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2. Institute of Biology of Southern Seas, Odessa Branch, Department of Water Quality Assessment.
3. Azov-Black Sea Ornithological station, Melitopol.
4. Odessa National University, Biological Faculty, Department of Zoology.
5. Danube Biosphere Reserve, Vilkovo.
6. Odessa National University, Biological Faculty, Department of Hydrobiology.
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These co-operations made fieldwork easier and made it possible to educate other fieldworkers on dragonflies.

Summary

In this report information gathered during the project 'Guardians of the watershed: Identifying Important Dragonfly Areas in Southwest Ukraine' is presented. The project was conducted from July 2006 to December 2007. The work for the project was coordinated by Elena Dyatlova in close co-operation with Vincent Kalkman and was funded by the Dutch ministry of Agriculture and Nature conservation. The project resulted in an overview of the dragonfly fauna and a list of Important Dragonflies Areas of SW Ukraine. This information is important when establishing new nature reserves and for the management of existing reserves. In order to do so a database was created containing Ukrainian records and additional fieldwork have been conducted. Based on four criteria six areas were selected as Important Dragonfly Areas:

1) Reservoirs in a lower part of Khadzhibejski Liman
2) Basin of South Bug and Ingul rivers
3) Lower Dniestr with tributaries and lakes and Dniestrovski Liman
4) Kinburn Peninsular
5) Dniepr Delta
6) Lower Danube and Predanube Region

Distribution maps of all species have been made available on internet (http://tinyurl.com/2brh5n). The project resulted in the start of an informal organised Odonata-community in Ukraine, which will maintain and further expand the database with distributional records.

1. INTRODUCTION

1.1. Dragonflies and conservation

Dragonflies are amongst the most visible and well-known freshwater animals due to their displays over water and their often bright colours. The group features prominently in nature management in the temperate regions of the world and they are often used as indicators for environmental health and conservation management. Their sensitivity to structural habitat quality (e.g. forest cover, water clarity) and amphibious habits make dragonflies well suited for use in evaluating environmental change in the long term (biogeography, climatology) and in the short term (conservation biology). The species are relatively easy to identify which enables mapping schemes conducted by volunteers, facilitating the use of distributional data on dragonflies in management. Many species in the temperate regions have shown a dramatic decline in distribution and abundance *(Sahlén et al., 2004).* Ukraine has a rich dragonfly fauna and 74 of the 130 European species are known from its territory. The distribution of the species occurring in Ukraine is reasonably well known *(Gorb et al., 2000)*. The best information was available for the southwestern part of Ukraine *(Dyatlova, 2006)*. However this information was not available in a form in which it can be used for nature management and an overview areas of importance to dragonflies was lacking.

The last edition of the Red Book of Ukraine was published in 1994. In a list of protected species the dragonflies *Calopteryx virgo*, *C. splendens ssp. taurica*, *Cercion lindeni, Coenagrion mercuriale, Anax imperator* and *Cordulegaster annulata* were included. The list included in this book is somewhat outdated. *Coenagrion mercuriale* is absent from the territory of Ukraine and the status of other species need re-evaluation. In Dyatlova *(2005d)* and Khrokalo *(2005)* a new list of species to be included in the new edition of Red Book were proposed.

1.2. Identifying Important Dragonfly Areas in Southwest Ukraine

Information on the distribution of dragonflies in Ukraine is scattered among scientific papers and in private and museum collections. In the monograph 'Dragonflies of Ukraine' *(Gorb et al., 2000)* records from SW Ukraine were mentioned but an overview of the regional fauna with information on habitats and rare species has been lacking. Due to this the information is not readily available for policy makers, making it difficult for them to use dragonflies as a conservation and management tool. The project 'Identifying Important Dragonfly Areas in SW Ukraine' addresses this problem by making the needed information available. The project had three main purposes:

1) Combining distributional records from literature, collections and fieldwork in a database.

2) Establishing a list of Important Dragonfly Area's based on the information gathered in the database.

3) Establishing a informal organised community of volunteers interested in dragonflies.

In this report information is given on the distribution of protected or rare species in SW Ukraine. Based on this information Important Dragonfly Areas are selected and described. The information on which this report is based is available through the website: http://dragonflyforall.narod.ru/. For more detailed information on the species and their protection the senior author can be contacted (Elena Dyatlova, lena.dyatlova@gmail.com)

2. STUDY AREA

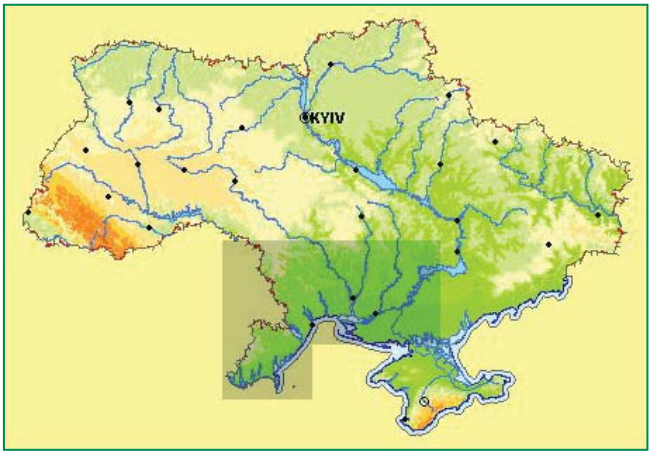
The territory of Ukraine is situated in the temperate zone of the Northern Hemisphere. The area of the whole country is 603,7 thousand sq. km. The current report focuses on the SW Ukraine and covers the territories administratively belonging to Odessa, Nikolaev and Kherson provinces. The area belongs to the plain Eastern European landscapes, which include steppe, dry-steppe and forest-steppe zones *(Physical geography of Ukraine, 2003)*.

All rivers in the area drain to the Black Sea Basin. Surface waters of the area includes large and small rivers, lakes, lagoons and reservoir storages. The main water arteries are large rivers: Danube, Dniestr, South Bug, Dniepr and their numerous tributaries and small rivers inflowing into the Black Sea *(Physical geography of Ukraine, 2003)*.

The climate is temperate-continental, intermediate from mild climate of Western Europe to continental climate of Eastern-European regions. The area experiences short, mild winters and hot summers. Delta parts of big rivers have specific climatic conditions. The daily and yearly oscillations of air temperature are here lower; the average value of relative humidity is higher in comparison with the surrounding steeps *(Nature of Odessa Province, 1979; Physical geography of Ukraine, 2003)*.

SW Ukraine is dominated by a large area of agriculture, it is very open (almost no natural forest) and large areas are devoid of any water. Habitats as bogs and peat marshes are lacking and almost all river systems are flooded in spring.

The main threats on freshwater ecosystems are hydroelectric power plants (eg. Dniestr River), pollution of wetlands, regulation and modification of the rivers and degradation of biotopes as a result of agricultural activities such as mass grazing and tillage. The negative influence has the destruction of natural connection between lakes and river with the artificial dams (eg, Danube River and predanube lakes), this caused the soiling of lakes bottom. In some cases this resulted in the mass loss of fish and other organisms. The transformation of naturally brackish lakes into reservoirs used for water storage caused negative impact on ecosystems. In some cases the surrounding soils became unsuitable for agriculture because of salinization (eg. Sasyk Lake) *(Wetlands of Ukraine, 2006)*. Men-induced fires in wetlands have impacted strongly on invertebrates diversity and their substrates for their development. They are especially very regular in dry years (ex. 2007).



Map of Ukraine (study area is indicated)

Turunchuk River, Dniestr Delta branch in spring.
Photo E. Dyatlova

Fire in the wetlands of the Lower Dniestr.
Photo A. Martynov

Heavy grassing pressure result in the loss of vegetation on the banks and has negative impacts on dragonfly diversity (Ingul River).
Photo E. Dyatlova

3. METHODS

3.1. Odonatological database

An overview of the distribution of dragonflies was needed in order to select areas with high importance for dragonflies. For this a Microsoft Access database was used to store records from literature, collections and fieldwork. The structure of the database was made by European Invertebrate Survey (the Netherlands) and is the same as used in several other European countries. A list of literature of which the records were digitalized is given in appendix 2. In many cases the identity of old published records was checked in the collection of Zoological Museum of Odessa National University and some hitherto unpublished records from these collection were inserted in the database *(Dyatlova, 2007a; Dyatlova, unpublished data)*. Besides records from collections, also records from new fieldwork were added and records from volunteers were included. The maps of species distribution were prepared using a computer program DMAP.

3.2. Fieldwork

In the field adult dragonflies were collected with a net (diameter of ring — 50 cm; shaft — 1, 80 m). Species easy to identify were released, other specimens were collected as voucher specimen. Larvae were collected with a hand-net in aquatic vegetation and from the bottom. Exuviae were collected on semi-aquatic vegetation.

Adults dragonflies were identified using different national and European literature sources *(Beshovsky, 1994; Gorb et al., 2000; Askew, 2004; Dijkstra, 2006)*. Larvae and exuvia were identified using keys by Matushkina & Khrokalo *(2002)* and Heidemann & Seidenbusch *(2002)*.

3.3. Volunteers

In 2006 a start was made with building a small working group of volunteers interested in dragonflies. A newsletter was issued and information was made available by internet ("Dragonflies of Ukraine" http://dragonflyforall.narod.ru/). At the moment about 16 volunteers are collecting records of Ukrainian dragonflies. 10 of these have contributed records from the SW Ukraine.

3.4. Criteria

Based on the distributional records in the database Important Dragonflies Areas in the SW Ukraine were identified. In order to do so a set of four criteria were applied. These criteria look at both the quality and quantity of the dragonfly fauna of a certain area. The four applied criteria are:

1. Areas with species of European concern:

Coenagrion ornatum (Habitat directive)

Gomphus flavipes (Habitat directive)

Lestes mactostigma (Declining in Europe, Sahlén et al., 2004)

2. Areas with species protected on the national level *(Red Book of Ukraine, 1994)*:

Anax imperator (III category of conservation)

Erythromma lindenii (I category of conservation)

3. Areas where species rare in the study area (but not protected) occur:

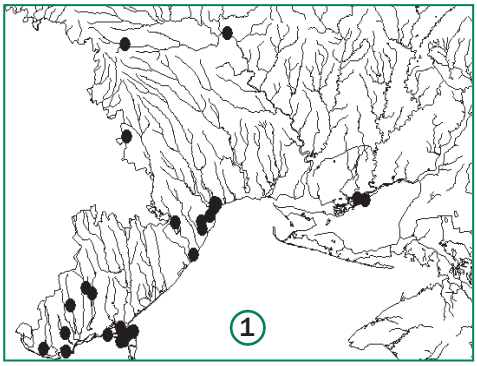
Aeshna cyanea
Calopteryx splendens ancilla
Coenagrion scitulum
Cordulia aenea
Gomphus vulgatissimus
Selysiothemis nigra
Sympetrum danae
Sympetrum depressiusculum
Sympetrum pedemontanum

4. Areas which high Odonata biodiversity of all species (biodiversity hotspots): 21 and more species in 10 by 10 square km.

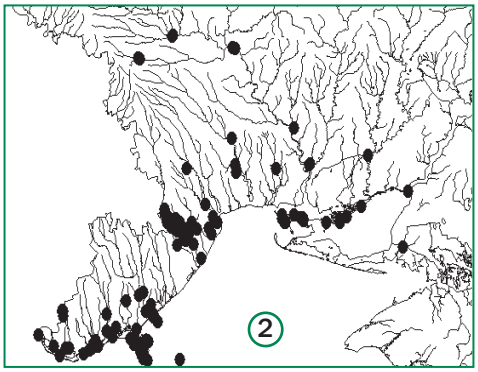
4. RESULTS

4.1. Distribution information

The database "Dragonflies of Ukraine" contains 409 records from prior to 1990, and 1492 records from 1990 onwards. The records of doubtful species known from old literature sources were omitted from the analysis: *Calopteryx virgo (Linnaeus, 1758)*, *Lestes virens (Charpentier, 1825)*, *Nehalennia speciosa (Charpentier, 1840)*, *Pyrrhosoma nymphula (Sulzer, 1776)*, *Aeshna juncea (Linnaeus, 1758)*, *Epitheca bimaculata (Charpentier, 1825)*, *Somatochlora flavomaculata (Vander Linden, 1825)*, *Somatochlora metallica (Vander Linden, 1825)*, *Leucorrhinia caudalis (Charpentier, 1840)*, *Leucorrhinia pectoralis (Charpentier, 1825)*. This is because the habitats for this species in the study area are probably absent and there are no recent reliably records for them. Future investigations are needed to specify the absence/presence of the species in the study area.

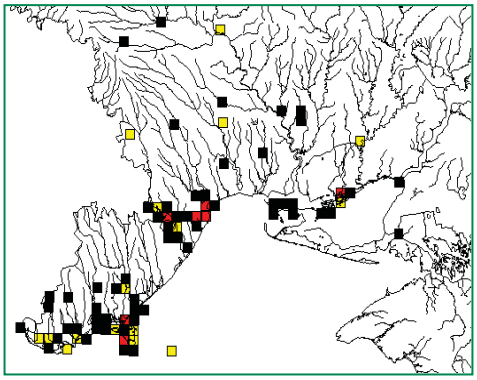


Localities of were records from dragonflies are known from. This is either based on records from literature, collections or unpublished records: *(1)* records prior to 1990; *(2)* records from after 1990.



4.2. Areas with high biodiversity of Odonata

Using coordinates of species records (10 by 10 km UTM-grid) a map with high diversity of dragonflies was made.



Map of areas with high biodiversity of Odonata. On the maps the squares are given in different colours depending on the number of species present for 10 by 10 km: 1–10 species (black); 11–20 species (yellow); 21 and more (red).

4.3. Selected areas

The four criteria where applied (see chapter 3.3 and table 1) and 6 areas important for dragonflies where recognised: 1) Reservoirs in a lower part of Khadzhibejski Liman; 2) Basin of South Bug and Ingul rivers; 3) Lower Dniestr with tributaries and lakes and Dniestrovski Liman; 4) Kinburn Peninsular; 5) Dniepr Delta; 6) Lower Danube and Predanube Region

Table 1. **Based on the criteria six areas with high value for dragonflies where selected**

Regions	Criteria 1	Criteria 2	Criteria 3	Criteria 4
1. Lower Danube and Predanube Region	•	•	•	•
2. Lower Dniestr with tributaries and lakes and Dniestrovski Liman	•	•	•	•
3. Reservoirs in a lower part of Khadzhibejski Liman	•		•	•
4. Kinburn Peninsular	•	•	•	
5. Dniepr Delta	•	•	•	•
6. Basin of South Bug and Ingul rivers	•		•	•

Map of the study area (SW Ukraine) and the position of the selected Important Dragonfly Areas (IDA).

4.3.1. Area 1: Lower Danube and Predanube Region

DESCRIPTION OF THE AREA

The Danube Delta is situated on the territory of two countries: Ukraine and Romania. UNESCO decided at 2nd of February 1999 to create an integrated international bilateral Romanian-Ukrainian Biosphere Reserve. The Danube is one of the biggest rivers in Europe. The area of Danube Delta is roughly 5000 square km and the Ukrainian part covers 1240 square km *(Karpova et al., 1998)*. The largest branch of the Danube in the territory of Ukraine is called 'Kilijskoe girlo'. Its has a length of 112 km, a width of 500 to 1200 m, an average depth of 10 to 20 m and a flow velocity of 1,0 m/sec *(Physical geography of Ukraine, 2003; Nature of Odessa Province, 1979; Karpova et al., 1998)*.

The river is mainly fed by melting water from snow. During the summer season rains play an important role in feeding of Danube. In the water regime there are three main phases: flood in spring time, high water in summer and autumn and low water in winter *(Nature of Odessa Province, 1979)*. The maximum water temperature is 26–27° C, minimal — 0,6° C *(Rotar, Lichodeeva, 2007)*. On the recently formed sandy spits there are open marine shallow waters, moist meadows and dry steep areas which form good conditions for reproduction and feeding sites for many organisms.

Predanube Lakes are of two types of origin: flood-plain lakes (originated in high-water bed of Danube River) and lagoon lakes (originated in the places where steep rivers outfalls into the sea as a result of geological descent of lower part of rivers and flooding of them by the sea. Annual drifts of Danube separated these lakes from the sea). *(Nature of Odessa Province, 1979)*. Kugurlui and Kartal belong to flood-plain lakes. Kagul, Yalpug, Saphyany, Katlabukh and Kartal have belong to the lagoons of steep rivers. All of them have an elongated, north-south directed, shape and are connected with Danube by channels *(Rotar, Lichodeeva, 2007; Nature of Odessa Province, 1979)*.

MANAGEMENT OF THE AREA

The area of the Danube Biosphere Reserve was formed by decree of the President of Ukraine (2 February 2004) is 49 676,46 hectares large.

The Danube Biosphere Reserve will be enlarged in the near future with the upper part of the Sasyk Lake and Lake Kugurlui. The islands Bolshoj Daller, Malyj Daller and Tatatu form a Regional Landscape Park 'Islands of Izmail' *(Booklet "Territories of Predanube Region…, 1999)*.

In the last decades the Predanube Lakes suffered from anthropogenic impact. Nevertheless, the upper part of Kitai and Yalpug lakes and the lower Katlabukh and Kagul wetlands still remain intact. The lakes Kugurlui-Kartal are included into the list of Ramsar sites *(Karpova et al., 1998)*.

The wetlands are of a national and communal form of property. The surrounding areas have a national, communal and private form of property *(Wetlands of Ukraine, 2006)*. In the protected areas of the Danube Biosphere Reserve all forms of land use are forbidden. On the surrounding territories all kinds of usage of natural resources are limited and controlled. This includes: hunting, fishery, fish rearing, grazing, frogs catching, traditional farming, particularly sheep breeding, mowing, recreation, viticulture, rice raising, provision of reed. In the Kilijskoe girlo (branch) organized tourism takes place by the Danube Biosphere Reserve staff.

The system of natural channels between lakes and Danube was destroyed as a result of territory modification, this caused the soiling of lakes bottom. These channels have been renewed, the sediment process have been stopped, although the water became of poor quality which sometimes causes the mass death of fish. Illegal hunting and fishery also cause a threat to the area. The nature values are also negatively impacted by pollution increased grazing by cattle and tillage.

The transformation of Sasyk Lake into a reservoir had negative impact on the ecosystem. The salinity level in the lake changed because of transferring of water from Danube. In Tatarbunar District over 60 thousands hectares of soil became daliny as a result of irrigation from the 'reservoir storage' *(Wetlands of Ukraine, 2006)*.

Danube Delta, "Vostochnoe" girlo (branch). Habitat of *Calopteryx splendens ancilla*. *Photo E. Dyatlova*

Wetlands in the South part of Kugurlui and Yalpug lakes, surroundings of Novonekrasovka Village. *Photo E. Dyatlova*

Wetlands on Ermakov Island in Danube Biosphere Reserve. *Photo E. Dyatlova*

Meadow in spring time in Vostochnoe girlo (branch) in Danube Biosphere Reserve. *Photo E. Dyatlova*

VALUE FOR DRAGONFLIES

Among species of European concern *Lestes macrostigma* and *Gomphus flavipes* were recorded. *L. macrostigma* occurs on Predanube Lakes (eg. Kitai Lake) *(Dyatlova, 2005b; Dyatlova, 2006)* and in the Danube Delta *(Dyatlova, 2005b; Dyatlova, 2006; Gorb, Ermolenko, 1996)*. *Gomphus flavipes* was mentioned by old and new records for Reni *(Dyatlova, 2005b; Dyatlova, 2006)*, Kilijskoe branch of Danube *(Polischuk, 1974)*, Izmail *(Bezvali, 1932)*; Vostochnoe branch of Danube *(Dyatlova, unpublished data)* and Tataru island *(Matushkina, 2006)*.

Coenagrion ornatum (species of European concern) is known only by the old records *(Bartenev, Popova, 1928; Bez-*

vali, 1932) and there are no information on recent populations.

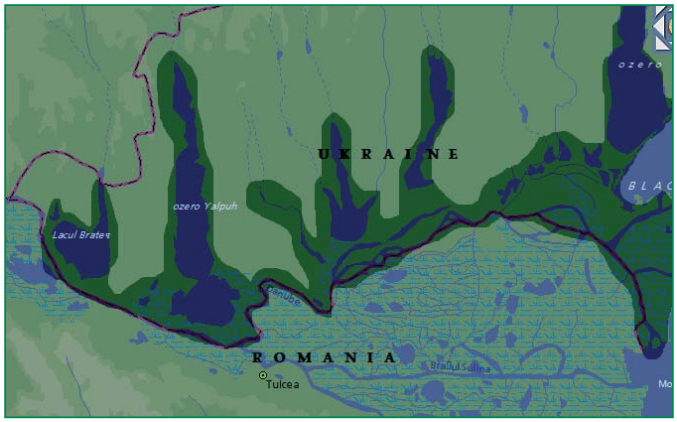
Erythromma lindenii and *Anax imperator* are protected species on the national level. *E. lindenii* was recorded from some lakes (eg. Yalpug Lake, Dzhantishejskoe Lake (SE from the Sasyk Lake)) and for the small pond on the bank of Danube River (near Izmail City) *(Dyatlova, 2005b; Dyatlova, 2006; Dyatlova, Martynov, in print)*. The species was also recorded in the Danube delta *(Gorb, Ermolenko, 1996; Pavlyuk, 1981)* and on Zmeiny Island *(Dyatlova, 2006)*.

The interesting *Calopteryx splendens ancilla* population from the Lower Danube was brought on record over 100 years ago *(Bartenev, 1912)* and it still exists there *(Dyatlova, 2005b; Dyatlova, 2006; Matushkina, 2006)*. Its peculiarity is the co-occurrence of the heterochromous and androchromous females.

Three species which are rare in the study area (*Gomphus vulgatissimus*, *Sympetrum depressiusculum* and *Cordulia aenea*) are known from this area only by old records *(Bartenev, Popova, 1928; Bezvali, 1932; Polischuk, 1974)*. In total over 40 species occur in the study area.

ADVICE FOR MANAGEMENT

Control of water quality and regulation of anthropogenic impact on the territories are important for conservation.



4.3.2. Area 2: Lower Dniestr with tributaries and lakes and Dniestrovski Liman

DESCRIPTION OF THE AREA

Dniestr River starts in Carpathians and runs to the Dniestrovsky Liman (lagoon) in the South. Roughly a stretch of 45 km of the Dniestr runs through the Odessa province. The Turunchuk branch (70 km length) runs parallel to the main river's bed. The area between the Dniestr and the Turunchuk is flooded in periods of high water and is largely covered with reed-wetlands *(Nature of Odessa Province, 1979)*. In spring period the Dniestr is largely snow-fed but in the period May to October it is rain fed. In the other periods of the year the subsoil waters play the main role in feeding the Dniestr *(Rotar, Lichodeeva, 2007)*.

MANAGEMENT OF THE AREA

The area is partly owned by the government and partly private property. The usage of nature resources is limited and controlled and largely limited to hunting, fishery and recreation. The Lower Dniestr is a water supply point for villages, cities and agricultural needs. The area surrounding the wetland is also mainly used for traditional farming (grazing, viticulture, irrigation).

The Dniestr hydroelectric power plant has is the main threat to the wetland. The artificial regulation of water in spring and summer time without taking into consideration the needs of ecosystem has a negative influence on fishery and results in a decreasing of biodiversity. Uncontrolled hunt-

ing, fishery and fires have also a negative impact on biodiversity. Some birds and animals are threatened due to by-catch in the fisheries nets (*Phalacrocorax carbo*, *Lutra lutra*). The territory is designated as a Ramsar sites. The area is 4374 hectares large and is a reserve zone 'Dnestrovskie plavni'. The territory falls under the protection from the Odessa fishery inspection ("Odesarybvod") and Beljaevski forestry *(Wetlands of Ukraine, Kiev, 2006)*.

Lower Dniestr between villages Mayaki & Palanka. *Photo Yu. Karmishev*

Lower Dniestr, near Vilcha Lake. *Photo E. Dyatlova*

VALUE FOR DRAGONFLIES

Erythromma lindenii and *Anax imperator* are protected on the national level in Ukraine *(Red Book, 1994)*. *Erythromma lindenii* was registered in the lower and slow-flowing part of the river and in the Northern part of Dniestrovsky Liman in a places with rich aquatic vegetation. This species which is redlisted in Ukraine is very common in some parts of the area *(Dyatlova, 2005a; Dyatlova, 2006; Dyatlova, unpublished data)*. *Sympetrum depressiusculum* (rare species in the SW Ukraine) is known by one recent record which was observed on the bank of the river in the surroundings of Mayaki Village *(Dyatlova, 2005a; Dyatlova, 2006)*.

The area holds a high number of dragonflies with 33 species of dragonflies being registered in the studied area.

ADVICE FOR MANAGEMENT

The area has a high value for nature and for an effective protection the creation of a National Park is important in order to regulate anthropogenic influence in the area.

4.3.3. Area 3: Reservoirs in a lower part of Khadzhibejski Liman

DESCRIPTION OF THE AREA

Khadzhibejski Liman (lagoon, estuary) is situated on the Black Sea shore roughly 7 km from Odessa. It was came into existence as a result of the flooding of the Malyj Kujalnik River by the Black Sea. The lagoon is separated from the sea by a natural dam of 4,5 km wide, 5 km long and a height above-sea level of 2 to 2,5 m. The date where the lagoon was separated from the sea is unknown, but it is known that in the XY century it was still connected with the sea *(Molodetsky et al., 2002)*. The lagoon covers an area of over 2.7 square km and is 40 km long with a width of 0,8 to 3,5 km. The depth varies from 4 to almost 7 meter *(Starushenko, Bushuev, 2001)*.

The north part the lagoon is shallow, in the direction to the sea the depth is increasing. The salinity of Khadzhibejski lagoon varies strongly (22–155 ‰) and is strongly impacted by rivers (Lagoons and river outlets complexes…,1988). Nowadays the salinity decreased to an average of 4,34 ‰ *(National report…, 1997–2001)*.

In the end of 90's of XIX century on the bank of Khadzhibejski lagoon a large park with a pond was created. In 1941 the dam was broken by high seawater and the park was destroyed by saline waters of the liman *(Molodetsky et al., 2002)*. The dam was restored but the park was not rebuild and only a small pond on the territory of clinical sanatorium "Khadzhibej" (South-Western bank of the liman, Usatovo Village) remains. This pond is a suitable place for many species of Odonata. The pond is fed by a flowing stream.

In the 1880[ies], a project was started to make a system of floatable drainage on the South bank of Khadzhibejski lagoon. A wide zone of filtration fields were created where waste waters from the city came in. In the middle of 1960[ties] the water, muds and leached of the lagoon were believed to be of perfect medical properties. The increased pressure on the lagoon due to the use as reservoir-storage for waste water from Odessa deteriorated the quality of the water. Till now filtration fields are the factors that have a negative influence on the ecosystem of the lagoon *(Starushenko, Bushuev, 2001)*. The impact of the waste water from Odessa is momentarily the main ecological problem of the area *(Molodetsky et al., 2002)*.

MANAGEMENT OF THE AREA

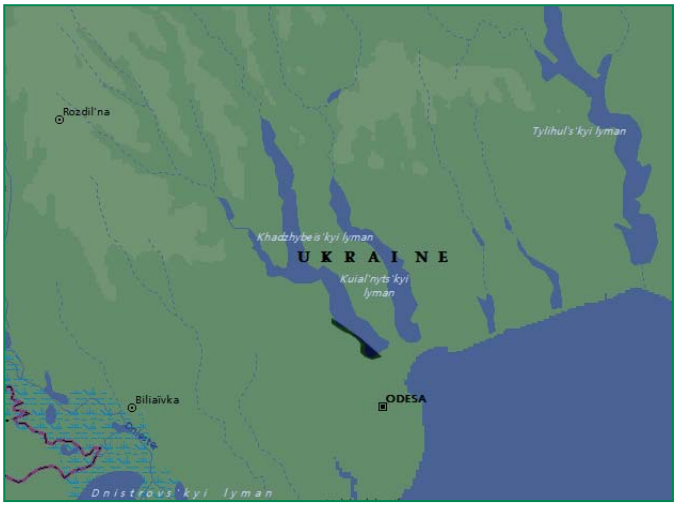
The territory is not protected and is strongly impacted with water pollution and road construction. Close to the reservoirs a children clinical sanatorium "Khadzhibej" subordinated to the Ukrainian Ministry of Health is situated. The former filtration fields are situated near the selected area.

Pond in the lower part of Khadzhibejski Liman, in Usatovo Village. *C. ornatum* habitat. *Photo A. Petrosyan*

VALUE FOR DRAGONFLIES

Over 24 species are known for this area. Among Odonata species of Europe-

an concern *Coenagrion ornatum* occurs near the pond *(Dyatlova, 2005c; Dyatlova, 2006)*. This pond is fed by a stream and this stream might be the preferred habitat of the species. *C. ornatum* was registered only for one pond in the area and the population is threatened. *S. pedemontanum*, a species rare in the SW Ukraine, is also known from this area *(Dyatlova, 2006)* (Altestovo Village).



ADVICE FOR MANAGEMENT

Protecting of small vulnerable ponds, prevent of waste disposal and water quality control.

4.3.4. Area 4: Kinburn Peninsular

DESCRIPTION OF THE AREA

Kinburn Peninsular is a low-lying territory situated between Dniepr-Bug Liman (lagoon) and the Yagorlytski Bay of the Black Sea (in Kherson and Nikolaev provinces). The length of peninsular is 40 km and it has a width of 8 to 10 km. The peninsular is important for many species of the birds. It has steppe vegetation and a wide zone of artificial coniferous groves, oak trees, birches, etc. On the territory of peninsular over 200 fresh — and salt-water lakes exist. In it's Eastern part the peninsular consist of swamps. There are numerous places of the peninsular where relict wood vegetation occurs.

MANAGEMENT OF THE AREA

In 1992 the Regional Landscape Park "Kinburnskaja Kosa" was created which covers an area of 17.890 hectares. The peninsular is included into the Black Sea Biosphere Reserve.

Brackish lagoon on Kinburn Peninsular.
Photo A. Makarov

Dried-up salty lagoon on Kinburn Peninsular.
Photo E. Dyatlova

VALUE FOR DRAGONFLIES

Lestes macrostigma is a species of European concern. The species was recorded in the South-West of peninsular near Pokrovka Village for coastal and saline inland wetlands. In that area *Lestes macrostigma* is very numerous (Tytar, pers. comm). The species probably occurs on other parts of peninsular because many suitable habitats were registered there (Dyatlova, Martynov, pers. obs). The information on the species distribution is very limited because the region is not enough studied for this moment. Future investigations will for sure bring new data on the distribution of *L. macrostigma* for the peninsular. *Anax imperator* is a species protected on the national level in Ukraine occurs on the peninsular *(Red Book, 1994) (Dyatlova, Martynov, unpublished data)*. *Selysiothemis nigra* is a rare species in the SW Ukraine. One specimen was registered near the salty lake in a coastal zone in the South-West of the peninsular in 2002 *(Tytar, 2007)* and was included into the checklist of dragonflies of Ukraine as a new species. In general, 11 species of dragonflies are recorded in the study area *(Dyatlova, Martynov, in print; Dyatlova, Martynov, unpublished data; Tytar, 2007; Tytar, pers.comm)*: *Orthetrum cancellatum, Selysiothemis nigra, Sympetrum fonscolombii, Sympetrum meridionale, Ischnura elegans, Crocothemis erythraea, Erythromma sp., Anax parthenope, Anax ephippiger and Anax imperator* but new investigations are still important in the area. The most abundant species is *Sympetrum fonscolombii,* it was registered in all parts of the peninsular *(Dyatlova, Martynov, unpublished data)*.

ADVICE FOR MANAGEMENT

The territory is poorly studied because of its isolated location and problems with transportation on sandy area. More investigating will help to develop ideas on management. It is part of a Nature Reserve and the area seems to relatively save.

4.3.5. Area 5: Dniepr Delta

DESCRIPTION OF THE AREA

The Dniepr River is the third largest river in Europe. In the territory of the Kherson Province it splits into several branches all ending in the Dnieprovski Liman (lagoon). At is broadest point the river is 410–815 m wide and 7 to 12 m deep. The flow velocity is 0,1–0,3 m/sec *(Physical geography of Ukraine, 2003)*.

MANAGEMENT OF THE AREA

The area is partly governmental and partly private property. In the wetlands the usage of nature resources is limited and controlled (hunting, fishery, grazing, send extraction, mowing, recreation, transportation by water). The areas surrounding the wetlands are also used for viticulture, irrigation and more intensive agriculture.

The main threat is caused the proposed series of dams, which will divide the Dnieprovski liman into separate reservoirs. Other threats are pollution of wet-

lands, degradation of irrigated agricultural lands and rice fields, regulation and modification of the river. Among potential threats are degradation of biotopes as a result of agricultural activities and a increasing pressure of grazing by cattle.

The territory belongs to a Ramsar site (Dnipro River Delta). In the selected area many small reservations exist, which are administered by societies of fishery and hunting and ichthyological special nature reserve "Chervona Chatka" *(Wetlands of Ukraine, 2006)*.

VALUE FOR DRAGONFLIES

L. macrostigma is a species of European concern, it was registered as a very numerous species for the Dniepr delta in Kherson over 100 years ago *(Brauner, 1902)*. In 2005 it was found to be very numerous in the surroundings of Rybal'che Village (saga). Mass emergence of adults and oviposition was observed *(Matushkina, 2006)*.

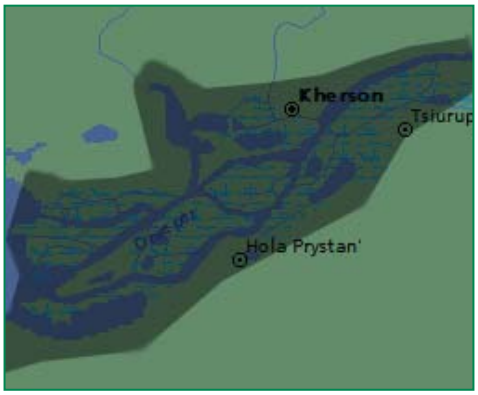
Coenagrion ornatum (species of European concern) is known only by the old records *(Brauner, 1902)* and there are no information on recent populations.

Erythromma lindenii is protected on National Level in Ukraine *(Red Book, 1994)*, it was registered for the Dnieper Delta, Konka River, Belogrudyj Island, near Golaya Pristan City, Staraya Zbur'evka Village (mass oviposition was registered) *(Dyatlova, 2004b; Dyatlova, 2006)* and in the surroundings of Rybal'che Village (saga) *(Matushkina, 2006)*. In 2007 the first and only record of *Cordulia aenea* was made in the Dniepr Delta *(Dyatlova, 2007)*. It was recorded flying along the bank of the Dniepr Delta, Golaya Pristan' vicinity, left bank of Konka River. The reed vegetation in that area is very patchy. 30 to 40 meters from the bank of the river an overflow areas with small reservoirs is situated. This area might be the actual habitat of the species. *Gomphus flavipes* (a species of European concern) and *Sympetrum depressiusculum* (rare in the study area) are known only from old records *(Brauner, 1902; Collection of Zoological Museum of Odessa University)*. The area is with a total of 35 species very rich in dragonflies (see map of the areas with high biodiversity of Odonata).

ADVICE FOR MANAGEMENT

The arrangements to establish a balance between human activities and ecological situation in the regions are proposed. This is the creation of treatment facilities and water protection zones. Besides an offer to improve the water quality and to establish a control of the organic substances which are incoming in the water are submitted *(Wetlands of Ukraine, 2006)*.

Dniepr Delta, left bank of Konka River. Habitat of *C. aenea*. *Photo M. Son*



4.3.6. Area 6: Basin of South Bug and Ingul rivers

DESCRIPTION OF THE AREA

South Bug and Ingul are snow — and rain-fed rivers which results in spring floods and low water in summer. Over 50 percent of the annual flow falls in spring time *(Physical geography of Ukraine, 2003)*.

MANAGEMENT OF THE AREA

In the North part of the area the Regional Lanscape Park 'Granitno-stepnoe Pobuzzhe' (6266 hectare) is situated since March 1994. This is a recreational area. The rapids of South Bug are a popular tourist attraction. The canyon cliffs are used for climbing. The territory is attractive for tourism, scientific investigations and is used for educational events.

In the 1970[ies] close to the recent regional park "Yuzhnoukrainskaya" nuclear power plant was built. The extension of nuclear power plant is actively discussed and the project is to make a part of the regional park as cooling pond (website of international social-economical union, http://www.seu.ru)

VALUE FOR DRAGONFLIES

Among species of European concern *Gomphus flavipes* occurs in this area *(Dyatlova, 2006)*. Among rare species in the SW Ukraine *Sympetrum pedemontanum (Dyatlova, 2006; Dyatlova, Martynov, in print)* and *Gomphus vulgatissimus* are recorded *(Dyatlova, 2006; Dyatlova, unpublished data)*. *Gomphus flavipes* and *G. vulgatissimus* were registered both as larvae, exuvia and adults. The exuvia were recorded on the stones and semi-aquatic vegetation on the river bank. *S. pedemontanum* was registered for a permanent, well-vegetated reservoir with stagnant shallow water near Ingul River mouth in Nikolaev City and Novaya Odessa City.

The area holds a high number of dragonfly species and over 23 species of dragonflies occur in this area.

South Bug River, Regional Landscape Park "Granitno-Stepnoe Pobuzh'e". *G. flavipes & G. vulgatissimus* habitat. *Photo E. Dyatlova*

Small reservoir on the bank of Ingul River mouth, Nikolaev City. S. *pedemontanum habitat*. *Photo E. Dyatlova*

ADVICE FOR MANAGEMENT

The creation of a cooling pond on the territory of Regional Park should be prevented. Such a pond will probably result in the warming of parts of the river and will deteriorate the conditions for aquatic organisms.

5. RECOMMENDATIONS

Six areas were selected as Important Dragonfly Areas:

1) Reservoirs in a lower part of Khadzhibejski Liman

2) Basin of South Bug and Ingul rivers

3) Lower Dniestr with tributaries and lakes and Dniestrovski Liman

4) Kinburn Peninsular

5) Dniepr Delta

6) Lower Danube and Predanube Region

It is recommended that conservation of dragonflies will play a role in further management of these areas. Future investigations should concentrate on key-species: population size and their habitats. The factors which have a negative influence on the key-species and dragonflies in general should be studied and reduced. Especially water quality and structure of semi-aquatic vegetation is of importance.

The information on the Important Dragonfly Areas are should be used for management of wetlands and for the creation of new protected areas. Several areas from the six which were selected belong to Ramsar sites (Areas 3, 5 and 6). In recent publication *(Wetlands of Ukraine, 2006)* on these areas information on dragonflies has been almost lacking and the publication was based mostly on birds. The information on key-species of dragonflies from the Ramsar sites are important for the protection of them in general. Besides dragonflies play an important role in water ecosystems and provide food for some birds and fish on the larval and adult stages.

NEED FOR FURTHER FIELDWORK

The "Map of the areas with high biodiversity of Odonata" shows that there are large parts of the SW Ukraine for which there are only a limited number of records available. This is partly because large areas of the region are dry and not many species are to be expected. Thus far most fieldwork concentrated on the large river deltas in the south as these are expected to have the highest value. However especially the northern part of the study area is poorly studied.

Data on smaller rivers and tributaries is still very limited. Most of them are situated in the northern parts of the study area: Yagorlyk, Kuchurgan, Kodyma, Tiligul, area of South Bug River which is situated lower than Regional Landscape Park "Granitno-stepnoe Pobuzh'e", Ingul and Ingulets rivers. Very limited information about dragonflies is available from the Kinburn Peninsular mostly because the logistics in this area are very difficult. Fieldwork in this area is only possible by organizing expeditions to the area. The other part of Black Sea Bioshere reserve is Tendra Peninsular. It is situated on the south from the Kinburn Peninsular. No information is known on dragonflies from that area. The information whether there are habitats on the Tendra Peninsular which are suitable for development of dragonflies is lacking.

THE ROLE OF VOLUNTEERS

Mapping the distributions of the species in the poorly explored regions could be undertaken in cooperation with volunteers. Summer courses could be organized in these areas for pupils and school teachers. After these courses they can continue investigations in the areas and send data to specialists using contact information on the website "Dragonflies of Ukraine".

It is important for both volunteers and researchers that information is easily available on Internet to let all interested people participate in the research. A publication of a small booklet on dragonflies from the area distributed among educational organizations could stimulate more work on dragonflies. The work for the identifying Important Dragonfly Areas in south-western Ukraine will stimulate similar investigations in the other parts of the country. This will make it possible to prepare a list of important dragonfly area for the whole country, which will be the new step in conservation of dragonflies in Ukraine.

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Maps and discussion on key species

Appendix 1

Below information is given on species of European concern, species mentioned on the Ukrainian Red list or species rare in SW Ukraine.

The distinguish old and recent records of key-species special symbols (triangles and circles) were used:

▲ Old data (before 1990)
● Recent data (after 1990)

AESHNA CYANEA

Red list status or Habitat Directive status: not listed.

Distribution: Very rare, recorded only once in the North of Odessa Province *(Artobolevsky, 1927)*.

Habitat: Breeds in a wide range of waterbodies, preferring those that are stagnant, small and shaded, often murky with no substrate other than leaf litter, such as garden ponds or forest pools. Feeds along woodland rides and clearings *(Dijkstra, 2006)*. No information is available on the habitat in the SW Ukraine.

Photo B. Daraz

Flight period in the SW Ukraine: no data.

ANAX IMPERATOR

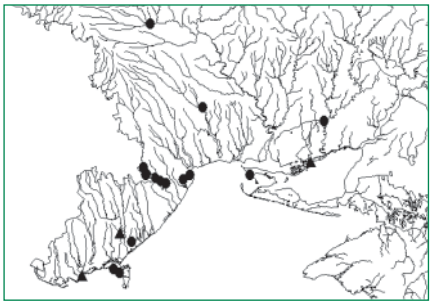
Red list status or Habitat Directive status: Red Book of Ukraine (1994), III category of conservation.

Distribution: Widespread but less common than *A. parthenope* in Odessa Province *(Bezvali, 1932; Dyatlova, 2006; Dyatlova, unpublished data; Martynov, unpublished data; Polischuk, 1974)*; Kherson Province *(Brauner, 1902; Dyatlova, Martynov, unpublished data; Tytar, 2004; Volkova et al., 1970; Collection of Zoological Museum of Odessa University)* and in Nikolaev Province *(Tytar, 2004; Volkova et al., 1970)*.

Habitat: Standing waters, often large and well-vegetated *(Dijkstra, 2006)*.

Flight period in the SW Ukraine: Beginning of June — Middle of August.

Photo R. Manger



COENAGRION SCITULUM

Red list status or Habitat Directive status: not listed.

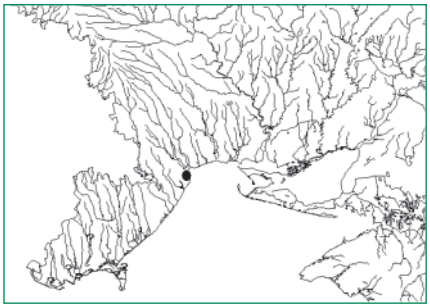
Distribution: Only one reliable record in the region (in Odessa) *(Dyatlova, 2004a; Dyatlova, 2006)*. The other

records from literature based on hydrobiological data in the Danube Delta are doubtful *(Polischuk, 1974)*.

Habitat: Sunny, still, sometimes slow-flowing, waters with rich aquatic vegetation, such as water-milfoils (*Myriophyllum*) and hornworts (*Ceratophyllum*) *(Dijkstra, 2006)*. In the surroundings of Odessa the species was recorded far from fresh water *(Dyatlova, 2004)*. The origin of these two specimens is not clear. The most likely is that the species developed in drainage waters.

Flight period in the SW Ukraine: no data.

Photo H. Niesen



COENAGRION ORNATUM

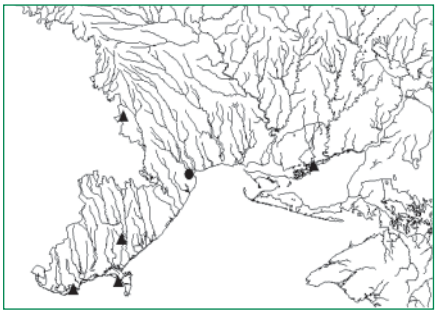
Red list status or Habitat Directive status: Declining in Europe *(Sahlen et al., 2004)* and in the EU's Habitats Directive on Appendix II (species must be included in a national network of protected habitats).

Distribution: For this moment only one recent population is known in the surroundings of Odessa in Usatovo Village *(Dyatlova, 2005c; Dyatlova, 2006)*. The pond where species occur suffers greatly from the anthropogenic impact as the road was expanded in this area and the part of the pond was filled with send. All other records in the region are very old (the end of the 19th — beginning of the 20th century). The species is mentioned by old records in literature for Danube region *(Bartenev, Popova, 1928; Bezvali, 1932)*, North of Odessa Province *(Artobolevsky, 1927)* and for the Dniepr Delta *(Brauner, 1902)*.

Habitat: Sunny streams and flowing ditches, often calcareous and with structured vegetation *(Dijkstra, 2006)*. In the SW Ukraine the species occurs in a small lake fed by a large stream.

Flight period in the SW Ukraine: End of May — End of June.

Photo Nino Mihokovic (photo was obtained through the project "Promotion of Dragonfly Protection in Croatia")



CORDULIA AENEA

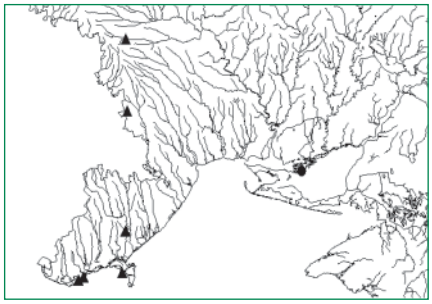
Red list status or Habitat Directive status: not listed.

Distribution: Rare and known from only a few recent records in the Dniepr Delta *(Dyatlova, 2007)*. In the beginning of the 20th century was recorded in the Danube Region *(Bartenev, Popova, 1928; Bezvali, 1932)* and in the North of Odessa Province *(Artobolevsky, 1927)*. The species probably is declining in the area.

Habitat: Standing waters, such as large ponds and small lakes in woodlands, bogs and heaths, but also oxbows, gravel pits, fishponds, sluggish rivers and canals *(Dijkstra, 2006)*. Recorded flying along the banks of the delta part of a big river. The reed vegetation in that area is very local and scarce. In 30–40 meters from the river's bank an overflow areas with small reservoirs is situated, the latter might be the actual habitat of the species.

Flight period in the SW Ukraine: no data.

Photo B. Daraz



ERYTHROMMA LINDENII

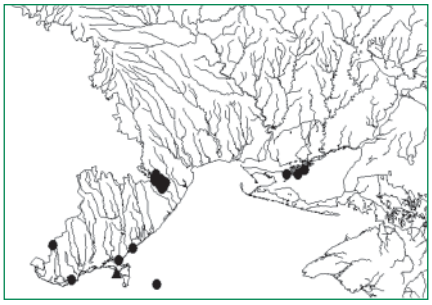
Red list status or Habitat Directive status: Red Book of Ukraine *(1994)*, I status of conservation.

Distribution: Recorded in Danube Region *(Dyatlova, 2006; Dyatlova, Martynov, in print; Gorb, Ermolenko, 1996; Pavlyuk, 1981)*, Lower Dniestr *(Dyatlova, 2004b, Dyatlova, 2005a; Dyatlova, 2006; Dyatlova, unpublished data)* and Dniepr river *(Dyatlova, 2004b; Dyatlova, 2006; Matushkina, 2006)*, quite rare, but sometimes locally common.

Habitat: Larger, well-oxygenated waters, including lakes, gravel pits, slow-flowing rivers and wide canals, with rich aquatic vegetation such as water-milfoil (*Myriophyllum*) *(Dijkstra, 2006)*. In the SW Ukraine recorded from lakes and large slow-flowing rivers.

Flight period in the SW Ukraine: Beginning of June — Beginning of August.

Photo A. Martynov



GOMPHUS VULGATISSIMUS

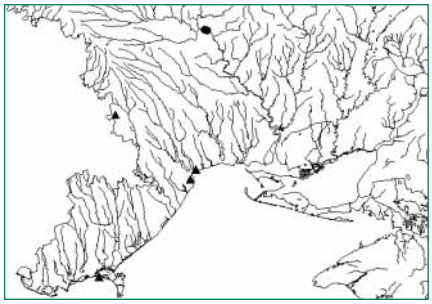
Red list status or Habitat Directive status: not listed.

Distribution: Recently was recorded for the South Bug River *(Dyatlova, 2006; Dyatlova, unpublished data)*. The old records were made in the beginning of the 20th century in Odessa *(Shugurov, 1903)* and in the N part of Odessa Province *(Artobolevsky, 1927)*. Recorded in the middle of 20th century in hydrobiological samples from the Danube Delta *(Polischuk, 1974)*.

Habitat: Middle and lower sections of rivers and streams. Favours a calm flow and sandy bottom (e.g. lowland streams and small rivers), avoiding small, fast-flowing, rocky-bottomed waters. Locally abundant in reservoirs, gravel pits and large lakes. The larvae burrow in fine sand, preferably covered with detritus *(Dijkstra, 2006)*.

Flight period in the SW Ukraine: no data

Photo M. Ushakov



GOMPHUS FLAVIPES

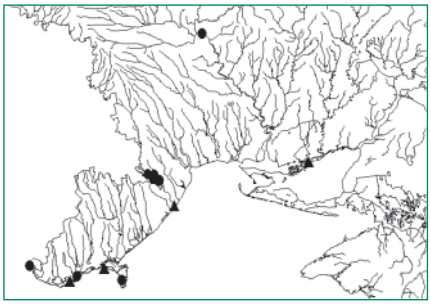
Red list status or Habitat Directive status: in the EU's Habitats Directive on Appendix IV (survival of national populations must be ensured).

Distribution: Rare. Found near large rivers: Danube *(Bezvali, 1932; Dyatlova, 2005b; Dyatlova, 2006; Dyatlova, unpublished data; Matushkina, 2006; Polischuk, 1974)*, Dniestr *(Brauner, 1910; Dyatlova, 2005a; Dyatlova, 2006; Dyatlova, unpublished data)*, South Bug *(Dyatlova, 2006)* and Dniepr *(Brauner, 1902; Collection of Zoological Museum of Odessa University)*.

Habitat: Slow-flowing lower sections of large rivers with sandy beds. Larvae burrow shallowly in fine substrates wit relatively high concentrations of organic matter *(Dijkstra, 2006)*. Occurs also in rivers with muddy beds.

Photo H. Niesen

Flight period in the SW Ukraine: Beginning of June — Middle of July.



LESTES MACROSTIGMA

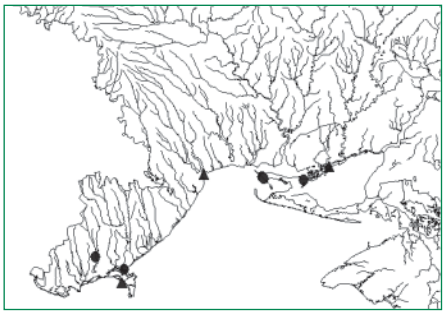
Red list status or Habitat Directive status: Declining in Europe *(Sahlen et al., 2004)*.

Distribution: Occurs in Danube Region (rare) *(Dyatlova, 2005b; Dyatlova, 2006; Gorb, Ermolenko, 1996; Pavlyuk, 1981)*; numerous in Dnieper Delta *(Brauner, 1902; Matushkina, 2006)*. One specimen was found in Odessa in the middle of the 20 century by I. Maltsev *(Dyatlova, 2007a)*. Also recorded on Kinburn Peninsular *(V. Tytar, pers. comm)*.

Habitat: Almost exclusively in shallow water with dense rushes, particularly Sea Club-rush (*Bolboschoenus maritimus*), of coastal and saline inland wetlands, e.g. abandoned salt pans, dune ponds and salt-marsh fringes and steppe lakes *(Dijkstra, 2006)*. In the SW Ukraine found in coastal reservoirs and in wetlands near lakes.

Photo H. Niesen

Flight period in the SW Ukraine: Middle of June — beginning of July.



SELYSIOTHEMIS NIGRA

Red list status or Habitat Directive status: not listed.

Distribution: Only one recent record from Kinburn Peninsular *(Tytar, 2007)*.

Habitat: Standing, shallow waters *(Dijkstra, 2006)*. In the SW Ukraine recorded near coastal lakes.

Flight period in the SW Ukraine: no data.

Photo V. J. Kalkman

SYMPETRUM DANAE

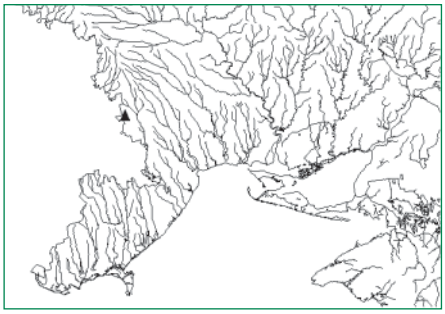
Red list status or Habitat Directive status: not listed.

Distribution: One old record in the North of Odessa Province *(Artobolevsky, 1927)*.

Habitat: Mostly acidic waters, such as bogs, moorland and heathy lakes, but also breeds in small tarns, drying ponds and ditches *(Dijkstra, 2006)*. No data on habitats for the SW Ukraine available.

Flight period in the SW Ukraine: no data.

Photo B. Daraz



SYMPETRUM DEPRESSIUSCULUM

Red list status or Habitat Directive status: not listed.

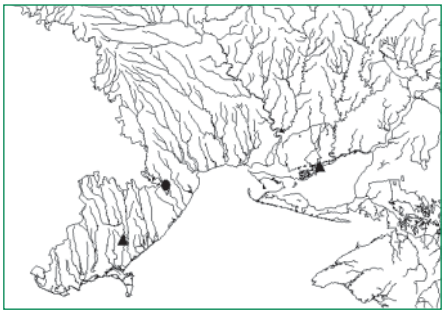
Distribution: Very rare, one recent record of one specimen in Dniestr Delta *(Dyatlova, 2005a; Dyatlova, 2006)*. The other records in Tatarbunary *(Bezvali, 1932)* and Kherson *(Brauner, 1902)* are rather old.

Habitat: Distinct ecology is not fully understood, but it reaches high densities only in very specific habitats, including rice paddies, fishponds, seasonally dry lakes and cooling-water basins. Many of these are dry in winter (whereas most waterbodies are driest in summer) and have swampy borders. Utilises secondary ha-

bitats, such as drying heathy lakes, in the vicinity of core habitats *(Dijkstra, 2006)*. The only recent record from the SW-Ukraine is from the banks of a large, slow-flowing river.

Flight period in the SW Ukraine: no data.

Photo B. Daraz



SYMPETRUM PEDEMONTANUM

Red list status or Habitat Directive status: not listed.

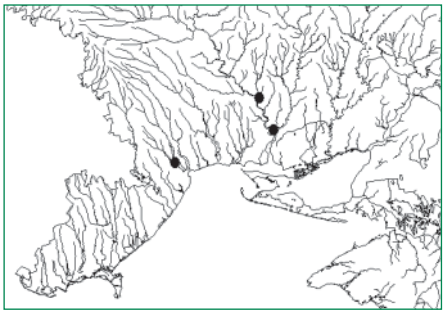
Distribution: Very rare, found occasionally in the surroundings of Odessa and from the South Bug basin (Nikolaev and Novaya Odessa cities) *(Dyatlova, 2006; Dyatlova, Martynov, in print)*.

Habitat: Appears to be selective, but its preferences are not fully understood.

Often said to favour hilly areas, perhaps because of associated seepage. In the west, inhabits slow-flowing waters with a fair amount of vegetation, such as grassy drainage ditches and irrigation channels. Also breeds in still waters, such as pools in quarries and inundation zones. Sites are often shallow and sunny, with developing but not too dense vegetation *(Dijkstra, 2006)*. The locality near Odessa is a permanent, well-vegetated reservoir with stagnant shallow water near a large river.

Flight period in the SW Ukraine: not enough data (beginning of July — beginning of August).

Photo B. Daraz



CALOPTERYX SPLENDENS ANCILLA

Red list status or Habitat Directive status: not listed.

Distribution: Recorded only for Lower Danube and its delta part *(Bartenev, 1912; Dyatlova, 2005b;Dyatlova,2006; Matushkina, 2006)*.

Habitat: Large river

Flight period in the SW Ukraine: middle May — end of August.

Photo E. Dyatlova

Appendix 2

Literature on dragonflies of SW-Ukraine

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Important Dragonfly Areas in Southwest Ukraine

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