National Academy of Sciences of Ukraine
Ministry of Education and Science of Ukraine

Bogdan Khmelnitsky Melitopol State Teachers' Training University, Biodiversity Research and Training Centre, the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, the Azov and Black Sea Interdepartmental Ornithological Station at I.I. Shmalgauzen Zoology Institute of the National Academy of Sciences of Ukraine and Bogdan Khmelnitsky MSTTU, Laguna Ecological Non-Government Organization

Expert Opinion and Scientific Report No. 1

Description of Seasonal Ornithological Complexes within the Site of EUROCAPE Wind Park and Adjacent Territories



Under the terms of Agreement No. 03l/07 - 16 dated 02.08.2016.
Performance of Researches and Processing of Monitoring Data in Respect of Adjustment of the Expert Opinion and Scientific Report on the Impact of 500 MW Wind Park in Pryazovske and Melitopol Districts of Zaporizhia Region (hereinafter referred to as the Wind Park), including the Route of 330 kV Power Transmission Line, on Seasonal Ornithological Complexes and Migrating Birds, Bats within the Boundaries of Divnynske, Dobrivka, Dunaivka, Girsivka, Nadezhdine Village Councils of Pryazovske District and Mordvynivka, Nove Village Councils of Melitopol District of Zaporizhia Region

Melitopol, 2016

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Expert Opinion (Adjustment)

on Assessment of EUROCAPE Wind Park Sites Construction Influence on the Seasonal Ornithological Complexes and Migratory Birds within the Boundaries of Divnynske, Dobrivka, Dunaivka, Girsivka and Nadezhdine Village Councils in Pryazovske District and Mordvynivka Village Council in Melitopol District of Zaporizhia Region

Melitopol, 2016

Approved by: _____	**Approved by: _____**
Professor V.V. Molodychenko **Rector of** **Bogdan Khmelnitsky Melitopol** **State Teachers' Training University**	**V.D. Siokhin** **Head of Laguna** **Ecological Non-Government Organization**

Melitopol **December 10, 2016**

Expert Opinion (Adjustment)

on Assessment of EUROCAPE Wind Park Sites Construction Influence on the Seasonal Ornithological Complexes and Migratory Birds within the Boundaries of Divnynske, Dobrivka, Dunaivka, Girsivka and Nadezhdine Village Councils in Pryazovske District and Mordvynivka Village Council in Melitopol District of Zaporizhia Region

Customers: Vestas Ukraine LLC, EuroCape Ukraine I LLC

Contractor: Bogdan Khmelnitsky Melitopol State Teachers' Training University, Biodiversity Research and Training Centre, the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, the Azov and Black Sea Interdepartmental Ornithological Station at I.I. Shmalgauzen Zoology Institute of the National Academy of Sciences of Ukraine and Bogdan Khmelnitsky MSTTU of the Ministry of Education and Science of Ukraine, Laguna Ecological Non-Government Organization.

Grounds for preparation of the Expert Opinion:

- Contract No. 3n for Development of the Scientific and Technical Product *Performance of Ornithological Assessment of the Wind Power Plants Impact from the Designed Site in the Areas Adjacent to the Molochnyi Estuary National Preserve within Pryazovske District of Zaporizhia Region* dated April 1, 2009; Supplementary Agreement No. 2 dated June 3, 2010
- Contract No. 5l/10 - 14 for Development of the Scientific and Technical Product *Performance of Studies and Material Processing Related to Adjustment of the Expert Opinion and Scientific Report on Influence of Construction of the Wind Park Sites on the Seasonal Ornithological Complexes and Migratory Birds within the Boundaries of Divnynske, Dobrivka, Dunaivka, Girsivka and Nadezhdine Village Councils in Pryazovske District and Mordvynivka Village Council in Melitopol District of Zaporizhia Region* dated October 29, 2014
- State License of I.I. Shmalgauzen Zoology Institute of the National Academy of Sciences of Ukraine and Prescription No. 1 of the same Institute dated 15.10.1998
- Scientific Report under Contract No. 3n for Development of the Scientific and Technical Product *Performance of Ornithological Assessment of the Wind Power Plants Impact from the Designed Site in the Areas Adjacent to the Molochnyi Estuary National Preserve within Pryazovske and Melitopol Districts of Zaporizhia Region* dated April 1, 2009
- Expert Opinion (Contract No. 3n of April 1, 2009) on Location and Impact of the Designed Wind Power Plants on the Ornithological Complexes of the Environment and on Migratory Birds, as Well as Bats, in the Areas Adjacent to the Molochnyi Estuary National Preserve and Subregional Zones of High Bird Diversity during the Migration Period within Pryazovske and Melitopol Districts of Zaporizhia Region dated July 30, 2010

- Expert Opinion and Scientific Report (Contract No. 5l/10 - 14 of October 29, 2014) on Adjustment of the Expert Opinion and Scientific Report on Influence of Construction of the Wind Park Sites on the Seasonal Ornithological Complexes and Migratory Birds within the Boundaries of Divnynske, Dobrivka, Dunaivka, Girsivka and Nadezhdine Village Councils in Pryazovske District and Mordvynivka Village Council in Melitopol District of Zaporizhia Region dated December 23, 2014

- Scientific materials, databases and GIS information on the seasonal distribution and quantity of birds from the Azov and Black Sea Interdepartmental Ornithological Station, the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems and Laguna Ecological NGO for the previous years.

Terms of the work execution: 2009 through 2011 (under Contract No. 3n of April 1, 2009 and Supplementary Agreement No. 2 of June 3, 2010); in 2014 (under Contract No. 5l/10 - 14 of October 29, 2014), 2012 through 2016 (in accordance with the lists of scientific topics funded from the state budget in the scientific subdivisions of Bogdan Khmelnitsky Melitopol State Teachers' Training University, planned scientific topics of the Azov and Black Sea Ornithological Station, initiative ornithological studies of Laguna Ecological NGO); in 2016 (under Contract No. 03l/07 - 16 of August 2, 2016).

Administrative and Economic System of the Territory Governing

In terms of administrative division, the designed territory of the site of EUROCAPE Wind Park, buffer zones and adjacent territories within a radius of 2 km belong to Divnynske, Dobrivka, Dunaivka, Girsivka and Nadezhdine Village Councils of Pryazovske District and Mordvynivka Village Council of Melitopol District in Zaporizhia Region.

General Expert Opinion

General Expert Opinion is based on the following scientific data, which are presented and discussed in detail in the Scientific Report:

1. Retrospective monitoring data for the previous years on the description of seasonal bird migrations and the seasonal ornithological complexes
2. Current description of the migratory status of birds in spring and autumn (monitoring data on species composition, numbers, migration periods, directions and altitudes of passage, diurnal activity, forming and disintegration of migratory gatherings, general description of seasonal migrations of birds and species of the transcontinental migratory complex, which are protected by the international conventions and agreements, description of regional state of red-breasted goose and other semi-aquatic species of birds, which are exposed to the heightened danger owing to the influence of wind power objects)
3. Current description of wintering, nesting and post-nesting ornithological complexes (monitoring data on species composition, numbers, places of localization, feeding activity, protected species)
4. Register of bird species that are protected by the national legislation and the international conventions and agreements
5. Assessment of impact of the designed territory of EUROCAPE Wind Park on the seasonal bird complexes according to the international standards
6. Cartographic materials with the description of seasonal bird migrations, wintering, nesting and post-nesting ornithological complexes in the designed territory of EUROCAPE Wind Park site, buffer zones and adjacent territories, developed on the basis of field trips in AutoCAD format (A3 format).

The construction of EUROCAPE Wind Park sites is approved without restrictions within the boundaries of Divnynske, Dobrivka, Dunaivka, Girsivka and Nadezhdine Village Councils in

Pryazovske District and Mordvynivka Village Council in Melitopol District of Zaporizhia Region (see Fig. 1.1 - 1.2 of the Scientific Report) in accordance with:

- cartographic materials and other planning documentation provided by the Customer as regards the planning pattern of the wind park sites
- scientific researches held by the Contractor as specified in the Schedules and the Requirements Specifications to Contract No. 3n of April 1, 2009, Supplementary Agreement No. 2 of June 3, 2010, Contract No. 5l/10 - 14 of October 29, 2014, Contract No. 03l/07 - 16 of August 2, 2016, as well as using the scientific materials, databases and GIS information on the seasonal distribution and quantity of birds, their migrations within EUROCAPE Wind Park sites, buffer zones, adjacent regional and subregional areas of high diversity of birds from the Azov and Black Sea Interdepartmental Ornithological Station, the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Laguna Ecological NGO for the previous years and the current data.

National Academy of Sciences of Ukraine
Ministry of Education and Science of Ukraine
Laguna Ecological Non-Government Organization, Bogdan Khmelnitsky Melitopol State Teachers' Training University, Biodiversity Research and Training Centre, the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems and the Azov and Black Sea Interdepartmental Ornithological Station at I.I. Shmalgauzen Zoology Institute of the National Academy of Sciences of Ukraine and Bogdan Khmelnitsky MSTTU

Approved by: _____ O.M. Goridko Director of VESTAS UKRAINE LLC	**Approved by: _____** Professor V.V. Molodychenko Rector of Bogdan Khmelnitsky Melitopol State Teachers' Training University
Approved by: _____ P.J. O'Brien Director of EUROCAPE UKRAINE I LLC	**Approved by: _____** V.D. Siokhin Head of Laguna Ecological Non-Government Organization

Scientific Report

(Adjustment of the Monitoring Data Received for the Current Period and the Previous Years of the Studies)

on Assessment of EUROCAPE Wind Park Sites Construction Influence on the Seasonal Ornithological Complexes and Migratory Birds within the Boundaries of Divnynske, Dobrivka, Dunaivka, Girsivka and Nadezhdine Village Councils in Pryazovske District and Mordvynivka Village Council in Melitopol District of Zaporizhia Region

Melitopol, 2016

Authors

- **V.D. Siokhin,** Correspondent Member of the Ukrainian Ecological Academy of Sciences, Candidate of Biological Science, Specialist in Ornithology and Applied Ecology (Biodiversity Research and Training Centre, the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Laguna Ecological NGO)

- **P.I. Gorlov,** Candidate of Biological Science, Senior Researcher, Specialist in Ornithology (Biodiversity Research and Training Centre, the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, the Azov and Black Sea Ornithological Station and Laguna Ecological NGO)

- **Y.I. Chernichko,** Leading Researcher, Doctor of Biological Science, Specialist in Ornithology and Ecology (Biodiversity Research and Training Centre, I.I. Shmalgauzen Zoology Institute of the National Academy of Sciences of Ukraine, the Azov and Black Sea Ornithological Station and Laguna Ecological NGO)

- **Y.O. Andriushchenko,** Associate Professor, Candidate of Biological Science, Specialist in Ornithology (Biodiversity Research and Training Centre, I.I. Shmalgauzen Zoology Institute of the National Academy of Sciences of Ukraine, the Azov and Black Sea Ornithological Station and Laguna Ecological NGO)

- **R.M. Chernichko,** Candidate of Biological Science, Specialist in Ornithology (Biodiversity Research and Training Centre, I.I. Shmalgauzen Zoology Institute of the National Academy of Sciences of Ukraine and the Azov and Black Sea Ornithological Station)

- **O.A. Diadicheva,** Research Fellow, Specialist in Ornithology (Biodiversity Research and Training Centre, I.I. Shmalgauzen Zoology Institute of the National Academy of Sciences of Ukraine and the Azov and Black Sea Ornithological Station)

- **S.V. Vynokurova,** Research Fellow, Specialist in GIS Technologies (Biodiversity Research and Training Centre, I.I. Shmalgauzen Zoology Institute of the National Academy of Sciences of Ukraine, the Azov and Black Sea Ornithological Station and Laguna Ecological NGO)

- **O.M. Dolynna,** Research Fellow, Specialist in Assessment of Biodiversity Components (Biodiversity Research and Training Centre, the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems and Laguna Ecological NGO)

- **I.B. Salnykova-Budenko,** Research Fellow, Specialist in Zoning of Biodiversity Components (Biodiversity Research and Training Centre, the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems and Laguna Ecological NGO)

- **V.I. Dolynnyi,** Junior Research Fellow, Specialist in Instrumental Methods of Bird Research (Biodiversity Research and Training Centre, the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems and Laguna Ecological NGO)

- **A.I. Sydorenko,** Junior Research Fellow, Specialist in Ornithology (Biodiversity Research and Training Centre, Laguna Ecological NGO)

- **O.A. Ilyichov,** Leading Engineer, Specialist in Instrumental Methods of Bird Research (the Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems)

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Chapter 1. General Description of the Designed Territory of EUROCAPE Wind Park Sites

1.1. Territories, planning characteristic and location of EUROCAPE Wind Park sites

Administratively the wind park territories and adjacent areas within the radius of 1 - 2 km are located within the boundaries of Divnynske, Dobrivka, Dunaivka, Girsivka and Nadezhdine Village Councils in Pryazovske District and Mordvynivka Village Council in Melitopol District of Zaporizhia Region. The preliminary planning structure of the wind park as of 2016 is presented in Fig. 1.1.

According to the design documentation, as of the moment of research, the wind park territory includes two relatively separated plots - Fig. 1.1:

The first one – the territories adjacent to the Villages of Mordvynivka (Mordvynivka Village Council in Melitopol District) and Dobrivka (Dobrivka Village Council in Melitopol District), 60 wind turbines.

The second one – the territories among the Villages of Girsivka (Girsivka Village Council in Pryazovske District), Dunaivka (Dunaivka Village Council in Pryazovske District) and Divnynske (Divnynske Village Council in Pryazovske District), 106 wind turbines.

166 wind turbines with the total power of 500 MW are planned to be installed in the designed territory of the wind park sites. The main number of wind turbines is intended to be installed within agricultural hedgerows. Types of the wind turbines have the following parameters related to the hub heights:

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- V112 – 119 m, maximum height (blade top) – 175 m, blade of 56 m
- V126 – 119 m, maximum height (blade top) – 180 m, blade of 63 m.

General plan of the location of EUROCAPE Wind Park sites with buffer zones and adjacent territories within Pryazovske and Melitopol Districts of Zaporizhia Region for AutoCAD program is presented in Fig. 1.2. Layout diagram of EUROCAPE Wind Park sites is presented in satellite data – Fig. 1.3.

Land plots for the WTGs are located outside of residential settlements. Sanitary protection zones and town planning measures concerning improvement of the environment established by the state permit documentation have been observed while selecting the location of wind turbine generators.

In the west, the territories of the wind park sites are located at the distance of 4 - 8 km from the Molochnyi Estuary Wetland of International Importance (Fig. 1.2 – 1.3). On the other sides, the sites of the wind park are surrounded by agricultural lands. The very territories of the wind park sites are located in agricultural lands with agricultural hedgerows. The majority of the designed territory is represented by various agrophytocenosises (agricultural lands) with unpredictable crops rotations. The forest plantations are represented by agricultural hedgerows different in species composition of tree plantations, width and shrub layer. The considerable part of agricultural hedgerows are on the decline because of substantial man impact (deforestation, fires) leading them to significant degradation. Natural steppe vegetation has been preserved only within agricultural hedgerows and separate local lower reaches (gullies and small stream canals – the Dzhekelnia River, etc.). The only woodland, inconsiderable in area (46.5 ha), is located in the buffer zone of the site in the territory of Mordvynivka Village Council and is characterized by minimum species composition of trees and shrubs.

Anthropogenic impact on the agricultural hedgerows is quite substantial and it leads to their significant degradation. Tall agricultural hedgerows with prevailing oaks have only been preserved in one place between the Villages of Dunaivka and Girsivka.

Road infrastructure within the wind park sites is represented by local roads running mostly alongside of agricultural hedgerows.

Current examination of the planned wind park sites in Melitopol and Pryazovske Districts showed that the area here is represented mostly by dry arable land divided by agricultural hedgerows. The main economic activity is tillage.

The disposition of the wind park territory from anthropogenic landscape perspective is presented in satellite data (Fig. 1.3).

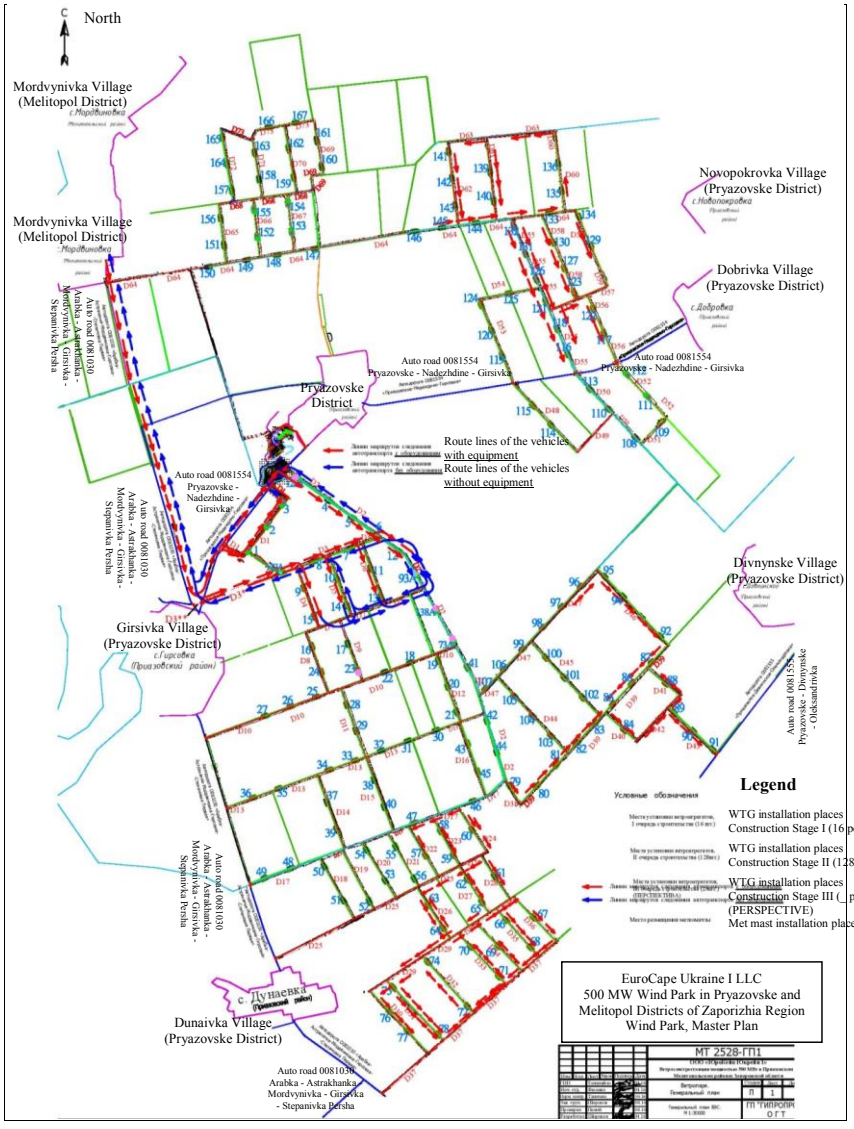


Fig. 1.1. Current design layout of WTGs at the designed sites of EUROCAPE Wind Park within the boundaries of Divnynske, Dobrivka, Dunaivka, Girsivka and Nadezhdine Village Councils in Pryazovske District and Mordvynivka Village Council in Melitopol District of Zaporizhia Region as of 2016

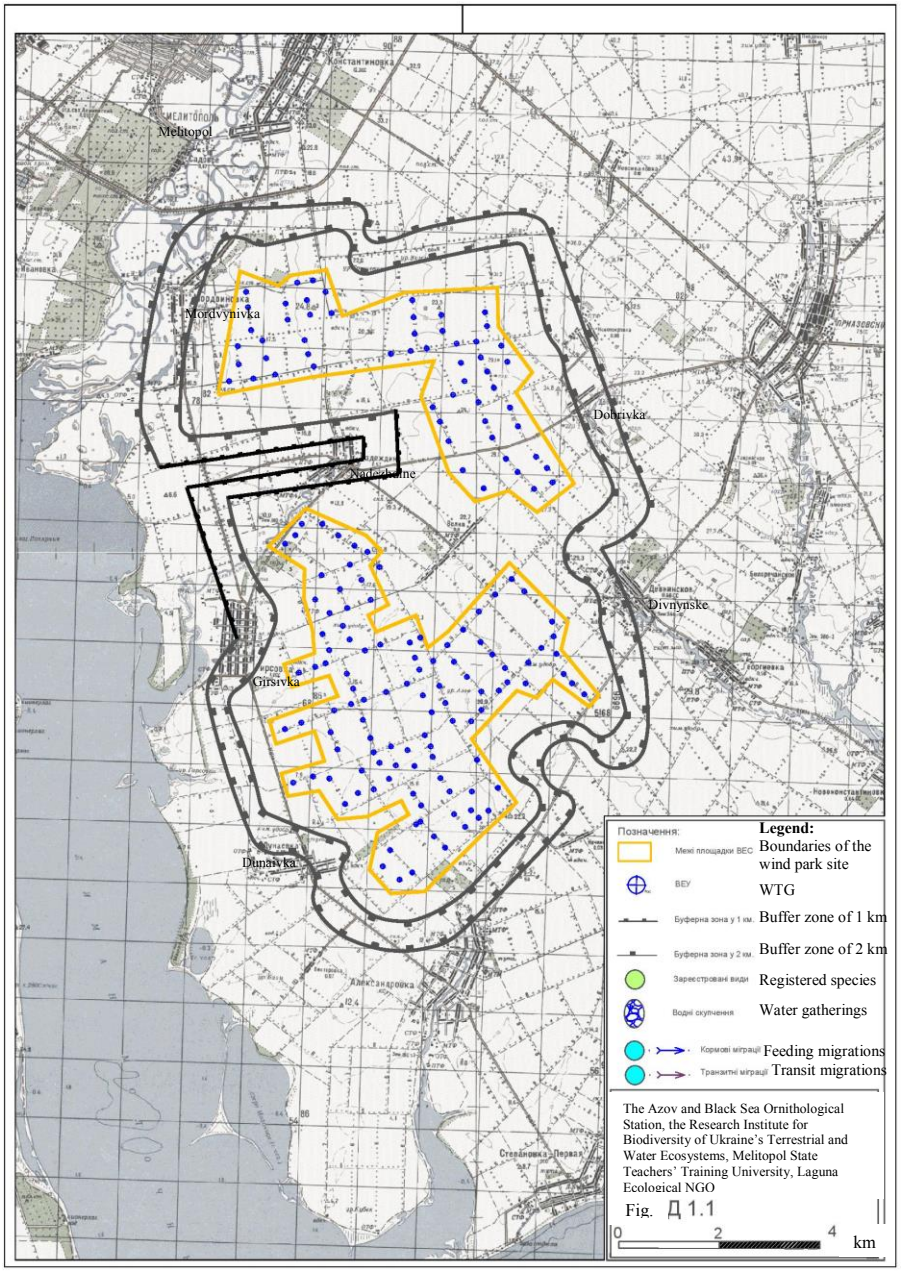


Fig. 1.2. General location plan of EUROCAPE Wind Park sites with the buffer zones and adjacent territories within Pryazovske and Melitopol Districts of Zaporizhia Region for AutoCAD program

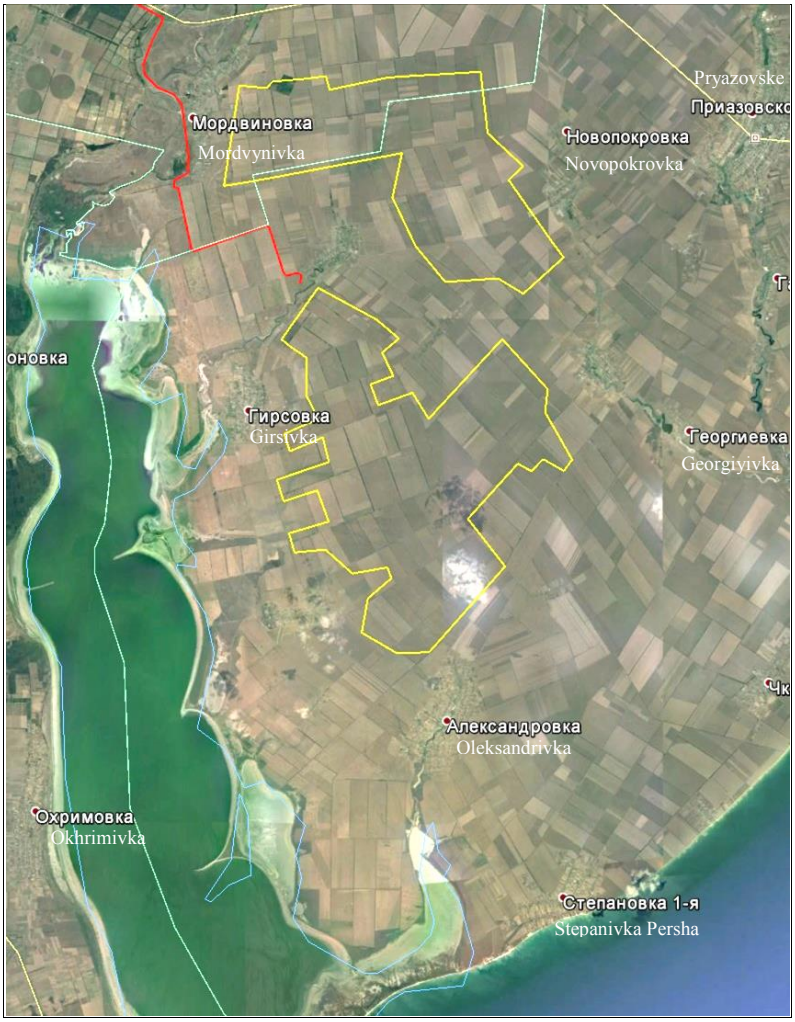


Fig. 1.3. Layout diagram of EUROCAPE Wind Park sites in satellite data

1.2. Natural protected areas

In accordance with the national legislation, natural protected areas are subdivided into the natural protected areas of the first order (wildlife preservations and national parks) and of the lower orders (preserves of national and local importance).

There are no any natural protected areas of the first order (wildlife preservations and national parks) within the wind park site and adjacent territories up to 4 km. The natural protected areas of the lower orders (preserves of local importance) also are not represented within the wind park sites.

Only one natural protected area is located in the territories adjacent to the wind park sites - the Molochnyi Estuary Wetland of International Importance, which is a part of the

Azov Seaside National Natural Park. The Molochnyi Estuary also belongs to IBA (Important Bird Areas), as important places for seasonal habitation of semi-aquatic birds.

The estuary is recognized to be the land of international importance, which is protected by the International Ramsar Convention, therefore any activity within the land is also governed by Regulation No. 935 of the Cabinet of Ministers of Ukraine "On the Measures for Protection of Wetlands of International Importance" dated 23.11.1995 and Regulation No. 1287 of the Cabinet of Ministers of Ukraine "On the Procedure for Assignment of the Wetlands of International Importance Status to Wetlands" dated 29.08.2002. As a result of establishing the Azov Seaside National Natural Park (Decree No. 154/2010 of the President of Ukraine dated 10.02.2010), the Molochnyi Estuary Wetland became its part.

The seashore abrasion and accumulative (old and modern sea benches) landscape complexes with various biotopes, as well as riverine landscape complexes with relatively preserved natural steppe and flood plain vegetation, are the most important in terms of ecosystem.

The mouth sections of small rivers at the Azov Seashore play a special role, as environment contrast here led to emergence of unique wetland landscapes, which house many semi-aquatic birds in the course of year. These very mouth sections play a most important role in supporting bird species diversity. Besides, the rivers and gullies, which flow into the estuary, are environmental landscape corridors that connect the Azov Seaside Massif with the coastal territory.

The watershed spaces and benches above the flood plain adjacent to the estuary, where agricultural activity is developed intensively, as well as some right bank areas, which are altered as a result of recreation activity, are anthropogenically changed.

Vulnerability of the Molochnyi Estuary is high enough, which is accounted for by the abrupt change of stream conditions depending on the level of its connection with the Sea of Azov and, as a result, change of biological diversity and fish capacity.

The Molochnyi Estuary Wetland of International Importance (included in the Register of the Ramsar Convention) is an important element in general structure of ecological network of regional, national and Pan-European levels.

The landscape structure of the territory within the Molochnyi Estuary Wetland consists of 5 types of terrain (Fig. 1.4):

- Terrains of river benches. *Typical biotopes:* clay precipices, remains of steppe vegetation on the slopes, artificial forest plantations on the terraced slopes and on sands alongside of the right bank, salt marshes, pastures and grasslands, old gardens, recreational buildings of children health centres
- Flood plain terrains (the near-mouth part of the Molochna and Tashchenak Rivers). *Typical biotopes:* sand silty beaches, meadows, shallow waters, deep-water sections of the riverbed, thickets of rush and water swamp vegetation
- Terrains of seaside coastal halogenic plains (stretched on the spits). *Typical biotopes:* saline cavities, thickets of rush in the coastal part, sand silty beaches, shallow water, islets, buildings. The big accumulative islands (Pidkova, Dovgyi) situated along the left bank of the estuary have a status of separate landscape terrain. *Typical biotopes:* shallow waters, depleted vegetation cover, thickets of rush
- Seaside abrasion terrains alongside of precipitous estuary shores. *Typical biotopes:* sandy clay precipices, sand silty beaches
- Seaside abrasion halogenic terrains (along the left bank of the estuary). *Typical biotopes:* shrub thickets, agricultural hedgerows, stand-alone trees, saline swamps.

The natural importance of the Molochnyi Estuary is characterized by the following features.

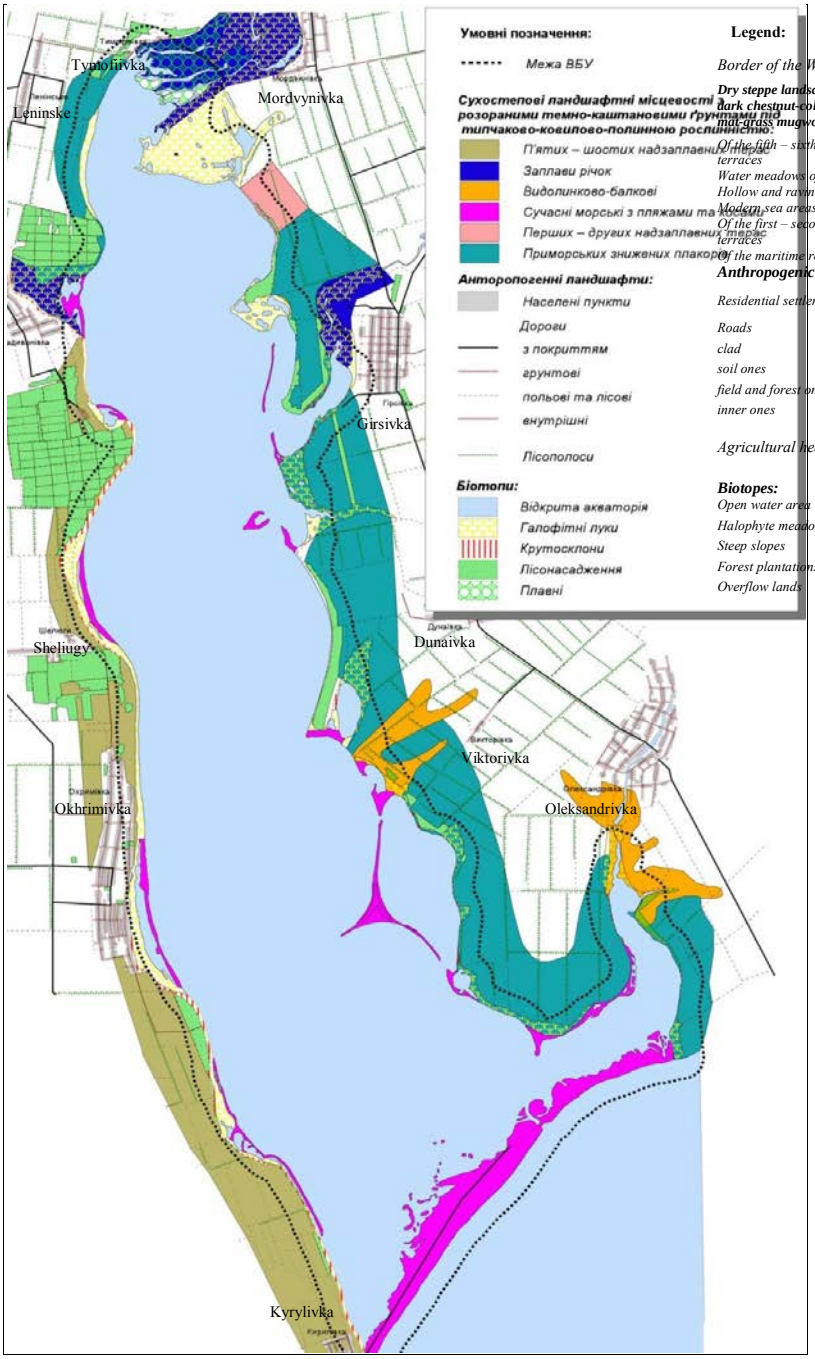


Fig. 1.4. Diagram of landscape complexes of the Molochnyi Estuary Wetland

1. Biological complex of the wetland is characterized by rather high diversity and includes:

- 274 species of birds (112 species nest, 213 were observed during migration period, 98 were observed in winter period) with the total amount of birds in different seasons over 250 thousand specimens
- 700 species of vascular plants
- 33 species of fish
- 2 species of amphibious and 6 species of reptiles
- 30 species of mammals
- more than 300 species of other representatives of the biological complex.

2. The Molochnyi Estuary is an important area for conservation of rare species of animals and plants:

- 149 species of birds pertain to Pan-European Conservation Importance (SPEC). 15 species are protected by the International Union for Conservation of Nature (IUCN), 259 species are protected by the Bern Convention and 147 species are protected by the Bonn Convention. 96 species are guard-protected by the Agreement on the Conservation of African-Eurasian Migratory Waterbirds - AEWA; 41 species fall within the scope of the Convention on International Trade in Endangered Species (CITES). Besides, 44 species of birds are listed in the Red Data Book of Ukraine (Annex 1, Table 1.1)
- 33 species of insects are listed in the Red Data Book of Ukraine and the European Red List
- 33 species of vascular plants are under protection at World, European and state levels. 9 species are listed in the World Red List (IUCN), 16 species are booked in the European Red List. Vascular plants grow at the researched area, out of 439 species of vascular plants - 17 species are listed in the Red Data Book of Ukraine.

Significance of the territory as places for breeding and wintering of animals, as well as mass moulting of birds, according to international criteria for wetlands

Criterion 2. 149 species of birds (54 %) pertain to the species of Pan-European Conservation Importance (SPEC), in particular 10 species (3.6 %) are the species of global nature-preservation importance; 18 species (6.6 %) - the species of mainly European habitat and of an unfavourable conservation status; 72 species (26 %) - the species of not only European habitat and of an unfavourable conservation status; 49 species (17.9 %) - the species of mainly European habitat and of a favourable conservation status. 15 species (5.4 %) are listed in the Vulnerable Species List of the International Union for Conservation of Nature (IUCN). 259 species are protected by the Bern Convention and 147 species - by the Bonn Convention. 96 species (35 %) are protected under the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), and CITES Convention applies to 41 species (15 %). 44 species of birds (16 %) are listed in the Red Data Book of Ukraine.

Criterion 4. The wetland provides conditions for nesting of several thousand couples and wintering of about 20 thousand specimens of water birds.

Criterion 5. Over 20 thousand specimens of water birds are staying here regularly and large quantity of anseriformes (*Anseriformes),* ciconiiformes (*Ciconiiformes)* and shore birds (*Charadriiformes)* representatives gathers in this territory.

Criterion 8. The Molochnyi Estuary plays a significant role in reproduction of the populations of Mugil soiuy and Flatfish in the Azov basin. This water body is one of two existent (other one is the Syvash), where the natural reproduction of these commercial valuable fish species takes place. Hydrochemical conditions, which have been formed in the water body, forward the effective spawning of these species. In addition, spawning of such species as Neogobius melanostomus, monkey goby, and grass goby takes place here.

Seasonal significance of the ornithological complexes of given territory in terms of the ecological network

The Molochnyi Estuary Wetland of International Importance is a key element in the overall structure of ecological network at the national and Pan-European levels. The territory is included in the Azov and Black Sea Environmental Natural Corridor, which runs from the Danube in the west to the Don in the east along the seacoasts of the Azov and Black Seas and covers the seaside parts of Odesa, Mykolaiv, Kherson, Zaporizhia and Donetsk Regions. The most intensive flyway of birds in the Eastern Europe within the African-Eurasian Migration Region runs along this corridor. The Molochnyi Estuary is connected with the Syvash by general routes. If taken together with the Syvash, the importance of this territory for birds exceeds that of the common Danube Delta (Ukraine and Romania) together with the water bodies of the Bulgarian seaside.

The uplands and agrocenosises around the estuary are not environmentally significant in their own right but their supply of migratory birds with forage resources is an integral part of the overall value of the territory. The agricultural hedgerows and forest plantations, especially those along the south-western border of the wind park sites, are important for nesting of small falcon species, perching birds, etc.

Besides the territories of the natural protected areas of the first order, preserves of local importance are located in the adjacent territories (Table 1.1).

Table 1.1. List of Preserves of Local Importance Located in the Territories Adjacent to EUROCAPE Wind Park Sites

No.	Object name	Type	Area, ha	Location
1	Virgin plot	botanical	332.6	Melitopol District, near the Molochna River bed behind Mordvynivka Village
2	Virgin plot	botanical	10.0	Melitopol District, near Mordvynivka Village
3	Virgin plot	botanical	502.0	Melitopol District, flood plain of the Molochna River, outskirts of Mordvynivka Village
4	Agricultural hedgerow	botanical	3.0	Pryazovske District, within the lands of Dunaivka Village

Therefore, the wind park sites do not pertain to the natural protected areas and do not have influence on the state of biodiversity in the territory of given category, including the natural protected areas at the adjacent plots. It is proved by following.

1. Location of the wind park sites only in anthropogenic landscape complexes (agricultural lands) - Fig. 1.2 – 1.3.

2. Distance from the wind park sites to the natural protected areas is 4 - 8 km (Fig. 1.2 – 1.3).

3. About 95% of birds in the Molochnyi Estuary Wetland are semiaquatic group connected with water territories; it minimizes the wind park impact owing to their small quantity within the wind park (Chapters 4 - 6 of the Scientific Report).

4. The majority of transit and feeding migrations within the wind park sites is characterized by safe altitudes of bird movements (Chapters 4 - 6 of the Scientific Report).

5. All preserves of local importance, which are located in the territories adjacent to EUROCAPE Wind Park sites, without exception are botanical. Technological infrastructure of the wind park sites during construction and operation shall be located outside the natural protected areas.

Chapter 2. Technical Approaches to Organizational Management, Research Techniques

2.1. Methodological foundation concerning execution of works

Scientific programmes, techniques, basic scientific publications

The Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, the Azov and Black Sea Ornithological Station of Melitopol State Teachers' Training University with the assistance of leading scientists of Ukraine have developed the scientific programmes: Monitoring and Support of Biological Diversity in the Wetlands of Ukraine in 1995 [1], and in 2004 – the special programme of Regional Ornithological Monitoring (ROM), oriented to wetlands and other territories of the south of Ukraine.

Under the auspices of Wetlands International - AEME the Programme and Action Plan for Waterbird Monitoring in the Azov-Black Sea Region of Ukraine were developed in 1998 [2, 3], and in 2000 their translation in English were published for acquaintance by the countries of the Black Sea region [4].

This programme is mostly oriented to the monitoring of waterbirds and is prepared in terms of fulfilment of Ukraine's commitments to the Ramsar Convention, assistance of its participation in the Bonn Convention and the Agreement on Protection of African-Eurasian Migratory Ways. Since birds in wetlands are one of the main objects, then organization of monitoring has seasonal aspect (monitoring of nesting ornithological complexes, seasonal distribution and migrations, winter ornithological complexes, monitoring of rare species).

According to the project of Wetlands International – AEME, a grant of the Ministry of Agriculture, Nature Management and Fishery and the Ministry of Foreign Affairs of the Kingdom of the Netherlands (Programme International Nature Management), as well as a grant of the Ministry of the Environment and Energy of Denmark (Danish Co-operation for Environment in Eastern Europe), the Azov and Black Sea Ornithological Station organized and carried out the censuses of nesting birds in the wetlands of the Azov and Black Sea ornithological corridor in 1998 using air, ground and water transport. Based on the results of work the monograph Quantity and Distribution of Nesting Semi-Aquatic Birds in the Wetlands of the Azov and Black Sea Coast of Ukraine (under the editorship of V. Siokhin, p. 475) was published in 2000 [5].

The project: Assessment of Biodiversity of Migratory Water Birds in Wetlands within the Corridor and Determination of Important Places of Seasonal Distribution for Feeding and Ways of their Movement was executed in 2004-2005 within the grant of GEF/IBRD *Conservation of Biodiversity in the Azov and Black Sea Corridor* (No. TF 028267 UA).

Within the framework of Contract No. 96, of September 19, 2007 for Development of Scientific and Technical Product *Methodological Support of the Development of Regional Programme for Formation of Ecological Network within Zaporizhia Region* [6] with the State Administration of Environmental Protection in Zaporizhia Region, the edition: Procedure of Inventory and Assessment of the Current State of Biodiversity of Natural Complexes and Landscapes, Which are Required for the Formation of Regional Ecological Networks was prepared in 2007.

Within the framework of the programme of BBI - Matra 2008/020 BUWA Project 08-043 (Government of the Netherlands): Optimization of the Structure of Hunting Areas and Management of Semi-Aquatic Birds, Rise in the Level of Ecological Education of Hunters for the Purpose of Semi-Aquatic Birds Protection, the brochure "Structure of Databases and Control System, Usage of GIS Information for Organization of Monitoring, Basic Cartographic Materials" [7] was developed in 2009 - 2010 and researches on assessment of the ornithological conditions for the period of post-nesting gatherings and early stages of autumn migration (August) in wetlands of the south of Ukraine, and especially for the region of the Syvash, were carried out.

In 2010 the Azov and Black Sea Ornithological Station organized and carried out censuses of migratory birds in the wetlands of the Azov and Black Sea ornithological corridor within the scope of Ukrainian part of the project of Wetlands International: Migratory Stops in the Black Sea - NL1202.000.001 – funds and methodological support were provided for by the Customer, the Black Sea programme Wetlands International.

According to the state budget programme of the Ministry of Education and Science of Ukraine, the Contractor has prepared and develops specialized application-oriented and fundamental projects,

which enable to develop the conceptual and methodological bases for carrying out of researches at the wind park sites:

- Structural-functional significance of seasonal ornithological complexes in formation of ecological network of the Azov and Black Sea ecological corridor and African-Eurasian transcontinental migratory ways, registration number: 0112U001150 (2012 – 2014)

- Development of complex and integral methodological bases of protection and assessment of environmental effects in the course of designing and construction of wind power stations in the Azov and Black Sea region, registration number: 0113U002144 (2013 – 2014)

- Development of scientific information system of monitoring, assessment and forecast of biodiversity status in the regional territories and at the sites of wind and solar power plants, electric network lines within the Azov and Black Sea region, registration number: 0115U000255 (2015 – 2016)

- Development of radar monitoring system for observation of transcontinental bird migrations in the key natural and anthropogenic monitoring grounds in the Azov and Black Sea region, registration number: 0115 U000256 (2015 – 2017).

The Contractor held an international academic and research conference Ecological Monitoring of Wind and Solar Power Plants on the 3 - 4 of October, 2014 on the basis of scientific subdivisions of Melitopol Teachers' Training University and Botieve Wind Park (Wind Power, DTEK). Participants from Ukraine, Russia, Germany, Sweden and Holland have discussed a question on assessment of environmental effects of wind, solar power stations, PTLs in the course of their designing, construction and operation.

Based on the results of the conference following methodological and resource materials were published:

- Materials of International Academic and Research Conference *Ecological Monitoring of Wind and Solar Power Plants* // Edited by V.D. Siokhin // Branta Publishing Council, Melitopol, 2014. – 175 p. [8]

- Methodological Bases of Protection and Assessment of Environmental Effects in the Course of Designing, Construction and Operation of Wind and Solar Power Plants, Electrical Supply Network Lines: Methodological Guide / V.D. Siokhin, P.I. Gorlov, Y.O. Andriushchenko, A.M. Volokh and others – Melitopol: Bogdan Khmelnitsky MSTTU, 2014. – 147 p. [9].

The ornithological station has started and publishes an international ROM (regional ornithological monitoring) Bulletin, which numbers 9 issues as of today (2004 – 2016).

Methodological aspects of the description of ornithological situation in the region in terms of the expert appraisal for possible impact of wind park construction and operation on birds

Wind power facilities are point objects of considerable height. Their danger for birds does not exceed such one from PTL (power transmission lines) towers, but mainly it is even considerably lesser[1]. This is due to the fact that PTLs cover considerable areas, as opposed to wind parks, sites of which have considerably smaller sizes. Wind power facilities might be threatening for birds in the event that probability of collision of birds with WTGs is very high.

Such situation may occur in cases when WTGs are located in the places, where the ways of dense movements of large quantity of birds pass. Assessment of impact of wind park construction and operation on birds shall proceed from positions of analysis of availability of the ways of dense movements of large quantity of birds within the designed territory.

Such analysis shall take into consideration several moments. First of all, it is ecological description of the project territory, which shall be based on physiognomic approach, as the very landscape peculiarities of natural and anthropogenic complexes first and foremost define various features of ornithological situation. In this sense, physiognomic approach to ecological description of the territory is closely interwoven with functional analysis, which enables to define the role of different natural and anthropogenic complexes in life cycle of that or another groups of bird species, to single out zones with high biodiversity and outline their functional connections with the project

[1] http://en.wikipedia.org/wiki/Wind_power
http://energyfacilities.puc.state.mn.us/documents/PubliImpacts%Turbines,% Revised.pdf.
http://news.bbc.co.uk/2/hi/uk_news/scotland/tayside_and_central/7892277m
http://ru.wikipedia.org/wiki/%D0%92%D0%B5%D1%82%D1%8DD0%B0
http://www.bwea.com/ref/lowfrequencynoise.html
http://www.cres.gr/kape/publications//CRESTRANSWINDENVIRONMENT.doc.
www.canwea.ca/pdf/talkwind/

territory.

On the other hand, assessment of ornithological situation must be differentiated according to the main phenological stages of bird life cycle (nesting period, spring and autumn migrations, wintering), as functional usage of that or another natural and anthropogenic complexes and pattern of bird movements in each individual stage are essentially different among themselves.

Special attention shall be paid to analysis of ornithological situation in the course of migrations, as large quantity of birds fly over the region at this period. Local differentiation of migratory processes into feeding migrations (for all seasons of year) and transcontinental migrations (for spring and autumn migration) is the most pressing issue in description of ornithological situation in the region during migrations in terms of assessment of wind park impact on birds.

Collisions of birds with operating blades of WTGs may occur in the course of bird flying. Risk of collision depends on the quantity of birds, flying properties of one or another group of birds, biotopes of bird stay, season of year, diurnal and flying activity.

It is obvious that representatives of birds of prey with high flying properties have a better chance to avoid a collision with the wind park than bustard (crane-like birds), pheasant or partridge (fowl-like birds). Birds, for which soaring in the sky and calm flying are typical (harriers, buzzards, some species of gulls), have more time to react to the wind park than species of birds, for which quick straight flying is typical (geese, ducks, perching birds). Also among factors that have an effect on the possibility of collision shall be noted the size of a bird and its aggregative behaviour. So, birds that fly one by one specimen or in small flocks (birds of prey, ciconiiformes) usually avoid collisions. But then birds of large flocks have many possibilities to get under blades of WTGs.

Biotopes of bird stay, namely, places where birds stay the major portion of life cycle, also play their certain part. If water is the main biotope for hydrophilic group of birds, then a level of influence may be from minimal to vanishing (zero impact). For birds, which use both area of water bodies and dry land, or completely stay within upland in their life, this risk certainly increases.

Behaviour of birds changes in the course of year. During seasonal migrations birds, first of all, gather into flocks, secondly, show high diurnal activity. In winter period flying activity goes down to passages from roost places to forage plots and conversely. During nesting period all birds try to lead a hidden mode of life, carry out a minimum of passages and avoid open land areas. All these changes of behaviour also influence on the possibility of collisions.

Ability of birds to lead active life both in the daytime and at night characterizes their diurnal activity. In the course of migrations some species of birds fly only in the daytime (the majority of perching birds and diurnal birds of prey) or only at night (shore birds, owls, herons). There is a large group of birds, which fly both in the daytime and at night covering long distances. According to this, the risk of collision with wind parks reduces or increases.

While speaking about numbers of birds it shall be revealed expected direct relation of collision occurrences for concrete species of birds with their quantity. According to the data of Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States, the majority of bird collisions with wind parks were observed for the group of perching birds. Quantity of birds of prey is rather small, and in accordance with this - low percentage of collisions for these species.

Weather conditions, while being analysed in detail, have proved to be privileged for determination of the level of wind park impact on birds. Any species of birds in fog or in a strong wind automatically get into high-risk group, which even increases considerably in the event of night passages.

Predictive assessment of wind park impact on birds, which shall be used for the expert appraisal, has been developed on the basis of generally accepted guidelines of BirdLife International reflected in the directive document - Windfarms and Birds: An Analysis of the Effects of Windfarms on Birds, and Guidance on Environmental Assessment Criteria and Site Selection Issues. Access mode to the electronic resource - http://www.birdlife.org/eu/pdfs/BirdLife_Bern_ windfarms. pdf. [11]

Environmental criteria for impact assessment in the document of BirdLife International were calculated and interpreted using proposed table, fragment of which is given below.

Fragment of the table for determination of environmental criteria for assessment of the wind park impact on birds (Windfarms and Birds…, page 5).

Taxons	Anxiety factor	Barriers for movement	Collisions	Biotopes loss/ damage
Divers (loons) *(Gaviidae, Gavia stellata*)	√	√	√	
Cormorants *Phalacrocoracidae* (*Phalacrocorax aristotelis*)				√
Ciconiiformes - *Ciconiiformes*			√	
Anseriformes *(Anserini*, *Cygnus Cygnus*, *Anser brachyrhynchus*, *A. albifrons*, *Branta leucopsis, B.bernicla*)	√		√	

While recognizing the objectivity of such approach to assessment of the wind park impact, it shall be noted some moments that require more detailed analysis of situation.

Firstly, it has been suggested prognostic analysis at species level, as the analysis of large taxons, which is used by BirdLife International, is less correct than the one suggested by us. It is inadmissible to examine the wind park impact on individual taxonomic group of birds (anseriformes, ciconiiformes, and shore birds) without their division into species, as some species of a taxon may be in the risk group, but not observed within the wind park site. Such impact assessment will be far from the true picture.

Secondly, from the point of view of the annual cycle of birds, the wind park effects on them have different level during nesting period or in the course of migrations, wintering or during formation of post-nesting gatherings. Just because these periods of bird life are considered separately in our calculations and impact shall be assessed according to seasonal cycles of bird life.

At the stage of the wind park construction planning it is possible to determine only effects, which are based on prognoses with statical probability. Confirmation of prognostic data is possible after carrying out researches at the sites with operating wind parks. At this stage it is necessary to divide, with respective assumptions, possible effects on natural complexes from the wind park and powerful influence of anthropogenic factors and natural fluctuation processes. But it may be stated that the last group of influence is dominant in the region for the majority of wind park sites, including the site and buffer zones (1 - 2 km).

Using of terms “positive” and “negative” influence in the Scientific Report and Expert Opinion is rather important and forms general and special assessments of natural complexes and its individual components. As of today the most important is determination of negative effects, which shall be divided into low, medium, high and the most harmful effects. But using of these terms will have different functional meaning for different groups of animals and plants. That is why different terms are used in the Scientific Report for discussing and description of possible wind park impact on natural complexes.

If prognosis of the impact requires measures for compensations of the negative influence, then their types and scopes shall be suggested. At the same time it is worthwhile to distinguish measures intended for prevention, reduction and compensation of respective negative effects.

For expert appraisal of expected dangers for natural components caused by the park of wind turbine generators, it is necessary to differentiate dangers according to different aspects and describe them completely, to the extent possible. Dangers or negative effects, which may be created by the park of wind turbine generators, may be differentiated in following format according to the international standards.

Format for carrying out assessment of impacts caused by construction and operation of wind park sites in accordance with the international standards

1. Impacts caused by construction on species of plants and animals, which may be considered as significant, in accordance with the legislation on species protection.

1/a – Emissions of hazardous substances in the course of work execution at the construction site, for example, from construction machinery and transport (exhaust gases, leakages, usage of

materials that create a danger) and connected with this potential hazards for animal reproduction and habitat, as well as plant growth places.

1/b - Deterring and exclusion by visual effects, deterring by noise, for example, in the course of possible field and drilling works, as well as by construction machinery, transport that operate at the construction site, and by stay of people.

1/c - Occupying the territory by working platforms and equipment that operates at the construction site, and connected with this creation of possible obstacles for migratory ways of animals by access roads and equipment, which operates at the construction.

1/d - Loss of breeding places for species owing to occupying the territory while preparing construction works.

1/e - Loss of individual specimens of protected species in the course of construction works.

2. Impacts caused by equipment on protected species of plants and animals, which may be considered as significant, in accordance with the legislation on species protection.

2/a - Long-time territory occupation and as a consequence of this, change of environment characteristics and disruption of biotopic complexes.

2/b - Deterring of bats and bird species by mast vertical structures.

2/c - Barrier impact on migratory species of birds and obstacles for flight of birds and bats.

3. Impacts caused by production on species of plants and animals, which may be considered as significant, in accordance with the legislation on species protection.

3/a - Deterring caused by rotor motion, shadows flicker, light gleams and noise emission.

3/b - Deterring caused by additional development of landscape element territories, which were not influenced before.

3/c - Disturbing or irritation of protected species and other species of birds and bats owing to night-time illumination.

3/d - Collisions of individual specimens of different species of birds and bats with the wind turbine generators.

2.2. Basic techniques of ornithological researches

Technical approaches to carrying out of monitoring researches

Techniques

Obtained results were preliminarily analysed in the field conditions, and finally – in the laboratory (office).

Processed and properly prepared results of censuses were added to the database of specially developed computer program WebBirds. Field monitoring data were tabulated in the table of bird counts and movement (Table 2.1) and the table of observations of migratory activity of birds at migration grounds (Table 2.2). Along with formation of Table 2.1 the data were plotted on the cartographic base (Fig. 2.1) for subsequent creation of figures in AutoCAD program. Layout diagram of WTGs within the wind park sites was assumed as a basis for all cartographic materials that are presented in reports and program products. Movements in the course of monitoring carrying out within the wind park site and buffer zones, adjacent territories were recorded by means of *GPS-tracks*. Distribution of birds and their migratory movements are presented in AutoCAD program with multilayer data.

Table 2.1. Registration of Bird Counts and Movements for Generation of Cartographic Material

Symbol	Date	Time	Species	N	Type of migration (Transit – 1, Diurnation – 2)	Compass point	Altitude
1	25.05.16	09.00	Common raven	15	1	SW	10
2		09.15	Hooded crow	8			

Table 2.2. List of Information According to Migratory Activity of Birds at Migration Grounds

Date	Species	Latin name	Time	N	Compass point	Altitude	Aggregative behaviour
01.04.2016	Greater white-fronted goose	*Anser albifrons*	16.50	120	NE	400	400, 20, 25
	Grey heron	*Ardea cinerea*	17.10	2	E	100	2
	Yellow-legged gull	*Larus cachinnans*	17.10	6	E	20	27

All spatial movements were registered by means of navigators. Tracks of each exit were reflected in Google Earth program as KML files with subsequent cartographical connection of received information to the territory of the site (Fig. 2.1).

All photographs were exported to the program FastStone Image Viewer, which together with cameras' software in Exif mode of metadata enabled to control the location-based data of taken photographs, the date and conditions of photographing.

Statistical processing of obtained data has been carried out in Microsoft Excel 2007 and Statistica Release 7 (Basic Statistic module) programs.

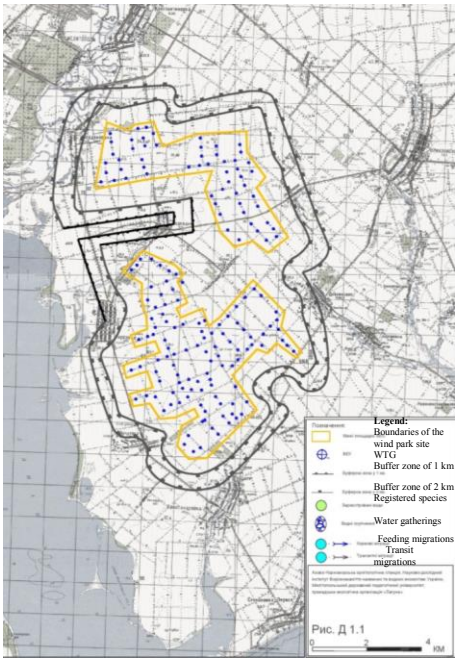


Fig. 2.1. Cartographic basis for generation of monitoring information on bird counts and migrations

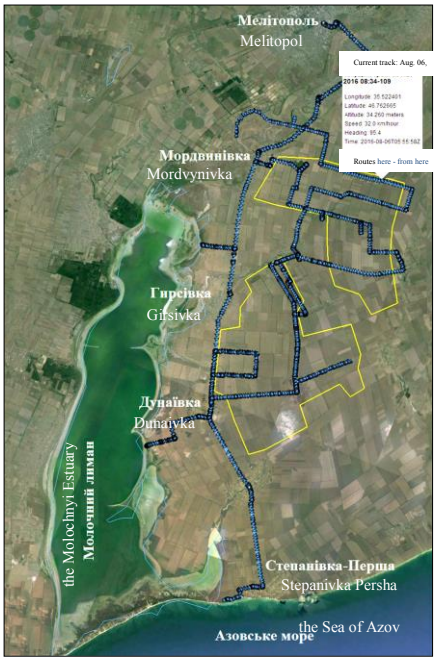


Fig. 2.2. Classic route for carrying out of researches (birds and bats)
(- boundaries of EuroCape Wind Park; - GPS-track)

Monitoring territories for seasonal census of birds

Territories for monitoring were determined in coordinate system in the first years of execution of works and were compulsory during following years. They included monitoring territories, transects, migration points within the wind park sites No. 1 and No. 2 and buffer zones. Important complex monitoring plots in the adjacent territories are: – coastal plots and water area of the Molochnyi Estuary (outskirts of Dunaivka Village); – coastal plots of upper reaches of the Molochnyi Estuary (between the Villages of Girsivka and Mordvynivka) – Fig. 2.2.

Migration monitoring grounds for census of birds

At this stage of design activity on creation of the sites WP 1 and WP 2 with total power of 500 MW and carrying out of monitoring works, three migration monitoring grounds were established in 2016 (Fig. 2.3). Location and functional meaning of the grounds is characterized by following features.

Migration monitoring ground No. 1 (Fig. 2.3). Is located in the designed territory of the wind park site No. 1 (northern territory). Characterizes the state of migratory complexes within agrocenoses and agricultural hedgerows and is a matrix also for description of the wind park site No. 2 (southern one). This territory mainly characterizes migratory state of land birds (feeding and transit) and transit semi-aquatic birds. In general terms, obtained information on bird migrations in the designed territory of the wind park reflects the species composition of land birds, their quantity and seasonal activity.

Migration monitoring ground No. 2 (Fig. 2.3). Is located in adjacent territories (partially include buffer zone of 2 km) to the wind park sites and includes coastal plots and water area of the Molochnyi Estuary. Researches enable assessment of seasonal migratory complexes of semi-aquatic birds and their feeding migration to the wind park sites. Partially characterizes the state of transit migrations of semi-aquatic birds.

Migration monitoring ground No. 3 (Fig. 2.3). Is located on the Stepanivska Spit (near Stepanivka Village), at the distance of 11 - 18 km from the wind park sites. This migration monitoring ground exists in the course of last 15 years for the control of transcontinental migrations and seasonal gatherings of semi-aquatic birds of migratory complex. Monitoring data from the ground No. 3 are important for determination of the place of the wind park sites in the main migratory corridors of semi-aquatic birds. For example, on 18 - 19.07.2016 transit migrations of Arctic birds were observed at this ground. At the same time transcontinental migrations at the wind park sites practically have not been observed. It is quite clear that different types of biotopes have also different migratory properties both on species composition and quantity.

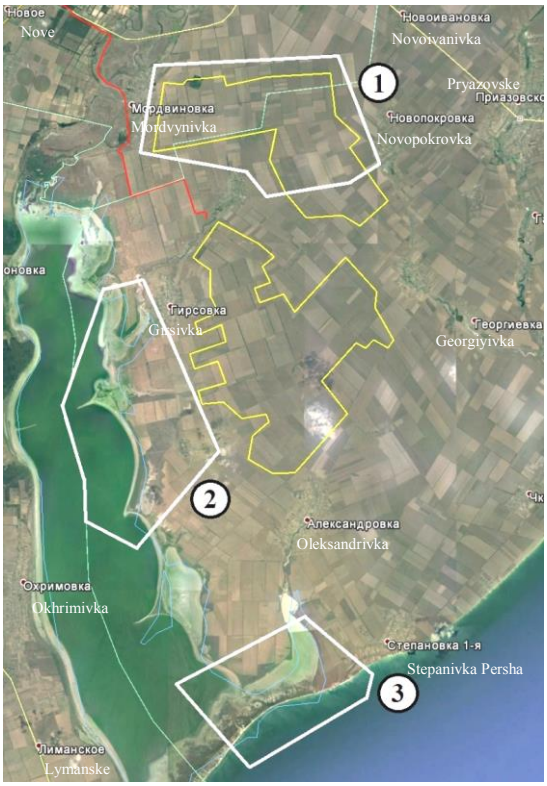


Fig. 2.3. Layout diagram of migration monitoring grounds (1 - 3)

List of compulsory monitoring parameters

Description of seasonal ornithological complexes within the wind park sites, buffer zones of 1 - 2 km, adjacent territories included following main parameters:

1. Species description of seasonal ornithological complexes
2. Quantity and dynamics of seasonal ornithological complexes
3. Frequency of bird observing by time and biotopes
4. Directions of migrant passages, including feeding and transit ones
5. Altitude characteristics of migrations and feeding movements
6. Behaviour characteristics of birds during the period of migrations within the wind park site
7. Degree of the wind park site attractivity for seasonal ornithological complexes
8. Trophic migrations and usage factor of biotopes as forage plots
10. Determination of influence factors of anthropogenic and natural character on the state of seasonal ornithological complexes.

Equipment

Standard research tools have been used during work execution at the wind park sites, as well as special equipment, among which are following ones:

- binocular Etherna (10x) – 1 item
- binocular Bushnell (10x) – 2 items
- telescope VIXEN Geoma 20-60x80 – 1 item
- telescope Vixen Geoma 65A (set with GL20) – 1 item
- navigator GARMIN GPSMAP 78s – 2 items
- laser rangefinder-altimeter NICON Forestry 550 – 1 item
- pad Samsung Galaxy Tab 2 10.1 16GB – 2 items
- meteorological station Le Crosse 1700 – 1 item
- cameras Nicon D7100, Nicon D80 and Canon EOS 450D
- motor car VAZ 21213 NIVA - 2 items
- motor car Chevrolet Niva – 1 item

European bird guide (Collins Bird guide/ Second edition, 2009) [10] has been used to determine species belonging, sex, age of birds, as well as characteristics of winter plumages. BatSound Real-time Spectrogram Analysis Software program, version 4.1 has been used for analysis of audio files with bat voices.

Practically all cartographic materials for description of seasonal status of birds have been executed in AutoCAD program.

Basic research techniques for ornithological complexes

Standard techniques are the basis for carrying out monitoring works and they include authoring approaches with its correction in accordance with specified tasks. Following techniques have been used while carrying out ornithological works.

- Monitoring route (route census enables to obtain data over different seasons in order to compare them correctly among themselves. When carrying out monitoring works in the course of some years, route censuses enable to calculate average annual rates of species diversity and number of birds; this corresponds to the principle of statistical validity)
- Monitoring points (point bird censuses enable to obtain information not only about quantity of birds and diversity of species, but also for determination of their movements' time dynamics)
- Monitoring representative areas (bird censuses at the representative areas give the information about ornithological situation within the wind park site and adjacent territories. The main factor, which has an influence on the selection of the monitoring plot, is the excessive biodiversity of the territory)
- Registration points of migratory birds (the place – point for migratory observations usually serves for several years. The main condition of selection is unimpeded circular scan within a radius of at least 2 - 4 km)
- Special monitoring plots (determined for the purpose of more detailed examination of the threat of collision of birds with blades and supports of wind turbine generators and are connected with thorough checking of plots adjacent to the wind turbines on the subject of searching proofs for birds' and bats' getting under moving elements of the WTGs).

Route censuses

Route census enables to obtain data over different seasons in order to compare them correctly among themselves. When carrying out monitoring works in the course of some years, route censuses enable to calculate average annual rates of species diversity and quantity of birds; this corresponds to the principle of statistical validity.

Censuses shall be carried out both within the wind park sites and outside them. They may be space-fixed and selective. Width of the census strip shall be differentiated depending on:

- peculiarities of movement (on foot, by motor car)
- visibility of the biotope (open biotope, agricultural hedgerow, forest and so on)
- peculiarities of species biology (hidden, live in open biotopes)
- size of specimens
- light (clear, cloudy)
- season of year (nesting, post-nesting, migratory, winter)

List of required parameters for record:

Date
Time
Place
Counters
Type of the census (on foot, driving)
Availability of route sheet
Weather influence on the quality of census (hinders, does not hinder)
Length of the route in each biotope and the total
Quantity for each species

Conditions of carrying out. Work shall be carried out weather permitting, when visibility, possibility of movement for the counters and bird behaviour will not substantially effect on the results of censuses.

Registration of birds. It is advisable to use binoculars and telescope for determination of species, sex and age of birds. In other respects more attention shall be paid to continuous examination on the route. Birds that flew in transit during the census shall be recorded separately and entered in other form. Generalized data of the census for each individual route shall be recorded in proper cards. The route, places of gatherings or heightened concentration of birds, places of observing rare species or interesting observations (unusual species, uncommon flights and so on) shall be plotted on the map of census plot.

Census on foot, on linear transect with differentiated width of census strip for different groups of bird species (50, 100, 500 and 1000 m)

While passing the fixed route, the counter shall indicate only absolute figures of registered specimens of each species and supplement the figure on the map with conventional signs of stay pattern in the place of registration. As far as possible, sex and age of birds shall be indicated. The majority of figures concerning waterfowls, herons, sandpipers, birds of prey and other birds shall reflect their total number at the water body, if it is not large or is clearly visible, or shall be correlated with the width of the biotope enveloped by the censuses. In such a case the relative density of birds shall be calculated for researched biotope - specimens/ ha. For convenience of determination of the width of a strip, in which birds were observed, the angular domain of the first observation and the distance to the bird along a straight line from the counter shall be registered. Such form of bird registration is typical for point censuses and on linear transects it has a nature of succession of consecutive circle diagrams located along the axis of the route. Circle diagram enables to calculate the width of biotope strip enveloped by the censuses with lesser error. After obtaining accurate data as to the width of a strip for individual species or groups of species it shall be taken into account in subsequent calculations. But rounding of the strip width figure is also possible to certain gradations (50, 100, 250, 500 m and others), which have inessential influence on the accuracy of calculations. It completely satisfies the purpose of work for inventory of fauna and general assessment of territory significance.

If the route is not space-fixed, then the counter shall indicate the beginning of a new biotope and its length each time. Usually movement velocity is 0.75 - 1.0 km/ hour in the morning, and 1.25 - 1.5

km/ hour - in the evening. It is appropriate to carry out evening routes only during the period of parallel observations of bird migrations at OP (observation points).

Schematic map. Linear transect shall be accompanied with route outline, if it is passed for the first time, or with a map, in the event of fixed transects, with indication of the length of crossed biotopes and exact fixation of the start, the route and the finish of a counter movement. Individual route segments may be corrected repeatedly. Areas of bird gatherings or heightened concentration also shall be marked on a visit map. Bird registration in the field journal shall be carried out for each section of a biotope. Any other form of registration is incorrect and shall not be subject to analysis.

Registration of birds. When giving birds a fright the distance, at which they have taken wing, shall be recorded, but not the distance, to which they flew. Birds in front and on sides of the counter shall be recorded. Birds behind shall not be counted, if it is not a new species for this census. In such case its occurrence shall be recorded after passing given section by the ornithologist. On the basis of obtained data the final table shall be formed, where next to the species of bird and a biotope, the quantity of specimens counted over the whole route and two-sided (to the left and to the right of the specialist) width of census corridor (50, 100 m and others, or concrete metric area, based on received data concerning the width of census strip) shall be recorded.

Censuses on foot at a representative area

Purpose of censuses is determination of species composition and density of bird population during nesting period and in other seasons of annual cycle. Mapping of registration points of individual couples or specimens enables to distinguish birds of three categories in the population: N (ГН) – specimens that are nesting; CR (КР) – conservative reserve of the population, birds that do not take part in breeding but keep the connection with the biotope; LR (ЛР) - labile reserve of the population, specimens that do not breed in given season and do not keep connections with the biotope.

Grounds. Visit map, on which routes throughout the site are plotted, their types, boundaries of biotopes, their approximate areas.

Size of a representative area. Representative area must have the main territory and the territory for correction of distribution of not numerous species to complete the registration of all species. All species of birds shall be registered in the main territory, and in the correction one - only not numerous species. In “open” biotopes an area is equal to 40 - 80 and 100 - 300 hectares respectively.

For “strip” biotopes (agricultural hedgerows and so on) a length shall be taken as a basis: the main territory - not less than 2 km, and the correction one - 5 km.

Coastal cliffs, as a nesting biotope, are marked by the summary length within the whole area of a representative area, with indicating of the mean height and the range of values and type of soil.

Species maps. Visit map shall be processed after a route; occurrences of individual species shall be transferred to species and complex schematic maps.

It is recommended to use two types of censuses at an area: linear transect and standard point censuses, with registration of birds on circle diagrams (see below). Routes may be strictly space-fixed, and may be tracked with some changes, which increase the probability of revealing new species. The main condition is that censuses have to cover the whole territory of a representative area. It is advisable to change the direction of passing the very same route each time, in order that time parameters do not have an influence on the results. For registration of birds that sing early in the morning but very short time (pigeons, thrushes and others), it is recommended to organize a 15-minute listening of the whole territory of an area before the beginning of routes, it will enable to compare the approximate quantity of these species according to morning peak of activity with occurrences on the route. It is advisable to change the place of listening from time to time. In simple biotopes and open landscapes the velocity of a census may be equal to 0.75 - 1.0 km/ hour.

Driving examination of census squares

In zonal landscapes census shall be carried out along a route, within which driving routes shall be tracked in such a manner to observe the whole their area the most completely. On a selective basis censuses shall be carried out also in rural communities.

Driving censuses in wetlands

In wetlands census shall be carried out within especially dedicated plots on walking and driving routes along water bodies with stops at the places, from which open water areas are well within view, and their observing by means of telescopes. In case of bad conditions of roads (owing to precipitation) movement shall be carried out along hard surfaced roads parallel to the coast, with exits to water bodies for their observation. To achieve the most complete coverage of a water body by censuses, exits shall be carried out with such a frequency that the field of observation of the next section of the water area shall be overlapped with the previous one.

Point censuses

Point censuses on foot in closed biotopes. Point censuses, with a duration of 5 - 10 minutes in every 250 - 400 m (depending on the complexity of a biotope), shall be carried out in the course of a route mainly in tree-shrubby biotopes, natural and homogeneous woods, where visual communication with birds is mostly complicated. It is recommended to count birds in 20 points within a route, but number of points may also be less, if conditions of the territory are adverse to it. Census point should not be marked at the boundary of biotopes, but only in the centre or in limiting boundaries of each of them.

Route of point censuses shall be tracked in a shape of a circle or rectangle, to spend time efficiently. If the terrain does not allow tracking a route in a shape of closed circle, it shall be planned with regard to visiting existing biotopes.

Schematic map. Movement diagram with outline of the neighbourhood of census points also shall be charted for point census. Difference in diagrams is only that adhering to approximate scale of the whole route is not compulsory. The terrain around each of 20 points shall be sketched in detail, with numbering them, and numbers are indicated in the diagram.

Registration of migratory birds at equipped observation point (OP)

Place (point) for special observations shall be selected in advance and it usually serves for several years. A main condition of selection is unimpeded circular scan within a radius of at least 2 - 4 km. OP shall be equipped with a shelter in case of bad weather for the period of observations. Optimal is the availability of mounted semi-sloping support at the OP for registration of high-altitude migrations by a counter in a recumbent position.

Start time of the observations is 30 minutes before the sunrise. Migratory birds shall be recorded separately for each of 4 morning hours of continuous observations and 2 evening ones, which end in 30 minutes after the sunset. The evening observations may be combined with the censuses on a short fixed route. The best results may be obtained by synchronous work of two observers, one of which shall record high-altitude migration during 15 minutes of each morning hour.

Migratory birds shall be registered during 15 minutes of each whole hour *between the morning and the evening hours of continuous observations*. Data of these control spans of time enable to assess the intensity of migrations during the day-time hours, which are not under control.

Cloudiness, direction and strength of wind, temperature and precipitation, visibility conditions shall be registered at the beginning of observations and their stability or occurred changes shall be confirmed every hour.

Each individual specimen or flock, time, the direction and altitude of flight, the shape of a flock *shall be recorded*.

During hours of darkness it is necessary to listen to the dome of the sky up to 1-2 hours at night, on moonlight nights (5 days before a full moon and 2 days after it) observations shall be carried out by means of a terrestrial telescope, alternating 15- minute registrations with 15- minute rest pauses.

Long-term observations at OP are extremely labour-intensive; that is why it is recommended to carry out them during the first 3 days of each ten-day period from 11.03 till 23.05 and from 11.08 till 13.11.

Point census of bird gatherings

Shall be carried out for mapping of mainly waterfowl and wading birds at representative areas. The work is aimed at collecting primary material for future zoning and development of a management-

plan for wetlands, creation of a register of structural elements of ecological network. According to the results of true or transect censuses, the exact place of localization of mono- species and poly- species bird gatherings, the borders of main biotopes or, for example, locations of rookeries shall be plotted on a map. It is more convenient to take the areas of a water body of feeding fields, if birds have fed there, from modern electronic maps. Also it is necessary to plot the localization of considerable engineering facilities, places of drain and water intake channels on a map, as well as important anthropogenic factors, in particular availability of tents, fishermen and so on. If some changes occur in the location of birds during twenty-four hours, then this must be reflected in one or several maps of the representative area. The map must be added with data on the water level for the period of observation, water bloom or contamination, and in the presence of proper devices – water saltiness and temperature.

Censuses of semi-aquatic birds in colonial concentrations

Quantity. While carrying out count works, data on relative (number of birds per unit of an area or unit of a route) and absolute (detailed count of birds at the places of colonial concentrations, nesting, pre-nesting and post-nesting gatherings) quantities shall be used. Absolute method of censuses shall be directly used for colonial type of nesting and it has several modifications.

Depending on the type of nesting and concrete species, different census methods shall be used. It shall be noted that proposed method of bird census must be adapted to collect (while visiting colonies) other main monitoring characteristics.

Method of true (absolute) census shall be used for colonial visitations of gull-like birds, sandpipers, great cormorant, rooks, which include no more than 500 - 600 couples of nesting birds.

Method of partial true census (maximum extrapolation) is real for considerable by quantity colonies of gulls and cormorants, as well as for supposed in visitation colonies of ciconiiformes birds.

Method of incomplete census. Shall be used for hard-to-reach colonies of ciconiiformes birds. Localization of a colony shall be determined at the first stage, after which the number of birds that take wing and come flying (shall be recorded separately) during 3 - 4 morning hours (5.00 - 9.00) shall be determined by means of high-quality optical instruments.

Count of birds according to photographs of bird colonies on sand, clay and complex cliffs shall also be used in this method.

Terms, periods of works. While determining terms and periods of researches, first of all, the possibility of collecting maximum number of monitoring characteristics shall be taken into consideration. However, the terms of works shall be determined depending on the tasks, qualification of researchers, available time for working, and in accordance with this, the number of parameters that shall be recorded. It is necessary to take into account three main moments while carrying out field works:

- reproductive status of bird colonies must correspond to the least vulnerable periods of nesting
- depending on weather conditions, it is necessary to choose such time for visiting nesting colonies, at which the alarm factor will be minimal
- such duration of stay in colonial concentrations, in the course of which a researcher will not harm (anxiety factor) nesting birds.

First nesting census corresponds to the period of 20.04. - 15.05., and the second one: 25.05. - 20.06. Censuses will the most completely describe the nesting situation with these terms and periods of researches.

Chapter 3. Monitoring of Wintering Birds within the Sites of EUROCAPE Wind Park, Buffer Zones and Adjacent Territories

3.1. Ex post description of the ornithological situation in winter period

Weather conditions of the current winter season have significant influence on the species composition, quantity and distribution of wintering birds. The primary factor for semi-aquatic birds is the extent and area of frost penetration into the estuary, which becomes frozen over completely in the most severe winters (e.g., in January of 1997, 2002 - 2003, 2006 and 2008). In this case only part of the Molochna River in its lower reach remains free of ice. In such years the aggregate quantity and species diversity of semi-aquatic birds are minimal (Table 3.1). The maximum diversity of semi-aquatic species was observed in 2004 and 2007 (27 - 28 species) and the maximum quantity - in 2005 and 2007 (approximately 50 - 60 thousand specimens), when the estuary was completely free of ice (Table 3.1). In many respects, the accessibility of forage for wintering birds also depends on the thickness and density of snow cover and on the existence of thin crust of ice over snow. Besides the direct influence of weather conditions, the status of young winter crops and the availability of unharvested remainder of sunflower seeds in the fields adjacent to the estuary are important for anseriformes and for a number of passeriformes and pigeon birds.

Table 3.1. Aggregate Quantity of Semi-aquatic Birds During Wintering at the Molochnyi Estuary, According to the Results of Average Winter (January) Censuses

Year	Quantity		Ice covering*	% observed
	species	birds		
1998	7	19,786	P	50 - 75
2000	14	21,334	P	80 - 95
2001	18	24,729	P	80 - 95
2002	5	3,256	E	20 - 25
2003	2	12	E	20
2004	28	34,922	F	80 - 95
2005	18	60,408	F	80 - 95
2006	5	11,099	E	50 - 75
2007	27	54,109	F	50 - 75
2008	8	1,058	E	75 - 95
2010	22	7,530	E	50 - 75
Average	**14**	**21,658**		

Notes: E - the estuary is **entirely** under ice , P – the estuary is **partially** frozen, F - the water area is **free** of ice.

98 species of birds have been registered on the Molochnyi Estuary and in the adjacent territory in winter period in different years. This number varies for different winters depending on the weather conditions during the counts. The distribution of birds is also very changeable in different years. The mean perennial spread of birds during wintering is shown in Fig. 3.1.

For comparison we took the data of winter counts of 2007 and 2010, when the censuses were carried out not only on the Molochnyi Estuary, but also in the adjacent territories, including the area of the prospective wind park. The winter of 2007 was characterized by rather high temperatures, without ice on the water bodies and snow cover. Weather conditions during observation in 2010 were somewhat different: the monthly average temperatures of January and February were much lower than the mean annual temperatures; the estuary and the offshore strip of the Sea of Azov were completely under ice. Fields and meadows were covered with snow, a thickness of which sometimes reached 12 - 20 cm. The difference in weather conditions affected both the quantitative and qualitative composition of wintering birds.

Birds of wetland complex connected with water body prevailed in 2007. Their number was over 58,621 specimens out of 82,385 ones, or 71% of all registered (Table 3.2). In 2010, only 7,530 birds were counted, mostly those living in the fields or near human residence. Distribution of birds throughout the territory was also very different. While in 2007 the majority of birds was observed on the water (ducks, swans) or near it (geese, gulls, herons), in 2010 almost all the birds wintered at a significant distance from the water body (Fig. 3.2).

Analysis of dominating taxons and species of birds has revealed the same irregularity. So, in mild winter anseriformes (mallard and sea scaup) were dominating, but in severe winter – perching birds (common starling and rook).

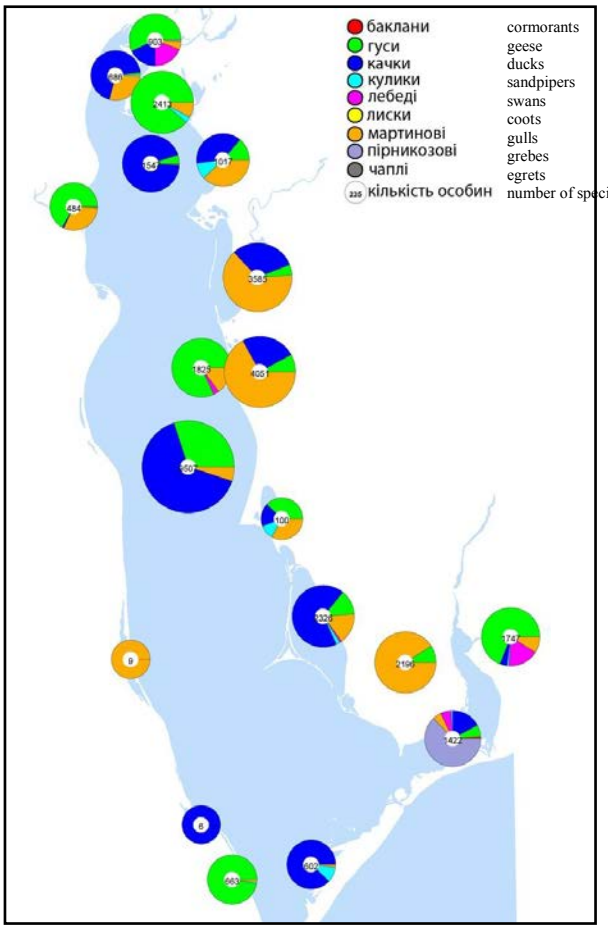


Fig. 3.1. Distribution and number of wintering birds on the Molochnyi Estuary (researches of many years)

When analysing obtained results on impact of the wind park on wintering birds, it shall be emphasized that wind parks do not pose any threat to the birds connected with the water body. The blades of wind turbines in operation may pose hazard only to ducks (mostly mallard) and geese, which feed on winter crops in the fields, as well as to gulls (yellow-legged, common and black-headed gulls), rooks and starlings. The special threat is posed by the operating blades of wind turbines in poor weather conditions, when the visibility for birds is limited, e.g. in a mist, which often occurs in winter, or in a heavy fall of snow. But this threat is not greater than the one posed by PTLs or other high structures (lighthouses, telephone towers, etc.). The hazard of collisions in mild winters favourable for wintering of birds is more probable than it is in cold ones with heavy snowfalls.

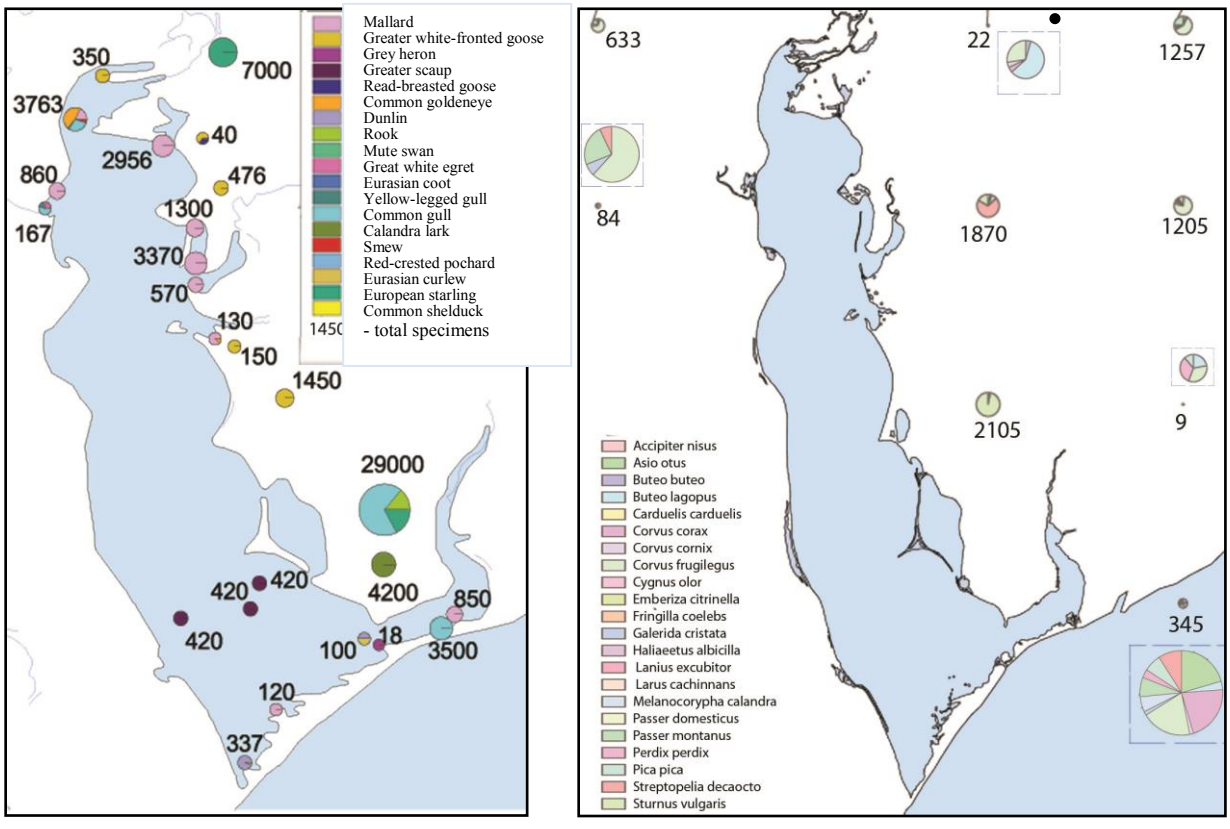
As already stated, ornithological situation in winter period depends to some extent on weather conditions that determine the accessibility of forage, availability of open water area of water bodies, snow situation in agrocenoses and so on.

When describing the weather conditions in winter of 2012 - 2013, it shall be mentioned that daily average air temperatures were equal to 2.5 ºC (Fig. 3.3).

Table 3.2. Comparative Characteristic of the Species and Quantitative Composition of Wintering Birds in Mild (2007) and Severe (2010) Winter (species listed in the Red Data Book - marked in red)

English name	Latin name	Number of specimens	
		2007	2010
Great crested grebe	*Podiceps cristatus*	4	
Cormorant	*Phalacrocorax carbo*	21	
Eurasian bittern	*Botaurus stellaris*	1	
Great white egret	*Egretta alba*		
Grey heron	*Ardea cinerea*	29	
Red-breasted goose	*Rufibrenta ruficollis*	17	
Greylag goose	*Anser anser*	2	
Greater white-fronted goose	*Anser albifrons*	2,696	
Mute swan	*Cygnus olor*	10	5
Whooper swan	*Cygnus cygnus*	16	
Common shelduck	*Tadorna tadorna*	88	
Mallard	*Anas platyrhynchos*	14,134	
Common pochard	*Aythya ferina*	3	
Tufted duck	*Aythya fuligula*	7	
Greater scaup	*Aythya marila*	12,660	
Common goldeneye	*Bucephala clangula*	1,913	
Smew	*Mergus albellus*	230	
Goosander	*Mergus merganser*	6	
Hen harrier	*Circus cyaneus*	34	
Western marsh-harrier	*Circus aeruginosus*	1	
Eurasian sparrowhawk	*Accipiter nisus*	2	2

Rough-legged buzzard	*Buteo lagopus*	3	145
Common buzzard	*Buteo buteo*	2	1
White-tailed eagle	*Haliaeetus albicilla*	7	3
Grey partridge	*Perdix perdix*		29
Water rail	*Rallus aquaticus*	3	
Grey plover	*Pluvialis squatarola*	4	
Dunlin	*Calidris alpina*	370	
Eurasian curlew	*Numenius arquata*	25	
Black-headed gull	*Larus ridibundus*	75	
Yellow-legged gull	*Larus cachinnans*	353	2
Common gull	*Larus canus*	25,843	
Eurasian collared dove	*Streptopelia decaocto*		1,367
Long-eared owl	*Asio otus*	2	70
Crested lark	*Galerida cristata*		165
Calandra lark	*Melanocorypha calandra*	4,638	42
Skylark	*Alauda arvensis*	186	
Great grey shrike	*Lanius excubitor*		1
European starling	*Sturnus vulgaris*	13,460	2,358
European magpie	*Pica pica*	137	66
Rook	*Corvus frugilegus*	4,821	2,309
Hooded crow	*Corvus cornix*	23	64
Common raven	*Corvus corax*	10	76
House sparrow	*Passer domesticus*		45
Eurasian tree sparrow	*Passer montanus*		653
Chaffinch	*Fringilla coelebs*	78	24
European greenfinch	*Chloris chloris*	94	
European goldfinch	*Carduelis carduelis*		22
Linnet	*Acanthis cannabina*	357	
Yellowhammer	*Emberiza citrinella*	10	81
Total		**82,375**	**7,530**



2007 2010

Fig. 3.2. Distribution of wintering birds in the mild (2007) and severe (2010) winters

Fig. 3.3. Description of weather conditions (air temperature, °C) in the winter period of 2012/2013

The minimum (-9 °C) and maximum (+13 °C) values were observed on the 23 - 24 and the 1 of December 2012, respectively. Daily air temperatures were above zero during 64 days, below it - 18 days and equal to zero - 8 days.

Over the whole period, rain precipitations were recorded 10 times (1 in December, 5 in January and 4 in February) and snow precipitation - 8 times (2, 5 and 1 respectively).

Snow cover did not have complete distribution, and frequent thaws and warming periods caused snow melting on the agricultural fields (Fig. 3.4). Ice situation in the water area of the Molochnyi Estuary did not impede birds to stay in the wetland.

So, the weather conditions in winter of 2012-2013 may be considered mild for wintering ornithological complex of the researched region (Fig. 3.5).

Fig. 3.4. Observation in winter period (the Molochnyi Estuary, 2013)

Fig. 3.5. Open water areas of the Molochnyi Estuary in January 2013

Description of ornithological complex in the winter period of 2012/2013

Special field researches were carried out on the 26 of January 2013. Plots of the Molochnyi Estuary from its upper reaches to the lower part have been observed (Fig. 3.6).

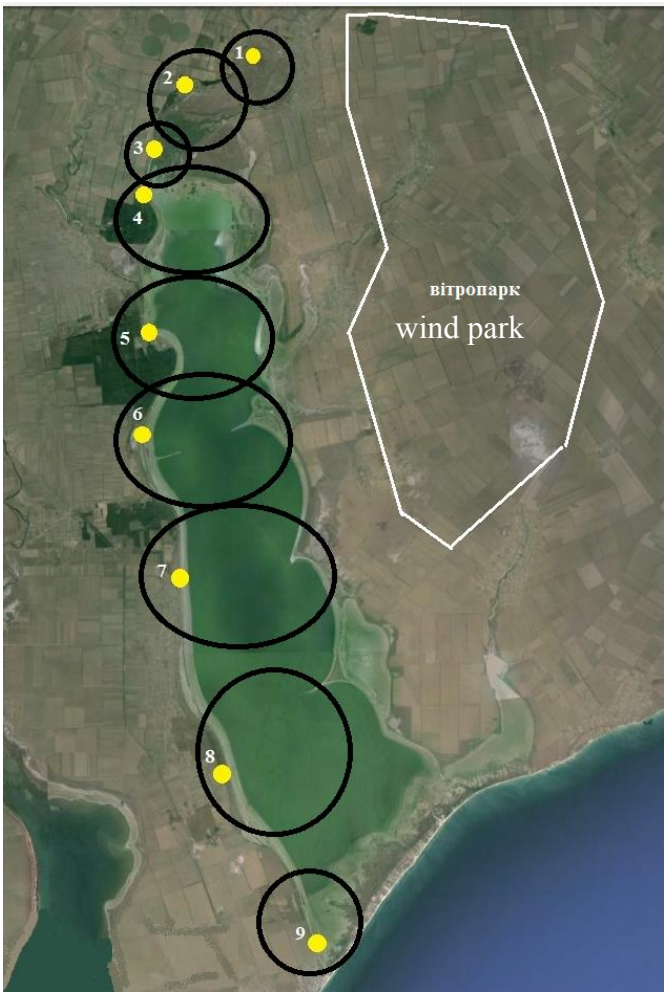


Fig. 3.6. Observation points and areas included in the censuses on January 26 - 27, 2013

The main purpose of the censuses was to reveal waterfowl gatherings, which use the upland plots for feeding, flying daily from the water to the dry land.

In addition, the information about birds wintering in the region was collected during occasional driving to the Molochnyi Estuary and to the territories adjacent to the wind park site (Stepanivka Persha, outskirts of the Village of Mordvynivka).

The territory of the wind park has submeridional spreading, parallel to the left shore of the Molochnyi Estuary. The main factor, which determines the species composition and number of birds within the wind park, is the accessibility of forage and absence of human disturbing factor. Biotopes that are presented here have almost entirely artificial origin. Generally they are agricultural fields and agricultural hedgerows. Small wood area near Mordvynivka Village, also man-planted origin, has dimensions of 700 x 800 m. The Dzhekelnia River, which crosses the site, pertains to small rivers of the Azov Sea region, has narrow valley and the width of water level from 3 to 10 m. The river banks are overgrown with rush, strips of which also do not have wide distribution.

According to the results of winter count carried out on the 26 of January 2013, we state that species diversity of birds numbered 32 species with total quantity of 24,820 birds. The upper part of the Molochnyi Estuary (observation points 1 - 4 in Fig. 3.6) became a refuge for 2,654 specimens (or 10.7% of all registered), 14,300 specimens (57.6%) were registered in the middle part (points 5 - 7), and 7,866 specimens (31.7%) were observed in the lower part of the estuary (points 8 - 9). So we can see that birds use the area of the whole estuary unevenly, preferring its middle and lower parts. Species diversity on these plots of the Molochnyi Estuary had other regularities. Most of all – 26 species were registered in the upper part, and in the middle and the lower parts of the estuary - 17 and 16 respectively.

Representatives of wetland complex dominated, namely, common gull – 20,090 specimens, mute swan – 1,240 specimens and common shelduck – 1,018 specimens. Only these three species made up 90% of all birds.

Skylark (196 specimens) and corn bunting (185 specimens) dominated in the group of open space birds, which occurred generally on the agricultural areas. Fieldfare (302 specimens) turned out to be the common species in the wood areas (agricultural hedgerows and man-planted woods). 18 among 32 species had quantity less than 10 specimens. These are all 6 representatives of birds of prey, and 10 species of perching birds (Table 3.3).

Taxonomic description of the ornithological complex of wintering birds shows that all registered birds pertain to 5 series with irregular species representation and quantity (Table 3.4, Fig. 3.7). Perching birds were the most numerous – 17 species, or 53%; however their total quantity was only 1,224 specimens, or 4.9% of all birds. While only 2 (6.3%) specimens of shore birds (common and yellow-legged gulls) gave in the counts 20,243 specimens (81.6%). Such situation is typical and is caused by birds' behaviour peculiarities in winter period. Features of this behaviour are: either birds' stay in large gatherings (common gull) or single occurs of certain species.

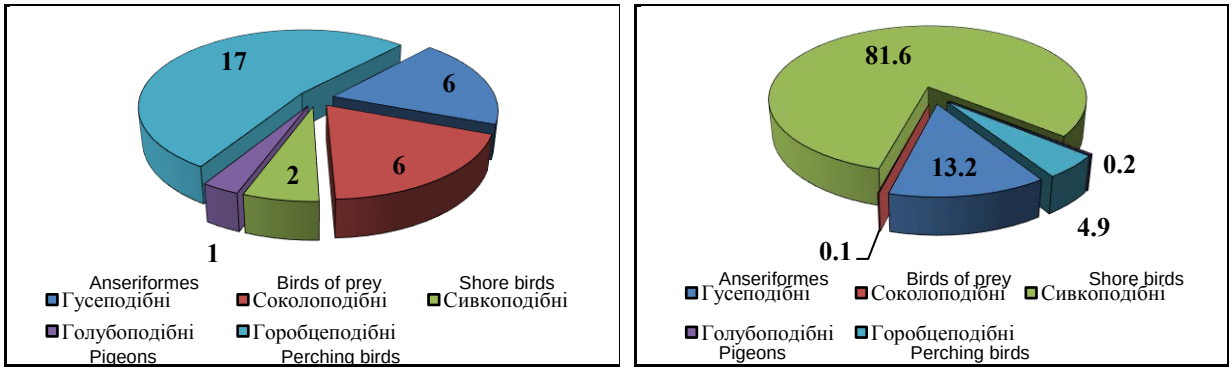
Table 3.3. Results of Winter Bird Censuses at the Molochnyi Estuary on the 26 of January, 2013

No.	Species	Observation points*									Total
		1	2	3	4	5	6	7	8	9	
1	Greylag goose *(Anser anser)*									9	**9**
2	Greater white-fronted goose *(Anser albifrons)*									8	**8**
3	Mute swan (*Cygnus olor)*			180	34	72		24		930	**1,240**
4	Whooper swan *(Cygnus cygnus)*									85	**85**
5	Common shelduck *(Tadorna tadorna)*				68		950				**1,018**
6	Mallard *(Anas platyrhynchos)*			450	120				2	198	**770**
	Anas spp.				150						**150**
7	Hen harrier (*Circus cyaneus)*		1			1				1	**3**
8	Eurasian sparrowhawk *(Accipiter nisus)*		1		1	1					**3**
9	Rough-legged buzzard *(Buteo lagopus)*		1				2				**3**
10	Long-legged buzzard *(Buteo rufinus)*		1								**1**
11	Common buzzard *(Buteo buteo)*		1								**1**
	Buteo spp.				1						**1**
12	White-tailed eagle *(Haliaeetus albicilla)*				1						**1**
13	Yellow-legged gull (*Larus cachinnans)*			50		20	10	25		48	**153**
14	Common gull *(Larus canus)*			850	230	1500	4800	6500	10	6200	**20,090**
15	Woodpigeon *(Columba palumbus)*				60						**60**
16	Skylark (*Alauda arvensis)*			64		30	69		33		**196**
17	*Calandrella spp.*					30			2		**32**
18	European starling (*Sturnus vulgaris)*	70				30					**100**
19	European magpie *(Pica pica)*	5							1		**6**
20	Eurasian jay *(Garrulus glandarius)*	1							1		**2**
21	Hooded crow *(Corvus cornix)*			2	1	1					**4**
22	Common raven (*Corvus corax)*			1							**1**
23	Blackbird *(Turdus merula)*					1					**1**
24	Fieldfare *(Turdus pilaris)*	205					97				**302**
25	Great tit *(Parus major)*		1			1					**2**
26	Eurasian tree sparrow *(Passer montanus)*		25			50			40		**115**
27	Chaffinch *(Fringilla coelebs)*	1	50				35		45	60	**191**
28	European greenfinch *(Chloris chloris)*	1									**1**
29	Hawfinch *(Coccothraus. coccothraustes)*					1					**1**
30	Corn bunting (*Emberiza calandra)*									185	**185**
31	Yellowhammer (*Emberiza citrinella)*								8		**8**
32	Reed bunting *(E. schoeniclus)*		2								**2**
	Passer spp.		25				50				**75**
Total specimens		**283**	**108**	**1597**	**666**	**1738**	**6013**	**6549**	**142**	**7724**	**24,820**
Total species		**6**	**8**	**7**	**9**	**13**	**7**	**3**	**9**	**10**	**32**

Notes: * Observation points as in Fig. 3.6; - dominants; , - subdominants

Table 3.4. Taxonomic Description of the Ornithological Complex of Wintering Birds within the Territories Adjacent to the Wind Park in February 2013

Series	n species	%	n specimens	%
Anseriformes (*anseriformes*)	6	18.8	3,280	13.2
Birds of prey (*falconiformes*)	6	18.8	13	0.1
Shore birds (*charadriiformes*)	2	6.3	20,243	81.6
Pigeons (*columbiformes*)	1	3.1	60	0.2
Perching birds (*passeriformes*)	17	53.0	1,224	4.9
Total	**32**	**100**	**24,820**	**100**



species representation (number of species) quantity of birds (%)

Fig. 3.7. Taxonomic description of the ornithological complex of wintering birds within the territories adjacent to the wind park in February 2013

Description of the ornithological situation in winter period of 2013/2014

Researches of ornithological situation in the winter period of 2014 have been carried out within all-European Christmas bird censuses. Depending on weather-climatic conditions, the execution of works was carried out during the most suitable periods for registration of winter ornithological complex before the beginning of pre-migration change of behaviour. Those very conditions were observed during the second ten days of February. Our researches were carried out on the 13 - 14 of February, 2014. Counts comprise the territory adjacent to the wind park owned by EuroCape Ukraine Company within the part of Pryazovske district (the Villages of Dobrivka, Georgiyivka, and Novokostiantynivka). Both territories of agricultural areas, agricultural hedgerows and man-planted wood areas, and water area of the Tubalskyi Estuary and the Sea of Azov in the outskirts of the Villages of Novokostiantynivka and Prymorskyi Posad (Fig. 3.8) are included.

Fig. 3.8. Territory of wintering bird censuses in February 2014

Weather-climatic characteristics of the region of researches reflect the picture of general warming, among features of which are following: daily average above-zero air temperatures, absence of long-continued snow cover and free of ice water area of the Sea of Azov and adjacent to it estuaries (Molochnyi, Utliutskyi, Tubalskyi) during almost all winter period.

In 2014 the anomalously warm December and the first part of January changed into cold and essential snap after the 20 of January, when air temperatures dropped at night up to -18 °C. At such temperatures the water area of the Sea of Azov became completely covered with ice. In addition, snowfalls on the 27 - 29 of January covered the land with snow and high north-eastern wind up to 15 m/s made most of roads impassable. So, some species of birds flew away to the south of Ukraine, to the Crimea where winter was milder, owing to existing weather conditions. At that time the accessibility of forage on the agricultural fields within the wind park owned by EuroCape Ukraine Company was extremely hard, therefore most of birds, especially of synanthropic group, stayed near the residential settlements. These were, first of all, the representatives of perching birds (*Passeriformes*): rook (*Corvus frugilegus*), European starling (*Sturnus vulgaris*), hooded crow (*Corvus cornix*), European magpie (*Pica pica*), and Eurasian tree sparrow (*Passer montanus*).

During the interval of the 7 - 9 of February, the anticyclonic type of weather with characteristically low temperatures and high air pressure changed into cyclonic one, with its inherent rather high temperatures and low air pressure. Daily average above-zero air temperatures started from the 9 of February. At this particular time, snows on the fields melted away, birds began to move more actively throughout the territory in search of forage, but the water area was still covered with ice, except small areas in the Berdianska and Obytichna Gulfs, and on the north of the Biriuchyi Island.

Table 3.5. Species Diversity of Wintering Birds within the Territories Adjacent to the Wind Park in February 2014

No.	Species	Buffer zones	Adjacent territories	Σ
1	Cormorant (*Phalacrocorax carbo*)	13		**13**
2	Hen harrier (*Circus cyaneus*)		1	**1**
3	Eurasian sparrowhawk (*Accipiter nisus*)	1		**1**
4	Peregrine falcon (*Falco peregrinus*)	1		**1**
5	Rough-legged buzzard (*Buteo lagopus*)	1		**1**
6	Common buzzard (*Buteo buteo*)	1		**1**
7	Yellow-legged gull (*Larus cachinnans*)	16		**16**
8	Syrian woodpecker (*Dendrocopos syriacus*)		1	**1**
9	Eurasian collared dove (*Streptopelia decaocto*)		2	**2**
10	Skylark (*Alauda arvensis*)	65	14	**79**
11	European starling (*Sturnus vulgaris*)		5	**5**
12	European magpie (*Pica pica*)	9		**9**
13	Jackdaw (*Corvus monedula*)		2	**2**
14	Rook (*Corvus frugilegus*)	268	64	**332**
15	Hooded crow (*Corvus cornix*)	23	80	**103**
16	Common raven (*Corvus corax*)	2		**2**
17	European goldfinch (*Carduelis carduelis*)	80		**80**
18	Fieldfare (*Turdus pilaris*)	25		**25**
19	Eurasian tree sparrow (*Passer montanus*)		15	**15**
	Passerinae spp.	6	15	**21**
	Total	**511**	**199**	**710**

There was no negative weather influence at the moment of carrying out observations. Visibility was up to 4 - 6 km, wind of the east directions, 3 - 5 m/s. There were no precipitations during the counts carrying out. Cloudiness was from 75 to 100%.

19 species of birds with the total number of 710 specimens were registered according to the results of investigation carried out on 13 - 14.02.2014 in all. Species composition of birds, their quantity and distribution are reflected in Table 3.5.

All registered birds pertain to 6 taxonomic series: pelicans, birds of prey, shore birds, woodpeckers, pigeons and perching birds (Table 3.6).

Table 3.6. Taxonomic Description of Wintering Birds within the Territories Adjacent to the Wind Park in February 2014

Series	n species	%	n specimens	%
Pelicans (*pelecaniformes*)	1	5.3	**13**	1.8
Birds of prey (*falconiformes*)	5	26.3	**5**	0.7
Shore birds (*charadriiformes*)	1	5.3	**16**	2.3
Woodpeckers (*piciformes*)	1	5.3	**1**	0.1
Pigeons (*columbiformes*)	1	5.3	**2**	0.3
Perching birds (*passeriformes*)	10	52.6	**673**	94.8
Total	**19**	**100.1**	**710**	**100**

Representatives of perching birds were dominating – 10 species with the total number of 673 specimens; there were no subdominants owing to small quantity of representatives of other taxons (37 specimens): pelicans – 1 species, 13 specimens and shore birds – 1 species, 16 specimens; as for species, the most numerous taxon, except perching birds, were birds of prey – 5 species with quantity of 5 specimens.

More detailed analysis of birds' distribution throughout the territory revealed the ambiguity in domination of one or another taxon. For example, generally representatives of perching birds and birds of prey (72%) occurred within the buffer zones of the wind park.

199 specimens of 4 taxons (28%) were observed in the adjacent territories. Such mosaicity is caused by the availability of proper biotopes that are selected by a certain group of birds.

Description of altitude intervals of birds' movement

All recorded birds (710 specimens, 100% of the total number), which were registered during the censuses within the buffer zones and in the adjacent territories, had been observed either on the ground or in flight within the altitude interval under 20 m (128 specimens). So, 582 specimens (82%) were registered directly on the ground, 9 specimens (1.3%) - at the altitude up to 5 metres, 89 specimens (12.5%) - over 5 to 10 m, 17 specimens (2.4%) - over 10 to 15 m and 13 specimens (1.8%) - over 15 to 20 m.

Such data are anticipated and the pattern of birds' distribution by the altitudes of flights is traditional for winter period, when birds perform only feeding migrations in search of forage at small altitudes (Fig. 3.9).

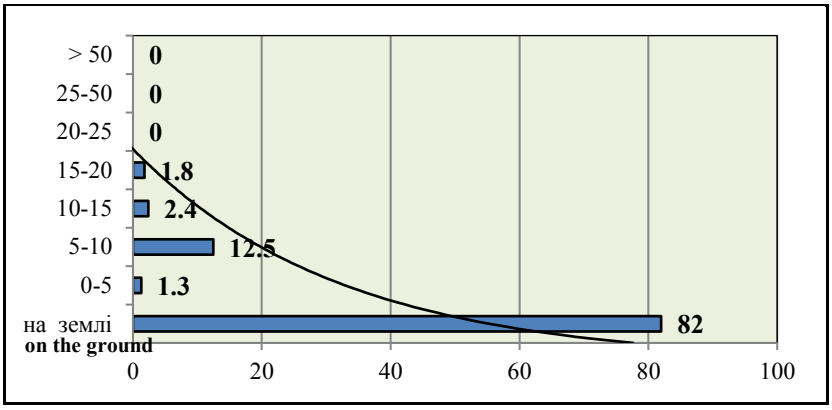


Fig. 3.9. Description of the altitudes of daily movements of wintering birds within the territories adjacent to the wind park in February 2014 (quantity in %)

Places of excessive biological diversity

Retrospective materials indicate the availability of traditional places of bird gatherings in winter period, among which are the Molochnyi Estuary, the Tubalskyi Estuary and fishery ponds in the mouth of the Korsak River.

Contrary to the expectations, no bird gatherings have been revealed in the mouth of the Korsak River and on the Molochnyi Estuary, where the water area was covered with the continuous ice layer, and birds diversity numbered up to 10 species (generally at the expense of perching birds).

The same situation arose on the Tubalskyi Estuary, which was unattractive for birds owing to lack of water since the autumn of 2013. Only one gathering of hooded crows (80 specimens) has been observed during researches near the Village of Novokostiantynivka. Domestic solid waste landfill, which is located in 2 km to the north-west from the Village of Novokostiantynivka (8 km from the wind park), attracted yellow-legged gulls, rooks, European starlings and hooded crows. Quantity of listed species also was very small.

3.2. Description of ornithological situation in the winter period of 2016

Material and technique

Investigations of ornithological situation within EuroCape Wind Park were carried out on the 30 of February 2016. Walking and driving techniques of bird censuses have been used. The area covered by bird censuses was equal to not less than 80% for the territory of the wind park sites, 60% – in the buffer zones and 70% of the adjacent territories; the offshore strip of the Molochnyi Estuary formed a census strip with the width of 500 m (Fig. 3.10).

In wetlands, census was carried out within especially dedicated plots on walking and driving routes along the water bodies with stops at the places, from which open water areas were well within view, and their observation by means of telescopes. Point censuses, of duration from 10 to 30 minutes, were carried out on the shore of the Molochnyi Estuary and in the centre of EuroCape Wind Park sites (Fig. 3.11 - 3.12).

Observations have been carried out by means of Etherna and Bushnell binoculars (10-x) and VIXEN Geoma telescope (20-60x80). European bird guide (Collins Bird guide / Second edition, 2009) was used to identify species, sex, age of birds, as well as characteristics of winter and transition plumages. Mapping of places of bird gatherings, as well as spatial description of our movements has been made by means of GARMIN GPSMAP 78s navigator.

Linear dimensions between the objects and flight altitude of bird flocks were measured by means of laser altimeter NICON Forestry 550. Weather data in January 2016 were fixed by means of compact meteorological station LeCrosse 1700. Photographing of biotopes and birds was executed by cameras Nicon D80 and Canon EOS 450D with compulsory accompanying of each frame by EXIF metadata (date, coordinates, and conditions of photographing). Statistical processing of obtained data has been carried out in Microsoft Excel 2007 and Statistica Release 7 programs.

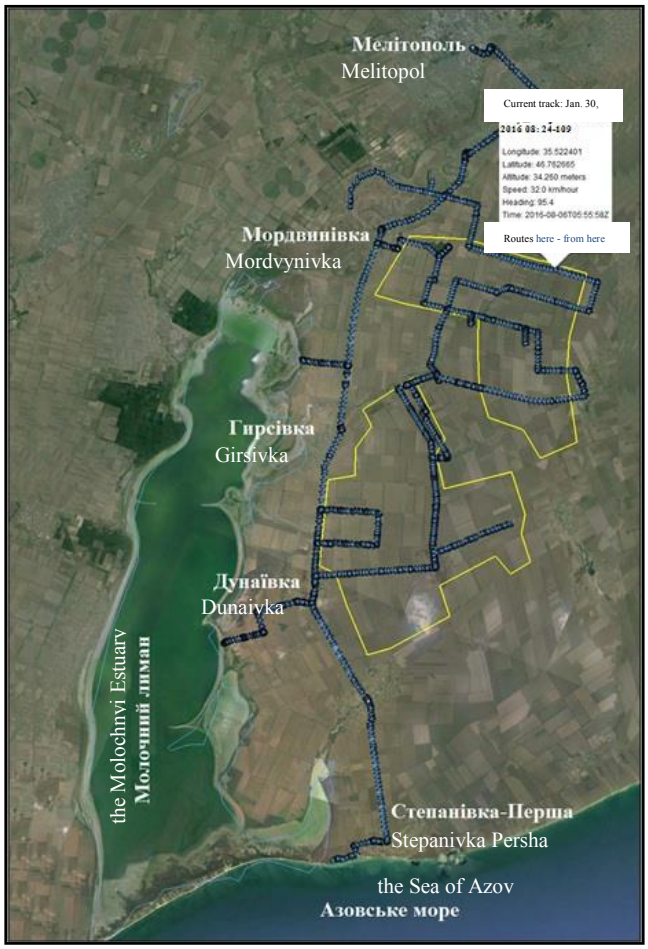


Fig. 3.10. GPS-track (▶▶▶) and observation points (●) during wintering bird censuses within EuroCape Wind Park in January 2016

Fig. 3.11. Open water areas of the upper reaches of the Molochnyi Estuary in winter 2016

Fig. 3.12. Monitoring of the ornithological status of EuroCape Wind Park territory in January 2016

Weather conditions of January 2016

Weather-climatic characteristics of the researched region reflect the picture of unstable conditions, among features of which are following: wide range of daily air temperatures, daily average above-zero air temperatures of the second ten-day period of January, absence of long-continued snow cover and free of ice water area of the Sea of Azov and adjacent to it estuaries (Molochnyi, Utliutskyi, Tubalskyi) during almost all December; and covered with ice water area after frosts of the first ten-day period of January. At the moment of carrying out observations air temperatures were above zero, and wind was of the west direction. Principal weather parameters are given in Fig. 3.13.

Generally, picture of weather conditions of January - February, 2016 differs rather sharply from the weather conditions of the last year, when after relatively warm January of 2015 (positive daily average temperatures were observed from the 10 of January) temperature dropped in February and have not exceeded 0 ºC for a long time, which reflected in the course of bird movement throughout the researched territory.

In 2016, cold weather of the third ten-day period of January changed by rise of temperature after the 27 of January, when night air temperature rose from -7…-13 ºC to +1…+5 ºC. At such temperatures the water area of the Sea of Azov and the Molochnyi Estuary became free of ice gradually.

At that time the forage resources on the agricultural fields within EuroCape Wind Park were impoverished, therefore most of birds, especially of synanthropic group, stayed near the residential settlements. These were, first of all, representatives of perching birds (*Passeriformes*): rook (*Corvus frugilegus*), European starling (*Sturnus vulgaris*), hooded crow (*Corvus cornix*), European magpie (*Pica pica*), and Eurasian tree sparrow (*Passer montanus*).

During all February daily average temperatures remained positive, even at night temperatures were not below -3 ºC. At that time birds began to move more actively throughout the territory in search of forage, but the water area was still partially covered with ice.

There was no negative weather influence at the moment of carrying out ornithological observations. Wind of the west direction, 2 m/s. There were no precipitations during the counts carrying out. Cloudiness from 0 to 25%.

Peculiarities of weather-climatic conditions of researched territory are presented in Fig. 3.11 - 3.12.

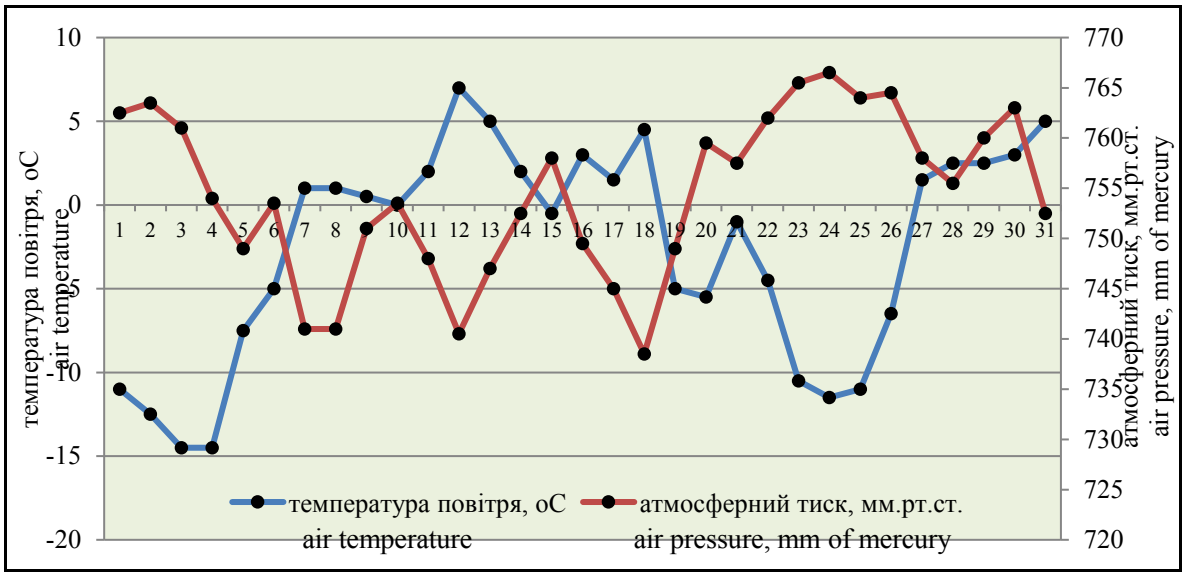


Fig. 3.13. Weather-climatic description of January 2016 in Mordvynivka Village

25 species of birds with the total number of 555 specimens have been registered in all, according to the results of ornithological research carried out within EuroCape Wind Park, buffer zones and adjacent territories on the 30 of January, 2016. Species composition of birds, their quantity and distribution in the researched region are reflected in Table 3.7, in Fig. 3.14 and in Annex 1 (Tables 1.1 - 1.1.1 and AutoCAD schematic map, Fig. Д 1.1).

Table 3.7. Description of Species Diversity of Birds within EuroCape Wind Park, Buffer Zones and Adjacent Territories in January 2016

No.	Species		Wind park sites	Buffer zones	Adjacent territories	Total
1	Whooper swan (*Cygnus cygnus*)				7	**7**
2	Mallard (*Anas platyrhynchos*)				51	**51**
3	Greater scaup (*Aythya marila*)				20	**20**
4	Hen harrier (*Circus cyaneus*)				1	**1**
5	Eurasian sparrowhawk (*Accipiter nisus*)		1			**1**
6	Rough-legged buzzard (*Buteo lagopus*)		2		2	**4**
7	White-tailed eagle (*Haliaeetus albicilla*)				1	**1**
8	Pigeon hawk (*Falco columbarius*)				2	**2**
9	Grey partridge (*Perdix perdix*)		11		9	**20**
10	Black-headed gull (*Larus ridibundus*)		21	25	15	**61**
11	Yellow-legged gull (*L. cachinnans*)				29	**29**
12	Common gull (*Larus canus*)				28	**28**
13	Eurasian collared dove (*Streptopelia decaocto*)		6	17		**23**
14	Crested lark (*Galerida cristata*)			12		**12**
15	Skylark (*Alauda arvensis*)		12	17		**29**
16	European starling (*Sturnus vulgaris*)		26	48		**74**
17	European magpie (*Pica pica*)		3	8		**11**
18	Rook (*Corvus frugilegus*)		12	31	16	**59**
19	Hooded crow (*Corvus cornix*)		10		6	**16**
20	Common raven (*Corvus corax*)		2			**2**
21	European robin (*Erithacus rubecula*)		3			**3**
22	Blackbird (*Turdus merula*)		14		6	**20**
23	Great tit (*Parus major*)			5		**5**
24	Eurasian tree sparrow (*Passer montanus*)			49		**49**
25	Chaffinch (*Fringilla coelebs*)		8	7	12	**27**
	Total	**species**	**14**	**10**	**15**	**25**
		birds	**131**	**219**	**205**	**555**

All registered birds pertained to 6 taxonomic series – goose-like birds (*anseriformes*), birds of prey (*falconiformes*), fowl-like birds (*galliformes*), shore birds (*charadriiformes*), pigeons (*columbiformes*) and perching birds (*passeriformes*) (Table 3.8, Fig. 3.15). Representatives of perching birds were dominating – 12 species with the total number of 307 specimens; shore birds – 3 species with quantity of 118 specimens and goose-like birds – 3 species with quantity of 78 specimens were subdominants. The most numerous taxons in terms of species, except perching birds, were birds of prey – 5 species with quantity of 9 specimens. More detailed analysis of birds' distribution throughout the territory revealed the ambiguity in domination of one or another taxon. For example, representatives of all taxons, except goose-like birds, were observed within the wind park, at that 131 specimens (23.6%) were recorded there. The buffer zones attracted shore birds (black-headed gull), pigeons (woodpigeon) and perching birds (219 specimens, 39.5%), and 205 specimens of 5 taxons (36.9%) were observed in the adjacent territories.

Such mosaicity is caused by the availability of proper biotopes that are selected by a certain group of birds. So, the adjacent territories are mainly attractive for shore birds and goose-like birds, where there are enough forage resources for them, as opposed to the territory of the wind park, owing to its continuous agricultural development.

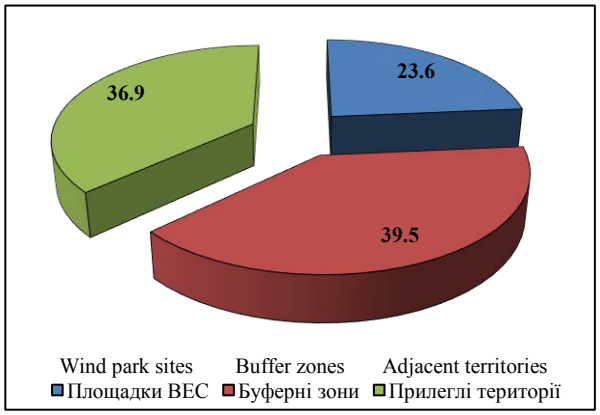


Fig. 3.14. Description of bird staying within EuroCape Wind Park, buffer zones and adjacent territories in January 2016 (quantity in %)

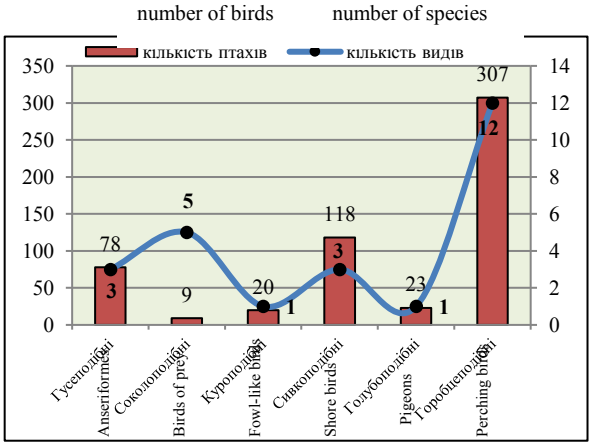


Fig. 3.15. Species representation of bird taxons registered within EuroCape Wind Park, buffer zones and adjacent territories in winter 2016

Table 3.8. Taxonomic Description of Ornithological Complex of Wintering Birds within EuroCape Wind Park, Buffer Zones and Adjacent Territories in January 2016

Series	Wind park sites		Buffer zones		Adjacent territories		Σ	
	species	specimens	species	specimens	species	specimens	species	specim.
Goose-like birds – *anseriformes*	-	-	-	-	3	78	**3**	**78**
Birds of prey – *falconiformes*	2	3	-	-	4	6	**5**	**9**
Fowl-like birds – *galliformes*	1	11	-	-	1	9	**1**	**20**
Shore birds – *charadriiformes*	1	21	1	25	3	72	**3**	**118**
Pigeons – *columbiformes*	1	6	1	17	-	-	**1**	**23**
Perching birds – *passeriformes*	9	90	8	177	4	40	**12**	**307**
Total	**14**	**131**	**10**	**219**	**15**	**205**	**25**	**555**

Biotopic bird distribution

Species diversity of birds and their quantity depend to some extent on the number of distinguished biotopes. In investigated region we have revealed such landscape-biotopic units: agrocenosis (agricultural lands), agricultural hedgerows and man-made forests, shorefaces and quarries, steppe plots, offshore strip and human settlements. Each of biotopes is a territory of occurrence of individual bird groups. For example, birds of agricultural lands, wetland complex, and synanthropic species (inhabitants of human settlements). Thus, species diversity of birds depends on the area of each biotope. We have subdivided the territory of investigations into water area, open space, agricultural hedgerows and human settlements. Description of distribution of wintering birds in biotopes is given in Table 3.9.

It was revealed in the course of carrying out researches that the most attended in winter period were the plots of open space; 167 specimens (30.1%) have been observed there, 127 specimens (22.9%) stayed in agricultural hedgerows and man-made forests, and the water area of the Molochnyi Estuary attracted 111 specimens (20.0%). 4 human settlements had been investigated during the censuses – Mordvynivka, Nadezhdine, Girsivka and Dunaivka – 150 specimens (27.0%) were observed there.

Table 3.9. Biotopic Distribution of Wintering Birds within EuroCape Wind Park, Buffer Zones and Adjacent Territories in January 2016

Zones \ Biotopes		Biotopes of bird distribution				∑	
		water areas	open space	agricultural hedgerows	human settlements	abs.	%
Wind park sites		-	56	75	-	**131**	**23.6**
Buffer zones		-	78	40	101	**219**	**39.5**
Adjacent territories		111	33	12	49	**205**	**36.9**
Total	**abs.**	**111**	**167**	**127**	**150**	**555**	**100**
	%	**20.0**	**30.1**	**22.9**	**27.0**		**100**

Directions of passage

Western direction prevailed among directions of feeding migration movements of wintering birds (Table 3.10, Fig. 3.16). 65 specimens (52.0% of the total number of migrants) flew in this direction. Mainly they were starling and Eurasian tree sparrow. Also there were a certain percentage of birds, which flew in the southern (19.2%), north-eastern (11.2%) and northern (10.4%) directions (generally they were semi-aquatic birds), in other directions passage of birds was not numerous (Table 3.10).

Such directivity is typical and is caused by a vector of coast line of the Molochnyi Estuary, weather conditions, as well as feeding migratory flights of perching birds throughout the site of the designed wind park.

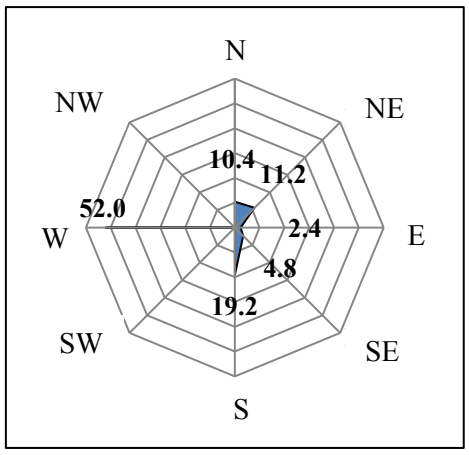


Fig. 3.16. Directions of feeding migrations of birds within EuroCape Wind Park, buffer zones and adjacent territories in January 2016

Table 3.10. Directions of Feeding Migrations of Wintering Birds within EuroCape Wind Park, Buffer Zones and Adjacent Territories

Direction	∑	
	abs.	%
N	13	10.4
NE	14	11.2
E	3	2.4
SE	6	4.8
S	24	19.2
SW	-	-
W	65	52.0
NW	-	-
Total	**125**	**100**

Description of altitude intervals of birds' movement

The overwhelming majority of recorded birds (555 specimens, 100% of the total bird quantity), which were registered at EuroCape Wind Park site, within the buffer zones and in the adjacent territories, had been observed either on the ground (430 specimens) or in flight within the altitude interval under 50 m (125 specimens) (Fig. 3.17).

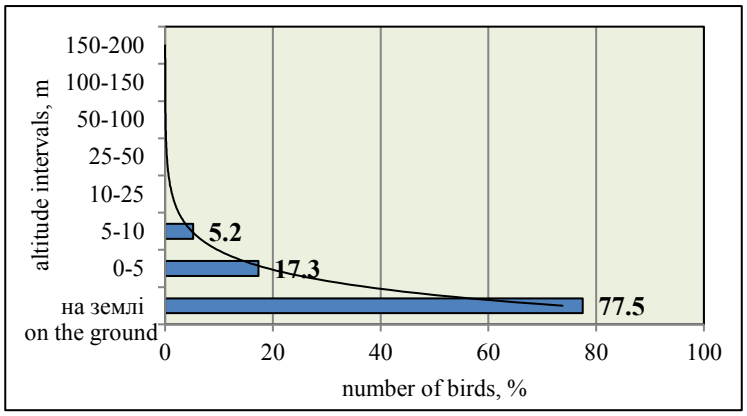


Fig. 3.17. Description of the altitudes of daily movements of wintering birds within EuroCape Wind Park, buffer zones and adjacent territories in January 2016 (quantity in %)

So, 430 specimens (77.5%) were registered directly on the ground, 96 specimens (17.3%) - at the altitude up to 5 metres, and 29 specimens (5.2%) - from 5 to 10 m, at higher altitudes birds have not been recorded.

Such data are anticipated and the pattern of birds' distribution by the altitudes of flights is traditional for winter period, when birds perform only feeding migrations in search of forage.

Pair correlation coefficient between the altitude of bird passage and their quantity turned out to be very high, equal to 0.9 (Fig. 3.17).

3.3. Distribution of wintering birds according to the nature conservation lists of national and international importance

Following species listed in the Red Data Book of Ukraine (2009) were registered in the course of censuses in January 2016: hen harrier (*Circus cyaneus*) – 1 specimen and white-tailed eagle (*Haliaeetus albicilla*) – 1 specimen in the adjacent territories. The total quantity of rare birds does not exceed 1% (0.4%) of all recorded ones (Table 3.11).

Table 3.11. Bird Species Listed in the Red Data Book of Ukraine according to the Results of Winter Counts in January 2016

No.	Species	Wind park sites	Buffer zones	Adjacent territories	∑
1	Hen harrier (*Circus cyaneus*)	-	-	1	**1**
2	White-tailed eagle (*Haliaeetus albicilla*)	-	-	1	**1**
	Total birds listed in the Red Data Book of Ukraine	-	-	2	**2**
	Total birds within the plot	**131**	**219**	**205**	**555**
	% of the total quantity	**-**	**-**	**1.0**	**0.4**

In addition to revealing representatives of winter avifauna, their quantity and distribution throughout the researched territory, we have carried out their ranking in accordance with the international nature conservation lists: the Red Data Book of Ukraine, the List of the International Union for Conservation of Nature (IUCN), the European Red List, the Bonn and Bern Conventions, as well as the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Table 3.12).

Table 3.12. Distribution of Winter Avifauna according to Nature Conservation Lists

No.	English name	Latin name	Status	ERL	RDBU	IUCN	BERN	BONN	CITES
1	Whooper swan	*Cygnus cygnus*	m, w				2	1, 2	
2	Mallard	*Anas platyrhynchos*	m, w, n				3	1, 2	
3	Greater scaup	*Aythya marila*	m, w	EN			3	1, 2	
4	Hen harrier	*Circus cyaneus*	m, w		RARE	LC	2	1, 2	2
5	Eurasian sparrowhawk	*Accipiter nisus*	m, w				2	1, 2	2
6	Rough-legged buzzard	*Buteo lagopus*	m, w				2	1, 2	2
7	White-tailed eagle	*Haliaeetus albicilla*	m, w, n		RARE	LC	2	1, 2	1
8	Pigeon hawk	*Falco columbarius*	m, w				2	2	2
9	Grey partridge	*Perdix perdix*	m, w, n	VU			3		

No.	English name	Latin name	Status	ERL	RDBU	IUCN	BERN	BONN	CITES
10	Black-headed gull	*Larus ridibundus*	m, w, n				3		
11	Yellow-legged gull	*Larus cachinnans*	m, w, n						
12	Common gull	*Larus canus*	m, w				3		
13	Eurasian collared dove	*Streptopelia decaocto*	m, w, n				3		
14	Crested lark	*Galerida cristata*	m, w, n				3		
15	Skylark	*Alauda arvensis*	m, w, n				3		
16	European starling	*Sturnus vulgaris*	m, w, n				2		
17	European magpie	*Pica pica*	m, w, n				2		
18	Rook	*Corvus frugilegus*	m, w, n				2		
19	Hooded crow	*Corvus cornix*	m, w, n				2		
20	Common raven	*Corvus corax*	m, w, n				3		
21	European robin	*Erithacus rubecula*	m, n						
22	Blackbird	*Turdus merula*	m, w, n				3	2	
23	Great tit	*Parus major*	m, w, n				2		
24	Eurasian tree sparrow	*Passer montanus*	m, w, n				3		
25	Chaffinch	*Fringilla coelebs*	m, w, n				3		

Notes: **Status**: m – species occurs in the course of seasonal migrations; w – species is found in winter period; n – species occurs in nesting period. **RDBU** – Conservation status of the Red Data Book of Ukraine: **EN** – endangered; **VU** – vulnerable; **RARE** – rare; **UR** – unrated. **IUCN** – Conservation status of the International Union for Conservation of Nature: **EN** – endangered; **NT** – near threatened; **VU** – vulnerable; **LC** – least concern. **ERL** - Conservation status of the European Red List: **VU –** vulnerable, species that may be rated to an endangered category in the near future, if the effect of factors influencing on their condition continues; **EN –** endangered, species that are seriously at risk of extinction; their preservation is hardly probable, reproduction is impossible without carrying out special measures. **BONN** – the Bonn Convention: **Annex I (1)** includes species that are in danger of extinction; **Annex II (2)** includes species, state of which is unfavourable, preservation and regulation of using which needs international agreements, as well as that species, state of which might be considerably improved as a result of international cooperation, which may be carried out based on international agreements. The same species may be included both to Annex I and Annex II. **BERN** – the Bern Convention, or the Convention on the Conservation of European Wild Flora and Fauna and Natural Habitats, includes **Annex II (2) –** list of fauna species that are subject to special protection; **Annex III (3) –** fauna species that are subject to protection. **CITES** – the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora: **Annex I** includes species "that are in danger of extinction, trade in which causes or may cause negative influence on their existence. Trade in specimens of such species must be especially severely regulated for that purpose to do not endanger their survival for the future, and must be allowed only in exceptional cases"; **Annex II (2)** includes: "a) all species, which are not necessarily threatened with extinction for now, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and b) that have to be subject to regulation in order to enable the possibility to get the trade in specimens of certain species mentioned in subparagraph (a) of this paragraph under effective control".

As Table 3.12 shows, the representatives of winter ornithological complex in the region of EuroCape Wind Park, buffer zones and in the adjacent territories are listed in 6 nature conservation lists. Most of them were related to the Bern Convention (23 species out of 25, or 92.0%), 11 species of which are subject to special protection, 12 species are subject to protection. Situation with relation to the Bonn Convention is interesting: 2 species among 9 species of ornithological complex, which are included in this Convention, rate to Annex II (state of which is unfavourable), and 7 species are included simultaneously both to Annex II and I (are in danger of extinction), which is possible in the context of this nature conservation document. 2 species are listed in the Red Data Book of Ukraine (2009), and pertain to the category "rare". Also 2 species are listed in the Red List of the IUCN ("least concern" category). In addition, 5 species are included in the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (Annexes 1 and 2), 2 species are listed in the European Red List.

With regard to a degree of bird pertaining to nature conservation lists, the following picture is being completed. 2 (8.0%) of 25 species are not listed in any of nature conservation documents: yellow-legged gull (*Larus cachinnans*) and European robin (*Erithacus rubecula*). And the overwhelming majority of the representatives of spring ornithological complex is included in 1 or 2 lists (13 and 5 species respectively), in 3 documents – 3 species (12.0%). Moreover, there were observed 2 species, which are listed simultaneously in 5 conservation documents – hen harrier (*Circus cyaneus*) and white-tailed eagle (*Haliaeetus albicilla*).

3.4. Assessment of impacts on birds caused by the construction and operation of the designed territory of the wind park in the winter period of 2016

1. Impacts caused by the construction.

1a – emissions of hazardous substances. Emissions of hazardous substances will not exceed the permissible rates during the construction, owing to small quantity of machinery and equipment, absence of stationary sources of pollution and short period of construction works. There is no negative impact on birds.

1b – deterring by visual effects and noise. Factor of deterring by noise is practically absent, due to the absence of considerable gatherings of birds in the territory of the wind park sites. Slight by quantity feeding migrants move throughout the territory, are characterized by low density, short period of staying due to low feeding value of the plots of the site and have large areas of alternative forage territories in 2- kilometres zone and outside it. Impact of these factors shall be characterized as low.

1c – occupying the territory by working platforms and equipment. Impact of this factor in winter period shall be estimated as low, and in the course of the wind park operation it is absent.

1d – loss of breeding places. Negative impact of this factor is absent in winter period.

1e – loss of individual specimens of protected species. 2 species: (hen harrier – *Circus cyaneus,* white-tailed eagle – *Haliaeetus albicilla)* were registered within the territories adjacent to the wind park sites in the winter period of 2016. Possibility of their feeding migrations to the wind park territory is extremely low due to unsatisfactory state of forage resources for birds of prey. Negative impact of the wind park shall be characterized as low.

2. Impacts caused by equipment.

2a – long-time territory occupation and change of environment characteristics. As the territory of the wind park site is represented almost exclusively by anthropogenic types of biotopes (agricultural areas, agricultural hedgerows), the creation of infrastructure of the wind park sites will not be threatening for movement of birds in winter period. In accordance with plan structure of the wind park placement, considerable changes in the dominant biotopes are not predicted.

Impact shall be estimated as low.

2b – deterring by mast vertical structures. This factor is not threatening for small quantity of birds that occur in winter period and use the altitude corridor of 5 - 10 m during the flights (technical characteristics of the wind turbines might potentially create a threat for birds that fly at the altitudes of 50 - 170 m owing to rotor motion, but in winter 2016 birds have not been recorded at these altitudes). Birds get accustomed quickly to the existing structures, therefore the negative impact on birds is low, and for the majority of species it is absent.

2c – barrier impact and obstacles for flight. Birds, which use the wind park site as the feeding territories, generally move at the altitudes under 50 m, negative impact shall be estimated as low, and for the majority of species it is absent.

3. Impacts caused by the wind park operation.

3a – deterring caused by rotor motion, shadows flicker, light gleams.

Negative impacts owing to rotor motion, shadow flicker and light gleams shall be estimated as low, and for the majority of birds, which stay in the feeding territories at EuroCape Wind Park sites in winter, they are absent.

3b – additional territory development. Owing to extremely low attractivity of feeding territories and lack of safety ground biotopes for roosting time, this factor will not have an effect on wintering birds and shall be characterized as low.

3c – disturbing owing to night-time illumination. Impact of this factor shall be estimated as very low.

3d – collisions with the wind turbine generators. Small quantity of birds at the wind park sites in winter period and absence of considerable feeding gatherings and roosts enable to predict that negative impact on birds will be very low.

Chapter 4. Monitoring of Spring Migration of Birds within the Sites of EUROCAPE Wind Park, Buffer Zones and Adjacent Territories

4.1. Ex post description of the ornithological situation during spring migration

Distribution of birds in the course of spring migration is connected with the water area of the Molochnyi Estuary and the Sea of Azov and their coast. Much less it spreads to the territory of the wind park and buffer zones, therefore the construction of the wind park will not have a significant influence on the ornithological situation.

Spring migration of birds over the coast of the Molochnyi Estuary starts towards the end of February. According to retrospective data for the 1990's, a noticeable passage wave of some waterfowl species is observed during the first ten days of March. These are primarily anseriformes, the most noticeable of which are the migratory movements of greater white-fronted goose (*Anser albifrons*). Separate small skeins (up to 100 birds) were observed already on the 1 - 2 of March and the peak of the first passage wave over the Molochnyi Estuary was on the 3 of March (over 1,000 geese flew above the observation point at the outskirts of Stepanivka Persha Village on that day in 1990 and more than 8,800 - in 1998). High intensity of the first passage wave holds out also on the 4 - 5 of March (over 2,500 geese on 04.03.1998 and up to 6,600 on 05.03) and then subsides gradually. During the first ten days of March the passage of following birds is also observed: greylag goose (*Anser anser*), which was the most intensive also on the 3 of March (over 1,700 specimens in 1998); mallard (*Anas platyrhynchos*) with the peak on 03.03 (600 - in 1998); northern pintail (*Anas acuta*) with the peak on 01.03 (over 150 specimens); Eurasian widgeon (*Anas penelope*), garganey (*Anas querquedula*), common pochard (*Aythya ferina*) with the peak on 02.03 (over 400 specimens); greater scaup (*Aythya marila*), tufted duck (*Aythya fuligula*) and goosander (*Mergus merganser*) with the peak on 05.03 (up to 250 specimens). The migration of mute swan (*Cygnus olor*) with the peak on 04.03 (up to 390 specimens) and less noticeable migration of whooper swan (*Cygnus cygnus*) occur in the period of the 1 - 5 of March. The first wave of passage also includes the migration of some charadriiformes species, such as northern lapwing (*Vanellus vanellus*) – on the 1 - 4 of March (dozens of specimens), common redshank (*Tringa totanus*) since 04.03, yellow-legged gull (*Larus cachinnans*) and common gull (*Larus canus*) with the peak on 04.03 (over 2,200 specimens in 1998), black-headed gull (*Larus ridibundus*) with the peak on 03.03 (up to 800 specimens) and little gull (*Larus minutus*). Cormorant (*Phalacrocorax carbo*), as well as, in small numbers, black-throated loon (*Gavia arctica*) and great white egret (*Egretta alba*) are observed in passage since the 1 - 2 of March.

Out of the species listed in the Red Data Book of Ukraine, red-breasted goose (*Rufibrenta ruficollis)* was observed in passage on the 3 - 5 of March and common goldeneye (*Bucephala clangula*) – on the 1 - 4 of March. The quantity level of these species was dozens of specimens. Besides, a passage wave of red-breasted merganser (*Mergus serrator*) was recorded on 01 - 03.03 with the maximum intensity of passage on 02.03 (over 600 specimens). Migrating common cranes (*Grus grus*) – 5 - 7 specimens (1999) on the 7-8 of March and great bustard (*Otis tarda*) on 05.03.1997 were observed in the delta of the Molochna River. Out of the rare species of charadriiformes, single great black-headed gulls (*Larus ichthyaetus*) on the 1 - 4 of March and Eurasian curlews (*Numenius arquata*) on the 2 - 3 of March were observed in the lower reaches of the estuary. Out of the rare birds of prey, single peregrine falcons (*Falco peregrinus*) and white-tailed eagles (*Haliaeetus allbicilla*) were recorded in the lower reaches of the estuary during the first ten days of March.

During the second ten days of March, a new considerable passage wave of white-fronted goose is observed – the peak on 13.03 (over 11,000 geese in 1991). Greylag goose, mute swan (dozens of specimens on 10 - 13.03), mallard, common teal (*Anas crecca*), greater scaup (dozens of specimens on 12 - 13.03) and tufted duck migrate with low intensity. Yellow-legged, common and black-headed gulls and northern lapwing continue their migration, and ruff (*Philomachus pugnax*) starts its passage. Out of pigeons, separate small flocks of stock pigeon (*Columba oenas*) and turtle dove (*Streptopelia turtur*) are observed in passage.

Out of the species listed in the Red Data Book of Ukraine, following were observed in passage: red-breasted goose on the 13 of March, common goldeneye and red-breasted merganser (dozens of specimens) on the 11 - 12 of March, and common crane on the 11of March.

During the third ten days of March, observations were carried out directly at the record points in the lower reaches (outskirts of Stepanivka Persha Village) and in the upper reaches (outskirts of Mordvynivka Village) of the Molochnyi Estuary in 2009 - 2010 (Table 4.8). According to the data of 2010, two more last moderate passage waves of white-fronted goose with the maximum intensity on

March 21 (over 360 specimens) and March 30 (236 specimens) were observed at this period. During the third ten days, the migration of greylag goose, mute swan (dozens of specimens on 23.03) and whooper swan (dozens on 22.03), mallard, garganey (Table 4.8), northern pintails (dozens on 21 - 23.03), Eurasian wigeons (hundreds) continues and nearly comes to an end. The migration movements of common teal, common shelduck (*Tadorna tadorna*) and common pochards are also observed. The migration of great crested grebe (*Podiceps cristatus*) and greater scaups (dozens and hundreds of specimens) is well-marked towards the end of March, but mainly over the offshore strip of the sea. Movements of the flocks of cormorant, black-headed gull, Mediterranean gull (*Larus melanocephalus*), slender-billed gull (*Larus genei*), little gull, common gull, northern lapwing (peak of passage on 22.03.2010 – 250 specimens), ruff (dozens of specimens) and common redshank are observed over the coast (Table 4.1). The passage of grey heron (*Ardea cinerea*) and great white egret (Table 4.1), as well as common buzzard (*Buteo buteo*) on 25.03.2010 and turtle dove (23 - 28.03.2009) continues.

Out of the species listed in the Red Data Book of Ukraine, red-breasted goose was finishing its migration on 22 - 23.03, following species were observed in passage: great bustard on 21.03.2010, Eurasian curlew on 21 - 30.03.2009/ 2010, whimbrel (*Numenius phaeopus*) on 24 - 29.03.2010, common crane on 22.03.2009, great black-headed gull on 22 - 30.03.2009/ 2010, ruddy shelduck (*Tadorna ferruginea*) on 24.03.2009, pallid harrier (*Circus macrourus*) and long-legged buzzard (*Buteo rufinus*) on 24.03.2010, peregrine falcon and saker falcon (*Falco cherrug*) on 23 - 28.03.2010, short-eared owl (*Asio flammeus*) on 24 - 26.03.2010. The migration of Eurasian oystercatchers (*Haematopus ostralegus*) is very intensive during this period, especially along the barrier spit and the sea coast (Table 4.1).

Table 4.1. Results of the Observations of the Apparent Spring Waterfowl Migration at the Record Points on the Coast of the Molochnyi Estuary in March 2009 - 2010

Bird species name		Dates of observations	Total number		
English	Scientific		Lower reaches		Upper reaches
			2009	2010	2010
Great crested grebe	*Podiceps cristatus*	25 - 30.03	57	228	-
Cormorant	*Phalacrocorax carbo*	22 - 30.03	1254	700	-
Great white egret	*Egretta alba*	22 - 29.03	2	11	-
Grey heron	*Ardea cinerea*	21 - 26.03	2	3	-
Read-breasted goose	*Rufibrenta ruficollis*	22 - 23.03	-	29	-
Greylag goose	*Anser anser*	21 - 29.03	440	31	-
Greater white-fronted goose	*Anser albifrons*	21 - 31.03	-	1,068	-
Mute swan	*Cygnus olor*	21 - 30.03	22	39	8
Whooper swan	*Cygnus cygnus*	22 - 26.03	37	-	-
Common shelduck	*Tadorna tadorna*	21 - 29.03	30	58	17
Mallard	*Anas platyrhynchos*	23 - 30.03	18	137	80
Common teal	*Anas crecca*	24 - 29.03	4	-	24
Eurasian wigeon	*Anas penelope*	23 - 30.03	-	112	350
Northern pintail	*Anas acuta*	21 - 30.03	61	89	-
Garganey	*Anas querquedula*	21 - 30.03	141	5	108
Common pochard	*Aythya ferina*	29.03	-	5	-
Greater scaup	*Aythya marila*	22 - 30.03	-	220	-
Western marsh-harrier	*Circus aeruginosus*	27.03	-	1	-
Common crane	*Grus grus*	22.03	1	-	-
Northern lapwing	*Vanellus vanellus*	22 - 26.03	1	262	40
Eurasian oystercatcher	*Haematopus ostralegus*	21 - 31.03	213	360	-
Green sandpiper	*Tringa ochropus*	23 - 24.03	-	-	18
Common greenshank	*Tringa nebularia*	26.03	1	-	-
Common redshank	*Tringa totanus*	21 - 30.03	52	18	4
Ruff	*Philomachus pugnax*	21 - 29.03	-	66	43
Dunlin	*Calidris alpina*	23.03	-	3	-
Common snipe	*Gallinago gallinago*	23 - 24.03	-	-	3
Eurasian curlew	*Numenius arquata*	21 - 26.03	1	1	-
Great black-headed gull	*Larus ichthyaetus*	22 - 30.03	17	3	-
Mediterranean gull	*Larus melanocephalus*	23 - 30.03	529	1,937	-
Little gull	*Larus minutus*	28.03	3	-	-

Black-headed gull	*Larus ridibundus*	21 - 30.03	137	656	317
Slender-billed gull	*Larus genei*	22 - 30.03	106	220	-
Yellow-legged gull	*Larus cachinnans*	21 - 30.03	288	+	78
Common gull	*Larus canus*	23 - 30.03	502	275	1

Directions and altitudes of spring passage

The vast majority of birds migrating in spring fly at the altitudes under 100 m (Table 4.2). Long-distance transit passages of geese and northern lapwings, local and distant movements of individual flocks of cormorant, mallard and Mediterranean gull occur at considerably higher altitudes (up to 500 - 1,000 m) (Table 4.2).

The north-eastern direction prevails among passage directions. Migratory and feeding passages of waterfowl in the eastern and south-western directions are observed quite often (Table 4.2, Fig 4.1). Such directivity of migrations is the most typical for the lower reaches of the estuary, and in its upper reaches also northward spring movements become more frequent.

Table 4.2. Directions and Altitudes of Spring Waterfowl Passage over the Coast of the Molochnyi Estuary in 2009 - 2010 (outskirts of Stepanivka Persha Village)

Bird species name		Main directions	Other directions	Prevailing altitudes (m)	Other altitudes (m)
English	Scientific				
Great crested grebe	*Podiceps cristatus*	NE	E, SW	up to 50	-
Cormorant	*Phalacrocorax carbo*	NE, SW	E, W	up to 50	50 - 500
Great white egret	*Egretta alba*	NE	SW	up to 100	-
Grey heron	*Ardea cinerea*	NE	SW	up to 100	-
Read-breasted goose	*Rufibrenta ruficollis*	W	N	up to 100	-
Greylag goose	*Anser anser*	NE	N, W	100 - 500	up to 50
Greater white-fronted goose	*Anser albifrons*	NE	N, E	up to 100	100 - 1,000
Mute swan	*Cygnus olor*	NE	E, W, SW, NW, N	up to 50	50 - 100
Whooper swan	*Cygnus cygnus*	E	SW	up to 100	-
Common shelduck	*Tadorna tadorna*	E, NE	SW, W, N	up to 50	50 - 100
Mallard	*Anas platyrhynchos*	E	NE, SW, W	up to 50	100 - 500
Eurasian wigeon	*Anas penelope*	NE	NW, N, E	up to 50	50 - 100
Northern pintail	*Anas acuta*	NE, E	NW	up to 100	-
Garganey	*Anas querquedula*	NE	SW, W	up to 50	-
Greater scaup	*Aythya marila*	NE	SW, E	up to 50	50 - 100
Northern lapwing	*Vanellus vanellus*	NE, E	SW	up to 100	100 - 500
Eurasian oystercatcher	*Haematopus ostralegus*	NE	E, SW	up to 50	50 - 100
Common redshank	*Tringa totanus*	NE	SW, S, W	up to 100	-
Ruff	*Philomachus pugnax*	NE	NW, N, S	up to 50	50 - 100
Great black-headed gull	*Larus ichthyaetus*	SW	NE	up to 50	-
Mediterranean gull	*Larus melanocephalus*	NE	NW, SW, N, E, W	up to 50	50 - 500
Black-headed gull	*Larus ridibundus*	NE	SW, W, N, NW	up to 50	50 - 100
Slender-billed gull	*Larus genei*	SW, NE	W, E	up to 50	50 - 100
Yellow-legged gull	*Larus cachinnans*	NE	SW, N	up to 50	-
Common gull	*Larus canus*	NE	SW, W, NW, E	up to 50	50 - 100

Notes: N – northern direction, NE – north-eastern, E – eastern, S – southern, SW – south-western, W – western, NW – north-western.

Waterfowl gatherings on the coasts of the Molochnyi Estuary during spring migration

In March, a lot of waterfowl gather both in the offshore strip and on the seashore during migration stops for rest and feeding (Table 4.3, Fig. 4.2). Spring gatherings of grebe, greater scaup and mallard are the most typical in the offshore strip of the sea, gatherings of Eurasian oystercatcher (hundreds of specimens) – along the seashore and on the shoals in the lower reaches of the estuary. Common shelduck, ruff, Eurasian curlew, redshank and dunlin (*Calidris alpina*) gather on wet alkaline lands and on the shoals of the barrier spit. Hundreds of ducks, mainly mallard, Eurasian wigeon and garganey, gather on the shoals of the estuary and on the channels. Hundreds of specimens of northern lapwing, yellow-legged, common and Mediterranean gulls concentrate on alkaline lands and plough-lands of the estuary coast (Table 4.3).

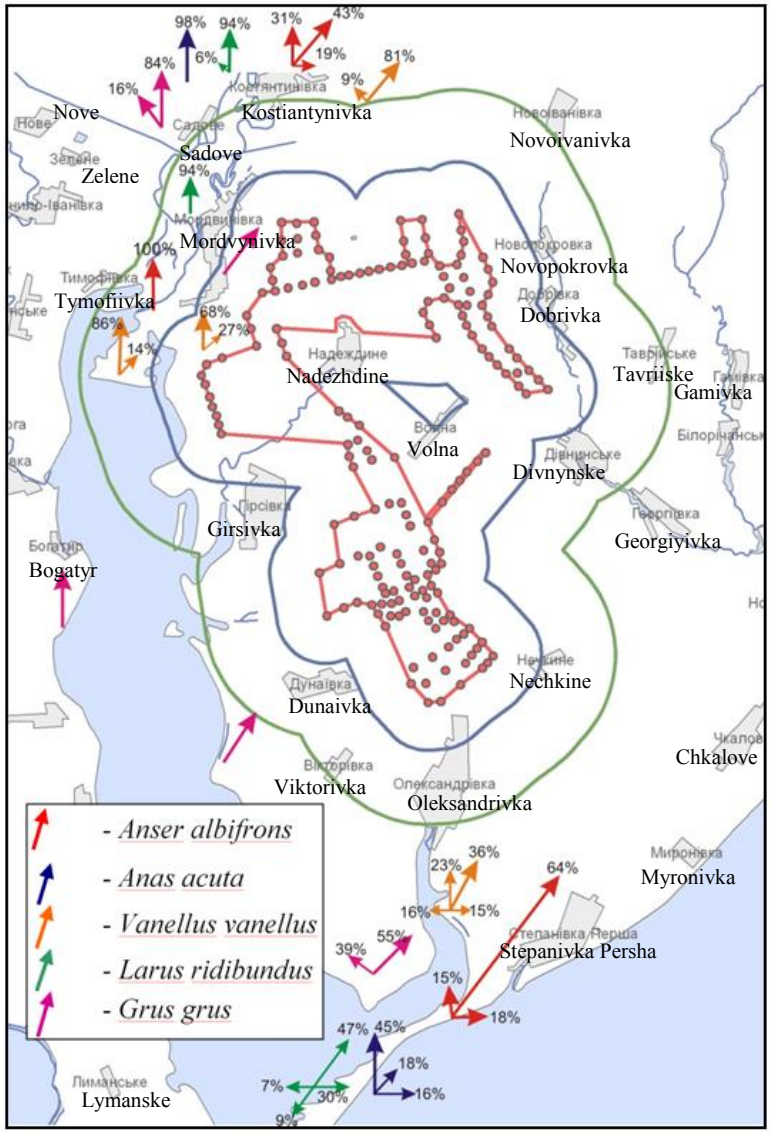


Fig. 4.1. Main directions of spring passage of the control waterfowl species at the Molochnyi Estuary

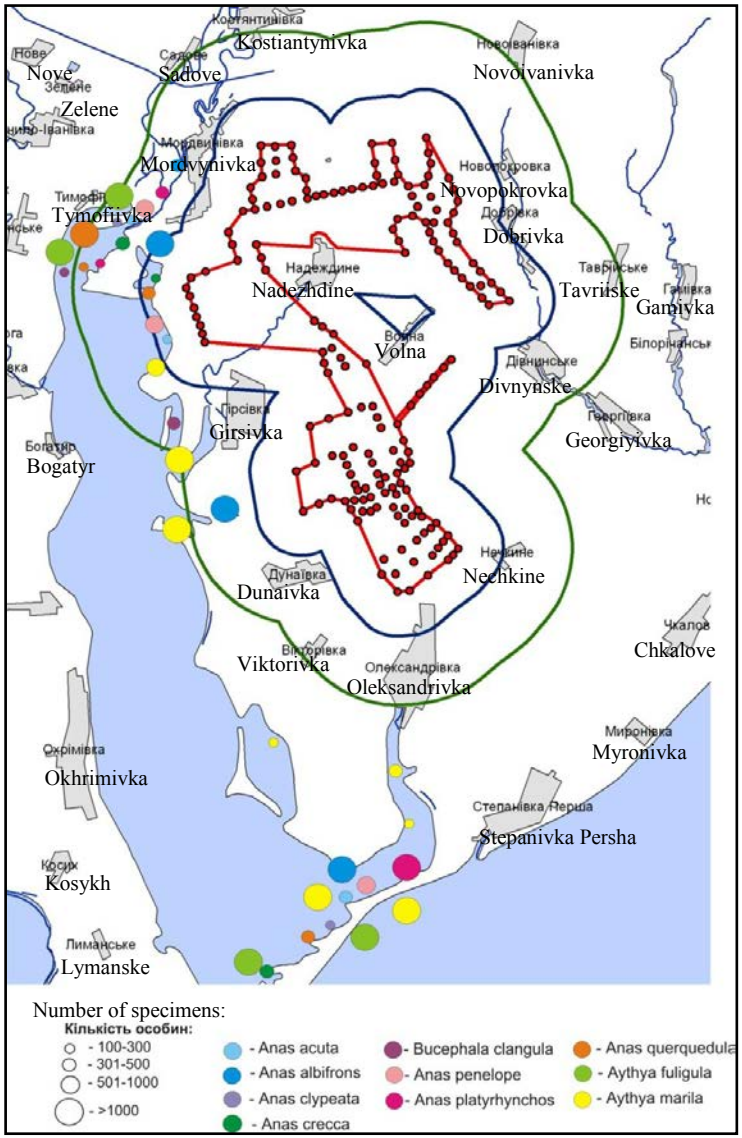


Fig. 4.2. Location of the largest gatherings of anseriformes during spring migration according to the data of the 2000s

Table 4.3. Description of the Largest Gatherings of Waterfowl at the Coasts and Water Area of the Molochnyi Estuary during the Spring Migration of 2009 - 2010

Bird species name		Quantity (specimens)	Date		Location
English	Scientific		2009	2010	
Great crested grebe	*Podiceps cristatus*	700; 1,500	29.03	27.03	Sea
Common shelduck	*Tadorna tadorna*	93; 490	22.03	23.03	Barrier spit
Mallard	*Anas platyrhynchos*	600	-	26.03	Lower reaches of the estuary
Eurasian wigeon	*Anas penelope*	260	-	26.03	Lower reaches of the estuary
Garganey	*Anas querquedula*	458; 184	26.03	26.03	Lower reaches of the estuary
Greater scaup	*Aythya marila*	200	-	26.03	Lower reaches of the estuary
Common crane	*Grus grus*	37	22.03	-	Barrier spit
Northern lapwing	*Vanellus vanellus*	250	-	22.03	Lower reaches of the estuary
Eurasian oystercatcher	*Haematopus ostralegus*	131; 316	29.03	28.03	Barrier spit
Common redshank	*Tringa totanus*	70; 176	24.03	28.03	Lower reaches of the estuary
Ruff	*Philomachus pugnax*	35; 260	24.03	25.03	Barrier spit
Dunlin	*Calidris alpina*	66; 240	26.03	26.03	Barrier spit
Eurasian curlew	*Numenius arquata*	38; 56	29.03	29.03	Barrier spit
Mediterranean gull	*Larus melanocephalus*	300; 370	29.03	29.03	Spit, ploughed land
Yellow-legged gull	*Larus cachinnans*	66; 286	26.03	26.03	Barrier spit
Common gull	*Larus canus*	70; 272	26.03	27.03	Lower reaches of the estuary

According to the retrospective (Chernichko, Chernichko, 2003; Diadicheva, Popenko, Koshelev, 2005; Diadicheva, Koshelev, 2006) and current data (2009 - 2010) 229 species of birds have been reliably recorded in the researched territory in spring period. Among them, there are 45 species listed in the latest edition of the Red Data Book of Ukraine (2009) and 27 of them were observed directly in 2009 - 2010.

Description of ornithological situation during the spring migration of 2014

Availability of migration corridor, which passes along the north coast of the Azov and Black Seas rounding them, is a peculiarity of the region. This factor causes high diversity of species of passage – they number over 200 bird species during migrations in the region.

During spring passage that part of migration flow, which rounds the Sea of Azov on the west, is divided into some parts. One of them crosses the sea in the northern direction, and heads deep into the continental part of Eastern Europe using the water area of the Molochnyi Estuary and the Dnipro River Valley. The birds, which fly from the coast into the continent, form a small part to the east of the Molochnyi Estuary. The rest of the flow heads along the northern coast of the Sea of Azov to the northern east. So, the concentration of migration flow occurs in the region of key wetlands (the Utliutskyi and Molochnyi Estuaries, the Obytichna Spit and the Obytichna Gulf, the Berdianska Gulf), which, however, is divided at once into low-number flows. The lion's share of migrants flies further along the Azov coast in the north-eastern direction.

Taxonomic description of ornithological complex of birds within the territories adjacent to the wind park during the spring migration of 2014

Ornithological research of spring migration of birds in the region were carried out in the monitoring territories that include the Molochnyi Estuary (all its plots), the coast of the Sea of Azov near the Villages of Stepanivka Persha and Novokostiantynivka (the Tubalskyi Estuary). Besides, the counts cover maximum quantity of terrestrial biotopes, namely: agricultural areas, agricultural hedgerows, man-planted forest areas, virgin plots of the steppe, residential settlements, etc. So, researches executed in the region provide objective information about the ornithological situation in the territory, where the construction and operation of the wind park owned by EuroCape Ukraine Company are planned, and may form the basis of the expert appraisal on determination of the level of the wind park influence on birds during spring migration.

All birds registered in the spring passage pertain to 12 taxonomic series – pelicans (*pelecaniformes*), grebes (*podicipediformes*), goose-like birds (*anseriformes*), crane-like birds (*gruiformes*), fowl-like birds (*galliformes*), hoopoe-like birds (*upupiformes*), birds of prey

(*falconiformes*), shore birds (*charadriiformes*), owl-like birds (*strigiformes*), swift-like birds (*apodiformes*), pigeons (*columbiformes*) and perching birds (*passeriformes*) (Table 4.4, Fig.4.3). Representatives of perching birds were dominating – 19 species; subdominants: anseriformes – 10 species and shore birds – 11 species (Table 4.4). Availability of high species diversity resulted in high quantity of birds of a concrete group. So, perching birds (4,430 specimens) head the list, then shore birds (3,311 specimens) and anseriformes (2,165 specimens) follow (Table 4.4).

Table 4.4. Taxonomic Description of Migration Ornithological Complex within the Territories Adjacent to the Wind Park in Spring, 2014

Series	March		April		Spring 2014	
	species	specimens	species	specimens	species	specimens
Grebes	1	**101**			1	**101**
Pelicans	1	**39**	1	**26**	1	**65**
Anseriformes	8	**1,743**	5	**422**	10	**2,165**
Crane-like birds	1	**10**	1	**132**	1	**142**
Fowl-like birds	1	**2**	1	**4**	1	**6**
Birds of prey	2	**8**	2	62	3	**70**
Shore birds	6	**1,749**	10	**1,562**	11	**3,311**
Strigiformes			1	**2**	1	**2**
Upupiformes	1	**2**	1	**1**	1	**3**
Apodiformes			1	**252**	1	**252**
Pigeons	2	**25**			2	**25**
Perching birds	17	**2,905**	9	**1,525**	19	**4,430**
Total	**40**	**6,584**	**32**	**3,988**	**52**	**10,572**

More detailed analysis of birds' distribution throughout the territory has revealed the same regularity in domination of one or another taxon. For example, perching birds had the highest species diversity both in March and in April, and dominated also quantitatively. But such tendency has been lost for the representatives of perching birds in the adjacent territories (the Molochnyi and Tubalskyi Estuaries) in March. Anseriformes (8 species, 1,479 specimens) occupied the first position, shore birds (6 species, 557 specimens) – the second one, but perching birds were only the third (9 species, 244 specimens).

The situation radically changed in April. High diversity of the representatives of perching birds was not observed in the adjacent territories at all; shore birds (9 species, 1,034 specimens) occupied the first position and anseriformes (5 species, 395 specimens) – the second one.

In general, the situation was different in the adjacent territories of high diversity. Representatives of anseriformes (10 species, 1,874 specimens) dominated here in spring 2014, and then followed shore birds (10 species, 1,600 specimens). Only 9 species, 244 specimens of perching birds were observed (Fig. 4.3 - 4.4).

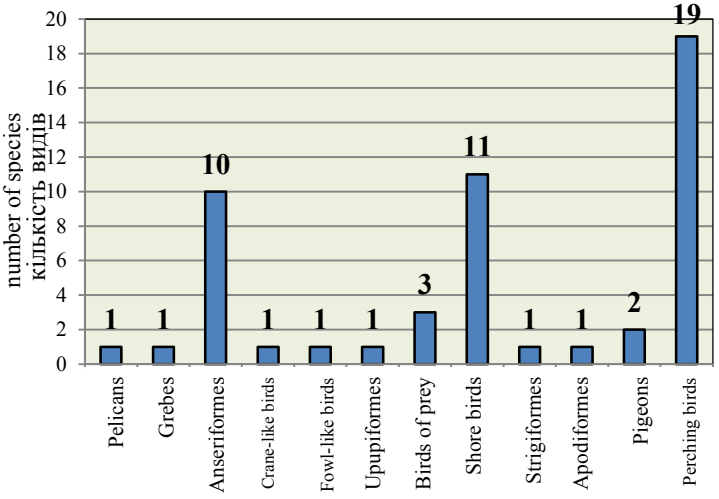
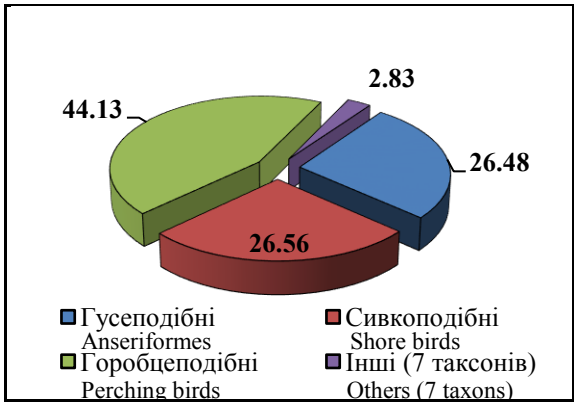


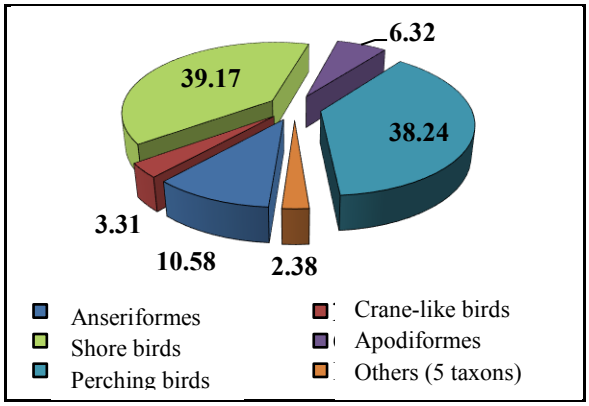
Fig. 4.3. Species representation of bird taxons in the territories adjacent to the wind park in spring 2014

Such mosaic character is caused by the availability of proper biotopes that are selected by a certain group of birds. It is hard to expect stay of representatives of anseriformes, ciconiiformes or pelicans within the wind park owing to complete agricultural development of the territory.

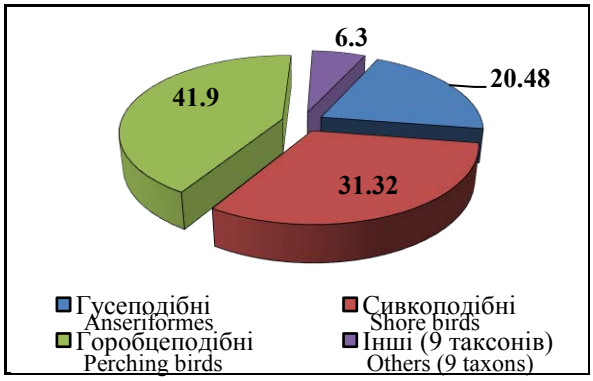
Bird species, which quantitatively predominated over others, were in each taxonomic group. So, among perching birds: rook - *Corvus frugilegus* numbered 67.7% of quantity, European starling - *Sturnus vulgaris* – 15.2%; in other groups: among shore birds – ruff - *Philomachus pugnax* (40.5%) and Mediterranean gull - *Larus melanocephalus* (36%) dominated, and among anseriformes – common shelduck - *Tadorna tadorna* (41.3%) and Eurasian wigeon - *Anas penelope* (32.5%).



A. March



B. April



C. Spring, 2014

Fig. 4.4. Taxonomic description of the ornithological complex within the territories adjacent to the wind park in March (A), April (B) and in spring 2014 (C) (number of birds)

Quantitative characteristic

The total quantity of 52 registered species of birds is 10,572 specimens (Table 4.5), 6,708 specimens of which (or 63.5% of all registered birds) were observed in the buffer zones and in the territories adjacent to the wind park, and 3,867 specimens (36.5%) – at the monitoring plots of high biological diversity (the Molochnyi and Tubalskyi Estuaries). Such correlation of birds by different territories is unusual, owing to small area of the wind park in comparison with the area of the adjacent plots, and higher diversity of biotopes in the latter.

The most numerous were rook (*Corvus frugilegus*), Mediterranean gull (*Larus melanocephalus*) and European starling (*Sturnus vulgaris*), 4,189 specimens of which were observed. Quantity of other bird species was 2,519 specimens. 2,068 specimens of semi-aquatic birds have been registered and 4,637 specimens of upland birds.

Table 4.5. General Description of Migration Ornithological Complex in the Buffer Zones and within the Territories Adjacent to the Wind Park in Spring 2014

No.	Species	Plot 1	Plot 2	Total
1	Great crested grebe *(Podiceps cristatus)*	101		**101**
2	Cormorant *(Phalacrocorax carbo)*	65		**65**
3	Mute swan (*Cygnus olor)*		65	**65**
4	Greylag goose (*Anser anser)*		1	**1**
5	Common shelduck (*Tadorna tadorna)*	159	735	**894**
6	Mallard (*Anas platyrhynchos)*	34	235	**269**
7	Garganey (*Anas querquedula)*		99	**99**
8	Northern pintail *(Anas acuta)*		77	**77**
9	Northern shoveler *(Anas clypeata)*		4	**4**
10	Red-crested pochard *(Netta rufina*)		6	**6**
11	Common pochard (*Aythya ferina)*		22	**22**
12	Eurasian wigeon *(Anas penelope)*	73	630	**703**
13	Western marsh-harrier *(Circus aeruginosus)*	1		**1**
14	Common kestrel (*Falco tinnunculus)*	45	2	**47**
15	Red-footed falcon *(Falco vespertinus)*	22		**22**

16	Grey partridge (*Perdix perdix)*	6		**6**
17	Eurasian coot (*Fulica atra)*		142	**142**
18	Northern lapwing *(Vanellus vanellus)*	23	13	**36**
19	Black-winged stilt (*H. himantopus*)		12	**12**
20	Pied avocet (*Recurvirostra avosetta)*		72	**72**
21	Common redshank *(Tringa totanus)*		4	**4**
22	Ruff *(Philomachus pugnax)*	735	606	**1,341**
23	Whimbrel (*Numenius phaeopus*)	5	5	**10**
24	Mediterranean gull *(Larus melanocephalus)*	558	633	**1,191**
25	Black-headed gull *(Larus ridibundus)*	62	86	**148**
26	Slender-billed gull (*Larus genei*)	69		**69**
27	Yellow-legged gull *(Larus cachinnans)*	259	113	**372**
28	Terns *(Chlidonias spp.)*		56	**56**
29	Long-eared owl *(Asio otus)*	2		**2**
30	Woodpigeon (*Columba palumbus)*	1		**1**
31	Rock pigeon (domestic type) *(Columba livia var. domestica)*	24		**24**
32	Hoopoe *(Upupa epops)*	1	2	**3**
33	Common swift *(Apus apus)*	252		**252**
34	Skylark (*Alauda arvensis)*	158		**158**
35	Crested lark (*Galerida cristata)*		5	**5**
36	White wagtail (*Motacilla alba)*	157	5	**162**
37	Yellow wagtail (*Motacilla flava)*	34		**34**
38	European starling (*Sturnus vulgaris)*	654	18	**672**
39	European magpie *(Pica pica)*	39	2	**41**
40	Jackdaw *(Corvus monedula)*	8		**8**
41	Rook (*Corvus frugilegus)*	2,800	200	**3,000**
42	Hooded crow (*Corvus cornix)*	43	10	**53**
43	Common raven (*Corvus corax)*	2	2	**4**
44	Barn swallow *(Hirundo rustica)*	212		**212**
45	Northern wheatear (*Oenanthe oenanthe)*	6		**6**
46	European robin *(Erithacus rubecula)*	11		**11**
47	Common redstart *(Ph. phoenicurus)*	2		**2**
48	Great tit *(Parus major)*	2		**2**
49	Eurasian tree sparrow (*Passer montanus)*	40		**40**
50	Chaffinch (*Fringilla coelebs)*	18		**18**
51	Linnet *(Acanthis cannabina)*		1	**1**
52	Corn bunting *(Emberiza calandra)*		1	**1**
	Ducks *(Anas spp.)*	25		**25**
Total	**species**	**37**	**32**	**52**
	birds	**6,708**	**3,864**	**10,572**

In consideration of the location of the Molochnyi Estuary Wetland near to the wind park site and, to a lesser extent, the Tubalskyi Estuary, we can observe the domination of semi-aquatic bird species here. So, 3,717 specimens (or 96.1%) of bird species that are biotopically attracted to wetlands have been registered in the adjacent territories over the whole period of spring observations.

Following species dominated here: ruff (*Philomachus pugnax*), garganey (*Anas querquedula*) and common shelduck (*Tadorna tadorna*). Number of upland species in the adjacent territories over the whole period of observations was 150 specimens.

The total number of birds that were registered in the spring passage is 10,572 specimens. Part of these birds was in migration status (3,713 specimens), which is subdivided into transit one, when birds pass long distances without stop within the wind park, and feeding one, when birds fly on small distances in search of forage. Analysis of such distribution shows the domination of feeding migrants (2,488 specimens, or 67% of the total number of migrating birds) over the transit ones (1,225 specimens, or 33%).

Species diversity of birds ranged from 15 species (16.03) to 7 (29.03) during the migration; and was slightly lower in April (10 - 12 species) than in March (7 - 15 species), but stable. Species diversity in March was 13-14 species, in April – 12 - 24. Maximum species diversity was observed on the 28 of April (24 counted species), although the quantity of birds was the highest on the 29 of March (Fig. 4.5 - 4.6).

Rook (*Corvus frugilegus*) was a dominant among migrants; ruff (*Philomachus pugnax*) and Mediterranean gull (*Larus melanocephalus*) were subdominants. It was a rook that caused the maximum values in April (26.04), when 1,105 specimens (74.6% of all birds on this day) were registered in the course of migrations.

Ratio of the feeding and transit migrants is rather indicative migration characteristic, which defines the intensity of migration. In March the dynamics of feeding migrants' quantity has a tendency towards reduction of absolute indices, with small peak of quantity at the end of the month (31.03), while quantity of transit migrants, on the contrary, increases gradually till the end of March, but drops dramatically on 31.03, and in April increases again (Fig. 4.5 - 4.7). Such state of ornithological situation indicates the ceasing of an active migration in the region.

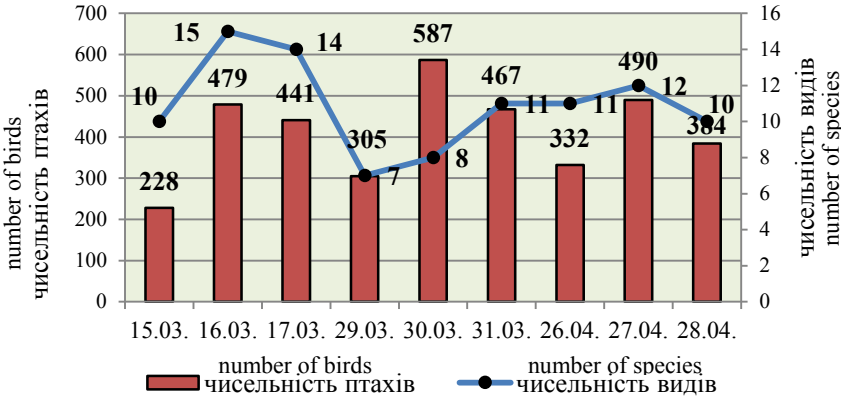


Fig. 4.5. Species diversity and number of birds that migrated in spring 2014

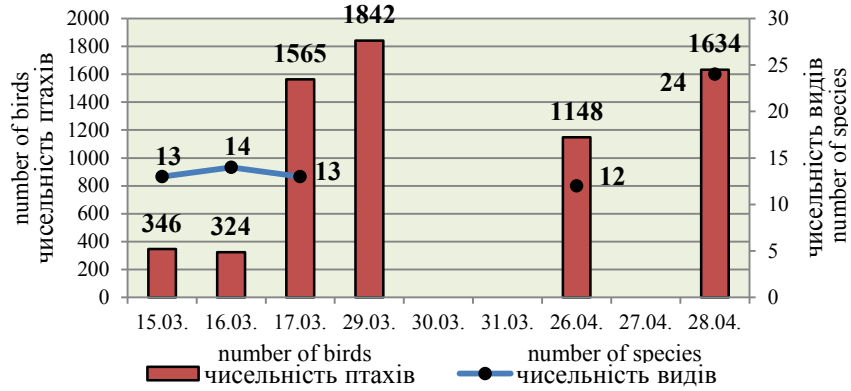


Fig. 4.6. Species diversity and number of birds registered in the course of censuses in spring 2014

Fig. 4.7. Species diversity and number of birds in spring 2014

Directions of the spring migration of 2014

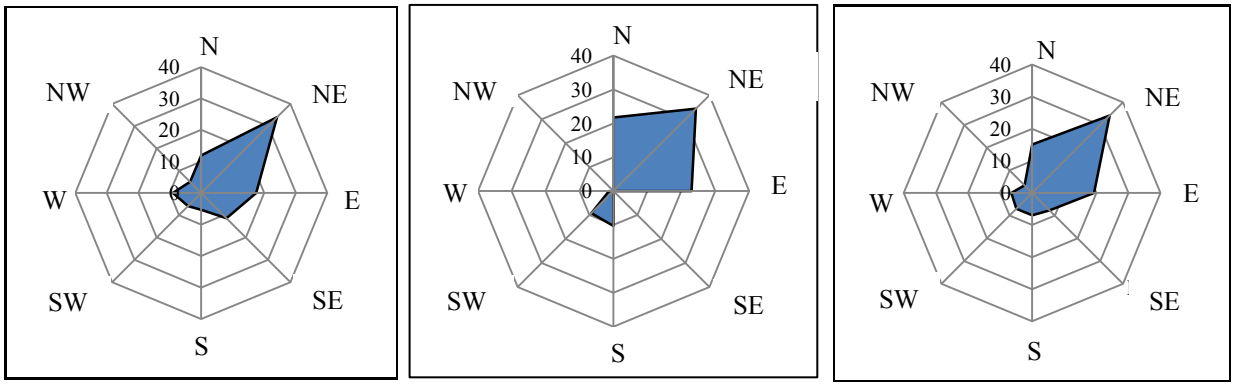
North-eastern (34.2%), northern and eastern directions prevailed among passage directions (Table 4.6, Fig. 4.8); 2,544 specimens (68.4%) flew in these directions. Generally they were semi-aquatic birds, small perching birds and rooks. Such movements were periodic for rook at this period and connected with spring feeding migrations. In addition, migration bird movements were observed in south-eastern (284 specimens, 7.6%), south-western (259 specimens, 6.9%) and southern (258 specimens, 6.9%) directions. Birds' passage in other directions was not numerous (Table 4.6).

Table 4.6. Description of Directions of the Spring Migration in 2014

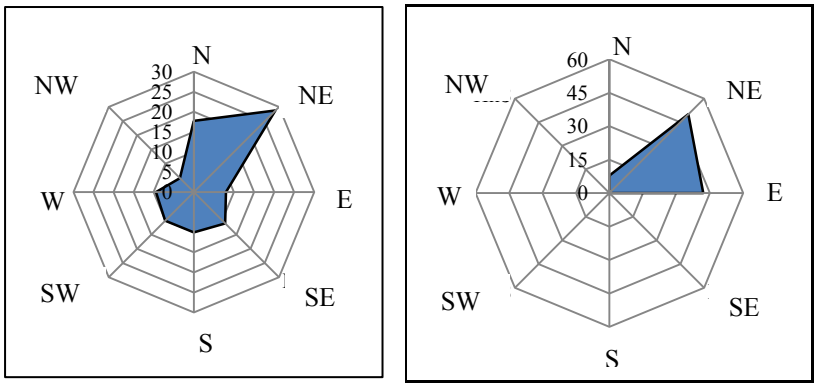
Direction	Dates of observations									Σ
	15.03	**16.03**	**17.03**	**29.03**	**30.03**	**31.03**	**26.04**	**27.04**	**28.04**	
N		7	23	45	96	128		142	120	**561**
NE	27	271	205	92	80	178	172	133	110	**1,268**
E			21	69	276	71	64	155	59	**715**
SE	113	88	29		17	37				**284**
S	24	29	35		24	22	12	48	64	**258**
SW	46	74	28				84	12	15	**259**
W	18	10	30	43	94	31			16	**242**
NW			70	56						**126**
Total	**228**	**479**	**441**	**305**	**587**	**467**	**332**	**490**	**384**	**3,713**

Such directions are typical and caused by a vector of the coastline of the Sea of Azov, along the north coast of which the majority of birds flies to breeding places.

When analysing the directions of migration in different months of observations, we shall say about the classical pattern of passage in March (the majority of birds flew to the north-east and to the east). In April we also have the typical passage directions for spring period, but with slightly increased attraction of birds to the north. So, 11.9% of all registered migrants flew in the northern direction in March, and 21.7% - in April. Index of quantity of birds that flew to the north-east was stable during all months (34.0% in March and 34.4% - in April). More detailed description of the directions of spring migration is given in Table 4.6 and in Fig. 4.8.



A. All migrants, March, 2014 B. All migrants, April C. All migrants, spring 2014



D. Feeding migrants, spring E. Transit migrants, spring

Fig. 4.8. Description of directions of birds' passage in spring 2014 (quantity, %)

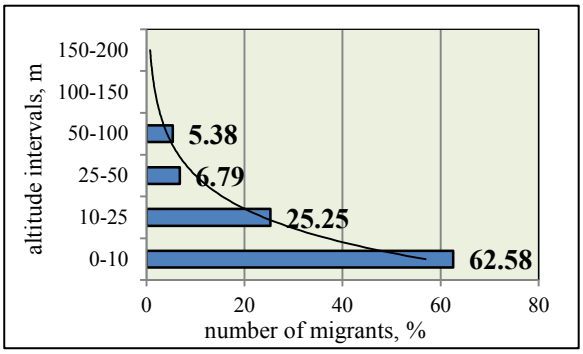
Differences between months are caused by the change of dominating groups of migrants. If in March the representatives of anseriformes (swans, geese, and ducks) are typical in the passage, for which northern direction is less expressed and birds prefer north-eastern direction, then in April perching birds and shore birds dominate, for majority of which the northern direction is typical.

When comparing the directions of birds' passage in the course of feeding and transit migrations, we shall say about narrow directivity of the transit migrants (north, north-east and east) and wide range of flying away of feeding migrants (with different intensity in all directions). Explanation of this fact lies in the aspect of diurnal activity of different groups of migrants. So, mass scale of the process is a peculiarity of transit passage of birds, with the involvement of rather large number of birds and species, purposeful active type of flight (flapping and soaring) in proper direction, long distance of

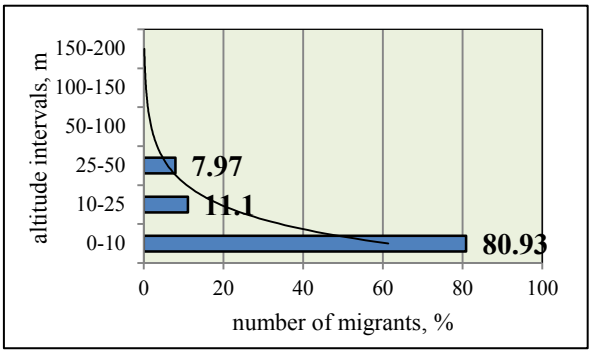
single passage (up to 600 km), without delay and stop in the migration route. Therefore, feeding migrants show somewhat different type of behaviour, which is defined by long-term staying of birds within the region, daily feeding passages from the roosts to feeding places, the whole range of migration directions caused only by search of forage, formation of gatherings different by size, short distances of passages. Just such pattern has been revealed in the course of observations in spring 2014 (Fig. 4.8).

Description of altitude intervals of birds' movement

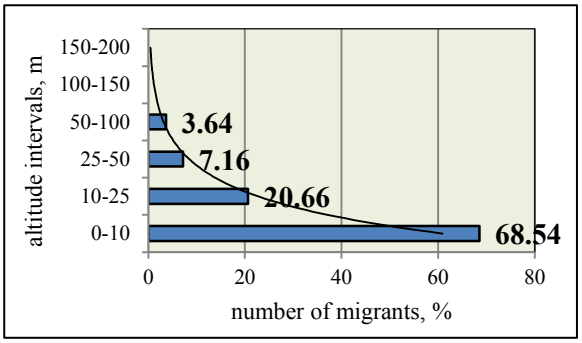
High-altitude bird movements in spring 2014 were distributed in the following way. In March the vast majority of birds (2,372 specimens, or 96.3% of the total number of birds) was observed either on the ground (1,569 specimens) or in flight within the altitude interval under 50 m (803 specimens). Only 135 specimens (3.7%) of birds were recorded within the interval of 50 - 100 m (Fig. 4.9).



A. March, 2014



B. April, 2014



C. Spring, 2014

Fig. 4.9. Description of altitudes of birds' passage during the spring migration of 2014

In April such tendency has remained further. 1,151 specimens or 100% of birds were observed within the altitude interval under 50 m. Also there are certain regularities in the passage of feeding and transit migrants. The situation with feeding migrants in March is interesting: 25% of birds stayed on the ground or near it and 43.1% - at the altitude of 10 - 25 m that differs from April (65.1 and 18% respectively) (Fig. 4.10).

Such data are anticipated and the pattern of birds' distribution by the altitudes of flights is traditional for the territory of the wind park site and for this season.

When comparing passage altitudes for different groups of birds, we shall notice that transit migrants flew higher than feeding ones. Especially it is noticeable in March, when big (by size) birds (swans, geese, ducks, and egrets) migrate over long distances. Owing to it the altitudes of passage are rather considerable. In April, when species composition of migrants is changing toward the domination of perching birds, the altitudes of passage decrease both for transit and for feeding migrants.

Exponential line of the trend in the linear diagrams of Fig. 4.9 and 4.10 confirms mathematically the hypothesis about safety of the altitudes of birds' passage during the spring migration of 2014. According to the results of observations, part of birds that use the altitude intervals over 50 m is 3.64%, and for mathematical predictions (see trend line in Fig. 4.19, C) it is even less.

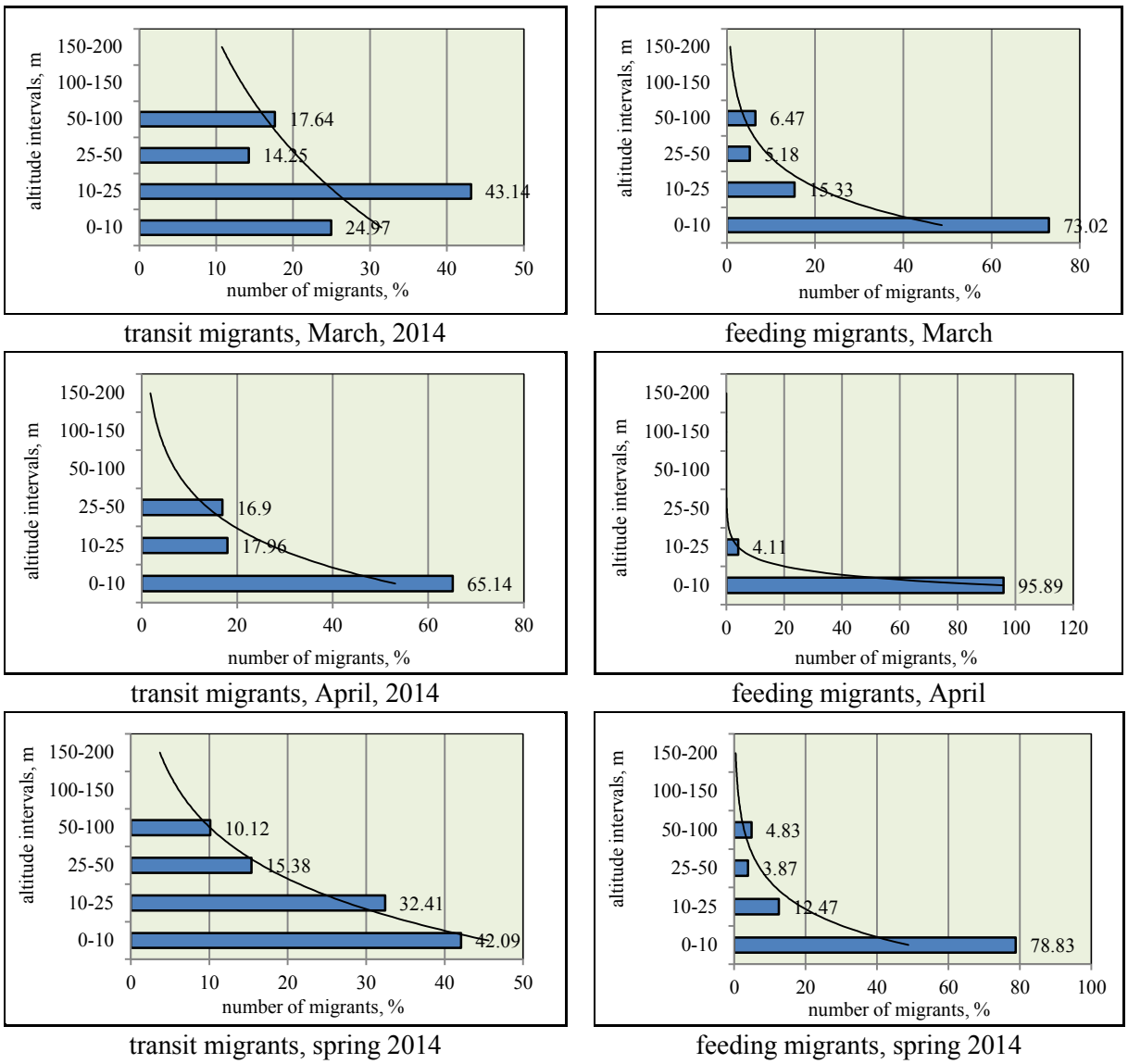


Fig. 4.10. Comparison of passage altitudes for feeding and transit migrants during the spring migration of 2014

Bird species listed in the Red Data Book of Ukraine

4 species of birds listed in the Red Data Book of Ukraine were recorded in the researched territory in spring 2014 (Table 4.7). The pattern of their distribution has following features. Out of 4 bird species recorded in spring, 1 species (whimbrel - *Numenius phaeopus*) had been observed at the Tubalskyi Estuary, other 3 species (red-crested pochard - *Netta rufina*, black-winged stilt - *Himantopus himantopus*, pied avocet - *Recurvirostra avosetta)* – at the Molochnyi Estuary. Number of rare species is small everywhere. Only pied avocet (*Recurvirostra avosetta)* was observed in the flock of 72 birds that is rather common picture during the period of migration.

Table. 4.7. Bird Species Listed in the Red Data Book of Ukraine that were Counted in Spring 2014

No.	**Species name**	∑
1	Red-crested pochard (*Netta rufina*)	**6**
2	Whimbrel (*Numenius phaeopus*)	**5**
3	Black-winged stilt (*Himantopus himantopus*)	**12**
4	Pied avocet (*Recurvirostra avosetta)*	**72**
	Total (4 species)	**95**

4.2. Basic ornithological monitoring in 2016

Key tasks of the observations were following: study of species composition of birds, their quantity, analysis of taxonomic division of the whole ornithological complex, fixation of passage directions and movement altitudes of bird flocks. Individual investigations of birds, which are listed in the Red Data Book of Ukraine, or rare for the region, as well as distribution of spring avifauna according to such nature conservation documents as the List of the International Union for Conservation of Nature (IUCN), the European Red List, the Bonn and Bern Conventions, as well as the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) were also important.

Such analysis has been carried out after demand of Ukrainian legislation and current trend of approximation of national nature conservation legislation to the international one, mainly to the Birds Directive and the Habitat Directive, as component parts of the Pan-European Network Natura - 2000.

Weather conditions

Analysis of weather conditions in the region of investigations is very important owing to dependence of the majority of bird life phenomena on such indices as air temperature, directions and strength of wind, air pressure, and precipitation.

Fact of interconnection between phenology of migratory processes and dynamics of weather-climatic indices is obvious. For that very reason, we have analysed not only the period when the censuses were carried out (March and April, when an active progress of migratory processes was observed), but also the month that preceded the beginning of migration (February).

In general, the weather in February of 2016 is characterized by rather high air temperatures, in comparison with past years (for example, average temperature values in February 2015 were + 1.25 ^{o}C, and in February 2016 – + 3.53 ^{o}C). Minimum temperatures in February were not critical for birds, and index of daily average temperature below 0 ^{o}C was observed only on 8.02.2016 (at the same time, minimum indices of temperature of the last year were - 5 ^{o}C, on 18.02.2015, and number of days with the temperature below zero was equal to 7). Already from the 9 of February daily average air temperatures had crossed the mark of 0 ^{o}C, and were positive later.

Daily average air temperatures in March fluctuated from 0.5 to 9.5 ^{o}C, at the mean equal to 6.56 ^{o}C. The situation has changed in April: temperature varied from 8.0 to 16.5 ^{o}C, at the mean it was 13.5 ^{o}C (Table 4.8), which is almost no different from the analogous period of the last year. All of these, implicitly, have had an effect on a progress of migration process. More detailed description of weather-climatic conditions is shown in Table 4.8 and in Fig. 4.11.

Table 4.8. Description of Weather Conditions of February - April, 2016

Parameter	n	M ± m	min	max	Cv
Air temperature. February	29	3.53 ± 2.36	- 0.5	8.5	66.8
Air pressure. February	29	765.5 ± 5.33	756.5	775.0	0.7
Air temperature. March	31	6.56 ± 1.93	0.5	9.5	29.5
Air pressure. March	31	761.1 ± 4.64	749.0	767.0	0.6
Air temperature. April	30	13.53 ± 2.32	8.0	16.5	17.14
Air pressure. April	30	759.4 ± 4.19	748.5	766.0	0.55

After the first non-intensive migration wave of anseriformes, shore birds and other bird species (the end of March), the second one that was characterized by larger species diversity and also larger quantity (975 specimens of 22 species as against 318 specimens of 17 species respectively) followed in the middle of April.

Such difference is caused by average monthly temperature increase (13.5 ^{o}C), improvement of forage conditions for birds, as well as species diversity of migratory birds. Active migratory processes became hindered at the end of April, since the major part of birds began to prepare for nesting.

Observations of change of typical winter climatic conditions, which are characterized by inverse relationship between air temperatures and air pressure, to spring ones, when increase of air pressure also leads to rise of air temperature, are interesting. We have observed such situation in 2016 both in February and in March.

However, anticyclone type of the weather, when high atmospheric pressure leads to air temperature reduction, is more typical for migration start of birds. Such periods were fixed on the 15 - 18 of February, on the 9 - 12 and 23 - 26 of March, as well as on the 7 - 14 and 21 - 26 of April (Fig.

4.11). Active passage of anseriformes, shore birds, perching birds and other bird species was observed just at this very time.

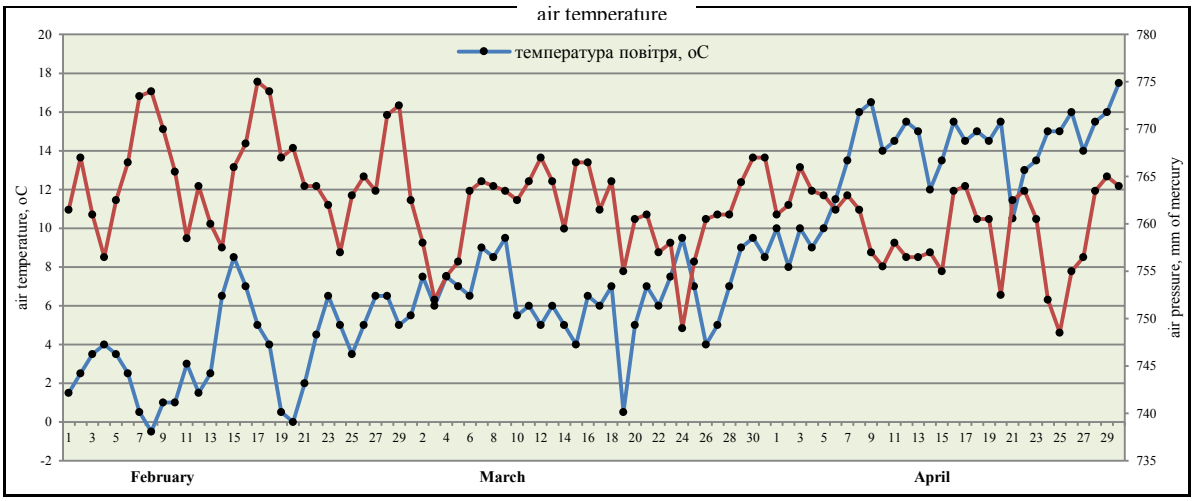


Fig. 4.11. Weather-climatic description of February - April of 2016, according to the data of meteorological station of Mordvynivka Village

Taxonomic description of ornithological complex of birds within EuroCape Wind Park, buffer zones and adjacent territories during the spring migration of 2016

All birds registered in the spring passage pertain to 11 taxonomic series – grebes (*podicipediformes*), pelicans (*pelecaniformes*), ciconiiformes (*ciconiiformes*), goose-like birds (*anseriformes*), birds of prey (*falconiformes*), fowl-like birds (*galliformes*), crane-like birds (*gruiformes*), shore birds (*charadriiformes*), pigeons (*columbiformes*), hoopoe-like birds (*upupiformes*) and perching birds (*passeriformes*) (Tables 4.9 - 4.11). Representatives of perching birds were dominating – 25 species; subdominants: shore birds – 12 species (Table 4.11). Availability of high species diversity resulted in also high quantity of birds of the concrete group. So, perching birds (1,354 specimens) head the list, then shore birds (923 specimens) follow, and then anseriformes (301 specimens) (Table 4.10).

More detailed analysis of birds' distribution throughout the territory has revealed another regularity in domination of one or another taxon. For example, perching birds had the highest species diversity within the wind park in March, which were dominating quantitatively (17 species, 238 specimens) at this time, anseriformes (1 species, 65 specimens) took up the second position, and shore birds (2 species, 26 specimens) were the third (Table 4.9, Fig. 4.12). In the adjacent territories, shore birds (7 species, 103 specimens) were dominating in March; anseriformes (4 species, 54 specimens) were subdominants.

The situation has not changed much in April. In the territory of the wind park perching birds (22 species, 938 specimens) also took up the first position, and shore birds (2 species, 185 specimens) – the second one (Table 4.10). And in the adjacent territories shore birds (12 species, 609 specimens) were dominating, perching birds (10 species, 155 specimens) - subdominants.

In general, the situation in the adjacent territories was different from the wind park area. Representatives of shore birds (12 species, 712 specimens) dominated here in spring 2016, and then followed perching birds (12 species, 178 specimens), anseriformes (4 species, 126 specimens) and pelicans (1 species, 30 specimens); other taxons were not numerous (Table 4.11, Fig. 4.12).

Such mosaic character is caused by the availability of proper biotopes that are selected by a certain group of birds. It is hard to expect stay of large quantity of anseriformes or shore birds within EuroCape Wind Park owing to complete agricultural development of the territory; representatives of these taxons occur, in the first place, in the adjacent territories, and to a lesser extent, in the buffer zones.

Bird species, which quantitatively predominated over others, were in each taxonomic group. So, among perching birds: European starling – *Sturnus vulgaris* – numbered 41.1% of quantity, corn bunting – *Emberiza calandra* – 12.1%, rook – *Corvus frugilegus* – 7.8%, in other groups following were dominating: among anseriformes - greater white-fronted goose – *Anser albifrons* (76.7%), among

shore birds - ruff – *Philomachus pugnax* (56.1%) and sandpipers – *Calidris spp.*(13.3%), and among pelicans - cormorant – *Phalacrocorax carbo* – gave 100% of quantity.

Table 4.9. Taxonomic Description of Migration Ornithological Complex within EuroCape Wind Park, Buffer Zones and Adjacent Territories in March 2016

Series	WP and buffer zones		Adjacent territories		∑	
	n species	n specimens	n species	n specimens	n species	n specimens
Anseriformes	1	65	4	54	**4**	**119**
Birds of prey	4	8	1	4	**4**	**12**
Shore birds	2	26	7	103	**7**	**129**
Pigeons	1	4	1	1	**1**	**5**
Perching birds	17	238	4	23	**19**	**261**
Total	**25**	**341**	**17**	**185**	**35**	**526**

Table 4.10. Taxonomic Description of Migration Ornithological Complex within EuroCape Wind Park, Buffer Zones and Adjacent Territories in April 2016

Series	WP and buffer zones		Adjacent territories		∑	
	n species	n specimens	n species	n specimens	n species	n specimens
Grebes	-	-	1	5	**1**	**5**
Pelicans	-	-	1	30	**1**	**30**
Ciconiiformes	-	-	2	5	**2**	**5**
Anseriformes	1	110	3	72	**3**	**182**
Birds of prey	5	18	3	4	**5**	**22**
Fowl-like birds	1	4	-	-	**1**	**4**
Crane-like birds	-	-	1	18	**1**	**18**
Shore birds	2	185	12	609	**12**	**794**
Pigeons	1	18	1	4	**1**	**22**
Hoopoe-like birds	1	1	-	-	**1**	**1**
Perching birds	22	938	10	155	**25**	**1,093**
Total	**33**	**1,274**	**34**	**902**	**52**	**2,176**

Table 4.11. Taxonomic Description of Migration Ornithological Complex within EuroCape Wind Park, Buffer Zones and Adjacent Territories in Spring 2016

Series	WP and buffer zones		Adjacent territories		∑	
	n species	n specimens	n species	n specimens	n species	n specimens
Grebes	-	-	1	5	**1**	**5**
Pelicans	-	-	1	30	**1**	**30**
Ciconiiformes	-	-	2	5	**2**	**5**
Anseriformes	1	175	4	126	**4**	**301**
Birds of prey	5	26	3	8	**5**	**34**
Fowl-like birds	1	4	-	-	**1**	**4**
Crane-like birds	-	-	1	18	**1**	**18**
Shore birds	3	211	12	712	**12**	**923**
Pigeons	1	22	1	5	**1**	**27**
Hoopoe-like birds	1	1	-	-	**1**	**1**
Perching birds	24	1,176	12	178	**25**	**1,354**
Total	**36**	**1,615**	**37**	**1,087**	**54**	**2,702**

When comparing the ornithological situation that had emerged within EuroCape Wind Park, its buffer zones and adjacent territories among themselves, the discrepancies, which serve confirmation of bird inclination to proper biotopes, were revealed definitely. When analysing materials presented as diagrams in Fig. 4.13, we can see that representatives of perching birds (*Passeriformes*) were dominants by quantity of birds in the area of EuroCape Wind Park during the whole spring, but representatives of shore birds (*Charadriiformes*) – in the adjacent territories. Subdominants in March were following: species of anseriformes in the territory of the wind park and in the adjacent territories, but in April – species of shore birds at the wind park sites and perching birds in the adjacent territories.

From the point of view of species representation of taxons, it is logical conclusion about definite dependence of bird quantity on number of species within each of dominating taxons (Fig. 4.13 - 4.14).

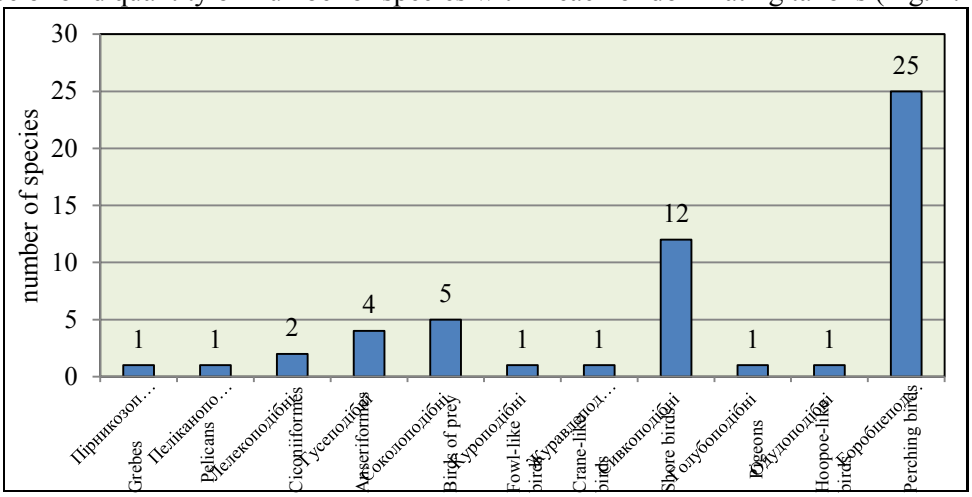
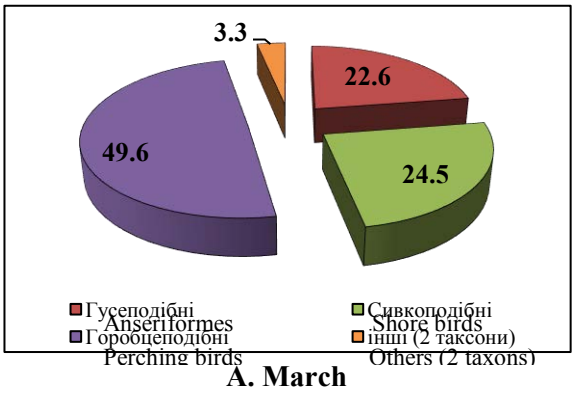
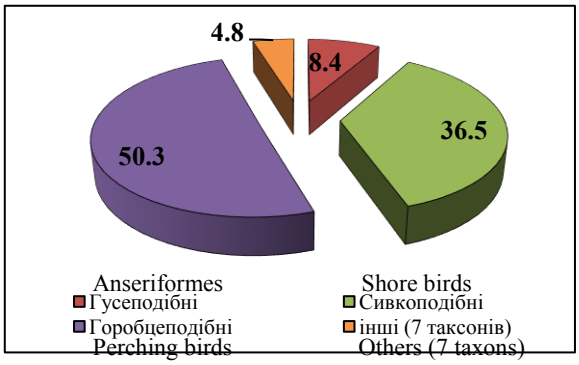


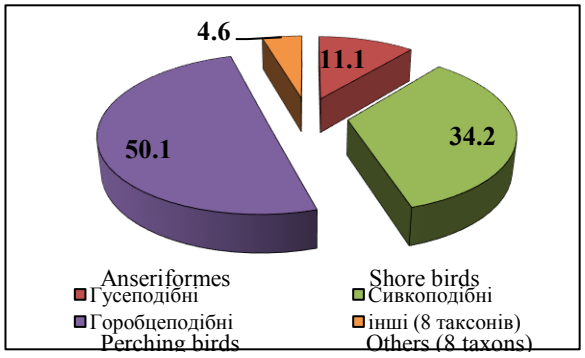
Fig. 4.12. Species representation of bird taxons registered within EuroCape Wind Park, buffer zones and adjacent territories in spring 2016



A. March



B. April



C. Spring, 2016

Fig. 4.13. Taxonomic description of ornithological complex of EuroCape Wind Park and adjacent territories in March (A), April (B) and in spring, 2016 (C)
(number of birds in %)

Quantitative characteristic

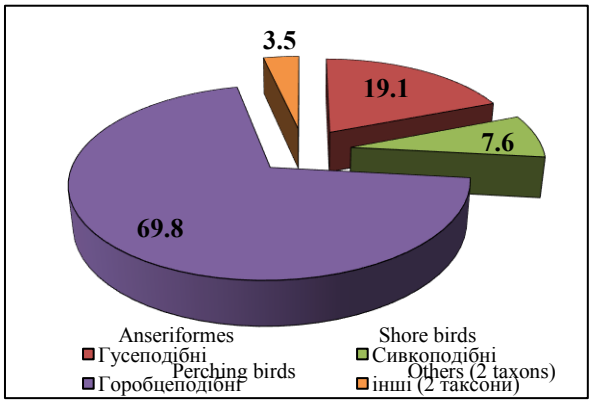
The total quantity of 54 registered species of birds is 2,702 specimens, 754 specimens of which (or 27.9% of all registered birds) were observed directly at the sites of EuroCape Wind Park, 861 specimens (31.9%) – in the buffer zones of 1 and 2 km, and 1,087 specimens (40.2%) – in the adjacent territories. Such correlation of birds by different territories is slightly unusual, owing to relatively small area of the wind park in comparison with the area of the adjacent plots, and higher diversity of biotopes in the latter, and may be caused by transit migratory movements of birds through the territory of the designed wind park (Tables 4.12 - 4.13).

European starling (*Sturnus vulgaris*), greater white-fronted goose (*Anser albifrons*) and corn bunting (*Emberiza calandra*) were the most numerous at the wind park sites and in the buffer zones, 848 specimens of them (or 46.1%) were observed. Quantity of other bird species was 993 specimens.

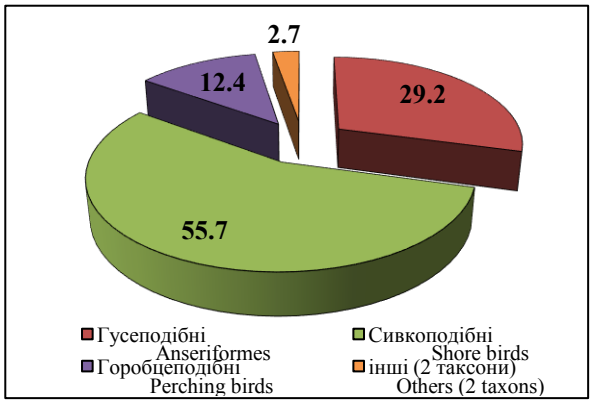
612 specimens of semi-aquatic birds and 1,229 specimens of upland birds have been counted at the wind park sites and in the buffer zones.

In consideration of the location of the Molochnyi Estuary Wetland near to EuroCape Wind Park sites, the domination of semi-aquatic bird species would be expected in the adjacent territories; analysis of obtained results shows just very regularity. So, 896 specimens (or 82.4%) of bird species that are biotopically attracted to wetlands have been registered here over the whole period of spring observations.

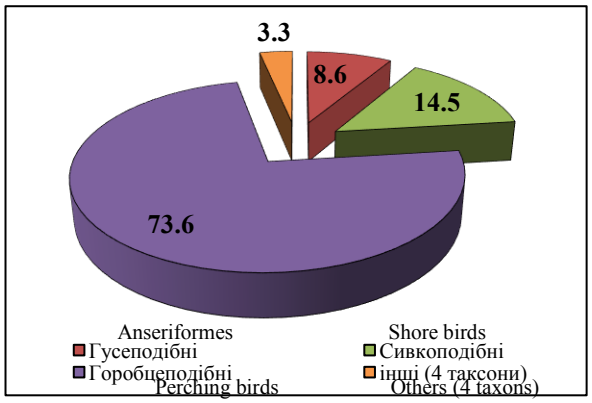
Following species dominated here: ruff (*Philomachus pugnax*), black-headed gull (*Larus ridibundus*) and dunlin (*Calidris alpina*). Quantity of upland species in the adjacent territories was 191 specimens over the whole period of observations. The most numerous among them were white wagtail (*Motacilla alba*), European starling (*Sturnus vulgaris*) and yellow wagtail (*Motacilla flava*).



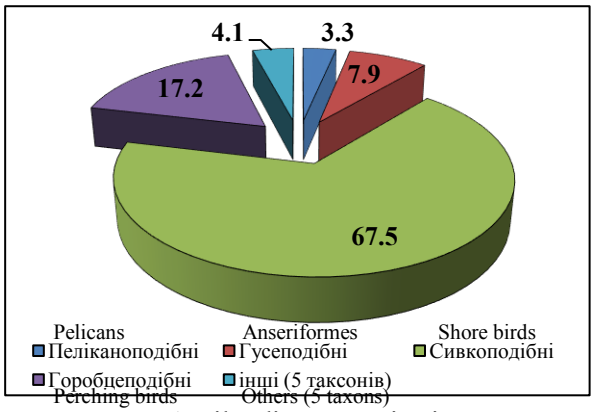
A. March, WP and buffer zones



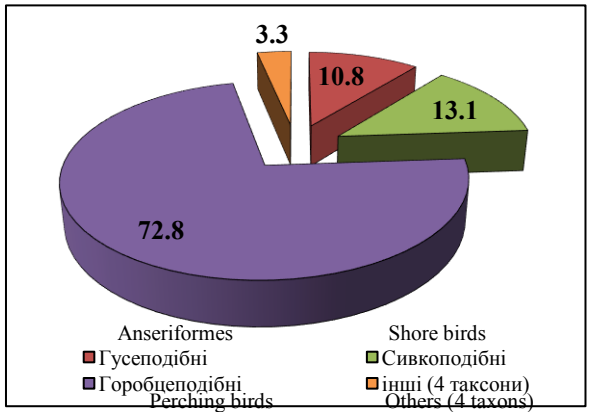
B. March, adjacent territories



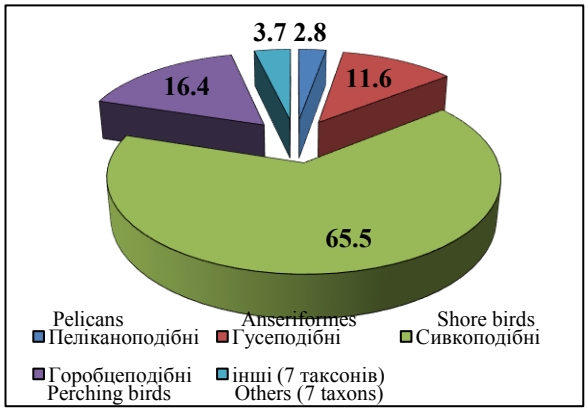
C. April, WP and buffer zones



D. April, adjacent territories



E. Spring 2016, WP and buffer zones



F. Spring 2016, adjacent territories

Fig. 4.14. Comparative taxonomic description of the ornithological complex of EuroCape Wind Park sites and adjacent territories in spring 2016 (number of birds in %)

More detailed description of bird species composition and distribution at EuroCape Wind Park sites, in buffer zones and within adjacent territories during spring migration is given in Tables 4.12 - 4.13 and in Annex 1 (Tables 1.2 - 1.7 and AutoCAD schematic maps, Fig. Д 1.2 - Д 1.7).

The total quantity of birds that were registered in the spring passage is 2,702 specimens. Part of these birds was in migration status (1,771 specimens), which is subdivided into transit one, when birds pass long distances without stop within EuroCape Wind Park, and feeding one, when birds fly on small distances in search of forage. Analysis of such distribution shows the domination of transit migrants (1,371 specimens, or 77.4% of the total number of migrating birds) over the feeding ones (400 specimens, or 22.6%).

Table 4.12. Description of Birds' Spring Migration at EuroCape Wind Park, in Buffer Zones and Adjacent Territories in 2016

Parameters		Date			Total	
		20.03	8.04	20.04	abs.	%
Total species		**35**	**37**	**34**	**54**	**100**
Absolute quantity		**526**	**1,380**	**796**	**2,702**	**100**
Total migrants	species	17	22	18	**31**	**-**
	quantity	318	975	478	**1,771**	**65.54**
Feeding migrants	species	8	13	14	**17**	**-**
	quantity	116	158	126	**400**	**22.59**
Transit migrants	species	10	11	5	**16**	**-**
	quantity	202	817	352	**1,371**	**77.41**
Censuses	species	29	32	33	**49**	**-**
	quantity	208	405	318	**931**	**34.46**
Semi-aquatic	species	11	13	13	**21**	**38.88**
	quantity	248	533	295	**1,076**	**39.82**
Upland	species	24	24	21	**33**	**61.12**
	quantity	278	847	501	**1,626**	**60.18**
Direction	N	100	241	199	**540**	**30.49**
	NE	125	662	85	**872**	**49.24**
	E	40	22	10	**72**	**4.06**
	SE	10	7	-	**17**	**0.96**
	S	23	16	113	**152**	**8.58**
	SW	7	3	19	**29**	**1.64**
	W	-	17	8	**25**	**1.41**
	NW	13	7	44	**64**	**3.62**
Altitudes	0 - 10	192	221	285	**698**	**39.42**
	10 - 25	33	49	56	**138**	**7.79**
	25 - 50	-	567	137	**704**	**39.75**
	50 - 100	-	-	-	**-**	**-**
	100 - 150	-	-	-	**-**	**-**
	150 - 200	-	-	-	**-**	**-**
	> 200	93	138	-	**231**	**13.04**

Table 4.13. General Description of Migration Ornithological Complex in EuroCape Wind Park Territory, in Buffer Zones and within Adjacent Territories in Spring 2016

No.	Species	WP and buffer zones			Adjacent territories			Total
		20.03	8.04	20.04	20.03	8.04	20.04	
1	Great crested grebe (*Podiceps cristatus*)					5		**5**
2	Cormorant (*Phalacrocorax carbo*)					30		**30**
3	Great white egret (*Egretta alba*)						3	**3**
4	Grey heron (*Ardea cinerea*)						2	**2**
5	Greater white-fronted goose (*Anser albifrons*)	65	110		28	28		**231**
6	Mute swan (*Cygnus olor*)				8	5		**13**
7	Common shelduck (*Tadorna tadorna*)				6			**6**
8	Mallard (*Anas platyrhynchos*)				12	39		**51**
9	Eurasian sparrowhawk (*Accipiter nisus*)	1	1					**2**
10	Rough-legged buzzard (*Buteo lagopus*)	3	1		4	2		**10**
11	Common buzzard (*Buteo buteo*)	2	2	1			1	**6**
12	Red-footed falcon (*Falco vespertinus*)			1				**1**
13	Common kestrel (*Falco tinnunculus*)	2	3	9			1	**15**

No.	Species		WP and buffer zones			Adjacent territories			Total
			20.03	8.04	20.04	20.03	8.04	20.04	
14	Grey partridge (*Perdix perdix*)				4				**4**
15	Eurasian coot (*Fulica atra*)						18		**18**
16	Northern lapwing (*Vanellus vanellus*)					3	7	6	**16**
17	Grey plover (*Pluvialis squatarola*)							2	**2**
18	Turnstone (*Arenaria interpres*)							6	**6**
19	Pied avocet (*Recurvirostra avosetta*)					5	15	8	**28**
20	Eurasian oystercatcher (*Haematopus ostralegus*)							2	**2**
21	Common redshank (*Tringa totanus*)					2		4	**6**
22	Ruff (*Philomachus pugnax*)			45	46	71	144	211	**517**
23	Dunlin (*Calidris alpina*)						20	45	**65**
	Sandpipers (Calidris spp.)				80			43	**123**
24	Eurasian curlew (*Numenius arquata*)					2		5	**7**
25	Black-headed gull (*Larus ridibundus*)		7			14	38	26	**85**
26	Yellow-legged gull (*Larus cachinnans*)		19	7	7	6	10	5	**54**
27	*Terns* (*Chlidonias spp.*)						12		**12**
28	Woodpigeon (*Columba palumbus*)		4	11	7	1		4	**27**
29	Hoopoe (*Upupa epops*)				1				**1**
30	Barn swallow (*Hirundo rustica*)				28				**28**
31	Crested lark (*Galerida cristata*)		2	3				2	**7**
32	Skylark (*Alauda arvensis*)			9	2	6			**17**
33	Yellow wagtail (*Motacilla flava*)							21	**21**
34	White wagtail (*Motacilla alba*)				8		58	8	**74**
35	European starling (*Sturnus vulgaris*)		62	422	41		20	11	**556**
36	European magpie (*Pica pica*)			9	13				**22**
37	Rook (*Corvus frugilegus*)		4	48	34	11		8	**105**
38	Hooded crow (*Corvus cornix*)		6	14	12			2	**34**
39	Wren (*Troglodytes troglodytes*)		1	2					**3**
40	*Warblers sp.* (*Phylloscopus sp.*)			2					**2**
41	Pied flycatcher (*Ficedula hypoleuca*)		5						**5**
42	Collared flycatcher (*Ficedula albicollis*)		2						**2**
43	Northern wheatear (*Oenanthe oenanthe*)			2		2		3	**7**
44	Black redstart (*Phoenicurus ochruros*)		2	5		4			**11**
45	European robin (*Erithacus rubecula*)		2	2					**4**
46	Fieldfare (*Turdus pilaris*)		4	6					**10**
47	Blackbird (*Turdus merula*)		7	18			2		**27**
48	Eurasian tree sparrow (*Passer montanus*)		6		30				**36**
49	Brambling (*Fringilla montifringilla*)		11	12					**23**
50	Chaffinch (*Fringilla coelebs*)		45	48			4		**97**
51	European greenfinch (*Chloris chloris*)		8	22	5				**35**
52	European goldfinch (*Carduelis carduelis*)		5	18	5				**28**
53	Corn bunting (*Emberiza calandra*)		66	55	27		16		**164**
54	Yellowhammer (*Emberiza citrinella*)				6				**6**
	Perching birds (*Passer spp.*)			30					**30**
	Total	**species**	**25**	**26**	**20**	**17**	**19**	**23**	**54**
		birds	**341**	**907**	**367**	**185**	**473**	**429**	**2,702**

Species diversity of birds generally was stable during the migration, and varied in the range from 17 species (20.03) to 22 (8.04), with decrease of species diversity to 18 species towards the end of April. The tendency among birds that were registered at the site of EuroCape Wind Park has not changed in the course of censuses, but species diversity increased from 29 species in March to 32-33 species in April. Maximum species diversity was observed on the 20 of April (33 counted species), although quantity of birds was the highest on the 8 of April (Fig. 4.15 - 4.17).

When analysing the dynamics of birds' quantity, it shall be noticed that ruff (*Philomachus pugnax*) was a dominant among the migrants; European starling (*Sturnus vulgaris*) and greater white-fronted goose (*Anser albifrons*) were subdominants. Greater white-fronted goose was observed in passage mainly towards the end of March (when it made up almost a third of counted migrants – 29.3%), European starling – at the beginning of April (42.1% of migrants counted on 8.04.), and ruff – towards the end of April (38.3% of migrating birds counted on 20.04).

Ratio of feeding and transit migrants is rather indicative migration characteristic, which defines the intensity of migration (Table 4.12). We can see that the dynamics of feeding migrants' quantity has a tendency towards stability of absolute indices (116 - 158 specimens), while number of transit migrants is not high at first (202 specimens on March, 20), then their quantity increases dramatically (817 specimens at the beginning of April), but already towards the end of the month decreases again (to 352 specimens counted on April, 20) (Table 2.6). Such state of ornithological situation indicates the ceasing of an active transit migration within the sites of EuroCape Wind Park.

Birds' quantity, in general, was not high in March (35 species, 526 specimens) (Fig. 4.15). In April the situation was as follows: peak of quantity was observed on 2.04 (1,380 specimens, absolute index over the whole spring), with a little increase also in species diversity (37 species); towards the end of the month, on April, 20, it decreases again, making up 796 specimens of 34 species (Fig. 4.17). This may be explained by the fact that active migration passages have already ceased at that period.

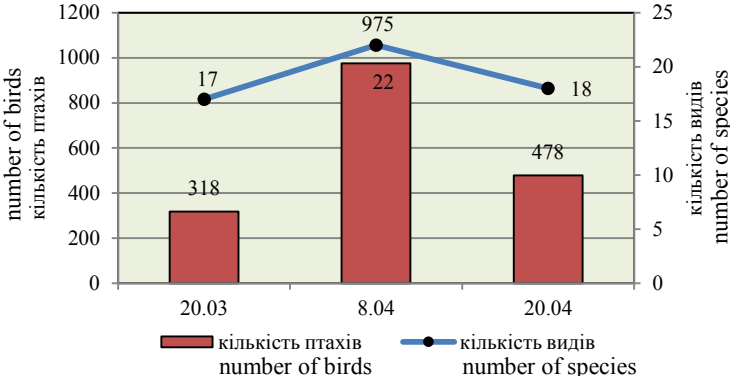


Fig. 4.15. Species diversity and number of birds that migrated through the territory of EuroCape Wind Park in spring 2016

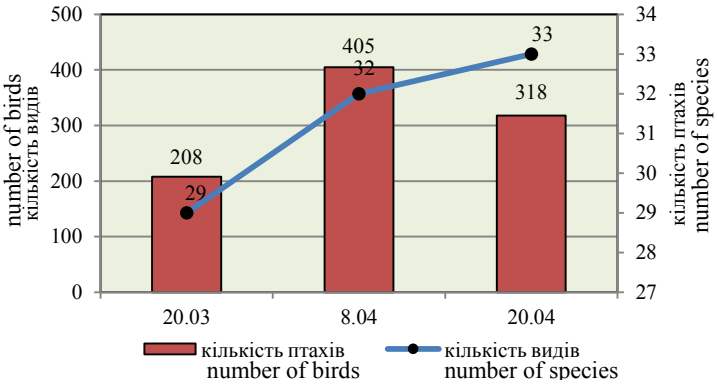


Fig. 4.16. Species diversity and number of birds registered in the course of censuses at EuroCape Wind Park in spring 2016

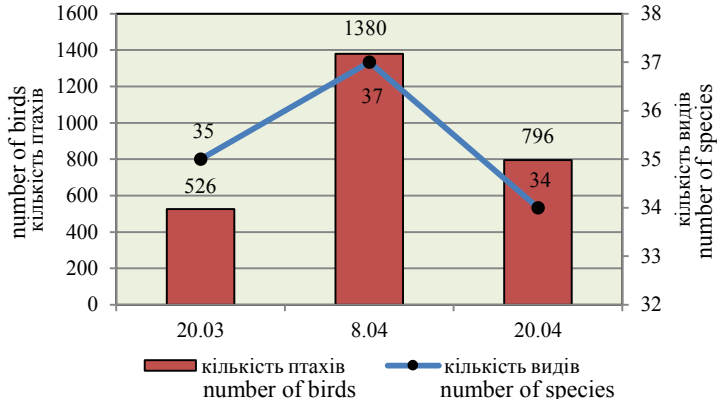


Fig. 4.17. Species diversity and number of birds within EuroCape Wind Park area in spring 2016

Biotopic distribution of birds

Species diversity of birds and their quantity depend to some extent on the number of distinguished biotopes (Fig. 4.18 - 4.19). In the investigated region we have revealed such landscape-biotopic units: agrocoenosis (agricultural lands), agricultural hedgerows and man-made forests, steppe plots of open space, offshore strip and human settlements. Each of biotopes is a territory of occurrence of individual bird groups (Table 4.14).

Table 4.14. Biotopic Distribution of Birds within EuroCape Wind Park, Buffer Zones and Adjacent Territories in Spring 2016

Zones \ Biotopes		Biotopes of birds' distribution				∑	
		water areas	open space	agricultural hedgerows	human settlements	abs.	%
Wind park sites		-	398	356	-	**754**	**27.9**
Buffer zones		-	360	343	158	**861**	**31.9**
Adjacent territories		577	175	213	122	**1,087**	**40.2**
Total	**abs.**	**577**	**933**	**912**	**280**	**2,702**	**100**
	%	**21.4**	**34.5**	**33.7**	**10.4**	**100**	

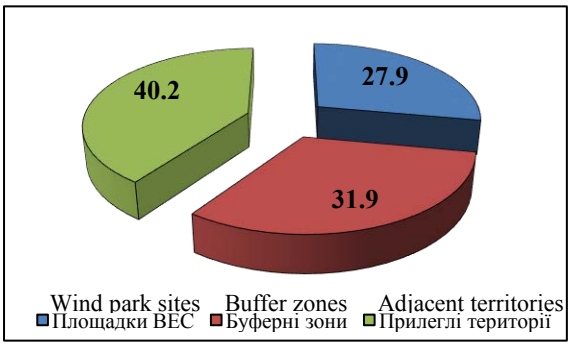


Fig. 4.18. Distribution of birds throughout functional zones of the designed territory, %

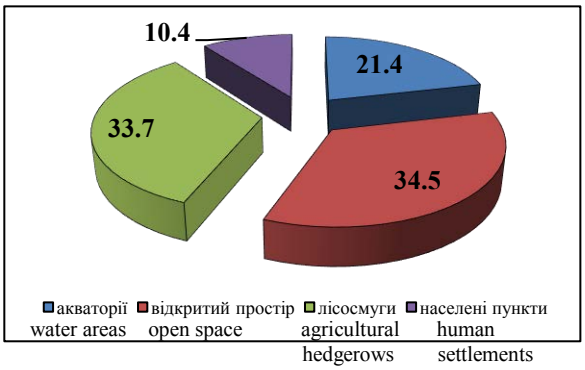


Fig. 4.19. Biotopic distribution of birds throughout the designed territory, %

In consideration of location of the wind park sites near to the Molochnyi Estuary Wetlands, the domination of semi-aquatic species would be logically expected, but analysis of the field material has not revealed such regularity. 21 species of semi-aquatic birds were registered with quantity of 1,076 specimens, or 39.8%, the overwhelming majority of which had been observed in the buffer zones and adjacent territories, that is quite clear owing to impoverished forage resources of biotopes of the Molochnyi Estuary. However, if consider the territory of EuroCape Wind Park and the adjacent territories separately, then the ratio will be different (33.2% were semi-aquatic birds at the wind park sites and in the buffer zones, and 82.4% - in the adjacent territories). We observed mostly ruff (*Philomachus pugnax*), greater white-fronted goose (*Anser albifrons*) and sandpipers (*Calidris spp.*), which had not formed considerable gatherings. 33 species of birds with quantity of 1,626 specimens were registered at the uplands (60.2%). Dominants here were following: European starling (*Sturnus vulgaris*), corn bunting (*Emberiza calandra*) and rook (*Corvus frugilegus*), which made up 50.7% of all counted upland birds.

While carrying out researches it turned out that the plots of open space were the most visited during the spring migration (933 specimens, 34.5%), as well as agricultural hedgerows and man-made forests (912 specimens, 33.7%), but water areas of the Molochnyi Estuary Wetland attracted 577 specimens (21.4%). Following villages had been observed in the course of censuses: Mordvynivka, Nadezhdine, Girsivka and Dunaivka (regularly), as well as Volna, Divnynske and Georgiyivka (periodically), where 280 specimens (10.4%) were found (Table 4.14).

Directions of the spring migration of 2016

North-eastern (49.2% of all migrants) and northern (30.5%) directions prevailed among directions of the spring passage (Table 4.15, Fig. 4.20). 1,412 specimens flew in these directions. Generally they were semi-aquatic birds (gulls, ruff and greater white-fronted goose), as well as small perching birds (corn bunting, wagtails and starling). In addition, migration bird movements were observed in southern (152 specimens, 8.6%), eastern (72 specimens, 4.1%) and north-western (64 specimens, 3.6%) directions. Birds' passage in other directions was not numerous (Table 4.15).

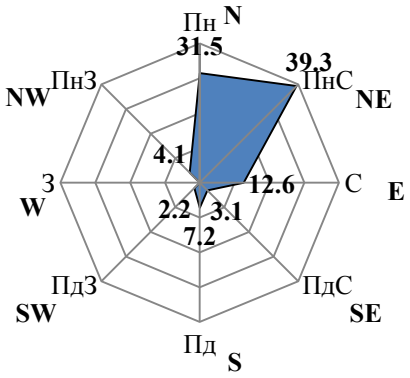
Such directions are typical for given terrain and season, and a little percentage of migrants that flew in southern direction may be explained by feeding movements of perching birds and shore birds.

When analysing the directions of migration in different months of observations, we shall say about the classical pattern of passage both in March and in April (the majority of birds flew to the

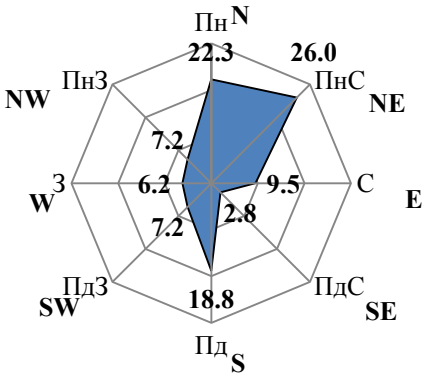
north and the north-east) (Fig. 4.20). More detailed description of the directions of spring migration is given in Table 4.15 and in Fig. 4.20.

Table 4.15. Description of the Directions of Spring Migration within EuroCape Wind Park in 2016

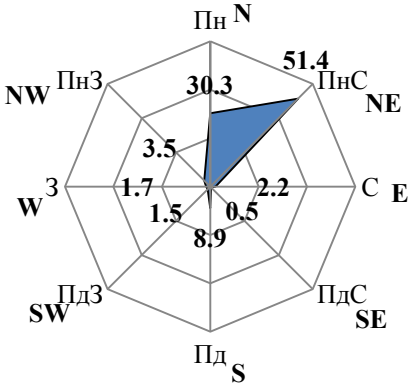
Compass point	March		April		Spring, 2016	
	abs.	%	abs.	%	abs.	%
N	100	31.5	440	30.3	**540**	**30.49**
NE	125	39.3	747	51.4	**872**	**49.24**
E	40	12.6	32	2.2	**72**	**4.06**
SE	10	3.1	7	0.5	**17**	**0.96**
S	23	7.2	129	8.9	**152**	**8.58**
SW	7	2.2	22	1.5	**29**	**1.64**
W	-	-	25	1.7	**25**	**1.41**
NW	13	4.1	51	3.5	**64**	**3.62**
Total	**318**	**100**	**1,453**	**100**	**1,771**	**100**



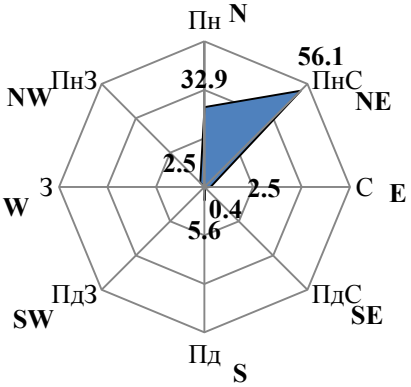
A. All migrants, March



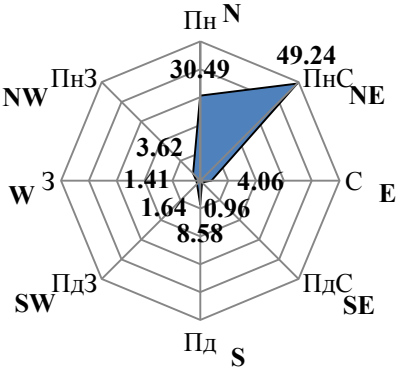
D. Feeding migrants, spring



B. All migrants, April



E. Transit migrants, spring



C. All migrants, spring 2016

Fig. 4.20. Description of directions of birds' passage within EuroCape Wind Park in spring 2016 (quantity in %)

When comparing the directions of birds' passage in the course of feeding and transit migrations, we shall say about narrow directivity of transit migrants (north-east and north) and wide range of flying away of feeding migrants (with different intensity in all directions, with prevailing, again, the

north-eastern and northern, as well as southern directions). Explanation of this fact lies in the aspect of diurnal activity of different groups of migrants. So, mass scale of the process is a peculiarity of transit passage of birds, with the involvement of rather large number of birds and species, purposeful active type of flight (flapping and soaring) in proper direction, long distance of single passage (up to 600 km), without delay and stop in the migration route. Therefore, feeding migrants show somewhat different type of behaviour, which is defined by long-term staying of birds within the region, daily feeding passages from the roosts to feeding places, the whole range of migration directions caused only by search of forage, formation of gatherings different by size, short distances of passages. Just such pattern has been revealed in the course of observations within EuroCape Wind Park in spring 2016 (Fig. 4.20).

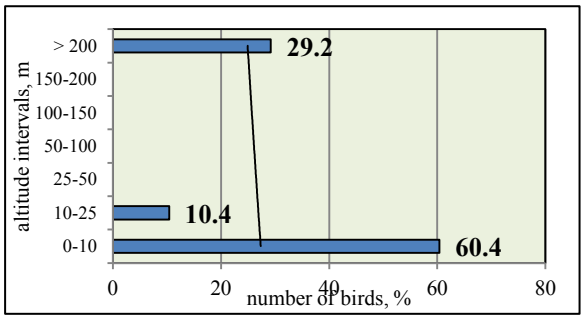
Description of altitude intervals of birds' movement

Table 4.16. Description of the Main Altitudes of the Spring Migration within EuroCape Wind Park in 2016

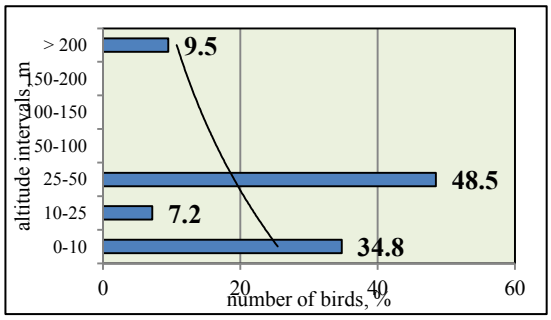
Altitude intervals	March		April		Spring, 2016	
	abs.	%	abs.	%	abs.	%
0 - 10	192	60.4	506	34.8	**698**	**39.42**
10 - 25	33	10.4	105	7.2	**138**	**7.79**
25 - 50	-	-	704	48.5	**704**	**39.75**
50 - 100	-	-	-	-	**-**	**-**
100 - 150	-	-	-	-	**-**	**-**
150 - 200	-	-	-	-	**-**	**-**
> 200	93	29.2	138	9.5	**231**	**13.04**
Total	**318**	**100**	**1,453**	**100**	**1,771**	**100**

High-altitude bird movements within EuroCape Wind Park and adjacent territories in spring 2016 were distributed in the following way.

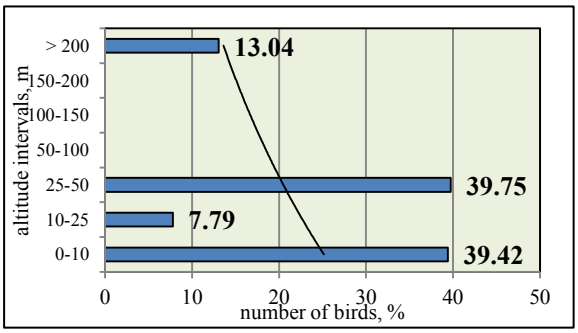
In March the majority of birds (192 specimens, or 70.8% of the total number of migrants), which were registered at the sites of EuroCape Wind Park, within buffer zones and in the adjacent territories, had been observed either near the ground (192 specimens) or in flight within the altitude interval under 25 m (33 specimens). There has not been counted any flock in the interval of 50 - 170 m potentially dangerous for birds. Besides, 93 specimens (29.2%) of birds were counted at the altitudes over 200 m (Table 4.16, Fig. 4.21).



A. March, 2016



B. April, 2016



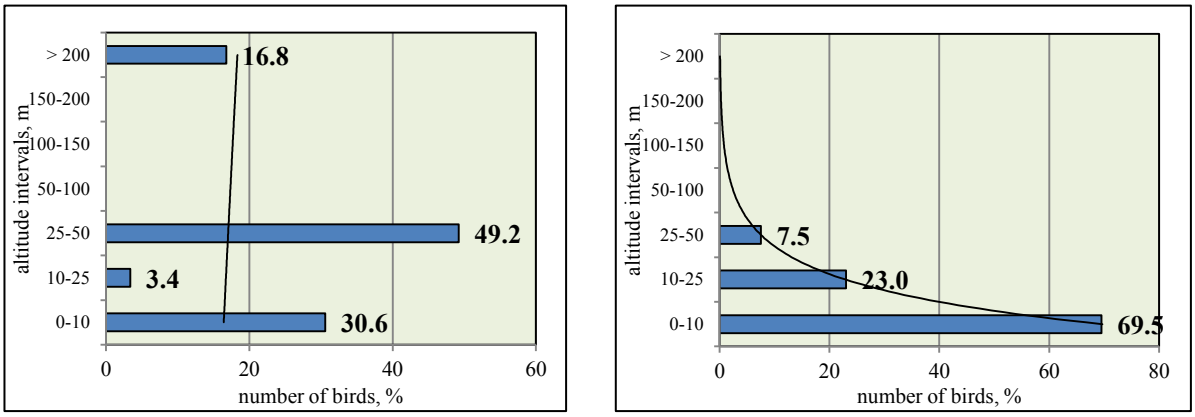
C. Spring, 2016

Fig. 4.21. Description of altitudes of birds' passage within EuroCape Wind Park during the spring migration (quantity in %)

In April the tendency has slightly changed. 1,315 specimens, or 90.5% of birds were observed within the altitude interval under 50 m. 138 specimens (9.5%) more were registered at the altitudes over 200 m. Also there are certain regularities in the passage of feeding and transit migrants. If transit migrants selected altitudes up to 10 m (small perching birds) – 30.6%, 25 - 50 m (gulls, cormorant,

rook) – 49.2% and over 300 m (greater white-fronted goose), then feeding migrants were counted mainly near the ground (69.5%), or at the altitudes of 10 - 25 m (23.0%) (Fig. 4.22). Such data are anticipated and the pattern of birds' distribution by altitudes of flights is traditional for the territory of the wind park sites and for this season.

When comparing the passage altitudes for different groups of birds, we shall notice that transit migrants flew higher than feeding ones. Especially it is noticeable in March, when big (by size) birds (swans, geese, cormorants, gulls, etc.) migrate over long distances. Owing to it the altitudes of passage are rather considerable; the majority of birds select intervals over 200 m. In April, when the species composition of migrants is changing toward the domination of perching birds, the altitudes of passage decrease both for transit and for feeding migrants. It shall be noted that towards the end of April, 2016 the quantity of transit migrants in the territory of EuroCape Wind Park was no longer high (Table 4.12) that indicates the ceasing of an active migratory process in given territory.



transit migrants, spring 2016 feeding migrants, spring 2016

Fig. 4.22. Comparison of passage altitudes for feeding and transit migrants within EuroCape Wind Park during the spring migration of 2016

Exponential line of the trend in the linear diagrams of Fig. 10 and 11 confirms mathematically the hypothesis about safety of the altitudes of birds' passage within EuroCape Wind Park during the spring migration of 2016. Also, birds that use altitude intervals over 50 to 200 m have not been counted (Fig. 4.21 - 4.22).

4.3. Distribution of birds registered during the spring migration of 2016 according to the nature conservation lists of national and international importance

Bird species listed in the Red Data Book of Ukraine

3 species of birds listed in the Red Data Book of Ukraine were recorded in the researched territory in spring 2016 (Tables 4.17 - 4.19): pied avocet – *Recurvirostra avosetta*, Eurasian oystercatcher – *Haematopus ostralegus* and Eurasian curlew – *Numenius arquata*. All of them have been observed in the adjacent territories. At that, number of rare species and quantity of birds were not the same in different months: if in March 7 specimens of 2 species were counted, then in April – 30 specimens of 3 species.

Birds' quantity of rare species is small everywhere; mainly, they were counted one at a time or in small flocks of several specimens. In general, quantity of rare avifauna has not exceeded 1.4% of all observed birds in spring 2016.

Table 4.17. Birds Listed in the Red Data Book of Ukraine according to the Results of Censuses in March 2016

No.	Species	Wind park sites	Buffer zones	Adjacent territories	∑
1	Pied avocet (*Recurvirostra avosetta*)	-	-	5	**5**

2	Eurasian curlew (*Numenius arquata*)	-	-	2	**2**
	Total birds listed in the Red Data Book of Ukraine	-	-	7	**7**
	Total birds within the plot	**214**	**127**	**185**	**526**
	% of the total quantity	**-**	**-**	**3.8**	**1.3**

Table 4.18. Birds Listed in the Red Data Book of Ukraine according to the Results of Censuses in April 2016

No.	Species	Wind park sites	Buffer zones	Adjacent territories	∑
1	Pied avocet (*Recurvirostra avosetta*)	-	-	23	**23**
2	Eurasian oystercatcher (*Haematopus ostralegus*)	-	-	2	**2**
3	Eurasian curlew (*Numenius arquata*)	-	-	5	**5**
	Total birds listed in the Red Data Book of Ukraine	-	-	30	**30**
	Total birds within the plot	**540**	**734**	**902**	**2,176**
	% of the total quantity	**-**	**-**	**3.3**	**1.4**

Table 4.19. Birds Listed in the Red Data Book of Ukraine according to the Results of Censuses in Spring 2016

No.	Species	Wind park sites	Buffer zones	Adjacent territories	∑
1	Pied avocet (*Recurvirostra avosetta*)	-	-	28	**28**
2	Eurasian oystercatcher (*Haematopus ostralegus*)	-	-	2	**2**
3	Eurasian curlew (*Numenius arquata*)	-	-	7	**7**
	Total birds listed in the Red Data Book of Ukraine	-	-	37	**37**
	Total birds within the plot	**754**	**861**	**1,087**	**2,702**
	% of the total quantity	**-**	**-**	**3.4**	**1.4**

In addition to revealing representatives of avifauna during spring migration, their quantity and distribution throughout the researched territory, the necessity of their ranking in accordance with nature conservation lists have arisen: the Red Data Book of Ukraine, the List of the International Union for Conservation of Nature (IUCN), the European Red List, the Bonn and Bern Conventions, as well as the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Table 4.20).

Table 4.20. Distribution of Avifauna of Spring Migration of 2016 according to Nature Conservation Lists

No.	English name	Latin name	Status	ERL	RDBU	IUCN	BERN	BONN	CITES
1	Great crested grebe	*Podiceps cristatus*	m, w, n				3		
2	Cormorant	*Phalacrocorax carbo*	m, w, n						
3	Great white egret	*Egretta alba*	m, w, n				2	2	
4	Grey heron	*Ardea cinerea*	m, w, n				3		
5	Greater white-fronted goose	*Anser albifrons*	m, w				3	1, 2	
6	Mute swan	*Cygnus olor*	m, w, n				3	1, 2	
7	Common shelduck	*Tadorna tadorna*	m, w, n				2	1, 2	
8	Mallard	*Anas platyrhynchos*	m, w, n				3	1, 2	
9	Eurasian sparrowhawk	*Accipiter nisus*	m, w				2	1, 2	2
10	Common buzzard	*Buteo buteo*	m, w, n				2	1, 2	2
11	Rough-legged buzzard	*Buteo lagopus*	m, w				2	1, 2	2
12	Red-footed falcon	*Falco vespertinus*	m, n	VU			2	2	2
13	Common kestrel	*Falco tinnunculus*	m, w, n				2	2	2
14	Grey partridge	*Perdix perdix*	m, w, n	VU			3		
15	Eurasian coot	*Fulica atra*	m, w, n				3	2	
16	Grey plover	*Pluvialis squatarola*	m				3	2	
17	Northern lapwing	*Vanellus vanellus*	m, w, n	VU			3	2	
18	Turnstone	*Arenaria interpres*	m				2	2	

No.	English name	Latin name	Status	ERL	RDBU	IUCN	BERN	BONN	CITES
19	Pied avocet	*Recurvirostra avosetta*	m, n		RARE	LC	2	2	
20	Eurasian oystercatcher	*Haematopus ostralegus*	m, n		VU	LC	3		
21	Common redshank	*Tringa totanus*	m, n				3	1, 2	
22	Ruff	*Philomachus pugnax*	m				3	1, 2	
23	Dunlin	*Calidris alpina*	m				2	1, 2	
24	Eurasian curlew	*Numenius arquata*	m, w		EN	NT	3	1, 2	
25	Black-headed gull	*Larus ridibundus*	m, w, n				3		
26	Yellow-legged gull	*Larus cachinnans*	m, w, n						
27	Woodpigeon	*Columba palumbus*	m, w, n						
28	Hoopoe	*Upupa epops*	m, n				2		
29	Barn swallow	*Hirundo rustica*	m, n				2		
30	Skylark	*Alauda arvensis*	m, w, n				3		
31	Crested lark	*Galerida cristata*	m, w, n				3		
32	White wagtail	*Motacilla alba*	m, w, n				2		
33	Yellow wagtail	*Motacilla flava*	m, n				2		
34	European starling	*Sturnus vulgaris*	m, w, n				2		
35	European magpie	*Pica pica*	m, w, n				2		
36	Rook	*Corvus frugilegus*	m, w, n				2		
37	Hooded crow	*Corvus cornix*	m, w, n				2		
38	Wren	*Troglodytes troglodytes*	m, w, n				2		
39	Pied flycatcher	*Ficedula hypoleuca*	m				2		
40	Collared flycatcher	*Ficedula albicollis*	m				2		
41	Northern wheatear	*Oenanthe oenanthe*	m, n				2		
42	Black redstart	*Phoenicurus ochruros*	m, n				2	2	
43	European robin	*Erithacus rubecula*	m, n						
44	Fieldfare	*Turdus pilaris*	m, w				3	2	
45	Blackbird	*Turdus merula*	m, w, n				3	2	
46	Eurasian tree sparrow	*Passer montanus*	m, w, n				3		
47	Brambling	*Fringilla montifringilla*	m, w				2		
48	Chaffinch	*Fringilla coelebs*	m, w, n				3		
49	European greenfinch	*Chloris chloris*	m, w, n				2		
50	European goldfinch	*Carduelis carduelis*	m, w, n				2		
51	Corn bunting	*Emberiza calandra*	m, w, n				3		
52	Yellowhammer	*Emberiza citrinella*	m, w, n				2		

Notes: **Status**: m – species is found in the course of seasonal migrations; w – species occurs in winter period; n – species is found in nesting period.

RDBU – Conservation status of the Red Data Book of Ukraine: **EN** – endangered; **VU** – vulnerable; **RARE** – rare; **UR** – unrated.

IUCN – Conservation status of the International Union for Conservation of Nature: **EN** – endangered; **NT** – near threatened; **VU** – vulnerable; **LC** – least concern.

ERL – Conservation status of the European Red List: **VU –** vulnerable, species that may be rated to an endangered category in the near future, if the effect of factors influencing on their condition continues; **EN –** endangered, species that are seriously at risk of extinction; their preservation is hardly probable, reproduction is impossible without carrying out special measures.

BONN – the Bonn Convention: **Annex I (1)** includes species that are in danger of extinction; **Annex II (2)** includes species, state of which is unfavourable, preservation and regulation of using which needs international agreements, as well as that species, state of which might be considerably improved as a result of international cooperation, which may be carried out based on international agreements. The same species may be included both to Annex I and to Annex II.

BERN – the Bern Convention, or the Convention on the Conservation of European Wild Flora and Fauna and Natural Habitats, includes **Annex II (2)** - list of fauna species that are subject to special protection; **Annex III (3)** - fauna species that are subject to protection.

CITES – the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora: **Annex I (1)** includes species "that are in danger of extinction, trade in which causes or may cause negative influence on their existence. Trade in specimens of such species must be

especially severely regulated for that purpose to do not endanger their survival for the future, and must be allowed only in exceptional cases"; **Annex II (2)** includes: "a) all species, which are not necessarily threatened with extinction for now, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and b) that have to be subject to regulation in order to enable the possibility to get the trade in specimens of certain species mentioned in subparagraph (a) of this paragraph under effective control".

As Table 4.20 shows, the representatives of spring ornithological complex in the region of EuroCape Wind Park, buffer zones and in the adjacent territories are listed in 6 nature conservation lists. Most of them were related to the Bern Convention (48 species of 52, or 92.3%), 26 species of which are subject to special protection, 22 species are subject to protection. Situation with relation to the Bonn Convention is interesting: 11 species among 22 species of ornithological complex, which are included in this Convention, rate to Annex II (state of which is unfavourable), and 11 more species are included simultaneously both to Annex II and I (are in danger of extinction), which is possible in the context of this nature conservation document. 3 species are listed in the Red Data Book of Ukraine (2009), among which 1 species is endangered, 1 species – rare and 1 species - vulnerable. Also 3 species are listed in the Red List of IUCN (least concern – 2, near threatened - 1). In addition, 5 species are included in the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora, 3 species are listed in the European Red List.

With regard to a degree of bird pertaining to nature conservation lists, the following picture is being completed. 4 (7.7%) of 92 species are not listed in any of nature conservation documents: cormorant (*Phalacrocorax carbo*), yellow-legged gull (*Larus cachinnans*), woodpigeon (*Columba palumbus*) and European robin (*Erithacus rubecula*). And the overwhelming majority of the representatives of spring ornithological complex is included in 1 or 2 lists (24 and 15 species respectively), in 3 documents – 6 species (11.5%). Moreover, there have been observed species, which are listed simultaneously in 4 conservation documents: red-footed falcon (*Falco vespertinus*), pied avocet (*Recurvirostra avosetta*) and Eurasian curlew (*Numenius arquata*).

More detailed distribution of the representatives of spring migration ornithological complex according to conservation lists is given in Tables 4.21 - 4.22.

Table 4.21. Distribution of Bird Species Observed During the Spring Migration of 2016 by the Categories of Nature Conservation Lists

ERL		**RDBU**		**IUCN**		**BONN**		**BERN**		**CITES**	
category	N	category	N	category	N	category	N	category	N	category	N
VU	**3**	EN	**1**	LC	**2**	1	**-**	2	**26**	1	**-**
		VU	**1**	NT	**1**	2	**11**	3	**22**	2	**5**
		RARE	**1**			1 and 2	**11**				
∑	**3**	∑	**3**	∑	**3**	∑	**22**	∑	**48**	∑	**5**

Table 4.22. Distribution of Bird Species Observed During the Spring Migration of 2016 by the Quantity of Nature Conservation Lists

Being listed in nature conservation lists	**species**	**%**
0	4	7.7
1	24	46.2
2	15	28.8
3	6	11.5
4	3	5.8
5	-	-
6	-	-
Total	**52**	**100**

4.4. Assessment of impacts caused by the construction and operation of the designed territory of the wind park during spring migration of birds

1. Impacts caused by the construction.

1a – emissions of hazardous substances. Emissions of hazardous substances will not exceed the permissible rates during the construction, owing to absence of stationary sources of pollution and short period of construction works. There is no negative impact on migrating birds.

1b – deterring by visual effects and noise. Factor of deterring by noise is practically absent, due to the absence of considerable in quantity migration gatherings in the territory of the wind park sites. Feeding migrants move throughout the territory and have large areas of alternative forage territories in 2- kilometre buffer zone and outside it. There are greater sources of noise in the adjacent zones

(agricultural engineering, local motor roads). In addition, for the birds recorded at the wind park sites, the forage territories are more connected with crop rotations than with the project work.

Deterring by visual effects is not threatening; therefore impact of these factors on birds shall be characterized as low. From our point of view, effect of this factor for the period of migrations will lessen the risks concerning the negative impact of the wind park on birds.

1c – occupying the territory by working platforms and equipment. Physical dimensions of the wind park sites are rather large (generally, about 13,000 ha), which enable birds to fly easily past the working platforms with equipment located on them during the construction. The territory, which will be occupied by working platforms and equipment, will not exceed 1% of the total area. It will enable birds to fly easily past the working platforms with equipment located on them during the construction. Besides, the slight density of the placement of working platforms and equipment will not obstruct feeding flights of birds, due to large total area of the wind park sites and considerable distances between the wind turbines (about 500 m). According to personal observations at already operating wind parks, birds get accustomed quickly to the constructed wind parks. Therefore this negative impact on migratory birds during the construction is low, and during the operation of the wind park it is absent.

1d – loss of breeding places. Negative impact on transit migrating birds is absent, and on feeding migrants it is low. For that species, which remain within EuroCape Wind Park for nesting on completion of the migration, the loss of breeding places is not significant. Low density of birds nesting, small species composition makes possible to select nesting places without obstacles. Slight loss of nesting places, owing to the wind park construction, will have not continuous, but mosaic pattern, leaving the major part of the wind park territory for free selection of nesting places. Besides, the majority of species recorded in the course of nesting are common and widely distributed in the region, with their high quantity. Negative impact of this factor shall be estimated as low.

1e – loss of individual specimens of protected species. 3 rare species of birds have been registered in the territory of researches, which are observed in the adjacent territories: pied avocet – *Recurvirostra avosetta*, Eurasian oystercatcher – *Haematopus ostralegus* and Eurasian curlew – *Numenius arquata*.

The possibility to meet rare species is rather slight. During the registration of species in the territory of the wind park sites, the negative impacts of the wind park on them are very low. This is due to the fact that counted rare species are mainly attached to the semi-aquatic biotopes, within which their main transit movements and feeding migrations take place.

Negative impact of the wind park shall be estimated as low.

2. Impacts caused by equipment.

2a – long-time territory occupation and change of environment characteristics. As the territory of the wind park sites is represented for the most part by the anthropogenic types of biotopes (agricultural areas, agricultural hedgerows), then the creation of small (by the area) infrastructure will not be threatening for gatherings and feeding movements of birds, as the major part of the territory will remain without changes.

Analysis of field researches indicates small migration gatherings of birds and migration stops within the wind park sites. In regard to feeding migrants, recorded species are characterized by their wide distribution and the ability to manoeuvre easily throughout the territory. Negative impact on migrating birds is low.

2b – deterring by mast vertical structures. Vertical structures are the signal for short-term change of the course for migratory birds, at that the large area of the wind park enable to do it easily. Besides, slight density of the placement of equipment will not obstruct feeding flights of birds, due to large total area of the wind park and considerable distances between the wind turbines. High-power electric network lines pass near the sites. Special observations have not revealed negative impact on migrating birds of both vertical structures (towers) and horizontal ones (electric wires). Negative impact on migrating birds shall be estimated as low.

2c – barrier impact and obstacles for flight. Technical characteristics of the wind turbines create a threat for migrating birds that fly within the interval of 50 - 170 m owing to rotor motion.

According to the results of investigations in spring 2016, the major part of migrating birds (1,540 specimens, or 86.9% of the total number of migrants) flew at the altitudes up to 50 m. Also, certain part of migrants (231 specimens, 13.1%) was recorded at the altitudes over 200 m (generally,

at the altitude of 300 - 400 m). There has not been registered any flock in the altitude interval of 50 - 170 m, which may be dangerous for flights, over the period of observations within the wind park and in the buffer zones in spring 2016.

On the basis of summary analysis of bird migration altitudes, it may be stated that they are not threatening and influence of the wind park on birds shall be estimated as low.

3. Impacts caused by the wind park operation.

3a – deterring caused by rotor motion, shadows flicker, light gleams.

Technical characteristics of the wind turbines may potentially create a threat for migratory birds that fly at the altitudes of 50 - 170 m owing to rotor motion. Analysis of researches shows that this altitude interval has not been used within the designed sites of the wind park. According to our observations at already operating wind parks, the impact of this factor on birds during the period of migrations has not been revealed. So, negative impacts caused by rotor motion, shadows flicker and light gleams shall be estimated as low, and for the majority of birds that stay at the wind park sites they are absent.

3b – additional territory development. Effect of this factor is possible for birds, which are nesting within the sites. Negative impact on migratory birds is absent. It shall be considered that in comparison with the impacts of wind parks, the influence of agricultural works in the course of year is much higher.

3c – disturbing owing to night-time illumination. Percentage of birds, which migrate at night, is small. And small by the quantity and species diversity transit migrants will not sense the night-time illumination within the sites due to illumination of adjacent residential settlements. Parallel researches of bats' activity during night time in the territory of the wind park enabled to carry out observation of night ornithological situation. As a result of carried out works, we have not revealed any case of creation of hazardous situation owing to nocturnal migrations of birds.

Impact of this factor shall be estimated as very low.

3d – collisions with the wind turbine generators. When evaluating the observation data of the migration in spring 2016, namely such important aspects as the total quantity of birds, dynamics of the passage intensity, description of the altitude and directions of the migration, diurnal activity, we shall state that the negative impact on migrants was low.

Chapter 5. Monitoring of Nesting Ornithological Complex Within the Sites of EUROCAPE Wind Park, Buffer Zones and Adjacent Territories

5.1. Ex post description of the nesting ornithological complex

Availability of the main nesting biotopes determines the peculiarities of ornithological situation in the area of the planned territory. Only three of those biotopes are determinative. Open biotopes are the largest in area; they include primarily agricultural fields, pastures and a small number of meadows. The second important biotope within the site of the wind park is agricultural hedgerows and small man-planted forests, in which the birds of tree and shrub complex make their nests. The third, which is the least important within the site, is a complex of biotopes connected with the existence of the Dzhekelnia River, on which several small ponds are located. Availability of residential settlements, which attract birds as a place for nesting, as well as feeding place, has significant influence on the composition of nesting avifauna.

But determining factor that has an influence on the species composition and the quantity of birds within the wind park site and buffer zones (1 - 2 km) is the availability of the Molochnyi Estuary near to the site, as well as, to a lesser extent, the coast of the Sea of Azov and other surrounding water bodies.

Over the years of research, 126 species have been recorded during nesting on the Molochnyi Estuary.

According to the current data, the species composition of birds, which nest on the Molochnyi Estuary, is considerably smaller. The reason is both the natural fluctuation of the quantity of many species and the influence of weather and climatic conditions of a specific year.

Colonial semi-aquatic birds

The birds, which nest on the islands, spits and alkaline lands, are the most numerous on the estuary. They form 75% of all nesting birds at the Molochnyi Estuary Wetland, creating large mono-species or poly-species colonies. In different years, such colonies included following species: cormorant, yellow-legged gull, common, gull-billed, sandwich and little terns, various species of sandpipers, the most numerous of which were pied avocet and, in certain years, collared pratincole.

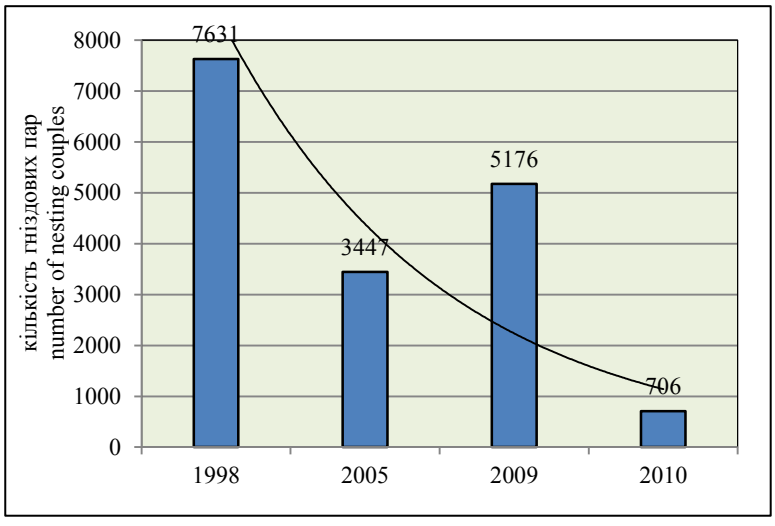


Fig. 5.1. Population dynamics for birds, which nest on the islands, spits and alkaline lands of the Molochnyi Estuary

As can be seen from Fig. 5.1, number of birds on the islands, spits and alkaline lands fluctuated considerably from year to year and had a general tendency to reduction.

Location of the main colonial concentrations of semi-aquatic birds has been changed in the same way (Fig. 5.2).

The drastic reduction in the quantity of colonial semi-aquatic species is caused by actual absence of connection between the estuary and the Sea of Azov in recent years and the fact that the water level in the water body has dropped in the conditions of hot summer temperatures of recent years. This led to disappearance of some islands, which had served as places of birds' nesting for many years. For example, since 2005, the Islands of Dovgyi and Pidkova had merged with the coast, and nesting stopped on them. Since 2009, the system of Kyrylivski Islands had lost its significance, but new islands appeared in the upper part of the estuary, just on which birds nested in large quantities in 2009. In 2010, further reduction was observed in the amount of birds' nesting on the islands, spits and alkaline lands: down to 706 couples. But the largest colonies were located near to the site of the wind park (Fig. 5.2).

According to our data, in 2010 the total number of colonial semi-aquatic birds of the whole estuary was 706 couples, 472 couples of which nested near to the wind park site (Table 5.1).

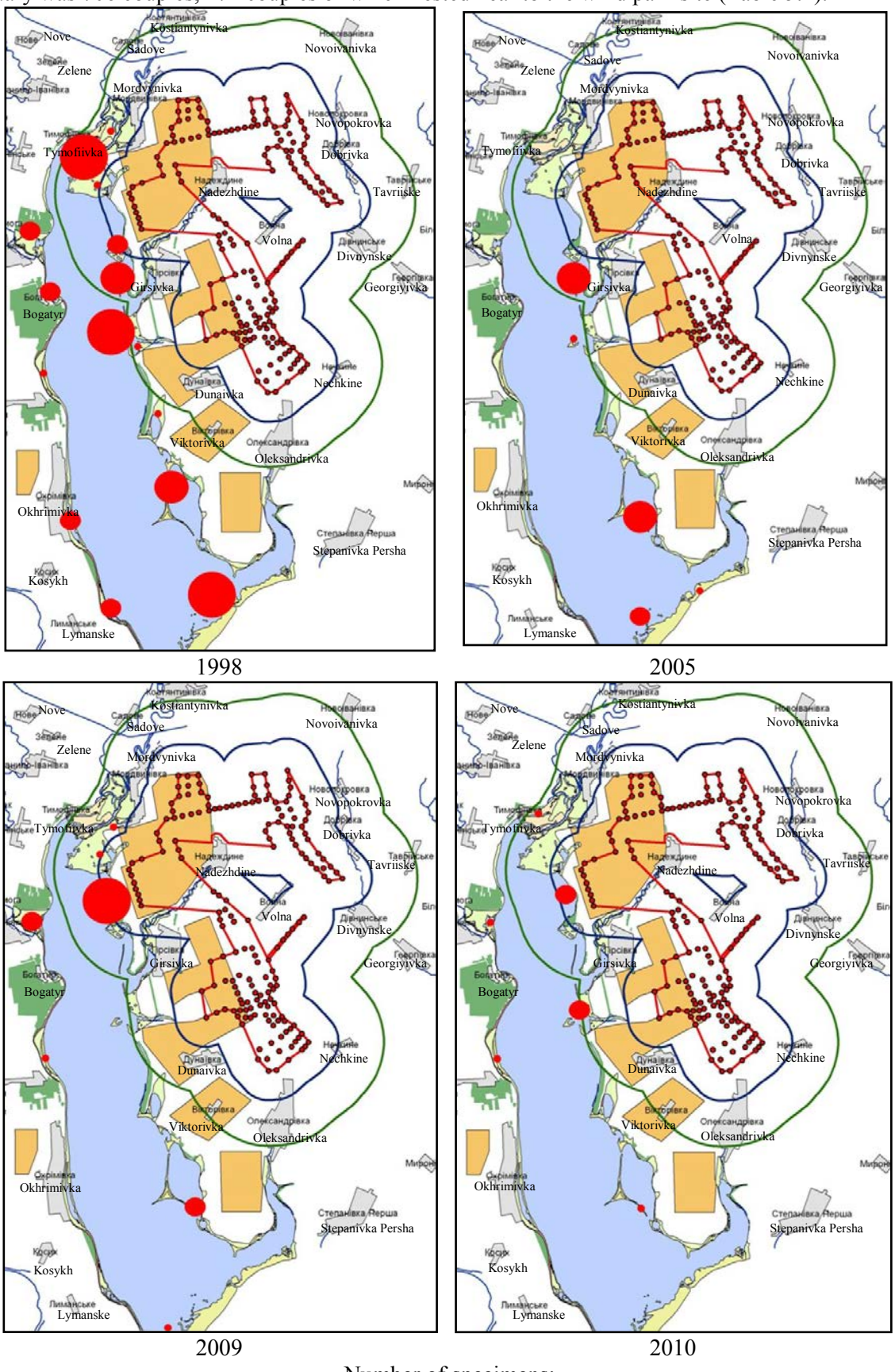


Fig. 5.2. Change of location of colonial concentrations of semi-aquatic birds by years

Table 5.1. Colonial Semi-aquatic Birds that Nested at the Molochnyi Estuary in 2010

English name	Latin name	Quantity
Kentish plover	*Charadrius alexandrinus*	9
Northern lapwing	*Vanellus vanellus*	9
Pied avocet	*Recurvirostra avosetta*	84
Eurasian oystercatcher	*Haematopus ostralegus*	3
Common redshank	*Tringa totanus*	3
Collared pratincole	*Glareola pratincola*	1
Slender-billed gull	*Larus genei*	62
Yellow-legged gull	*Larus cachinnans*	145
Common tern	*Sterna hirundo*	155
Little tern	*Sterna albifrons*	1
Total		**472**

Thus, numbers and location of the mass colonial semi-aquatic birds that nest near the wind park site are inclined to considerable fluctuations; therefore this process needs constant monitoring by professional ornithologists. According to recommendations of the experts from Denmark that have researched the influence of operating wind parks on the breeding colonies of semi-aquatic birds, such colonies shall be located at the distance not nearer than 1 km from wind turbines. In 2010, the nearest colony, which included 145 couples of yellow-legged gull, was located at the distance of over 2 km from the planned wind park lines. Our observations show that yellow-legged gulls feed on fields, near residential settlements, roads in the area of the wind park site, and also can cross the latter in search of forage (Fig. 5.3). And while adult birds get accustomed to the wind park operation quite quickly and fly past it, young unexperienced birds are likely not to avoid the collision. In 2009, gull-billed tern nested in the above mentioned colony, and its quantity was 824 couples. This bird feeds on insects over the fields included in the wind park site territory and it may also become a victim of collision. However, the altitude intervals, which birds usually use during feeding, are not critical. There is no collision threat for other birds that nest on the islands, spits and alkaline lands.

Birds of tree and shrub complex

According to our data, 54 - 62 species of birds nest in the tree and shrub biotopes in the area of the wind park site. The most prevalent among them are common whitethroat, rook, red-footed falcon, common kestrel, lesser grey shrike and woodpigeon (Table 5.2).

Table 5.2. Birds of Tree and Shrub Complex that Nested in the Territory of the Wind Park Site in 2010

English name	Latin name	Quantity
Little egret	*Egretta garzetta*	**46**
Red-footed falcon	*Falco vespertinus*	**120**
Common kestrel	*Falco tinnunculus*	**72**
Common quail	*Coturnix coturnix*	**18**
Woodpigeon	*Columba palumbus*	**9**
Common cuckoo	*Cuculus canorus*	**8**
Tree pipit	*Anthus trivialis*	**18**
Lesser grey shrike	*Lanius minor*	**101**
Golden oriole	*Oriolus oriolus*	**18**
European magpie	*Pica pica*	**34**
Rook	*Corvus frugilegus*	**1,750**
Common whitethroat	*Sylvia communis*	**250**
European goldfinch	*Carduelis carduelis*	**500**
Total		**2,944**

Collisions with the wind park structures are of low probability for the majority of birds of tree and shrub complex. Only the birds that gather into large colonies make an exception. In 2009 - 2010 we revealed 6 - 8 such colonies in the territory of the wind park site, which included rooks (92 - 95%), little egret (about 5%), red-footed falcon (2 - 3%) and common kestrel. Among the listed species, a rook has the highest probability to collide with the blades of wind turbine. This is the dominant species, which feeds within and outside the territory of the whole wind park site (Fig. 5.3 - 5.4). Collisions are not likely for such species as red-footed falcon and common kestrel. These birds are well-adapted to local conditions.

Birds of open biotopes

This category includes about 9 - 10 species of perching birds, the most widespread of which are calandra lark, sky lark, tawny pipit, black-headed wagtail, white wagtail. We have determined only the relative quantity of sky lark that nests in the researched territory, and it was 1.1 couples/ ha. Isabelline wheatear nests within the wind park site locally, near to the high-water bed of the Dzhekelnia River; its quantity in 2009-2010 was about 20 - 24 couples.

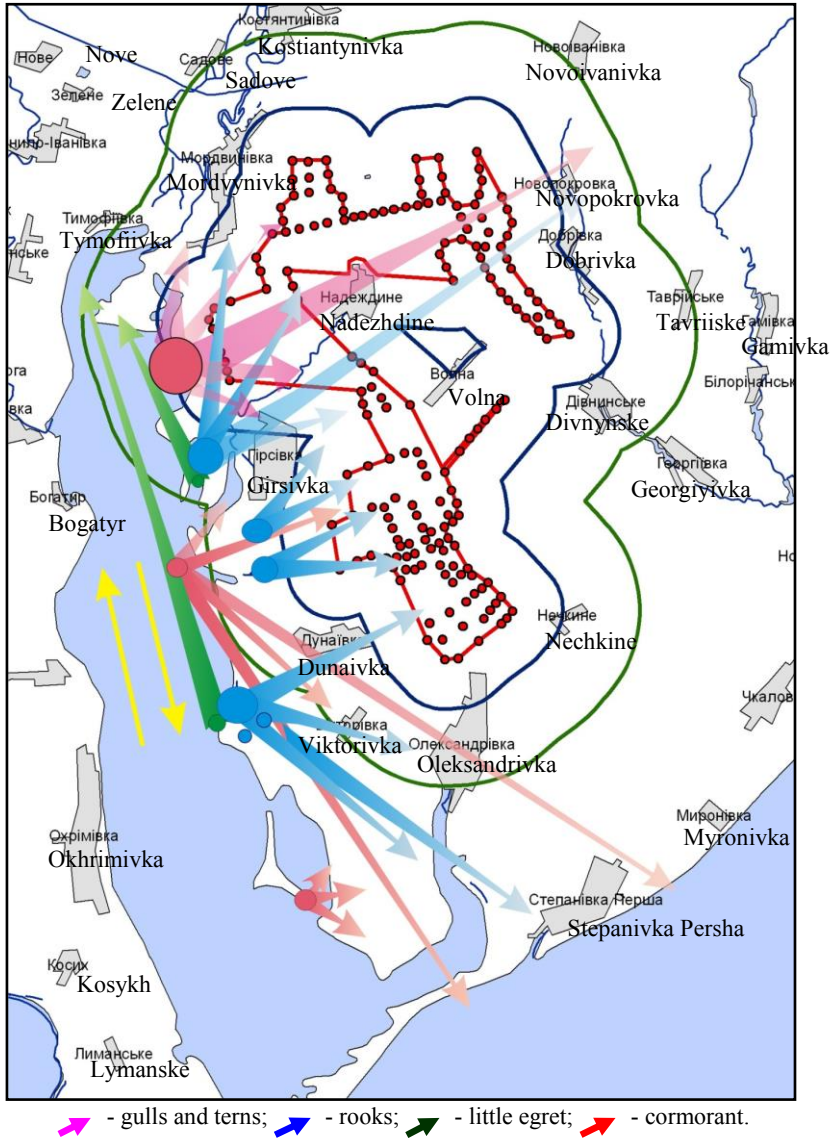


Fig. 5.3. Diagram of feeding dispersions of birds during nesting period (2010)

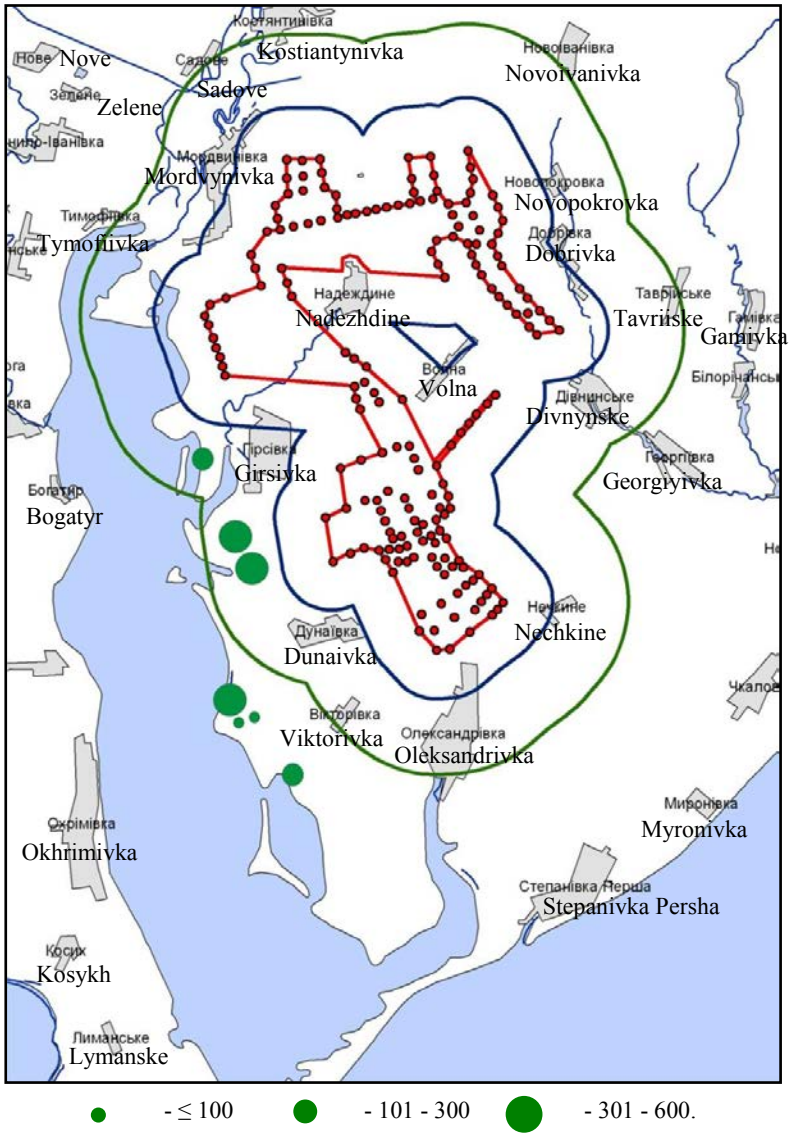


Fig. 5.4. Location of colonies of the birds of tree and shrub complex in 2009 - 2010

Other bird species

Starlings shall be named among other bird species, which can collide with the wind turbine blades. They are not exposed to such threat during nesting, but after the young birds leave their nests, starlings make feeding passages in large flocks, which may reach 2 - 3 thousand specimens in number. During this time, the probability of their collisions with the wind turbines increases. However, in consideration of their large quantity, this cannot be an obstacle for the wind park construction in this territory.

Description of the nesting ornithological complex in 2014

Current assessment of ornithological situation within the wind park site and buffer zones during nesting period was carried out on 20 - 22.04.2014 and on 20 - 21.05.2014.

Assessment of ornithological situation in the buffer zones (1 - 2 km) during the nesting period of 2014

Bird nesting complex in the buffer zones includes birds of anthropogenic complex and partially birds of saline biotopes.

Anthropogenic complexes are represented by two types: rustic units (villages) and agricultural areas with agricultural hedgerows.

Rustic units (Mordvynivka Village, Dobrivka Village, Novopokrovka Village, Nadezhdine Village, Divnynske Village, Girsivka Village, and Dunaivka Village).

Nesting ornithological complex of rustic units located within 2- km zone of the project is typical for the maritime villages of the region, with identical species composition of birds. In 2014 following species were dominating: European starling (*Sturnus vulgaris)*, sparrows (house – *Passer domesticus* and Eurasian tree – *Passer montanus*), European greenfinch (*Chloris chloris),* barn swallow *(Hirundo rustica)*, crested lark *(Galerida cristata)*, white wagtail (*Motacilla alba),* and hoopoe *(Upupa epops)*. Due to considerable areas of the residential settlements, the complex is characterized by relatively large quantity of birds and numbers approximately 280 – 320 nests. Species listed in the national or international Red Lists have not been registered within these biotopes.

Agricultural areas with agricultural hedgerows. Open spaces (agricultural areas) and agricultural hedgerows with different state of tree and shrub plantations prevail in the anthropogenic complex of agricultural areas within 1 - 2- km zone of the project. Skylark (*Alauda arvensis)* is a dominating nesting species of agricultural areas. Single nesting couples of grey partridge *(Perdix perdix)* have been registered. Tree and shrub complex of birds in the buffer zones is slight by its species composition and quantity. Following species are dominating at nesting: common kestrel (*Falco tinnunculus),* hooded crow *(Corvus corone),* European magpie (*Pica pica),* lesser grey shrike *(Lanius minor),* common whitethroat (*Sylvia communis),* European greenfinch *(Chloris chloris).* Vigorous plural-row agricultural hedgerows with shrubs are a place of nesting mainly for perching birds. Other agricultural hedgerows are without shrubs, but with tall trees, in which mostly small birds of prey and Corvidae family are found, the quantity of perching birds here becomes considerably less. Birds listed in the national or international Red Lists also have not been recorded in ornithological complex of this type of biotopes.

Birds of mentioned biotopes located in the buffer zones occasionally use the wind park site as a feeding territory. Operation of the wind park does not pose a threat to any of species - inhabitants of the biotopes of anthropogenic complexes, and possible impact shall be characterized as very low. It is caused by such facts that, first of all, dimensions of feeding plots for the overwhelming majority of species are small in area, and secondly, coincide with the location of nesting territory. Only two bird species (European starling – *Sturnus vulgaris* and barn swallow – *Hirundo rustica)* were registered within the wind park site during the period of feeding migrations. The wind park site does not pose a threat to these species, as their quantity is very small, and altitudes of movement do not exceed 10 m.

Semi-aquatic complexes.

They are partially situated only within 2- km zone and include the coastal territories of the Molochnyi Estuary and flood plain plots of the Molochna River. Practically there are no semi-aquatic ornithological complexes in connection with the lack of water in the major part of the Molochnyi Estuary in 2012 – 2014. Saline and partially meadow phytocenosis were the main biotopes. Following species have been recorded: Northern lapwing (*Vanellus vanellus),* white wagtail (*Motacilla alba),* yellow wagtail *(Motacilla flava),* northern wheatear *(Oenanthe oenanthe),* common redshank (*Tringa*

totanus), and pied avocet (*Recurvirostra avosetta)*. Probably the nesting complex of these biotopes numbered approximately 40 - 65 nests in 2014. Operation of the wind park does not pose a threat to these birds, and it is caused by following factors:

- nesting ornithological complex is represented only by semi-aquatic species of birds, life cycle of which takes place outside the wind park;
- small quantity of birds;
- low active feeding movements in 1 - 2- km zones are characterized by safe altitude interval of 5 – 10 m.

Assessment of ornithological situation within the site of EuroCape Wind Park during the nesting period of 2014

Biotopical and species description of birds of the nesting complex of 2014

Overall site of the wind park was divided into Site 1 and Site 2, which are discussed in the text. Main biotopes for birds' nesting within the wind park site are: two anthropogenic complexes – agricultural areas, agricultural hedgerows and man-planted forest in the north of Site 1.

The ratio of the number of species and number of recorded nests is presented in Table 5.3.

Table 5.3. Distribution and Number of Birds that Nested in the Main Biotopes of the Wind Park Site in 2014

No.	Biotope	Number of species	Number of nests
1	Agricultural areas*	2	38
2	Agricultural hedgerows	12	249
3	Man-planted forest in the north of Site 1	9	11
Total		**23**	**298**

* - This biotope is the largest in area, but the possibility of birds' nesting depends on crop rotations of the specific year.

In 2014, 22 species of birds were registered during nesting at the wind park site.

By biotopic distribution, birds of agricultural hedgerows dominated (12 species), 8 species - in the man-planted forest, and only 2 species - within the agricultural areas (Table 5.3). Censuses of 2014 enable to state following. The major quantity of bird species (12) was registered in the agricultural hedgerows and was the most numerous – 249 nests. 9 species were registered in the man-planted forest area, but with small quantity – 11 nests. Nesting complexes of birds of open biotopes were represented exclusively by two species – skylark (*Alauda arvensis)* and common quail *(Coturnix coturnix),* also with small quantity (38 nests). The last biotope is the largest in area, but density of nests' placement is characterized by rather low indices.

The most important factor, which influences the formation of nesting complexes at the agricultural areas, is annual crop rotations that set the selection of these territories for nesting in direct dependence on the kind of cultivated products.

The main nesting biotopes are presented in Fig. 5.5 - 5.8.

According to the results of censuses, 298 nests of birds were registered within the wind park site in 2014 (Table 4.18). Rook (*Corvus frugilegus*) is the dominant in nesting – 250 nests. In consideration of the total area of the wind park territory, the quantity of other species is extremely small. So, only for skylark (*Alauda arvensis*) 36 nests have been recorded, and for all other species nesting quantity is 1 – 2 couples. 50 points of birds' nesting have been registered and it characterizes very low density of nest distribution.

According to data of the censuses of 2014, 3 rookeries of rooks have been registered within the wind park site (Table 5.4).

Colonies of rook *(Corvus frugilegus)* in buffer 2- km zone are the important factor of nesting quantity. 4 colonial habitations with the total quantity of 1,120 nests have been recorded (Table 5.4). Degradation of these colonies is observed in recent years. Feeding migrations of birds from these colonies to the wind park site has been recorded lately, but altitudes of their movement are 10 – 15 m.

Fig. 5.5. Fields with grain crops (the wind park site)

Fig. 5.6. Saline biotopes in 2 - km buffer zone (wadi of the Molochna River, near to Mordvynivka Village)

Fig. 5.7. Man-planted forest area (in the north of the wind park site, near to Mordvynivka Village)

Fig. 5.8. Saline lower reaches on the coast of the Molochnyi Estuary (buffer zone in 2 km, near to Girsivka Village)

Table 5.4. Results of the Census of Nesting Birds within the Wind Park Site on 20 - 21.05.2014

No.	Species	Nests/ couples	Buffer zones and adjacent territories
Site 1			
1	Common whitethroat (*Sylvia communis)*	*1	
1	Yellowhammer (*Emberiza citrinella)*	1*	
1	Red-backed shrike *(Lanius collurio)*	1	
1	Lesser grey shrike *(Lanius minor)*	1	
1	European greenfinch *(Chloris chloris)*	2*	
1	Long-eared owl *(Asio otus)*	1*	
1	Barred warbler *(Sylvia nisoria)*	1*	
1	Garden warbler *(Sylvia borin)*	2*	
1	Thrush nightingale *(Luscinia luscinia)*	1*	
2	Woodpigeon *(Columba palumbus)*	1	
3	Long-eared owl *(Asio otus)*	1	
4	Common kestrel (*Falco tinnunculus)*	1	
5	Hooded crow *(Corvus cornix)*	1	
6	Thrush nightingale *(Luscinia luscinia)*	1*	
7	Great tit *(Parus major)*	1	
8	European magpie (*Pica pica*)	1	
9	Common quail *(Coturnix coturnix)*	1*	
10	Grey partridge *(Perdix perdix)*	1*	
11	Rook *(Corvus frugilegus)*	150	
12	Skylark (*Alauda arvensis)*	4*	
13	Skylark (*Alauda arvensis)*	8*	
14	Rook *(Corvus frugilegus)*	50	
15	European magpie (*Pica pica*)	1	
16	Woodpigeon *(Columba palumbus)*	1	
17	Grey partridge *(Perdix perdix)*	1*	
18	Lesser grey shrike *(Lanius minor)*	1*	
19	Skylark (*Alauda arvensis)*	6*	
20	Yellowhammer (*Emberiza citrinella)*	1*	
21	Thrush nightingale *(Luscinia luscinia)*	1*	
22	Common kestrel *(Falco tinnunculus)*	1	
23	Rook *(Corvus frugilegus)*	15	
Total Site 1 (species/ nests)		18/ 260	
Site 2			
24	Hooded crow *(Corvus cornix)*	1	
25	Yellowhammer (*Emberiza citrinella)*	1*	
26	Woodpigeon *(Columba palumbus)*	1	
27	European magpie (*Pica pica*)	1	
28	Skylark (*Alauda arvensis)*	8*	
29	Grey partridge *(Perdix perdix)*	1*	
30	Common kestrel (*Falco tinnunculus)*	1	
31	Tawny pipit (*Anthus campestris)*	1*	
32	Skylark (*Alauda arvensis)*	8*	
33	Long-eared owl *(Asio otus)*	1	
34	Common quail *(Coturnix coturnix)*	1*	
35	Yellowhammer (*Emberiza citrinella)*	1*	
36	Red-backed shrike *(Lanius collurio)*	1	
37	Lesser grey shrike *(Lanius minor)*	1	
38	Golden oriole *(Oriolus oriolus)*	1*	
39	Hooded crow *(Corvus cornix)*	1	
40	Yellowhammer (*Emberiza citrinella)*	1*	
41	European magpie (*Pica pica*)	1	
42	European goldfinch *(Carduelis carduelis)*	1*	
43	Tree pipit *(Anthus trivialis)*	1*	
44	Woodpigeon *(Columba palumbus)*	1	
45	European magpie (*Pica pica*)	1	
46	Skylark (*Alauda arvensis)*	2*	
47	Rook *(Corvus frugilegus)*		120**

48	Rook *(Corvus frugilegus)*		300**
49	Rook *(Corvus frugilegus)*		450**
50	Rook *(Corvus frugilegus)*		250**
Total Site 2 (species/ nests)		**15/ 38**	**1,120**
Total (species/ nests)		**22/ 298**	**1,120**

Note: * - nesting behaviour; ** - data of survey.

Distribution of the wind park territory for Site 1 and Site 2 enables to describe specifically the state of ornithological situation in different seasons, and especially during the period of nesting, which is caused by concrete definition of the buffer zones. Obtained data are the starting point for carrying out subsequent monitoring. Comparative description of the sites is given in Table 5.5.

Table 5.5. Quantity of Nesting Ornithological Complex within the Wind Park Site on 20 - 21.05.2014

No.	Species	Site 1	Site 2	Total
1	Rook *(Corvus frugilegus)*	215		215
2	European magpie (*Pica pica*)	2	3	5
3	Skylark (*Alauda arvensis)*	18	18	36
4	Common kestrel *(Falco tinnunculus)*	2	1	3
5	Grey partridge *(Perdix perdix)*	2	1	3
6	Thrush nightingale *(Luscinia luscinia)*	3		3
7	Lesser grey shrike *(Lanius minor)*	2	1	3
8	Long-eared owl *(Asio otus)*	2	1	3
9	Woodpigeon *(Columba palumbus)*	2	2	4
10	Yellowhammer (*Emberiza citrinella)*	2	3	5
11	European greenfinch *(Chloris chloris)*	2		2
12	Garden warbler *(Sylvia borin)*	2		2
13	Common whitethroat (*Sylvia communis)*	1		1
14	Red-backed shrike *(Lanius collurio)*	1	1	2
15	Barred warbler *(Sylvia nisoria)*	1		1
16	Hooded crow *(Corvus cornix)*	1	2	3
17	Great tit *(Parus major)*	1		1
18	Common quail *(Coturnix coturnix)*	1	1	2
19	Golden oriole *(Oriolus oriolus)*		1	1
20	Tawny pipit (*Anthus campestris)*		1	1
21	European goldfinch *(Carduelis carduelis)*		1	1
22	Tree pipit *(Anthus trivialis)*		1	1
	Total	**260**	**38**	**298**

Relatively identical species diversity of recorded birds and number of species recorded at the sites are observed (18 – 15 bird species). The largest quantity was registered for Site 1 – 206 nests, due to colonial habitations of rook *(Corvus frugilegus)*. If we exclude the quantity of rook, then the number of nests at the sites will be approximately the same (45 and 38).

Feeding and transit bird migrations within the wind park site and buffer zones during the nesting period of 2014

In consideration of the revealed species that nest in the project territory, it shall be noted that certain species of birds were already hatching their clutches of eggs, that's why other species, which were found at the wind park site at the end of April 2014, shall be considered to be feeding or transit migrants. It makes possible to appraise the ornithological "load" of migrants on the site and buffer zones. It shall be noted that it is an additional "load" for nesting period.

Transit migrations of species, which were recorded over the period of the observations, last at the wind park site till the 12 - 15 of May, since revealed transit migrants move quickly to other migration territories.

The end of April is the period, within which birds already begin to nest, but transit migration still takes place. In addition, both local birds and transit migrants visit the wind park site and buffer zones in the course of feeding migrations (feeding, rest, and roosting time). According to defined techniques of ornithological researches, integrated observations of bird migration and counts of met birds were carried out at the wind park site and in the buffer zones on 20 – 22.04.2014 (Tables 5.6 - 5.7).

Table 5.6. Results of Bird Census within the Wind Park Site on 20 - 22.04.2014

No.	Time	Species	Quantity
Site 1			
1	8.00	Hoopoe (*Upupa epops)*	2
2		European greenfinch *(Chloris chloris)*	1
2		European magpie (*Pica pica*)	2
2		Hooded crow *(Corvus cornix)*	1
2		Woodpigeon *(Columba palumbus)*	5
3		Rook *(Corvus frugilegus)*	12
4		Hooded crow *(Corvus cornix)*	3
5		Grey partridge *(Perdix perdix)*	2
6		Black-headed gull (*Larus ridibundus)*	21
7		Rook *(Corvus frugilegus)*	18
8		Woodpigeon *(Columba palumbus)*	2
9	9.00	Great tit *(Parus major)*	5
10		European starling *(Sturnus vulgaris)*	8
11		Ruff (*Philomachus pugnax)*	48
12		Blackbird *(Turdus merula)*	4
13		House sparrow (*Passer domesticus)*	22
14		European starling *(Sturnus vulgaris)*	16
15		Ruff (*Philomachus pugnax)*	120
16		Crested lark (*Galerida cristata)*	6
17		Hooded crow *(Corvus cornix)*	2
18	10.00	Skylark (*Alauda arvensis)*	12
19		Ruff (*Philomachus pugnax)*	120
20		European starling *(Sturnus vulgaris)*	8
21		Black-headed gull (*Larus ridibundus)*	61
22		Yellow-legged gull (*Larus cachinnans)*	11
23		Yellow wagtail *(Motacilla flava)*	18
23	11.00	White wagtail (*Motacilla alba)*	7
Total Site 1 (species/ nests)			**537**
Site 2			
24		European starling *(Sturnus vulgaris)*	35
25		Rook *(Corvus frugilegus)*	28
26		Rook *(Corvus frugilegus)*	21
27		Rook *(Corvus frugilegus)*	46
28		Rook *(Corvus frugilegus)*	96
29	12.00	Ruff (*Philomachus pugnax)*	68
30		European starling *(Sturnus vulgaris)*	22
31		Woodpigeon *(Columba palumbus)*	4
32		Grey partridge *(Perdix perdix)*	6
33		Common kestrel (*Falco tinnunculus)*	2
34		Tawny pipit (*Anthus campestris)*	1
35		Skylark (*Alauda arvensis)*	14
36		Hooded crow *(Corvus cornix)*	2
37		European starling *(Sturnus vulgaris)*	8
38		Blackbird *(Turdus merula)*	5
39	13.00	Common kestrel (*Falco tinnunculus)*	2
40		Woodpigeon *(Columba palumbus)*	1
41		Hooded crow *(Corvus cornix)*	3
42		European starling *(Sturnus vulgaris)*	7
43		Eurasian tree sparrow *(Passer montanus)*	6
44		Yellowhammer (*Emberiza citrinella)*	1
45		European magpie (*Pica pica*)	1
46		Woodpigeon *(Columba palumbus)*	2
47		Common quail *(Coturnix coturnix)*	1
48		Rook *(Corvus frugilegus)*	7
49		European starling *(Sturnus vulgaris)*	21

50		Common kestrel (*Falco tinnunculus)*	3
51	14.00	Lesser grey shrike *(Lanius minor)*	2
Total Site 2 (nests)			**415**
Total (species/ nests)			**952**

Table 5.7. Results of the Census of Bird Migration Movements within the Wind Park Site and Buffer Zones on 20 - 22.04.2014

No.	Time	Species	Quantity	Type of migration	Altitude (m)	Direction
52	08.00	Rook (*Corvus frugilegus)*	16	Feeding	10	N
53		European starling *(Sturnus vulgaris)*	48	Feeding	5	S
54		Yellow-legged gull *(Larus cachinnans)*	2, 4, 3 (9)	Feeding	10	E
55		Ruff (*Philomachus pugnax)*	24, 12 (36)	Feeding	10	E
56	09.00	Common swift (*Apus apus*)	4, 4, 8, 2, 2 (22)	Transit	10	N
57		Barn swallow *(Hirundo rustica)*	12	Feeding	5	NE
58		White wagtail (*Motacilla alba)*	12, 4, 4 (20)	Transit	10	E
59		Rook (*Corvus frugilegus)*	2, 4, 2, 4 (16)	Feeding	5	W
60		Mediterranean gull *(L. melanocephalus)*	32, 20 (52)	Transit	250	E
61		Eurasian tree sparrow *(Passer montanus)*	12	Feeding	5	N
62	10.00	Common kestrel (*Falco tinnunculus)*	4	Feeding	10	N
63		Yellow wagtail (*Motacilla flava)*	8, 12, 4, 6 (30)	Transit	10	NE
64	11.00	White wagtail (*Motacilla alba)*	12, 8, 2, 4 (26)	Transit	10	E
65		Rook (*Corvus frugilegus)*	27	Feeding	10	W
66		Black-headed gull (*Larus ridibundus)*	14	Feeding	5	N
67		Ruff (*Philomachus pugnax)*	48	Feeding	10	S
68	12.00	Common swift *(Apus apus)*	2, 4, 4, 5 (15)	Transit	10	NE
Total specimens (12 species)			**407**			

Note. N – north, NE – northern east, NW – northern west, W – west, SW – southern west, E – east, SE – southern east, S – south.

29 species of birds in all were registered during the period of observations at the end of April 2014. 24 species with the total number of 952 specimens were recorded in the course of feeding, rest and nesting within the wind park site and buffer zones (Table 5.8). At the same time, 13 species with quantity of 407 specimens were recorded in the course of migrations. Among them, 6 species of transit migrants with quantity of 150 specimens were recorded and 7 species – in the course of feeding migrations - 257 specimens (Table 5.8).

Table 5.8. Number of Birds within the Wind Park Site and Buffer Zones on 20 - 22.04.2014

No.	Species	Site 1		Site 2		Total
		Counts	Migrants	Counts	Migrants	
1	Hoopoe (*Upupa epops)*	2				2
2	European greenfinch *(Chloris chloris)*	1				1
3	European magpie (*Pica pica*)	2		1		3
4	Hooded crow *(Corvus cornix)*	6		5		11
5	Woodpigeon *(Columba palumbus)*	7		7		14
6	Rook *(Corvus frugilegus)*	30	27	198	32	287
7	Grey partridge *(Perdix perdix)*	2		6		8
8	Black-headed gull (*Larus ridibundus)*	90	14			104
9	Great tit *(Parus major)*	5				5
10	European starling *(Sturnus vulgaris)*	24		93	48	165
11	Ruff (*Philomachus pugnax)*	288	48	68	36	440
12	Blackbird *(Turdus merula)*	4		5		9
13	House sparrow (*Passer domesticus)*	22				22
14	Crested lark (*Galerida cristata)*	6				6
15	Skylark (*Alauda arvensis)*	12		14		26
16	Yellow-legged gull (*Larus cachinnans)*	11			9	20
17	Yellow wagtail (*Motacilla flava)*	18				18

18	White wagtail (*Motacilla alba)*	7			20	27
19	Common kestrel (*Falco tinnunculus)*			7	4	11
20	Tawny pipit (*Anthus campestris)*			1		1
21	Eurasian tree sparrow *(Passer montanus)*			6	12	18
22	Yellowhammer (*Emberiza citrinella)*			1		1
23	Common quail *(Coturnix coturnix)*			1		1
24	Lesser grey shrike *(Lanius minor)*			2		2
25	Common swift (*Apus apus*)		15		22	37
26	Barn swallow *(Hirundo rustica)*				12	12
27	Mediterranean gull *(L. melanocephalus)*				52	52
28	Yellow wagtail (*Motacilla flava)*		30			30
29	White wagtail (*Motacilla alba)*		26			26
Total		**537**	**160**	**415**	**247**	**1,359**

Following species were dominating among counted ones within the wind park site: ruff (*Philomachus pugnax)* – 356 specimens, rook *(Corvus frugilegus)* – 128 specimens, European starling *(Sturnus vulgaris)* – 117 specimens, black-headed gull (*Larus ridibundus)* – 90 specimens. Quantity of other species was 1 – 22 specimens. There was no any regularity in the distribution of birds.

Among feeding migrants also ruff (*Philomachus pugnax)* – 84 specimens, rook *(Corvus frugilegus)* – 59 specimens, European starling *(Sturnus vulgaris)* – 48 specimens dominated in quantity. Quantity of feeding migrants by bird species varied within the range of 22 – 46 specimens (Table 5.7).

The major part of transit and feeding migrations took place within the buffer zones.

The quantitative indices of migrations in the project territory shall be considered as very low. In addition, the majority of transit migrants have been recorded in the buffer zones, and those that migrated across the wind park site were characterized by small altitudes of movement (Table 5.7). Considering the altitudes of transit migrations, it may be said about insignificant impact on the migration complex of birds in given period of researches.

Bird species listed in the Red Data Book of Ukraine have not been recorded in the territory of the wind park site and buffer zones during this period.

The overall analysis of the ornithological situation during nesting period within the wind park site and in the buffer zones enables to reveal its following main peculiarities. Species composition of nesting birds in the researched territory is divided in three groups according to the feature of relative position of nesting and feeding territory:

a) nesting and feeding territory coincide - such species are prevalent

b) feeding territory may be, to a greater or a lesser extent, spatially divided (some tree and shrub and synanthropic species – birds of residential settlements)

c) feeding territory is located outside the nesting one (sometimes even remote in some kilometres) - black-headed (*Larus ridibundus)* and yellow-legged (*Larus cachinnans)* gulls.

At that, species that pertain to the first two groups are mainly found in the course of nesting at the wind park site and in the buffer zones. Bird species, which pertain to the third group, fly into the project territory, but such cases are characterized by low frequency and small quantity. In addition, altitudes of their movement in the course of feeding migrations do not exceed 20 m, and more often they use an altitude of 5 – 10 m.

The majority of migration movements takes place outside the wind park site during this period and is characterized by small quantity and low altitudes (5 – 10 m). Local birds, which use the wind park site with buffer zones for feeding, do not create the numerous gatherings; move slowly and at small altitudes (5 - 10 m).

On the whole, in consideration of species composition of nesting ornithological complex of the residential settlements, the wind park site and the buffer zones, biological and behavioural peculiarities of each bird species, it may be concluded that the construction and operation of the wind park do not pose a threat to mentioned ornithological complex and the impact shall be characterized as low.

5.2. Description of ornithological situation during the nesting period of 2016

Study of birds during the nesting period was carried out in the course of several field visits, which covered the territory of the wind park, buffer zones in 1 and 2 km, with compulsory

investigation of the adjacent territories (plots of upper and middle part of the Molochnyi Estuary). It shall be noted that phenological terms of nesting period for different species are very time-expanded, that is why first observations of nesting behaviour have been started during the study of migration state of birds in April, when nesting behaviour is typical for the majority of species (herons, cormorants, gulls, larks, starlings and others). Observations in May gave indubitable evidences of nesting of different species in the researched territory, since almost all birds were sitting on nests. So, collection of information on ornithological situation during nesting period was carried out on: April 23 - 25, May 10 - 15, as well as June 28, 2016.

Assessment of ornithological situation in the territory of EuroCape Wind Park

Out of 44 bird species, which were observed over the whole territory of researches, 33 ones (or 75.0%) were recorded at the wind park site. Quantity of these species was 652 specimens, or 46.8% of all registered birds (Table 5.9).

The majority of birds are nesting; however, the wind park territory is visited also by non-nesting species (gulls, herons). Special investigations gave information about 26 species of birds, nesting of which had been proved. As proved nesting we understand the availability of a nest, nestlings, nesting behaviour (mating song, «drawing aside» from a nest, courtship display, aggressive behaviour etc.) or those facts when destroyed nests, dead nestlings, eggs have been found. Thus, the total quantity of nests in the territory of EuroCape Wind Park reaches 200. In consideration of extremely hiding behaviour of certain bird species (lark, partridge, quail, owls, warblers and others), undercount according to our estimations is about 20%, which enables to assert the availability of about 250 nests of not less than 30 bird species in the territory of the wind park and its buffer zones (Table 5.10 and Fig. 5.9; as well as Annex 1, AutoCAD schematic map Fig. 1.8).

Rook (*Corvus frugilegus*) was dominating species. 4 colonies of rook had been revealed within EuroCape Wind Park sites, 3 of them were inhabited during the nesting period of 2016 (Fig. 5.10 - 5.12). It shall be said that 3 colonies have been recorded within upper (Site 1) EuroCape Wind Park site, and one more – in 1- km buffer zone.

Coordinates of the location of the first colony are: 46.723204 N / 35.501648 E. Rook colony is situated at the distance of: 14.66 m from the road; 3,201.47 m from the nearest human settlement; 12,650.88 m from the coast of the Molochnyi Estuary. Rooks placed their nests in the agricultural hedgerow (trees are planted in 3 rows) in the trees of black locust (*Robinia pseudoacacia L.*). Number of nests in this colony is 12.

Table. 5.9. Ornithological Description of EuroCape Wind Park, Buffer Zones and Adjacent Territories During the Nesting Period of 2016

No.	Species	Quantity*			
		WP	BZ	AT	Total
1	Grey heron (*Ardea cinerea*)	1			**1**
2	Long-legged buzzard (*Buteo rufinus*)	2			**2**
3	Common buzzard (*Buteo buteo*)	2			**2**
4	Red-footed falcon (*Falco vespertinus*)	6	2		**8**
5	Common kestrel (*Falco tinnunculus*)	16	6	4	**26**
6	Grey partridge (*Perdix perdix*)	16	2		**18**
7	Common quail (*Coturnix coturnix*)	1	2		**3**
8	Turnstone (*Arenaria interpres*)			6	**6**
9	Common redshank (*Tringa totanus*)			4	**4**
10	Ruff (*Philomachus pugnax*)		151	83	**234**
11	Dunlin (*Calidris alpina*)			26	**26**
12	Eurasian curlew (*Numenius arquata*)			3	**3**
13	Black-headed gull (*Larus ridibundus*)	41	12	16	**69**
14	Yellow-legged gull (*Larus cachinnans*)		12	17	**29**
15	Sandwich tern (*Thalasseus sandvicensis*)			28	**28**
16	Common tern (*Sterna hirundo*)			11	**11**
17	Woodpigeon (*Columba palumbus*)	8	6		**14**
18	Turtle dove (*Streptopelia turtur*)	11			**11**
19	Long-eared owl (*Asio otus*)	6			**6**
20	Scops owl (*Otus scops*)	2			**2**

21	Little owl (*Athene noctua*)		2			**2**
22	Hoopoe (*Upupa epops*)		3			**3**
23	Barn swallow (*Hirundo rustica*)		28			**28**
24	Crested lark (*Galerida cristata*)			6		**6**
25	Skylark (*Alauda arvensis*)		34	29	4	**67**
26	Tawny pipit (*Anthus campestris*)		5	4		**9**
27	Yellow wagtail (*Motacilla flava*)		4	9		**13**
28	White wagtail (*Motacilla alba*)			2		**2**
29	Red-backed shrike (*Lanius collurio*)		8			**8**
30	Lesser grey shrike (*Lanius minor*)		14	2		**16**
31	Golden oriole (*Oriolus oriolus*)		3			**3**
32	European starling (*Sturnus vulgaris*)		12			**12**
33	European magpie (*Pica pica*)		23	2	6	**31**
34	Rook (*Corvus frugilegus)*		345	248	7	**600**
35	Hooded crow (*Corvus cornix*)		23	4	5	**32**
36	Barred warbler (*Sylvia nisoria*)		2			**2**
37	Garden warbler (*Sylvia borin*)		7	2		**9**
38	Common whitethroat (*Sylvia communis*)		2			**2**
39	Thrush nightingale (*Luscinia luscinia*)		6			**6**
40	Eurasian tree sparrow (*Passer montanus*)			12		**12**
41	Chaffinch (*Fringilla coelebs*)		8			**8**
42	European greenfinch (*Chloris chloris*)		2	2		**4**
43	European goldfinch (*Carduelis carduelis*)		4			**4**
44	Yellowhammer (*Emberiza citrinella*)		5	7		**12**
Total		**species**	**33**	**21**	**14**	**44**
		birds	**652**	**522**	**220**	**1,394**

Notes: * – quantity includes all registered nesting couples and birds that do not breed;
WP – territory of EuroCape Wind Park; **BZ** – buffer zones; **AT** – adjacent territories.

Table 5.10. Results of the Census of Birds Nesting within EuroCape Wind Park Sites on 23 - 25.04. and 10 - 15.05.2016 (numbering in accordance with schematic map, Fig. Д 1.8)

No.	Species	Nests
Site 1		
1	Little owl (*Athene noctua*)	1
	Hooded crow (*Corvus cornix*)	1
2	Yellowhammer (*Emberiza citrinella*)	1*
	Barred warbler (*Sylvia nisoria*)	1*
	Garden warbler (*Sylvia borin*)	2*
	Common whitethroat (*Sylvia communis*)	1
	Long-eared owl (*Asio otus*)	1*
	European greenfinch (*Chloris chloris*)	1*
	Red-backed shrike (*Lanius collurio*)	1
	Chaffinch (*Fringilla coelebs*)	1
3	Turtle dove (*Streptopelia turtur*)	1
4	Woodpigeon (*Columba palumbus*)	1
5	Common kestrel (*Falco tinnunculus*)	1
6	Thrush nightingale (*Luscinia luscinia*)	1*
7	Hooded crow (*Corvus cornix*)	1
8	Woodpigeon (*Columba palumbus*)	1
9	Red-backed shrike (*Lanius collurio*)	1
10	Tawny pipit (*Anthus campestris*)	1
11	Garden warbler (*Sylvia borin*)	1
12	Rook (*Corvus frugilegus*)	12
13	Long-eared owl (*Asio otus*)	1*
14	European magpie (*Pica pica*)	1
15	Common kestrel (*Falco tinnunculus*)	1
16	Lesser grey shrike (*Lanius minor*)	1
17	Thrush nightingale (*Luscinia luscinia*)	1*
18	Red-footed falcon (*Falco vespertinus*)	1

19	European magpie (*Pica pica*)	1
20	Hooded crow (*Corvus cornix*)	1
21	Turtle dove (*Streptopelia turtur*)	1
22	Tawny pipit (*Anthus campestris*)	1
23	Rook (*Corvus frugilegus*)	42
24	European magpie (*Pica pica*)	1
25	Yellowhammer (*Emberiza citrinella*)	1*
26	Skylark (*Alauda arvensis*)	6*
27	Grey partridge (*Perdix perdix*)	1*
28	Lesser grey shrike (*Lanius minor*)	1
29	Common quail (*Coturnix coturnix*)	1*
30	Rook (*Corvus frugilegus*)	98
Total Site 1 (species/ nests)		**22/ 175**
Site 2		
31	Tawny pipit (*Anthus campestris*)	1
32	Chaffinch (*Fringilla coelebs*)	1
	Red-backed shrike (*Lanius collurio*)	1
	European goldfinch (*Carduelis carduelis*)	1*
33	Woodpigeon (*Columba palumbus*)	1
	Garden warbler (*Sylvia borin*)	1
	Common kestrel (*Falco tinnunculus*)	1
	Yellowhammer (*Emberiza citrinella*)	1
34	Lesser grey shrike (*Lanius minor*)	1
35	Woodpigeon (*Columba palumbus*)	1
36	Common kestrel (*Falco tinnunculus*)	1
37	Long-eared owl (*Asio otus*)	1
38	European magpie (*Pica pica*)	1
39	Lesser grey shrike (*Lanius minor*)	1
40	Yellowhammer (*Emberiza citrinella*)	1*
41	Hooded crow (*Corvus cornix*)	1
42	Common kestrel (*Falco tinnunculus*)	1
43	Hoopoe (*Upupa epops*)	1
44	Grey partridge (*Perdix perdix*)	1
45	Skylark (*Alauda arvensis*)	4*
46	Scops owl (*Otus scops*)	1*
47	Skylark (*Alauda arvensis*)	6*
48	Thrush nightingale (*Luscinia luscinia*)	1*
49	Lesser grey shrike (*Lanius minor*)	1
50	European goldfinch (*Carduelis carduelis*)	1*
51	Golden oriole (*Oriolus oriolus*)	1*
52	Chaffinch (*Fringilla coelebs*)	1
53	Hooded crow (*Corvus cornix*)	1
54	Common kestrel (*Falco tinnunculus*)	1
55	Yellowhammer (*Emberiza citrinella*)	1*
56	European greenfinch (*Chloris chloris*)	1*
57	Woodpigeon (*Columba palumbus*)	1
58	Skylark (*Alauda arvensis*)	2*
59	Tawny pipit (*Anthus campestris*)	1*
60	Common kestrel (*Falco tinnunculus*)	1
61	Woodpigeon (*Columba palumbus*)	1
62	Hooded crow (*Corvus cornix*)	1
Total Site 2 (species/ nests)		**20/ 25**
Total (species/ nests)		**26/ 200**

Note: ***** – nesting behaviour.

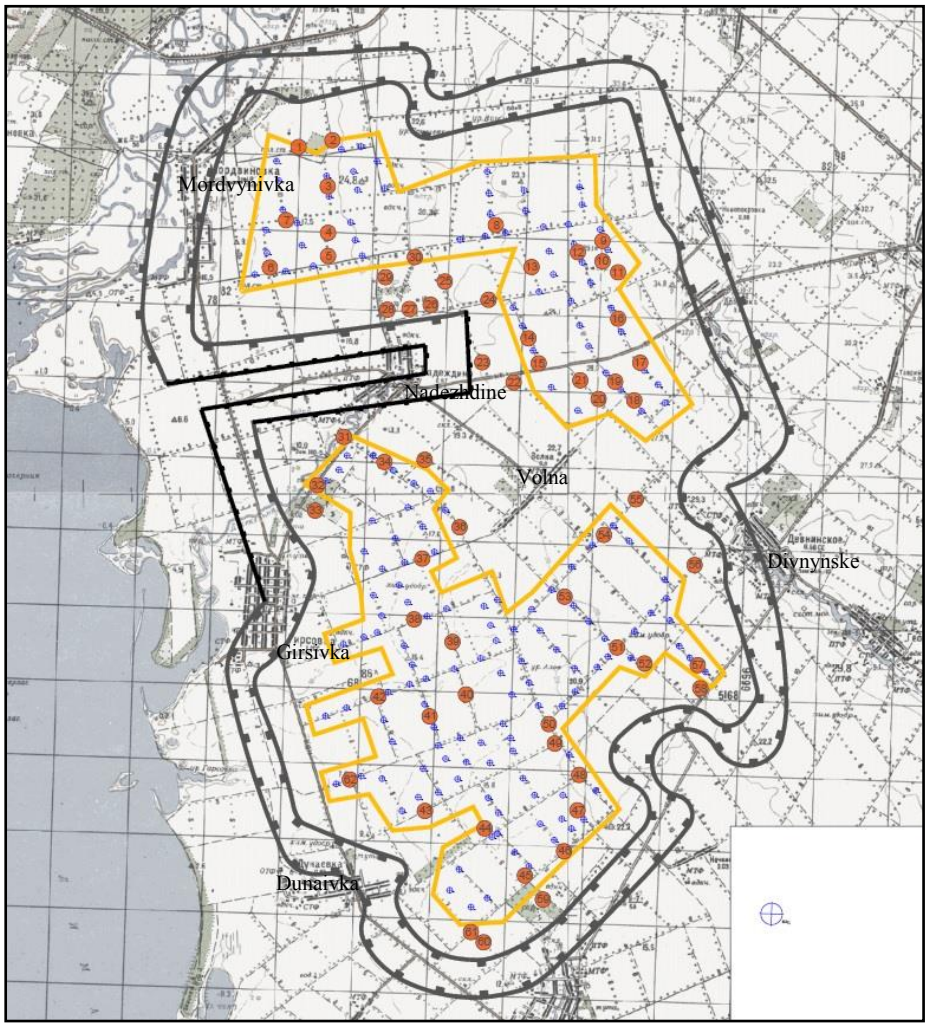


Fig. 5.9. Distribution of bird nests throughout the territory of EuroCape Wind Park during the nesting period of 2016 (legend in Table 5.10)

Coordinates of the location of the second colony are: 46.699575 N / 35.467223 E. Rook colony is situated at the distance of: 626.07 m from the road; 1,448.09 m from the nearest human settlement; 9,261.5 m from the coast of the Molochnyi Estuary. Birds created the colony in the agricultural hedgerow (trees are planted in 5 rows) in the trees of black locust (*Robinia pseudoacacia L.*). Number of nests in this colony is 42.

Coordinates of the location of the third rook colony are: 46.724513 N / 35.446567 E. Rooks placed their nests in the trees of black locust (*Robinia pseudoacacia L.*) in the agricultural hedgerow, in which trees are planted in 5 rows. This colony is situated at the distance of: 261.55 m from the road; 2,494.26 m from the nearest human settlement; 9,220.89 m from the coast of the Molochnyi Estuary. Number of nests in this colony is 98.

Coordinates of the location of the fourth colony are: 46.706572 N / 35.502496 E. Rook colony is situated at the distance of: 11.83 m from the road; 2,786.679 m from the nearest human settlement; 11,975.8 m from the coast of the Molochnyi Estuary. Birds created the colony in the agricultural hedgerow (trees are planted in 5 rows) in the trees of black locust (*Robinia pseudoacacia L.*). Number of nests in this colony is 28. Its external appearance indicated that birds had not used it for nesting in the course of recent several years.

Analysis of rook colonies' distribution by quantity of nests showed that there were no very small colonies (up to 10 nests) in the researched territory, 3 small ones (11 - 50 nests), 1 medium colony (51 - 100 nests), big (101 - 500 nests) and very big (more than 500 nests) – have not been recorded.

The total number of inhabited nests in group rook colonies located in the territory of EuroCape Wind Park is 152 nests, or 86.9% of found nests at Site 1 (Table 5.11).

Table 5.11. Rook Colonies at EuroCape Wind Park in 2016

No.	Coordinates	Nests
1	46.723204 N / 35.501648 E	12
2*	46.699575 N / 35.467223 E	42
3	46.724513 N / 35.446567 E	98
4	46.706572 N / 35.502496 E	28
	Total	**180**

Note: *- Colony No. 2 is located in the buffer zone

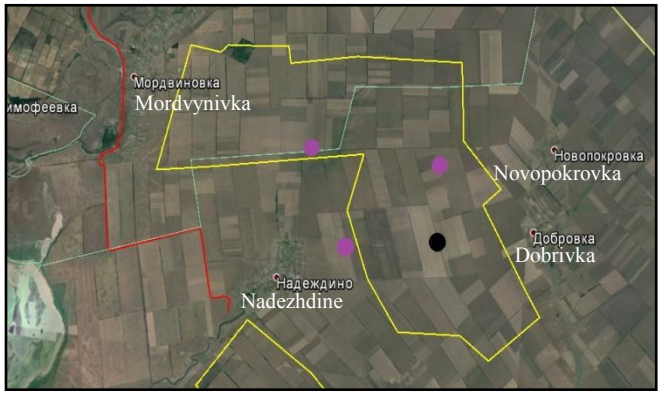


Fig. 5.10. Rook (*Corvus frugilegus*) colonies in the territory of EuroCape Wind Park in 2016

Fig. 5.11. Rook (*Corvus frugilegus*) colony in the agricultural hedgerow of black locust (*Robinia pseudoacacia L.*)

Fig. 5.12. Rook (*Corvus frugilegus*) full clutch of five eggs

As regards other representatives of Corvidae family, which nest in the territory of EuroCape Wind Park sites, we have found the nests of hooded crow (*Corvus cornix*) (6 nests) and European magpie (*Pica pica*) (4 nests). Colonies of hooded crow together with rook have not been revealed within EuroCape Wind Park sites. All of them were located individually, except for one nest, near which also the nest of little owl (*Athene noctua*) was recorded. Birds built their nests in the agricultural hedgerows in the trees of black locust (*Robinia pseudoacacia L.*).

Colonies of European magpie together with rook also have not been revealed in the territory of EuroCape Wind Park sites. All 4 nests were located one by one, and 3 of them at that were at the wind park sites and one more – in 1-km buffer zone. As in the case of other Corvidae, birds built their nests in the agricultural hedgerows in the trees of black locust (*Robinia pseudoacacia L.*).

So, when carrying out research on distribution of nests of single species of Corvidae family, 6 nests of hooded crow (1 nest is included in group colonies and 5 nests of individual nesting) and 4 nests of European magpie (all of them – nests of individual nesting) have been found within EuroCape Wind Park sites. Quantity of other bird species is extremely small and lies within the range from individual nests of concrete species (scops owl, little owl, common kestrel, and yellowhammer) to several couples (lark, garden warbler).

The overall composition of ornithological complex of EuroCape Wind Park sites includes 33 species of 8 taxons, out of which 19 species (57.6%) pertain to perching birds series with quantity of 535 specimens, or 82.1% (Table 5.12, as well as Tables 1.8 - 1.10 in Annex 1).

When comparing species diversity and quantity of birds at individual plots, we shall state that the wind park sites with the largest indices of species diversity (33 species) have also the highest indices of bird quantity (652 specimens, 46.8%) mainly at the expense of rook colonies and occurrence of certain percentage of birds that do not breed. Paradoxical situation had emerged in the adjacent territories: both the smallest species diversity and the lowest birds' quantity were observed there. Description of bird diversity and quantity is shown in Fig. 5.13.

Table 5.12. Taxonomic Description of Nesting Ornithological Complex within EuroCape Wind Park, Buffer Zones and Adjacent Territories in 2016

Series	Wind park sites		Buffer zones		Adjacent territories		Σ	
	species	specimens	species	specim.	species	specim.	species	specim.
Ciconiiformes (*ciconiiformes*)	1	1	-	-	-	-	1	**1**
Birds of prey (*falconiformes*)	4	26	2	8	1	4	4	**38**
Fowl-like birds (*galliformes*)	2	17	2	4	-	-	2	**21**
Shore birds (*charadriiformes*)	1	41	3	175	9	194	9	**410**
Pigeons(*columbiformes*)	2	19	1	6	-	-	2	**25**
Owl-like birds (*strigiformes*)	3	10	-	-	-	-	3	**10**
Hoopoe-like birds (*upupiformes*)	1	3	-	-	-	-	1	**3**
Perching birds (*passeriformes*)	19	535	13	329	4	22	22	**886**
Total	**33**	**652**	**21**	**522**	**14**	**220**	**44**	**1,394**

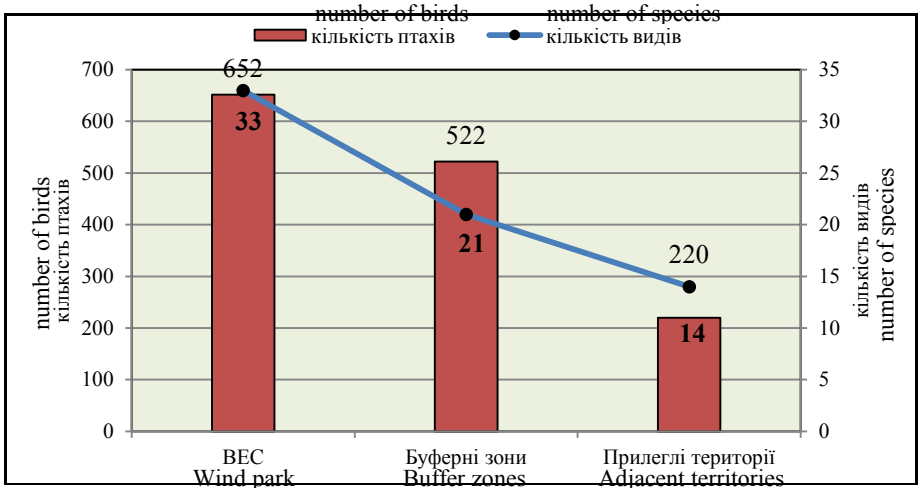


Fig. 5.13. Species diversity and quantity of birds within EuroCape Wind Park, buffer zones and adjacent territories during the nesting period of 2016

Biotopic description of birds of the nesting complex of 2016

Description of birds' distribution throughout the territory of researches gives an estimate of giving preferences by them to one or another biotope. There are only two types of biotopes within EuroCape Wind Park sites: agricultural areas and agricultural hedgerows. Human settlements (urban landscapes) appear in the buffer zones, and wetlands are added in the adjacent territories. Detailed description of the quantity of species and birds in these biotopes is given in Table 5.13 and in Fig. 5.14, and appearance of the main nesting biotopes and nests – in Fig. 5.15 - 5.20.

Table 5.13. Distribution and Quantity of Birds throughout the Main Biotopes of the Wind Park Sites, Buffer Zones and Adjacent Territories during the Nesting Season of 2016

No.	Biotope	S*	WP		BZ		AT		Total	
			species	birds	species	birds	species	birds	species	birds
1	Agricultural areas	1	11	167	12	237	2	8	**11**	**412**
2	Agricultural hedgerows and man-planted forest	3	22	485	8	225	2	11	**22**	**721**
3	Wetlands	2	-	-	-	-	9	194	**9**	**194**
4	Urban landscape	4	-	-	2	60	1	7	**2**	**67**
	Total		**33**	**652**	**21**	**522**	**14**	**220**	**44**	**1,394**

Notes: S* – ranking of biotopes by the area; **WP** – territory of EuroCape Wind Park; **BZ** – buffer zones; **AT** – adjacent territories.

When analysing Table 5.13 we can see that ranking of biotopes by the area places agricultural areas at the first place, as they are the most spread in the territory of EuroCape Wind Park. But they are not a biotope with the largest indices of species diversity (11 species) and quantity (412 specimens). Indices for non-typical urban landscape are quite low. However, biotopes that have mosaic diversity of landscape components (wetlands and man-planted forest with agricultural hedgerows) become a refuge for 31 bird species, or 70.5% of all registered species, with quantity of 915 specimens, or 65.6% of all birds.

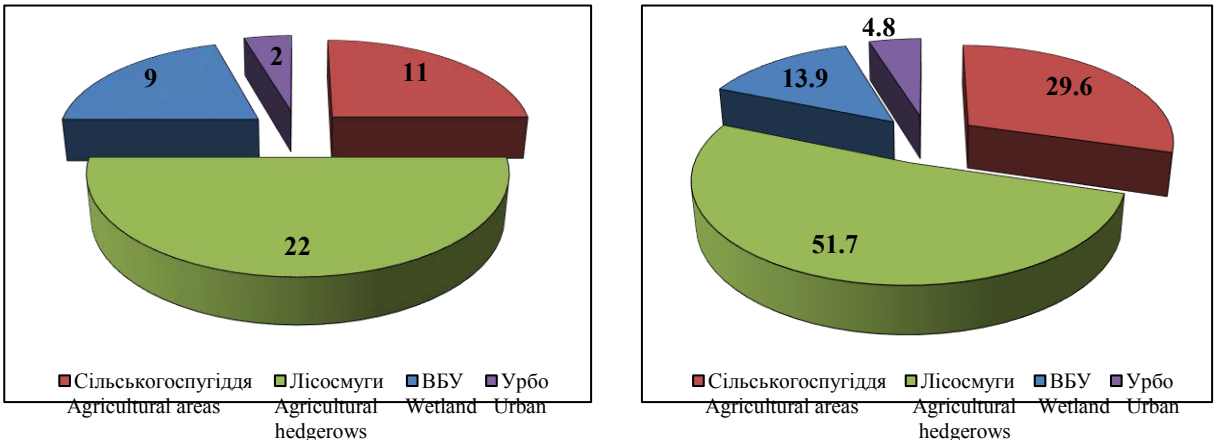


Fig. 5.14. Distribution of birds in the main biotopes within EuroCape Wind Park, buffer zones and in the adjacent territories in 2016 (on the left – number of species, on the right – quantity of birds in %)

Ornithological situation in the buffer zones (1 - 2 km) during the nesting period of 2016

Nesting complex of birds within 1- and 2- km zone of the project is represented mainly by the birds of anthropogenic complex. Special attention was paid to one-kilometre buffer zone, as the nearest to the designed wind park sites.

Anthropogenic complexes, which are the place of birds' nesting, in turn, are represented by two types: rustic units (villages) and agricultural areas with agricultural hedgerows.

Rustic units. Nesting ornithological complex of rustic units located within the buffer zones of the project is typical for the maritime villages of the region, with identical species composition of birds. Usually these are such species as: European starling (*Sturnus vulgaris*), sparrows (house – *Passer domesticus* and Eurasian tree – *Passer montanus*), barn swallow (*Hirundo rustica*), crested lark (*Galerida cristata*), white wagtail (*Motacilla alba*), European greenfinch (*Chloris chloris*), and hoopoe (*Upupa epops*). There are no species listed in the national or international conservation lists among them. In 2016, birds at nesting were not recorded here, but such ones, which had not bred, were observed.

Agricultural areas with agricultural hedgerows. Open spaces (agricultural areas) and agricultural hedgerows with different state (by vigour and age) of tree and shrub plantations prevail in the anthropogenic complex of agricultural areas within 2- km zone of the project. Skylark (*Alauda arvensis)* is a dominating nesting species of agricultural areas, but it is characterized by very small quantity. Single nesting couples of grey partridge *(Perdix perdix),* common quail (*Coturnix coturnix*) and tawny pipit (*Anthus campestris*) have been registered. Tree and shrub complex of birds in the buffer zones is slight by species composition and quantity. Following species are observed at nesting here: rook (*Corvus frugilegus),* common kestrel (*Falco tinnunculus),* European magpie (*Pica pica),* lesser grey shrike *(Lanius minor),* garden warbler (*Sylvia borin*), woodpigeon (*Columba palumbus*), European greenfinch (*Chloris chloris*) and yellowhammer (*Emberiza citrinella*).Vigorous multi-row agricultural hedgerows with shrubs are a place of nesting mainly for perching birds. Other agricultural hedgerows are without shrubs, but with tall trees, in which mostly small birds of prey and Corvidae family are found, the quantity of perching birds becomes considerably less. The birds listed in the national or international Red Lists also have not been recorded in the ornithological complex of this type of biotopes. On the whole, 67 nests of 12 species have been registered in 1- km buffer zone, out of 200 nests of 26 species.

Fig. 5.15. Fields with grain crops (upper site of the wind park)

Fig. 5.16. Multi-row agricultural hedgerows of black locust (*Robinia pseudoacacia L.*) (lower site of the wind park)

Fig. 5.17. Man-planted forest area (1- km buffer zone in the north of the wind park, near to Mordvynivka Village)

Fig. 5.18. Saline lower reaches on the coast of the Molochnyi Estuary (buffer zone in 2 km, near to Girsivka Village)

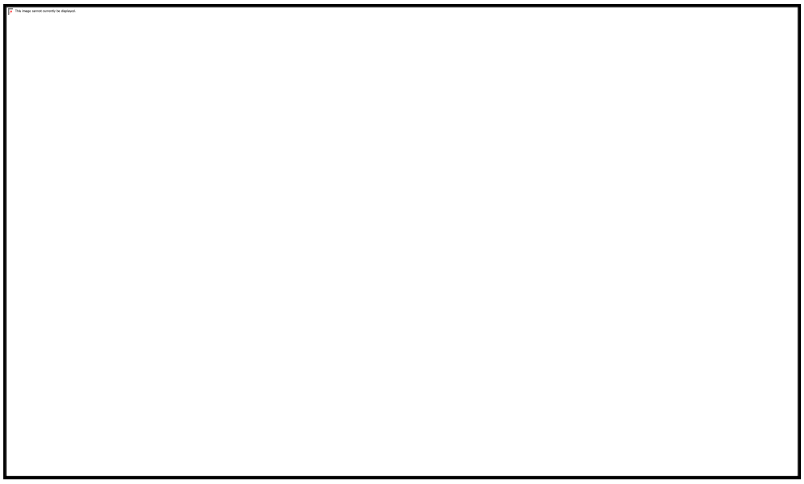


Fig. 5.19. A nest of common kestrel (*Falco tinnunculus*)

Fig. 5.20. A nest of European magpie (*Pica pica*) in the dead tree

It shall also be said that except for nesting birds, also that birds, which had not bred, were recorded. 388 specimens of such birds were observed in the buffer zones.

Birds of mentioned biotopes located in the buffer zones occasionally may use the wind park sites as a feeding territory. Construction and operation of the wind park will not pose a threat to any of species - inhabitants of the biotopes of anthropogenic complexes, and possible impact shall be characterized as very low. It is caused by such facts that, first of all, dimensions of feeding plots for the overwhelming majority of species are small in area, and secondly, coincide with the location of nesting territory. Only 4 bird species (barn swallow – *Hirundo rustica,* rook – *Corvus frugilegus*, hooded crow – *Corvus cornix* and black-headed gull – *Larus ridibundus)* have been registered at the wind park sites during the period of feeding migrations. The wind park site will not pose a threat to these species, as their quantity is very small (66 specimens), and altitudes of movement are under 50 m.

Ornithological situation in the adjacent territories during the nesting period of 2016

Gatherings of migrating birds are typical for these territories in the course of spring migration. However, since the Molochnyi Estuary was separated from the Sea of Azov in recent years, and existed in semi-closed mode, its salinity has risen considerably, but the area of water zone has decreased. Semi-aquatic ornithological complexes were practically absent in connection with lack of water on the major part of the Molochnyi Estuary in 2012 - 2014. Saline and partially meadow phytocenosis were the main biotopes.

In this regard nesting complexes have not been formed at the adjacent plots of upper and middle parts of the Molochnyi Estuary during the nesting season of 2016. Only birds that had not bred were recorded here (Table 5.14, Fig. 5.21 - 5.22).

Table 5.14. Description of Ornithological Complex of the Adjacent Territories during the Nesting Period of 2016

No.	Species		N*
1	Common kestrel (*Falco tinnunculus*)		**4**
2	Turnstone (*Arenaria interpres*)		**6**
3	Common redshank (*Tringa totanus*)		**4**
4	Ruff (*Philomachus pugnax*)		**83**
5	Dunlin (*Calidris alpina*)		**26**
6	Eurasian curlew (*Numenius arquata*)		**3**
7	Black-headed gull (*Larus ridibundus*)		**16**
8	Yellow-legged gull (*Larus cachinnans*)		**17**
9	Sandwich tern (*Thalasseus sandvicensis*)		**28**
10	Common tern (*Sterna hirundo*)		**11**
11	Skylark (*Alauda arvensis*)		**4**
12	European magpie (*Pica pica*)		**6**
13	Rook (*Corvus frugilegus)*		**7**
14	Hooded crow (*Corvus cornix*)		**5**
Total		**species**	**14**
		birds	**220**

Note: N*- quantity of birds includes only birds that do not breed

Fig. 5.21. Saline biotopes of the wash of the Molochna River, near to Mordvynivka Village

Fig. 5.22. Coast of the Molochnyi Estuary near to Girsivka Village

The total quantity of recorded birds here was 220 specimens of 14 species. Birds had not created considerable gatherings at this period of annual cycle; on the whole, only 15.8% of recorded birds were observed in the adjacent territories.

Situation with the species listed in the Red Data Book of Ukraine – Eurasian curlew (*Numenius arquata*) deserves special consideration. It shall be noted that quantity of this species was small (3 specimens), in addition, this species do not nest in the region.

When analysing the situation with regularity of birds' visiting the wind park sites from the adjacent territories, which is given in Table 5.15, we can see that potential risk group is only 17.7% of the total quantity. However, more than a half of the whole ornithological complex (57.3%) even if visit EuroCape Wind Park sites, but never fly in the dangerous area.

Table 5.15. Bird Categories According to Regularity of Visiting EuroCape Wind Park Sites

Bird category	Quantity	%
Continually visit the wind park and may fly over 50 m	39	17.7
Occasionally visit the wind park and may fly over 50 m	16	7.3
Visit the wind park, but never fly over 50 m	126	57.3
Never visit the wind park territory	39	17.7
Total	**220**	**100**

5.3. Comparative characteristic of nesting ornithological complex by the results of monitoring researches in 2014 and 2016

This subparagraph enables to carry out a comparative analysis of nesting situation in 2014 and in 2016. Construction works have not been performed at the wind park sites during these years; that is why changes in species composition, quantity and places of nest location were mainly connected with anthropogenic influence and population waves of individual species. Tendencies in changes of nesting ornithological complex, which were observed at the wind park sites, are typical also for other territories of given landscape-biotopic groups. From our point of view, complex of effective anthropogenic changes, among which dominating was factor of bird anxiety while carrying out agricultural works and destruction of agricultural hedgerows by people, was the main factor. For such species as rook *(Corvus frugilegus),* from our point of view, changes of quantity are mainly connected with their population waves. Besides, it shall be considered also slight undercount of nesting birds, since individual species are characterized by hiding behaviour during nesting period.

Species composition of nesting ornithological complex. In 2014 - 2016 nesting ornithological complex of these territories included 28 species (Table 5.16). 22 species were recorded at nesting within the wind park sites in 2014, and 26 species – in 2016. Number of species of nesting birds was slightly larger at Site No. 1 (2014 – 18 species, 2016 – 22 species) and fewer their quantity was recorded within Site No. 2 (2014 – 15 species, 2016 – 19 species). In spite of the fact that design dimensions of Site No. 2 are considerably larger than of Site No. 2, small majority of nesting birds have been registered at the latter. These indices, from our point of view, are connected with larger diversity of biotopic complexes within Site No. 2 (man-planted forest area, natural steppe and shrub vegetation in the wadies of small rivers). At the same time, Site No. 2 is mainly represented by agrocenosis with agricultural hedgerows. In comparison with 2014, following bird species, which had not been observed before, were recorded in 2016 - turtle dove (*Streptopelia turtur*), chaffinch *(Fringilla coelebs*), red-footed falcon (*Falco vespertinus*), hoopoe *(Upupa epops),* little owl (*Athene noctua*), scops owl (*Otus scops*). At the same time, following species, which had been registered in 2014, were not recorded in the censuses of 2016 - great tit *(Parus major),* tree pipit *(Anthus trivialis).* It is possible that such differences are mainly connected also with undercount of nesting birds.

Quantity. Difference between the total quantity of nesting ornithological complexes by years, in comparison, is: 298 nests in 2014; 239 nests in 2016. Slight fluctuations of quantity are mainly connected with change in the number of rook (*Corvus frugilegus)* nests, which is a dominant by quantity as compared to the whole nesting ornithological complex: in 2014 - 72.2%; in 2016 - 63.6%. Quantity of rooks within the wind park sites decreased by 52 nests in 2016 (Table 5.16). It shall be

noted that number of rook (*Corvus frugilegus)* colonies decreased considerably also in the adjacent territories. So, in 2014 number of colonies in these territories was 1,120 nests, and in 2016 they were absent.

Table 5.16. Comparative Description of Species Composition and Number of Nests of Nesting Birds within EuroCape Wind Park Sites in 2014 and 2016

No.	Species / Year / Site		2014			2016		
			No. 1	No. 2	Total	No. 1	No. 2	Total
1	Common kestrel (*Falco tinnunculus)*		2	1	3	2	5	7
2	Golden oriole *(Oriolus oriolus)*			1	1		1	1
3	Yellowhammer (*Emberiza citrinella)*		2	3	5	2	3	5
4	Hooded crow *(Corvus cornix)*		1	2	3	3	3	6
5	Turtle dove (*Streptopelia turtur*)					2		2
6	Rook *(Corvus frugilegus)*		215		215	152		152
7	Skylark (*Alauda arvensis)*		18	18	36	6	12	18
8	European greenfinch *(Chloris chloris)*		2		2	1	1	2
9	Chaffinch (*Fringilla coelebs*)					1	2	3
10	Red-footed falcon (*Falco vespertinus*)					1		1
11	Barred warbler *(Sylvia nisoria)*		1		1	1		1
12	Garden warbler *(Sylvia borin)*		2		2	3	1	4
13	Common whitethroat (*Sylvia communis)*		1		1	1		1
14	Grey partridge *(Perdix perdix)*		2	1	3	1	1	2
15	Hoopoe (*Upupa epops*)						1	1
16	Common quail *(Coturnix coturnix)*		1	1	2	1		1
17	Woodpigeon *(Columba palumbus)*		2	2	4	2	4	6
18	Great tit *(Parus major)*		1		1			
19	Little owl (*Athene noctua*)					1		1
20	Long-eared owl *(Asio otus)*		2	1	3	2	1	3
21	Scops owl (*Otus scops*)						1	1
22	Thrush nightingale *(Luscinia luscinia)*		3		3	2	1	3
23	European magpie (*Pica pica*)		2	3	5	3	1	4
24	Red-backed shrike *(Lanius collurio)*		1	1	2	2	1	3
25	Lesser grey shrike *(Lanius minor)*		2	1	3	2	3	5
26	Tree pipit *(Anthus trivialis)*			1	1			
27	Tawny pipit (*Anthus campestris)*			1	1	2	2	4
28	European goldfinch *(Carduelis carduelis)*			1	1		2	2
Total		**species**	18	15	22	22	19	26
		nests	**260**	**38**	**298**	**193**	**46**	**239**

According to preliminary figures, density of bird nesting at both sites was 8.3 nests / km^2 (the total area of the sites is approximately 36 km^2; Site No. 1 - 16 km^2; Site No. 2 - 20 km^2). Density of nesting within Site No. 1 was 16.3 nests/ km^2 (2014) and 12.1 nests/ km^2 (2016). Site No. 2 is characterized by smaller indices (1.9 nests/ km^2 (2014) and 2.3 nests/ km^2 (2016)).

Maximum density of nest placement has been observed for agricultural hedgerows and man-planted afforestation, and smaller one - for agrocenoses.

Following may be stated for 19 bird species, which have been counted at nesting within the wind park sites during two years of monitoring (Table 5.16):

- tendencies to increase in quantity of nests were observed for 5 species
- decrease of nests quantity was observed for 1 species
- stable nesting with slight differences of quantity is typical for 13 species.

More representative data on description of nesting complex may be obtained only with introduction of monitoring at the initial stages of construction of the wind park sites and their putting into operation.

5.4. Distribution of birds registered during the nesting period of 2016 according to the international nature conservation lists and conventions

3 species of birds listed in the Red Data Book of Ukraine were recorded in the researched territory during the nesting period of 2016 (Table 5.17). Nature of their distribution has following features. Out of 3 rare bird species following were observed directly at EuroCape Wind Park: long-legged buzzard (*Buteo rufinus*) – 2 specimens and scops owl (*Otus scops*), with quantity also 2 specimens (registered by voices). 1 species listed in the Red Data Book of Ukraine (Eurasian curlew – *Numenius arquata*) has been observed in the adjacent territories. On the whole, number of representatives of rare bird species was low, and has not exceeded 0.5% of all birds.

More detailed description of occurrences of rare species is given in Table 5.17.

Table 5.17. Birds Listed in the Red Data Book of Ukraine according to the Results of Censuses During the Nesting Period of 2016

No.	Species	Wind park site	Buffer zones	Adjacent territories	∑
1	Long-legged buzzard (*Buteo rufinus*)	2	-	-	**2**
2	Eurasian curlew (*Numenius arquata*)	-	-	3	**3**
3	Scops owl (*Otus scops*)	2	-	-	**2**
	Total birds listed in the Red Data Book of Ukraine	4	-	3	**7**
	Total birds within the plot	**652**	**522**	**220**	**1,394**
	% of the total quantity	**0.6**	**-**	**1.4**	**0.5**

Distribution of birds registered during the nesting period of 2016 according to the international nature conservation lists and conventions

In addition to revealing representatives of avifauna of nesting period, their quantity and distribution throughout the researched territory, it have arisen the necessity of their ranking in accordance with nature conservation lists: the Red Data Book of Ukraine, the List of the International Union for Conservation of Nature (IUCN), the European Red List, the Bonn and Bern Conventions, as well as the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) - Table 5.18.

Table 5.18. Distribution of Birds Observed During the Nesting Period of 2016 According to Nature Conservation Lists

No.	English name	Latin name	Status	ERL	RDBU	IUCN	BERN	BONN	CITES
1	Grey heron	*Ardea cinerea*	m, w, n				3		
2	Long-legged buzzard	*Buteo rufinus*	m, w, n	VU	RARE	LC	2	1, 2	2
3	Common buzzard	*Buteo buteo*	m, w, n				2	1, 2	2
4	Red-footed falcon	*Falco vespertinus*	m, n	VU			2	2	2
5	Common kestrel	*Falco tinnunculus*	m, w, n				2	2	2
6	Grey partridge	*Perdix perdix*	m, w, n	VU			3		
7	Common quail	*Coturnix coturnix*	m, w, n				3	2	
8	Turnstone	*Arenaria interpres*	m				2	2	
9	Common redshank	*Tringa totanus*	m, n				3	1, 2	
10	Ruff	*Philomachus pugnax*	m				3	1, 2	
11	Dunlin	*Calidris alpina*	m				2	1, 2	
12	Eurasian curlew	*Numenius arquata*	m, w		EN	NT	3	1, 2	
13	Black-headed gull	*Larus ridibundus*	m, w, n				3		
14	Yellow-legged gull	*Larus cachinnans*	m, w, n						
15	Sandwich tern	*Thalasseus sandvicensis*	m, n				2	2	
16	Common tern	*Sterna hirundo*	m, n				2	2	
17	Woodpigeon	*Columba palumbus*	m, w, n						

No.	English name	Latin name	Status	ERL	RDBU	IUCN	BERN	BONN	CITES
18	Turtle dove	*Streptopelia turtur*	m, n				3		
19	Long-eared owl	*Asio otus*	m, w, n				2		2
20	Scops owl	*Otus scops*	m, n		RARE	LC	2		2
21	Little owl	*Athene noctua*	m, w, n				2		2
22	Hoopoe	*Upupa epops*	m, n				2		
23	Barn swallow	*Hirundo rustica*	m, n				2		
24	Crested lark	*Galerida cristata*	m, w, n				3		
25	Skylark	*Alauda arvensis*	m, w, n				3		
26	Tawny pipit	*Anthus campestris*	m, n				2		
27	Yellow wagtail	*Motacilla flava*	m, n				2		
28	White wagtail	*Motacilla alba*	m, w, n				2		
29	Red-backed shrike	*Lanius collurio*	m, n				2		
30	Lesser grey shrike	*Lanius minor*	m, n				2		
31	Golden oriole	*Oriolus oriolus*	m, n				2		
32	European starling	*Sturnus vulgaris*	m, w, n				2		
33	European magpie	*Pica pica*	m, w, n				2		
34	Rook	*Corvus frugilegus*	m, w, n				2		
35	Hooded crow	*Corvus cornix*	m, w, n				2		
36	Barred warbler	*Sylvia nisoria*	m, n				2		
37	Garden warbler	*Sylvia borin*	m, n				2		
38	Common whitethroat	*Sylvia communis*	m, n				2		
39	Thrush nightingale	*Luscinia luscinia*	m				2	2	
40	Eurasian tree sparrow	*Passer montanus*	m, w, n				3		
41	Chaffinch	*Fringilla coelebs*	m, w, n				3		
42	European greenfinch	*Chloris chloris*	m, w, n				2		
43	European goldfinch	*Carduelis carduelis*	m, w, n				2		
44	Yellowhammer	*Emberiza citrinella*	m, w, n				2		

Notes: **Status**: m – species occurs in the course of seasonal migrations; w – species is found in winter period; n – species occurs in nesting period. **RDBU** – Conservation status of the Red Data Book of Ukraine: **EN** – endangered; **VU** – vulnerable; **RARE** – rare; **UR** – unrated. **IUCN** – Conservation status of the International Union for Conservation of Nature: **EN** – endangered; **NT** – near threatened; **VU** – vulnerable; **LC** – least concern. **ERL** - Conservation status of the European Red List: **VU –** vulnerable, species that may be rated to an endangered category in the near future, if the effect of factors influencing on their condition continues; **EN –** endangered, species that are seriously at risk of extinction; their preservation is hardly probable, reproduction is impossible without carrying out special measures. **BONN** – the Bonn Convention: **Annex I (1)** includes species that are in danger of extinction; **Annex II (2)** includes species, state of which is unfavourable, preservation and regulation of using which needs international agreements, as well as that species, state of which might be considerably improved as a result of international cooperation, which may be carried out based on international agreements. The same species may be included both to Annex I and to Annex II. **BERN** – the Bern Convention, or the Convention on the Conservation of European Wild Flora and Fauna and Natural Habitats, includes **Annex II (2) –** list of fauna species that are subject to special protection; **Annex III (3) –** fauna species that are subject to protection. **CITES** – the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora: **Annex I (1)** includes species "that are in danger of extinction, trade in which causes or may cause negative influence on their existence. Trade in specimens of such species must be especially severely regulated for that purpose to do not endanger their survival for the future, and must be allowed only in exceptional cases"; **Annex II (2)** includes: "a) all species, which are not necessarily threatened with extinction for now, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and b) that have to be subject to regulation in order to enable the possibility to get the trade in specimens of certain species mentioned in subparagraph (a) of this paragraph under effective control".

As is obvious from Table 5.18, the representatives of the ornithological complex of nesting period in the region of EuroCape Wind Park, buffer zones and in the adjacent territories are listed in 6 nature conservation lists. Most of them were related to the Bern Convention (42 species of 44, or 95.5%), 30 species of which are subject to special protection, 12 species are subject to protection. Situation with relation to the Bonn Convention is interesting: 7 species out of 13 species of the ornithological complex, which are included in this Convention, pertain to Annex II (state of which is unfavourable), and 6 species are included simultaneously both to Annex II and I (are in danger of extinction), which is possible in the context of this nature conservation document.

3 species are listed in the Red Data Book of Ukraine (2009), among which 1 species is endangered, 2 species – rare. Also 3 species are listed in the Red List of IUCN (least concern – 2, near threatened - 1).

In addition, 7 species are included in the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora, 3 species are listed in the European Red List.

With regard to a degree of bird pertaining to nature conservation lists, the following picture is being completed. 2 (4.5%) of 44 species are not listed in any of nature conservation documents: yellow-legged gull (*Larus cachinnans*) and woodpigeon (*Columba palumbus*). And the overwhelming majority of the representatives of ornithological complex of nesting period is included in 1 or 2 lists (25 and 11 species respectively), in 3 documents – 2 species (4.5%), and in 4 documents – 3 species (6.8%); species that are included in 5 documents have not been recorded.

Long-legged buzzard (*Buteo rufinus*) is under protection of all 6 nature conservation documents.

More detailed distribution of birds, which have been observed during the nesting period, according to conservation lists is given in Tables 5.19 - 5.20.

Table 5.19. Distribution of Bird Species Recorded During the Nesting Period of 2016 by the Categories of Nature Conservation Lists

ERL		RDBU		IUCN		BONN		BERN		CITES	
category	N	category	N	category	N	category	N	category	N	category	N
VU	**3**	RARE	**2**	LC	**2**	1	**-**	2	**30**	1	**-**
		EN	**1**	NT	**1**	2	**7**	3	**12**	2	**7**
						1 and 2	**6**				
∑	**3**	∑	**3**	∑	**3**	∑	**13**	∑	**42**	∑	**7**

Table 5.20. Distribution of Bird Species Observed During the Nesting Period of 2016 by the Quantity of Nature Conservation Lists

Being listed in nature conservation lists	species	%
0	2	4.5
1	25	56.9
2	11	25.0
3	2	4.5
4	3	6.8
5	-	-
6	1	2.3
Total	**44**	**100**

5.5. Assessment of impacts on birds caused by the construction and operation of the designed site of the wind park during the nesting period of 2016

Nesting ornithological complex within the wind park sites and buffer zones is characterized by low quantity and species diversity. At that, all bird species included in its composition in given territories are characterized by such fact that their feeding plots coincide with the nesting territories, or are located in close proximity to them.

There are potential territories with increased quantity of semi-aquatic birds within the water areas adjacent to the wind park sites. But these colonies are characterized by small quantity in recent years, owing to absence of natural nesting biotopes because of the drying up of semi-aquatic shallow plots.

Quantity and density of birds' nesting in man-planted forest areas and steppe plots are very low both at the wind park sites and within the buffer zones. The impact of the wind park practically for all species of this group of biotopes may be characterized as low, as long-distance feeding migrations are not typical for them. Only rook, which carries out long-distance feeding movements, makes an exception.

The overall analysis of ornithological situation during nesting period within the wind park sites, in the buffer zones and in the adjacent territories enabled to reveal its following main peculiarities. Species composition of birds, which nest in the researched territory, is divided in three groups according to the feature of relative position of nesting and feeding territory:

a) nesting and feeding territory coincide - such species are prevalent

b) feeding territory may be, to a greater or a lesser extent, spatially divided (some birds of tree and shrub complex)

c) feeding territory is located outside the nesting one (sometimes even remote in some kilometres) – yellow-legged gull (*Larus cachinnans*).

At that, species that pertain to the first two groups are mainly found in the course of nesting at the wind park sites and in the buffer zones, owing to peculiarities of their territorial behaviour during nesting and their small quantity. Bird species, which pertain to the third group, nest mainly rather far from the wind park sites. Flights of the birds of this group into the territory of EuroCape Wind Park

exist, but they are characterized by low frequency and small quantity. In addition, altitudes of their movement in the course of feeding migrations do not exceed 25 m, and more often they use the altitudes under 15 m.

On the whole, in consideration of the species composition of nesting ornithological complexes, their biotopical distribution, biological and behavioural peculiarities of each bird species, it may be concluded that the construction and operation of EuroCape Wind Park do not pose a threat to mentioned ornithological complex and the impact shall be characterized as very low.

Assessment of impacts caused by the construction and operation of EuroCape Wind Park sites during the nesting period in 2015

1. Impacts caused by the construction.

Negative impacts during the construction of wind turbine generators may be conditioned by following factors:

1a – emissions of hazardous substances. Emissions of hazardous substances will not exceed the permissible rates during the construction, owing to small quantity of machinery and equipment, as well as absence of stationary sources of pollution. There is no negative impact on nesting birds.

1b – deterring by visual effects and noise. Stay of machinery and people within the site, as well as noise originated by them, may have insignificant negative impact on birds when this activity is carried out within nesting plots, or near to them. It is actual, first of all, for larks and birds of agricultural hedgerows (European magpie – *Pica pica*, common kestrel – *Falco tinnunculus*). Effect of this factor decreases owing to availability of alternative nesting places not only within the wind park sites, but also outside them (even more suitable than in the territory of the wind park); it enables birds to select safe territories. So, negative impact of this factor may be estimated as very low.

1c – occupying the territory by working platforms and equipment. Physical dimensions of the wind park sites and buffer zones are rather large; therefore the infrastructure in the course of the wind park construction has local character by scale and is characterized by the short period of process works. In spite of large quantity of wind turbine generators their density, as well as density of placement of working platforms and equipment, are characterized by low indices, therefore they will not obstruct feeding migrations of birds and placement of nests. This negative impact on birds during the construction shall be estimated as low, and during the operation of the wind park it is absent.

1d – loss of breeding places. For bird species, which nest within the wind park sites, loss of breeding places is not significant. Small species composition and their small quantity will enable to select without obstacles nesting places at the wind park sites. Approximate percentage of occupation by the equipment will be small. Slight loss of nesting places owing to the wind park construction will have not continuous, but extremely mosaic pattern, leaving the major part of the wind park territory for free selection of nesting places. Besides, the majority of species recorded in the course of nesting is common and widely distributed in the region. Negative impact of this factor shall be estimated as low.

1e – loss of individual specimens of protected species. In 2016, 2 rare bird species were recorded within the sites of EuroCape Wind Park: long-legged buzzard – *Buteo rufinus* and scops owl – *Otus scops*.

Long-legged buzzard has not nested at the sites of EuroCape Wind Park in 2016, and in the case of scops owl – only one nesting couple has been observed. The possibility of loss of certain protected species, which is caused by the wind park construction, is extremely low, and there is no such threat for semi-aquatic birds. Negative impact shall be estimated as low.

2. Impacts caused by equipment.

2a – long-time territory occupation and change of environment characteristics. As the territory of the sites of the designed wind park is represented exclusively by anthropogenic types of biotopes (agricultural areas, agricultural hedgerows), creation of the infrastructure of the wind park sites is not threatening for nesting of birds and feeding movements. Machinery and personnel, which will work at the construction for a certain period, have an inessential anthropogenic load on birds and their nesting places. Significant changes in dominant nesting biotopes (agricultural hedgerows) are not planned due to planning structure of the wind park location. The impact shall be estimated as negligible.

2b – deterring by mast vertical structures. Vertical structures are the signal for nesting birds to select other place for nesting, and large area of the wind park enables to do it without obstacles. Besides, high-voltage line of electric networks passes near the sites. Special observations have not revealed negative impact on birds of both vertical structures (towers) and horizontal ones (electric wires). Negative impact on birds during nesting period is low.

2c – barrier impact and obstacles for flight. During nesting period, when there is no a task to pass long distances and birds go into a state of increased caution, the altitudes of passages become lesser and are characterized by the interval up to 15 m. Species composition of birds, which breed within the wind park sites or visit them for feeding during nesting period, is lesser than in the course of migrations. Designed distance between the wind turbines (500 - 800 m and more) is enough to do not create linear barriers. Local birds get accustomed quickly to the existing structures, therefore the negative impact on birds is low, and for the majority of nesting species it is absent.

3. Impacts caused by the wind park operation.

3a – deterring caused by rotor motion, shadows flicker, light gleams. Technical characteristics of the wind turbines create a threat for migrating birds that fly at the altitudes of 50 - 170 m owing to rotor motion. Analysis of researches during nesting period of birds shows that birds do not use this altitude interval within the wind park site. According to our observations at already operating wind park, the impact of this factor on birds' nesting complexes has not been revealed. So, negative impacts caused by rotor motion, shadows flicker and light gleams shall be estimated as low, and for the majority of birds, which are in the course of nesting or in the feeding territories at the sites of EuroCape Wind Park, they are absent.

3b – additional territory development. As significant changes of dominant landscapes in the course of the wind park construction will not take place, then the nesting capacity of biotopes will not change. Reduction or increase of bird quantity during nesting period mostly depends on population waves and anthropogenic factor of permanent agricultural works in the course of year, which are in large excess over the level of influence in comparison with the wind park.

3c – disturbing owing to night-time illumination. Bird activity at night ceases in nesting period. Observations of bird nests near to illuminated buildings have not revealed negative effect of light on the breeding success. Negative impact of birds disturbing within EuroCape Wind Park owing to night-time illumination is absent.

3d – collisions with the wind turbines. When estimating the data of observations of birds' behaviour near to the high-voltage line of electric networks, we shall state their unobstructed movement over this continuous linear barrier. Special researches in the territory of already constructed wind parks also indicate that for the majority of birds operating wind turbine is not an obstacle. Negative impact is low.

Impacts caused by the risk of reduction in the level of bird populations.

Analysis of quantity of birds, species of which may be exposed to the negative influence of the wind park, shows that the territory of the sites is not the places of their general habitations. Practically all recorded species are dominants and widely distributed. Nesting plots are located not only in the territory of the wind park, but also outside it (in the buffer zones and – probably – in the adjacent territories).

Quantitative data of birds, which nest in the project territory, as compared with the European population of recorded species, enable to state that almost for all species their percentage does not exceed 1.0%. More detailed analysis shows that their part of European population is 0.00... - 0.002%.

On the basis of analysis of obtained data we shall state that the wind park impact on birds is absent during the period of nesting, from the point of view of threats for the quantity of their populations. There are no negative impacts that can reduce the quantity of bird populations.

Based on system analysis of the information concerning quantity, behaviour, feeding trends and aspects of nesting biology, the influence of the wind park on birds, which stayed within the wind park sites during the period of nesting in 2016, shall be characterized as low.

Chapter 6. Monitoring of Autumn Migration of Birds Within the Sites of EUROCAPE Wind Park, Buffer Zones and Adjacent Territories

6.1. Ex post description of the ornithological situation during autumn migration

Autumn migration of birds at the Azov and Black Sea Coast starts already in the second half of July, with its intensity raising gradually since the middle of August and reaching its peak in September and the first half of October, and so called "transit" migrations usually end by the middle of November. Instead, in the second half of November and early in December, the pre-winter migrations of mainly waterfowl (geese and ducks) take place at the Azov and Black Sea Coast, from the continental parts of the country, where the weather conditions make the life of these birds harder. Besides waterfowl, such migration movements are also typical for starlings, Bohemian waxwings, thrushes, rooks and some other perching birds' species.

Both quantitative and qualitative composition of migrants changes during the autumn months of transit, which is caused by certain biological and weather preconditions. There is a significant difference in the species composition and the nature of migrations between individual years. Essential distinctions between the migrations of birds on the Molochnyi Estuary are shown by the example of August 2009 (Tables 6.1 - 6.3).

For example, as the intensity of migrations grows, the number of species taking part in the process increases (a maximum of 173 species in September). The number of birds also increases. The average number for one count increases in September, subsides gradually in October and grows again in November due to arrival of ducks and geese before the beginning of cold season. In November, the concentration of birds also grows considerably in the most suitable biotopes, which affects the average quantity of species during the records.

But in 2009, due to the fact that for the last two years the water level in the Molochnyi Estuary had been minimal, the conditions of stay changed for many species. It affected the total number of species, which is almost a third (51) of the mean annual situation in August (134), but the quantity in species has grown on account of gulls and sandpipers, for which the area of the estuary shoals provides favourable conditions for feeding and rest. Changes in the composition of dominant species are well obvious in Table 6.2. Among which it shall be noted almost total absence of ducks and piscivorous species, such as sandwich tern, grebes and others. In other words, during the years when the amount of ducks, especially mallards, drops dramatically, the presence of other species almost does not obstruct the operation of the wind park plots located at a considerable distance from the coast.

Table 6.1. Number of Species and Their Average Quantity per 1 Census During Autumn Migrations According to the Data of Many Years

Month	Number of species	Average quantity
July	64	87.5
August	134	143
Comparison with August of 2009	51	206
September	173	166.2
October	148	109
November	104	661.6

Table 6.2. Changes in the Dominant Species Composition of Migratory Birds in August 2009, in Comparison with the Data of Many Years

Scientific name	English name	Average quantity per 1 census
In August according to the data of many years		
Corvus frugilegus	Rook	893.8
Larus ridibundus	Black-headed gull	658.0
Chlidonias leucopterus	White-winged tern	629.6
Anas platyrhynchos	Mallard	501.8
Thalasseus sandvicensis	Sandwich tern	406.7
Fulica atra	Eurasian coot (common)	379.4

Calidris alpina	Dunlin	344.0
Calidris ferruginea	Curlew sandpiper	283.2
Philomachus pugnax	Ruff	276.8
Anas penelope	Eurasian wigeon	244.3
In August 2009		
Larus ridibundus	Black-headed gull	5000.0
Chlidonias leucopterus	White-winged tern	726.3
Calidris ferruginea	Curlew sandpiper	591.7
Philomachus pugnax	Ruff	323.7
Chlidonias niger	Black tern	300.0
Larus genei	Slender-billed gull	225.0
Egretta garzetta	Little egret	197.0
Recurvirostra avosetta	Pied avocet	176.8
Sterna hirundo	Common tern	125.7
Calidris alpina	Dunlin	106.7

In conclusion of description of some common characteristics of autumn migration, we shall add that the intensity of bird passages across the plots of the wind park starts growing since September due to such species as ducks, diurnal birds of prey, starlings and wagtails. Since the end of September and in October they are joined by geese and cranes and in November ducks and geese form the main front of ornithological movements across the plots of the wind park. Common peculiarities of autumn migrations also include the fact that the vast majority of perching birds' species flies along the right high coast of the estuary. Only larks and swallows fly in a wide front across the plots of the wind park, but wind turbines have zero impact on these species during their passage. Furthermore, swallows and some species of falcons use the wind turbines, which are temporarily out of operation, for a rest.

During hours of darkness, the majority of transit migrants fly at considerable altitudes and only those flocks of birds, which have a stop on the estuary or its coast, may find themselves in those high-altitude layers where the wind turbines operate. But the probability of such events is considerably less than 0.1%.

In general, during operation of all turbines, the wind park may considerably reduce the area of forage lands for some birds of prey, including those listed in the Red Data Book of Ukraine (harriers, red-footed falcons, kestrels, buzzards), but the availability of considerable amount of such lands at a distance of 2 - 5 km from the wind turbines significantly compensates for above-named losses.

Table 6.3. Changes in Species Composition of Birds Migrating in the Course of Autumn Months, by the Example of 10 Species Prevailing in Quantity for Each Month (According to the Data of Many Years)

Month	Scientific name	English name	Average quantity per 1 census
July	Anas platyrhynchos	Mallard	477.4
	Chlidonias leucopterus	White-winged tern	370.0
	Larus ridibundus	Black-headed gull	299.3
	Calidris ferruginea	Curlew sandpiper	225.0
	Philomachus pugnax	Ruff	158.2
	Anas querquedula	Garganey	146.1
	Cygnus olor	Mute swan	86.0
	Tringa totanus	Common redshank	79.4
	Larus ichthyaetus	Great black-headed gull	69.8
	Larus cachinnans	Yellow-legged gull	62.0
August	Corvus frugilegus	Rook	893.8
	Larus ridibundus	Black-headed gull	658.0
	Chlidonias leucopterus	White-winged tern	629.6
	Anas platyrhynchos	Mallard	501.8
	Thalasseus sandvicensis	Sandwich tern	406.7
	Fulica atra	Eurasian coot	379.4

Month	Scientific name	English name	Average quantity per 1 census
	Calidris alpina	Dunlin	344.0
	Calidris ferruginea	Curlew sandpiper	283.2
	Philomachus pugnax	Ruff	276.8
	Anas penelope	Eurasian wigeon	244.3
September	Fulica atra	Eurasian coot	2,824.0
	Anas penelope	Eurasian wigeon	1,786.0
	Larus ridibundus	Black-headed gull	783.0
	Anser albifrons	Greater white-fronted goose	757.0
	Anas platyrhynchos	Mallard	704.2
	Anas acuta	Northern pintail	625.6
	Aythya ferina	Common pochard	347.5
	Anas crecca	Common teal	211.4
	Larus genei	Slender-billed gull	211.3
	Philomachus pugnax	Ruff	203.9
October	Aythya ferina	Common pochard	522.3
	Anas penelope	Eurasian wigeon	466.8
	Sturnus vulgaris	European starling	436.3
	Anas platyrhynchos	Mallard	352.9
	Aythya marila	Greater scaup	294.3
	Larus ridibundus	Black-headed gull	270.2
	Calidris alpina	Dunlin	259.3
	Fulica atra	Eurasian coot	218.5
	Anas crecca	Common teal	137.6
	Egretta alba	Great white egret	133.5
November	Aythya marila	Greater scaup	8,630.5
	Anser albifrons	Greater white-fronted goose	6,769.2
	Larus genei	Slender-billed gull	5,295.3
	Aythya fuligula	Tufted duck	4,546.0
	Larus ridibundus	Black-headed gull	1,818.6
	Sturnus vulgaris	European starling	1,480.6
	Anas platyrhynchos	Mallard	864.2
	Corvus frugilegus	Rook	770.0
	Fringilla coelebs	Chaffinch (European)	607.3
	Calidris alpina	Dunlin	276.2

July-August. The vast majority of species, which fly by transit route at this time, pertains to sandpipers and terns, but there are also certain species of ducks, such as garganey that starts seasonal migrations at this time. Other numerous species gather at this time on the water bodies after completion of the nesting period and make only small feeding flights. This especially concerns mallard, which flies in flocks from the water bodies to the adjacent agricultural areas after the crops have been harvested, sometimes over a distance up to 10 - 15 km. Also flocks of sandpipers-ruffs make the same passages. At this time, the seacoast is the main migration route for the majority of species and only separate small flocks or individual specimens fly along the valleys of small rivers and the gullies (Fig. 6.1). Young specimens of Montagu's and pallid harriers, which fly above the plots of the wind park in August, may be the most vulnerable to the wind turbines, but in consideration of the fact that they hunt in the course of their flight, the route of their movement does not exceed 25 - 30 m above the land. This reduces the risk of accidental collision.

September and the first half of October. Migration of the majority of species takes place during this period, and not only of waterfowl, but also of other ecological groups of birds. The intensity of passage above the valley of the Molochna River and across the majority of the wind park plots grows, in a wide front running for 30 - 50 km deep inland. As a rule, the altitudes of migration in the morning and evening hours are above 100 m, and only in a strong wind the altitude of migrations goes down. But the majority of bird species fly past the turbines of the wind park. The problem may

arise only at night, when it is misty, when the visibility is low and the negative impact of wind turbines on some ducks and geese may grow.

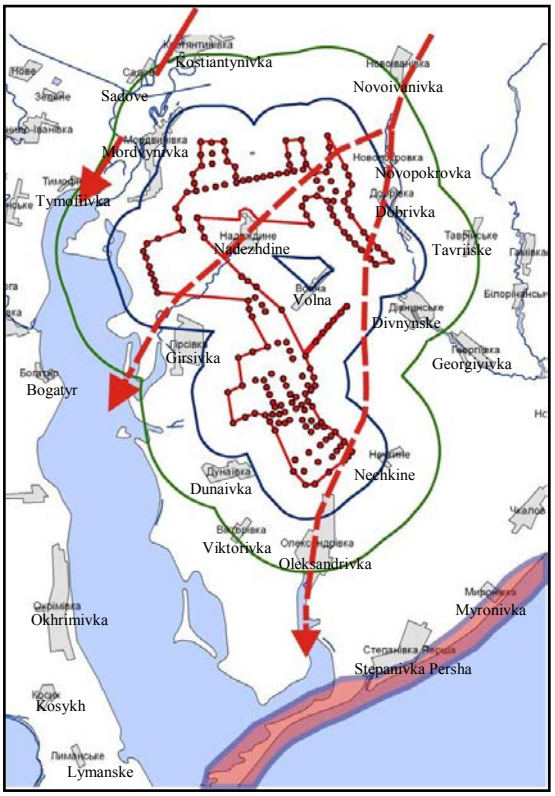


Fig. 6.1. Passage directions in July - August

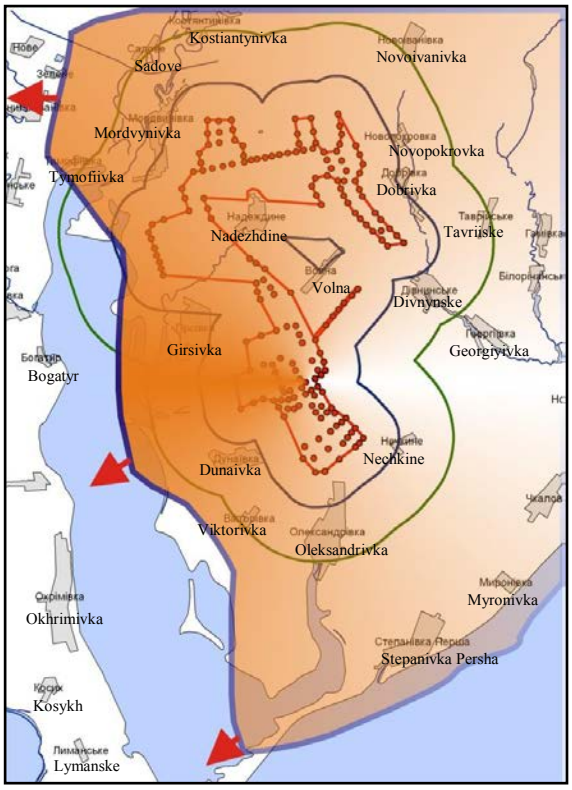


Fig. 6.2. Passage directions in September - October

Migrations of quail in the hours before dawn end in nearly vertical descending of the birds onto fields; therefore their horizontal movement in the surface layer is almost absent. The turbines of the wind park may have a negative impact only on some birds of prey (long-legged buzzard, hen harrier and Montagu's harrier), especially on the young specimens (Fig. 6.2).

Second half of October - November. The period of cranes' passage ending and the highest intensity of migrations of white-fronted goose, great bustard, some species of ducks, particularly scaups, northern pintail, common goldeneye, rooks, starlings, etc. As to the zones of intensive passage and the altitudes of migrations, there are no special changes in comparison with the previous period, apart from the increase of general background of birds' local movements within the coastal strip of the Sea of Azov (Fig. 6.3). Great bustards use these lands for migration stops very seldom, mostly on the northern plots of the wind park, and transit passage takes place at an altitude that exceeds the height of the wind turbine. In addition to the latitudinal routes of birds' movement, the directions of passages are supplemented at this period with a rather mighty meridian one, related to the migrations of ducks and geese from the continental parts of the country. Among the rare species, which may be negatively affected by the wind park, red-breasted goose, which is an endemic species of the Northern Siberia,

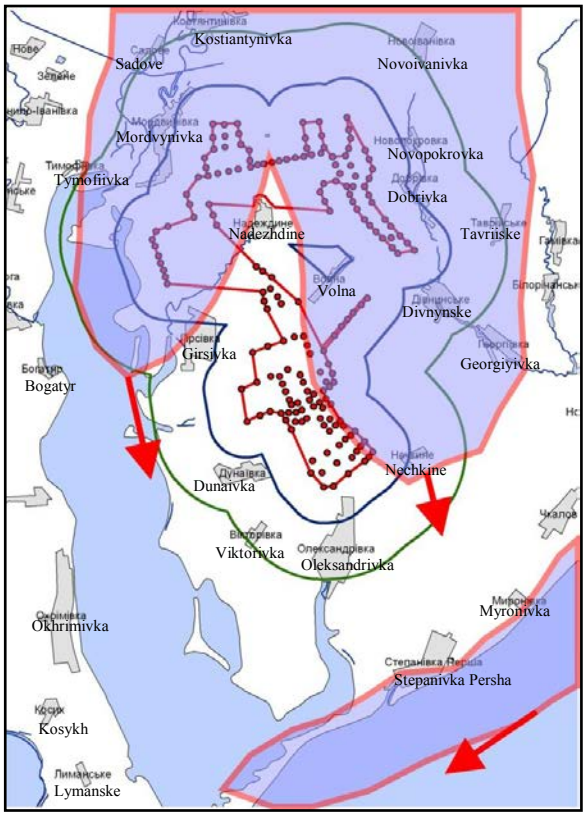


Fig. 6.3. Passage directions in November

and white-tailed eagle shall be noted. However, this is possible only in the conditions of poor visibility during feeding passages and so on.

Description of ornithological situation during the autumn migration of 2014

Beginning of the period of post-nesting birds' migrations and creation of pre-migration gatherings falls on the middle of August. The majority of birds have lost relation with nesting territories by this time and move freely throughout the region.

Researches were carried out on 13 - 15.08.2014. Counts cover the water areas of the Molochnyi Estuary and adjacent biotopes (agricultural fields and agricultural hedgerows, as well as residential settlements). All registered birds are divided into three plots, in accordance with biotopes (Fig. 6.4). The northern part covers the territory from the place where the Molochna River flows into the estuary and till the Village of Girsivka. The middle plot stretches between the Villages of Girsivka and Okhrimivka. The southern part includes the lower part of the Molochnyi Estuary and adjacent territories. According to results of the censuses 64 bird species in all with the total number of 15,519 specimens have been registered. Gradual increase in birds' quantity is observed from the north to the south, and considerable increase in species diversity has been recorded at the south plot (Table 6.4).

Black-headed gull (5,864 specimens) and ruff (5,773 specimens) were indubitable dominants. Only these two species formed 75% of all registered ones. The northern plot did not have large bird gatherings, and the total quantity of the most distributed here barn swallow was 235 specimens. Ruff was a background species in other places. Such situation is typical for August. Just these very species (black-headed gull, ruff and barn swallow) start their slow movement to the south at this period, forming large gatherings in the Azov and Black Sea region.

When analysing birds' behaviour for the purpose of determination of their attraction to the sites of the wind park, we considered dominants, which are characterized by wide spatial movement in search of forage, roosts, or in the course of migration passages. Such group of birds comprises black-headed gull, ruff, and barn swallow.

Observation of this target group gave following results.

1. The majority of places, where these species were found, were related to the Molochnyi Estuary Wetland.

2. Although black-headed gull and ruff feed not only in the water area of the estuary, but also in agrocenoses, all their gatherings have been registered on the agricultural fields and saline-steppe plots along the coasts of the Molochnyi Estuary.

3. Barn swallow does not form large gatherings, but migrate diffusely throughout the territory. We have not revealed factors that would cause swallows' stay within the wind park; instead the geography of occurrences of this species includes all biotopes. However, from the point of view of risks for the species, the altitude intervals, which swallows have used, are not threatening for them. Usually birds were registered in the interval under 30 m.

We shall note that besides dominants, 52 bird species out of 64, or 81% had the total quantity less than 50 specimens over the whole census route, and 36 of these 52 – less than 10 specimens. Hereby, aggregative behaviour of birds at this period, their migratory activity and small quantity indicate safety living conditions during the construction and operation of the wind park.

Table 6.4. Results of the Bird Count at the Molochnyi Estuary on the 13 - 15 of August, 2014

No.	English name	Latin name	Plot 1	Plot 2	Plot 3	∑
1	Little bittern	*Ixobrychus minutus*		1		**1**
2	Black-crowned night heron	*Nycticorax nycticorax*	9			**9**
3	Great white egret	*Egretta alba*	6			**6**
4	Little egret	*Egretta garzetta*	27			**27**
5	Grey heron	*Ardea cinerea*	26			**26**
6	Glossy ibis	*Plegadis falcinellus*	2			**2**
7	White stork	*Ciconia ciconia*	2			**2**
8	Greylag goose	*Anser anser*			20	**20**
9	Common shelduck	*Tadorna tadorna*			180	**180**
10	Mallard	*Anas platyrhynchos*			10	**10**
11	Northern shoveler	*Anas clypeata*			21	**21**
12	Common pochard	*Aythya ferina*			80	**80**
13	Montagu's harrier	*Circus pygargus*			1	**1**

14	Western marsh-harrier	*Circus aeruginosus*	2	4	12	**18**
15	Common buzzard	*Buteo buteo*		7	1	**8**
16	Common kestrel	*Falco tinnunculus*	8	2	23	**33**
17	Grey partridge	*Perdix perdix*			6	**6**
18	Ring-necked pheasant	*Phasianus colchicus*			3	**3**
19	Common moorhen	*Gallinula chloropus*	1			**1**
20	Black-winged stilt	*Himantopus himantopus*	1	1		**2**
21	Common redshank	*Tringa totanus*			6	**6**
22	Ruff	*Philomachus pugnax*		2,523	3,250	**5,773**
23	Dunlin	*Calidris alpina*			1	**1**
	Sandpipers spp.	*Calidris spp.*			270	**270**
24	Eurasian curlew	*Numenius arquata*			1	**1**
25	Black-headed gull	*Larus ridibundus*	54		5,810	**5,864**
26	Slender-billed gull	*Larus genei*	2	5		**7**
27	Yellow-legged gull	*Larus cachinnans*			6	**6**
	Gulls spp.	*Larus sp.*			620	**620**
28	Common tern	*Sterna hirundo*		1		**1**
29	Rock pigeon	*Columba livia var. domes.*	10			**10**
30	Eurasian collared dove	*Streptopelia decaocto*		9		**9**
31	Turtle dove	*Streptopelia turtur*	21	10		**31**
32	Common cuckoo	*Cuculus canorus*			1	**1**
33	European roller	*Coracias garrulus*	1		1	**2**
34	Common kingfisher	*Alcedo atthis*		1		**1**
35	European bee-eater	*Merops apiaster*			11	**11**
36	Hoopoe	*Upupa epops*	8	4	23	**35**
37	Bank swallow	*Riparia riparia*		25		**25**
38	Barn swallow	*Hirundo rustica*	235	453	180	**868**
39	Crested lark	*Galerida cristata*	1		1	**2**
40	Calandra lark	*Melanocorypha calandra*			1	**1**
41	Skylark	*Alauda arvensis*			7	**7**
42	Tree pipit	*Anthus trivialis*			1	**1**
43	Pipits spp.	*Anthus spp.*	1			**1**
44	Yellow wagtail	*Motacilla flava*	5			**5**
45	White wagtail	*Motacilla alba*	47		7	**54**
46	Red-backed shrike	*Lanius collurio*	4	7	4	**15**
47	Lesser grey shrike	*Lanius minor*	27	11	21	**59**
48	Golden oriole	*Oriolus oriolus*	3	2		**5**
49	European starling	*Sturnus vulgaris*	21		1	**22**
50	European magpie	*Pica pica*	2		4	**6**
51	Jackdaw	*Corvus monedula*			139	**139**
52	Rook	*Corvus frugilegus*			200	**200**
53	Hooded crow	*Corvus cornix*	18		113	**131**
54	Common raven	*Corvus corax*		2	4	**6**
55	Warblers spp.	*Phylloscopus spp.*		1	1	**2**
56	Black redstart	*Phoenicurus ochruros*		1		**1**
57	Blackbird	*Turdus merula*	5	13		**18**
58	Great tit	*Parus major*		1	2	**3**
59	Eurasian tree sparrow	*Passer montanus*	15	40	440	**495**
	Sparrows spp.	*Passer spp.*	50	50		**100**
60	Chaffinch	*Fringilla coelebs*		7		**7**
61	European goldfinch	*Carduelis carduelis*	2	6	10	**18**
62	Linnet	*Acanthis cannabina*			2	**2**
63	Corn bunting	*Miliaria calandra*	20	180	20	**220**
64	Yellow bunting	*Emberiza hortulana*		1		**1**
Total		**species**	**32**	**28**	**43**	**64**
		birds	**636**	**3,368**	**11,515**	**15,519**

Note: Plot number as in Fig. 6.4.

Out of the birds listed in the Red Data Book of Ukraine, 5 species: glossy ibis, Montagu's harrier, black-winged stilt, Eurasian curlew and European roller were observed in August 2014, with the total quantity of 8 specimens (Table 6.5). Only Montagu's harrier and European roller are the

potential residents of the wind park, other species completely depend on the availability of wetland biotopes, within which they stay. Small quantity and occasional infrequent occurrences of these birds in the territory of the wind park enable to state about extremely low impact of the wind park on them.

Table 6.5. Description of Occurrences of Rare Bird Species on the 13 - 15 of August, 2014

No.	English name	Latin name	Plot 1	Plot 2	Plot 3	∑
1	Glossy ibis	*Plegadis falcinellus*	2			**2**
2	Montagu's harrier	*Circus pygargus*			1	**1**
3	Black-winged stilt	*Himantopus himantopus*	1	1		**2**
4	Eurasian curlew	*Numenius arquata*			1	**1**
5	European roller	*Coracias garrulus*	1		1	**2**
Total		**species**	**3**	**1**	**3**	**5**
		birds	**4**	**1**	**3**	**8**

Note: Plot number corresponds to the legend in Fig. 4.32.

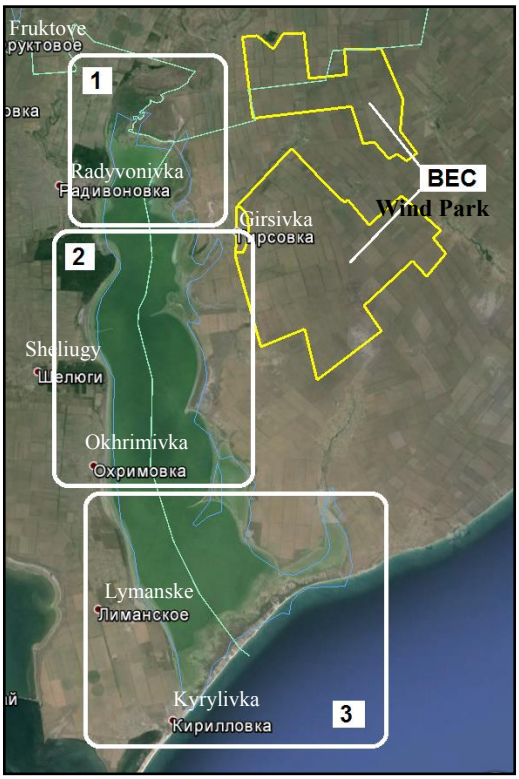


Fig. 6.4. Territories of ornithological researches on 13 - 15.08.2014

In September 2014 the counts were carried out thrice, it enabled to trace the dynamics of change of species composition of birds during autumn migration and the fluctuation of quantity. Standard routs in the upper part of the Molochnyi Estuary were included in the counts. Special attention was paid to waterfowl, owing to their large quantity and high flying activity during daylight hours (Table 6.6).

44 species in all were registered in September. Species diversity had slight deviations during all September counts and was equal to 25 - 27 species. However, species composition had some distinctions. A number of species were observed only in early September (6.09) and were absent on other census days (Montagu's harrier, Eurasian wigeon, broad-billed sandpiper, gull-billed tern). Instead other species were registered only at the end of month (22.09) – Eurasian sparrowhawk, sanderling, slender-billed gull and others. Such change of species composition is caused by migratory waves and periods of domination of one or another taxon.

Following species had the largest quantity: common shelduck (over 5,000 specimens), slender-billed gull (over 4,000 specimens) and black-headed gull (about 2,500 specimens). Quantity of other species was considerably less.

Table 6.6. Description of Ornithological State of the Territories Adjacent to the Wind Park in September 2014 (Upper Reaches of the Molochnyi Estuary)

No.	Species		Quantity		
	English name	Scientific name	06.09	13.09	22.09
1	Great white egret	*Egretta alba*			4
2	Western marsh-harrier	*Circus aeruginosus*	5	3	3
3	Montagu's harrier	*Circus pygargus*	2		
4	Eurasian sparrowhawk	*Accipiter nisus*			1
5	Common buzzard	*Buteo buteo*			1
6	Common kestrel	*Falco tinnunculus*			6
7	Red-footed falcon	*Falco vespertinus*			2
8	Eurasian hobby	*Falco subbuteo*		2	
9	Mallard	*Anas platyrhynchos*	200		7
10	Gadwall	*Anas strepera*		2	
11	Northern shoveler	*Anas clypeata*	60	58	

12	Eurasian wigeon	*Anas penelope*	80		
13	Northern pintail	*Anas acuta*	70		12
14	Common teal	*Anas crecca*	67	66	112
15	Common shelduck	*Tadorna tadorna*	5,190	748	5,636
16	Ruddy shelduck	*Tadorna ferruginea*	1	4	
17	Tufted duck	*Aythya fuligula*		1	
18	Greater scaup	*Aythya marila*		1	
19	Northern lapwing	*Vanellus vanellus*	68	82	2
20	Golden plover	*Pluvialis apricaria*			1
21	Ruff	*Philomachus pugnax*	150	577	94
22	Pied avocet	*Recurvirostra avosetta*	32	56	
23	Ringed plover	*Charadrius hiaticula*	17	9	1
24	Little ringed plover	*Charadrius dubius*	19		5
25	Curlew sandpiper	*Calidris ferruginea*	29	11	
26	Dunlin	*Calidris alpina*	250	8	3
27	Broad-billed sandpiper	*Limicola falcinellus*	1		
28	Sanderling	*Calidris alba*			1
29	Little stint	*Calidris minuta*	16	8	15
30	Common greenshank	*Tringa nebularia*		6	2
31	Spotted redshank	*Tringa erythropus*		2	
32	Marsh sandpiper	*Tringa stagnatilis*	2	1	
33	Wood sandpiper	*Tringa glareola*	19	42	
34	Common snipe	*Gallinago gallinago*	1	2	2
35	Eurasian curlew	*Numenius arquata*		1	1
36	Yellow-legged gull	*Larus cachinnans*	72	134	
37	Black-headed gull	*Larus ridibundus*	190	2,460	656
38	Slender-billed gull	*Larus genei*			4,224
39	Little gull	*Larus minutus*	520	540	253
40	Common tern	*Sterna hirundo*		18	
41	Gull-billed tern	*Gelochelidon nilotica*	1		
42	Common kingfisher	*Alcedo atthis*		1	
43	Common raven	*Corvus corax*			8
44	Barn swallow	*Hirundo rustica*			220
Total		**species**	**25**	**27**	**26**
		birds	**7,062**	**4,843**	**11,272**

In October 2014 researches were carried out within the same monitoring plot, as in September (upper reaches of the Molochnyi Estuary). It shall be noted that October is a period of active migration of not only local bird species, but also many northern populations. Just such change of species composition we have observed in the course of censuses (Table 6.7).

Table 6.7. Description of Ornithological State of the Territories Adjacent to the Wind Park on the 10 of October, 2014 (Upper Reaches of the Molochnyi Estuary)

No.	English name	Scientific name	∑	No.	English name	Scientific name	∑
1	Greater white-fronted goose	*Anser albifrons*	28	15	Common crane	*Grus grus*	22
2	Greylag goose	*Anser anser*	4	16	Northern lapwing	*Vanellus vanellus*	103
	Geese *spp.*	*Anser spp.*	100	17	Ruff	*Philomachus pugnax*	99
3	Mallard	*Anas platyrhynchos*	10	18	Dunlin	*Calidris alpina*	6
4	Northern pintail	*Anas acuta*	870	19	Yellow-legged gull	*Larus cachinnans*	140
5	Eurasian wigeon	*Anas penelope*	210	20	Black-headed gull	*Larus ridibundus*	265
6	Northern shoveler	*Anas clypeata*	15	21	Slender-billed gull	*Larus genei*	550
7	Garganey	*Anas querquedula*	2	22	Little gull	*Larus minutus*	1
8	Common teal	*Anas crecca*	990	23	Red-capped lark	*Calandrella cinerea*	20
9	Common pochard	*Aythya ferina*	2	24	Lesser short-toed lark	*Calandr. rufescens*	250
10	Common shelduck	*Tadorna tadorna*	8,330	25	Barn swallow	*Hirundo rustica*	1
11	Ruddy shelduck	*Tadorna ferruginea*	66	26	Common raven	*Corvus corax*	3
12	Goosander	*Mergus merganser*	11	27	Song thrush	*Turdus philomelos*	1

13	Western marsh-harrier	*Circus aeruginosus*	2	28	Whinchat	*Saxicola rubetra*	1
14	Eurasian sparrowhawk	*Accipiter nisus*	2				
Total							**12,104**

Such "northern" species as white-fronted goose, Eurasian wigeon, and common crane have appeared in the region. Distinct dynamics of growing quantity is observed for some species – common shelduck, Northern pintail, common teal, Eurasian wigeon; reduction for other group – black-headed and slender-billed gulls, ruff.

The total quantity of birds at the end of September and in October is comparatively the same. Changes of species composition took place, but common shelduck dominated, as the upper reaches of the Molochnyi Estuary were very attractive for it in October. Only this species was registered with quantity almost 70% of the total one.

Censuses, which were carried out on the 11 of November at the monitoring permanent point at the upper reaches of the Molochnyi Estuary, indicate the ceasing of migratory process for the majority of bird species, which is followed by reduction in species diversity and the total quantity (Table 6.8).

Registration of rough-legged buzzard, hen harrier, white-winged lark and great grey shrike is the change indicator of species composition of the ornithological complex in November. All these species are typical migrants and appear in our region at the end of autumn migration. Usually all of them stay in the south of Ukraine during winter period.

Reduction in quantity of common shelduck indicates the redistribution of places of migration stops and gatherings, as well as birds' flying away to the traditional wintering areas at the Central Syvash.

Table 6.8. Description of Ornithological State of the Territories Adjacent to the Wind Park on the 11 of November, 2014 (Upper Reaches of the Molochnyi Estuary)

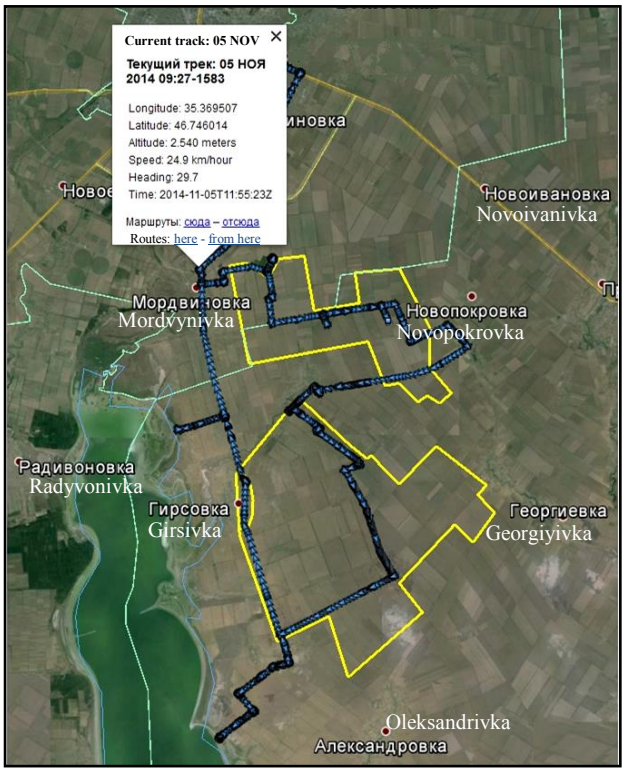
No.	English name	Scientific name	∑
1	Greater white-fronted goose	*Anser albifrons*	**13**
2	Mallard	*Anas platyrhynchos*	**8**
3	Northern shoveler	*Anas clypeata*	**12**
4	Common teal	*Anas crecca*	**14**
5	Common shelduck	*Tadorna tadorna*	**1,650**
6	Western marsh-harrier	*Circus aeruginosus*	**1**
7	Hen harrier	*Circus cyaneus*	**4**
8	Rough-legged buzzard	*Buteo lagopus*	**1**
9	Ruff	*Philomachus pugnax*	**1**
10	Common snipe	*Gallinago gallinago*	**2**
11	Yellow-legged gull	*Larus cachinnans*	**472**
12	Black-headed gull	*Larus ridibundus*	**30**
13	Tree pipit	*Anthus trivialis*	**1**
14	Yellowhammer	*Emberiza citrinella*	**8**
15	Reed bunting	*Emberiza schoeniclus*	**3**
16	Skylark	*Alauda arvensis*	**14**
17	White-winged lark	*Melanocorypha leucoptera*	**3**
18	Great grey shrike	*Lanius excubitor*	**1**
19	Linnet	*Acanthis cannabina*	**94**
Total			**2,332**

Research of the wind park site

Researches of ornithological situation during autumn migration were also carried out on the 5 - 6 of November, 2014. NIVA Chevrolet motor car was used. The total length of the route is 145 km, about 80 km of which are within the wind park sites, and about 45 km - within the buffer zones of 1 and 2 km (Fig. 6.5, Table 6.9).

Bird censuses were carried out in the course of driving route and during walking routes, as well as at the observation points (4 points within the wind park sites and 2 points on the left coast of the Molochnyi Estuary).

Climatic conditions were characterized by fair, warm (10 - 13 ^{o} C) weather, with the southern wind of medium strength (4 m/s). There were no atmospheric phenomena, which might obstruct the bird counts or worsen the visibility.



GPS- track sites of the wind park

Fig. 6.5. GPS- track of bird counts carried out on the 5 of November, 2014

Migrants registered in the course of active passage, and this is only 4 bird species, were observed singly (hen harrier – 9 occurrences), or in flocks of from 7 (mallard) to 450 (white-fronted goose) specimens. Mean size of flocks varied from 1 (hen harrier) to 145.1 (white-fronted goose) specimens in a flock. This result shall be considered high, since birds form migration gatherings during seasonal and especially autumn migrations. In addition, we see that white-fronted goose dominates among migrating birds, it has been observed in 16 flocks, from 36 to 450 specimens in a flock.

The total quantity of migrants is 2,398 that are 39.9% of all registered birds.

The part of birds, which were not migrating but were observed during counts, comprises 32 species with quantity of 3,609 specimens. Ducks, black-headed gull and rook dominated. These species made up almost 70% of all registered ones.

Table 6.9. Description of Ornithological Complex of Birds at the Wind Park Site, in the Buffer Zones and at the Molochnyi Estuary in November According to Stay Character (Migrating or Registered During the Counts)

No.	Species name		Aggregative behaviour	M*	Counts	∑
	English	Scientific				
1	Red-necked grebe	*Podiceps grisegena*	70		70	**70**
2	Greater white-fronted goose	*Anser albifrons*	170, 140, 150, 60, 120, 320, 450, 58, 110, 110, 60, 36, 58, 110, 100, 270	2,322		**2,322**
3	Mallard	*Anas platyrhynchos*	10, 24, 12, 7	41	12	**53**
4	Ducks spp.	*Anas spp.*	1,500		1,500	**1,500**
5	Hen harrier	*Circus cyaneus*	1, 1, 1, 1, 1, 1, 1, 1, 1	8	1	**9**
6	Rough-legged buzzard	*Buteo lagopus*	1		1	**1**
7	Long-legged buzzard	*Buteo rufinus*	1		1	**1**
8	Common buzzard	*Buteo buteo*	1		1	**1**
9	Common kestrel	*Falco tinnunculus*	1, 1		2	**2**
10	Black-headed gull	*Larus ridibundus*	2, 65, 450		517	**517**
11	Yellow-legged gull	*Larus cachinnans*	1, 15, 20		36	**36**
	Gulls spp.	*Larus sp.*	55		55	**55**
12	Rock pigeon	*Columba livia var. domes.*	150, 30		180	**180**
13	Eurasian collared dove	*Streptopelia decaocto*	8		8	**8**
14	Crested lark	*Galerida cristata*	3		3	**3**
15	Skylark	*Alauda arvensis*	5		5	**5**
16	European starling	*Sturnus vulgaris*	120		120	**120**
17	Eurasian jay	*Garrulus glandarius*	1, 1, 3		5	**5**
18	European magpie	*Pica pica*	3, 2, 1, 1, 1, 5, 3, 2, 2, 2		22	**22**
19	Jackdaw	*Corvus monedula*	15		15	**15**
20	Rook	*Corvus frugilegus*	6, 8, 80, 400		494	**494**
21	Hooded crow	*Corvus cornix*	1, 1, 1, 1, 1, 3, 15, 2		25	**25**
22	Common raven	*Corvus corax*	2, 2, 1		5	**5**

23	Warbler spp.	*Phylloscopus spp.*	3		3	**3**
24	Fieldfare	*Turdus pilaris*	15		15	**15**
25	Great tit	*Parus major*	1, 1		2	**2**
26	African stonechat	*Saxicola torquata*	1		1	**1**
27	Eurasian tree sparrow	*Passer montanus*	35		35	**35**
28	Sparrows spp.	*Passer spp.*	50, 25, 20, 5, 5	25	80	**105**
29	Chaffinch	*Fringilla coelebs*	20, 10		30	**30**
30	European greenfinch	*Chloris chloris*	150		150	**150**
31	European goldfinch	*Carduelis carduelis*	150		150	**150**
32	Linnet	*Acanthis cannabina*	20		20	**20**
33	Corn bunting	*Miliaria calandra*	2, 45		47	**47**
Total		**species**		**4**	**32**	**33**
		birds		**2,398**	**3,609**	**6,007**

Notes: **M** – migrants

For proper understanding of the situation with birds' distribution throughout the territory of researches and assessment of the wind park impact on the ornithological complexes subsequently, the whole territory covered by censuses was divided into the wind park site, including buffer zones of 1 and 2 km, as well as a permanent plot in the upper reaches of the Molochnyi Estuary (Mordvynivka). In addition, birds were divided according to the character of stay into migrants and those that were registered during the counts but were not in the course of migration state. Detailed description of such division is presented in Table 6.10, analysis of which gives us following conclusions.

1. Species diversity of birds within the wind park and at the Molochnyi Estuary has essential distinctions. If for migrating birds this factor is the same (3 species were registered in the course of passage both within the site and at the Molochnyi Estuary), then counts show that the wind park site and the buffer zones attracted 30 species of birds, but the Molochnyi Estuary with adjacent territories - only 8 species.

2. Species diversity is the factor of less importance for determination of the level of possible threat from the wind park than quantity of birds. Migrating species with quantity of over 60% were registered within the site, and in the course of counts (not migrating birds) about 70% were at the Molochnyi Estuary. We shall remind that greater white-fronted goose numbered 2,322 specimens out of 2,398 migrating birds, and was recorded in the course of transit passage at the altitudes over 200 m (from 300 up to 500 m).

3. The overall performance of birds' distribution in November 2014 indicates that birds preferred rather more the biotopes of the Molochnyi Estuary than the wind park sites (Table 6.10).

Table 6.10. Distribution of Birds at the Wind Park Sites Including Buffer Zones and at the Molochnyi Estuary

Stay character		Wind park and buffer zones	The Molochnyi Estuary
Counts	**species**	**30**	**8**
	birds	**1,153**	**2,456**
	%	**31.9**	**68.1**
Migrants	**species**	**3**	**3**
	birds	**1,440**	**958**
	%	**60.1**	**39.9**
Total	**species**	**30**	**11**
	birds	**2,593**	**3,414**
	%	**43.2**	**56.8**

When analysing the dynamics of migration process we shall state the presence of at least two migration waves in early September (perching birds, shore birds) and on the first ten days of October (anseriformes, shore birds, birds of prey). The maximal values of quantity were registered during the second wave of passage (first ten days of October), when over 12 thousand specimens of 28 bird species were recorded per one census. However, the largest species diversity was observed in the middle of August (15.08 – 45 species), when the majority of birds had not started yet their active migration and stayed within the Azov and Black Sea region. Quantity and species diversity considerably decrease on the first ten days of November, which certainly indicates flying away of the

majority of migrants from the region and ceasing of autumn migration by this time. More detailed description of the dynamics of autumn migration is shown in Fig. 6.6.

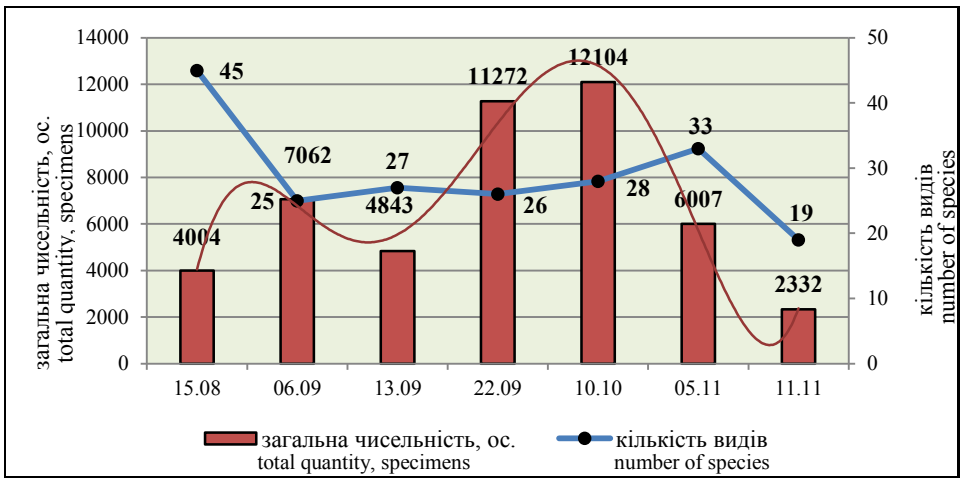


Fig. 6.6. Description of the dynamics of quantity and species composition of birds in the territories adjacent to the wind park in the course of the autumn migration of 2014

Description of migration directions

The overall picture of birds' autumn migration in the Azov and Black Sea region shall be characterized by the domination of south-western directions that is to some extent caused by stretching of the coastline of the Sea of Azov (Fig. 6.7).

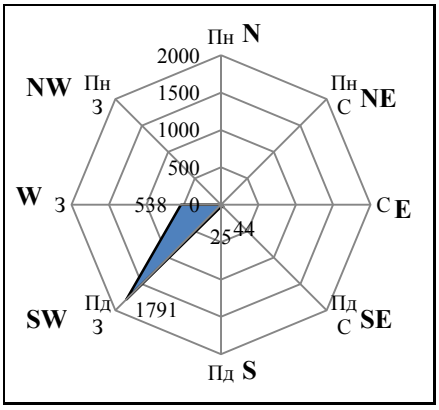


Fig. 6.7. Directions of bird migration during the counts on 5.11.2014

In addition, change of the main representatives of ornithological taxons is observed in different periods of autumn migration, it is reflected in the quantity of birds and activity of migration. For example, passage of small perching birds is typical for early stages of migration in August, and among the waterfowl complex we see the domination of sandpipers, gulls, terns. Just these species formed the main part of migrants (more than 50%), which flew in the south-western direction.

In September picture of passage changed a little. Long-distance migrants from the north have appeared in the region. These are dunlin and curlew sandpiper in the first place. Active passage of black-headed gull and abrupt increase in the quantity of common shelduck is also a typical picture for this period. We observe the beginning of active migration of ducks, mainly mallard. In general, these species, numbering more than 60% of all registered ones, flew in the south-western direction.

October is the most active period of autumn migration for many species of birds, which was reflected in the species diversity, quantity in species and their migration directions. Following species dominated at this period: European bee-eater, white wagtail, barn swallow. Almost all of them are the transit species according to the character of their passage, with typical accurate observance of certain migration directions. As in the previous months, the south-western direction was the main, but the part of the southern and western ones increased, which is caused by the wide range of migrating bird species.

In November migratory activity of the majority of bird species goes down. For perching birds it comes to an end. Birds, which have got to the Azov and Black Sea region at this period, shall be subdivided into those, which will continue migration in the southern and western directions after a while and under unfavourable weather conditions, and those, which will form winter complex. The latter prevail in quantity. Flying activity of birds at this period is connected with search of forage; just because of this birds were registered in different directions of migration. Analysis of passages shows rather high values for uncharacteristic directions for the period of migration, namely, the northern and

north-eastern ones. Birds of wetland complex used traditionally the south-eastern direction, towards the water area of the Sea of Azov.

When analysing the migratory activity of birds within the wind park in November 2014 we shall state that following directions were the main for the majority of birds: the south-western (1,791 specimens or 74.69% of all registered), western (538 specimens or 22.44%), south-eastern (44 specimens or 1.83%) and southern (25 specimens, or 1.04%). More detailed description of the directions of autumn migration is given in Fig. 4.35.

Description of altitude intervals

Study of the behaviour of birds of all taxonomic series according to the level of usage of different altitude intervals in the course of passages is almost principal factor, which may indicate the safety or danger created by the wind park. In 2014 we carried out ornithological observations in accordance with the techniques that enable to distribute all birds according to the altitudes, at which they were registered. In addition, we have included data of monitoring observations in the Azov and Black Sea region to the analysis, which describe birds with high probability from the point of view of using altitude corridors by them during passages.

Materials of observations at the permanent route in the upper reaches of the Molochnyi Estuary, which had been carried out from August to November of 2014, were also used. Observations directly within the wind park site were carried out on the 5 of November, 2014.

Analysis of obtained data enables to reveal some distinctions of this behaviour reaction of birds. So, if we divide all migrating birds into transit and feeding ones, then we see the difference in the altitudes of passages. The majority of migrants in Fig. 6.8 were found to be transit (greater white-fronted goose – 2,322 specimens, of the total 2,398 specimens, or 96.8%), and feeding movements throughout the territory of the wind park were carried out at the altitudes under 10 m, that is above the ground, or within the agricultural hedgerows.

If we analyse birds of wetland complex, just which dominated in the results of censuses at the permanent point on the Molochnyi Estuary, then the distribution according to passage altitudes is a little more various (Fig. 6.9). It was found that more than half of all registered birds (55.8%) use altitudes of 25 - 50 m (gulls, birds of prey, some species of sandpipers). Altitudes less than 10 m, which are typical for the majority of the species of perching birds, are less popular among waterfowl, only 2.26%. However, the part of birds of medium altitudes (10 - 25 m) is essential and amounts to 36.24% of all registered. Transit migrants that use altitudes over 200 m amounted to 5.65%, i.e. there were no many such birds at the Molochnyi Estuary over the whole period of observations. Less than 1% of birds were recorded at the altitudes of 50 - 100 m. So, 94.3% of birds have used safe altitude intervals under 50 m. It is also confirmed by the exponential trend line, which demonstrates that the part of birds, which may use harmful to them altitude intervals over 50 to 170 metres, in accordance with the model of birds' distribution developed on the basis of the results of permanent observations of waterfowl, will not exceed 5 - 7% of the total quantity of migrants. Thus, the influence of the wind park on birds of wetland complex during autumn migration shall be considered low.

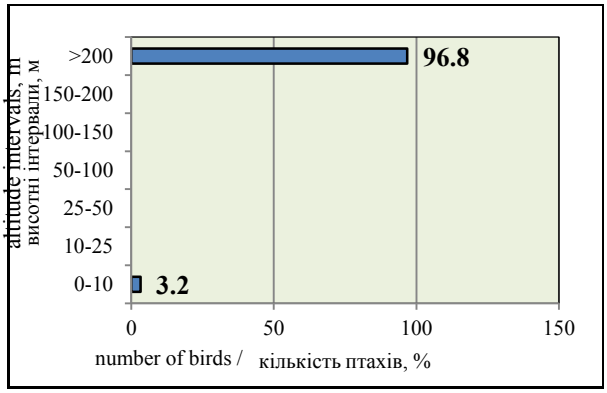


Fig. 6.8. Description of altitude intervals, which were used by birds within the wind park, buffer zones and adjacent territories on 05.11.2014

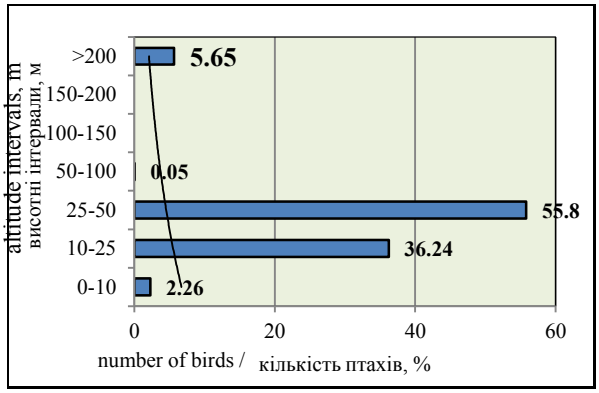


Fig. 6.9. Estimated performance of altitude intervals used by birds of wetland complex during the autumn migration of 2014

Species listed in the Red Data Book of Ukraine

11 species of birds listed in the Red Data Book of Ukraine were registered in all (Table 6.11). Quantity of the vast majority of them is small, and 6 species were observed with quantity less than 10 specimens. Only lesser short-toed lark, which is regular migrating and wintering species in recent years, was observed with quantity of 250 specimens at the coast of the Molochnyi Estuary on the 10 of October.

6 out of 11 species of rare birds (54.5%) do not use the wind park site, as according to their ecological properties they are attracted by the wetlands (the Molochnyi Estuary). Birds of prey (3 species) and common crane will not sense negative impact of the wind park owing to low quantity and irregularity of visitations of the former, and transit character of occurrence of the latter. More detailed description of the distribution and quantity of rare species is presented in Table 6.11.

So, we shall state that owing to small quantity of the majority of rare species, peculiarities of their ecology (waterfowl species) and behaviour (altitude intervals of passages), impact of the wind park on them shall be estimated as low and such that do not pose a threat to their populations.

Table 6.11. Rare Species of Birds Within the Wind Park, Buffer Zones and Adjacent Territories in Autumn 2014

No.	Species		Quantity					
	English name	Latin name	06.09	13.09	22.09	10.10	5.11	11.11
1	Montagu's harrier	*Circus pygargus*	2					
2	Hen harrier	*Circus cyaneus*					9	4
3	Long-legged buzzard	*Buteo rufinus*					1	
4	Gadwall	*Anas strepera*		2				
5	Ruddy shelduck	*Tadorna ferruginea*	1	4		66		
6	Common crane	*Grus grus*				22		
7	Pied avocet	*Recurvirostra avosetta*	32	56				
8	Ringed plover	*Charadrius hiaticula*	17	9	1			
9	Marsh sandpiper	*Tringa stagnatilis*	2	1				
10	Eurasian curlew	*Numenius arquata*		1	1			
11	Lesser short-toed lark	*Calandrella rufescens*				250		
Total		**species**	**5**	**6**	**2**	**3**	**2**	**1**
		birds	**54**	**73**	**2**	**338**	**10**	**4**

6.2. Basic ornithological monitoring within the wind park site in 2016

Description of birds' ornithological complex within EuroCape wind park, buffer zones and adjacent territories in summer 2016

Driving censuses and censuses from observation points were the basic methods of material collection, and were carried out on the 26 of July and the 7 of August, 2016 (Fig. 6.10 - 6.11). Cartographic materials are presented in AutoCAD program (Annex 1, Fig. Д 1.11 - 1.12, Table 1.11 - 1.12). In view of rather strong heat in summer 2016, the censuses have been carried out only in the morning (before midday) and evening hours, when birds are the most active. The major part of the territory of the wind park sites, buffer zones and adjacent territories has been investigated over the period of observations.

Peculiarity of such observations is the researches, which have been carried out not only at the wind park site and within the buffer zones, but also in the adjacent territories (water area of the Oleksandrivska Gulf of the Molochnyi Estuary and the Sea of Azov near to the Stepanivska Spit). Distance of counted territories from the wind park sites was up to 13 km. Maximum consideration was given to distribution of waterfowl and birds of prey dominants, availability/ absence of representatives listed in the Red Data Book of Ukraine, as well as recorded birds being listed in other nature conservation documents.

Key recorded plots (Fig. 6.18 - 6.19) within regional territory of EuroCape Wind Park were following ones:

1. The wind park sites with buffer zones
2. Water area of the Oleksandrivska Gulf of the Molochnyi Estuary and the Sea of Azov near to the Stepanivska Spit (up to 13 km from the wind park sites)
3. Plots of the upper and middle part of the Molochnyi Estuary (up to 7 km from the wind park sites).

Fig. 6.10. Research of post-nesting bird gatherings at the sites of EuroCape Wind Park in summer 2016

Fig. 6.11. Forest plantations – rest places of birds in afternoon heat

It shall be noted that the construction and operation of the wind park practically will not pose any threat for the vast majority of birds during post-nesting period, which pertain to species - habitants of open spaces, tree and shrub and synanthropic groups.

At the same time, species that pertain to wetland group need individual analysis of ornithological situation in the region in the context of assessment of possible wind park impact on birds, which form post-nesting and pre-migration gatherings. It is connected with that fact that the wind park sites are located in sufficient proximity to the water areas of the Molochnyi Estuary and the Sea of Azov, and food reserve enable considerable quantity of waterfowls to feed here.

Taxonomic description of birds' ornithological complex within EuroCape Wind Park, buffer zones and adjacent territories in summer 2016

All birds registered in the course of formation of post-nesting and pre-migration gatherings pertain to 13 taxonomic series – grebes (*podicipediformes*), pelicans (*pelecaniformes*), ciconiiformes (*ciconiiformes*), goose-like birds (*anseriformes*), birds of prey (*falconiformes*), fowl-like birds (*galliformes*), crane-like birds (*gruiformes*), shore birds (*charadriiformes*), pigeons (*columbiformes*),

owl-like birds (*strigiformes*), swift-like birds (*apodiformes*), hoopoe-like birds (*upupiformes*) and perching birds (*passeriformes*) (Tables 6.12 - 6.13, Fig. 6.13). Representatives of perching birds were absolute dominants – 27 species, subdominants – shore birds – 18 species (Table 6.12). However, availability of high species diversity has not resulted in high quantity of birds of the concrete group: shore birds (2,734 specimens) head the list, then perching birds (898 specimens) follow, and then - pelicans (148 specimens) – Table 6.12.

More detailed analysis of birds' distribution throughout the territory has revealed following regularity in domination of one or another taxon. For example, perching birds had the highest species diversity within the wind park in summer, and dominated also quantitatively at this time (26 species, 816 specimens or 84.9%); other taxons were not numerous both in terms of species and in a quantitative sense (Table 6.12, Fig. 6.12 and 6.13 A).

Table 6.12. Taxonomic Description of Ornithological Complex within EuroCape Wind Park, Buffer Zones and Adjacent Territories in Summer 2016

Series	WP and buffer zones		Adjacent territories		∑	
	n species	n specimens	n species	n specimens	n species	n specimens
Grebes	-	-	1	17	**1**	**17**
Pelicans	-	-	1	148	**1**	**148**
Ciconiiformes	-	-	3	18	**3**	**18**
Anseriformes	-	-	4	33	**4**	**33**
Birds of prey	5	26	5	22	**5**	**48**
Fowl-like birds	-	-	1	1	**1**	**1**
Crane-like birds	-	-	1	33	**1**	**33**
Shore birds	-	-	18	2,734	**18**	**2,734**
Pigeons	4	91	-	-	**4**	**91**
Owl-like birds	1	1	-	-	**1**	**1**
Swift-like birds	1	20	-	-	**1**	**20**
Hoopoe-like birds	1	7	-	-	**1**	**7**
Perching birds	26	816	7	82	**27**	**898**
Total	**38**	**961**	**41**	**3,088**	**68**	**4,049**

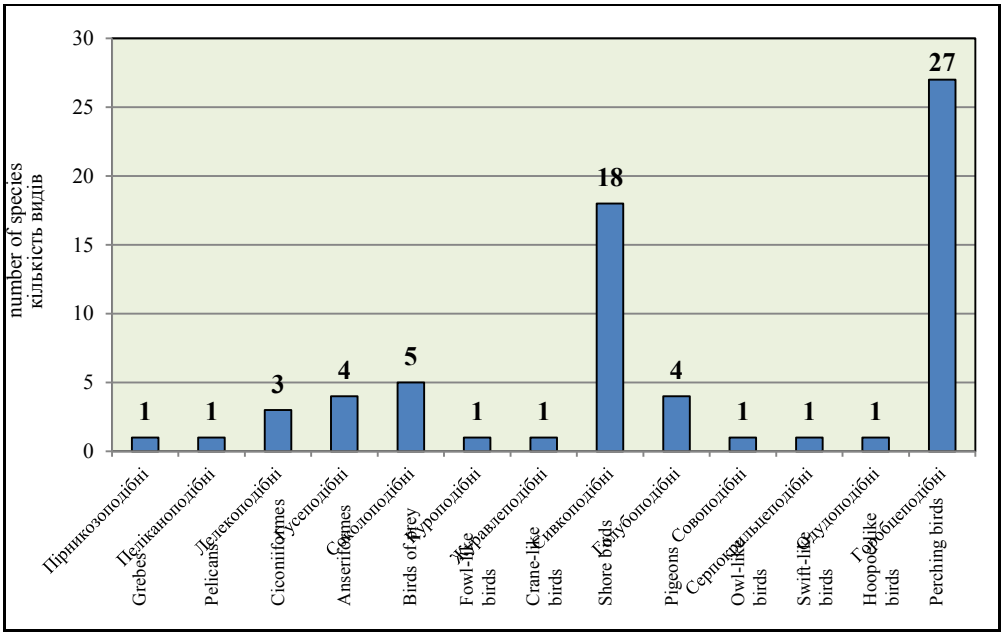
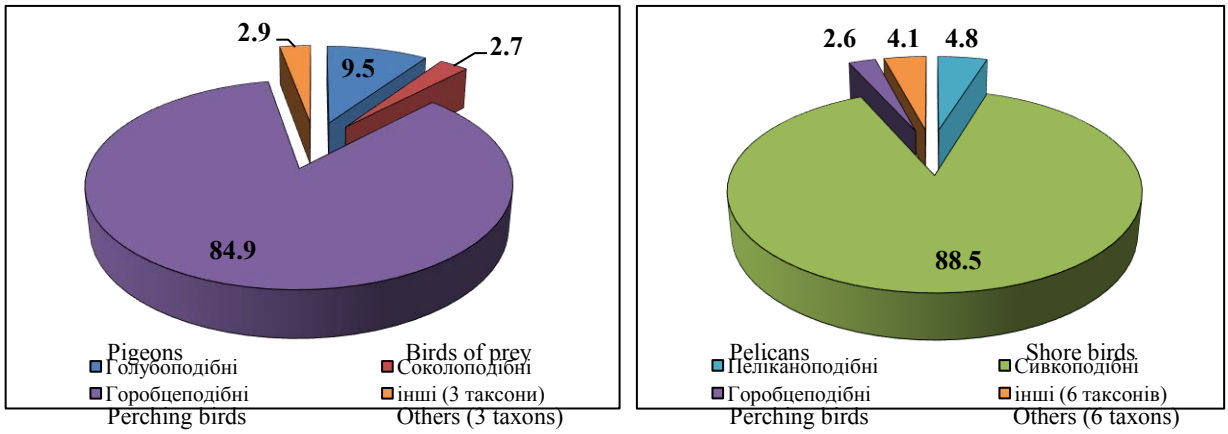


Fig. 6.12. Species representation of bird taxons registered within EuroCape Wind Park, buffer zones and adjacent territories in summer 2016

Situation in the adjacent territories was quite different. Representatives of shore birds (18 species, 2,734 specimens) dominated here quantitatively and taxonomically in summer 2016, then pelicans (1 species, 148 specimens) and perching birds (7 species, 82 specimens) followed (Table 6.12, Fig. 6.14).



A. Summer 2016, wind park sites and buffer zones

B. Summer 2016, adjacent territories

Fig. 6.13. Comparative taxonomic description of ornithological complex of the site of EuroCape Wind Park and adjacent territories in summer 2016 (number of birds in %)

Such mosaic character is caused by the availability of proper biotopes that are selected by a certain group of birds. It is hard to expect stay of large quantity of representatives of pelicans, anseriformes or shore birds within the sites of EuroCape Wind Park owing to complete agricultural development of the territory.

Bird species, which quantitatively predominated over others, were in each taxonomic group. So, among perching birds barn swallow – *Hirundo rustica* – amounted to 25.6% of quantity, and small perching birds – *Passer spp.* – 27.5%, in other groups following species dominated: among shore birds ruff – *Philomachus pugnax* (36.3%), black-headed gull – *Larus ridibundus* (20.7%) and yellow-legged gull – *Larus cachinnans* (15.6%), and among pelicans cormorant – *Phalacrocorax carbo* – amounted to 100% of quantity (148 specimens).

Quantitative characteristic

The total quantity of 68 registered bird species is 4,049 specimens, out of which 354 specimens (or 8.7% of all registered birds) have been observed at the sites of EuroCape Wind Park, 607 specimens (14.9%) in the buffer zones of 1 and 2 km, and 3,088 specimens (76.4%) – in the adjacent territories (upper and middle part of the Molochnyi Estuary, as well as its Oleksandrivska Gulf and coastal plots of the water area of the Sea of Azov). Such correlation of birds by different territories is typical, owing to relatively small area of the wind park in comparison with the area of adjacent plots, and higher diversity of biotopes in the latter (Table 6.13).

Following species were the most numerous at the wind park sites and in the buffer zones: barn swallow (*Hirundo rustica*), small perching birds (*Passer spp.*), rock pigeon (domestic type) (*Columba livia varia domestica*) and lesser grey shrike (*Lanius minor*), 594 specimens of which have been observed, or 61.8%. Quantity of other bird species was 367 specimens. Semi-aquatic birds have not been recorded at the wind park sites and in the buffer zones and quantity of upland birds was 961 specimens.

In consideration of location of the Molochnyi Estuary Wetland and (to a lesser extent) the Sea of Azov near to the sites of EuroCape Wind Park, we can observe the domination of semi-aquatic bird species here. So, 3,006 specimens (or 97.3%) of bird species that are biotopically attracted to wetlands were registered in the adjacent territories over the whole period of observations in summer 2016. Following species dominated here: ruff (*Philomachus pugnax*), black-headed (*Larus ridibundus*) and yellow-legged (*Larus cachinnans*) gulls. Quantity of upland species in the adjacent territories was 82 specimens over the whole period of observations.

More detailed description of bird species composition and distribution during formation of post-nesting and pre-migration gatherings at EuroCape Wind Park sites, in buffer zones and within adjacent territories is given in Table 6.13 and in Annex 1 (Tables 1.11 - 1.12 and AutoCAD schematic maps, Fig. Д 1.11 - Д 1.12).

It shall be noted that only 5.1% of all registered birds (205 specimens) carried out feeding migratory movements within the wind park sites, buffer zones and adjacent territories in search of forage.

Table 6.13. General Description of Ornithological Complex in EuroCape Wind Park Territory, in the Buffer Zones and within the Adjacent Territories in Summer 2016

No.	Species	26.07	7.08			Total
		AT*	WP	BZ	AT	
1	Great crested grebe (*Podiceps cristatus*)				17	**17**
2	Cormorant (*Phalacrocorax carbo*)	148				**148**
3	Little egret (*Egretta garzetta*)				1	**1**
4	Grey heron (*Ardea cinerea*)	7			2	**9**
5	Glossy ibis (*Plegadis falcinellus*)				8	**8**
6	Mute swan (*Cygnus olor*)	4				**4**
7	Common shelduck (*Tadorna tadorna*)	7			2	**9**
8	Mallard (*Anas platyrhynchos*)				8	**8**
9	Common pochard (*Aythya ferina*)				2	**2**
	Ducks (*Anas spp.*)				10	**10**
10	Western marsh-harrier (*Circus aeruginosus*)			1	3	**4**
11	Long-legged buzzard (*Buteo rufinus*)		1		2	**3**
12	Common buzzard (*Buteo buteo*)			2	3	**5**
13	Red-footed falcon (*Falco vespertinus*)			1	1	**2**
14	Common kestrel (*Falco tinnunculus*)		17	4	13	**34**
15	Grey partridge (*Perdix perdix*)				1	**1**
16	Eurasian coot (*Fulica atra*)				33	**33**
17	Northern lapwing (*Vanellus vanellus*)	3				**3**
18	Turnstone (*Arenaria interpres*)	6				**6**
19	Black-winged stilt (*Himantopus himantopus*)				18	**18**
20	Eurasian oystercatcher (*Haematopus ostralegus*)	5				**5**
21	Common redshank (*Tringa totanus*)				4	**4**
22	Ruff (*Philomachus pugnax*)	305			690	**995**
23	Dunlin (*Calidris alpina*)	23				**23**
	Sandpipers (*Calidris spp.*)	123				**123**
24	Eurasian curlew (*Numenius arquata*)	4				**4**
25	Black-tailed Godwit (*Limosa limosa*)	4				**4**
26	Mediterranean gull (*Larus melanocephalus*)	147			4	**151**
27	Little gull (*Larus minutus*)	68				**68**
28	Black-headed gull (*Larus ridibundus*)	560			5	**565**
29	Slender-billed gull (*Larus genei*)	12				**12**
30	Yellow-legged gull (*Larus cachinnans*)	422			4	**426**
	Gulls (*Larus spp.*)				50	**50**
31	Black tern (*Chlidonias niger*)	21				**21**
	Terns (*Chlidonias spp.*)				15	**15**
32	Gull-billed tern (*Gelochelidon nilotica*)	12				**12**
33	Sandwich tern (*Thalasseus sandvicensis*)	153				**153**
34	Common tern (*Sterna hirundo*)	76				**76**
35	Woodpigeon (*Columba palumbus*)		2			**2**
36	Rock pigeon (domestic type) (*Columba livia var. domestica*)			75		**75**
37	Eurasian collared dove (*Streptopelia decaocto*)		7			**7**
38	Turtle dove (*Streptopelia turtur*)		7			**7**
39	Little owl (*Athene noctua*)			1		**1**
40	Common swift (*Apus apus*)			20		**20**
41	Hoopoe (*Upupa epops*)			7		**7**
42	Barn swallow (*Hirundo rustica*)			230		**230**
43	Bank swallow (*Riparia riparia*)				20	**20**
44	Crested lark (*Galerida cristata*)			1		**1**
45	Skylark (*Alauda arvensis*)			9	3	**12**
46	Yellow wagtail (*Motacilla flava*)			3		**3**
47	White wagtail (*Motacilla alba*)		3	32		**35**
48	Red-backed shrike (*Lanius collurio*)		15	5		**20**
49	Lesser grey shrike (*Lanius minor*)		52	18		**70**
50	Golden oriole (*Oriolus oriolus*)		1	1		**2**

51	European starling (*Sturnus vulgaris*)		45		25	**70**
52	European magpie (*Pica pica*)		3		1	**4**
53	Jackdaw (*Corvus monedula*)			1		**1**
54	Rook (*Corvus frugilegus*)			15	3	**18**
55	Hooded crow (*Corvus cornix*)		8	3		**11**
56	Common raven (*Corvus corax*)		1	2		**3**
57	Northern wheatear (*Oenanthe oenanthe*)		1	3	1	**5**
58	Common redstart (*Ph. phoenicurus*)		1		1	**2**
59	Thrush nightingale (*Luscinia luscinia*)		3	1		**4**
60	Great tit (*Parus major*)		1			**1**
61	House sparrow (*Passer domesticus*)			10		**10**
62	Eurasian tree sparrow (*Passer montanus*)		35	5		**40**
63	Chaffinch (*Fringilla coelebs*)			15		**15**
64	European greenfinch (*Chloris chloris*)		1	1		**2**
65	European goldfinch (*Carduelis carduelis*)		10	25		**35**
66	Linnet (*Acanthis cannabina*)		4	10		**14**
67	Corn bunting (*Emberiza calandra*)		2	7		**9**
68	Yellowhammer (*Emberiza citrinella*)			14		**14**
	Perching birds (*Passer spp.*)		134	85	28	**247**
Total		**species**	**20**	**22**	**30**	**28**	**68**
		birds	**2,110**	**354**	**607**	**978**	**4,049**

Note: **WP** – EuroCape Wind Park sites; **BZ** – buffer zones; **AT** – adjacent territories (upper and middle parts of the Molochnyi Estuary); **AT*** – lower part of the Molochnyi Estuary and offshore strip of the Sea of Azov).

Biotopic distribution of birds

Species diversity of birds and their quantity depend in a certain manner on the number of distinguished biotopes (Fig. 6.14 - 6.15). We have revealed such landscape-biotopic units in the investigated region: agrocenosis (agricultural lands), agricultural hedgerows and man-planted forest areas, steppe plots of open space, offshore strip and human settlements. Each of biotopes is a living territory of individual groups of birds (Table 6.14).

Table 6.14. Biotopic Distribution of Birds within EuroCape Wind Park, Buffer Zones and Adjacent Territories in Summer 2016

Zones \ Biotopes		**Biotopes of birds' distribution**				**∑**	
		water areas	**open space**	**agricultural hedgerows**	**human settlements**	**abs.**	**%**
Wind park sites		-	222	132	-	**354**	**8.7**
Buffer zones		-	373	129	105	**607**	**14.9**
Adjacent territories		2,421	518	120	29	**3,088**	**76.4**
Total	**abs.**	**2,421**	**1,113**	**381**	**134**	**4,049**	**100**
	%	**59.8**	**27.5**	**9.4**	**3.3**		**100**

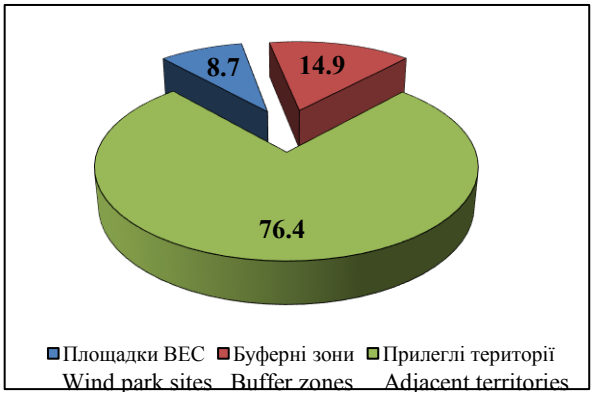


Fig. 6.14. Distribution of birds throughout functional zones of the designed territory, %

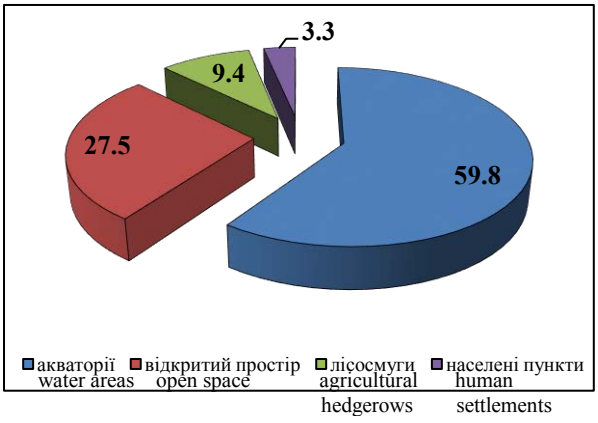


Fig. 6.15. Biotopic distribution of birds throughout the designed territory, %

In consideration of location of the wind park sites near to the wetlands, the domination of semi-aquatic birds here would be logically expected; analysis of the field material has revealed just such regularity. 29 species with quantity of 3,003 specimens of semi-aquatic birds were registered, or 73.7%, the overwhelming majority of which had been observed in the adjacent territories. As we can see, the territories adjacent to EuroCape Wind Park are attractive for semi-aquatic birds. We have observed mostly ruff (*Philomachus pugnax*), black-headed gull (*Larus ridibundus*) and yellow-legged gull (*Larus cachinnans*), which formed rather large gatherings. 39 species of birds with quantity of 1,046 specimens were registered at the uplands (26.3%). Small perching birds (*Passer spp*.) were the dominants here, which made up 23.6% of all counted upland birds, as well as barn swallow - *Hirundo rustica* (22.0%).

While carrying out researches it turned out that the plots of offshore strip had been the most visited during formation of post-nesting and pre-migration gatherings – 2,421 specimens (59.8%) were observed there, open space attracted 1,113 specimens (27.5%), and 381 specimens (9.4%) stayed in the agricultural hedgerows and man-planted forests. Following villages had been observed in the course of censuses: Mordvynivka, Nadezhdine, Girsivka and Dunaivka –134 specimens (3.3%) were observed there (Table 6.14, Fig. 6.15).

Passage directions of birds, which form post-nesting and pre-migration gatherings

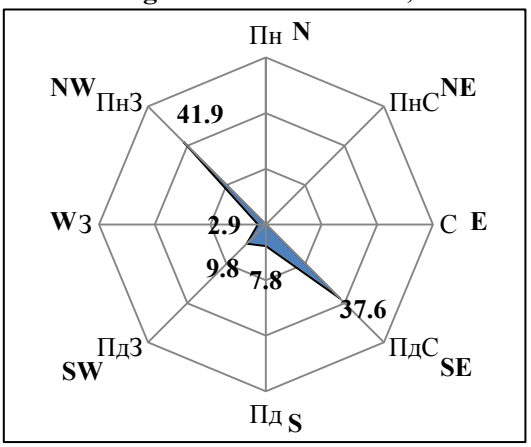


Fig. 6.16. Directions of birds' migration within EuroCape Wind Park in summer 2016

North-western and south-eastern directions prevailed among directions of passage (Fig. 6.16). 163 specimens (79.5% of the total quantity of feeding migrants) flew in these directions. Generally they were semi-aquatic birds (ruff, mallard and gulls), birds of prey and small perching birds, which were flying in search of forage towards the Sea of Azov or to agrocenosis. Small perching birds (first and foremost, barn swallow, as well as chaffinch and corn bunting), while flying in these directions, carried out daily feeding movements both throughout the territory of the wind park sites and outside it. In addition, migration movements of birds have been observed in the south-western (20 specimens, 9.8%), southern (16 specimens, 7.8%) and western (6 specimens, 2.9%) directions; in other ones flight of birds have not been observed at this period of year.

Passage altitudes of birds, which form post-nesting and pre-migration gatherings

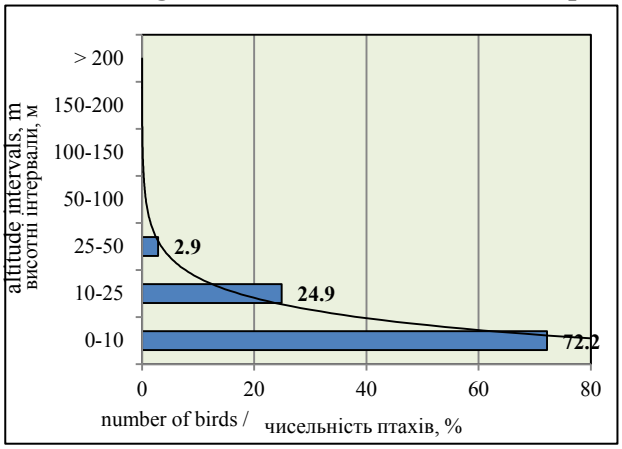


Fig. 6.17. Description of altitudes of birds' passage within EuroCape Wind Park in summer 2016

Analysis of results of the researches has shown that all birds (205 specimens, or 100% of the total quantity of migrants), which carry out feeding migratory flights in summer, flew at the altitudes under 50 m (Fig. 6.18). They were, first of all, small perching birds (swallows, starlings), which move through agricultural hedgerows and at a small altitude through open space, as well as waterfowls – gulls, ducks, ruffs. At that, the major part of them was recorded in the near-ground interval under 10 m (72.2%). In summer 2016, birds have not been counted at altitudes of 50 - 170 m potentially dangerous for birds (Fig. 6.18).

Exponential trend line in the linear diagram of Fig. 6.17 mathematically confirms the hypothesis about safety of the altitudes of birds' flight within EuroCape Wind Park in the course of formation of post-nesting and pre-migration gatherings in summer 2016.

Adjacent territories

The Oleksandrivska Gulf of the Molochnyi Estuary and the offshore strip of the Sea of Azov near the Stepanivska Spit

In July 2016, the territories located near to the Village of Stepanivka Persha (the Oleksandrivska Gulf of the Molochnyi Estuary), were characterized by the high biodiversity. 20 bird species with quantity of 2,110 specimens have been recorded here (Fig. 6.18, Table 6.15), it made up more than a half (52.1%) of all birds counted in summer. Such situation was quite expected because the water level was high in 2016, which is connected with filling of the Molochnyi Estuary and its gulfs with water after cleaning of flood gully at Stepanivska Spit in 2015. Availability of proper forage resources caused absolute dominance of waterfowl bird species here (2,110 specimens, or 100%). Upland species have not been recorded on the 26 of July.

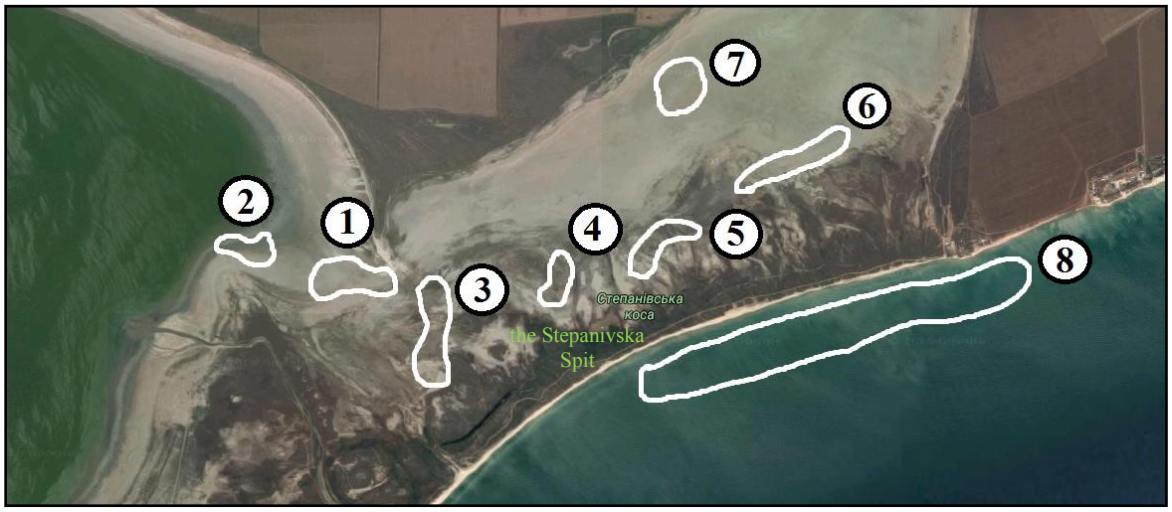


Fig. 6.18. Count plots (3 - ⬭) of carried out ornithological observations in the territories adjacent to EuroCape Wind Park – the Oleksandrivska Gulf of the Molochnyi Estuary and the offshore strip of the Sea of Azov near the Stepanivska Spit – July 26, 2016

Table 6.15. Description of the State of Post-nesting Bird Gatherings in the Territories Adjacent to EuroCape Wind Park – the Oleksandrivska Gulf of the Molochnyi Estuary and the Offshore Strip of the Sea of Azov near the Stepanivska Spit (26.07.2016)

No.	Species	Gathering								Total
		1	2	3	4	5	6	7	8	
1	Cormorant (*Phalacrocorax carbo*)	108	22		12				6	**148**
2	Grey heron (*Ardea cinerea*)				2	4	1			**7**
3	Mute swan (*Cygnus olor*)			4						**4**
4	Common shelduck (*Tadorna tadorna*)			7						**7**
5	Northern lapwing (*Vanellus vanellus*)						3			**3**
6	Turnstone (*Arenaria interpres*)				6					**6**
7	Eurasian oystercatcher (*Haematopus ostralegus*)				5					**5**
8	Ruff (*Philomachus pugnax*)	120			120	65				**305**
9	Dunlin (*Calidris alpina*)				23					**23**
	Sandpipers (*Calidris spp.*)				80	20	23			**123**
10	Eurasian curlew (*Numenius arquata*)				4					**4**
11	Black-tailed Godwit (*Limosa limosa*)				4					**4**
12	Mediterranean gull (*Larus melanocephalus*)		120	27						**147**
13	Little gull (*Larus minutus*)			28				40		**68**
14	Black-headed gull (*Larus ridibundus*)			164	86		40	120	150	**560**
15	Slender-billed gull (*Larus genei*)			12						**12**
16	Yellow-legged gull (*Larus cachinnans*)	81	81	16	24				220	**422**
17	Black tern (*Chlidonias niger*)					21				**21**
18	Gull-billed tern (*Gelochelidon nilotica*)				12					**12**
19	Sandwich tern (*Thalasseus sandvicensis*)		60		45				48	**153**
20	Common tern (*Sterna hirundo*)		20			21	20		15	**76**

Total	**species**	**3**	**5**	**7**	**12**	**4**	**4**	**2**	**5**	**20**
	birds	**309**	**303**	**258**	**423**	**131**	**87**	**160**	**439**	**2,110**

Note: Bird gatherings 1 - 7 – the water area of the Oleksandrivska Gulf; **8 –** the offshore strip of the Sea of Azov near the Stepanivska Spit.

Upper and middle parts of the Molochnyi Estuary

As well as the lower part of the Molochnyi Estuary (the Oleksandrivska Gulf), the territory of its middle and upper part also had high biological diversity in August 2016, which was also caused by filling of the estuary with water and improvement of forage resources. 29 bird species with quantity of 979 specimens (24.2% of all birds registered in summer 2016) were recorded here (Table 6.16, Fig. 6.19 - 6.20). Semi-aquatic birds also dominated here – 17 species, 896 specimens. Upland birds were recorded in the quantity of 83 specimens of 12 species.

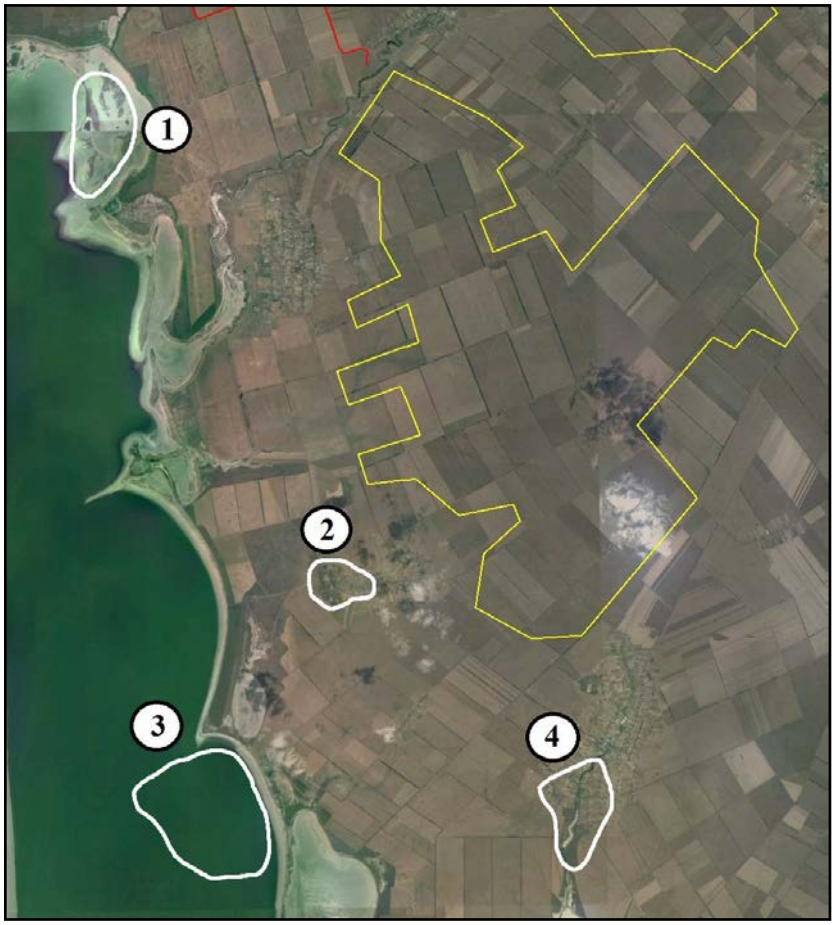


Fig. 6.19. Count plots (⬭ - 3) of carried out ornithological observations in the territories adjacent to EuroCape Wind Park (▭ - boundaries of the wind park) – upper and middle parts of the Molochnyi Estuary on the 7 of August, 2016

Table 6.16. Description of the State of Post-nesting Bird Gatherings in the Territories Adjacent to EuroCape Wind Park – Upper and Middle Parts of the Molochnyi Estuary (7.08.2016)

No.	Species	Plots				Total
		1	2	3	4	
1	Great crested grebe (Podiceps cristatus)	17				17
2	Little egret (Egretta garzetta)	1				1
3	Grey heron (Ardea cinerea)	2				2
4	Glossy ibis (Plegadis falcinellus)				8	8
5	Common shelduck (Tadorna tadorna)				2	2
6	Mallard (Anas platyrhynchos)				8	8
7	Common pochard (Aythya ferina)				2	2

	Ducks (Anas spp.)				10		10
8	Western marsh-harrier (Circus aeruginosus)				3		3
9	Long-legged buzzard (Buteo rufinus)		2				2
10	Common buzzard (Buteo buteo)		1		2		3
11	Red-footed falcon (Falco vespertinus)				1		1
12	Common kestrel (Falco tinnunculus)		2		6	5	13
13	Grey partridge (Perdix perdix)			1			1
14	Eurasian coot (Fulica atra)					33	33
15	Black-winged stilt (Himantopus himantopus)				13	5	18
16	Common redshank (Tringa totanus)				2	2	4
17	Ruff (Philomachus pugnax)					690	690
18	Mediterranean gull (Larus melanocephalus)		3		1		4
19	Black-headed gull (Larus ridibundus)		1		4		5
20	Yellow-legged gull (Larus cachinnans)		2		2		4
	Gulls (Larus spp.)				50		50
21	Terns (Chlidonias spp.)				15		15
22	Bank swallow (Riparia riparia)		20				20
23	Skylark (Alauda arvensis)					3	3
24	European starling (Sturnus vulgaris)			10		15	25
25	European magpie (Pica pica)			1			1
26	Jackdaw (Corvus monedula)			1			1
27	Rook (Corvus frugilegus)			3			3
28	Northern wheatear (Oenanthe oenanthe)			1			1
29	Common redstart (Ph. phoenicurus)			1			1
	Perching birds (Passer spp.)					28	28
Total		species	10	7	10	11	29
		birds	51	18	109	801	979

Count plots: 1 – water area of the upper part of the Molochnyi Estuary near to Girsivka Village; **2 –** urban landscapes of Dunaivka Village; **3 –** water area of the middle part of the Molochnyi Estuary near to Viktorivka Village; 4 – the pond in Oleksandrivka Village.

Fig. 6.20. Species listed in the Red Data Book of Ukraine (glossy ibis – *Plegadis falcinellus* and black-winged stilt – *Himantopus himantopus*) together with ruff (*Philomachus pugnax*) on the pond in the Village of Oleksandrivka

Description of autumn migration according to the results of monitoring researches in 2016

Key tasks of the observations were following: study of species composition of birds, their quantity, analysis of taxonomic division of the whole ornithological complex, fixation of passage directions and movement altitudes of bird flocks. Individual investigations of birds, which are listed in the Red Data Book of Ukraine, or rare for the region, as well as distribution of autumn migratory ornithological complex according to other nature conservation documents, were also important.

Weather conditions

Analysis of weather conditions in the region of investigations is very important owing to dependence of the majority of bird life phenomena on such indices as air temperature, directions and strength of wind, air pressure, and precipitation.

A fact of interconnection between phenology of migratory processes and dynamics of weather-climatic indices is obvious. In general, the weather in autumn 2016 shall be characterized by rather abrupt drops of temperature and air pressure oscillation. So, temperature reductions by 6 - 7 ºC were frequent during only 1 - 2 days. In what follows, at the beginning of November, the tendency of decrease of temperature indices remained. On the first days of the month they did not exceed 8 ºC, which coincided with ceasing of autumn migration in the territory of EuroCape Wind Park.

Daily average air temperatures towards the end of August varied from 20.0 to 29.5 ºC, at the mean equal to 24.8 ºC. In what follows, the situation has changed: in September temperature varied from 9.5 to 26.0 ºC, at the mean equal to 18.3 ºC, in October – from 1.5 to 19.0 ºC, at the mean equal to 9.3 ºC (Table 6.17). Such abrupt drop of temperature, implicitly, has had an effect on a progress of migration process. More detailed description of weather-climatic conditions is shown in Table 6.17 and in Fig. 6.21.

Dynamics of migration, owing to abrupt variations of temperatures and air pressure, was not the same: towards the end of August and in September there was still small quantity of migrating birds, and the peak of autumn migration fell on October.

Table 6.17. Description of Weather Conditions of the End of August - October 2016

Parameter	n	M ± m	min	max	C_v
Air temperature. August	7	24.8 ± 3.68	20.0	29.5	14.86
Air pressure. August	7	754.1 ± 2.27	751.0	757.0	0.30
Air temperature. September	30	18.3 ± 5.04	9.5	26.0	27.54
Air pressure. September	30	754.7 ± 3.55	742.0	760.0	0.47
Air temperature. October	31	9.3 ± 5.01	1.5	19.0	53.7
Air pressure. October	31	759.8 ± 6.03	749.0	770.5	0.79

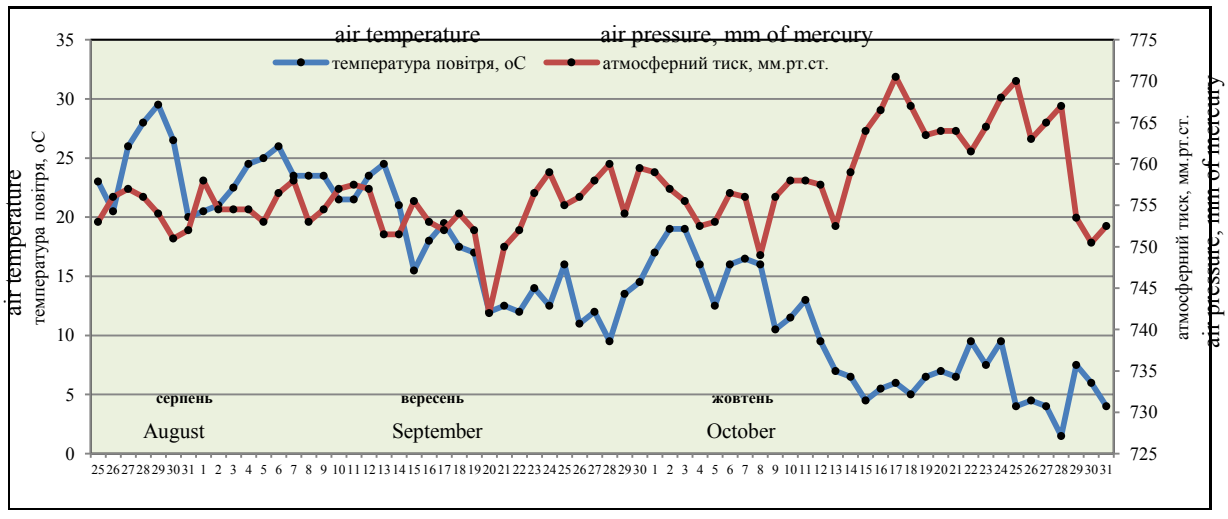


Fig. 6.21. Weather-climatic description of the end of August - October 2016, according to the data of meteorological station of Mordvynivka Village

Taxonomic description of birds' ornithological complex within EuroCape Wind Park, buffer zones and adjacent territories during the autumn migration of 2016

All birds registered in the autumn passage pertain to 11 taxonomic series – grebes (*podicipediformes*), ciconiiformes (*ciconiiformes*), goose-like birds (*anseriformes*), birds of prey (*falconiformes*), fowl-like birds (*galliformes*), shore birds (*charadriiformes*), pigeons (*columbiformes*), coraciiformes (*coraciiformes*), hoopoe-like birds (*upupiformes*), piciformes (*piciformes*) and perching birds (*passeriformes*) (Tables 6.18 - 6.21, Fig. 6.22). Representatives of perching birds were dominating – 31 species, subdominants: shore birds – 15 species (Table 6.21). Availability of high species diversity resulted in also high quantity of birds of a concrete group. So, shore birds (3,072 specimens) head the list, then perching birds (2,896 specimens) follow, and then anseriformes (648 specimens) (Table 6.21).

More detailed analysis of birds' distribution throughout the territory has revealed another regularity in domination of one or another taxon. For example, perching birds had the highest species diversity within the wind park and in the buffer zones (BZ) in August, which dominated also quantitatively (14 species, 172 specimens) at this time. Shore birds (3 species, 61 specimens) took up the second position (Table 6.18, Fig. 6.23). In the adjacent territories, shore birds (13 species, 346 specimens) were dominating in August, other taxons were not numerous.

In September situation in the wind park territory has not changed: perching birds (16 species, 358 specimens) also took up the first position here, and shore birds (3 species, 53 specimens) – the second one (Table 6.19). Similar situation was observed in the adjacent territories: perching birds and shore birds dominated.

Whereas in October situation with taxons - subdominants was different. Perching birds dominated in the wind park territory and in the buffer zones, and shore birds – in the adjacent territories; subdominants: shore birds and pigeons in the wind park territory and in the buffer zones, perching birds and anseriformes - in the adjacent territories (Table 6.20, Fig. 6.23).

In general, situation in the adjacent territories was different from the wind park area. Representatives of shore birds (15 species, 2,785 specimens) dominated here in autumn 2016, then perching birds (16 species, 845 specimens) followed and anseriformes, 648 specimens of 4 species of which had been recorded (Table 6.21, Fig. 6.23).

Such mosaic character is caused by the availability of proper biotopes that are selected by a certain group of birds. It is hard to expect stay of representatives of grebes, anseriformes or shore birds directly within EuroCape Wind Park owing to complete agricultural development of the territory; representatives of these taxons occur, in the first place, in the adjacent territories, and to a lesser extent, in the buffer zones.

Bird species, which quantitatively predominated over others, were in each taxonomic group. So, among perching birds: European starling – *Sturnus vulgaris* – numbered 45.6% of quantity, rook – *Corvus frugilegus* – 15.1%, in other groups following were dominating: among shore birds black-headed gull – *Larus ridibundus* (68.8%), ruff – *Philomachus pugnax* (13.9%), and yellow-legged gull – *Larus cachinnans* (6.4%), among anseriformes: ducks – *Anas spp.* (69.4%) and mallard – *Anas platyrhynchos* (24.2%), and among pigeons – rock pigeon (domestic type) – *Columba livia varia domestica* (67.1%).

Table 6.18. Taxonomic Description of Migration Ornithological Complex within EuroCape Wind Park, Buffer Zones and Adjacent Territories in August 2016

Series	WP and buffer zones		Adjacent territories		∑	
	n species	n specimens	n species	n specimens	n species	n specimens
Grebes	-	-	1	11	**1**	**11**
Birds of prey	3	7	-	-	**3**	**7**
Fowl-like birds	2	9	-	-	**2**	**9**
Shore birds	3	61	13	346	**13**	**407**
Pigeons	2	10	-	-	**2**	**10**
Coraciiformes	2	7	-	-	**2**	**7**
Hoopoe-like birds	1	1	-	-	**1**	**1**
Perching birds	14	172	5	53	**16**	**225**
Total	**27**	**267**	**19**	**410**	**40**	**677**

Table 6.19. Taxonomic Description of Migration Ornithological Complex within EuroCape Wind Park, Buffer Zones and Adjacent Territories in September 2016

Series	WP and buffer zones		Adjacent territories		∑	
	n species	n specimens	n species	n specimens	n species	n specimens
Anseriformes	-	-	1	7	**1**	**7**
Birds of prey	3	6	-	-	**3**	**6**
Fowl-like birds	1	17	-	-	**1**	**17**
Shore birds	3	53	4	192	**4**	**245**
Pigeons	3	11	-	-	**3**	**11**
Perching birds	16	358	9	150	**17**	**508**
Total	**26**	**445**	**14**	**349**	**29**	**794**

Table 6.20 Taxonomic Description of Migration Ornithological Complex within EuroCape Wind Park, Buffer Zones and Adjacent Territories in October 2016

Series	WP and buffer zones		Adjacent territories		∑	
	n species	n specimens	n species	n specimens	n species	n specimens
Grebes	-	-	1	19	**1**	**19**
Ciconiiformes	-	-	2	19	**2**	**19**
Anseriformes	-	-	3	641	**3**	**641**
Birds of prey	5	20	2	2	**5**	**20**
Fowl-like birds	-	-	2	29	**2**	**29**
Shore birds	2	173	2	2,247	**3**	**2,420**
Pigeons	4	136	1	22	**4**	**158**
Piciformes	-	-	1	1	**1**	**1**
Perching birds	23	1,521	11	642	**23**	**2,163**
Total	**34**	**1,850**	**25**	**3,622**	**44**	**5,470**

Table 6.21. Taxonomic Description of Migration Ornithological Complex within EuroCape Wind Park, Buffer Zones and Adjacent Territories in Autumn 2016

Series	WP and buffer zones		Adjacent territories		∑	
	n species	n specimens	n species	n specimens	n species	n specimens
Grebes	-	-	1	30	**1**	**30**
Ciconiiformes	-	-	2	19	**2**	**19**
Anseriformes	-	-	4	648	**4**	**648**
Birds of prey	6	33	2	2	**6**	**35**
Fowl-like birds	2	26	2	29	**3**	**55**
Shore birds	4	287	15	2,785	**15**	**3,072**
Pigeons	5	157	1	22	**5**	**179**
Coraciiformes	2	7	-	-	**2**	**7**
Hoopoe-like birds	1	1	-	-	**1**	**1**
Piciformes	-	-	1	1	**1**	**1**
Perching birds	29	2,051	16	845	**31**	**2,896**
Total	**49**	**2,562**	**44**	**4,381**	**71**	**6,943**

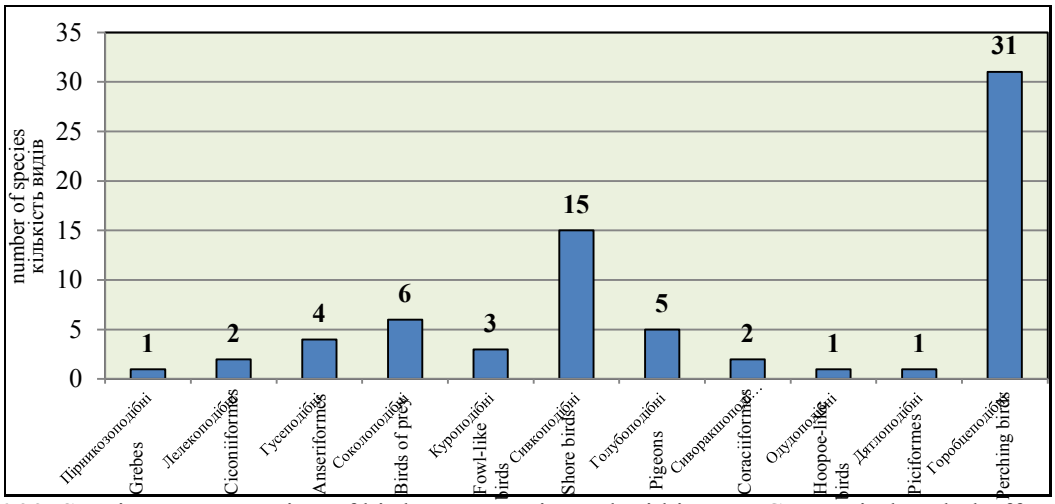


Fig. 6.22. Species representation of bird taxons registered within EuroCape Wind Park, buffer zones and adjacent territories in autumn 2016

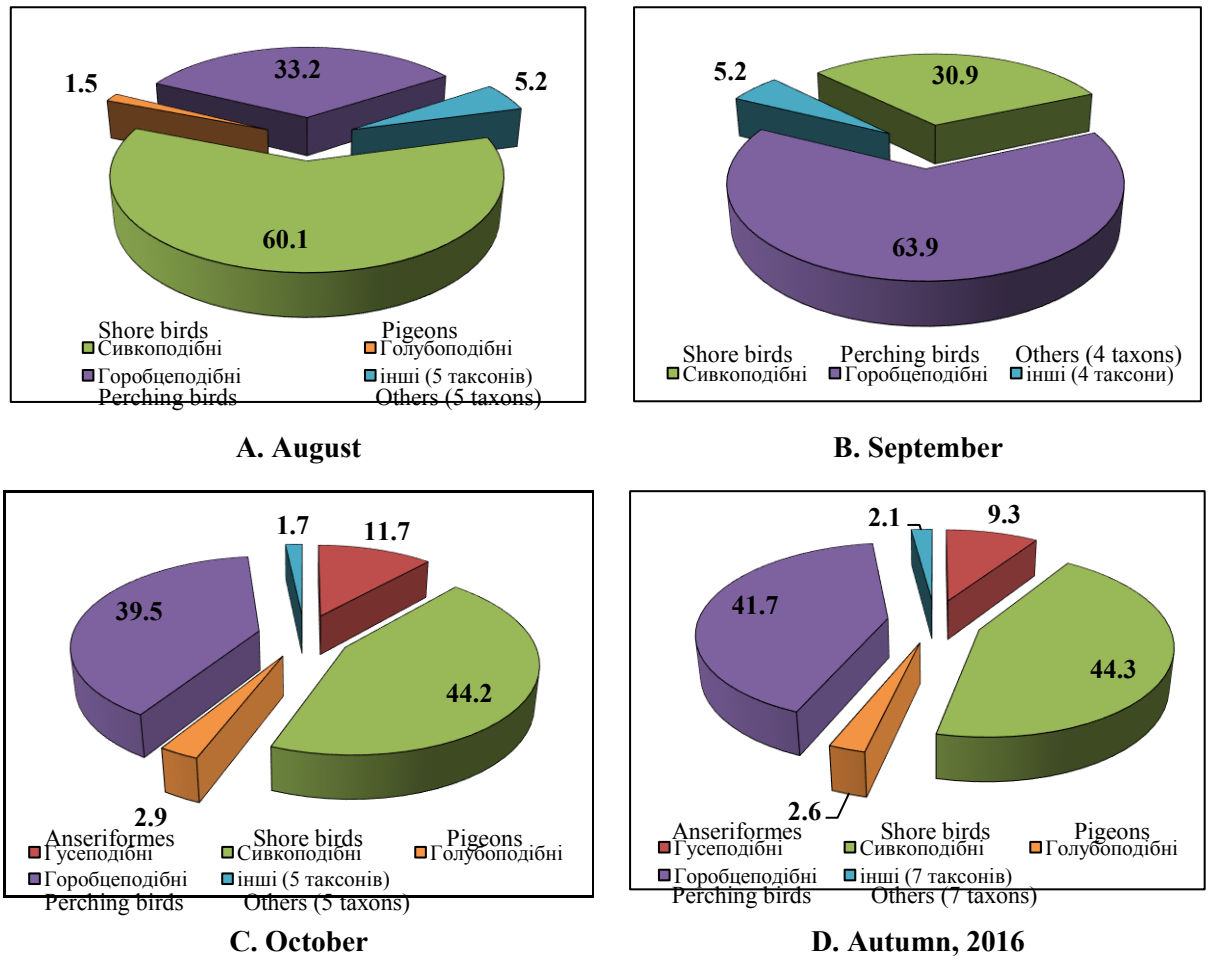
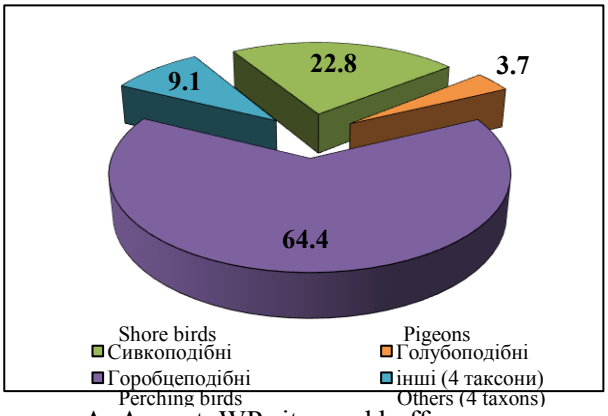


Fig. 6.23. Taxonomic description of ornithological complex of EuroCape Wind Park and adjacent territories in August (A), September (B), October (C) and in autumn, 2016 (D) (number of birds in %)

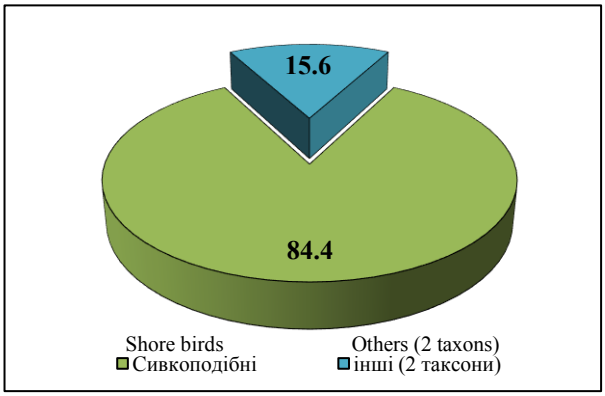
When comparing the ornithological situation that had emerged within the sites of EuroCape Wind Park and in the adjacent territories among themselves, the discrepancies, which serve confirmation of bird inclination to proper biotopes, were revealed definitely. When analysing materials presented as diagrams in Fig. 6.24, we can see that representatives of perching birds (*Passeriformes*) were absolute dominants by quantity of birds in the territory of the designed wind park and in the buffer 1- and 2- kilometres zones in autumn 2016, but shore birds (*Charadriiformes*) dominated within the adjacent territories (especially, at the water area and the coast of the Molochnyi Estuary) in autumn. Following species were subdominants: species of shore birds in the territory of the wind park and in the buffer zones, perching birds in the adjacent territories. From the point of view of species representation of taxons, it is logical conclusion about definite dependence of birds' quantity on the number of species within each of dominating taxons (Fig. 6.24).

Quantitative characteristic

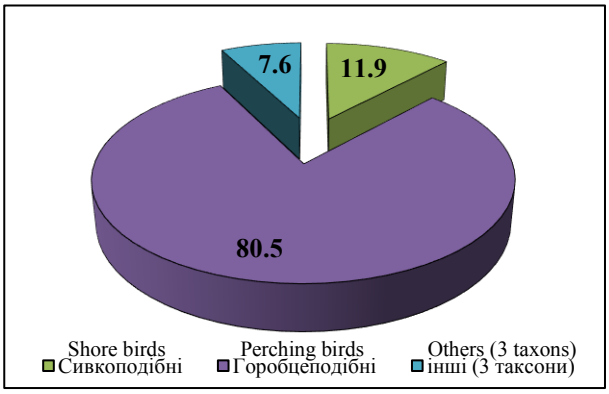
The total quantity of 71 registered species of birds is 6,943 specimens, 936 specimens of which (or 13.5% of all registered birds) were observed directly at the sites of EuroCape Wind Park, 1,626 specimens (23.4%) – in the buffer zones of 1 and 2 km, and 4,381 specimens more (63.1%) – in the adjacent monitoring plots (the Molochnyi Estuary). Such correlation of birds by different territories is understandable owing to higher diversity of biotopes in the adjacent territories (Tables 6.22 - 6.23). European starling (*Sturnus vulgaris*), Eurasian tree sparrow (*Passer montanus*), rook (*Corvus frugilegus*), ruff (*Philomachus pugnax*), European goldfinch (*Carduelis carduelis*) and rock pigeon (domestic type) (*Columba livia varia domestica*) had been the most numerous at the wind park sites and in the buffer zones, 1,772 specimens of which were observed, or 69.2%. Quantity of other bird species was 790 specimens. 2,275 specimens of upland birds were counted in the territory of EuroCape Wind Park and in the buffer zones, 287 specimens - of semi-aquatic ones.



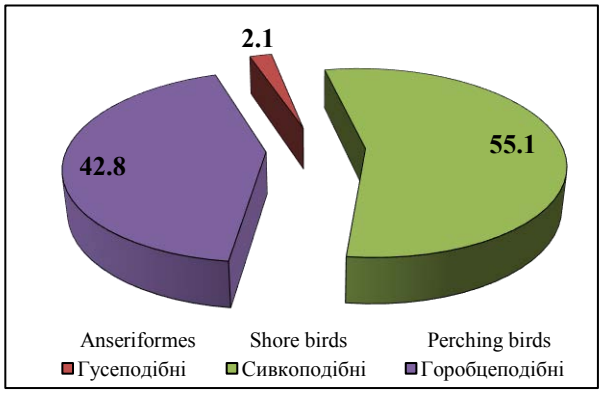
A. August, WP sites and buffer zones



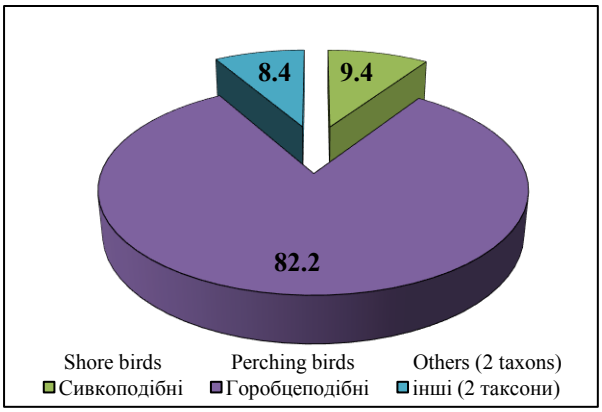
B. August, adjacent territories



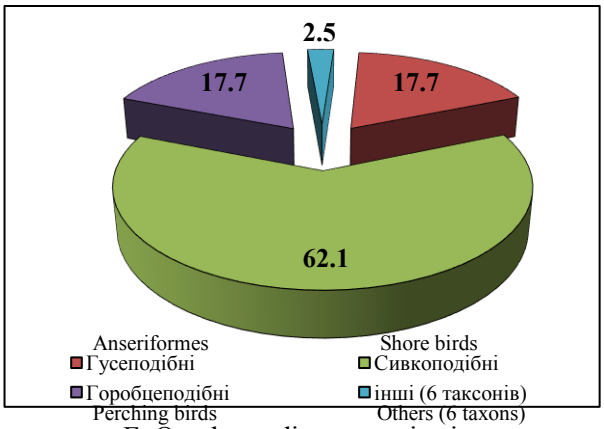
C. September, WP sites and buffer zones



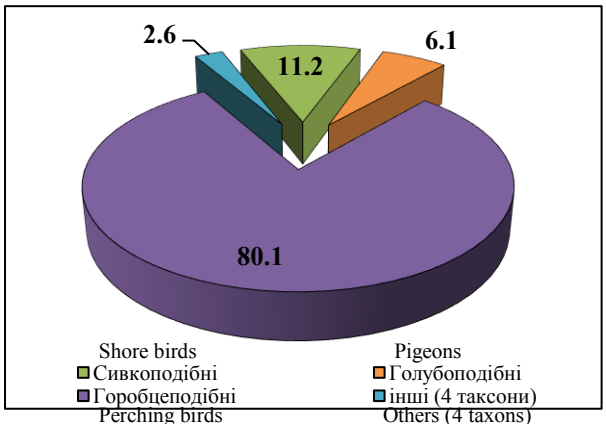
D. September, adjacent territories



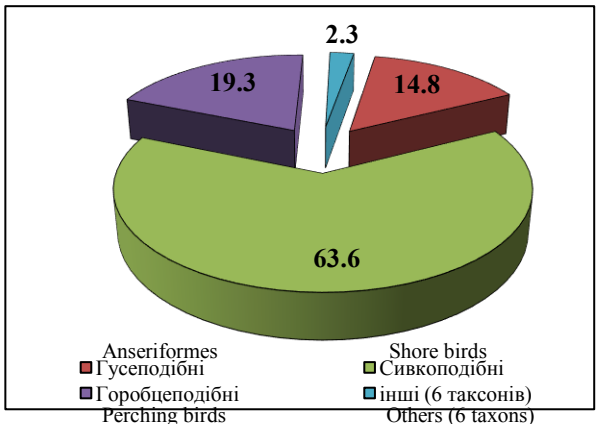
E. October, WP sites and buffer zones



F. October, adjacent territories



G. Autumn 2016, WP sites and buffer zones



H. Autumn 2016, adjacent territories

Fig. 6.24. Comparative taxonomic description of ornithological complex of EuroCape Wind Park sites and adjacent territories in autumn 2016 (number of birds in %)

In consideration of location of the Molochnyi Estuary Wetland near to the sites of the designed wind park, we can observe the domination of semi-aquatic bird species here. So, 3,482 specimens (or 79.5%) of bird species that are biotopically attracted to wetlands were registered in the adjacent territories over the whole period of autumn observations.

Following species dominated here: black-headed gull (*Larus ridibundus*), ducks (*Anas spp.*), rook (*Corvus frugilegus*), ruff (*Philomachus pugnax*) and European starling (*Sturnus vulgaris*). Quantity of upland species in the adjacent territories was 899 specimens (20.5%) over the whole period of observations.

More detailed description of bird species composition and distribution during autumn migration at EuroCape Wind Park sites, in the buffer zones and within the adjacent territories is given in Tables 6.22 - 6.23 and in Annex 1 (Tables 1.13 - 1.20 and AutoCAD schematic maps, Fig. Д 1.13 - Д 1.20).

The total number of birds that were registered in the autumn passage is 6,943 specimens. Part of these birds was in migration status (3,054 specimens, 43.9%), which is subdivided into transit one, when birds pass long distances without stop within EuroCape Wind Park, and feeding one, when birds fly on small distances in search of forage. Analysis of such distribution shows the domination of feeding migrants (2,497 specimens, or 81.8% of the total number of migrating birds) over the transit ones (557 specimens, or 18.2%).

Table 6.22. Description of Birds' Autumn Migration in EuroCape Wind Park Territory, in the Buffer Zones and Adjacent Territories in 2016

Parameters		Date				Total	
		28.08	25.09	9.10	26.10	abs.	%
Total species		**40**	**29**	**25**	**38**	**71**	**100**
Absolute quantity		**677**	**794**	**2,141**	**3,331**	**6,943**	**100**
Total migrants	species	21	15	17	13	**35**	**-**
	quantity	407	372	263	2,012	**3,054**	**43.99**
Feeding migrants	species	13	12	6	13	**24**	**-**
	quantity	246	158	81	2,012	**2,497**	**81.76**
Transit migrants	species	9	5	11	-	**19**	**-**
	quantity	161	214	182	-	**557**	**18.24**
Censuses	species	34	29	20	32	**65**	**-**
	quantity	270	422	1,878	1,319	**3,889**	**56.01**
Semi-aquatic	species	14	5	6	8	**22**	**30.99**
	quantity	418	252	1,866	1,233	**3,769**	**54.28**
Upland	species	26	24	19	30	**49**	**69.01**
	quantity	259	542	275	2,098	**3,174**	**45.72**
Direction	N	45	27	11	-	**83**	**2.71**
	NE	17	25	-	73	**115**	**3.77**
	E	16	78	13	-	**107**	**3.51**
	SE	28	30	-	1,200	**1,258**	**41.19**
	S	203	63	125	117	**508**	**16.64**
	SW	23	30	-	484	**537**	**17.58**
	W	75	119	114	100	**408**	**13.35**
	NW	-	-	-	38	**38**	**1.25**
Altitudes	0 - 10	347	339	242	553	**1,481**	**48.49**
	10 - 25	60	33	21	236	**350**	**11.46**
	25 - 50	-	-	-	1,223	**1,223**	**40.05**
	50 - 100	-	-	-	-	-	-
	100 - 150	-	-	-	-	-	-
	150 - 200	-	-	-	-	-	-
	> 200	-	-	-	-	-	-

Table 6.23. General Description of Migration Ornithological Complex in EuroCape Wind Park Territory, in the Buffer Zones and within the Adjacent Territories in Autumn 2016

No.	Species	WP and buffer zones				Adjacent territories				Total
		28.08	25.09	9.10	26.10	28.08	25.09	9.10	26.10	
1	Great crested grebe (*Podiceps cristatus*)					11		14	5	**30**
2	Great white egret (*Egretta alba*)							3	11	**14**
3	Grey heron (*Ardea cinerea*)							2	3	**5**
4	Common shelduck (*Tadorna tadorna*)						7			**7**
5	Mallard (*Anas platyrhynchos*)								157	**157**

No.	Species	WP and buffer zones				Adjacent territories				Total
		28.08	25.09	9.10	26.10	28.08	25.09	9.10	26.10	
6	Northern pintail (*Anas acuta*)								9	**9**
7	Garganey (*Anas querquedula*)								25	**25**
	Ducks (*Anas spp.*)								450	**450**
8	Eurasian sparrowhawk (*Accipiter nisus*)	1		6						**7**
9	Rough-legged buzzard (*Buteo lagopus*)				1					**1**
10	Long-legged buzzard (*Buteo rufinus*)			1	1			1		**3**
11	Common buzzard (*Buteo buteo*)		1	2	3					**6**
12	Red-footed falcon (*Falco vespertinus*)	2	1							**3**
13	Common kestrel (*Falco tinnunculus*)	4	4	5	1			1		**15**
14	Grey partridge (*Perdix perdix*)	8	17					20	8	**53**
15	Common quail (*Coturnix coturnix*)	1								**1**
16	Ring-necked pheasant (*Phasianus colchicus*)								1	**1**
17	Northern lapwing (*Vanellus vanellus*)						3			**3**
18	Turnstone (*Arenaria interpres*)					8				**8**
19	Eurasian oystercatcher (*Haematopus ostralegus*)					2				**2**
20	Common redshank (*Tringa totanus*)					3				**3**
21	Ruff (*Philomachus pugnax*)	42	29	83		134	138			**426**
22	Dunlin (*Calidris alpina*)	7				17				**24**
23	Eurasian curlew (*Numenius arquata*)					4				**4**
24	Mediterranean gull (*Larus melanocephalus*)					9				**9**
25	Little gull (*Larus minutus*)					39				**39**
26	Black-headed gull (*Larus ridibundus*)	12	19			36	37	1,660	350	**2,114**
27	Slender-billed gull (*Larus genei*)					6				**6**
28	Yellow-legged gull (*Larus cachinnans*)		5	90			14	14	73	**196**
	Gulls (*Larus spp.*)								150	**150**
29	Black tern (*Chlidonias niger*)					65				**65**
30	Whiskered tern (*Chlidonias hybrida*)					8				**8**
31	Sandwich tern (*T. sandvicensis*)					15				**15**
32	Woodpigeon (*Columba palumbus*)	4	8	10						**22**
33	Stock pigeon (*Columba oenas*)				4					**4**
34	Rock pigeon (domestic) (*Columba livia var. domestica*)				120					**120**
35	Eurasian collared dove (*Streptopelia decaocto*)		2		2				22	**26**
36	Turtle dove (*Streptopelia turtur*)	6	1							**7**
37	European roller (*Coracias garrulus*)	2								**2**
38	European bee-eater (*Merops apiaster*)	5								**5**
39	Hoopoe (*Upupa epops*)	1								**1**
40	Syrian woodpecker (*Dendrocopos syriacus*)								1	**1**
41	Barn swallow (*Hirundo rustica*)	28	16							**44**
42	Crested lark (*Galerida cristata*)		4		2					**6**
43	Skylark (*Alauda arvensis*)	2			3	4				**9**
44	Tawny pipit (*Anthus campestris*)	1								**1**
45	Yellow wagtail (*Motacilla flava*)		20			17	3			**40**
46	White wagtail (*Motacilla alba*)		11	1		9	26	40		**87**
47	Red-backed shrike (*Lanius collurio*)	1								**1**
48	Lesser grey shrike (*Lanius minor*)	2								**2**
49	European starling (*Sturnus vulgaris*)	29	82		950	8	52		200	**1,321**
50	Eurasian jay (*Garrulus glandarius*)								1	**1**
51	European magpie (*Pica pica*)	7	10	7	5				1	**30**
52	Jackdaw (*Corvus monedula*)						2			**2**
53	Rook (*Corvus frugilegus*)	60	80	16		15	27	45	195	**438**
54	Hooded crow (*Corvus cornix*)	2	4	6	9		2		7	**30**
55	Common raven (*Corvus corax*)		1	1	3					**5**
56	Wren (*Troglodytes troglodytes*)				1					**1**
57	Pied flycatcher (*Ficedula hypoleuca*)			2						**2**
58	African stonechat (*Saxicola torquata*)				2					**2**
59	Common redstart (*Ph. phoenicurus*)	4								**4**
60	European robin (*Erithacus rubecula*)			3						**3**
61	Fieldfare (*Turdus pilaris*)			6	47					**53**
62	Blackbird (*Turdus merula*)		7	7					1	**15**

No.	Species		WP and buffer zones				Adjacent territories				Total
			28.08	25.09	9.10	26.10	28.08	25.09	9.10	26.10	
63	Great tit (*Parus major*)		3	1		1					**5**
64	House sparrow (*Passer domesticus*)					32					**32**
65	Eurasian tree sparrow (*Passer montanus*)		16	30		110		9			**165**
66	Chaffinch (*Fringilla coelebs*)		14	31	42	10		16		15	**128**
67	European greenfinch (*Chloris chloris*)			6	32					5	**43**
68	European goldfinch (*Carduelis carduelis*)					125				92	**217**
69	Linnet (*Acanthis cannabina*)					10				5	**15**
70	Corn bunting (*Emberiza calandra*)			54	20	2		13			**89**
71	Yellowhammer (*Emberiza citrinella*)		3	1	1						**5**
	Perching birds (*Passer spp.*)					65				35	**100**
	Total	**species**	**27**	**26**	**20**	**23**	**19**	**14**	**10**	**22**	**71**
		birds	**267**	**445**	**341**	**1,509**	**410**	**349**	**1,800**	**1,822**	**6,943**

Species diversity of birds varied in the range from 21 species (the end of August) to 17 - 13 ones (October) during the migration. It is interesting that under the circumstances of the lowest quantity of migrants (407 specimens) in August, the highest species diversity was observed. Among birds, which had been registered at the wind park sites, the tendency was slightly different in the course of censuses. Species diversity was 34 species in August, in September – 29, and in October – 20 - 32 species. We can see rather interesting situation: if at the end of August species diversity was the highest with the lowest quantity (34 species, 270 specimens), then at the beginning of October, on the contrary, the highest quantity (1,878 specimens) was with the lowest species diversity (20 species) (Fig. 6.25 - 6.27).

When analysing the dynamics of birds' quantity, it shall be noted that European starling (*Sturnus vulgaris*) was a dominant among the migrants, and black-headed gull (*Larus ridibundus*) - subdominant. Just very these species gave maximum values in autumn 2016, when 1,647 specimens of them have been registered during migrations (53.9% of all migrating birds over the autumn period).

Ratio of feeding and transit migrants is rather indicative migration characteristic, which defines the intensity of migration (Table 6.22). We can see that the dynamics of feeding migrants' quantity has a tendency towards decrease of absolute indices, with drop of quantity at the beginning of October and its abrupt surge at the end of the month, but transit migrants had stable quantity from the end of August till the beginning of October, and toward the end of the month they have not been observed at all (Table 6.22). Such state of ornithological situation indicates ceasing of an active migration within the sites of EuroCape Wind Park from the beginning of November.

The total number of birds recorded toward the end of August and in September was not high (40 - 29 species, 677 - 794 specimens), but in October increased dramatically with fluctuation of species diversity (2,141 - 3,331 specimens of 25 - 38 species) (Fig. 6.23). This may be explained by the fact that the most active migration passages just fell on October.

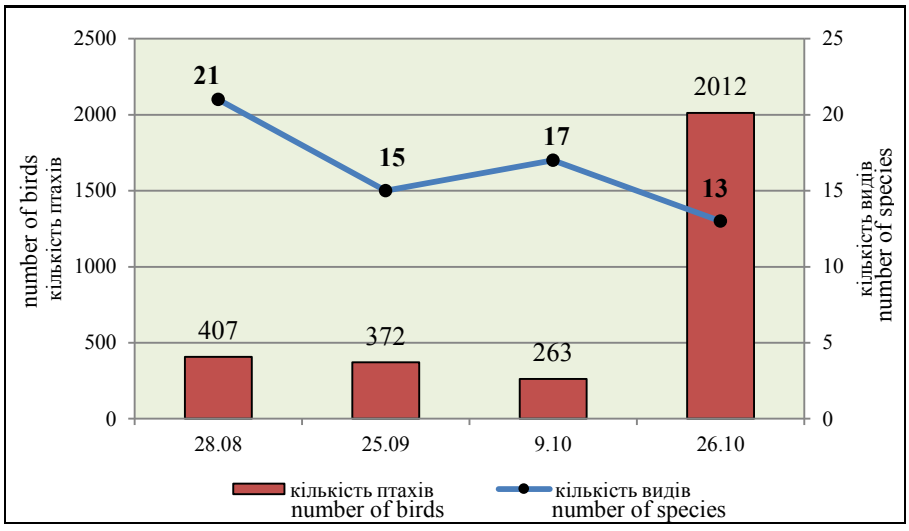


Fig. 6.25. Species diversity and number of birds that migrated through the territory of EuroCape Wind Park in autumn 2016

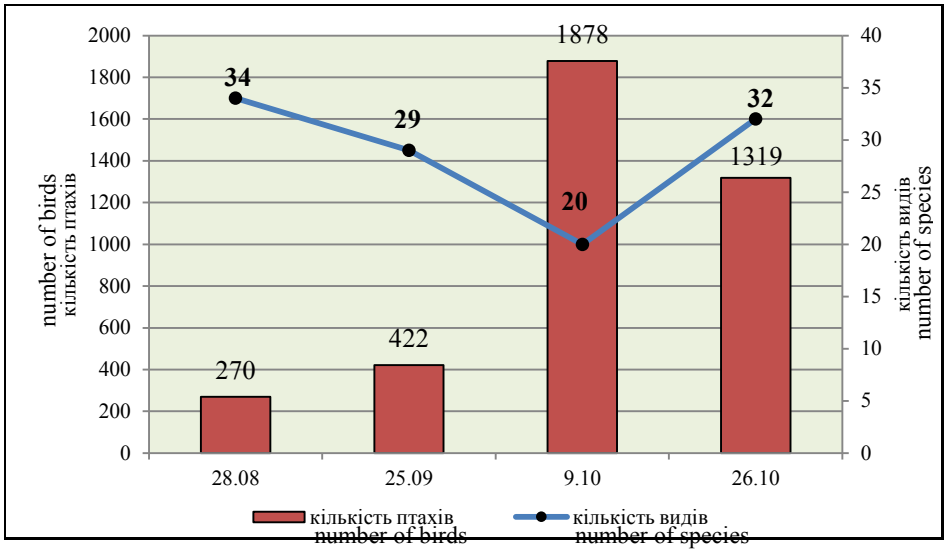


Fig. 6.26. Species diversity and number of birds registered in the course of censuses at EuroCape Wind Park in autumn 2016

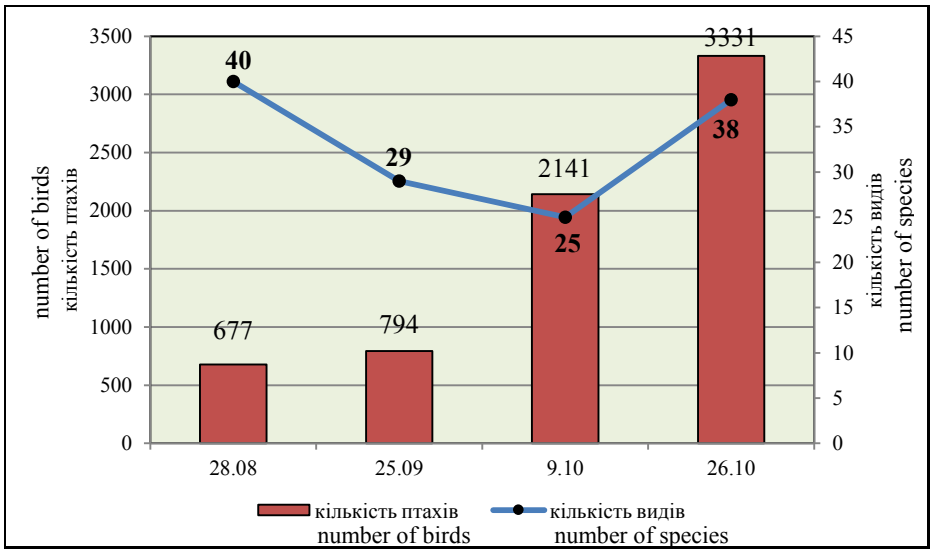


Fig. 6.27. Species diversity and number of birds within EuroCape Wind Park area in autumn 2016

Biotopic distribution of birds

Species diversity of birds and their quantity depend to some extent on the number of distinguished biotopes (Fig. 6.28 - 6.29). In investigated region we have revealed such landscape-biotopic units: agrocoenoses (agricultural lands), agricultural hedgerows and man-planted forest areas, steppe plots of open space, the offshore strip and human settlements. Each of biotopes is a territory of occurrence of individual bird groups (Table 6.24).

Table 6.24. Biotopic Distribution of Birds within EuroCape Wind Park, Buffer Zones and Adjacent Territories in Autumn 2016

Zones \ Biotopes		Biotopes of birds' distribution				∑	
		water areas	open space	agricultural hedgerows	human settlements	abs.	%
Wind park sites		-	538	398	-	**936**	**13.5**
Buffer zones		-	675	447	504	**1,626**	**23.4**
Adjacent territories		1,995	1,324	717	345	**4,381**	**63.1**
Total	**abs.**	**1,995**	**2,537**	**1,562**	**849**	**6,943**	**100**
	%	**28.7**	**36.5**	**22.5**	**12.3**	**100**	

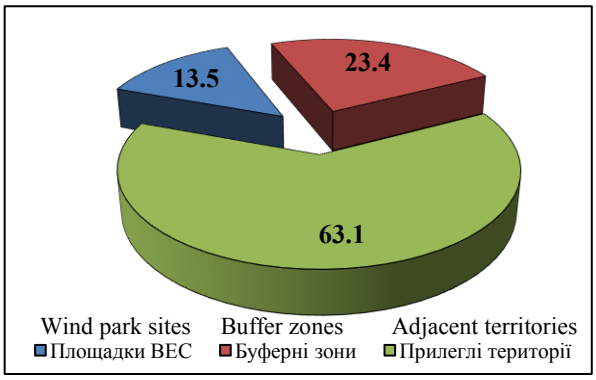


Fig. 6.28. Distribution of birds throughout functional zones (%)

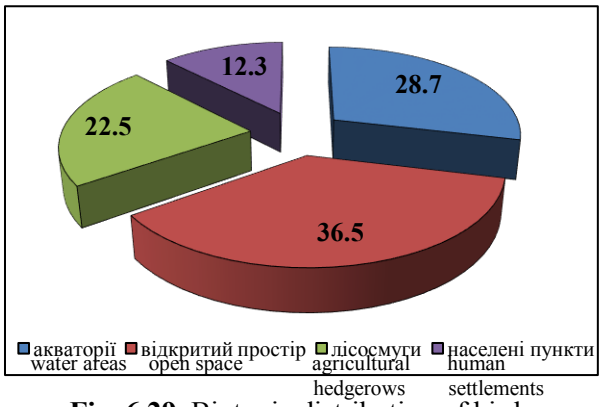


Fig. 6.29. Biotopic distribution of birds throughout the designed territory (%)

In consideration of location of the wind park sites near to the Molochnyi Estuary Wetlands, the domination of semi-aquatic species would be logically expected; but analysis of the field material has not revealed such regularity. 22 species with quantity of 3,769 specimens of semi-aquatic birds were registered, or 54.3%, the overwhelming majority of which had been observed in the buffer zones and adjacent territories. We have observed mostly black-headed gull (*Larus ridibundus*), ducks, ruff (*Philomachus pugnax*) and mallard (*Anas platyrhynchos*), which formed rather large gatherings. 49 species of birds with quantity of 3,174 specimens were registered at the uplands (45.7%). Dominants here were following: European starling (*Sturnus vulgaris*), rook (*Corvus frugilegus*) and European goldfinch (*Carduelis carduelis*), which made up 62.3% of all counted upland birds.

While carrying out researches it turned out that the plots of open space had been the most visited during the autumn migration – 2,537 specimens were observed there (36.5%), 1,995 specimens stayed at the water areas (28.7%), and agricultural hedgerows and man-planted forests attracted 1,562 specimens (22.5%). Following villages had been observed in the course of censuses: Mordvynivka, Nadezhdine, Girsivka and Dunaivka (regularly), as well as Volna, Divnynske and Georgiyivka (periodically), 849 specimens (12.3%) were observed there (Table 6.24).

Directions of the autumn migration of 2016

The south-eastern direction (41.2% of all migrants) prevailed among passage directions (Table 6.25, Fig. 6.30). 1,258 specimens flew in this direction; generally they were semi-aquatic birds (gulls, terns, and ruff) and small perching birds (wagtails, chaffinch, and European goldfinch). In addition, migration bird movements were observed in the south-western (537 specimens, 17.6%), southern (508 specimens, 16.6%) and western (408 specimens, 13.4%) directions. Birds' passage in other directions was not numerous (Table 6.25). Such directions are typical for given terrain.

When analysing the directions of migration in different months of observations, we shall say about an interesting pattern of passage in October (more than a half of birds – 52.7% – flew to the south-east), which is caused by feeding flights of starling. Toward the end of August and in September we have typical for autumn period passage directions (south, east and west) (Fig. 6.30). More detailed description of directions of autumn migration is given in Table 6.25 and in Fig. 6.30.

Table 6.25. Description of the Main Directions of Autumn Migration within EuroCape Wind Park in 2016

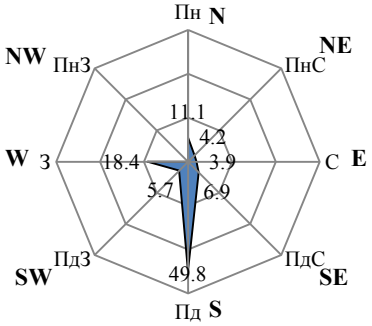
Compass point	August		September		October		Total	
	abs.	%	abs.	%	abs.	%	abs.	%
N	45	11.1	27	7.4	11	0.5	**83**	**2.71**
NE	17	4.2	25	6.7	73	3.2	**115**	**3.77**
E	16	3.9	78	20.9	13	0.6	**107**	**3.51**
SE	28	6.9	30	8.1	1,200	52.7	**1,258**	**41.19**
S	203	49.8	63	16.9	242	10.6	**508**	**16.64**
SW	23	5.7	30	8.1	484	21.3	**537**	**17.58**
W	75	18.4	119	31.9	214	9.4	**408**	**13.35**
NW	-	-	-	-	38	1.7	**38**	**1.25**
Total	**407**	**100**	**372**	**100**	**2,275**	**100**	**3,054**	**100**

Differences between months are caused by the change of dominating groups of migrants. If in September shore birds were the main migrants in the passage, which prefer the southern direction, then in September - October perching birds dominate, for the majority of which the western, south-western and south-eastern directions are typical.

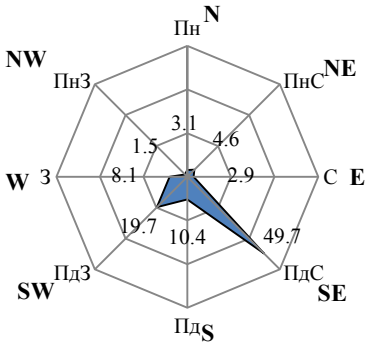
When comparing the directions of birds' passage in the course of feeding and transit migrations, we shall say about narrow directivity of transit migrants (mainly, the south and the west) and wide range of flying away of feeding migrants (mainly, in the south-western and, partially, southern directions; and advantage of the south-eastern direction among feeding migrants is caused by above mentioned feeding flights of starling). Explanation of the difference between directions of feeding and transit passages of birds lies in the aspect of diurnal activity of different groups of migrants. So, mass scale of the process is a peculiarity of transit passage of birds, with the involvement of rather large number of birds, purposeful active type of flight (flapping and soaring) in proper direction, long distance of single passage, without delay and stop in the migration route.

Therefore feeding migrants show somewhat different type of behaviour, which is defined by long-term staying of birds within the region, daily feeding passages from the roosts to feeding places, the whole range of migration directions caused only by search of forage, formation of gatherings different by size, short distances of passages.

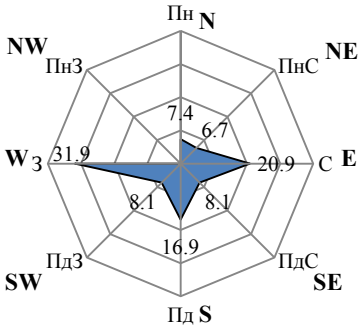
Just such pattern has been revealed in the course of observations within EuroCape Wind Park in autumn 2016 (Fig. 6.30).



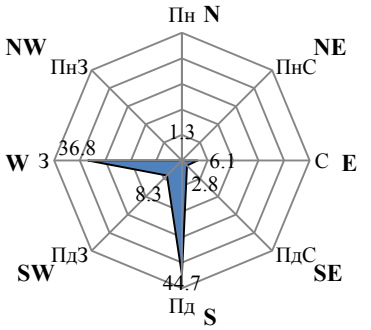
A. All migrants, August



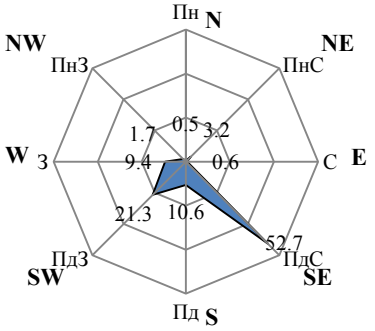
D. Feeding migrants, autumn



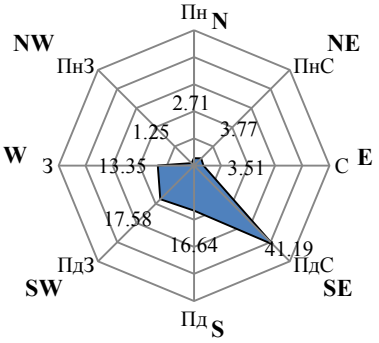
B. All migrants, September



E. Transit migrants, autumn



C. All migrants, October



F. All migrants, autumn 2016

Fig. 6.30. Description of directions of birds' passage within EuroCape Wind Park in autumn 2016 (quantity in %)

Description of altitude intervals of birds' movement

High-altitude bird movements within EuroCape Wind Park and adjacent territories during autumn migration of 2016 were distributed in the following way. Toward the end of August the overwhelming majority of birds (347 specimens, or 85.3% of the total number of migrants), which were registered in the wind park territory, within the buffer zones and in the adjacent territories, had been observed at the altitudes under 10 m. Besides, 60 specimens (14.7%) of birds were counted in flight within the altitude interval of 10 - 25 m. Birds have not been observed in potentially dangerous altitude interval of 50 - 170 m (Table 6.26, Fig. 6.31). The same tendency has been observed also in September: 339 specimens (91.1%) of birds were observed near the ground and only 33 specimens (8.9% of birds) – at the altitudes of 10 - 25 m.

In October the tendency has changed. 795 specimens, or 34.9% of birds were observed within the altitude interval under 10 m, 257 specimens (11.4%) – at the altitudes of 10 - 25 m, and more than a half of registered migrants (1,223 specimens, 53.7%) flew at the altitude of 25 - 50 m.

Table 6.26. Description of the Main Altitudes of Autumn Migration within EuroCape Wind Park in 2016

Altitude intervals	August		September		October		Total	
	abs.	%	abs.	%	abs.	%	abs.	%
0 - 10	347	85.3	339	91.1	795	34.9	**1,481**	**48.49**
10 - 25	60	14.7	33	8.9	257	11.4	**350**	**11.46**
25 - 50	-	-	-	-	1,223	53.7	**1,223**	**40.05**
50 - 100	-	-	-	-	-	-	-	-
100 - 150	-	-	-	-	-	-	-	-
150 - 200	-	-	-	-	-	-	-	-
> 200	-	-	-	-	-	-	-	-
Total	**407**	**100**	**372**	**100**	**2,275**	**100**	**3,054**	**100**

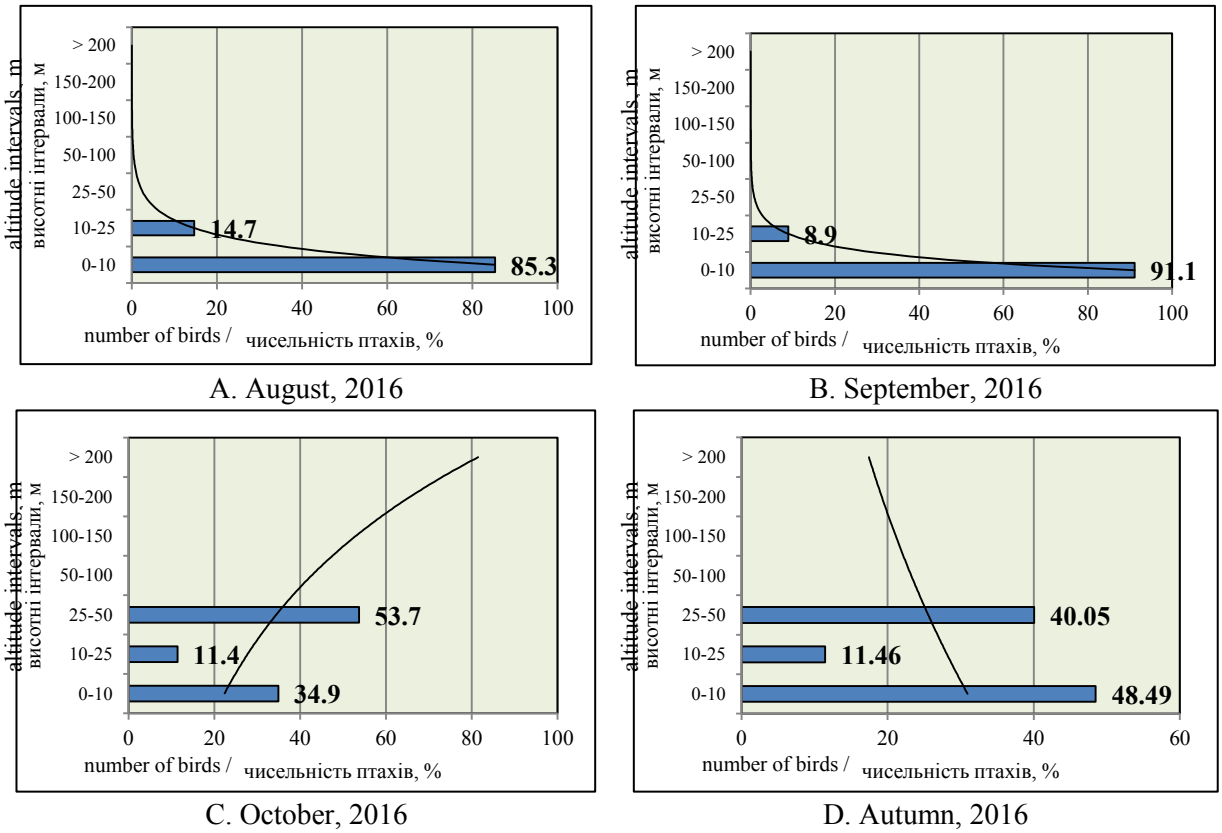
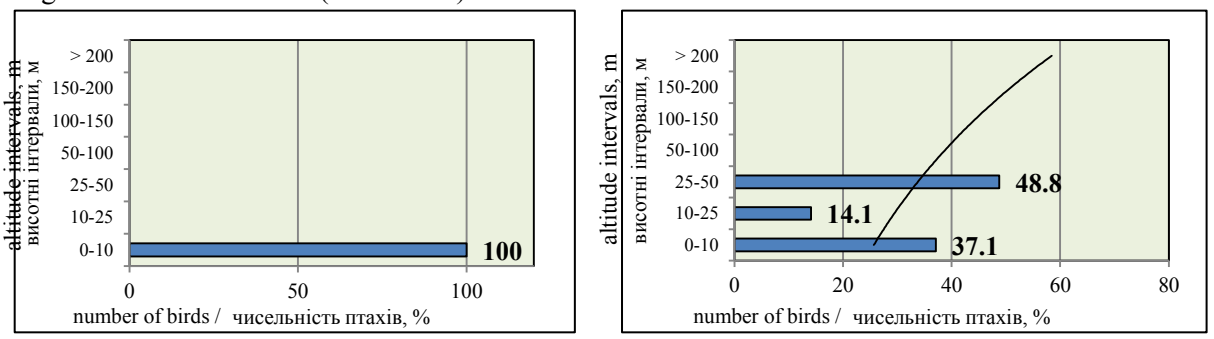


Fig. 6.31. Description of altitudes of birds' passage within EuroCape WP during autumn migration

There are also certain regularities in the passage of feeding and transit migrants. When comparing the passage altitudes for different groups of birds, we shall note that transit migrants flew lower than feeding ones (Fig. 6.32). All registered transit migrants have been observed within the altitude interval under 10 m, which is caused by the fact that they were mainly perching birds (chaffinch, corn bunting, wagtails) and shore birds (ruff, turnstone, terns), which select lower altitude

intervals. Passage altitudes of feeding migrants differ: 37.1% of birds have been counted on the ground or near it, 14.1% - at the altitude of 10 - 25 m, and 48.8% - at the altitude of 25 - 50 m (Fig. 6.32). Such data are expected and the pattern of birds' distribution by passage altitudes is typical for given territory and season. It shall be noted that transit migrants have not been counted at all in the territory of EuroCape Wind Park toward the end of October, 2016; it indicates ceasing of an active migratory process in this territory. Trend lines in the diagrams of Fig. 6.31 and 6.32 confirm mathematically the hypothesis about safety of the altitudes of birds' passage within the wind park during the autumn migration of 2016: there has not been counted any flock of birds in potentially dangerous altitude interval (50 - 170 m) in autumn.



transit migrants, autumn 2016 feeding migrants, autumn 2016

Fig. 6.32. Comparison of passage altitudes for feeding and transit migrants within EuroCape Wind Park in the autumn migration of 2016

6.3. Advanced level of assessment of the state of migrations and migratory gatherings at the monitoring grounds

Certain monitoring grounds, which are represented by typical landscape-biotopical complexes, have been assigned for the purpose of clarification of the role of individual plots of the whole designed territory for birds during seasonal migrations (Fig. 6.33).

Fig. 6.33. Layout of monitoring grounds (1 - 3)

Principles, by which these grounds were assigned, and their concise description are stated in the methodological part. It shall be noted that all birds registered during spring and autumn migrations were included in calculations, with their partition into transit and feeding ones.

1,771 specimens in all have been registered over the period of three field visits in the course of spring migrations. Monitoring plots 1 and 2 had approximately the same quantity of birds (312 and 332 respectively), and 1,127 specimens have been observed throughout the whole other territory (or 63.6% of the total quantity). Proportion between transit and feeding migrants remained also within two monitoring grounds. Transit migrants dominated – 72.8% at Ground 1, and 70.2% at Ground 2. Ceasing of transit migration in the second part of April within monitoring Ground No. 1 (the northern site of EuroCape Wind Park), and its availability within Ground No. 2 and on the whole other area (including within the water areas of the Molochnyi Estuary and the Sea of Azov) is indicative. Analysis of species diversity within monitoring grounds indicates dominance of representatives of perching birds within Ground No. 1, birds of waterfowl group (shore birds, anseriformes, crane-like birds) within Ground 2, and throughout the whole other territory individual bird species were attracted by typical for them biotopes.

More detailed description of quantity distribution of feeding and transit migrants at the monitoring plots in the course of spring migration is shown in Table 6.27.

Table 6.27. Quantity Distribution of Feeding and Transit Migrants at the Monitoring Migration Plots 1 - 2 Within the Wind Park Sites, Buffer Zones and Adjacent Territories in Spring Period of 2016 (in accordance with Tables 1.3, 1.5, 1.7, Fig. Д 1.3, Д 1.5, Д 1.7)

Territories / terms	20.03.2016		08.04.2016		20.04.2016		Total				Total migrants
	feeding	transit	feeding	transit	feeding	transit	feeding		transit		
							abs.	%	abs.	%	
Monitoring migration plot 1	25	47	32	180	28	-	85	27.2	227	72.8	312
Monitoring migration plot 2	35	30	41	96	23	107	99	29.8	233	70.2	332
Total	**60**	**77**	**73**	**276**	**51**	**107**	**184**	**28.6**	**460**	**71.4**	**644**
Other territories*	56	125	85	541	75	245	216	19.1	911	80.8	1,127
Total designed territory**	**116**	**202**	**158**	**541**	**126**	**352**	**400**	**22.6**	**1,371**	**77.4**	**1,771**

* Other territories - the wind park sites, buffer zones and adjacent territories with the exception of monitoring migration plots.

** Designed territory - the wind park sites, buffer zones, adjacent territories and monitoring migration plots.

4 field visits have been carried out during autumn migration, in the course of which observations covered post-nesting gatherings and the beginning of migratory movements in August, slow migration in September and at the beginning of October, as well as periods of active migration in the second part of October.

The total number of registered birds was equal to 3,054 specimens, out of which 2,497 specimens (81.8%) were observed in the course of feeding passages, and 557 specimens (18.2%) were transit migrants. Monitoring Plot No. 1 has been used by birds of quantity equal to 419 specimens, and Plot No. 2 – 816 specimens. The results of analysis of transit and feeding migrants according to their distribution throughout monitoring grounds turned out to be interesting. So, 384 specimens (or 91.6%) carried out feeding flights within Plot No. 1, but birds of transit flocks were only 35 specimens (8.4%). Quite another picture was observed within monitoring Plot No. 2, when transit migrants (392 specimens, or 48.0%) and feeding ones (424 specimens, 52.0%) were almost in equal proportion. Such observations indicate attractivity of the water areas of the Molochnyi Estuary and its coastal strip for migrating birds, at that time, when agrocenoses of the northern part of EuroCape Wind Park were visited by birds in small quantity. Detailed description of autumn observations at the monitoring grounds is presented in Table 6.28.

Table 6.28. Quantity Distribution of Feeding and Transit Migrants at the Monitoring Migration Plots 1 - 2 Within the Wind Park Sites, Buffer Zones and Adjacent Territories in Autumn of 2016 (in accordance with Tables 1.14, 1.16, 1.18, 1.20, Fig. Д .1.14, 1.16, 1.18, 1.20)

Territories / terms	28.08.2016		25.09.2016		09.10.2016		26.10.2016		Total				Total migrants
	feeding	transit	feeding	transit	feeding	transit	feeding	transit	feeding		transit		
									abs.	%	abs.	%	
Monitoring migration plot 1	33	-	44	14	24	21	283	-	384	91.6	35	8.4	419
Monitoring migration plot 2	42	131	40	140	54	121	288	-	424	52.0	392	48.0	816
Total	**75**	**131**	**84**	**154**	**78**	**142**	**571**	**-**	**808**	**65.4**	**427**	**34.6**	**1,235**
Other territories*	171	30	74	60	3	40	1,441	-	1,689	92.9	130	7.1	1,819
Total designed territory**	**246**	**161**	**158**	**214**	**81**	**182**	**2,012**	**-**	**2,497**	**81.8**	**557**	**18.2**	**3,054**

* Other territories - the wind park sites, buffer zones and adjacent territories with the exception of monitoring migration plots.

** Designed territory - the wind park sites, buffer zones, adjacent territories and monitoring migration plots.

The Stepanivska Spit has been selected as representative monitoring observation point; it separates the Sea of Azov from the Molochnyi Estuary. Observations of the beginning of migratory movements of birds were carried out here during 5 days in the middle - toward the end of July, 2016. Analysis of bird movements shows the picture similar to the situation at monitoring Plot No. 2 during

autumn migration. Quantity distribution of feeding and transit migrants within this monitoring ground is shown in Table 6.29. Analysis of this table indicates almost equal proportion between feeding (4,132 specimens, 42.7%) and transit migrants (5,549 specimens, 57.3%) with some inessential dominance of the latter. Thus, the role of the water areas and coastal strips in support of migrating birds is confirmed. The territory of EuroCape Wind Park at that period (the second half of summer) is not attractive for birds, quantity of which is very low.

Table 6.29. Quantity Distribution of Feeding and Transit Migrants at the Monitoring Migration Ground No. 3 (the Stepanivska Spit) in Autumn of 2016

Territories / terms	16.07.2016		17.07.2016		18.07.2016		19.07.2016		26.07.2016		Total	
	feeding	transit	feeding	transit	feeding	transit	feeding	transit	feeding	transit	feeding	transit
Monitoring migration plot	1,877	125	1,620	185	597	2,429	38	1,185	-	1,625	4,132 42.7%	5,549 57.3%
Total migrants	**2,002**		**1,805**		**3,026**		**1,223**		**1,625**		**9,681 (100%)**	

General conclusion on the role of individual plots of the designed territory, which is based on carried out researches, gives grounds to state that the least quantity of birds during seasonal migrations has been observed within the northern and southern part of EuroCape Wind Park. At these periods of the annual cycle of birds, the water areas of the Sea of Azov and the Molochnyi Estuary, which are located at a distance from 6 to 12 km to the south and southern west from EuroCape Wind Park, are of the greatest importance.

6.4. Distribution of birds recorded during the autumn migration of 2016 according to the nature conservation lists of national and international importance

Distribution of birds recorded in summer 2016, according to international and national nature conservation lists

5 species of birds listed in the Red Data Book of Ukraine were recorded in the researched territory in summer 2016 (Table 6.30). Quantity of rare bird species, which stay in the region of investigations, is low and equal to 38 specimens (0.9% of the number of counted birds).

Table 6.30. Rare Avifauna of EuroCape Wind Park, Buffer Zones and Adjacent Territories (Summer 2016)

No.	Species	Wind park sites	Buffer zones	Adjacent territories	∑
1	Glossy ibis (*Plegadis falcinellus*)	-	-	8	**8**
2	Long-legged buzzard (*Buteo rufinus*)	1	-	2	**3**
3	Black-winged stilt (*Himantopus himantopus*)	-	-	18	**18**
4	Eurasian oystercatcher (*Haematopus ostralegus*)	-	-	5	**5**
5	Eurasian curlew (*Numenius arquata*)	-	-	4	**4**
	Total birds listed in the Red Data Book of Ukraine	1	-	37	**38**
	Total birds within the plot	**354**	**607**	**3,088**	**4,049**
	% of the total quantity	**0.3**	**-**	**1.2**	**0.9**

It shall be noted that only 1 specimen of 1 species (long-legged buzzard – *Buteo rufinus*) out of rare birds has been observed directly in the designed wind park territory, therefore it may be stated about low degree of attractivity of the wind park sites for them. Representatives of the Red Data Book of Ukraine have not been counted in the buffer zones, and in the adjacent territories 37 specimens of 5 species have been observed (glossy ibis – *Plegadis falcinellus*, long-legged buzzard – *Buteo rufinus*, black-winged stilt – *Himantopus himantopus*, Eurasian oystercatcher – *Haematopus ostralegus* and

Eurasian curlew – *Numenius arquata*), which is rather low factor for this season. That is why the construction and operation of the wind park will not influence rare avifauna.

In addition to revealing representatives of avifauna during creation of post-nesting and pre-migration gatherings, their quantity and distribution throughout the researched territory, it have arisen the necessity of their ranking in accordance with nature conservation lists: the Red Data Book of Ukraine, the List of the International Union for Conservation of Nature (IUCN), the European Red List, the Bonn and Bern Conventions, as well as the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Table 6.31).

Table 6.31. Distribution of Avifauna Counted in Summer 2016 According to International and National Nature Conservation Lists

No.	English name	Latin name	Status	ERL	RDBU	IUCN	BERN	BONN	CITES
1	Great crested grebe	*Podiceps cristatus*	m, w, n				3		
2	Cormorant	*Phalacrocorax carbo*	m, w, n						
3	Little egret	*Egretta garzetta*	m, n				2		
4	Grey heron	*Ardea cinerea*	m, w, n				3		
5	Glossy ibis	*Plegadis falcinellus*	m		VU	LC	2	2	
6	Mute swan	*Cygnus olor*	m, w, n				3	1, 2	
7	Common shelduck	*Tadorna tadorna*	m, w, n				2	1, 2	
8	Mallard	*Anas platyrhynchos*	m, w, n				3	1, 2	
9	Common pochard	*Aythya ferina*	m, w, n				3	1, 2	
10	Western marsh-harrier	*Circus aeruginosus*	m, w, n				2	1, 2	2
11	Long-legged buzzard	*Buteo rufinus*	m, w, n	VU	RARE	LC	2	1, 2	2
12	Common buzzard	*Buteo buteo*	m, w, n				2	1, 2	2
13	Red-footed falcon	*Falco vespertinus*	m, n	VU			2	2	2
14	Common kestrel	*Falco tinnunculus*	m, w, n				2	2	2
15	Grey partridge	*Perdix perdix*	m, w, n	VU			3		
16	Eurasian coot	*Fulica atra*	m, w, n				3	2	
17	Northern lapwing	*Vanellus vanellus*	m, w, n	VU			3	2	
18	Turnstone	*Arenaria interpres*	m				2	2	
19	Black-winged stilt	*Himantopus himantopus*	m, n		VU	LC	2	2	
20	Eurasian oystercatcher	*Haematopus ostralegus*	m, n		VU	LC	3		
21	Common redshank	*Tringa totanus*	m, n				3	1, 2	
22	Ruff	*Philomachus pugnax*	m				3	1, 2	
23	Dunlin	*Calidris alpina*	m				2	1, 2	
24	Eurasian curlew	*Numenius arquata*	m, w		EN	NT	3	1, 2	
25	Black-tailed Godwit	*Limosa limosa*	m	VU			3	1, 2	
26	Mediterranean gull	*Larus melanocephalus*	m				2	2	
27	Little gull	*Larus minutus*	m, n				2		
28	Black-headed gull	*Larus ridibundus*	m, w, n				3		
29	Slender-billed gull	*Larus genei*	m, n				2	2	
30	Yellow-legged gull	*Larus cachinnans*	m, w, n						
31	Black tern	*Chlidonias niger*	m				2	2	
32	Gull-billed tern	*Gelochelidon nilotica*	m, n	VU			2	2	
33	Sandwich tern	*Thalasseus sandvicensis*	m, n				2	2	
34	Common tern	*Sterna hirundo*	m, n				2	2	
35	Woodpigeon	*Columba palumbus*	m, w, n						
36	Rock pigeon	*Columba livia*	m, n				3		
37	Eurasian collared dove	*Streptopelia decaocto*	m, w, n				3		
38	Turtle dove	*Streptopelia turtur*	m, n				3		
39	Little owl	*Athene noctua*	m, w, n				2		2
40	Common swift	*Apus apus*	m, n				3		
41	Hoopoe	*Upupa epops*	m, n				2		
42	Barn swallow	*Hirundo rustica*	m, n				2		
43	Bank swallow	*Riparia riparia*	m, n				2		
44	Crested lark	*Galerida cristata*	m, w, n				3		
45	Skylark	*Alauda arvensis*	m, w, n				3		

No.	English name	Latin name	Status	ERL	RDBU	IUCN	BERN	BONN	CITES
46	Yellow wagtail	*Motacilla flava*	m, n				2		
47	White wagtail	*Motacilla alba*	m, w, n				2		
48	Red-backed shrike	*Lanius collurio*	m, n				2		
49	Lesser grey shrike	*Lanius minor*	m, n				2		
50	Golden oriole	*Oriolus oriolus*	m, n				2		
51	European starling	*Sturnus vulgaris*	m, w, n				2		
52	European magpie	*Pica pica*	m, w, n				2		
53	Jackdaw	*Corvus monedula*	m, w, n				2		
54	Rook	*Corvus frugilegus*	m, w, n				2		
55	Hooded crow	*Corvus cornix*	m, w, n				2		
56	Common raven	*Corvus corax*	m, w, n				3		
57	Northern wheatear	*Oenanthe oenanthe*	m, n				2		
58	Common redstart	*Phoenicurus phoenicurus*	m, n				2	2	
59	Thrush nightingale	*Luscinia luscinia*	m				2	2	
60	Great tit	*Parus major*	m, w, n				2		
61	House sparrow	*Passer domesticus*	m, w, n				2		
62	Eurasian tree sparrow	*Passer montanus*	m, w, n				3		
63	Chaffinch	*Fringilla coelebs*	m, w, n				3		
64	European greenfinch	*Chloris chloris*	m, w, n				2		
65	European goldfinch	*Carduelis carduelis*	m, w, n				2		
66	Linnet	*Acanthis cannabina*	m, w, n				2		
67	Corn bunting	*Emberiza calandra*	m, w, n				3		
68	Yellowhammer	*Emberiza citrinella*	m, w, n				2		

Notes: Status: m – species occurs in the course of seasonal migrations; w – species is found in winter period; n – species occurs in nesting period. **RDBU** – Conservation status of the Red Data Book of Ukraine: **EN** – endangered; **VU** – vulnerable; **RARE** – rare; **UR** – unrated. **IUCN** – Conservation status of the International Union for Conservation of Nature: **EN** – endangered; **NT** – near threatened; **VU** – vulnerable; **LC** – least concern. **ERL** - Conservation status of the European Red List: **VU –** vulnerable, species that may be rated to an endangered category in the near future, if the effect of factors influencing on their condition continues; **EN –** endangered, species that are seriously at risk of extinction; their preservation is hardly probable, reproduction is impossible without carrying out special measures. **BONN** – the Bonn Convention: **Annex I (1)** includes species that are in danger of extinction; **Annex II (2)** includes species, state of which is unfavourable, preservation and regulation of using which needs international agreements, as well as that species, state of which might be considerably improved as a result of international cooperation, which may be carried out based on international agreements. The same species may be included both to Annex I and to Annex II. **BERN** – the Bern Convention, or the Convention on the Conservation of European Wild Flora and Fauna and Natural Habitats, includes **Annex II (2) –** list of fauna species that are subject to special protection; **Annex III (3) –** fauna species that are subject to protection. **CITES** – the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora: **Annex I (1)** includes species "that are in danger of extinction, trade in which causes or may cause negative influence on their existence. Trade in specimens of such species must be especially severely regulated for that purpose to do not endanger their survival for the future, and must be allowed only in exceptional cases"; **Annex II (2)** includes: "a) all species, which are not necessarily threatened with extinction for now, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and b) that have to be subject to regulation in order to enable the possibility to get the trade in specimens of certain species mentioned in subparagraph (a) of this paragraph under effective control".

As is obvious from Table 6.31, birds, which form post-nesting and pre-migration gatherings in the area of EuroCape Wind Park, buffer zones and in the adjacent territories, are listed in 6 nature conservation lists. Most of them were related to the Bern Convention (65 species out of 68, or 95.6%), 24 species of which are subject to special protection, 41 species are subject to protection. Situation with relation to the Bonn Convention is interesting: 15 species among 27 species of the ornithological complex, which are included in this Convention, rate to Annex II (state of which is unfavourable), and 12 more species are included simultaneously both to Annex II and I (are in danger of extinction), which is possible in the context of this nature conservation document. 5 species are listed in the Red Data Book of Ukraine (2009), out of which 1 species is rare, 1 species – endangered and 3 species – vulnerable. Also 5 species are listed in the Red List of IUCN (("least concern" category – 4 species, "near threatened" category – 1). In addition, 6 species are included in the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora, 6 species are listed in the European Red List.

With regard to a degree of bird pertaining to nature conservation lists, the following picture is being completed. 3 (4.4%) of 68 species are not listed in any of nature conservation documents:

cormorant (*Phalacrocorax carbo*), yellow-legged gull (*Larus cachinnans*) and woodpigeon (*Columba palumbus*). And the overwhelming majority of representatives of the ornithological complex is included in 1 or 2 lists (35 and 18 species respectively), in 3 documents – 7 species (10.3%), and in 4 – 4 species (5.9%); species that are included in 5 documents have not been recorded. Long-legged buzzard (*Buteo rufinus*) is under protection of all 6 nature conservation documents.

More detailed distribution of birds, which form post-nesting and pre-migration gatherings, according to conservation lists is given in Tables 6.32 - 6.33.

Table 6.32. Distribution of Bird Species Counted in Summer 2016 by the Categories of Nature Conservation Lists

ERL		RDBU		IUCN		BONN		BERN		CITES	
category	N	category	N	category	N	category	N	category	N	category	N
VU	**6**	VU	**3**	LC	**4**	1	**-**	2	**41**	1	**-**
		RARE	**1**	NT	**1**	2	**15**	3	**24**	2	**6**
		EN	**1**			1 and 2	**12**				
∑	**6**	∑	**5**	∑	**5**	∑	**27**	∑	**65**	∑	**6**

Table 6.33. Distribution of Bird Species Observed in Summer 2016 by the Quantity of Nature Conservation Lists

Being listed in nature conservation lists	species	%
0	3	4.4
1	35	51.4
2	18	26.5
3	7	10.3
4	4	5.9
5	-	-
6	1	1.5
Total	**68**	**100**

Distribution of birds recorded during the autumn migration of 2016 according to the nature conservation lists

5 species of birds listed in the Red Data Book of Ukraine were recorded in the researched territory in autumn 2016 (Tables 6.34 - 6.36). Nature of their distribution has following features. Out of 5 bird species counted in autumn, 3 species were observed in the adjacent territories (Eurasian oystercatcher – *Haematopus ostralegus,* Eurasian curlew – *Numenius arquata* and long-legged buzzard – *Buteo rufinus*), 1 species was observed in the buffer zones (long-legged buzzard – *Buteo rufinus*), and 3 species - directly in the territory of the designed wind park (long-legged buzzard – *Buteo rufinus*, stock pigeon – *Columba oenas* and European roller – *Coracias garrulus*). At that, number of rare species and quantity of birds were not the same in different months: if in August 8 specimens of 3 species were counted, in October – 7 specimens of 2 species, and in September representatives of rare avifauna have not been observed.

Bird quantity in rare species is small everywhere, they were observed one at a time in the course of autumn migration of 2016. In general, quantity of rare avifauna has not exceeded 0.2% of all observed birds in autumn 2016.

Table 6.34. Birds Listed in the Red Data Book of Ukraine according to the Results of Censuses in August 2016

No.	Species	Wind park sites	Buffer zones	Adjacent territories	∑
1	Eurasian oystercatcher (*Haematopus ostralegus*)	-	-	2	**2**
2	Eurasian curlew (*Numenius arquata*)	-	-	4	**4**
3	European roller (*Coracias garrulus*)	2	-	-	**2**
	Total birds listed in the Red Data Book of Ukraine	2	-	6	**8**
	Total birds within the plot	**152**	**115**	**410**	**677**
	% of the total quantity	**1.3**	**-**	**1.5**	**1.2**

Table 6.35. Birds Listed in the Red Data Book of Ukraine according to the Results of Censuses in October 2016

No.	Species	Wind park sites	Buffer zones	Adjacent territories	∑
1	Long-legged buzzard (*Buteo rufinus*)	1	1	1	**3**
2	Stock pigeon (*Columba oenas*)	4	-	-	**4**
	Total birds listed in the Red Data Book of Ukraine	5	1	1	**7**
	Total birds within the plot	**448**	**1,402**	**3,622**	**5,472**
	% of the total quantity	**1.1**	**0.07**	**0.03**	**0.2**

Table 6.36. Birds Listed in the Red Data Book of Ukraine according to the Results of Censuses in Autumn 2016

No.	Species	Wind park sites	Buffer zones	Adjacent territories	∑
1	Long-legged buzzard (*Buteo rufinus*)	1	1	1	**3**
2	Eurasian oystercatcher (*Haematopus ostralegus*)	-	-	2	**2**
3	Eurasian curlew (*Numenius arquata*)	-	-	4	**4**
4	Stock pigeon (*Columba oenas*)	4	-	-	**4**
5	European roller (*Coracias garrulus*)	2	-	-	**2**
	Total birds listed in the Red Data Book of Ukraine	7	1	7	**15**
	Total birds within the plot	**936**	**1,626**	**4,381**	**6,943**
	% of the total quantity	**0.7**	**0.06**	**0.2**	**0.2**

In addition to revealing representatives of avifauna during the autumn migration, their quantity and distribution throughout the researched territory, it have arisen the necessity of their ranking in accordance with nature conservation lists: the Red Data Book of Ukraine, the List of the International Union for Conservation of Nature (IUCN), the European Red List, the Bonn and Bern Conventions, as well as the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Table 14).

Table 6.37. Distribution of Avifauna of Autumn Migration of 2016 according to Nature Conservation Lists

No.	English name	Latin name	Status	ERL	RDBU	IUCN	BERN	BONN	CITES
1	Great crested grebe	*Podiceps cristatus*	m, w, n				3		
2	Great white egret	*Egretta alba*	m, w, n				2	2	
3	Grey heron	*Ardea cinerea*	m, w, n				3		
4	Common shelduck	*Tadorna tadorna*	m, w, n				2	1, 2	
5	Mallard	*Anas platyrhynchos*	m, w, n				3	1, 2	
6	Northern pintail	*Anas acuta*	m, w				3	1, 2	
7	Garganey	*Anas querquedula*	m, w				3	1, 2	
8	Eurasian sparrowhawk	*Accipiter nisus*	m, w				2	1, 2	2
9	Rough-legged buzzard	*Buteo lagopus*	m, w				2	1, 2	2
10	Long-legged buzzard	*Buteo rufinus*	m, w, n	VU	RARE	LC	2	1, 2	2
11	Common buzzard	*Buteo buteo*	m, w, n				2	1, 2	2
12	Red-footed falcon	*Falco vespertinus*	m, n	VU			2	2	2
13	Common kestrel	*Falco tinnunculus*	m, w, n				2	2	2
14	Grey partridge	*Perdix perdix*	m, w, n	VU			3		
15	Common quail	*Coturnix coturnix*	m, w, n				3	2	
16	Ring-necked pheasant	*Phasianus colchicus*	m, w, n				3		
17	Northern lapwing	*Vanellus vanellus*	m, w, n	VU			3	2	
18	Turnstone	*Arenaria interpres*	m				2	2	
19	Eurasian oystercatcher	*Haematopus ostralegus*	m, n		VU	LC	3		
20	Common redshank	*Tringa totanus*	m, n				3	1, 2	
21	Ruff	*Philomachus pugnax*	m				3	1, 2	
22	Dunlin	*Calidris alpina*	m				2	1, 2	
23	Eurasian curlew	*Numenius arquata*	m, w		EN	NT	3	1, 2	
24	Mediterranean gull	*Larus melanocephalus*	m				2	2	

No.	English name	Latin name	Status	ERL	RDBU	IUCN	BERN	BONN	CITES
25	Little gull	*Larus minutus*	m, n				2		
26	Black-headed gull	*Larus ridibundus*	m, w, n				3		
27	Slender-billed gull	*Larus genei*	m, n				2	2	
28	Yellow-legged gull	*Larus cachinnans*	m, w, n						
29	Black tern	*Chlidonias niger*	m				2	2	
30	Whiskered tern	*Chlidonias hybrida*	m				2		
31	Sandwich tern	*Thalasseus sandvicensis*	m, n				2	2	
32	Woodpigeon	*Columba palumbus*	m, w, n						
33	Stock pigeon	*Columba oenas*	m, w, n		VU	LC	3		
34	Rock pigeon	*Columba livia*	m, n				3		
35	Eurasian collared dove	*Streptopelia decaocto*	m, w, n				3		
36	Turtle dove	*Streptopelia turtur*	m, n				3		
37	European roller	*Coracias garrulus*	m, n	VU	EN	NT	2	2	
38	European bee-eater	*Merops apiaster*	m, n				2	2	
39	Hoopoe	*Upupa epops*	m, n				2		
40	Syrian woodpecker	*Dendrocopos syriacus*	m, n				2		
41	Barn swallow	*Hirundo rustica*	m, n				2		
42	Skylark	*Alauda arvensis*	m, w, n				3		
43	Crested lark	*Galerida cristata*	m, w, n				3		
44	Tawny pipit	*Anthus campestris*	m, n				2		
45	White wagtail	*Motacilla alba*	m, w, n				2		
46	Yellow wagtail	*Motacilla flava*	m, n				2		
47	Red-backed shrike	*Lanius collurio*	m, n				2		
48	Lesser grey shrike	*Lanius minor*	m, n				2		
49	European starling	*Sturnus vulgaris*	m, w, n				2		
50	Eurasian jay	*Garrulus glandarius*	m, w, n				2		
51	European magpie	*Pica pica*	m, w, n				2		
52	Jackdaw	*Corvus monedula*	m, w, n				2		
53	Rook	*Corvus frugilegus*	m, w, n				2		
54	Hooded crow	*Corvus cornix*	m, w, n				2		
55	Common raven	*Corvus corax*	m, w, n				3		
56	Wren	*Troglodytes troglodytes*	m, w, n				2		
57	Pied flycatcher	*Ficedula hypoleuca*	m				2		
58	African stonechat	*Saxicola torquata*	m, n				2	2	
59	Common redstart	*Phoenicurus phoenicurus*	m, n				2	2	
60	European robin	*Erithacus rubecula*	m, n						
61	Fieldfare	*Turdus pilaris*	m, w				3	2	
62	Blackbird	*Turdus merula*	m, w, n				3	2	
63	Great tit	*Parus major*	m, w, n				2		
64	House sparrow	*Passer domesticus*	m, w, n				2		
65	Eurasian tree sparrow	*Passer montanus*	m, w, n				3		
66	Chaffinch	*Fringilla coelebs*	m, w, n				3		
67	European greenfinch	*Chloris chloris*	m, w, n				2		
68	European goldfinch	*Carduelis carduelis*	m, w, n				2		
69	Linnet	*Acanthis cannabina*	m, w, n				2		
70	Corn bunting	*Emberiza calandra*	m, w, n				3		
71	Yellowhammer	*Emberiza citrinella*	m, w, n				2		

Notes: Status: m – species occurs in the course of seasonal migrations; w – species is found in winter period; n – species occurs in nesting period. **RDBU** – Conservation status of the Red Data Book of Ukraine: **EN** – endangered; **VU** – vulnerable; **RARE** – rare; **UR** – unrated. **IUCN** – Conservation status of the International Union for Conservation of Nature: **EN** – endangered; **NT** – near threatened; **VU** – vulnerable; **LC** – least concern. **ERL** - Conservation status of the European Red List: **VU –** vulnerable, species that may be rated to an endangered category in the near future, if the effect of factors influencing on their condition continues; **EN –** endangered, species that are seriously at risk of extinction; their preservation is hardly probable, reproduction is impossible without carrying out special measures. **BONN** – the Bonn Convention: **Annex I (1)** includes species that are in danger of extinction; **Annex II (2)** includes species, state of which is unfavourable, preservation and regulation of using which needs international agreements, as well as that species, state of which might be considerably improved as a result of international cooperation, which may be carried out based on international agreements. The same species may be included both to Annex I and to Annex II. **BERN** – the Bern Convention, or the Convention on the Conservation of European Wild Flora and Fauna and Natural Habitats, includes **Annex II (2) –** list of fauna species that are

subject to special protection; **Annex III (3) –** fauna species that are subject to protection. **CITES** – the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora: **Annex I (1)** includes species "that are in danger of extinction, trade in which causes or may cause negative influence on their existence. Trade in specimens of such species must be especially severely regulated for that purpose to do not endanger their survival for the future, and must be allowed only in exceptional cases"; **Annex II (2)** includes: "a) all species, which are not necessarily threatened with extinction for now, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and b) that have to be subject to regulation in order to enable the possibility to get the trade in specimens of certain species mentioned in subparagraph (a) of this paragraph under effective control".

As is obvious from Table 6.38, the representatives of autumn ornithological complex in the region of EuroCape Wind Park, buffer zones and in the adjacent territories are listed in 6 nature conservation lists. Most of them were related to the Bern Convention (68 species out of 71, or 95.8%), 42 species of which are subject to special protection, 26 species are subject to protection. Situation with relation to the Bonn Convention is interesting: 16 species among 28 species of the ornithological complex, which are included in this Convention, rate to Annex II (state of which is unfavourable), and 12 species are included simultaneously both to Annex II and I (are in danger of extinction), which is possible in the context of this nature conservation document. 5 species are listed in the Red Data Book of Ukraine (2009), among which 2 species are endangered, 1 species – rare and 2 species - vulnerable. Also 5 species are listed in the Red List of IUCN (least concern – 3, near threatened – 2). In addition, 6 species are included in the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (Annex 2), 5 species are listed in the European Red List.

With regard to a degree of bird pertaining to nature conservation lists, the following picture is being completed. 3 (4.2%) of 71 species are not listed in any of nature conservation documents: yellow-legged gull (*Larus cachinnans*), woodpigeon (*Columba palumbus*) and European robin (*Erithacus rubecula*). And the overwhelming majority of the representatives of spring ornithological complex is included in 1 or 2 lists (37 and 20 species respectively), in 3 documents – 7 species (9.9%), and in 4 – 2 species (2.8%). Moreover, there was a species that is listed simultaneously in 5 conservation documents – European roller (*Coracias garrulus*). Long-legged buzzard (*Buteo rufinus*) is under protection of all 6 nature conservation documents.

More detailed distribution of the representatives of autumn migration ornithological complex according to conservation lists is given in Tables 6.38 - 6.39.

Table 6.38. Distribution of Bird Species Observed During the Autumn Migration of 2016 by the Categories of Nature Conservation Lists

ERL		RDBU		IUCN		BONN		BERN		CITES	
category	N	category	N	category	N	category	N	category	N	category	N
VU	**5**	EN	**2**	NT	**2**	1	**-**	2	**42**	1	**-**
		VU	**2**	LC	**3**	2	**16**	3	**26**	2	**6**
		RARE	**1**			1 and 2	**12**				
∑	**5**	∑	**5**	∑	**5**	∑	**28**	∑	**68**	∑	**6**

Table 6.39. Distribution of Bird Species Observed During the Autumn Migration of 2016 by the Quantity of Nature Conservation Lists

Being listed in nature conservation lists	species	%
0	3	4.2
1	37	52.1
2	20	28.2
3	7	9.9
4	2	2.8
5	1	1.4
6	1	1.4
Total	**71**	**100**

6.5. Assessment of impacts caused by the construction and operation of the designed territory of the wind park during autumn migration of birds

Conclusion about the influence of EuroCape Wind Park on post-nesting bird gatherings

The main purpose for birds during formation of post-nesting and pre-migration autumn gatherings is rise in physical properties by means of intensive feeding and improvement of flying characteristics. As a consequence, birds concentrate in places with enough amount of feed forming gatherings, different by size, within the wind park sites and in the adjacent territories. Two types of behaviour are typical for bird species of wetland complex, depending on the location of their feeding territories. So, ruff, gulls, Eurasian coot, terns, other shore birds (the most numerous species, which make up a considerable part of the absolute quantity of birds) stay in the water area of the

Oleksandrivska Gulf of the Molochnyi Estuary and at the coastal plots of the Sea of Azov water area within twenty-four hours, without use of the mainland. The water area is a rest place for such species as ruff and gulls, and feeding flights they carry out to agricultural lands adjacent to the gulf. In addition, some species (gulls, terns, herons) demonstrate mixed type of behaviour.

Rest and feeding places for the main gatherings (by quantity and diversity) are remote from the project area (up to 8 - 13 km).

Ruff (*Philomachus pugnax*) had been the most numerous among sandpipers in 2016, all its recordings, also as other sandpipers, were fixed exclusively out of the area of the wind park sites. As to gulls and terns, they also were observed in the adjacent territories.

In general, it may be stated that the wind park impact on birds during the period of post-nesting gatherings is low.

Conclusion about the influence of EuroCape Wind Park during autumn migration of birds

1. Impacts caused by the construction.

1a – emissions of hazardous substances. Emissions of hazardous substances will not exceed the permissible rates during the construction, owing to absence of stationary sources of pollution and short period of construction works. There is no negative impact on migrating birds.

1b – deterring by visual effects and noise. Factor of deterring by noise is practically absent, due to the absence of considerable in quantity migration gatherings in the territory of the wind park sites. Feeding migrants move throughout the territory and have large areas of alternative forage territories in 2- km buffer zone and outside it. There are greater sources of noise in the adjacent zones (agricultural engineering, local motor roads). In addition, for the birds recorded at the wind park sites, feeding territories are more connected with crop rotations than with the project work.

Deterring by visual effects is not threatening; therefore impact of these factors on birds shall be characterized as low. From our point of view, effect of this factor for the period of migrations will lessen the risks concerning the negative impact of the wind park on birds.

1c – occupying the territory by working platforms and equipment. Physical dimensions of the wind park sites are rather large (generally, about 13,000 ha), which enable birds to fly easily past the working platforms with equipment located on them during the construction. The territory, which will be occupied by working platforms and equipment, will not exceed 1% of the total area. It will enable birds to fly easily past the working platforms with equipment located on them during the construction. Besides, the slight density of the placement of working platforms and equipment will not obstruct feeding flights of birds, due to large total area of the wind park sites and considerable distances between the wind turbines (about 500 m). According to personal observations at already operating wind parks, birds get accustomed quickly to the constructed wind parks. Therefore this negative impact on migrating birds during the construction is low, and during the operation of the wind park it is absent.

1d – loss of breeding places. Negative impact on migrating birds is absent. For that species, which remain for wintering within EuroCape Wind Park on completion of the migration, the loss of breeding places is not significant. Low density of birds nesting, small species composition makes possible to select nesting places without obstacles. Slight loss of nesting places, owing to the wind park construction, will have not continuous, but mosaic pattern, leaving the major part of the wind park territory for free selection of nesting places. Besides, the majority of species recorded in the course of nesting are common and widely distributed in the region, with their high quantity. Negative impact of this factor shall be estimated as low.

1e – loss of individual specimens of protected species. 5 rare bird species have been registered in the territory of researches, 3 of which were observed in terrestrial biotopes of the wind park sites (long-legged buzzard – *Buteo rufinus*, stock pigeon – *Columba oenas* and European roller – *Coracias garrulus*), 1 species – in the buffer zones and 3 species – in the adjacent territories.

The possibility to meet rare species is rather slight. During the registration of species in the territory of the wind park sites, negative impacts of the wind park on them are very low. This is due to the fact that birds of prey have a good sense of direction in the course of passage relative to existing towers of electric networks and other high-rise structures in the adjacent territories, and are not characterized by migration movements at night. Other counted rare species are mainly attached to the semi-aquatic biotopes, within which their main transit movements and feeding migrations take place.

Negative impact of the wind park shall be estimated as low.

2. Impacts caused by equipment.

2a – long-time territory occupation and change of environment characteristics. As the territory of the wind park sites is represented for the most part by the anthropogenic types of biotopes (agricultural lands, agricultural hedgerows), then the creation of small (by the area) infrastructure will not be threatening for gatherings and feeding movements of birds, as the major part of the territory will remain without changes.

Analysis of field researches indicates small migration gatherings of birds and migration stops within the wind park sites. In regard to the feeding migrants, recorded species are characterized by their wide distribution and the ability to manoeuvre easily throughout the territory. Negative impact on migrating birds is low.

2b – deterring by mast vertical structures. Vertical structures are the signal for short-term change of the course for migratory birds, at that the large area of the wind park enable to do it easily. Besides, the slight density of the placement of equipment will not obstruct the feeding flights of birds, due to large total area of the wind park and considerable distances between the wind turbines. High-power electric network lines pass near the sites. Special observations have not revealed the negative impact on the migrating birds of both vertical structures (towers) and horizontal ones (electric wires). Negative impact on migrating birds shall be estimated as low.

2c – barrier impact and obstacles for flight. Technical characteristics of the wind turbines create a threat for migrating birds that fly within the interval of 50 - 170 m owing to rotor motion.

According to the results of investigations in autumn 2016 all migrating birds (3,054 specimens, or 100% of the total number of migrants) flew at the altitudes up to 50 m. There has not been registered any flock in the altitude interval of 50 - 170 m, which may be dangerous for flights, over the period of observations within the wind park and in the buffer zones in autumn 2016.

On the basis of summary analysis of bird migration altitudes, it may be stated that they are not threatening for birds and influence of the wind park on them shall be estimated as low.

3. Impacts caused by the wind park operation.

3a – deterring caused by rotor motion, shadows flicker, light gleams.

Technical characteristics of the wind turbines may potentially create a threat for migratory birds that fly at the altitudes of 50 - 170 m owing to rotor motion. Analysis of researches shows that this altitude interval almost is not used within the designed sites of the wind park. According to our observations at already operating wind parks, the impact of this factor on birds during the period of migrations has not been revealed. So, negative impacts caused by rotor motion, shadows flicker and light gleams shall be estimated as low, and for the majority of birds that stay at the wind park sites they are absent.

3b – additional territory development. Effect of this factor is possible for birds, which are nesting within the sites. Negative impact on the migratory birds is absent. It shall be considered that in comparison with the impacts of wind parks, the influence of agricultural works in the course of year is much higher.

3c – disturbing owing to night-time illumination. Percentage of birds, which migrate at night, is small. And small by the quantity and species diversity transit migrants will not sense the night-time illumination within the sites due to illumination of adjacent residential settlements. Parallel researches of bats' activity during night time in the territory of the wind park enabled to carry out observation of night ornithological situation. As a result of carried out works, we have not revealed any case of creation of hazardous situation owing to nocturnal migrations of birds.

Impact of this factor shall be estimated as very low.

3d – collisions with the wind turbine generators. When evaluating the observation data of the migration in autumn 2016, namely such important aspects as the total quantity of birds, dynamics of passage intensity, description of the altitude and directions of the migration, diurnal activity, we shall state that the negative impact on migrants was low.

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CHAPTER 7. Description of the State of Transcontinental Migrations of Individual Bird Species of the International Conventions

Description of transcontinental migrations of greater white-fronted goose *(Anser albifrons)*

The main task was to carry out analysis of space-time relations of birds of the fauna of Ukraine within their habitats. Analysis of the database of Bird Banding Centre enables to ascertain places of nesting, migration routes and wintering areas of birds – transcontinental migrants.

At the average 750 thousands of greater white-fronted geese fly through the Azov and Black Sea region both in spring and in autumn. From 120 to 360 thousand specimens of greater white-fronted goose fly through the north part of Ukraine each spring. Migration intensity in autumn is considerably lower – quantity of greater white-fronted goose usually does not exceed 50 thousand specimens.

Migratory movements of greater white-fronted goose (Anser albifrons) within the natural habitat

Those geese gatherings, which nest in the north of Eastern Europe, Western Siberia and on the Taimyr, are connected with the territory of Ukraine. The main wintering areas of these geese are located (Scott, Rose, 1996):

- in Western Europe (the Netherlands, Great Britain, France) quantity of this gathering shall be estimated equal to 600 thousand birds
- in the Black Sea Region (including also Ukraine) quantity of this population shall be estimated equal to 650 thousand specimens
- in Central Europe (mainly, in the Pannonian plain) quantity shall be estimated equal to 100 thousand specimens (Madsen, Reed, Andreev, 1996).

Database of Bird Banding Centre numbers 44 returns of greater white-fronted geese and all of them were ringed outside of Ukraine – 43 of them were caught during wintering in Western Europe (39 – in the Netherlands, 4 – in Great Britain). And only one adult bird was ringed in nesting (moult) place – the Taimyr (the Russian Federation), but shot down during spring migration in Poltava Region. Practically all of them pertain to the northern half of Ukraine.

From the Azov and Black Sea Region we have only 3 returns of geese, which were ringed during wintering in the Netherlands in previous years. These data indicate that certain part of birds changes wintering places, in our case – Western Europe to the Black Sea region.

Two migration routes of greater white-fronted geese are being completed in Ukraine, and both have latitudinal directivity, that is, general direction of spring movement is the eastern one, autumn – the western one (Fig. 7.1).

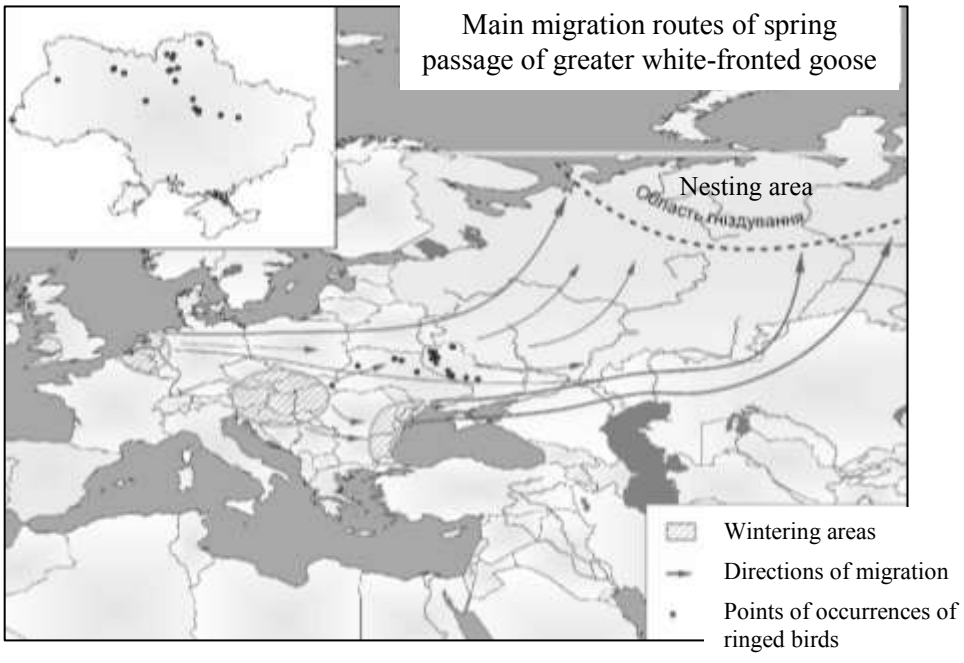


Fig. 7.1. Main migration routes of spring passage of greater white-fronted goose

The first of them passes along the Azov and Black Sea migration route. It connects the Black Sea and Central Europe wintering areas with nesting places in Siberia. This route covers the coastal areas of the southern regions and steppe areas of the Crimea Autonomous Republic and has the width of 100 – 150 km and even more. A considerable part of birds flies over the water area of the Black Sea between the Crimea and the delta of the Danube. Migration route of these geese to the east of Ukraine passes through Kuban, the lower reaches of the Don and the Ural (Fig. 7.2).

Key region in seasonal migrations of these geese is the southern part of Western Siberia and Northern Kazakhstan – birds stay here for a long time both in spring and in autumn to recover their fat reserves, which they need for further migration movement. The Ob River Valley is also important riverbed for bird migrations during both seasonal movements. It shall be emphasized once more that spring and autumn migrations in this region do not differ practically by quantitative indices (with the exception of birds that have died during wintering).

The second route of greater white-fronted geese movement in Ukraine passes through its northern part. A considerable part of geese flies along Polissia migration route, which includes the most northern regions of the country. Many birds migrate more southward of this flying route, reaching the central regions, but general directivity of movements remains latitudinal one. The northern migration route of geese is formed by the birds, which winter in Western Europe, and part of geese that winter in Central Europe (the Pannonian plain), and in spring they get to Ukraine after passing Carpathians.

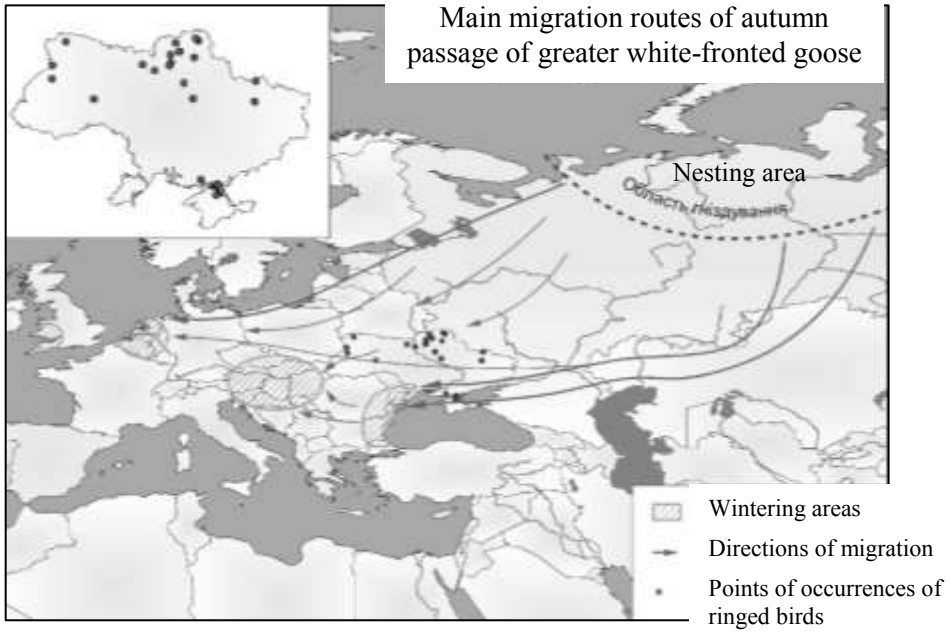


Fig. 7.2. Main migration routes of autumn passage of greater white-fronted goose

Migrations of greater white-fronted geese in the north of Ukraine differ substantially in spring and in autumn – in the first place it concerns the intensity of flight in different seasons. It is connected with distribution of routes of different population gatherings. The majority of geese fly from nesting areas directly to the side of wintering areas in the course of autumn migration, crossing Karelia, Baltic countries, Poland and Germany. Part of birds may migrate some southward – just very these birds may be observed in the northern parts of Ukraine.

Pattern of routes of geese return to nesting places differs in spring. While moving away from wintering, the front of migrating geese gradually widens. But as opposed to autumn, more mass migration is observed in its southern part.

West-European geese get to Ukraine through Volynska Region and the northern part of Lviv Region. In the territory of our country the front of migration continues to widen. In Left-bank Ukraine, part of geese begins to change the direction of their migration from the south-eastern and eastern to the north-eastern and northern. While moving to the east borders, the majority of geese, which nest in European tundra, turn to the northern east and north.

But it is known that certain small part of greater white-fronted geese, which winter in Western Europe, nest in the tundra of Western Siberia and the Taimyr. Routes of their movements are different, in comparison with more western populations. In spring, these birds, after the east regions of Ukraine, fly further in the

eastern direction to the southern part of Western Siberia and Northern Kazakhstan. More likely, somewhere in the area of the Lower Volga these birds join that migration flow of geese, which fly from the Black Sea region.

Regional aspect of transcontinental migrations of greater white-fronted goose (Anser albifrons)

First registration of migrating flocks of greater white-fronted goose in 2015 fall on the 2 - 3 (oral report of Y.I. Chernichko) and 5 - 8 of March. According to the data of observers at the coast of the Sea of Azov, a flock of 40 birds was recorded in the north-eastern direction within the scientific field station of B. Khmelnitsky MSTTU in the Village of Stepanivka Persha on 06.03.2015 (S.Y. Khlystun, oral report) and over the Village of Chkalove (Pryazovske District of Zaporizhia Region) on 07.03.2015, where fishermen observed 2 flocks (50 specimens in each), which flew along the coastal strip to the northern east (R.H. Bielov, oral report). In addition, we have recorded transit migratory movements of goose over the City of Melitopol on the 9th (1 flock in the south-eastern direction), 11 and 12 of March (2 flocks to the southern east, 1 flock to the northern east). All flocks registered over the city flew at the altitudes over 500 m. After these registrations, which may be related to the first wave of migration with high probability, a pause has occurred, caused possibly by violent fluctuations of air pressure values during the period of the 13 - 19 of March. Since the 20 of March air pressure stabilizes, which is a precondition for migratory activity of birds in spring, because bird passages are connected just with anticyclone weather type.

Special observations carried out in the Azov and Black Sea region at that period have confirmed the monitoring data of many years about the progress of second, the most active wave of greater white-fronted goose migration.

So, on the 21 of March, 2015 we have registered 20 flocks with the total quantity of 2,780 specimens (lim: 20 -360; C_v = 76.41%) within the Obytichna Spit and Gulf during daylight hours, which on the average was 140.3 specimens per one flock. In addition to observations in the daytime, 5 more flocks had been registered during hours of darkness (the first half of night), quantity of which was estimated by the voice activity as not less than 50 specimens in each flock. Next day migration had been halted and no one flock was registered within the Obytichna Spit.

A similar situation has been recorded by the observer R.H. Bielov in the outskirts of the Village of Chkalove (10 km to the west of Botieve Wind Park). He registered 35 flocks of greater white-fronted goose during a period of the 20 - 23 of March. The peak of activity also fell on the 21 of March, when 20 flocks had flown. The majority of flocks were of the quantity from 50 to 120 specimens, and the total quantity of all geese has been estimated equal to 2,700 specimens, which on the average is 90 specimens per one flock. Altitudes of the flight were over 300 - 400 m, and the north-eastern direction was dominating (22 flocks) with expressed passage in the northern (5 flocks) and the eastern (3 flocks) directions.

According to oral report of S.Y. Khlystun, he has recorded not less than 10 flocks in the daytime at altitudes over 300 m along the coast line (the northern east) within the Village of Stepanivka Persha on the 20 - 22 of March. Active nocturnal migration of geese took place – also about 10 flocks.

5 flocks, which had flown to the north and southern east, were observed in the city of Melitopol in the evening and the first half of night on the 20 - 21 of March.

According to data of colleagues from other observation points in the Azov and Black Sea region, the same picture has been observed in Kherson and Odesa Regions.

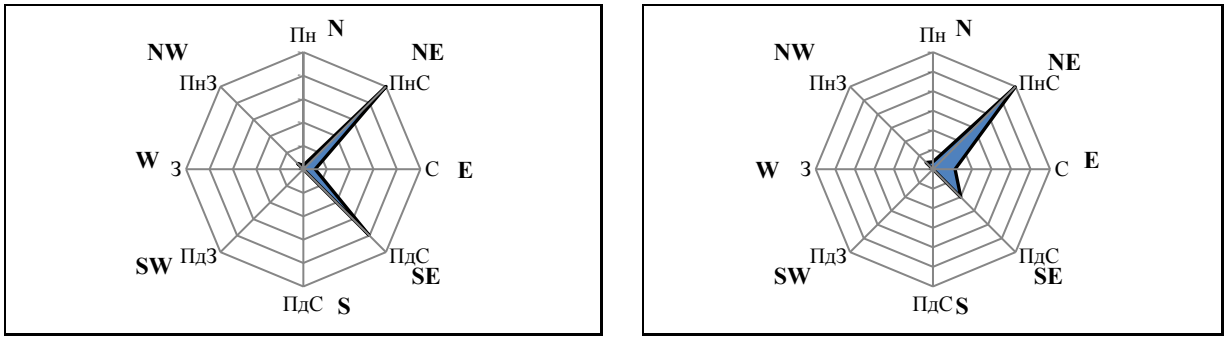
Researches carried out toward the end of March (on the 27 - 31 of March) may be characterized as the third wave of passage with some distinctions. So, traditional for spring passage directions of migration have been somewhat changed. Observation points were located at the flood plain of the Molochna River to the north (2 km) and south (13 km) of Melitopol at that period. Information about geese migration over the city has also been collected. 34 flocks in all were registered, with the total quantity of 1,888 specimens (lim: 8 - 220; C_v = 77.91%), on the average 55.5 specimens per one flock. It is interesting that 892 specimens flew in the north-eastern direction, or 47.2% of all registered at that period (11 flocks; lim: 12 - 220), and 996 specimens – to the southern east, or 52.8% (23 flocks; lim: 8 - 150). Average size of flocks that flew to the northern east is larger (81.1 specimens/ flock) than to the southern east (43.3 specimens/ flock). Passage altitudes were over 400 m.

Directions of migration. Northern and eastern passage directions are typical for spring migration (Table 7.1). Analysis of Table 2.12 shows that 56.89% of all registered flocks flew just in these very directions, with dominating of north-eastern one (50.00%). Rather high quantity of flocks (23) has been registered in non-typical south-eastern direction (generally over Melitopol City), part of which is 39.66% (Fig. 7.3). While analysing quantity of birds, the picture somewhat changes. Already 74.86% of all registered migrants kept to traditional directions, but part of the south-eastern passages was only 20.91%.

Size of flocks varied from 8 to 360 specimens and was 85.03 specimens/ flock for all observations. Bird flocks, which flew to the north (190 specimens, 1 flock) and east (186.7 specimens/ flock), were the largest, and those that flew to the southern east (43.3 specimens/ flock) – the smallest ones. Besides, statistical analysis of size of flocks, which flew in traditional and non-typical directions, has revealed reliable distinctions. Geese flew to the southern east in flocks of reliably smaller size than in the northern and eastern directions (mean threshold of probability, $\beta \geq 0.99$).

Table 7.1. Description of Directions of Spring Migration of Greater White-Fronted Goose in the South of Zaporizhia Region in 2015

Compass point	N flocks		∑ specimens		M ± m	min	max	C_v
	abs.	%	abs.	%				
N	1	1.72	190	3.85	190	190	190	-
NE	29	50.00	2,942	59.66	101.4 ± 78.5	12	360	77.33
E	3	5.17	560	11.35	186.7 ± 80.8	140	280	43.3
SE	23	39.66	996	20.19	43.3 ± 30.6	8	150	70.65
NW	2	3.45	244	4.95	122	24	220	113.60
Total	**58**	**100**	**4,932**	**100**	**85.03 ± 74.66**	**8**	**360**	**87.80**



A. Number of flocks (n = 58) B. Quantity of birds (n = 4,932)

Fig. 7.3. Directions of greater white-fronted goose migration in the south of Zaporizhia Region in spring, 2015

Regional aspect. Collected information of 8 points from more than 10 observers enabled to appraise the migration process in terms of regional aspect. The second wave of greater white-fronted goose migration within the south of Zaporizhia Region is characterized by indices, typical for this period.

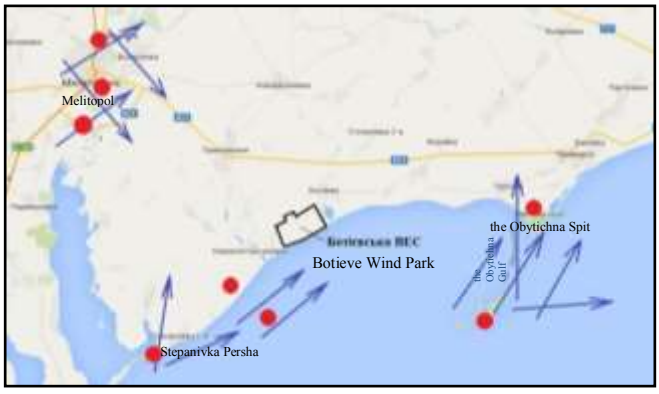


Fig. 7.4. Spring migration of greater white-fronted goose in 2015

The south-eastern direction remains the main one of migration, which is caused by submeridional extension of the coastal line and location of nesting places of the species, where birds are flying to. Graphic representation of registered flocks (Fig. 7.4) enables to draw up a pattern of the passage, where constant migration flows dominate at the north-western Azov region, but over the City of Melitopol we can see appearance of the part of birds that fly in the south-eastern direction. It shall be noted that the latter were observed over the City of Melitopol exclusively in evening, therefore there is reason to believe that these are geese that flew to the water area of the Sea of Azov to rest toward the end of diurnal passage (perhaps from Odesa Region).

Altitudes of migration passages. Description of spring passage of birds was also based on conditional partition of the altitudes that had been used by migrating geese. As there are objective difficulties of precise

determination of passage altitude for individual flock, all registered flocks are distributed by altitude intervals with a step of 100 m. Such partition was caused by the type of migration. All flocks have been observed in the course of transit flight, when birds form up certain order (shape of a flock) and gain altitudes, inherent to migrations for long distances. In addition, birds keep strictly to migration directions. So, no one flock that flew lower than 300 m have been registered (Table 7.2).

When analysing Table 2.13 we can see that 60.34% of all flocks and 44.22% of the total quantity of birds in the south of Zaporizhia Region used altitudes over 400 to 500 m. Approximately 20% of flocks flew above and below this altitude interval each, and from 23.95% (below) to 31.83% (above) of birds (Table 7.2, Fig. 7.5).

So, rather large territory of the south of Ukraine was covered by observations in 2015. Analysis of the whole information indicates traditional terms of the beginning and progress of the first two waves of migration, availability of stable migratory corridors, certain dependence on weather-climatic conditions and stably low quantity of birds, in comparison with the 90s of the last century.

Table 7.2. Description of Altitudes of Greater White-Fronted Goose Passage in Spring, 2015

Altitudes, m	N flocks		∑ specimens		M ± m	min	max	C_v
	abs.	%	abs.	%				
< 400	12	20.7	1,181	24.0	98.4 ± 68.0	12	240	69.13
400 - 500	35	60.3	2,181	44.2	62.3 ± 55.0	8	280	88.26
> 500	11	19.0	1,570	31.8	142.7±103.6	40	360	72.55
Total	**58**	**100**	**4,932**	**100**	**85.0 ± 74.7**	**8**	**360**	**87.80**

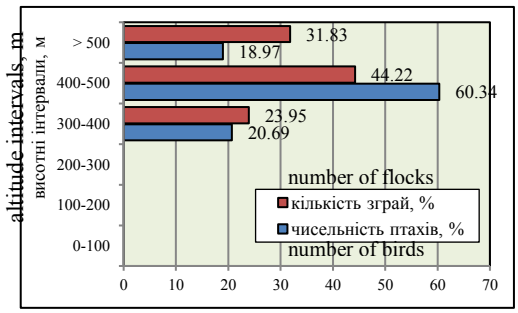


Fig. 7.5. Altitudes of spring passage of greater white-fronted goose in 2015

Description of birds, which migrate along transcontinental Afro-Eurasian routes by the example of the model species of sandpipers: curlew sandpiper (*Calidris ferruginea)* and broad-billed sandpiper (*Limicola falcinellus)*

Wetlands of the Azov and Black Sea ecological corridor differ in their ecological capacity, food reserve, an area of available shallow feeding territories and, accordingly, that significance, which they have as places of migration stops of sandpipers. Further, by the example of two species of sandpipers that carry out long-distance transcontinental migrations using mainly inland water bodies for stops in Eurasia, it shall be considered a ranking of the wetlands within the Azov and Black Sea ecological corridor according to their significance; determination of key territories, which have a primary, transboundary importance for conservation of these species, and of less importance, secondary stop places, which, however, summarily also support a certain part of their Eurasian populations.

It shall be noted that importance of individual elements of the Azov and Black Sea ecological corridor may change in the course of certain long time intervals, owing to changes of ecological conditions in individual wetlands (changes of salinity, composition of food reserve, overgrowing with emergent vegetation and so on). Therefore comparative evaluation of transboundary importance of territories, which are included in the Azov and Black Sea ecological corridor, is based on recent data of synchronous bird censuses within it that have been carried out in autumn periods of 2004, 2006, 2009 - 2010 (ROM Bulletin, 2005, 2008, 2010). In case of availability of monitoring data of many years concerning individual territories within the Azov and Black Sea ecological corridor, they have been used in comparative aspect.

Curlew sandpiper - Calidris ferruginea

Long-distance migrant. Nests in the tundra zone of Russia from the Yamal Peninsula in the west to the Chukotski Peninsula in the east. According to results of sandpiper banding by the staff of the Azov and Black Sea ornithological station (Fig. 2.2.1), curlew sandpipers, which migrate in the Azov and Black Sea ecological corridor, are distributed at nesting places in the tundra of Russia to the east at least to the Taimyr Peninsula, inclusive.

Part of them migrates through the Nordic Countries, Poland, Germany, England and Spain in autumn (Fig. 7.6). Considerable quantity of them turns to the southern east to the wetlands of the Azov and Black Sea ecological corridor and stops within it mainly in August – at the beginning of September, before flying away to wintering areas. The major part of curlew sandpipers fly along the continental Mediterranean route, also stopping at the Azov and Black Sea coast of Ukraine (Khomenko & Diadicheva, 1999; Diadicheva & Khomenko, 2006).

According to data of censuses of the 1990s by the Azov and Black Sea ornithological station, over 72,000 of curlew sandpipers stopped at the wetlands of the Azov and Black Sea ecological corridor in August, mainly at the Syvash (Diadicheva & Khomenko, 2006). It makes up over 6.5% of the whole (not nesting) population of the West Palaearctic region (1,070,000 specimens, according to Delany, Scott, 2002). Part of birds changes contour feathering at this time, and about 14% begin moult of flight feathers. August quantity of this species within the Azov and Black Sea ecological corridor has slightly decreased in the 2000s, but remains considerable. For example, about 55,260 of curlew sandpipers were counted here in August, 2006 (ROM Bulletin, 2008), which makes up over 5% of the population of the West Palaearctic region (Table 7.3).

The main wintering areas of curlew sandpipers, which migrate through the Azov and Black Sea ecological corridor, are located in the territory of countries of North, West and Southern Africa (Fig. 2.2.1). According to banding results, they have been revealed at least in 8 African countries: Tunisia, Morocco, Chad, Sudan, Senegal, Mali, Namibia and the Republic of South Africa.

In spring, curlew sandpipers fly away from African wintering areas, flying, according to banding data, through Mediterranean countries – Italy, Greece (Fig. 7.6) towards the wetlands of the Azov and Black Sea ecological corridor. They make short-term (about 5 days) stop within it, reaching maximum quantity in May. According to data of censuses of the 1990s, it was up to 32,700 only at the Syvash (Diadicheva, Khomenko and others, 1999), which makes up more than 3% of the whole (not nesting) population of the West Palaearctic region. To the northward of the Azov and Black Sea region, autumn occurrences of birds ringed in the region prevail. Obviously, they fly further to nesting places in spring, through inland territories along Mediterranean flight route. According to calculations, on the assumption of weight of birds and energy demands for flight, part of them probably makes the second intermediate migration stop in the Caspian Sea region, prior to reach nesting places (Khomenko & Diadicheva, 1999; Khomenko & Diadicheva, 2000).

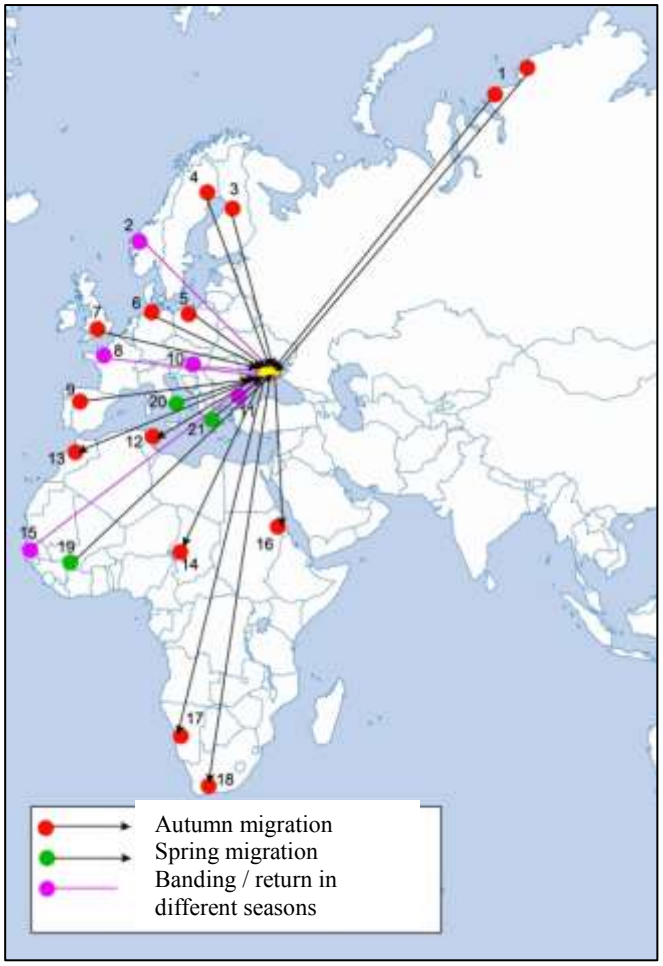


Fig. 7.6. Transboundary spatial relations of curlew sandpipers, which migrate through the Azov and Black Sea ecological corridor, according to results of banding by the Azov and Black Sea ornithological station (1 – Russia, the Taimyr Peninsula; 2 – Norway; 3 – Finland; 4 – Sweden; 5 – Poland; 6 – Germany; 7 – Great Britain; 8 – France; 9 – Spain; 10 – Hungary; 11 – Bulgaria; 12 – Tunisia; 13 – Morocco; 14 – Chad; 15 – Senegal; 16 – Sudan; 17 – Namibia; 18 – the Republic of South Africa; 19 – Mali; 20 – Italy; 21 – Greece)

As has already been stated above, wetlands within the Azov and Black Sea ecological corridor have inequivalent importance for migration stops of sandpipers [39, 36]. Wetlands of the Central and East Syvash are the key territories for curlew sandpiper (Table 7.3, Fig. 7.7), which may support simultaneously its summary quantity up to 54,000 - 72,000 in favourable years. The Utliutskyi and Molochnyi Estuaries are of

the second importance, which support simultaneously up to 5,000 of curlew sandpipers in certain years. The Tendrivska Gulf and South-Karkinitskyi complex may be considered to be wetlands of the third category in terms of their importance for this species (Fig. 2.2.2). The Tylihulskyi and Kuialnytskyi Estuaries, the Kinburnski Lakes and Berdianski Wetlands correspond to the fourth level, as of the 2000s (100 - 200 specimens simultaneously). Other wetlands of the north-western and north Black Sea region, the Crimea and the north Azov Sea region usually support simultaneously small gatherings of this species, of quantity up to 100 specimens. It shall be estimated mainly as not numerous migrant (at the level of tens – hundreds of specimens), according to literary data, also outside of the Azov and Black Sea ecological corridor (Diadicheva, Khomenko and others, 1999).

Table 7.3. Comparative Quantity of Curlew Sandpipers at Different Plots of the Azov and Black Sea Ecological Corridor during Autumn Migration in the 2000s

Territory	Quantity in August			% of the West Palaearctic non-nesting population
	2004	2006	2009	
North-Western Black Sea Region	114	115	172	0.01 - 0.02
Northern Black Sea Region	852	235	166	0.02 - 0.08
Central Syvash	9,342	25,677	7,946	0.7 - 2.4
East Syvash	4,101	28,150	5,050	0.4 - 2.6
North-Western Azov Sea Region	575	1,078	6,521	0.05 - 0.6
Total	**14,984**	**55,255**	**19,855**	**1.4 - 5.2**

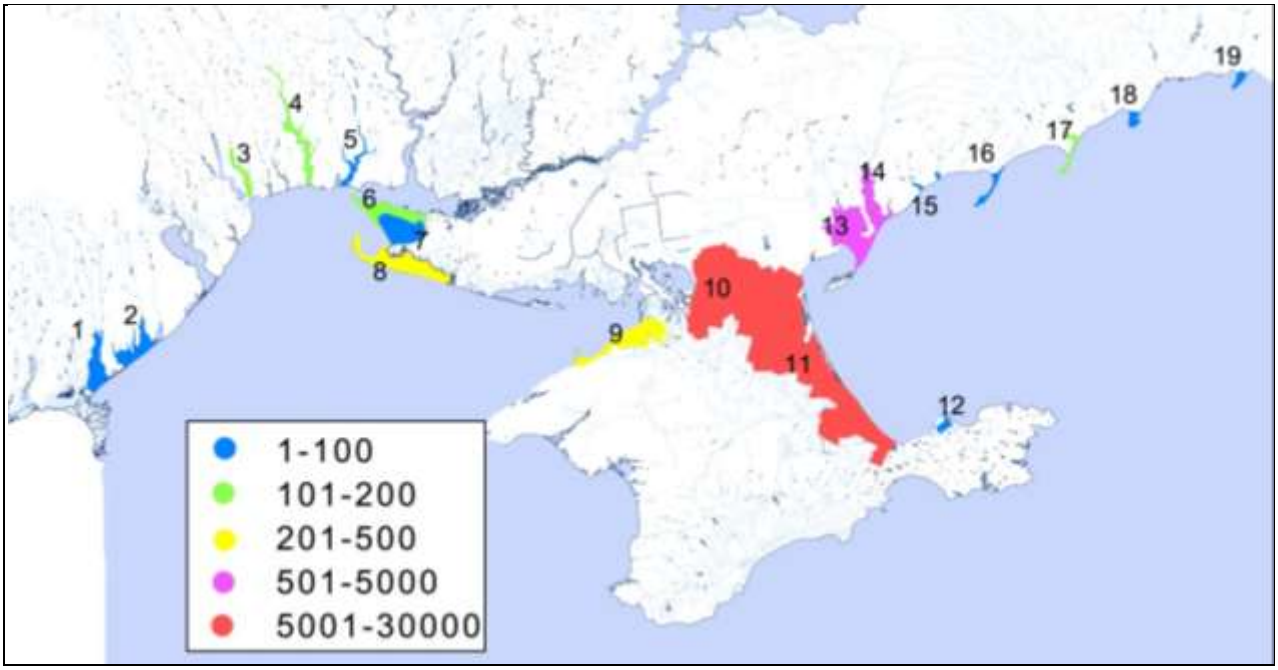


Fig. 7.7. Ranking of wetlands of the Azov and Black Sea ecological corridor according to their importance for curlew sandpiper during autumn migrations in the 2000s (levels of quantity are marked by corresponding colours): 1 – the Sasyk Lake, 2 – the Shahany and Alibei Estuaries, 3 – the Kuialnytskyi Estuary, 4 – the Tylihulskyi Estuary, 5 – the Berezanskyi Estuary, 6 – the Kinburnska Spit and Lakes, 7 – the Yahorlytska Gulf, 8 – the Tendrivska Gulf, 9 – the Karkinitski Wetlands, 10 – the Central Syvash, 11 – the East Syvash, 12 – the Aktashske Lake, 13 – the Utliutskyi Estuary and Syvashyk Lake, 14 – the Molochnyi Estuary, 15 – the Deltas of the Korsak River and the Domuzla River, 16 – the Obytichna Spit, 17 – the Berdianska Spit, 18 – the Bilosaraiska Spit, 19 – the Kryva Spit.

Broad-billed sandpiper - Limicola falcinellus. Long-distance migrant. Nests in the south tundra zone and forest tundra from Scandinavia in the west to the delta of the Kolyma in the east. Nominotypical subspecies (*Limicola falcinellus falcinellus*), which migrates through the Azov and Black Sea region, inhabits the west part of the area of species, reaching to the east to the delta of the Yenisei. According to results of sandpiper banding by the staff of the Azov and Black Sea ornithological station (Fig. 2.2.3), broad-billed sandpipers, which migrate in the Azov and Black Sea ecological corridor, are distributed at nesting

places in Scandinavia, nesting in the territory of the north Norway has been proved by directly occurrence of ringed bird (Diadicheva, Matsievskaya, 2000).

Broad-billed sandpipers make migration stops in the wetlands of the Azov and Black Sea ecological corridor in the course of both autumn and spring migration. Spring concentrations are more considerable and may reach up to 6,000 - 8,000 specimens in the second half of May (Diadicheva, Matsievskaya, 2000; Chernichko, Grinchenko, Siokhin, 1991), and even over 8,000 in certain years (May 2001, 2005). It makes up about 12.7% of nesting population of the West Palaearctic (61,000 - 64,000 specimens, according to Delany, Scott, 2002).

Autumn quantity of species in the Azov and Black Sea ecological corridor is considerably lower. Towards the end of the 1990s, up to 2,200 of broad-billed sandpipers have been observed in autumn, mainly in August. Taking into consideration change of scale of age in the course of August, their total quantity was estimated in 3,000 - 4,000 only at the Syvash (Diadicheva, Khomenko and others, 1999), which makes up 4.8 - 6.3% of nesting population of the West Palaearctic. A general tendency of weight increase of broad-billed sandpipers has been observed during autumn stops within the Azov and Black Sea ecological corridor, with higher degree of credibility for young birds (Diadicheva, Khomenko and others, 1999).

Quantity of this species has slightly decreased in the 2000s (according to results of August censuses in 2004 - 2009) and is about 900 specimens (ROM Bulletin, 2005). But such decreasing of quantity may reflect only partially the objective tendency, and partially be the consequence of lack of special-purpose projects on study of this species since 1998.

According to banding data, broad-billed sandpipers, which stop in the wetlands of the Azov and Black Sea ecological corridor in spring, migrate in autumn through the countries of Scandinavia and Poland (Fig. 7.8). In October – November they are observed already in the territory of the United Arab Emirates, where they may stay for wintering. In spring, in May they fly from wintering areas to the territories of the Azov and Black Sea ecological corridor through Egypt, the United Arab Emirates, Turkey, Bulgaria (Fig. 7.8). Absence of spring occurrences of ringed birds along the Atlantic Coast confirms that broad-billed sandpipers, after stop in the Azov and Black Sea region, fly to nesting areas along inland routes.

Fig.7.8. Transboundary spatial relations of broad-billed sandpipers, which migrate through the Azov and Black Sea ecological corridor (1 – Norway; 2 – Finland; 3 – Sweden; 4 – Poland; 5 – Turkey; 6 – Bulgaria; 7 – the United Arab Emirates; 8 – Egypt)

The East Syvash is a key territory within the Azov and Black Sea ecological corridor for migration stops of broad-billed sandpipers. The primary importance of the East Syvash for this species has been confirmed by observations of both the 1990s (Diadicheva, Khomenko and others, 1999; Diadicheva, Matsievskaya, 2000; Chernichko, Grinchenko, Siokhin, 1991) and the 2000s (Fig. 7.9, Table 7.4). The Central Syvash and the Tendrivska Gulf are of secondary importance. The Utliutskyi and Molochnyi

Estuaries correspond to the third level of quantity in certain years (Fig. 7.9). Other wetlands of the north-western and north Black Sea region, the Crimea and the north Azov Sea region support simultaneously only small gatherings of this species, of quantity up to 50 birds.

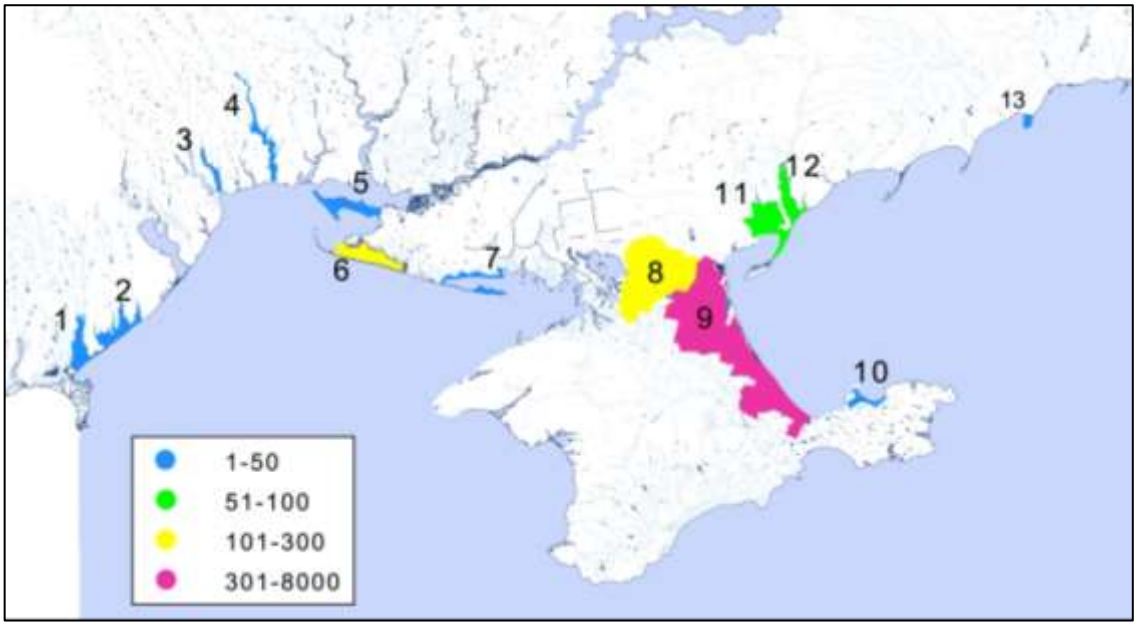


Fig. 7.9. Ranking of wetlands of the Azov and Black Sea ecological corridor according to their importance for broad-billed sandpipers during seasonal migrations in the 2000s (levels of quantity are marked by corresponding colours) - 1 – the Sasyk Lake, 2 – the Shahany, Alibei and Burnas Estuaries, 3 – the Kuialnytskyi Estuary, 4 – the Tylihulskyi Estuary, 5 – the Kinburnska Spit and Lakes, 6 – the Tendrivska Gulf, 7 – the Dzharylhatska Gulf and the Dzharylhach Island, 8 – the Central Syvash, 9 – the East Syvash, 10 – the Aktashske Lake and Ostaninski Plavni, 11 – the Utliutskyi Estuary and the Syvashyk Lake, 12 – the Molochnyi Estuary, 13 – the Bilosaraiska Spit

Table 7.4. Comparative Quantity of Broad-billed Sandpipers at Different Plots of the Ecological Corridor during Autumn and Spring Migration in the 2000s

Territory	Quantity in May / August			% of the West Palaearctic population
	2004, May	2004, August	2009, August	
North-Western Black Sea Region	-	74	31	0.05 - 0.1
Northern Black Sea Region	-	305	0	0 - 0.5
Central Syvash	101	0	1	0 - 0.2
East Syvash	3,760	507	350	0.6 - 6.0
North-Western Azov Sea Region	-	2	88	0 - 0.1
Total	**3,861**	**888**	**470**	**0.8 - 6.1**

So, important transboundary and international significance of the Azov and Black Sea ecological corridor for migrating sandpipers lies in following**:**

- wetlands of the Azov and Black Sea ecological corridor are one of the most important places for migration stops of curlew and broad-billed sandpipers in the course of autumn migration from nesting places in tundra and forest tundra of Scandinavia and the northern part of Russia to wintering areas in countries of Africa and South Asia

- wetlands of the Azov and Black Sea ecological corridor support over 5 - 6.5% of the West Palaearctic population of curlew sandpiper during autumn migrations

- the East Atlantic and Mediterranean flight routes cross within the Azov and Black Sea ecological corridor

- wetlands of the Azov and Black Sea ecological corridor are one of the few key places for migration stops of sandpipers in the course of spring passage to nesting areas

- wetlands of the Azov and Black Sea ecological corridor support over 12.7% of the West Palaearctic nesting population of broad-billed sandpiper during spring migration. The Azov and Black Sea ecological corridor is of prime importance in the international aspect during the periods of spring and autumn migrations for conservation of European population of this species, which have restricted nesting area and very limited number of territories for migration stops

- at least 42 species of sandpipers have been observed within the Azov and Black Sea ecological corridor, which have international nature conservation status and are protected by the Bern Convention; 41 species that are protected by the Bonn Convention on the Conservation of Migratory Species of Wild Animals; 39 species that are protected by the AEWA Agreement on the Conservation of African-Eurasian Migratory Waterbirds; 11 species that are listed in the Red Data Book of Ukraine, 3 – in the European Red List, 5 – in the Red Data Book of the IUCN. The Azov and Black Sea ecological corridor is a necessary constituent part in the conservation and protection of nesting populations of these species at different periods of their annual life cycles.

Transboundary importance of the Azov and Black Sea ecological corridor for migratory complexes of birds of European global nature conservation significance, which form wintering

To determine the transboundary importance of the Azov and Black Sea ecological corridor as a significant component of the European ecological network, first of all, those species, which have global nature conservation significance in Europe, shall be emphasized (Table 7.5). Out of 13 such species, which are found in Ukraine, following 6 winters regularly or periodically within the region being investigated: red-breasted goose *(Rufibrenta ruficollis),* lesser white-fronted goose *(Anser erythropus),* white-eyed pochard *(Aythya nyroca),* white-headed duck *(Oxyura leucocephala)*, imperial eagle *(Aquila heliaca)* and great bustard *(Otis tarda).*

Unfortunately, wintering of only red-breasted goose and great bustard are more or less studied, including at the south of Ukraine. Due to this, it is known now that they form considerable gatherings here at this period of the annual cycle: red-breasted goose - up to 30 thousand specimens, which makes up about 70% of its world population, and great bustard – up to 11 thousands, which makes up over 30% of its world population.

Table 7.5. Species of European Global Nature Conservation Significance in the Azov and Black Sea Region of Ukraine

No.	Species	Categories of protection*				Winter in the region
		ETS	Bonn	AEWA	RDBU	
1	Pelecanus crispus	V	1	+	endangered	
2	Rufibrenta ruficollis	L	2	+	vulnerable	+
3	Anser erythropus	V	2	+	vulnerable	+
4	Aythya nyroca	V	2	+	vulnerable	+
5	Oxyura leucocephala	E	1	+	endangered	+
6	Aquila clanga	E	2	-	rare	
7	Aquila heliaca	E	2	-	rare	+
8	Falco naumanni	V	2	-	endangered	
9	Crex crex	V	-	-		
10	Otis tarda	D	1	-	endangered	+
11	Chettusia gregaria	E	2	+		
12	Numenius tenuirostris	-	1	+	endangered	
13	Acrocephalus paludicola	E	2	-	endangered	

Categories of protection **ETS - the European Threat Status:** E - endangered species, V - vulnerable species, R - rare species, D - declining species, L - localized. **Bonn - the Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention):** 1 - migratory species that are in danger of extinction; 2 - migratory species that need conservation and regulation of using. **AEWA - the Agreement on the Protection of African-Eurasian Migratory Waterbirds. RDBU - the Red Data Book of Ukraine (2009).***

Reports about lesser white-fronted goose, white-eyed pochard, white-headed duck and imperial eagle are rather fragmentary. None the less, materials on the relations of the south-Ukrainian wintering of these six species of European global nature conservation significance with other regions of nesting, migratory and

winter concentrations, enable to ground the transboundary importance of the Azov and Black Sea corridor of Ukraine, especially, if they are corroborated by charts of waterbirds' wintering.

Red-breasted goose (Rufibrenta ruficollis)

Red-breasted goose nests almost within only three large Arctic peninsulas - the Yamal, Gydan and Taimyr (Cramp, Simmons, etc., 1986). On completion of nesting period birds migrate to the south and carry out long-term stops in the north of Kazakhstan, at which almost the whole world population of the species concentrates. Toward the end of October, the major part of them flies to the west making the last migration stop in the region of the Manych Lake. They reach wintering territories in the course of November (Fig. 7.10 - 7.11).

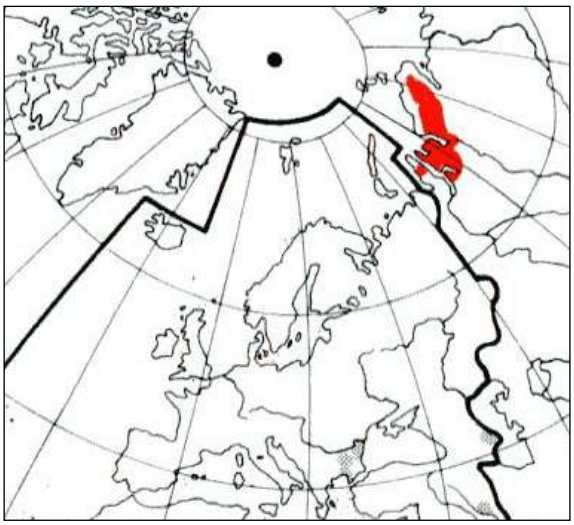


Fig. 7.10. Nesting area of red-breasted goose (Cramp, Simmons etc., 1986)

Fig. 7.11. Distribution of red-breasted goose - *nesting (orange), migrations (yellow), wintering (blue)*

Red-breasted goose was rare flying past and, much less, wintering species in the Azov and Black Sea region of Ukraine before the middle of XX century, as had wintered generally at the Caspian Sea Coast. However, since the 60s of XX century, quantity of red-breasted geese wintering here began to decrease and since 1975 their wintering at the Caspian Sea has not been recorded (Pryklonskyi, 1976). At the same time the species began to be registered more to the west more often and in larger quantity.

Flocks of wintering red-breasted geese are registered on the Danube since 1974 - beginning of more or less regular censuses of wintering birds in Ukraine (Sabinevskyi, 1977). A case of their wintering in the north-western Azov region - on the Molochnyi and Utliutskyi Estuaries was registered in 1980 (Lysenko, 1991). Rarity of occurrences and small quantity of red-breasted geese in flight were caused by the fact that they, first of all, are nocturnal migrants and, in the second place, stop for a rest only in several points on the route from nesting places to wintering areas.

Later collected reports showed wider distribution of wintering red-breasted geese in the south of Ukraine. Besides the north-western Azov region and the Danube region, wintering gatherings are regularly recorded practically throughout the whole Azov and Black Sea Coast of Ukraine, with the exception of the south Crimea, where they are observed as individual specimens and occasionally. Rather large gatherings are formed on the Syvash, along the Crimea coasts in the 2000s, and also far from large water bodies - in the area of Askaniya-Nova Biosphere Reserve in recent years (Havrylenko, 2011), where they use ponds of the zoo for a rest. The largest wintering concentrations have been registered at the northern plots of the Syvash – 25,407 specimens (Andriushchenko, Popenko and others, 2003) and in the Danube- Dniester interfluve area - up to 17,000 specimens (Rusiev, Andriushchenko and others, 2008). Red-breasted geese keep mostly in common flocks with greater white-fronted goose (*Anser albifrons)*, more rarely - in homotypical ones, which number several thousand specimens, maximum - up to 15,000 in one flock.

Quantity of red-breasted geese in wintering areas in the Azov and Black Sea region undergoes considerable fluctuations in course of winter: from several hundreds to more than 30 thousand specimens (Fig. 7.12).

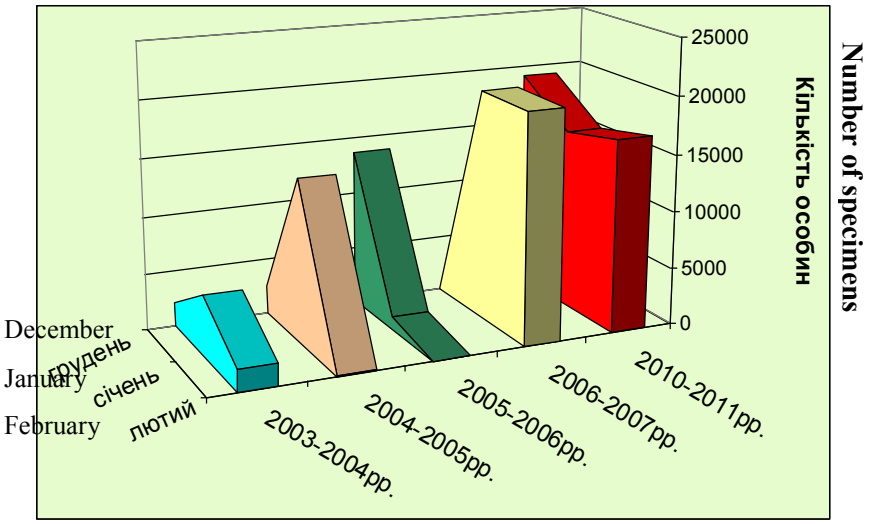


Fig. 7.12. Dynamics of red-breasted goose quantity by months and years (2003 - 2011)

It turns out that depending on the nature of winter (availability or lack of deep snow cover, ice-covered ground and other weather factors, which obstruct feeding) red-breasted geese redistribute within the wintering area. Inaccessibility of forage owing to continuous deep snow cover forces red-breasted geese to move on, from the places of maximum concentration in the southern east of Kherson Region and the northern east of the Crimea mainly to the west - to the south of Odesa Region, and subject to deterioration of conditions also here - farther to Romania, Bulgaria, reaching the European part of Turkey and the north-western Greece. However, birds return again to the previous territories immediately after snow melting there (Fig. 7.13).

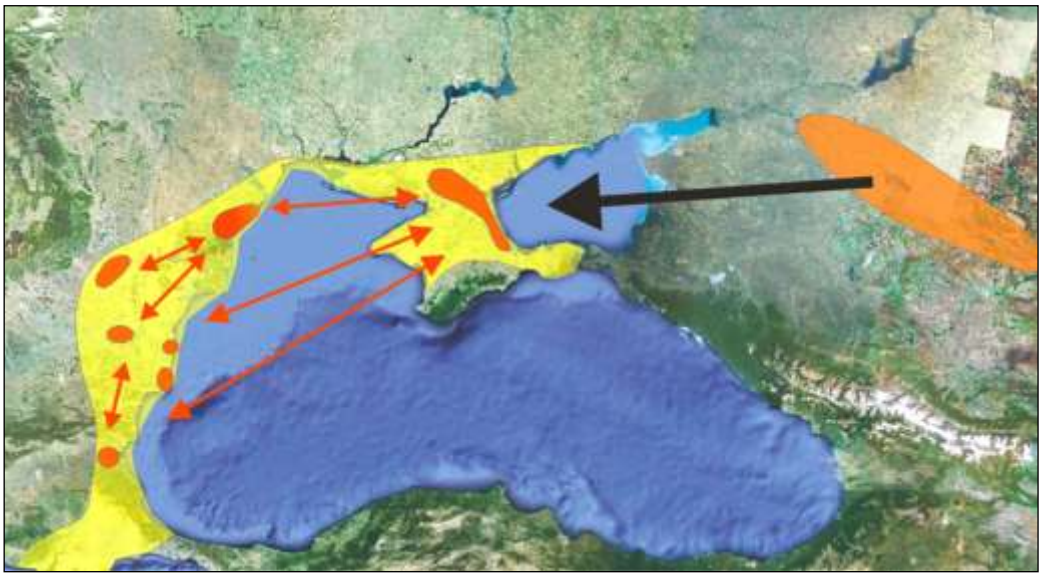


Fig. 7.13. Chart of formation of wintering area of red-breasted goose and redistribution of birds within it - *mass gatherings in the course of autumn migration (orange), wintering area (yellow), regular mass gatherings during wintering (red), autumn migration (black arrow), movements in course of winter (red arrows)*

So, following countries are of great importance for preservation of wintering of red-breasted goose: Russia, Ukraine, Romania, Bulgaria, Turkey, Greece, and in the past and, entirely probable, subject to deterioration of wintering conditions, in after years - Azerbaijan and Iran. Moreover, at present the Azov and Black Sea region of Ukraine (mainly the Syvash and the Danube- Dniester interfluve area) is a key area for species wintering, secondary ones - water bodies and adjacent to them territories at the Black Sea coast in Romania and Bulgaria, and reserve ones - at the Black Sea coast of Turkey, the Aegean Sea coast of Turkey and Greece, the Caspian Sea coast of Azerbaijan and Iran.

Lesser white-fronted goose (Anser erythropus)

Nesting area of lesser white-fronted goose covers tundra and forest tundra of Eurasia from Norway to the Chukotski ridge. Wintering areas are located in South Europe, in the Azov and Black Sea region, at the Caspian Sea coast, in China (Fig. 7.14).

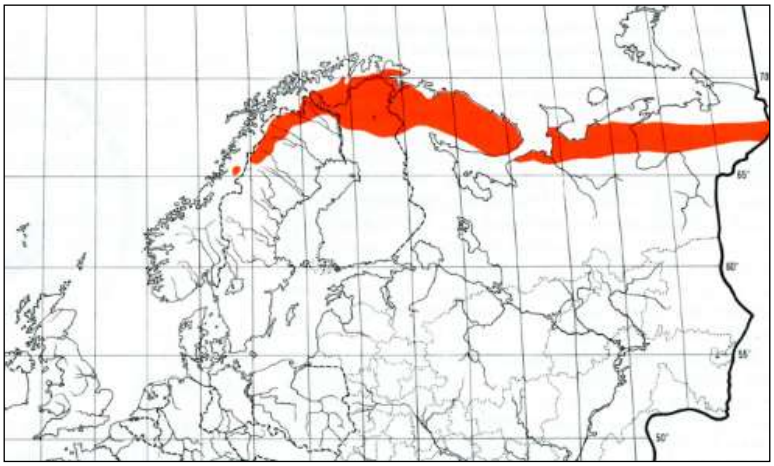


Fig. 7.14. Nesting area of lesser white-fronted goose in Europe (Cramp, Simmons etc., 1986)

Lack of good optical instruments and devices at the disposal of ornithologists in the middle of the 80s did not enable to single out lesser white-fronted goose among the mass of greater white-fronted goose, in flocks with which it usually keeps. Information about flocks of supposedly lesser white-fronted geese was received from hunters and ornithologists, but all informants had determined the species by high voice tonality, at the same time without knowledge of it and without regard for overlapping of the range with such of greater white-fronted goose. The correctness of determination, from our point of view, may be assessed only by means of caught birds or visually, but through powerful optical instruments. Only few known cases of catching this species of geese in the region (from the Danube to the north-western Azov Sea region) have been numbered, and all of them are of 30 years remoteness and more.

In January - February of 2002, out of over 110 thousand geese recorded in the Crimea and Kherson Syvash region, approximately a third had been observed individually through powerful optical instrument (Swarovski telescope with magnification of 60) and only 5 lesser white-fronted geese were revealed (Grinchenko, Popenko and others, 2003). Later, data about occurrences of the species have been received from Askaniya-Nova Biosphere Reserve (report of V.S. Havrylenko). Other evidences of occurrences of flocks with quantity of several hundred specimens give rise to doubt. Subject to presented, it may be noted that it is next to nothing known about the wintering area of lesser white-fronted goose in the south of Ukraine and that is why its special investigations are required (Fig. 7.15).

Fig. 7.15. Chart of relations between different parts of distribution of lesser white-fronted goose in the south of Europe and in Western Asia - *wintering area (yellow), potential but little studied part of the wintering area (orange)*

White-headed duck (Oxyura leucocephala)

World population made up about 100,000 specimens at the beginning of XX century and has decreased to 15,000 during 100 years. It is caused by reduction of areas suitable for nesting owing to overregulation of river flows, reclamation works, illegal hunting, and death in nets in the course of commercial fishing. Nature of stay in Ukraine has not been determined, not least because of hidden habit of life: birds keep on large fresh and brackish water bodies with bed of rushes and reaches, the sea gulfs, the estuaries, usually one by one specimens (the Red Data Book of Ukraine, 2009).

That is why, as of today, white-headed duck is one of the least studied species of birds in Europe: reports on its occurrences are very fragmentary and their quantity is too small. It is considered that present range of white-headed duck in Europe both on the whole and, in particular winter one, is too fragmented: a distance between the nearest plots reaches thousand kilometres (Fig. 7.16).

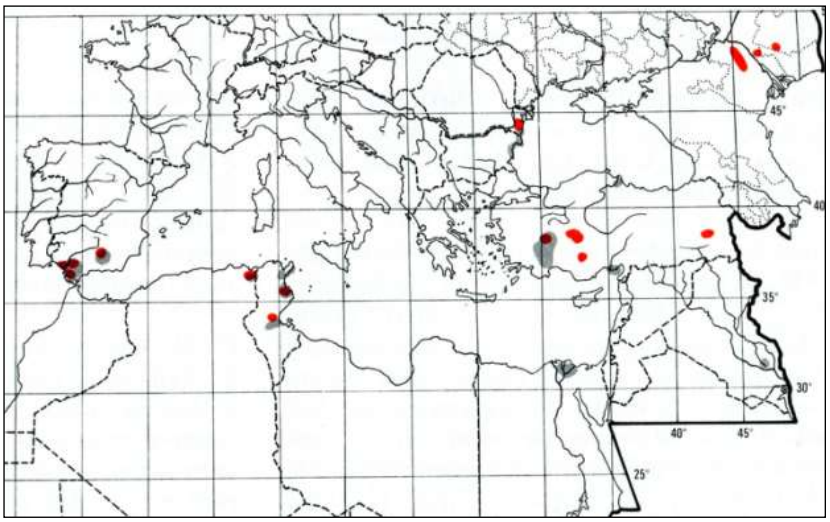


Fig. 7.16. Range of white-headed duck in Europe and the Mediterranean (Cramp, Simmons etc., 1986)

But observations of recent years indicate the availability of wintering of the species also in the Azov and Black Sea region of Ukraine (reports of M.M. Bezkaravainyi, S.P. Prokopenko). Based on them and subject to peculiarities of needs for white-headed duck wintering, following boundaries of possible distribution of the species in the region in winter period may be outlined: it may cover small water bodies of the south part of the steppe Crimea and the foothills (Fig. 7.17).

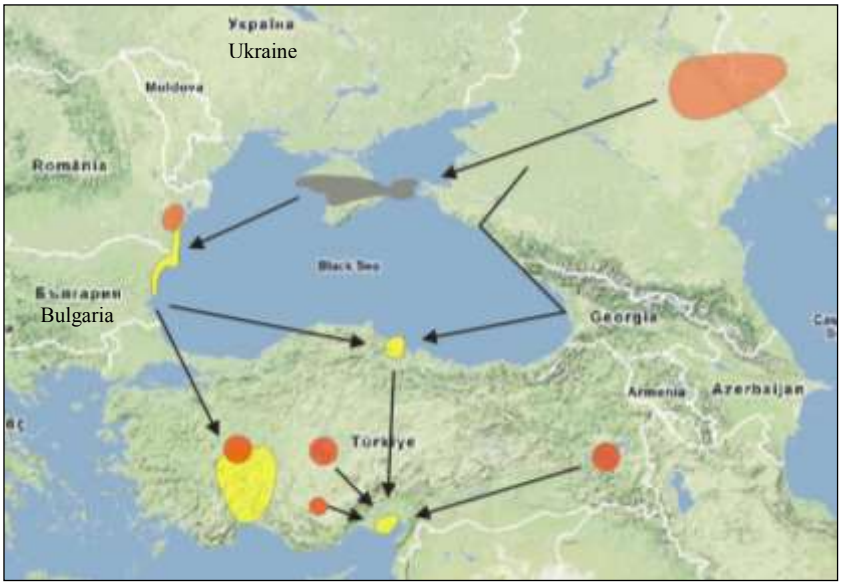


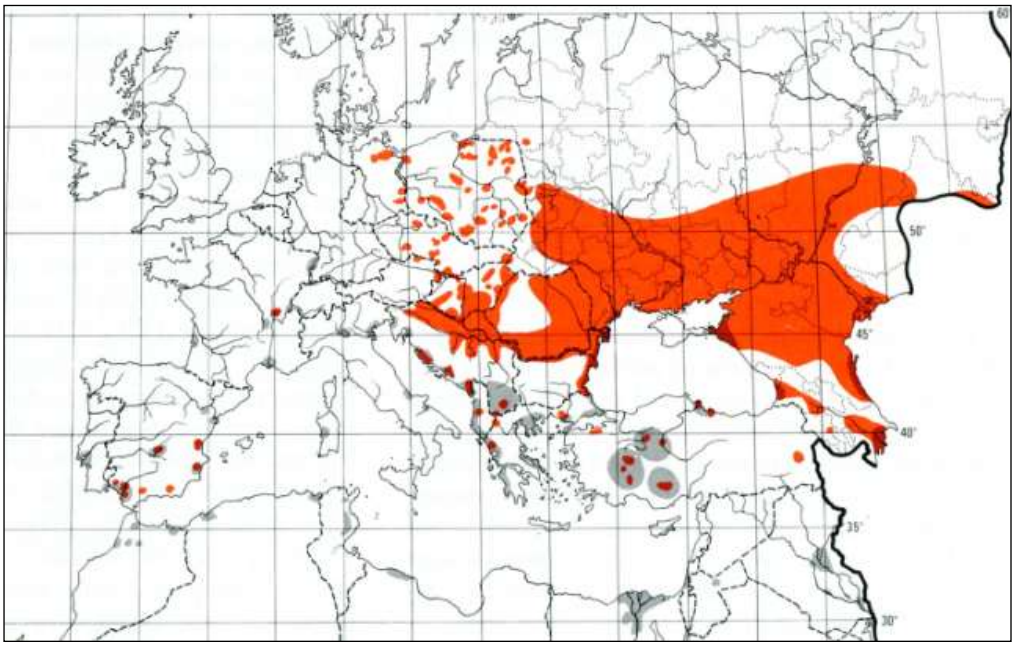
Fig. 7.17. Chart of relations between different parts of distribution of white-headed duck in the southern east of Europe and Asia Minor (*nesting area (red), wintering area (yellow), possible wintering area (grey)*

White-eyed pochard (Aythya nyroca)

The total quantity in Europe reaches 10,000 - 50,000 specimens according to different assessments. Number of birds that remain for wintering in Ukraine is small and inclined to fluctuations depending on the conditions of concrete winter. The Danube region is the most important for wintering of the species in Ukraine.

The species was numerous in the plavni of all large rivers in the past. Change of its quantity on the whole, and during wintering in particular, takes place owing to degradation of habitats, introduction of grass carp (feeding competitor), drying-out of the estuaries and their transformation into rice fields, overgrowing of water bodies with rush owing to eutrophication, enhancement of anxiety factor, illegal capture by hunters (the Red Data Book of Ukraine, 2009).

European wintering of white-eyed pochard is mainly located in the south of the Iberian and Balkan Peninsulas, as well as along the west coast of the Caspian Sea, the west and east coasts of the Black Sea (Cramp, Simmons etc., 1986, 1987) (Fig. 7.18). Winter occurrences of this species have become regular lately also at the northern coast of the Black Sea, that is – in the Azov and Black Sea region of Ukraine (ROM Bulletin …, 2009, 2011) - Table 7.6.



nesting area (red), wintering area (grey)

Fig. 7.18. Distribution of white-eyed pochard in Europe (Cramp, Simmons etc., 1986)

Table 7.6. Places of Occurrences of Wintering White-eyed Pochards in the Course of Average Winter Censuses of 2005 - 2010 in the Azov and Black Sea Region of Ukraine

Years	The delta of the Danube	The Odeski Estuaries	The Tarkhankut Peninsula	The southern coast of the Crimea	The East Syvash
2005		120			7
2006	2,590				
2008				1	
2009	4		180		

So, collected reports enable to outline present winter range of white-eyed pochard in the Black Sea region: it rings round the sea of the same name, though their distribution in it is uneven and depends on the availability and condition of ice cover in concrete winter (Fig. 7.19). Accordingly, the south-Ukrainian wintering is of great transboundary importance, connecting with itself the continuous Black Sea range in winter period.

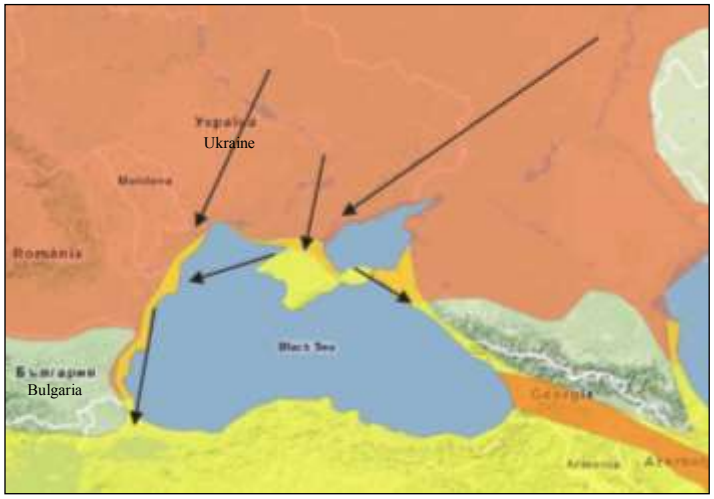


Fig. 7.19. Chart of relations between different parts of distribution of white-eyed pochard in the Black Sea region - *nesting area (red), wintering area (yellow), overlapping of nesting and wintering areas (orange)*

Great bustard (Otis tarda). Great bustard is a bird of open spaces of the southern Eurasia and the northern Africa (Fig. 7.20). Owing to the fact that considerable territories here are substantially transformed, first of all owing to agricultural production, this species turned out to be critically endangered everywhere. Only in some countries of Europe due to carrying out effective protective measures (Spain, Portugal, Hungary), as well as in the southern part of the European Russia, great bustard still remains comparatively common species (Andriushchenko, Stadnychenko, 1999; Andriushchenko, 2002; Horoshko, 2000; Kariakyn, 2000; Khrustov, Zavyalov, and others, 2000; Khrustov, Svinariov, 2000).

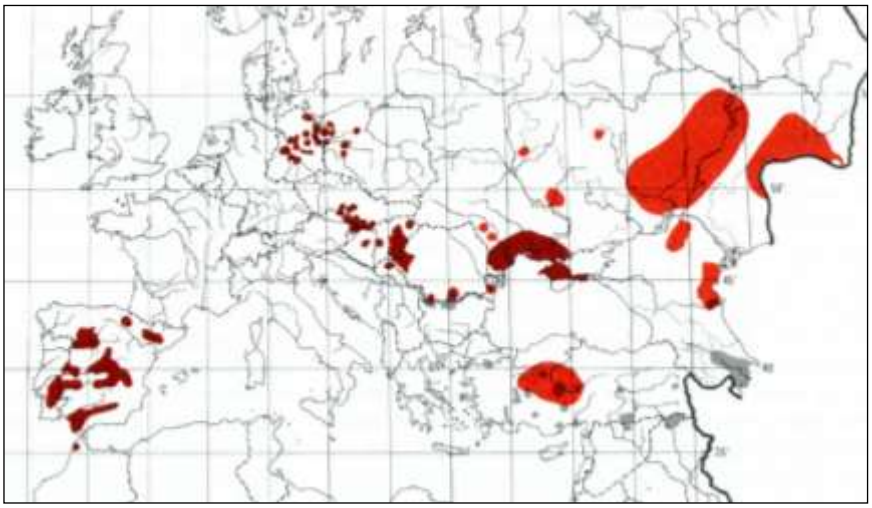


Fig. 7.20. Distribution of great bustard in Europe (Cramp, Simmons etc., 1987)

Condition of Ukrainian populations of great bustard became worse catastrophically towards the end of the last and in the present century, especially during the last 40 - 50 years: quantity of birds had dramatically decreased everywhere; nesting area of the species had disintegrated into small, considerably mutually distant colonies; natural habitats had been cardinally transformed. At present this tendency remains.

The specificity of current condition of great bustard in Ukraine consists in insufficient information about the species and low level of real bird protection against the background of high level of economic development of the territory and its overpopulation with people, with lack of plots where populations would be really protected. Great bustard does not nest in nature reserves and parks and almost is not observed there in the course of year. In some of them great bustard is rare, but at the same time its considerable gatherings are distributed outside of the conservation territories. It is just because the species in Ukraine needs urgent effective and coordinated protection at the national level.

Birds winter at the southern parts of Kherson and Zaporizhia Regions, more rarely – at the northern, as well as the major part of the steppe Crimea (Andriushchenko, 2007). Wintering in Odesa, Mykolaiv and Donetsk Regions is possible, sometimes individual birds or small flocks are observed more to the north. Quantity of wintering birds depends on weather conditions of concrete winter. If there is little snow and winter is warm, then the majority of birds may remain in the areas more to the north and east (the northern, central, eastern regions of Ukraine and adjacent to them territory of Russia). Repeated oppositely directed movements of great bustard - now in the southern, now in the northern directions, are observed even in the course of one winter. So, birds that fly to the north or northern east may be observed already in February, but after snowfall in January movements in opposite direction are recorded. Up to 11,000 - 12,000 specimens of the species have been numbered at wintering areas during typical winters, out of which over 80% - at the south of Kherson and Zaporizhia Regions, about 15% - at the Crimea (Andriushchenko, 2002). In accordance with the Action Plan for Great Bustard (Otis tarda) in Europe [80], quantity of the east-European population of great bustard, range of which covers Germany, Austria, Czechia, Slovakia, Hungary, Moldova, Romania, Bulgaria, Yugoslavia, Turkey, Ukraine and European part of Russia, is equal to 10,449 - 14,983 birds, and quantity of the whole European population (together with Portugal and Spain) is 24,945 - 29,983. Based on the results of our own censuses, it may be concluded that approximately 54.1 - 68.9% of the east-European population or 27.0 - 28.8% of the whole European population of the species winter in the south of Ukraine.

It shall be considered that approximately 500 - 720 great bustards stay in Ukraine during nesting period, and till autumn - winter period the quantity of Ukrainian gathering of the species may increase up to 800 - 1,000 specimens as a result of population increment. So, out of 7,246 - 8,096 great bustards that winter in the south of Ukraine, about 6,446 - 7,096 or 70 - 80%, probably, pertain to the Russian population, which is proved by the results of satellite tracking of 6 females observed in Zavolzhye (Watzke,2007) - Fig. 7.21. In consideration of this, following may be concluded: wintering in Ukraine is of great importance not only for the east-European, but also for the whole European population of great bustard, and especially for its Russian gathering. It imposes great responsibility on Ukraine for the conservation of the species in Europe.

When summarizing collected material, it may be suggested a chart of formation of wintering area of great bustards, which nest in Ukraine, in the southern east of European Russia and the northern west of Kazakhstan (Fig. 7.22).

Fig. 7.21. Nesting places and migration route of great bustards, which winter in the south of Ukraine, according to the data of satellite tracking

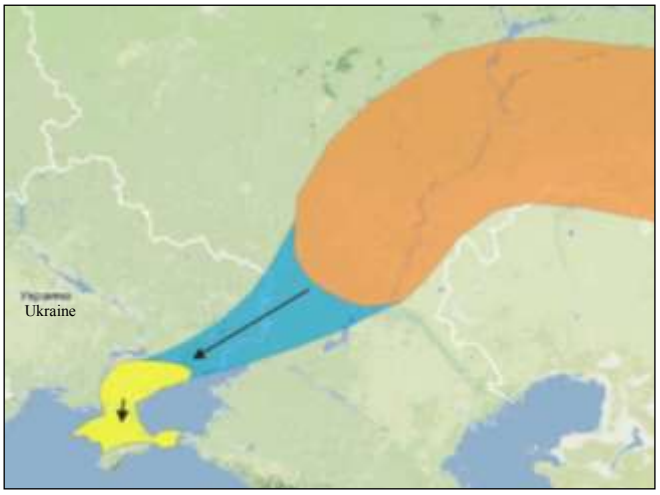


Fig. 7.22. Chart of formation of wintering area of great bustard in Eastern Europe - *nesting area (orange), migration area (blue), wintering area (yellow)*

Chapter 8. Conceptual and Structural Approaches to Organization and Execution of Monitoring of Seasonal Ornithological Complexes and Other Natural Components within the Wind Park Site, Buffer Zones and Adjacent Territories

8.1. Conceptual approaches

Generating of the system of monitoring, assessment and prediction of the biodiversity state in the territories of the wind parks within the Azov and Black Sea region is extremely important. It is connected with the availability of natural territories at the Azov and Black Sea Coast of Ukraine, which are not only the reservoirs of unique biodiversity, but also support numerous populations of migrating birds on Eurasian scales and unique steppe plant associations. This fact imposes significant obligations in regard to determination of qualitative assessment of complex changes in controlled ecosystems, protection, monitoring and management of natural complex components both in natural and in anthropogenic territories.

The main task for execution of works on monitoring of landscape and biological diversity is the creation of combined research system coordinated with respect to space and time with common format of monitoring change system, which is based on the natural territorial entities (ecosystems, landscape and biotopical groups, transformed territories) of different categories and levels of natural complexes of plants and animals. Status of diversity is one of the main indicators, which ensures the objective appraisal and directions of changes in the natural complexes.

The main idea of carrying out monitoring works is combination of three blocks of researches, which would be connected among themselves by proper logistics and accumulate finally the generalized information for its using not only for economic development, but also for observance of environmental legislation. It enables to combine conceptually and practically following three main blocks (stages of researches):

- assessment of biodiversity state at the design stage of construction
- carrying out of monitoring during the periods of operation of wind parks
- forming of monitoring data on biodiversity in automated monitoring system at the regional levels.

When carrying out further introduction of monitoring works at the technological sites of the wind park it is necessary to develop complex monitoring programmes (complex of dominating natural components) and special – for species (separately vegetation, amphibian and reptiles, ornithological complexes, cheiropterous animals), which will be the basis for carrying out monitoring at the sites. With regard to the geographical location, toponymy of territories, landscape and biotopical characteristics, proximity or remoteness of the natural protected areas, and state of biodiversity, the priorities on introduction of primary monitoring programmes shall be determined by the decision of the wind park directorates.

At the regional level, the basis for creation of local and special monitoring programmes are the preceding developments of the Azov and Black Sea Ornithological Station, which are already introducing at the regional level within the Azov and Black Sea Coast of Ukraine:

- Monitoring and Support of Biological Diversity in the Wetlands of Ukraine - Scientific Programme (Melitopol, 1995) [1]
- Programme for Monitoring of Semi-aquatic Birds of the Azov and Black Sea Region of Ukraine, which was developed together with Wetlands International-AEME, The Netherlands and the Black Sea Programme of Wetlands International, Kyiv (Melitopol, 1998) [2]
- Plan of Actions on the Introducing of Monitoring Programme for Semi-aquatic Birds in the Azov and Black Sea Region of Ukraine, Wetlands International – AEME, Melitopol-Kyiv, 1998 [3]
- Regional Ornithological Monitoring Programme (ROM- the Azov and Black Sea Coast), Melitopol-Kyiv, 2001
- Procedure of Inventory and Assessment of the Current State of Biodiversity of Natural Complexes and Landscapes, Which are Required for the Formation of Regional Ecological Networks, Melitopol, 2007 [4]
- Adaptation of International Waterfowl – IWC Procedure for the Creation of Regional Monitoring Programme “Average Winter Bird Counts in the Azov and Black Sea Region of Ukraine”, which was prepared together with the Black Sea Programme of Wetlands International, Melitopol-Kyiv, 2009 [5].

For now Biodiversity Scientific Centre at MSTTU, the Research Institute for Biodiversity of Ukraine’s Terrestrial and Water Ecosystems at MSTTU, Laguna Ecological Non-Government Organization carry out monitoring works within the Azov and Black Sea Ecological Corridor, which enable to introduce the latest scientific and practical developments on assessment of impacts of the wind park construction and operation on natural components. They include following authorings:

- procedure of the estimation of the level of impact and formation scheme of predictive assessment of impact of the wind park construction and operation on seasonal complexes of birds and migrations subject to peculiarities of ecological description of the site and buffer areas, landscape structure, phases of bird life cycles, seasonal features of their behaviour "Method-prognosis-Birds" (certificate of authorship)

- mathematical model with the software and computer simulation of the assessment of the wind park impact on natural components and complexes on the basis of WebBirds web-based application (certificate of authorship)

- integrated ornithological monitoring programme that is adapted to wind park sites

- pilot integrated monitoring programme for natural components that is adapted to wind park sites.

Monitoring works, which **the Contractor** has already been carrying out, enable (according to the results of researches) the introduction of latest scientific and practical developments, which exceed the analogues of other countries by their multifactor model.

It makes possible the development of new direction of integrated actions, which ensure on the one hand execution of government order on the development of wind-power engineering, and on the other hand – are directed at preservation of natural complexes and ensuring of minimum impact of wind parks by means of organization and carrying out monitoring at wind park sites with proper working out of measures for management of natural complexes and minimization of impact of the wind park sites. Key technological basis is a development of mobile WEB application based on server accumulation of monitoring data for the purpose of improvement and efficiency in the process flow: field researches – data bases creation – electronic processing of monitoring data. And development of mathematical model with the software and computer simulation of the assessment of the wind park impact based on the monitoring of seasonal ornithological and other natural complexes will make possible the presentation of objective expert appraisal for further development of management plans and mechanisms for minimization of anthropogenic impacts on natural components.

In accordance with international and national legislation, as well as international directives and standards of the World Bank and International Finance Corporation, the execution of natural complexes monitoring at the different stages of the construction of wind park sites shall be obligatory.

8.2. Structural approaches to organization and execution of natural complexes monitoring at the wind park sites

Structure of the proposed integrated monitoring programme is a special-purpose monitoring programme, which is connected with tasks on assessment of impact of the wind park sites on seasonal natural complexes and their management. This programme differs from basic monitoring programmes by the number of monitoring parameters and volume, periodicity of their formation and list of management measures. Presented materials in this subsection form only structural approaches to organization and execution of monitoring. The programme itself will be created after adoption of decision about its implementation and the Customer requirements. The structure of execution of seasonal ornithological complexes monitoring shall be discussed more detailed. The procedure for carrying out monitoring works for vegetation and plant associations, wing-handed animals is given in approximate format.

Structural approaches to organization and execution of monitoring. Include 3 stages.

The first stage. Determination of tasks, creation of monitoring implementation scheme.

The second stage. Includes following actions:

- determination of periods and stages of carrying out monitoring researches
- determination of the list of monitoring parameters
- determination of the list of monitoring territories with corresponding coordinate parameters
- determination of the basic techniques for carrying out monitoring researches
- creation of cartographical materials on the GIS basis and AutoCAD program, KML files
- creation of automated system for the formation of databases, files' structure and their control
- determination of the format for monitoring information transmission to the Customer.

The third stage. Execution of monitoring and presentation of its results for working out measures on management and assessment of impacts of the wind park construction and operation on natural components.

Periods of carrying out monitoring researches

In given aspect, it shall be distinguished the periodicity and duration of censuses within a year and duration of monitoring works by years.

Periodicity and duration of censuses within a year. Periods of carrying out researches are connected with the periods of the activity of natural components (Table 8.1), which are more typical for the Azov and Black Sea Ecological Corridor.

Birds. Monitoring of birds is meant for a long term and includes both technological periods of provision of infrastructure and construction of the wind park sites and the period of the wind park operation.

Seasonal activity of birds in given region lasts for 11 months and includes periods of nesting, migrations in spring and in autumn, wintering. In general 11 counts are suggested in the course of year. When determining terms and periods of researches we proceed from the possibility of obtaining maximum number of monitoring characteristics, which describe the concrete period of year and are functionally connected with the wind park sites.

Table 8.1. Periods of Activity and Structure of Counts

No.	Objects	01	02	03	04	05	06	07	08	09	10	11	12
1	Birds	w (1)	w (1)	ms (2)	ms (1) n (1)	n (1)	n (1)		g (1)	ma (1)	ma (2)	ma (1)	w (1)
2	Vegetation				(1)	(1)				(1)			
3	Amphibians				(1)	(1)	(1)						
4	Reptiles				(1)	(1)	(1)						
5	Chiropterans				m (1)	br (1)	br (1)		m (1)	m (1)	m (1)		

Note: Birds: w - wintering, ms - spring migration, n - nesting, g - gathering in autumn, ma - migrations in autumn, (1 - 2) - number of monitoring counts. **Bats:** m - migrations, br - breeding period.

Concrete periods for carrying out observations within a year are determined on the basis of works of many years in these territories.

Spring migration. Execution of works in this period fall on the first and the third ten-day periods of March, the first ten-day period of April. An additional census falls on March or April. Depending on weather characteristics of concrete year the periods of observations may be changed within March - April by means of operative decision making. An additional census falls on March or April.

Nesting. The first nesting count corresponds to the period of 25 - 28.04, and the second one – 25.05 - 28.05. The third nesting count shall be carried out too as required (05 - 15.06). With such periods of carrying out counts the information will include data concerning early and late nesting birds.

Gathering in autumn. These counts shall be carried out on the first ten-day period of August. It enables to compare the counts with data of previous years. Besides, on the second and third ten-day periods of August the hunting starts and ornithological state of the territories will be considerably changed.

Autumn migration. The counts cover the second ten-day period of September, the first and the second ten-day periods of October and the first ten-day period of November. Two additional censuses fall on October and November. It is allowed to adjust census periods in accordance with weather conditions and the state of migration waves.

Wintering. Terms of carrying out counts for the period of wintering shall be distributed as follows. State of formed wintering falls on the second ten-day period of January. The period of wintering breakup falls on the second ten-day period of February. These periods are also determined according to the results of researches of many years.

Vegetation. Monitoring of plant associations is mainly meant for technological periods of provision of infrastructure and construction of the wind park sites. It includes three periods of observation according to three periods of field works (April, May, September), which enable to estimate the state of plants with different stages of vegetation. Monitoring of the wind park sites after their putting into operation may be carried out in a compact format for determination of the state of plant associations.

Amphibians and reptiles. Monitoring of these groups of animals is also mainly meant for technological periods of provision of infrastructure and construction of the wind park sites. It includes four periods of observation according to four periods of field works (April, May, June), which enable to estimate their distribution, state of quantity depending on the stages of their reproductive cycles. Monitoring of the wind park sites after their putting into operation may be carried out in a compact format for revealing consequences in the distribution and quantity of amphibians and reptiles.

Chiropterans. Monitoring of bats is meant for a long term and includes both technological periods of provision of infrastructure and construction of the wind park sites and the period of the wind park operation. For the reason that according to our researches and retrospective data the territories of the wind park sites and buffer zones are not the places of increased diversity zones of high quantity of bats, including both their places in the course of reproductive cycles and migrations, it shall be proposed 6 counts and 2 more shall be reserved for migration periods. Reserved counts shall be distributed as follows, one for the spring migration, and one for the migration in autumn.

Monitoring territories

When discussing this subsection we shall proceed from the fact that the majority of regional territories within the Azov and Black Sea Ecological Corridor are characterized by comparatively high level of knowledge during recent years. From our point of view, following moments shall be considered when determining monitoring territories:

- wind park sites shall include integrated monitoring plots in natural territories (for estimation of the state of nesting birds, vegetation, amphibians and reptiles), special-purpose monitoring plots (for separate estimation of nesting birds, vegetation, amphibians and reptiles, bats); at the agricultural areas (for estimation of use as feeding territories by birds, bats); directly at the plots of the wind park location (for estimation of possible loss of birds and bats)
- integrated and special-purpose monitoring plots, which reflect the structure of dominating landscape and biotopical complexes, shall also be situated within the buffer zones (for estimation of the state of nesting birds, feeding activity of wing-handed animals), as well as monitoring transects (for determination of feeding and migratory activity of bats in different seasons)
- number of monitoring plots shall be determined when developing monitoring programme and shall be agreed with the Customer. But their quantity should not exceed the possibility of their observation within 1 - 2 days. When determining monitoring plots, those ones, on which researches of many years and counts in the course of execution of the project on preparation of scientific basis have been carried out, shall be included too.

Main tasks of monitoring researches

Ornithological monitoring. Includes periods of nesting (N), migrations (in spring and in autumn, post-nesting gatherings) - M, wintering (W). These designations will be used in the course of further creation of cartographical and tabular materials.

N. Nesting

General outline of presentation of monitoring works at this period includes four blocks (1 - 4) with proper list of tasks.

1. Description and clarification of species composition of nesting birds.
1.1. Drawing up species lists in regard to:
- main types of nesting biotopes
- rare species of national legislation
- rare species of international conventions and lists of protected species
- determined vulnerable bird species, which have different level of impact of the wind park.
2. Landscape and biotopical description of nesting places.
2.1. Cartographic description of biotopical diversity.
2.2. Determination of areas, which are used by birds as nesting places.
2.3. Determination of factors of influence on the state of landscape and biotopical complexes.
3. Distribution and quantity of nesting birds.
3.1. Cartographic description of the location of nesting complexes.
3.2. Determination of the level of stability and “comfort” of nest habitations.
3.3. Determination of factors of influence on the quantity and distribution of birds, including also possible impact of the wind park.
4. Trophic migrations.
4.1. Location and description of feeding plots and determination of trophic groups of birds.
4.2. Trophic migrations and their seasonal dynamics, drawing up cartographical materials for long-distance migrants and vulnerable species.
4.3. Determination of factors of influence on feeding behaviour and trophic migrations within the wind park sites and buffer zones (1 - 2 km), including also possible impact of the wind park.

M. Migrations and post-nesting gatherings

General outline of presentation of monitoring works concerning seasonal distribution of birds includes 2 periods in the course of year with proper list of tasks.

Spring (Ms)

a) Dynamics of coming, migration and forming of migration gatherings:

- chronological changes in quantity and species composition
- species composition of migration waves, dominating and vulnerable species and their quantity
- ending of migration (registration of transit flocks of the last migrants).

Autumn (Ma)

b) Forming of post-nesting gatherings (dynamics of species composition and quantity, main places of gatherings).

c) Migrations of local bird species.

d) Dynamics of passage, migration and forming of migration gatherings:

- chronological changes in quantity and species composition of migrants
- migration waves, species composition, dominating and vulnerable species and their quantity
- phenological registration of the last migrating gatherings and flocks.

W. Wintering

1. Determination and description of landscape elements, on which wintering bird complexes shall be formed.
2. Drawing up the lists of wintering birds according to dynamics of their forming, maximum diversity and breakup.
3. Description of diversity and quantity of wintering complexes and disperse species in water and terrestrial landscape elements within the wind park sites, buffer zones and adjacent territories of high diversity.
4. Determination of tendencies in the dynamics of bird quantity in the semi-aquatic complex and in the location of wintering complexes.
5. Determination of diurnal trophic migrations and the level of using feeding biotopes by birds within the wind park sites and buffer areas, influence factors, including also possible impact of the wind park.
6. Determination of factors of influence on forming and existence of bird wintering complexes (abiotic, anthropogenic, feeding, impact of the wind park).
7. Cartographic description of the location of wintering complexes and feeding plots.

Monitoring of plant associations

1. Overall description of plant cover of landscape elements in regional aspect and within the wind park site.
2. Mapping of integrated and specialized floral monitoring plots with natural vegetation.
3. Description of the influence on the natural plant associations as a result of carrying out works on provision of infrastructure, construction and operation of the wind park.
4. Drawing up a management plan on minimization of impact of the wind park construction and determination of measures for restoration of natural vegetation complexes upon completion of the construction.
5. Execution of control monitoring works within 3 - 4 years after completion of the wind park construction for assessment of the state of plant associations within the wind park site.

Monitoring of amphibians and reptiles

1. Description, typification and mapping of the main habitat biotopes.
2. Determination of species composition and biotopical distribution of mature animals.
3. Description of the influence of abiotic factors on the distribution by biotopes and by seasons.
4. Description of the influence on habitat places of amphibians and reptiles as a result of carrying out works on provision of infrastructure, construction and operation of the wind park.
5. Drawing up a management plan on minimization of impact of the wind park construction and determination of measures for restoration of natural habitat places of amphibians and reptiles upon completion of the construction.

8. Execution of control monitoring works in 2 - 3 years after completion of the wind park construction for assessment of the state of habitat places of amphibians and reptiles within the wind park sites.

Monitoring of wing-handed animals

1. Determination of places for carrying out censuses at the transepts and monitoring plots by means of broadband detector (with recording device) to register echographic and social signals of bats.
2. Description of breeding season (determination of bat species, approximate quantity and distribution according to habitat places, drawing up a register of their habitations with definition of types and their location, determination of hunting areas and their diurnal activity, description of local migratory activity of bats).
3. Description of the period of regional and continental migrations (determination of bat species, approximate quantity and distribution according to habitat places, directions of migrations and their intensity and altitudes, determination of the terms of the most intensive migrations (migration waves), possible description of the main migration routes at the regional level.
4. Creation of seasonal key territories cadastre in coordinate system.
5. Conclusions on the wind park impact on forming and the state of seasonal habitation of bats and possible ways for minimization of the wind park impact.
6. Determination of factors of influence on the seasonal state of bats, drawing up of management plans on the minimization of possible impact of the wind park.

Monitoring parameters

Final list of monitoring parameters will be determined during the development of monitoring programme. Preliminary list of monitoring parameters in the form of data base structure, as an example, is shown for the period of bird migrations in Tables 8.2 - 8.3.

Table 8.2. List of Monitoring Parameters for the Assessment of Migrations (M)

Code	Name of parameters	Note
M 1	Date	
M 2	Time	Start - end of observations
M 3	Code of the place or monitoring plot	In accordance with determined encoding
M 4	Name or code of the biotope	In accordance with the drawn up register or determined encoding
M 5	Cloudiness in amount	0- cloudless, 1- individual cumulus clouds, 2- less than a half of the sky is with clouds, 3- less than a half of the sky is free of clouds, 4- continuous cloudiness, 5- stratus
M 6	Precipitation	According to the data of meteorological points and portable meteorological station (within 3 hour)
M 7	Wind direction (8 points)	1- north, 8- north-western direction
M 8	Wind strength (0 - 5)	0- calm, 1- light breeze up to 3 m/s, 3- fresh breeze up to 10 m/s, 4- strong breeze up to 17 m/s, 5- storm wind up to 25 m/s
M 9	Bird species	Name or determined code
M 10	Absolute quantity or density	Numerical indicator
M 11	Status of species	Partially non-migratory, nesting or partially migrating, migratory, moulting, wintering
M 12	Character of species' stay	Rest, roosting time, feeding, moult
M 13	Altitude of passage	According to the data of an altimeter and other data
M 14	Distance of trophic migrations	On the basis of cartographic materials
M 15	Type of feeding area	

Table 8.3. Structure of Computer Data Bases Concerning Migration of Birds at the Observation Point or Monitoring Plot

Field	Field name	Type	Width
1	Date	Date	8
2	Place or code of the monitoring plot	Character	6

3	Lat coordinates	Character	5
4	Lon coordinates	Character	5
5	Start of the observations	Numeric	5
6	End of the observations	Numeric	5
7	Species	Numeric	2
8	Quantity during the first hour	Numeric	4
9	Quantity during the second hour	Numeric	4
10	Quantity during the third hour	Numeric	4
11	Quantity during the fourth hour	Numeric	4
12	Quantity during the other hours of daylight ones	Numeric	4
13 - 20	Quantity by compass points	Numeric	5
21 - 24	Quantity by altitudes	Numeric	5
25	Maximum quantity in a flock	Numeric	3
26	Average quantity in a flock	Numeric	3
27	Informant / observer	Character	6

Adaptation of generally accepted techniques for collection of field materials on study of dominant components of landscape and biological diversity to the tasks of location and operation of the wind park sites subject to international requirements

The standard for carrying out minimum monitoring characteristics using modern equipment, which is recommended for monitoring of natural components at the wind park sites concerning realization of the international programme "Europe for legal acts", is given in Table 8.4.

Table 8.4. Standard of Carrying Out Minimum Monitoring Characteristics for Assessment of Natural Components at the Wind Park Sites

Subject of mapping	Place of mapping	Time of mapping	Subject of documentation
Mapping of birds, which rest or fly past, paying special attention to timid / sensitive, rare, strictly protected, and endangered species (in Germany, for example: cranes, geese, swans, diurnal birds of prey)	Within the wind park plus 2,000 m local environment In the coastal zone, if needed, coastal biotopes shall be included in researches	In the course of passage in spring and in autumn One research of the territories approximately once every 10 days	Round-the-clock complete observation of the territories shall be carried out for each mapping; if needed – by several observers Following data shall be documented in a map and list for resting or migrating birds: date/ time, bird species, quantity, a territory of rest or an altitude and direction of passage
Mapping of nesting birds	Within the wind park plus 1,000 m local environment, "Big birds" (diurnal birds of prey, cranes, storks etc.) and "important" birds, which nest on the ground (heron and others), within the wind park plus 2,000 m local environment; big diurnal birds of prey (e. g. eagle) up to 6 km	A research once a week shall be carried out during hatching	A map of all available biotopes in the territory being investigated shall be drawn up as a basis for mapping Observations of all bird species shall be reflected in this map Nesting birds shall be plotted on the map together with location area of their nests or supposed centre of the plot Place of observation shall be plotted on the map for birds searching food All observations shall be documented (including also widely distributed) Widely distributed birds, which are not endangered (the Red Data Book) and not much protected, shall be marked in the lists, at that separate list shall be drawn up for each biotope that has been found in the territory being researched Observations of endangered birds (the Red Data Book) and birds under special protection (or important birds for some other reason) shall be plotted on the map particularly accurately

Subject of mapping	Place of mapping	Time of mapping	Subject of documentation
Mapping of the territories used by birds	The wind park plus 1,000 m	In summer, after hatching and in winter after autumn passage of birds	Observations of birds, which search food in the territory being investigated at this time or stay there for some other reason, shall be documented in the map and lists
	The wind park plus local environment (in certain cases at a distance up to 6 km)	Round the year, work shall be carried out in accordance with all terms of researches	Important feeding territories of birds, to visit which birds will have to fly through the wind park, over it or around Roosting places and other places where many birds or "important" birds stay regularly, which may contact with the wind park
Clarification of hunting activity of bats	The wind park plus 1,000 m (mainly near and among shrubs, marsh territories and other attractive biotopes)	In all seasons, when bats hunt in this terrain	Determination of hunting species, and intensity of hunting by means of visual and acoustical perception, or, if needed, using sound analysis Plots of hunting shall be marked in the map; date, time, temperature and wind, species of bats, number of hunting animals and so on shall be documented in lists
Clarification of migratory activity of bats	The wind park plus 1,000 m	In all seasons, when bats hunt in this terrain	It shall be carried out research of availability of flight routes of regular usage in the planning area, by which bats may cross the wind park (for example, on the way from inhabitation to feeding territories, which they use constantly) Flight routes shall be marked in the map and depending on their usage (species, time, temperature and wind, number of flying animals and so on) shall be documented in lists
Clarification of all forms of bat habitations (winter, temporary and so on)	The wind park plus local environment (depending on the importance, in certain cases at a distance up to10 km)	In all seasons	Inhabitation locations shall be determined by means of search, observation of activity connected with flying into and out etc., and shall be marked in the map Inhabitations shall be documented in lists; type of inhabitation, species of bats that live there, number of animals and description of inhabitation (dimensions, state and others) shall be stated in a protocol

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Annexes

Annex 1. Birds. Seasonal migrations, nesting, post-nesting gatherings, wintering. Tabular and cartographic materials in the program AutoCAD.

Annex 2. Bird species occurring within the boundaries of the Molochny Estuary, adjacent territories and that have a protected status.

Annexes

Annexes 1.

Birds. Seasonal migrations, nesting, post-nesting gatherings, wintering. Tabular and cartographic materials in the program AutoCAD.

Scheme of presenting tabular and cartographic materials in scientific report and electronic media at the following registry.

File name of tables (Annex 1.1)	File name of AutoCAD map charts (Annex 1.2)
Table_1.1_accountings_wintering_30.01.2016	1.1_EuroCape_Zimovka2016
Table_1.1.1_migrations_wintering_30.01.2016	
Table_1.2_accountings_20.03.2016	1.2_EuroCape_20.03.16_obliku
Table_1.3_migrations_20.03.2016	1.3_EuroCape_20.03.16_migracii
Table_1.4_accountings_08.04.2016	1.4_EuroCape_08.04.16_obliku
Table_1.5_migrations_08.04.2016	1.5_EuroCape _08.04.16_migracii
Table_1.6_accountings_20.04.2016	1.6_EuroCape_20.04.16_obliku
Table_1.7_migrations_20.04.2016	1.7_EuroCape_20.04.16_migracii
Table_1.8_nesting_20.05.2016	1.8_EuroCape_Gnezdovanie2016
Table_1.9_accountings_28.07.2016	1.9_EuroCape_ 28.07.16_obliku
Table_1.10_migrations_28.07.2016	1.10_EuroCape_28.07.16_migracii
Table_1.11_accountings_07.08.2016	1.11_EuroCape_07.08.16_obliku
Table_1.12_migrations_07.08.2016	1.12_EuroCape_07.08.16_migracii
Table_1.13_accountings_28.08.2016	1.13_EuroCape_28.08.16_obliku
Table_1.14_migrations_28.08.2016	1.14_EuroCape_28.08.16_migracii
Table_1.15_accountings_25.09.2016	1.15_EuroCape_25.09.16_obliku
Table_1.16_migrations_25.09.2016	1.16_EuroCape_25.09.16_migracii
Table_1.17_accountings_09.10.2016	1.17_E uroCape_09.10.16_obliku
Table_1.18_migrations_09.10.2016	1.18_EuroCape_09.10.16_migracii
Table_1.19_accountings_26.10.2016	1.19_EuroCape_26.10.16_obliku
Table_1.20_migrations_26.10.2016	1.20_EuroCape_26.10.16_migracii

Annex 1.1. The list and structure of the tables of the number and distribution of birds during the wintering, spring and autumn migrations, nesting and post-nesting gatherings within the sites of Eutocape Wind Park, buffer zones and adjacent territories in 2016 (to form the AutoCAD map charts in accordance with Annex 1.2).

Contents of Annex 1.1.

Table 1.1. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 30.01.2016 (according to the map chart, Fig. Д 1.1).

Table 1.1.1 Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 30.01.2016 (according to the map chart, Fig. Д 1.1).

Table 1.2. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 20.03.2016 (according to the map chart, Fig. Д 1.2).

Table 1.3. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 20.03.2016 (according to the map chart, Fig. Д 1.3).

Table 1.4. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 08.04.2016 (according to the map chart, Fig. Д 1.4).

Table 1.5. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 08.04.2016 (according to the map chart, Fig. Д 1.5).

Table 1.6. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 20.04.2016 (according to the map chart, Fig. Д 1.6).

Table 1.7. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 20.04.2016 (according to the map chart, Fig. Д 1.7).

Table Д 1.8. Accounting results of nesting birds within the site of the Wind Farm on 23 – 25.04.2016 (according to the map chart, Fig. Д 1.8).

Table 1.9. Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 28.07.2016 (according to the map chart, Fig. Д 1.9).
Table 1.10. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 28.07.2016 (according to the map chart, Fig. Д 1.10).
Table 1.11. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 07.08.2016 (according to the map chart, Fig. Д 1.11).
Table 1.12. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 07.08.2016 (according to the map chart, Fig. Д 1.12).
Table 1.13. Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 28.08.2016 (according to the map chart, Fig. Д 1.13).
Table 1.14. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 28.08.2016 (according to the map chart, Fig. Д 1.14).
Table 1.15. Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 25.09.2016 (according to the map chart, Fig. Д 1.15).
Table 1.16. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 25.09.2016 (according to the map chart, Fig. Д 1.16).
Table 1.17. Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 09.10.2016 (according to the map chart, Fig. Д 1.17).
Table 1.18. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 09.10.2016 (according to the map chart, Fig. Д 1.18).
Table 1.19. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 26.10.2016 (according to the map chart, Fig. Д 1.19).
Table 1.20. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 26.10.2016 (according to the map chart, Fig. Д 1.20).

Annex 1.2. The cartographic materials in the program AutoCAD on the number and distribution of birds during the wintering, spring and autumn migrations, nesting and post-nesting gatherings within the sites of Eurocape Wind Park, buffer zones and adjacent territories in 2016 (according to the tables of Annex 1.1).

Contents of Annex 1.2.

Map chart, Fig. Д 1.1. Bird accounting results and accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 30.01.2016 (according to Tabl. 1.1 and 1.1.1).
Map chart, Fig. Д 1.2. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 20.03.2016 (according to Tabl.1.2).
Map chart, Fig. Д 1.3. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 20.03.2016 (according to Tabl.1.3).
Map chart, Fig. Д 1.4. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 08.04.2016 (according to Tabl.1.4).
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Map chart, Fig. Д 1.6. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 20.04.2016 (according to Tabl.1.6).
Map chart, Fig. Д 1.7. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 20.04.2016 (according to Tabl.1.7).
Map chart, Fig. Д 1.8. Accounting results of nesting birds within the site of the Wind Farm on 23 – 25.04.2016 and 10 - 15.05.2016 (according to Tabl.1.8).
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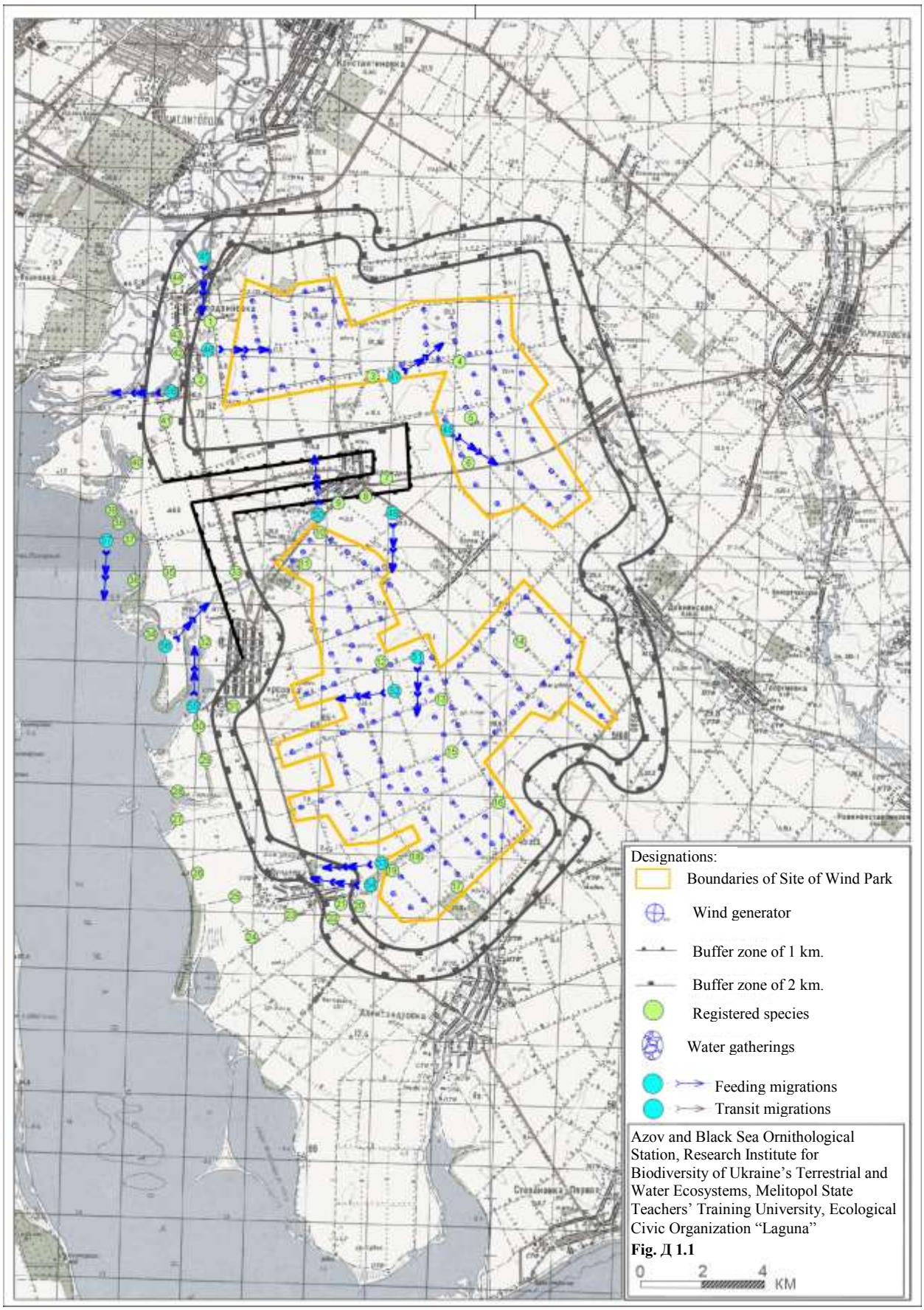
Map chart, Fig. Д 1.10. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 28.07.2016 (according to Tabl.1.10).
Map chart, Fig. Д 1.11. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 07.08.2016 (according to Tabl.1.11).
Map chart, Fig. Д 1.12. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 07.08.2016 (according to Tabl.1.12).

Map chart, Fig. Д 1.13. Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 28.08.2016 (according to Tabl.1.13).
Map chart, Fig. Д 1.14. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 28.08.2016 (according to Tabl.1.14).
Map chart, Fig. Д 1.15. Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 25.09.2016 (according to Tabl.1.15
Map chart, Fig. Д 1.16. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 25.09.2016 (according to Tabl.1.16).
Map chart, Fig. Д 1.17 Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 09.10.2016 (according to Tabl.1.17).
Map chart, Fig. Д 1.18. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 09.10.2016 (according to Tabl.1.18).
Map chart, Fig. Д 1.19 Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 26.10.2016 (according to Tabl.1.19).
Map chart, Fig. Д 1.20. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 26.10.2016 (according to Tabl.1.20).

Annex 2.

Table 2.1. Bird species occurring within the boundaries of the Molochny Estuary, adjacent territories and that have a protected status.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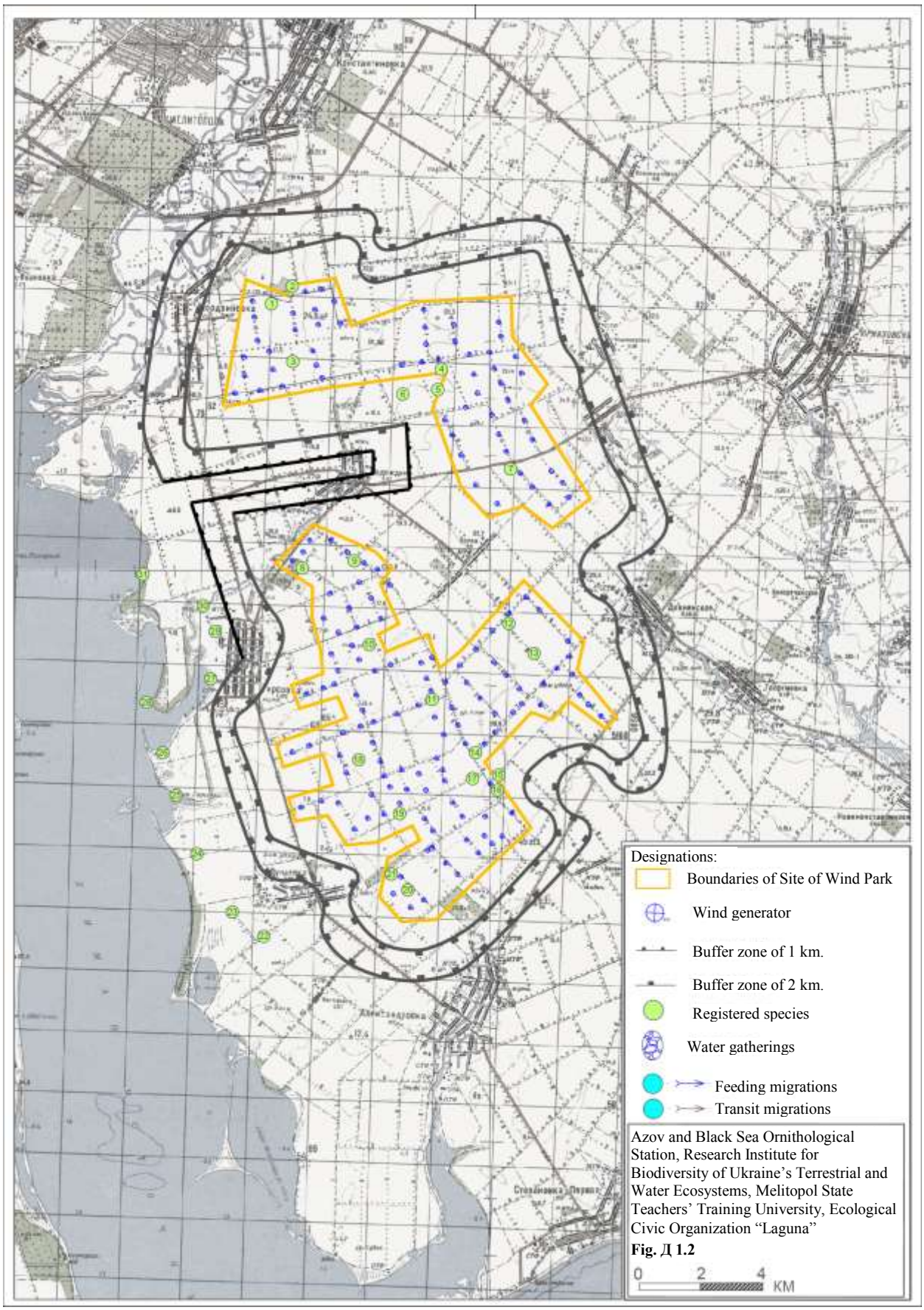
Wind generator
Buffer zone of 1 km.
Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
Azov and Black Sea Ornithological Station, Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Melitopol State Teachers' Training University, Ecological Civic Organization "Laguna"
0 2 4 KM

Fig. Д 1.1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Water gatherings
Feeding migrations
Transit migrations
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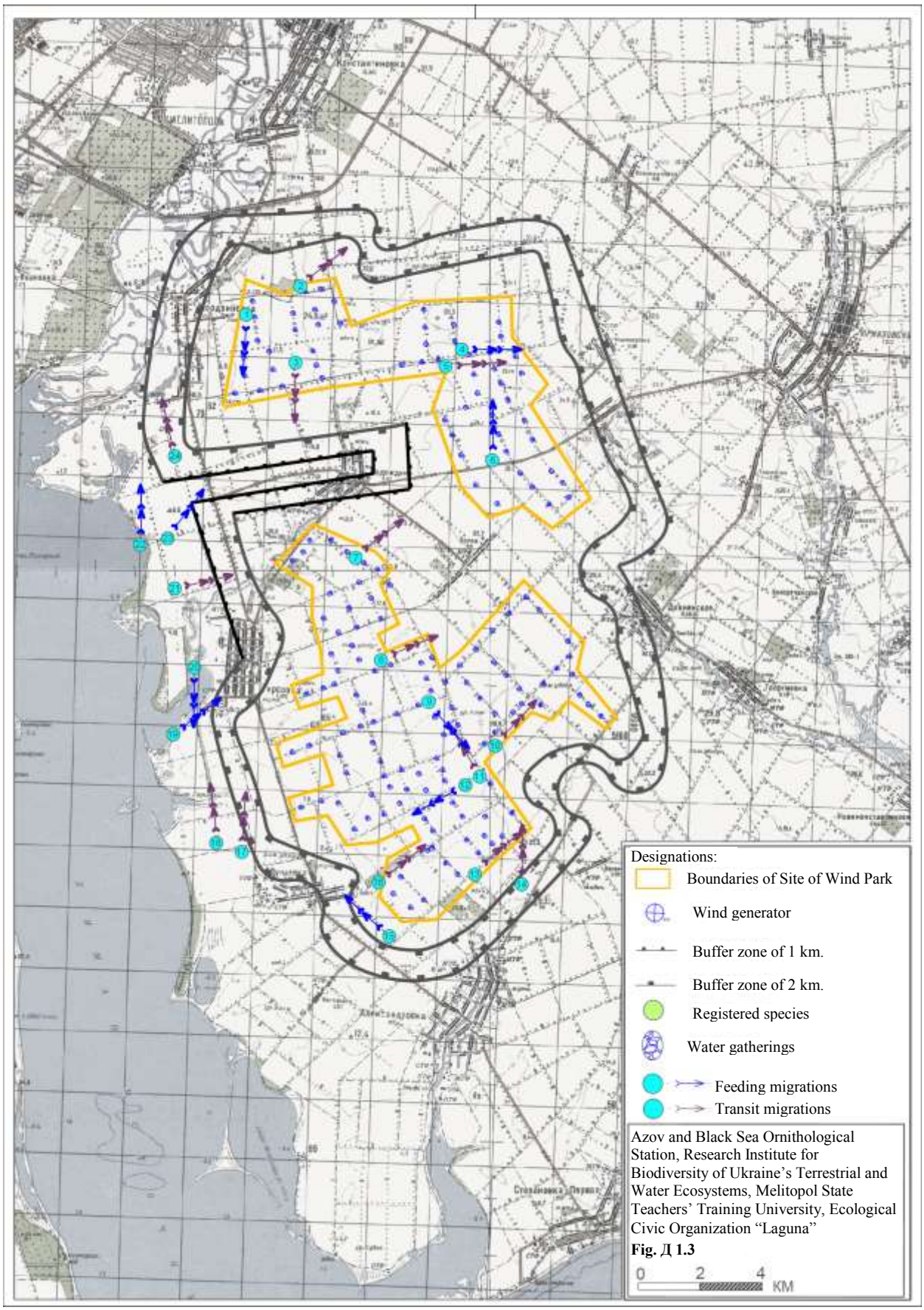
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Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
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Fig. Д 1.3
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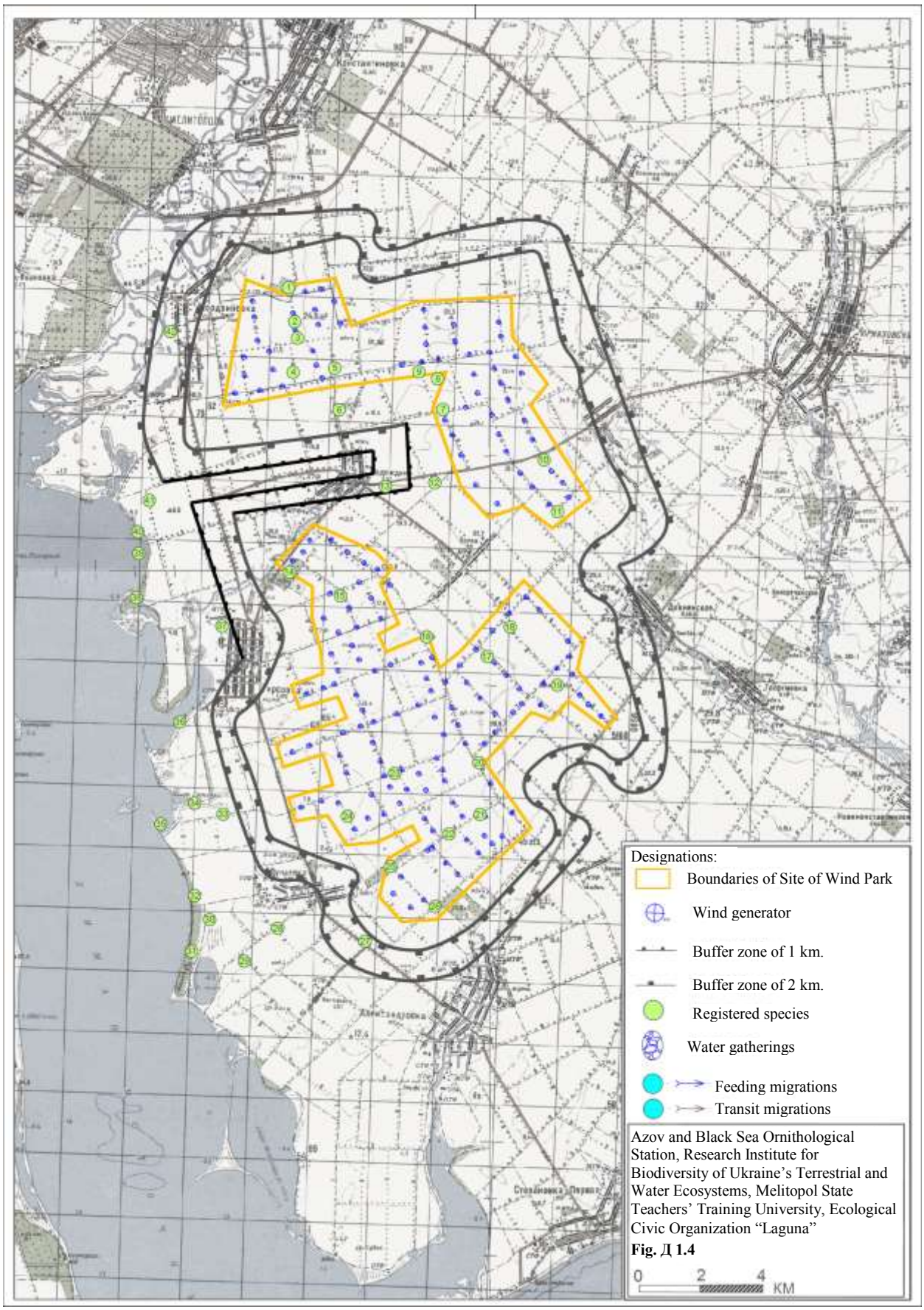
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Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
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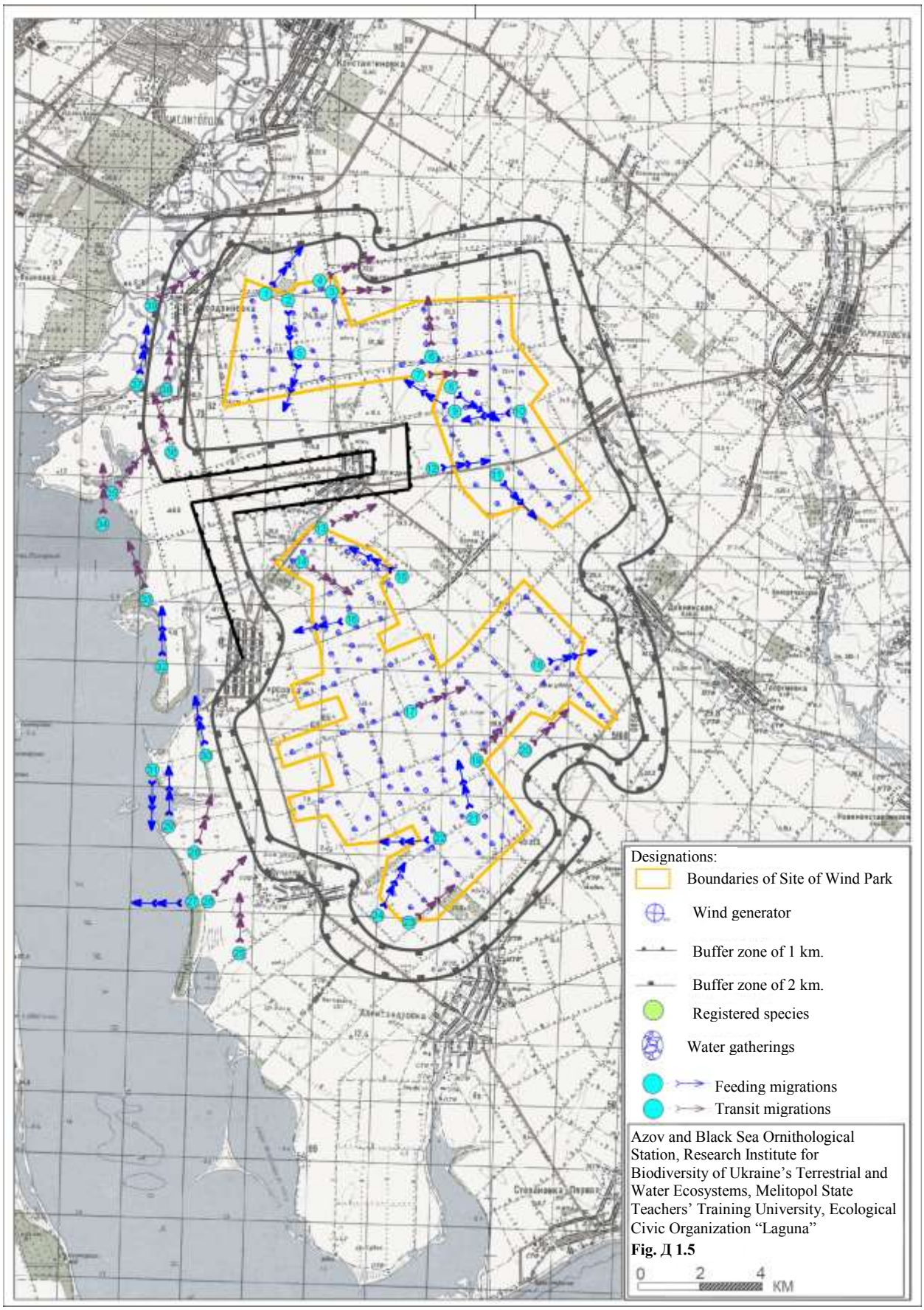
Fig. Д 1.4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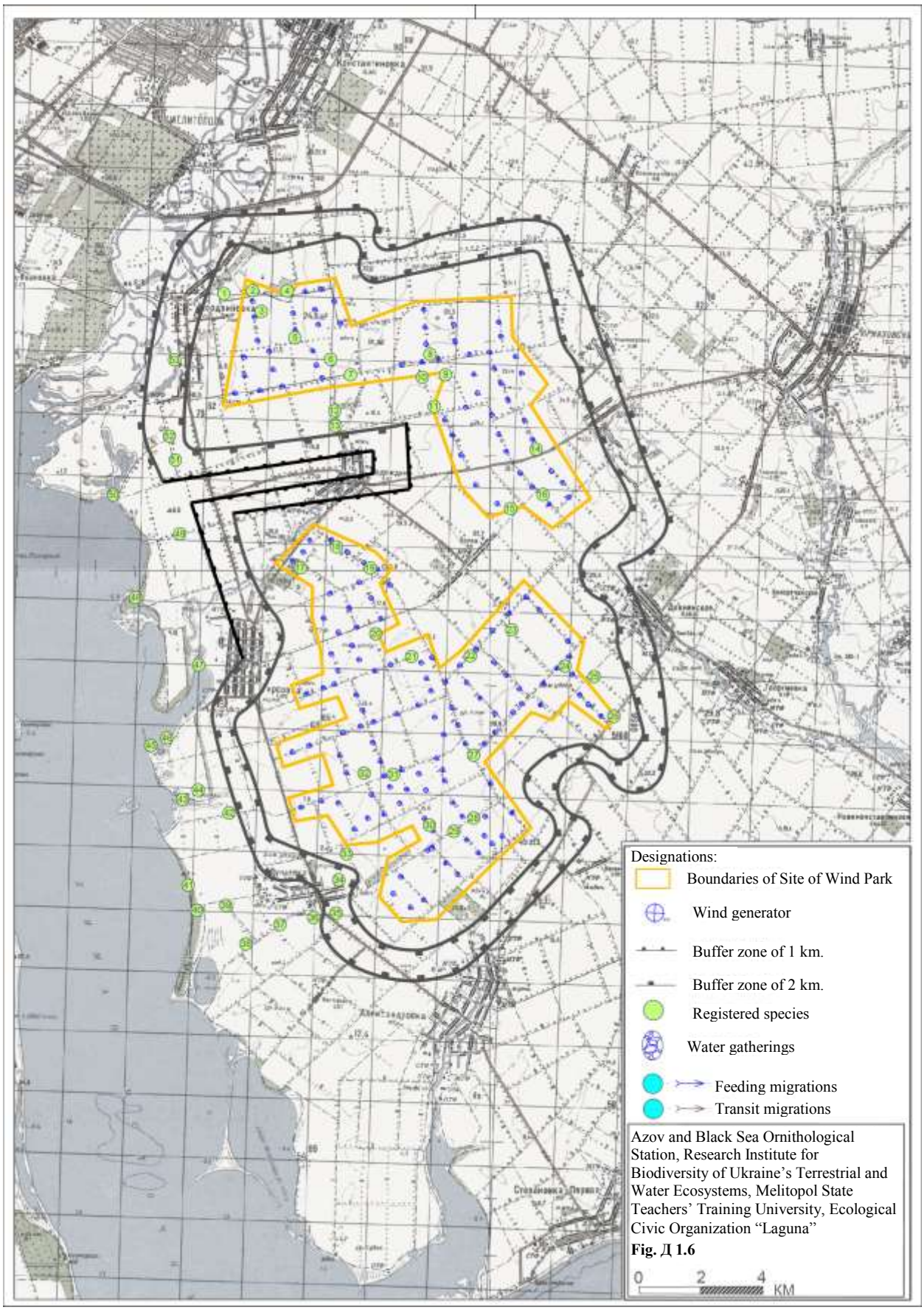
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Wind generator
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Registered species
Water gatherings
Feeding migrations
Transit migrations
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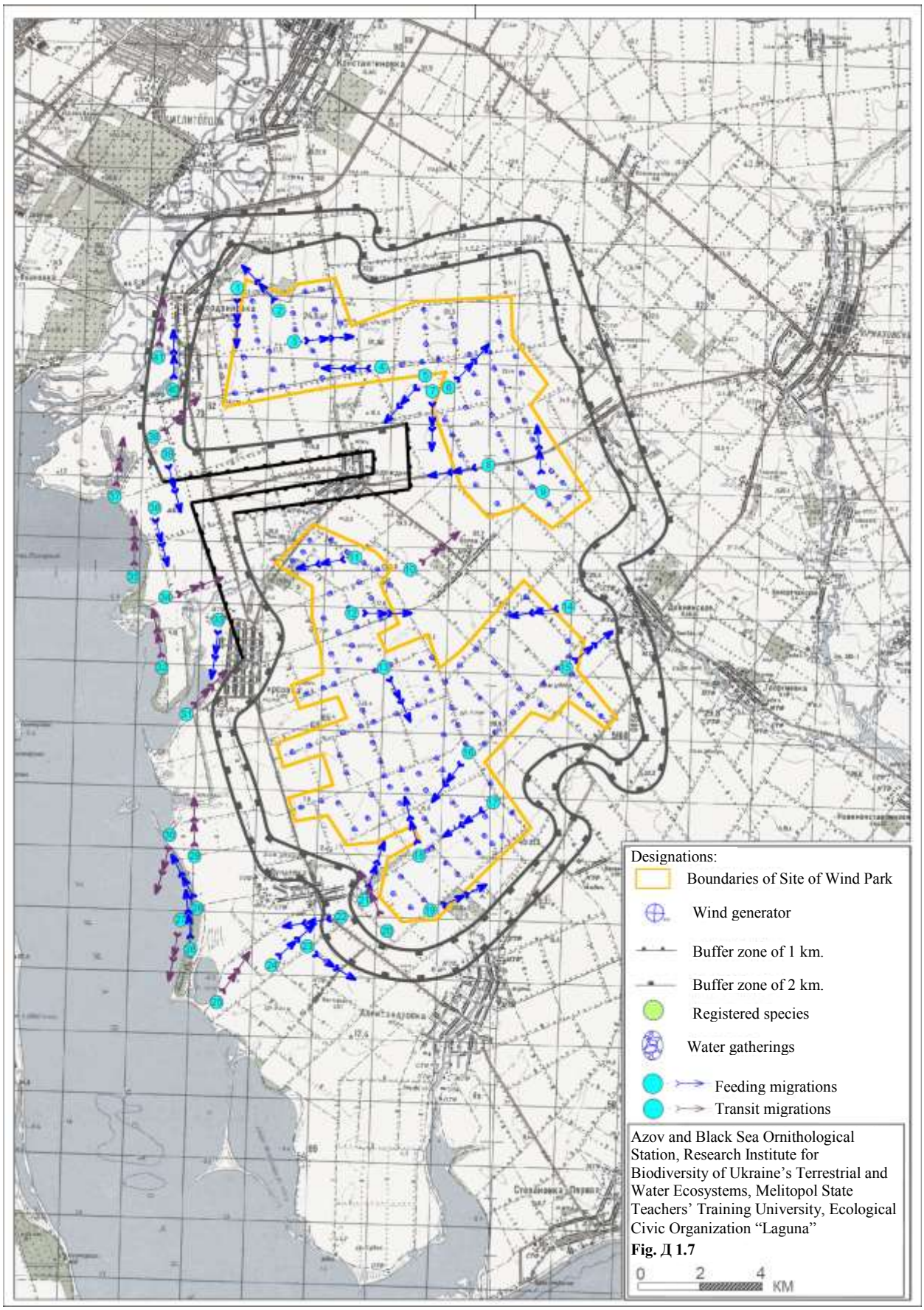
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Water gatherings
Feeding migrations
Transit migrations
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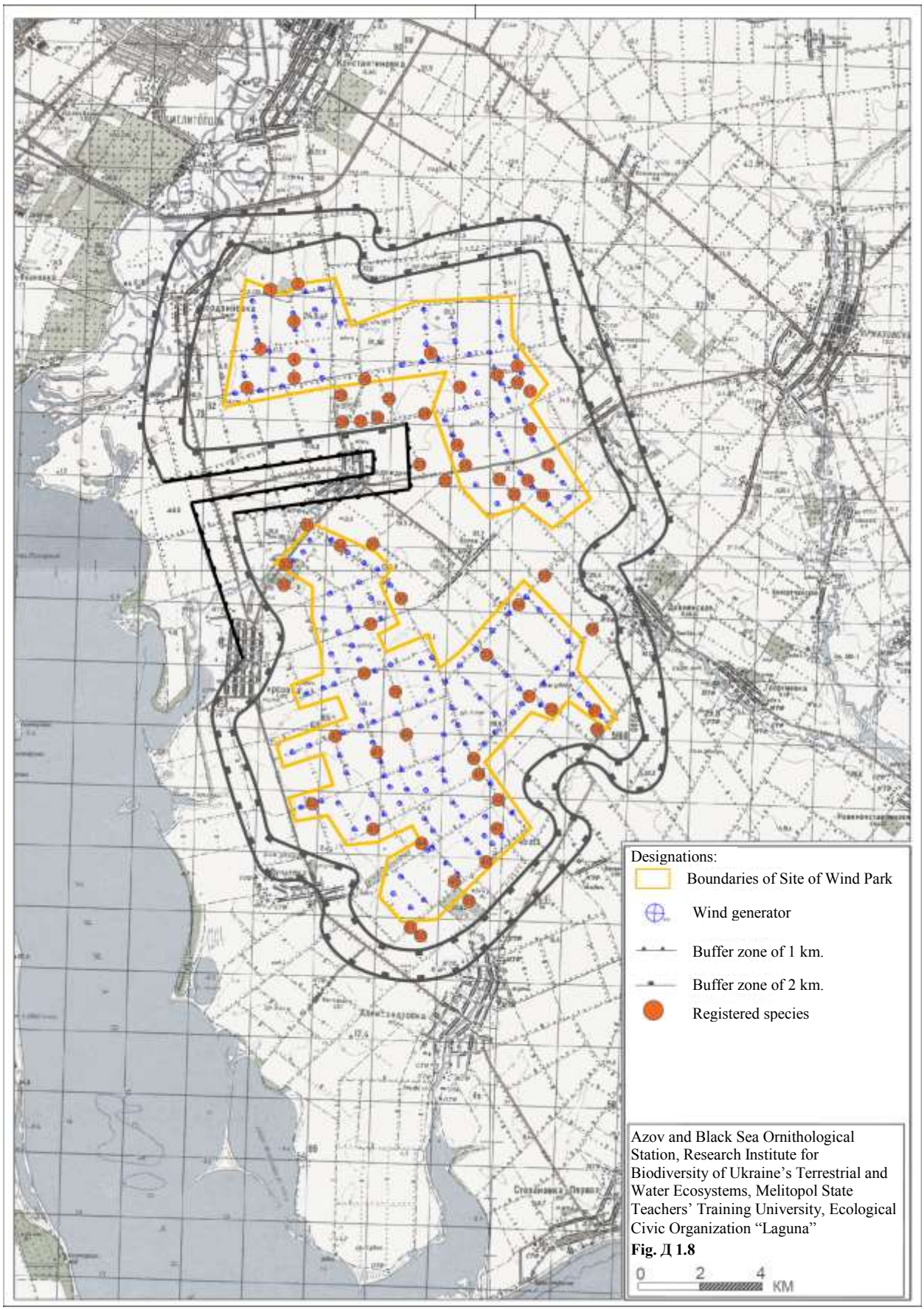
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Fig. Д 1.8
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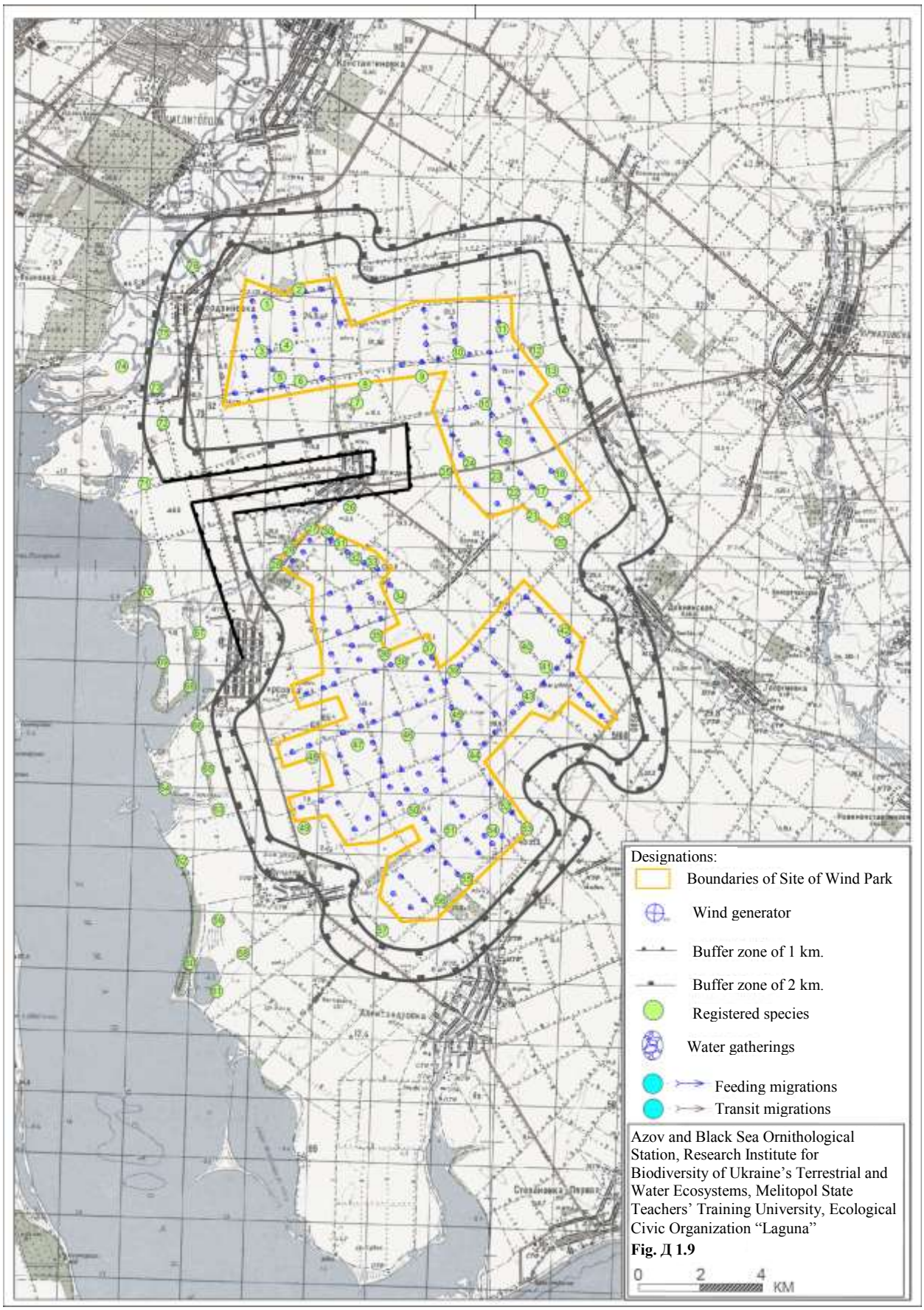
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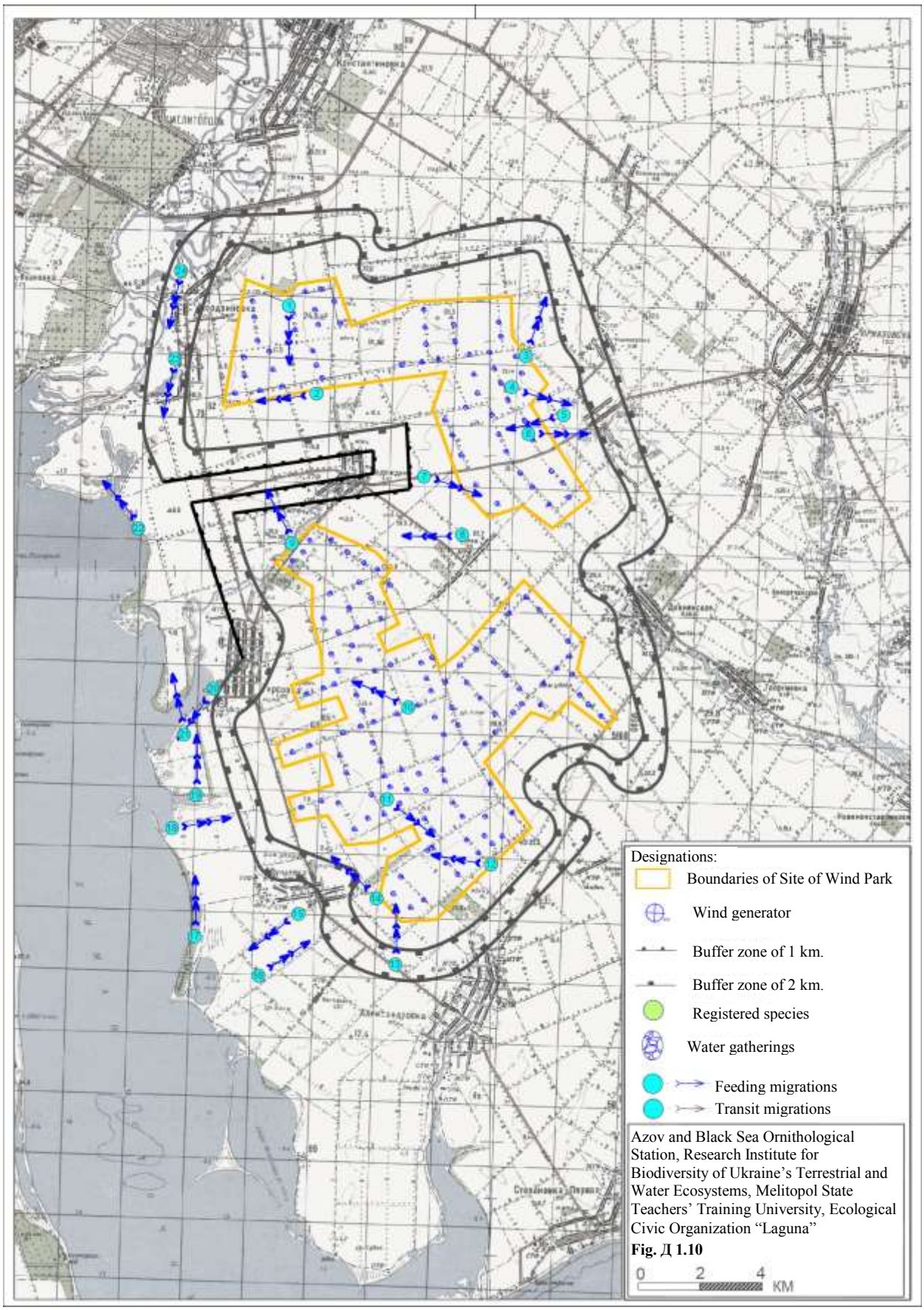
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Feeding migrations
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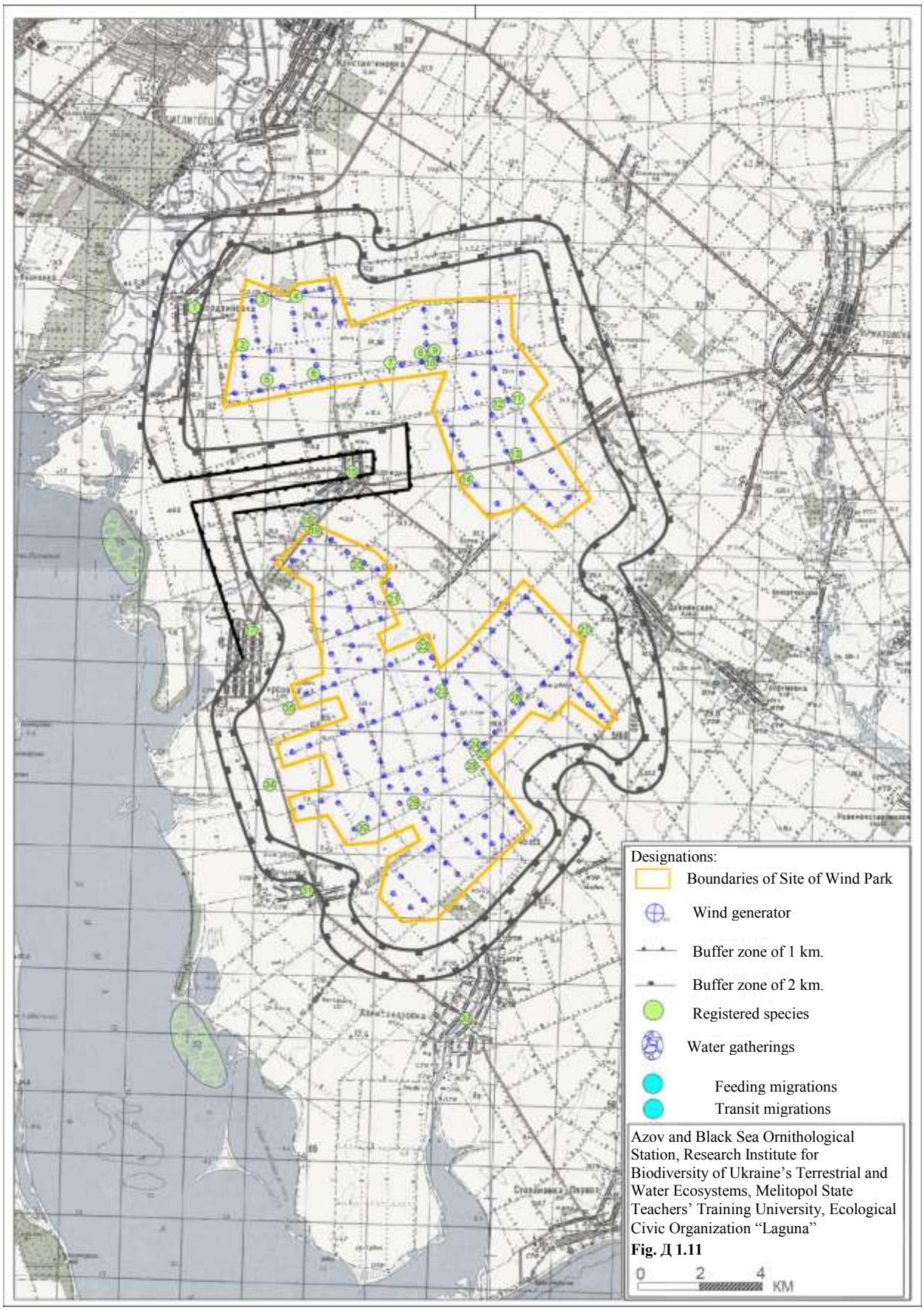
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Transit migrations
Azov and Black Sea Ornithological Station, Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Melitopol State Teachers' Training University, Ecological Civic Organization "Laguna"
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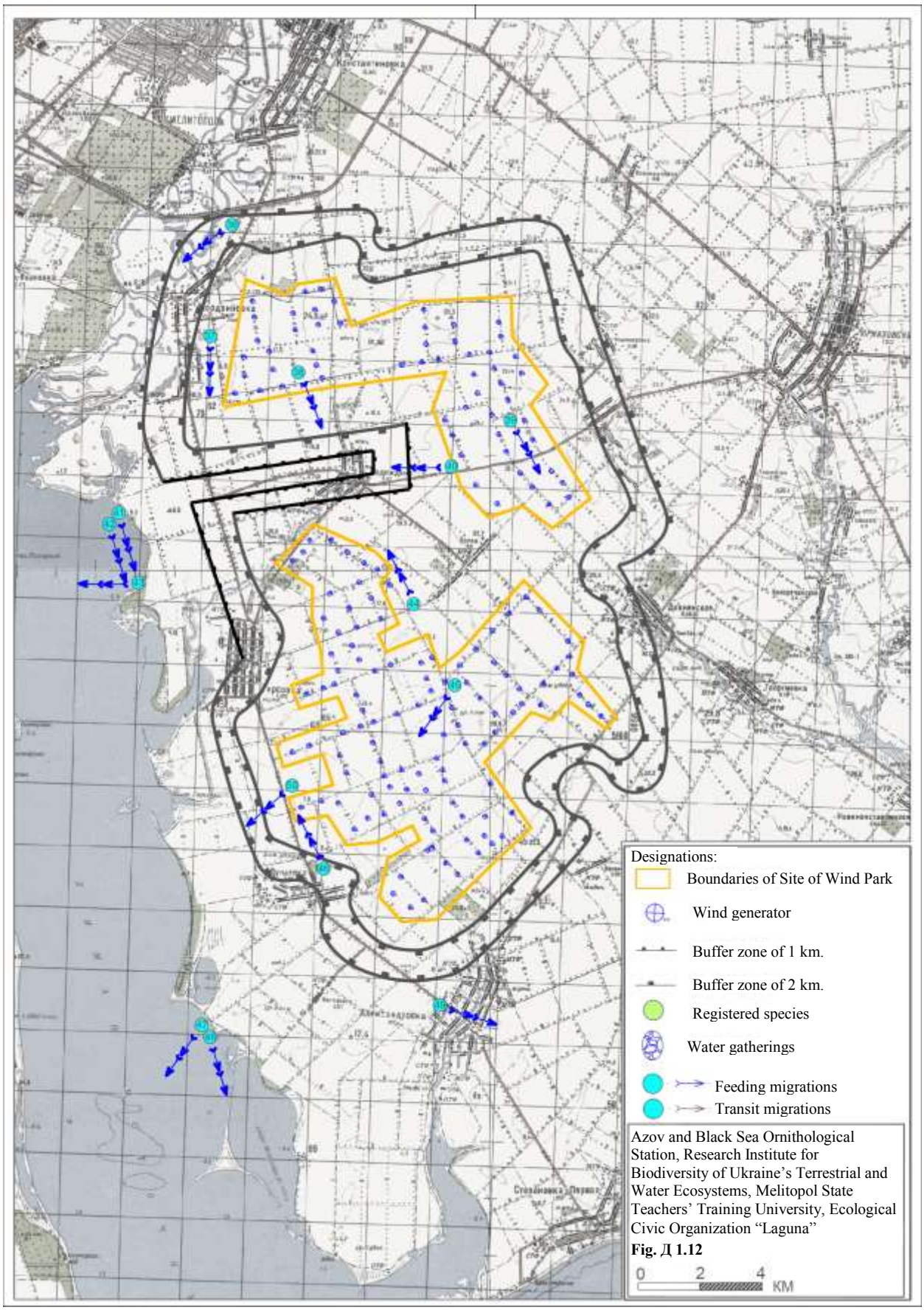
KM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Wind generator
Buffer zone of 1 km.
Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
Azov and Black Sea Ornithological Station, Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Melitopol State Teachers' Training University, Ecological Civic Organization "Laguna"
Fig. Д 1.12
0
2
4
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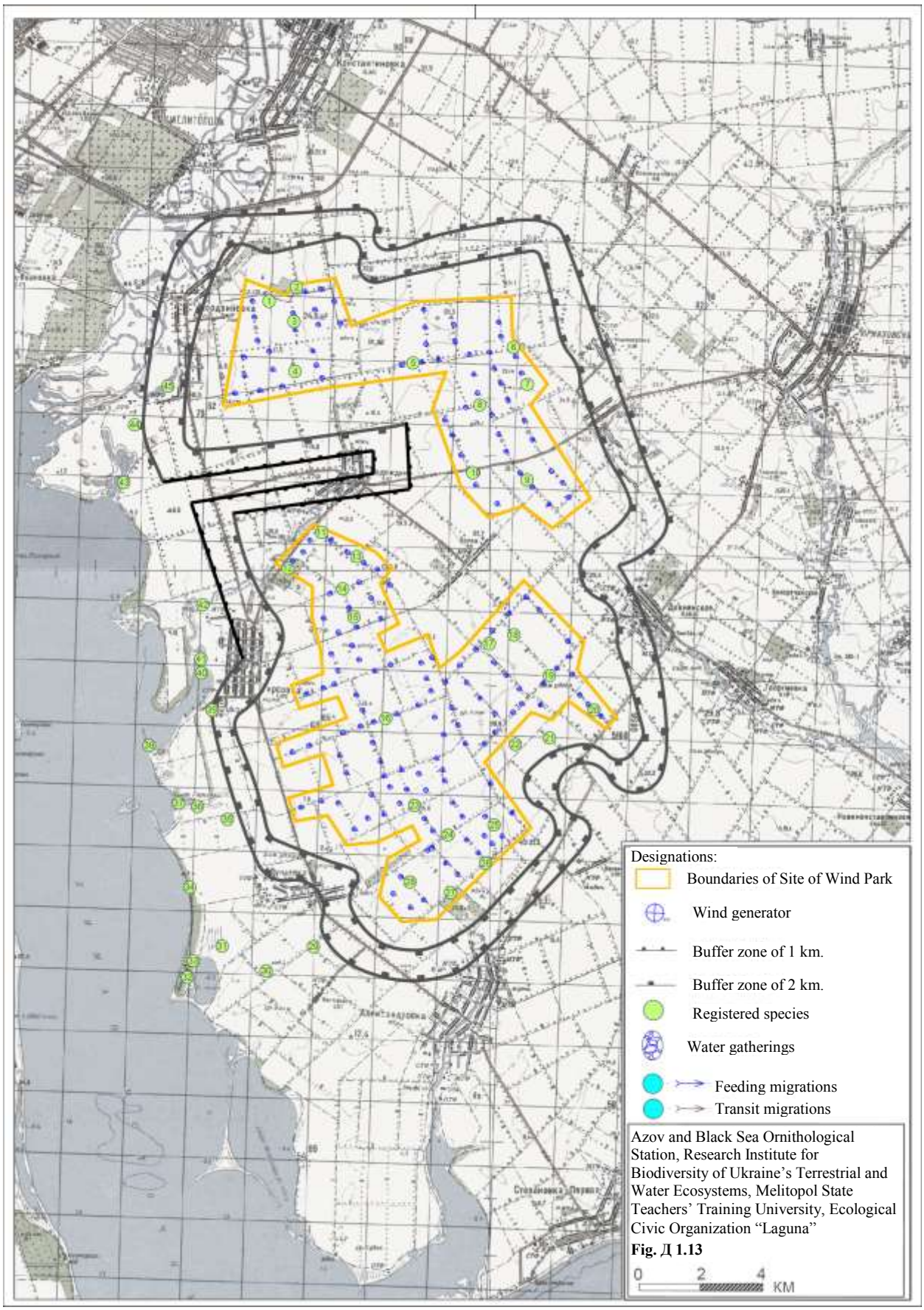
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Buffer zone of 1 km.
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Registered species
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Feeding migrations
Transit migrations
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Fig. Д 1.13
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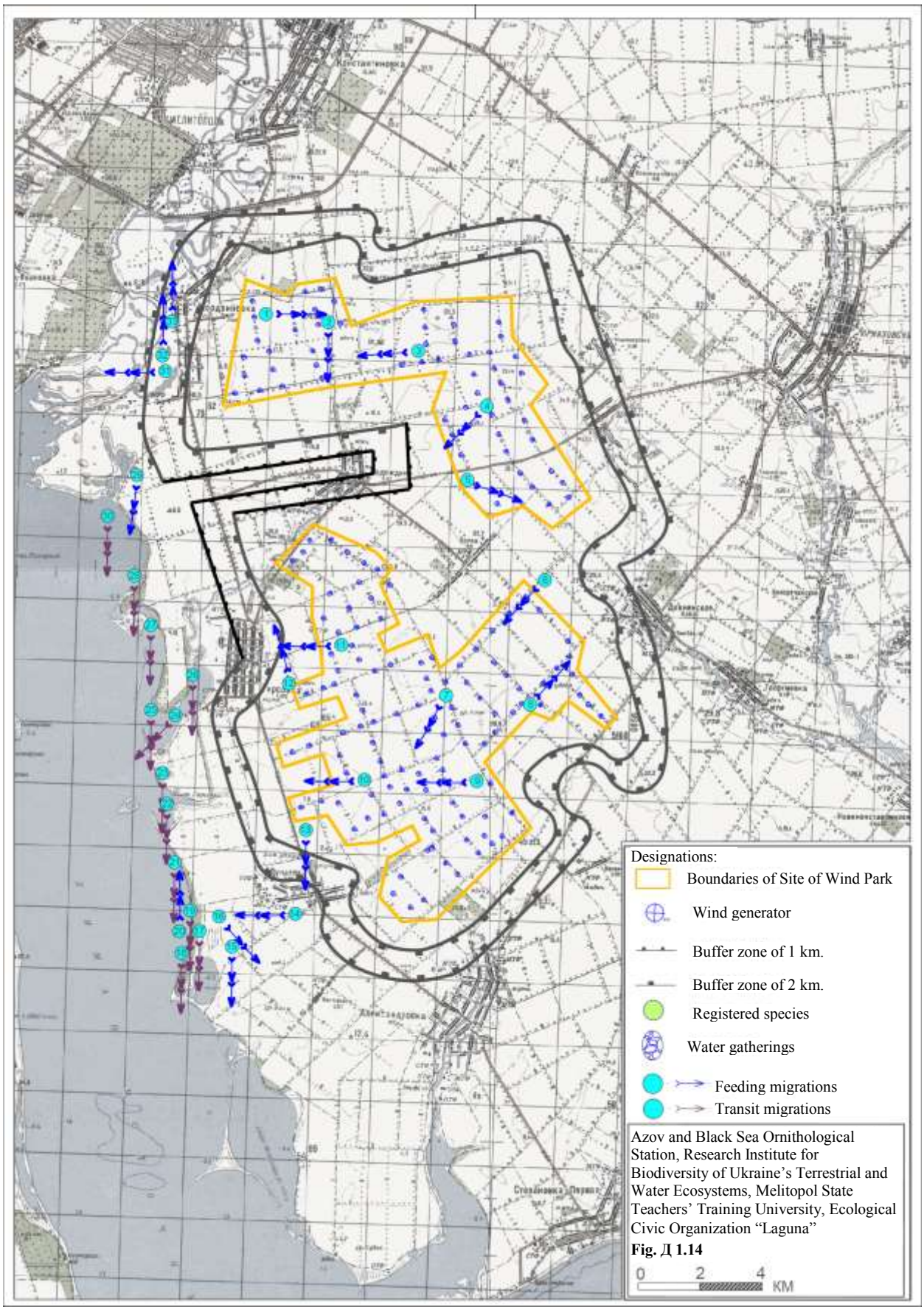
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Wind generator
Buffer zone of 1 km.
Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
Azov and Black Sea Ornithological Station, Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Melitopol State Teachers' Training University, Ecological Civic Organization "Laguna"
Fig. Д 1.14
0
2
4
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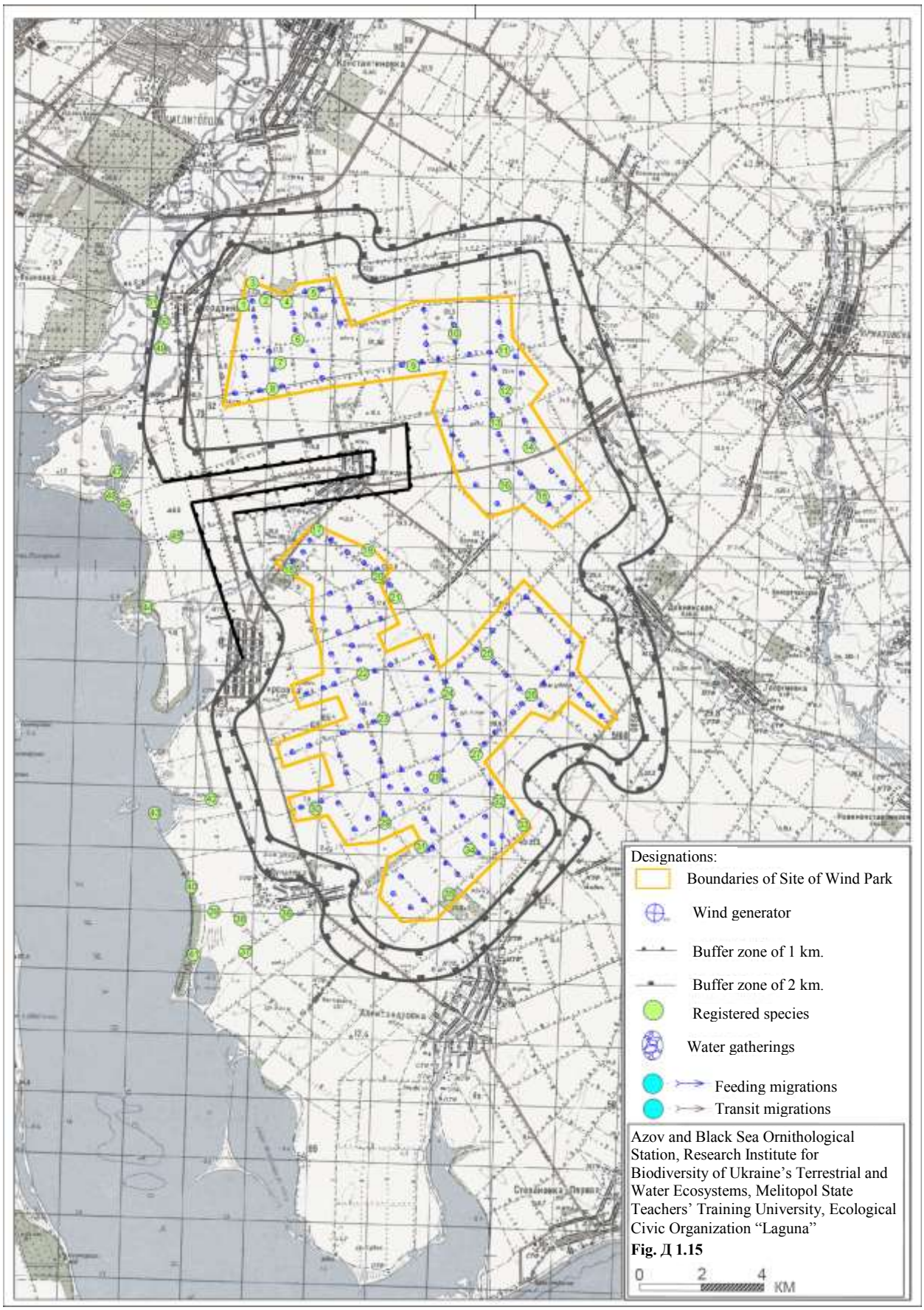
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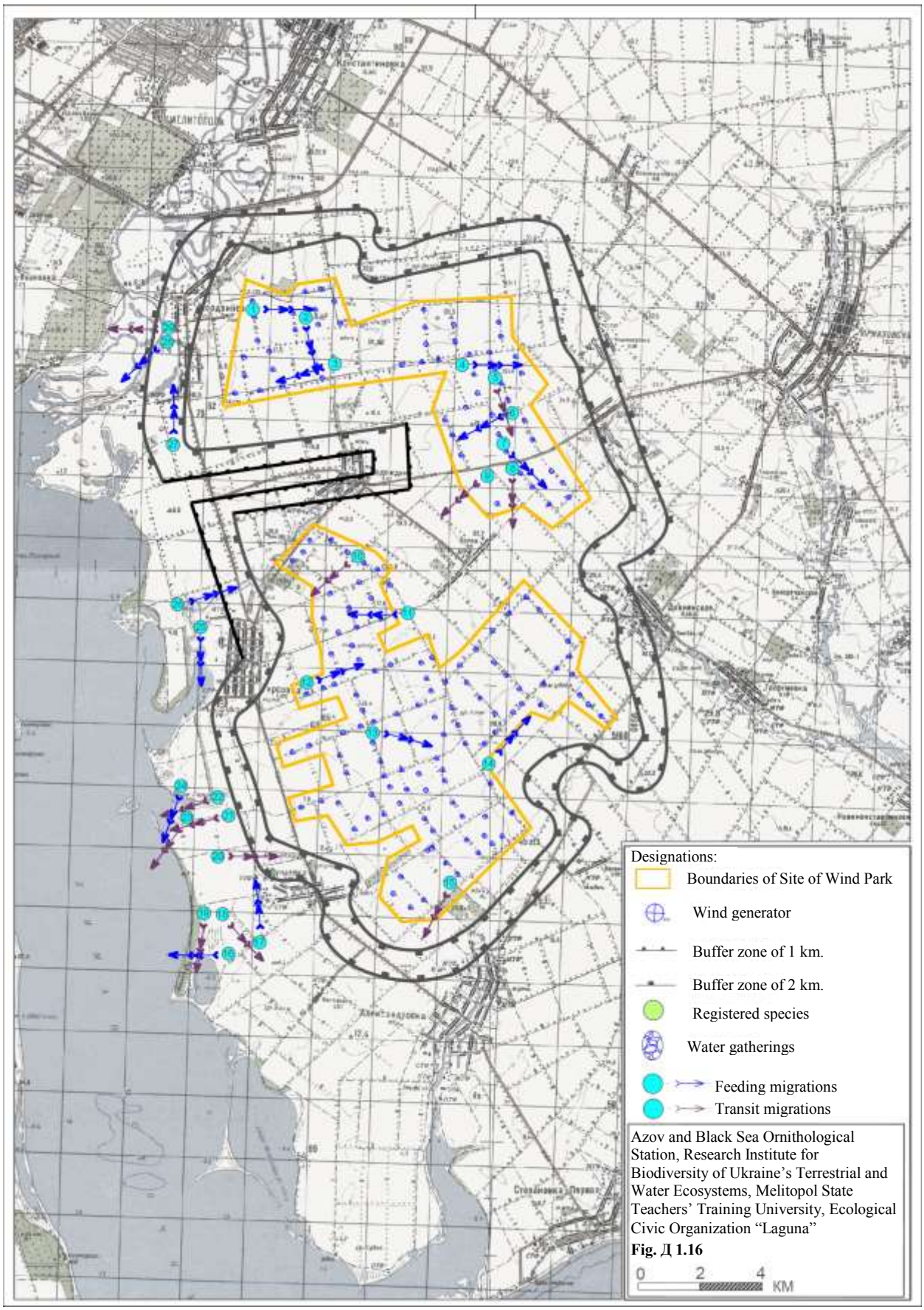
Wind generator
Buffer zone of 1 km.
Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
Azov and Black Sea Ornithological Station, Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Melitopol State Teachers' Training University, Ecological Civic Organization "Laguna"
Fig. Д 1.15
0
2
4
KM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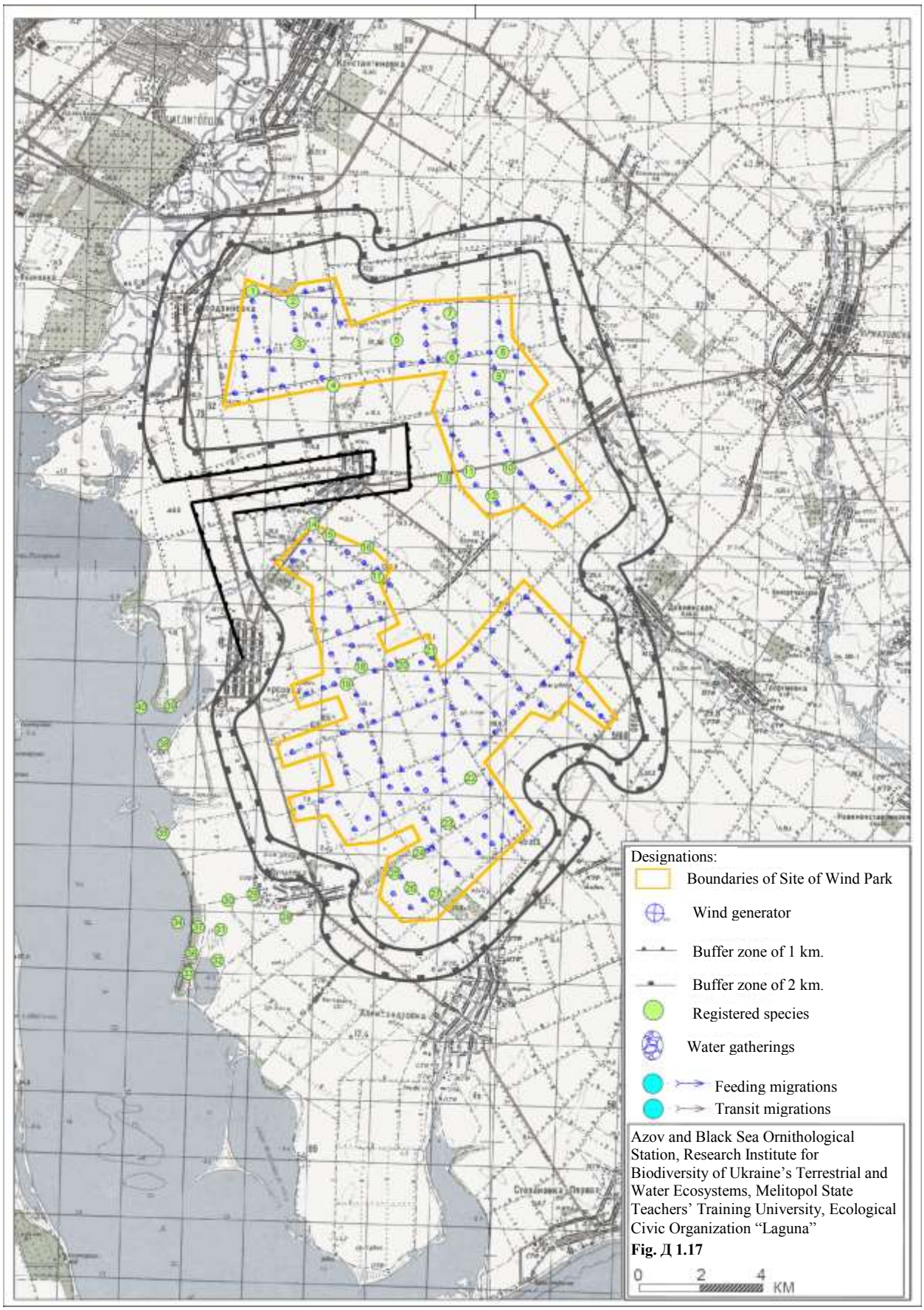
Wind generator
Buffer zone of 1 km.
Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
Azov and Black Sea Ornithological Station, Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Melitopol State Teachers' Training University, Ecological Civic Organization "Laguna"
Fig. Д 1.16
0
2
4
KM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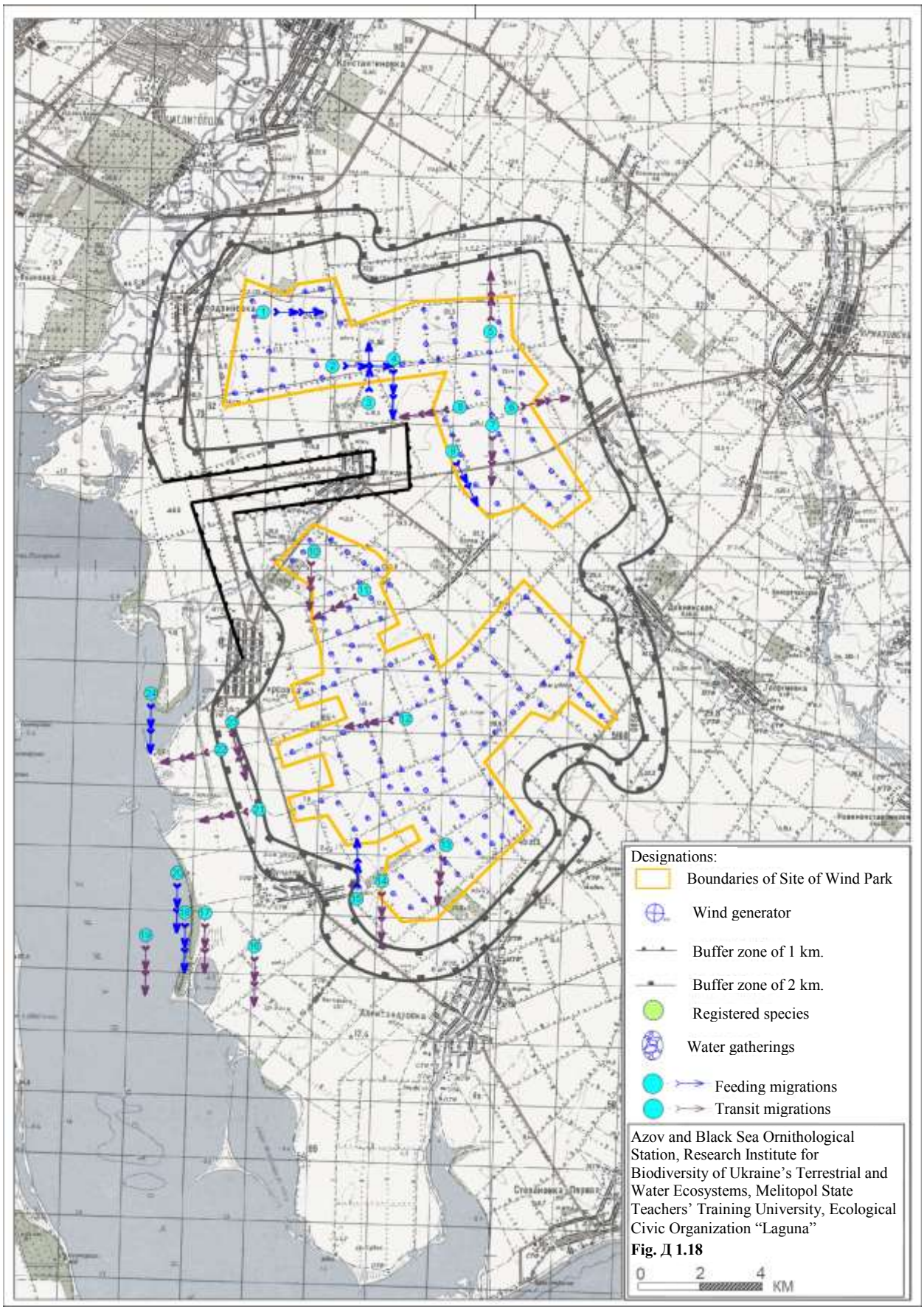
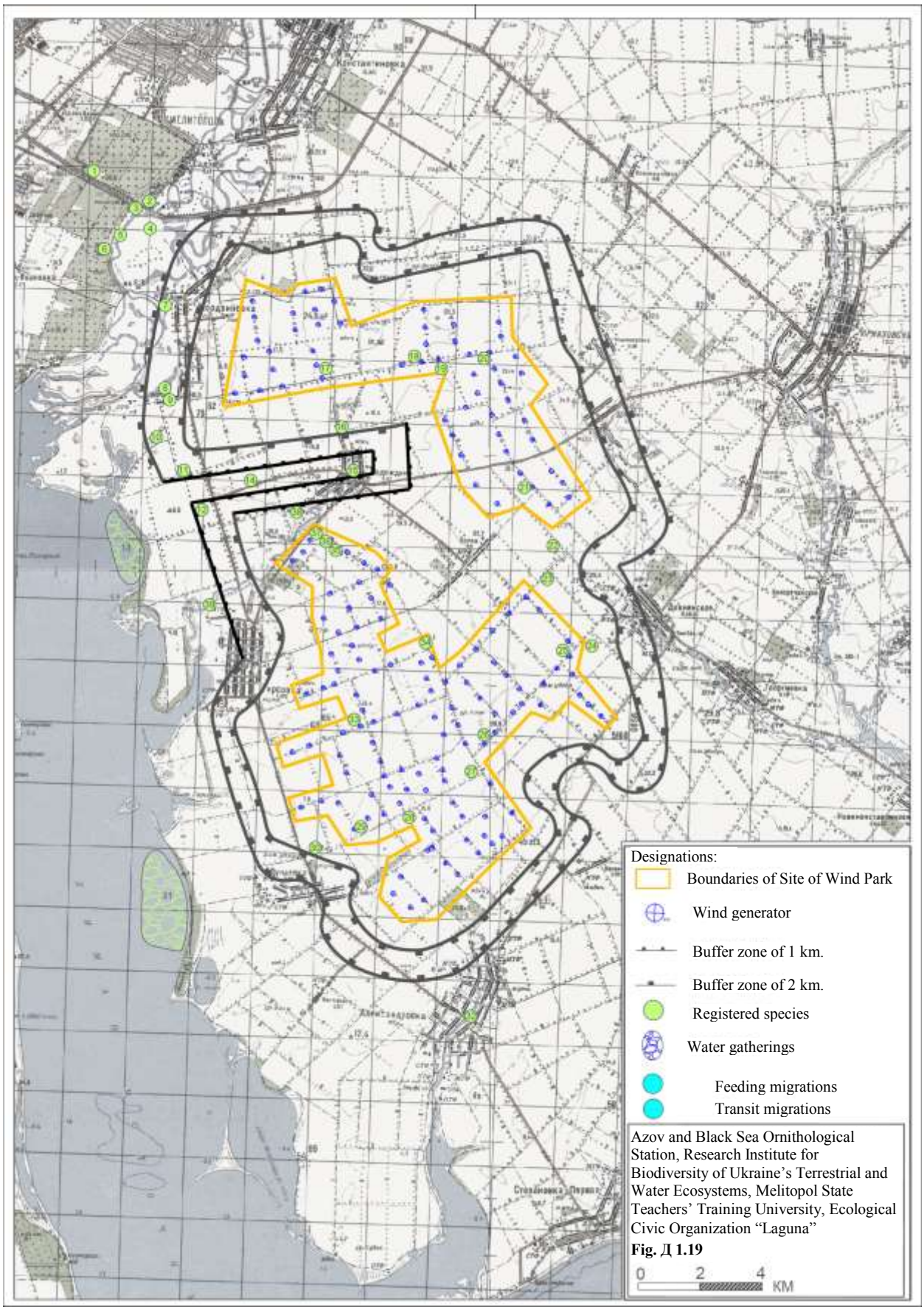
Wind generator
Buffer zone of 1 km.
Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
Azov and Black Sea Ornithological Station, Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Melitopol State Teachers' Training University, Ecological Civic Organization "Laguna"
Fig. Д 1.17
0 2 4
KM


Designations:
Boundaries of Site of Wind Park
Wind generator
Buffer zone of 1 km.
Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
Azov and Black Sea Ornithological Station, Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Melitopol State Teachers' Training University, Ecological Civic Organization "Laguna"
Fig. Д 1.18
0 2 4 KM


Designations:
Boundaries of Site of Wind Park
Wind generator
Buffer zone of 1 km.
Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
Azov and Black Sea Ornithological Station, Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Melitopol State Teachers' Training University, Ecological Civic Organization "Laguna"
Fig. Д 1.19
0 2 4 KM

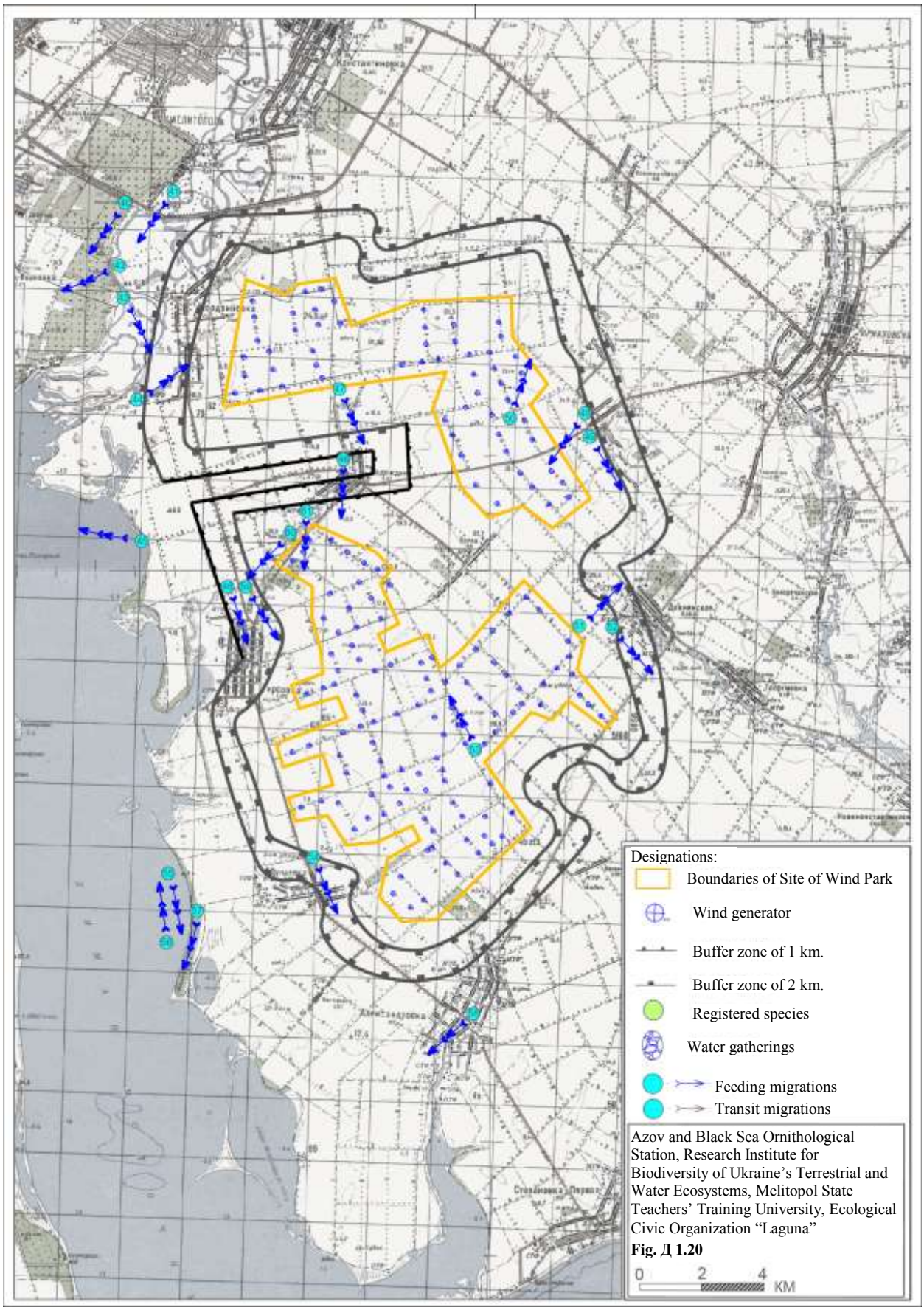

Designations:
Boundaries of Site of Wind Park
Wind generator
Buffer zone of 1 km.
Buffer zone of 2 km.
Registered species
Water gatherings
Feeding migrations
Transit migrations
Azov and Black Sea Ornithological Station, Research Institute for Biodiversity of Ukraine's Terrestrial and Water Ecosystems, Melitopol State Teachers' Training University, Ecological Civic Organization "Laguna"
Fig. Д 1.20
0
2
4
KM

Table 1.1 Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 30.01.2016 (according to the map chart, Fig. Д 1.1).

Number	Time	Specie	Quantity
1	10.00	*Eurasian collared dove* (*Streptopelia decaocto*)	**5**
2		Skylark (*Alauda arvensis*)	**17**
W		Rook (*Corvus frugilegus)*	**12**
4		Rough-legged buzzard (*Buteo lagopus*	**2**
5		*Grey partridge* (*Perdix perdix*)	**11**
6		Hooded crow (*Corvus cornix*)	**4**
7		*Eurasian collared dove* (*Streptopelia decaocto*)	**5**
8		Eurasian tree sparrow (*Passer montanus*)	**26**
9		*Chaffinch* (*Fringilla coelebs*)	**7**
10		Hooded crow (*Corvus cornix*)	**2**
11	11.00	Blackbird (*Turdus merula)*	**5**
12		*Eurasian sparrowhawk* (*Accipiter nisus*)	**1**
13		Skylark (*Alauda arvensis*)	**12**
14		Little gull (*Larus ridibundus*)	**21**
15		*Common raven* (*Corvus corax)*	**2**
16		*European robin* (*Erithacus rubecula)*	**1**
17		*European robin* (*Erithacus rubecula)*	**2**
18		European magpie (*Pica pica*)	**3**
19		*Chaffinch* (*Fringilla coelebs*)	**8**
20		Rook (*Corvus frugilegus)*	**16**
21		European starling (*Sturnus vulgaris*)	**18**
22	12.00	*Crested lark* (*Galerida cristata)*	**4**
23		*Merlin* (*Falco columbarius)*	**1**
24		Blackbird (*Turdus merula)*	**6**
25		*Grey partridge* (*Perdix perdix*)	**9**
26		Hen harrier (*Circus cyaneus*)	**1**
27		Little gull (*Larus ridibundus*)	**5**
28		Hooded crow (*Corvus cornix*)	**6**
29		*Chaffinch* (*Fringilla coelebs*)	**12**
30		Rough-legged buzzard (*Buteo lagopus*)	**2**
31		*Crested lark* (*Galerida cristata)*	**8**
32		Rook (*Corvus frugilegus)*	**16**
33		European magpie (*Pica pica*)	**5**
34		Yellow-legged gull (*L.cachinnans*)	**24**
35		*Merlin* (*Falco columbarius)*	**1**
36		Common gull *(Larus canus)*	**7**
37		Mallard *(Anas platyrhynchos)*	**45**
38		Common gull *(Larus canus)*	**7**
39		*Whooper swan* (*Cygnus cygnus)*	***7***
39		Greater scaup	**20**
39		Common gull *(Larus canus)*	**14**
40		*White-tailed eagle* (*Haliaeetus albicilla*)	**1**
41		Great tit *(Parus major)*	**5**
42		European starling (*Sturnus vulgaris*)	**12**
43		*Eurasian collared dove* (*Streptopelia decaocto*)	**7**
44	13.00	Little gull (*Larus ridibundus*)	**25**
Total specimens (25 species) – during accountings			**430**

Table 1.1.1 Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 30.01.2016 (according to the map chart, Fig. Д 1.1).

Number	Time	Specie	Quantity	Migtation type	Height (m)	Direction
45	10.00	Rook (*Corvus frugilegus)*	11	Feeding migration	10	S
46		European magpie (*Pica pica*)	3	Feeding migration	5	N
47		Hooded crow (*Corvus cornix*)	4	Feeding migration	10	NE
48		Blackbird (*Turdus merula)*	6	Feeding migration	5	SE
49		Rook (*Corvus frugilegus)*	4	Feeding migration	10	S
50		Eurasian tree sparrow (*Passer montanus*)	8	Feeding migration	5	N
51		Blackbird (*Turdus merula)*	3	Feeding migration	5	S
52		*Eurasian collared dove* (*Streptopelia decaocto*)	6	Feeding migration	5	W
53		European starling (*Sturnus vulgaris*)	26	Feeding migration	5	W
54		Eurasian tree sparrow (*Passer montanus*)	15	Feeding migration	5	W
55		Yellow-legged gull (*L.cachinnans*)	5	Feeding migration	5	N
56		Little gull (*Larus ridibundus*)	10	Feeding migration	10	NE
57		Mallard *(Anas platyrhynchos)*	6	Feeding migration	5	S
58	13.00	European starling (*Sturnus vulgaris*)	18	Feeding migration	5	W
Total specimens (14 species) - *during feeding migrations*			**125**			

Note: N – north, NE – north east, NW – north west, W – west, SW – south west, E – east, SE – south east, S – south.

Table 1.2. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 20.03.2016 (according to the map chart, Fig. Д 1.2).

Number	Time	Specie	Quantity
1	09.00	European starling (*Sturnus vulgaris*)	**8**
2		Winter wren *(Troglodytes troglodytes)*	**1**
2		*Fieldfare* (*Turdus pilaris)*	**4**
3		Rough-legged buzzard (*Buteo lagopus*)	**1**
4		Common redstart (*Phoenicurus phoenicurus*)	**2**
5		*European greenfinch (Chloris chloris)*	**8**
5		*European goldfinch* (*Carduelis carduelis*)	**5**
6		Rook (*Corvus frugilegus)*	**4**
7	10.00	*Crested lark (Galerida cristata)*	**2**
8		*Woodpigeon* (*Columba palumbus*)	**3**
9		*Eurasian sparrowhawk* (*Accipiter nisus*)	**1**
10		*Corn bunting* (*Emberiza calandra*)	**12**
11		*Corn bunting* (*Emberiza calandra*)	**2**
12		*Chaffinch* (*Fringilla coelebs*)	**7**
13		Common buzzard *(Buteo buteo)*	**1**
14		Rough-legged buzzard (*Buteo lagopus*)	**2**
15		European starling (*Sturnus vulgaris*)	**28**
16		Blackbird (*Turdus merula)*	**4**
17		*Common kestrel* (*Falco tinnunculus)*	**2**
18		Common buzzard *(Buteo buteo)*	**1**
19		Hooded crow (*Corvus cornix*)	**6**
20	11.00	Little gull (*Larus ridibundus*)	**7**
21		Yellow-legged gull *(Larus cachinnans)*	**12**
22		*Woodpigeon* (*Columba palumbus*)	**1**
23		Rough-legged buzzard (*Buteo lagopus*)	**2**
24		Skylark (*Alauda arvensis*)	**6**
25		*Pied avocet* (*Recurvirostra avosetta*)	**5**
25		Common redshank (*Tringa totanus*)	**2**
26		*Northern lapwing* (*Vanellus vanellus*)	**3**
27		*Ruff* (*Philomachus pugnax*)	**21**
28		*Mute swan* (*Cygnus olor*)	**8**
29		*Northern wheatear* (*Oenanthe oenanthe*)	**2**
30		*Ruff* (*Philomachus pugnax*)	**15**
31		Eurasian curlew (*Numenius arquata*)	**2**
31		*Common shelduck* (*Tadorna tadorna*)	**6**
31	12.00	Mallard *(Anas platyrhynchos)*	**12**
Total specimens (29 species) – during accountings			**208**

Table 1.3. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 20.03.2016 (according to the map chart, Fig. Д 1.3).

Number	Time	Specie	Quantity	Migtation type	Height (m)	Direction
1	09.00	Eurasian tree sparrow (*Passer montanus*)	6	Feeding migration	5	S
2		Greater white-fronted goose (*Anser albifrons)*	22	Transit migration	400	NE
3		Blackbird **(***Turdus merula)*	3	Transit migration	5	S
4		European starling (*Sturnus vulgaris*)	18	Feeding migration	10	N
5		*Corn bunting* (*Emberiza calandra*)	22	Transit migration	5	N
6	10.00	*Woodpigeon* (*Columba palumbus*)	1	Feeding migration	5	N
7		*Chaffinch* (*Fringilla coelebs)*	26	Transit migration	10	NE
8		*Collared flycatcher*	2	Transit migration	2	NE
9		*Corn bunting* (*Emberiza calandra*)	10	Feeding migration	5	SE
10		*Brambling* (*Fringilla montifringilla)*	11	Transit migration	10	NE
11		European pied flycatcher (*Ficedula hypoleuca)*	5	Transit migration	2	NW
12		Yellow-legged gull *(Larus cachinnans)*	7	Feeding migration	10	SW
13		*Chaffinch* (*Fringilla coelebs)*	12	Transit migration	5	NE
14		Greater white-fronted goose (*Anser albifrons)*	43	Transit migration	400	N
15		European starling (*Sturnus vulgaris*)	8	Feeding migration	15	NW
16	11.00	*European robin* (*Erithacus rubecula)*	2	Transit migration	2	NE
17		Greater white-fronted goose (*Anser albifrons)*	28	Transit migration	400	N
18		Rough-legged buzzard (*Buteo lagopus*)	2	Transit migration	10	N
19		*Ruff* (*Philomachus pugnax*)	35	Feeding migration	10	NE
20		Black-headed gull *(Larus ridibundus)*	14	Feeding migration	20	S
21		Black redstart (*Phoenicurus ochruros*)	4	Transit migration	3	NE
22		Yellow-legged gull *(Larus cachinnans)*	6	Feeding migration	10	N
23		Rook (*Corvus frugilegus)*	11	Feeding migration	20	NE
24	12.00	*Corn bunting* (*Emberiza calandra*)	20	Transit migration	5	N
Total specimens (17 species) – during migrations			**318**			

Note. N – north, NE – north east, NW – north west, W – west, SW – south west, E – east, SE – south east, S – south.

Table 1.4. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 08.04.2016 (according to the map chart, Fig. Д 1.4).

Number	Time	Specie	Quantity
1	08.00	Blackbird (*Turdus merula)*	**6**
1		Winter wren *(Troglodytes troglodytes)*	**2**
1		Common redstart (*Phoenicurus phoenicurus*)	**3**
1		*Chaffinch* (*Fringilla coelebs*)	**12**
2		Hooded crow (*Corvus cornix*)	**4**
3		*Woodpigeon* (*Columba palumbus*)	**2**
4		*Common kestrel* (*Falco tinnunculus)*	**1**
5		Common buzzard *(Buteo buteo)*	**1**
6		*European greenfinch (Chloris chloris)*	**4**
6		*Corn bunting* (*Emberiza calandra*)	**6**
6		Leaf warbler *(Phylloscopus sp)*	**2**
6		*European robin* (*Erithacus rubecula)*	**2**
7		*Eurasian sparrowhawk* (*Accipiter nisus*)	**1**
8		*Fieldfare* (*Turdus pilaris)*	**6**
9		Rook (*Corvus frugilegus)*	**21**
10		*Corn bunting* (*Emberiza calandra*)	**8**
11		Rough-legged buzzard (*Buteo lagopus*)	**1**
12		*European goldfinch* (*Carduelis carduelis*)	**7**
13	09.00	*Crested lark (Galerida cristata)*	**3**
14		*Woodpigeon* (*Columba palumbus*)	**1**
14		*European greenfinch (Chloris chloris)*	**4**
14		*Corn bunting* (*Emberiza calandra*)	**6**
14		Blackbird (*Turdus merula)*	**6**
14		European magpie (*Pica pica*)	**2**
15		Skylark (*Alauda arvensis*)	**4**
16		Common buzzard *(Buteo buteo)*	**1**
17		*Woodpigeon* (*Columba palumbus*)	**2**
18		*Common kestrel* (*Falco tinnunculus)*	**1**
19		Hooded crow (*Corvus cornix*)	**2**
20		*Northern wheatear* (*Oenanthe oenanthe*)	**2**
21		Skylark (*Alauda arvensis*)	**5**
22		Hooded crow (*Corvus cornix*)	**2**
23		*European greenfinch (Chloris chloris)*	**14**
24		European starling (*Sturnus vulgaris*)	**6**
25		European magpie (*Pica pica*)	**3**
26	10.00	*European goldfinch* (*Carduelis carduelis*)	**5**
27		*Corn bunting* (*Emberiza calandra*)	**17**
28		Blackbird (*Turdus merula)*	**2**
29		Rough-legged buzzard (*Buteo lagopus*)	**1**
30		*White wagtail (Motacilla alba)*	**22**
31		Little gull (*Larus ridibundus*)	**38**
32		Yellow-legged gull *(Larus cachinnans)*	**5**
33		*Chaffinch* (*Fringilla coelebs*)	**4**
34		*Northern lapwing* (*Vanellus vanellus*)	**7**
35		Mallard *(Anas platyrhynchos)*	**14**
36	11.00	*Ruff* (*Philomachus pugnax*)	**62**
37		European starling (*Sturnus vulgaris*)	**20**
38		Cormorant *(Phalacrocorax carbo)*	**18**
39		*Great crested grebe* (*Podiceps cristatus*)	**5**
39		*Eurasian coot* (*Fulica atra)*	**18**
40		*Pied avocet* (*Recurvirostra avosetta*)	**7**
41		Rough-legged buzzard (*Buteo lagopus*)	**1**
42	12.00	Rook (*Corvus frugilegus)*	**6**
Total specimens (32 species) – during accountings			**405**

Table 1.5. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 08.04.2016 (according to the map chart, Fig. Д 1.5).

Number	Time	Specie	Quantity	Migtation type	Height (m)	Direction
1	08.00	European starling (*Sturnus vulgaris*)	6	Feeding migration	10	NE
2		Hooded crow (*Corvus cornix*)	4	Feeding migration	10	S
3		*Corn bunting* (*Emberiza calandra*)	8	Transit migration	5	NE
4		European starling (*Sturnus vulgaris*)	150	Transit migration	50	NE
5		*Woodpigeon* (*Columba palumbus*)	3	Feeding migration	5	SW
6		*Corn bunting* (*Emberiza calandra*)	10	Transit migration	5	N
7		*Brambling* (*Fringilla montifringilla)*	12	Transit migration	5	N
8		*European goldfinch* (*Carduelis carduelis*)	6	Feeding migration	5	NE
9		Rook (*Corvus frugilegus)*	5	Feeding migration	10	NW
10		European magpie (*Pica pica*)	1	Feeding migration	5	W
11		*Common kestrel* (*Falco tinnunculus)*	1	Feeding migration	5	SE
12	09.00	Yellow-legged gull *(Larus cachinnans)*	7	Feeding migration	15	N
13		European starling (*Sturnus vulgaris*)	260	Transit migration	50	NE
14		Blackbird **(***Turdus merula)*	6	Transit migration	10	SE
15		Hooded crow (*Corvus cornix*)	2	Feeding migration	10	NW
16		Rook (*Corvus frugilegus)*	8	Feeding migration	10	W
17		*Chaffinch* (*Fringilla coelebs)*	20	Transit migration	5	NE
18		*Woodpigeon* (*Columba palumbus*)	3	Feeding migration	5	N
19		Black redstart (*Phoenicurus ochruros*)	2	Transit migration	3	NE
20		Greater white-fronted goose (*Anser albifrons)*	62	Transit migration	300	NE
21		Rook (*Corvus frugilegus)*	8	Feeding migration	10	N
22		European magpie (*Pica pica*)	3	Feeding migration	10	W
23		Greater white-fronted goose (*Anser albifrons)*	48	Transit migration	400	NE
24	10.00	*Passerinae spp.*	30	Feeding migration	20	NE
25		*Ruff* (*Philomachus pugnax*)	60	Transit migration	50	N
26		*White wagtail (Motacilla alba)*	24	Transit migration	5	NE
27		*Mute swan* (*Cygnus olor*)	5	Feeding	50	W

				migration		
28		*White wagtail (Motacilla alba)*	12	Transit migration	5	NE
29		*Pied avocet* (*Recurvirostra avosetta*)	8	Feeding migration	10	N
30		*Corn bunting* (*Emberiza calandra*)	16	Feeding migration	5	N
31		Cormorant *(Phalacrocorax carbo)*	12	Feeding migration	20	S
32		Yellow-legged gull *(Larus cachinnans)*	5	Feeding migration	10	N
33	11.00	Dunlin *(Cal. alpina)*	20	Transit migration	5	N
34		Greater white-fronted goose (*Anser albifrons)*	28	Transit migration	300	N
35		*Chlidonias spp.*	12	Transit migration	5	NE
36		*Chaffinch* (*Fringilla coelebs)*	16	Transit migration	5	N
37		Mallard *(Anas platyrhynchos)*	25	Feeding migration	30	N
38		*Ruff* (*Philomachus pugnax*)	45	Transit migration	50	N
39	12.00	*Ruff* (*Philomachus pugnax*)	22	Transit migration	30	NE
Total specimens (22 species) – during migrations			**975**			

Note. N – north, NE – north east, NW – north west, W – west, SW – south west, E – east, SE – south east, S – south.

Table 1.6. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 20.04.2016 (according to the map chart, Fig. Д 1.6).

Number	Time	Specie	Quantity
1	09.00	*Barn swallow* (*Hirundo rustica*)	**21**
2		*White wagtail (Motacilla alba)*	**2**
3		Rook (*Corvus frugilegus)*	**4**
4		Hooded crow (*Corvus cornix*)	**2**
4		Yellowhammer (*Emberiza citrinella)*	**1**
4		*Hoopoe* (*Upupa epops*)	**1**
4		Eurasian tree sparrow (*Passer montanus*)	**5**
4		European magpie (*Pica pica*)	**2**
5		*Woodpigeon* (*Columba palumbus*)	**2**
6		*Common kestrel* (*Falco tinnunculus)*	**1**
7		Common buzzard *(Buteo buteo)*	**1**
8		*European greenfinch (Chloris chloris)*	**2**
9		Yellowhammer (*Emberiza citrinella)*	1
10		Rook (*Corvus frugilegus)*	**12**
11		Hooded crow (*Corvus cornix*)	**1**
12		*European greenfinch (Chloris chloris)*	**1**
13		*Corn bunting* (*Emberiza calandra*)	**2**
14		*Grey partridge* (*Perdix perdix*)	**2**
15	10.00	Skylark (*Alauda arvensis*)	**2**
16		*Red-footed falcon (Falco vespertinus)*	**1**
17		*Woodpigeon* (*Columba palumbus*)	**2**
18		Yellowhammer (*Emberiza citrinella)*	**1**
19		*Common kestrel* (*Falco tinnunculus)*	**1**
20		European magpie (*Pica pica*)	**2**
21		Yellowhammer (*Emberiza citrinella)*	**2**
22		Hooded crow (*Corvus cornix*)	**1**
23		*Common kestrel* (*Falco tinnunculus)*	**1**
24		*Woodpigeon* (*Columba palumbus*)	**2**
25		Eurasian tree sparrow (*Passer montanus*)	**6**
26		European starling (*Sturnus vulgaris*)	**4**
27		*Common kestrel* (*Falco tinnunculus)*	**1**
28		Hooded crow (*Corvus cornix*)	**1**
29		*European greenfinch (Chloris chloris)*	**2**
30		*Grey partridge* (*Perdix perdix*)	**2**
31		European magpie (*Pica pica*)	**2**
32	11.00	Yellow-legged gull *(Larus cachinnans)*	**7**
33		European magpie (*Pica pica*)	**1**
34		European starling (*Sturnus vulgaris*)	**8**
35		*Corn bunting* (*Emberiza calandra*)	**1**
36		*Crested lark* (*Galerida cristata)*	**2**
37		Hooded crow (*Corvus cornix*)	**2**
38		*Northern wheatear* (*Oenanthe oenanthe*)	**3**
39		Yellow wagtail (*Motacilla flava*)	**4**
40		*Ruff* (*Philomachus pugnax*)	**15**
41		Great white egret (*Egretta alba*)	**3**
41		*Little egret* (*Ardea cinerea*)	**2**
42		*Common kestrel* (*Falco tinnunculus)*	**1**
43		*Calidris spp.*	**23**
44		*Ruff* (*Philomachus pugnax*)	**26**
44		*Northern lapwing* (*Vanellus vanellus*)	**2**
45		*Dunlin (Calidris alpina)*	**18**
45		Ruddy turnstone *(Arenaria interpres)*	**6**
45		Eurasian oystercatcher *(Haematopus ostralegus)*	**2**

45		Grey plover *(Pluvialis squatarola)*	**2**
46		*Pied avocet* (*Recurvirostra avosetta*)	**6**
46	12.00	Eurasian curlew (*Numenius arquata*)	**5**
47		*Dunlin (Calidris alpina)*	**9**
47		*Ruff* (*Philomachus pugnax*)	**11**
47		Common redshank (*Tringa totanus*)	**4**
47		*Northern lapwing* (*Vanellus vanellus*)	**4**
48		Little gull (*Larus ridibundus*)	**21**
49		Common buzzard *(Buteo buteo)*	**1**
50		*Ruff* (*Philomachus pugnax*)	**22**
51		*Common kestrel* (*Falco tinnunculus)*	**2**
52		Hooded crow (*Corvus cornix*)	**1**
53	13.00	Rook (*Corvus frugilegus)*	**8**
Total specimens (34 species) – during accountings			**318**

Table 1.7. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 20.04.2016 (according to the map chart, Fig. Д 1.7).

Number	Time	Specie	Quantity	Migtation type	Height (m)	Direction
1	09.00	Rook (*Corvus frugilegus)*	6	Feeding migration	5	S
2		European starling (*Sturnus vulgaris*)	5	Feeding migration	10	NW
3		*Common kestrel* (*Falco tinnunculus)*	1	Feeding migration	10	N
4		European magpie (*Pica pica*)	2	Feeding migration	5	W
5		Rook (*Corvus frugilegus)*	4	Feeding migration	5	SW
6		Yellowhammer (*Emberiza citrinella)*	1	Feeding migration	3	NE
7		*Corn bunting* (*Emberiza calandra*)	4	Feeding migration	3	S
8		*European goldfinch* (*Carduelis carduelis*)	5	Feeding migration	5	W
9	10.00	*Woodpigeon* (*Columba palumbus*)	1	Feeding migration	5	N
10		*White wagtail (Motacilla alba)*	6	Transit migration	5	NE
11		European magpie (*Pica pica*)	1	Feeding migration	5	W
12		European magpie (*Pica pica*)	2	Feeding migration	5	N
13		*Common kestrel* (*Falco tinnunculus)*	1	Feeding migration	10	S
14		Eurasian tree sparrow (*Passer montanus*)	7	Feeding migration	5	NW
15		European starling (*Sturnus vulgaris*)	8	Feeding migration	10	NE
16		*Common kestrel* (*Falco tinnunculus)*	1	Feeding migration	10	SW
17		Hooded crow (*Corvus cornix*)	2	Feeding migration	5	SW
18		European magpie (*Pica pica*)	1	Feeding migration	10	N
19	11.00	Hooded crow (*Corvus cornix*)	2	Feeding migration	5	N
20		*Corn bunting* (*Emberiza calandra*)	20	Transit migration	5	NW
21		*Barn swallow* (*Hirundo rustica*)	7	Feeding migration	10	NE
22		Eurasian tree sparrow (*Passer montanus*)	12	Feeding migration	5	SW
23		European starling (*Sturnus vulgaris*)	11	Feeding migration	10	S
24		Yellow-legged gull *(Larus cachinnans)*	5	Feeding migration	15	N
25		Yellow wagtail (*Motacilla flava*)	12	Transit migration	5	NE
26		Black-headed gull *(Larus ridibundus)*	5	Feeding	15	N

				migration		
27		*Ruff* (*Philomachus pugnax*)	50	Transit migration	30	S
28		*Pied avocet* (*Recurvirostra avosetta*)	2	Feeding migration	10	NW
29		*White wagtail (Motacilla alba)*	8	Transit migration	3	N
30		*Ruff* (*Philomachus pugnax*)	27	Transit migration	30	S
31	12.00	Dunlin *(Cal. alpina)*	10	Transit migration	3	NW
32		Dunlin *(Cal. alpina)*	8	Transit migration	5	N
33		Rook (*Corvus frugilegus)*	8	Feeding migration	10	S
34		Yellow wagtail (*Motacilla flava*)	5	Transit migration	3	NE
35		*Ruff* (*Philomachus pugnax*)	60	Transit migration	30	N
36		*Woodpigeon* (*Columba palumbus*)	4	Feeding migration	10	S
37		*Calidris spp.*	20	Transit migration	10	N
38		*Ruff* (*Philomachus pugnax*)	46	Transit migration	20	NE
39		Hooded crow (*Corvus cornix*)	2	Feeding migration	10	S
40		European starling (*Sturnus vulgaris*)	16	Feeding migration	5	N
41	13.00	*Calidris spp.*	80	Transit migration	10	N
Total specimens (19 species) – during migrations			**478**			

Note. N – north, NE – north east, NW – north west, W – west, SW – south west, E – east, SE – south east, S – south.

Table Д 1.8. Accounting results of nesting birds within the site of the Wind Farm on 23 – 25.04.2016 and 10 - 15.05.2016 (according to the map chart, Fig. Д 1.8).

Number	Specie	Nests
Site 1		
1	*Athene noctua (Athene noctua)*	1
1	Hooded crow (*Corvus cornix*)	1
2	Yellowhammer (*Emberiza citrinella)*	1*
2	Barred warbler *(Sylvia nisoria)*	1*
2	Garden warbler *(Sylvia borin)*	2*
2	Sylvia communis (Sylvia communis)	1
2	Long-eared owl *(Asio otus)*	1*
2	*European greenfinch (Chloris chloris)*	1*
2	Red-backed shrike *(Lanius collurio)*	1
2	*Chaffinch* (*Fringilla coelebs)*	1
3	Turtle dove *(Streptopelia turtur)*	**1**
4	*Woodpigeon* (*Columba palumbus*)	1
5	*Common kestrel* (*Falco tinnunculus)*	1
6	*Thrush nightingale (Luscinia luscinia)*	1*
7	Hooded crow (*Corvus cornix*)	1
8	*Woodpigeon* (*Columba palumbus*)	1
9	Red-backed shrike *(Lanius collurio)*	1
10	Tawny pipit *(Anthus campestris)*	**1**
11	Garden warbler *(Sylvia borin)*	1
12	Rook (*Corvus frugilegus)*	12
13	Long-eared owl *(Asio otus)*	1*
14	European magpie (*Pica pica*)	1
15	*Common kestrel* (*Falco tinnunculus)*	1
16	Lesser grey shrike *(Lanius minor)*	1
17	*Thrush nightingale (Luscinia luscinia)*	1*
18	*Red-footed falcon (Falco vespertinus)*	**1**
19	European magpie (*Pica pica*)	1
20	Hooded crow (*Corvus cornix*)	1
21	Turtle dove *(Streptopelia turtur)*	**1**
22	Tawny pipit *(Anthus campestris)*	**1**
23	Rook (*Corvus frugilegus)*	42
24	European magpie (*Pica pica*)	1
25	Yellowhammer (*Emberiza citrinella)*	1*
26	Skylark (*Alauda arvensis*)	6*
27	*Grey partridge* (*Perdix perdix*)	1*
28	Lesser grey shrike *(Lanius minor)*	1
29	*Common quail (Coturnix coturnix)*	1*
30	Rook (*Corvus frugilegus)*	98
Total for Site 1 (species/nests)		22/175
Site 2		
31	Tawny pipit *(Anthus campestris)*	1
32	*Chaffinch* (*Fringilla coelebs)*	1
32	Red-backed shrike *(Lanius collurio)*	1
32	*European goldfinch* (*Carduelis carduelis*)	1*
33	*Woodpigeon* (*Columba palumbus*)	1
33	Garden warbler *(Sylvia borin)*	1
33	*Common kestrel* (*Falco tinnunculus)*	1
33	Yellowhammer (*Emberiza citrinella)*	1
34	Lesser grey shrike *(Lanius minor)*	1
35	*Woodpigeon* (*Columba palumbus*)	1

36	*Common kestrel* (*Falco tinnunculus)*	1
37	Long-eared owl *(Asio otus)*	1
38	European magpie (*Pica pica*)	1
39	Lesser grey shrike *(Lanius minor)*	1
40	Yellowhammer (*Emberiza citrinella)*	1*
41	Hooded crow (*Corvus cornix*)	1
42	*Common kestrel* (*Falco tinnunculus)*	1
43	*Hoopoe* (*Upupa epops*)	**1**
44	*Grey partridge* (*Perdix perdix*)	1
45	Skylark (*Alauda arvensis*)	4*
46	Common scops owl *(Otus scops)*	1*
47	Skylark (*Alauda arvensis*)	6*
48	*Thrush nightingale (Luscinia luscinia)*	1*
49	Lesser grey shrike *(Lanius minor)*	1
50	*European goldfinch* (*Carduelis carduelis*)	1*
51	*Golden oriole (Oriolus oriolus)*	1*
52	*Chaffinch* (*Fringilla coelebs)*	**1**
53	Hooded crow (*Corvus cornix*)	1
54	*Common kestrel* (*Falco tinnunculus)*	1
55	Yellowhammer (*Emberiza citrinella)*	1*
56	*European greenfinch (Chloris chloris)*	1*
57	*Woodpigeon* (*Columba palumbus*)	1
58	Skylark (*Alauda arvensis*)	2*
59	Tawny pipit *(Anthus campestris)*	1*
60	*Common kestrel* (*Falco tinnunculus)*	1
61	*Woodpigeon* (*Columba palumbus*)	1
62	Hooded crow (*Corvus cornix*)	1
Total for Site 2 (species/nests)		**20/25**
Total (species/nests)		**26/200**

Note: ***** - the nesting behavior.

Table 1.9. Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 28.07.2016 (according to the map chart, Fig. Д 1.9).

Number	Time	Specie	Quantity
Site of Wind Park			
1	08.00	Rook (*Corvus frugilegus)*	**15**
2		*Chaffinch* (*Fringilla coelebs)*	**1**
3		European magpie (*Pica pica*)	**2**
4		Turtle dove *(Streptopelia turtur)*	**4**
5		*Common kestrel* (*Falco tinnunculus)*	**1**
6		*Woodpigeon* (*Columba palumbus*)	**2**
7		Skylark (*Alauda arvensis*)	**6**
8		*White wagtail (Motacilla alba)*	**2**
9		European magpie (*Pica pica*)	**4**
10		*Grey partridge* (*Perdix perdix*)	**6**
11		*Common kestrel* (*Falco tinnunculus)*	**2**
12		Yellowhammer (*Emberiza citrinella)*	**1**
13		Lesser grey shrike *(Lanius minor)*	**2**
14		*Crested lark (Galerida cristata)*	**6**
15	09.00	*Common quail (Coturnix coturnix)*	1
16		Lesser grey shrike *(Lanius minor)*	**1**
17		Common buzzard *(Buteo buteo)*	**1**
18		Lesser grey shrike *(Lanius minor)*	**2**
19		Rook (*Corvus frugilegus)*	**12**
20		*Red-footed falcon (Falco vespertinus)*	**2**
21		Lesser grey shrike *(Lanius minor)*	**6**
22		European magpie (*Pica pica*)	**4**
23		*Common kestrel* (*Falco tinnunculus)*	**1**
24		Common buzzard *(Buteo buteo)*	**1**
25		Eurasian tree sparrow (*Passer montanus*)	**12**
26	10.00	Rook (*Corvus frugilegus)*	**28**
27		Yellow wagtail (*Motacilla flava*)	4
28		European starling (*Sturnus vulgaris*)	**12**
29		*Little egret* (*Ardea cinerea*)	**1**
30		*Common kestrel* (*Falco tinnunculus)*	**1**
31		Turtle dove *(Streptopelia turtur)*	**2**
32		Lesser grey shrike *(Lanius minor)*	**2**
33		*Chaffinch* (*Fringilla coelebs)*	**1**
34		*Hoopoe* (*Upupa epops*)	**1**
35		*Common kestrel* (*Falco tinnunculus)*	**1**
36		*Red-footed falcon (Falco vespertinus)*	**4**
37		European magpie (*Pica pica*)	**2**
38		Hooded crow (*Corvus cornix*)	**3**
39		Garden warbler *(Sylvia borin)*	**1**
40		Turtle dove *(Streptopelia turtur)*	**1**
41	11.00	Long-legged buzzard *(Buteo rufinus)*	**2**
42		Red-backed shrike *(Lanius collurio)*	**2**
43		Tawny pipit *(Anthus campestris)*	**1**
44		Yellowhammer (*Emberiza citrinella)*	**1**
45		European magpie (*Pica pica*)	**4**
46		Lesser grey shrike *(Lanius minor)*	**2**
47		Little gull (*Larus ridibundus*)	**25**
48		*Grey partridge* (*Perdix perdix*)	**8**
49		Rook (*Corvus frugilegus)*	**80**
50		*Common kestrel* (*Falco tinnunculus)*	**2**
51		European magpie (*Pica pica*)	**1**
52		Hooded crow (*Corvus cornix*)	**2**

53		*Golden oriole (Oriolus oriolus)*	**1**
54		Skylark (*Alauda arvensis*)	**6**
55		Lesser grey shrike *(Lanius minor)*	**1**
56		Hooded crow (*Corvus cornix*)	**2**
57	12.00	Rook (*Corvus frugilegus)*	**124**
Total			**425**
Buffer zones.			
58		European magpie (*Pica pica*)	**1**
59		Common redshank (*Tringa totanus*)	**4**
60		Yellow-legged gull *(Larus cachinnans)*	**12**
61		*Common tern (Sterna hirundo)*	**8**
62		*Ruff* (*Philomachus pugnax*)	**21**
63		*Ruff* (*Philomachus pugnax*)	**17**
64	13.00	*Dunlin (Calidris alpina)*	**5**
65		*Common kestrel* (*Falco tinnunculus)*	**3**
66		Hooded crow (*Corvus cornix*)	**5**
67		Ruddy turnstone *(Arenaria interpres)*	**6**
68		Eurasian curlew (*Numenius arquata*)	**3**
69		Yellow-legged gull *(Larus cachinnans)*	**5**
70		*Sandwich tern (Thalasseus sandvicensis)*	**21**
71		Skylark (*Alauda arvensis*)	**4**
72		Rook (*Corvus frugilegus)*	**12**
73		*Ruff* (*Philomachus pugnax*)	**68**
74		*Ruff* (*Philomachus pugnax*)	**27**
75		Yellow wagtail (*Motacilla flava*)	**9**
76	14.00	*Ruff* (*Philomachus pugnax*)	**12**
Total			**243**
Total specimens (35 species) – during accountings			**668**

Table 1.10. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 28.07.2016 (according to the map chart, Fig. Д 1.10).

Number	Time	Specie	Quantity	Migtation type	Height (m)	Direction
1	08.00	*Barn swallow* (*Hirundo rustica*)	8	Feeding migration	5	S
2		Yellow-legged gull *(L. cachinnans)*	2	Feeding migration	10	W
3		Rook (*Corvus frugilegus)*	8	Feeding migration	5	N
4		Hooded crow (*Corvus cornix*)	4	Feeding migration	10	SE
5	09.00	Yellow-legged gull *(L. cachinnans)*	2	Feeding migration	15	NE
6		*Barn swallow* (*Hirundo rustica*)	8	Feeding migration	5	W
7	10.00	Hooded crow (*Corvus cornix*)	4	Feeding migration	10	SE
8		Little gull (*Larus ridibundus*)	12	Feeding migration	10	W
9		Yellow-legged gull (*L. cachinnans)*	2	Feeding migration	15	N
10	11.00	*Barn swallow* (*Hirundo rustica*)	12	Feeding migration	5	W
11		Little gull (*Larus ridibundus*)	16	Feeding migration	10	SE
12	12.00	Rook (*Corvus frugilegus)*	10	Feeding migration	10	W
13		Yellow-legged gull *(L. cachinnans)*	6	Feeding migration	5	N
14		Skylark (*Alauda arvensis*)	5	Feeding migration	3	NW
15		Rook (*Corvus frugilegus)*	7	Feeding migration	10	SW
16		*Common kestrel* (*Falco tinnunculus)*	1	Feeding migration	10	NE
17		Little gull (*Larus ridibundus*)	4,4,2,6 (16)	Feeding migration	15	N
18	13.00	*Ruff* (*Philomachus pugnax*)	45	Feeding migration	10	N
19		European magpie (*Pica pica*)	5	Feeding migration	5	N
20		Dunlin *(Cal. alpina)*	21	Feeding migration	3	SW
21		*Common tern (Sterna hirundo)*	3	Feeding migration	5	N
22		Sandwich tern *(Thal. sandvicensis)*	7	Feeding migration	10	NW
23		*Ruff* (*Philomachus pugnax*)	18	Feeding migration	10	S
24		*Ruff* (*Philomachus pugnax*)	26	Feeding migration	15	S
Total specimens (12 species) – during migrations			**248**			

Note. N – north, NE – north east, NW – north west, W – west, SW – south west, E – east, SE – south east, S – south.

Table 1.11. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 07.08.2016 (according to the map chart, Fig. Д 1.11).

Number	Time	Specie	Quantity
1	6.50	*Common kestrel* (*Falco tinnunculus)*	**3**
		Domestic pigeon (*Columba livia var. domestica*)	**50**
		Barn swallow (*Hirundo rustica*)	**155**
		Lesser grey shrike *(Lanius minor)*	**2**
		Eurasian tree sparrow (*Passer montanus*)	**5**
		House sparrow (*Passer domesticus*)	**10**
		European greenfinch (Chloris chloris)	**1**
		Thrush nightingale (Luscinia luscinia)	**1**
2		*Northern wheatear* (*Oenanthe oenanthe*)	**1**
		Common kestrel (*Falco tinnunculus)*	**1**
		Red-backed shrike *(Lanius collurio)*	**2**
		Lesser grey shrike *(Lanius minor)*	**10**
3		*Common kestrel* (*Falco tinnunculus)*	**1**
4		*Woodpigeon* (*Columba palumbus*)	**1**
5		Turtle dove *(Streptopelia turtur)*	**1**
		Common kestrel (*Falco tinnunculus)*	**1**
		Red-backed shrike *(Lanius collurio)*	**2**
		Lesser grey shrike *(Lanius minor)*	**11**
6		Red-backed shrike *(Lanius collurio)*	**3**
7		*Common kestrel* (*Falco tinnunculus)*	**1**
8		European magpie (*Pica pica*)	**1**
9		*Golden oriole (Oriolus oriolus)*	**1**
10	8.00	Common redstart (*Ph. phoenicurus*)	**1**
11		Eurasian tree sparrow (*Passer montanus*)	**25**
12		*Thrush nightingale (Luscinia luscinia)*	**1**
13		Hooded crow (*Corvus cornix*)	**2**
14		Lesser grey shrike *(Lanius minor)*	**7**
15		Common swift (*Apus apus*)	**20**
		Hoopoe (*Upupa epops*)	**1**
		Barn swallow (*Hirundo rustica*)	**50**
		Red-footed falcon (Falco vespertinus)	**1**
		Little owl (*Athene noctua*)	**1**
		Crested lark (*Galerida cristata)*	**1**
		White wagtail (Motacilla alba)	**2**
16		*Great crested grebe* (*Podiceps cristatus*)	**17**
		Little egret (*Egretta garzetta*)	**1**
		Little egret (*Ardea cinerea*)	**2**
		Long-legged buzzard (*Buteo rufinus*)	**2**
		Common buzzard *(Buteo buteo)*	**1**
		Common kestrel (*Falco tinnunculus)*	**2**
17	9.00	Turtle dove *(Streptopelia turtur)*	**3**
		Eurasian collared dove (*Streptopelia decaocto*)	**7**
		Linnet (*Acanthis cannabina*)	**1**
		Corn bunting (*Emberiza calandra*)	**2**
18		*Hoopoe* (*Upupa epops*)	**2**
		Skylark (*Alauda arvensis*)	**2**
		White wagtail (Motacilla alba)	**5**
		Red-backed shrike *(Lanius collurio)*	**2**
		Lesser grey shrike *(Lanius minor)*	**4**
		Golden oriole (Oriolus oriolus)	**1**

		Hooded crow (*Corvus cornix*)	**1**
		Common raven (*Corvus corax)*	**1**
		Corn bunting (*Emberiza calandra*)	**1**
		Yellowhammer (*Emberiza citrinella)*	**5**
		Small passerine birds (*Passer spp*.)	**85**
19		*Common kestrel* (*Falco tinnunculus)*	**2**
		Small passerine birds (*Passer spp*.)	**50**
20		*Common kestrel* (*Falco tinnunculus)*	**3**
		Small passerine birds (*Passer spp*.)	**25**
21		*Common kestrel* (*Falco tinnunculus)*	**4**
22		*Common kestrel* (*Falco tinnunculus)*	**1**
23		European magpie (*Pica pica*)	**2**
24		Hooded crow (*Corvus cornix*)	**5**
		Common raven (*Corvus corax)*	**1**
		Thrush nightingale (Luscinia luscinia)	**2**
		Great tit *(Parus major)*	**1**
		Eurasian tree sparrow (*Passer montanus*)	**10**
		Small passerine birds (*Passer spp*.)	**25**
25		*Common kestrel* (*Falco tinnunculus)*	**2**
26		*Woodpigeon* (*Columba palumbus*)	**1**
		Small passerine birds (*Passer spp*.)	**19**
		European greenfinch (Chloris chloris)	**1**
27	10.00	Domestic pigeon (*Columba livia var. domestica*)	**25**
		Corn bunting (*Emberiza calandra*)	**3**
		Yellowhammer (*Emberiza citrinella)*	**1**
28		Turtle dove *(Streptopelia turtur)*	**3**
		Small passerine birds (*Passer spp*.)	**15**
		Red-backed shrike *(Lanius collurio)*	**6**
		Lesser grey shrike *(Lanius minor)*	**9**
29		Red-backed shrike *(Lanius collurio)*	**2**
		Lesser grey shrike *(Lanius minor)*	**15**
30		European starling (*Sturnus vulgaris*)	**45**
		European goldfinch (*Carduelis carduelis*)	**10**
		Linnet (*Acanthis cannabina*)	**3**
		Hooded crow (*Corvus cornix*)	**1**
31		*Grey partridge* (*Perdix perdix*)	**1**
		European starling (*Sturnus vulgaris*)	**10**
		European magpie (*Pica pica*)	**1**
		Jackdaw (*Corvus monedula*)	**1**
		Rook (*Corvus frugilegus)*	**3**
		Northern wheatear (*Oenanthe oenanthe*)	**1**
		Common redstart (*Ph. phoenicurus*)	**1**
32		Mediterranean gull (*Larus melanocephalus*)	**1**
		Little gull (*Larus ridibundus*)	**3**
		Yellow-legged gull *(Larus cachinnans)*	**2**
		Black-winged stilt (*Himantopus himantopus*)	**13**
		Common redshank (*Tringa totanus*)	**2**
		Red-footed falcon (Falco vespertinus)	**1**
		Common buzzard *(Buteo buteo)*	**2**
		Common kestrel (*Falco tinnunculus)*	**6**
		Ducks (*Anas spp.*)	**10**
		Gulls (*Larus spp*.)	**50**
33	11.00	*Glossy ibis* (*Plegadis falcinellus*)	**8**
		Common shelduck (*Tadorna tadorna*)	**2**
		Mallard *(Anas platyrhynchos)*	**8**
		Common pochard (*Aythya ferina*)	**2**

		Black-winged stilt (*Himantopus himantopus*)	**5**
		Common redshank (*Tringa totanus*)	**2**
		Ruff (*Philomachus pugnax*)	**690**
		Eurasian coot (*Fulica atra)*	**33**
		Common kestrel (*Falco tinnunculus)*	**4**
34		Common buzzard *(Buteo buteo)*	**1**
		Hoopoe (*Upupa epops*)	**1**
		Skylark (*Alauda arvensis*)	**7**
		White wagtail (Motacilla alba)	**25**
		Hooded crow (*Corvus cornix*)	**2**
35	11.45	Yellow wagtail (*Motacilla flava*)	**3**
		Red-backed shrike *(Lanius collurio)*	**3**
		Lesser grey shrike *(Lanius minor)*	**12**
		Northern wheatear (*Oenanthe oenanthe*)	**3**
Total specimens (51 species) – during accountings			**1734**

Table 1.12. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 07.08.2016 (according to the map chart, Fig. Д 1.12).

Number	Time	Specie	Quantity	Migtation type	Height (m)	Direction
36	6.50	*Western marsh-harrier* (*Circus aeruginosus*)	1	Feeding migration	15	SW
37		Rook (*Corvus frugilegus)*	15	Feeding migration	10	S
38		Common kestrel (*F. tinnunculus*)	1	Feeding migration	7	S
39	8.00	*White wagtail (Motacilla alba)*	3	Feeding migration	5	SE
40		Common kestrel (*F. tinnunculus*)	1	Feeding migration	7	W
		Hoopoe (*Upupa epops*)	3	Feeding migration	5	W
41		Mediterranean gull (*L. melanocephalus*)	3	Feeding migration	25	SE
		Little gull (*Larus ridibundus*)	1	Feeding migration	25	SE
42		*Bank swallow* (*Riparia riparia*)	20	Feeding migration	10	SE
43	9.00	Yellow-legged gull *(Larus cachinnans)*	2	Feeding migration	30	W
44		*Chaffinch* (*Fringilla coelebs*)	15	Feeding migration	7	NW
		European goldfinch (*Carduelis carduelis*)	25	Feeding migration	7	NW
		Linnet (*Acanthis cannabina*)	10	Feeding migration	7	NW
		Corn bunting (*Emberiza calandra*)	3	Feeding migration	7	NW
		Yellowhammer (*Emberiza citrinella)*	8	Feeding migration	7	NW
45		Long-legged buzzard (*Buteo rufinus*)	1	Feeding migration	50	SW
46	10.00	*Barn swallow* (*Hirundo rustica*)	25	Feeding migration	25	NW
47		Little gull (*Larus ridibundus*)	1	Feeding migration	30	SW
		Terns (*Chlidonias spp*.)	15	Feeding migration	5	SW
48	11.00	*Western marsh-harrier* (*Circus aeruginosus*)	3	Feeding migration	15	SE
49		Common kestrel (*F. tinnunculus*)	1	Feeding migration	10	SE
		Small passerine birds (*Passer spp*.)	28	Feeding migration	5	SE
		Skylark (*Alauda arvensis*)	3	Feeding migration	15	SE
		European starling (*Sturnus vulgaris*)	15	Feeding migration	20	SE
50	11.45	Common buzzard *(Buteo buteo)*	1	Feeding migration	30	SW
		Common raven (*Corvus corax)*	1	Feeding migration	50	SW
Total specimens (19 species) – during migrations			**205**			

Note. N – north, NE – north east, NW – north west, W – west, SW – south west, E – east, SE – south east, S – south.

Table 1.13. Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 28.08.2016 (according to the map chart, Fig. Д 1.13).

Number	Time	Specie	Quantity
1	09.00	Eurasian tree sparrow (*Passer montanus*)	**11**
2		Yellowhammer (*Emberiza citrinella)*	**1**
3		Turtle dove *(Streptopelia turtur)*	**2**
4		European magpie (*Pica pica*)	**2**
5		*European roller* (*Coracias garrulus*)	**2**
6		European bee-eater (*Merops apiaster*)	**5**
7		Tawny pipit *(Anthus campestris)*	**1**
8		*Common kestrel* (*Falco tinnunculus)*	**2**
9		*Eurasian sparrowhawk* (*Accipiter nisus*)	**1**
10	10.00	European starling (*Sturnus vulgaris*)	**12**
11		*Common redstart* (*Phoenic. phoenicurus*)	**2**
12		Red-backed shrike *(Lanius collurio)*	**1**
13		*Hoopoe* (*Upupa epops*)	**1**
14		Yellowhammer (*Emberiza citrinella)*	**1**
15		*Red-footed falcon (Falco vespertinus)*	**2**
16		Skylark (*Alauda arvensis*)	**2**
17		*Common quail (Coturnix coturnix)*	**1**
18		*Grey partridge* (*Perdix perdix*)	**8**
19		*Chaffinch* (*Fringilla coelebs)*	**2**
20		European magpie (*Pica pica*)	**2**
21		*Common kestrel* (*Falco tinnunculus)*	**1**
22		Great tit *(Parus major)*	**3**
23		Yellowhammer (*Emberiza citrinella)*	**1**
24		*Woodpigeon* (*Columba palumbus*)	**2**
25		Hooded crow (*Corvus cornix*)	**2**
26		Lesser grey shrike *(Lanius minor)*	**2**
27		*Chaffinch* (*Fringilla coelebs)*	**1**
28	11.00	*Common kestrel* (*Falco tinnunculus)*	**1**
29		Rook (*Corvus frugilegus)*	**6**
30		Skylark (*Alauda arvensis*)	**4**
31		Yellow wagtail (*Motacilla flava*)	**5**
32		*Little gull (Larus minutus)*	**10**
33		Whiskered tern *(Chlidonias hybrida)*	**8**
34		Black tern *(Chlidonias niger)*	**22**
35		*White wagtail (Motacilla alba)*	**3**
36		Eurasian curlew (*Numenius arquata*)	**4**
37		*Dunlin (Calidris alpina)*	**11**
38		Little gull (*Larus ridibundus*)	**21**
39		European starling (*Sturnus vulgaris*)	**8**
40		Black tern *(Chlidonias niger)*	**14**
41		Common redshank (*Tringa totanus*)	**3**
42		*Ruff* (*Philomachus pugnax*)	**27**
43		*Eurasian oystercatcher*	**2**
44		*Ruff* (*Philomachus pugnax*)	**41**
45	12.00	*Dunlin (Calidris alpina)*	**7**
Total specimens (34 species) – during accountings			**270**

Table 1.14. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 28.08.2016 (according to the map chart, Fig. Д 1.14).

Number	Time	Specie	Quantity	Migtation type	Height (m)	Direction
1	09.00	Rook (*Corvus frugilegus)*	16	Feeding migration	20	N
2		*Barn swallow* (*Hirundo rustica*)	11	Feeding migration	5	S
3		Turtle dove *(Streptopelia turtur)*	4	Feeding migration	5	W
4		Common redstart (*Ph. phoenicurus*)	2	Feeding migration	2	SW
5		Eurasian tree sparrow (*Passer montanus*)	5	Feeding migration	5	SE
6	10.00	*Chaffinch* (*Fringilla coelebs)*	7	Feeding migration	3	SE
7		*Chaffinch* (*Fringilla coelebs)*	4	Feeding migration	3	SE
8		European starling (*Sturnus vulgaris*)	17	Feeding migration	10	NE
9	10.00	*Woodpigeon* (*Columba palumbus*)	2	Feeding migration	5	W
10		Little gull (*Larus ridibundus*)	12	Feeding migration	10	W
11		*Barn swallow* (*Hirundo rustica*)	6	Feeding migration	5	W
12		European magpie (*Pica pica*)	3	Feeding migration	10	N
13		Rook (*Corvus frugilegus)*	28	Feeding migration	15	S
14		Rook (*Corvus frugilegus)*	9	Feeding migration	10	W
15	11.00	*White wagtail (Motacilla alba)*	6	Feeding migration	5	S
16		Yellow wagtail (*Motacilla flava*)	12	Feeding migration	3	SE
17		Black tern *(Chlidonias niger)*	8	Transit migration	2	S
18		Dunlin *(C. alpina)*	6	Transit migration	2	S
19		Ruddy turnstone *(Arenaria interpres)*	8	Transit migration	5	S
20	12.00	Little gull (*Larus ridibundus*)	15	Feeding migration	10	N
21		*Great crested grebe (Podiceps cristatus)*	3	Transit migration	2	S
22		*Little gull (Larus minutus)*	22	Transit migration	10	S
23		*Ruff* (*Philomachus pugnax*)	48	Transit migration	5	S
24		Black tern *(Chlidonias niger)*	21	Transit migration	5	SW
25		Mediterranean gull *(L. melanocephalus)*	9	Transit migration	10	S
26	13.00	Slender-billed gull *(L. genei)*	6	Transit migration	10	S
27		*Little gull (Larus minutus)*	7	Transit migration	10	S

28		Sandwich tern *(T. sandvicensis)*	15	Transit migration	5	S
29		*Ruff* (*Philomachus pugnax*)	18	Feeding migration	5	S
30		*Great crested grebe (Podiceps cristatus)*	8	Transit migration	5	S
31		*Ruff* (*Philomachus pugnax*)	42	Feeding migration	10	W
32		*Barn swallow* (*Hirundo rustica*)	11	Feeding migration	5	N
33	14.00	Rook (*Corvus frugilegus)*	16	Feeding migration	15	N
Total specimens (21 species) – during migrations			**407**			

Note. N – north, NE – north east, NW – north west, W – west, SW – south west, E – east, SE – south east, S – south.

Table 1.15. Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 25.09.2016 (according to the map chart, Fig. Д 1.15).

Number	Time	Specie	Quantity
1	08.00	*Barn swallow* (*Hirundo rustica*)	**8**
2		*Crested lark (Galerida cristata)*	**4**
3		*Eurasian collared dove* (*Streptopelia decaocto*)	**2**
4		Eurasian tree sparrow (*Passer montanus*)	**12**
5		*Red-footed falcon (Falco vespertinus)*	**1**
6		Rook (*Corvus frugilegus)*	**22**
7		*White wagtail (Motacilla alba)*	**6**
8		Great tit *(Parus major)*	**1**
9		Yellowhammer (*Emberiza citrinella)*	**1**
10		*Common kestrel* (*Falco tinnunculus)*	**1**
11	09.00	*Chaffinch* (*Fringilla coelebs)*	**3**
12		Turtle dove *(Streptopelia turtur)*	**1**
13		European magpie (*Pica pica*)	**2**
14		*Grey partridge* (*Perdix perdix*)	**8**
15		*Woodpigeon* (*Columba palumbus*)	**2**
16		European magpie (*Pica pica*)	**1**
17		Blackbird *(Turdus merula)*	**3**
18		*European greenfinch (Chloris chloris)*	**6**
19		Hooded crow (*Corvus cornix*)	**2**
20		*Common kestrel* (*Falco tinnunculus)*	**1**
21	10.00	Yellow-legged gull *(Larus cachinnans)*	**5**
22		*Common kestrel* (*Falco tinnunculus)*	**1**
23		*Woodpigeon* (*Columba palumbus*)	**2**
24		*Grey partridge* (*Perdix perdix*)	**9**
25		Rook (*Corvus frugilegus)*	**10**
26		Hooded crow (*Corvus cornix*)	**2**
27		Rook (*Corvus frugilegus)*	**4**
28		Little gull (*Larus ridibundus*)	**13**
29		Common buzzard *(Buteo buteo)*	**1**
30		Yellow wagtail (*Motacilla flava*)	**4**
31		*Ruff* (*Philomachus pugnax*)	**22**
32		*Corn bunting* (*Emberiza calandra*)	**17**
33		European magpie (*Pica pica*)	**2**
34		European starling (*Sturnus vulgaris*)	**26**
35	11.00	*Common raven* (*Corvus corax)*	**1**
36		Rook (*Corvus frugilegus)*	**3**
37		Hooded crow (*Corvus cornix*)	**2**
38		Jackdaw (*Corvus monedula*)	**2**
39		*Ruff* (*Philomachus pugnax*)	**45**
40		Yellow wagtail (*Motacilla flava*)	**3**
41		Little gull (*Larus ridibundus*)	**10**
42	12.00	Rook (*Corvus frugilegus)*	**8**
43		Yellow-legged gull *(Larus cachinnans)*	**6**
44		*White wagtail (Motacilla alba)*	**8**
45		Rook (*Corvus frugilegus)*	**16**
46		*Northern lapwing* (*Vanellus vanellus*)	**3**
47		Little gull (*Larus ridibundus*)	**22**
48		*Common shelduck* (*Tadorna tadorna*)	**7**
49		European starling (*Sturnus vulgaris*)	**56**
50		Rook (*Corvus frugilegus)*	**16**
51	13.00	Eurasian tree sparrow (*Passer montanus*)	**9**
Total specimens (29 species) – during accountings			**422**

Table 1.16. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 25.09.2016 (according to the map chart, Fig. Д 1.16).

Number	Time	Specie	Quantity	Migtation type	Height (m)	Direction
1	08.00	Eurasian tree sparrow (*Passer montanus*)	11	Feeding migration	5	N
2		*Chaffinch* (*Fringilla coelebs)*	12	Feeding migration	3	S
3		Little gull (*Larus ridibundus*)	6	Feeding migration	10	W
4	09.00	Rook (*Corvus frugilegus)*	10	Feeding migration	15	N
5		*Corn bunting* (*Emberiza calandra*)	14	Transit migration	5	S
6		*Common kestrel* (*Falco tinnun.)*	1	Feeding migration	5	W
7		Blackbird *(Turdus merula)*	4	Feeding migration	2	S
8		*Corn bunting* (*Emberiza calandra*)	23	Transit migration	5	W
9		Yellow wagtail (*Motacilla flava*)	5	Transit migration	3	SW
10		*Chaffinch* (*Fringilla coelebs)*	16	Transit migration	5	SW
11	10.00	*Woodpigeon* (*Columba palumbus*)	4	Feeding migration	10	W
12		*Barn swallow* (*Hirundo rustica*)	8	Feeding migration	5	N
13		Eurasian tree sparrow (*Passer montanus*)	7	Feeding migration	5	SE
14		*Ruff* (*Philomachus pugnax*)	7	Feeding migration	5	SE
15		Yellow wagtail (*Motacilla flava*)	11	Transit migration	5	S
16	11.00	Little gull (*Larus ridibundus*)	5	Feeding migration	10	З
17		European starling (*Sturnus vulgaris*)	27	Feeding migration	10	N
18		*Chaffinch* (*Fringilla coelebs)*	16	Transit migration	5	SE
19		*White wagtail (Motacilla alba)*	14	Transit migration	3	S
20		*Ruff* (*Philomachus pugnax*)	31	Transit migration	10	N
21		*Corn bunting* (*Emberiza calandra*)	13	Transit migration	5	W
22	12.00	*Ruff* (*Philomachus pugnax*)	62	Transit migration	10	З
23		*White wagtail (Motacilla alba)*	4	Transit migration	3	SW
24		Yellow-legged gull *(Larus cachinnans)*	5	Feeding migration	20	S
25		Yellow-legged gull *(Larus cachinnans)*	3	Feeding migration	10	S
26		European starling (*Sturnus vulgaris*)	25	Feeding migration	5	NE
27		Rook (*Corvus frugilegus)*	18	Feeding migration	20	N

28		European magpie (*Pica pica*)	5	Feeding migration	10	SW
29	13.00	*White wagtail (Motacilla alba)*	5	Transit migration	3	W
Total specimens (15 species) – during migrations			**372**			

Note. **N** – north, **NE** – north east, **NW** – north west, **W** – west, **SW** – south west, **E** – east, **SE** – south east, **S** – south.

Table 1.17. Bird accounting results on the plots of the site of the Wind Farm and buffer zones on 09.10.2016 (according to the map chart, Fig. Д 1.17).

Number	Time	Specie	Quantity
1	08.00	*White wagtail (Motacilla alba)*	**1**
2		Yellowhammer (*Emberiza citrinella)*	**1**
3		*Common kestrel* (*Falco tinnunculus)*	**1**
4		Yellow-legged gull *(Larus cachinnans)*	**65**
5		European magpie (*Pica pica*)	**1**
6		Long-legged buzzard (*Buteo rufinus*)	**1**
7		*Eurasian sparrowhawk* (*Accipiter nisus*)	**1**
8		*European greenfinch (Chloris chloris)*	**24**
9		*Fieldfare* (*Turdus pilaris)*	**6**
10	09.00	Hooded crow (*Corvus cornix*)	**1**
11		Hooded crow (*Corvus cornix*)	**2**
12		*Common kestrel* (*Falco tinnunculus)*	**1**
13		Common buzzard *(Buteo buteo)*	**1**
14		European magpie (*Pica pica*)	**3**
15		Hooded crow (*Corvus cornix*)	**1**
16		Yellow-legged gull *(Larus cachinnans)*	**13**
17		*Common kestrel* (*Falco tinnunculus)*	**1**
18	11.00	Rook (*Corvus frugilegus)*	**6**
19		*Eurasian sparrowhawk* (*Accipiter nisus*)	**1**
20		Hooded crow (*Corvus cornix*)	**2**
21		*Eurasian sparrowhawk* (*Accipiter nisus*)	**1**
22		*Chaffinch* (*Fringilla coelebs)*	**20**
23		*Ruff* (*Philomachus pugnax*)	**18**
24		*Woodpigeon* (*Columba palumbus*)	**2**
25		*Woodpigeon* (*Columba palumbus*)	**3**
26		*Common kestrel* (*Falco tinnunculus)*	**1**
27	12.00	*Common kestrel* (*Falco tinnunculus)*	**1**
28		Rook (*Corvus frugilegus)*	**45**
29		*Common kestrel* (*Falco tinnunculus)*	**1**
30		Long-legged buzzard (*Buteo rufinus*)	**1**
31		*Grey partridge* (*Perdix perdix*)	**12**
32		*Grey partridge* (*Perdix perdix*)	**8**
33		Little gull (*Larus ridibundus*)	**600**
34		*Great crested grebe* (*Podiceps cristatus*)	**2**
35	13.00	Little gull (*Larus ridibundus*)	**850**
36		Great white egret (*Egretta alba*)	**3**
37		*Little egret* (*Ardea cinerea*)	**2**
38		Little gull (*Larus ridibundus*)	**30**
39		Little gull (*Larus ridibundus*)	**140**
40		*Great crested grebe* (*Podiceps cristatus*)	**5**
Total specimens (20 species) – during accountings			**1878**

Table 1.18. Accounting results of bird migratory movements within the site of the Wind Farm and buffer zones on 09.10.2016 (according to the map chart, Fig. Д 1.18).

Number	Time	Specie	Quantity	Migtation type	Height (m)	Direction
1	08.00	Rook (*Corvus frugilegus)*	2	Feeding migration	20	N
2		Rook (*Corvus frugilegus)*	8	Feeding migration	5	N
3		*Common raven* (*Corvus corax)*	1	Feeding migration	15	N
4		Common buzzard *(Buteo buteo)*	1	Feeding migration	10	S
5		Blackbird (*Turdus merula)*	4	Transit migration	2	N
6		*European robin* (*Erithacus rubecula)*	3	Transit migration	3	N
7		*Corn bunting* (*Emberiza calandra*)	12	Transit migration	5	W
8		European pied flycatcher (*Fic. hypoleuca*)	2	Transit migration	2	S
9		Yellow-legged gull *(L. cachinnans)*	12	Feeding migration	10	W
10		Blackbird (*Turdus merula)*	3	Transit migration	2	N
11		*Chaffinch* (*Fringilla coelebs)*	22	Transit migration	5	W
12		*Eurasian sparrowhawk* (*Accipiter nisus*)	2	Transit migration	10	W
13		*Woodpigeon* (*Columba palumbus*)	5	Transit migration	10	S
14		*European greenfinch (Chloris chloris)*	8	Transit migration	10	S
15		European magpie (*Pica pica*)	3	Feeding migration	5	N
16		*White wagtail (Motacilla alba)*	2,10,8,2,2 (24)	Transit migration	5	S
17		*White wagtail (Motacilla alba)*	2,4,6,2,2 (16)	Transit migration	5	S
18		Yellow-legged gull (*L. cachinnans)*	2,8,2,2(14)	Feeding migration	10	S
19		*Great crested grebe* (*Podiceps cristatus*)	2,1,1,2,1(7)	Transit migration	2	S
20		Black-headed gull (*L. ridibundus)*	2,2,1,2,3,1, 1,4,2,4 (22)	Feeding migration	10	S
21		*Eurasian sparrowhawk* (*Accipiter nisus*)	1	Transit migration	10	W
22		*Ruff* (*Philomachus pugnax*)	65	Transit migration	10	З
23		*Corn bunting* (*Emberiza calandra*)	8	Transit migration	5	S
24		Black-headed gull (*L. ridibundus)*	18	Feeding migration	15	S
Total specimens (17 species) – during migrations			**263**			

Note. N – north, NE – north east, NW – north west, W – west, SW – south west, E – east, SE – south east, S – south.

Table 1.19. Bird accounting results within the sites of the Wind Farm, buffer zones and adjacent territories on 26.10.2016 (according to the map chart, Fig. Д 1.19).

Number	Time	Specie	Quantity
1	7.50	*Eurasian jay* (*Garrulus glandarius*)	**1**
2		Rook (*Corvus frugilegus)*	**10**
3		Great egret (*Egretta alba*)	**11**
4		Mallard *(Anas platyrhynchos)*	**7**
5		*Little egret* (*Ardea cinerea*)	**3**
6		*Eurasian collared dove* (*Streptopelia decaocto*)	**22**
7	9.00	Domestic pigeon (*Columba livia var. domestica*)	**120**
8		*Eurasian collared dove* (*Streptopelia decaocto*)	**2**
9		Hooded crow (*Corvus cornix*)	**2**
		Corn bunting (*Miliaria calandra*)	**2**
10		Eurasian tree sparrow (*Passer montanus*)	**25**
11		European magpie (*Pica pica*)	**1**
12		Hooded crow (*Corvus cornix*)	**2**
13	10.00	*Great crested grebe (Podiceps cristatus)*	**5**
		Mallard *(Anas platyrhynchos)*	**150**
		Northern pintail (*Anas acuta*)	**9**
		Garganey (*Anas querquedula*)	**25**
		Ducks spp.	**450**
14		European magpie (*Pica pica*)	**1**
15		Blackbird (*Turdus merula)*	**1**
16		Hooded crow (*Corvus cornix*)	**2**
17		*House sparrow* (*Passer domesticus*)	**32**
18		Eurasian tree sparrow (*Passer montanus*)	**5**
19		Rough-legged buzzard (*Buteo lagopus*)	**1**
20		*Stock pigeon* (*Columba oenas*)	**4**
21	11.00	Great tit *(Parus major)*	**1**
22		Common buzzard *(Buteo buteo)*	**2**
23		*Common raven* (*Corvus corax)*	**1**
24		Eurasian tree sparrow (*Passer montanus*)	**5**
25		*Linnet* (*Acanthis cannabina*)	**10**
26		*European goldfinch* (*Carduelis carduelis*)	**25**
27		Eurasian tree sparrow (*Passer montanus*)	**50**
28		European magpie (*Pica pica*)	**3**
29		*Common kestrel* (*Falco tinnunculus)*	**1**
30		Winter wren *(Troglodytes troglodytes)*	**1**
31	12.00	Yellow-legged gull *(Larus cachinnans)*	**70**
		Gulls spp.	**150**
32		Rook (*Corvus frugilegus)*	**15**
		Hooded crow (*Corvus cornix*)	**4**
		Syrian woodpecker (*Dendrocopos syriacus*)	**1**
33		*Crested lark* (*Galerida cristata)*	**2**
34		Skylark (*Alauda arvensis*)	**3**
35		Passerinae spp.	**42**
36	13.00	Eurasian tree sparrow (*Passer montanus*)	**25**
37		African stonechat (*Saxicola torquata*)	**2**
38		European magpie (*Pica pica*)	**1**
39	13.45	Hooded crow (*Corvus cornix*)	**3**
		Grey partridge (*Perdix perdix*)	**8**
		Ring-necked pheasant (*Phasianus colchicus*)	**1**
Total specimens (41 species) – during accountings			**1319**

Table 1.20. Accounting results of bird migratory movements within the sites of the Wind Farm, buffer zones and adjacent territories on 26.10.2016 (according to the map chart, Fig. Д 1.20).

Number	Time	Specie	Quantity	Migtation type	Height (m)	Direction
40	7.50	*European goldfinch* (*Carduelis carduelis*)	52	Feeding migration	5	SW
		Rook (*Corvus frugilegus)*	100	Feeding migration	20	SW
41		*European goldfinch* (*Carduelis carduelis*)	40	Feeding migration	7	SW
42		*Linnet* (*Acanthis cannabina*)	5	Feeding migration	7	SW
43		European starling (*Sturnus vulgaris*)	200	Feeding migration	50	SE
44	9.00	*Chaffinch* (*Fringilla coelebs*)	15	Feeding migration	10	NE
45	10.00	Little gull (*Larus ridibundus*)	100	Feeding migration	15	W
46		Rook (*Corvus frugilegus)*	70	Feeding migration	35	S
47		*Chaffinch* (*Fringilla coelebs*)	10	Feeding migration	10	SE
48		European starling (*Sturnus vulgaris*)	250	Feeding migration	50	SW
49	11.00	*European goldfinch* (*Carduelis carduelis*)	35	Feeding migration	15	SE
50		Passerinae spp.	23	Feeding migration	10	NE
51		*European goldfinch* (*Carduelis carduelis*)	35	Feeding migration	7	NE
52		Common buzzard *(Buteo buteo)*	1	Feeding migration	25	SE
53		*Fieldfare* (*Turdus pilaris)*	35	Feeding migration	5	NW
54		Hooded crow (*Corvus cornix*)	3	Feeding migration	10	SE
55		Little gull (*Larus ridibundus*)	250	Feeding migration	10	SE
56		Yellow-legged gull (*L. cachinnans)*	3	Feeding migration	10	NW
57	12.00	*Passerinae spp.*	35	Feeding migration	5	S
58		*European greenfinch (Chloris chloris)*	5	Feeding migration	5	SW
59		European starling (*Sturnus vulgaris*)	600	Feeding migration	30	SE
		European starling (*Sturnus vulgaris*)	100	Feeding migration	40	SE
60		*Common raven* (*Corvus corax)*	2	Feeding migration	50	SW
		European goldfinch (*Carduelis carduelis*)	30	Feeding migration	5	SW
61	13.00	*Fieldfare* (*Turdus pilaris)*	12	Feeding migration	5	S

62	13.45	Long-legged buzzard (*Buteo rufinus*)	1	Feeding migration	35	SE
Total specimens (13 species) – during migrations			**2012**			

Note. N – north, NE – north east, NW – north west, W – west, SW – south west, E – east, SE – south east, S – south.