Key ornithological territories in western Priokhotye

V V Pronkevich, M V Kryukova and A N Makhinov
Institute of Water and Ecology Problems FEB RAS, Russia, Khabarovsk

E-mail: vp_tringa@mail.ru

Abstract. The results of studying the current state of the habitats of waterfowls and semiaquatic birds in the western part of the coast of the Sea of Okhotsk are reviewed. These habitats are of crucial importance for the reproduction of the birds, as well as for their massive migratory concentrations on the East Asian-Australian migration route in the summer-autumn period. A description of the natural conditions of these territories is provided and the most valuable biotopes are identified, including drying zones rich in marine invertebrates, waterlogged coastal grass fields and moss bogs with karst lakes. Especially significant clusters of birds are formed in the large sea bays – Shchastya, Nikolaya, Ulbanskii, Konstantin, Tugurskii Bays, Udskaya guba, on the Mukhtel Lake, and in the Amur liman. The state of these territories is currently considered as satisfactory, but nonetheless there are certain threats for the ornithologic fauna and bird population. We propose measures for the conservation of birds at the "Okhotsk section" of the East Asian-Australian migration route. We also suggest to organize wetlands of regional significance “Nikolaya, Ulbanskii and Konstantin Bays” in Tuguro-Chumikanskii district and the natural park “Shchastya Bay” in Nikolaevskii district of Khabarovsk Krai.

1. Introduction
Some of the most valuable territories important for maintaining the global diversity of birds in Priokhotye are the coastal areas of its western part, where conditions for mass stopovers of migrants on the East Asian-Australian bird migration route, as well as for the reproduction of a number of rare and endangered species of the world fauna, are preserved. Deep bays are the areas of mass stopovers of migrants to replenish the energy necessary to cover distances of more than 10 thousand kilometers. The importance of these migratory stopovers for the conservation of bird biodiversity remains underestimated. Moreover, the coastal territories of the sea bays under consideration are the breeding sites for globally rare bird species. Those territories are especially important for the preservation of such narrow-areal species as the Nordmann's greenshank, swan goose and Steller's sea eagle.

Since the territory is poorly accessible and insufficiently studied, suffering from poaching, fires and pollution of coastal waters, it is extremely important to study the wildlife of this part of the Priokhotye and develop prompt measures to protect it.

The aim of our research was the identification and comprehensive study and assessment of the state of the territories in the Western Priokhotye crucial for waterfowls and semiaquatic birds in order to develop scientifically based measures for their conservation on the Asian-Pacific bird migration route.

2. Objects, data and methods
The first scientific studies of the wildlife of the territory in question were conducted by A.F. Midden-
dorf in the middle of the 21st century [1]. A comprehensive study and assessment of the state of the coastal territories of the Western Priokhotye was being carried out at the Institute of Water and Ecology Problems of the Far Eastern Branch of the Russian Academy of Sciences since the 1990s to identify key habitats for waterfowls and semiaquatic birds and to develop scientifically based measures for their conservation.

Expeditionary studies of coastal territories of sea bays from the mouth of the Amur River and the Amur liman in the east to the Konstantin Bay in the west, including littoral zones, river floodplains, inundated and thermokarst lacustrine-boggy complexes that are characterized by high diversity of ornithological fauna, were conducted. These studies resulted in new data on the distribution and abundance of waterfowls and semiaquatic birds, the state of terrestrial coastal-marine and wetland valley ecosystems, and a description of the natural conditions of these territories.

When conducting research work, a comprehensive approach was used to assess the state of key ornithological territories of the southwestern Priokhotye, which, in addition to basic ornithological and biogeographic studies, included a wide range of geomorphological, botanical, zoological, geoenvironmental, hydrological, and other studies with the corresponding advanced methodological techniques combining full-scale study of the state of the environment with analytical and cartographic methods.

3. Results and discussion

The bays were formed during the postglacial transgression of the sea which began 15-17 thousand years ago and is still ongoing. Therefore, the coastline here is very young [2]. The coastal areas of the western part of Priokhotye have a predominantly low-mountainous relief; the main elevations extend in the form of ridges in the northeast direction. Most of the territory has an altitude of 400-500 m above the sea level and only individual mountain ranges rise to 900-1000 m above the sea level (Syran, Chadanyan, Talim mountains and Kivun ridge). The mountain ranges bear the features of a long continental alignment and have smooth outlines, while the watershed surfaces are plate-like in nature. Mountain ranges with steep, high thrusts drop off into sea bays on a significant part of the coast. The abrasion-denudation processes of destruction of the coasts are intensely manifested on the protrusions of the coasts, whereas the recesses of the coastline feature accumulation of marine deposits as well as loose and mostly pebble-boulder deposits brought by rivers in the form of narrow beaches and long marine sand bars protruding into the sea.

The terrain on the estuarine parts of the rivers flowing into the Sea of Okhotsk and on the adjacent areas of the coast is flat. Large areas here are occupied by sedge-grass, grass and shrub-sedge fields wet to varying degrees, grass-moss bogs are interspersed with spring bushes, sphagnum bogs and marshes - with larch and Siberian dwarf-pine.

The places where the largest rivers flow into the Sea of Okhotsk feature significant drainage zones being emptied of sea water during low tides, that were formed by alluvial river sediments redeposited along the sea coast. They occupy a particularly large area on the coasts of the bays of Ulbanski and Konstantin [3]. A favorable combination of biotopes, including rich marine invertebrate drainage zones, waterlogged coastal grass fields with saucer-shaped lakes located on them, moss bogs with thermokarst lakes, ensures a high diversity and abundance of waterfowls and semiaquatic birds.

The environmental conditions of the Amur liman are formed under the influence of geomorphological and climatic contrasts, a combination of runoff and tidal currents, shallow depths, prolonged ice phenomena and a significant influx of Amur terrigenous runoff. Tallgrass coastal-water communities with bulrush and sea club-rush acting as ecosystem engineers are widespread in the shallow waters of the Amur liman in the drying zone. These types of plants cannot tolerate salinization of soil and water, and under conditions of the liman they get the opportunity to grow due to a significant desalination of water [4]. The vegetative propagation of these plants determines the phenomenon of clonal mosaicity in their distribution; they form dense thickets in the shallowest areas - the so-called “Amur plavni”.

The heterogeneity of the relief structure of the territory under consideration, the influence on the
climate of the Arctic air masses regularly moving here in winter and tropical air masses in summer, the proximity of the coldest continental regions of the Northern Hemisphere (northeastern Yakutia) and the abnormal for these latitudes severity of the Sea of Okhotsk complicate the already variegated landscape of Priokhotye. Permafrost rocks can be found sporadically spread through the plains and in the mountains.

The high contrast and diversity of the environmental conditions of the Western Priokhotye allows various representatives of the ornithological fauna to find suitable conditions for reproduction and feeding in this area. The coastal grass fields and the tidal zone, where the enormous densities of birds concentrate in the second half of summer, are especially significant for the preservation of the diversity of birds. Here are the breeding sites of the Nordmann's greenshank, oyster catcher, swan goose, and Steller's sea eagle that have a high international status of rare species. These biotopes are also attractive for numerous migrants – loons, geese, ducks, sandpipers that form clusters with a relative average number of birds of up to 1300 specimen/km² in coastal grass fields and up to 700 specimen/km² in the tidal zone. Among them, there are species included in Red Data Books of Endangered Species of the Russian Federation [5] and Khabarovsk Krai [6]: Far-Eastern curlew, Aleutian tern, murrelet, etc.

The richness of rivers flowing into the Sea of Okhotsk and of sea bays with various species of freshwater and marine fish largely determines a relatively high abundance of ichthyophagous birds – Steller's sea eagle, white-tailed eagle, osprey, whose nests are confined to the banks near river mouths and shallow bays, where the birds can feed not only during Pacific salmon spawning, but also during other periods.

The biotopes of sphagnum bogs and marshes with larch and Siberian dwarf-pines interspersed with grass-moss bogs that are located in close proximity to river floodplains, lakes, and coastal grass fields in the tidal zone are of interest from an ornithological point of view.

Particularly favorable conditions for nesting of many species of waterfowls and semiaquatic birds have developed in the thickets of tallgrass coastal-aquatic plants that occupy vast areas of shallow water in the Amur liman. About 30% of the ornithological fauna of coastal territories can be observed there. The whooper swan and Bewick's swan, lesser white-fronted goose, swan goose, hen-harrier, hooded crane, and Aleutian tern that are included in Red Data Books of Endangered Species of the Russian Federation [5] and Khabarovsk Krai [6] breed and make stopovers here during the period of seasonal migrations.

The maximum peaks of species diversity and total bird density were observed in the coastal areas in the spring, in the second half of the summer and at the beginning of the autumn. The first peak is caused by the processes of bird’s breeding and the appearance of early breeding birds, while the third is determined by the southern passage of later migrants.

The sea bays under study are the key territories of international importance for migratory stopovers of a number of sandpiper species nesting in the northern tundra of Eurasia and wintering in the Southeast Asia, Australia and New Zealand [7]. The migration strategy of these birds involves long-distance flights with only a few stopovers to replenish energy reserves. The only opportunity for them to replenish the reserves of fat on this migration route is in the Western Priokhotye and on the coast of the Yellow Sea. Considering the ongoing degradation of fodder habitats in the Southeast Asia associated with human activities [8], the importance of the sea bays of the Western Priokhotye for compensating the energy losses of migratory birds still remains underestimated.

Especially significant clusters of birds are formed in large sea bays of Shchastye, Nikolaya, Ulbanskii, Konstantin, Tugurskii, in Shantarskie Islands, on the Mukhtel Lake and in Amur liman (fig. 1). For birds, these areas are the most valuable parts of the coast of the Sea of Okhotsk, the degradation of which negatively affects the well-being of individual populations and bird species in general. The problem of their conservation is in many respects the problem of the conservation of their habitats throughout the entire range, i.e. key ornithological territories. The condition of these
territories can now be considered satisfactory, but at the same time there exist certain threats to the ornithological fauna and the bird populations.

Figure 1. Key Ornithological Territories in Western Priokhotye (1 – Shantarskie Islands; 2 – Tugurskii bay; 3 – Konstantin bay; 4 – Ulbanskii bay; 5 – Nikolaya bay; 6 – Mukhtel lake; 7 – Shchastye bay; 8 – Amur liman).

The variety of natural and anthropogenic factors limiting the number of birds in the Western Priokhotye boils down to the following [9]:

1. Habitat changes, in particular, as a result of as follows:
   - decrease in feed productivity of habitats (e.g., a decrease in fish productivity of water bodies);
   - destruction of nesting supports, defective trees as a result of fires and logging;
   - transformation of habitats due to the construction of public facilities (settlements, fishing and tourist centers, winter huts, cordons, etc.);
   - adverse hydrologic regime in the estuarine parts of the rivers;
   - grazing of domestic animals (destruction of the habitats of chicks of the Nordmann’s greenshank by domestic deer, etc.);
   - contamination of sea coasts and coastal waters with oil and oil products;
   - increase in turbidity of water during the extraction of alluvial minerals.

2. Disturbance factor, in particular, as a result of recreational use of the territory, etc.
3. Direct persecution (hunting, egg collection, trapping for captivity and taxidermy).
4. Indirect elimination (hunting traps, fishing nets).
5. Influence of predators (wild predators and domestic dogs).
6. Adverse wintering conditions.
7. Chemical pollution of feed objects.

In order to preserve populations of nesting bird species as well as places of mass gatherings of migrant birds on the flyby, we propose to organize specially protected natural territories in the western part of the Sea of Okhotsk as a part of the Scheme of promising specially protected natural areas of regional significance for 2011-2020 timeframe called "Strategies for environmental safety of Khabarovsk Krai for the period up to 2020" approved by the decree of Khabarovsk Krai Government No. 758- rp dated December 11, 2010.
They include the wetlands “Nikolaya, Ulbanskii and Konstantin sea bays” in the Tuguro-Chumikanskii municipal district with a total area of 193 thousand hectares and the natural park “Shchastye Bay” in Nikolaevskii municipal district of Khabarovsk Krai with a total area of 40 thousand hectares.

The purpose of their organization is the preservation and restoration of typical wetlands, coastal-marine landscapes, adjacent territories and ecological systems associated with them, rare and endangered plant and animal species included in the Red Data Books of Endangered Species of the Russian Federation and Khabarovsk Krai and their habitats, having high environment-forming, nature conservation and economic importance.

4. Conclusion
The study of the biological and landscape diversity of the Western Priokhotye made it possible to identify key territories for the preservation of unique ornithological complexes. We established that a favorable combination of biotopes of coastal littoral, grass fields, swamps, floodplains of rivers with lake complexes, forests within small coastal areas of the Nikolaya, Ulbanskii, Konstantin, Tugurskii, Shchastye bays, on Udskaya guba, on the Mukhtel lake and in the Amur liman determine a high diversity of nesting rare species of birds (Nordmann's greenshank, Steller's sea eagle, white-tailed eagle, osprey, Aleutian tern, swan goose, oyster catcher), as well as mass migratory concentrations of birds.

The new data on the wildlife, unique natural objects and natural resources of the still understudied territory of the Western Priokhotye may become the basis for the ecological planning of these territories, for the justify the allocation of specially protected natural territories and territories for recreational use, and in the future, when planning the economic development of the territory, for the justification of investment projects.

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