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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:

4 August – 15 September 2002

Report published:

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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 4 August to 15 September 2002. It investigated wolves, jerboas, vipers and migratory birds and continued a study initiiated in August/September 2001.

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. The quantitative baseline set in 2001 for monitoring the relative abundance of wolves in the area was checked against data for 2002. Although there seems to be a decline in the relative abundance of wolves in the area, this it is not statistically significant. Moreover, the population in the study area appears to be in a stable condition, as indicated by the sex ratio of 1:1 and the presence of 30% or even 50% of young. These population parameters appear not to have changed since 2001.

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 for the second year running to produce results, where no data on jerboa densities previously existed. The study confirmed densities of fewer than two individuals per hectare, showing that *Stylopidus telum falzfeini* is under intense pressure and in danger of extinction in the area.

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, 37 capture days resulted in 1704 birds of 39 species (35 passerine and 4 non-passerine species) being caught in one Helgoland and several mist nets, measured and ringed. A bird list of 161 species encountered during the expedition was also compiled.

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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 4 August to 15 September 2002. 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 continued the first ever large-scale wolf survey in the area (initiated by Biosphere Expeditions in 2001) by conducting hide-based night time surveys and by tracking wolves along transects. The jerboa and the steppe viper were also studied.

The Kinburnska Kosa Landscape Park is part of the larger Kinburn peninsula. Relatively little internal 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.

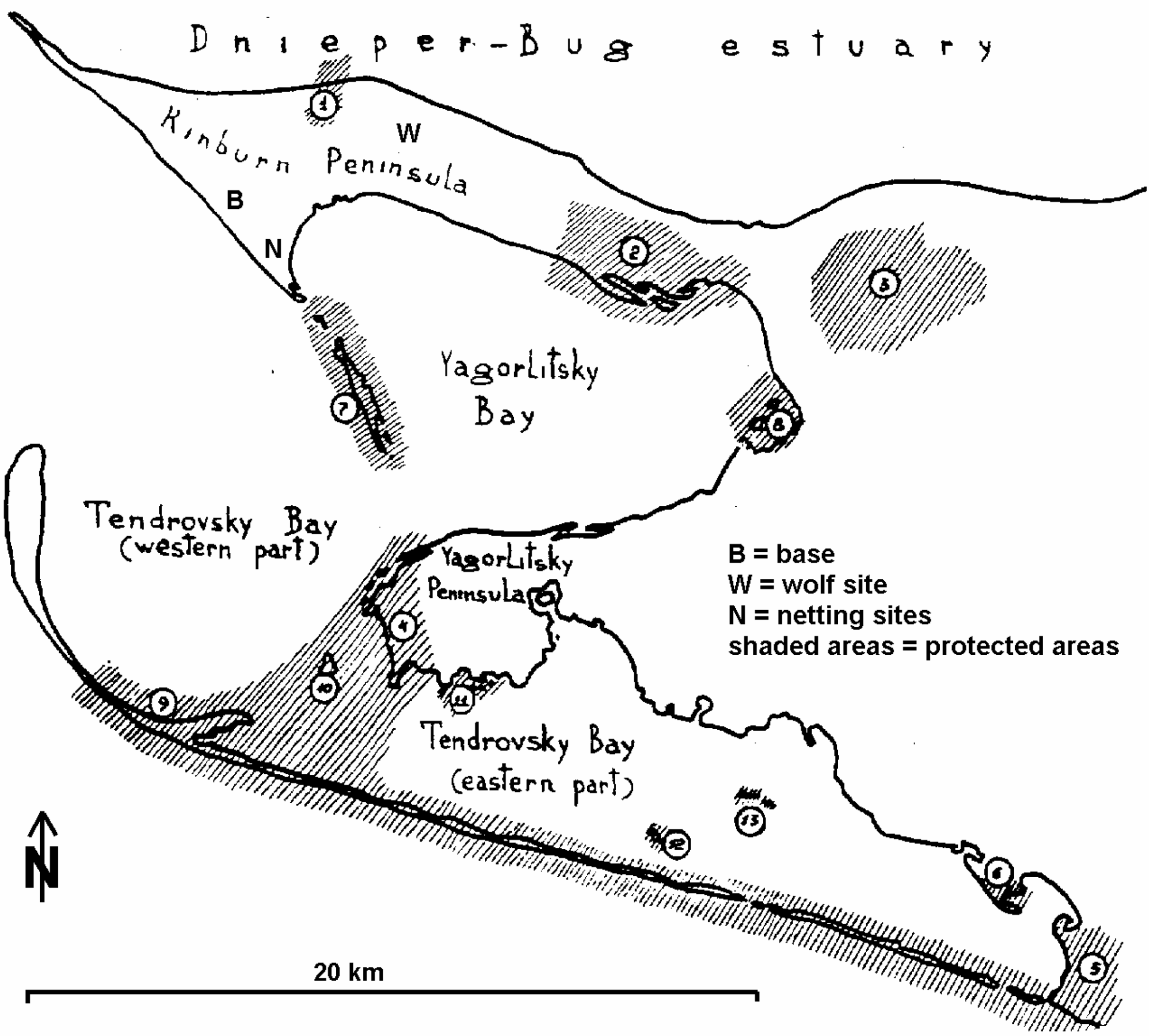

Fig 1.2a. The Kinburn peninsula (46º 30' N, 31º 40' E) and adjacent protected areas.
For location of the peninsula inside Ukraine, see map on front cover.

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

4 August - 18 August 2002
18 August - 1 September 2002
1 September - 15 September 2002

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 ???????A (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). Three to four 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 tent camp 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. A mobile phone transmitter is also present on the opposite bank of the Dnieper river on the mainland. This provided intermittent mobile phone coverage and the expedition used 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. 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. Around the Kinburnska transport was by Land Rover Td5 110 Defender, which was driven over from the UK by the expedition leader. The Land Rover was extremely reliable (its clutch plates had to be replaced in nearby Kherson, but this was due to excessive wear due to driver error, rather than a catastrophic failure).

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. There were several cases of mild and one case of serious diarrhoea during the 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

Petro Gorlov was born in the Ukraine in 1967. He has a degree from Melitopol State Pedagogical University in biology and is a qualified geography and biology teacher. He is currently employed as an ornithologist at the Azov-Black Sea Ornithological Station, which is a sub-division of the Zoological Institute of the Ukrainian Academy of Sciences. His main research interest is passerine and wader migration studies. He has participated in various ornithological expeditions to the Ukraine, Siberia, and Poland.

(2) Wolf and mammal and small vertebrates group

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.

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-ordinators and Helpers

Zinovy Petrovych, the Director of the Kinburnska Kosa Regional Landscape Park provided crucial park support and back-up. His son Orest Petrovych acted as a very reliable translator, driver and helper.

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

4 August – 18 August 2002

Roger Charters (UK), Anabela Ferreira (POR), Anita Hempenius (NL), Rebecca Lock (UK), Karen Neubert (D), Ulrich Niewind (D).

18 August – 1 September 2002

Brigitte Herrmann (D), Jenny Holden (UK), Anna Lundgren (SWE), Katherine Wilden (UK).

1 September – 15 September 2002

Sabine Franzke (D), Jane Niederhauser (US), Benedikt Teich (D), Keith Vinicombe (UK), Warren Young (UK).

Throughout the expedition

Advisor: Zinovy Petrovych, Director of the Kinburnska Kosa Regional Landscape Park. Driver & translator: Orest Petrovych. 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	14,208	
Expenditure		% of which spent directly on project
Payment to Ukraine logistics co-ordinator (Valentin Pashkevitch) for organising research permits, visas and visa assistance for team members and other logistical support.	1,970	100
Staff Ukraine includes salaries, travel expenses, bonuses	4,248	100
Staff UK includes salaries for expedition portion, travel expenses	1,741	100
Expedition logistics includes communication, fuel, food and accommodation, tips, petty cash anc miscellaneous items	1,852	100
Equipment and hardware includes research library, spring scales, bird nets, night sights, tents, medical supplies, fuel, mobile phones, GPSs, solar showers and various other small items	301	100
Income – Expenditure	4,096	
Total percentage spent directly on project	71%	

1.10. Acknowledgements

This study was conducted by Biosphere Expeditions which runs wildlife conservation expeditions all over the globe. 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 Roger Charters (UK), Anabela Ferreira (POR), Sabine Franzke (D), Brigitte Herrmann (D), Anita Hempenius (NL), Jenny Holden (UK), Rebecca Lock (UK), Anna Lundgren (SWE), Karen Neubert (D), Jane Niederhauser (US), Ulrich Niewind (D), Benedikt Teich (D), Keith Vinicombe (UK), Katherine Wilden (UK), Warren Young (UK). 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 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 logistical support, our scientists Petro Gorlov and Volodymyr Tytar for providing crucial scientific grounding and leadership, as well as Land Rover, Motorola, Silva, Field & Trek, Globetrotter Ausrüstung 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

Volodymyr Tytar
I.I. Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine

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 four 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 humans, 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 diverse 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, when 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 2-12 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 20th century, because of its supposed threat to populations of ungulates and domestic livestock. 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 Convention on the Conservation of European Wildlife & Natural Habitats (Bern, 1979). 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 sea supported a significant wolf population, which was reaching densities of above 15 individuals per 1,000 sq. km. Later, in the 13th to 16th 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 the tracking down and shooting of 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.

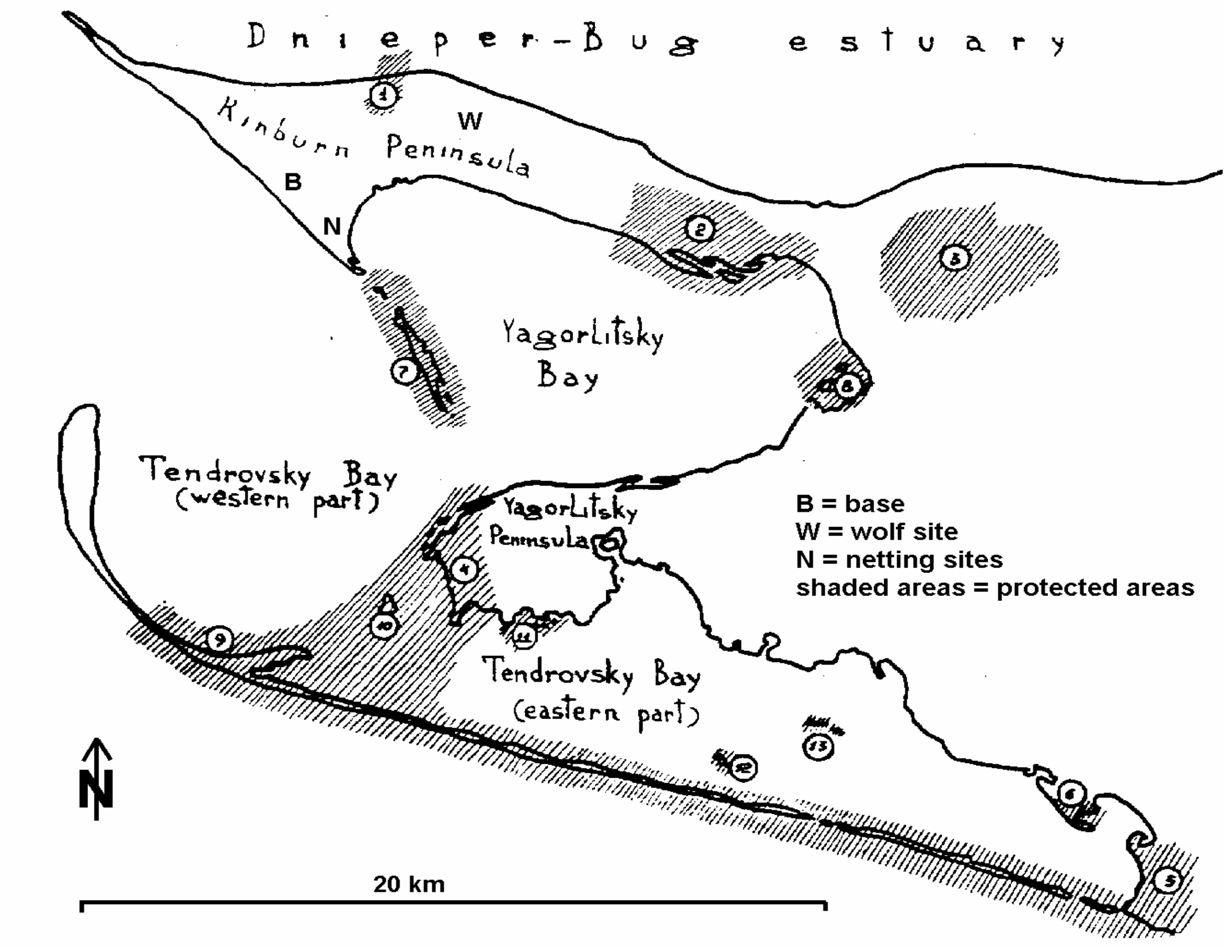

Fig 2.1b. The Kinburn peninsula (46º30' N, 31º40' E) with transect and adjacent protected areas of the Black Sea (Chornomorski) Biosphere Reserve (shaded).

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 state 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 locals perceive 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 so alarming, 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, then 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 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 7.33 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).

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

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

The transect itself was partitioned into two sections: one in the North and one in the South, measuring about 3.52 km and 3.81 km, respectively. Surveys of the transects were done on foot. 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 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 between 7 August and 11 September 2002 as distances (in km) from the Northern end of the transect. The average time between two checks was about 2.1 days. In most cases both sections of the transect were checked in one day (16 out of 18), therefore pooled data was used in the analysis.

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

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.

In order to attract the wolves, bait was set close to a watch tower on 9 August 2002 (a sheep carcass) and on 26 August 2002 (a calf carcass).

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, i.e. wolves could have been moving faster around) 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 7 August (the start date of the survey) has the number 160, and 11 September (the final day of the survey) has the number 195. To avoid any bias we use tracks/km/day instead of just simply the number of tracks recorded on a particular day.

Cumulated number of tracks/km/day versus date fits well into the linear model (see fig. 2.3a), R^2 being 0.882 and the slope (B) equalling 0.149±0.014 (n=18). The fact that the data is well approximated by the linear model means that the “flow” of wolf tracks crossing the transect during the survey was at a more or less steady rate, just as it was the case in the previous survey of 2001. However, comparing both surveys, it can be stated that in the second year the “flow” of wolf tracks across the transect was reduced at least twice, meaning less wolf activity and/or fewer animals populating the area.

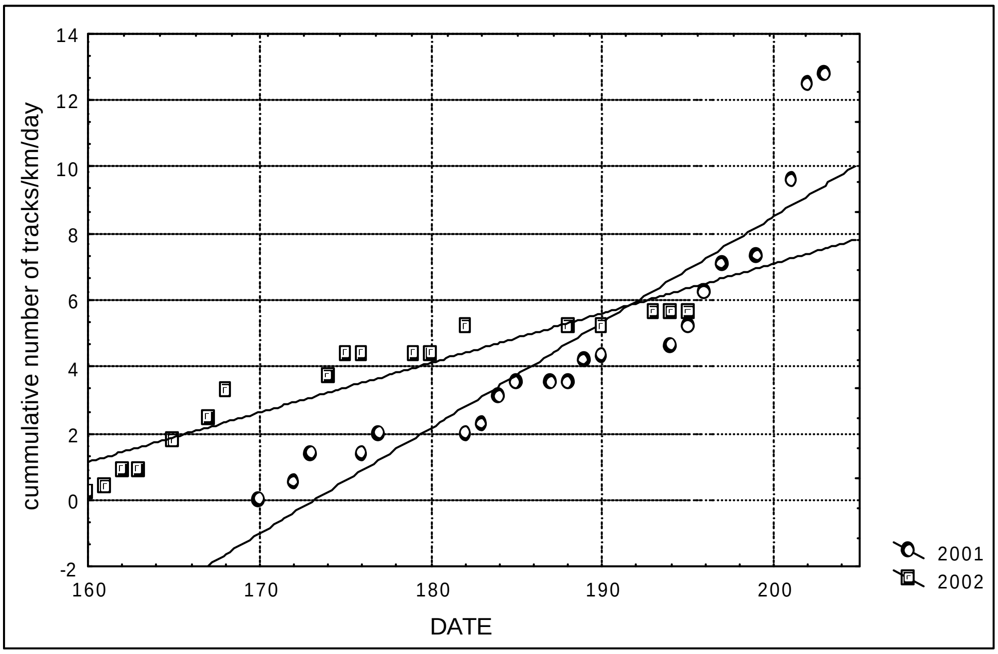

Fig. 2.3a. Increase in cumulative numbers of wolf tracks/km/day during the surveys of 2001 and 2002

Less wolf activity could be due to the earlier start of the survey in 2002. It may be that wolves for most of the time of the survey were solitary. Indeed, usually one to three individuals would form a track (average totalling 1.421±0.097, *n*=38), however in most cases (24 out of 38) only one was animal recorded. If we consider this to be normally expected at this particular time of the year, then the presence of two or more animals together could be a matter of chance. This can easily be checked by viewing the record of one animal as no departure from the "norm" and assigning it the value of zero, the record of two animals as one departure (+1), and three as two (+2), and comparing the mean (M) and variance (σ^2) of this series. Both are fairly similar (0.421 and 0.358, respectively) and the relationship σ^2/M is identical to 1 (Kolmogorov-Smirnov d=0.025, p=n.s.), so we are dealing with a Poisson series, giving a theoretical number of solitary wolves expected to be met as 24.9. Indeed, meeting two or three wolves together at this particular time of the year is a rare event.

A full account of the regression summaries for monitoring purposes is presented in Table 2.3b.

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

Regression Summary for dependent variable: pooled data of cumulative number of wolf tracks/km/day (surveyed 17.08.-19.09.2001)		
Model: Y=A+B*x		
Final loss: 41.748390923 R=.91364		
Variance explained: 83.474%		
n=21	A	B
Estimate	-54.849	0.317
Std.Err.	6.080	0.032
t(19)	-9.022	9.797
p-level	0.000	0.000
Regression Summary for dependent variable: pooled data of cumulative number of wolf tracks/km/day (surveyed 7.08.-11.09.2002)		
Model: Y=A+B*x		
Final loss: 7.379849521 R=.93910		
Variance explained: 88.191%		
n=18	A	B
Estimate	-22.654	0.149
Std.Err.	2.403	0.014
t(16)	-9.426	10.931
p-level	0.000	0.000

The next logical step in the 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, in 2001 there had been no preferred direction in which wolves were moving: there were 23 records of wolves heading eastwards, and 29 heading westwards. In 2002 there were 11 records of wolves heading eastwards, and 19 heading westwards. Besides that, E-W (and vice-versa) movements did occur in 2001 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 non-random 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.

However, in 2002 this seems not have been the case. The time series for the survey of 2002 can be shown in the following way:

<u>EEE</u> <u>WWWWWWWWWWWWW</u> <u>EE.</u>

That is, we have 3 series of alterations. In this case values of *R* less or equal to 4 mean a non-random character of wolf movements across the transect primarily in a westerly direction.

What does seem to continue to occur non-randomly is the selection by wolves of habitat types along the transect for crossings. Once again most of the records of wolf tracks have been made in forested areas (predominantly consisting of pine plantations) rather than open areas, reflecting this proportion between different habitat types in the study area.

Also, in moving around from one side of the transect to the other, wolves continue to prefer roads and lanes, rather than making their way through rough vegetation. And once again, the animals seem to be crossing the transect predominantly in its middle part around the location of forest quarters 87/88. The general pattern of the distribution of the number of crossings recorded along the transect in 2002 (see fig. 2.3c) is quite similar to the one recorded in the previous survey. This distribution too 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 can be considered as random departures from the normal route that could be due, for instance, to the very dry summer conditions of 2002, so more (than theoretically expected) tracks were recorded nearby the edge of the Dnieper Estuary.

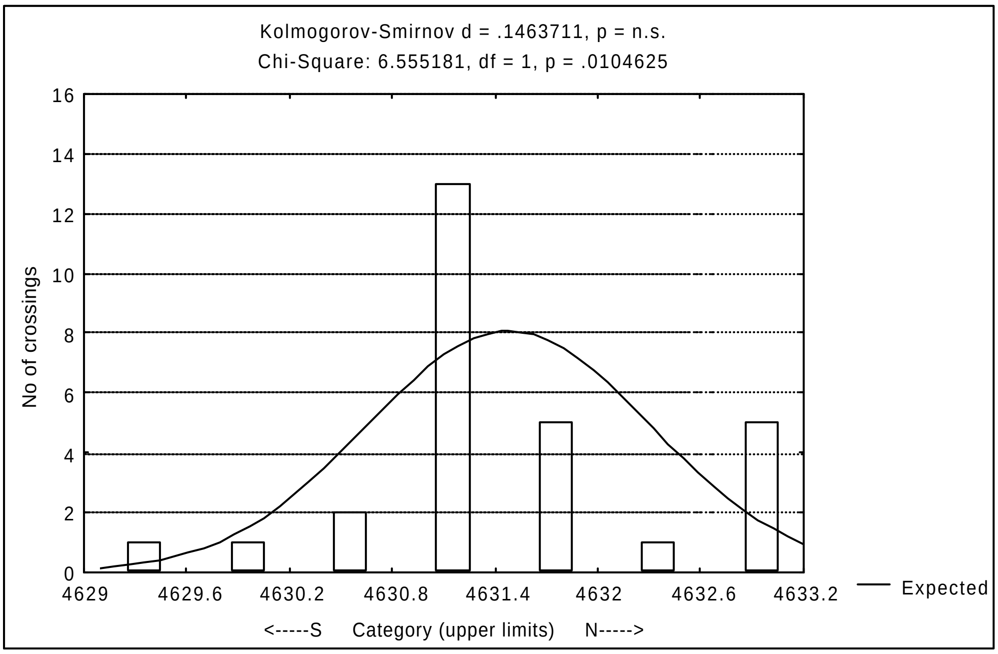

Fig.2.3c. Distribution of wolf track numbers along the transect in the survey of 2002

Finally 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. Once again, as in the survey of 2001, the measurements do not vary much as shown by their coefficients of variation: 11.9% for the length (L) of the footprint, 11.9% for the width (B), and 6.9% for the shape (S), computed as (B/L) x 100. Differences between both surveys are statistically insignificant.

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).

The scatterplot reveals two patches of plots: one of smaller animals (7 footprints in the 2001 survey and 6 in 2002) and one of larger (17 and 18 footprints, respectively). This may be reflecting the ratio of young and adult wolves roaming in the area during the time of the survey. If so, young in 2001 made up at least 29% of the wolf population in the area, whereas in 2002 around 25%. The difference is insignificant. Perhaps these figures could have changed, had the survey been extended for a month or two after the wolves had congregated. However, they do seem to be fairly consistent with figures found in the literature stating, for instance, one third, and up to one half of the population consisting of young individuals (Makridin 1978).

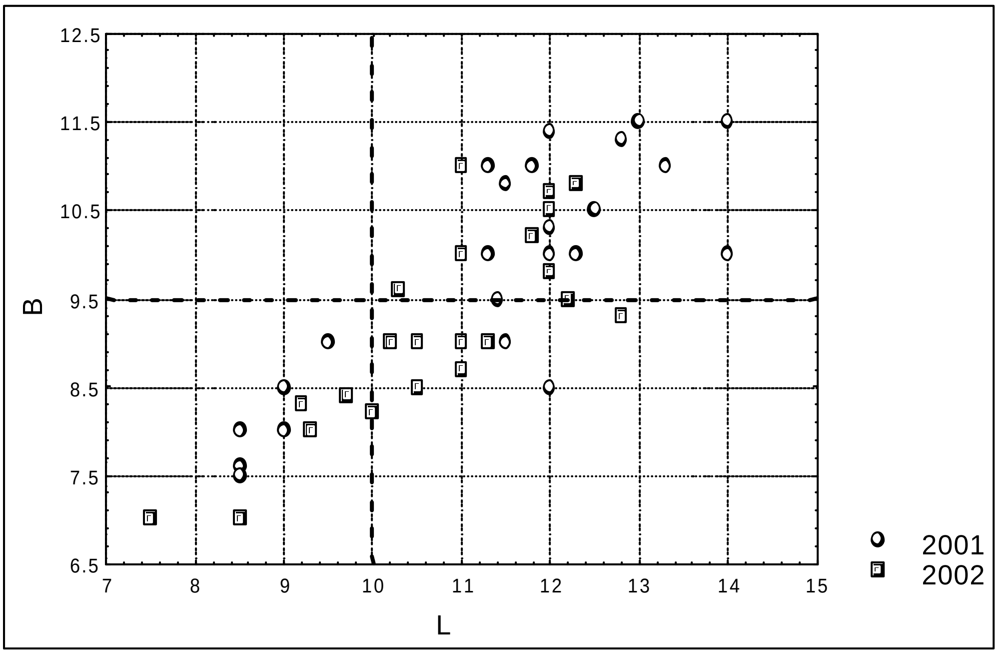

Fig. 2.3d. Scatterplot of wolf foot length (L) by foot width (B) measured in centimetres (cm)

As in the analysis of footprint measurements recorded in the previous survey a fairly distinct classification was made of male and female footprints. Indeed, according to Rukovski (1984), male tracks should be wider (S being around 77%), whereas female tracks should be somewhat elongated (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 (for both 2001 and 2002) 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, and assuming that animals in clusters characterised in a certain way are females or either males. Numbers of footprints belonging to a particular age group and sex, according to the results of this analysis, as well as means of S for the distinguished clusters, are summarised in Table 2.3e below. All differences between both surveys turned out to be statistically insignificant.

As we can see, results from our data give other proportions than indicated by Rukovski (1984), S being around 90% for males and around 80% for females. This could be, of course, due to the fact that we were measuring footprints made in the sand. However, in both cases the male shape indices (S) are larger than those of females by about 17%. We consider this to be a remarkable co-incidence confirming that we may indeed be properly distinguishing males and females.

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

2001

Group	Sex	n (number of footprints)	S = (B/L) x 100
Adults	Female	10	80.32±1.65
	Male	7	92.10±1.39
Young	Male	7	91.15±1.17

2002

Group	Sex	n (number of footprints)	S = (B/L) x 100
Adults	Female	7	79.10±1.20
	Male	11	89.38±1.26
Young	Male	6	86.75±1.81

Once again we assume 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 (as indicated by the chi-square test equalling 0.89, *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. This was as well the case in the previous study of year of 2001. That could mean that young male wolves start at an earlier time exploring their surroundings or moving a longer distance than their sisters. It may be as well 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 appear when the transect is surveyed for wolf tracks in the same way for at least a second time. Table 2.3f presents the relative abundance of wolves, estimated as the number of tracks per one kilometer of the transect recorded during the surveys of 2001 and 2002. As far as the raw data is not distributed normally (in terms of statistics), transformations have been applied to make the comparison between the figures in a correct manner according to conventional statistical procedures (see Ludwig & Reynolds, 1988). Log-transformation and the conversion of the raw data by adding to each value 3/8 and then extracting the square root was used. Although there seems to a drop in the relative abundance of wolves in the area (especially if one considers the data derived from the raw, non-transformed, data), nevertheless the decline is not statistically significant (the t-value being around 1.5, *df*=37).

Table 2.3f. Relative abundance of wolves, estimated as number of tracks per 1 km of transect

2001

	Valid N	Mean	Minimum	Maximum	Std.Dev.	Standard Error
NUM/KM	21	0.607	0	2.887	0.738	0.161
LGNUM/KM	21	0.173	0	0.590	0.162	0.035
SQNUM/KM	21	0.941	0.61237	1.806	0.320	0.070

2002

	Valid N	Mean	Minimum	Maximum	Std.Dev.	Standard Error
NUM/KM	18	0.313	0	0.852	0.340	0.080
LGNUM/KM	18	0.105	0	0.268	0.110	0.026
SQNUM/KM	18	0.805	0.61237	1.108	0.203	0.048

2.4. Conclusions

During the 2002 survey there has been a more or less constant flux of wolves crossing the transect, however, at a slower rate than in 2001. Less wolf activity could be due to the earlier start of the survey in 2002.

There is an indication that more wolves have been moving westwards, whereas in 2001 animals were moving in both directions. This could be result of placing the bait for the wolves nearby the watch tower on the western side of the transect.

As in 2001, most of the records of wolf tracks were made in forested areas (predominantly consisting of pine plantations) rather than open areas, reflecting the proportion between different habitat types in the study area. Moving around from one side of the transect to the other, wolves continue to prefer roads and lanes.

Once again, the animals seem to be crossing the transect predominantly in its middle part. The general pattern of the distribution of the number of crossings recorded along the transect in 2002 is quite similar to the one recorded in the previous survey.

Departures from this normal route could be due, for instance, to the very dry summer conditions of 2002, when relatively more tracks were recorded nearby the Dnieper estuary. Incidentally, the lack of rainfall could also be an important contributing factor in the slight decline in total wolf activity recorded in 2002.

The population in the study area is likely to be in a healthy condition, as indicated by the sex ratio of 1:1 and the presence of 30% or even 50% of young; these pivotal population parameters appear not to have changed since 2001.

The quantitative baseline set in 2001 for monitoring the relative abundance of wolves in the area has been checked against the data for 2002. Although there seems to be decline in the relative abundance of wolves in the area, nevertheless it is not (or not yet?) statistically significant. For this reason further monitoring should be conducted to make this clear: is the wolf population in the area declining, and if so why, or are we recording just fluctuations in animal numbers due to statistical "noise" and sampling error?

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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*).

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 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* (see Fig. 3.1a above). This subspecies, naturally, is endemic to the region and this is one of the reasons for listing it the Ukrainian Red Data Book (1994).

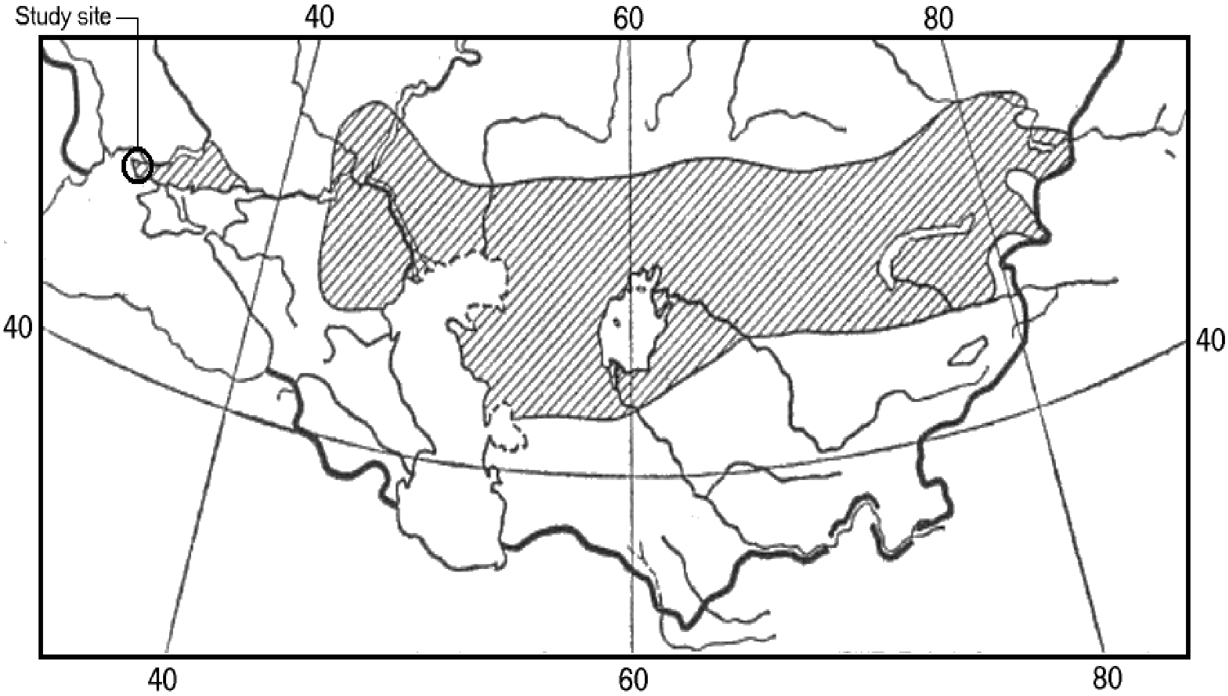

Fig. 3.1b. Geographical home range of the jerboa, *Stylodipus telum* with Kinburnska Kosa Regional Landscape Park study site location (see also Fig. 3.1.c). Note the disjunction between the Western and Eastern portions of the species' home range. Adapted from Flint (1970).

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 routs 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. 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 (see also Fig. 2.1b above).

Rationale

Declining numbers of *Stylodipus telum falzfeini* are a concern for the authority of the Kinburnska Kosa Regional Landscape Park, however numbers and densities have yet 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.

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 by the local scientists and the expedition leader. Field guides were also provided.

For the purpose of this study 6 sample plots (the same number as in the 2001 survey) 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. Two of the plots (1J and 2J) were the same ones studied in year before (2001); to avoid confusion plots examined for the first time in 2002 are named 7J-10J. Groups of 3-4 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, many roots, partially collapsed entrance). Only categories 1 and 2 were used for calculations of jerboa densities.

Table 3.2a. Plot parameters.

Plot code	Plot corner coordinates (N, E)		Adjusted size (m x m)	Adjusted area (ha)	Habitat; date of survey
1J	1: 46º 31.112’ 2: 46º 31.224’ 3: 46º 31.223’ 4: 46º 31.120’	31º 44.075’ 31º 44.084’ 31º 44.047’ 31º 44.042’	207.4 x 53.51	1.11	Open steppe, no trees; 20.09.01; 24.08.02
2J	1: 46º 31.227’ 2: 46º 31.331’ 3: 46º 31.332’ 4: 46º 31.224’	31º 44.087’ 31º 44.086’ 31º 44.046’ 31º 44.050’	199.98 x 52.23	1.04	Sandy steppe, undulating small hills; 13.09.01; 24.08.02
7J	1: 46º 31.142’ 2: 46º 31.079’ 3: 46º 31.168’ 4: 46º 31.147’	31º 44.153’ 31º 43.828’ 31º 43.877’ 31º 43.983’	198.12 x 53.51	1.06	Sandy steppe, undulating small hills; 28.08.02
8J	1: 46º 30.920’ 2: 46º 30.939’ 3: 46º 30.821’ 4: 46º 30.792’	31º 35.616’ 31º 35.735’ 31º 35.943’ 31º 35.787’	198.13 x 52.24	1.04	Sandy steppe, undulating small hills; 28.08.02
9J	1: 46º 32.243’ 2: 46º 32.218’ 3: 46º 32.229’ 4: 46º 32.206’	31º 44.623’ 31º 44.628’ 31º 44.772’ 31º 44.771’	198.78 x 68.51	1.30	Sandy coastal steppe, undulating small hills; 5.09.02
10J	1: 46º 30.206’ 2: 46º 30.211’ 3: 46º 30.103’ 4: 46º 30.053’	31º 45.376’ 31º 45.418’ 31º 45.591’ 31º 45.440’	216.64 x 66.23	1.43	Open steppe, hill top; 12.09.02

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 converted all plot coordinates into meters (*y, x*). In the case of 1J, for example, we get a tetragon with corner coordinates 22.22, 44.60; 229.61, 56.06; 227.75, 8.92; 37.03, 2.55 (*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 (i.e., Y_{max}= 227.75-22.22 = 207.39; X_{max}= 56.06-2.55 = 53.51). This was done in order to accommodate all hole records into a rectangle, thus somewhat increasing the sample plot size to an average of 201.67 x 57.87 m (1.16 ha) (see Table 3.2a).

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 (σ^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 (χ^2) test was applied to confirm if the sample is in agreement with the theoretical Poisson (random) series expecting the ratio of σ^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.

The chi-square (χ^2) test was applied to check the assumption that holes grouped into activity categories (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.

3.3. Results and Discussion

As in the previous year, no holes were detected within the sample plot 1J. Data on 2J, 7J-10J regarding hole numbers, their use, and calculated densities (according to Gizenko's method) are summarized in Tables 3.3a and 3.3b. Figures in the tables are derived from the adjusted sample plots.

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

Plot code	Activity				Used holes	Unused holes
	1	*2*	*3*	*4*		
2J (2001)	6	3	5	7	9	12
2J (2002)	6	13	2	9	19	11
7J	7	8	5	8	15	13
8J	7	8	5	13	15	18
9J	17	4	9	6	21	15
10J	4	9	18	46	13	64
pooled data (only for the 2002 survey)	41	42	39	82	83	121

As can be seen, densities are quite comparable with those recorded for the Chornomorski Biosphere Reserve, reaching up to 1.5 ind./ha and 2.3 ind./ha on pastureland adjacent to the reserve. 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).

Table 3.3b. Jerboa densities.

Plot code	Adjusted plots (ind./ha)
2J (2001)	1.24-1.73
2J (2002)	2.60-3.65
7J	2.02-2.83
8J	2.06-2.88
9J	2.31-3.23
10J	1.30-1.82
average (only for the 2002 survey)	1.72-2.40

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 (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, with one exception (10J).

Table 3.3c. Ratios of used and unused holes.

Plot code	used	unused	χ^2	p<
2J (2001)	9	12	0.39	0.51
2J (2002)	19	11	2.13	0.14
7J	15	13	0.14	0.71
8J	15	18	0.27	0.60
9J	21	15	1.00	0.32
10J	13	64	38.5	0.00

This conclusion is supported by the χ^2-test, and assuming that the population of animals within the surveyed sample plots are in some kind of equilibrium, whereby birth and death rates are approximately equal. Empty plots (1J) and more abandoned than populated holes in plot 10J give a reason to assume that this equilibrium is probably very fragile, especially considering the low total numbers of individuals present.

Density figures in Table 3.3b may be used for year-to-year comparisons for purposes of establishing population trends. For instance, jerboa density seems to have increased in plot 2J. 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 in 2001 by examining the relationships between the mean (M) and variance (σ^2) for pinpointed holes in blocks of various size ranging from 100 to 3,000 m^2.

Blocks of various size are used in the analysis, because distribution patterns may change if clumping is the case. However, the ratio σ^2/M remains fairly stable and is not significantly different from 1.0, meaning a generally random distribution of holes within the sample plots. This conclusion is supported by the lack of any correlation between block size and σ^2/M as far as all the correlation coefficients between block size and σ^2/M are way above the acceptable confidence level, p>0.05. For statistical details of the method and how the χ^2-test is applied in this case see Greig-Smith, 1983 or Ludwig & Reynolds, 1988. Plot 2J has been tested for this purpose twice, once in 2001, and for the second time in 2002.

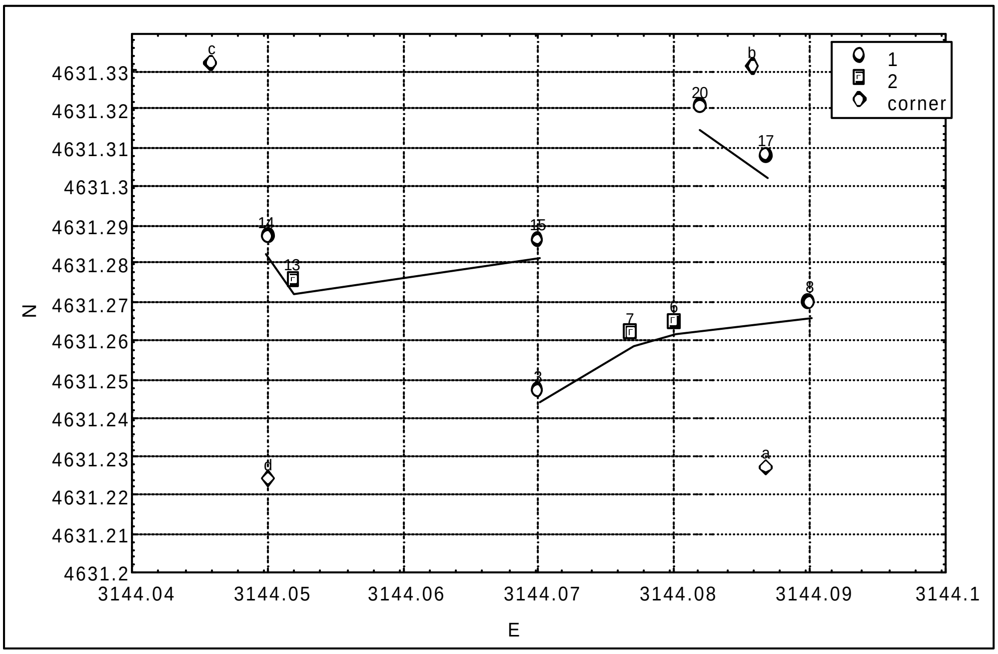

Fig. 3.3a. Scatterplot of used holes recorded in 2001 in plot 2J and distances between nearest neighbours (circles – used holes with marked signs, squares – used holes, rhombuses – corners)

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 σ^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.

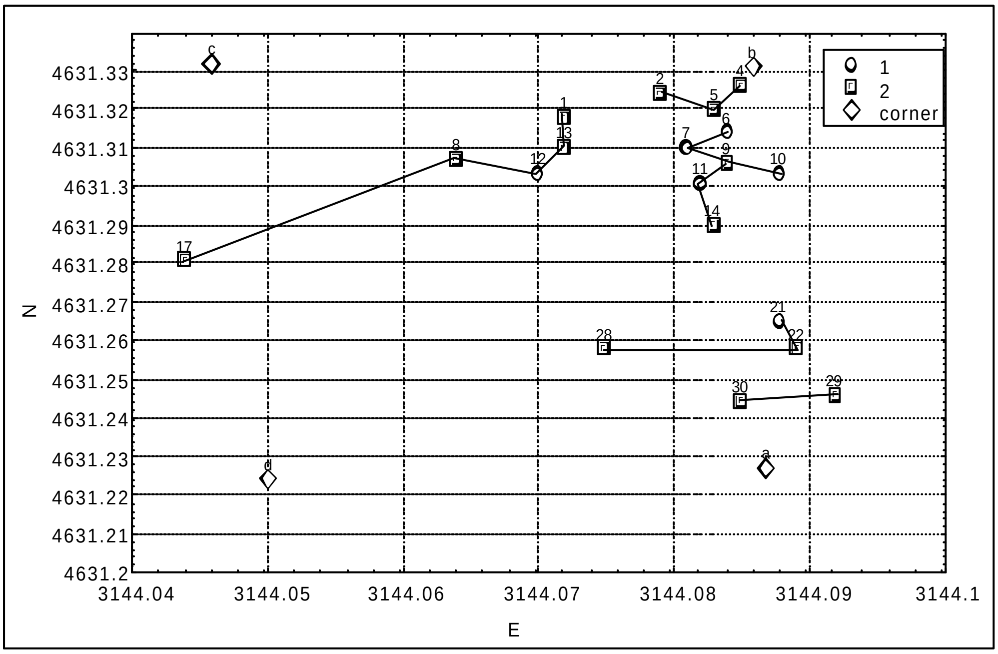

Fig. 3.3b. Scatterplot of used holes recorded in 2002 in plot 2J and distances between nearest neighbours (circles – used holes with marked signs, squares – used holes, rhombuses – corners)

Given the random spatial distribution of jerboa holes and having confirmed this pattern in the 2002 survey, we can attempt to test distance sampling and the consistency of the method, which could be a more efficient way of monitoring the jerboa populations. As said above, we have chosen the "nearest neighbour" method and distances were measured between a given hole and its nearest neighbour in one and the same sample plot (2J), treating this time only used holes. The results are summarized in Table 3.3e below and Figs. 3.3a & b above.

In this table mean distances between used holes may be useful in estimating numbers of jerboa per hectare. There is no significant difference between values (both raw and log-transformed) estimated in 2001 and 2002 for the 2J sample plot (*t*-tests have shown no marked differences, all $p > 0.05$), showing thus that the method is consistent allowing standardised replication, or establishment of confidence levels about a mean. This conclusion is supported by the similar degree of variability (i.e., coefficients of variation) of distance measures in both cases, 17.6% in the first time and 19.3% in the second.

Table 3.3e. Distance sampling of jerboa holes in plot 2J:
DIST=raw distances in meters; LGDIST=log-transformed distances

2J (2001)				
	Valid N*	Mean	Std.Dev.	Standard Error
DIST	6	23.81	10.00	4.08
LGDIST	6	3.07	0.54	0.22
2J (2002)				
	Valid N*	Mean	Std.Dev.	Standard Error
DIST	14	16.82	13.49	3.61
LGDIST	14	2.66	0.51	0.14
	t-value	df	p	
DIST	1.14	18	0.27	
LGDIST	1.61	18	0.13	

* note valid N is not equal to the number of used holes

Taking into account that $D=\sqrt{S}/2$, and that one animal makes use of 5 to 7 temporary burrows, densities in plot 2J would be ranging from about 0.63 to 0.88 ind./ha (in 2001), and 1.35 to 1.89 (in 2002). These estimates, as those obtained by using quadrat (or block) sampling methods seem to indicate increasing numbers. However, it is likely that both sets are are showing merely statistical fluctuations, as indicated by lack of difference between the mean “neighbourhood” distances.

Finally, a few words on the orientation of hole entrances. As in the previous study, no narrow specific direction was found to be preferred, in general terms there are somewhat more entrances facing E or W, rather than N or S.

3.4. Conclusions

One sad conclusion made in the previous (2001) survey was that amongst six plots surveyed, of what appeared to be suitable habitats for the jerboa *Stylodipus telum falzfeini*, three were empty. Plot 1J repeatedly studied in 2002 continued to be unpopulated by the animals. There is yet no explanation for this, although jerboas do inhabit neighbouring plots.

The survey has confirmed once again the low density of the population in the area of the Kinburnska Kosa Regional Landscape Park and the figures presented here are comparable with 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. Plotless or distance methods for this purpose have been tested for the first time ever and appear very promising. The 2002 survey has confirmed the validity of the approaches we have chosen, especially in terms of replicability and comparability.

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, although one plot (10J) shows the population in a critical condition. This fragile equilibrium, however, 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.

3.5. References

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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. Eastern Steppe Viper on the sands of the Kinburnska Kosa Landscape Park. Photo: M. Hammer.

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. 4.1a).

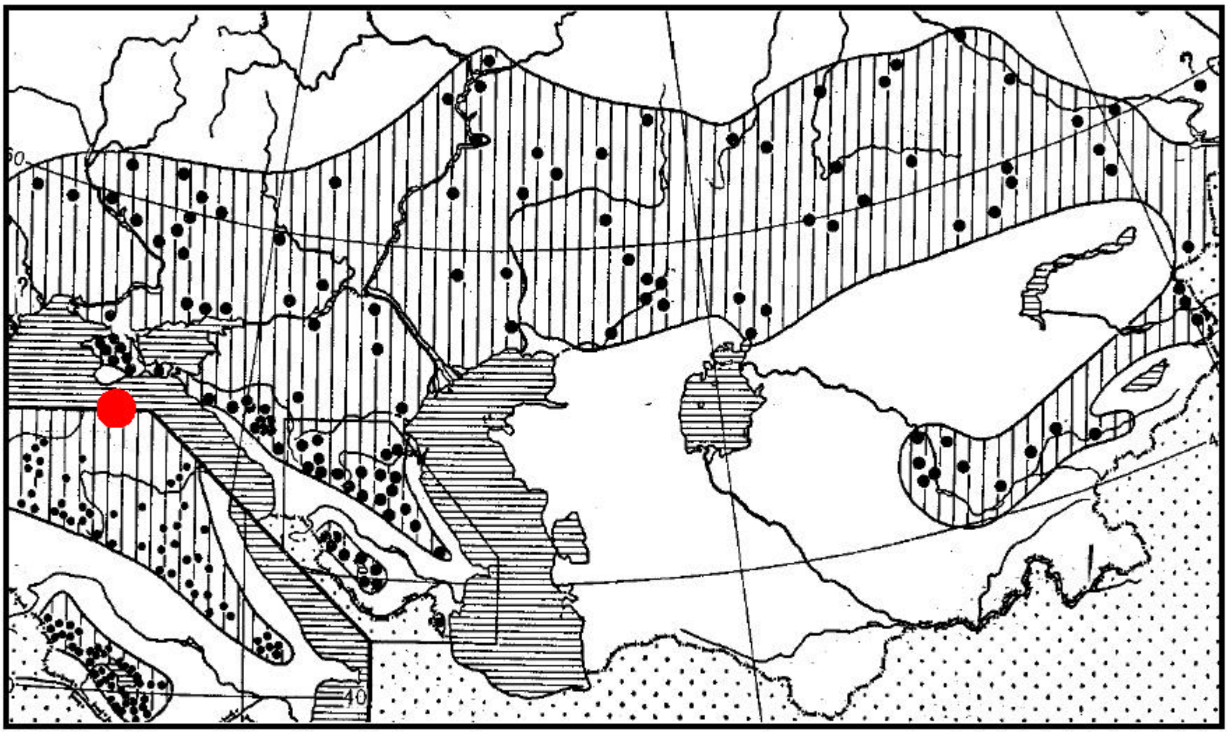

Fig. 4.1b. Home range of the Eastern Steppe Viper (*Vipera ursinii renardi*) in countries of the former Soviet Union. The red dot denotes the study area of the Kinburnska Kosa. From Bannikov et a. (1997).

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.

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. Nevertheless, Darevski (1987) encourages to estimate reptile numbers and abundance at any time of the year once there is a chance to see the animals.

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 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. Vipers were recorded by surveyors as well during the counting of jerboa holes and on occasional walks occurring between the Wolf Camp and points on the transect used for detecting wolf tracks.

In general, there was no preferred daytime hour for inspecting the routes. This has been checked by the chi-square test, assuming that inspections (for both the transect and occasional walks) were more or less evenly distributed throughout the daytime.

Since the survey lasted for more than a month weather conditions and temperatures could have had an impact on the time of the finding of a viper and as well lead to a shift in the size of a viper likely to be detected. Fortunately, we have by and large escaped these complications as shown in Figs. 4.2a and 4.2b, showing the absence of any definite trend (using the least square fitting procedure).

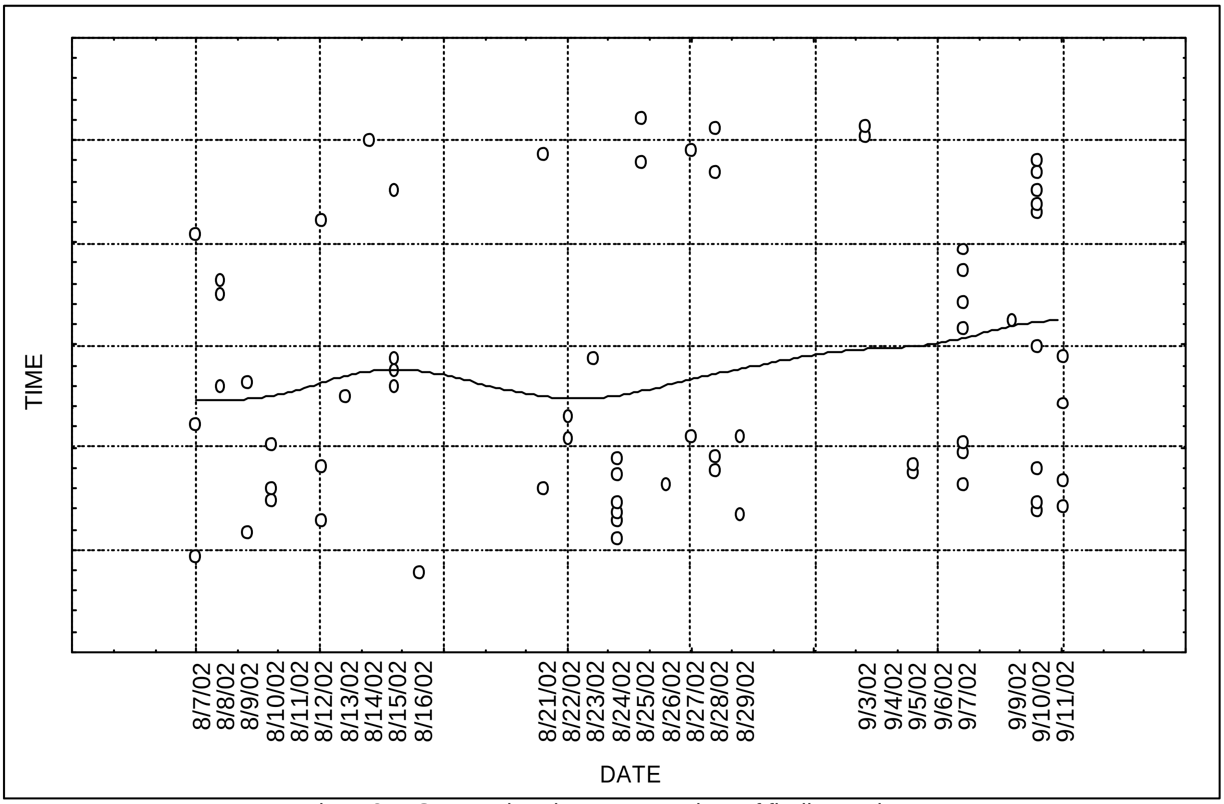

Fig. 4.2a. Scatterplot: dates versus time of finding a viper.

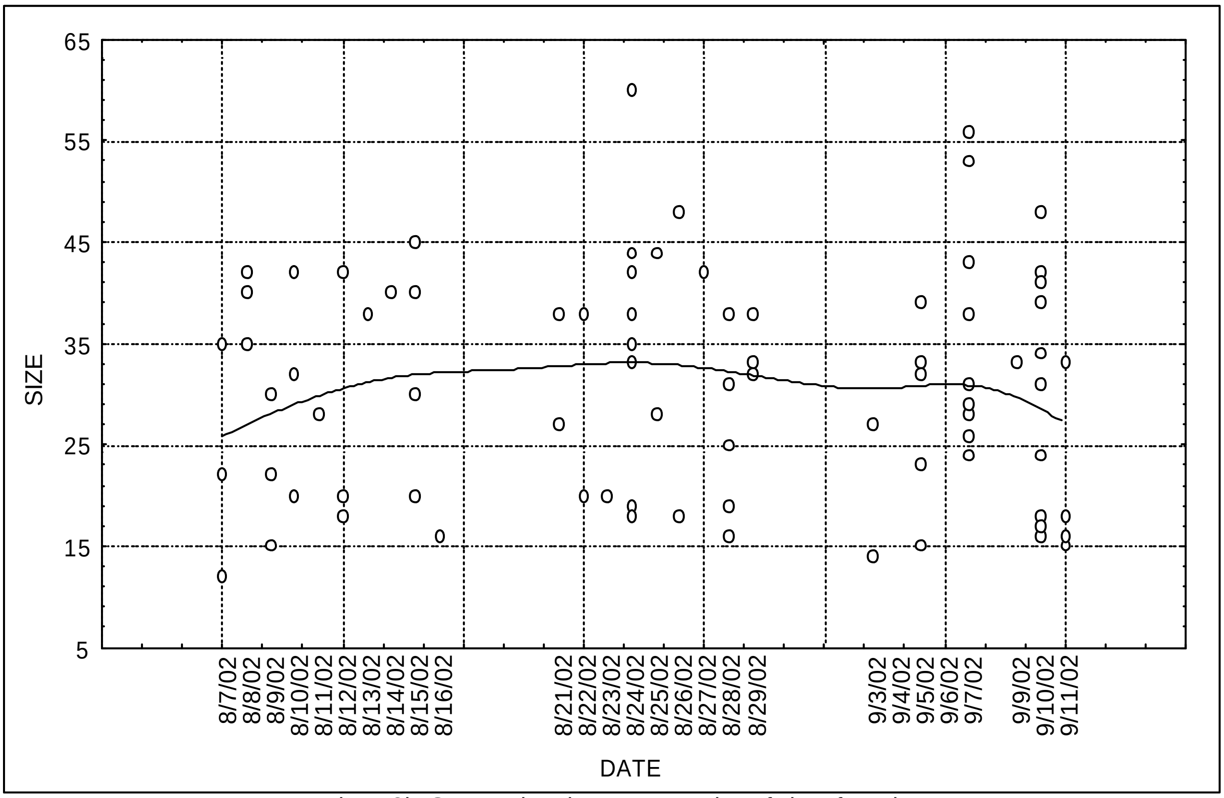

Fig. 4.2b. Scatterplot: dates versus size of viper found.

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

4.3. Results and Discussion

109 records of vipers were made during the survey lasting from 7 August 2003 until 11 September 2002.

18 of them were made on the transect, and in 5 cases no vipers were detected here during the inspections. The average abundance can be calculated as 0.198 ± 0.042 ind./km, ranging from the minimum positive record of 0.136 to the maximum of 0.568 ind. /km.

Six random walks were undertaken for accounting for viper abundances (Table 4.3a). Most of these crossed open grassland, a more preferred habitat by the reptiles than any other.

Table. 4.3a. Parameteres of random walks and calculated abundances of vipers.

Date	Starting point		Ending point		Distance (km)	Abundance (ind./km)
	time	location	time	location		
7.09	9:51	46º 31.041 31º 42.910	15:29	N 46º 29.338 E 31º 45.264	10.4	1.25
10.09	9:08	46º 31.014 31º 44.005	9:56	N 46º 31.929 E 31º 44.031	1.54	1.95
10.09	10:02	46º 32.045 31º 44.007	10:30	N 46º 32.712 E 31º 43.894	1.26	0.79
10.09	16:16	46º 31.014 31º 44.005	16:58	N 46º 31.806 E 31º 43.914	1.54	3.25
10.09	17:03	46º 31.804 31º 43.836	17:18	N 46º 31.428 E 31º 43.863	0.70	1.43
11.09	12:28	46º 30.528 31º 44.218	12:51	N 46º 31.084 E 31º 43.664	1.45	0.00

The average abundance derived from the data obtained during the random walks equals 1.445 ± 0.450 ind./ km, ranging from the minimum positive record of 0.79 to the maximum of 3.25 ind. /km. These figures are much higher than those found for the transect, but it should be realized that only less than a third of the length of the transect crosses open grassland habitat, so this result is not surprising.

Nevertheless, the transect survey may yield meaningful results as far as its inspection is carried out on a regular and standardized basis. We can, for instance, suppose at least that there might be now fewer vipers in the area since the range of abundance values derived from transect data has decreased from 0.142-0.926 to 0.136-0.568 ind. /km.

In other places nearby the study arae the highest records of vipers come from Orlov Island (46°17?N, 32°44?E) and Potievska Tendra (about 46°8?N, 32°13?E): with 5 ind./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, and may as well depend on the type of habitat where assessments of population abundances are been made.

An encouraging result, increasing our confidence on the reliability of the collected data, has repeatedly emerged from the analysis of viper numbers recorded during the daytime (Fig. 4.3a. below).

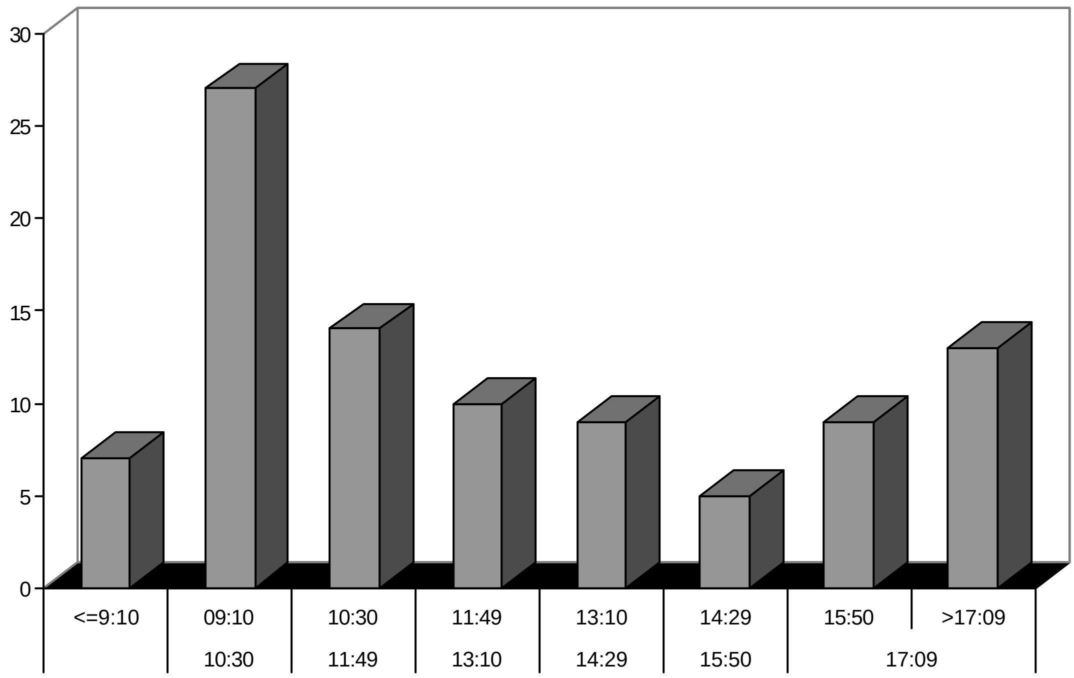

Fig. 4.3a. Daytime record of viper numbers.

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 a minimum during the hottest part of the day, and once again rising in the late afternoon when temperatures drop down.

This year data has repeatedly yielded, however a much more clear pattern of the population structure of the viper in the study area represented by the histogram of viper length data (see Fig. 4.3b). 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).

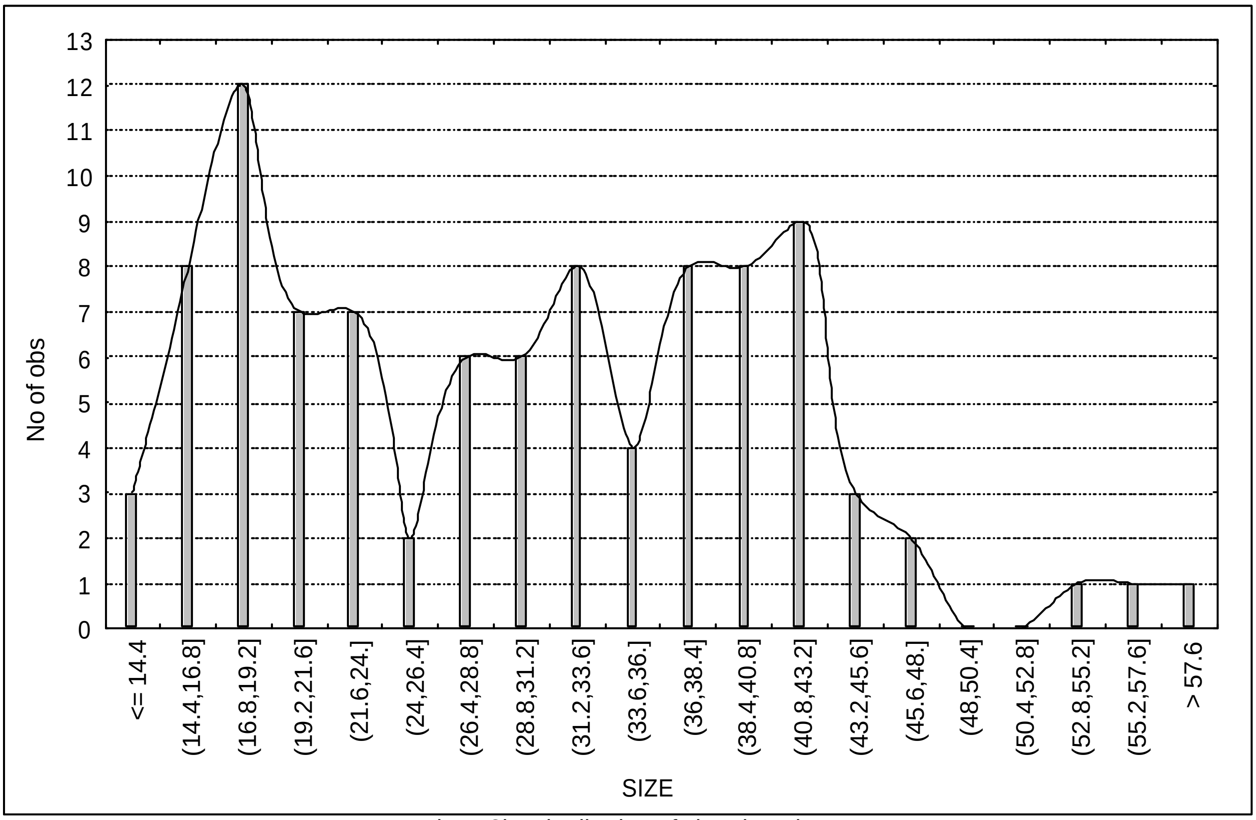

Fig. 4.3b. Distribution of viper length.

The graph clearly indicates the presence of at least 4 size classes. By using k-means cluster analysis these can be distinguished as clusters (Table 4.3b).

Table 4.3b. K-means cluster analysis of viper size data.

Clusters	No.1	No.2	No.3	No.4
number of cases	36	25	30	3
average size of individuals (cm) in the cluster	18.33	30.84	40.93	56.33

Indeed, as in the previous year, there are more juveniles (cluster No.1) of the current year than those born at least a year ago (cluster No.2), 38% and 27%, respectively, and about 32% (cluster No.3) are possibly at the age of three; only 3% of the individuals averaging about 56 cm are presumably older than three. Under these circumstances about 35% of the population is in its reproductive state; further monitoring is necessary to sort out the question: is this amount of reproducing individuals enough to maintain the population in the area or not?

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 and surroundings of nature reserves.

Although there are some problems associated with data collected within and beyond the breeding season, data from the current survey in August-September seem to be fairly reliable and replicable.

Monitoring should continue in subsequent years. Comparative data from future surveys will be a first test of the quality of baseline and current data, confirming or rejecting negative trends in the area.

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5. Autumn Migration of Passerines on the Kinburn Peninsula

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5.1. Introduction

This study was carried out on the territory of the Regional Landscape Park "Kinburnska Kosa" (Kinburnskaya spit) over the period 1 August 2002 to 15 September 2002. It was organized and supported by the international organization "Biosphere Expeditions".

5.2. Materials and Methods

19 amateur ornithologists participated in the expedition. They were divided into three research groups. Every group consisted of 5-6 people and worked in a tent camp for two weeks.

Main work methods were a visual census of birds on the Kinburnskaya spit (see Fig. 2.1b) and catching, processing and ringing of live birds. To count birds we used SILVA binoculars with 10 times magnification and a telescope "Evolution" with 20-60 times magnification.

Catching and ringing was done with the help of 10 mist and one Helgoland type net. The mist nets were coloured black and had 4 pockets. Four nets were 12 m, 4 - 9 m, 1 - 10 m and 1 - 6 m in length. They were located in shrubs at a distance of 30 – 118 m from the camp. The Helgoland trap was placed at a distance of 112 m from the camp (see Fig. 2.1b). To determine the direction of migration, we identified each bird's direction of entry into the net, before removal from the net.

The Kinburnskaya spit is situated submeridionally, so birds caught in the nets, had been flying from the south-east or north-west. The mouth of the Helgoland opened out toward the north-west so birds caught in it were flying south-east. The nets were checked every hour.

Temperature and air pressure were registered every day in the morning, afternoon and evening. To do this, a SILVA GPS Multi-Navigator was used. The total duration of daily observations was never fewer than 15 hours during daylight hours. To characterize diurnal activity of birds we considered a period from dawn until 10.00 to be the morning hours and a period from 16.00 until darkness to be the evening hours.

The bird census was taken along standard routes. The first route (4 km long) followed the sea coastline and included birds of open water areas. The second route (2 km long) was along the coast of Yagorlytsky bay, where we counted birds preferring inner bays and lakes. Some participants of the expedition with experience of determining birds in their natural surroundings took individual census routes around the camp. Such counts were taken on average once every five to seven days.

All captured birds were identified (including their age and sex), measured (standard measurements of wing, tarsus, tail and bill length), weighed (using Pesola spring balance), ringed with rings of Kiev Ringing Centre and finally released. All data obtained were included in special ringing forms and notebooks for future analysis.

Apart from this, we prepared special forms to register migratory flocks. Over the expedition period such species as Grey Heron, Redshank, Honey Buzzard, Bee-Eater, Montagu's Harrier, Pallid Harrier, Marsh Harrier, Kestrel, Red-footed Falcon were observed to be migrating. The flight direction and its height as well as the number of birds were recorded. Where possible we also determined sex and age of the birds.

1862 individuals were caught in a total. 1704 individuals of 39 species were ringed (1 species of Coraciiformes, 1 species of Cuculiformes, 1 species of Piciformes, 1 species of Upupiformes, 35 species of Passeriformes). In the census forms of migratory flocks and single birds there 655 records were made.

Weather conditions

In the South of Ukraine the transition from the end of summer to the beginning of autumn is characterized by a change from hot dry weather to a rainy period with cool nights. Average annual analysis of the situation shows that this change takes place during the second half of August, when the air temperature in the afternoon decreases from 35ºC to 22-24ºC. During this period the cloud cover varied sharply. During daylight hours there were 8 clear days, 16 days with cloud cover of up to 50%, 15 days with cloud cover of 50-100%. Three days were completely overcast. Stars could be seen on all but nine nights.

Air pressure determines the intensity of migration of small Passerines. In August the air pressure has a sharp amplitude of low and upper indices. The low index was 1000 HPa, on 13 August, and the upper index was 1022 HPa, from 25 to 26 August. In September there was a relatively stable decrease of the air pressure from 1018 HPa down to 1005 HPa.

Rain of different intensity occurred during that period. Thus on days with a sharp decrease in air pressure, from 12 to 15 August, there were heavy thunderstorms. All over Europe similar conditions were being experienced. On only two days there was rain of seasonal average heaviness.

5.3. Results

1704 individuals of 39 bird species (1 species of Coraciiformes, 1 species of Cuculiformes, 1 species of Piciformes, 1 species of Upupiformes, 35 species of Passeriformes) were caught and ringed during 37 field days.

Catpure dynamics analysis of all Passerine birds showed the presence of several migratory waves on the Kinburn peninsula during August to September, with waves most evident for common species.

The most common species captured was the Swallow, with the majority caught in the Helgoland trap. Several birds which had flown into the inner compartment attracted other birds with their songs and calls, thus often causing capture of a high number of birds. Flycatchers, Whitethroats, Warblers and Chiffchaffs respectively were the next most numerous birds captured.

1147 individuals (67.9%) were caught in mist nets. 540 individuals (32.1%) flew into the Helgoland trap, which was specially oriented to catch birds flying Southeast. In total 1041 birds flew in this direction (61.5%), and 653 (38.5%) flew toward the Northwest.

Brief characteristics of the most numerous migrants are given below.

Swallow

Migration of this species on the Kinburn peninsula took place during all of August. After 5 September Swallows were no longer captured, but their movements were still observed. Over the period of observation four migratory waves were registered; 24.9% (80 individuals) were caught between 10 and 11 August, 23.4% (75 birds) from 28 to 29 August; intensification of migratory activity was also recorded 16 and 24 August.

321 individuals were caught and ringed in total, 293 (91.3%) of them were juveniles and 28 (8.7%) were adults. 12 females and 11 males were reliably identified. 299 birds (93.1%) flew into the Helgoland trap and 22 individuals (6.9%) were caught by mist nets. The principal migratory direction was Southeast (315 birds). Six birds flew into the net whilst flying toward the Northwest.

During the period 9 to 11 August all Swallows captured (93 birds) were released after ringing in different directions, except Southeast. 100% of these birds returned to the principal direction of their migration (Southeast).

The most active migration of Swallows was in the evening hours, from 16.00 to 18.00 with a peak from 17.00 to 18.00. During this period, 176 birds were caught (54.8%). (Incidentally, the same migration tendency was also registered for Sand Martins, of which 89.1% were caught in the evening hours.)

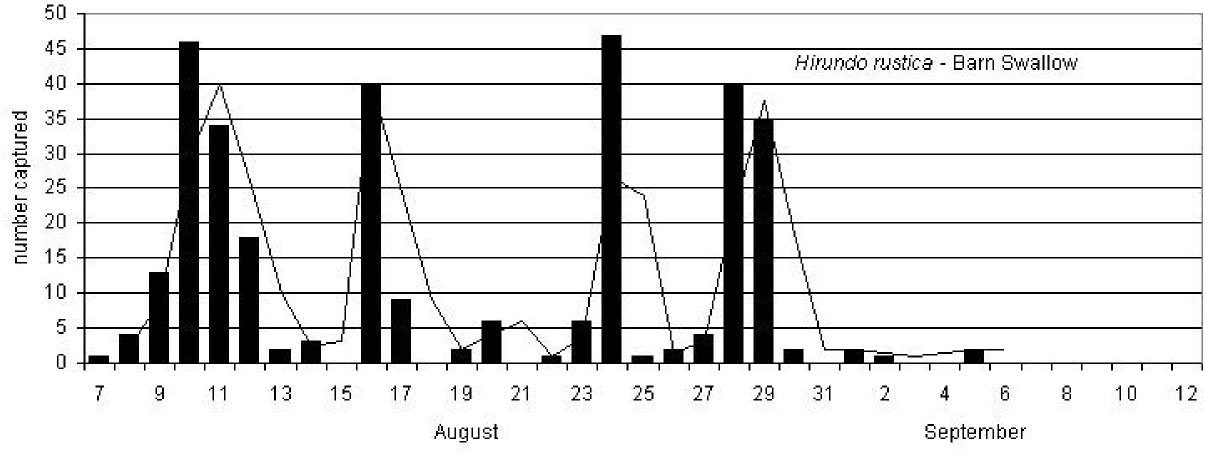

Fig 5.3a. Barn Swallows captured during the expedition.

103 captured Swallows had small fat reserves, 102 were of average fatness, 54 individuals had no fat reserves and only 62 Swallows had sufficient fat quantity for distant migration. Based on the ringing recoveries of Swallows we obtained data which showed that birds caught later in the capture period had greater body fat content, than those caught earlier. Thus we can come to the conclusion that the Kinburn peninsula is a good feeding base for Swallows before their migration commences.

Flycatchers

449 birds were caught during the expedition (26.8% out of all the bird species). This is the most numerous bird group. It was represented by four species (Red-breasted Flycatcher, Spotted Flycatcher, Pied and Collared Flycatchers).

Red-breasted Flycatcher

Migration began on 15 August and lasted until the end of the expedition. Two clear migratory waves were registered in this period, the first from 1 to 5 and the second from 9 to 10 September.

241 Red-breasted Flycatchers were ringed in total (236 juveniles and 5 adults). 144 birds (59.8%) flying to the Northwest and 97 birds (40.2%) flying the Southeast were caught. Visual observations showed that their principal migration direction was to the Northwest, and the high share of birds flying toward the Southeast can be explained by their specific migration pattern: migrations of Red-breasted Flycatcher occur as movements of small groups and separate individuals in shrubby vegetation with simultaneous feeding behaviour.

223 birds (92.5%) were caught by our mist nets and only 18 Red-breasted Flycatchers flew into the Helgoland trap.

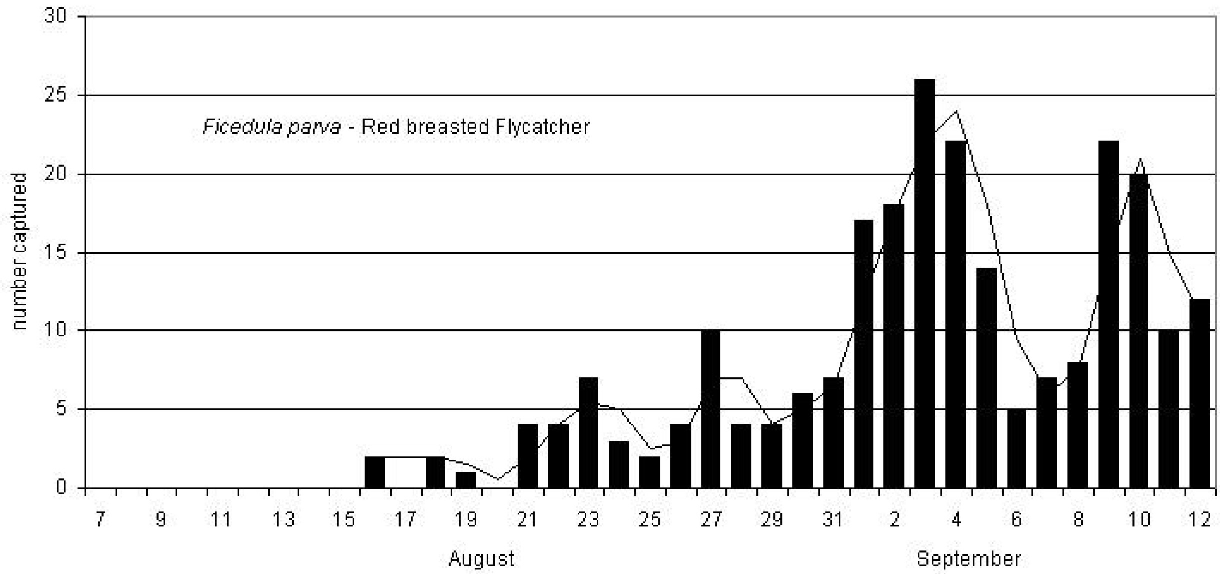

Fig 5.3b. Red breasted Flycathcers captured during the expedition.

Most birds had no (149 individuals) or few (71 individuals) fat reserves. In September there were fewer birds with absence of fat reserves than that in August.

165 (68.5%) Red-breasted Flycatchers flew in the morning hours (from dawn till 10.00). From then on there was a slow decrease of the migratory activity until darkness.

Spotted Flycatcher

Migration of Spotted Flycatcher ocurred during the entire period of observations. Its intensity was relatively stable, yet from 4 to 5 and on 9 September some increase in migration activity was observed.

There were 146 (95.4%) juveniles out of 153 captured birds (127 of them were caught by the mist nets).

60 birds had small fat reserves, 52 birds were of average fatness. 31 individuals had no fat resources.

All species of Flycatcher had an increased flight activity during the morning hours. Thus 82 individuals (53.6%) of Spotted Flycatcher were caught before 10.00.

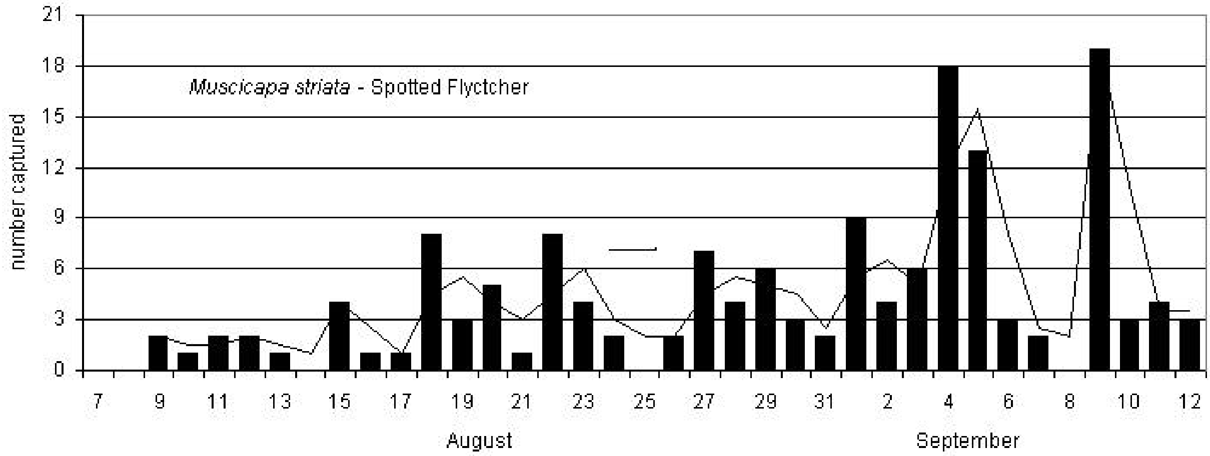

Fig 5.3c. Spotted Flycatchers captured during the expedition.

Observation showed that within the camp territory Spotted Flycatchers were actively feeding in open places during daylight hours. They avoided shrubby vegetation where the nets were hidden.

Pied Flycatcher

The Pied Flycatcher was not a numerous migrant, but it was regularly caught in the nets during the entire expedition period. The highest capture number (14 Pied Flycatchers) was recorded on 18 August .

In a total 53 birds were captured, 51 of them juveniles. Only 10 Pied Flycatchers had sufficient fat reserves for their migration, other birds were of average fatness (10 birds), 11 birds had little fat or fat reserves were absent (22 birds).

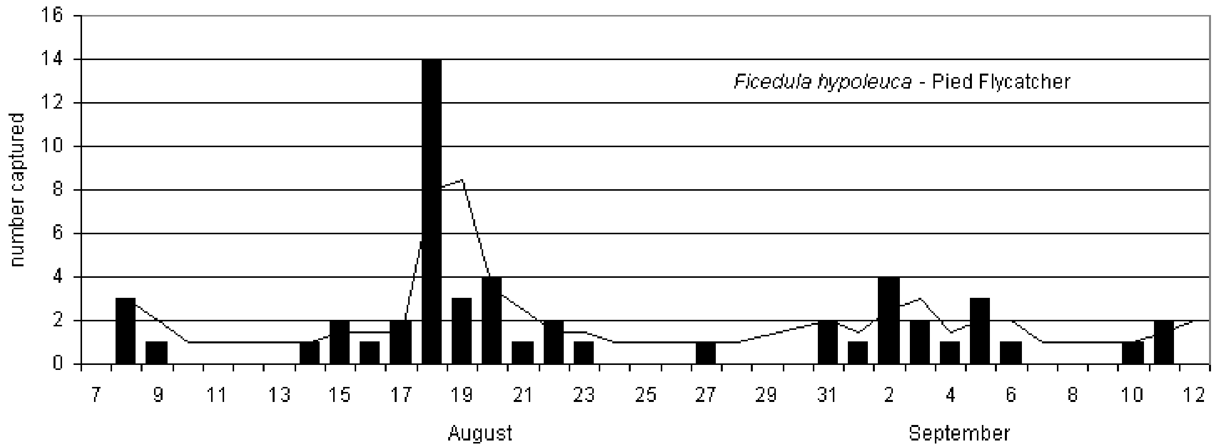

Fig 5.3d. Pied Flycatchers captured during the expedition.

Almost 68% were caught during the morning hours. After 10.00 capture frequency decreased sharply to single individuals. After 17.00 Pied Flycatchers were neither captured in the nets, nor observed near the camp.

Red-backed Shrike

Our observations showed that the Kinburn peninsula is a favourite migratory route for Red-backed Shrike and Lesser Grey Shrike. A high number of these birds were observed throughout the expedition. Relatively low capture numbers for Lesser Grey Shrikes (60 birds) did not reflect the real situation. This robust and strong bird is capable of highly maneuverable flight. When captured in a mist net, it can easily disentangle and release itself, as was seen by us many times. Therefore, the total number of Red-backed Shrike present was considerably higher than those caught.

146 Shrikes were ringed in total. 137 individuals were young, and 9 were adult (8 males and 1 female). 91 (62.3%) individuals were captured flying Southeast, whilst 55 birds (37.7%) were captured flying Northwest. Visual observations showed that the principal direction of the autumn migration was Southeast.

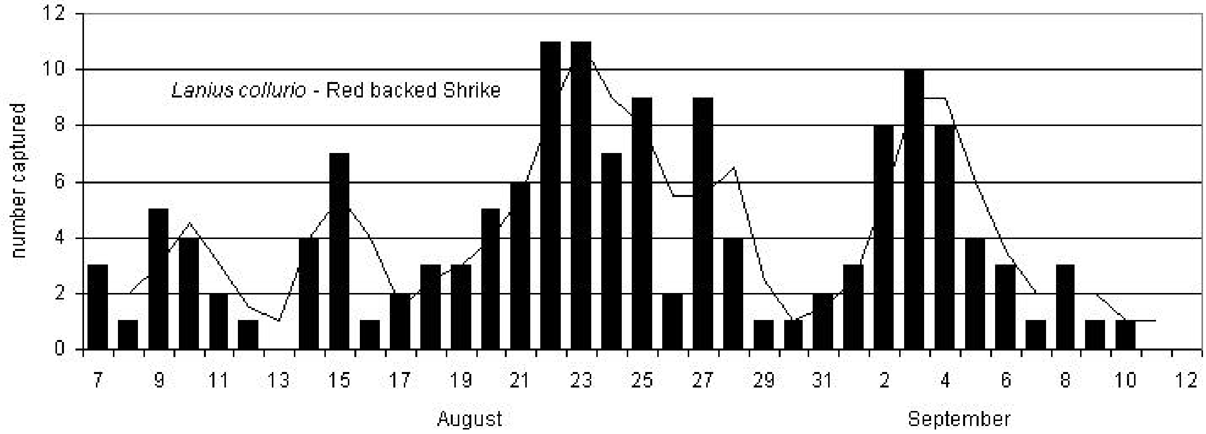

Fig 5.3e. Red backed Shrikes captured during the expedition.

By the end of August (20 to 27 August) the migration became more active and 60 Shrikes (41.1%) were captured during this period. Another less pronounced wave of migration was registered between 2 and 4 September when 26 Shrikes (19.2%) were ringed.

Fatness shows that the birds were ready for distance flights. 57 birds had very large fat recourses, 46 Shrikes had a lot of fat and 26 birds were of average fatness. Before 10.00 78 birds (53.4%) were caught. The Shrikes were also quite active during the afternoon; 46 birds were caught.

Warblers and Whitethroats

During the expedition five species of these birds were registered (we ringed 97 Blackcaps, 81 Garden Warblers, 33 Whitethroats, 24 Barred Warblers and 16 Lesser Whitethroats). The proportion of these birds was 15% out of all the birds captured.

Blackcap

This species was encountered from the beginning of the expedition on 1 August, but was captured only after 9 August and then until 12 September. On 9 September 18 Blackcaps were captured. This one-day peak of migration was also registered for Garden Warblers (81 individuals captured in total).

Uniquely, the share of captured adult birds is quite high for Blackcap. There were 19 birds (19.6%) – 11 females and 8 males. 25 males and 23 females were reliably identified among juveniles. These data resemble the census results for the previous year's expedition from August to September 2001 (there had been about 48% of males among juveniles and 64% of females among adults).

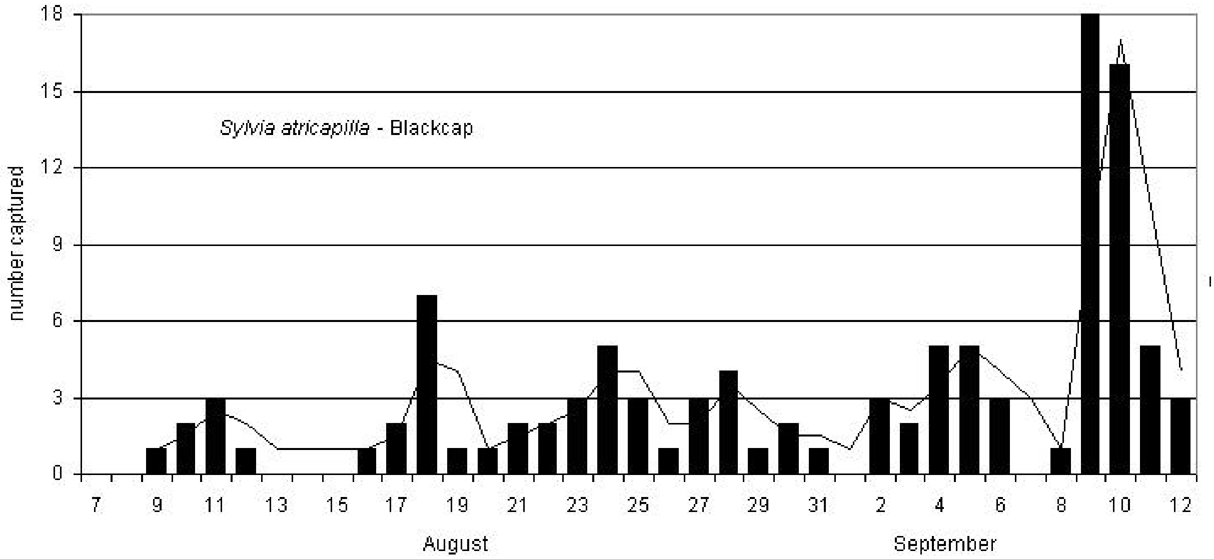

Fig 5.3f. Blackcaps captured during the expedition.

Most birds had a very high (40 individuals) or high (27 birds) degree of fatness. 73% (71 birds) of Blackcaps were caught during the morning hours. After 10.00 the nets captured only single individuals of this species.

Garden Warbler

Migration of this species took place during the whole period of our expedition. 81 Garden Warblers were captured in a total. In August from 1 to 5 birds a day were captured; 8 days during this month Garden Warbles were neither captured, nor observed. From 3 September onwards the species was observed daily and on 9 September 13 birds (16%) were caught and ringed.

Like all Warbler species, Garden Warblers were well fattened. In August 47% of birds had large fat reserves, in September 56%.

About 54% of Garden Warblers were caught during the morning hours, and the share of birds captured during the afternoon hours was also relatively high at 36%. Only 10% were caught in the evening.

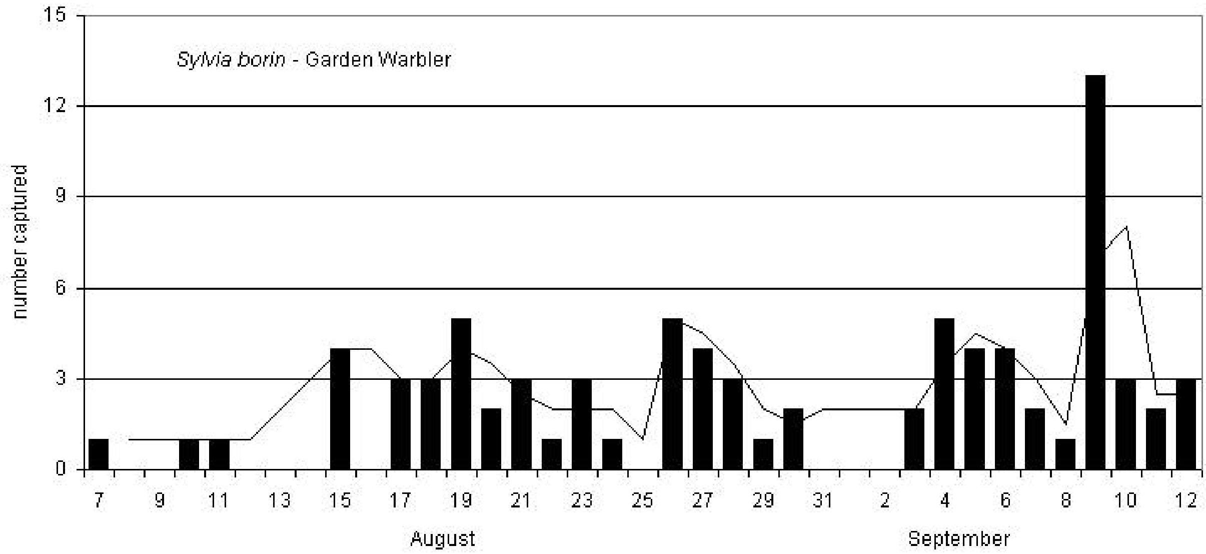

Fig 5.3g. Garden Warblers captured during the expedition.

From an analysis of their faeces and typical spots on the feathers near the beak it is evident that blackberries (*Rubus* sp., growing abundantly during the expedition period) were the dominant foodstuff for all species of Warblers, Blackcap and Whitethroats.

Thrush Nightingale

Migratory movements of this species begins in midsummer. During the expedition period 83 Nightingales were caught and we observed two waves of migration towards the end of the expedition. Over the period 7 to 12 August, the first migration wave, we caught 28 birds (34%). After that no birds were captured until the second migration wave. During those non-catpure dyas, air pressure was very low, which also appeared to affect capture rates of other species.

The second wave of migration was observed from 15 to 28 August, when 47 birds (57%) were caught. After this period only single individuals of Nightingale were captured at irregular intervals.

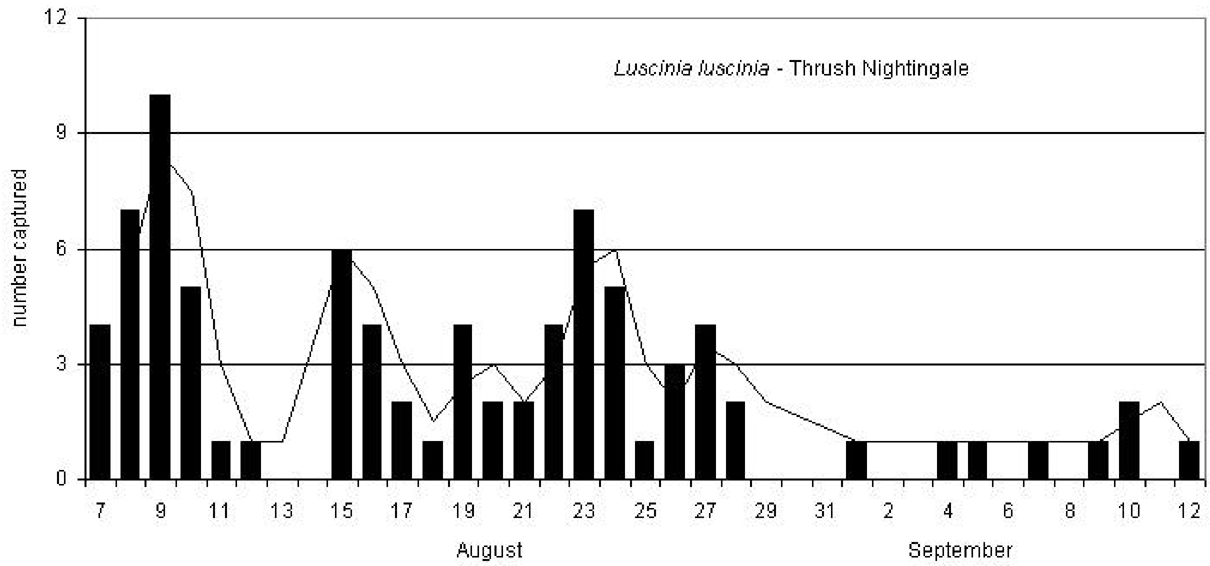

Fig 5.3h. Thrush Nightingales captured during the expedition.

About 80% of Nightingales had sufficient fat reserves and were ready to fly for long distances. From our observations it appears that Nightingales migrate during the night and feed during the day. This behaviour affected the dynamics of diurnal capture frequency. Thus during the first two hours of our capture routine (from dawn until 7.00) 50 Nightingales were caught in the nets. It appears they were present in the vegetation near the nets, because they were resting there after their night flight.

Wood Warbler

Wood Warbler migration took place during the whole of August until the middle of September. Movements of birds were observed frequently. Maximum capture numbers were registered on 10, 20, 27 and 31 August and 5 September.

The principal direction of migration was Southeast. Out of 116 captured birds, 111 (95.7%) were juveniles. Most birds (94 individuals) had practically no fat reserves.

Active feeding behaviour of Wood Warblers was observed throughout the study period. Capture frequency was relatively equal in the morning (53 individuals) and during the rest of the day (43 individuals) until evenving, but decreased in the evening (22 individuals).

Willow Warbler

This bird was captured between 8 August and the middle of September. Only single individuals were caught. The first migratory wave was recorded over the period 18 to 25 August. What appeared to be a mass migration (see below) occurred between 2 and 5 September (on 4 September the highest number of Willow Warbler were caught), when birds were moving through thickets of *Elaeagnus argentea*. Activity of migration during the day and its direction were similar to the previous bird species. During the first migratory wave the share of birds with sufficient fatness for long flight was 16%, in the second wave this share increased to 28%.

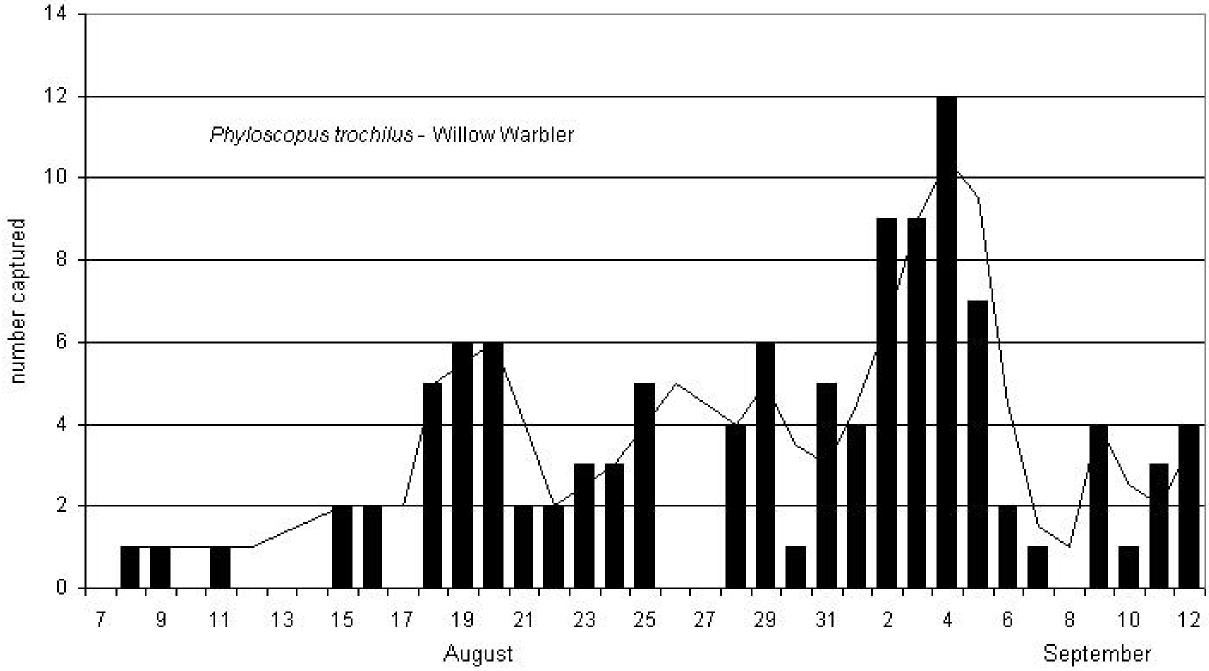

Fig 5.3i. Willow Warblers captured during the expedition.

5.4. Conclusions

During August to September 2002 mass migrants of Passerines were Sand Martin, Red-breasted Flycatcher, Spotted Flycatcher, Red-backed Shrike, Wood Warbler and Willow Warbler. Their number increased to at least 100 captured individuals. Their total number is 65% out of all birds ringed during the expedition period. It proves that the territory of the Kinburnska Kosa Landscape Park is a very important area for migrations of the above mentioned species and for their stopovers to replenish with energy. The area around the Kinburn spit, where the expedition bird camp was situated and studies were conducted, should be protected from human impact to allow the birds to rest and feed before crossing the Black Sea.

6. Bird List

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The bird list below was compiled with the help of expedition team members and includes records of birds encountered during the whole of the expedition and in all habitats surveyed for birds and wolves across the peninsula.

Table 6a. Bird species encountered by the expedition team. “A” stands for “abundant”, “NSC” for “no specific count”. Where possible habitat where birds were encountered is given, as well as a relative abundance “common” or “few” and/or a specific count.

	Inland Lake/Salt Marsh	Open Steppe/Scrub	Estuary	Plantation	Alder Grove	Seashore	Pine forest	On migration or in flight	Common	Few	Number seen
Gavia arctica Black-throated Diver/Loon						✓		✓		✓	1
Gavia stellata Red-throated Diver/Loon						✓		✓		✓	1
Gavia immer Great Northern Diver/Loon						✓		✓		✓	1
Tachybaptus ruficollis Little Grebe						✓		✓		✓	3
Podiceps cristatus Great Crested Grebe	✓		✓			✓			✓		1000
Podiceps grisegena Red Necked Grebe						✓			✓		300
Podiceps nigricollis Black Necked Grebe	✓					✓			✓		1500
Pelecanus onocrotalus White Pelican	✓		✓			✓		✓	✓		500
Phalacrocorax carbo (Great) Cormorant	✓		✓			✓		✓	✓		12000
Egretta garzetta Little Egret	✓		✓			✓			✓		40
Egretta alba Great (white) Egret	✓		✓			✓		✓	✓		30
Ardea cinerea Grey Heron	✓		✓			✓		✓	✓		25
Ardea purpurea Purple Heron	✓							✓		✓	17
Ciconia ciconia White Stork								✓		✓	47
Plegadis falcinellus Glossy Ibis	✓							✓		✓	11
Cygnus olor Mute Swan	✓		✓					✓	✓		570
Anser anser Greylag Goose	✓		✓							✓	32
Tadorna tadorna Shelduck	✓		✓							✓	22

	Inland Lake/Salt Marsh	Open Steppe/Scrub	Estuary	Plantation	Alder Grove	Seashore	Pine forest	On migration or in flight	Common	Few	Number seen
Aythya fuligula Tufted Duck						✓		✓		✓	
Anas platyrhynchos Mallard	✓		✓			✓		✓	✓		1400
Anas acuta Pintail	✓							✓		✓	8
Anas clypeata (Northern) Shoveler	✓							✓		✓	
Anas penelope Wigeon	✓							✓		✓	3
Anas crecca (Common)Teal	✓							✓		✓	
Anas querquedula *Garganey*	✓		✓					✓	✓		50
Aythya ferina Pochard	✓							✓	✓		
Somateria mollissima (Common) Eider						✓			✓		7000
Bucephala clangula Goldeneye	✓									✓	1
Mergus merganser Goosander	✓					✓		✓		✓	1
Haliaeetus albicilla White-tailed Eagle							✓			✓	1
Pandion haliaetus Osprey						✓		✓		✓	2
Hiereaatus pennatus Booted Eagle		✓		✓			✓	✓		✓	1
Milvus migrans Black Kite		✓		✓				✓		✓	1
Circus aeruginosus Marsh Harrier		✓						✓	✓		10
Circus cyaneus Hen Harrier		✓						✓		✓	2
Circus pygargus Montagu's Harrier		✓						✓		✓	2
Circus macrourus Pallid Harrier		✓						✓		✓	3
Buteo rufinus Long-legged Buzzard		✓		✓				✓		✓	1
Buteo buteo (vulpinus) Common Buzzard		✓		✓	✓			✓		✓	8
Pernis apivorus Honey Buzzard		✓		✓	✓			✓		✓	13
Accipiter nisus (Eurasian) Sparrowhawk		✓		✓	✓					✓	22
Accipiter gentilis Goshawk		✓		✓	✓					✓	1

	Inland Lake/Salt Marsh	Open Steppe/Scrub	Estuary	Plantation	Alder Grove	Seashore	Pine forest	On migration or in flight	Common	Few	Number seen
Falco tinnunculus (Common) Kestrel		✓		✓	✓			✓	✓		8
Falco vespertinus Red-footed Falcon		✓		✓	✓			✓	✓		3
Falco subbuteo (Eurasian) Hobby		✓		✓				✓		✓	6
Falco peregrinus Peregrine		✓		✓				✓		✓	1
Perdix perdix Grey Partridge		✓							✓		10
Coturnix coturnix (Common) Quail		✓							✓		20
Phasianus colchicus (Common) Pheasant		✓							✓		14
Porzana porzana Spotted Crake	✓								✓		NSC
Fulica atra Coot	✓		✓						✓		900
Haematopus ostralegus (Eurasian) Oystercatcher	✓		✓			✓			✓		10
Recurvirostra avocetta (Pied) Avocet	✓		✓			✓			✓		10
Himantopus himantopus Black-winged Stilt	✓		✓						✓		5
Charadrius dubius Little Ringed Plover	✓		✓			✓		✓		✓	2
Charadrius hiaticula Ringed Plover	✓		✓			✓		✓		✓	4
Charadrius alexandrinus Kentish Plover	✓		✓			✓			✓		10
Pluvialis squatarola Grey Plover	✓		✓					✓		✓	15
Pluvialis apricaria Golden Plover	✓		✓					✓		✓	1
Vanellus vanellus (Northern) Lapwing	✓		✓						✓		20
Calidris alba Sanderling	✓		✓			✓				✓	5
Arenaria interpres Turnstone	✓		✓			✓		✓		✓	25
Calidris alpina Dunlin	✓		✓			✓		✓		✓	150
Calidris ferruginea Curlew Sandpiper	✓		✓			✓		✓		✓	30
Limicola falcinellus Broad billed Sandpiper	✓		✓					✓		✓	2
Calidris minuta Little Stint	✓		✓			✓		✓		✓	10

	Inland Lake/Salt Marsh	Open Steppe/Scrub	Estuary	Plantation	Alder Grove	Seashore	Pine forest	On migration or in flight	Common	Few	Number seen
Tringa glareola Wood Sandpiper	✓		✓					✓		✓	5
Tringa ochropus Green Sandpiper	✓		✓					✓		✓	5
Tringa totanus Redshank	✓	✓	✓			✓			✓		25
Actitus hypoleucos (Common) Greenshank						✓		✓		✓	1
Limosa limosa Black-tailed Godwit	✓		✓			✓		✓		✓	6
Numenius arquata (Eurasian) Curlew	✓	✓	✓			✓		✓		✓	15
Numenius phaeopus Whimbrel	✓	✓	✓			✓		✓		✓	3
Gallinago gallinago Great Snipe	✓							✓		✓	2
Phalaropus lobatus Red-necked Phalarope	✓		✓					✓		✓	15
Philomachus pugnax Ruff	✓	✓	✓			✓		✓	✓		50
Stercorarius parasiticus Parasitic/Arctic Skua						✓		✓		✓	1
Larus ridibundus Black headed Gull	✓	✓	✓			✓			✓		700
Larus cachinnans Yellow-legged Gull	✓	✓	✓			✓			✓		100
Larus genei Slender-billed Gull	✓		✓			✓		✓	✓		100
Larus melanocephalus Meditteranean Gull	✓		✓			✓				✓	30
Larus ichthyaetus Pallas's/Great black headed Gull	✓		✓			✓				✓	2
Larus minutes Little Gull	✓		✓			✓				✓	50
Sterna albifrons Little Tern	✓		✓			✓				✓	150
Sterna sandvicensis Sandwich Tern	✓		✓			✓		✓		✓	300
Sterna nilotica Gull-billed Tern	✓		✓			✓		✓		✓	20
Sterna hirundo Common Tern	✓		✓			✓		✓	✓		1500
Sterna caspia Caspian Tern	✓		✓			✓				✓	20
Streptopelia decaocto (Eurasian) Collared Dove		✓		✓	✓				✓		10
Streptopelia turtur (European) Turtle Dove		✓		✓	✓					✓	2

	Inland Lake/Salt Marsh	Open Steppe/Scrub	Estuary	Plantation	Alder Grove	Seashore	Pine forest	On migration or in flight	Common	Few	Number seen
Cuculus canorus (Common) Cuckoo	✓	✓	✓	✓	✓				✓		5
Asio otus Long-eared Owl					✓		✓			✓	1
Athene noctua Little Owl		✓		✓	✓				✓		2
Otus scops (Eurasian) Scops Owl							✓			✓	3
Caprimulgus europaeus (European) Nightjar							✓	✓	✓		5
Apus apus Swift	✓	✓	✓					✓	✓		100
Upupa epops (Eurasian) Hoopoe		✓							✓		5
Alcedo atthis (Common) Kingfisher	✓		✓			✓		✓	✓		5
Merops apiaster (European) Bee-Eater		✓						✓	✓		600
Coracias garrulus Roller		✓								✓	2
Dendrocopos major Great-spotted Woodpecker				✓	✓		✓			✓	2
Dendrocopos syriacus Syrian Woodpecker		✓		✓	✓		✓		✓		4
Jynx torquilla Wryneck							✓	✓		✓	NSC
Alauda arvensis Skylark		✓							✓		50
Galerida cristata Crested Lark		✓							✓		10
Lullula arborea Woodlark				✓	✓		✓	✓		✓	NSC
Melanocorypha calandra Calandra Lark		✓							✓		10
Riparia riparia Sand Martin	✓	✓				✓		✓	✓		50
Hirundo rustica Barn Swallow	✓	✓				✓		✓	✓		6000
Anthus campestris Tawny Pipit		✓		✓	✓		✓	✓		✓	NSC
Anthus pratensis Meadow Pipit		✓		✓	✓		✓	✓		✓	NSC
Anthus trivialis Tree Pipit		✓		✓	✓		✓	✓		✓	NSC
Motacilla alba White/Pied Wagtail		✓				✓		✓	✓		20
Motacilla flava Yellow Wagtail		✓				✓		✓	✓		50

	Inland Lake/Salt Marsh	Open Steppe/Scrub	Estuary	Plantation	Alder Grove	Seashore	Pine forest	On migration or in flight	Common	Few	Number seen
Erithacus rubecula Robin				✓	✓		✓			✓	2
Luscinia luscinia Thrush Nightingale		✓		✓	✓		✓	✓	✓		10
Luscinia megarhynchos Common Nightingale		✓								✓	1
Phoenicurus phoenicurus (Common) Redstart		✓		✓	✓		✓			✓	5
Phoenicurus ochruros Black Redstart		✓		✓	✓		✓			✓	5
Oenanthe oenanthe (Northern) Wheatear		✓				✓			✓		30
Oenanthe isaballina Isabelline Wheatear		✓								✓	5
Saxicola rubetra Whinchat		✓						✓	✓		10
Saxicola torquata Stonechat		✓						✓	✓		5
Turdus merula (Common) Blackbird		✓		✓	✓		✓	✓		✓	NSC
Sylvia borin Garden Warbler		✓		✓	✓		✓	✓	✓		2
Sylvia nisoria Barred Warbler				✓	✓		✓	✓		✓	2
Sylvia atricapilla Blackcap		✓		✓	✓		✓	✓	✓		10
Sylvia curruca Lesser Whitethroat		✓		✓	✓		✓	✓		✓	5
Sylvia communis (Common) Whitethroat		✓		✓	✓		✓	✓	✓		10
Acrocephalus schoenobaenus Sedge Warbler	✓		✓					✓		✓	NSC
Locustella fluviatilis River Warbler	✓		✓					✓		✓	NSC
Acrocephalus scirpaceus (European) Reed Warbler	✓		✓					✓		✓	NSC
Acrocephalus palustris Marsh Warbler	✓		✓					✓		✓	NSC
Acrocephalus arundinaceus Great Reed Warbler	✓		✓					✓	✓		NSC
Hippolais icterina Icterine Warbler		✓		✓	✓			✓		✓	10
Hippolais pallida Olivaceous Warbler		✓		✓				✓		✓	1
Phylloscopus trochilus Willow Warbler		✓		✓	✓		✓	✓	✓		50
Phylloscopus sibilatrix Wood Warbler		✓		✓	✓		✓	✓		✓	NSC

	Inland Lake/Salt Marsh	Open Steppe/Scrub	Estuary	Plantation	Alder Grove	Seashore	Pine forest	On migration or in flight	Common	Few	Number seen
Phylloscopus collybita ChiffChaff		✓		✓	✓		✓	✓		✓	NSC
Muscicapa striata Spotted Flycatcher		✓		✓	✓		✓	✓	✓		50
Ficedula hypoleuca Pied Flycatcher		✓		✓	✓		✓	✓		✓	10
Ficedula albicollis Collared Flycatcher		✓		✓	✓		✓	✓		✓	10
Ficedula parva Red breasted Flycatcher		✓		✓	✓		✓	✓	✓		50
Certhia familiaris Treecreeper							✓	✓		✓	2
Parus major Great Tit		✓		✓	✓		✓		✓		10
Parus caeruleus Blue Tit		✓		✓	✓		✓		✓		NSC
Lanius minor Lesser grey Shrike		✓		✓	✓			✓	✓		25
Lanius collurio Red backed Shrike		✓		✓	✓			✓	✓		30
Pica pica (Common) Magpie		✓		✓	✓		✓		✓		10
Garrulus glandarius (Eurasian) Jay					✓		✓			✓	3
Corvus corone corvix Hooded Crow		✓		✓	✓		✓		✓		NSC
Corvus corax (Common) Raven		✓		✓	✓		✓			✓	5
Sturnus vulgaris (Common) Starling		✓		✓	✓		✓		✓		100
Oriolus oriolus (Eurasian) Golden Oriole		✓		✓	✓		✓			✓	5
Passer domesticus House Sparrow		✓		✓	✓				✓		NSC
Passer montanus Tree Sparrow		✓		✓	✓		✓		✓		30
Fringilla coelebs (Common) Chaffinch		✓		✓	✓		✓	✓		✓	NSC
Acanthis cannabina Linnet		✓		✓	✓				✓		10
Carduelis carduelis (European) Goldfinch		✓		✓	✓		✓		✓		10
Carduelis chloris Greenfinch		✓		✓	✓		✓			✓	NSC
Coccothraustes coccothraustes Hawfinch		✓		✓	✓		✓			✓	10

Total 161 species.

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