAs**, is essentially a cross-sectoral problem, therefore the Ministry of Agriculture of the Russian Federation is responsible for sustainable fisheries and conservation of aquatic biological resources (Federal Agency for Fishing), and the Ministry of Science and Higher Education of the Russian Federation – for scientific and technical policy.

Public councils have been established under the federal executive bodies to preliminary discuss projects and documents being developed, including on the operation of SPAs and the conservation and sustainable use of biodiversity.

There is the Expert council on specially protected areas under the MNRE of Russia, the purpose of which is to develop proposals and recommendations to ensure decision-making on strategic issues of development of the system of specially protected areas in the Russian Federation and important issues related to certain specially protected areas.

Institutions of the Far Eastern Branch of the Russian Academy of Sciences, such as the National Scientific Center of Marine Biology, the Pacific Oceanological Institute, the Pacific Geographical Institute etc., being structural units of the Ministry of Science and Higher Education of the Russian Federation, carry out studies on conservation of marine biodiversity, and participate in international programmes and projects.

A coupled analysis of spatial distribution of biodiversity, economic activities and trends in its development has allowed identifying three key areas that are critical for the conservation of the biodiversity of marine ecosystems, one of which is the south of the Far East (the Sea of Japan and the southern part of the Sea of Okhotsk). High biological diversity coincides here with areas of intensive economic development of the coast (GEF/UNDP project, 2012).

[4] Resolution of the Government of the Russian Federation of 03.11.2018 № 131.

# Model NEAMPAN reserves (Sikhote-Alin Nature Reserve and FESMBR)

The **Far East of the Russian Federation** as a whole, and its South in the first turn, has no equal among all regions of Russia on variety of species of fauna and flora, including in coastal marine zones. There are unique natural sites, many of which are of international or federal significance. Due to the geographical location of the region, the high activity of geological processes and specific climatic features, unique natural complexes were formed, which are characterized by a drastic contrast of landscapes, a complex combination of them in the environment and a set of different species of plants and animals.

With regard to the biocenotic diversity of the coastal zone of the Far Eastern seas of Russia, the existing system of protected marine areas is not representative (Current state, 2009).

## Sikhote-Alin State Natural Biosphere Reserve

The **Sikhote-Alin State Natural Biosphere Reserve** after K.G. Abramov under the MNRE of Russia (Sikhote-Alin Reserve) was established to reduce threats to marine and coastal ecosystems of the reserve. Since 1991 a part of the water area of the Sea of Japan was included into the protective reserve zone of the reserve.

The coastal strip along the coast of the Sea of Japan, 25 km wide. Here, the influence of the sea is most pronounced. Characterized by the largest range of habitats, and high diversity of ecosystems and species. There is the greatest population density and, therefore, the highest anthropogenic load on ecosystems.

The central part of the reserve and adjacent areas of the eastern slopes of Sikhote-Alin. It is less affected by the sea and is characterized by lower levels of ecosystems and species.

The ecosystems of the coast of the Sea of Japan and marine ecosystems are under conservation in the reserve.

From the point of view of the biogeographic patterns manifested here, its location could be considered as nodal; it is representative with respect to the natural complexes of this landscape province in general.

The high reference value of the Sikhote-Alin Reserve is determined by the fact that it includes less-altered natural landscapes and is adjacent to areas subject to anthropogenic pressure.

Coastal areas and water areas are characterized by the big number of rare endemic and relict species.

Specific brackish-water biotopes – mineralized lakes, estuaries, lagoons and estuaries of rivers – are formed at the junction of the mixing of saline sea and fresh continental waters.

Brackish waters also serve as a place for “physiological sluicing” of the most valuable commercial anadromous fishes – sturgeons and salmons. Here they are adapt to the changing conditions of salinity and osmoregulation. Compared to other brackish-water complexes of Siberia and the Far East of Russia, the inhabitants of estuaries and lagoons of the basin of the Sea of Japan are distinguished by a large species diversity.

From the point of view of biogeographic regularities manifested in the reserve it is representative with regards to the natural complexes of this landscape province in general.

### Far Eastern State Marine Biosphere Reserve (FESMBR)

The **Far Eastern State Marine Biosphere Reserve (FESMBR)**, 1978 (branch of the National Scientific Center of Marine Biology of the Far Eastern Branch of the Russian Academy of Sciences), was established as the first Russian SPA aimed at the conservation of marine ecosystems and to perform research activity in the field of the biology of the sea.

The reserve is a specialized marine reserve, and includes various types of ecosystems – terrestrial, marine and island, is located in an area that is exposed to a sufficiently strong anthropogenic impact, including oil transport.

The biodiversity of the reserve is associated in the coastal part of the Gulf with littoral (tidal zone) and sublittoral zones, which are characterized by certain species of animals and plants (littoral zone – small crustaceans, wingless insects, and sublittoral zone – bottom vegetation and organisms).

Phytoplankton inhabits the upper horizons of the water column, which are represented mainly by diatom algae.

The most typical plant communities of the sublittoral zone are formed by laminaria, dichloria and other algae. Algal vegetation near the coast facing the continent differs from the vegetation of the seaward coastal areas. On open areas of the coast, on rocky soil, there are many mussels, sea urchins and stars.

Plants characteristic for marine climate, including endemics, are growing on the islands of the reserve. Yew and dwarf larch still exist from conifers on the islands. A characteristic feature of the island's vegetation is the multi-trunk and stunted trees, as well as the presence of large vines: Actinidia, grapes.

Crustaceans, ctenophores, and jellyfish predominate in the zooplankton of the Peter the Great Bay. Gastropods and bivalves are the most numerous.

Some 60% of fish species fall to the share of bottom and bottom fish of boreal origin, 40% – subtropical and tropical species (hammerhead shark, flying fish, tuna, etc.).

Red Book species: species listed in the Red Book of Russia registered in the Reserve include:
- marine invertebrates – 10 species (1 species of brachiopods, 7 species of mollusks, 2 species of crustaceans);
- about 60 species of birds, among which – crested shelduck, spoon-bill, Chinese egret, small petrel, Von Schrenck's bittern, white-tailed eagle, Steller's sea eagle, peregrine falcon, black vulture, Far Eastern curlew, etc.;
- marine mammals – false killer whale, harbor porpoise, sei whale.

## Management of NEAMPAN sites of Russia

### Sikhote-Alin State Natural Biosphere Reserve

The Sikhote-Alin Reserve is under the Ministry of Natural Resources and Ecology of the Russian Federation and its activity is determined by the Regulations on the Federal State Institution “Sikhote-Alin State Natural Biosphere Reserve”.

Protection of natural complexes and objects in the land and water areas of the reserve and its protective zones is carried out by a special state inspection for the protection of the reserve.

The special state inspection for the protection of the land and water areas of the reserve includes the director of the reserve, who is the chief state inspector.

The director directly supervises the reserve and is personally responsible for its activities and is accountable to the MNRE of Russia.

The reserve is a legal entity – the federal state institution and is funded by the federal budget.

The land and its subsoil, water, flora and fauna, located in the reserve, are provided to the reserve for permanent (perpetual) use on the rights provided for by the federal laws.

The state control in the field of establishment and operation of the reserve is carried out by the MNRE of Russia and other specially authorized state bodies of the Russian Federation within their competence.

By the Resolution of the Governor of Primorsky Krai of March 5, 1997[5], the terrestrial area of protective zones of the reserve was significantly increased and a protective zone was established for marine areas of the reserve, including those areas of the reserve where the marine reserve area was lacked. At the same time, the norm was included into the Provision on the Protective Zone – with the permission of the Administration of the Primorsky Krai, industrial catch of marine biological resources could be made in the protective zone of the reserve.

## Far Eastern Marine Biosphere Reserve

**The Far Eastern Marine Biosphere State Nature Reserve** is a multifunctional organization with clearly determined goals, priorities and activities, headed by the director, its activity is determined by the Provision on the Reserve[6].

The structural subdivisions of the reserve, including the protection department, the scientific department, the environmental education department, and the main work support groups carry out the relevant activities.

Activities aimed at the implementation of the state environmental monitoring, implementation of the state supervision in the field of protection and use of specially protected areas are allowed in the Reserve.

To ensure the operation of the reserve, the "List of areas of partial economic use of the territory of the Far Eastern Marine Biosphere State Natural Reserve, where activities aimed at ensuring the operation of the Reserve are allowed" is determined (Appendix № 4 to the Provision on the Far Eastern Marine Biosphere State Natural Reserve as amended on 04.09.2017).

The Reserve is managed by the National Scientific Center for Marine Biology of the Far Eastern Branch of the Russian Academy of Sciences.

State supervision in the field of protection and use of the area of the Reserve is carried out by the Federal Service for Supervision of Natural Resources (in accordance with the Agreement of 28.08.2003 regulating the relations of reserves of the Russian Academy of Sciences and the Ministry of Natural Resources. The

[5] Resolution of the Governor of the Primorsky krai of 05.03.1997 № 93, as amended on 27.02.2015 № 15-pg.
[6] Order of the Federal Agency of Scientific Organizations of 12.10.2016 № 50n.

Agreement provides for interaction and cooperation in part of improving the state management of the federal natural reserves of the Russian Academy of Sciences), as well as the National Scientific Center for Marine Biology of the Far Eastern Branch of the Russian Academy of Sciences.

In general, the objectives of the selected model NEAMPAN reserves (Sikhote-Alin Nature Reserve and FESMBR) at the present stage of their development are clearly determined, linked to the conservation of marine ecosystems and increase of biodiversity, and meet the Goals 14 of the UN 2030 Agenda for Sustainable Development and other modern international approaches to the operation of the MPAs.

## 2. Background of strategic/management plan of the target MPA

Marine protected areas and/or water areas of multi-purpose use are often considered as model sites for elaboration of effective, integrated environmental management programmes.

Although all natural processes are closely interrelated, it is very difficult to create a single integrated management regime for all of them, because:
- marine resources are not distributed in all coastal and marine areas evenly;
- there are differences in the forms of use.

The period of instability, inherent in the modern world economy, makes the task of strategic environmental planning of marine and coastal protected areas with their fundamental openness to the world ocean especially relevant and complicated.

## General strategic planning approaches for marine protected areas

The strategic objective in this area is the conservation of the unique marine ecosystem, maintaining its integrity and life support functions for sustainable development of society, improvement of the quality of life, health of the coastal population and demographic situation.

**The basis of the strategic/management plan for marine protected areas is an adaptive management**, which is applied under:
- the interconnectedness of different habitats in the marine environment and the interdependence of neighboring biological communities;
- strong impact from adjacent coastal or marine areas.

Adaptive management includes such methods as identification of problems that are usually linked to the marine environment.

Implementation of adaptive management under the use of natural resources in coastal marine zones, inland seas and high seas should include the protection of key habitats, ecosystems and animal migration corridors.

Typically, the following adaptive control mechanisms are used:
- spatial zoning, which include fisheries management; zones of environmental protection; zones of oil and gas production, including areas of exploration, areas of environmental monitoring and safety zones around wells; areas of waste disposal; areas of transport operation and areas surveillance/monitoring; aquaculture areas; areas of scientific research and monitoring (e.g. fisheries); service area (e.g. laying of cables);

- permits or licenses for certain types of economic activity.

Types of activities that require licenses and permits are as follows:
- commercial activities, including tourism;
- construction of infrastructure – berths, booms, pontoons, mariculture devices, etc.;
- any works on infrastructure repair, drilling or waste disposal;
- long-term anchoring of vessels;
- removal of debris from containers;
- some types of research work.

Management effectiveness depends on a number of factors:
- taking into account the impact of catchment areas that act through river flow and diffuse (non-point) sources of pollution;
- the nature of economic activities in the coastal zone, which directly affects coastal waters and underwater landscapes;
- conditions of coastal water areas where economic activity is carried out;
- the impact of coastal waters beyond the limits of national legislation (200-mile zone).

## Official documents at the federal and regional level for planning of the development and improvement of the Russian SPA system, including MPAs

The coastal and marine environment of Russia includes many unique coastal sites that provide habitat for a variety of representatives of biota and conditions for the diversity of habitats and species.

The basis of strategic planning in the Russian Federation[7], including for the purposes of marine protected areas, is the system of state strategic planning, based on programme-and-target planning and including territorial planning to determine and implement the priorities of socio-economic development of Russia for the medium (up to 6 years) and long-term (over 6 years) perspectives.

Planning of the development and improvement of the Russian SPA system, which include MPAs and contribute to the conservation of biological diversity at all hierarchical levels, is envisaged in various documents of the federal and regional levels. (Table 2)

Such strategic documents as the **Concept of the Long-Term Development of the Russian Federation for the Period by 2020**[8], are important for the management of MPAs. This document determines that ensuring environmental protection, rational use and reproduction of natural resources is one of the key public goods that form the basis of long-term socio-economic development. It is envisaged to preserve and protect the natural environment, increase the bioproductivity of natural systems to safe levels, and restore species diversity. In the development of the provisions of the Concept, a number of measures was developed, including the development of sectoral strategies that identify the goals, priorities and objectives of Russia's socio-economic development.

The "**Fundamentals of environmental policy of the Russian Federation for the period through 2030**" (Decree of the President of the Russian Federation of 30.04.2012) says that the strategic goal of the state policy

[7] Federal law "On strategic planning in the Russian Federation" of 28.06.2014 № 172-FZ as edited on 03.07.2016 №277-FZ.
[8] Resolution of the Government of the Russian Federation of November 17, 2008 № 1662-p, as amended on 10.02.2017.

in the field of environmental development is addressing of socio-economic tasks that ensure environmentally oriented economic growth, conservation of a favorable environment, biological diversity and natural resources.

The strategic goal of the state policy in the field of environmental protection is formulated in the "**Ecological Doctrine of the Russian Federation**" (Decree of the Government of the Russian Federation of 21.08.2002 № 1225-r). It consists in conservation of natural systems, maintaining their integrity and life-supporting functions for the sustainable development of society, ensuring the country's environmental safety. The environmental doctrine considers the creation and development of specially protected areas (SPAs) of different levels among the main directions of the state environmental policy.

The "**Concept of development of specially protected areas (SPAs) through 2020**" (Decree of the Government of the Russian Federation of 22.12.2011 № 2322-r), which is aimed at development of a system of **SPAs** by improving the efficiency of the state management in the sphere of organization and functioning of the system of **SPAs** for sustainable development of the Russian Federation, provision of ecological safety, protection of biological and landscape diversity, conservation and rational use of natural and cultural heritage. To achieve this goal, it is necessary to address a number of tasks, including the continuation of the formation of a representative geographical network of **SPAs** first of all – the establishment of new reserves and national parks; as well as provision of an effective system of protection of natural and historical-and-cultural complexes and objects in specially protected areas.

The "**Strategy for the conservation of rare and endangered species of animals, plants and fungi in the Russian Federation for the period through 2030**" (Decree of the Government of the Russian Federation of 17.02.2014 № 212-r) includes the definition of scientific grounds, principles and methods for conservation of rare and endangered species of flora and fauna.

The strategic and programmatic documents for the development of the fisheries complex envisage the implementation of measures for the conservation, reproduction and effective use of aquatic biological resources, for the prevention, containment and elimination of illegal and unregulated fishing, and for the development of principles of sustainable use, which corresponds to the objectives of biodiversity conservation ("**Strategy for the development of the fisheries complex of the Russian Federation for the period up to 2030**", **2017**[9]).

The comprehensive marine scientific research in the interests of the Russian Federation, the develop**ment of the systems of monitoring of the state of the marine environment and coastal areas** are among the principles of the national maritime policy specified in the "**Maritime Doctrine of the Russian Federation for the period through 2020**"[10]. The long-term objectives in the field of industrial fisheries set forth by the Marine Doctrine include the adoption of measures aimed at the conservation of populations of valuable fish species and other biological resources and their strict enforcement.

The **"Strategy for the Development of the Maritime Activities of the Russian Federation for the period through 2030"**[11] determines the transition to an integrated approach to planning of the development of the coastal zones of the land and marine areas of specific coasts of the country through separating them into a single object of the state administration as one of the strategic objectives of the development of maritime activities of the Russian Federation.

[9] Resolution of the Government of the Russian Federation of 08.12.2010 № 2205-r.
[10] Resolution of the Government of the Russian Federation of 17.11.2008 № 1662-p, as amended on 10.02.2017.
[11] Resolution of the Government of the Russian Federation of December 8, 2010 № 2205-ru.

Important in this context are the strategic and policy documents on socio-economic development within the boundaries of specific territories, as well as the strategy of socio-economic development of the federal districts and subjects of the Russian Federation. Although biodiversity conservation is not a direct objective of these strategies, all of them include a set of measures aimed at the development of **SPAs**.

For instance, the "**Strategy of Socio-Economic Development of the Primorsky krai through 2030**"[12] provides for the development of the fisheries complex as one of the priorities. Thematic direction "Environmental Protection and Environmental Safety" includes the establishment of a favorable and safe living environment for people by improving the environmental situation in the Primorsky krai.

To implement the documents of the state strategic planning in accordance with the decision of the Government of the Russian Federation on the basis of programme-and-target planning **the state programmes** for the development of specific sectors are now adopted, which along with plans of implementation of the adopted strategies and the federal targeted programmes for addressing the intersectoral problems constitute the system basis of activity of the state governing bodies linked to the budget process. It is important that such state programmes are adopted for specific sectors of nature use: forestry, hunting, fisheries, which are based on the sustainable use of biological resources.

The **State Programme of the Russian Federation "Environmental Protection for 2012-2020"**[13] with a special sub-programme "Biological diversity of Russia" is also the basis for strategic planning for the purposes of MPAs. The programme determines that an effective system of the state regulation and management in the field of environmental protection requires the development and effective operation of a network of specially protected areas, including marine, for the conservation and restoration of populations of rare and endangered species of flora and fauna, reducing regional differences in the network of specially protected areas, ensuring the adoption of science-based decisions in the field of conservation of biological diversity and use of natural resources.

The sub-programme is aimed at the implementation of the main priorities and objectives of the state policy in the field of biodiversity conservation, stipulating the assignment of issues of conservation and sustainable use of biological diversity and ecosystem services to the priority areas of national policy.

The basis for the development of **SPAs**, including marine ones, for the Far East region is the State Programme of the Russian Federation "**Socio-economic Development of the Far East and the Baikal region**"[14].

## International GEF/UNDP projects contributed to the development of medium-term management plans for a number of reserves including those with marine water area

**International GEF/UNDP projects** implemented in 2010-2015 under the auspices of the MNRE of Russia have contributed to the development of medium-term management plans for a number of reserves, including those with marine water area, and to the institutional improvement of the network of marine and coastal protected areas of Russia.

[12] Resolution of the Administration of the Primorsky krai of 28.12.2018 № 668-pa.
[13] Decree of the Government of the Russian Federation of 15.04.2014 № 326, as amended on 06.07.2017.
[14] Resolution of the Government of the Russian Federation of 15.04.2014 № 308 with amendments of 31.08.2018.

With the support of the MNRE of Russia / GEF / UNDP project "Strengthening the Marine and Coastal Protected Areas of Russia" (2010-2013), a management plan for the Far Eastern State Marine Biosphere Reserve was developed.

The basis of the strategic/management plan for the objectives of marine protected areas is identification of directions and priorities of activities under planning of MCPAs, the concretization of the objectives of the reserve taking into account the specific natural, historical, cultural and socio-economic conditions.

The planned strategic directions and priorities should contribute to the integration of the MCPAs into the socio-economic structure of the region, they are calculated for 15-20 years, that is, significantly exceeding the terms of the management plan being developed, and may remain relevant for an indefinitely long time.

Table 2. Documents of the federal and regional level related to planning and development of SPA system of Russia, including MPAs

| | **Key strategies / programmes** | **Relevant authorities / Ministries** | **Key relevant contents** |
|---|---|---|---|
| State level strategy | Concept of the Long-Term Socio-Economic Development of the Russian Federation for the Period by 2020 (2008)[15] | | A major policy document that reflects the country's development objectives in the frame of sustainable development (economic, social and environmental dimensions)[16].<br><br>Ensuring environmental protection, rational use and reproduction of natural resources is one of the key public goods that form the basis of long-term socio-economic development. |
| | Maritime Doctrine of the Russian Federation for the period by 2020 (2001)[17] | | Sets out comprehensive national policy on the sea coast, in the inland sea waters, territorial sea, exclusive economic zone, continental shelf of the Russian Federation and in the open sea. The policy covers such areas as:<br>- comprehensive marine scientific research<br>- the development of the systems of monitoring of the state of the marine environment and coastal areas<br>- interaction and coordination in formulation, implementation of the national ocean policies with relevant bodies including local governments |
| | Strategy for the Development of the Maritime Activities of the Russian Federation for the period through 2030 (2010)[18] | - | Development of marine activities of the Russian Federation, transition to an integrated approach to planning of the development of coastal zones of land and marine areas of specific coasts of the country by allocating them to a separate single object of state administration. |
| | Environmental Doctrine of the Russian Federation of 2002[19] | | The ecological doctrine considers establishment and development of specially protected areas (SPAs) of |

[15] Resolution of the Government of the Russian Federation of November 17, 2008 № 1662-p, as amended on 10.02.2017.
[16] https://sustainabledevelopment.un.org/content/documents/1043natrepeng.pdf
[17] Decree of the President of the Russian Federation of July 27, 2001 № Pr-1387. http://csef.ru/en/politica-i-geopolitica/510/morskaya-doktrina-rossijskoj-federaczii-na-period-do-2020-goda-7984
[18] Resolution of the Government of the Russian Federation of December 8, 2010 № 2205-ru.
[19] Order of the Government of the Russian Federation № 1225-r of 31.08.2002.

| | | | |
|---|---|---|---|
| | | | different levels among the main directions of the state policy in the field of ecology. |
| | Fundamentals of the State Policy in the Field of Environmental Development of the Russian Federation for the period up to 2030[20], and Action Plan for their implementation[21] | | Addressing of socio-economic tasks, ensuring environmentally oriented economic growth, conservation of the favorable environment, biological diversity. |
| | Concept of development of the system of specially protected areas of the federal significance for the period through 2020[22], and the Action Plan for its implementation | | Objectives include development of system and forming representative geographic network of protected areas including MPAs, establishing new protected areas, provision of environmental safety, protection of biodiversity and landscape, conservation and rational use of natural heritage |
| | Strategy for the conservation of rare and endangered species of animals, plants and fungi in the Russian Federation for the period through 2030[23] | | Preserving habitats of rare and endangered species of animals, plants and fungi by ensuring the operation of an effective system of SPAs, determine the important role of SPAs of regional and local significance in the formation of spatially functional network of areas with various nature use regimes for the conservation of biological diversity.<br>Identification of scientific grounds, principles and methods of conservation of rare and endangered species of flora and fauna |
| Area / sector specific strategy | Strategy for the development of the fisheries complex of the Russian Federation for the period up to 2030 (2017)[24] | | Outlines the implementation of measures for the conservation, reproduction and effective use of aquatic biological resources, for the prevention, containment and elimination of illegal and unregulated fishing, and for the development of principles of sustainable use, which corresponds to the objectives of biodiversity conservation |
| Area / sector specific strategy | Strategy of Socio-Economic Development of the Primorsky krai through 2030[25] | Administration of the Primorsky | Development of the fisheries industry. Direction "Environmental Protection and Environmental Safety" includes the establishment of the favorable and safe living environment for people by improving the environmental situation in the Primorsky krai. |
| State programmes | Environmental Protection, 2012-2020[26] | Ministry of Natural Resources and Environment [27] | Includes a special sub-programme "Biological diversity of Russia" is the basis for strategic planning for the purposes of MPAs. |
| | Socio-economic Development of the Far East and the Baikal region[28] | | The basis for the development of protected areas, including marine ones, for the Far East region |

[20] approved by the President on 30 April 2012
[21] Decree of the President of the Russian Federation of 28 April 2012 № Pr-1102.
[22] Decree of the Government of the Russian Federation of 22.12.2011 № 2322-r
[23] Order of the Government of the Russian Federation of 17.02.2014 № 212-r.
[24] Resolution of the Government of the Russian Federation of 08.12.2010 № 2205-r.
[25] Resolution of the Administration of the Primorsky krai of 28.12.2018 № 668-pa.
[26] Decree of the Government of the Russian Federation of 15.04.2014 № 326, as amended on 06.07.2017. http://government.ru/en/docs/7108/
[26] Resolution of the Government of the Russian Federation of 15.04.2014 № 308 with amendments of 31.08.2018.
[28] Resolution of the Government of the Russian Federation of 15.04.2014 № 308 with amendments of 31.08.2018.

# 3. Objective of MPA management plan

As MPAs in Russia are considered part of the SPA system, as indicated in section 1 above, the management plan of SPAs that include MPA – is a document developed by the SPAs **themselves** for the current and operational planning of activities and identifying activities for the management of a specially protected area taking into account the economic, social and environmental conditions of the reserve location.

Management plan includes activities:
- on monitoring;
- to ensure reliable protection of natural complexes and objects in the relevant SPA;
- on regulation of limited economic activity and nature use within SPA and its protective zone;
- on carrying out scientific research;
- on development of environmental education, etc.

This document justifies the material costs for carrying out necessary works, determines the expected results of activity, and establishes a monitoring programme that allows to assess the effectiveness of the SPA management.

All specially protected areas are within the boundaries of one or more administrative districts (municipalities). In this regard, the SPA management could not be effectively planned within only their own borders, in isolation from the surroundings, from integrated planning and design, which is carried out within the boundaries of the relevant administrative entities.

The management plans are coordinated with the socio-economic development programmes of regions, where the SPAS are located.

The **Strategy for the conservation of rare and endangered species of animals, plants and fungi in the Russian Federation for the period through 2030**[29] and the **Plan for the conservation of rare and endangered species of animals, plants and fungi for the period through 2030**[30] envisage the tasks of preserving habitats of rare and endangered species of animals, plants and fungi by ensuring the operation of an effective system of SPAs, determine the important role of SPAs of regional and local significance in the formation of spatially functional network of areas with various nature use regimes for the conservation of biological diversity.

The objectives of the development of the system of SPAs, including marine, conservation of natural ecological systems, natural landscapes and natural complexes, objects of flora and fauna are anchored by the "**Fundamentals of the state policy in the field of environmental development of the Russian Federation for the period through 2030 and the Action Plan for their implementation**"[31].

The objectives of the **Concept of development of the system of specially protected areas of the federal significance for the period through 2020** and the **Action Plan for its implementation**[32] are the development of the system of specially protected areas, the formation of a representative geographic network of specially protected areas, including marine protected areas, establishment of new reserves and national parks by

[29] Order of the Government of the Russian Federation of 17.02.2014 № 212-r.
[30] Order of the Ministry of Natural Resources and Environment of the Russian Federation of 27.12.2018 № 40-r.
[31] Decree of the President of the Russian Federation of 28 April 2012 № Pr-1102.
[32] Order of the Government of the Russian Federation of 22.12. 2011 № 2322-r.

increasing the efficiency of the state administration in the field of organization and operation of the system of specially protected areas in the interests of sustainable development of the Russian Federation, provision of environmental safety, protection of biological and landscape diversity, conservation and rational use of natural heritage.

The addressing of the problems of the Russian biological diversity conservation is the establishment of new and expansion of existing SPAs, including marine ones, what will ensure the conservation of biological and landscape diversity of large areas, habitats of rare and endangered species of plants and animals, as well as contribute to the development of ecosystem services.

## Objectives of the NEAMPAN sites

The main objective of the Sikhote-Alin State Natural Biosphere Reserve after K.G. Abramov of the MNRE of Russia (**Sikhote-Alin Reserve**) is the conservation of the natural functioning of typical and unique natural complexes, including marine, Sikhote-Alin mountain system, study of natural course of natural processes and phenomena, individual species, typical and unique ecological systems, as well as development of principles and methods for control of the natural environment.

The main objectives of the **Sikhote-Alin Reserve** include:
- organization of ongoing studies of protected marine ecosystems in interrelation with terrestrial and river ecosystems;
- studies of the ecological state of the coastal sea waters of the Sikhote-Alin Biosphere Reserve;
- study of modern relief-forming processes in the coastal part of the Sikhote-Alin Reserve;
- organization and monitoring of natural dynamics of the Reserve's ecosystems, including marine ecosystems at 64 permanent test sites (PTSs) located in all vegetation zones and three topo-ecological profiles;
- study of distribution and number of waterfowls on the sea coast of Northern Primorye; and
- study of the population structure and population dynamics of the Larga seal.

The main goal of the Far Eastern State Marine Biosphere Reserve (**FESMBR**) of the FEB RAS is to protect the environment of the structurally rich marine and island flora and fauna of the Peter the Great Bay, and in the first turn – conservation of the gene pool of marine and coastal communities.

The objectives of the **FESMBR** include:
- protection of water and coastal areas; research, study and monitoring of marine and island biocenoses of animals and plants; development of scientific bases for conservation and restoration of marine and island biogeocenoses and scientific recommendations for marine conservation;
- implementation of the protection of natural areas aimed at the conservation of biological diversity and maintaining the natural state of protected natural complexes and objects;
- organization and carrying out of scientific researches, including the maintenance of the Chronicles of Nature;
- implementation of the state environmental (ecological) monitoring;
- environmental education and development of educational tourism;
- assistance in training of scientific personnel and specialists in the field of environmental protection.

Overall, the objectives of the management plans and capacity building of the developing MPA system of Russia is based on the strategic objectives set forth in the Strategic Plan for Biodiversity 2011-2020 of the CBD and

on the main goals and tasks of the state management in the environmental sphere contained in the documents and plans in the field of biodiversity conservation and SPAs and related legislative instruments.

## 4. Key contents of the management plans

Marine protected areas are a key element of ecosystem-based management.

Since the Russian MPAs play an important role in the conservation of the marine environment, water bodies, biodiversity, monitoring of global changes and the implementation of Russia's international obligations in the field of environmental protection and biological diversity, the content of the MPA management plans should reflect this.

## Approaches to the management plans in scientific publications

Scientific publications have developed approaches to planning MPAs and allocating them legally into independent category.

Planning, establishment and management of the national MPA system has the goal of creating an effective MPA network of Russia, which is based on the following principles:

- representativeness: the MPA system should adequately reflect the structure of natural biological diversity;
- a variety of forms; the MPA system includes a variety of traditional and specific categories and types of SPAs;
- compliance and advanced development; the growth of loads on the water area should correspond to the adequate development of its MPA system. The design and long-term development of the MPA system should take into account the dynamics of potential threats to biodiversity;
- social efficiency; the MPA system is a national asset, organized and supported by the state in the interests of the whole society for sustainable socio-economic development;
- institutional integration; the MPA system is an integral, equal and independent part of the economic and social spheres of the state, regulated by special legislation. The MPA system is a special economic form of environmental management with its own set of environmental, information, social and economic functions;
- inter-regional conjugacy; the organization of the Russian MPA system is based on the need to coordinate efforts on conservation of widely migratory objects of biological diversity, the range of which covers more than one marine area, and is associated with the lack of “tight” boundaries between the marine areas or their parts;
- regulation of nature use;
- establishment of protective areas and ecological corridors;
- functionality; it is related to the regulation of nature use, including partial conservation of valuable natural complexes, protection of individual ecosystems and their plurality of elements (Voronov, 1997).

## The contents of management plans for SPAs, including MPAs

The contents of management plans for SPAs, including MPAs, complies with the basic strategic documents of development of Russia, related to the maritime, natural resource, environmental and scientific activities: the Maritime Doctrine of the Russian Federation, Ecological Doctrine of the Russian Federation and other strategies

and development concepts adopted by the Government of Russia, and the national action plans in the field of environmental protection.

Interaction between the federal SPAs, including MPAs, with regional SPAs and other forms of territorial protection (fisheries protected zones, areas with special regime of navigation) should also be considered in the MPA management plans.

The content of the SPA management plan (including MPAs) should include activities on strengthening the role of MPA in the conservation of endangered rare species of marine and near-water migratory animals.

## The format of management plans

The format of management plans should include:

- general characteristics (area of land and sea parts of the federal MPAs and protective zones, the share of water surface area, etc.);
- protection of water areas and coasts (general staff of MPA, general security staff, security staff assigned to coastal and sea areas, indicators of the coastline length and area of water area per inspector; availability of vessels);
- research and monitoring (general scientific staff, staff of hydrobiologists, ichthyologists, specialists in seabirds and mammals; number of components of marine ecosystems for which regular observations are carried out according to the standardized methodology);
- environmental education (number of employees of environmental education departments, number of sci-pop publications on marine topics published by the MPA personnel);
- necessary shipboard and other technical support of the MPA;
- the possibility of using remote water area control methods by MPA;
- strengthening the role of MPA in monitoring of marine and coastal ecosystems (identification of necessary conditions in the field of monitoring of marine and coastal biodiversity). Prospects for the use of remote methods of research and monitoring of coasts and waters within MPA. Description of the MPA role in monitoring and controlling the distribution of marine and island alien/invasive species.

The MPA management plan should include sections on the territorial structure of reserves, the action plan itself, monitoring and evaluation of implementation.

## Development of management plans for FESMBR and Sikhote-Alin Reserve

The key contents of Russia's SPA management plans, including MPAs, is related to the tasks of conservation of the landscape and ecological diversity of the coastal marine areas of Russia and adjacent waters, considering the identified trends in environmental changes and the specificities of their regional manifestations.

As it was indicated in the section 2, the management plan for the Far Eastern State Marine Biosphere Reserve was developed with the support of the MNRE of Russia / GEF / UNDP international project, which included the following main steps of development:

- analysis of natural features of SPAs, including marine SPAs;
- analysis of the current organization and activities of the reserve (national park);

- identification of strategic directions and priorities of activities.

The Sikhote-Alin Reserve also has its management plan.

Aimed at the planning of activity of SPAs, including MPAs, Rosprirodnadzor has developed "Recommendations for the development of medium-term management plans for state natural reserves and national parks"[33], which are used by SPAs, but are advisory in nature.

This document recommended that the SPAs should interact with a sufficient number of stakeholders during the preparation of the management plan, involving them in its development and discussion.

## Regime of the reserves

A special regime of the reserve is established for the Sikhote-Alin State Natural Biosphere Reserve after K.G. Abramov under the MNRE of Russia in accordance with the 2009 Regulations on the Federal State Institution[34].

On the whole land and water area of the reserve, any activity contrary to the objectives of the reserve and the regime of special protection of its territory is banned, including: activities that change the hydrological regime of land; prospecting and development of minerals, destruction of soil cover, mineral outcrops, rock outcrops. The reserve carries out activities that do not contradict with its objectives and the established regime. The reserve carries out business activities solely in so far as it serves to achieve the goals for which it was established.

Also, in accordance with the **2017 Provision on the FEMBSNR**[35], the regime for the protection and use of land areas and water bodies within the protective zones of the Reserve is established.

The reserve has its own development strategy, the med-term prospects of which are fixed in the management and development plan for the relevant period.

This plan takes into account all possible financial revenues, issues of equipment modernization, issues of interaction with other organizations. The plan contains the complete official name of the SPA, type: (Marine and coastal SPA); SPA current status (Active); SPA category (state nature reserve); the SPA significance (Federal); international status of SPA (Biosphere reserve); profile (biosphere); date of establishment; regulatory legal framework for the operation of SPA; the SPA location in the structure of administrative and territorial division; cadastral number of the land plot; total area of SPA; the area of the marine specially protected area; protective zone size; the rationale for the SPA establishment and its significance; geographical position; number of sites.

Of importance in the management plan of the reserve is information on: the list of the main objects of protection; the existence within the borders of SPA of other SPAs; the documents that establish the mode of economic use and zoning of the territory; list of zones; the documents that establishes the regime of protection and use of the buffer zone; the list of protective zones; information on prohibited and permitted activities and nature use;

[33] Order of the Federal Service for Nature Use Supervision of the Ministry of Natural Resources and Environment of the Russian Federation of 03.12.2007 № 491 "On improvement of the system of planning of major activity of the state natural reserves and national parks".
[34] Order of the MNRE of Russia of 07.08.2003 № 712 with amendments of 26.03.2009 № 71.
[35] Order of the Federal Agency of Scientific Organizations of 12.10.2016 № 50n, as amended on 04.09.2017.

information about the state agencies and legal persons responsible for provision of the safety and operation of SPA.

In general, the integration of SPAs, including marine and coastal, into a single management system of environmental protection activity through the development and implementation of management plans is a particularly important task in the strategy of development and integration of all types of SPAs of the Russian Federation (federal, regional).

## 4.1. Links between monitoring/assessment results and management

Regular evaluation and monitoring should be an important component of any programme or action plan to assess, within a specific time frame, the goals and objectives for the implementation of the relevant measures. Monitoring and evaluation is recognized as a necessary tool for the management of any programme or project activity and are an integral part of any internationally recognized project activity.

### General approaches to monitoring and evaluation as management tools of the SPA, including MPAs

The section "Monitoring and Evaluation of Implementation" of the SPA management plan in accordance with the "**Recommendations for the development of medium-term plans for the management of state nature reserves and national parks**"[36] should provide indicators for carrying out the monitoring of core activities and indicators of implementation of integrated environmental monitoring of the state of protection and use of natural, historical and cultural complexes and objects in SPA.

The monitoring of the main activity consists in monitoring of the implementation of the action plans and the achievement of the forecast indicators of the activities of all structural divisions. It is mandatory to include the main forecast indicators, in terms of the implementation of the function of the state management of SPA, as well as observation of the dynamics of violations of nature protection regime and the effectiveness of protective measures; the attendance at the territory and the impact of the development of tourism and recreation on natural, historical and cultural objects; effectiveness of environmental education activities; the influence of the economic activity of the protective zone on the state of natural, historical and cultural complexes and objects.

One of the highest priority activities of specially protected coastal marine land and water areas is environmental monitoring of protected marine and coastal ecosystems, which is based on data on the status of taxon-indicator populations.

The categorization of marine ecosystems as "very complex systems", which include a large number of organisms from different taxonomic and trophic groups that interact in complex ways with each other and with the environment, suggests the possibility of their different sensitivity and ambiguous response to the same intensity of technogenic impact.

The main problem of environmental monitoring in terms of control of biological diversity and the state of ecological systems is identification of changes in biota caused by the response to specific economic activities.

[36] Order of Rosprirodnadzor under the MNRE of Russia of 03.12.2007 № 491.

The specificity of biological diversity monitoring is that the object of monitoring is, for example, not the population of a single species of organisms, but the property(-ies) characterizing the population of different species at the ecosystem level. In other words, controlled biodiversity variables ("ecosystem variables") should reflect the integral ("systemic") characteristics of biota.

The modern system of monitoring of marine ecosystems should provide for regular control over the level of biological diversity in this area. This is a rather expensive approach, requiring the involvement of a large number of specialists capable of covering the taxonomic diversity of biota in the given water area. Monitoring requires observation of seasonality, particularly in faunal studies, that allow taking into account migrating species and their seasonal contribution to ecosystems.

Existing environmental monitoring programmes in the Russian marine areas usually include a wide range of physical, chemical and biological environmental variables. The list of parameters does not contain integral, ecosystem variables (indicators) – functions of the state of marine ecosystems.

Thus, the assessment of the impact on ichthyofauna is based on the findings of fishery monitoring.

Specially protected coastal marine areas and water areas are convenient objects for monitoring the current dynamics of natural processes, as they are usually integral natural complexes, which include a variety of landscapes.

This makes it possible to more reasonably and reliably identify changes in not only their individual main components, but also to detect general patterns in the direction of changes in the conditions of minimal impact of economic activity on the environment.

Monitoring and control of the physical factors of the environment of MPAs is an integral part of the system of observation of the state of marine and coastal ecosystems. It usually includes a standard list of regular hydrochemical and hydrological observations of a fixed number of variables. The list of measured parameters of the marine environment, methods of field and laboratory analyses should be agreed with the relevant executive authorities. Quantitative chemical analysis (water and sediments) should be carried out by certified laboratories.

## State Cadastre of Specially Protected Areas – Instrument linking monitoring results and management

An important instrument of communication between the results of monitoring and management is the **State Cadastre of Specially Protected Areas**[37] – a systematic collection of documented information on specially protected areas of federal, regional and local significance.

The State Cadastre Of Specially Protected Areas is ran in order to assess the state of the natural reserve fund, identification of the prospects for the development of the network of these areas, increase the effectiveness of the state control in the field of protection and use of specially protected areas, and also accounting of these territories under planning the socio-economic development of regions.

[37] Order of the MNRE of Russia of 19.03.2012 № 69.

Organizations and institutions engaged in the management of protected areas developed the "Methodic recommendations to the federal state budgetary institutions engaged in the management of specially protected areas, on maintaining the state accounting, the state cadastre and the state monitoring of fauna objects in the reserves, national parks and sanctuaries"[38].

### Types of monitoring for coastal marine SPAs of the Far Eastern region of Russia

For coastal marine SPAs of the Far Eastern region of Russia, such types of monitoring could be:

- monitoring of pollutant transport by rivers;
- monitoring of atmospheric deposition, primarily with a view to forecasting the development of the processes of eutrophication of water areas as being particularly important for the waters of the south of the Far East of the Russian Federation;
- monitoring the impact of sea level rise on coastal marine ecosystems and their individual natural components, monitoring of coastal marine communities near oil platforms;
- monitoring of invaded marine organisms.

In general, the formation of a geographically representative network of specially protected marine areas of different status and specialization should be based primarily on the results of monitoring and assessment of the effectiveness of biodiversity conservation by the existing system of MPAs, on the identified gaps in their system that affect the efficiency of their core environmental functions (Current state, 2009).

# 5. NEAMPAN sites studies

## 5.1. Overview

The main goal of the MPAs is biodiversity conservation and increase, conservation of ecosystems, i.e. the ability of marine ecosystems to return to their natural state or it maintaining. Effective MPAs can ensure the long-term viability and genetic diversity of marine species and systems. Such advantages are the result of the protection of rare and endangered species, conservation of habitats, as well as prevention of external activities that damage the marine environment

In the Russian Federation, marine and coastal protected areas are areas in the tidal or marine area, together with waters that cover them, and flora and fauna associated with them. These territories have historical and cultural features, the environment of which is subject to full or partial protection by law or other regulatory acts. (see *Table 3* for MPAs in Far Eastern seas)

Table 3 Marine Protected Areas of the Far Eastern Seas

| N | Name MPA | Protected area status | Year of foundation | Area of protected areas, ha | | The area of the security zone, ha | |
|---|---|---|---|---|---|---|---|
| | | | | Common общая | Including marine water area | common общая | Including marine water area |
| 1 | Far Eastern State Marine Biosphere Reserve | Federal significance | 1978 | 64 316,3 | 63 000 | 72 300 | 69 450 |
| 2 | Kronotsky State Biosphere Reserve | Federal significance | 1934, year of accession water areas 1982 | 1 147 619,37 | 3 463 300 | | |

[38] Order of VNII Ecology under the MNRE of Russia of 25.04. 2018.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | Magadan State Reserve | Federal significance | 1982 | | | | 2 km along the Pyagin Peninsula and the Yamskiy Islands |
| 4 | South Kamchatka State zakaznik | Federal significance | 1983 | 322 000 | 92 868,63 | | |
| 5 | Malyye Kurily, State zakaznik | Federal significance | 1984 | 45 000 | 5 200 | | |
| 6 | Bukhta Kraternaya Regional zakaznik | Regional significance | 1987 | 20 | 20 | | |
| 7 | Poronaysky State Reserve | Federal significance | 1988 | 56 695 | | | 17 300 |
| 8 | «Zaliv Vostok» the bay of the Peter the Great **zakaznik** | Regional significance | 1989 | 1 820 | 1 820 | | |
| 9 | Dzhugdzhursky state reserve | Federal significance | 1990 | 859 956 | 53 700 | | |
| 10 | Sikhote-Alin State Biosphere Reserve | Federal significance | 1935, year of accession water areas 1991 | 40 428 | 2 900 | | |
| 11 | Komandorskiy Reserve State Reserve | Federal significance | 1993 | 3 648 679 | 463 300 | | |
| 12 | Курильский заповедник | Federal significance | 1984 , year of accession water areas 1995 | 65 861,5 | | | 32 000 |
| 13 | Kuril State Reserve | Federal significance | 1995 | 327 156 | 83 000 | | |
| 14 | Shantar Islands National State Park | Federal significance | 2013 | 515 500 | 7 428,4 | | |

Monitoring of biological systems is carried out in MPA, as in all reserves of the Russian Federation in the form:

“Chronicle of nature” - the inventory of the fauna and flora and

Study of biological diversity and monitoring of protected areas.

According to the standard monitoring instruction in biosphere reserves of Russia monitoring, which include both Russian MPA members of NEAMPAN, including environmental monitoring, is continuous and unlimited time tracking of an object in order to ensure the desired state or development of the object.

According to the regulations on biosphere reserves, all protected areas of this level should conduct background monitoring in their territories and waters.

These works are carried out by ROSKOMHYDROMET on networks of biosphere pickets. But unfortunately, after the 90s, such work within the network of the State Hydromet was stopped. But according to the regulations on biosphere reserves, they must be implemented.

The purpose of monitoring is to identify trends in nature under the influence of the economy and economy under the influence of nature and to ensure the regulation of these influences in the public interest.

No economic activity is carried out in the territories of the protected areas, but the impact of regional and local economic systems is monitored according to the load level through the assessment of the input of pollutants with atmospheric precipitation and surface runoff.

For the purpose of monitoring, its tasks are closely related. These primarily include the task of monitoring the climate, atmospheric pollution, the transformation of technogenesis products in the geosystem, and the response of biota and its elements to pollution. With a broader understanding of the tasks of monitoring, its functions include monitoring and managing natural ecosystems used by humans.

At the same time, control is understood as an element of the environmental management system, and accordingly, its development should fully ensure the solution of management problems.

At the same time, control (monitoring) is understood as an important element of the environmental management system, and, accordingly, its development should fully provide the necessary environmental information to solve management problems.

Environmental monitoring includes monitoring of atmospheric air, land, forests, water bodies, wildlife, the unique ecological system of Lake Baikal, the continental shelf of the Russian Federation, the state of the subsoil, the exclusive economic zone of the Russian Federation, inland waters and the territorial sea of the Russian Federation.

In Russia, MPAs are not singled out as a separate type of protected areas; therefore, all requirements for a system of terrestrial protected areas are extended to MPAs.

Ministry of Natural Resources of Russia:

- coordinates the activities of federal executive bodies in organizing and implementing environmental monitoring;
- Coordinates methodological and regulatory technical documents of federal executive bodies on the organization and implementation of environmental monitoring;
- provides compatibility of information systems and databases on the state of the environment.

MNR of Russia and other federal executive bodies (Russian Academy of Sciences, Ministry of Science and Higher Education, Ministry of Agriculture and others):

- form a state system for monitoring the state of the environment and ensure the functioning of this system;
- interacts with public authorities of the constituent entities of the Russian Federation (government bodies of the constituent entities of the Russian Federation on the organization and implementation of environmental monitoring; federal executive bodies are ministries, and their structures in the regions, subordinate only to the federal level.
- local government bodies in this case, the administrations of the subjects of the federation (territory, region, republic)
- with the participation of executive authorities of the constituent entities of the Russian Federation, collects, stores, analyzes and generates state information resources on the state of the environment and the use of natural resources

In this case, we are talking about the fact that the executive branch of the constituent entities of the federation, through its bodies (for example, the natural resources department and nature protection departments) creates information resources for use by all consumers.

The main issues facing the study of the natural environment for monitoring:

- what is the state of the environment at present, what are the trends in natural changes and what changes can be expected in the future;?
- what are the reasons for possible changes (including unwanted ones), and what is their source;?
- what loads, impacts are harmful, what level of exposure is permissible.

The goals and objectives of ecological monitoring determine the main criteria for the selection of objects of observation (indicators), the frequency and time of observations, and the territorial distribution of their points:

1. Sensitivity criterion: Operational forecast and operational management is possible only if tracking is sensitive enough to environmental changes, i.e. during tracking, slight changes in the observed variables should be recorded.

2. Selectivity criterion: Prediction and control tasks determine the need for selective tracking, i.e. the tracking system should provide not only a general assessment of environmental changes, but also identify its causes and factors specifically.

3. Criteria for representativeness: The prediction results and management strategies should be acceptable for a sufficiently large area, which requires representativeness of the tracking results.

4. Criterion of economic efficiency: The entire monitoring organization should be such that, with a minimum of observations and at their minimum cost, ensure the full implementation of the first three conditions.

Observed objects are ultimately individual characteristics of the elements of ecosystems and processes. In addition, in the selected zones of the biosphere region, there is a need to use a system of different, but mutually related methods. In the core there are only non-perturbing methods (mainly full-scale decryption of aerospace images with a minimum of groundwork), in the buffer and peripheral zones the whole range of possible methods was used.

Observations cover, given the above criteria, the main components and properties of geosystems:

a) geological and mineralogical base;
b) relief;
c) meteorological regime and climate;
d) hydrological regime;
e) the composition of atmospheric deposition and the composition of surface and underground runoff;
e) fauna;
g) microbiota;
h) soil;
i) population;
j) household and equipment;

In addition, the following components and processes are added to marine and coastal waters:

k) geochemical parameters of water;
l) biotic components (bioindicators of the state of the marine environment);
m) sedimentation processes in the mixing zone of fresh and sea waters.

In this way the priority areas for monitoring natural processes and phenomena should include:

- observations of changes in the level of biodiversity and the qualitative composition of biota (flora and fauna), primarily vertebrates and vascular plants;
- observations of the status of populations, rare plant and animal species;
- species particularly vulnerable due to the formation of mass aggregations (colonial birds, marine mammals etc.);
- species-indicators of natural communities and ecosystems;

- observations of the state of ecosystems, which are the etalons for a specific physiographic region;
- observations of extremely rare and unique species.

The priority inventory work should include:

- compiling of annotated species lists;
- compiling of inventories of rare, unique and requiring special attention objects of animate and inanimate nature, habitats of rare species of animals and plants.

All these components, processes, priority areas for monitoring are carried out at weather stations ROSKOMHYDROMET (MNR) and are used by the MPA for their research.

These elements are indeed controlled at first-class stations, which include stations in the area under consideration by the MPA)

## 5.2. Sikhote-Alin Nature Biosphere Reserve

### General information

Sikhote-Alin Reserve was founded in 1935 within the protected territory of 1,000,000 hectares and a buffer zone of 700,000 hectares.

Nowadays the territory of the Reserve is 401,600 ha (*Figure 2*)

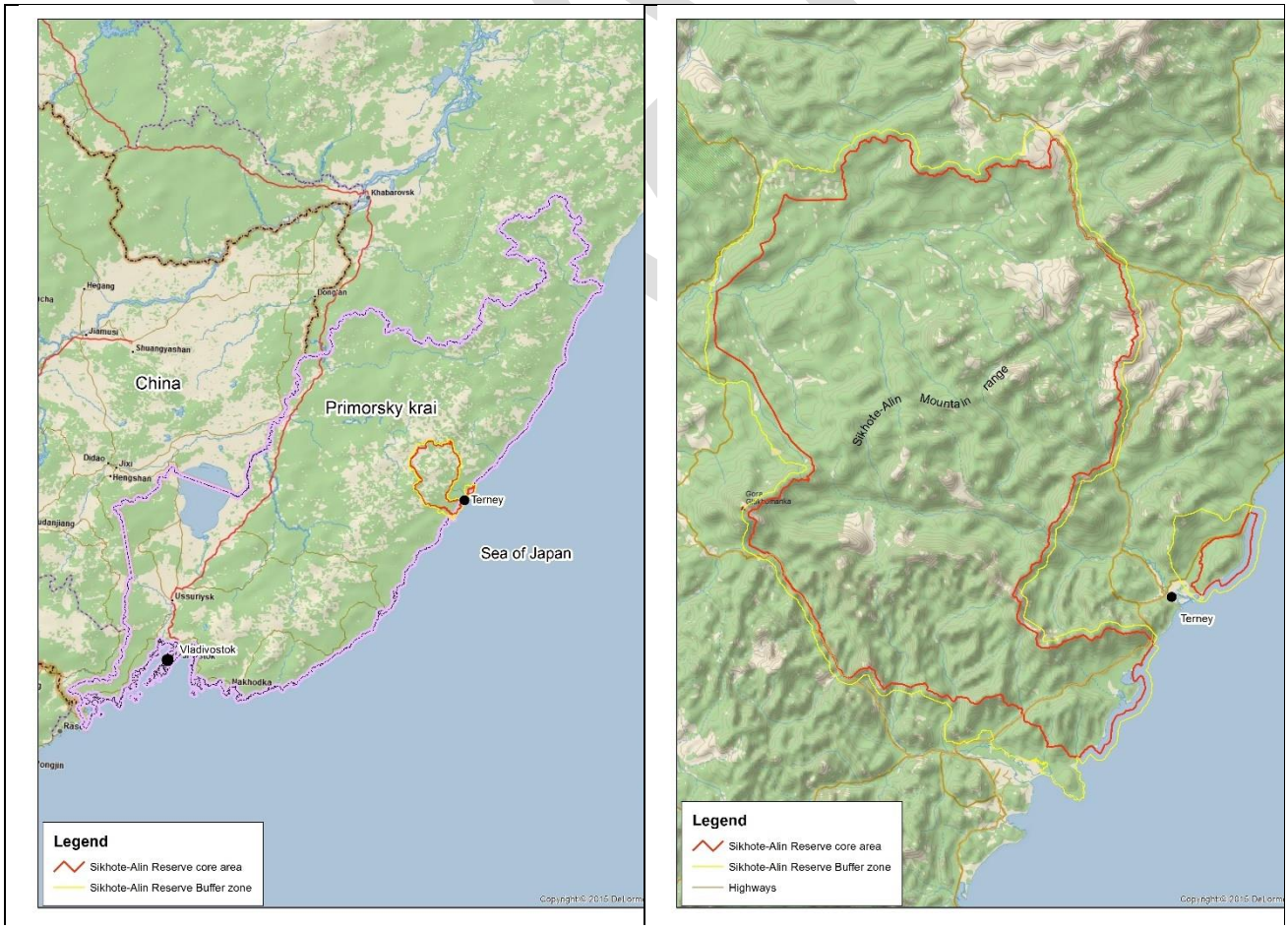


Figure 2 Sikhote-Alin Reserve map

It consists of two units: a basic area of 397,400 ha and a separated area « Abrek» of 4,200 ha. These sites include also the protected marine zone of the Sea of Japan with total area of 2,900 ha. Sikhote-Alin Reserve occupies the Central Part of Sikhote-Alin mountain range with peaks ranging from 600 to 1,000 m above the sea level. The highest peak is Gluhomanka mountain (1,598 m).

The west macroslope of Sikhote-Alin Range is long with smaller hills and less relief. The east slope is short and includes greater relief, breaking by steep rocks at coast of the Sea of Japan.

The climate of the Reserve is of a distinctive monsoon character, with harsh westerly winds in winter and light easterly winds in summer. The average air temperature is 3.4°C on the coast, 1.6°C in the foothills on the eastern slopes, and 0.4°C on the western slopes. Precipitation through the year is 813 mm, 682 mm and 689 mm on the coast, lower foothills of the eastern slope, and western slope, respectively. Winter lasts about four months. The Reserve is the area with non-uniform thickness and duration of snow cover.

The Reserve territory is 95% forested.

The Reserve conserves in its huge area unique natural complexes of coniferous broad-leaved forests and ecosystems of the Sea of Japan coast in natural condition and development.

There are 1,076 species of vascular plants, 280 species of moss, 434 species of lichen, 670 herbaceous species and 740 species of fungi in the territory of the Reserve.

There are 61 species of terrestrial mammals in the Reserve territory, 7 of them are included into the IUCN Red List and 11 species of marine mammals (8 species included into IUCN Red List)

More than 389species of birds (24 species included into IUCN Red List), 8 species of reptiles, 207species of fishes, 334 species of marine invertebrates and about 4,000 species of terrestrial invertebrates live in the Reserve territory.

There are three main direction of the Reserve's activity:

- territory protection (prevention of poaching in the land area and in the marine zone, prevention and suppression of forest fires, forestry works). Protection of the sea includes regular patrols on a boat to detect violations, as well as monitoring the sea from the coast and using a webcam to timely detect vessels illegally located in the marine area of the reserve
- scientific activity (monitoring of natural communities, use of scientific achievements in wildlife management practice in the region, participation in ecological assessments, organization of students practice of profile high schools),
- environmental education (work with local population, tourist activity, dissemination of information about the Reserve activity).

Primary activity of the Reserve Protection Department is to prevent, suppress poaching in the territory, to prevent and suppress forest fires, and to maintain forest infrastructure. Inspectors of the Reserve regularly patrol the territory of the reserve in order to reveal and prevent violation of the nature protection legislation.

Actions for prevention forest fires include clearing of the fire-prevention roads, building and repairing of fire-prevention bases in the Reserve territory, information propaganda and lectures on fire-prevention themes.

Employees of the Reserve Protection Department have joint spot-checks with frontier management of Federal Security Service (FSB) of Russia in Primorsky Krai to protect marine core area.

Since 2011 the Reserve has been participating in the international MIST/SMART program, the aim of which is to increase efficiency of anti-poaching spot-checks in the protected territories which are important for a tiger.

Within the framework of this program employees of reserve regularly participate in the international trainings and seminars together with delegations from other countries of South East Asia where tigers live.

Support of the international funds, such as WCS, WWF, Rhinoceros and Tiger Conservation Fund, Tiger Conservation Fund, gives a possibility to use modern technologies in the reserve's activity: independent photo- and video-cameras, satellite phones. Use of the new equipment allows increasing efficiency of nature protection actions.

Work with local population is the important component of Ecological Education Department activity. Regular lectures, excursions in the museum of the Reserve, weeks of «Open Doors», etc. give a possibility for inhabitants of nearby settlements to learn more about the Reserve. The reserve conducts lectures for schoolchildren annually on World Marine Mammal Day, World Oceans Day, World Whale Day, and several times a year the reserve holds actions to clean the coast of garbage ("Clean Coast" action)

Many actions and holidays are spent in the Reserve annually. Among the most favorite actions are a festival «Tiger Day», annual planting of Korean pines, an action «Clean Coast».

Annually groups of Russian tourists visit the Reserve. Now there are 6 Ecological Trails in the Reserve. International cooperation concerning ecological education is actively developing. The Reserve attracts attention of foreign tourists and film crews, Such as Netflix, BBC.

## Management and Administration Peculiarity

The Sikhote-Alin Nature Reserve is an environmental, research, and environmental-educational organization.
The aim of the Reserve is to preserve and study the natural course of natural processes and phenomena.
The institution "Sikhote-Alin Reserve" is managed by the Ministry of Natural Resources and Ecology of the Russian Federation.

The activity of the Reserve is carried out in accordance with the documents of title: the Charter of the Reserve, the Regulation on the Reserve, the Regulation on the Buffer zone. According to these documents, the activity of the Reserve may include:

1. Implementation of measures to preserve the natural state of ecosystems (fire prevention, biotechnological measures, measures to mark the boundaries of the reserve, etc.);
2. Identification and suppression of violations of the established protection regime (staying in the territory and water area without permission of the administration of the Reserve, collecting forest and marine biological resources, poaching, etc.);
3. Environmental monitoring;
4. Conducting research.

The main requirement for any type of activity in the territory and water area of the reserve: non-interference in the natural course of natural processes.

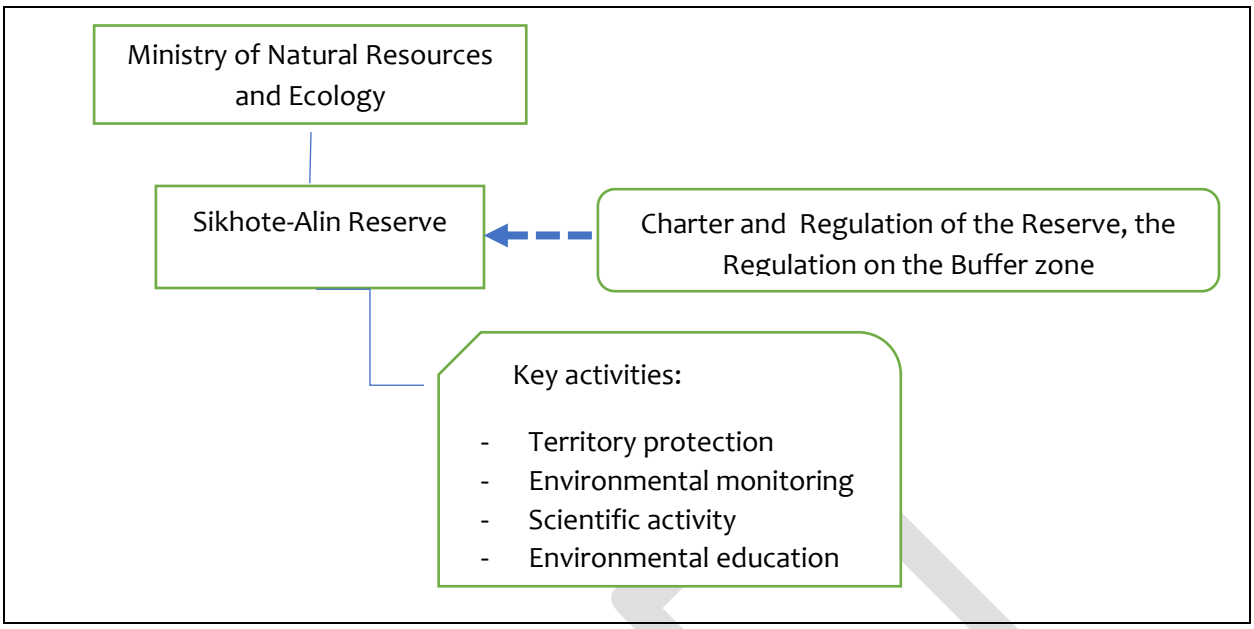


Figure 3 Management strucutre of Sikhote-Alin Reserve

## Socio-economic situation

The socio-economic situation in the region in which the reserve is located has a significant impact on all areas of the reserve's work: the level of poaching, the local population's interest in the reserve's activities, etc. The reserve receives annual data on the socio-economic situation in the region from the local Administration. Data on the socio-economic condition of the region include: the main types of industry in the region, population size, average wage, unemployment rate. These data help to understand the place of the reserve in the region, to compare the level of wages in the reserve and the region.

The Reserve is located in the north of Primorsky Krai, with the low density of the population. Near the border of the reserve are 3 large settlements: Terney, Plastun, Melnichnoe, with a total population of about 7-8 thousand people. Most of the reserve is located within the Terney administrative district, the total population of which is about 11 thousand people.

The economy of the region is determined by forestry, woodworking, food industry. All large enterprises in this sector of the economy, Terneyles OJSC, Amgu OJSC, CTC Teknovood CJSC, PTS Hardwood CJSC, Svetlaya Branch of Primorsklesprom JSC are focused on exporting products to Japan, China and Korea. The main types of products manufactured on the territory of the Terney municipal district are commercial wood, veneer, wood chips, lumber. Extraction of aquatic biological resources is not a significant industry in the Terney district where the reserve is located.

According to statistics for 2018, the population employed in the economy was 7.2 thousand people, which is 69.19% of the total population of the region. The registered unemployment rate is 2.18% of the total working-age population of the region.

However, despite official data, the income level of most of the population is low. This affects the level of local residents' use of resources of both forest and marine ecosystems.

## Existing factors and potential threats adversely affecting the nature complexes of the Reserve

The main negative anthropogenic factors are determined by the main industry of the region - logging. By the end of the 1980s, all cedar forests in the territories adjacent to the reserve were industrial cuttings. By 2019, all forest stands along the perimeter of the reserve's borders have been cut or forest fires, with the exception of a small massif in the Tayozhnaya river basin. In addition, in the forests along the perimeter of the Reserve, a dense network of forest roads was laid, many of which became public roads.

The main directions of the use of marine biological resources: salmon fishing, crab, squid, marine invertebrates. Despite the fact that the norms for the extraction of marine bioresources are determined by federal laws, in reality, these norms are not always respected. Moreover, local residents very rarely receive permits for the extraction of marine biological resources. The main extraction of marine biological resources (crab, salmon, etc.) is carried out by local residents, for whom this type of fishing is the main source of income. This type of activity is explained by high unemployment in the region and low wages among the working population. Extraction of marine bioresources allows local residents to receive a much higher income than legal work. The main problem of illegal extraction of marine bioresources near the reserve's water area is that there are no fish-breeding sites in this area, and thus local residents do not have the opportunity to acquire a license for legal fishing.

Another anthropogenic factor that probably has a significant impact on marine ecosystems is plastic pollution of the marine area. In 2019, together with GREENPEACE Russia, the Reserve is going to conduct the first study, the purpose of which is to assess the pollution of the reserve's water with plastic. Similar studies are planned to be carried out on an ongoing basis. Based on the results of the work, a report will be prepared and recommendations will be developed to reduce the level of plastic pollution.

## Organization of protection of the marine area of the Reserve

The marine area of the Reserve is protected by inspectors of the reserve's protection department. There is a small vessel for patrolling the Reserve's marine area.
During the navigation period (April - October), the inspectors of the reserve regularly patrol the reserve's water area and the protected area to identify and prevent violations of the protection regime.

In addition, reserve inspectors regularly conduct joint raids with inspectors of marine services (State Inspectorate for Small Vessels, State Maritime Inspectorate).Furthermore, in order to control the marine area during the period of active extraction of marine biological resources, the Reserve organized the duty of inspectors on huts and observation posts located on the shores of the Sea of Japan. Also, in the Blagodatnoye area (the most attractive bay for the extraction of marine biological resources), round-the-clock video surveillance of the sea was organized using a webcam with the possibility of remote online viewing.

## Management of scientific research in the Sikhote-Alin Reserve

Scientific research in the Sikhote-Alin Reserve is carried out in accordance with research plans.
A long-term plan of scientific research is being developed for 5 years and approved by the Director of the Department of Protected Areas of the Ministry of Natural Resources and Ecology. Currently, the Research Plan 2018-2023 is in force.

The annual research plan is prepared in accordance with the long-term plan and approved by Director of the Reserve. The Research plans (both long-term and annual) are developed by scientists of the scientific department of the Reserve. The decision to include themes in the plans is made at the Scientific and Technical Council. The Scientific and Technical Council is an advisory agency to the Director of the reserve. The Scientific and Technical Council includes all the scientific staff of the Reserve, Deputy directors, members of scientific institutes, members of non-profit organizations, members of the district administration.

The research plan includes, as a rule, themes of scientists of the reserve. Also, the plan may include long-term scientific work of third-party researchers.

Due to the fact that the number of scientific employees of the scientific department of the Reserve is limited, the Reserve is interested in cooperation with scientists from institutes of the Russian Academy of Sciences, Universities, etc. to study the natural complexes of the reserve.

Scientific research in the territory and water area of the Reserve is possible only with the permission of the Administration of the Reserve. To obtain such permission, the following conditions must be met:

1. Conclude an agreement on scientific cooperation between the Reserve and the Institute / University. The contract determines the responsibility of each party, including the mandatory observance of the conditions of the reserve's protection regime when conducting scientific research (without disturbance to the natural complexes of the reserve)
2. The Institute / University is obliged to provide in advance a program of scientific research in the territory or water area of the Reserve. The program is evaluated by the scientific staff of the reserve, if necessary, the program is adjusted.
3. After completion of work, a technical report must be submitted to the Reserve, and a scientific report - after completion of processing the results.

## Organization of scientific research of the marine area

Due to the limited staff of scientists in the reserve, it is impossible to carry out comprehensive monitoring of all parameters (hydrochemical, hydrobiological, assessment of micro- and macrobenthos, assessment of the status of ichthyofauna, etc.) of marine ecosystems annually. Environmental monitoring is a mandatory activity of the reserve. However, the list of specific parameters for monitoring depends on the resources available to the reserve (financial and human).

Employees of the scientific department annually record marine pinnipeds (Phoca largha): the total number of animals, as well as the number of subadults and youngs, are estimated. Marine mammals are on the top of the food pyramid of marine ecosystems, so they are indicators of the state of the entire ecosystem.

Every 5-10 years, the Reserve carries out comprehensive monitoring of the state of marine ecosystems in the water area of the Reserve together with the institutes of the Far Eastern Branch of the Russian Academy of Sciences. The latest comprehensive monitoring of marine phytocenoses and marine invertebrates was carried out in 2010 (Galysheva et al. 2012). As a result of this work, the species composition of macrobenthos was compiled, lists of species of marine invertebrates were supplemented, and the composition of soils was determined. Monitoring data showed the stable state of marine ecosystems of the reserve.

## Scientific Research and Monitoring in the Sikhote-Alin Reserve

The most important directions of research activity of Sikhote-Alin Reserve are long-term complex researches of ecosystems and their components of Central Sikhote-Alin in the permanent marked grounds, routes, and profiles. In order to fulfill this work the Reserve carries out interaction and close cooperation with Russian and foreign research institutions, higher schools, and local forestry, industrial, agricultural enterprises and foundations.

All researching results are used for implementing main activity of Reserve, for preparing documents for different authorities in order to make a decision on nature protection actions, such as protection of rare species of plants and animals, creation of new nature protected territories, carrying out of ecological expertise, fulfillment of economic projects.

The main scientific long-term investigations in the Reserve:

- Climate change
- Vegetation transformations under the impact of the external factors
- Natural dynamic of the native and the derivative associations
- Biodiversity and its transformation
- Destructive processes
- Plant and animal phenology
- Dynamic of rare species populations
- Dynamic of main animal species population size
- Marine ecosystems

### *Climate change*

Climate of separate parts of the Reserve is rather differing, because of relief complexity, remoteness from the coast and other physiographic features of the region. Most of all these distinctions are shown in eastern (coastal) and western (continental) macro slopes of Sikhote-Alin. Eastern macro slope constantly is under the impact of the East Sea and Pacific Ocean, therefore its climate is characterized by high humidity and smoothness over of the majority of the hydrothermal phenomena. Here, in the first half of summer prevalence of marine winds is observed with sudden drop in temperature, fogs and incessant rains. The western slopes are isolated from direct influence of the sea by the Sikhote-Alin Range.

The reserve does not monitor climatic indicators in the marine area (water temperature, ice thickness, etc.). This monitoring is conducted by the Hydrometeorological Research Center of Russian Federation (Hydrometcenter of Russia)

The average January temperature on eastern slopes of Sikhote-Alin mountains is -12.9℃, on western it reaches -24.0℃, the average temperature of July is accordingly +15℃ and +18℃; the annual sum of precipitations for western slopes is 676.2 mm, for eastern slopes is 826.4 mm (Gromyko 2016).

For the whole period of observation annual temperature for the coast made up +2.5℃ (with minimum of -3.8℃ in 1940 and maximum of +4.8℃ in 1991). Strong increase of average annual temperature occurred in 1951. From that time, it became above 0℃. In the period 1940-1960 it increased with the rate of 3.1℃ for 10 years. The rise of temperature occurred in all months of the year, with maximum for later autumn and winter months.

In the period for climate changing estimations (1961-1990) that was specified by the World Hydrometeorological Service the rise of temperature continued, but mainly in summer months.

The next abrupt rise of temperature was registered in 1989, then it exceeded 4.5°C, but in the second part of 1990 90th it somewhat decreased.

Thus, although the general increase of temperature in the whole period of observations, its rate varied and from the middle of 1990 90th it has stabilized with the tendency of lowering. Analysis of annual precipitation amounts shows its decline. However, at the same time there is a significant increase in precipitation in the winter period: 91 mm in 40-50 years 20th century to 184.2 mm at the beginning of the 21st century.

### *Marine ecosystems*

Organizing of long-term researches of protected marine and terrestrial ecosystems, ecosystems of lakes, rivers and other systems within a cooperation area which are in economic use is one of the major activities of Sikhote-Alin Biosphere Reserve, the territory of the World Nature Heritage.
These investigations are very important for understanding of many processes that occur in the East and Okhotsk Seas. The current that comes from the Strait of Tartary to the south not only considerably cools the coastal waters and affect the climate of the Central Sikhote-Alin but also contributes to the sea organisms moving including organisms of the ecosystems of the Reserve. The sea ecosystems are highly damaged by fishery, especially in aquatories of buffer zones and by polluting rivers and the sea. In the low watercourse of Serebryanka river sufficiently large Terney settlement is located. During periodic rising of river level and flooding in summer- autumn time the river takes out household rubbish which pollutes the sea and the sea coast throughout 20 km, including the Reserve areas.

**Box. Key species studied**

- Marine phytocenosis:
  - Laminaria phytocenoses (laminaria japonica)
  - Zoster (zostera asiatica)
  - Laminaria gurjanovae
- Marine invertebrates (inventory ongoing – by scientists both of the reserve and Institutes of Academy of Science)
  - Marine bivalve mollusks
  - Types
    - Cnidaria
    - Sipuncula
    - Annelida
    - Mollusca
    - Arthropoda
    - Echinodermata
    - Tunicata
- Marine ichthyofauna
  - Thermophilic fish species
- Seabirds
- Marine mammals
  - Harbor seal
  - Sea lions -

There are five main directions in scientific research of the Marine ecosystems:

1. Study of marine phytocenosis
2. Study of marine invertebrates
3. Study of marine ichthyofauna
4. Study of seabirds
5. Study of marine mammals

Study of marine phytocenosis

1978-1979 Fadeev V.I. conducted the first hydrobiological surveys of the phytocenoses of the marine area. The work was carried out using the diving quantitative method (Fadeev 1980). Laminaria phytocenoses (Laminaria japonica), growing mainly in capes at a depth of 2-15 meters, were studied. It is revealed that it occupies the largest bottom areas at a depth of up to 7 m. The “deep” kelp falls to depths of 15–18 m, is marked on pebbles and has a higher percentage of coverage (Fadeev, 1980). Zoster (Zostera asiatica) is marked on sandy bottoms of various sizes at

depths of 5–15 m. At a depth of 10 m, Zoster is found in separate spots up to 10 sq. M (80% coverage area) (Fadeev, 1980).

In 1998, Galanin D.A. Investigated the upper sublittoral zone and revealed Laminaria gurjanovae (20% coverage) and Laminaria japonica (70% coverage) at depths from 1 m to 3 m. In the "Kutovaya" part of the Convenient bottle in the horizon of the upper sublittoral and at depths from 2 to 5 m, the phytocenosis of Zostera asiatica with a design coating of 15–20% is expressed (Galanin, 2000).

In 2008 -2010 Yu.A.Galysheva carried out a sampling of hydrobiological samples from depths of 2.5–15 m. In the convenient and Golubichnaya bays. It is revealed that the biocenoses in the northern Primorye water area are distinguished by the smallest benthos variety (Shannon index up to 2.5), however, characterized by its maximum quantitative indicators (up to 30 kg / $m^2$ in the Laminaria japonica belt) (Galysheva, 2012).

The flora of marine plants includes 37 species from 3 Divisions: Green algae Division (4 species); Brown algae Division (17 species); Red algae Division (16 species). Inventory of marine flora is ongoing.

Study of marine invertebrates

The first summary list of species composition of bivalve mollusks, within the sea kilometer zone of the Sikhote-Alin nature reserve was obtained by E. Kolpakov. according to literary data (Fadeev, 1980; Lutaenko, 2003; Galanin, 2000; Kolpakov, Kolpakov, 2004) and according to his original materials (Kolpakov, 2006). The modern fauna of marine bivalve mollusks of the reserve includes 27 species belonging to 6 orders, 15 families and 25 genera.

In 2006-2008 an inventory of marine invertebrates in the reserve was conducted. As a result, the list of marine invertebrates in the marine area of the Sikhote-Alin Nature Reserve was supplemented with 31 new names of the following types: CNIDARIA, SIPUNCULA, ANNELIDA, MOLLUSCA, ARTHROPODA, ECHINODERMATA

At present, the fauna of marine invertebrates includes 59 species of 7 types:

- Cnidaria - 3 kinds (2 classes)
- Sipunculida - 1 species,
- Annelida - 20 species,
- Mollusc - 21 species (3 classes)
- Arthropoda - 3 species
- Echinodermata - 9 species
- Tunicata - 2 species

The inventory of the invertebrate fauna is ongoing.

Study of marine ichthyofauna

The first inventory of the ichthyofauna of the reserve was carried out in 1999. The annotated list included 64 species of fish from inland waters and the marine area of the reserve.

In the next years, due to the lack of an ichthyologist on the staff of the reserve, faunistic studies were conducted by employees of outside scientific organizations.

The taxonomic composition of marine fish species varies from year to year. It should also be borne in mind that during the summer period, thermophilicfish species can penetrate into the waters of the northern Primorye due to the closeness to the southern border of the Pacific boreal region.

Now 34 thermophilic fish species have been registered in the water area of the reserve. Total ichthyofauna of the reserve has 207 species (Table 4).

Table 4 Fish of the Sikhote-Alin Reserve

| **Class Petromyzontida** | |
|---|---|
| Order Petromyzontiformes – Family Petromyzontidae | 2 species |
| **Class Chondrichthyes** | |
| Order Lamniformes Family Lamnidae | 2 species |
| Order Carcharhiniformes – Family Sphyrnidae – | 1 species |
| Order Squaliformes Family Squalidae | 1 species |
| Order Rajiformes Family Rajidae | 1 species |
| **Class Actinopterygii** | |
| Order Acipenseriformes, Family Acipenseridae | 3 species |
| Order Clupeiformes, | |
| Family Engraulidae | 1 species |
| Family Clupeidae | 3 species |
| Order Cypriniformes | |
| Family Cyprinidae | 23 species |
| Family Cobitidae | 2 species |
| Family Nemacheilidae | 2 species |
| Order Osmeriformes | |
| Family Osmeridae | 3 species |
| Family Salangidae | 1 species |
| Order Salmoniformes | |
| Family Thymallidae | 2 species |
| Family Salmonidae | 12 species |
| Order Esociformes, Family Esocidae | 1 species |

| **Class Actinopterygii (cont)** | |
|---|---|
| Order Gasterosteiformes | |
| Family Hypoptychidae | 1 species |
| Family Gasterosteidae | 4 species |
| Order Syngnathiformes, Family Syngnathidae | 1 species |
| Order Scorpaeniformes | |
| Family Sebastidae | 5 species |
| Family Hexagrammidae | 4 species |
| Family Cottidae | 29 species |
| Family Hemitripteridae | 3 species |
| Family Psychrolutidae | 2 species |
| Family Agonidae | 12 species |
| Family Cyclopteridae | 4 species |
| Family Liparidae | 2 species |
| Order Perciformes | |
| Family Lateolabracidae | 1 species |
| Family Polyprionidae | 1 species |
| Family Coryphaenidae | 1 species |
| Family Echeneidae | 1 species |
| Family Carangidae | 3 species |
| Family Bathymasteridae | 1 species |
| Family Cryptocanthodidae | 1 species |
| Family Zoarcidae | 2 species |
| Family Stichaeidae | 14 species |
| Family Pholidae | 4 species |
| Family Anarhichadidae | 1 species |
| Family Trichodontidae | 1 species |
| Family Ammodytidae | 1 species |

| | |
|---|---|
| Order Gadiformes | |
| Family Gadidae | 3 species |
| Family Lotidae | 1 species |
| Order Lophiiformes, Family Lophiidae | 1 species |
| Order Mugiliformes, Family Mugilidae | 2 species |
| Order Beloniformes | |
| Family Exocoetidae | 1 species |
| Family Hemiramphidae | 1 species |
| Family Belonidae | 1 species |
| Family Scomberesocidae | 1 species |

| | |
|---|---|
| Family Gobiidae | 6 species |
| Family Trichiuridae | 1 species |
| Family Scombridae | 2 species |
| Family Centrolophidae | 1 species |
| Family Stromateidae | 3 species |
| Order Pleuronectiformes, Family Pleuronectidae | 18 species |
| Order Tetraodontiformes | |
| Family Monacanthidae | 1 species |
| Family Tetraodontidae | 4 species |
| Family Molidae | 1 species |

Constant faunistic study of the ichthyofauna of the reserve is an important part of scientific research, since the emergence of new, thermophilic fish species is one of the signs of global climate change and changes in the oceans.

Study of seabirds

Ornithological research is one of the main directions of scientific work in the reserve. Lagoon lakes in the coastal part of the reserve and the coastline are one of the key resting places along the migratory paths of migratory birds. Annual bird counts during spring and autumn migration allow tracking global changes in the world avifauna and distribution of birds.

Currently, the scientists of the Reserve are analyzing the results of accounting for the 1968-2018. (See Box for the list of seabirds in the Reserve).

**Box. List of seabirds of Sikhote-Alin Reserve:**

1. *Gavia stellata* (Pontoppidan, 1763). Red-throated Loon
2. *Gavia arctica* (Linnaeus, 1758). Black-throated Loon
3. *Gavia pacifica* (Lawrence, 1858). Pacific Loon
4. *Gavia adamsii* (G.Gray, 1859). Yellow-billed Loon
5. *Podiceps auritus* (Linnaeus, 1758). Horned Grebe
6. *Podiceps grisegena* (Boddaert, 1783). Red-necked Grebe
7. *Podiceps cristatus* (Linnaeus, 1758). Great Crested Grebe
8. *Fulmarus glacialis* (Linnaeus, 1761). Northern Fulmar
9. *Puffinus carneipes* Gould, 1844. Flesh-footed Shearwater
10. *Puffinus tenuirostris* (Temminck, 1836). Short-tailed Shearwater
11. *Phalacrocorax carbo* (Linnaeus, 1758). Great Cormorant
12. *Phalacrocorax capillatus* (Temminck et Schlegel, 1849). Japanese Cormorant
13. *Phalacrocorax pelagicus* Pallas, 1811. Pelagic Cormorant
14. *Aix galericulata* (Linnaeus, 1758). Mandarin Duck
15. *Clangula hyemalis* (Linnaeus, 1758). Long-tailed Duck
16. *Histrionicus histrionicus* (Linnaeus, 1758). Harlequin Duck
17. *Melanitta americana* (Swainson, 1832). Black Scoter
18. *Melanitta deglandi* (Bonaparte, 1850). White-winged Scoter
19. *Larus ridibundus* (Linnaeus, 1766). Black-

Study of marine mammals

The reserve staff register all meetings with marine mammals in the reserve marine area and buffer zone. This information is recorded in a special database. At present, among the marine mammals, representatives of the orders Predatory (3 species) and Cetacea (8 species).

The most common species of the kilometer preserved marine area ofthe reserve are the Harbour Seal - *Phocalargha* Pallas and the sea lions - *Eumetopiasjubatus* Schreber.

On the coast of the reserve there are 2 largest rookeries of the Harbour Seal. Seals registration surveys on rookeries are carried out constantly.

In accordance with legal documents, the Reserve does not have the right to interfere in the life of the forest and marine ecosystems of the Reserve. Therefore, the results of scientific research on the study of natural complexes of the reserve can only be used to prepare recommendations for improving the protection and conservation program of entire ecosystems or their components.

## 5.3 The Far-Eastern State Marine Biosphere Nature Reserve (FEMBR)

### General information

*Security zone*: 3 nautical miles around the sea, 500 meters around the land.

The FEMBR is located in the western part of the East/Japan Sea and occupies about 10% of the area of Peter the Great Bay, the southernmost and warmest waters of the Far Eastern seas of

Russia. The area of the reserve is 64,136.3 hectares, of which 63,000 hectares is water and 1,136.3 hectares is land consisting of islands, kekurs (sea stacks) and the island botanical garden on Popov island. The small islands of the reserve, comprising a total area of barely 1,000 hectares, show remarkable examples of plant community adaptations to specific marine conditions. As the first marine reserve in Russia, this area has natural coasts, islands and the shelf of Peter the Great Bay, which is the richest in terms of biological diversity of Russia's coastal waters. It is home to over 5,000 species of plants and animals. Almost all species of algae, invertebrates and fishes of Peter the Great Bay inhabit the Reserve, two-third of vascular plants of Primorye are concentrated on its islands, and almost all conserved and rare species are among them. Marine Reserve, its area and the adjacent Khasan natural park, are situated on a crossing of spring-autumn migrations of birds (Siberia-Japan and Arctic-China). That's why about 360 bird species can be observed here, and the rarest species of the world ornithofauna among them. 18 of 19 Larga seal breeding-ground of Peter the Great Bay are located in the Reserve. Almost all landscapes of the South Primorye are accumulated in the Reserve: subtropical forests, bogs and steppes; mountains, warm sandy bay, sand cold depths of the Sea of Japan, streams, rivers, lakes and lagoons.

The nature reserve consists of 4 different sites - clusters with different function ():

- Eastern marine cluster (marked as No.2 in Figure 4) is situated in Rimsky-Korsakov Islands and bights (Figure 5). The marine protected area is 45,000 ha, and the area of islands including Stenin Island is 900 ha. Eastern cluster, including the islands, is a strictly protected area, where any kinds of human activities not allowed.

- Southern marine cluster (No.4) is situated on the western coast of Possiet Bay and includes Vera and Falshivy islands. The marine protected area is 15,000 ha (Figure 6). The estimated area of the islands is less than 200 ha. Southern cluster is the research zone, where scientific research info conversation and rehabilitation of natural ecosystems is performed, and educational excursions are allowed.

- Western marine cluster (No. 3) has the marine protected area is 3,000 ha (Figure 6). This marine cluster is the research zone, where scientific research info conversation and rehabilitation of natural ecosystems is performed, and educational excursions are allowed.

- Northern cluster (No.1) has no marine part. It includes a land plot on Popov island 216,3 ha (Figure 7). The Northern cluster, like the whole of Popov Island, is located within the city of Vladivostok is open to visitors and is meant for environmental education. Here the Museum «Marine nature and its conservation», Botanical Gardens, Ecological Education Center, ancient village and the ecological trails are located, which attract numerous visitors.

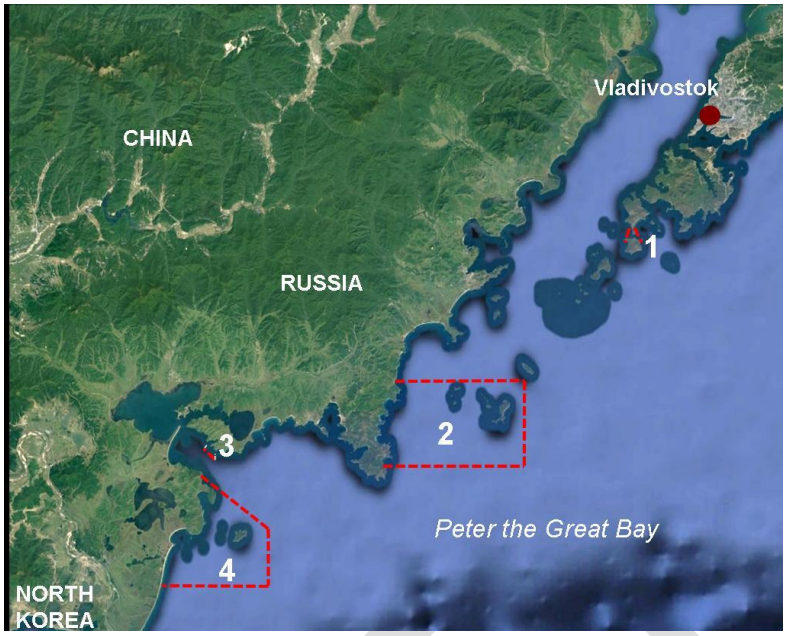


Figure 4 Map of FEMBR including 4 different clusters: 1- Northern cluster, 2 – Eastern marine cluster, 3- Western marine cluster, 4 – Southern marine clusters.

Table 5 Summary of the FEMBR clusters

| | Eastern marine cluster | Southern marine cluster | Western marine cluster | Northern cluster |
|---|---|---|---|---|
| Marine protected areas | 45,000 ha + 900 ha (islands) | 15,000 ha + 200 ha (islands) | 3000 ha | No marine part& 216.3 ha (land and islands) |
| Restrictions | Strictly protected area | Research zone | Research zone | Educational / excursion zone |
| Human activities | | Research and rehabilitation of natural ecosystem, Educational excursion | Research and rehabilitation of natural ecosystem, Educational excursion | Open to visitors Environmental education |
| Key ecological features | No | No | No | No |

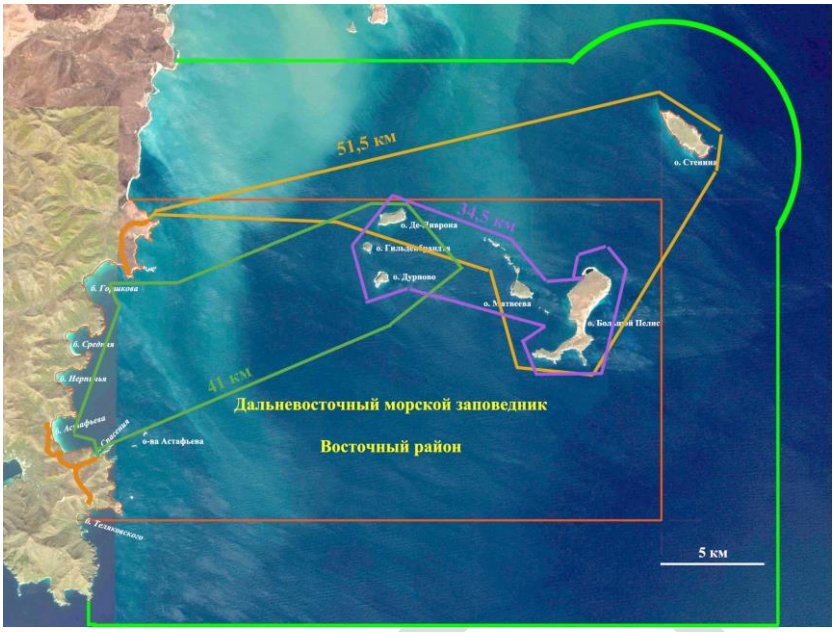


Figure 5 Eastern and western marine clusters: the boundary of the FEMBR (red line), the boundary of the security zone (bright green line), patrol routes – (orange, purple, brown, dark green lines).


Figure 6 Southern and Western marine clusters of the Eastern marine cluster: the boundary of the FEMBR (red line), the boundary of the security zone (bright green line), patrol routes – (orange, purple, brown, dark green lines).

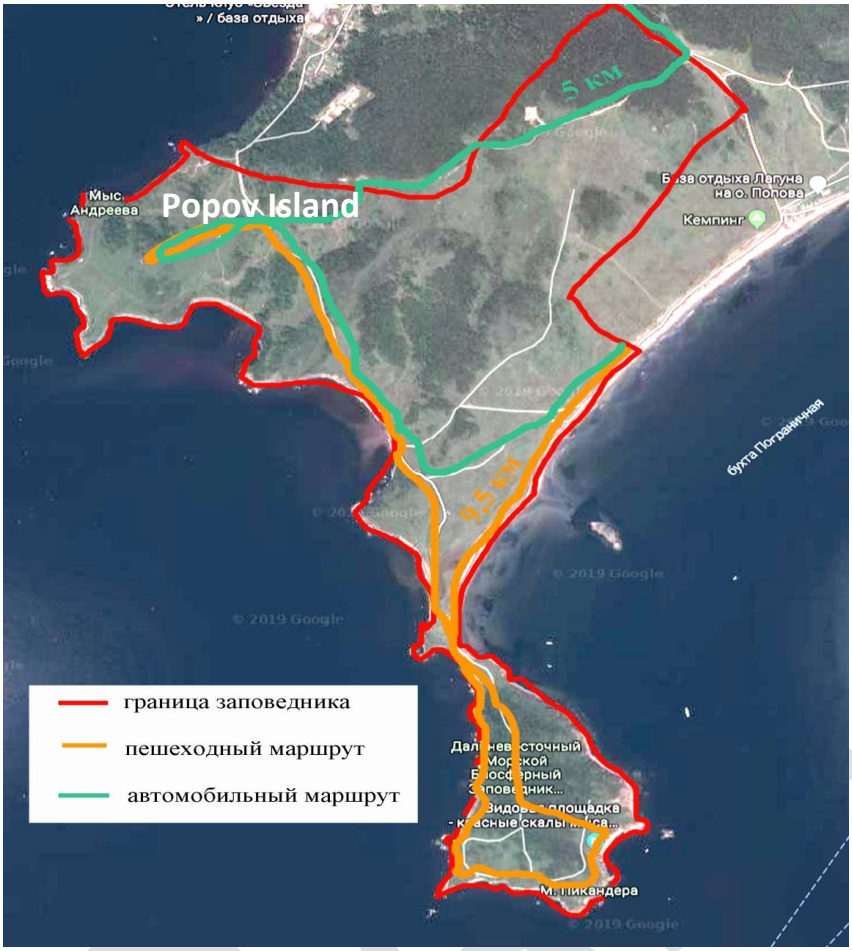


Figure 7 Northern clusters: the boundary of the FEMBR reserve (red line), pedestrian routes (orange line), car routes (green line).

### *Structural units*

Far-Eastern State Marine Biosphere Nature Reserve (FEMBR) is a Branch of the Federal State Budgetary Institution of Science " *AV Zhirmunsky*National Scientific Center of Marine Biology Far Eastern Branch of the Russian Academy of Sciences (NSCMB FEB RAS). This area was taken for conservation in 1978 by the initiative of the Institute of Marine Biology FEB RAS.

Structural units of FEMBR (on April, 2019) (Figure 8) : Branch Manager (Director); Deputy director of the branch in the field of environmental protection; Deputy director for General Affairs; Deputy director of the branch for educational tourism and environmental education; Deputy director of Development; Branch Chief Accountant; Branch Specialist.
Administrative and managerial staff - 11 people: implementation of general management:

1. Department of security -38 people - organization of protection and interaction with related structures, work with the local population, conducting internal control.

2. Department of sciences (Laboratory for the study of biological diversity and monitoring of protected areas) - 5 people - conducting an inventory and monitoring of the fauna and flora of the reserve.

3. Department of educational tourism and environmental education - 8 people - organization and development of tourism, promotion of tourism products of the reserve to the tourist services market, organization of environmental education activities, organization of environmental education activities of the Museum “Nature of the Sea and its Protection” and the Center for Environmental Education.

4. Department for the maintenance - 9 people - provision of fuel and lubricants, building materials, organization of supplies for all departments, repair of buildings and structures. Separate unit on the Popov Island of 8 people. - ensuring the maintenance of buildings and structures.

*Affiliation:* since 1978 –Russian Academy of Sciences, since 2018-now- Ministry of Science and Higher Education.

In accordance with the Federal Law 33 "Specially Protected Natural Territories” the main objective of the activity of FEMBR is conducting research and educational activities as well to preserve the natural environment of the richest in composition island and marine fauna and flora of Peter the Great Bay of the Sea of Japan.

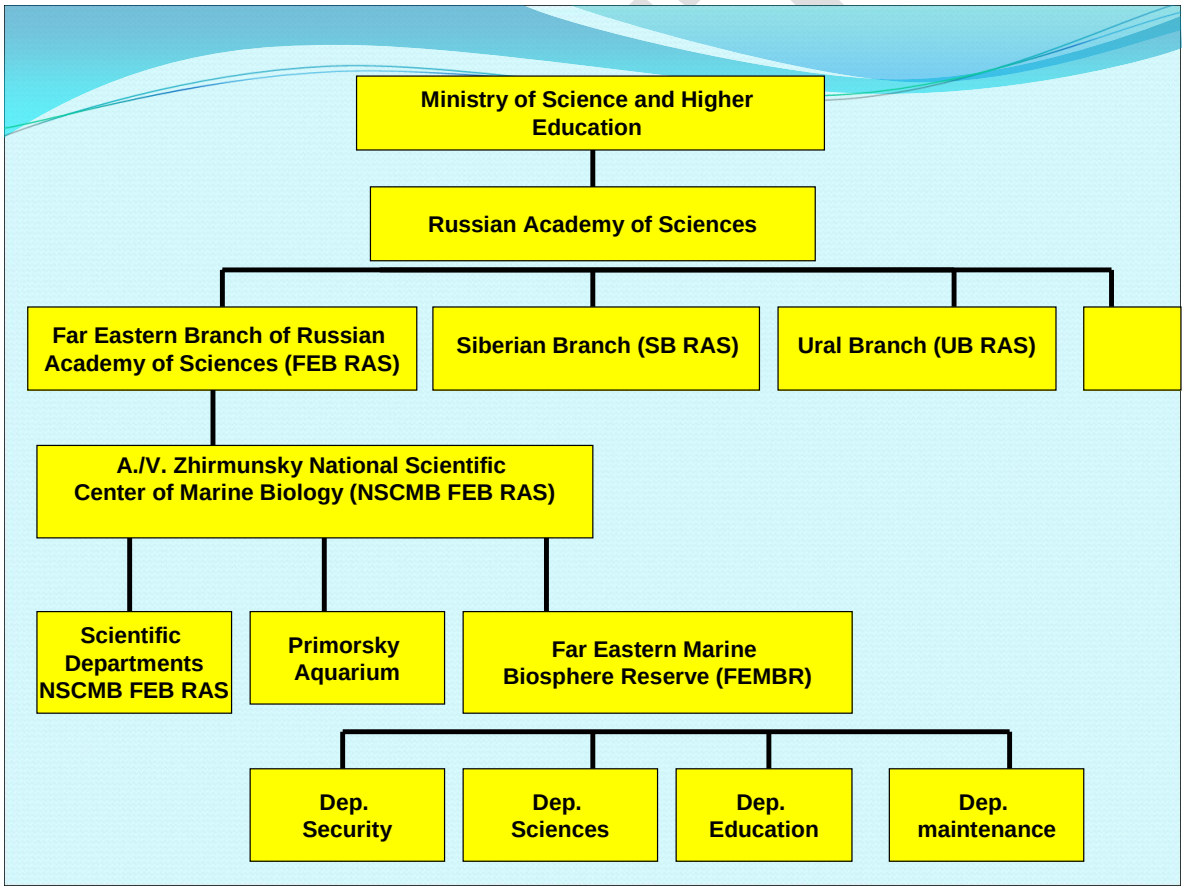


Figure 8 Institutional structure of the FEMBR.

### *Strategic area of activity:*

Aim of FEMBR: conservation of natural complexes and valuable natural objects. The purpose of the reserve is to preserve for future generations the gene pool of animals and plants of the Peter the Great Bay . The main directions of scientific activity are study and mapping of deep sea and terrestrial communities; inventory of species and landscape diversity, monitoring and assessment of the impact of anthropogenic and natural

factors on biota; study of the biology of rare and endangered species. An inventory of the fauna and flora of the reserve has been carried out. Within the framework of the program "Biodiversity of the World Ocean: composition and distribution of biota," monitoring and research of biological diversity of flora and fauna is carried out. Modern technologies which aid in accounting for marine biological resources and monitoring of natural populations of especially valuable commercial hydrobionts are being developed.

***Relationship to the national strategy, basic plans and laws***

On State Strategy of the Russian Federation on the Environmental Protection and Sustainable Development on Specifically Protected Natural Territories; National Strategy and Workplan on Conservation of Biodiversity.

## Monitoring and assessment of the current status ofFEMBR

***Biological parameters:***

- "Chronicle of nature" - the inventory of the fauna and flora of the FEMBR;
- Study of biological diversity and monitoring of protected areas.

Active research of the FEMBR biota was started in 1978. The main topic of scientific research in 1981-1985, was an inventory of marine and island ecosystems of the Far Eastern State Marine Reserve. During this period, a description of the flora of the islands of the reserve (Biological and Soil Institute of the Far Eastern Scientific Center) of the Academy of Sciences of the USSR was carried out by G.E. Kurentsova, Gorovoy P.G. (Pacific Institute of Bioorganic Chemistry, Far Eastern Scientific Center, Seledets VP (Pacific Institute of Geography, Far Eastern Scientific Center, USSR Academy of Sciences). During this period, birds of the FEBMR were studied by ornithologists of the Biological and Soil Institute of the Far Eastern Scientific Center of the USSR Academy of Sciences Litvinenko N.M., Nechaev V.A., Shibaev Yu. V., Far Eastern State University (FESU) Nazarov Yu.N. Amphibians, reptiles, and mammals of the Reserve's islands were studied by Yu.D. Chugunov. Bottom communities of the FEMBR were studied under the supervision of O.A. Skarlato and A.N. Golikov from the Zoological Institute of the USSR Academy of Sciences. Sea belly s, phytoplankton, algae were studied by the Institute of Marine Biology, Far Eastern Scientific Center of the USSR. In the 90s continued extensive research of biota of the FEMBR. The results of 25 years of study of the flora and fauna FEMBR were presented in the Three Catalogues (Kussakin O.G., A.V. Adrianov, Tyurin S.A.), Two monographs "Far-Eastern Marine Biospherical reserve". Biota. (Eds. A.N. Tyurin, A.V. Drozdov). Vladivostok: Dalnauka, 2004, 848 p. Here 66 authors present both original works and lists compiled on the basis of data from literature. More than 5000 species are included in the list: marine biota is represented by 32 phyla, island and freshwater biota is represented by 26 phyla. Annotated list and charts with indication of organisms sampling locations form a basis for future monitoring of the Reserve biota and large-scale biomapping.

In accordance with the Plan of research works of the Far Eastern Marine Biosphere State Nature Reserve, Far East RAS for 2014-2017, approved on December 24, 2014 by the FASO Russia within the framework of the program "Biodiversity of the World Ocean: composition and distribution of biota" State registration №115081110047, FASO 0268-2014-0014, on the topic No. 0273-2014-0001 "Monitoring and research of biological diversity of the Far Eastern marine biosphere Reserve Far East RAS" the biota of the reserve is being investigated.

Since 2014 FEMBR and the Presidium of the Far Eastern Branch of the Russian Academy of Sciences are the founders of the Journal "Biota and the environment of protected areas" (Figure 6). The journal publishes articles on a wide range of issues related to protected natural areas, but based on scientific research on the biota and environment of the FEMBR. All data available on: http://biota-environ.com/ *( Notes: the journal publishes the results of natural science, humanitarian and interdisciplinary, fundamental and applied, experimental and theoretical studies of natural objects and organisms of specially protected territories and water areas (protected areas) of any categories, values and sizes. All submitted materials are reviewed and edited. The scientific specialization of the journal monitoring of the biological diversity of protected areas; biology, zoology, ethology, ecology, biogeography of individual species, populations and communities of invertebrates and vertebrates of protected areas; botany, algology, mycology; ecology of plants and fungi of protected areas; rare, relic, endemic plants and animals; species included in the Red Books of the International Union for the Conservation of Nature and Natural Resources.; history and problems of nature conservation in regions and individual protected areas; archaeological sites, petroglyphs; ethnographic research; toponymy; biographies of researchers of protected areas; justification for the creation of protected areas.)*

***Accomplished results:***

1. Scientific researches providing long-term preservation of social-ecological systems are carried out. Technologies for monitoring and rational use of marine biological resources were developed in the direction "Modern technologies for accounting for marine biological resources and monitoring of natural populations of especially valuable commercial hydrobionts of the Far Eastern Marine Biosphere State Nature Reserve".

2. Partnerships with educational and research institutions of the region are established and operate now with FEFU UNESCO Chair in Marine Ecology, Pacific Institute of Geography FEB RAS, and Pacific Oceanological Institute FEB RAS. Within the framework of the agreement between the Russian Science Foundation and the FEFU, a grant was received for the implementation in 2014-2018 of a comprehensive scientific program "Technologies for monitoring and rational use of marine biological resources" "Modern technologies for accounting for marine biological resources and monitoring of natural populations of particularly valuable commercial hydrobionts."

3. An agreement on scientific and technical cooperation with the Pacific Institute of Geography of the Far Eastern Branch of the Russian Academy of Sciences has been signed in the field of joint research programs on the study of the spatial structure of terrestrial landscapes and their dynamics in the coastal and insular parts of the reserve.

- The distribution of mass species of hydrobionts in the water area of the Southern and Eastern sections of the reserve is shown.
- Natural populations of particularly valuable commercial hydrobionts: trepang (*Apostichopus japonicus)*, giant octopus (*Enteroctopus dofleini),* Kamchatka crab (*Paralithodes camtschaticus* ) and scallop (*Mizuhopecten yessoensis)* ;
- Monitoring of the local population of largae (Spotted seal, *Phocalarga*) in the FEMBR water area. 98% of larga population reproduces their offspring on the islands of the reserve.
- Mapping of underwater landscapes using remote sensing;
- Determination of the species composition of pinnipeds and cetaceans occurring within the boundaries of the Far Eastern Marine Biosphere State Nature Reserve.
- Researches of macrobenthos communities.
- New results on the penetration of alien species of hydrobionts - *Modiolus nipponicus* and *Fistulobalanus kondakovi* - into the waters of FEMBR.
- Data of macrobenthos` monitoring communities;
- The life forms of the East Asian species of the genus Nabalus (Asteraceae) are described;

- Mass emissions of the Japanese anchovy in the northwest of the East/Japan Sea and south-west of the Sea of Okhotsk were studied;
- Macrobiosis of the seaside scallop, Swift scallop and Japanese scallop was described;
- Species composition of pinnipeds and cetaceans, found within the boundaries of FEMBR were determined.
- Heavy metals in brown algae-macrophytes in the area of FEMBR was detected.

*Plants*

The small islands of the reserve, comprising a total area of barely 1000 hectares, show remarkable examples of plant community adaptations to specific marine conditions.A total of 880 species of plants have been recorded on the islands, 62 of which are classified as Specially Protected Species and are included in the Red Data Book of the Russian Federation with various ranks. Among them are Lilium cernuum and Lilium lancifolium, Japanese orchid (Pogonia japonica), Solanum megacarpum, fern Straits (Botrychium strictum), pyrrosia (Pyrrosiapetiolosa), iron birch (Betula schmidtii), and sweet oak (Quercus dentata). Fourteen species, including raspberry (Rubuspungens), maiden grape (Parthenocissustricuspidata), Limonium tetragonum, and veronicoides, are protected only in the Far Eastern Marine Biosphere Reserve.Western Pacific endemic species make up 2% of the total number of native species in the reserve. These include Vorobyov'sfestuca (Festuca vorobievii), Helen's hierochloe (Hierochloëhelenae), Poazhirmunskii bluegrass, Gordejevii clover (Trifoliumgordejevii), Kitagawialitoralis and others. The sea terraces and gently sloping coasts of the reserve are covered with Rosa rugosa and Rhododendron schlippenbachii. Narrow ledges of the capes are entirely crowned by the majestic tall-flowered pine (Pinus densiflora).

*Birds*

Small rocky islands give shelter to thousands of birds. 188 species of birds (nesting, colonial, and migratory) can be observed directly in the reserve. The islands are home to the world's largest population of nested black-tailed gulls (Larus crassirostris) and Ussuri cormorants (Phalacrocorax capillatus). In the lagoon near Cape OstrovokFalshivi, about 100,000 birds gather each year, including waders, ducks, geese, herons, and storks. In total, the reserve has 28 species of birds included in the Red Book of the International Union for Conservation ofNature and of Russia. Among these are the deadlock-rhinoceros (Cerorhinca monocerata), falcon-peregrine (Falco peregrinus), small sturgeon (Oceanodroma monorhis), streaked shearwater (Calonectrisleucomelas), and grasshopper warbler (Locustellapleskei). On theisland of Furugelma, the rare small spoonbill (Platalea minor) and yellow-eared heron (Egrettaeulophotes) have recently begun nesting.The richness of the underwater world of the reserve is attributed to natural phenomena.

*Aquatic creatures*

The water surface and the deep sea of the reserve are inhabited by more than 1600 species of multicellular plants and animals, made up of boreal, subtropical, and arctic species, including 200 species of fish, 450 species of crustaceans, 30 species of echinoderms and more than 200 species of mollusks. The reserve contains wide representation of mollusks or soft-bodied animals, 7 species of which are listed in the Red Book of Russia.Cephalopod mollusks in the reserve include not only typical inhabitants of the cold Far Eastern seas, but also thermophilic marine animals. The most unusual of these are octopuses. Less known species include cuttlefish, which are representatives of subtropical waters.The Far Eastern trepang (Apostichopus japonicus) is on the verge of extinction, and is a specially protected echinoderm resident at the reserve. Trepang is famous for its pharmacological properties. Especially attractive are the island rookeries of the seal (Phoca largha), for which the reserve has become the only place where these charming animals reproduce and nurture their offspring without fear.

***Data availability:***

The main topic of scientific research is an inventory of marine and island ecosystems of the Far Eastern State Marine Reserve. The results of 30 years of study of the flora and fauna FEMBR were presented in the three Catalogues (Kussakin O.G., A.V. Adrianov, Tyurin S.A.) and two monographs "Far-Eastern Marine Biospherical reserve". Biota. (Eds. A.N. Tyurin, A.V. Drozdov). Vladivostok: Dalnauka, 2004, 848 p. Here 66 authors were present both original works and lists compiled on the basis of data from literature. More than 5000 species are included in the list: marine biota is represented by 32 phyla, island and freshwater biota is represented by 26 phyla (*Table 6*). Annotated list and charts with indication of organisms sampling locations form a basis for future monitoring of the Reserve biota and large-scale biomapping.


Figure 9 . Journal "Biota and the environment of protected areas" founded by FEMBR

Since 2014 FEMBR and the Presidium of the Far Eastern Branch of the Russian Academy of Sciences are the founders of the Journal "Biota and the environment of protected areas" (
Figure 9). The journal publishes articles on a wide range of issues related to protected natural areas but based on scientific research on the biota and environment of the FEMBR.

Table 6. The results of the chronicles and biota census of the FEMBR (38 types from 6 kingdoms, 5649 species were described)

| Regnum | Phylum | # Species |
|---|---|---|
| Animalia | Annelida | 248 |
| | Arthropoda | 825 |
| | Brachiopoda | 1 |
| | Bryozoa | 16 |
| | Cephalorhyncha | 1 |
| | Chaetognatha | 5 |
| | Chordata | 528 |
| | Cnidaria | 41 |
| | Ctenophora | 4 |
| | Echinodermata | 38 |
| | Mollusca | 340 |
| | Nematoda | 121 |
| | Nemertea | 22 |
| | Phoronida | 2 |
| | Platyhelminthes | 12 |
| | Porifera | 3 |
| | Rotifera | 14 |
| Chromista | Bacillariophyta | 522 |
| | Cercozoa | 1 |
| | Cryptophyta | 11 |
| | Foraminifera | 78 |
| | Haptophyta | 1 |
| | Myzozoa | 151 |
| | Ochrophyta | 163 |
| Fungi | Ascomycota | 466 |
| | Basidiomycota | 66 |
| Plantae | Bryophyta | 76 |
| | Charophyta | 212 |
| | Chlorophyta | 314 |
| | Glaucophyta | 1 |
| | Marchantiophyta | 45 |
| | Rhodophyta | 81 |
| | Tracheophyta | 904 |
| Protozoa | Euglenozoa | 109 |
| Eubacteria | Cyanobacteria | 217 |

| | | | | | |
|---|---|---|---|---|---|
| | Sipuncula | **3** | | | |
| | Tardigrada | 1 | | **Total** | **5649** |
| | Xenacoelomorpha | 6 | | | |

*References (significant contribution) (see reference list 5.3_1):*

## Main activities and issues/threats

The purpose of the reserve is to preserve for future generations the gene pool of animals and plants of the Peter the Great Bay of the Sea of Japan. The main directions of scientific activity are study and mapping of deep sea and terrestrial communities; inventory of species and landscape diversity ; study of the biology of rare and endangered species. An inventory of the fauna and flora of the reserve has been carried out. Within the framework of the program "Biodiversity of the World Ocean: composition and distribution of biota (2014-2017)" research of biological diversity of flora and fauna is carried out. Modern technologies which aid in accounting for marine biological resources and monitoring of natural populations of especially valuable commercial hydrobionts are being developed.

*Monitoring of macrobenthos communities (Southern and Western parts)*: Studies of macrobenthos communities are carried out in the western part of the Far Eastern Marine Reserve during summer 2014 and 2015 . The results of remote monitoring studies of the benthos of this region were summarized and analyzed; results show that on five base sections, noted a decrease in the biocenotic role of macrophytes. (see reference list 5.3_2)

*Studies of epifauna – assessment of the state of trepang (Southern and Eastern section* (except islands): The epifauna of macrobenthos of the FEMBR was studied using a remote-controlled underwater vehicle. The present state of settlements of Far Eastern trepang *(Apostichopus japonicus*) in the Far Eastern Marine Reserve was studied during summer 2014. As a result of the studies, it was shown that the density of trepang settlements near the mainland coast is higher than in the pristine water areas of the reserve (4 times in the Southern section and 2.5 times in the Eastern section). Seasonal movements of trepang are noted: in autumn, large specimens migrate to depth, and in early summer to shallow water. At present, the average size of individuals and the density of trepang settlements in the reserve do not differ from indicators in the unguarded waters of the Peter the Great Bay. In the period of maximum settlement density, the population of trepang in the reserve reaches 600 thousand, which is 8% of its population in the Peter the Great Bay in the early 2000s. (see reference list 5.3_3)

*Studies on coastal scallop (Southern section)*: Using underwater control apparatus, the distribution of the coastal scallop (*Mizuhopecten yessoensis*) was studied in the water of the Southern section of the Far Eastern Marine Reserve (2014-2017). It was shown that one-quarter of the seaside scallops in Peter the Great Bay are concentrated in this site. (see reference list 5.3_4)

*Monitoring of coastal fish biotope (Southern part):* Monitoring of coastal biotope fish in the southern part FEMBR is being carried out. The study of the distribution of fish and their density records, conducted in 2012 and 2014 in Furugelma Island, as well as in the bays of Sivuchya, Kalevala and Pemzova in 2014, revealed a decrease in species diversity, density and biomass compared to the mid-1990s. The decrease in the species diversity of fish is explained by the partial degradation of biotopes (disappearance of the *Zostera marina*) and a slight increase in the period of high water temperatures, which prevents the approach of some cold-water fish to shallow coastal waters. (see reference list 5.3_5)

*Survey of sea birds population*:

Counts are conducted to ascertain the number of seabirds, migratory, and nesting birds in the Far Eastern Marine Reserve in 2014. New data have been obtained on the penetration of alien species of aquatic organisms into the waters of the Reserve. (see reference list 5.3_6)

*Protection and inspection*:

On the territory of the reserve there are 8 cordons of protection, with 38 state inspectors who have access to motorboats. Two of these cordons include video surveillance. Main violations of the protected regime include poaching of valuable sea animals: trepang (*Apostichopus japonicus*), seaside scallop (*Mizuhopecten yessoensis*) and Kamchatka crab *(Paralithodes camtschaticus*). No any information exchange between scientific studies and inspectors about the situation of the species available.

### *Socio-economic parameters*

No any official information on the economic activities affecting the ecology of the FEMBR can be provided.

*Educational facilities in FEMBR*:

With the purpose of environmental education of the local people and the promotion of environmental knowledge in the reserve, a museum called "Nature of the Sea and Its Protection" was established in 2007. The area of the museum is 240 square meters. It has eight rooms and an aquarium room. The halls of the museum exhibit the history of the reserve and of Far Eastern marine science, and show the inhabitants of Peter the Great Bay in the Sea of Japan, which represents one of the world's richest ocean ecosystems: coral reefs, fishing industry, and marine culture. Particular attention is paid to protected plant and animal species which reside in the Far Eastern Marine Biosphere Reserve. The museum includes an archaeological and ethnographic complex under the open sky, which recreates the residential, economic and ritual buildings of the ancient indigenous peoples of Primorye. The design and interior of the Early Iron Age are made in the traditions of the Kronun culture. In the ethnographic zone, the life of hunters and fishermen of the 19th century is presented: a pile barn, a funerary house and attributes of a shaman. The wise attitude of ancient people towards nature is shown. The Center for Environmental Education of the Population was established in the reserve. Master classes, lectures, seminars for teachers, and excursions on natural routes are organized. The Center for Environmental Education can be visited for several days at a time; the Center includes living accommodations, a dining room, and a study room. Local residents are invited to work in the museum and the Center for Environmental Education. They can also arrange meals for visitors.

*Environmental education / engagement of local community*:

In order to spread knowledge about biological diversity and the need to preserve it, the Far Eastern Marine Biosphere Reserve establishes alliances with local organizations, international foundations, and cultural and scientific organizations at local and regional levels. With these public organizations, the BR raises funds, engages in environmental actions, and holds festivals and rallies. The reserve works with libraries, museums, the institute of teacher training, and settlement administrations. In the reserve, within the framework of sustainable technologies, educational excursion routes are successfully conducted. These routes are provided by tourist companies with which the reserve contracts. Local residents are attracted to work to serve tourists. They provide the transport component of all tours, provide food, and accompany tourists on the route. Special training is conducted for local residents who are willing to conduct excursions inside the reserve. Students of the Far Eastern Federal University carry out practical studies inside the reserve. Employees of the reserve deliver reports at international conferences and forums.

*Participation in international projects:*

In addition, they take part in international projects, such as:«Assessment of the effectiveness of management of marine protected areas» by IUCN, WWF, NOAA;«Economic development of the TUMANNA TREDA area» (Tumen River Economic Development Area) by UNDP;«Establishment of a transboundary PA system in the area of the Tumen River and the adjacent water area and territory» by UNDP; «Strengthening Marine and Coastal Protected Areas of the Russian Federation» by UNDP / GEF / Ministry of Natural Resources of Russia Future vision. More details on: http://www.imb.dvo.ru/index.php/ru/mezhdunarodnoe-sotrudnichestvo

:https://morskoyzapovednik.ru

*Activities undertaken by the Reserve:*

Together with public organizations, funds, cultural institutions in the reserve during the reporting period, the following activities were carried out during (2014-2017):

- Environmental action "For Clean Coast" 64 volunteers;
- Festivals (amount of 3) Coverage of the population - 580 people.
- Schoolchildren jamboree- 60 people;
- Regional meeting of teachers of pre-school educational organizations. - 300 people.
- Family quest for the museum 120 people.
- Workshop on hydrobiology for middle school students - 30 people.
- Master class for schoolchildren - 18 people.
- Hazardous lessons in the schools of the Khasansky district ". - 1200 people.

*Accomplished results (available for 2014-2017):*

2372 people took part in the events. At the local and regional levels, alliances have been established with public organizations, international foundations, educational, cultural and scientific organizations to promote knowledge of biological diversity and the need to preserve it.

Within the framework of green sustainable technologies, a number of excursion routes successfully are operated in the reserve. Some of the routes were taken outside the reserve. It makes possible to develop tourism without increasing the burden on the nature reserves of the reserve. In addition, a museum and an open-air archaeological and ethnographic complex are open for tourists to visit. Also, one can meet the animal world of the sea in the aquarium.

The tourism infrastructure is represented by the Center for Environmental Education (Popov Island), with accommodation for 60 beds, rooms for classes (seminars) and mass events, 2 dining rooms, a medical center. The total number of tourists who visited these routes in 2017 is 5 620 people.

The reserve became the winner in the nomination "Leaders of the Tourist Industry of Primorye in 2016" and "Leaders of the Tourist Industry of Primorye in 2017".

Excursion services of the reserve are certified by the Russian National Standard GOST R Certification System. A certificate of conformity has been obtained for "Accommodation facility services. Furnished rooms" GOST R certification system. Local residents are attracted to work to service tourists. They provide the transport component of all tours, meals.

Efficiency indicator of this activity is the routes of the reserve are included in the guest route along the Khasansky district of the All-Russian Forum of Tour Operators "Pacific Breeze". Department of Tourism Primorsky Krai gave a free site to the reserve on the IV Pacific Tourism Forum.

Under the agreement with FEFU, the students of the faculty of service and tourism are involved in assessing the presentation of the reserve in social networks. Prospects of tourist products of the reserve` promotion are studied. (Notes: no official information on the contribution of the tourism in the FEMBR for economy of the local community available). (see reference list 5.3_7)

*Environmental parameters:*

Monitoring of environmental parameters in the reserve is not conducted. State of the environment in the FEMBR is estimated taking into account the data of the automatic meteorological station of the Primgidromet located on the Furugelm Island in the southern section of FEMBR. The station measures the direction and speed of wind, precipitation, atmospheric pressure and air temperature. Primorsky Hydrometeorology and Environmental Monitoring Department (Primgidromet) is part of the Federal Service for Hydrometeorology and Environmental Monitoring. Primgidromet carries out its activities in accordance with Article 69 of the Federal Law "On Environmental Protection" and Resolution "On Approval of the Regulation on public service is monitoring the state of the environment" from August 23, 2000 N 622. *http://www.primgidromet.ru/* (Note: no information regarding plan for for monitoring of environmental parameters.)

## 5.3 Environmental monitoring in Russian part of NEAMPAN.

Monitoring of environmental parameters on territories of reserves is not conducted. Only in FEMBR is automatic meteorological station of the Primgidromet located on the Furugelm Island in the southern section of FEMBR. Environmental monitoring has a wider scope, since it also includes monitoring of ecosystems and species.

MPA conduct research on monitoring species and ecosystems, but not routine environmental monitoring. Which is performed by ROSKOMHYDROMET at its stations. As mentioned above, until the 90s ROSKOMHYDROMET monitored the environmental parameters at biosphere pickets inside the protected areas, but now only at stations near the MPA.ROSKOMHYDROMET conducts standard monitoring at its stations according to parameters and methods approved by the state, and the MPA uses the results for their own purposes.

The data from the nearest stations of the Primgidromet are used to assess the state of ecosystems in nature reserves and determine the impact on them. Primorsky Hydrometeorology and Environmental Monitoring Department (Primgidromet) is part of the Federal Service for Hydrometeorology and Environmental Monitoring. Primgidromet carries out its activities in accordance with Article 69 of the Federal Law "On Environmental Protection" and Resolution "On Approval of the Regulation on public service monitoring the state of the environment" from August 23, 2000 N 622. *http://www.primgidromet.ru/*

Environmental monitoring in reserves is usually carry out at network stations at the Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET) (Table 7). In Primorsky Kray, monitoring of contamination of air, inland waters, soil and marine environment is implemented by Primorsky

Territorial Office on Hydrometeorology and Environmental Monitoring.

In the Sikhote Alins Reserve, the station is located almost in the center of the reserve in the Terney settlement, and for the FEMBZ the station is located more than 50 km south of it.

Table 7. Structure of programs of environmental monitoring network

| Environment | Number of items | Periodicity of observations | Controlled parameters |
|---|---|---|---|
| Atmospheric air | 12 | At 3 terms Daily | NO, $NO_2$, CO, $CO_2$, $SO_2$, $H_2S$, Dust, $SO_4$=, $NH_3$, HCl, $CH_2O$, $C_6H_5OH$, Heavy metals, benz (a) pyrene |
| Atmospheric precipitation and snow cover | 22 | Monthly and seasonal | Specific electro conductivity, pH, $SO_4^{=}$, $NO_3^{-}$, $NH_4^{+}$, $Cl^{-}$, $HCO_3^{-}$, $Na^{+}$, $K^{+}$, $Ca^{++}$, $Mg^{++}$, Zn |
| Surface water | 34 | Every 10 days, Monthly Seasonal | Gas composition, main ions, N, P, K, $O_2$, phenols, oils, pesticides, detergents, heavy metals, fluorides, boron, hydrogen sulfide, |
| Sea water and sediments | 37 | Every 10 days, Monthly Seasonal | Oxygen, N, P, K, phenols, oils, pesticides, detergents, heavy metals, Phyto-zoo-plankton, |
| Marine hydrobionts stations | 39 | Seasonal | Phyto-zoo-plankton, bentos |
| Freshwater hydrobionts points | 29 | Seasonal | Phyto-zoo-plankton, bentos |
| Soils | 15 | Seasonal | Pesticides, heavy metals, pH, fluorides, benz (a) pyrene |
| Radioactive contamination of environment | 33 | Daily | radionuclide composition of atmospheric fallouts, sea and river water, sediments and soils |

Ecological monitoring in Russian ROSHYDROMET network is realize on directions:

- atmospheric air, atmospheric precipitation and snow cover;
- sea and surface water on hydrochemical and hydrobiological factors;
- sediments;
- soils;
- radioactive contamination of all objects of ecosystems.

## Monitoring atmosphere pollution

National programmes provide for monitoring of atmospheric pollution in the cities of Far East of Russia and chemical composition of precipitation in the region being carried out by the Federal Service of Russia on Hydrometeorology and Environmental Monitoring (ROSHYDROMET) (Table 8, Table 9).

Monitoring of atmospheric pollution is mainly performed on stationary sites situated in residential areas near highways and large industrial facilities, and in some towns it is carried out under plumes of industrial emissions.

The main station for Far Eastern State Marine Biosphere Reserve is Posyet (years of observation 1947-2019), the main station for the **Sikhote-Alin Biosphere Reserve** of the MNRE of Russia is Terney.

Observers of all national network stations except Terney station sample gross monthly precipitation. Precipitations sampled within a month are poured into a glass container and placed in a refrigerator. In the beginning of next month the sample is transferred to the chemistry laboratory of Center for Monitoring and

Pollution Control of Primorsky administration of ROSHYDROMET.

Terney station samples are also poured into a glass container but the sampling period is only 7 days. The weekly samples are then transferred to the chemical laboratory.

Table 8 Sample analysis methods

(A) Precipitation and snow cover composition

| ***Components*** | ***Methods*** |
|---|---|
| ***$NO_3$, $NH_4$*** | ***Spectrophotometry*** |
| ***Na, K, Ca, Mg*** | ***Flame spectrophotometry*** |
| ***pH*** | ***Potentiometric*** |
| ***Conductivity*** | ***Conductometer*** |
| ***$SO_4$*** | ***Nephelometric*** |
| ***Cl, $HCO_3$*** | ***Potentiometric titration*** |

(B) Air pollution

| ***Components*** | ***Methods*** |
|---|---|
| ***$NH_3$, NO, $NO_2$, $SO_2$, $H_2S$*** | ***Spectrophotometry*** |
| ***Formaldehyde*** | ***Spectrophotometry*** |
| ***Fe, Cd, Co, Mn, Cu, Ni, Pb, Cr, Zn*** | ***Atomic Absorption Spectrometry*** |
| ***CO*** | ***Electrochemical*** |
| ***Suspended solids (SS)*** | ***Gravimetric*** |
| ***$SO_4$*** | ***Nephelometric*** |
| ***Benz(a)pyrene*** | ***Electrochemical*** |

(C) EANET

| ***Components*** | ***Methods*** |
|---|---|
| ***Wet deposition (the same parameters as for precipitation)*** | ***The same methods as for precipitation composition*** |
| ***Dry deposition (NH4, NO3, SO4, Cl, K, Na, Ca, Mg)*** | ***Ion chromatography (analysis is performed in Irkutsk)*** |

Table 9 Frequency of observations at different monitoring stations in Primorsky Kray

| **Kind of monitoring** | **Frequency** |
|---|---|
| Air pollution | three times a day |
| Precipitation composition | once a month |
| Snow cover composition | once a winter |
| Precipitation acidity | every rain event |
| EANET, dry deposition | every two weeks |
| EANET, wet deposition | every rain event |

## Monitoring water pollution (sea and surface land water) - National programs of Water monitoring

The Federal Service on Hydrometeorology and Environmental Monitoring (ROSHYDROMET) is responsible for routine monitoring in Russia. In Primorsky Kray, monitoring of contamination of air, river waters, soil and marine environment is implemented by Primorsky Office on Hydrometeorology and Environmental Monitoring according to State Monitoring Programs.

Previously, background monitoring at Biosphere Reserves was conducted by Far Eastern Regional Hydromet. Res. Inst, but monitoring is currently carried out by Primorsky UGMS branches - centers for Hydro - and environmental monitoring (Figure 10).

The amount and quality of all types of municipal and industrial wastewaters are controlled by the subdivisions of Federal Service for Environmental, Technological and Nuclear Supervision (ROSTECHNADZOR). Main related issue is a development of Maximum Permissible Discharge of wastes – MPD on base of Maximum permissible concentration of chemical substances (MPC) (Table 10, Table 11).

The MPC are developed by scientific and engineering organizations for the different water users and affirmed by the Federal Service for Environmental, Technological and Nuclear Supervision, and Ministry of Natural Resources. The quality of underground water is a subject of responsibility of subdivisions of the Ministry of Natural Resources.

The monitoring of these parameters is mainly responsible for the ROSKOHYDROMET network, and the departments of nature protection and nature management of the Primorsky Krai are responsible for the implementation of measures to prevent / mitigate the emergency, and in case of emergency, the Ministry of Emergency Situations is responsible.

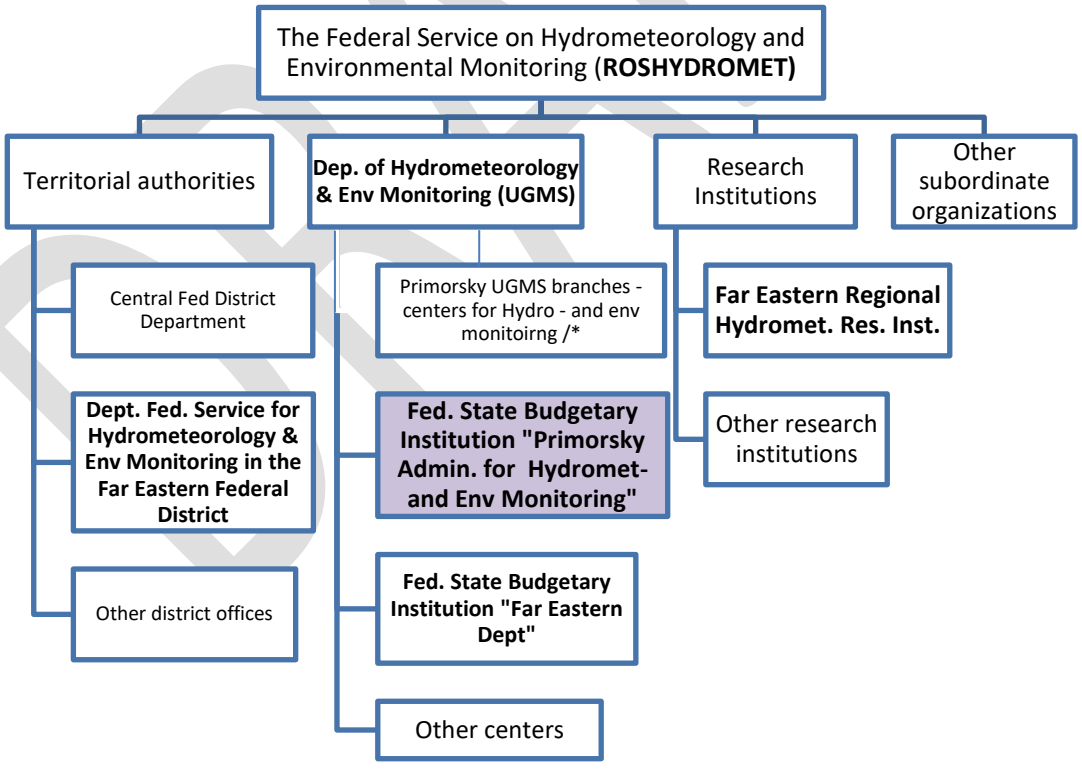


Figure 10 Institutional framework of ROSHYDROMET

/* In the past, background monitoring at Biosphere Reserves was conducted by Far Eastern Regional Hydromet. Res. Inst,

Table 10 Table 5. Maximum permissible concentration of chemical substances (mg/l) in waters used for the different purposes

| Parameter | Drinking | "Public" waters | Fishery purpose |
|---|---|---|---|
| pH | 6-9 | 6-9 | 6.5-8.5 |
| Mineralization | 1000 mg/l | 1000 mg/l | 1000 |
| BOD5 | nd | nd | 2.0 |
| COD | 5.0 mg/l ($KMnO_4$) | 5.0 mg/l ($K_2Cr_2O_7$) | 15 ($K_2Cr_2O_7$) |
| PHC (petroleum hydrocarbons) | 0.1 mg/l | 0.1 mg/l | 0.05 |
| Detergents (Surfactants) | 0.5 mg/l | 0.5 mg/l | 0.1 |
| Phenols (summary) | 0.25 mg/l | 0.25 mg/l | 0.001 |
| $Al^{3+}$ | 0.5 mg/l | 0.5 | 0.04 |
| $Be^{2+}$ | 0.0002 mg/l | 0.001 | 0.0003 |
| B (summary) | 0.5 mg/l | 0.5 | 10*, 0.1 |
| Fe (summary) | 0.3 mg/l | 0.3 | 0.05*, 0.1 |
| Cd (summary) | 0.001 mg/l | 0.001 | 0.005 |
| Mn(summary) , Ni(summary) | 0.1 mg/l | 0.1 | 0.05*, 0.01 |
| Cu(summary) | 1.0 mg/l | 1.0 | 0.005*, 0.001 |
| As(summary) | 0.05 mg/l | 0.05 | 0.01*, 0.05 |
| Hg(summary) | 0.0005 mg/l | 0.0005 | 0.0001*, $<10^{-5}$ |
| Cr | 0.05 $Cr^{6+}$, 0.5 $Cr^{3+}$ | | 0.02$Cr^{6+}$,0.07$Cr^{3+}$ |
| Zn (summary) | 5 mg/l | 1.0 | 0.05*, 0.01 |
| Pb(summary) | 0.03 mg/l | 0.03 | 0.01*, 0.1 |
| $N\text{-}NO_3^-$ | 10 mg/l | 10 | 9.1 |
| $N\text{-}NO_2^-$ | 0.75 | 0.8 | 0.02 |
| $N\text{-}NH_4^-$ | nd | 1.0 | 0.4 |
| $SO_4^{2-}$ | 500 mg/l | 500 | 100 |
| $F^-$ | 1.2-1.5 mg/l | 1.5 | 0.75 |
| $CN^-$ | 0.035 mg/l | 0.1 | 0.05 |
| HCH | 0.002 mg/l | 0.02 | <0.00001 |
| DDT (summary) | 0.002 mg/l | 0.1 | <0.00001 |
| PCBs | 0.001 | 0.001 | 0.0001 |

* - for sea water only; nd – not determined;

Table 11 Water quality criteria based on concentration of chemical substances (mg/l)

| Parameter | Type of water use | MPC | High pollution | Extremely high pollution |
|---|---|---|---|---|
| Mineralization | fisheries | 1000 | > 10000 | > 50000 |
| DO | fisheries | | < 3.0 | < 2.0 |
| BOD5 | fisheries | 2.0 | > 10 | > 40 |
| COD($K_2Cr_2O_7$) | fisheries | 15 | > 150 | > 750 |
| $N\text{-}NH_4^+$ | fisheries | 0.4 | > 4.0 | > 20 |
| $N\text{-}NO_2^-$ | fisheries | 0.02 | > 0.2 | > 1.0 |
| $N\text{-}NO_3^-$ | fisheries | 9.1 | > 91 | > 910 |
| $P\text{-}PO_4$ | fisheries | 0.05 | > 0.5 | > 2.5 |
| $SO_4^{2-}$ | fisheries | 100 | > 1000 | > 5000 |
| Fe | hygienic | 0.1 | > 3.0 | > 5.0 |
| Al | fisheries | 0.04 | > 0.4 | > 2.0 |
| Zn | fisheries | 0.01 | > 0.1 | > 0.5 |
| Mn | fisheries | 0.01 | > 0.3 | > 0.5 |
| Ni | fisheries | 0.01 | > 0.1 | > 0.5 |
| Cu | fisheries | 0.001 | > 0.03 | > 0.05 |
| Cd | hygienic | 0.005 | > 0.015 | > 0.025 |
| $Pb^{2+}$ | hygienic | 0.006 | > 0.018 | > 0.03 |

| | | | | |
|---|---|---|---|---|
| $Cr^{6+}$ | fisheries | 0.02 | > 0.2 | > 1.0 |
| $Cr^{3+}$ | fisheries | 0.07 | > 0.7 | > 3.5 |
| PHC | fisheries | 0.05 | > 1.5 | > 2.5 |
| Detergents | fisheries | 0.1 | > 1.0 | > 5.0 |
| Phenols | fisheries | 0.001 | > 0.030 | > 0.050 |
| HCH, DDTs | fisheries | 0.00001 | > 0.00003 | > 0.00005 |
| $F^-$ | fisheries | 0.75 | > 7.5 | > 37.5 |
| B | hygienic | 2.67 | > 26.7 | > 133.5 |
| $H_2S$ | fisheries | 0.00001 | > 0.00010 | > 0.00050 |

The quantitative criteria based on the concentration observed are established for the classification of contamination events in ambient waters. According to these criteria all events are divided on pollution (exceeding MPC), high pollution and extremely high pollution. State Office for Supervision on the Protection of Consumer's Rights and Human Welfare – subdivision of Ministry of Health and Social Development is an executive authority responsible for the establishment of sanitary hygienic MPC, and State Fishery Service – subdivision of Ministry of Agriculture is responsible for establishment and affirmation of MPC for the waters used for fishery purposes.

In case the high level of pollution is found, required response may vary by cases. In case of serious problems of the administration of the territories and municipalities, the bodies of the Ministry of Emergency Situations may decide to introduce an emergency regime with appropriate measures for the evacuation of the population and rehabilitation of the territory.

The general objectives of State Monitoring Program in Russia are:

1) Observation on the water quality at the background (pristine) sites, and near the possible sources of contamination due to human activity as well;

2) Assessment and prediction (prognosis) of the water quality changes under the influence of the natural and human factors;

3) Provision the needs of state (governmental), business and human communities in the reliable information about ambient water quality and its changes for the subsequent use for the prevention/remediation of environmental damage.

The water quality monitoring plan at the different monitoring sites is established according to the several criteria including population of watershed and significance for the biological resources. The several classes of monitoring sites are established.

Additionally to the hydrological and chemical parameters, the hydrobiological features are studied. The hydrobiological works include description of phytoplankton, zooplankton, zoobenthos and periphyton communities, carried out three times per year (spring, summer and fall) at all Stations Class I and some Stations Class II and III (Table 12, Table 13).

Table 12. Description of observation (parameters measured) on the monitoring stations of different classes in Primorsky Krai

A total of 5 categories of station classes in the Russian Federation

| Class of Station | Type of observation | Parameters measured |
|---|---|---|
| II | Concise Program Type 2 (CPT-2) | Hydrological parameters, visual observation, |

| | | |
|---|---|---|
| | | temperature, conductivity, DO, pH, SS, BOD, COD, and 2-3 characteristic pollutants |
| III | Concise Program Type 3 (CPT-3) | CPT-2 plus all characteristic pollutants |
| IV | Full Program | CPT-3 **plus** Eh, macro-ions, N-$NH_4$, $NO_3$, $NO_2$, $PO_4$, Fe, Si, oil products (PHC), PAH, trace metals, POPs |

Table 13. Number of monitoring stations of different class in Primorsky Kray and frequency of observations

| Number and class of stations | Frequency |
|---|---|
| 1 station of class II | Every 10 days |
| 19 stations of class III | Every month |
| 13 stations of class IV | Every hydrological phase |

Information on analytical methods required for the various water quality monitoring parameters is given in Table 14. This table includes list of recommended methods and some metrological characteristics of them.

Table 14. Brief description of some analytical methods used in the monitoring of ambient water quality in Primorsky Kray

| **Parameters** | **Methods** | **Measurement range** | **Precision** |
|---|---|---|---|
| Suspended solids (SS) | Gravimetric | 2-50 mg/l | --- |
| $SO_4^{2-}$ | Nephelometry | 2.0-50 mg/l | 0.1 + 0.17C |
| Surfactants (detergents) | Colorimetry after extraction | 0.010-0.050 mg/l<br>0.050-0.400 mg/l | 0.006<br>0.12C |
| Phenols | | 0.002-0.018 mg/l<br>0.018-0.025 mg/l | 0.6 + 0.13C<br>1.6+0.05C |
| N-$NO_2^-$, P-$PO_4^{3-}$ | Colorimetry | 0.010-0.300 mg/l | 0.004 + 0.13C |
| $NH_4^+$ | | 0.30-4.00 mg/l | 0.05 |
| Si | | 0.1-2.0 mg/l | 0.05 + 0.045C |
| $Fe_{Total}$ | | 0.05-1.00 mg/l | 0.006 + 0.12C |
| $NO_3$ | Potentiometry | 0.01-6200 mg/l | 20% |
| F | | 0.2-4.0 mg/l | 0.01 + 0.096C |
| pH | | 4.0-10 | 0.01 |
| $O_2$ | Titration | 1.0-15.0 mg/l | 0.034C |
| Cl | | 2.0-15.0 mg/l | 0.17C |
| Ca, Mg | | 1.0-100 mg/l | 0.2 + 0.044C |
| COD ($K_2Cr_2O_7$) | | 4.0-80 mg/l | 1.3 + 0.057C |
| $BOD_5$ | | 1.0-11.0 mg/l | 0.3 + 0.06C |
| Petroleum Hydro-carbons(PHC) | Infrared spectrophotometry | 0.02-2.0 mg/l | 0.004 + 0.20C |
| ά, γ-HCH | Gas chromatography | 0.002-0.050 µg/l | 0.0008 + 0.17C |
| DDE | | 0.005-0.150 µg/l | 0.002 + 0.093C |
| DDD | | 0.010 –0.300 µg/l | 0.001 + 0.22C |
| DDT | | 0.020-0.500 µg/l | 0.010 + 0.096C |
| Na | Flame spectrometry | 1.0-50 mg/l | 0.08 + 0.04C |
| K | | 1.0-5.0 mg/l | 0.03+0.06C |
| Cu, Ni, Co, Pb, Hg | Voltamperometry (ASV) and/or Atomic Absorption (AAS) | 0.1-1000µg/l | 20% |
| Mn, Zn | | 5–300 µg/l | 5% |
| Cd | | 0.005-50 µg/l | 15% |

"C" in the last column means "concentration"

## Monitoring results and assessment of causes

Monitoring of the state of the ecosystems of the reserves (of the parameters above) showed that the main impact factors are climate change and transboundary transport of pollutants with atmospheric transport, as well as sea currents and river runoff. As to species of the reserves, species monitoring data are also used, especially data on invasions.

An analysis of atmospheric precipitation monitoring results showed that the lowest concentrations of polluting substances, including heavy metals, in the air of MPA data were observed during the movement of air flows from the northern regions of the Far East. With the southern outflows of air masses passing over the territory of the Japanese Islands and the Sea of Japan, an increase in the concentrations of a number of pollutants was observed. Southwestern airborne mass removal from the regions of the PRC and North Korea is also accompanied by an increase in the concentration of pollutants in the surface layer of the atmosphere.

An analysis of the results of monitoring pollution of coastal sea waters in the MPA area showed that In the Northern region (where is SASBR) there are several local sources of significant pollution to coastal waters, largely from ore-mining and ore-chemical production. The largest is located near Rudnaya and Zerkalnaya Bays. Pollution includes large quantities of Pb, Cu, Zn, Cd, As, B and others in dissolved and suspended forms. Insignificant dot pollution of coasts and coastal waters is marked by garbage and waste products.

Decisions on measures are taken by administrations on the basis of proposals from environmental protection committees, as well as other departments (health, natural resources, regional offices of Ministry of Emergency Situations and others).

Rudnaya and Zerkalnaya Bays enter the transitional zone (sometimes called the cooperation zone) of the SABR.

*(Anthropogenic impacts)*

The southern part of Primorskii Krai from the Tumen River mouth to the Amur Bay has a high natural-resource potential. Far Eastern Marine Reserve is located in this area.

Landscapes here are mainly low mountains with river valleys going out to the sea. The coastline is heavily rugged. Sources of sediment run-off in combination with an active wave regime has resulted in the formation of sea deposits of titanium-magnesium and building sand. Accessibility of shores and large bays allows easier port construction here. The vast shallow-water bays and favourable hydrological conditions give rise to valuable for fishery resources and provide a good base for mariculture development. Rivers have maintained their fishery potential only partially, however. The aesthetic beauty of the shores, favourable climate and sandy bays and beaches make this region suitable for recreation. Deposits of curative mud in the south of this sub-region, have led to development of curative-sanatorium establishments here.

In this region water pollution is sporadic here and is connected with disposal of sanitary and, to a lesser extent, industrial waste waters. Build-up of pollutants in marine organisms is not high. River flow is a major natural source of chemical substances in coastal marine areas. Anthropogenic pressure on coastal watersheds influences the concentration and flow of different chemical substances, including river pollutants. It is difficult, however, to distinguish anthropogenic impact from natural variability.

With careful selection they can be consumed, although constantly increasing pollution from the Tumen River basin has become an issue here. Many years of effort to treat waste in the PRC have eased the industrial pollution, but pollution from domestic sewage is on the rise. Pollution of coasts and coastal waters by garbage and waster waters is significant and is dated near settlements and mouth's zones of the rivers.

The results of the analysis of environmental monitoring revealed a number of environmental hot spots in Russian coastal waters near the MPAs under consideration (Table 15).

*Table 15 Environmental Hot Spots in Coastal Waters near Russian MPA of NEAMPAN*

| Location | Problems | Roots of problems |
|---|---|---|
| Some localities of the Amurskii Bay near FESBR | Elevated concentration of POPs, metals, nutrients in coastal waters, plankton, bottom sediments, organisms. Depletion of oxygen content. Deterioration of benthic and plankton communities. Marine litter and oil sleeks. | Water contamination by industrial and municipal sewage due to lack of treatment. Weak port management of pollution from ships and/or port facilities. |
| Small bays in the southern part of Peter the Great Bay included FESBR equatoria | Seasonal eutrophication and marine litter | Contamination due to unorganized recreation activity during summer season. |
| Rudnaya Pristan in the middle Primorskii Krai near SASBR | High concentration of metals in bottom sediments, water and organisms. Deterioration of benthic communities. | Contamination by river discharge and atmospheric deposition from the adjoining watershed with mining and ore processing industries. |
| Coastal waters of Primorskii Krai | Elimination of high valuable species (sea cucumber, sea urchin, some crabs) | Poaching or irrational over exploitation of resources. |

## Recommendations on monitoring and assessment strategies and plans for sustainable MPAs

The main objectives of environmental monitoring in the environmental management system of MPA should be:

- Information support of state authorities, local governments, legal entities and individuals on environmental issues
- Preparation of good quality data for the annual state environmental report and regional reports
- Information support for the development of forecasts of socio-ecological development of the country, its regions
- Information support of executive authorities exercising state control in the field of environmental protection and state environmental review
- Ensuring the development of federal programs in the field of environmental protection, targeted programs of constituent entities of the Russian Federation, investment programs in the field of environmental protection
- Ensuring Russia's participation in international environmental monitoring programs and projects

The main source of pollutants to protected areas and water areas is transboundary air transport and, transboundary river runoff. Therefore, the basis of environmental monitoring is monitoring of atmospheric deposition and surface water.

Analysis of results of ecological monitoring in MPA, first of all air and river monitoring pollution problems demonstrates a need to take action on the following key issues:

1. Unify monitoring parameters, methodologies and technical standards/criteria used in country studies. The lack of unified standards limits the effort to jointly address atmospheric deposition and contaminated river inputs in the NEAMPAN Region;

2. Conduct additional joint research and develop an integrated regional monitoring network that tracks dust/sandstorms and that looks for ways to reduce pollution delivered by rivers and trans-boundary movement of pollutants such as dust and sandstorms in the region; and

3. Expand the effort to obtain reliable regional and national level data on trace pollutants (dissolved forms of some metals and persistent organic pollutants at µg and ng volumes) in air pollution and on river and coastal water pollutants.

Moreover, the total supply of a substance to assess the power of polluting atmospheric deposition can be obtained only by collecting all forms of atmospheric deposition.

The most common species on the littoral and upper sublittoral of the Fucales order are recommended as indicators of marine pollution for temperate latitudes: for the northern sector of the Pacific (from 40 N) - Fucus evanescens and Cystoseira crassipes; for the northwestern coast of the Sea of Japan, in particular the coast of the Sabr - Pelvetia wrightii; it is also advisable to use the wide-boreal Costaria costata, which is common on the Asian and American coasts of the Pacific Ocean. The alga Scytosiphon lomntaria, which is common in subtropical, temperate, and subarctic waters of both hemispheres, is proposed as an indicator. Of the mollusks, Collisella cassis is recommended as indicators of the state of the marine environment for the northern sector of the Pacific (Table 16).

Species monitoring is carried out both by employees of the reserve, and mainly by employees of the Institute of Marine Biology, Far Eastern Branch of the Russian Academy of Sciences.

Based on the analysis of the correlation coefficients between the metal content in water (in solution and in suspension) and in organisms, it is shown that a number of species can be indicative for assessing pollution of marine ecosystems by pollutants. As a rule, the correlation coefficient should be at least 0.75.

Table 16. Reliable correlation coefficients between the content of metals in water (in solution and in suspension) and in organisms.

| Species | Fe | | Mn | | Zn | | Cu | | Pb | | Cd | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | solution | suspension | solution | suspension | solution | suspension | solution | suspension | solution | suspension | solution | suspension |
| Costaria costata | | | 0,71 | 0,68 | 0,79 | | 0,83 | 0,80 | | | | |
| Fucus evanescens | 0,54 | 0,54 | 0,87 | 0,85 | 0,91 | | 0,52 | | | | | |
| Pelvetria wrightii | | | | | 0,83 | | | 0,74 | | 0,71 | | |
| Scytosiphon lomentaria | | 0,82 | 0,99 | 0,90 | 0,99 | 0,99 | | 0,29 | | 0,82 | | |
| Cystoseira crassipes | | | 0,98 | 0.88 | 0,67 | | | 0,60 | | 0.57 | | |
| Sargassum miyabei | | 0,74 | | 0,83 | | 0,82 | | 0,77 | | | | 0,95 |
| Collisella cassis | | | | | 0,31 | 0,42 | | | | | | |

## 6. Conclusions

Marine reserves should be considered as reference areas of the sea that have been significantly less affected by humans than other areas. These water areas are of great economic and scientific value, as they are indispensable for comparative analysis and research of environmental processes in fishing areas of the sea.

International experience in assessing the biotic and economic significance of MPAs of different level should be taken into account under planning the establishment of the territorial network of MPAs, based on the integrated zoning of the marine areas of the Russian Federation and coasts by physical-geographical, biological criteria, and criteria of vulnerability and resistance to basic economic activities.

It is necessary to assess existing and planned marine and coastal SPAs using a criteria-based network planning system for the development of a methodology for planning an MPA network.

To improve the effectiveness of the MPA network management it is reasonable to apply an integrated approach to the determination and establishment of boundaries and zoning of these areas, adapted to specific conditions.

The integration of different sectoral approaches, different levels of the state management in the context of the 'land-sea' boundary is a fundamental basis for the effective management and conservation of the coastal marine environment.

It is necessary to envisage scientific research to identify the main limiting natural factors affecting the development of natural complexes of MPAs, and to assess the degree of threats to them in various types of environmental management to optimize biodiversity conservation and improve the management of MPAs, taking into account anthropogenic pressure and climate change.

The MPA plans should include measures to assess the existing and emerging risks and threats to Russia's marine biological diversity, forecast of relevant threats and their characteristics.

The plan should draw attention to threats and assist in the understanding of the need for urgent action. An important place in the MPA plan should be taken by the necessary measures to increase the degree of MPAs preparedness for emergency situations, safeguarding of protected objects in the event of spills of oil products and other chemicals, as well as other technogenic disasters.

The basis for the organization of research activities and environmental monitoring in SPAs, including marine, should be a system of priorities, developed taking into account the natural specifics and actual needs of SPA, as well as the potential needs of the bodies of the state authorities and management at the regional and federal levels. This system of priorities should be determined for inventory, monitoring, problem-oriented researches.

The priority inventory work should include:
- compiling of annotated species lists;
- compiling of inventories of rare, unique and requiring special attention objects of animate and inanimate nature, habitats of rare species of animals and plants.

The priority areas for monitoring natural processes and phenomena should include:
- observations of changes in the level of biodiversity and the qualitative composition of biota (flora and fauna), primarily vertebrates and vascular plants;
- observations of the status of populations, rare plant and animal species;
- species particularly vulnerable due to the formation of mass aggregations (colonial birds, marine mammals etc.);
- species-indicators of natural communities and ecosystems;
- observations of the state of ecosystems, which are the etalons for a specific physiographic region;
- observations of extremely rare and unique species.

Priority in nature reserves and national parks should be considered the problem-oriented researches aimed at the:

- development or improvement of environmental monitoring methods;
- identification of the norms of the state of the environment and the levels of permissible impacts on natural complexes;
- elucidation of the causes of adverse trends in the dynamics of natural complexes, the forecast of their consequences, as well as the consequences of potentially adverse external impacts on natural complexes of a specially protected area;
- development and improvement of measures for the conservation and restoration of natural complexes and objects;
- scientific support for the organization of environmental education and educational tourism;
- increasing the ability of protected ecosystems and landscapes to self-regulation and self-recovery. (**Recommendations for the development of mid-term plans, 2007**.)

For the water areas of marine reserves, it is reasonable to monitor and conduct a complete inventory of bottom natural complexes to identify the completeness of the spatial structure of bottom communities.

The priority activities in the field of MPA monitoring are:

- study and monitoring of the state and functioning of marine and coastal natural complexes and their individual components;
- monitoring of natural recovery processes and environmental reactions to changes in the intensity of anthropogenic impact, including the development of programmes of measures aimed at its reduction and complete elimination of the impact on the MPA;
- monitoring of ecological consequences of climate change for the dynamics of modern relief-forming and, especially, coastal processes, the state of bottom sediments and soils of coasts;
- monitoring of vegetation, fauna of marine and coastal natural complexes of MPA, including the study of processes and mechanisms of adaptation of their biota to climate change.

To improve the management of the Russian MPAs and biodiversity conservation, optimization of the management structure of national protected areas and development of an environmental and economic rationale to ensure the conservation and restoration of biodiversity in coastal ecosystems is needed.

Improvement of the mechanism of integrated coastal areas management will contribute to minimizing the anthropogenic destruction of habitats and improvement of the management of these areas.

It is necessary to identify the environmental risks of economic activity in coastal marine areas.

Also, the MPA management plans should include partnership activities with extracting companies and other economic entities in the field of biodiversity monitoring (including invasive species) and the protection of MPA marine areas, as well as the promotion of environmental tourism and possible strengthening of the MPA role in supporting the traditional management of indigenous peoples.

Activities on environmental education and public awareness, the development of eco-tourism on the basis of MPAs are also part of the management plan.

MPAs can serve as a focal point for the development of eco-tourism. At this, it should be borne in mind that the increase in the number of visitors is likely to cause damage to the protected area. Therefore, the plan should include the development of methodic recommendations for identification of the permissible load of ecotourism

on the MPA and necessary measures for the development of ecotourism in those areas of the MPA, where it is permissible.

The issue of communication capabilities is a fundamental part of the effective management of MPAs.

The management plans should envisage for the measures to increase efficiency of the MPA management.

The appropriate organizational structure allowing to avoid intersectoral conflicts, incompatibility of decisions/actions and inefficiency of the management system in general should also find a place in the management plans.

**For the Russian Far East, priorities of activity in the sphere of MPAs include:**

- scientific substantiation and planning of the formation of the territorial network of MPAs, including their location, area size, optimization of boundaries, functions they perform to maximize the full protection of the diversity of natural coastal and marine areas; organization of ecological corridors and reconstruction of existing natural ecological corridors between SPAs, taking into account their local, regional and international significance;
- use of integral quality indicators of ecological functions as the main criteria for allocation of eco-corridors;
- ensuring compliance with the regime of marine security zones in accordance with the organizational, legal and technical and technological requirements.

When planning the MPAs, found for the perspective in the areas of the sea coasts of the Far East of the Russian Federation, it is necessary to use functional and territorial principles, maintain a guaranteed minimum of protected species of flora and fauna, maintain an optimal ratio of biogeocenoses that form a key complex of elements in the territory, maintain a balance between highly transformed and natural ecosystems, and determine the routes of migratory species, mainly in the areas of the sea border.

One of the main directions of MPA management plans in the Far Eastern region is to improve the territorial network of MPAs and increase its representativeness.

To ensure the sustainable development of the marine regions of the Far East, the Russian Federation should promote the development of ecosystem services, promote regional cooperation for the conservation of marine ecosystems of the seas of the North-Western Pacific.

Strengthening the activities of the MPAs and the new policy in the sphere of their operation is needed to achieve the objectives of conservation of the marine environment.

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