# Biosphere Expeditions

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## Expedition report

# Monitoring wolf, jerboa, viper and bird populations and studying bird migration on the Kinburn peninsula, Black Sea, Ukraine


Expedition dates:

12 August – 23 September 2001

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# Abstract


This study was part of an expedition to the Kinburn Black Sea peninsula in Ukraine run by Biosphere Expeditions from 12 August to 23 September 2001. It investigated wolves, jerboas, vipers and migratory birds.

In the wolf (*Canis lupus*) study, relative abundance methods of counting wolf tracks along a transect were used to compute indices reflecting relative wolf densities. From these indices speculative computations about total wolf numbers in the area yield an absolute maximum of 40 individuals (but, in fact, there are fewer). This is far below the common lore number of several hundred wolves in the area. This result will be used in educating local people about their canine neighbours and as a baseline for future monitoring and conservation efforts.

In the study of Falzfein's thick-tailed three-toed jerboa (*Stylopidus telum falzfeini*), a rigorous quantitative approach of plotless and distance methods to estimate jerboa densities from field signs was used to produce results, where no data on jerboa densities previously existed. The study confirmed densities of significantly fewer than 2 individuals per hectare, showing that *Stylopidus telum falzfeini* is under intense pressure and in danger of extinction in the area. Statistical implications, reasons for this decline and comparative jerboa population dynamics are also discussed.

In the Eastern steppe viper (*Vipera ursinii*) study, vipers were recorded as a supplementary activity as they were found in the field during the wolf and jerboa studies. Abundance and density were calculated from these data, suggesting that the Eastern steppe viper may not be as seriously threatened on the Kinburn peninsula as in other parts of Ukraine.

In the study of migratory birds, 38 capture days resulted in 1331 birds of 42 species (35 passerine and 7 non-passerine species) being caught in one Helgoland and several mist nets, measured and ringed. In addition 85 species were noted during the regular visual observation census walks. Finally, a bird list of 161 species encountered during the expedition was also compiled.

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Ö³ äîñë³äæåííÿ çä³éñíåí³ íà Ê³íáóðíñüêîìó ï³âîñòðîâ³ ç 12 ñåðïíÿ ïî 23 âåðåñíÿ 2001 ðîêó çà ó÷àñòþ «Biosphere Expeditions». Âèâ÷àëèñÿ âîâêè, ºìóðàí÷èêè, ñòåïîâà ãàäþêà òà ì³ãðóþ÷³ ïòàõè. Ó âèïàäêó âîâêà (*Canis lupus*) çàñòîñîâóâàëèñÿ òðàíñåêòí³ ìåòîäè âèçíà÷åííÿ â³äíîñíî¿ ÷èñåëüíîñò³ òâàðèí. Ö³ ìåòîäè ïîêàçàëè, ùî ìàêñèìàëüíà ÷èñåëüí³ñòü âîâê³â íà äîñë³äæóâàí³é òåðèòîð³¿ ìîæå ñÿãàòè 40, ïðîòå íàñïðàâä³ öÿ ÷èñåëüí³ñòü íàáàãàòî íèæ÷à ³ íå ìîæå áóòè ìîâè òóò ïðî ñîòí³ îñîáèí. Îòðèìàí³ äàí³ ñëóãóâàòèìóòü äëÿ ³íôîðìóâàííÿ ì³ñöåâîãî íàñåëåííÿ òà äëÿ ïîäàëüøîãî ìîí³òîðèíãó ÷èñåëüíîñò³ ïîïóëÿö³¿ âîâê³â.

×èñåëüí³ñòü ºìóðàí÷èêà (*Stylopidus telum falzfeini*) âèçíà÷àëè çà äîïîìîãîþ ïëîùàäíèõ òà áåçïëîùàäíèõ (äèñòàíö³éíèõ) ìåòîä³â. Íà äàí³é òåðèòîð³¿ öå ðîáèòüñÿ âïåðøå. Ðåçóëüòàòè îáë³êó ïîêàçàëè, ùî íà ãåêòàð³ çóñòð³÷àºòüñÿ íå á³ëüøå äâîõ îñîáèí ³ ºìóðàí÷èêó òóò çàãðîæóº çíèêíåííÿ. Ðîçãëÿíóò³ ñòàòèñòè÷í³ çàêîíîì³ðíîñò³ ðîçïîä³ëó ºìóðàí÷èêà ïî äîñë³äæóâàí³é òåðèòîð³¿, ïðè÷èíè íèçüêî¿ ÷èñåëüíîñò³ òâàðèí. Ñòåïîâó ãàäþêó (*Vipera ursinii*) â³äçíà÷àëè ï³ä ÷àñ ïðîõîäæåííÿ òðàíñåêò òà îáë³êó ºìóðàí÷èêà. Âèçíà÷åíà â³äíîñíà ÷èñåëüí³ñòü ãàäþêè äîçâîëÿº ïðèïóñòèòè, ùî íà äàí³é òåðèòîð³¿ âèä äîñèòü çâè÷àéíèé ³ éîìó, ïîêè ùî, çíèêíåííÿ íå çàãðîæóº, ÿê öå ñïîñòåð³ãàºòüñÿ â ³íøèõ ì³ñöÿõ â Óêðà¿í³.

Îáë³ê ì³ãðóþ÷èõ ïòàõ³â ïðîâîäèëè íà ïðîòÿç³ 38 äí³â. Â³äëîâëåíî 1331 îñîáèíó 42 âèä³â (35 ãîðîáèíèõ ³ 7 íåãîðîáèíèõ) çà äîïîìîãîþ ñòàö³îíàðíî¿ ïàñòêè òà ñ³òîê («ïàâóòèíîê»). Ïòàõ³â îáì³ðÿëè òà ê³ëüöþâàëè. Äîäàòêîâî çàðåºñòðîâàíî 85 âèä³â ï³ä ÷àñ îáë³êîâèõ åêñêóðñ³é. Ðàçîì çà ÷àñ åêñïåäèö³¿ çóñòð³íóòî 161 âèä ïòàõ³â.

# Contents

# 1. Expedition Review

## 1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. Projects are not tours, photographic safaris or excursions, but genuine research expeditions placing ordinary people with no research experience alongside scientists who are at the forefront of conservation work. Expeditions are open to all and there are no special skills (biological or otherwise) required to join. Expedition team members are people from all walks of life and of all ages, looking for an adventure with a conscience and a sense of purpose. More information about Biosphere Expeditions and its research expeditions can be found at www.biosphere-expeditions.org.

This expedition report deals with an expedition to the Kinburnska Kosa peninsula, Black Sea, Ukraine from 12 August to 23 September 2001. The expedition conducted a large-scale survey of bird migration patterns by catching passing birds in nets and measuring, identifying, ringing, and releasing them. It also carried out the first ever large-scale wolf survey in the area by conducting hide-based night time surveys and by tracking wolves along transects. The jerboa and the steppe viper were also studied and bird lists were compiled.

The Kinburnska Kosa Landscape Park is part of the larger Kinburn peninsula. Relatively little internal, and no independent, data exists on wolf numbers in the park and one of the purposes of the expedition was to estimate relative numbers in the region. Data presented here will be used in the formulation of management plans, and to educate local people about their canine neighbours.

The peninsula is used by many bird species as a so-called "stepping stone" for crossing the Black Sea on their North-South migration routes from places such as Scandinavia and Siberia in the North to Africa and the Mediterranean in the South. Birds congregate on the peninsula to feed, rest and moult, because the area is relatively undisturbed and sufficiently remote. The concentration of migratory birds in autumn is so high that the area in vernacular Ukrainian is known as a "bird railway station". Migratory patterns and species composition in this area needed to be investigated, particularly by long-term, concerted monitoring methods. Biosphere Expeditions in conjunction with local scientists established such a monitoring project and data presented here on birds and mammals will aid conservation efforts undertaken in the area and will support arguments for the extension of the current landscape park into a larger national park.

## 1.2. Research Area

The Kinburnska Kosa Landscape Park was created in 1992 and is situated in the Ukraine on the Northern shores of the Black Sea, at the confluence of the Dnieper river, North-West of the Crimea. The park measures 18,000 hectares including 12,000 hectares of terrestrial habitats and 6,000 hectares of aquatic habitats. Habitats include natural sand dune areas covered with steppe vegetation, planted pine forests, lagoons and marine environments. The climate is continental and semi-arid with hot summers and cold winters. The peninsula was created by the shifting sands of the Dnieper and Bug rivers, rising out of the Black Sea only in the Quaternary.

15 flowering plant species are endemic to the region, amongst them orchids listed in the Red Data Book. In summer and early autumn hundreds of thousand birds use the Kinburn peninsula as a stopover during their annual migration. Wolves are common in the remoter parts of the peninsula, where they hunt mainly for wild boar and other, smaller mammals.

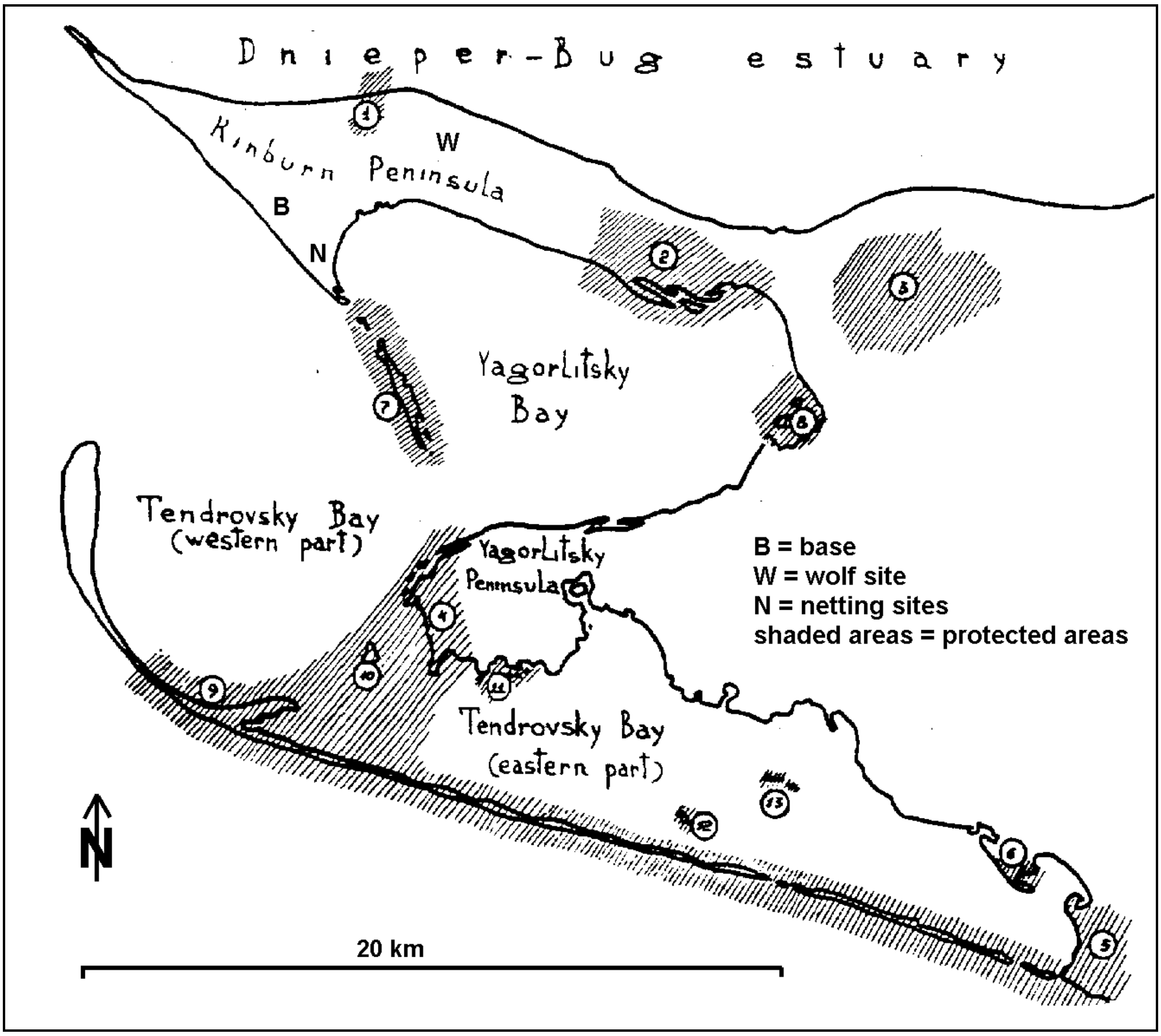


Fig 1.2a. The Kinburn peninsula (46º 30' N, 31º 40' E) and adjacent protected areas.
For location of the peninsula inside Ukraine, see map on front cover.

## 1.3. Dates

The expedition ran over a period of six weeks divided into three two-week slots, each composed of a team of international research assistants, guides, support personnel and an expedition leader. Expedition team dates were

12 August - 26 August 2001
26 August - 9 September 2001
9 September - 23 September 2001

Dates were chosen to coincide with the migratory season for birds and the end of the breeding season for wolves when they start to congregate into packs again.

## 1.4. Local Conditions & Support

Expedition base and study sites

The expedition team was based in the village of Ï ÎÊÐÎÂÊA (Pokrovka) in a summer house with basic amenities. There was an outdoor latrine, and an outdoor solar shower, central heating, but no running water (there was an outdoor well and pump instead). 3-4 team members shared a basic room.

From this base teams were divided into study groups, one working on bird netting and censusing by the coast, the other working on wolves, jerboas, vipers and bird lists in the interior (see Figure 1.2a. for locations). The bird group stayed in a former fishermans hut by the coast, the wolf group in a tent camp in the interior. Both groups were accompanied by a local scientist. Logistical support, amongst other things with food and water, was by car from the expedition base, where all meals for the study groups were prepared by an expedition cook.

Field communications

There is was no landline telephone at base. Instead the expedition used an Iridium Motorola satellite telephone with internet connection. This worked extremely well and e-mail contact was available throughout. Shortly before the expedition's arrival, a mobile phone transmitter was installed on the opposite bank of the Dnieper river on the mainland. This provided intermittent mobile phone coverage and the expedition purchased four pay-as-you-go mobile phones on the Kyivstar network. These were then used for fairly reliable communication between base and the research groups. Earlier 5W two-way radios proved too weak to cover the distances between the research groups and base.

Transport & vehicles

Team members had to make their own way to the assembly point at Kiev main railway station. From there onwards and back to the train station all transport & vehicles were provided for the expedition team. Unfortunately the vehicle provided (a Russian-manufactured UAZ minibus) proved to be very unreliable and prone to sudden breakdowns and prolonged periods of repair. Luckily the local park director kindly assisted the expedition with his cars and staff whenever the Uaz was out of action.

Medical support & insurance

The expedition leader was fully trained in expedition and wilderness medicine, and the expedition carried a comprehensive medical kit. Further medical support was provided by a medical post in Pokrovka village and a hospital in Ochakiv (12 km by ambulance and boat). All team members were required to be in possession of adequate travel insurance covering emergency medical evacuation and repatriation. Emergency evacuation procedures were in place. There were no major medical incidents. To the credit of the expedition cook, there were no cases of serious diarrhoea throughout the entire expedition.

### 1.5. Local Scientists

The expedition team was divided into rotating activity groups, each of which was led by a local scientist.

(1) Bird group

Elena Diadicheva was born in Kiev in 1963. Her Master's Degree in Zoology is from Kiev State University. Since 1985 she has been working as an ornithologist at the Azov-Black Sea Ornithological Station, which is a sub-division of the Institute of Zoology of the National Academy of Sciences of Ukraine. Her main research interest is passerine and wader migration studies. She has participated in various ornithological expeditions to the Ukraine, Siberia, and Poland.

(2) Wolf and small vertebrates

Volodymyr Tytar was born in 1951. His Master's Degree in Biology is from Kiev State University. He started his career as an invertebrate zoologist before shifting towards management planning for nature conservation purposes in the Northern Black Sea area (for example the Ukrainian Danube delta, the Dnieper estuary etc.). He first visited the Kinburnska Kosa area in 1975 and has been involved in surveying and conservation measures there ever since.

(3) Funnel net (Helgoland type)

Dr Anatoly Poluda was born in Russia in 1953. His Master's Degree in Zoology is from Kiev State University. Since 1974 he has been working as an ornithologist in the Institute of Zoology of the National Academy of Sciences of Ukraine. When Ukraine gained its independence, Anatoly became the Director of the Ukrainian Bird Ringing Centre. In 1994 he gained his PhD on bird migration along the coasts of the Kiev Water Reservoir from the National Academy of Sciences of Ukraine. Dr Poluda assisted the expedition in erecting the net and spent a few days at the end of the expedition with the bird research group.

### 1.6. Expedition Leader

This expedition was led by Matthias Hammer. Born in Germany, he went to school there, before joining the Army at 18, and serving for several years amongst other units with the German Parachute Regiment. After active service he came to the UK and was educated at Christ Church, Oxford (studying for a BA in Biological Sciences), and King's College, Cambridge (studying for a PhD in Biological Anthropology). During his time at university he either organised or was involved in the running of several expeditions, some of which were conservation expeditions (for example to the Brazil Amazon, Madagascar, and the Indian Himalayas), whilst others were mountaineering/climbing expeditions (for example to the Russian Caucasus, the Alps, the Rocky Mountains, or the Seychelles). He is a ski instructor, mountain leader and survival skills instructor.

### 1.7. Logistics co-ordinator

Valentin Pashkevich of "Dzherelo SPK" in Kiev provided important advice and logistical support in organising transport, train tickets, visas, research permits, government clearance etc.

### 1.8. Expedition Team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds

12 August – 26 August 2001

Helen Boulden (UK), Gudrun Dieckmann (Germany), Ben Gingell (UK), Gwen Hitchcock (UK), Elizabeth Power (UK/Belgium).

26 August – 9 September 2001

Helen Boulden (UK), Jenny Holden (UK), Jean Hopkin (UK), Karin Rack (the Netherlands), Wietse Siebenga (the Netherlands).

9 September – 23 September 2001

Helen Boulden (UK), Chris Burnett (UK), Susanne Jockers (Germany), Emma Jones (UK), Jemma Nissel (UK), Raychel Sterry (UK/Baharain). Journalist: Franz Lerchenmüller (Germany - for "Die Zeit" newspaper).

Throughout the expedition

Advisor: Zinovy Petrovych, Director of the Kinburnska Kosa Regional Landscape Park. Driver & translator: Orest Petrovych. Additional driver: Igor. Expedition cook, host and soul of the expedition: Svietlana Shibko with her husband Vladimir and her daughter Yulia.

### 1.9. Expedition Budget

Each team member paid towards expedition costs a contribution of £990 per person per two week slot. The contribution covered accommodation and meals, supervision and induction, a permit to access and work in the Landscape Park, all maps and special non-personal equipment, all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses like telephone bills, souvenirs etc., as well as visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how this contribution was spent are given below.

| **Income** | £ | |
|---|---|---|
| Expedition contributions | 18,440 | |
| **Expenditure** | | % of which spent directly on project |
| Payment to Ukraine logistics co-ordinator (Valentin Pashkevitch)<br>for food, travel, accommodation, research permits, visas and visa assistance for team members, scientists' and Valentin's salaries and other logistical support. | 9,546 | 100 |
| Equipment and hardware<br>includes research library, spring scales, bird nets, night sights, tents, medical supplies, fuel, mobile phones, GPSs, solar showers and various other small items | 4,073 | 43 |
| Travel<br>includes travel expedition leader, excess baggage for equipment | 1,093 | 100 |
| Communication | 549 | 100 |
| **Income – Expenditure** (unadjusted) | 3,179 | |
| **Income – Expenditure** (adjusted to % spent on project) | 3,953 | |
| **Total percentage spent directly on project** | 70% | |

## 1.10. Acknowledgements

This study was conducted by Biosphere Expeditions, which runs wildlife conservation expeditions all over the globe. Expeditions are open to all, there are no special skills (biological or otherwise) required to join and there are no age limits whatsoever. Without our expedition team members who provide an expedition contribution and give up their spare time to work as research assistants. Without our expedition team members who provide an expedition contribution and give up their spare time to work as research assistants, none of this research would have been possible. The expedition team were H. Boulden, C. Burnett, G. Dieckmann, B. Gingell, G. Hitchcock, J. Holden, J. Hopkin, S. Jockers, E. Jones, F. Lerchenmüller, J. Nissel, E. Power, K. Rack, W. Siebenga, R. Sterry. The support team included amongst others our advisor and invaluable support organiser whenever we needed him Zinovy Petrovych, Director of the Kinburnska Kosa Regional Landscape Park; his son, driver and translator Orest Petrovych; our additional driver Igor; our expedition cook, host and soul of the expedition Svietlana Shibko with her husband Vladimir and her daughter Yulia. Biosphere Expeditions would also like to thank Valentin Pashkevitch for providing all-important logistical support, our scientists Elena Diadicheva and Volodymyr Titar for providing crucial scientific grounding and leadership, Katherine Wilden for assistance in writing this report, as well as Land Rover and Gerald Arnhold for their sponsorship.

## 1.11. Further Information & Enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website www.biosphere-expeditions.org.

Enquires should be addressed to Biosphere Expeditions at the address given below.

# 2. Wolf Survey

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## 2.1. Introduction

### Wolf natural history & regional history

The wolf (*Canis lupus*) is the third largest predator in Europe, after the brown bear and the polar bear. It looks like a large German shepherd dog. Since the species has a large distribution area and lives in a variety of habitats, its variation in size, colour, and weight is remarkably high. This variation has led to the subdivision of the species into several subspecies (up to 16), and the one present in the Kinburn area (see below) was though to be, at least in the past, *Canis lupus campestris* Dwigubski 1804, or the “steppe wolf”. However, it may be that this particular subspecies has been driven out of the area (Bibikov & Filimonov, 1985) and is being replaced by the nominate subspecies, *Canis lupus lupus* Linnaeus 1758, or “grey wolf”.

An adult male wolf weighs from 20 to 80 kg; females are smaller (15 to 55 kg). Larger animals are found in more Northern latitudes; the average weight of wolves in Ukraine is 30 to 36 kg (Gurski, 1985), rarely as much as 72 kg (one record from the Ukrainian Carpathians).

Wolves walk on their toes and their tracks are similar to those of a large dog, showing 4 toes and their nails. The fifth toe is found only on the front legs and does not touch the ground.

Fig. 2.1a. Wolf prints in the sand of the Kinburnska Kosa Landscape Park. Photo: M. Hammer

Coat colour is extremely variable, from pure white in arctic areas to brown, reddish, grey, pale grey and silver. Individual variation in other body and head markings complicate colour patterns, although wolves tend to maintain a more uniform colour locally. Moulting occurs in spring and the new coat grows in early autumn. Wolves live 8 to 16 years in the wild, depending on the availability of food and other factors (Mech, 1995).

Until recently the wolf had the largest distribution area of any terrestrial mammal. It occupied the whole Northern Hemisphere north of 20° N, including the entire North American continent, Eurasia and Japan. Following extermination efforts by huamns, the species' range is now greatly reduced. Originally found throughout Europe, at the end of the 18th century, wolves were still present in all European countries with the exception of Great Britain and Ireland. During the 19th century, and especially in the years following the Second World War, wolves were exterminated from all Central and Northern European countries. During the 1960s, wolf distribution was smaller than it is today, with small remnant populations in Portugal, Spain, Italy, Greece, and Finland, and more numerous populations in the East. In the last twenty years, the species has been recovering naturally in several parts of Europe, including Ukraine.

The wolf has a very diversified diet and is a true generalist that feeds opportunistically on what is most available in its habitat. Wolf diet may include large or small vertebrates, invertebrates, vegetables and carcasses. Diet composition throughout the geographic range depends on the relative abundance and seasonal variation of potential prey. In South West Ukraine, for instance, Gurski (1985) reports the wolf to prey on roe deer and wild boar, foxes and brown hare, and even consuming corn and water melons found in the fields. However, in this farmland area the predominant proportion of kills (Gurski states up to 90%) is considered to consist of domestic livestock, primarily sheep, horses, and cows. In summer resort areas, such as the beaches of the Kinburn peninsula, wolves may scavenge on refuse left aside by tourists camping at the seaside, seize stray dogs etc.

Wolves live in diverse habitat types and their broad distribution ranges show the species' adaptability to the most extreme habitat conditions. In general, large forest areas are particularly suitable for wolves in Europe (in Ukraine, for instance, the Northern forested region or the Carpathians), although wolves are not primarily a forest species.

Wolves live in social units (packs) that co-operate in hunting, reproducing and defending their territories. A pack is fundamentally a family unit that originates when a pair establishes a territory and reproduces. Strong social bonds between the pack members regulate internal stability and the dynamics of the pack. A linear hierarchy among pack members is built and maintained through ritualised aggressive behaviour. Individuals at higher dominance level take most of the initiative and have most of the privileges in feeding and reproducing. Young animals stay in the pack up to the age of two years, at which tme they face the alternative of dispersing in search of a new partner and new territory, or staying in the pack and attempting to reach higher dominance levels. Prey densities, wolf density and availability of free territory play a role in determining what reproductive strategy to follow. The pack size ranges from 2 to 13 wolves, the number depending on its productivity, the success of dispersion, and prey density. In Europe, pack size is mostly a function of human control, and large packs are extremely rare. In South West Ukraine, Gurski (1978) reports packs numbering 6-9 and 4-7 individuals. A wolf is sexually active when it is two years old. Oestrus lasts 5-7 days, once a year, generally from January to March. Parturition occurs after 60-65 days and litter size varies from 2 to 12 pups. Generally only one litter is produced in each pack.

Wolves are territorial and each pack actively defends its own territory from wolves of neighbouring packs. Territory size varies greatly, depending on wolf and prey densities, geographical features, human disturbance, and human infrastructure. In Europe territory size generally ranges from 100 to 500 sq. km. Gurski (1978) considers wolves in South West Ukraine to occupy areas around 300 to 600 sq. km. Territories are actively advertised by wolves through markings with urine and faeces left in strategic sites within the territory and along the boundaries.

Densities vary significantly. In Europe densities are generally 1-3 wolves per 100 sq. km, although a comparison is extremely difficult due to the differences in methods and time of the year to which the estimates refer.

The wolf is often reported to be a direct threat to humans, but in post-war Ukraine there have been only 2 documented attacks of wolves, both in the region of the Carpathians (Heptner et al., 1967). A far more substantive basis for the age-old warfare between humans and the wolf is predation of domestic livestock, most notably cattle and sheep. The wolf has been persecuted, especially in the 20$^{th}$ century, because of its supposed threat to populations of ungulates and domestic livestock, most notably cattle and sheep. This persecution has gone so far, particularly in Western and Central Europe, that wolves have almost disappeared there. No wonder that the species is now listed for protection under the Berne Convention on the Conservation of European Wildlife & Natural Habitats. In Ukraine, however, where the total wolf population according to official statistics is above 2,500 - although this is very likely to be a considerable over-estimation (Zhyla, 2000) - the general public attitude to the species is much as to a pest.

Historically wolves have been met in abundance in Ukraine. Kirikov (1952, 1959), for instance, considers that about 1,000 years ago the area between the Lower Dnieper and the Black Sea supported a significant wolf population, which was reaching densities of above 15 individuals per 1,000 sq. km. Later, in the 13$^{th}$ to 16$^{th}$ centuries, when the Tatar hordes established themselves in the region, wolves were fairly abundant. So much so that in particular places the word "*byry*" (meaning "wolf" in Tatar) formed the root for a number of toponyms, for instance, *"Berezan"* (a river, estuary and island near the Kinburnska Kosa Landscape Park), *"Biryuchi"* (an island in the Sea of Azov).

However, with the colonisation of the area some 200 years ago, the wolf was already in decline (for instance in the Crimea), and since 1844 hunters were being awarded for shooting wolves. Although today only a small number of hunters in Ukraine would consider tracking down and shooting wolves to be an economically worthwhile venture, previously the bounty system of encouragement appears to have worked quite well, particularly in the 1930s, when wolves were eradicated in the Southern and Central regions of Ukraine (Migulin, 1938).

During the Second World War, when persecution of wolves was for obvious reasons not very high on the agenda, they once again returned to the area, but were put under varying pressures again by hunters when the war ended. However, as Roman (1996) states, wolf numbers in the Kinburn area were never high due to the scarce number of prey. Nevertheless, wolves have been re-establishing their numbers in the Kinburn area since 1947 after, according to Selunina (1992, 1996), a 30 year long absence. Their numbers continued to be low until the late 1980s, when the population of animals started to grow. In 1988 wolves reached the area of the Kinburnska Kosa Landscape Park.

## Location

The Kinburnska Kosa Landscape Park was created in 1992 and is situated in Ukraine on the Northern shores of the Black Sea, at the confluence of the Dnieper river, North-West of the Crimea. The park measures 18,000 hectares including 12,000 hectares of terrestrial habitats and 6,000 hectares of aquatic habitats. Habitats include natural sand dune areas covered with steppe vegetation, planted pine forests, lagoons and marine environments. The climate is continental and semi-arid with hot summers and cold winters. The peninsula was created by the shifting sands of the Dnieper and Bug rivers, rising out of the Black Sea only in the Quaternary.

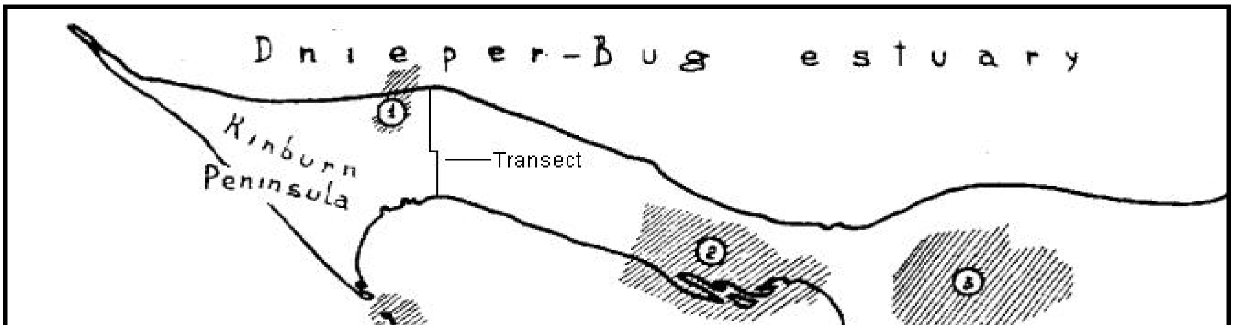


Fig 2.1b. The Kinburn peninsula (46º 30' N, 31º 40' E) with transect and adjacent protected areas of the Black Sea (Chornomorski) Biosphere Reserve (shaded).

## Rationale

Large carnivores, including wolves, have traditionally been given a "high profile" by both wildlife managers and the public, because of their intimidating size and predatory behaviour. Wolves have become very popular in the global media, taking on a symbolic value as a survivor from a history of global persecution.

In Ukraine numbers have been controlled periodically in an effort to reduce predation on game and domestic livestock. The Kinburn area, where several hunting districts (one within the Kinburnska Kosa Landscape Park itself) and farms are located, in this respect, has been no exception. The reduction of wolf numbers was primarily the responsibility of these districts, however, most of them, as state enterprises, have come to an economic standstill and/or are in the process of being reorganised in one way or another. Due to the economic slowdown they are nowadays hard pushed to cope with only a fraction of their previous responsibilities, including the control of wolf numbers. This has become a cause of concern for the Kinburnska Kosa authority, because local people are perceiving wolves as an increasing threat to domestic livestock and are demanding eradication measures. The Kinburnska Kosa authority, however, is not considering the situation to be a cause for concern, but realises that a sound decision in this case can be made only if numbers or data reflecting the relative abundance of wolves in the area are available. The purpose of this survey was to gather such data and set a quantitative baseline for monitoring wolf abundance in the area in the coming years.

## 2.2. Materials and Methods

Numerous studies have been conducted on the ecology and population dynamics of wolves. However, because of their highly mobile nature and generally large home ranges, obtaining accurate and precise population estimates can be difficult. Nevertheless, because wolves leave behind conspicuous signs such as tracks, scats and kills, wolf inventories can be relatively successful. Various techniques for surveying wolves and estimating abundance have been developed, but most are non-statistical since they do not employ sampling. This disallows any probabilistic modelling, standardised replication, or establishment of confidence levels about a mean.

The best estimates of population sizes are considered to come from the total count methods using, for instance, aerial snow-tracking surveys, or radio-telemetry for determining absolute abundance. These methods, however, are not available to the staff of the Kinburnska Kosa Landscape Park for a variety of reasons, ranging from purely natural (for instance, in dense pine-forested areas where visibility is poor an aerial survey technique may not be practical) to technical (lack of suitable equipment and training).

Under these circumstances the prudent option is to focus, for the current study at least, on relative abundance methods which produce indices reflecting the density of the wolf population. For example, given a standard technique, such as counting tracks along transects, it is possible to say that if area A has a higher frequency of tracks than area B, there must be more animals in area A, even if we do not know the exact numbers in either area. Similar logic is used to compare relative abundance in the same area over time.

However, although a linear relationship is assumed between the index and actual density, indices have rarely been validated for most groups of animals. Despite this indices are increasingly being employed in many management contexts, largely because of the problems associated with obtaining precise counts of estimates of population size. In this respect, track surveys are relatively quick, easy, and inexpensive methods for determining relative abundance of wolves. In some cases researchers have attempted to extrapolate from an index to a real density using correction factors. For instance, Danilov et al. (1996) used data about animal movement patterns (for example distance moved per day) to convert index data into real density. However, there are a number of assumptions that need to be made, which are rarely true or difficult to test. Nevertheless, making certain such assumptions may be useful for providing at least a guidance for the numbers of animals in the area, keeping in mind, of course, the limitations of any such approach.

Wolf track surveys are usually limited to the winter months and snowy conditions. However, the sandy terrain of the Kinburn peninsula offers an opportunity to spot wolf tracks at any time of the year, although the track imprints might not be so clear in sand as they would be in snow, especially if for a week or two there has been no rain.

One uninterrupted ploughed transect line, about 2 m wide and 7.42 km long cross-cutting the peninsula in a near-to-longitudinal direction was established for track count surveys (see Fig 2.1b above). The transect, in fact, follows a lane between forest quarters 14/15, 34/35, 62/63, 87/88, 123/124, 157/158, 157/176. Natural borders for this transect are set by the fresh to subsaline waters of the Dnieper Estuary in the North and by sea waters of Yagorlitski Bay in the South. Hence any movements across the transect, particularly in a latitudinal direction (i.e., E-W, and vice-versa), are most likely to be detected. The transect crosses (and/or borders) a variety of habitats, consisting of both forested and open areas (see Table 2.2a below).

The transect itself was partitioned into 2 sections: one in the North and one in the South, measuring about 3.46 km and 3.96 km respectively. Surveys of the transects were done on foot. The expedition's survey team consisted of two scientists and several paying, untrained expedition team members who gave up their holiday time to assist in this research project. Their work and the expedition contribution they paid made this research possible. Expedition team members were taught how to recognise and record wolf tracks by the local scientists and the expedition leader. Field guides were also provided.

Crossing points were recorded as distances (in km) from the Northern end of the transect. The average time between two checks was about 2 days. However, it was not always possible to check both sections in one day. The Northern section was checked for wolf tracks 17 times (between 17 August and 17 September 2001, average time between two checks 1.88 days), and the Southern one 12 times (between 23 August and 19 September 2001, average time between checks 2.33 days). Despite the overlap of dates (8 times, or in 38% of the cases, both sections of the transect were checked on the same day), their averages are different ($t$=4.15; $p$<0.05), so, in fact, we may have been producing two sets of data. On the one hand this may be a complication as far as both sets should, perhaps, be treated separately, on the other hand it may be an advantage, because an opportunity emerges for comparing results from both sets for consistency. Note that pooled data was used as well, particularly after testing for homogeneity.

Table 2.2a. Variety and percentage of habitats crossed (and/or bordered) by the transect.

<table>
<tr><td colspan="3">Forested area<br>65.6%</td><td colspan="2">Open area<br>34.4%</td></tr>
<tr><td colspan="2">Dense<br>56.3%</td><td rowspan="2">Patchy<br>9.3%</td><td rowspan="2">Open area with some pine<br>7.1%</td><td rowspan="2">Open grassland<br>27.3%</td></tr>
<tr><td>Mature<br>18.2%</td><td>Medium to small<br>38.1%</td></tr>
</table>

All wolf tracks were registered on the survey route, including measurement of the direction and number of animal. If the number of animals was unclear, it was clarified by following the tracks. A number of tracks were measured according to Rukovski (1984), but many had to be rejected, because of their vague outlines in the sand.

Between 1 and 19 September surveyors, after walking the transect, took a random path back, using a GPS to navigate back to the camp. Crossings were recorded as usual. On the random walk back, records were taken of all wolf tracks noticed. By the end of the survey 37 such records were taken within a square plot of 7 km x 7 km.

Results were registered in a log, indicating the survey route (transect section), footprint direction and the number of animals, and occasionally footprint measurements.

Abundance was calculated as the number of wolves (i.e. individual tracks) per kilometre of route. An array of statistical methods using the *Statistica 4.5* package and *Basic Programmes* of Ludwig & Reynolds (1988) were used to process the transect data and to analyse the spatial pattern of wolf tracks within the survey plot.

## 2.3. Results and Discussion

One question, before discussing abundances, is whether the relationship between track numbers and the number of wolves (or their activity) in the area of the transect is more or less constant throughout the time of the survey. This can be assessed by plotting cumulated numbers of tracks against the dates from the beginning of the survey up to its end, and estimating corresponding regression values. For this purpose dates have been transformed, following Zaitsev (1984), into a continuous sequence of numbers, so, for instance 17 August (the start date of the survey) has the number 170, and 19 September (the final day of the survey) has the number 203.

In both cases, for the Northern and Southern portions of the transect, the relationship is linear, coefficients of determination ($R^2$) being 0.935 and 0.816, and slopes ($B$) equalling 0.851±0.058 ($n$=17) and 0.891±0.134 ($n$=12), respectively. For our particular purpose it is just the slope values that are of greatest interest in that they reflect the rates of any changes taking place.

In terms of statistics, both these slope values are identical ($t$=0.27; $p$>0.05), so we have pooled the data from both subsets to consider the entire transect (Fig. 2.3a below).

Pooling data does, however, pose a problem as sometimes tracks have been counted on the same day on both sections of the transect, resulting in a reasonable chance that the number of recorded tracks may be, for instance, a double estimate of what could be expected from surveying one section only. To avoid any bias we use here, for the pooling of data, tracks/km/day instead of merely the number of tracks recorded on a particular day. Under those circumstances the Northern and Southern portions of the transect can now be treated in the same way, i.e. using tracks/km/day instead of track numbers. As a result only $B$ values are different from those stated above ($B$=0.246±0.017 and 0.225±0.034 respectively), all other conclusions remain valid. It is also worth noting that pooled data (cumulated number of tracks/km/day versus date) also fits well into the linear model, $R^2$ being 0.839 and the slopes ($B$) equalling 0.3151±0.032 ($n$=21).

The fact that this data fits fairly well into a linear model means that the “flow” of wolf tracks crossing the transect during the survey was at a more or less steady rate, approximately at an average of about one individual per km of transect each three days. Even if the number of wolves (and/or their activity) in the study area during the survey was variable, fluctuations have been occurring to a limited degree around a fairly constant level, similar in both sections of the transect, as shown by the identical $B$ values.

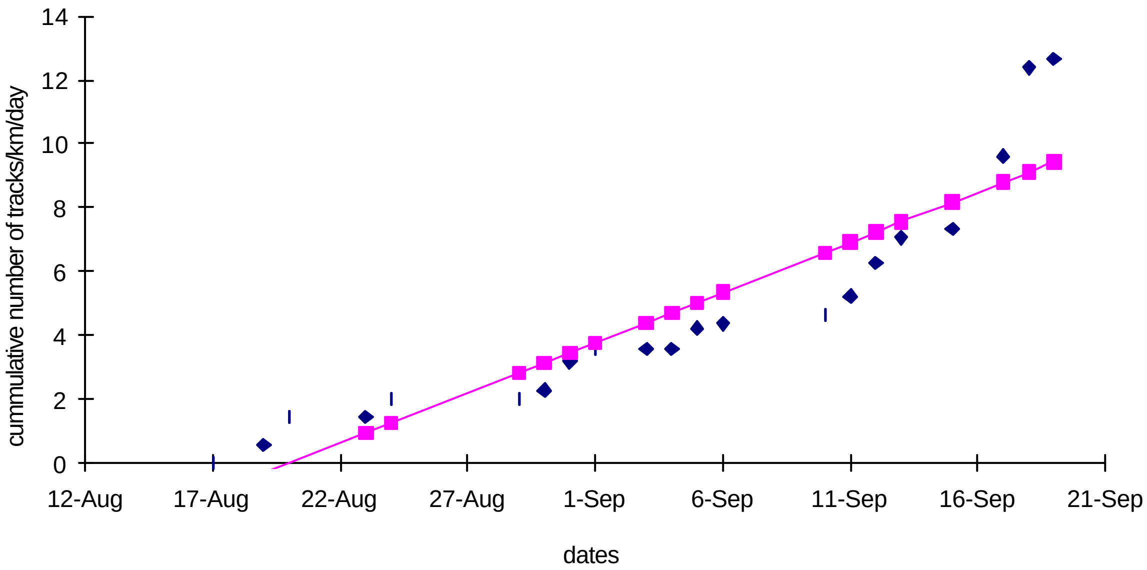


Fig. 2.3a. Increase in cumulative numbers of wolf tracks/km/day during the survey; ◆ - raw counts; - regression line (linear model) and estimated counts.

The above argument also holds true as a good justification for us to ignore, or at least attach less importance to, the bias concerning the particular time each section was surveyed. In other words, the difference between average dates, although statistically significant, may be having no real impact on the interpretation of the results of the survey.

There is, however, an indication that more wolves could be coming to the area (or the same number may be increasing its activity) closer to the end of the survey, around 18 and 19 September. At least 2 counts made at this time in the Southern section of the transect are above the expected value and fall out of the $\pm 2\sigma$ limits, so a more lengthy survey could, possibly, detect a departure from linearity occurring in late September and onwards. Furthermore, it may be that wolves for most of the survey were solitary and only towards the end of the survey started congregating into packs again. Indeed, although on average 1 to 3 individuals would form a track (average totalling 1.375±0.099, *n*=40), in most cases (28 out of 40) only one animal was recorded. If we consider this to be normal behaviour for this time of year, then the presence of 2 or more animals together could be a matter of chance. This can be tested by considering the record of one animal as no departure from the "norm" and assigning it the value of zero, the record of 2 animals as one departure (+1), and 3 as 2 (+2), and comparing the mean (M) and variance ($\sigma^2$) of this series. Both are fairly similar (0.375 and 0.394, respectively) and the relationship $\sigma^2$/M is identical to 1 ($\chi^2$=41.0, *df*=39), so we are dealing with a Poisson series, giving the expected number of solitary wolves as 27.5. Hence meeting 2 or 3 wolves together at this particular time of the year is indeed a rare event.

Table 2.3b. Regression summaries for cumulative numbers of wolf tracks/km/day.

Regression Summary for dependent variable:
cumulative number of wolf tracks/km/day in Northern section of transect (surveyed 17.08.-17.09.2001)

n=17 — R= .967; $R^2$= .935; Adjusted $R^2$= .931; F(1,15)=217.23; p<.000;
Std. Error of estimate: 0.609

| | BETA | St. Error. of BETA | B | St. Error. of B | t(15) | p-level |
|---|---|---|---|---|---|---|
| Intercept | | | -41.927 | 3.089 | -13.57 | .000 |
| Dates | 0.967 | 0.066 | 0.246 | 0.017 | 14.74 | .000 |

Regression Summary for dependent variable:
cumulative number of wolf tracks/km/day in Southern section of transect (surveyed 23.08.-19.09.2001)

n=12 — R= .903; $R^2$= .816; Adjusted $R^2$= .798; F(1,10)=44.43; p<.000;
Std. Error of estimate: 0.960

| | BETA | St. Error. of BETA | B | St. Error. of B | t(10) | p-level |
|---|---|---|---|---|---|---|
| Intercept | | | -41.016 | 6.448 | -6.36 | .000 |
| Dates | 0.903 | 0.135 | 0.225 | 0.034 | 6.67 | .000 |

Regression Summary for dependent variable:
pooled data of cumulative number of wolf tracks/km/day (surveyed 17.08.-19.09.2001)

n=21 — R= .916; $R^2$= .839; Adjusted $R^2$= .830; F(1,19)=98.931; p<.000;
Std. Error of estimate: 1.453

| | BETA | St. Error. of BETA | B | St. Error. of B | t(19) | p-level |
|---|---|---|---|---|---|---|
| Intercept | | | -54.529 | 5.957 | -9.153 | .000 |
| Dates | 0.916 | 0.092 | 0.315 | 0.032 | 9.946 | .000 |

Slope values of the linear model, given the appropriate time frame, seem to be good estimators of wolf number (and/or activity) dynamics and could be used for monitoring purposes. For this reason we consider a full account should be presented of the regression summaries (as computed by the *Statistica 4.5* package) that may be useful in any future development of this approach (see Table 2.3b above). For reasons of uniformity, data considering tracks/km/day has been used.

The next logical step in our analysis is to characterise this “flow” of wolf tracks crossing the transect.

In the first instance, we can ask whether there is any preferred direction in which wolves are moving. In answering this question we have considered only generalised latitudinal movements (from E to W, and vice-versa) as these are most clearly defined by the nature of the transect and comprise the overwhelming majority of the collected data.
Generally speaking, there has been no preferred direction in which wolves have been moving: there have been 23 records of wolves heading eastwards, and 29 heading westwards (no statistical difference, $\chi^2$=0.692, $p$<0.405). Pooled data has been used for this purpose.

Besides that, E-W (and vice-versa) movements have occurred in a random manner. This has been checked by sorting out how many series there have been of alternative movements across the transect from the beginning up to the end of the survey, excluding those records when on the same day the transect was crossed in both directions by an equal number of wolves. This time series can be shown in the following way:

WWW E W EE WW E WW E,

That is, we have 8 series of alterations. This sequence may be of non-random character if there are only a few series or, on the contrary, too many of them. A quantification of what is few or much is given by the serial criteria *R* (Runyon, 1977), and in our case these values are 3 = <*R*> = 11, so 8 is in between, meaning that wolves have been crossing the transect in both directions randomly.

It is randomly as well that wolves have been choosing habitat types along the transect for crossings. Most of the records of wolf tracks have been made in forested areas (predominantly consisting of pine plantations) rather than open areas, 32 and 12 records, respectively. However, the proportion of area under forest is higher (around twice that of open area), so, in fact, these figures are merely reflecting this proportion between different habitat types ($\chi^2$=0.96, $p$<0.325). Once again we have an indication that wolves are not primarily a forest species, and in practice can be met anywhere.

In moving around from one side of the transect to the other wolves do, however, prefer to use roads and lanes, rather than pushing their way through rough vegetation: 33 records of wolf tracks (out of a total of 40) are confined to these roads and lanes.

Besides preferring to move along roads and lanes, wolves seem to be crossing the total transect predominantly in its middle part around the location of forest quarters 87/88, or in the section of the transect between kilometres 3 and 4 (see Fig. 2.3c below). This occurs predominantly at an average point of 3.20 ±0.31 km (counting from the Northern end of the transect), and the general pattern of the distribution of the number of crossings recorded along the transect, which for the purpose of this analysis has been subdivided into a sequence of one kilometre sections, is fairly close to normal, meaning that wolves are indeed preferring to cross the transect in one and the same place and all other crossings recorded outside of this preferred section are just random departures from the normal route.

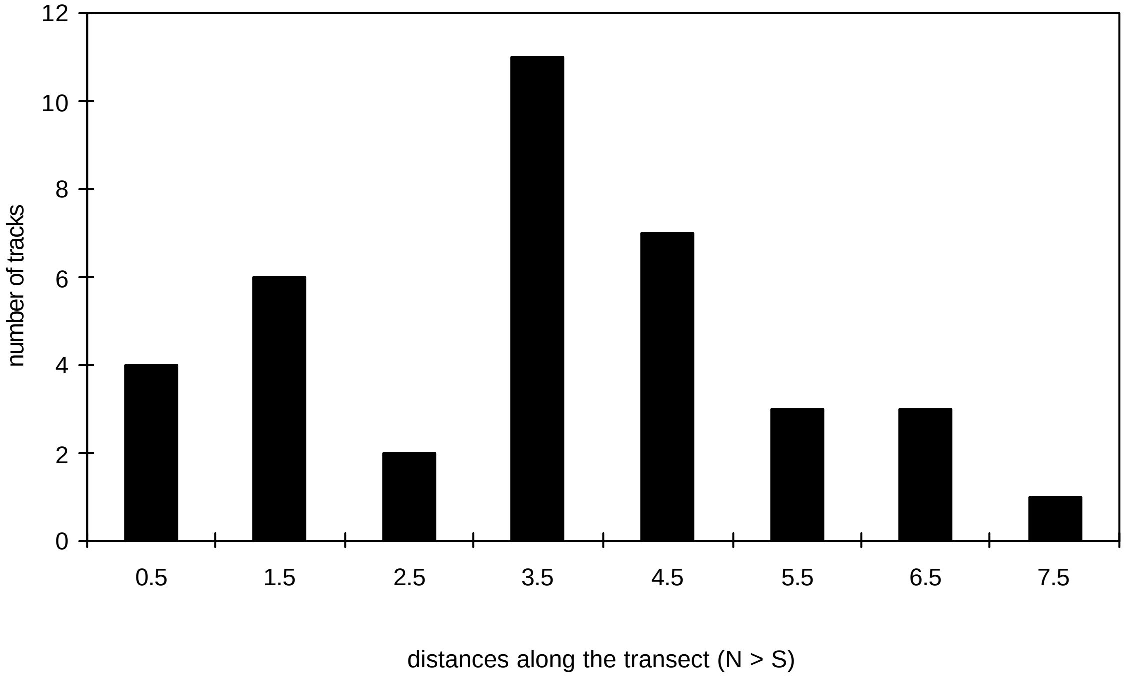


Fig.2.3c. Distribution of wolf track numbers along the transect

The reason for this could be the presence of a “rendezvous site” approx. 2 km West of the middle part of the transect. In the last few days of the expedition, the expedition team discovered a thick and low pine stand with a profusion of wolf tracks and other signs, some of which appeared to be resting places. Large numbers of tracks led into and out of the pine stand. An hour-long survey of the area on the last day of the expedition revealed further signs and tracks and strongly suggests a site of very high wolf activity. Unfortunately, due to the lack of time, no further investigations were carried out. Future expeditions will investigate this further.

More evidence for the assumption that wolves tend to use the same routes for moving around the area may be the non-random character of the distribution of wolf tracks within the 7 km x 7 km plot, where 37 track records were made. The clumping of tracks, or either their random or uniform order of distribution was explored by examining the relationship between the variance ($\sigma^2$) and mean (M) in blocks of 1 sq. km. This relationship ($\sigma^2$/M=2.33) significantly exceeds 1.0, indicating a considerable degree of clumping. Indeed, the distribution of wolf tracks in this 49 sq. km plot is well approximated by the negative binomial distribution ($\chi^2$=1.88, *df*=3), widely used for modelling clumped non-random distributions. For monitoring purposes it may be worthwhile to mention that the *k*-parameter for this particular distribution has been calculated as 0.364 (using *Basic Programmes* of Ludwig & Reynolds, 1988).

To wind up with questions not directly related to abundances, we conclude with the analysis of track (footprint) measurements. As mentioned above, imprints of wolf tracks in sand may be fairly obscure, so they are not easy to measure and raise certain doubts that this can be done accurately enough to carry out a meaningful analysis. In total, 24 footprints of the wolf foreleg were measured in between 18 August and 15 September 2001. Surprisingly or not, the measurements do not vary too much as shown by their coefficients of variation: 16% for the length (L) of the footprint, 14% for the width (B), and 8% for the shape (S), computed as (B/L) x 100. Nevertheless, it is quite evident that tracks have been produced by a variety of animals and the easiest way to expose this fact is to plot foot length (L) against foot width (B) (see Fig 2.3d below).

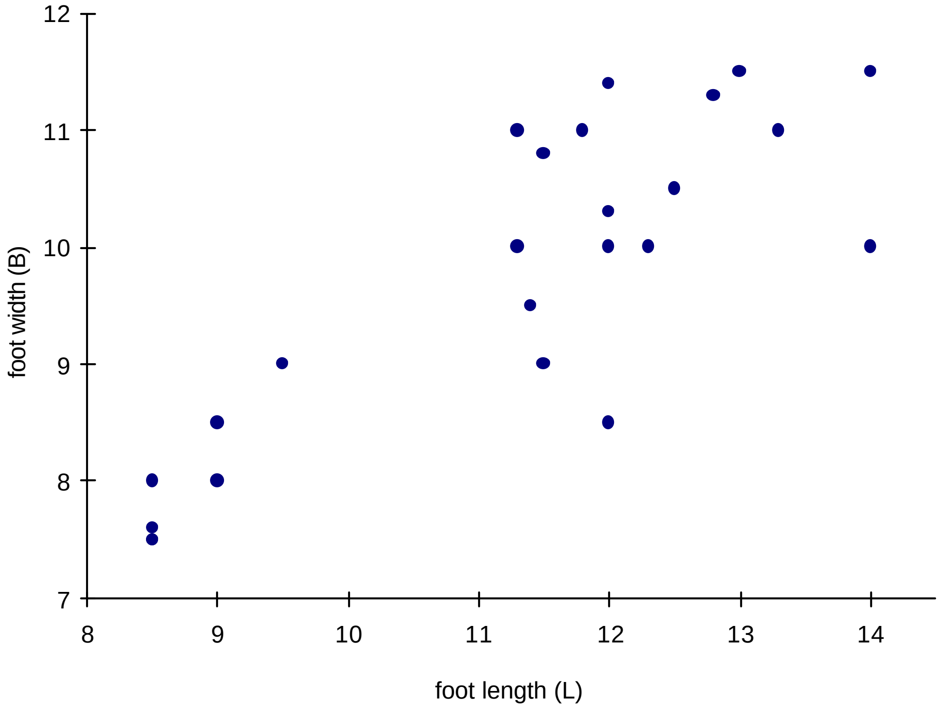


Fig. 2.3d. Scatterplot of wolf foot length (L) by foot width (B) measured in centimetres (cm)

The scatterplot reveals 2 patches of plots: one of smaller animals (7 footprints) and one of larger (17 footprints). This may be reflecting the ratio of young and adult wolves roaming in the area during the time of the survey. If so, young make up at least 29.2% of the wolf population in the area, and there may be 70.8% or fewer adults. Perhaps these figures could have changed, had the survey been extended for a month or two. However, they seem to be fairly consistent with figures found in the literature stating, for instance, 26%, 28.1%, 31%, 31.1%, 31.9%, one third, and up to one half of the population consisting of young individuals (Makridin, 1978).

A further analysis of footprint measurements allows for fairly distinct classification of male and female footprints. Indeed, according to Rukovski (1984), male tracks should be wider (B : L = 1 : 1.3, S being around 77%), whereas female tracks should be somewhat elongated (B : L = 1 : 1.5, S around 67%). These proportions have been derived primarily from measurements of footprints made in the snow, so we can expect that our data may differ from these particular proportions. However, the difference between male and female footprints should stay clear. The relatively small number of measured footprints in our sample may also be a source of variation. To separate the footprints by sex objectively, the method of *k*-means clustering was applied, using L, B and S as variables. Numbers of footprints belonging to a particular age group and sex, according to the results of this analysis, as well as means of S and the B : L ratio for the distinguished clusters, are summarised in Table 2.3e below. In fact, we are assuming here that animals in clusters characterised in a certain way are females or either males.

Table 2.3e. Results of *k*-means cluster analysis of footprint measurements.

| Group | Sex | n (number of footprints) | S = (B/L) x 100 | B : L ratio |
|---|---|---|---|---|
| Adults | Female | 10 | 80.32±1.65 | 1 : 1.250±0.028 |
| | Male | 7 | 92.10±1.39 | 1 : 1.087±0.016 |
| Young | Male | 7 | 91.15±1.17 | 1 : 1.098±0.014 |

It can be seen that results from our data give other proportions than those given by Rukovski (1984), S being around 92% for males and around 80% for females. This could be, of course, due to the fact that we were measuring indistinct footprints made in the sand. However, in both cases the male shape indices (S) are larger than those of females by 17%. We consider this to be a remarkable co-incidence confirming that we are indeed properly distinguishing males and females.

Once again, the ratio of footprints left behind by animals of different sex may be reflecting the proportion between males and females. If so, the ratio between adult male and female wolves inhabiting the area is identical to 1:1 ($\chi^2$=0.53, *df*=1).

An interesting fact resulting from the *k*-means cluster analysis of footprint measurements may be that all the recorded young have turned out to be males. That could mean that young male wolves start at an earlier time exploring their surroundings or moving a longer distance than their sisters. Or it may be that we have to double the estimate of young, that may indeed total about half of the wolf population in the area.

Finally, we come up to abundances, and, as stressed in our methods, one should be aware that we are dealing with relative abundances (i.e. indices), the significance of which will appear when the transect will be surveyed for wolf tracks in the same way for at least a second time, hopefully in 2002.

As both sections of the transect were surveyed in a somewhat different way, relative abundances (using raw and log-transformed data) were computed separately for both sets. For the Northern section this averaged index was 0.527±0.153 individual/km ($n$=17), and for the Southern section 0.505±0.230 individual/km ($n$=12). In terms of statistics both are identical ($t$=0.32; $p$=0.76 in the case of raw data, and $t$=0.16; $p$=0.88 in the case of log-transformed data), so we have pooled the sets, taking into account the fact that both sections were sometimes surveyed on the same day, resulting in an index of 0.603±0.158 individual/km ($n$=21).

It is tempting to speculate on figures of absolute abundances of wolves in the study area (although there may be too many untestable assumptions that have to be made, especially when we have been working *without* recognisable individuals). As mentioned above, in some cases researchers have attempted to extrapolate from an index to a real density using, say, data about animal movement patterns (for example, distances moved per day).

We too may assume that by monitoring the transect we are estimating how many animals (in fact, their tracks) are met in a rectangle, one side of which is the transect length (L) itself and the other consisting of two pieces, both equalling the distance moved per day by a wolf. In such a way density ($D$) may be computed by a modified formula from Höglund et al. (1967) (in Caughley, 1977):

$$D = \frac{n}{2 \times L \times w}$$

where n is the number of observed animals, L is the length of the transect (in km), and w is the average distance from the transect line to the animal. This last value is unknown. However, we may assume that it should be around the moving distances of the animals. Of course, one animal may be crossing the transect more than once and this is a drawback we cannot avoid. However, this may mean as well that the real number of wolves in the area is lower than our estimates (but not higher!)

So, what are those moving distances and how much does a wolf cover in a day? In this particular case the help of radiotelemetry would be greatly desired. There are, however, quite a lot of indications concerning daily moving distances in the literature, for instance Mech (1995). Most of this data, of course, is from winter surveys.

Valuable summaries in this respect have been made by Sysoev (1968), Pulliainen (1963), Priklonski (1973). Sysoev considers wolves to be moving within a day distances ranging between 0.8 km to 40 km, Pulliainen postulates a larger and wider range, 20 to 200 km, and Priklonski states an average of 18.54 km, and considers that this figure varies only slightly (about 6%) from place to place, depending on the type of habitat the animals are crossing: if the area is open, the distance may be around 25.6 km, if sheltered (for instance, moving in a forest), then the distance may be reduced to 14.7 km.

Another approach to this issue originates from theoretical considerations concerning relationships between body weight and home range (Harestad & Bunnell, 1979; Puzachenko & Zvenigorodskaya, 1988): in theory, a wolf weighing 33 kg covers an average daily distance of 5.4 km.

Now, once we have an array of moving distances, we can try, on the one hand, to calculate the absolute wolf abundances for the area of the Kinburnska Kosa Landscape Park, totalling about 120 sq. km. On the other, it would be unrealistic to assume that the home range of the population does not extend beyond the park boundaries, so we consider here too areas 2 and 3 times larger, i.e. 240 sq. km and 360 sq. km. These figures fit quite well into sizes of wolf pack home ranges quoted, for instance, by Vasidlov et al. (2001) for Poland (90-350 sq. km), the Ukrainian Carpathians (100 sq. km), Ukraine in general (150 sq. km). We have also included an area of 1,600 sq. km, corresponding to the total sand dune area of the Lower Dnieper used by wolves, according to Roman (1996). Resulting tentative estimates of absolute wolf abundances are summarised in Table 2.3f below.

Table 2.3f. Absolute wolf abundances in the Kinburnska Kosa study area for a variety of daily moving distances.

| Daily moving distance (km) | 1 animal in area (sq.km) | Total number in area (sq.km) | | | |
|---|---|---|---|---|---|
| | | 120 | 240 | 360 | 1,600 |
| 0.8 | 2.7 | 44.4 | 88.9 | 133.3 | 592.6 |
| 5.4 | 17.9 | 6.7 | 13.4 | 20.1 | 89.4 |
| 14.7 | 48.8 | 2.5 | 4.9 | 7.4 | 32.8 |
| 18.54 | 61.5 | 2.0 | 3.9 | 5.9 | 26.0 |
| 20 | 66.4 | 1.8 | 3.6 | 5.4 | 24.1 |
| 25.6 | 85.0 | 1.4 | 2.8 | 4.2 | 18.8 |
| 40 | 132.8 | 0.9 | 1.8 | 2.7 | 12.0 |
| 200 | 663.8 | 0.2 | 0.4 | 0.5 | 2.4 |

Considering these figures, it seems sensible to reject as unrealistic those estimates below 2 (shaded cells). It also seems very unlikely that wolves in the study area have been moving around at the rate of 800 meters per day. But even so, their numbers in the park itself would be below 40. More reasonable appear estimates assuming daily moving distances ranging between 5 and 15 km. In that case there may be one pack in the park, one or two in an area twice that of the park, one to three in an area three times larger than the park.

Of course it may be an exaggeration to extrapolate far up to an area of 1,600 sq. km. However, if wolves in the area are indeed covering within a day an average distance of around 5 km, 89.4 is a perfect estimate supporting the estimate of between 60 and 100 wolves made for the area by Roman (1996) in the course of a laborious survey.

## 2.4. Conclusions

During the survey there has been a more or less constant flux of wolves crossing the transect in both directions, predominantly in its middle portion. Wolves do prefer to move along roads and lanes, but do not appear to have a preference for either open or forested habitat.

The population in the study area is likely to be in a good, unhunted condition, indicated by the sex ratio of 1:1 and the presence of 30% or even 50% of young (usually males would be the first to be shot by hunters, distorting the 1:1 ratio).

A quantitative baseline has been set for monitoring the relative abundance of wolves in the area.

A speculation on the absolute abundance of wolves in the study area shows that numbers (fewer than 40) are well below those recognised by the general public (several hundred).

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# 3. Jerboa Survey

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## 3.1. Introduction

### Jerboa natural history

*Stylodipus telum* is a medium sized, bipedal jerboa. The generic name *Scirtopoda* Brandt, 1843, is often used for this species, particularly in the Russian and Ukrainian literature on mammals. In English, species of *Stylodipus* are referred to as "thick-tailed three-toed jerboas" (Macdonald, 2001).

Fig. 3.1a. Falzfein's thick-tailed three-toed jerboa (*Stylodipus telum falzfeini*).
© Rare and declining plants and animals in Ukraine (1986).

Jerboas have extremely long hind feet and short forelegs; they always walk upright or hop like kangaroos. Solitary, nocturnal animals, with a low tolerance for heat, jerboas spend the day in individual burrows with plugged entrances. In the Northern parts of their range (see Fig. 3.1b.) they hibernate; some jerboas of the true deserts aestivate. They feed on plant matter, especially seeds, and insects. They do not drink, but survive on water obtained from food or produced by their own metabolism. A jerboa can hop faster than a person can run, and a single leap may carry it more than 1.8 metres. Females have eight mammae, have 1 to 3 litters each year and give birth to 2 to 6 young in each litter.There are about 25 jerboa species, 22 of them in Asia. They are classified in 10 genera of the phylum Chordata, subphylum Vertebrata, class Mammalia, order Rodentia, family Dipodidae (birch mice, jumping mice, and jerboas).

Head and body length of *Stylodipus telum* is 100-130 mm, tail length is 63-132 mm, and hind foot length is 45-60 mm; individuals weigh approximately 60 g. Its upper parts are sandy or buffy, being darkened somewhat by a sprinkling of black-tipped and completely black hairs. The hairs along the sides of the body have a white base and a bright buffy tip. The underparts, the backs of the feet, and the hip stripe are white. The tail is about the same colour as the back, except that the base may be encircled by white; there is no distinct terminal tuft or white tip. When the animal sits, the tail is used as a prop. Each hind foot has three digits, the middle one being the longest. Each toe has a stout claw concealed by stiff hairs; the soles of the hind feet are also haired. The ears are relatively short. The incisor teeth are white and grooved.

*Stylodipus telum* occurs across the belt of semidesert and North temperate deserts from Southern Ukraine to Eastern Kazakhstan. However, the continuous distribution of the species is interrupted between the Dnieper and Volga (see Fig 3.1b.) and it is believed that this gap appeared in the late Pliocene just before the beginning of the ice ages (Selunina, 1998). Since then the isolated population in Ukraine found primarily in the sandy area in between the Dnieper and the Northern Black Sea coast, including the Kinburn peninsula, has been on its own pathway of evolution and adaptation. So much so that divergence from populations from the main home range of the species East of the Volga seems to have been far enough for it to be recognized as a particular subspecies, *Stylodipus telum falzfeini.* This subspecies, naturally, is endemic to the region and this is one of the reasons for listing it the Ukrainian Red Data Book (1994).

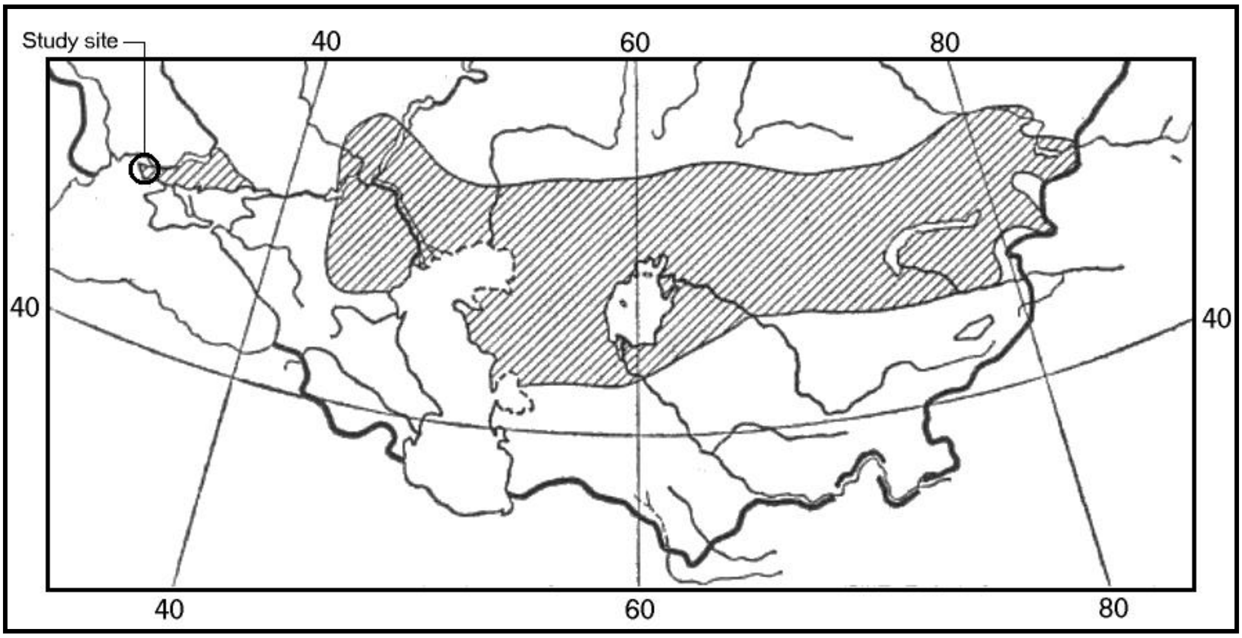


Fig. 3.1b. Geographical home range of the jerboa, *Stylodipus telum* with Kinburnska Kosa Regional Landscape Park study site location (see also Fig. 3.1.c). Note the disjunction between the Western and Eastern portions of the species' home range. Adapted from Flint et al. (1970).

*Stylodipus telum* generally inhabits deserts and steppes and occasionally has been reported in cultivated fields and pine forests (Selunina, 1998). *Stylodipus telum falzfeini*, in particular, inhabits sandy areas usually appearing in the region as vast patches of open land (so-called "arenas"). The animal excavates two kinds of burrows for summer use. Simple temporary holes (tunnels 0.6-2 m long) are dug for one day's rest or for shelter and/or escape routes during the night. Entrances to these holes are never plugged and are often marked by small mounds or piles of dirt. The permanent burrows are more complex, usually having a main entrance, emergency exits, and one or more chambers. Overall length of the passageways according to Selunina (1988) is 3-18 m. The entrance is kept sealed by day and highly cryptic. No mounds or other field signs mark the permanent burrow.

*Stylodipus* is generally nocturnal, individuals appearing 1.5-2 hours after sunset with peaks of activity from about 22.00 to 24.00 hours and at around 03.00 hours. It hibernates from September or October to mid-March. The diet consists of lichens, rhizomes, bulbs, seeds, and wheat. Individual home ranges are only 20-45 meters in diameter during the summer and do not overlap. Following its participation in reproductive activity, however, an individual may shift its range once or twice a month. The overall breeding season lasts from March to August, but it is not known whether females give birth more than once. The number of young per litter is 2-8, usually 3-5.

In the 1940s densities in sand areas reached 10-12 holes per hectare (Zubko, 1940). In 1962 the total population of the subspecies was estimated to be 400,000-450,000 individuals. However, since then it has greatly suffered from intensive planting of forests, which has in places totally destroyed the habitat of the jerboa. Declining numbers and shrinking habitats have been another reason for including the species into the Ukrainian Red Data Book (1994).

Selunina (1992) assumes that only 25,000 ha of habitat are left that are more or less suitable for the animal and estimates the number of individuals of the subspecies as 15,000-20,000, out of which 3,000 are found in the protected area of the Black Sea (Chornomorski) Biosphere Reserve, which neighbors the current study site in the Kinburnska Kosa Regional Landscape Park (see Fig 3.1c). For certain divisions of the Biosphere Reserve she provides the following densities: Ivano-Rybalchanski Division (46°26´N, 32°8´E): 1.5 ind./ha, 0.2 ind./ha on tops of dunes, 2.3 ind./ha on pastureland adjacent to the reserve, 2 individuals spotted from a motorcycle in the night along a transect 20 km long; Solonoozerny Division (46°28´N, 31°57´E): 0.5 ind./ha, 1.4 ind./ha on adjacent pasture and land occupied by recently planted pine.

## Location

The Kinburnska Kosa Landscape Park was created in 1992 and is situated in Ukraine on the Northern shores of the Black Sea, at the confluence of the Dnieper river, North-West of the Crimea. The park measures 18,000 hectares including 12,000 hectares of terrestrial habitats and 6,000 hectares of aquatic habitats. Habitats include natural sand dune areas covered with steppe vegetation, planted pine forests, lagoons and marine environments. The climate is continental and semi-arid with hot summers and cold winters. The peninsula was created by the shifting sands of the Dnieper and Bug rivers, rising out of the Black Sea only in the Quaternary.

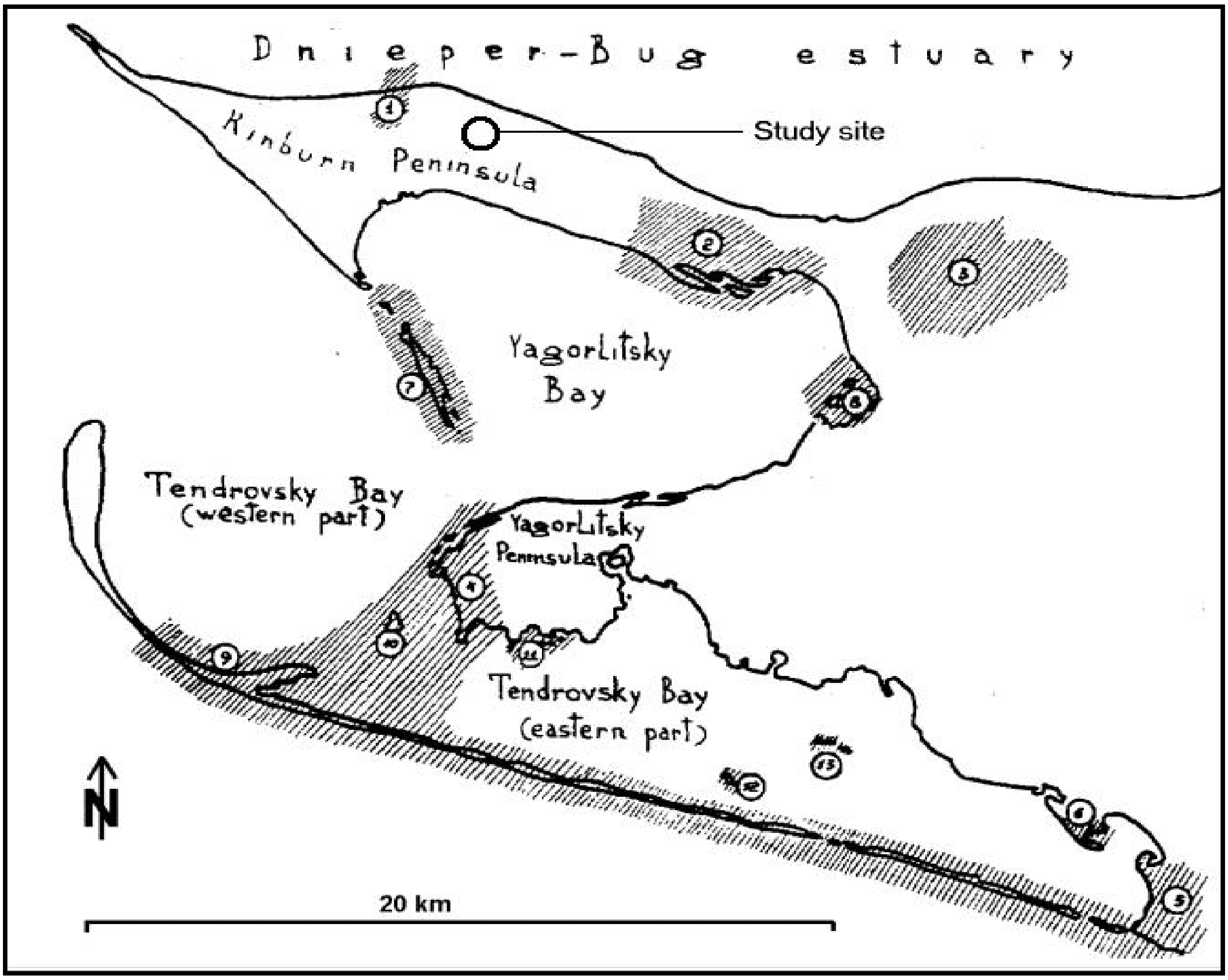


Fig 3.1c. The Kinburn peninsula (46º 30' N, 31º 40' E) with study site and adjacent protected areas of the Black Sea (Chornomorski) Biosphere Reserve (shaded).

## Rationale

Declining numbers of *Stylodipus telum falzfeini* are a concern for the authority of the Kinburnska Kosa Regional Landscape Park, yet numbers and densities have to date not been estimated. An estimate would thus aid proper monitoring of the population by setting a quantified baseline. Therefore, the aim of this survey was to obtain appropriate data for establishing a baseline for densities of jerboa within the park. A supplementary survey was undertaken of selected features of the spatial organization of the jerboa population for collecting additional quantitative data that may lead to a better understanding of population trends and peculiarities of jerboa biology.

### 3.2. Materials and Methods

One of the covenient methods for estimating densities of *Stylodipus telum falzfeini* is to count holes made by the animals within sample plots set up in the appropriate habitat. Gizenko (1983) considers that one animal digs up and makes use of 5 to 7 holes as temporary burrows. Heske and co-authors (1995) report similar figures, 4 and 6 for a population in Daghestan. Thus, by dividing the number of recorded used holes by 5 and/or 7, an estimate can be made of the number of animals within the plot, and dividing this number by the area of the plot (usually expressed in hectares) will produce the density. Gizenko used for this purpose sample plots measuring 200 x 50 metres. Selunina (1988 & 1992) followed this method in her estimation of *Stylodipus telum falzfei* densities in the Chornomorski Biosphere Reserve. We too have followed as far as possible Gizenko's method for at least two reasons: simplicity and possibility to compare the results for the Kinburnska Kosa Regional Landscape Park with those stated above for the Chornomorski Biosphere Reserve.

Table 3.2a. Plot parameters.

| Plot code | Plot corner coordinates (N, E) | | Adjusted size (m x m) | Adjusted area/ tetragon area (ha) | Habitat; date of survey |
|---|---|---|---|---|---|
| 1J | 1: 46º 31.112'<br>2: 46º 31.224'<br>3: 46º 31.223'<br>4: 46º 31.120' | 31º 44.075'<br>31º 44.084'<br>31º 44.047'<br>31º 44.042' | 207.4 x 77.8 | 1.61 / 0.96 | Open steppe, no trees; 20.09.01 |
| 2J | 1: 46º 31.227'<br>2: 46º 31.331'<br>3: 46º 31.332'<br>4: 46º 31.224' | 31º 44.087'<br>31º 44.086'<br>31º 44.046'<br>31º 44.050' | 207.4 x 101.9 | 2.11 / 1.49 | Sandy steppe, undulating small hills; 13.09.01 |
| 3J | 1: 46º 31.223'<br>2: 46º 31.326'<br>3: 46º 31.330'<br>4: 46º 31.224' | 31º 44.126'<br>31º 44.124'<br>31º 44.084'<br>31º 44.090' | 203.7 x 85.2 | 1.74 / 1.35 | Sandy steppe, almost flat ground; 16.09.01 |
| 4J | 1: 46º 30.996'<br>2: 46º 31.065'<br>3: 46º 31.074'<br>4: 46º 30.967' | 31º 43.681'<br>31º 43.641'<br>31º 43.675'<br>31º 43.640' | 211.1 x 85.2 | 1.80 / 1.16 | Open steppe; 19.09.01 |
| 5J | 1: 46º 32.243'<br>2: 46º 32.218'<br>3: 46º 32.229'<br>4: 46º 32.206' | 31º 44.623'<br>31º 44.628'<br>31º 44.772'<br>31º 44.771' | 275.9 x 68.5 | 1.89 / 1.12 | Flat open steppe; 20.09.01 |
| 6J | 1: 46º 32.358'<br>2: 46º 32.471'<br>3: 46º 32.473'<br>4: 46º 32.356' | 31º 44.670'<br>31º 44.712'<br>31º 44.660'<br>31º 44.711' | 216.7 x 96.3 | 2.09 / 1.40 | Hilly open steppe; 2 fox dens within the plot; 20.09.01 |

The expedition's survey team consisted of several paying, untrained expedition team members who gave up their holiday time to assist in this research project. Their work and the expedition contribution they paid made this research possible. Expedition team members were trained in how to set up plots and recognise holes and burrows by the local scientists and the expedition leader. Field guides were also provided.

For the purpose of this study 6 sample plots (1J-6J) were chosen and measured by the expedition members and the expedition leader using a GPS device for pinpointing sample corners and holes, and a compass for determining hole entrance orientation. Groups of 3-5 researchers then systematically scanned the entire plot for jerboa holes by covering on foot several times. Double counting holes was eliminated by marking holes already recorded. Because not all of the holes were in use, we defined activity as follows: 1 = used with marked signs of recent usage (tracks, seeds, droppings), 2 = used, 3 = not used, 4 = not used with marked signs (spider's webs blocking entrance, many roots growing into burrow, partially collapsed entrance). Only categories 1 and 2 were used for calculations of jerboa densities.

Sample plots were supposed to be of standard rectangular shape, approximately 200 x 50 m (1.00 ha). However, in the field they proved difficult to measure and because of the undulating terrain, plot edge markers were difficult to see for expedition team members combing the inside of the plot for jerboa holes. All this meant that in practice plots were in some way or other distorted and a number of jerboa hole records (and sometimes quite a few!) were taken outside of the plot boundary line connecting the corners of the plot. To cope with this distortion, we have handled the data in two ways.

Firstly, all plot coordinates (N, E) were converted into meters (y, x) by extracting from each value the minimum value (separately for N and E) and multiplying each such difference by 1.852 (as 1' = 1.852 m). In the case of 1J, for example, we get a tetragon with corner coordinates 14.8, 0; 205.6, 9.3; 207.4, 77.8; 0, 61.1 (Y-axis corresponding to N, and X-axis to E); this tetragon fits into a rectangular, one corner of which is placed into the origin of the coordinates (i.e., 0, 0) and the other one across the diagonal into the point with maximum coordinate values (207.4, 77.8). This was done in order to accommodate all hole records into a rectangle, thus somewhat increasing the sample plot size to an average of 220.4 x 85.8 m (1.89 ha) (see Table 3.2a.)

Secondly, the other way of treating the data was to compute the area of the irregular tetragons (average area of 1.25 ha) and *not* including in the analysis those sightings of holes outside their boundaries; this, however, meant the loss of 2 records of used holes in plot 2J, 2 in 3J, and 8 in 4J.

Statistical methods have been used to assess the pattern of distribution of holes within sample plots (random, clumped, or uniform) by examining the relationships between the mean (M) and variance ($\sigma^2$) for pinpointed holes (pooled samples and samples of used and unused holes are treated separately) in blocks of various size ranging from 100 to 3,000 $m^2$. The chi-square ($\chi^2$) test was applied to confirm if the sample is in agreement with the theoretical Poisson (random) series expecting the ratio of $\sigma^2/M$ to be equal to 1.0 (Ludwig & Reynolds, 1988).

In addition we tested plotless or distance methods (Greig-Smith, 1983) for measuring spatial organization by calculating values derived from distances between holes (distances measured between a given hole and its nearest neighbour). In theory, the derived mean distance (D) is equal to one half of the square root of the average area (S) occupied by one individual (in our case hole): $D=\sqrt{S}/2$. This means that we can calculate how many individuals are present per hectare and/or the distances themselves may be used as a measure of population density. Distances ($D_{i,j}$) between hole $i$ and hole $j$ were calculated as: $D_{i,j} = \sqrt{(y_i - y_j)^2 + (x_i - x_j)^2}$, where $x$ and $y$ are the corresponding coordinates. Where the measured distances were not distributed normally, logarithmic transformation was applied to the data. This allows for a more justified use of statistical methods for quantitative comparisons, in particular *t*-tests. Here too, pooled samples and samples of used and unused holes were treated separately.

The chi-square ($\chi^2$) test was applied to check the assumption that holes grouped into activity categories (1, 2, 3, 4 on one hand, and pooled 1 and 2, i.e. "used holes", and 3 and 4, i.e. "unused holes", on the other) are present in equal or unequal numbers. The same test was applied for assessing any prevalence of hole entrance direction (0º-90º, 90º-180º, 180º-270º, 270º-360º; and more specifically, 0º-45º, 45º-90º, 90º-135º, 135º-180º, 180º-225º, 225º-270º, 270º-315º, 315º-360º).

### 3.3. Results and Discussion

No holes were detected within sample plots 1J, 5J and 6J. Data on 2J, 3J and 4J regarding hole numbers, their use, and calculated densities (according to Gizenko's method) are summarized in Tables 3.3a and 3.3b. Figures in Table 3.3a were derived from the adjusted sample plots, whereas Table 3.3b considers various approaches to estimating plot size as described above.

Table 3.3a. Number of holes encountered in each adjusted sample plot.

| Plot code | Activity | | | | Used holes | Unused holes |
|---|---|---|---|---|---|---|
| | *1* | *2* | *3* | *4* | | |
| 2J | 6 | 3 | 5 | 7 | 9 | 12 |
| 3J | 5 | 7 | 8 | 13 | 12 | 21 |
| 4J | 4 | 9 | 7 | 3 | 13 | 10 |
| *pooled data* | 15 | 19 | 20 | 23 | 34 | 43 |

As can be seen, densities are quite comparable with those recorded for the Chornomorski Biosphere Reserve: 0.2-1.5 ind./ha. These figures, however, are well below those recorded for the nominate subspecies in the Eastern portion of the species' home range, where densities may reach a maximum of 12-20 ind./ha (probably one of the reasons why direct sightings of the animals are rarely used for counting their numbers; at least our attempts to spot animals after dark using night sights were unsuccessful).

Table 3.3b. Jerboa densities.

| Plot code | Adjusted plots (ind./ha) | Tetragons (ind./ha) |
|---|---|---|
| 2J | 0.61-0.85 | 0.67-0.94 |
| 3J | 0.98-1.38 | 1.06-1.48 |
| 4J | 1.04-1.45 | 0.62-0.87 |
| 2-4J | 0.86-1.20 | 0.79-1.10 |
| 1-6J | 0.43-0.60 | 0.42-0.59 |

This may be evidence that *Stylodipus telum falzfeini* is at the verge of extinction and at risk of local extinction if population numbers continue to decline, particularly if the species is disturbed in its habitat and/or, even worse, the habitat is being destroyed, as may happen if, for instance, current plans for additional forest plantations are enacted.

Yet the situation seems to be stable in some way in the sense that the population continues to maintain itself, despite its low numbers. Such a conclusion can be drawn by considering the ratio of used and unused holes in sample plots 2J-4J (Table 3.3c). Theoretically, a more or less rapidly declining population should be leaving behind more unused holes than used ones, whereas a conspicuously growing population should be revealing the opposite. In our case, used and unused holes are in fact present in roughly equal numbers.

Table 3.3c. Ratios of used and unused holes.

| Plot code | used | unused | $\chi^2$ | p< |
|---|---|---|---|---|
| 2J | 9 | 12 | 0.39 | 0.513 |
| 3J | 12 | 21 | 2.45 | 0.117 |
| 4J | 13 | 10 | 0.43 | 0.532 |
| Total | 34 | 43 | 1.05 | 0.305 |

This conclusion is supported by the $\chi^2$-test, suggesting that the population of animals within the surveyed sample plots are in some kind of equilibrium, whereby birth and death rates are approximately equal. Although it is hard to predict how long the population will be in this state, it is not unreasonable to assume that this equilibrium is probably fragile, especially considering the low total numbers of individuals present. It is worth noting with some concern that the number of unused holes in plot 3J is fairly high (21) and its further (even slight) increase may mean a prevalence over used holes, indicating a reduction in the numbers animals populating this particular plot.

Table 3.3d. Hole distribution. Note that values differing significantly from 1.0 are marked by an asterisk (*). Amongst these outliers attention may be drawn to clumping that may be occurring in blocks of 900 $m^2$ (in 3 such cases $\sigma^2/M$ exceeds 1.0). However, additional quantitative data would be needed to clarify this question.

| Plot code | Used holes | | Unused holes | | Pooled sample | |
|---|---|---|---|---|---|---|
| | block size ($m^2$) | $\sigma^2/M$ | block size ($m^2$) | $\sigma^2/M$ | block size ($m^2$) | $\sigma^2/M$ |
| 2J | 100 | 0.96 | 100 | 0.95 | 100 | 0.69* |
| | 400 | 0.82 | 400 | 0.75 | 400 | 0.94 |
| | 900 | 1.00 | 900 | 0.80 | 900 | 1.15 |
| | 3000 | 0.73 | 3000 | 0.40 | 3000 | 0.77 |
| 3J | 100 | 1.10 | 100 | 1.06 | 100 | 1.23* |
| | 400 | 1.20 | 400 | 1.40 | 400 | 1.14 |
| | 900 | 1.06 | 900 | 1.75* | 900 | 1.94* |
| | 2400 | 0.80 | 2400 | 0.92 | 2400 | 1.02 |
| 4J | 100 | 0.93 | 100 | 0.95 | 100 | 1.06 |
| | 900 | 1.69* | 900 | 0.76 | 900 | 1.45 |
| | 2100 | 1.41 | 2100 | 1.00 | 2100 | 0.79 |
| Pearson's correlation coefficient {r} between block size and $\sigma^2/M$ | | | | | | |
| | -0.159, p=0.640 | | -0.386, p=0.241 | | -0.244, p=0.469 | |

Density figures of Table 3.3c may be used for year-to-year comparisons for purposes of establishing population trends. Whether they prove to be robust may depend on how we set or adjust the boundaries for the sample plots, and at least 15-20 plots (Gizenko recommends 20) have to be surveyed each time to reach an acceptable standard error. In this respect distance sampling could be more effective, especially when individuals (holes) are sparse and widely scattered, presumably in a random order.

Clumping of holes, as well as either their random or uniform order of distribution was explored by examining the relationships between the mean (M) and variance ($\sigma^2$) for pinpointed holes (pooled samples and samples of used and unused holes treated separately) in blocks of various size ranging from 100 to 3,000 $m^2$ (Table 3.3d).

Blocks of various size are used in the analysis, because distribution patterns may change if clumping is the case. However, as is evident from Table 3.3b, the ratio $\sigma^2/M$ remains fairly stable and in most cases (28 out of 33) is not significantly different from 1.0, meaning a generally random distribution of holes within the sample plots (for statistical details of the method and how the $\chi^2$-test is applied in this case see Greig-Smith, 1983 or Ludwig & Reynolds, 1988). This conclusion is supported by the lack of any correlation between block size and $\sigma^2/M$ as far as all the correlation coefficients between block size and $\sigma^2/M$ are way above the acceptable confidence level, p>0.05).

It is most likely that this spatial pattern is due to the overall decline in jerboa numbers, which has led to a sporadic distribution of individuals. Theoretically, and as individual home ranges in jerboa do not overlap much, increasing animal numbers would not lead to a clumped spatial pattern. Instead a uniform distribution of animals, which would be indicated by the ratio $\sigma^2/M$ being significantly less than 1.0, would be the result. This is exactly what may be occurring in the Eastern portion of the home range of the species. However, as the data above suggest, this is not the case in the Southern part of Ukraine, where *Stylodipus telum falzfeini* is under intense pressure and in danger of extinction. The random spatial pattern of unused holes suggests that the situation has been the same for some time, lasting at least as long as the holes stay more or less intact and can be detected by a researcher.

Now, once we have ascertained the random spatial distribution of jerboa holes, we can attempt to test distance sampling, which could be a more efficient way of monitoring the jerboa populations. However, distance sampling requires that the population is distributed at random (Greig-Smith, 1983). As explained above, we have chosen the "nearest neighbour" method and distances were measured between a given hole and its nearest neighbour in 3 sample plots (2J-4J), treating pooled samples and samples of used and unused holes separately. The results are summarized in Table 3.3e.

In this table the most interesting figures are those characterizing mean distances between used holes, as they may be useful in estimating numbers of jerboa per hectare. There is no significant difference between values (both raw and log-transformed) derived for all three (2J-4J) sample plots (*t*-tests have shown no marked differences, all $p > 0.05$).

Table 3.3e. Distance sampling of jerboa holes. D = distances (in meters), SE = standard error (meters), n = number of measured distances.

| Plot code | Used holes | | Unused holes | | Pooled sample | |
|---|---|---|---|---|---|---|
| | n | D±SE (m) | n | D±SE (m) | n | D±SE (m) |
| 2J | 6 | 23.81±4.08 | 8 | 26.75±6.29 | 12 | 15.74±4.29 |
| 3J | 8 | 17.28±3.92 | 15 | 14.34±2.12 | 24 | 12.13±1.67 |
| 4J | 10 | 13.16±2.53 | 7 | 27.98±4.41 | 16 | 14.16±2.30 |
| Total | 24 | 17.20±2.07 | 30 | 20.83±2.46 | 52 | 13.59±1.42 |
| Log-transformed data | | | | | | |
| 2J | 6 | 3.069±0.221 | 8 | 3.103±0.240 | 12 | 2.489±0.206 |
| 3J | 8 | 2.599±0.291 | 15 | 2.508±0.156 | 24 | 2.271±0.147 |
| 4J | 10 | 2.420±0.189 | 7 | 3.266±0.143 | 16 | 2.373±0.219 |
| Total | 24 | 2.642±0.141 | 30 | 2.843±0.121 | 52 | 2.352±0.105 |

On the assumption that differences between mean distances for samples considering used holes can be neglected, we can use the overall average for all three sites (17.20±2.07 meters) to estimate jerboa densities. Taking into account confidence limits (±SE*1.96), and that $D=\sqrt{S/2}$, and that one animal makes use of 5 to 7 temporary burrows, densities would range from 0.79 to 2.90 ind./ha and be mostly around 1.21 and 1.69 ind./ha.

These estimates seem to be somewhat higher than those obtained by using quadrat (or block) sampling methods, for instance, the lower estimate for 2J stated above, 0.61 ind./ha (see Table 3.3b), is below the limit of 0.79 ind./ha. However, it is likely that both sets are consistent, because all the other estimates derived using block sampling methods fit into the expected range derived from the mean distance.

Incidentally, we may note here as well that, although 4J shows a difference in distance values for used and unused holes (13.16±2.53 m and 27.98±4.41 m respectively), the overall averages (pooled data of 2J, 3J, 4J) for used and unused holes are not significantly different ($t$=0.67, $p$=0.510). This appears to confirm our assumption concerning the contemporary equilibrium in the jerboa population. Nevertheless, special attention should be drawn to 4J, because the smaller average distance between used holes on one hand, and a larger one between unused holes may be an indication of increasing numbers of jerboa, presumably from 0.46-0.64 ind./ha to 2.1-2.9 ind./ha. Another encouraging indication of such an increase could be the somewhat larger number of used holes (13) in the plot compared to the number of unused ones (10). Having said that, it is presently impossible to make any sound conclusions using these numbers.

In the course of applying the "nearest neighbour" method to our data we have also taken notice of the relationships between neighbouring holes. These fall into 3 categories: both "neighbours" are used, only one of them is used, both are not used. Pooled data from 2J, 3J, 4J was used for deriving numbers characterising each category (see Table 3.3d.)

Table 3.3f Relationship between neighbouring holes in terms of their utilization by jerboas

| category | used/ used | used/ not used | not used/ not used |
|---|---|---|---|
| number | 11 | 26 | 15 |
| percent | 21.2 | 50.0 | 28.8 |

Numbers are distributed unevenly between the categories. In particular there are significantly more neighbouring holes one of which is used and the other one not, and far fewer where both are in use. As this kind of pattern is quite likely to be a reflection of competition between individuals, the "nearest neighbour" method may be used not only for estimating animal numbers and densities, but also for detecting and quantifying important biological relationships, in our case competition. These figures too will be of significance to monitoring the population of jerboas as far as any changes to abundances and/or the supply of resources (food, shelter etc.) are very likely to shift them to another value.

Finally, a few words on the orientation of hole entrances. No narrow specific direction was found to be preferred, although in general terms there are somewhat more entrances facing E or W (46) than N or S (30).

### 3.4. Conclusions

One sad conclusion is that amongst six plots surveyed, of what appeared to be suitable habitats for the jerboa *Stylodipus telum falzfeini*, three were empty. A possible explanation for this could be heavy predation from both foxes and/or raptors, but this is as yet unclear.

The survey has confirmed the low density of the population in the area of the Kinburnska Kosa Regional Landscape Park and the figures presented here are comparable with (if perhaps somewhat higher than) those quoted earlier for the neighbouring Chornomorski Biosphere Reserve. It is hard to arrive at any firm conclusions, as so far the quantitative basis for calculation has been fairly poor. However, this survey represents a start and for the first time has attempted a rigorous quantitative approach and tested various approaches to estimating jerboa densities. Plotless or distance methods for this purpose have been tested for the first time ever and appear very promising. The next survey should confirm the validity of the approaches we have chosen, especially in terms replicability and comparability. More plots should be investigated in addition to plots 1J-6J.

The results of this year's survey allow us to assume that the population in the Kinburnska Kosa Regional Landscape Park is for now at least in a state of equilibrium. However, this equilibrium can easily be disturbed by outside influences with drastic consequences for the continued existence of the species in the region. Conservation measures targeting the jerboa *Stylodipus telum falzfeini* should therefore always be on the agenda of the park authorities.

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Fig. 3.1a is from: Rare and declining plants and animals in Ukraine. Kiev: Naukova Dumka, 1986, p. 218.

Fig. 3.1b is from: Flint V.E., Chugunov Yu.D., Smirin V.M. Mammals of the USSR. Moscow: Mysl, 1970, p. 318.

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# 4. Viper Survey

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## 4.1. Introduction

The Meadow Viper (*Vipera ursinii*), also known as Orsini's Viper in Western Europe, is a threatened and Red Data book listed rare snake that in Europe only occurs in scattered pockets. There are, however, several subspecies of Meadow Viper and one, *Vipera ursinii renardi*, is reasonably abundant further throughout Eastern Europe to the Caucasus and Central Asia (see Fig 4.1a.). In the Ukrainian and Russian literature this particular viper subspecies is commonly referred to as the "Eastern Steppe Viper" (Anon., 1988; Anon., 1994; Bannikov et al., 1977), and "Steppe Viper" is used for the whole species. It is this particular subspecies, the Eastern Steppe Viper, that is present in the area of the Kinburnska Kosa Landscape Park (see above).

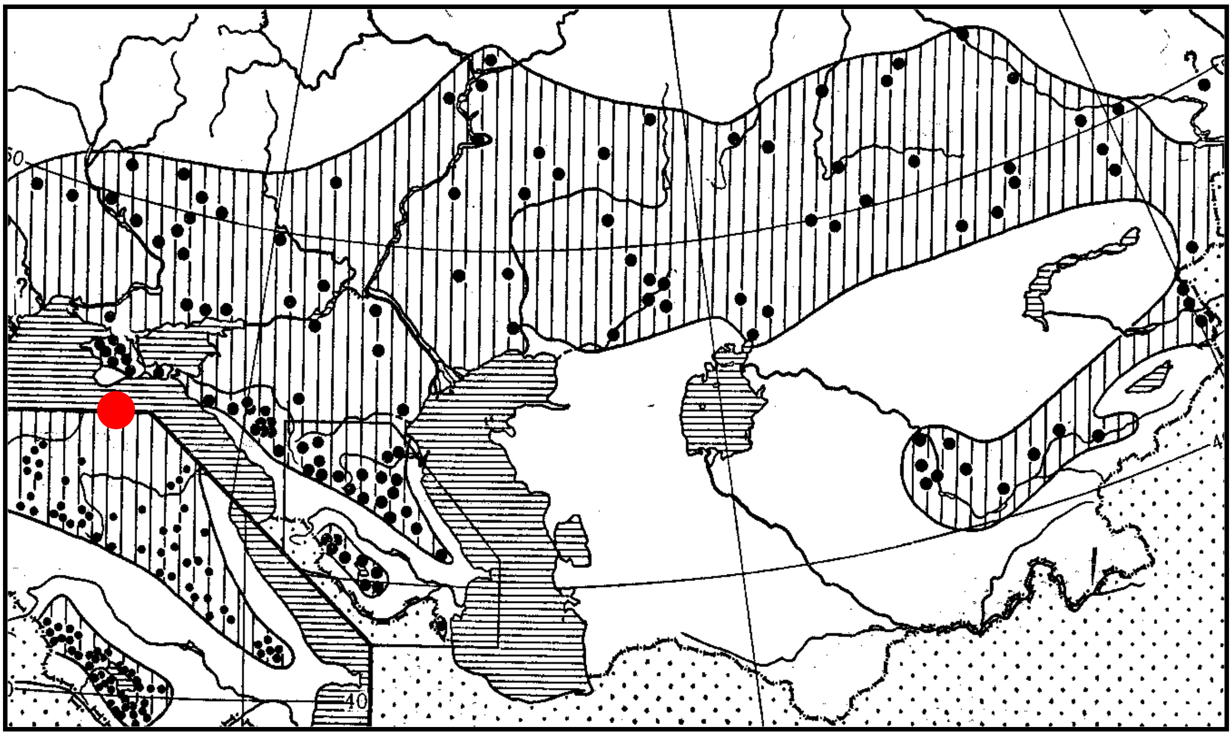

Fig. 4.1a. Home range of the Eastern Steppe Viper (*Vipera ursinii renardi*) in countries of the former Soviet Union. The red dot denotes the study area of the Kinburnska Kosa. From Bannikov et a. (1997).

The Steppe Viper is the smallest European viper, being fairly short and stout, usually reaching 35-45 cm (maximum up to 60 cm) in length. As other vipers, it is remarkable for being able to flatten its body, which may be most pronounced when basking in the sun or in order to assume a more formidable appearance on the approach of a threat. Males generally have longer tails than females. The head is strongly depressed, and so broad behind as to be abruptly defined from the anterior part of the body, or "neck". The eye has a vertical pupil. Sexes are alike in colouration. The ground colour of the back is brownish-grey with a dark dorsal zigzag band; dark brown or black spots extend along the sides (see Fig. 4.1b).

Mating takes place in spring. In the area of the Kinburnska Kosa Landscape Park this occurs particularly in April (Kotenko, 1977), when sometimes great numbers of males can be seen wriggling around the females. Young undergo development within the oviducts and are born from July to September. The number of young in one brood varies from 5 to 20, and their length may vary from 12 to 18 cm. Young immediately after birth resist all handling, hissing and/or snapping, after the manner of their parents. The periodical shedding of the outer layer of the epidermis in a single piece, including even the covering of the eye, is one of the most striking peculiarities of snakes. The skin becomes detached at the lips, and is turned inside out from head to tail, without any sort of laceration when the snake is in good health. The first shedding follows soon after birth and at least three exuviations take place during the period of activity (in April/May, July/August, and late August/September). The Steppe Viper reaches sexual maturity at the age of 3, being by that time 31-35 cm long. Lifespan in the wild is limited to 7 or 8 years.

Fig. 4.1b. The Eastern Steppe Viper (*Vipera ursinii renardi*). Photo: M. Hammer.

Steppe Vipers are typical ground-snakes living above ground, apparently favouring open meadows and grassland, and occasionally climbing bushes or entering the water. A vertical pupil denotes more or less nocturnal habits. Nevertheless the species is far from being exclusively nocturnal, basking in the sun, and pairing and breeding in the daytime. They do, however, shun high temperatures and as daily temperatures rise, the vipers switch to a nocturnal pattern of behaviour. Hibernation is from late October-November to the first half of March (Kotenko, 1977).

The species subsists on a varied diet, including rodents, lizards, frogs and nestlings. A considerable amount of prey consists of orthopteran insects (grasshoppers, locusts etc.). Although venomous, the poison of this rather placid viper is not considered dangerous to humans.

It is largely this poison factor that led until recently to the persecution of the animal. Remarkably, even within protected areas, such as of the Chornomorski Reserve, which borders the Kinburnska Kosa Landscape Park, wardens up to the late 1950s were paid a bonus for killing vipers (Anon., 1988). However the species has to a much greater extent suffered from human encroachment, which has destroyed or considerably reduced suitable habitats, resulting in a strong decline in numbers. Since 1980 the Eastern Steppe Viper has been listed in the national Red Data Book, which assigns it the status of a "declining species". Another, more recent blow and continuing threat to the viper population has been illegal harvesting of venom for medicinal purposes and trade of specimens being captured for zoos and private collections. The authority of the Kinburnska Kosa Landscape Park is strongly opposed to any such kind of activity and is doing its best to keep poachers out of the area.

### Rationale

To date there are no good figures characterising abundance of the vipers in the park which can provide baseline data for the efficiency of protection measures. The purpose of this survey was to provide incidentally during other survey work some baseline data for estimating viper abundance in the park.

### 4.2. Materials and Methods

Probably the best time for estimating viper numbers and abundance would be the breeding season when the animals are most gregarious. So, recording individuals met in August and September, as was done in this study, is likely to reflect population numbers, but perhaps not as accurately as in spring. In addition the August and September counts are likely to consist of many recently born juveniles, not all of which will survive the winter to reappear once again in spring.

Methods applied in this survey were very basic. Vipers were recorded during the inspection of transects or routes of known length within an approximately 2 m wide strip used primarily for counting wolf tracks; records were made of the dates, time of the day and of the approximate length of the animal, which was assessed visually, so there was no handling of the animals. There was no preferred daytime hour for inspecting the routes. During the counting of jerboa holes (see above), vipers were recorded by surveyors (also see above) within sample plots 1J-4J of known size.

Abundance is calculated as the number of vipers per kilometre of route and density as number of vipers per hectare. Usual statistical methods have been employed to process the data.

## 4.3. Results and Discussion

60 vipers were recorded during the survey lasting from 16 August until 19 September. The average number of vipers met along a route was 0.247±0.086 per kilometre, ranging from 0.142 to 0.926. In other words, 1 to 9 vipers were met on a 10 km route at this time of the year.

Plot assessment of viper density ranged from 0.48 to 4.60 individuals per hectare of size-adjusted plot area or 0.68-5.93 individuals per hectare of tetragon area (see Table 4.3a.).

Table 4.3a. Viper densities in jerboa hole sampling plots (for plot codes and explanation see jerboa survey above).

| Plot code | Date of survey | Time of day | Adjusted area/ tetragon area (ha) | Number of vipers detected | Density per ha of adjusted area / tetragon area |
|---|---|---|---|---|---|
| 1J | 12.09 | 17:23-17:39 | 1.61 / 0.96 | 3 | 1.86 / 3.13 |
| 2J | 13.09 | 16:13 | 2.11/ 1.49 | 1 | 0.48 / 0.68 |
| 3J | 16.09 | 16:30-17:37 | 1.74/ 1.35 | 8 | 4.60 / 5.93 |
| 4J | 19.09 | 17:00 | 1.80/ 1.16 | 1 | 0.53 / 0.89 |
| | | | | Total 13 | Average 1.87 / 2.66 |

These variable figures may be due to small number of plots surveyed. More such plots (around 15 to 20) would be needed to make a justified statistical assessment of the mean density and perhaps get an insight to the distribution pattern of vipers. With the data in hand it is difficult to compare these figures with any other data (e.g. Kotenko, 1996), as much of this published data was collected during the breeding season and densities were derived from transect strip data. Therefore plot assessment of viper density and discussion will be possible once additional expeditions have gathered more data.

So, is the abundance of 0.142 to 0.926 vipers per kilometre high or low? Once again, we face the problem of comparing data gathered within and beyond the breeding season. However, we can consider the breeding season data to be some kind of "optimistic" baseline, but, as mentioned above, should keep in mind that a smaller proportions of juveniles will be met in the spring samples.

Breeding season estimates of Eastern Steppe Viper abundance have been obtained in a comparable fashion by Kotenko (1977, 1996) for the Chornomorski Biosphere Reserve. The highest records come from Orlov Island (46°17´N, 32°44´E) and Potievska Tendra (about 46°8´N, 32°13´E): with 5 individuals/km and 1-4 ind./km, respectively; in these places the viper is considered to be very abundant. However, in most places of the reserve, estimates fluctuate between 0.2-2 ind./km. So there is indeed some degree of overlapping between the two sets of estimates, especially if the extremes are excluded, but it does seem that there could be fewer vipers in the park. However, it may be that many of them were not sighted due to lower chances of coming across one in August-September.

The question that this raises is whether are we at all "properly" recording viper numbers at this time of the year and whether they are indeed reflecting certain basic features of viper ecology and behaviour? An encouraging result, increasing our confidence on the reliability of the collected data, has emerged from the analysis of viper numbers recorded during the daytime (Fig. 4.3b. below).

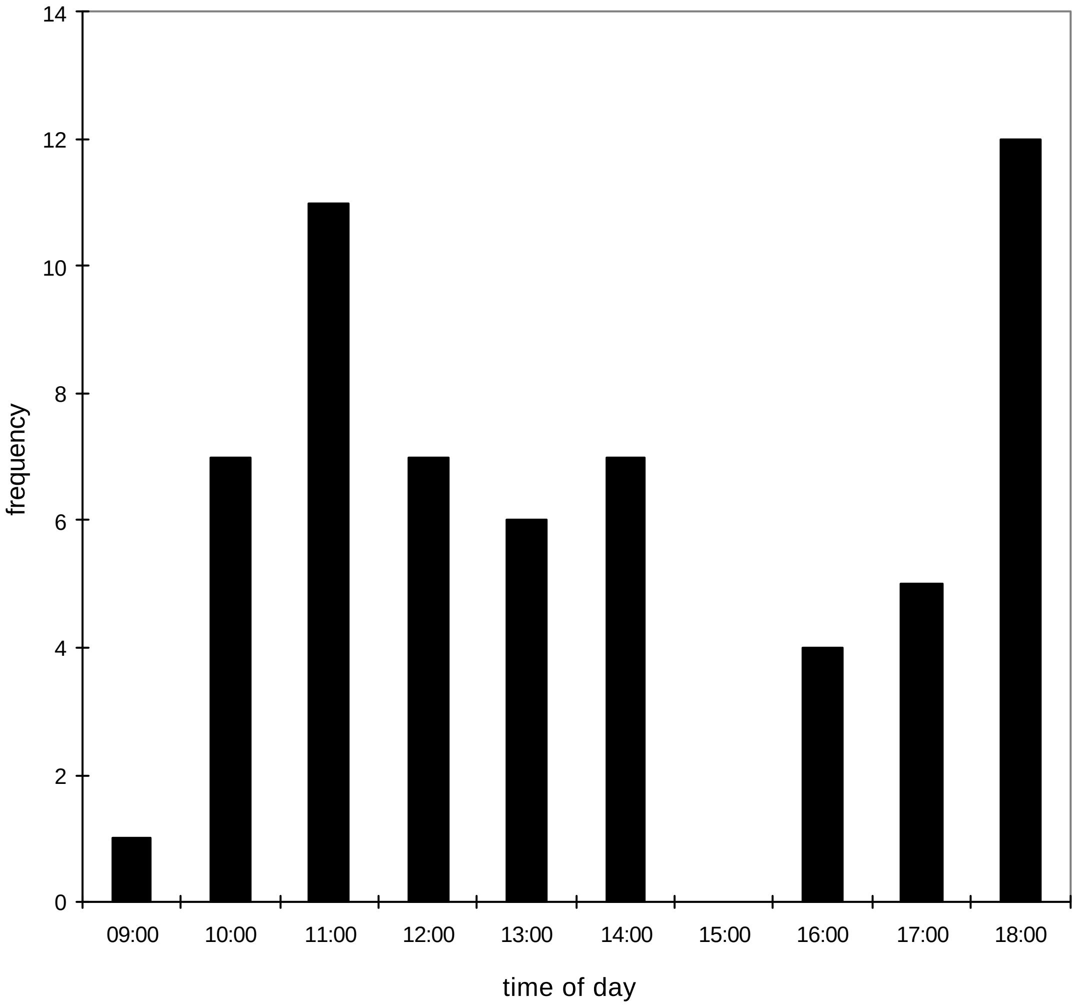


Fig. 4.3b. Daytime record of viper numbers.

As mentioned, the Eastern Steppe Viper shuns high temperatures and tends to avoid the mid-day heat, which reaches its peak at around 15:00. This is exactly what the graph below shows: viper numbers increasing in the morning hours, later declining all the way down to zero during the hottest part of the day, and once again rising in the late afternoon when the air cools down. Of course, these results may be to some extent "blurred" by the fact of pooling the data into one set and ignoring the gradual drop of daytime temperatures, particularly in the final stages of the expedition. Nevertheless, the general pattern is evident.

A less obvious pattern is represented by the histogram of viper length data (see Fig. 4.3c). Such histograms are usually used for identifying population structure composed of various age groups (or size groups if the precise age of the animals is unknown). Indeed, there are more juveniles (size class 12-18 cm) of the current year than from the previous two (size classes 20-30 cm), 31% and 29%, respectively, and only 14% are of the age of three (size class 31-35 cm); the rest of the population (26%) consists of individuals above 35 cm, presumably older than three. In broader terms, 60% of the population consists of immature individuals and 40% of the individuals (or fewer) may reproduce. Theoretically, under these circumstances many more juveniles would be expected. It may be, of course, that they have perished before the survey, so there was no chance of encountering them or it could be that we were just not seeing them, although this seems unlikely. Additional data will be necessary to clarify this question, which may provide a valuable insight into the population trend of the viper in the area.

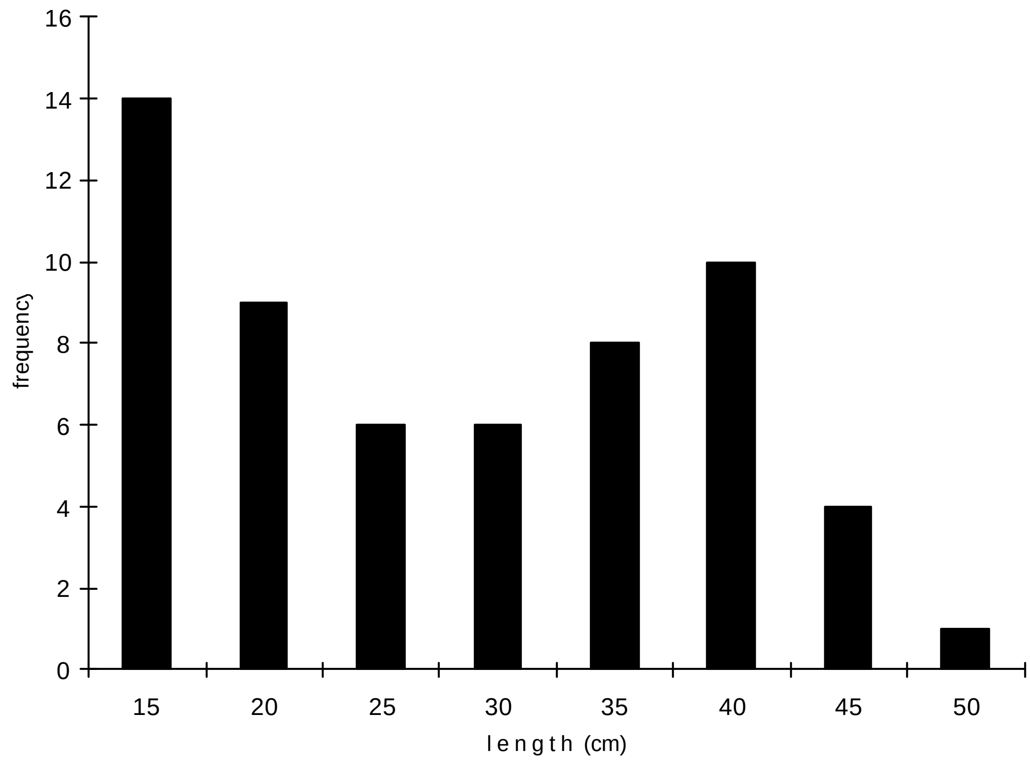


Fig. 4.3c. Distribution of viper length.

## 4.4. Conclusions

The threat to the Eastern Steppe Viper may not be as serious in the Kinburnska Kosa Landscape Park as in other parts of Ukraine and numbers seem to be comparable or not very much below those estimated for strictly protected areas.

Although there are some problems associated data collected within and beyond the breeding season, data from the current survey in August-September seem to be fairly reliable. It is the intention to continue surveying in subsequent years. Comparative data from future surveys will be a first test of the quality of our current baseline data. Of course, different weather conditions have to be taken into account and linked with the records; this may involve not only measuring temperature and rainfall during the survey, but also an analysis of meteorological data characterising the period between surveys. Furthermore, there may be a need for a more precise estimation of viper length, perhaps by photographing each specimen met in the field.

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# 5. Autumn Bird Migration

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## 5.1. Introduction

Different aspects of bird migration (number dynamics, phenology, biometry and population waves, etc.) are the subjects of extensive studies in Western Europe, especially along the Atlantic coast. Despite this, knowledge of bird migration in more Eastern continental regions is scant. Such data analysis is especially interesting in the protected areas (National Parks, Reserves) for the purpose of effective protection of these areas. Areas along the sea coast, sea spits and islands are also of special interest, because they concentrate birds of different species before their long distance flights across the sea. Reported here is an autumn bird migration study within the area of the Kinburn Landscape Park (Ukraine, Nikolaev Region, Ochakov District). This area is part of the larger Kinburn peninsular, used by many bird species as a ‘stepping stone’ for crossing the Black Sea. Special attention was given to passerine bird migration. because very little information is available about it from this region. The study from August to September 2001 covered the migration period of long-distance migrants who winter in Africa, the Mediterranean and South-Western Asia. Data are valuable for comparative analysis with similar data from other adjacent areas and can contribute to better protection of the biodiversity in the Landscape Park ‘Kinburnska Kosa’.

### Location

The Kinburnska Kosa Landscape Park was created in 1992 and is situated in Ukraine on the Northern shores of the Black Sea, at the confluence of the Dnieper river, North-West of the Crimea. The park measures 18,000 hectares including 12,000 hectares of terrestrial habitats and 6,000 hectares of aquatic habitats. Habitats include natural sand dune areas covered with steppe vegetation, planted pine forests, lagoons and marine environments. The climate is continental and semi-arid with hot summers and cold winters. The peninsula was created by the shifting sands of the Dnieper and Bug rivers, rising out of the Black Sea only in the Quaternary.

This study was carried out between 14 August and 20 September 2001 as a part of research expedition conducted by Biosphere Expeditions. The bird research site was situated in the southern part of the Kinburn peninsular, on the south-eastern edge of a sand spit with salt marsh vegetation and several rows of willow bushes. This spit is edged by the Black Sea along its Western beach and has salt lakes and Yagorlytski Bay in its Eastern part. The distance between the base expedition camp and the end of the spit was about 2 km. This area is a part of the Kinburn Landscape Park and it is very important for the postbreeding and migration concentrations of birds. The area around the bird research site includes mixed salt marsh and steppe vegetation, sandy beach, small lakes and bushes.

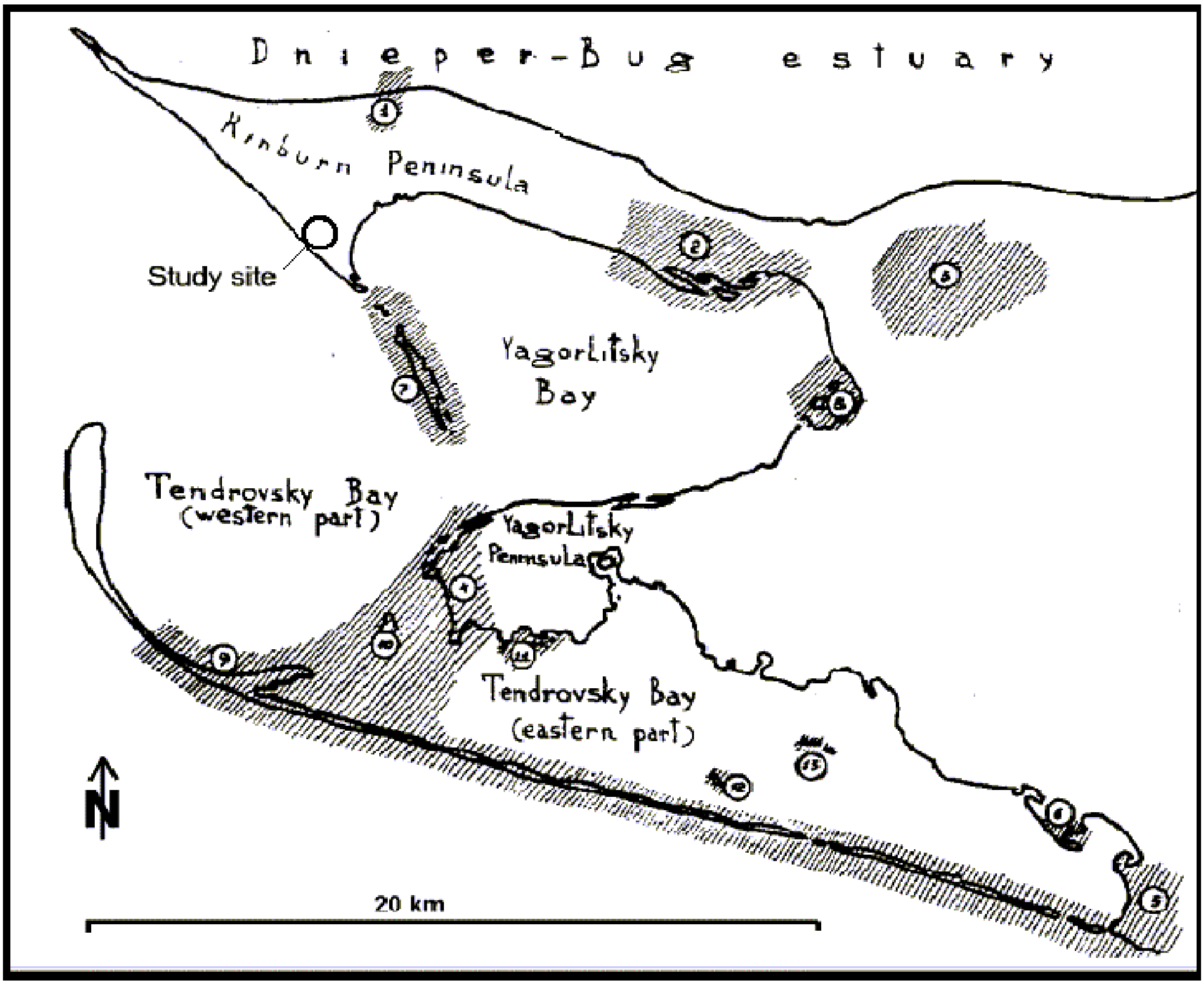


Fig 5.1a. The Kinburn peninsula (46° 30' N, 31° 40' E) with study site and adjacent protected areas of the Black Sea (Chornomorski) Biosphere Reserve (shaded).

## 5.2. Materials and Methods

The expedition survey team included biologists and several untrained expedition team members who gave up their holiday time to assist in this research project. The latter were changed over after 5 days. Team size varied between 2-3 expedition team members + 1-2 local biologists + 1 expedition leader. Expedition work was supported by the director of the Kinburn Landburn Landscape Park.

Expedition team members were trained in bird identification, in work with mist nets and a funnel net, in extracting captured birds from mist nets and in bird ringing. Field guides were also provided.

One big funnel net of the Helgoland type and up to 7 mist nets were set up around the research site, within a 0.5 km radius. All captured birds were identified (including their age and sex), measured (standard measurements of wing length, tail and bill length and wing formula for some species), weighed (using a Pesola spring balance), ringed with the rings of Kiev Ringing Centre and finally released. All data obtained were included in special ringing forms and notebooks for future analysis. In addition a standard census route (about 4 km length) was established along the beach up to the Southern end of the spit and back along the salt lakes. One local biologist and 1-2



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other team members carried out regular censuses of birds on this census route. Additional censuses were conducted around a large salt lake near the camp where the species composition was sometimes different. Some team members who had experience of bird identification carried out visual observation of bird migration on the sea beach near the camp. These data gave interesting additional information on raptor migration and were also recorded on forms. All birds along the census route were identified and counted per species. Data obtained were recorded on forms to study number dynamics and phenology of migration.

Weather conditions were noted every 3 hours between 06:00 and 18:00 (wind direction, air temperature, % of clouds in the sky, rain, fog, etc.). These data were recorded to illuminate the influence of weather on migration. During the study period weather conditions were quite stable. Air temperature was between 10 – 29ºC in the morning and 14-33ºC in the afternoon.

The hottest period was between 14 - 24 August. There were 8 days with little rain and 4 days with heavy rain and storms (28 - 29 August, 3 & 6 September). There were 17 days with strong winds during the day or in the evening (20, 22, 24, 26, 28 - 30 August and 2, 3, 4, 6, 8, 10, 12,18 - 20 September).

## 5.2. Results and Discussion

During the study period of 38 capture days 1331 birds of 42 species (35 passerine and 7 non-passerine species) were captured, measured and ringed (Table 5.2a). In addition 85 species were noted during the visual observations (Table 5.2b).

Certain waves of passerine migration with maximum numbers of captured and ringed birds can be discerned. In August peak numbers of captured birds during the day were on 16 - 17, 19 - 20 and 24 August. The dominant species that formed these waves of migration was the Willow Warbler (*Phyllocsopus trochilus*). The main subdominants were Red breasted Flycatcher (*Ficedula parva*), Wood Warbler (*Phylloscopus sibilatrix*) and Red backed Shrike (*Lanius collurio*). Spotted Flycatcher (*Muscicapa striata*) and Blackcap (*Sylvia atricapilla*) were also among subdominants, but only during the first peak period (16 - 17 August).

In September maximum numbers of birds captured were on 5, 11, 15 and 17 September. The last two days were also maxima for the whole study period. Dominant species in September were Red breasted Flycatcher and Spotted Flycatcher. Subdominants were Blackcap, Red backed Shrike and Garden Warbler (*Sylvia borin*). Willow Warbler also became one of the main subdominant species at the end of September (within the last two peak days on 15 and 17 September). For all the above mentioned species the study area seems to be an important stopover site on their autumn migratory fly-way.

Table 5.1a. List of bird species captured and ringed during the expedition.

| Species | Total ringed | % |
|---|---|---|
| *Accipiter nisus* (Eurasian) Sparrowhawk | 3 | 0.23 |
| *Coturnix coturnix* (Common) Quail | 1 | 0.07 |
| *Cuculus canorus* (Common) Cuckoo | 1 | 0.07 |
| *Caprimulgus europaeus* (European) Nightjar | 1 | 0.07 |
| *Upupa epops* (Eurasian) Hoopoe | 1 | 0.07 |
| *Alcedo atthis* (Common) Kingfisher | 3 | 0.23 |
| *Jynx torquilla* Wryneck | 5 | 0.38 |
| *Riparia riparia* Sand Martin | 1 | 0.07 |
| *Hirundo rustica* Barn Swallow | 6 | 0.45 |
| *Anthus trivialis* Tree Pipit | 2 | 0.15 |
| *Motacilla alba* White/Pied Wagtail | 7 | 0.53 |
| *Motacilla flava* Yellow Wagtail | 2 | 0.15 |
| *Erithacus rubecula* Robin | 15 | 1.13 |
| *Luscinia luscinia* Thrush Nightingale | 29 | 2.18 |
| *Phoenicurus phoenicurus* (Common) Redstart | 53 | 3.98 |
| *Oenanthe oenanthe* (Northern) Wheatear | 1 | 0.07 |
| *Saxicola torquata* Whinchat | 6 | 0.45 |
| *Turdus philomelos* Song Thrush | 1 | 0.07 |
| *Sylvia borin* Garden Warbler | 124 | 9.32 |
| *Sylvia nisoria* Barred Warbler | 4 | 0.30 |
| *Sylvia atricapilla* Blackcap | 128 | 9.62 |
| *Sylvia curruca* Lesser Whitethroat | 9 | 0.68 |
| *Sylvia communis* (Common) Whitethroat | 29 | 2.18 |
| *Acrocephalus schoenobaenus* Sedge Warbler | 10 | 0.75 |
| *Locustella fluviatilis* River Warbler | 3 | 0.23 |
| *Locustella luscinioides* Savi's Warbler | 1 | 0.07 |
| *Acrocephalus scirpaceus* (European) Reed Warbler | 3 | 0.23 |
| *Acrocephalus palustris* Marsh Warbler | 14 | 1.05 |
| *Acrocephalus arundinaceus* Great reed Warbler | 8 | 0.60 |
| *Hippolais icterina* Icterine Warbler | 25 | 1.88 |
| *Phylloscopus trochilus* Willow Warbler | 210 | 15.78 |
| *Phylloscopus sibilatrix* Wood Warbler | 58 | 4.36 |
| *Phylloscopus collybita* ChiffChaff | 2 | 0.15 |
| *Muscicapa striata* Spotted Flycatcher | 127 | 9.54 |
| *Ficedula parva* Red breasted Flycatcher | 287 | 21.56 |
| *Ficedula hypoleuca* Pied Flycatcher | 11 | 0.83 |
| *Ficedula albicollis* Collared Flycatcher | 8 | 0.60 |
| *Parus major* Great Tit | 3 | 0.15 |
| *Lanius minor* Red backed Shrike | 112 | 8.41 |
| *Lanius collurio* Lesser grey Shrike | 4 | 0.30 |
| *Oriolus oriolus* (Eurasian) Golden Oriole | 5 | 0.38 |
| *Carduelis carduelis* (European) Goldfinch | 9 | 0.68 |
| *TOTAL* | 1331 | 100 |

We can also establish clear peak periods in migration of non-passerine species and some passerines from our visual observations (Table 5.2b). Peaks are especially obvious in transit migrants that are not breeding in the area and for the species breeding in small numbers. In wader species these periods were 17 - 18 August for Turnstone (*Arenaria interpres*), 22 - 23 August for Sanderling (*Calidris albor*), 30 August - 4 September for Grey Plover (*Pluvialis squatardla*), 12 September for Kentish Plover (*Charadrius alexandrinus*), 23 August for Ruff (*Philomochus pugnax*), 23 - 30 August for Curlew Sandpiper (*Calidris feruginea*), 12 September for Curlew (*Numenius arguata*).

As to the other bird groups, a clear peak in Honey Buzzard (*Pernis apirvorus*) migration was observed on 19 September, intensive migration of Swallows (*Hirundo rustica*), White and Yellow Wagtails (*Motacilla alba, Motacilla floura*) was on 20 September, migratory peaks in Sand Martins (*Riparia riparia*) were on 10 and 20 September.

For some species which dominated capture more detail descriptions of their migration patterns in the area are possible.

### Red breasted Flycatcher

The most numerous migrating passerine species in August/September. Its numbers increased starting 5 September in comparison with August. Migration peaks in September were on 6, 15 and 17 September (i.e. they are similar to the general peaks of passerine migration in the area). This species is also numerous on migration in the Western Crimea (our data), but it is much less numerous in more Eastern areas on the Azov-Black Sea coast. So the Kinburn peninsula region appears to be an important stopover site for this species on autumn migration. There were many more young birds (subadults) than adults (proportion of the latter consisting of only 2.8%). Such migration pattern may be the result of non-stop night migration of adults or of sex differences in migration routes. 89% of Red breasted Flycatchers captured had low and very low fat reserves, the proportion of fattened birds increased in September.

### Willow Warbler

This is the second most numerous species after Red breasted Flycatcher. As mentioned above, Willow Warbler predominated over the other species in August and its number dynamics show a peak on 17, 19 and 23 August. Then the species numbers clearly decrease in early September and show a main peak on 14 - 15 September, probably the result of migration of different populations over the area. The first migration started in August and another one (perhaps from more distant areas) followed in mid-September. Young birds were dominant in both groups (about 81%) , but the proportion of adults was higher than in previous species. Proportions of fattened birds captured also was quite high – about 64.3% during the whole period.

### Blackcap

The species was observed migrating from 15 August onwards, but its numbers clearly increased in mid-September. Peak numbers were noted on 15 and 17 September. The proportion of adults was quite low – 10.9%. Relation between males and females in young birds was about 1:1 (48% of birds were males). In adults, females were predominant (64%). This may be explained by sex differences in terms of adult migration.

### Spotted Flycatcher

Its numbers clearly increased starting 11 September and ran up to a maximum on 20 September. Adult birds dominated at the beginning of migration. From then on mainly subadults migrated.

**Garden Warbler**

Numbers clearly increased in September as compared with August. Peaks in migration were on 5, 7, 14, 17 September. The proportion of subadults was high – 88.7%. A characteristic peculiarity of the species is a very high level of fat reserves that seem to be sufficient for non-stop migration across the sea.

**Red backed Shrike**

Numbers were higher in August and then decreased after 5 September. Young birds were predominant over adults (21.4%). Adults were more numerous in August and after 10 September only young birds continued the migration. 90% of birds had high or very high levels of fat reserves, sufficient for long-distance migration. Almost all birds were well fattened from the end of August onwards.

The six species described above constitute about 74% of ringed totals. For these passerines the area of the Kinburn Landscape Park is especially important as a resting and feeding place on migration. In addition, the wetlands of the Kinburn Peninsula support large post-breeding and migratory gatherings of Great Crested Grebes, Cormorants, Mallards, Eiders, Coots, Redshanks, etc. (Table 5.2b).

Table 5.1b. List of bird species observed migrating during census walks.

| *Species* | Maximum numbers within one day | Date with maximum numbers | Number of days when species was observed |
|---|---|---|---|
| *Gavia arctica*<br>Black throated Diver/Loon | 1 | 18.09 | 1 |
| *Podiceps cristatus*<br>Great crested Grebe | 1976 | 23.08 | 9 |
| *Podiceps grisegena*<br>Red necked Grebe | 3 | 22.08 | 1 |
| *Podiceps nigricollis*<br>Black necked Grebe | 369 | 29.08 | daily |
| *Puffinus puffinus*<br>Manx Shearwater | 1 | 19.09 | 1 |
| *Pelecanus onocrotalus*<br>White Pelican | 110 | 12.09 | 8 |
| *Phalacrocorax carbo*<br>(Great) Cormorant | 9910 | 17.09 | daily |
| *Egretta garzetta*<br>Little Egret | 15 | 18.08 | daily |
| *Egretta alba*<br>Great (white) Egret | 70 | 17.09 | daily |
| *Ardea cinerea*<br>Grey Heron | 49 | 17.09 | daily |
| *Ciconia ciconia*<br>White stork | 35 | 23.08 | 1 |
| *Plegadis falcinellus*<br>Glossy Ibis | 10 | 17.09 | 2 |
| *Cygnus olor*<br>Mute Swan | 205 | 12.09 | 10 |

| *Species* | Maximum numbers within one day | Date with maximum numbers | Number of days when species was observed |
|---|---|---|---|
| *Anser anser*<br>Greylag Goose | 30 | 26.08 | 3 |
| *Tadorna tadorna*<br>Shelduck | 158 | 17.09 | 7 |
| *Anas platyrhynchos*<br>Mallard | 4596 | 30.08 | daily |
| *Anas acuta*<br>Pintail | 34 | 18.08 | 2 |
| *Anas clypeata*<br>(Northern) Shoveler | 150 | 18.09 | 2 |
| *Anas penelope*<br>Wigeon | 16 | 18.09 | 2 |
| *Anas crecca*<br>Teal | 300 | 18.09 | 5 |
| *Anas querquedula*<br>Garganey | 50 | 23.08, 2.09 | 6 |
| *Somateria mollissima*<br>(Common) Eider | 4980 | 30.08 | daily |
| *Bucephala clangula*<br>Goldeneye | 2 | 21.08 | 2 |
| *Mergus serrator*<br>Red breasted Merganser | 5 | 29.08, 12.09 | 3 |
| *Haliaeetus albicilla*<br>White tailed Eagle | 1 | 22.08, 12.09 | 2 |
| *Pandion haliaetus*<br>Osprey | 3 | 19.09 | 4 |
| *Circus aeruginosus*<br>Marsh Harrier | 10 | 19.09 | daily |
| *Circus cyaneus*<br>Hen Harrier | 1 | 3.09 | 1 |
| *Circus pygargus*<br>Montagu's Harrier | 1 | 17.09 – 20.09 | 4 |
| *Circus macrourus*<br>Pallid Harrier | 1 | 12.09 | 1 |
| *Buteo buteo (vulpinus)*<br>Common Buzzard | 3 | 22.08, 19.09 | 3 |
| *Pernis apivorus*<br>Honey Buzzard | 59 | 19.09 | 4 |
| *Accipiter nisus*<br>(Eurasian) Sparrowhawk | 1 | 19.09 | 1 |
| *Falco tinnunculus*<br>(Common) Kestrel | 1 | 1.09, 8.09 | 2 |
| *Falco vespertinus*<br>Red footed Falcon | 6 | 19.09 | 2 |
| *Falco subbuteo*<br>(Eurasian) Hobby | 6 | 19.09 | 3 |
| *Coturnix coturnix*<br>(Common) Quail | 1 | 11.09 | 1 |
| *Phasianus colchicus*<br>(Common) Pheasant | 7 | 12.09 | 2 |
| *Fulica atra*<br>Coot | 3800 | 3.09 | 5 |
| *Haematopus ostralegus*<br>(Eurasian) Oystercatcher | 21 | 4.09 | 11 |

| *Species* | Maximum numbers within one day | Date with maximum numbers | Number of days when species was observed |
|---|---|---|---|
| *Recurvirostra avocetta*<br>(Pied) Avocet | 10 | 17.09 | 4 |
| *Charadrius hiaticula*<br>Ringed Plover | 1 | 23.08 – 3.09 | 4 |
| *Charadrius alexandrinus*<br>Kentish Plover | 40 | 12.09 | 6 |
| *Pluvialis squatarola*<br>Grey Plover | 68 | 4.09 | daily |
| *Vanellus vanellus*<br>(Northern) Lapwing | 5 | 23.08 | 1 |
| *Calidris alba*<br>Sanderling | 46 | 23.08 | 2 |
| *Arenaria interpres*<br>Turnstone | 529 | 17.08 | 8 |
| *Calidris alpina*<br>Dunlin | 613 | 30.08 | 10 |
| *Calidris ferruginea*<br>Curlew Sandpiper | 129 | 23.08 | 11 |
| *Limicola falcinellus*<br>Broad billed Sandpiper | 13 | 30.08 | 2 |
| *Calidris minuta*<br>Little Stint | 2 | 18.08 | 1 |
| *Tringa glareola*<br>Wood Sandpiper | 4 | 23.08 | 3 |
| *Tringa ochropus*<br>Green Sandpiper | 3 | 18.08 | 5 |
| *Actitis hypoleucos*<br>Common Sandpiper | 2 | 28.08 | 2 |
| *Xenus cinereus*<br>Terek Sandpiper | 1 | 30.08 | 1 |
| *Tringa totanus*<br>Redshank | 577 | 18.08 | daily |
| *Actitus hypoleucos*<br>(Common) Greenshank | 6 | 18.09 | 9 |
| *Tringa stagnatilis*<br>Marsh Sandpiper | 2 | 18.08 | 1 |
| *Numenius arquata*<br>(Eurasian) Curlew | 42 | 12.09 | 11 |
| *Numenius phaeopus*<br>Whimbrel | 10 | 23.08 | 3 |
| *Philomachus pugnax*<br>Ruff | 118 | 23.08 | 2 |
| *Stercorarius parasiticus*<br>Parasitic/Arctic Skua | 3 | 12.09 | 3 |
| *Larus ridibundus*<br>Black headed Gull | 690 | 23.08 | daily |
| *Larus argentatus*<br>Yellow legged Gull | 260 | 29.08 | daily |
| *Larus genei*<br>Slender billed Gull | 300 | 18.09 | 5 |
| *Larus melanocephalus*<br>Meditteranean Gull | 320 | 17.09 | daily |
| *Sterna albifrons*<br>Little Tern | 18 | 22.08 | 2 |

| *Species* | Maximum numbers within one day | Date with maximum numbers | Number of days when species was observed |
|---|---|---|---|
| *Sterna sandvicensis*<br>Sandwich Tern | 460 | 18.08 | 8 |
| *Sterna hirundo*<br>Common Tern | 479 | 17.08 | daily |
| *Streptopelia decaocto*<br>(Eurasian) Collared Dove | 1 | 21.08 | 1 |
| *Cuculus canorus*<br>(Common) Cuckoo | 1 | 17.08 – 23.08 | 3 |
| *Upupa epops*<br>(Eurasian) Hoopoe | 3 | 17.08 | 7 |
| *Alcedo atthis*<br>(Common) Kingfisher | 1 | 21.08 | 1 |
| *Merops apiaster*<br>(European) Bee-Eater | 52 | 17.09 | 3 |
| *Riparia riparia*<br>Sand Martin | 400 | 10.09 | 6 |
| *Hirundo rustica*<br>Barn Swallow | 1327 | 20.09 | 7 |
| *Motacilla alba*<br>White/Pied Wagtail | 189 | 20.09 | 7 |
| *Motacilla flava*<br>Yellow Wagtail | 175 | 20.09 | 5 |
| *Troglodytes troglodytes*<br>Wren | 1 | 27.08 | 1 |
| *Oenanthe isaballina*<br>Isabelline Wheatear | 1 | 24.08 | 1 |
| *Saxicola torquata*<br>Whinchat | 2 | 18.09 | 1 |
| *Acrocephalus schoenobaenus*<br>Sedge Warbler | 3 | 21.08 | 1 |
| *Phylloscopus trochilus*<br>Willow Warbler | 8 | 21.08 | 2 |
| *Sturnus vulgaris*<br>(Common) Starling | 350 | 12.09 | 2 |
| *Oriolus oriolus*<br>(Eurasian) Golden Oriole | 1 | 22.08 | 1 |

**Total 85 species**

Even one year of observations shows the high levels of bird species diversity in the area and the importance of it in support of biodiversity in the whole Azov-Black Sea region. Long-term monitoring work is necessary for a better understanding of different aspects of bird migration in the area. Protection of the Kinburn Spit from spontaneous tourists visits does not seem to be sufficient and as a result of this birds are often disturbed on their main resting and moulting sites. Reorganisation of the Landscape park area into a National Park with higher conservation status can help in the resolution of this problem.

# 6. Bird Lists

Christopher Burnett & Helen Boulden
Expedition team members

Both Helen Boulden and Christopher Burnett, both experienced birdwatchers and members of the expedition team, very kindly compiled species list of birds they encountered during the expedition.

Helen Boulden compiled her list between 13 September and 22 August 2001. She recorded habitat, months seen, relative numbers and whether the species was ringed in her presence.

Christopher Burnett compiled his list between 7 and 24 September 2001. He recorded species seen and included numbers where possible, with some species being marked ‘A’ for abundant or ‘NSC’ for no specific count.

Table 6.1a. Bird species list compiled by expedition team members Helen Boulden (HB) and Christopher Burnett (CB). “A” stands for abundant, “NSC” for no specific count. Shaded fields indicate where one or the other observer did not record or observe a particular species. Bird order follows Mullarney et al., 1999.

| | HB’s records | | | | | | | | | | | | CB’s records |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Habitat | | | | | | | Month seen | | Num-bers | | | |
| | Inland Lake/Salt Marsh | Open Steppe/Scrub | Estuary | Plantation | Alder Grove | Seashore | On Migration/In Flight | August | September | Common | Few | Ringed | Numbers observed |
| *Gavia arctica*<br>Black throated Diver/Loon | | | | | | | | | | | | | 3 |
| *Gavia immer*<br>Great Northern Diver/Loon | ✓ | | | | | | | | ✓ | | ✓ | | |
| *Tachybaptus ruficollis*<br>Little Grebe | | | | | | | | | | | | | 1 |
| *Podiceps cristatus*<br>Great crested Grebe | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | A |
| *Podiceps grisegena*<br>Red necked Grebe | | | | | | | | | | | | | 9+ |
| *Podiceps nigricollis*<br>Black necked Grebe | | | | | | ✓ | | ✓ | | | ✓ | | A |
| *Puffinus yelkouan*<br>Levantine Shearwater | | | | | | | | | | | | | 2 |
| *Pelecanus onocrotalus*<br>White Pelican | ✓ | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | A |
| *Phalacrocorax carbo*<br>(Great) Cormorant | ✓ | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | 10,000+ |
| *Egretta garzetta*<br>Little Egret | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | A |

| | HB's records | | | | | | | | | | | | CB's records |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Habitat | | | | | | | Month seen | | Num-bers | | | |
| | Inland Lake/Salt Marsh | Open Steppe/Scrub | Estuary | Plantation | Alder Grove | Seashore | On Migration/In Flight | August | September | Common | Few | Ringed | Numbers observed |
| *Egretta alba*<br>Great (white) Egret | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | A |
| *Ardea cinerea*<br>Grey Heron | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | A |
| *Ciconia ciconia*<br>White stork | | | | | | | ✓ | ✓ | | | ✓ | | |
| *Plegadis falcinellus*<br>Glossy Ibis | | | | | | | | | | | | | ±20 |
| *Cygnus olor*<br>Mute Swan | ✓ | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | A |
| *Anser anser*<br>Greylag Goose | | | | | | | ✓ | | ✓ | | ✓ | | 200+ |
| *Tadorna tadorna*<br>Shelduck | | | | | | | | | | | | | 200+ |
| *Aythya fuligula*<br>Tufted Duck | | | | | | | | | | | | | ±50 |
| *Anas platyrhynchos*<br>Mallard | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | NSC |
| *Anas acuta*<br>Pintail | | | | | | | | | | | | | <50 |
| *Anas clypeata*<br>(Northern) Shoveler | ✓ | | | | | | ✓ | ✓ | | | ✓ | | ±200 |
| *Anas penelope*<br>Wigeon | | | | | | | | | | | | | 100+ |
| *Anas crecca*<br>Teal | | | | | | | | | | | | | 500+ |
| *Aythya ferina*<br>Pochard | | | | | | | | | | | | | <50 |
| *Somateria mollissima*<br>(Common) Eider | ✓ | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | ±7000 |
| *Bucephala clangula*<br>Goldeneye | | | | | | ✓ | | ✓ | ✓ | ✓ | | | |
| *Mergus merganser*<br>Goosander | | | | | | | | | | | | | 6 |
| *Haliaeetus albicilla*<br>White tailed Eagle | ✓ | | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | | 3 |
| *Pandion haliaetus*<br>Osprey | ✓ | | | | | ✓ | | | ✓ | | ✓ | | 10+ |
| *Aquila clanga*<br>Spotted Eagle | | | | | | | | | | | | | 6 |
| *Hiereaatus pennatus*<br>Booted Eagle | | | | | | | | | | | | | 1 |
| *Milvus migrans*<br>Black Kite | | | | | | | | | | | | | 2 |

| | HB's records | | | | | | | | | | | | CB's records |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Habitat | | | | | | | Month seen | | Num-bers | | | |
| | Inland Lake/Salt Marsh | Open Steppe/Scrub | Estuary | Plantation | Alder Grove | Seashore | On Migration/In Flight | August | September | Common | Few | Ringed | Numbers observed |
| *Circus aeruginosus*<br>Marsh Harrier | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | ±150 |
| *Circus cyaneus*<br>Hen Harrier | | | | | | | | | | | | | 2 |
| *Circus pygargus*<br>Montagu's Harrier | | ✓ | ✓ | | | | | | ✓ | | ✓ | | ±80 |
| *Buteo rufinus*<br>Long legged Buzzard | | | | | | | | | | | | | <10 |
| *Buteo buteo (vulpinus)*<br>Common Buzzard | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | NSC |
| *Pernis apivorus*<br>Honey Buzzard | | | | | | | | | | | | | ±600 |
| *Accipiter nisus*<br>(Eurasian) Sparrowhawk | | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | ✓ | NSC |
| *Falco tinnunculus*<br>(Common) Kestrel | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | | ✓ | NSC |
| *Falco naumanni*<br>Lesser Kestrel | ✓ | | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | | 1 |
| *Falco vespertinus*<br>Red footed Falcon | | ✓ | | ✓ | ✓ | | ✓ | | ✓ | | ✓ | | ±50 |
| *Falco subbuteo*<br>(Eurasian) Hobby | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ±200 |
| *Falco peregrinus*<br>Peregrine | | | | | | | | | | | | | 2 |
| *Perdix perdix*<br>Grey Partridge | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | | | NSC |
| *Coturnix coturnix*<br>(Common) Quail | | ✓ | | | | | | ✓ | ✓ | ✓ | | | ±40 |
| *Phasianus colchicus*<br>(Common) Pheasant | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | | | NSC |
| *Porzana porzana*<br>Spotted Crake | | | | | | | | | | | | | 2 |
| *Gallinula chloropus*<br>Moorhen | | | | | | | | | | | | | NSC |
| *Fulica atra*<br>Coot | | | | | | | | | | | | | A |
| *Haematopus ostralegus*<br>(Eurasian) Oystercatcher | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | 1 |
| *Recurvirostra avocetta*<br>(Pied) Avocet | ✓ | | | | | | | ✓ | | | ✓ | | <20 |
| *Himantopus himantopus*<br>Black winged Stilt | ✓ | | | | | | | ✓ | | ✓ | | | |
| *Charadrius dubius*<br>Little ringed Plover | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | |

| | HB's records | | | | | | | | | | | | CB's records |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Habitat | | | | | | | Month seen | | Num-bers | | | |
| | Inland Lake/Salt Marsh | Open Steppe/Scrub | Estuary | Plantation | Alder Grove | Seashore | On Migration/In Flight | August | September | Common | Few | Ringed | Numbers observed |
| *Charadrius hiaticula*<br>Ringed Plover | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | <10 |
| *Charadrius alexandrinus*<br>Kentish Plover | | | | | | | | | | | | | 4 |
| *Pluvialis squatarola*<br>Grey Plover | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ±50 |
| *Vanellus vanellus*<br>(Northern) Lapwing | ✓ | | | | | | | ✓ | ✓ | ✓ | | | |
| *Calidris alba*<br>Sanderling | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | <50 |
| *Arenaria interpres*<br>Turnstone | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | 3 |
| *Calidris alpina*<br>Dunlin | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | NSC |
| *Calidris ferruginea*<br>Curlew Sandpiper | ✓ | | | | | ✓ | | ✓ | | | ✓ | | >100 |
| *Limicola falcinellus*<br>Broad billed Sandpiper | ✓ | | | | | | | ✓ | | | ✓ | | |
| *Calidris minuta*<br>Little Stint | | | | | | | | | | | | | <10 |
| *Tringa glareola*<br>Wood Sandpiper | ✓ | | | | | ✓ | | ✓ | | | ✓ | | 2 |
| *Tringa ochropus*<br>Green Sandpiper | | | | | | | | | | | | | 30+ |
| *Tringa totanus*<br>Redshank | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | A |
| *Actitus hypoleucos*<br>(Common) Greenshank | ✓ | | | | | | | ✓ | | | ✓ | | <50 |
| *Limosa limosa*<br>Black tailed Godwit | | | | | | | | | | | | | 8 |
| *Numenius arquata*<br>(Eurasian) Curlew | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | 100+ |
| *Numenius phaeopus*<br>Whimbrel | | | | | | | | | | | | | <10 |
| *Gallinago gallinago*<br>Great Snipe | | | | | | | | | | | | | <30 |
| *Phalaropus lobatus*<br>Red necked Phalarope | ✓ | | | | | | | ✓ | ✓ | ✓ | | | |
| *Philomachus pugnax*<br>Ruff | ✓ | | | | | ✓ | | ✓ | | ✓ | | | <30 |
| *Stercorarius parasiticus*<br>Parasitic/Arctic Skua | | | ✓ | | | ✓ | | ✓ | | | ✓ | | 5+ |
| *Stercorarius pomarinus*<br>Pomarine Skua | | | | | | | | | | | | | 1 |

| | HB's records | | | | | | | | | | | | CB's records |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Habitat | | | | | | | Month seen | | Num-bers | | | |
| | Inland Lake/Salt Marsh | Open Steppe/Scrub | Estuary | Plantation | Alder Grove | Seashore | On Migration/In Flight | August | September | Common | Few | Ringed | Numbers observed |
| *Larus ridibundus* Black headed Gull | | | | | | ✓ | | ✓ | ✓ | ✓ | | | NSC |
| *Larus argentatus* Yellow legged Gull | ✓ | | | ✓ | | ✓ | | ✓ | ✓ | ✓ | | | A |
| *Larus genei* Slender billed Gull | | | | | | ✓ | | ✓ | | | ✓ | | A |
| *Larus canus* Common Gull | | | | | | | | | | | | | 2 |
| *Larus melanocephalus* Meditteranean Gull | | | | | | ✓ | | ✓ | ✓ | ✓ | | | NSC |
| *Larus ichthyaetus* Pallas's/Great black headed Gull | | | ✓ | | | | | ✓ | | | ✓ | | 4 |
| *Larus minutes* Little Gull | ✓ | | | | | ✓ | | ✓ | ✓ | ✓ | | | ±40 |
| *Sterna albifrons* Little Tern | | | | | | ✓ | | ✓ | | ✓ | | | 1 |
| *Sterna sandvicensis* Sandwich Tern | ✓ | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | A |
| *Sterna nilotica* Gull billed Tern | | | | | | ✓ | | ✓ | | | ✓ | | 1 |
| *Sterna hirundo* Common Tern | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | A |
| *Columba oenas* Stock Dove | | | | | | | | | | | | | NSC |
| *Columba palumbus* Wood Pigeon | | | | | | | | | | | | | NSC |
| *Streptopelia decaocto* (Eurasian) Collared Dove | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | NSC |
| *Streptopelia turtur* (European) Turtle Dove | | | | | | | | | | | | | <10 |
| *Cuculus canorus* (Common) Cuckoo | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | 4 |
| *Asio otus* Long eared Owl | | ✓ | | ✓ | | | | ✓ | ✓ | | ✓ | | 2 |
| *Tyto alba* Barn Owl | | | | ✓ | | | | ✓ | ✓ | | ✓ | | 1 |
| *Athene noctua* Little Owl | | | | | | | | | | | | | 1 |
| *Otus scops* (Eurasian) Scops Owl | | | | | | | | | | | | | 1 |
| *Caprimulgus europaeus* (European) Nightjar | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | | | NSC |
| *Apus apus* Swift | | | | | | | | | | | | | 2 |

| | HB's records | | | | | | | | | | | | CB's records |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Habitat | | | | | | | Month seen | | Num-bers | | | |
| | Inland Lake/Salt Marsh | Open Steppe/Scrub | Estuary | Plantation | Alder Grove | Seashore | On Migration/In Flight | August | September | Common | Few | Ringed | Numbers observed |
| *Upupa epops*<br>(Eurasian) Hoopoe | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | | ✓ | ±30 |
| *Alcedo atthis*<br>(Common) Kingfisher | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | | ✓ | ✓ | NSC |
| *Merops apiaster*<br>(European) Bee-Eater | | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | | | A |
| *Coracias garrulus*<br>Roller | | | | | | | | | | | | | <10 |
| *Dendrocopos major*<br>Great spotted Woodpecker | | | | | | | | | | | | | 2-3 |
| *Dendrocopos syriacus*<br>Syrian Woodpecker | | | | | ✓ | | | ✓ | ✓ | | ✓ | | 2 |
| *Dendrocopos minor*<br>Lesser spotted Woodpecker | | | | | | | | | | | | | 1 |
| *Jynx torquilla*<br>Wryneck | | | | | | | | | | | | | 4 |
| *Alauda arvensis*<br>Skylark | | | | | | | | | | | | | NSC |
| *Galerida cristata*<br>Crested Lark | | | | | | | | | | | | | NSC |
| *Lullula arborea*<br>Woodlark | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | A |
| *Melanocorypha calandra*<br>Calandra Lark | ✓ | | | | | | | | ✓ | | ✓ | | |
| *Riparia riparia*<br>Sand Martin | ✓ | | ✓ | | | | ✓ | ✓ | | ✓ | | | A |
| *Hirundo rustica*<br>Barn Swallow | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | A |
| *Anthus campestris*<br>Tawny Pipit | | | | | | | | | | | | | 1 |
| *Anthus pratensis*<br>Meadow Pipit | | ✓ | | | | | | | ✓ | ✓ | | | NSC |
| *Motacilla alba*<br>White/Pied Wagtail | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | A |
| *Motacilla flava*<br>Yellow Wagtail | | | | | | ✓ | | ✓ | | | ✓ | | A |
| *Erithacus rubecula*<br>Robin | | | | | | | | | | | | | 6 |
| *Luscinia luscinia*<br>Thrush Nightingale | | ✓ | | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | |
| *Phoenicurus phoenicurus*<br>(Common) Redstart | | | | | | | | | | | | | A |
| *Phoenicurus ochruros*<br>Black Redstart | | | | | | | | | | | | | NSC |

| | HB's records | | | | | | | | | | | | CB's records |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| | Inland Lake/Salt Marsh | Open Steppe/Scrub | Estuary | Plantation | Alder Grove | Seashore | On Migration/In Flight | August | September | Common | Few | Ringed | Numbers observed |
| *Oenanthe oenanthe* (Northern) Wheatear | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | A |
| *Oenanthe isaballina* Isabelline Wheatear | | | | | | | | | | | | | 1 |
| *Oenanthe hispanica* Black eared Wheatear | | | | | | | | | | | | | 1 |
| *Saxicola torquata* Whinchat | | ✓ | | | | | | | ✓ | ✓ | | | A |
| *Saxicola torquata* Stonechat | | | | | | | | | | | | | NSC |
| *Turdus merula* (Common) Blackbird | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | NSC |
| *Sylvia borin* Garden Warbler | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | A |
| *Sylvia nisoria* Barred Warbler | | ✓ | | | | | | ✓ | | | ✓ | ✓ | |
| *Sylvia atricapilla* Blackcap | ✓ | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ | A |
| *Sylvia curruca* Lesser Whitethroat | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | NSC |
| *Sylvia communis* (Common) Whitethroat | | | | | | | | | | | | | NSC |
| *Acrocephalus schoenobaenus* Sedge Warbler | ✓ | ✓ | | | | | | ✓ | ✓ | ✓ | | ✓ | |
| *Locustella fluviatilis* River Warbler | ✓ | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | |
| *Acrocephalus scirpaceus* (European) Reed Warbler | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | ✓ | |
| *Acrocephalus palustris* Marsh Warbler | ✓ | ✓ | | | | | | ✓ | ✓ | ✓ | | ✓ | |
| *Acrocephalus arundinaceus* Great reed Warbler | ✓ | ✓ | | | | | | ✓ | | | ✓ | ✓ | |
| *Hippolais icterina* Icterine Warbler | | ✓ | | | | | | ✓ | | | ✓ | ✓ | |
| *Phylloscopus trochilus* Willow Warbler | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ | A |
| *Phylloscopus sibilatrix* Wood Warbler | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ | 6 |
| *Phylloscopus collybita* ChiffChaff | | | | | | | | | | | | | NSC |
| *Muscicapa striata* Spotted Flycatcher | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ | A |
| *Ficedula parva* Red breasted Flycatcher | | ✓ | | ✓ | | | | | ✓ | ✓ | | ✓ | A |

| | HB's records | | | | | | | | | | | | CB's records |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Habitat | | | | | | | Month seen | | Num-bers | | | |
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| *Ficedula hypoleuca*<br>Pied Flycatcher | | | | | | | | | | | | | 3 |
| *Parus major*<br>Great Tit | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | A |
| *Parus caeruleus*<br>Blue Tit | | | | | | | | | | | | | NSC |
| *Lanius minor*<br>Red backed Shrike | | ✓ | | | | | | ✓ | ✓ | ✓ | | ✓ | A |
| *Lanius collurio*<br>Lesser grey Shrike | | ✓ | | | | | | ✓ | | ✓ | | ✓ | |
| *Pica pica*<br>(Common) Magpie | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | | | |
| *Garrulus glandarius*<br>(Eurasian) Jay | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ | | | A |
| *Corvus corone corvix*<br>Hooded Crow | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | | | A |
| *Corvus corax*<br>(Common) Raven | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | | ✓ | | NSC |
| *Sturnus vulgaris*<br>(Common) Starling | | ✓ | | | ✓ | | | ✓ | ✓ | ✓ | | | A |
| *Oriolus oriolus*<br>(Eurasian) Golden Oriole | | ✓ | | | | | | ✓ | ✓ | | ✓ | ✓ | <20 |
| *Passer domesticus*<br>House Sparrow | | | | | | | | | | | | | A |
| *Passer montanus*<br>(Eurasian) Tree Sparrow | | | | | | | | | | | | | NSC |
| *Passer montanus*<br>Tree Sparrow | | ✓ | | | | | | ✓ | ✓ | ✓ | | | NSC |
| *Fringilla coelebs*<br>(Common) Chaffinch | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | | | NSC |
| *Acanthis cannabina*<br>Linnet | | | | | | | | | | | | | NSC |
| *Carduelis carduelis*<br>(European) Goldfinch | | ✓ | | | | | | | ✓ | ✓ | | ✓ | A |
| *Carduelis chloris*<br>Greenfinch | | | | | | | | | | | | | NSC |
| *Coccothraustes coccothraustes*<br>Hawfinch | | | | | | | | | | | | | 10 |

**Total 161 species**




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