

10-11. Information Sheet on Ramsar Wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

NOTE: It is important that you read the accompanying *Explanatory Note and Guidelines* document before completing this form.

1. Date this sheet was completed/updated:

June 1997

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Designation date

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Site Reference Number

2. Country: Russian Federation

3. Name of wetland: Kuban Delta (the site consists of two sections: Group of limans between the rivers Kuban and Protoka and Akhtaro-Grivenskaya group of limans).

4. Geographical coordinates: 45°42'N, 37°45'E

5. Altitude: 0.4-38.0 m above sea level

6. Area: 173,000 ha

7. Overview: The Kuban Delta is an extensive network of shallow water bodies (over 600 in number), channels, streams, irrigation canals and drains, covered with diverse aquatic and terrestrial vegetation. Numerous lakes and ridges provide important breeding, moulting and staging areas for waterbirds. The area lies on a major migration route, and a great number of birds stay there for winter. The delta also supports breeding populations of sturgeons and other species of fish.

8. Wetland Type (please circle the applicable codes for wetland types as listed in Annex I of the *Explanatory Note and Guidelines* document.)

marine-coastal: A . B . C . D . E . F . G . H . I . J . K

inland: L . M . N . O . P . Q . R . Sp . Ss . Tp . Ts
U . Va . Vt . W . Xf . Xp . Y . Zg . Zk

man-made: 1 . 2 . 3 . 4 . 5 . 6 . 7 . 8 . 9

Please now rank these wetland types by listing them from the most to the least dominant: F, O, Q, J, Ts, M, 6, 1, 3, 4, 2, 9.

9. Ramsar Criteria: (please circle the applicable criteria; see point 12, next page.)

1a . 1b . 1c . 1d . ³ 2a . 2b . 2c . 2d . ³ 3a . 3b . 3c . ³ 4a . 4b

Please specify the most significant criterion applicable to the site: 3a

10. Map of site included? Please tick *yes* -or- *no*

(Please refer to the *Explanatory Note and Guidelines* document for information regarding desirable map traits).

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12. Justification of the criteria selected under point 9, on previous page: 3a - the wetlands support large migrating, breeding and wintering populations of waterbirds (See Section 18).

13. General location: In Krasnodar Krai, 142 km northwest of the city of Krasnodar and 3 to 56 km of the towns of Primorsko-Akhtarsk, Slavyansk-on-Kuban and Temryuk (district centers). The southern border of the site lies along the shore of Kurchansky Liman, embraces the Kuban Delta and reaches the Sea of Azov. To the west and north, the borderline goes along the coast of the Sea of Azov and reaches the middle point of Akhtarsky Liman. To the east, the site borders agricultural land.

14. Physical features:

Geology and geomorphology

The Kuban Delta has formed several thousand years ago at the place of a sea bay. It is made up of shingle, sand and silt sediments, with quarternary loam deposits underneath. Dry river beds, ridges (former levees), canals, drains and shell bars by the sea are typical characteristics of the relief.

Genesis of wetland

In the Low Holocene, accumulation of sediments took place mainly in the triangle formed by the modern towns of Slavyansk-on Kuban, Temryuk and Primorsko-Akhtarsk. Since then, the Kuban River has changed its position many times, and new branches has developed, such as the Protoka, Temryuksky Rukav, Bugazsky Rukav, Kurkui, etc. The first three channels have formed 'plavni' complex at the Sea of Azov coast. Presently, the Delta is descending at a speed of 2 to 3 mm annually (Khrustalev 1973).

Beginning with the end of the XIX century and, especially, the 1930s, the development of irrigated agriculture began in the Delta, and a great number of wetlands were transformed into polders and fish ponds (c. 8,400 ha). Large marshy areas were turned into rice fields. At present, 'rice growing systems' occupy 106,000 ha in the Krasnodar Krai. A distinguishing feature of fish ponds is that they are surrounded by high levees and do not have shallows. The other characteristics do not differ much from those of natural lakes. Diversions of water from the natural wetlands to irrigation canals have altered their hydrological regime so that it becomes asynchronous to the natural one (Gineev, 1975, 1982).

All in all, the Kuban Delta is undergoing continuous change under the influence of both natural and anthropogenic factors.

Climate

The area has a mild climate influenced by two atmospheric currents: the northeastern (continental) and southwestern (marine). The mean annual air temperature range from +10.3° to +10.9°C. In January (the coldest month), the mean air temperature is between -1.6° and -3.1° C, with a minimum of -21.6° C. In July, the mean temperature is between +22.8° and +23.8° C. The warm period, when the temperature is above zero, lasts for 205-228 days. Annual precipitation is between 332 and 638 mm. The ice period lasts 30-102 days. The thickness of the ice cover reaches 50 cm in cold winters with the average of 25-30 cm. The earliest recorded date of freezing is 16 November, and the last date of snow melting is 23 March.

Hydrology

The Kuban River is the main source of water supply for the Delta wetlands. The Kuban is fed by snow and glacial melt (12%), rain (27-54%) and underground water. Regulation of the river (the first dikes were built in 1948) has resulted in a considerable reduction in the volume and period of spring flooding. There are 14 reservoirs on the river with a total volume of 5.62 km³. The natural hydrological regime of the Kuban is characterized by long-term cyclical changes. In the last decades, the highest water level was registered in the Kuban Delta in the periods of 1963-1965 and 1976-1977.

The annual hydrological regime of the sea shallows, limans and bays is characterized by a spring-summer flood resulting from the snow and glacial melting. During this period, there may be six or seven

major floods associated with heavy rains. At present, the water level in the wetlands decreases in autumn and winter, as well as in summer due to the diversion of water to irrigation canals. At the same time, some of the limans in the delta receive water from the rice fields and other agricultural lands, and as a result, the water level in these wetlands may increase in summer. Variations in water level and hydrochemical composition may also be a result of strong winds from the sea and incoming saline waters. This is a factor of great importance, as the mean depths in limans vary from 0.6 to 1.5 m (maximum depth is 2.5 m).

Four groups of limans are distinguished in the Kuban Delta: Akhtaro-Grivenskaya, Chernoyernikovsko-Sladkovskaya, Zhesterskaya and Kulikovsko-Kurchanskaya. The limans of the second and fourth groups connected with the Sea of Azov by channels. Presently, the Zhesterskaya and Chernoyernikovsko-Sladkovskaya groups of limans are fed by the river water, the Kurchansky liman- by water coming from the irrigation systems, and the Kulikovskaya and Akhtaro-Grivenskaya systems of limans have the mixed water supply (i.e. waters come from the sea, river and rice fields).

Soils

The soils in the Kuban Delta are alluvial. Sands and shell limestone containing the remains of *Cardium edule* shells are found in the coastal area. The soils are mainly immature, with a low content of humus. Along the sea edge, "solonchak" (saline) soils occur. These contain loamy sand and clay, with less than 2.5% of humus. The content of sulphates and chlorides reaches 11%. These soils form the bottoms of lagoons. The marshy-meadow and meadow solonchak soils are also typical for the sea coast and other lower sites. These consist of clay, loamy sand and sands; humus content is between 3.5 and 8.0%. In the salt content, chlorides (3-8%) and carbonates (0.2-0.4%) dominate. In the central part of delta ('Priazovsky Plavni'), on the alluvial deposits, 'plavni' soils develop: they are a mixture of sand, clay, coquina, plant residues and some other types of detritus. These soils are divided into the following categories: peat, peat-gley and humus-gley soils. The peat soils (the layer of peat is between 50 and 200 cm) have clays underneath. They are desalinated by the Kuban waters, and the salt content is less than 0.2-0.3% (up to 0.9%), with a pH of 5.7-6.7. Peatgley and humus-gley soils with loams underneath are most widely distributed in the Delta. The humus content is up to 3.2-4.5%. Sulphates and hydrocarbonates dominate chlorides (Blazhny, 1971).

Physical and chemical characteristics of the water

The coastal sea areas and lagoons are characterised by a range of salinities from 11.3 ‰ down to 2-3 ‰ near the shore. In the limans, the concentration of chemical elements in the water varies from 0.41 to 7.00%. In the early 1980s, it comprised 530 mg dm⁻³. Due to human activities, ionic concentrations have increased: chlorides 3-9 times, alkaline metals 2-7 times, and sulphates 1.2-4 times; phosphorus concentration has decreased (Kulii, 1990). Mean concentrations of biotic substances are: phosphorus 47.8-83.4 mg m⁻³, nitrogen 630-1140 mg m⁻³, and silicic acid 700-770 mg m⁻³. In recent years, a number of organic compounds alien to the natural ecosystems have been found in the wetlands. According to the RSFSR Water Ministry (data are of 1987), concentrations of pesticides in fish, caught in the Sea of Azov and coastal limans, comprise 0.33-0.46 mg per kg and reach 0.1-2.3 mg/kg in some organs.

Regulation of the Kuban River has resulted in the load of suspended sediments in the delta being reduced by 80%. The transparency of waters has increased comprising 0.5-8 m in the Sea of Azov, 0.2-0.8 m in the Akhtaro-Grivensky limans, 0.4-0.8 m in the limans of the Chernoyernikovsko-Sladkovskaya group, 0.45-0.9 m in the Zhestersky limans and 0.3-0.6 m in the Kulikovsko-Kurchanskaya group. In some small lakes and limans, transparency reaches 100%.

Catchment area

The Kuban River is 870 km long and has a catchment of 5,790,000 ha on the northern slope of the Greater Caucasus, the Stavropol highland offsets and Kuban lowland. 13,569 rivers belong to this catchment; their total length is 38,325 km. In recent decades, the water flow through the delta has been altered considerably. The wetlands in the Kuban Delta receive annually only 1.4 km³ out of 10-14 km³ of the mean flow of the river. The rest of the water resources are diverted mostly to irrigation systems. 1.63 km³ of run-offs from the rice fields are collected in limans. The amount of water coming to the delta limans from precipitation comprises 1.69 km³ annually.

15. Hydrological values: The Kuban River supplies the Sea of Azov with large amount of fresh water comprising 26% of the sea's freshwater balance. The Kuban flow determines the salinity and hydrological regime of this 'inland' sea. Wetland plants remove organic compounds, heavy metals, pesticides and other toxins from the water, temporary fixing them during tissue absorption. Wetland vegetation and soils filter water and contaminants and help to prevent eutrophication.

16. Ecological features:

The area of the Kuban Delta has been largely drained and converted into agricultural land during the last decades. As a result, there are two major ecosystems: (1) anthropogenic: reservoirs, rice fields, and (2) natural: a system of foredelta, salt lakes, deltaic freshwater and brackish water bodies, coastal shallows and lagoons.

Human modification of the environment is significant. However, natural links and trends manifest themselves more profoundly. Vegetation communities, which are seen as a major stabilizing factor, give some insight into genesis of water bodies in the delta, their hydrological regime, soils, velocity of water flow, etc. The classification of water bodies in the Kuban Delta has been made by A.G.Shekhov (1971). Four groups of types and 10 phytocoenosis types of limans have been distinguished. This classification and publications by A.M.Gineev (1985, 1989) have served as a basis for the classification of the Kuban's wetlands designed for the purpose of wetland inventory.

Deltaic freshwater and desalinated wetlands

These wetlands cover 102,800 ha (59.8% of the total area) and comprise a complex of open water bodies (limans), reed-beds and terrestrial habitats. The limans are fed mainly by the Kuban's fresh water. The water supply of the Kulikovsko-Kurchanskaya group of limans consists of waters coming from the rice fields to the extent of 70%, the rest is the Kuban's water. The Zhesterskaya and Chernoyernikovsko-Sladkovskaya groups of limans are fed by the river water, the Akhtaro-Grivenskaya group and the Bolshoi and Maly Kirpilsky limans receive water from the irrigation systems, and the rest of these wetlands are supplied by river waters.

The following habitat types are distinguished within this group:

- Terrestrial habitats: ridges, levees and other higher sites cover 21,600 ha (12.6%). Steppe meadows occupying the highest places are dominated by *Koeleria cristata*, *Festuca valesiaca*, *Madicago minima*, *M.orbicularis*, *Oposma tinctorium*, *Stipa pennata*, *Agropyreta pectinati* and *Festuca beckeri*. At lower sites, meadow species are found, including *Calamagrostis epigeios*, *Poa trivialis*, *Potentilla reptans* and *Trifolium pratense*. Marshy meadows are represented by the sedge and grass-sedge meadows with *Glyceria arundinacea* and common reed *Phragmites communis*. Some of these habitats are hardly accessible and provide refuges for wildlife and breeding grounds for a wide range of waterbirds.
- Reedbeds located between/by the limans cover 43,100 ha (25%) and include:
 - (a) Temporarily flooded reedbeds (14,000 ha; 8.1%): These wetlands dry out in summer due to the seasonal decrease in river flow and diversion of water to irrigation canals. Sometimes water flows 2-3 km off the gently sloping shore following strong winds. Pure reeds comprise 53% of the habitat area. The degree of basal coverage is 80-90% and the weight of dry matter is 297 metric centners per ha. The reed stems are quite large at these sites: 370-520 cm in height and 1.1-1.3 cm in thickness, with 15 to 66 stems per 1 m². These reeds provide refuges for wild boar *Sus scrofa* and nesting sites for herons.
 - (b) Permanently flooded reedbeds (29,100 ha; 16.9%): Dense reedbeds occur at the edges of limans in shallow waters down to 1.5 m deep. Pure reeds occupy 67.1% of the area covered by this habitat. The total number of phytiums is up to 10. Beds of narrow-leaved cat's-tail *Typha angustifolia* cover to 20% of the area occupied by emergent plants, with the basal coverage of 60 to 70% and productivity of 256 centner/ha. Broad-leaved cat's-tail *Typha latifolia* comprises 0.1% of the area with productivity of 148 centner/ha. At the edge of open waters, the common reed develops associations with submerged and floating plants, such as *Potamogeton nodosus*, *Huphar lutea*, *Ceratophyllum demersum*, *Lemna trisulca*, *L.minor*, *Salvinia natans*, *Hydrocharis morsus-ranae* and *Aldrovanda vesiculosa*. In the late 1980s and early 1990s, permanently inundated reedbeds largely increased in area due to an increase in concentrations of nitrogen, and the area of

open water reduced. Habitats of this type provide feeding, roosting and nesting sites for coot *Fulica atra* and other Rallidae, dabbling ducks and herons.

- Open waters of limans and lakes have a total area of 38,100 ha (22.2%) in this group of habitats. *Nymphaea alba* (weight of dry matter: 38 centners per ha) and *Trapa natans* (80 centner/ha) are widespread. Shallow areas of limans are overgrown with submerged plants: *Potamogeton perfoliatus* (17.7% of the area, degree of basal coverage 5-10%, productivity 50.1 centner/ha), *Potamogeton pectinatus* (4.8% of the area, degree of basal coverage 70-80%, productivity 95 centner/ha), *Myriophyllum spicatum* (2.8% of the area, productivity 51 centner/ha) and *Ceratophyllum demersum* (1.8% of the area, degree of basal coverage 70-85%, productivity 76 centner/ha). At other sites of the open freshwater area, associations of submerged and floating plant species are found in the following compositions: *Stratiotes aloides* with *Nymphaea*; *Ceratophyllum* with *Chara*; *Potamogeton perfoliatus* and *Potamogeton crispus*. *Stratiotes aloides* forms homogeneous coverage sometimes over the whole water body. *Vallisneria spiralis* also forms pure subaqueous meadows with the degree of coverage of 60-80%. *Nelumbo nuciferum* is less abundant. *Nymphoides peltatum* occurs sporadically.

Intermediate or barrier type of wetlands: brackish water bodies

These cover 48,600 ha (28.1%). The wetlands are fed mainly by fresh waters (70%), but also receive water from the sea and other saline sources. The following habitat types are recognized:

- Terrestrial habitats (ridges, levees and other higher sites) cover 8,200 ha (4.8%). Associations of steppe species include *Artemisia* + *Agropyron pectiniforme*, *Festuca sulcata* + *Stipa*, etc. At saline meadows, formations of herbs, sedges, *Stipa* and gramineous species occur, including *Alopecurus arundinacues*, *Tripolium pannonica*, *Carex extensa* and *Scirpus tabernemontani*. Marshy sites are dominated by sedges and grasses: *Carex riparia*, *C. vulpina*, *C. acuta*, *Agrostis stolonifera* and *Glyceria maxima*. For the most part, these habitats are almost inaccessible for people due to the dense reedbeds around them.
- Reedbeds located between/by the limans occupy 18,900 ha (10.9% of the total area). Within this type, three variants can be distinguished:
 - (a) Temporarily flooded reedbeds cover 6,600 ha (3.8%). These wetlands are periodically flooded and dry out again depending on the winds, irrigation practices and general climatic and inundation conditions of the year. In hypersaline wetlands, there is no vegetation and only spots of salt are found on the ground when these wetlands dry out. Common reed is a dominant species but reedbeds are not so dense and less productive in comparison with those in freshwater habitats. Other common species include *Schoenoplectus litoralis* and *Bulboschoenus maritimus*. The latter occupies up to 1.7% of the area with productivity of 83.7 centner per ha. These wetlands provide foraging areas and refuges for wildlife.
 - (b) Permanently flooded reedbeds have an area of 12,300 ha (7.1%). Seven reed formations are found there. The average number of reed stems per 1 km² is 99 (80-136); height of stems is 252 (150-340) cm; and productivity is 180-250 centner/ha. Reed grows in the waters to 60-80 cm deep, covering to 69.8% of the habitat area. Cat-tail occurs only at shallows (mainly *Typha laxmanni*). *Bulboschoenus maritimus* is less abundant and occurs at depths down to 105 cm (2.2% of the area, 84 centner/ha). At the edge of the open water area, reeds become sparse and other euryhaline and halophytous species appear: *Potamogeton pectinatus*, *Myriophyllum spicatum*, *Chara intermedia*, *Ruppia spiralis* and others. This habitat is important for coots, ducks, grebes and some other birds.
- Open waters have a total area of 21,500 ha (12.5%). *Potamogeton pectinatus* and *Myriophyllum spicatum* develop pure formations as well as associations with other submerged and floating plants. The degree of basal coverage comprises 69 to 85%. Areas of open water are important for a great number of waterfowl, including swans, gulls and grebes.

Foredelta water bodies

These wetlands are directly connected with the sea and supplied mostly by the sea waters. They occupy 12,800 ha (7.5%). Four habitat types are recognized:

- Terrestrial habitats have a total area of 2,400 ha (1.4%) and are represented mainly by solonetz, solonchaks and other areas with salty soils. At higher sites, steppe vegetation occurs. *Festuca*

sulcata is widespread in associations with *Artemisia* and various herbs. *Aeluropus litorallis* is a common species for saline meadows. *Atriplex verrucifera*, *Limonium caspium*, *Halocnemum strobilaceum* and *Artemisia* are found at solonchaks. Wet solonchaks are overgrown with *Salicornia herbacea*. Sparse reeds sometimes occur.

- Reedbeds located between/by the limans cover 5,100 ha (3.0%), including:
 - (a) Temporarily flooded reedbeds (2,000 ha, 1.2%). Reed is mainly thin-stemmed in these wetlands. At the edge of the water area, *Schoenoplectus compactus*, *S. triguete* and *Bulboschoenus maritimus* are found. Hypersaline sites lack vegetation. These reedbeds provide good nesting and hiding conditions for many birds.
 - (b) Permanently flooded reedbeds (3,100 ha, 1.8%) are represented by pure reed formations developing in saline waters down to 10-15 cm deep. Reed is thin-stemmed, with 107-157 stems per 1 km², 140-300 cm high. Productivity is 120-200 centner/ha. *Bulboschoenus maritimus* occurs at a depth to 65 cm, occupying 1.8% of the total area. At the edge of reedbeds, *Zannichellia major* occurs. Islands and other less accessible parts of this habitat are used by cormorants, gulls and other birds for breeding.
- Open water areas of lakes and limans total 5,500 ha. The vegetation is poor due to high salinity of waters. Halophytes (*Ruppia maritima*, *R. spiralis*, *Aeluropus litoralis*, *Najas marina* and *N. minor*) are common for the foredelta areas bordering on the sea. These wetlands provide important feeding and roosting grounds.

Marine habitats

Open sea bays and extensive coastal shallows with adjacent sand and coquina beaches occupy 7,800 ha (4.5%). The following habitat types are distinguished within this group:

- Terrestrial habitats cover 4,300 ha (2.5%). The coastal part of the Kuban Delta is distinguished by its clearly defined zoning structure: a strip of sand and shell limestone gives way to moving sands with psammophytes, which in turn changes for a zone with halophilic and meadow species. Sparse forest plantings and groups of trees or bushes (15 species) are found along the coast. At fixed sands, *Carex praecox*, *Iuncus maritimus*, *Elytrigia maeotica* and *Melilotus albus* occur. Such species as *Artemisia campestris*, *Astragalus excarpus*, *Plantago indica*, *Erungium maritimum* and *Hordeum geniculatum* appear closer to the sea. For moving sands, *Elymus arenarius* and *Calcile maritima* are common. Scarce reedbeds occur at some places. Lower sites flooded with sea waters and muds are also found at the beach.
- A 400 ha breakers zone (0.2% of the area) is bare. Sand and coquina bars are common.
- Coastal shallows to 4-5 m deep cover 4,300 ha (2.5%). The floor is formed with sand and shell limestone. Flat bare islands develop along the shore. Plants include *Ruppia* and *Zostera* species. Waterbirds are represented mainly by gulls and cormorants; in winter, also by wildfowl and grebes.

Wetlands of different types, especially brackish ones, may turn into each other quite rapidly, depending on the amount of water supply and anthropogenic impact.

17. Noteworthy flora: Botanical descriptions of the Kuban Delta list over 700 plant species. 103 plant species are found in the Delta limans, including 81 species of flowering plants, 20 species of algae, one species of ferns and one horsetail (Shekhov, 1972). On ridges and levees, 150 species of medicinal plants and 70 plants used as dyes have been noted.

There are no natural forests in the Kuban Delta. The largest artificial forest (1,500 ha of *Elaeagnus angustifolia*) is located on the Otchuevskaya spit. Along the canals, on the ridges and levees, around the lakes and hunters' cabins, small open stands are found consisting of the following species: *Acer tataricum*, *A. campestre*, *Salix alba*, *S. triandra*, *S. cinerea*, *Populus alba*, *Gleditschia triacanthos*, *Robinia pseudoacacia*, *Cernus sanguinea*, *Cotinus coggygria*, *Hippophae rhamnoides* and *Tamarix* sp.

Amongst the water plants, rare relict species are of particular interest. *Salvinia natans* forms associations (at a depth up to 0.5 m) with *Typha angustifolia*, *T. latifolia*, *Phragmites communis*, *Lemna triscula*, *L. minor* and *Ceratophyllum*. *Aldrovanda vesiculosa* grows in the shallows to 0.2 m deep. *Najas minor* occurs in freshwater lakes and *N. marina* in brackish water bodies; both species are found in

associations with *Ceratophyllum demersum* and *Potamogeton* sp. *Trapa maeotica* develops formations with *Ceratophyllum demersum*, *Nymphoides peltatum*, *Nymphaea alba* and *Nuphar luteum*. *Nelumbo nucifera* grows at a depth up to 1.5 m, and occur in composition with *Salvinia*, *Trapa*, *Nymphaea alba*, etc. (Yanenko & Nagalevsky, 1994).

21 plant species are included in the Red Data Books of the Russian Federation and Krasnodar Region. These are: *Nelumbo nucifera*, *Rhapontium solinum*, *Cladium martii*, *Aldrovanda vesiculosa*, *Bellevalia sarmatica*, *Nuphar lutea*, *Glaucium flavum*, *Trapa maeotica*, *Matricaria matricarioides*, *Acorus calamus*, *Nymphaea candida*, *Marsilia quadrifolia*, *Papver nudicaule*, *Salvinia natans*, *Bupleurum aureum*, *Hippuris vulgaris*, *Centaurium formosa*, *Peganum harmala*, *Polygonum aschersonicum*, *Najas minor* and *N. marina*.

18. Noteworthy fauna:

Birds

(a) Migrating species

The Eastern coast of the Sea of Azov lies at a crossroads on the migration routes of waterbirds breeding in the European part of Russia, Western Siberia and elsewhere, and wintering in the Black Sea basin, southern Europe, the Mediterranean basin, the Middle East and Africa.

Many waterbirds utilize the coastal wetlands and limans of the delta as staging areas in spring. The migration starts in February-March, and the total number of migrating birds is estimated at 1.2 to 2 million individuals. The most numerous migrants are greylag goose *Anser anser*, mute swan *Cygnus olor*, whooper swan *Cygnus cygnus*, mallard *Anas platyrhynchos*, pochard *Aythya ferina*, tufted duck *Aythya fuligula*, green-winged teal *Anas crecca*, garganey *Anas querquedula*, red-crested pochard *Netta rufina*, gadwall *Anas strepera*, northern pintail *Anas acuta* and coot *Fulica atra*. Other migrating species include: white-fronted goose *Anser albifrons*, lesser white-fronted goose *Anser erythropus*, bean-goose *Anser fabalis*, European wigeon *Anas penelope*, white-headed duck *Oxyura leucocephala*, shoveler *Anas clypeata*, snew *Mergus albellus*, shelduck *Tadorna tadorna* and red-breasted goose *Branta ruficollis*.

The total number of waterbirds migrating through the area in autumn is estimated at approximately 1.5 to 2.1 million individuals. In years when the autumn-winter season begins with cold spell, the birds pass through the area relatively quickly. The main passage of mallard *Anas platyrhynchos*, green-winged teal *Anas crecca*, pochard *Aythya ferina* and red-crested pochard *Netta rufina* takes place from September to December. Garganey *Anas querquedula*, pintail *Anas acuta*, wigeon *Anas penelope* and shoveler *Anas clypeata* migrate in November and early December. White-eyed pochard *Aythya nyroca*, shelduck *Tadorna tadorna* and white-headed duck *Oxyura leucocephala* occur in small numbers from August till November. An increase in the numbers of migrating geese has been observed in recent years. These include greylag goose *Anser anser*, white-fronted goose *Anser albifrons*, lesser white-fronted goose *Anser erythropus*, bean-goose *Anser fabalis* and red-breasted goose *Branta ruficollis*.

(b) Breeding species

The Delta supports breeding habitats for 46 wetland-dependent species of birds. Deltaic freshwater and desalinated wetlands, together with barrier (brackish) water bodies present the most important types of breeding habitats. Dabbling ducks dominate in the former group of wetlands, and diving ducks in the latter. The highest density of waterbirds is found in the Akhtaro-Grivenskaya group of limans. According to post-breeding counts undertaken during the period 1975-1977, the local population of waterbirds comprised 280,000 to 540,000 individuals (Krivenko, 1977). In 1995, it reduced to 70,000 individuals.

The Kuban Delta is an important area for breeding populations of colonial shore birds. According to counts undertaken in 1986-1989, ten species of waders breed in the delta shallows. Redshank *Tringa totanus* is the most plentiful in this group of species (1,200 pairs). Rare species include platinum *Glareola platinctola* (11-27 pairs), curlew *Numenius arquatus* (1 pair) and oyster-catcher *Haematopus ostralegus* (3 pairs).

Gulls are represented by herring gull *Larus argentatus* (420-470 pairs) and black-headed gull *Larus ridibundus* (50 pairs) which breed in the marine and coastal wetlands, at an area of 23,700 ha. Terns are more widely distributed and occur in the freshwater, barrier and marine groups of habitats (161,700 ha). These include the following species: common tern *Sterna hirundo* (570 pairs), little tern *Sterna albifrons* (55), white-winged black tern *Chlidonias leucoptera* (355), sandwich tern *Thalasseus sandvicensis* (36-37) and black tern *Chlidonias nigra* (660-670 pairs). The same sites are inhabited by Ardeidae: purple heron *Ardea purpurea* (1505 pairs), squacco heron *Ardeola ralloides* (362), grey heron *Ardea cinerea* (804), great white egret *Egretta alba* (202-227), little egret *Egretta garzetta* (320), night heron *Nycticorax nycticorax* (60), bittern *Botaurus stellaris* (260) and little bittern *Ixobrychus minutus* (180). Cormorant *Phalacrocorax carbo* is common in the marine and coastal groups of wetlands: 5,550 pairs. In the deepest parts of freshwater wetlands, grebes are found: great-crested grebe *Podiceps cristatus* (83 pairs), red-necked grebe *Podiceps griseigena* (22) and black-necked grebe *Podiceps nigricollis* (15). The total number of colonies in the Kuban Delta is 64.

(c) Wintering species

The numbers of wintering birds and species composition vary considerably depending on the severity of the winter. In recent years, the total number of wintering birds has varied between 150,000 and 500,000 individuals. The most abundant species are: mallard *Anas platyrhynchos* and green-winged teal *Anas crecca* (68.5%); pochard *Aythya ferina*, red-crested pochard *Netta rufina* and tufted duck *Aythya fuligula* (15.4%); greylag goose *Anser anser*, white-fronted goose *Anser albifrons* and lesser white-fronted goose *Anser erythropus* (12.3%). Coot *Fulica atra* is also abundant. Other common species include: mute swan, whooper swan, gadwall, grebes, herring gull and slender-billed gull. The white-headed duck, shelduck and snew also occur. Wintering populations of geese concentrate on small lakes, which are difficult to access, and on limans (groups of freshwater and brackish water bodies: 149,300 ha). Cormorants and gulls winter in marine and coastal wetlands (23,700 ha).

(d) Rare and threatened species

Eighteen species of birds currently listed in the Red Book of the Russian Federation and in the IUCN Red Book have been recorded in the area. Rare breeding birds include Dalmatian pelican *Pelecanus crispus* (50 pairs - 1986), Eurasian spoonbill *Platalea leucorodia* (162 pairs), glossy ibis *Plegadis falcinellus* (220-500), black-winged stilt *Himantopus himantopus* (240), avocet *Recurvirostra avosetta* (420), white-headed duck *Oxyura leucocephala* (1), white-eyed pochard *Aythya nyroca* and stone curlew *Burhinus oedipnemus* (unit findings). Birds occurring as passage migrants include white pelican *Pelecanus onocrotalus*, black stork *Ciconia nigra*, lesser white-fronted goose *Anser erythropus*, osprey *Pandion haliaetus* and little bustard *Otis tetrax*. Wintering birds include red-breasted goose *Branta ruficollis*, white-tailed eagle *Haliaeetus albicilla* and great bustard *Otis tarda*. Species of accidental occurrence: pygmy cormorant *Phalacrocorax pygmaeus* and buff-backed heron *Bubulcus ibis*.

Mammals

The most numerous species are: racoon dog *Nyctereutes procyonoides*, European hare *Lepus europaeus*, northern water vole *Arvicola terrestris*, red fox *Vulpes vulpes*, American mink *Mustela vison* and muskrat *Ondatra zibethicus*. Wild boar *Sus scrofa* is the most widespread ungulate: up to 250 individuals (Gineev, 1985). The European mink *Mustela lutreola* (50-60 individuals), Caucasian Otter *Lutra lutra meridionalis* (50) and marbled polecat *Vormela peregusna* (unit findings) are considered rare and endangered species.

Other fauna

The fish in the Kuban Delta comprise 65 species. Eight species of fish and 20 of invertebrates are considered rare and endangered (Chikhachev & Zakutsky, 1989). Fish and other animals are dependent to a large extent on the development of phyto- and zooplankton. Numbers and biomass of zooplankton (rotifers, copepods and cladocerans) vary with time and the type of water body: in May, numbers are up to $41.4-502.0 \times 10^3$ specimens m^{-3} with biomass of $0.1-1.5 \text{ g } m^{-3}$; in August, numbers reach $38.0-394.3 \times$

10^3 specimens m^{-3} and biomass $0.2-9.2$ g m^{-3} . The most productive habitats are provided by brackish water bodies, and the least productive are freshwater habitats. Phytoplankton amount to $0.5-272.3 \times 10^9$ specimens m^{-3} or $0.2-2.35$ g m^{-3} in May, and $1.5-363.9 \times 10^9$ specimens m^{-3} or $0.33-100.4$ g m^{-3} in August. The group of barrier or intermediate wetlands appears the richest in phytoplankton.

Amongst the Chiroptera, Leisler's bat *Nyctalus leisleri* and noctule bat *Nyctalus noctula* are common species. The most typical reptiles are water snake *Natrix tessellata*, grass snake *Natrix natrix* and European terrapin *Emys orbicularis*. *Vipera ursini* occurs seldom.

19. Social and cultural values: The social and cultural values of the Eastern Azov wetlands are very high. In Russia, the first fish hatcheries and rice-growing systems were developed in this region. Flood control methods were also devised and extensively tested in this area. The Eastern Azov area is renowned for its well-developed fisheries and agriculture. More than 200,000 t of fish are caught in the delta annually. Waterfowl are hunted in the wetlands, both for sport and food (150,000 birds annually), as well as wild boar (up to 40 individuals), maskrat (200,000) and other quarry species, and all wildlife provide important recreational opportunities.

20. Land tenure/ownership: The main forms of the land ownership at the site are state and communal. There are 15 land-owners in Slavyansky administrative district and 6 in Temryuksky district, including fishery farms, fish-growing farms, joint-stock companies, water management offices, agricultural farms, rural administrations and forestry enterprises. Small plots of land are in private property (farmers).

21. Current land use:

Agriculture: Irrigation is necessary to ensure the success of farming activities in the region. The diversion of water causes frequent changes in water level in reservoirs and also reduces the flow through the delta. Under natural conditions, the wetlands in the delta received 5.3 km³ of water annually, presently this has decreased to 1.4 km³. The runoff from 123,000 ha of irrigated fields, entering limans, comprises $1.2-1.6$ km³ annually (Chebanov, 1989). Pesticides are applied in large quantities: up to 42 tons annually (for 8.2×10^6 ha of arable land in the whole of Kuban catchment area). The amount of pesticides reaching the Kuban Delta was estimated at 25.8 t in 1986-1989. A decrease in inputs of phosphorus and an increase in nitrogen have been recorded. Excessive concentrations of nutrients cause rapid plant growth in the wetlands. Discharges of sulphate ions entail the development of zones with dissolved hydrogen sulphide in limans and the Sea of Azov. Toxic substances are also detected in the water. Concentrations of DDT and hexachloride (HCCH and derivatives) vary from 0.01 to 0.08 mg l⁻¹.

Mowing and grazing are traditional activities which are carried out on the islands, peninsulas, spits, floodplain meadows and 'plavni' areas. The present economic situation has closed large cattle-breeding collective farms, which is expected to give rise to private farming and reduce the damage resulted from the high concentration of the stock.

Fishery: Commercial fishing is conducted with nets and seines in the sea and limans, and is permitted within the Ramsar site and nature reserves. Sport fishing is allowed only with rod and line. In recent 40 years, the catches of all commercially valuable fish species have decreased dramatically (zahrte *Vimba vimba* by a factor of 50, zander by a factor of 4 and pomfret by a factor of 5). To compensate for this, hatcheries have been developed and millions of juvenile sturgeon, zahrte and *Chalcalburnus chalcoides* are released into the Kuban every year. There are more than 20 fish farms in the area, and many ponds, limans, reservoirs and the delta channels are used for fish growing, including such species as zander, pomfret, sazan *Cyprinus* sp., etc.

Forestry: These activities have positive effect on the whole ecosystem, with species and habitat diversity increasing as a result of forest planting. The total area of forest is 4,600 ha. However, in the mountains outside the site, logging continues, and leads to increased run-off and alteration of hydrological regime.

Waterfowl shooting: Shooting is allowed during the period 20 September to 20 December. Limits are set on the number of visits (not more than 3 days a week) and the daily harvest (two geese and ten ducks and coots). In some years, shooting for drakes (using decoys) is allowed in spring during one week. The shooting is considered to have little effect on the waterfowl populations.

Recreation: There are a number of resorts in the coastal area, including Eisk, Tempyuk and Primorsko-Akhtarsk. Popular recreation activities include sport shooting for waterfowl and fishing. 200,000 people take part in this kind of recreation. The recreational pressure is relatively low.

22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects: The Kuban River annually receives up to 0.3 km³ of polluted industrial, domestic and other drainage water. Petroleum products and heavy metals are particularly dangerous for natural ecosystems. The water in the Kuban Delta contains copper and zinc (to 0.5 mg l⁻¹), lead (0.62 mg l⁻¹) and cadmium (0.003 mg l⁻¹). Poor storage of pesticides and fertilizers and the scattering of poisoned grain from airplanes have caused mass deaths of birds. Eutrophication of wetlands and exploitation of gas deposits (flares) have also had a negative affect on the international importance of the site for waterbirds.

As to natural threats, floods caused by westerly storms off the sea are of particular importance. On some occasions, the eastern coast of the Sea of Azov is flooded to a depth of 2-3 metres. Because of the very low gradient, the sea water floods large areas, extending up the Kuban and its tributaries for 70 km, and the salinity in limans increases to 11-12 ‰. Such flooding occurred in 1739, 1831, 1892, 1914, and 1969. In spring, the floods cause losses of nests and litters of many birds and mammals. Approximately once a decade, unusually cold periods with heavy snowfall and extensive ice cover cause high mortality amongst wintering birds.

The area is being considered for coastal development. Because of the disintegration of the USSR, an active search for oil and gas has been carried out in the region. Rice-growing systems are expected to decrease in area because of decreasing funding; this will entail a drop in pollution from pesticides and fertilisers. Zones with dissolved hydrogen sulphide will decrease in area. Salinity is expected to increase from 11.6 to 13 ‰ in the Sea of Azov, and to 9.05 ‰ in the coastal limans. Many opportunities for recreation and resort developments in coastal areas of the Sea of Azov are under consideration.

23. Conservation measures taken: There are two Ramsar sites: Group of limans between the rivers Kuban and Protoka (88,400 ha) and Akhtaro-Grivenskaya Group of Limans (84,600 ha). The former includes the 37,800 ha Priazovsky federal nature reserve (wildlife refuge - 'zakaznik'), established in 1955.

Of particular significance was the adoption on 23 April 1994 of Decree No 572-p of the Federal Government of the Russian Federation. This establishes the Sadki State Nature Reserve ('zapovednik': status providing the highest degree of protection) with an area of 92,000 ha. The borders of this reserve should be defined by the year 2004.

Nature monuments established by local authorities include two wetland sites overgrown with *Nelumbo nucifera*.

24. Conservation measures proposed but not yet implemented: The following recommendations have been made:

- to establish a strictly protected zone: a strip, one km wide, along the edge of the sea (300 m of water area and 700 m of the shore) in the Kuban Delta;
 - to decrease the application of pesticides by using advanced methods of growing rice;
 - to develop forest shelter belts around water bodies, and thereby help to decrease the amount of nutrients reaching wetlands in run-off from adjacent farmland;
 - to reduce to a minimum the amount of time fertilizers are stored in the open;
 - to forbid using fertilizers and scattering poisoned grain on snow cover;
 - to develop a detailed plan for wetland conservation in the area.
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25. Current scientific research and facilities: Research on the delta's fauna has been carried out since the 19th century (Kalinichenko, 1835; Bogdanov, 1879; Ptushenko, 1915, etc.), on flora - since the 1950s (Bush, 1946; Shiffers, 1956; Kosebko, 1970). A.A.Vinokurov carried out research into fish-eating birds (1956). In the 1960s, detailed descriptions of avifauna by V.S.Ochapovsky were published. Since the 1960s, regular mid-winter counts of waterfowl have been conducted (Isakov, 1965, 1972; Krivenko, 1977).

26. Current conservation education: Kuban University promotes conservation education in the region through the publication of popular articles and books. The first book on the natural history of the Krasnodar Region to be targeted at the general public was published by F.V.Navozova in 1955. This was followed by a more detailed publication of 'Nature of Krasnodarsky Krai' in 1974. The local university continues to publish books, leaflets and posters with updated information. Some of them follow the expeditions of 'The Kuban River', 'The Sea of Azov' and 'The Eastern Azov', which were organized by scientific institutions and NGOs and received wide publicity.

27. Current recreation and tourism: The local societies of hunters and fishermen have 120,000 members. The best sites for waterfowl shooting in the delta have been allotted to the 'Kubanokhota' hunting society. In recent years, foreign tourism has been promoted, with hunting and fishing as the main activities. Besides, from 80,000 to 100,000 people take licences for sport fishing annually. In the coastal zone, there are a lot of campsites, holiday bases and resorts.

28. Jurisdiction:

Territorial: Administration of Krasnodar Krai (35 Krasnaya St., Krasnodar 350630).

Functional: State Committee of the Russian Federation for Environmental Protection (4/6 Bolshaya Gruzinskaya Street, Moscow 123812).

29. Management authority: There is no single management structure responsible for the status of wetlands and resource uses in the area. This function is performed by the administrations of Krasnodar Krai and its districts, by the Regional Committee of Environmental Protection and Natural Resources (19 Mira Street, Krasnodar 350640), the Hunting Management Office (71 Mira Street, Krasnodar 350630), the Black Sea and Sea of Azov Office on Management and Conservation of Waters (108a Krasnaya St., Krasnodar 350033), and Fishery Management Office "Krasnodarrybprom" (180 Krasnaya St., Krasnodar 350033).

The Priazovsky state nature reserve (wildlife refuge - 'zakaznik') is managed by the Central Hunting Management Office of the Russian Federation (Malaya Bronnaya St. 24-1, Moscow 103001, Russia).

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