Far Eastern Marine Biosphere Reserve (Russia)

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Summary

Brief information about Far Eastern Marine Biosphere Reserve in Peter the Great Bay, Sea of Japan is presented in the article.

Key words: nature reserve, biological diversity, environment, Peter the Great Bay.

The Far Eastern State Marine Reserve (hereinafter, the Reserve) was founded by the Decree of the Council of the USSR Ministers "On organization of the Far Eastern State Marine Reserve" No. 228 of March 24, 1978.

Fig. 1. Location of Reserve on the World map. NR – northern region of Reserve, ER – eastern, SR – southern, WR – western region of Reserve.

International Coordinating Council of UNESCO program "Man and Biosphere" included the Reserve into the international network of biosphere reserves in the year of the 25th anniversary of the Reserve, in 2003 [2; 4].

The modern name of the Reserve is Far Eastern Marine Biosphere State Natural Reserve of the Far Eastern Branch of the

Russian Academy of Sciences; briefly – Far Eastern Marine Biosphere Reserve (Russia).

Location of the Reserve.

The Reserve is located in the southern part of Primorski Krai. The area of the Reserve comprises about 11% of the total area of Peter the Great Bay (Fig. 1), Sea of Japan: 63,000 hectares of waters and 1,316 ha. of small islands.

The Reserve has a cluster structure, it consists of four regions: Eastern, Southern, Western and Northern (Fig. 1, 2). The Eastern Region occupy an area of water 45,000 ha, territory of 9 islands is 836.9 ha; the Southern Region occupy an area of water is 15,000 ha and total territory of 2 islands and of the cape on the continent is 263.1 ha; the Western Region occupy an area of water 3,000 ha; the Northern Region occupy 216.3 ha: Likandera Cape, southern part of Popova Island. Ledges, stones and banks are also included into the Reserve.

The Reserve has a Conservation zone around the boundaries of the Reserve: The Coast Conservation zone is 500 meters wide and the Sea Conservation zone is 3 nmi wide (Fig. 2).

The Reserve is a standard of nature of Peter the Great Bay. Peter the Great Bay is a unique area of the Sea of Japan.

Remarkable sights of nature of Peter the Great Bay.

First, Peter the Great Bay is the largest Bay of the Sea of Japan. The area of Peter the Great Bay is about 5600 km^2.

Second, the Reserve is located in the Temperate Climatic Zone of the Pacific Ocean. The climate of the region of the Peter the Great Bay is monsoon; north and north-western winds in winter change for south and south-eastern in summer. Summer is warm with rains, storms and fogs. The mean temperature of August is +21°C, maximum 23.6°C. Winter is windy and sunny; the mean temperature of January is -11° C, minimum -14.4°C. The mean annual rainfall is 684 mm; 84% of annual precipitation falls in summer. Peter the Great Bay located in the zone of confluence of subtopic and subboreal waters (currents). The water

of the surface of the Bay is heated to 23°C in August and to 26°C in small bays and coves. In winter the water temperature is -1.7°C [3].

Third, water salinity in the open area of the Bay is usually oceanic (32-34‰); in coves and inlets of the bay, into which freshwater streams and rivers flow, a gradual transition from sea water to fresh one is observed.

Fourth, the Bay coast is indented deeply and picturesque; there are little and small islands, reefs, sea stacks, and banks in the Bay; the highest and the largest island Big Pelis has a height of 190 m above sea level and a surface area less than 400 ha.

Finally, there is no anywhere in the world even a unique diversity of geological structures and soils like this, concentrated on a small territory of reserved islands and continental coast. Almost all of the landscapes of Southern Primorye: subtropical and boreal forests, broadleaf and coniferous forests; wetlands and steppes; rocks, warm-water sandy coves and cold-water depths of the Sea of Japan; streams, lakes, and brackish-water lagoons; underwater rock walls of the mainland coast, islands and banks and extensive horizontal sand-mad space bottom – are represented on the Islands of the Peter the Great Bay and in the coastal waters.

All this unique variety of waters, shores, bottom grounds, terrains, currents, and temperature regimes determines the unique diversity of animals and plants inhabiting Peter the Great Bay. In concordance with the laws of ecology highly diverse environment provides a high level of biological diversity.

The Reserve has all that there is in the Peter the Great Bay. The Reserve represents the entire variety of currents, temperature and water salinity regimes, grounds, underwater and terrestrial landscapes of Peter the Great Bay, and thus it is a standard of nature of Peter the Great Bay [2; 3].

Remarkable sights of wildlife of the Reserve.

The main directions of activity of the Reserve are recorded in its Statute in the following reading: "Study of biodiversity and mapping of benthic and terrestrial communities; monitoring of benthic and terrestrial communities for the evaluation of

anthropogenic and natural factors effect on biota of the Reserve and the entire region; study of biology of rare and endangered species; protection of marine water areas, islands and near-shore zone, ecological education and enlightenment".

More than 5100 species of organisms from bacteria to whales registered in the Reserve. It is almost all species of algae, invertebrates and fishes of the Peter the Great Bay. Among them there are more than 3000 multicellular organisms: 33 species of Cnidaria, more than 300 vermiforms, 21 – Nemertines, more than 250 mollusks, about 600 crustaceans, 30 echinoderms, about 500 vertebrates, among them 184 fishes, 256 birds, 24 mammals and other classes. 880 species of vascular plants are concentrated on small territory of the Reserve (1100 ha.), it is about two-thirds of vascular plants of Primorye, among them there are 48 rare species of Primorye and Russia, they are included in the Red Data books; there are almost all rare species of Primorye. Among them *Rubus pungens* Camb. grows in Russia on Stenina Island of the Reserve only [4].

New to world science species were founded and described in the Reserve:

two species of Algae: Primorien hapterophycus – *Hapterophycus primoriensis* Kepel, 2001 and Rhizoid hapterophycus – *Hapterophycus rhizoideus* Kloczc., 1996 (both Phaeophyceae, Scytosiphonaceae);

one Isopod crustacean – *Dynoides brevicornis* Kussakin & Malyutina, 1987 (Malacostraca, Isopoda);

ten species of hooded shrimps (Cumacea): Lamprops tenuis Tzareva et Vassilenko, 2006; Lamprops lomakinae Tzareva et Vassilenko, 1993; Lamprops pseudos*arsi* Tzareva et Vassilenko, 1993; *Diastylis paralaskensis* Vassilenko et Tzareva, 1990; *Dimorphostylis sculpturensis* Vassilenko et Tzareva; *Eudorellopsis leuconi* Vassilenko et Tzareva; *Bodotria ozolinshi* Tzareva et Vassilenko, 1993; *Bodotria furugelmiensis* Tzareva et Vassilenko, 2006; *Cumella kepeli* Tzareva et Vassilenko, 1993; *Pavlovskeola bicostata* Vassilenko et Tzareva, 1990 (Malacostraca, Cumacea);

three species of Fishes: Taranetz' sculpin – *Radulinopsis taranetzi* Yabe et Maruyama, 2001 (Scorpaeniformes: Cottidae); Seven-lined prickleback – *Ernogrammus zhirmunskii* Markevich et Kharin, 2011 (Perciformes: Stichaeidae); Cockscomb – *Alectrias markevichi* Sheiko, 2012 (Perciformes: Stichaeidae);

three species of vascular plants: *Hierochloë helenae* Probat. (*locus classicus* Bolshoy Pelis island), *Poa zhirmunskii* Probat. (*locus classicus* Very island), *Poa verae* Probat. (locus classicus Very island), *Carex pulchrifolia* A. E. Kozhevnikov (locus classicus Furugelma island).

Almost all the new species are still met in Russia in the Reserve only.

The Reserve is located at the crossing of spring and summer migration routes of birds (Siberia-Japan and Arctic – Southern Asia), and thus over 370 bird species including the rarest species can be observed here. 255 species of birds can be observed directly in the Reserve, more than 80 species nest in the Reserve. Among the nesting birds there are 10 rare species of world fauna (included in the IUCN Red list [7]): Schrenck's Bittern – *Ixobrychus eurhythmus*; Chinese Egret – *Egretta eulophotes*; Black-faced Spoonbill – *Platalea minor*; Peregrine Falcon – *Falko peregrinus*; Band-bellied Crake – *Porzana paykullii*; Watercock – *Gallicrex cinerea*; Tiger Shrike – *Lanius tigrinus*; Chestnut-cheeked Starling – *Sturnus philippensis*; Pleske's Grasshopper-warbler – *Locustella pleskei*; Yellow-billed Grosbeak – *Eophona migratoria* [7].

Two rare species Black-faced Spoonbill and Chinese Egret nest in Russia in the Reserve only [6]. Black-faced Spoonbill is the rarest species of birds of Russia. 4 pairs of these birds with nestling chicks are observed in the last 10 years every year on the cape Klavdii on Furugelma Island [6]. The 2012 census recorded a new high of 2,693 birds, thus the total number of mature individuals is estimated at 1,600, as adults appear to account for around 60% of the total population [7].

The global population of *Egretta eulophotes* is estimated at 2,600-3,400 individuals, roughly equivalent to 1,700-2,300 mature

individuals, based on recent records and surveys. However, this is thought to be an underestimate, as the number in China only is estimated at 1,000 mature individuals and could be around 1,500-2,000 mature individuals. On this basis, the population is placed in the band for 2,500-9,999 mature individuals, which is probably equivalent to 3,800-15,000 individuals. Population Trend – Decreasing [7].

Seal *Phoca largha* (Pallas, 1811) breeds on the Islands of the Reserve in winter. The number of Largha seals reaches 2500 in this season; this is basic mass of the Largha seal Peter the Great Bay.

Peter the Great Bay is located in the northernmost boundary of the habitat of many southern species, and in the southern boundary of the habitat of many northern species. So sub-tropical and sub-boreal species of marine and terrestrial animals and plants live here permanently or periodically. Animals and plants are concentrated, preserved here, and disperse far beyond its borders like if they were in a natural incubator.

Biota and environmental study activities.

The Reserve has been studied well in the warmer months (spring-autumn). So the Reserve has prospects for discovery new species of sea biota in winter. Studies of insects of the Islands have good prospects, Studies of insects of the Islands has good prospects, because as yet there was detected prior to 100 species, while on the mainland there are more than 25,000 species.

The underwater part of small islands, banks, rocks, reefs of the Reserve must be studied carefully. They are all similar to a stone column, on the seabed and they can be a natural monuments and objects for study and for recreational diving.

The Reserve is a well studied part of water area and islands of Peter the Great Bay, which has the highest biodiversity in all Russian seas [2; 3]. There are no other areas like this in Russia.

The results of the studies of the Reserve are presented in more than three hundred scientific and popular papers and books.

The main ones are papers with descriptions of new species of animals and plants for science and for the Reserve and the two-volume monograph (above 1700 pages) which summarized the

results of 25 year studies: "Far Eastern Marine Biosphere Reserve". Vol. 1. Research activities; Vol. 2. Biota. (A.N. Tyurin, Ed.), Vladivostok: Dal'nauka. 2004. (in Russian) [2; 3].

The first volume consists of 10 chapters and includes 92 articles of 94 authors providing information about investigation of the Reserve territory and biota. The results of archeological, historical, geological, soil, toponymical, meteorological, hydrological, microbiological, lichenological, botanical, hydrobiological, ichthyological, ornithological, theriological and monitoring investigations, as well as information about the history of the Marine Reserve foundation, organization of protection and ecological education are presented there [2].

The second volume is the collective product of 66 authors and it summarizes the results of 25-year floristic and faunistic studies of researches from institutes of the Russian Academy of Sciences, Ministry of Fish Industry, Russian universities and foreign scientists, who conducted investigations in the Reserve. More than 5100 species are included in the lists: marine biota is represented by 32 phyla, islands and freshwater biota is represented by 26 phyla. Annotated lists and charts with indication of organisms sampling locations will form a basis for further monitoring of the Reserve biota and large-scale biomapping [3].

The issue is unique for Russia. Over one hundred researchers contributed to this publication. But none of one hundred reserves in Russia no possesses such an extensive encyclopedic summary about studying of biota and environment studies on its territory [2; 3].

Protection of the Reserve.

The conservation of biological diversity of the Reserve is provided by a good protection of the Reserve. In particular, after the organization of the Reserve in 1978, it has recovered colonies of Black-tailed Gull, Ussuri cormorant and Rhinoceros Auklet. In the present time there are the world's largest breeding colonies of Black-tailed Gull (over 40 thousand individuals) and Ussuri cormorant (over

5 thousand individuals) on the Furughelma Island. The colony of Rhinoceros Auklet on Stenina Island (more than 2000 individuals) is the largest in the Primorye region [2]. Rare for the world's avifauna species of birds Chinese Egret and Black-faced Spoonbill also appeared and began to nest on the Furughelma Island.

Over the last 20 years the number of invertebrate species in the Reserve was increased with 15 species; the number of bird species was increased with 2 species; the number of fish species was increased with 14 species; the number of algae species was increased with 2 species; the number of species of vascular plants of the Islands of the Reserve was increased with 20 species [4].

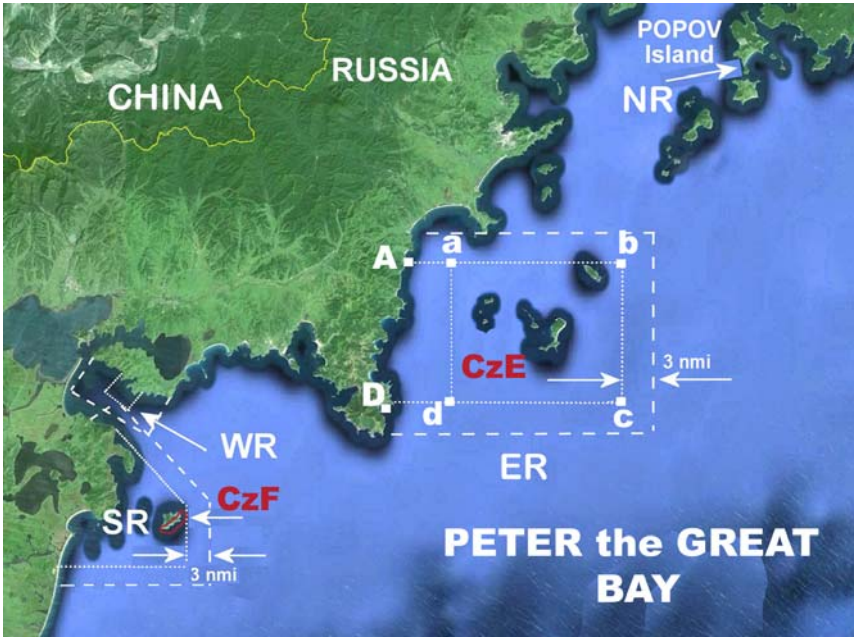

Fig. 2. Far Eastern Marine Biosphere Reserve in Peter the Great Bay (Russia); NR – Northern region of Reserve, ER – Eastern – AbcD, SR – Southern, WR – Western region of Reserve; CzE – Core Zone "Eastern" – abcd; CzF – Core Zone "Furugelm"

In accordance with the decisions of the UNESCO General Conference in Seville, 1995 [1], and of the 3rd World Congress of

Biosphere Reserves in Madrid, 2003, [5] the Reserve made zoning and defined 3 types of zones.

Core Zones are zones of strict protection. Visiting the Core Zones is extremely limited. Monitoring is allowed by special permission within special sites only. Catching (even for collections) as well as introduction of any organisms is prohibited here.

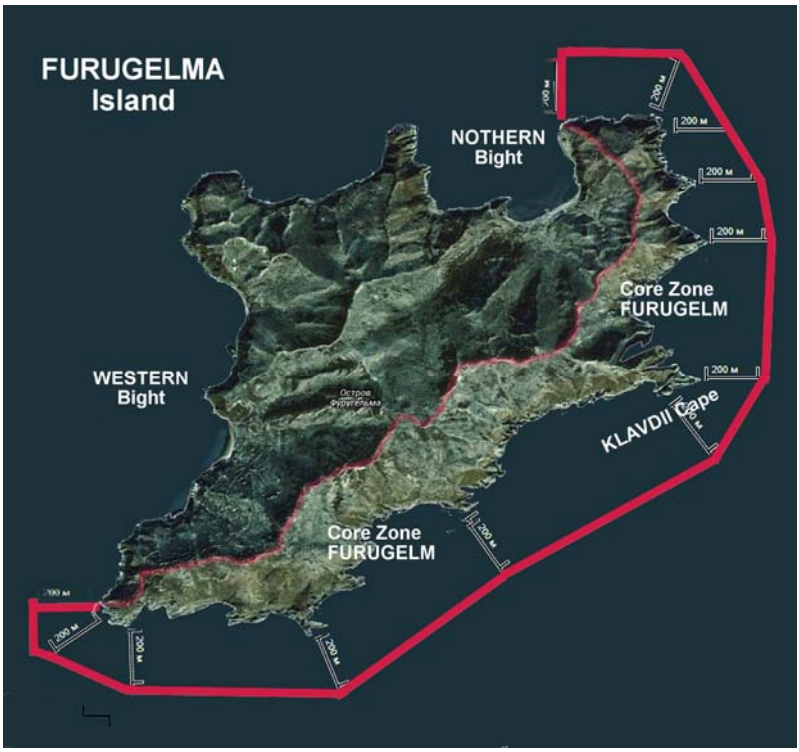

Fig. 3. Core Zone "Furugelm"

The first Core Zone "Eastern" occupies 32,400 hectares (13 km x 25 km) and includes 5 islands: Bolshoy Pelis, Matveeva, Durnovo, Gildebrandta, De-Livrona and many solitary rocks with the total area of about 460 ha. and adjacent water area (Fig. 2).

The second Core Zone "Furugelm" occupies 240 ha.: 120 ha. of land and 120 ha. of water [Fig. 3]. The purpose of the Core Zone "Furugelm" is to strength protection of bird rookeries, mainly of

rare bird species, included in the IUCN Red List, such as the Chinese Egret (*Egretta eulophotes* Swinhoe, 1860) and the Black-faced Spoonbill (*Platalea minor* Temminck et Schlegel, 1849), during their breeding, hatching and rising their offspring (Red List Category & Criteria, ver. 3.1, 2001: Vulnerable – VU) [7].

The Buffer Zone is a zone of research and protection. It is open for regulated visits. Removal, as well as introduction, of any organisms is also prohibited here. Ecological tourism, both underwater and terrestrial, is permitted via the special routes and under the control of guides and security officers of the Reserve.

The Transition Zone is the zone of co-operation of the Reserve with the regional administration and the local population.

The vessel traffic, fishing and crabs catching, tourism, aquaculture, deer farming, ecological tourism, photographing of birds and other animals and other activities of the local community are allowed within the Shore and Marine Transition Zones.

Ecological education in the Reserve.

According to the Seville strategy [1] and Madrid Action Plan [5], the Reserve performs its work on the following principles: (1) protection of the biota and environment; (2) study and monitoring of the environment and biota; (3) organization of limited economic activity and of nature resources rational management, and (4) ecological education. Within activities (3) and (4) the Reserve organizes trainings of local population on alternative methods of natural resource extraction.

The Reserve signed permanent contracts with 20 largest tourist companies of the Khasansky District. Besides the Reserve has a contract with the Travel Agency which organizes visits to the Reserve on cruise ships with international tourists. Owners of many local small (family) travel agencies willingly organize excursions in the Buffer and the Transition zones of the Reserve. They use the instructions and guidelines worked out by the Reserve's staff and also different publications on results of the research conducted in the Reserve for nature conservation.

The Reserve's administration actively contributes to the development of aquaculture in the Khasansky district. The Reserve has allocated a place of 100 hectares for experimental aquaculture. On this area scientists of the Reserve develop a scientific basis for collecting larvae of scallop (Mizuhopecten yessoensis). Residents of the Khasan district do the technical work in the nursery. Young scallops are used for remedial measures in the waters of the reserve and in adjacent waters [2; 4].

The Reserve demonstrates to the residents of the Khasan district the scientific model of sustainable development of the region. This direction includes the following elements: (1) strict nature protection, (2) organization of ecological education of the local population, advocacy the ideas of nature protection among the population, tourists and guests of Primorsky Krai, (3) widespread implementation of ecological tourism and aquaculture, which conserves natural resources, (4) the possibility of conflict-free co-existence along the coast, and (5) organization of the limited economic activity of local people living around the Reserve.

The Reserve has conducted an extensive work with different age and social status groups of local residents aimed to promote the necessity of conservation of ecosystems. Clean water and beaches, virgin forests on islands and a rich underwater wildlife within the Reserve were demonstrated to Reserve's visitors itself. The Reserve also popularized the cultural values and notions as for the necessity of care and conservation of all the biosphere's elements, particularly wildlife.

The Northern Region of the Reserve (area of 216.3 ha. on Popova Island) is suitable for guided tours. Territory of the Northern Region includes the Museum of Marine Nature, the Botanical Garden, the Eco-Center and the Paleo-Village. Also, the staff of the Reserve provides seminars for school teachers on how to conduct classes on nature protection at schools. Many of the tourist companies bring their clients to the Museum of the Reserve [2; 4].

Rating of the Reserve.

The Reserve is working closely with the administration of the Khasan district on the issue of "Sustainable development of the Khasan district". The administration of the Khasan district expresses respect to the Reserve and gives a high assessment of his work and gratitude him. For example, on the initiative of the director of the Reserve, the Administration of the Khasan district given title to new street of the village Vityaz by the name of the first Director of the Reserve Yuri D. Chugunov in 2013.

Openness of the Reserve.

The Reserve organized a website http://dvmarine.ru for disseminate information about the reserve and ecological knowledge wider.

The Reserve founded the scientific journal in which this article published, and created website of journal http://biota-environ.com for the exchange of scientific information with colleagues about other protected areas and waters.

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