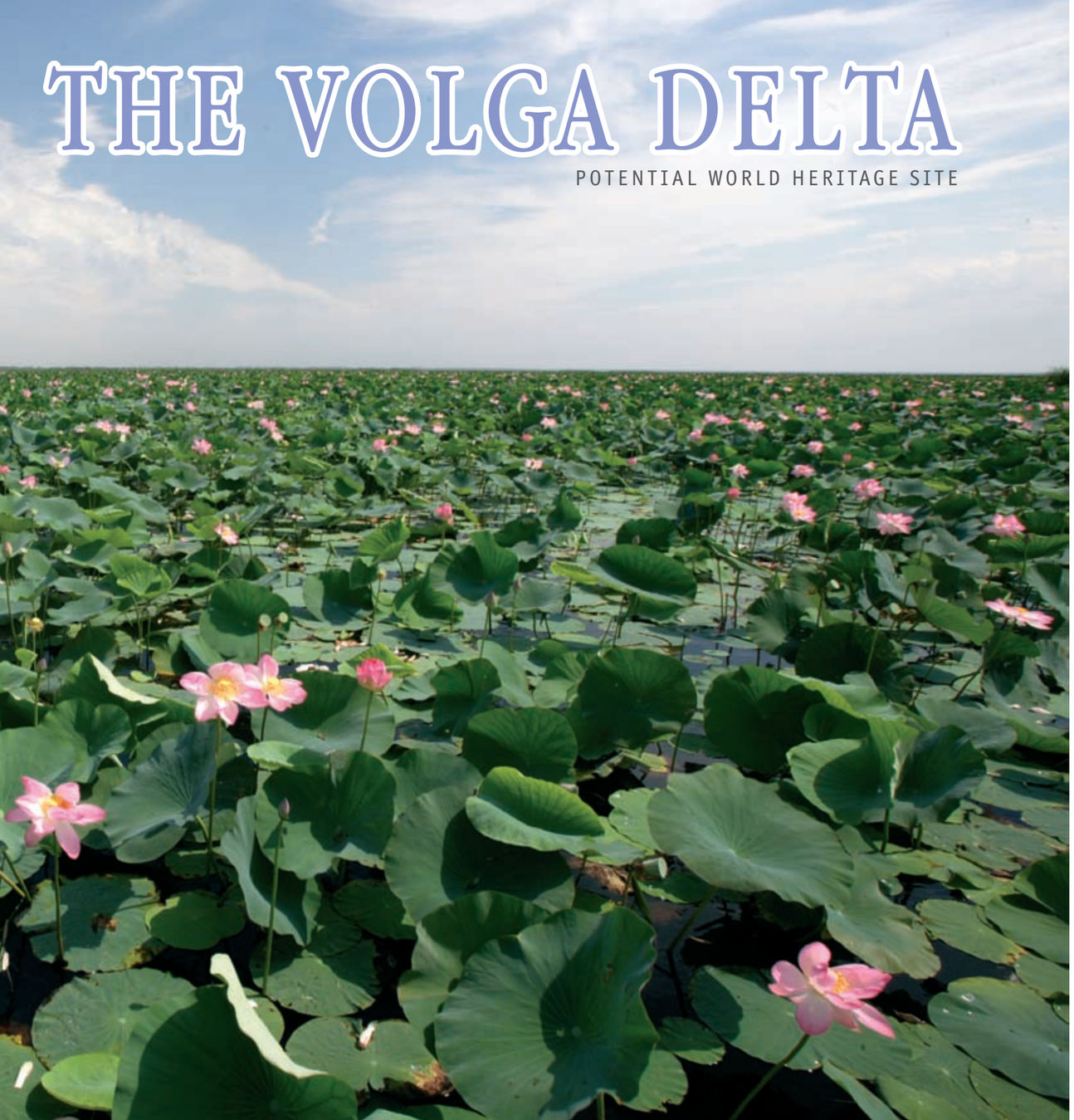


THE VOLGA DELTA

POTENTIAL WORLD HERITAGE SITE

Each State Party to this Convention recognizes that the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage situated on its territory, belongs primarily to that State. It will do all it can to this end, to the utmost of its own resources and, where appropriate, with any international assistance and co-operation, in particular, financial, artistic, scientific and technical, which it may be able to obtain.

CONVENTION CONCERNING THE PROTECTION OF THE WORLD CULTURAL AND NATURAL HERITAGE

INTRODUCTION

Among conventions and programs concerning nature conservation the UNESCO Convention concerning the Protection of World Cultural and Natural Heritage is the most effective and representative one. The primary objective of the Convention is to join international efforts for identification, protection, and overall support of cultural and natural sites of outstanding universal value.

The World Heritage List, which was opened in 1976, is representative of earth's regions and contains an impressive number of properties: 174 natural, 679 cultural and 25 mixed (natural and cultural) sites from 145 states. The Convention protects such world known natural sites as the Great Barrier Reef, Hawaiian Islands, Galapagos Islands, Grand Canyon, Mount Kilimanjaro, Iguazu Falls and Victoria Falls. The total area of natural World Heritage sites represents more than 13 percent of the total area of specially protected natural areas throughout the world.

Today the Russian Federation possesses 15 cultural and 8 natural World Heritage sites. 30 Russian Specially Protected Areas (SPA) including 11 State Nature Reserves and 5 National Parks enjoy World Heritage status.

Russian existing natural World Heritage sites are the Virgin Komi Forests, Lake Baikal, Volcanoes of Kamchatka, Golden Mountains of Altai, Western Caucasus, Central Sikhote Alin', Uvs Nuur Basin and Wrangel Island. Work is underway now to inscribe on the World Heritage List the following natural properties, which are currently included into the Russia's Tentative List: the Putorana Plateau, Magadansky Reserve, Commander Islands, Daurian Steppes, Lena Pillars, Great Vasyugan Mire, Krasnoyarsk Pillars and Ilmen Mountains.

Also, expert work is being carried out on the extension of the Tentative List with new potential natural WH sites, among which the Volga Delta – natural area within the borders of the Astrakhansky State Nature Reserve – is rightfully ranked first.

The outstanding value of natural complexes of the Astrakhansky Reserve has already gained international recognition: the territory is a part of the Volga Delta Ramsar site and possesses the status of a biosphere reserve. Besides, according to the results of the IUCN Gap Analysis of the World Natural Heritage, the territory of the Volga Delta has been recognized as positively deserving World Heritage status.

The Volga Delta lies at a crossroads of migratory flyways of numerous waterfowl species, which makes the territory a very important biodiversity conservation area. The Volga Delta is one of the world's most dynamic river deltas, and as a result of interaction between a large river and a landlocked basin of the Caspian Sea, the delta has a very specific hydrological regime. These features give to the Volga Delta a high chance of being nominated under several natural criteria. The Volga Delta is a unique natural region, which certainly deserves inscription onto the World Heritage List.

The present booklet is based on the materials of the Volga Delta nomination dossier prepared jointly in 2007-2008 by the Natural Heritage Protection Fund, the Astrakhansky State Nature Biosphere Reserve, Geography Institute of the Russian Academy of Sciences, The Lomonosov Moscow State University and the Russian Research Institute for Cultural and Natural Heritage with the assistance of the EURONATUR (Germany) and the UNDP/GEF project «Conservation of Wetland Biodiversity in the Lower Volga Region».

The analysis and the description of the state of conservation of natural complexes of the Astrakhansky Reserve are based on published materials, archival data and the results of long-term scientific researches carried out in the Reserve.

NOMINATION

«THE VOLGA DELTA»

(RUSSIAN FEDERATION)

For inscription on the
UNESCO WORLD CULTURAL AND
NATURAL HERITAGE LIST

Prepared by:
Natural Heritage Protection Fund
Astrakhansky State Nature Biosphere Reserve
Geography Institute of the Russian Academy of Sciences
The Lomonosov Moscow State University
Russian Research Institute for Cultural and Natural Heritage

With the support of:
EURONATUR
The UNDP/GEF project "Conservation of Wetlands Biodiversity in the Lower Volga Region"

IDENTIFICATION OF THE PROPERTY 1

1a. Country (and State Party if different)

Russian Federation.

1b. State, Province or Region

Astrakhkan Region, Kamyzyaksky, Ikryaninsky and Volodarsky Districts.

1c. Name of Property

«The Volga Delta».
The nominated property is located within boundaries of the Astrakhansky State Nature Biosphere Reserve.

1d. Maps and plans, showing the boundaries of the nominated property and buffer zone

A1. Location of the Astrakhansky Reserve on the map of Russia.
A2. Topographic map with precise indication of boundaries of the Reserve and its buffer zone. Scale 1:200 000.
A3. Specially protected natural areas of the Lower Volga. Scale 1:1 600 000.

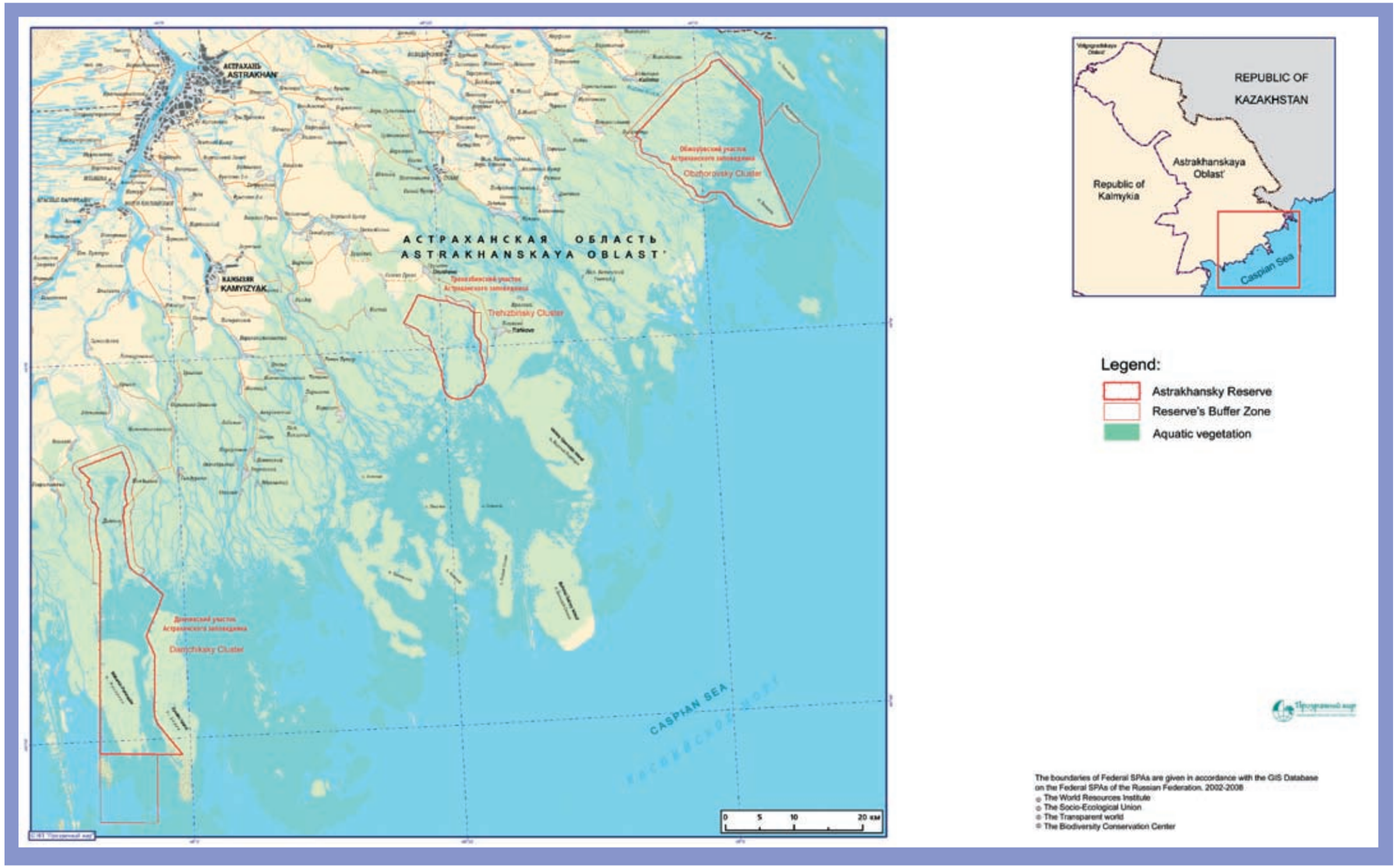
1e. Area of nominated property (ha.) and proposed buffer zone (ha.)

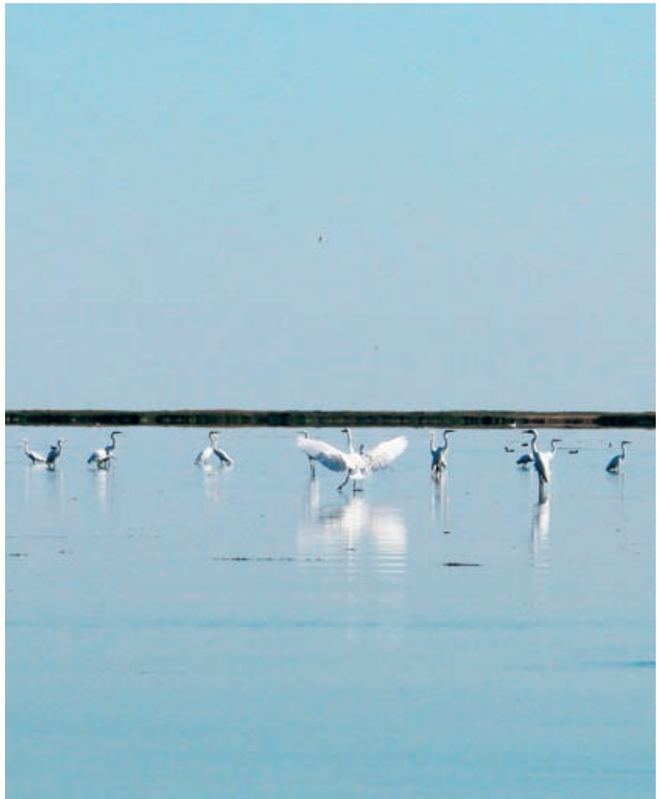
Area of the Reserve is 67 917 ha. Area of the buffer zone makes 31 000 ha. Area spreading between clusters is shown in table 1.

Table 1.

Clusters	Area (ha)		
	Total area	Sea aquatory	Buffer zone
Damchiksky cluster	30 050	9 430	9 000
Trekhizbinsky cluster	9 460	232	3 000
Obzhorovsky cluster	28 407	2 550	19 000
Total	67 917	12 212	31 000

The Astrakhansky State Nature Biosphere Reserve





DESCRIPTION 2

2a. Description of the property

The area of the Astrakhansky State Nature Biosphere Reserve consists of three clusters located in the western (Damchiksky cluster), central (Trekhizbinsky cluster) and eastern (Obzhorovsky cluster) parts of the Volga delta.

The Astrakhansky Biosphere Reserve lies in the Volga Delta intrazonal region of the Caspian biogeographical province, in the desert zone. According to Udvardy's classification of biogeographical provinces (extended by A. Voronov and V. Kucheruk) the reserve's area belongs to the desert Prikaspiysko-Bekpakdalinsky Province of the Palearctic Realm and immediately neighbors the Caspian Province. The region possesses natural features belonging to various biomes as the result of its location at the meeting point of two biogeographical provinces combined with the intrazonality and complex geological history of the region.

Geology

The Volga Delta sits within two structural-tectonic zones; the interzonal boundary lies approximately at the latitude of the Astrakhan' city. The northern portion of the delta is located within the limits of the Caspian syneclise, which is the East European Platform's largest depression. The southern portion of the delta lies within the borders of two platforms: the Epihercynian Scythian Platform and the Turan Platform. Geostructural features of the delta and of the adjacent water area of the northern Caspian Sea were the key factors determined the development of an extensive, flat subaqueous part of the delta (avandelta) and an extremely shallow sea area adjacent to the avandelta. Both subaerial and subaqueous parts of the delta have very gentle slopes (about $0{,}0002^0$) that, in its turn, determined the development of the world's most complicated and ramified network of distributary channels and the active sediment accumulation at the marine edge of the delta.

Landforms

The Volga Delta is situated in the Pre-Caspian Lowland, which is a dried seabed exposed as a result of the Hvalynian Sea recession in the Late Quaternary Period. The distinctive feature of the lowland is that the major part of it is located below the sea level. The relief is low and flat; its monotony is relieved only by salt domes with outcrops of more ancient Paleozoic and Mesozoic rock formations (Ulagan and Bol-

shoye Bogdo mountains), numerous lakes, sand dunes and hollows.

Basing on geomorphic characteristics, the Volga Delta can be divided into 3 zones, from its upper landward point to the marine edge of the delta.

The Upper Zone (about 60 kilometers along the stream) is the most ancient section of the delta with mean elevation of above – 23, 5 meters BS (Baltic mean sea level). It is characterized by prevalent development of large distributary channels and by a relatively simple structure of a waterway network. *The Middle Zone* (stretching along 40–60 km) is situated at a height of -24…-25 meters BS. It possesses a ramified network of well-developed, large waterways connected to one another through a limited number of intermittent side channels. *The Lower, or Coastal Zone* extends from the Middle Zone southward for 20-40 kilometers to the marine edge of the delta. It emerged from the water in 19-20-th centuries mainly because of sea level drop. It has a highly fragmented waterway network with the interchange of stream junction/separation segments and active streamflow redistribution between the channels.

There are relatively low and high landforms that can be observed in the Volga Delta (in cross direction). The low landforms are inter-ridge hollows and other depressions occupied with lakes, *ilmens* and *staritsas*. To high landforms relate levees along existing and intermittent waterways with heights of 2-3 meters in the Upper Zone and 0,3-0,4 meters in the Lower Zone, alluvial ridges up to 2 meters in height (former mouth spits), marine ridges (former marine islands) and Baer mounds. Baer mounds are low hills of disputable origin stretching from east to west. They are 0, 5-8 km in length, 100-500 meters in width and 2-12 meters in height. There are no Baer mounds in *the Upper Zone*, only a few of them are located in *the Lower Zone*, but there are over 400 Baer mounds in *the Middle Zone*.

The modern marine edge of the delta is the youngest and most rapidly evolving section of the delta. Modern relief formation processes take place here as a result of the accumulation of river alluvia and marine sediments. Thanks to extensive shallows covered with land and underwater vegetation and numerous open and isolated bays (*kultuk*) this piece of the delta looks very peculiar.

The distinctive feature of the Volga Delta's *Lower Zone* is an extensive avandelta (a subaqueous part of the delta), which is basically a wide platform gently inclined towards the sea. It juts out 35-50 kilometers into the sea and averages about 2 meters in depth (while the Caspian Sea level is –27 m BC). Flat relief of the zone becomes more complicated here because of numerous sandbanks and islands, natural furrows and artificial shipping channels, fish bypass channels and spoil banks along the channels. River waters slowly flow down over a shallow avandelta off to the sea and thus the zone of river and sea water mixing is located several tens of kilometers away from the marine edge of the delta.

All three clusters of the Astrakhansky Reserve lie within *the Lower Zone* of the Volga Delta and shallow coastal waters of the Volga.

Hydrological conditions

The Volga River (also called Ra in ancient times and *Itil'* in the Middle Ages) belongs to the rivers with so-called East European type of hydrological regime and is characterized by well-defined periods of annual spring floods, autumn overflows, summer and winter low-water periods. The river is fed primarily by snowmelt.

The hydrographic network of the Volga Delta is a very complicated system of water reservoirs and watercourses that includes large distributary channels, smaller waterways, *eriks* (narrow channels less than 30 meters in width), *ilmens* (small lakes), *bankas* (large natural reservoirs at the delta mouth where the runoff from the delta channels and smaller waterways accumulates before going further to the avandelta).

Mean velocity of water flow within the delta depends on the volume of river water coming into the delta, ice regime, wind direction as well as geomorphic structure and morphometric characteristics of water reservoirs. The current velocity reaches its maximum during the spring/summer flooding period.

The channels' beds are cut through the deltaic and even pre-deltaic deposits. The waterway network becomes more and more branched as approaching the delta's shoreline. 223 waterways run across the Lower Delta plain but there are up to 900 channel outlets at the marine edge of the delta that means approximately 5-6 outlets per each kilometer of the shoreline. Some channels continue further through the subaqueous delta plain as natural furrows or more often as artificially deepened shipping or fish bypass channels. Those channels are best developed and serve as the main waterways for the freshwater to flow out to the sea.

Annual inflow to the Volga Delta varies significantly, mainly for climatic reasons. Mean annual inflow is about 250 km^3; during the 20-th century, the swing was from 200 to 270 km^3. The hydrological regime of the Volga Delta has been seriously altered after the construction of a cascade of water reservoirs and power stations on the Volga River and on its large tributaries. This especially refers to the Volga Hydroelectric Power Station and the Volgograd Water Reservoir (the two culminating points of the Volga Power Plant Cascade).

Such regulation of the river flow has resulted in reduction of the volume and time of annual floods. Before the cascade construction, about 50% of the annual inflow occurred during the high-water period (April - June), while today it's only 40% for the same period of time. The flooding period now starts later and finishes earlier and in general it has become about 45 days shorter than in previous years.

Climate

Climate of the Reserve's area is formed under influence of Asian anticyclone. Solar radiance duration is up to 2400 h/year, total solar radiation reaches 118 ccal/sq.cm. Sum of air temperatures above +10° C makes 3500-3600° C. Duration of the warm period is over 250 days. Upon the average annually falls about 167 mm of precipitation, generally as summer showers. Total annual evaporation makes 1177 mm. All this determines air and soil dryness, drought frequency.

Influence of the Caspian Sea over the climate of the Reserve's clusters is seen in lower daily and higher nightly air temperatures (by 1-2 degrees) and 10-14 % higher air humidity than in the other parts of the delta. Due to this, the frost-free period is 15-30 days longer.

Monthly average temperatures		Annual precipitation level (mm)
января	июля	
–2,0°	+24,3°	217

	North	East	South	West
Wind frequency (%)	2,1	21,1	1,7	8,3
	North-east	South-east	South-west	North-west
Wind frequency (%)	7,9	8,8	3,0	6,6

Soils

The Reserve's soils are presented by alluvial sediments in their initial stages of the soil forming process. Alluvial sediments of different texture are transforming into meadow-marsh (meadow-*ilmen*), peat meadow-marsh (marsh-*ilmen*) and meadow-sod soils. At the islands of the Reserve, especially at its northern boundary, are found salinized soils of mosaic spreading.

In respect of the soil zonation, the area of the Reserve can be divided into upper, lower and *kultuk* zones.

The upper zone of the Reserve is relatively old: it has been already formed by the 1920s. The upper zone is located between absolute heights of -24.7 and -25.7 m. In its relief rise above elevated parts with sharply defined levee 1-2 m above the waterline, insular lower parts with ridges and dead channels and also the vast depression occupied by the drying Damchik *ilmen*.

Within the upper zone, the most widespread soils are alluvial meadow marsh soils. They are forming in conditions of shallow groundwater occurrence (up to 1.5 m) and rather prolonged surface floods. The *alluvial meadow-marsh soils* (meadow *ilmen* soils, by M.A. Gorbunova) are developed under bluejoint and wheat grass meadows. *Alluvial meadow-marsh peated soils* (marsh-*ilmen* soils, by M.A. Gorbunova) are developed under reed, cereal-reed and herb-reed meadows. Under halophytic meadows are developed *alluvial marsh saline soils* and meadow and *marsh solonchaks*. At levees in the upper zone of the reserve are formed *alluvial meadow saturated soils*. In the drying *ilmens* under beds of reed, reed mace and spire form *alluvial marsh limous-peat-gley soils*.

The lower zone of the Reserve has dried up at the stage of rapid sea level drop in 1930-1940-s. Occupying absolute heights between -25.7 and -26.5 m, this zone includes low delta islands with poorly developed levees with height about 0.5 m above the water level.

Soils of the lower zone are developed in conditions of prolonged flooding (3-4 months and more) and close groundwater occurrence (less than 0.5 m), which determines their strong overwetting. Large amount of organic remains coming onto the soils surface, in conditions of overwetting are poorly humified and are accumulated as peat-humus mass. The upper horizons, as a rule, are silted because of suspended solids accumulated by the river in the flood periods.

At the levees under willow forests form *alluvial marsh humus-gley soils*. Inside islands under reed meadows form *alluvial marsh limous humus gley soils*.

Kultuk zone is the youngest one. The land has been dried up during the prolonged water level drop period in 1950-1970-s. At present time, it is located between heights of -26.5 and -27.0 m.

Soils of the *kultuk* zone occupy intermediate position between underwater organic and mineral formations and alluvial marsh soils typical for the lower zone. The upper horizons of these soils are silted and contain large amount of humus and peated vegetable remains. At the depth of 5-10 cm they convert into strongly overmoistened mineral mass represented by sand and siltstone sediments with inclusion of shell detritus. Quite often at the surface is noted reddish oxidated warp. We have classified these soils as *alluvial marsh silt-gley soils*, poorly formed in most cases.

Thus, the soils of the Reserve are generally presented by different varieties of alluvial meadow-marsh and alluvial marsh soils. Peculiarities of soils are firstly connected with hydrologic conditions (length and height of floods, groundwater occurrence). In the soil cover of the reserve are sharply defined three zones. In the upper zone, hydromorphism is developed poorly than in the others, here is developed humus accumulation process, halogenesis is noted. In the lower zone, hydromorphism intensifies, decomposition of large amount of organic remains periodically takes place in anaerobe conditions, which leads to generation of peat-humus horizons. The *kultuk* zone soils are characterized by accumulation of poorly peated vegetable remains, silting of surface horizons and strong overwetting of the profile.

Flora and vegetation

The flora of the Astrakhansky Reserve includes a total of 314 vascular plant species belonging to 64 families. All flora species depending from their habitat and water regime are divided into several ecological groups: hydrophytes, hygrophytes, mesophytes, xerophytes and halophytes. Six hygrophyte species can also be regarded as hydrophytes (amphibians). There are also a number of true water plants, which appear within communities of terrestrial plants when those communities get flooded in high water periods, and disappear when the water gets low.

The flora of the Reserve is a part of the vegetable gene pool of Russia, and a variety of plants growing here have economically valuable features, such as forage plants (118 species), medicinal herbs (59 species), bee plants (41 species), ornamental plants (40 species), food plants (26), industrial plants (20), essential oil plants (10), dye plants (9), oil plants (6 species). Weeds number 77 species and noxious plants include 7 species.

Wide-spread economically significant plants include *Salix alba, Salix triandra, Rubus caesius, Phragmites australis, Typha angustifolia, Calamagrostis epigeios, Agropyron repens, Phalaris anmdinacea, Agrostis stolonifera L., Trachomitum sarmatiense, Sparganium erectum, Nelumbo caspica, Butomus umbellatus, Trapa natans, Nymphoides peltata, Salvinia natans, Spirodela polyrhiza, Lemna minor, Potamogeton perfoliatus, Potamogeton pectinatus, Vallisneria spiralis* and *Ceratophyllum demersum*.

The vegetation of the Reserve can be divided into 4 types: shrubs, forest vegetation, meadow vegetation and water vegetation.

Summergreen shrubs dominated by S*alix triandra, Tamarix ramosissima* and *Amorpha fruticosa* represent **shrub vegetation** of the Reserve.

Broadly spread Salix *triandra*-dominated communities grow on small islands and spits at the mouth of the delta channels and *eriks*.

Communities of *Tamarix ramosissima* are confined to salt marshes developed as a result of the influence of either natural or anthropogenic factors. The communities of T*amarix ramosissima* and meadow halophytes are commonly found building a complex biocenosis.

The formation of *Amorpha fruticosa* is scarce and appears as solitary bushes or small-sized thinned thickets 2-3 meters in height. It is situated mainly on high banks of islands inundated only in years abounding in water, and in burnt woods. It is also found replacing overmatured *Salix alba* in its communities.

Forest vegetation is of inundated deciduous forest vegetation type and is composed of different plant communities (lowland herb-grass-sedge, herb and herb-blackberry) generally dominated by *Salix alba*. Initially occurred on spits and islands at the mouth of the delta channels, they gradually develop into dense gallery forests growing along watercourses. The development of one or another forest type is connected to vertical growth of banks of islands. On slightly growing channel banks there are *S. alba*–motley grass-grasses-sedge grass associations, compared to the banks with rapid vertical growth where *S. alba*–motley-grass and *S. alba*–motley grass-bramble communities can be found.

Along with dense gallery forests there is shrub woodland (typical for the upper zone of the Reserve) developing as willow trees die off. The woodland species include *S. alba, Fraxinus excelsior, Amorpha fruticosa, Ulmus latifolia, Morus nigra*.

Riparian willow forests possess great significance for the protection of water resources. They promote the accumulation of alluvium and restrain erosion processes such as bank caving and shallowing of the delta channels and *eriks*.

Meadows can be classified into swamp, regular and steppe meadows. Swamp meadow is comprised of high grass formations (*Phragmites australis, Phalaris anmdinacea and Glyceria arundinacea*), high sedges (*Carex acutiformis and Bolboschoenus maritimus*), low sedges (*Eleocharis palustris and Scirpus supinus*), herbs (*Alisma plantago-aquatica, Veronica anagallis-aquatica, Polygonum hydropiper and Marsilea quadrifolia*), and macereed (*Typha angustifolia*). Waterlogged meadows occupy about 40 000 ha mainly covered by reedbeds and macereed.

Regular meadow consists of the following plant formations: high grasses (*Calamagrostis epigeios and Agropyron repens*), small grasses (*Aeluropus, Hierochloe odorata and Agrostis stolonifera L.*), low grasses (*Crypsis*), tall herbs (*Trachomitum sarmatiense, Lepidium latifolium and Aster tripolium*) and small herbs (*Lepidium pinnatifidum, Suaeda confusa, Argusia sibirica and Salicornia europaea*). About 50 % of regular meadows occur at firebreaks along the northern borders of the Reserve's clusters, where their development is driven by annual mowing. Other 50% are bush grass and *kendyr* meadows developed as a result of the vertical growth of islands and natural change of vegetation.

Steppe meadows, formed as a result of mowing and grazing management, consist of several plant formations respectively dominated by *Poa angustifolia, Cynodon dactylon, Glycyrrhiza glabra* and *Limonium gmelini*. Within this meadow type bluegrass meadows, couch grass meadows and licorice meadows replace bush grass meadows.

Aquatic vegetation includes true aquatic plants and amphibious plants. True aquatic plants cover a total area of 6,7 hectares; they can be divided into 4 general types: 1) rooted plants with floating leaves (*Trapa natans, Nymphaea candida, , Nuphar luteum, Nymphoides peltata, Potamogeton nodosus*); 2) totally submerged, rooted plants (*Myriophyllym spicatum, Myriophyllym verticillatum, Vallisneria spiralis, Elodea canadensis, Potamogeton perfoliatus, Potamogeton lucens, Potamogeton pectinatus, Potamogeton berchtoldii and Potamogeton crispus, Batrachium eradicatum* and *Batrachium rionii, Arabis* and *Caulinia minor*); 3) rootless plants, floating on water surface (*Hydrocharis morsus-ranae, Salvinia natans, Lemna minor, Spirodela polyrhiza*); 4) rootless submerged plants (*Ceratophyllum demersum L., Utricularia vulgaris*).

Aquatic plant communities dominated by floating leaf species - *Trapa natans, Nymphoides peltata, Nymphaea candida, Nuphar luteum* - are best represented in the Reserve. The communities of *Vallisneria spiralis, Potamogeton pectinatus, Potamogeton lucens* and *Potamogeton nodosus, Ceratophyllum demersum L.* are the most common among the submerged species.

Amphibious vegetation includes tall grasses (formations dominated respectively by *Phragmites australis, Zizania latifolia, Typha angustifolia, Typha latifolia, Typha laxmannii, Scirpus lacustris*) and short grasses (*Nelumbo nucifera, Sparganium erectum, Butomus umbellatus, Acorus calamus, Sagittaria sagittifolia* and *Alisma gramineum*). Amphibious plants, such as reed grass, macereed,

brunched burr and others, often grow in complex associations with aquatic plants of types 1,2 and 4 (see above).

Four plant species growing in the Reserve have been inscribed into the Red Data Book of the Russian Federation, namely *Nelumbo nucifera, Trapa natans, Marsiliea aegyptiaca* and *Aldrovanda vesiculosa*.

Nelumbo nucifera is the most remarkable among the rare and endangered plant species of the Reserve. The history of this relic plant dates back to the Cretaceous Period. It is regarded as a sacred plant in India and China. There are a few hypotheses about how the lotus came to be introduced into the Volga Delta. One of them is that the lotus was brought by migrating birds since the viable lotus seeds were found in their intestines. Other assumption is that the lotus came with the nomadic Kalmyks who also believed that the lotus was a sacred plant. The third hypothesis says the lotus is a native inhabitant of the Volga Delta and has been growing here over many thousand years. Upon the modern taxonomy, the lotus growing in the Volga delta has been singled out into separate specie - Caspian lotus (*Nelumbo caspica*).

At the time when the Reserve was established *N. caspica* could be found only in kultuks and occupied only 0,25 ha. Decrease of the Caspian Sea level has resulted in shallowing and sequential vegetal invasion of the avandelta's waters by submergent and emergent vegetation. By 1963, due to the occupation of new shallow areas, the total area of lotus fields in the Reserve increased up to 67 hectares.

Further redistribution of lotus fields is a result of the regulation of the Volga River flow due to the construction in 1958 of the Volgograd Hydroelectric Power Station. Decrease in the inflow to the Volga Delta during the high water period led to increasing vegetal invasion of the Delta's shallows by water plants in general and the lotus in particular. In 1970 lotus plants covered over 200 ha of the Reserve's area. In 1978 it was about 1000 ha, and in 1984 it came up to 1 500 ha, compared to 3 000 hectares in the entire Volga Delta. During the last decades lotus fields kept their growth and currently *N. caspica* occupies over 5 000 hectares of the Reserve's area.

Besides being an ornamental plant, the lotus, due to the extension of lotus-covered area, became within the last 20-30 years an important provider of food and refuge to waterfowl, which eat lotus nuts and fruit pulp. Wild boars readily eat lotus roots. In the autumn tens thousands of geese and thousands of swans feed on the lotus fields in the Damchiksky cluster. During summertime molt ducks take shelter under large lotus leaves.

Aldrovanda vesiculosa (L.) is another rare species for the Reserve as well as for the entire Astrakhan Region. However, the Reserve's habitats allow the species to increase the population size.

Marsiliea aegyptiaca (Willd.) is an extremely rare species. *M. aegyptiaca* along with *Aldrovanda vesiculosa* are low abundance species and both place increased demand on habitat conditions. Within the Reserve *M. aegyptiaca* can be found growing in small groups in flood communities located at sporadically flooded low sites. The fact that *M. aegyptiaca* mainly reproduces vegetatively provides the necessity to preserve its habitats, which is possible only within specially protected areas.

Trapa natans is a Tertiary relic species. Water chestnut tangles are majorly confined to running areas of reservoirs. Before 1930s water chestnut has been met mostly in *ilmens* and *kultuks*. At present time, it is widely spread in kultuks and at the shallow part of the avandelta.

Despite its wide areal, the spreading area and abundance of water chestnut are decreasing. The major reason is reservoirs drying up due to land melioration and collection of water chestnuts for cattle feeding. The Volga delta is an exception. Presence of well-developed system of dead channels, *ilmens, kultuks* and other reservoirs annually enriched by uliginous silt in the flood period, owes to mass growth of water chestnut, which is a perfect food for wild boars, geese and swans.

Under constant freshwater conditions typical for the Volga Delta, multi-species communities of submerged and semi-submerged plants may serve as centers of dispersal of the species over water reservoirs of the adjacent arid zone. In relation to gene pool conservation, *Myriophyllum verticillatum, Vallisneria spiralis, Caulinia minor, Potamogeton lucens* are of special importance among the given group of plants.

The flora of the Astrakhansky Reserve exhibits a unique diversity of plant communities developed in intrazonal environment. Due to increasing man-made transformation of landscapes and growing load on natural ecosystems the significance of the Reserve as a protected area also increases. Currently the Reserve provides the proper conservation of floral and coenotic diversity as well as optimal life conditions for numerous plant communities.

Fauna

The fauna of the Astrakhansky Reserve belongs mainly to the European fauna type, with the presence of elements of other fauna types. Nonsymbiotic aquatic invertebrates belong to 828 taxonomic units, including *Protozoa* (136 taxons), *Rotifera* (403), *Cladocerae* (142), *Copepoda* (70) and other animal groups (77). 225 invertebrate species relating to 8 classes have been registered at the bottom of reservoirs and in tangle fauna.

High diversity of microclimate conditions gave rise to the coexistance of various ecological groups of insects, from aquatic to mesophilous and desert ones.

Pisces

The diversity of environmental conditions (water depth, lowage and weediness of waters) found in water reservoirs of the Reserve accounts for the diversity of fish species (a total of 56 species belonging to 12 families). The most abundant are *Cyprinidae* (24 taxons) and *Agonidae* (11 taxons).

Volga-Caspian region is a global scale center known for the diversity and wealth of its fish fauna, with special emphasis on the diversity and richness of sturgeon species (*Acipenseridae*). *Huso huso, Acipenser gueldenstaedti, A. stellatus* are common here, *A.ruthenus* can also be found in the Reserve.

Among the fish fauna of the Reserve the most common species are freshwater species, mainly *Cyprinidae* and *Percidae*: carp, bream, Caspian roach, tench, rudd, silver bream, asp, lookup, and also pike, cat fish, river perch, pike perch, crucian carp and several species of *Cottidae*, while nase, sabre fish and Volga zander are found rarer. Diadromous and semi-anadromous fish which migrate to the Reserve's area during the spawning season represent quite a considerable portion of the Reserve's fish fauna another considerable part of which are marine fish. Anadromous fish species – *Acipenserodae* and *Clupeidae* – can be found in the Reserve's waters only when they migrate from the sea to their spawning grounds in the Volga River and back.

Many of the Reserve's reservoirs and waterways are migration paths or spawning grounds of fish. The main spawning grounds are inundated meadows (also called *poloys*) of the subaerial Delta. The water gets warm very early here giving rise to the rapid development of hydrobionts. Vegetation grown up before the beginning of the spawning season serves perfectly as a substrate for fish roe.

Not only fry but also larger fish have great significance for the nutrition of birds, animals, *amphibia* and reptiles inhabiting the Reserve.

Amphibias and reptiles

Lake frog is the most abundant of amphibian species of the Reserve. It lives in numerous channels, *eriks, ilmens and kultuks*. It is also widespread throughout the avandelta. *Pelobates fuscus* is much rarer. There are also unconfirmed reports on the observation of green toad and common hyla.

The dominant reptile species are grass-snake and common water snake. Pallas' coluber, fresh-water turtle and sand lizard are also found in the Reserve.

Mammals

The number of mammal species is relatively small. Theriofauna of the Reserve includes 33 species belonging to 7 orders: *Insectivora* (4), *Chiroptera* (8), *Lagomorpha* (1), *Rodentia* (8), *Carnivora* (9), *Pinnipedia* (1), *Artiodactyla* (3). However, with the exception of non-resident or unconfirmed species, the site-specific mammal group consists of 20 species, a fifth part of which are introduced species showing no genetic affinity to the Volga Delta. The distinctive features of the Reserve's mammal fauna are high productivity and dynamism of populations of some species. The life of some species, such as common vole, water vole, Old World harvest mouse, field mouse, common weasel, wild boar, otter, *Crocidura suaveolens*, *Crocidura leucodon*, European beaver, musquash, raccoon dog, American mink, is closely connected to natural conditions of extrazonal coastal landscapes. Other species are widespread throughout the Reserve's area: house mouse, common rat, fox and gray wolf. The third group of species includes those occasionally observed in the Reserve (Caspian seal, saiga and elk).

The *Insectivora* is represented by 4 species. Eared hedgehog dwells inconstantly, single cases of its appearance have been registered only after several low flood level years, and *Crocidura suaveolens* and *Crocidura leucodon*, both are quite abundant.

Russian desman (*Desmana moschata*) is listed in the Red Data Book of the Russian Federation (status 2), Astrakhan Region, and the IUCN Red Data Book (status VU). The information about this species is very scarce. It is a decreasing, rare relic species of Russia.

The *Lagomorpha* is represented by the only species - European (brown) hare (*Lepus europaeus*). It is a typical representative of the steppe-desert faunal complex.

The *Chiroptera*, an underexplored order of the Reserve's mammals, is represented by *Pipistrellus kuhli, Pipistrellus nathusii, Eptesicus serotinus, Vespertilio murinus* and *Nyctalus noctula*. Some of the abovementioned species visit the Reserve only during their seasonal migrations.

Two out of total of 9 species of *Rodentia* found in the Reserve are naturalized species (European beaver and musquash), the other 7 species are native ones. European beaver (*Castor fiber*) was imported from the Voronezhsky State Reserve. The beaver population has been decreasing since 1975, currently there is no beavers in the Reserve. The main cause of its extinction is the increase in water level in the Delta in winter season as a result of the evacuation of water from the Volgograd Water Power Plant that causes the inundation of lodges and animal loss. Ondatra (*Ondatra zibethicus*) was introduced to the Volga Delta in 1953-1954. By now, independently or by means of several target in-regional introductions, the species has occupied the entire Delta area and has become an integral component of the Reserve's biocenosis. *Arvicola terrestris* was common till the late 60s; now its number reduced. *Microtus arvalis* is commonly found in meadows, willow-motley grasses, reed grass and reed grass-sedge grass stations, though in the last two it is found more often.

The fauna of *Muridae* includes 4 species: *Apodemus agrarius, Mus musculus, Micromus minutus* and *Rattus norvegicus*.

Meriones tamariscinus was for the first time discovered 1989 on a salt marsh near the Babyatsky *erik* in the Damchiksky sector. Today large colonies of *Meriones tamariscinus* thickly settled in the northern part of the Damchiksky sector of the Reserve.

The *Carnivora* is represented by 3 families: *Canidae, Mustelidae* and *Felidae*. Among the *Canidae, Nyctereutes procyonoides* is the most abundant species. It was naturalized in the Delta in 1936 and in 1939. The *Nyctereutes procyonoides's* best habitats are located in the lower zone of the subaerial Delta – exactly where there is the Reserve's area, which is well protected and has plenty of food.

Canis lupus is a permanent resident of all the three sectors of the Reserve.

Vulpes vulpes rather belongs to the biocenosis of the Upper and Middle subaerial Delta, though is quite common in the Reserve, too.

Canis aureus was for the first time registered in the Reserve in 1989 in the Damchiksky sector. Today 1-2 families permanently live in this sector. Encounters with this animal in the Obzhorovsky sector have also been reported.

Mustella erminea, Mustella nivalis, Mustella vison and *Lutra lutra* represent the *Mustelidae* family. The most common is *Mustella erminea*. It is found in every of land biotopes. In contrast, *Mustella nivalis* is scarce in the Reserve. *Mustella vison* is an introduced species, which appeared in the Delta in the early 70s as a result of the site-specific

adaptation of animals escaped from fur farms. River otter is an indigenous species of the Delta, which is found throughout the Reserve but is the most abundant in the Damchiksky sector.

The Reserve's Records contain very limited records of *Felis chaus*. According to them, jungle cat was common in the Reserve until the middle 50s. Later it occurred more rarely and now special research is required to find out any information about the destiny of this species in the Reserve.

The Caspian seal is spotted in the Obzhorovsky and Damchiksky sectors of the Reserve in autumn and in springtime migrating in path of fish shoals, which come to their wintering or spawning grounds to the branches of the Volga River. During this period Caspian seal is found not only in the avandelta water area but also in the Delta channels.

Three species of hoofed mammals have been registered within the Reserve. The wild boar (*Sus scrofa*) is the only hoofed animal inhabiting the entire area of the Reserve from the subaerial Delta's reedbeds to the avandelta islands. It is one of the most important components of biocoenosis. Due to well-developed hydrographic network and the presence of natural levees, the Reserve's area is a maternity home for animals of the adjacent lowland reed grass belt. In recent years from 400 to 800 boars were reg-

istered in the Reserve before the farrowing period. Extensive reed and macereed thickets very much fit the tastes of the wild boar. However, during the flood period, the water rises up, and so it drives the wild boar out from the most low-lying places (*kultuks* and *ilmens*) and up to the levees. Thus, in May-June the bulk of boars gather on the levees. During the high water period, if the water is high and the flood period is long, which happens in the Delta once in 6-8 years, in that case boars and other animals starve, die of cold or perish of inanition. To save animals earth mounds for supplementary feeding during the high water period have been built in the Reserve's sectors.

Elk (*Alces alces*) and saiga (*Saiga tatarica*) are not the residents of the Reserve. Their sporadic winter visitations of the Reserve's area are caused mainly by unfavorable weather conditions.

Mammals are the key component of an ecosystem. In the Astrakhansky Reserve the composition of mammal species is almost equal for each sector. Hydrological regime is the main factor determining the status and dynamic characteristics of mammal populations.

Avifauna

The Volga river delta is one of the most important areas of birds accumulation during their seasonal migrations in Eurasia. At the clusters of Astrakhansky Reserve concentration of migrating waterfowl and near-water birds is especially high: *Anseriformes* (14 species), *Limicolae* (25), *Laridae* (7) and *Ciconiiformes* (11). Total migrations duration is 9 months, from March until November. Besides common spring and autumn transitional pass, within the Reserve as well as over the whole delta birds also shift to summer molting areas and back before the beginning of main autumn pass (*Anatinae, Haematopinae*). Also are noted early post nesting movements of many species, fore departure transitions of local populations and non-breeding birds, non-periodical migrations of wintering species, etc. Only in June shifts seemingly subside, but do not end.

Table 2. Bird species of the Astrakhansky Reserve.

Order	Total species	Number of nesting species	Passing through, shifting, wintering, aestivating species	Irregularly visiting species
Podicipediformes	4	4	-	-
Pelecaniformes	4	3	1	-
Ciconiiformes	12	11	-	1
Phoenicopteriformes	1	-	-	1
Anseriformes	29	10	14	3
Falconiformes	24	8	15	1
Galliformes	3	3	-	-
Gruiformes	13	6	5	2
Charadriiformes	52	8	39	5
Columbiformes	5	3	2	-
Cuculiformes	1	1	-	-
Strigiformes	7	3	3	1
Caprimulgiformes	1	-	1	-
Apodiformes	1	-	1	-
Coraciiformes	4	2	2	-
Upupiformes	1	1	-	-
Piciformes	5	2	2	1
Passeriformes	112	34	70	8
Total	279	99	155	23

During migration period prevail whooper swan (*Cygnus cygnus*) and mute swan (*Gygnus olor*), grey goose (*Anser anser*), mallard (*Anas platyrhynchos*), pintail (*Anas acuta*), European teal (*Anas crecca*), garganey teal (*Anas querquedula*), duck (*Anas strepera*), pochard (*Netta rufina*), diving ducks (*Aythya ferina* and *A. fuligula*), magpie diver (*Mergus albellus*). In the nesting period are numerous *Ciconiiformes, Pelecaniformes* and *Charadriiformes, especially* great white heron (*Egretta alba*) and common heron (*Ardea cinerea*), cormorant (*Phalacrocorax carbo*), black-headed gull (*Larus ridibundus*), Caspian gull (*Larus cachinnans*), great black-headed gull (*Larus ichthyaetus*), whiskered tern (*Chlidonias hybridus*), white-winged black tern (*Chlidonias leocopterus*) and black tern (*Chlidonias niger*). Accumulations of migrating birds at Damchiksky cluster are enormous. This area is located at the southwestern part of the lower Volga delta, where ice cover breaks earlier in spring and freezes later in winter. In March and April near Makarkin Island and at the adjacent waters stay up to 8 000 – 9 000 whooper swans, in October-November, up to 12 000. Local and passing mute swans keep together with them. Autumn stops of swans are long. Whooper swans keep at shallow waters of *kultuk* area until the river totally freezes over. Many swans and geese feed with rhizome and drupes of lotus that grows extensively at the Damchiksky cluster of the Reserve.

The Reserve is located at one of the largest migration routes of waterfowl and near water bird species nesting at the West Siberian plain, Northern Kazakhstan and other regions and wintering at the vast area of the south of Western Europe, Africa and Southwest Asia.

In spring, transitional migrations prevail. Major part of birds stop at the delta for a short time. Birds mostly keep at shallow reed bed areas of the delta. Total number of water birds per season is estimated as 7 million specimens (Krivenko et al., 1998).

Bird fauna of the Reserve counts 279 species, of which 99 nest at the Reserve's area, 155 are met during migrations and wintering and 23 irregularly visit the area (see table 2). The basis of local bird fauna is made of wetland species nesting on trees or in reed beds, but trophically connected with water reservoirs; over 30 species are forest

dwelling birds, only 3 species belong to meadow ecosystems and 3 to synanthropic species. Bird population of the Reserve is distinguished by diversity and large size. Richness of bird fauna is determined by peculiarities of ecological conditions and geographic location.

The Reserve's area is the part of the Wetland of International importance.

Upon the results of zoogeographical analysis, 50% of bird species nesting in the Volga delta belong to transpalearctic group or other even more widespread groups, 24.1% belong to European fauna type, 15.8%, to Mediterranean fauna type, 9.2%, to Mongolian, and 0.9%, to Chinese.

Within the Reserve's area are met 80 % of bird species, which nest over the whole delta of the Volga; during the migrations period was noted 96% of bird species of this category.

The Volga delta is the habitat and temporary dwelling area for a line of rare and disappearing bird species inscribed on the 2006 IUCN Red list (18 species) and into the Russian Federation Red Data Book (42 species). 64 bird species have been inscribed into the Red Data Book of Astrakhansky Region. 27 bird species of the Russian Red Data Book are nesting in the Astrakhansky Reserve, like Dalmatian pelican (*Pelecanus crispus*) (small colonies at Damchiksky and Obzhorovsky clusters), spoon-bill (*Platalea leucorodia*), glossy ibis (*Plegadis falcinellus*), buff-backed heron (*Bubulcus ibis*) (single nest found at Trekhizbinsky cluster), osprey (*Pandion haliaetus*) (3-4 pairs), white-tailed eagle (*Haliaeetus albicilla*) (up to 50-70 pairs on three clusters), saker falcon (*Falco cherrug*) (formerly one pair was nesting at Damchiksky cluster), little bustard (*Tetrax tetrax*) (2-3 pairs at Damchiksky cluster), black-winged stilt (*Himantopus himantopus*) (several pairs at the same cluster). Upon confirmed data, gallinule (*Porphyrio porphyrio*) is nesting at areas adjacent to Damchiksky cluster. During shifts and migrations are common: great black-headed gull (*Larus ichthyaetus*), little cormorant (*Phalacrocorax pygmaeus*), lesser white-fronted goose (*Anser erythropus*), black-winged stilt (*Himantopus himantopus*), peregrine (*Falco peregrinus*); rare but regularly are met during migrations: red-breasted goose (*Rufibrenta ruficollis*), golden eagle (*Aquila chrysaetos*), steppe eagle (*Aquila rapax*), white crane (*Grus leucogeranus*), avocet (*Recurvirostra avosetta*), Norfolk plover (*Burhinus oedicnemus*), great bustard (*Otis tarda*), European white pelican (*Pelecanus onocrotalus*). Black stork (*Ciconia nigra*) and flamingo (*Phoenicopterus roseus*) are visiting species; encounters of Bewick's swan (*Cygnus bewickii*), and white-headed duck (*Oxyura leucocephala*) are possible although they haven't been met for a long time.

Anseriformes are the most diverse in species and most numerous in the wetland species group. Many mute swans, grey geese, mallards and pochards are nesting. Mute swan demonstrates the positive influence of the Reserve to its population in the Volga delta. Restoration of the mute swan population has first begun at the Reserve's territory. The first nest was found at Obzhorovsky cluster in 1938. In late 1940-s nesting has become regular, and in 1953 15 pairs have been noted here. At the Trekhizbinsky cluster first swans' nests have been discovered in 1952, at Damchiksky cluster, in 1953. Mute swans began settling outside the Reserve's area, especially on lands near Obzhorovsky cluster. In 1961 at Obzhorovsky cluster 215 pairs were nesting, 162 of which were situated in groups by 5-7 nests, and one group even counted 30 nests. The total number of the delta population has reached 755 pairs in 1963. In 1967, the swan population size has reached its maximum of 327 pairs, and then started reducing as birds settled the adjacent areas. In 1981-1984 at Damchiksky clusters nested from 270 to 400 pairs, at Trekhizbinsky, from 4 to 11 pairs, at Obzhorovsky, from 250 to 350 mute swan pairs. The total number of pairs within the whole delta made 4-5 thousand pairs. In early 1990-s, due to

the water level rise, the number of nesting pairs sharply decreased. At present time the number of nesting pairs has stabilized.

Of special interest are colonies of *Ciconiiformes* and Pelecaniformes. Willow forests serve as their main nesting areas. Here is noted the rare phenomenon: for many years at all clusters exist colonies where nest together grey

heron, pond heron (*Ardeola ralloides*), great egret, little egret (*Egretta garzetta*), night heron (*Nycticorax nycticorax*), spoon-bill (*Platalea leucorodia*), glossy ibis (*Plegadis falcinellus*), and rarely buff-backed heron (*Bubulcus ibis*). Cormorants nest separately or in mixed colonies with herons, glossy ibises and spoon-bills. In 1981-1985, 7500-9000 cormorants and 1800-4700 *Ciconiiformes* have been nesting within the Reserve. The population size of these species has been changing within natural limits peculiar to local populations. Cormorants and herons fly feeding to the shallow sea armlets, or *kultuks*, and to spring floods rich with fish and water invertebrate.

Rare bird species

Species inscribed on the IUCN Red List:

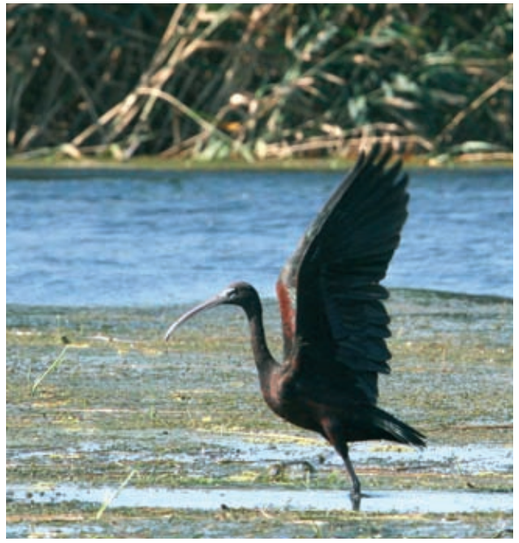
Dalmatian pelican (*Pelecanus crispus*) – rare nesting specie. From 1930 until 1967, Dalmatian pelicans were nesting within the Astrakhansky Reserve. Shallowing and overgrowing of the seashore caused their resettlement to the south, to deeper areas of the North Caspian. In the beginning of the current century, small nesting colonies have again appeared at Damchiksky and Obzhorovsky clusters. The Volga delta population size is 30-240 pairs with decreasing tendency. Dalmatian pelican has been inscribed on the 2006 IUCN Red List as vulnerable specie (VU).

Ferruginous duck (*Aythya nyroca*) – molting, passing by and a very rarely nesting specie. Ferruginous duck is nesting at hard to reach areas (insular reed timbers) which determines exceptional scarse nest findings. It molts also in hard to reach areas at small insular water reservoirs and at flooded reed beds. Formerly in early autumn ferruginous duck has formed small accumulations at areas with abundant aquatic vegetation (often together with common coot) at Damchiksky cluster. Autumn pass lasts until late November. Ferruginous duck has been inscribed on the IUCN Red List 2006, the population size decreases.

Marbled teal (*Anas angustirostris*) seems to be extinct in the Volga delta. The disappearing specie. No marbled teals were found in ducks capture for ringing in 1961-1983.

Saker falcon (*Falco cherrug*) – few cases of nesting registered. Specie with a decreasing population.

Roller (*Coracias garrulus*) – nesting and passing by specie. Stays at the delta from late April until late September. Roller is nesting in hollows and tree cracks. Is regularly met on communication and power lines.



The Reserve's area plays an important role not only as a nesting area for rare species, but also as a stopover place and rare species' wintering area. Of water birds such rare species as **lesser white-fronted goose** (*Anser erythropus*) and **red-breasted goose** (*Rufibrenta ruficollis*), an endemic of Western Siberia, the only relic representative of *Branta* genus, are met on passage.

White-headed duck (*Oxyura leucocephala*), the relic specie under threat of extinction, is occasionally visiting the area.

The most valuable prey birds are steppe and forest steppe representatives which often visit the reserved area during movements. These are **pale harrier** (*Circus macrourus*), Eurasian steppe endemic, **spotted eagle** (*Aguila clanga*) and the disappearing **lesser kestrel** (*Falco naumanni*).

For the disappearing **white crane** (*Grus leucogeranus*), the passing specie, the Reserve plays an important role in conservation of its Ob population. White cranes wintering in Iran stop over here. Since 1928 till 1985, from 2 to 22 white cranes have been observed at Damchiksky cluster of the Reserve. In March 1991, 5 birds were seen near the eastern boundary of this cluster. During last decades, 1-4 birds have been observed at Obzhorovsky cluster during spring and autumn flights.

Otidae family is presented by two species, **great bustard** (*Otis tarda*) and **little bustard** (*Tetrax tetrax*), both inscribed on the 2006 IUCN Red List. Small number of great bustards is noted during migrations: between 1976 and 1985 at Damchiksky cluster were registered 6 encounters of single birds and flocks of 4-11 specimens. Little bustard has been irregularly nesting near the northern boundary of this cluster, in autumn here appeared migrating flocks of up to 100 birds.

The threatened **sociable lapwing** (*Chettusia gregaria*), endemic of Russia and Kazakhstan, and **black-winged pratincole** (*Glareola nordmanni*) are rarely visiting the northern boundary of the Reserve.

JUSTIFICATION FOR INSCRIPTION 3

3a. Criteria under which inscription is proposed (and justification for inscription under these criteria)

The Volga Delta natural site is nominated for World Heritage status under the following criteria:

vii) Contains superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

Because of its mosaic structure where water landform elements (narrow and wide river channels, gulfs and open water areas) are naturally combined with terrestrial landform elements (islands of different size, shoals) and vegetation (gallery osier and reed beds, mace reed, wet meadows) the Volga Delta has an low-key but very much aesthetically pleasant, pacifying landscape. However, during the blooming season of the lotus (also called Caspian Rose) the delta has an eye-catching, magnificent look thanks to floating carpets made of hundreds of splendid rose-colored flower buds.

viii) Outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.

The Volga Delta is Europe's largest river delta and one of the world's biggest river delta systems. The Volga River flows into the Caspian Sea, the Earth's largest landlocked water body that is not connected to the ocean in the present geological era.

The history of the development of the Volga Delta is tightly connected with that of the Caspian Sea. The Caspian Sea level fluctuations are much higher in frequency and amplitude than those of the global sea level. The Caspian Sea level has reached its maximum highstand of +50 m AMSL in the Upper Pleistocene and was at its minimum lowstand of – 110 m AMSL in the Early Holocene. The average amplitude of sea-level fluctuations was found to be about 25 meters in the late-Holocene sea level cycle (about 2 500 years long) and about 3 meters in the instrumental observation period (i.e. during the last 150 years).

Over the course of its geologic history, the Volga Delta changed its location in connection with the Caspian sea level changes. Thus, the delta migrated hundreds of kilometers north and south from its current position. The modern Volga Delta began to form about 9 000 years ago when the Neocaspian transgression followed the significant Mangyshlak regression. The final stage of the Neocaspian transgression finished 2 500 years ago, since then the Volga Delta kept growing southward while the position of its top point remained unchanged. In that period the delta system possessed a high susceptibility to short-term fluctuations of generally decreasing sea level.

The causes of cyclic changes in the Caspian sea level still stay unclear but most scientists believe that they are caused mainly by climate change. The Volga provides most of the Caspian fresh water inflow that increases with increasing precipitation in the Volga Basin.

In the recent decades, the Caspian Sea coast has been drawing the attention of scientists in relation to global environmental changes. Global warming has sped up sea level rise that has resulted in coastal line changes. The forecast of the impact on the coastal ecosystems is difficult because of a slow rate of the sea level growth (by 13 centimeters in the 20-th century). The average rate of the most recent Caspian sea level rise was 100 times greater than that of the eustatic global mean sea level rise.
In connection to this, the Caspian Sea is an important natural laboratory to study short-term sea level fluctuations and their effects on a coastal zone (Kroonenberg et al., 2000). The Caspian Sea provides a unique chance to monitor in natural conditions the mechanism of response of the coastline to water level rise and to use the obtained information further to build and test different forecast models.

The modern Volga Delta bank and underwater slope gradients are the lowest among large river deltas throughout the world (less than 5 cm/km). As a result, the delta has an extremely complicated hydrographic system that includes large distributary channels, smaller waterways, *eriks* (narrow channels less than 30 meters in width), *ilmens* (small lakes) and isolated bays (*kultuks*). The delta also possesses an extensive avandelta (subaqueous part of the delta) with depths of 1,5-2,5 meters that stretches 35-50 kilometer out into the sea. River waters flow down slowly over a shallow avandelta off to the sea and thus the zone of river and sea water mixing is located several tens of kilometers away from the subaerial delta sea edge. The total area of the Volga Delta (incl. the avandelta) is over 20 000 square kilometers. The entire Volga River mouth area occupies 120 000 square kilometers (Mikhailov, 1997).

Therefore, the Volga Delta as a world scale unique natural property notably different from any of existing World Heritage river delta sites. The distinctive features of the Volga Delta are as follows: huge size, vast subaqueous part of the delta (avandelta), the zone of river and sea water mixing that is moved tens kilometers off to the sea, remarkably complicated hydrographic network, a very indented coastline, plenty of islands, high velocity of natural processes influenced by rapid Caspian sea level fluctuations.

ix) Outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.

The Volga Delta is an integral part of the Caspian Sea ecosystem, which development during geological time in many respects depended on cyclic sea-level fluctuations of the Caspian Sea. In the periods of marine transgressions the Caspian Sea flooded extensive plains adjacent to the sea and became connected to the World Ocean. During the periods of marine regressions, the area of the sea significantly decreased, sometimes to the limits of the South Caspian Basin, which led to the drying up of large portions of the seabed. As a result, the Caspian biota includes representatives of both southern and northern flora and fauna. The sturgeons, the herrings, the bullheads are all the remnants of the Tertiary fauna that underwent considerable changes over the course of a rich geological history of the Caspian Sea. Another group of the Caspian biota includes species came from northern seas, such as Caspian seal, salmon and white salmon, which still demonstrate some traits of cold-water behavior (e.g., winter breeding). Some factors, including significant length of the Caspian Sea, combination of extensive shallows and deep-water zones and diversity of environment, helped the biota to adapt to frequently changing environmental conditions.

Sites especially important for the ecosystem of the Caspian Sea are the so-called «life concentration zones», that means first river deltas. The most significant of them for the Northern Caspian Sea (as well as for the entire Caspian Sea) is the Volga Delta. Tens of fish species (incl. river, anadromous and semi-anadromous fish) concentrate there; it is also a home to a number of rare water plants, such as the lotus, *Trapa natans, Salvinia natans* and some other species. Vast wetlands make the Volga Delta one of the most important bird habitats in Eurasia. During the flood period, the *poloi* system of the delta with its temporary water reservoirs takes on special significance as breeding and feeding ground for the young of many fish species. In general, the Volga Delta ecosystem possesses the highest biodiversity in the Caspian Sea region.

Periodic marine transgressions and regressions caused periodic changes in the water and salt balance of the Caspian Sea, which, in its turn, had certain effect on the evolution of aquatic organisms. Sea level fluctuations influenced not only the evolution of marine ecosystems but also the development of the entire Caspian Sea drainage area. The Caspian Sea is the base level of tens of large, middle-size and small rivers. Sea level fall intensifies sediment flow-out and results in deeper cutting in of the rivers, while sea level rise slows down the river flow, reduces solid sediment flow-out, causes ground water level rise, underflooding of coastal area, salinization of soils and, as a result, it causes changes in the species composition of coastal communities, etc.

In relation to the climatic conditions, the Lower Volga is Europe's most arid region. Only here in the Peri-Caspian area desert phytocoenosis form zonal vegetation types. The region has an acutely continental climate. However, it was not always like that. During only the Holocene period climatic changes repeatedly caused fundamental reorganization of plant communities. Periods of the climate humidification coincided with marine transgressions and were characterized by the prevalence of forest and steppe ecosystems with considerable presence of broadleaf species (*Carpinus gen., Fagus, Ulmus gen., Quercus*) and coniferous species (*Pinus, Picea, Abies*). On the contrary, dehumidification of the climate led to the sea-level fall and therefore defined the prevalent development of steppe-desert and desert ecosystems.

Thus, the mouth area of the Volga River is an illustrative example of significant long-term ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals. The processes have resulted in the development of plant and animal communities capable to adapt to frequent and rapid changes of environmental conditions.

x) Contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation

The flora of the Astrakhansky Reserve exhibits a unique diversity of plant communities developed in intrazonal environment. Due to increasing man-caused transformation of landscapes and growing load on natural ecosystems, the significance of the Reserve as a protected area has also increased. Currently the Reserve provides proper conservation of floral and coenotic diversity as well as optimum life conditions for numerous plant communities. The flora of the Astrakhansky Reserve includes a total of 314 vascular plant species, with 4 species included in the Red Data Book of the Russian Federation: *Nelumbo caspica, Trapa natans, Marsiliea aegyptiaca* and *Aldrovanda vesiculosa*.

The diversity of environmental conditions (water depth, lowage and weediness of waters) found in water reservoirs of the Reserve accounts for the diversity of fish species (a total of 56 species belonging to 12 families). The region is a global scale center known for the diversity and wealth of its fish fauna, with special emphasis on the diversity and richness of sturgeon species (*Acipenseridae*). *Huso huso, Acipenser gueldenstaedti, A.stellatus* are common here, A.ruthenus can also be found in the Reserve.

The Volda Delta is a crossroad of flyways of many migratory waterfowl and water-related bird species. The Astrakhansky Reserve is located within the global transcontinental flyway that means that the area is of an outstanding value for biodiversity conservation. 80% of species nesting within the Volga Delta is found in the Reserve's area, while during the migration season 96% of species of this category can be observed.

The Volga Delta provides habitat or temporary refuge for a variety of rare and endangered birds, which are inscribed onto the IUCN Red Data Book (18 species, as of 2006) or to the Red Data Book of the Russian Federation (42 species). 64 bird species are entered in the Red Data Book of the Astrakhan Region.

Bird species listed in the International Red Data Book include *Pelecanus crispus, Aythya nyroca, Anas angustirostris, Falco cherrug, Coracias garrulus, Otis tarda* and *Tetrax tetrax*.

The nominated property is not only the habitat of rare and endangered nesting species. It is also a vital migratory stop-over site and wintering area for threatened migratory birds. Regarding waterfowl, some rare species are found here on passage, for example, *Anser erythropus* and *Rufibrenta ruficollis*, an endemic species of the Western Siberia and the only relic representative of this genus. *Oxyura leucocephala*, another threatened relic species, has also been observed occasionally in the Reserve. Among *Falconiformes* the most valuable species are *Circus macrourus*, an endemic of Eurasian steppes, *Aguila clanga*, and endangered *Falco naumanni*. The Reserve plays an important role in the conservation of the Ob' population of *Grus leucogeranus,* a threatened migratory species, as a stop-over point for cranes migrating to their wintering ground in Iran. Visitations of *Glareola nordmanni* and *Chettusia gregaria*, an endangered endemic species of Russia and Kazakhstan, have also been registered.

3b. Proposed Statement of Outstanding Universal Value

The Volga Delta forms where the Volga – the great Russian river – meets the Caspian Sea. The Caspian Sea is the Earth's largest landlocked water reservoir that has not been connected to the sea in the modern geological period. The sea is characterized by rapid and significant water level fluctuations accompanied by changes in the water surface area and water volume. The average rate of the most recent Caspian sea level rise was 100 times greater than that of the eustatic global mean sea level rise; the last Caspian sea-level cycle (1929-1995) has resulted in a 3-meter water level drop.

The Volga Delta is the largest delta in Europe and one of the world's largest deltas. It is situated in the Caspian Depression, which is one of the lowest points on the Earth (27 meters below sea level). The Volga Delta bank and underwater slope gradients are the lowest among large river deltas throughout the world (less than 5 cm/km). The delta thereof has extremely complicated hydrographic system and is characterized by an extensive avandelta (the subaqueous part of the delta) with depths of 1,5-2,5 meters that stretches 35-50 kilometer out into the sea. River waters slowly flow down over a shallow avandelta off to the sea and thus the zone of river and sea water mixing is located several tens of kilometers away from the delta's marine edge. The total area of the Volga Delta (incl. avandelta) is over 20 000 square kilometers.

The Volga Delta has the most complicated hydrographic network in the world. Approximately 900 waterways reach the marine edge of the delta. That very tangled network of channels and lakes in combination with rich vegetation makes the landscape very peculiar. It also makes the delta an oasis-looking area placed against a background of flat and monotonous, water- and vegetation-lacking deserts and semideserts.

Volga Delta is a region where mass concentration of migratory birds is observed, including many rare and endangered species. Many of them form large nesting colonies. There is a number of bird species of the Astrakhansky Reserve listed in the International Red Data Book, including *Pelecanus crispus, Aythya nyroca, Anas angustirostris, Falco cherrug, Coracias garrulus, Otis tarda* and *Tetrax tetrax*. The Reserve's territory is of great importance not only for rare and endangered nesting species. It is also a vital migratory stop-over site and wintering area for threatened migratory species.

The Volga Delta is a unique natural property possessing outstanding universal value and therefore is worthy of inscription on to the World Heritage List. Despite of showing resemblance in some characteristics to other large river delta systems, the Volga Delta as a natural complex is notably different from any of existing World Heritage sites.

The distinguishing features of the Volga Delta are as follows: huge size, extensive subaqueous part of the delta (avandelta), the zone of river and sea water mixing that is moved tens kilometers off to the sea, remarkably complicated hydrographic network, a very indented coastline, plenty of lakes, high dynamics of natural processes due to rapid Caspian Sea level fluctuations. Expansive lotus fields add a special charm and peculiarity to the Volga Delta landscape. During the blooming period of the Caspian Lotus (*Nelumbo caspica*) the Delta becomes an area of exceptional natural beauty and aesthetic importance.

3c. Comparative analysis (including state of conservation of similar properties)

1. GEOGRAPHIC ANALYSIS

1.1.The Udvardy scheme-based analysis (biogeographic realm level)

The Volga Delta (Astrakhansky State Biosphere Reserve) is located in Eastern Palearctic that, according to the Udvardy's realm, biome and province classification (1975) is one of the largest biogeographic kingdoms. However, this vast biogeographic region contains a comparatively small part of World Heritage (hereafter WH) properties (about 20 WH sites of 166 in total). Besides that, the sites are distributed disproportionately and are located mainly in the central and eastern parts of the region (in Siberia, Russian Far East, China, Korea and Japan), while the western part of Eastern Palearctic that possesses a wide range of ecosystems from arctic tundra on the Taymyr peninsula and taiga plains in Western Siberia to the Western Asia's uplands and Arabian deserts until recently has been represented by the only WH site – the Arabian Oryx Sanctuary in Oman (in 2007 the sanctuary became the first site removed from the WH List since the List was established).

Thus, the Volga Delta is situated in a region with an obvious deficiency of WH sites and the designation the Astrakhansky Reserve as a WH property will be a step towards a more balanced and representative WH List.

1.2. Thematic analysis (IUCN's Global Themes)

Currently the WH List includes more than 60 properties, which can be (fully or partly) defined as wetlands. Terrestrial wetlands together with coastal and marine areas, mountains and tropical forests are best-represented biomes on the List.

Wetlands most commonly found in WH sites are sea gulfs, waterlogged river valleys, lowland lake and marsh complexes, estuaries and other types of river deltas. However, there are only a few sites containing large river deltas of classic (trigonal) shape. Therefore, the Volga Delta has great potential for inscription on the World Heritage List as a typical wetland and a classic-shape large river delta.

Besides, the Volga and Lena river deltas are listed among the areas that have been defined by IUCN as priorities for selecting from them new WH sites.

It is also appropriate to mention that the Astrakhansky Reserve neighbors two specific natural areas of great scientific significance: the Ilmenno-Bugrovoy region and Caspian semi-deserts and deserts. The Ilmenno-Bugrovoy region adjoins the Volga Delta on the west; the region and the delta share a common geological origin. It is an extremely exotic landscape composed of shallow, elongated lakes divided by latitude-oriented hills (the so-called Baer mounds). Caspian semi-deserts and deserts adjacent to the Volga Delta pertain to the type of continental (cold-winter) deserts - a biome that is currently under-represented on the UNESCO WH List. The only WH example of it in Eurasia is a small desert area within the Uvs Nuur Basin (transboundary Russian-Mongolian WH site).

Therefore, it seems reasonable to include the two abovementioned areas as clusters into the Volga Delta nominating property as it would contribute to better credibility and representativeness of the WH List. These clusters can also be inscribed on the List later as an extension to an existing WH property (the expansion of existing sites is a common World Heritage practice).

2. COMPARISON WITH OTHER SIMILAR WORLD HERITAGE PROPERTIES

** THE WORLD HERITAGE LIST: Guidance and future priorities for identifying natural heritage of potential outstanding universal value (prepared by IUCN - Draft of May 15, 2006).*

The Volga Delta is a unique natural phenomenon, there is no exactly the same site existing in the world. However, as follows from a comparison of some general characteristics of the Volga Delta and other World Heritage properties containing river deltas, they have some certain similarity. It is probably best illustrated by the results of a comparison of the Volga Delta with the deltas of its nearest geographical neighbors - large Eurasian rivers (see Table 3).

CRITERION VII – natural phenomenon/ scenic site

Because of its mosaic structure where water landform elements (narrow and wide river channels, gulfs and open water areas) are naturally combined with terrestrial landform elements (islands of different size, shoals) and vegetation (gallery osier and reed beds, mace reed, wet meadows) the Volga Delta has an low-key but very much aesthetically pleasant, pacifying landscape. During the blooming season of the lotus (also called Caspian Rose) the delta has an eye-catching, magnificent look thanks to floating carpets made of hundreds of splendid rose-colored flower buds.

The presence of the lotus in the landscape is the main visual difference between the Volga Delta and two other European river deltas - Guadalquivir River Delta and Danube Delta - inscribed on the UNESCO WH List under criterion vii (aesthetic value; see Table 3).

Besides that, the avandeltas of the two abovementioned deltas are either weekly developed (Danube) or not developed at all (Guadalquivir River). In contrast to them, the Volga Delta in the Astrakhansky Reserve possesses numerous islands, bays, channels and shallows that make the landscape very picturesque.

CRITERION VIII – geology / paleontology / terrain

The Volga Delta is a unique landform occurred as a result of interaction between two large hydrological systems of Eurasia, the Volga River and the Caspian Sea.

World Heritage river delta complexes geographically closest to the Volga Delta are the Danube Delta (Romania), Guadalquivir Delta, (Spain) and Ganges-Brahmaputra Delta (India-Bangladesh). These sites (especially the Danube Delta) show maximum similarity to the Volga Delta (Table 3).

Some other WH sites containing river delta systems are St. Lucia Wetland Park (united inner deltas of a few rivers in the South African Republic), Djoudj Sanctuary (the inner delta of the Senegal River, West Africa, Senegal), Wood Buffalo National Park (the largest North American inner delta, Canada), Kakadu National Park (estuaries on the north coast of Australia). Being the Ramsar wetlands of international importance like the Volga Delta they, however, have not much in common with the nominating property. These delta complexes are located in other continents, have significantly different biota and their evolution goes under principally different natural conditions. None of them belongs to that classic (trigonal) type of a river delta that has been formed at the mouth of the Volga River.

There are also quite a few well-known river deltas comparable with the Volga Delta in terms of size and configuration and empting directly into the sea (for example, Lena Delta (total area about 3 million ha), Nile Delta (about 2,5 million ha), Orinoco Delta (about 2 million ha), Mississippi Delta (1 million ha)), which for some reason were not entered in the World Heritage List. But even if they did there would be no repetition since the Volga Delta is essentially different from any of them.

Let's consider, for example, another potential Russian World Heritage site - the delta of the greatest Siberian river Lena. Lena River flows into the Laptev Sea (Arctic Basin); its mouth is located in the subarctic zone that is characterized by severe climate, permafrost and the prevalence of swampy tundra. Therefore, since the Lena Delta and the Volga Delta occupy the opposite sides of the Earth's largest continent and lie within very different climate zones they can be regarded as continental-scale antipodes.

The world's largest estuarine deltas such as the deltas of Amazon, Ob', Parana and Yenisei rivers, are not included in the WH list, either

Table 3. The Volga Delta in comparison with the Eurasian delta systems belonging to natural World Heritage sites.

Name of a WH property and criteria for its inscription on the UNESCO WH List	Approximate measurements/area of an entire delta complex	WH property: – name – area / % of an entire delta complex	WH property: General characteristics: a) climate zone b) annual precipitation c) geological period when the development of the delta began	WH property: Biota: a) Number of mammal species b) Number of bird species c) Number of fish species d) Number of vascular plant species
Volga Delta (Russian Federation) **Proposed criteria:** **vii viii ix x**	150x200 kilometers/ about 2 million ha (1 million ha is an avandelta)	Astrakhansky Biosphere Reserve (3 clusters with buffer zones) 100 000 ha / 5,5 %	a) Southern temperate zone, desert zone b) about 200 mm c) Early Holocene	a) about 30 b) about 280 c) about 60 d) over 300
Danube Delta (Romania) **vii x**	70x100 kilometers/ 800 000 ha	Danube Delta Biosphere Reserve 680 000 ha / 85%	a) Southern temperate zone, steppe zone b) about 450 mm c) Late Pleistocene (Wurm-III)	a) about 40 b) over 300 c) about 60 d) about 70
Guadalquivir river delta - Marismas (Donana National Park WH site) (Spain) **vii ix x**	20x15 kilometers/ approx. 25 000 ha	Donana National Park 50 000 ha / 100 %	a) Mediterranean zone, sclerophyll forest zone b) about 550 mm c) Holocene	a) about 30 b) about 360 c) about 20 d) over 700
Ganges-Brahmaputra Delta (Sundarbans WH site, India-Bangladesh) **ix x**	300x300 kilometers/ about 8 million ha	Sundarbans National Park (India) and 3 sanctuaries (Bangladesh) with a total area of 300 000 ha / about 4%	a) Subequatorial zone, Monsoon zone b) 2000-3000 mm c) Holocene	a) about 50 b) over 300 c) over 120 d) over 300

CRITERION IX – ecological processes

The key factors determining site-specific features of ecological processes in the Volga Delta are as follows:

1) Huge size of the delta. It's Europe's largest river delta and one of the world's largest delta systems. Among river delta complexes presently enjoying World Heritage status the Volga Delta is exceeded only by the Ganges-Brahmaputra Delta (Table 3) whereas all others are significantly smaller. The Nile Delta and the Lena Delta are larger than the Volga Delta but they are not designated as World Heritage sites yet.

2) Well-developed avandelta. It is a 40-50-kilometer-wide, mildly sloping, shallow intermediate zone where natural processes are the most intensive. Water level here is highly changeable, the coastline is very indented and the landscape structure is especially diverse. Among natural WH sites containing river deltas a similar avandelta can only be found in the Ganges-Brahmaputra Delta with its vast mangrove thickets growing below the highest tide level and plenty of small and large islands. Monsoon climate contributes much to significant seasonal changes in the life of this delta. The Danube Delta is considerably elevated in relation to the Volga Delta. Its coastline is formed mainly by sandy hills and therefore it is relatively smooth. There is no such abundance of small coastal islands here as in the Volga Delta. Even in spite of annual spring floods, hydrological regime of the Danube Delta is comparatively more stable than that of the Volga Delta. The Guadalquivir Delta is a landlocked delta, however seasonal changes (floods in the winter rain season, for example) have also been observed here.

3) Distinctive hydrological features of the Volga Delta area, namely, almost complete absence of lakes (to compare, there is a great many round-shaped lakes in the Danube delta) and a complicated network of small channels (eriki) that serve as a connecting link between larger waterways (similar channels can also be found in the Danube Delta, but the network is well-developed only in the northern part of the delta).

4) Location in the lowland zone. Some areas within the Volga Delta lie at the level of Caspian Sea, i.e. 27 meters below sea level! This phenomenon is thought to be caused by the low-lying location and landlocked situation of the Caspian Sea. The Danub Delta, Guadalquivir Delta and the Ganges-Brahmapurta Delta lead into the Black Sea, the Atlantic Ocean and the Bay of Bengal opening to the Indian Ocean, respectively, and so they lie approximately at sea level (zero elevation). Thus, talking about the Volga Delta we mean the lowest part of one of the world's lowest lands.

5) Desert environment of the adjacent areas also plays a significant role. It contrasts with steppe areas surrounding the Danube Delta, subequatorial mangrove thickets of Sundarbans and mediterranean-type sclerophyllous vegetation of the Guadalquivir Delta region. The Volga Delta is characterized by a pronounced continental climate (annual temperature swing is from -30^{0}C to + 40^{0}C).

Thus, the Volga Delta is characterized by large scale, highly intensive and very specific natural processes that make the nominated property an important scientific research polygon.

It is relevant to mention that the three clusters of the Astrakhansky Reserve proposed for inscription on to the World Heritage List though not completely but adequately represent the whole delta complex. The clusters are located in western, central and eastern portions of the delta and include both upper delta and avandelta, thereby representing the most interesting and dynamic section of the Volga Delta, which is directly dependent on the water conditions of the Caspian Sea.

CRITERION X – biodiversity/ rare and endangered species

TThe Volga Delta is an oasis surrounded by arid areas. The highest biodiversity and species richness of main taxonomic groups of this region can be compared with that of those delta systems, which have already received WH status (Table 3).

Birds is the most representative group of the vertebrates tightly connected with the delta landscape. Let's compare the avifauna of the Volga Delta with that of its closest neighbor - the Danube Delta.

On the one hand, the number of bird species is approximately the same (280 and 300, respectively). Besides, mass gathering of waterfowl including some duck species (mallard duck, gadwall, teal, pochard and others), goose and swan species (whooper swan and mute swan) have been observed in both sites. Other bird inhabitants of both the Danube and the Volga deltas are ibises, storks and herons, cormorants, glossy ibises, different terns and sandpipers and also Dalmatian and white pelicans. Thus, the list of bird species looks quite similar for both properties, at least in relation to the most mass waterfowl and water-related species.

On the other hand, the avifauna of the Volga Delta has some site-specific features, for example:

- High number of white-tailed eagles (about 60-70 nesting pairs and numerous young birds). The species is listened in the International Red Data Book;
- White crane (International Red Data Book). Small number, but regularly seen on passage;
- Buff-backed heron (RF Red Data Book) is nesting though not regularly in the Volga Delta;
- A very rare phenomenon: common nesting of great white heron and little heron, glossy ibis, mallard duck, spoonbill, pond heron.

With regard to the vegetation of the Astrakhansky State Reserve, the blue lotus (*Nelumbo nucifera*) is the most remarkable of protected plant species in the reserve. It is one of the most beautiful water plants in the world, the floral symbol of Lower Volga, and a relic species that is scarce in Russia and therefore is entered into the Red Data Book of the Russian Federation. The lotus has a wide geographic range: it is found in north-east Australia, in Malaysian Archipelago, in Sri Lanka and Philippines, in the south of Japan, in Hindustan and Indo-China. In these countries it became a sacred plant, a symbol of traditional religions and faiths. There is also a small colony of lotus located at the mouth of the Kura River (Azerbaijan). Of course, the lotus is found in some WH sites located within its geographic range (i.e. in East and Southeast Asia), but it is nowhere so abundant as in the Volga Delta. In Russia the lotus is found only in three places: in the Northern Caspian region (Volga Delta), in the south of the Russian Far East (Priamur'ye and the Lake Khanka area) and on the east coast of the Sea of Azov (*limans* of the Kuban River Delta), but the two last places are not existing or potential WH sites.

Thus, we can make the inference that the Astrakhansky Reserve plays major role in the maintenance of natural populations of Nelumbo nucifera in Russia. In the reserve its natural plantations cover about 5 000 ha.

CONCLUSION

The Volga Delta forms where the Volga River - great Russian river, the largest river in Europe, and the true symbol of Russia - meets the Caspian Sea. The Caspian Sea is the Earth's largest landlocked water reservoir that does not connected to the sea in the modern geological period. The sea is characterized by rapid and significant water level fluctuations accompanied by changes in the water surface area and water volume. The average rate of the most recent Caspian sea level rise was 100 times greater than that of the eustatic global mean sea level rise; the last Caspian sea-level cycle (1929-1995) has resulted in a 3-meter water level drop.

The Volga Delta is the largest delta in Europe and one of the world's largest deltas. It is situated in the Caspian Depression, which is one of the lowest points on the Earth (27 meters below sea level). The Volga Delta bank and underwater slope gradients are the lowest among large river deltas throughout the world (less than 5 cm/km). The delta thereof has extremely complicated hydrographic system and is characterized by an extensive avandelta (the subaqueous part of the delta) with depths of 1,5-2,5 meters that stretches 35-50 kilometer out into the sea. River waters slowly flow down over a shallow avandelta off to the sea and thus the zone of river and sea water mixing is located several tens of kilometers away from the delta's marine edge of the delta. The total area of the Volga Delta (incl. avandelta) is over 20 000 square kilometers.

The Volga Delta has probably the most complicated hydrographic network in the world. Approximately 900 waterways reach the seafront of the delta. That very tangled network of channels and lakes in combination with rich vegetation makes the landscape very peculiar. It is also makes the delta an oasis-looking area placed against a

background of flat and monotonous, water- and vegetation-lacking deserts and semideserts.

Volga Delta is a region where mass concentration of migratory birds is observed, including many rare and endangered species. Many of them form large nesting colonies. The delta also plays an important role in the development of fishing industry.

The Volga Delta is a unique natural property possessing outstanding universal value and therefore is worthy of inscription on to the World Heritage List. Despite of showing resemblance in some characteristics to other large river delta systems, the Volga Delta as a natural complex is notably different from any of existing World Heritage sites. The distinguishing features of the Volga Delta are as follows: huge size, extensive subaqueous part of the delta (avandelta), the zone of river and sea water mixing that is "moved" tens kilometers off to the sea, remarkably complicated hydrographic network, a very indented coastline, plenty of lakes, high dynamics of natural processes due to rapid Caspian sea level fluctuations. Expansive lotus fields add a special charm and peculiarity to the Volga Delta landscape.

The Volga Delta is situated in the Eastern Palearctic where a deficiency of WH sites has been recognized. If the delta achieves World Heritage status, it will be a significant contribution to the elimination of a disbalance in global distribution of natural World Heritage sites as well as to strengthening the credibility of the World Heritage List. Despite the List already contains quite a number of wetland sites, the Volga Delta would be the first large river delta of classic trigonal type, having such complicated hydrographic network, and situated in arid and semi-arid environment. The high dynamics of natural processes in the Volga Delta caused by rapid Caspian Sea level changes deserves special attention. In the 20th century the rate of the Caspian sea level rise was 100 times higher than that of the eustatic global mean sea level rise, and so we can consider the Caspian seashore as a natural laboratory for studying and forecasting the effects of sea level changes on coastal wetland ecosystems.

It hardly seems possible to include into the World Heritage List the total area of the Volga Delta that is huge in size, so the purpose is to obtain World Heritage status for though comparatively small but best preserved, most valuable and rapidly developing portions of the delta: lower delta and avandelta, which are represented by the three clusters of the Astrakhansky State Biosphere Reserve.

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The booklet has been published with the support of the TNK-BP Company