O.M.P.O

Migratory Birds of the Western Palearctic

SNIPES
OF THE EASTERN BALTIC REGION AND BELARUS

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SNIPES *GALLINAGO GALLINAGO, GALLINAGO MEDIA, LYMNOCRYPTES MINIMUS* IN BELARUS

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INTRODUCTION

The territory of Belarus is characterized by high diversity of rich wetland resources, which are the main Snipes habitats. About 1,706,000 hectares of mires and 169,700 hectares of floodplain meadows are still under near natural conditions despite of large-scale drainage activities undertaken in Belarus during the 1960s – 1970s (Yatsuhna *et al*. 1998). However, only 317,200 hectares are included in the network of Belarus protected areas. Rapid changes in structure of vegetation cover in Belarus have negative effect upon populations of Snipes. Very limited data on population numbers, distribution and breeding ecology of Snipes in Belarus were obtained till now.

Only few irregular studies of the Common Snipe and Great Snipe in frameworks of more general investigations were carried out in limited number of localities in Belarus (Duchits 1972; Bishnev 1989). First population estimates (Tucker & Heath 1994; Hagemeijer & Blair 1997) were not very accurate. New estimates were obtained after completion the project "Breeding waders of Europe" (Nikiforov *et al*. 1997; Nikiforov & Mongin 1998). However, these estimates were made on the basis of few data on breeding densities and habitat distribution (Mongin 2000). Previous data on distribution of Common Snipe and Great Snipe were extremely limited and published only for some territories in Atlas of Berezinsky State Reserve (Bishnev 1996). All accessible data on the Jack Snipe were published in Red Data Book of the Republic of Belarus (1993).

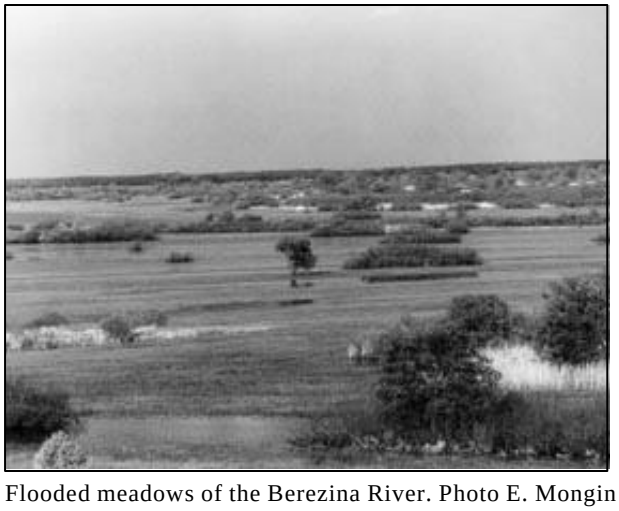
There were no special ringing schemes for Snipes in Belarus, as well as no analysis of ring recoveries for birds recovered here. The ringing of Snipes has started only in 1999 in framework of International Project Wader Wetland Inlands (WWI) targeted on study of inland migration routes and coordinated by J.J. Seeger.

The first special project to focus attention on these species was performed in Belarus in 2000–2001. It was a joint project of several Belarusian organizations and OMPO (Migratory Birds of Western Palearctic). This project was carried out in the framework of OMPO International Program "Snipes". The main goals of the project were the following:

- to estimate the size and distribution of the Belarusian breeding population of snipes;
- to designate key sites especially important for breeding populations of Great Snipe and Common Snipe in Belarus;
- to evaluate the breeding density and productivity of both species in different types of habitats;
- to define the current status of Jack Snipe;
- to start the intensive ringing program of breeding and migratory snipes in certain key habitats;
- to develop the guidelines for management and conservation plans for the Great Snipe and Common Snipe in Belarus;

It is expected that successful implementation of this program will help to develop the National Action Plan to protect Great Snipe population and to improve habitat management measures in key sites for this species.

It is also supposed that new data will be used for preparation of new edition of Belarus Red Data Book (the Great Snipe was included in preliminary list of species under threat of extinction in national level on the basis of new population estimates and trends).



Flooded meadows of the Berezina River. Photo E. Mongin

Fen of Dikoe. Vegetation communities. Photo E. Mongin

Former melioration areas in the Chernobyl disaster zone are habitats of Common Snipes and other animals. Photo E. Mongin

Habitats of snipes in the Pripyatski National Park. Photo E. Mongin

METHODS

Survey areas, and studies on habitat selection

Studies on snipes were carried out during 2000–2001. Intensive field works were performed in majority of administrative districts of Belarus (Fig. 1). The numbers, distribution and densities of snipes were investigated in more than 100 selected wetlands of different vegetation types. The size of wetlands ranged from 100 to 19,000 ha. The total area of surveyed wetlands was more than 70,000 ha. The largest tracts of fen mires with vast open areas covered in the frameworks of this project were located in southern part of Belarus. The largest studied tracts of open raised bogs as well as mire complexes predominated by this type of mires were situated mainly in central and northern regions of the country. Moreover, numerous vast floodplain meadows and different types of small wetlands located in valleys of rivers and lakes, the willow and birch swamps, drained wetlands, clearings in wet forests and former peat excavation areas were also studied.

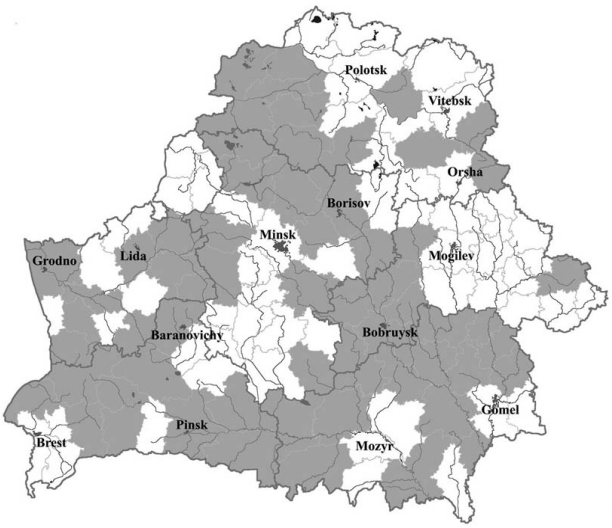


Figure 1. Administrative districts of Belarus covered by surveys during 2000-2001 (dark colour)

Detailed investigations on snipe abundance and habitat variables were carried out in certain selected sites with the total area about 5,000 ha.

Data on feeding habitat selection of Great Snipe were collected between 15 May and 10 June 2001 on the Dikoe fen and floodplain meadows of the Pripyat River.

Census methods and studies on breeding ecology

To define the breeding density of Common Snipe the counting of drumming males was carried out in the same territories in three periods: 1st period – 15–30 April, 2nd period – 10–25 May, 3rd period – 5–20 June. The counts were conducted along transects in selected territories of different habitats. Method of territory mapping was also used to determine density in habitats with small numbers of birds.

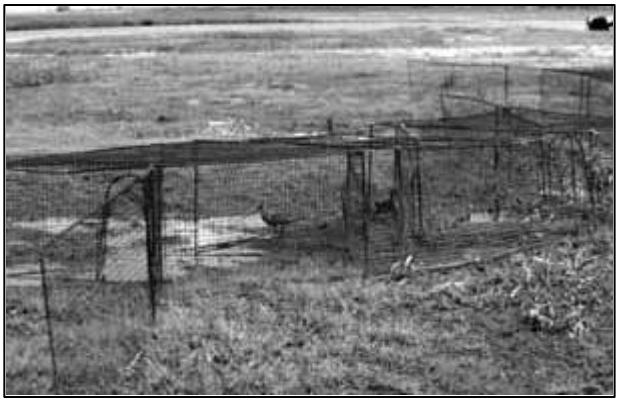
The Great Snipe was counted at the lekking arenas in late evening. The flushing birds were counted as well to estimate overall numbers of birds. A combined search methods have been used to find lekking arenas (Kålås 2000; Kuresoo & Luigujõe 2000). The breeding birds were caught by mist-nets at the lekking arenas.

The search of the Jack Snipe breeding sites was carried out simultaneously with surveys of the Common Snipe breeding habitats.

Nest searching of Common Snipes and Great Snipes was performed by means of the rope-dragging method. The breeding adult snipes were caught using mist-nets and nest-traps. The stage of incubation was determined using water test system elaborated primarily for snipes (Onno 1974).

To analyse the timing of breeding the 'main laying period' (MLP) concept was used (Väisänen 1977). According to this author, the MLP of a population is the shortest period in which about 80% of the clutches are started. This period was determined from a histogram with class intervals of five days.

Floodplain meadows of the Schara River. Searching of snipe nests by means of the rope-dragging method. Photo E. Mongin



Walk-in trap used for catching of snipes during autumn migration (Turov). Photo E. Mongin

Study of migration and measurements, sex determination

Detailed study of snipe migration was carried out in the same plot with area about 1.2 km^2 in the Pripyat River floodplain meadows during three years (vicinities of Turov, 52°05'N, 27°45'E). During autumn migration the counts of snipes were carried out at permanent routes. Migratory birds were caught in walk-in traps located in favourable food habitats.

All captured snipes were measured, weighted and aged. External criteria (Devort *et al*. 1986) were used to determine the sex in the Common Snipe. Moreover, juveniles were sexed by the method developed by Yurlov (1992) based on discriminate analysis of different morphological variables:

D = 0.207xLB + 0.595xLTS – 0.366xLT – 13.098

If D < 0 – male, if D > 0 – female.

LB – length of bill (to feathering), LTS – length of tarsus, LT – length of tail.

To determine the sex of Great Snipes methods suggested by J.A. Kålås at the OMPO Meeting on Snipes (Vilnius 2000) were used. The males have less size of head (total head length < 99 mm, female > 99 mm, overlap in the range 98-99 mm) and body mass (during breeding period males are seldom > 160 g). Besides their tips of wing feathers are very worn out and broken during the period of lekking activity.

RESULTS

Common Snipe *Gallinago gallinago*

Breeding densities in various habitats and habitat use

The results of field surveys in 2000–2001 have revealed a wide variety of Common Snipe habitats in Belarus. The Common Snipe is one of the most pliant breeding species of waders in Belarus using different types of habitats (Mongin *et al*. 1999).

Breeding densities of the Common Snipe strongly varied in different habitats as well as in the course of breeding period (Table 1). Large scale investigations were carried out in the following habitat types: floodplain meadows of rivers and lakes, large mire complexes, open areas of fens and raised bogs, transitional type of mires, open areas of wet forests, spent peatlands and wet forest clearcuts.

Mire vegetation occupies 17.1% of the total vegetation cover of Belarus (Golod 1994). Fen mires are the most widespread (61.1% of total mire area). The share of transitional type of mires is 20.7% and raised bogs occupy 18.2% of total mire area.

The highest densities of snipes were recorded at the beginning of breeding season (2–3 decades of April), when plenty of migratory birds were counted together with breed-

Fen of Dikoe (May). The highest densities of breeding Common Snipes were recorded here. Photo E. Mongin

Female of Common Snipe at the nest. Photo E. Mongin

Table 1. Breeding densities of Common Snipe in main types of habitats

Habitat types	Mean breeding density (pairs/100 ha)	Range of breeding density (pairs/100 ha)
Open bogs (oligotrophic)	0.07	0.08–0.1
Open transitional mires (mesotrophic)	18.3	2.6–37.6
Open fens (eutrophic)	21.0	2.5–47.1
Flood-plain meadows	5.3	1.5–11.9

ing birds. High densities of Common Snipes were recorded in majority of habitat types during this period. The maximum densities were recorded in open fens (70-150 males/ 100 ha). These habitats had favourable hydrological conditions. The birds were not recorded in inundated floodplain meadows located in large river valleys. Only single birds were registered in open raised bogs. Later on snipe densities decreased 2-5 times in all habitats (with the exception of valleys of big rivers). The birds appeared in temporary inundated floodplain meadows only during second half or the end of May, when flood water disappeared.

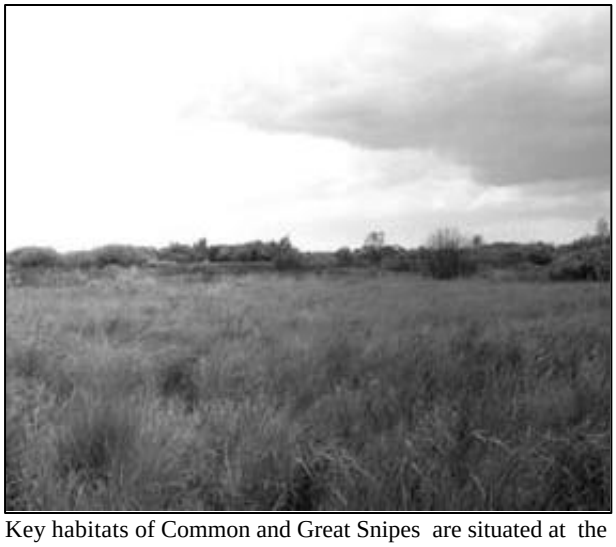
Open fen mires are mainly located in southern part of Belarus. Fen mires Zvanets (19,000 ha), Dikoe (8,100 ha) and Sporovo (2,400 ha) were among the largest studied mire tracts. The highest Common Snipe densities (up to 30–40 pairs/100 ha) were recorded in these fen mires. In one case the breeding density was up to 47.1 pairs/100 ha (fen mire in the floodplain of Lake Servech). Such densities were typical for open fen mire areas with sedge-hypnum communities and mire forbs. Common Snipe avoided large tracts of *Phragmites australis*, especially common for many sites within Zvanets fen mire.

When hydrological conditions were stable in these wetlands, the numbers of Common Snipe were stable as well. Very hot weather in May and June 2000–2001 had negative impact on the hydrological conditions of the majority of these wetlands. Level of water in ecosystems of some fens decreased by 25–30 cm. The densities of breeding Common Snipes in mire V'yunovka (part of Dikoe fen mire tract) decreased from 30 birds/100 ha in mid-May to 2.5 birds/100 ha in mid-June 2000. Snipe densities on the Dikoe and Sporovo fens decreased from 32–20 pairs/100 ha to 16.7–4 pairs/100 ha within a breeding period 2001.

During May – June rather high snipe densities were registered in different types of open mesotrophic fens. Up to 36–38 pairs/100 ha were recorded on the transitional mires of Chistic (100 ha, Berezinsky Reserve). Mosaic habitats are characteristic feature of this type of mires. Up to 33.3–36.8 breeding pairs per 100 ha were recorded in several sites of mosaic transitional mires in Pripyat National Park, although average and low densities of snipes were recorded on floodplain meadows.

The breeding densities ranged from medium to low in dependence of hydrological conditions and vegetation type in floodplain meadows. Many floodplains in valleys of big rivers were flooded until the middle of May. Snipes appeared on these territories later than in other habitats. Up to 3–6 pairs/100 ha bred on the *oxylomesophytica* and *mesohygrophytica* floodplain meadows (Soz, Dnieper, Berezina, Gayna Rivers). These meadows are overgrown by *Caricetum* and *Juncus* communities. Low density of breeding Common Snipes was recorded in floodplain meadows of the Pripyat River and in some sites along the Dnieper River where grass communities were predominant (1.5–3.7 pairs/100 ha). Up to 8–12 pairs/100 ha were recorded in the *oxylomesophytica-turfosa* (peaty meadows) meadows in floodplains of the Berezina and Dvinosa Rivers – the highest breeding densities that were registered among meadows habitats. Such type of meadows develops under conditions of rich and low flowing moistening. We observed that snipes disappeared from meadows, which were overgrown by high grass, or meadows with dry soil in the late May – early June.

The least breeding densities of snipes (0.08–0.1 pair/ 100 ha) were recorded on the vast mire complexes where raised bogs dominated. Wet bog moss pine forest and open *Eriophorum-Sphagnum* communities are characteristic of these wetlands. Large mire complexes are distinguished



Key habitats of Common and Great Snipes are situated at the Sporovo fen. Photo E. Mongin

Common Snipe juveniles during autumn migration. Photo E. Mongin

by diverse habitats including fens and mesotrophic mires. Snipes occupy such habitats, which occur at the edges of raised bogs. Only five pairs of the Common Snipe were recorded on the Duleby bog (the total area – about 5,000 ha). Snipes were absent on the Roznyanskoe bog (500 ha). Several birds were met on the Postrezie mire complex (the total area - about 3,000ha). Only 1-2 pairs/100 ha were recorded in the *Ledum-Cariceta-Pinetum-Betuletum* communities.

The Common Snipe avoids drained wetlands. Here we observed only single birds that were met in some wet patches. Later, when such wet patches became drier after dropping the water level, they disappeared. The snipes avoided overgrown with shrubs and reeds wetlands or swamps with close trees.

Breeding Common Snipes were recorded also in flooded former peat-extraction areas. Vegetation cover in these sites resembled transitional mires. Rather high breeding densities (up to 8—11 pairs/100 ha) were recorded in such type of habitats in comparison with other transformed habitats. Some cleared spaces of wet forests supported rather high numbers of breeding birds as well (14.3 pairs/100 ha).

According to the results of field works in 2000–2001, mean breeding density in habitats used by the Common Snipe was 15.5 pairs/100 ha. This density is somewhat higher than in Lithuanian population (Svazas *et al*. 2001). Probably, it is connected with presence of large mire tracts and floodplain meadows under natural or close to natural conditions in Belarus.

It is necessary to note the possibility of coexistence of two sub-populations of the Common Snipe inhabiting different groups of habitats in Belarus, like it was described by Svazas *et al*. (2001) for Lithuanian Common Snipes. This hypothesis should explain extremely protracted breeding period and significant changes of breeding densities in different types of habitats. According to Svazas *et al*. (2001), the birds from the first group nest only before the beginning of June in areas with unstable hydrological conditions or overgrowing with tall grass, and the birds from the second group occupy habitats with stable conditions and short grass during total breeding period and laying eggs during all breeding period, even in the beginning of July. The existence of different breeding sub-populations of Common Snipe inhabiting various types of habitats was defined by the means of genetic analysis (Paulauskas & Svazas 2002).

Snipes in Belarus bred early (2–3 decades of April) in habitats that were not exposed to considerable flooding (fens and transitional mires). Later they eluded such places if ones were overgrown by high grasses or became too dry. Nests were not found in typical fens in the end of May although birds were flushed (probably feeding birds and females with chickens). However, snipes were found in the fens that did not dry up in the middle of June. Latest terms of Common Snipes breeding were observed in floodplain meadows. Here the first birds were only recorded in the third decade of May, and the fresh clutches were discovered before the end of June.

Morphometric parameters of breeding Common Snipes

Biometric parameters of captured birds are shown in Table 2. Statistically significant differences between males and females were revealed in some measurements using *t*-test. Bill ($t = 5.6$, $p < 0.001$) and head ($t=5.4$, $p<0.001$) sizes were significantly larger in females in comparison with males. The length of tail ($t = 3.4$, $p<0.001$) and outer tail feather ($t = 3.7$, $p < 0.001$) was larger in males. Rouxel (2000) mentioned that it is possible to determine the sex in 80% of birds using this parameter. Mean measurements of captured females were close to the parameters of breeding females in Lithuania (Svazas *et al*. 2001).

Breeding phenology and success, egg measurements of Common Snipe

In addition to data collected in the course of this project, the materials from Database of the Ornithological Laboratory of the Institute of Zoology, Belarus National Academy of Sciences, were used for the analysis.

16 April was the earliest exactly fixed date of first egg laying. The Common Snipe is one of the earliest breeders among waders. Even earlier date of egg laying (11 April) was recorded for Common Snipe in Estonia (Onno 1974). MLP for the Common Snipe in Belarus was somewhat longer, than it was shown by Väisänen (1977) for other populations with more northern breeding grounds (Fig. 2). The egg laying period was rather extended, from April till June. It is typical of early breeding species with replacement clutches (Onno 1974).

The presence of several sharp peaks of egg laying during April was somewhat unusual. Probably, the first peak in early April was connected with the selectivity in nest finding: the nests were found more easily when the grass

Table 2. Morphometric parameters of adult Common Snipes caught during the breeding season in 2000–2001

	Mean		Min		Max		SD		Skewness		N	
	f	m	f	m	f	m	f	m	f	m	f	m
Wing, mm	137.4	137.2	132.0	136.0	143.0	140.0	3.40	1.64	-0.04	1.32	39	9
Tail, mm	62.4	67.7	52.0	60.5	71.0	71.0	4.30	3.40	-0.84	-1.26	39	9
Outer tail feather, mm	58.4	62.3	52.0	59.0	64.0	65.5	2.92	2.36	-0.13	-0.12	38	9
Tarsus, mm	33.8	33.2	32.3	32.1	36.5	34.7	1.15	0.99	0.73	0.63	39	9
Bill N, mm	64.5	60.0	60.1	57.5	68.6	65.1	2.10	2.45	0.35	0.95	39	9
Bill F, mm	70.0	65.2	66.7	62.7	74.5	68.9	2.40	2.17	0.68	0.19	39	9
Head, mm	101.0	95.7	96.5	93.0	105.5	103.0	2.49	3.09	0.29	1.78	39	9
Weight, g	111.3	108.0	94.6	105.0	124.1	112.5	7.70	3.50	-0.65	0.91	36	6

* Bill N - the bill length from the tip to the nostrils. Bill F - the bill length from the tip to the skull

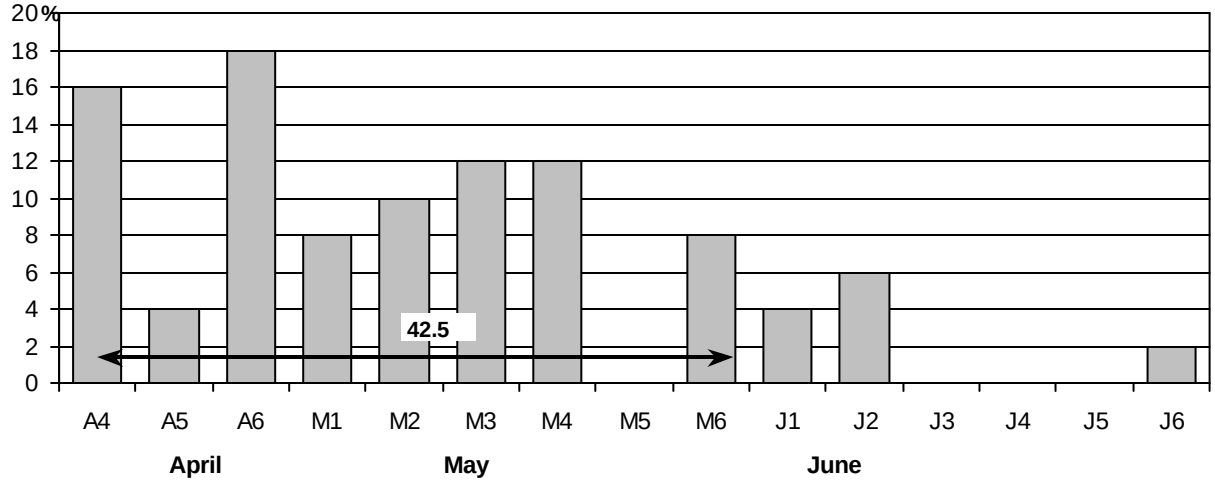


Figure 2. Breeding phenology (laying data of the first egg) and the main laying period (MLP) of Common Snipe in Belarus (n = 50). The black horizontal line on the histogram shows the length of MLP to the nearest half-class. Data grouped to five-day periods

was short. The peak in the end of April was formed by the clutches started in habitats with the most favourable hydrological conditions. Later, during the second half of May – the beginning of June, Common Snipe nested in the floodplain meadows. Thus, further peaks in mid-May and early June were, probably, formed by replacement clutches as well as clutches laid in sub-optimal habitat types. Different habitat use dependent on hydro-meteorological and some other habitat conditions was described for the Common Snipe also by Svazas *et al*. (2001).

The breeding success of the Common Snipe varied in different habitats covered by this study, but small number of records did not allow to analyse it. The destiny of 21 nests was watched. 38% of all nests failed. It is close to figures shown by other authors (Glutz von Blotzheim *et al*. 1977; Mason & Macdonald 1976; Green 1988; Svazas *et al*. 2001). The reasons were as follows: 37.5% of destroyed nests were crushed by livestock, 25% were destroyed by *Corvidae* (in some cases – Hooded Crow *Corvus corone cornix)* and 12.5% were failed due to the disturbance caused by human activities. The reasons of other failed nests are unknown.

Four eggs were found in majority of nests. Only one nest with three eggs was registered among 52 nests with completed clutch. In one case two Common Snipe nests were located 11 m one from another, though breeding density was not higher than 4 – 5 pairs/100 ha. Probably, it can be connected with shortage of places suitable for nesting during high flood water level.

Detailed egg measurements and calculated egg volume are show in Table 3. Mean egg measurements and volume were similar to those shown by Svazas *et al*. (2001)

Table 3. Measurements of Common Snipe eggs and the calculated egg volume.

	Mean	Min	Max	SD	Skewness	N
Length, mm	40.0	35.8	44.8	1.78	0.15	166
Width, mm	28.4	26.7	32.8	0.89	1.86	166
Volume, cm^3	14.09	11.85	20.93	1.33	1.95	166
Weight, g	16.0	14.0	17.7	1.03	-0.33	31

Chick of the Common Snipe. Photo E. Mongin

Clutch of the Common Snipe. Photo E. Mongin

for the birds breeding in Lithuania. Mean egg volume of Common Snipes breeding in Belarus was smaller, than in birds breeding in United Kingdom and along the coast of the Baltic Sea (Väisänen 1977). It confirms the opinion of this author that egg size increases from a continental to a maritime climate.

Population estimates and trends

The total Belarus breeding population of the Common Snipe in 2001 was estimated at about 80,000 pairs. Previous estimates were 70,000–90,000 breeding pairs (Nikiforov & Mongin 1998). Although contemporary estimate is very close to previous figures, now it is based on far better quality of data.

The accuracy of estimate (Table 4) was influenced by contradictory data on total areas of different habitat types extracted from different official sources. Mire vegetation typology (Golod 1994) and area estimates for mires under natural conditions as well as former peat-extraction areas made by Yatsukhno *et al*. (1998) were used in this study. The estimated numbers of Common Snipes breeding in floodplain meadows were calculated using areas of this habitat type shown by Stepanovich (1999).

We have no exact data on the Common Snipe population decrease in Belarus, although undoubtedly, somewhat decrease took place. It was connected with large-scale drainage programs carried out in Belarus since the 1950s. Significant population decrease or even total extinction of local birds was recorded in some wetlands located in vicinities of Belovezhskaya Pushcha after the drainage activities (Vladyshevsky 1966; Datskevich 1998). The studies carried out in drained fen mire Dziki Nikar near eastern border of Belovezhskaya Pushcha during 2000–2001 confirmed the absence of breeding Common Snipe in this area. Taking into consideration that the largest breeding densities were recorded in open fen mires, and during past 50 years the total area of fen mires was decreased not less than twice, it is possible to propose that total breeding population reduced 1.5 times. It is hardly likely that redistribution of breeding Common Snips took place, taking into consideration significant shortening of almost all wetlands used by this species. Only wet forest clear-cuts became new breeding habitat (before overgrowing). There is some decrease of breeding habitats for the Common Snipe due to the lack of cattle grazing and moving at present in Belarus, like in Lithuania (Svazas *et al*. 2001).

Study and ringing scheme of migratory Common Snipes

A detailed study of the Common Snipe migration was carried out in one permanent plot located in vicinities of Turov in the Pripyat River floodplain meadows. The study of wader migration has been started by author in this permanent plot since 1995. Intensive ringing of Common Snipe was conducted in 2000–2001 as part of the OMPO program.

The mean date of Common Snipe arrival in Southern Belarus (vicinities of Turov, the Pripyat River, 52°05'N, 27°45'E) was 25 March according to five-year study (1996–2000). The earliest record was 12 March 2000; the latest record was 6 April 1996. According to materials obtained from the Database of the Ornithological Laboratory of the Institute of Zoology, Belarus National Academy of Sciences, Common Snipes arrive later in more northern regions of Belarus.

According to the results of counts in 2000–2001, the number of Common Snipes recorded in April was 2–3 times higher than in May for majority of surveyed habitat types. Similar results were obtained in Lithuania (Svazas *et al*. 2001). Most probably, display activity of migrating males which breed in more northern and eastern grounds is the reason of this phenomenon.

The Autumn migration of Common Snipes was studied in detail in the same plot during three years (vicinities of Turov, 1999–2001), (Fig. 3). Hydrological conditions of the season affected general migration pattern in the floodplain meadows. The largest number of migrating Common Snipes was recorded in the floodplain meadows during the season with favourable hydrological conditions. Probably, the pattern of autumn migration in Common Snipe consists of several main waves of passage. The first wave is related to 2–3 decades of July and second – to mid-August. Moreover, a small wave probably takes place in 2–3 decades of September. It was confirmed also by Common Snipe surveys in ponds of the fish farm Selets during 2–3 decades of September, where autumn wader migration was studied in 1996–1998. 47.5–55 birds per 100 ha of drained ponds were recorded here during the 3rd decade of September.

Most probably, the peaks of passage in Common Snipe are formed by different terms of migration for juvenile and adult birds, as well as passage of birds from more northern and eastern breeding grounds. Age-ratio of birds captured in 2000 was calculated for each five-day period

Table 4. Mean breeding densities and estimated numbers of Common Snipe in different habitats

Habitat types	Mean breeding density (pairs/I 00 ha)	Area (1,000 ha)	Estimated numbers (pairs)
Open bogs	0.07	154.7	150
Open transitional mires	18.3	53.4–123.7	10,000-22,000
Open fens	21.0	220–275.2	46,000-58,000
Flood-plain meadows	5.3	169.7	9,000
Flooded peat-extraction areas	10.0	9.5	1,000
Wet forest clear-cut			2,000
Total	**15.5**		**68,000-92,000**

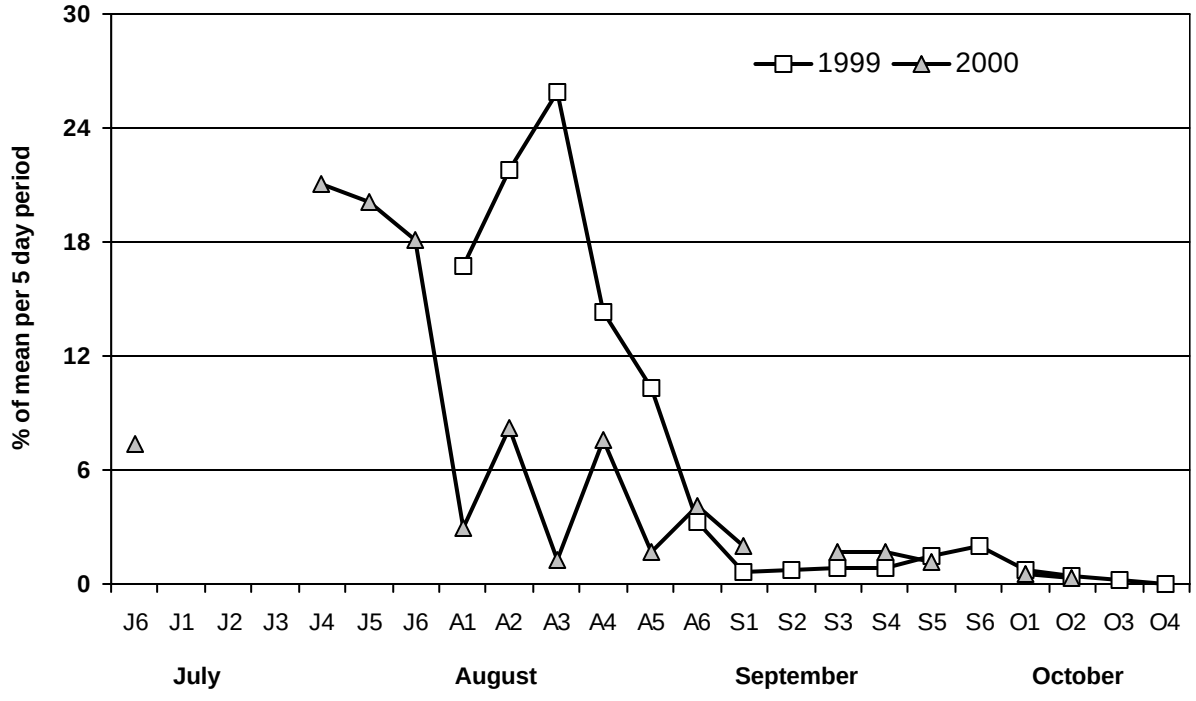


Figure 3. Passage dynamics of the Common Snipe in floodplain meadows of the Pripyat River during autumn migration. Data grouped to five-day periods

(Fig. 4). There were appreciable age-ratio fluctuations during the peaks and dips of passage. Probably, it is possible to explain peaks and dips in the age-ratio curve not only by arrival of one age category and departure of another one, but also by different speed of migration for adults and juveniles. It was noted by Devort (1997, 2000), that adult Common Snipes travel slower than younger birds. In France the adults gradually arrived in September and October, months in which age-ratio was less than two juvenile for each alder birds. At the same time this author found that 97% of birds crossing France in August were juveniles. Thus, it agrees with possibility that juveniles start migration movements in Belarus already in the end of June – beginning of July, During this period we observed significant increase of foraging Common Snipes.

Three juvenile and three adult birds were repeatedly captured in 2000. The body mass of repeatedly captured and weighted birds increased. In one case the body mass increase in adult bird was 7.5 g (7% of initial body mass) per six days, in other case the body mass of juvenile bird increased by 15.4 g (16%) per eight days.

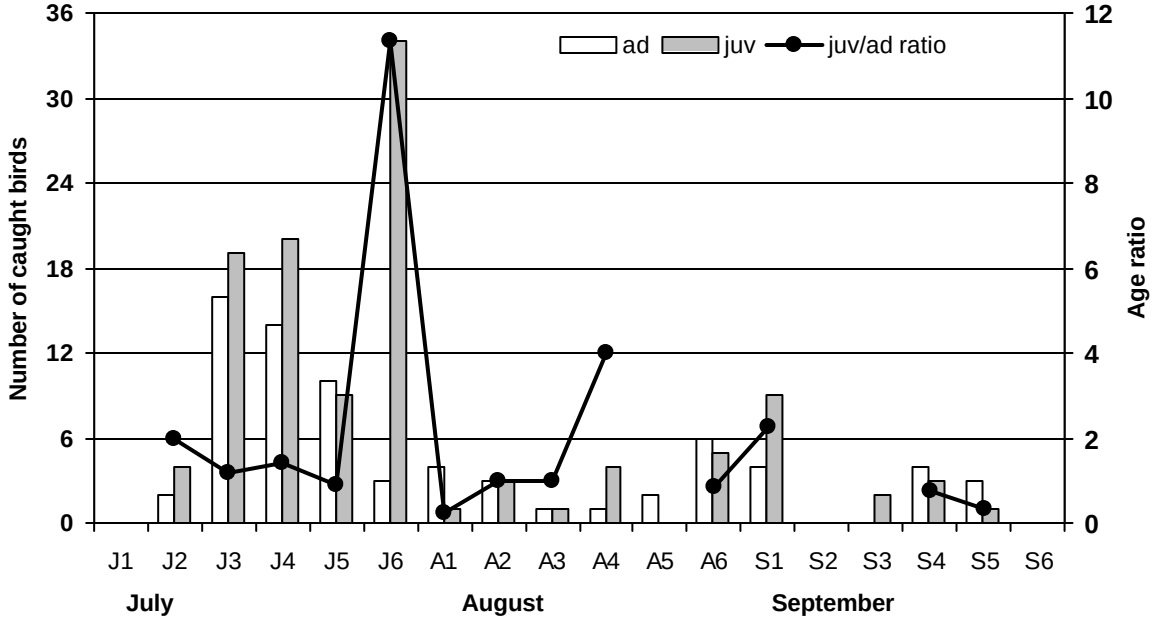


Figure 4. Age ratio and numbers of adult and juvenile Common Snipes caught during autumn migration in 2000. Data grouped to five-day periods.

Younger birds were heavier than adults and had also larger fat reserves. Consequently, juveniles were able to start migration earlier than adults. We have observed the departure of birds with accumulated fat reserves and gradual arrival of Common Snipes from other territorial groups (sub-populations) to store fat reserves or to replenish them after a long period of flight.

These data give an evidence of the great importance of floodplain meadows for Common Snipe accumulation of fat reserves during the post-nuptial migration.

During the post-nuptial migration Common Snipes were caught by walk-in-traps and mist-nets. Measurements of birds with defined age and sex are shown in Table 5. The same pattern of statistically significant differences was revealed using *t*-test in juvenile and adult birds. The length of bill (t = 4.4–4.6, p< 0.001) and head (t = 4.5, p< 0.001) was higher in females. The females were also heavier than males (t = 4.2, p < 0.001), the length of tarsus was also higher in females (t = 7.5, p < 0.001). The length of tail (t = 2.2, p < 0.05) and outer tail feather (t = 9.3, p < 0.001) was higher in males.

Statistically significant differences in measurements of juvenile and adult birds were found in two cases only. The length of outer tail feather was higher in adult birds (t = 11.7, p < 0.001). It should confirm the above mentioned assumption about continuation of tail feather growth in juveniles. The guide-book published by OMPO and CICB (Czajkowski 2002) also indicates that adults and juveniles can be aged by the length of the outer tail feather.

Also the mean length of tarsus was somewhat higher in adult birds (t=3.6, p<0.001), but variations (min and max length of tarsus) were higher in juveniles. Probably, the reasons of these differences are also twofold: Wlodarczyk and Kaczmarec (2000) stated that the differences between adult and juvenile Common Snipes (as well as other species) in length of tarsus can be explained in terms of bone calcification. In young birds tarsus consists mainly of cartilage tissue. When it is replaced by solid bone the tarsus shortens.

Only 15 Common Snipe recoveries were obtained by Belarus Bird Ringing Centre before 1993 (Fig. 5). All birds were ringed in the countries of Western Europe during autumn migration (from 25 July to 2 October). Only one Common Snipe was ringed in spring (14 April) in Czechoslovakia. The mean distance between ringing and recovery places was 1,387 km (range 617 – 2,143 km, SD = 496.9; n = 15). Two birds were shot in Belarus during the breeding period (Fig. 5). All other recoveries belong to the period of autumn migration (August). Baumanis (1985) and Kharitonov (1998) pointed out that there were no essential differences between the Common Snipe recoveries in the first and in the following non-breeding seasons, therefore, it is possible that the birds from east and north-east regions of Russia pass through Belarus mainly in western direction. It is in agreement with routes for continental populations shown by Cramp and Simmons (1983), Devort *et al.* (1986).

Due to intensive ringing scheme of migratory snipes, which was implemented as part of OMPO program in

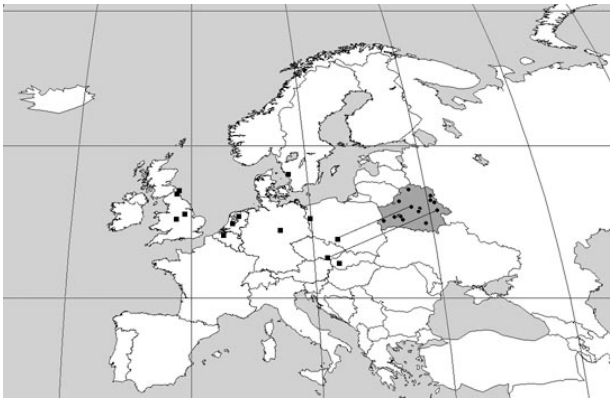


Figure 5. The Common Snipe recoveries from birds ringed beyond the bounds of Belarus according to the data of Belarus Bird Ringing Centre (ringing places and recoveries in Belarus during the breeding season are connected by lines)

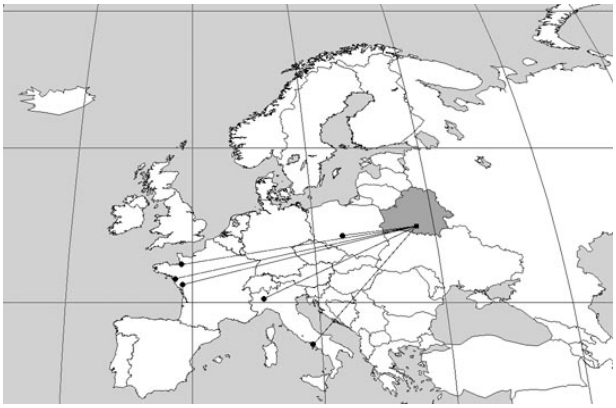


Figure 6. Recoveries of the Common Snipe ringed in Belarus during 2000–2001 (direct recoveries)

Table 5. Morphometric parameters of sexed juveniles of Common Snipe

	Mean		Min		Max		SD		Skewness		N	
	f	m	f	m	f	m	f	m	f	m	f	m
Wing, mm	137.0	135.9	127.0	129.0	143.0	140.5	3.34	2.88	-0.47	-0.51	43	54
Tail, mm	60.3	61.6	56.0	56.0	66.0	69.0	2.61	3.05	0.38	0.56	43	54
Outer tail feather, mm	52.3	57.0	47.5	52.0	57.0	68.0	2.06	2.78	0.24	0.84	43	54
Tarsus, mm	33.6	31.8	30.4	29.8	35.9	33.7	1.27	0.99	-0.21	0.09	43	54
Bill N, mm	63.9	61.1	57.4	55.4	72.5	67.9	3.52	2.86	0.52	0.62	43	54
Bill F, mm	71.1	68.0	64.1	61.2	80.4	74.9	3.68	2.91	0.60	0.39	43	54
Head, mm	100.0	96.8	91.1	90.0	109.5	104.3	3.88	3.19	0.43	0.67	43	54
Weight, g	102.4	94.9	84.1	81.5	124.8	110.5	10.36	7.06	0.45	0.27	42	54

* Bill N - the bill length from the tip to the nostrils. Bill F - the bill length from the tip to the skull

2000-2001, another six recoveries were obtained (Fig. 6). All recoveries were obtained during one-year period after ringing of juvenile birds (direct recoveries). Juvenile birds were ringed from 25 June to 28 July and recovered in July in Poland and in September – December in France and Italy. The mean recovery distance was 1,714 km (range 622-2,190 km, SD = 600.7; n = 6). Juveniles had south-west direction during post-nuptial migration, like the birds shot during the breeding season in Belarus territory. Probably, some of juveniles ringed during this period were from the local population.

Great Snipe *(Gallinago media)*

Breeding distribution and numbers

Formerly the Great Snipe was considered as a common breeding species in all regions of Belarus where suitable habitats occurred. Moreover, great importance of the Great Snipe as hunting species during spring and autumn hunting periods was mentioned (Fedyushin & Dolbik 1967). These authors indicated also that during one autumn day one hunter was able to shoot up to 40 birds. Later the Great Snipe was estimated as not numerous and common only in some places (Nikiforov *et al.* 1989).

Special counts of the Great Snipe were not carried out in Belarus up to now. The first published population estimate for Belarus (12,000-20,000 pairs; Tucker & Heath 1994) was not reliable, since it was based on extremely limited data. Later population size of the Great Snipe was estimated as 2,000-5,000 pairs on the basis of areas with suitable habitat types and mean densities of birds (Nikiforov *et al.* 1997; Nikiforov & Mongin 1998), but data quality was not very high due to restricted census information.

Detailed data on distribution and numbers of this species were collected only during the first special study undertaken during 2000-2001 as part of OMPO program on study of snipes in Belarus.

Intensive special study of the Great Snipe was carried out in majority of administrative districts in Belarus during two years (Fig. 7). Fifty-five Great Snipe leks were studied during this special survey, including 10 previously known. Moreover, more than 10 foraging sites where birds were flushed during breeding period were found.

Up to 20 lekking males were registered in majority of leks. Large leks (up to 30-40 lekking males recorded) occurred also rather often. Sometimes small leks with 3-10 lekking males were found near large leks. Total counted numbers in plots within the most favourable habitats reached 100-150 individuals and even more, if largest areas were evaluated. The most studied groups of leks were situated in the valley of the Pripyat River. The largest leks were located within 2–3 km, sometimes 5 km from each other. Smaller leks (with 3 – 5 and even up to 15 – 20 lekking males recorded) were located 400-800 m from the largest basic lek. Karpovich (1962) also observed that leks in Okski State Reserve, Russia, were located within 1-2 km and interchange of males existed between the leks.

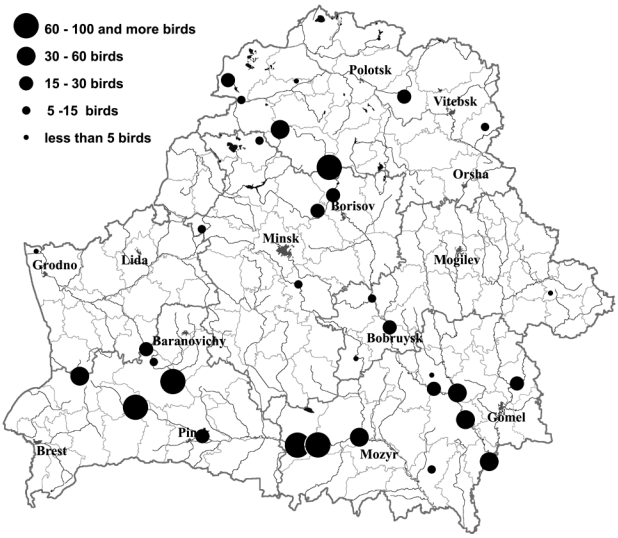


Figure 7. The distribution and size of Great Snipe leks and groups of leks in different administrative districts of Belarus. The estimated numbers of lekking males are shown by black circles of different size

The total contemporary Belarus breeding population of the Great Snipe is estimated at 4,600 – 6,000 males (Table 6). This estimation is based on the counted numbers of lekking males in known leks and estimated numbers of lekking males in predicted leks in floodplain meadows.

Probably, this estimate should be a little below the real number, as far as it is difficult to evaluate the Great Snipe numbers in small river floodplains. Such floodplains are characterised by the presence of wide variety of habitat types. Many of such floodplain habitats are transformed to a certain extent due to human activities. Although in majority of cases the Great Snipes avoid drained areas in some cases the leks were registered in secondary swamped former reclaimed areas.

The key breeding sites and habitat selection

According to our data, floodplain meadows are the most preferable breeding habitats for the Great Snipe (Table 7). About 71% of the leks found during the project were located in this habitat type. Moreover, considerable part of leks (18%) was found in fen mires. Only few leks were located in drained areas (5.5%). In such cases previously drained lands were currently undergoing the process of secondary swamping, or were temporary inundated during the flood. Few leks were found in transitional (mesotrophic) mires (5.S%).

In floodplain meadows the leks were located on drier high plots. Probably, it was connected with long period of flood, especially in large rivers (Dnieper, Pripyat). Such plots were predominated by mixed grass-forbs communities with sedge *(Carex spp.),* rush *(Juncus spp.)* and some other communities in lower areas. The leks were located in open meadows with scarce willow bushes. Main part of such meadows was exploited for cattle grazing.

The leks in fen mires were located among low, 25–40 cm, vegetation *(Caricetum* communities). The plants were strongly flattened by lekking males. Such places are char-

Table 6. Breeding population of the Great Snipe in Belarus according to surveys performed in 2000-2001

	Length, km	Total number	Total length, km	Number of males		
				Counted	Estimated	
					min	max
Large Rivers:	>500	7	3.409			
Pripyat River				163-255	860	980
Dnieper River				60-80	450	550
Soz River				50-70	150	200
Berezina River				100-150	350	450
Other Rivers					250	500
Middle-size Rivers:	101-500	41	6,702			
Ptich River				19-35	140	180
Schara River				37-50	200	240
Other Rivers				110-165	850	1,000
Small Rivers	10-100	1,871	40,516	136-205	850	1,250
Lakes (> 1 km^2)		279		125-170	500	650
Total				**800-1,180**	**4,600**	**6,000**

Table 7. Habitat selection of the Great Snipe according to the distribution of lekking arenas and all observations during breeding time

Habitat	Leks		All observations (breeding time)	
	Number	%	Number	%
Floodplain meadows	39	71.0	90	70.9
Fens	10	18.0	26	20.5
Transitional mires	3	5.5	6	4.7
Meliorated lands, polders	3	5.5	5	3.9
Total	**55**	**100**	**127**	**100**

acterised by rather permanent water level, it does not exceed in average 10-15 cm. It was registered that foraging birds preferred drier territories of fen mires, or fed on dry ridges in the periphery of fen mires. According to our preliminary data, it was connected with peculiarities of the Great Snipe feeding on earthworms as the main prey (Løfaldli *et al*. 1992). The same authors noted that Great Snipes in fen mires preferred to feed in drier territories choosing plots with relatively low penetrability. They have registered the negative relationship between soil penetrability and earthworm biomass in eutrophic fen.

The leks, feeding grounds and nesting sites in most cases were located very close to each other. Some of the most important environmental parameters for these habitats are shown in Table 8. Statistically significant differences were found in two cases only. Horizontal cover was higher in feeding grounds (n = 36), than in nesting sites (n = 9, t = 2.51 $p < 0.05$). Statistically significant differences in the height of vegetation were also found for leks, feeding grounds and nesting sites (ANOVA, $F_{(2,53)}$= 19.65 $p < 0.001$). This parameter was higher in feeding grounds than in nesting sites and leks (Tuckey's test for unequal N, $p < 0.001$). The nests were usually situated among not very tall vegetation, but more dense, than in feeding grounds and leks. It was shown by Løfaldli *et al*. (1992) that females choose for nesting the spots on borders between high and low vegetation, but vegetation cover in such sites is denser, than in feeding grounds and leks. On the whole, nest sites in Belarus were quite similar to such habitats described by other authors (Dement'ev & Gladkov 1951; Kozlova 1962; Glutz von Blotzheim *et al*. 1977). The majority of nests were found in floodplain meadows. The average horizontal cover and vegetation height at nest sites was somewhat smaller, than for Norwegian population (Løfaldli *et al*. 1992), where Great Snipes selected nest sites with low herb willow scrub vegetation communities.

Feeding grounds were located in proximity to lekking arenas. Altogether 40 soil samples from exact flushing sites of Great Snipes and 16 similar samples from random sites were collected in two types of habitats in 2001 (Table 9). The birds selected feeding grounds with the highest average biomass and density of earthworms in comparison with random sites, thought these differences were not statistically significant. Penetrability and earthworms' biomass in fen mires were similar with Norwegian data for this habitat type (Løfaldli *et al*. 1992), the differences were found only for average vegetation height and horizontal cover (detectability). Habitat characteristics in feeding sites at floodplain meadows were similar with such data for floodplain meadows in Latvia and Estonia (Aunins 2000; Kuresoo *et al*. 2001). Great Snipes selected the sites with moderate moisture where soil penetrability was higher than in average for whole meadow.

It coincides with opinion of different authors (Løfaldli *et al*. 1992; Kålås *et al*. 1997), that Great Snipe is a food and habitat specialist and occupies areas with high biomass of earthworms.

According to this study, the Pripyat River floodplain meadows are the most important habitats for the Great Snipe. The total estimated number is about 1,000 lekking males for this region. Floodplain meadows within the bounds of Mid-Pripyat State Landscape Reserve (Ramsar site no. 1090) are among the key sites. Here, in area stretched along about 5 km of riverbed, 88–125 lekking

Table 8. Comparison of average habitats variables in feeding, nesting and lekking sites of Great Snipe in Dikoe fen and floodplain meadows of the Pripyat River in 2000-2001

	Vegetation height (cm)		Height of tussocks (cm)		Vegetation density		Horizontal cover (m)		Soil penetrability (cm)		Moisture		N
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	
Feeding sites:													
Dikoe fen	35.0	8.37	19.7	8.98	77.3	10.33	4.9	0.96	12.3	2.29	3.3	0.52	6
Floodplain meadows	39.2	14.30	0.8	3.24	55.3	30.93	13.1	7.32	6.7	1.29	2.7	0.61	30
Nest sites	**20.1**	**11.04**	**3.8**	**6.50**	**78.3**	**20.00**	**5.4**	**2.25**	-	-	**3.2**	**1.30**	**9**
Lek sites	**15.5**	**6.25**	**3.0**	**5.37**	**55.0**	**33.76**	-	-	-	-	**3.5**	**1.13**	**11**

Table 9. Earthworm biomass and density in feeding sites of the Great Snipe and random sites of two types of habitats in 2001

	Earthworm biomass (g/m^2)		Earthworm density (ind/m^2)		N
	Mean	±SD	Mean	±SD	
Feeding sites:					
Dikoe fen	14.1	10.95	81.5	33.46	6
Floodplain meadows of the Pripyat River	32.5	47.24	125.9	145.35	30
Random sites:					
Dikoe fen	12.2	28.86	29.6	53.82	6
Floodplain meadows of the Pripyat River	7.8	15.26	40.0	57.19	10

males were counted. About 80 males were registered yet in neighbouring 5 km area. The total counted number of lekking males was not less than 250-300 individuals in this zone.

The other key site is located in floodplain meadows of Lake Sporovskoe and in adjacent fen mire. 65–80 lekking males were registered here. The total estimated number is probably about 150 males. This site is designated as the Sporovsky Biological Reserve (Ramsar Site no. 1007).

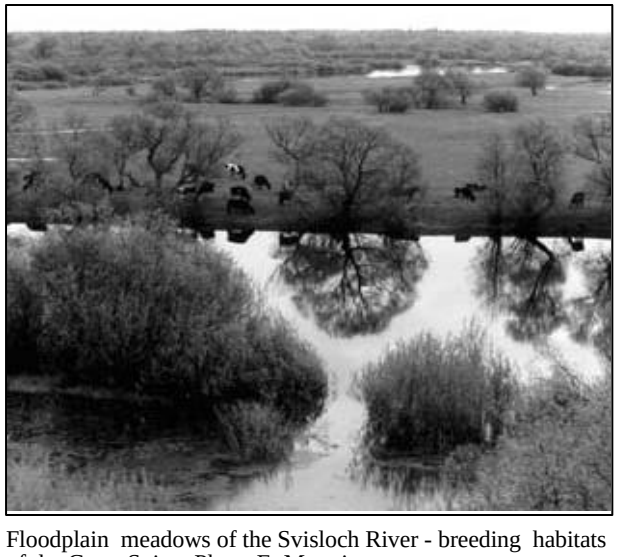
The third key site is located in floodplain fen mires near Lake Servetch (it is not included in the list of potential Ramsar sites yet, but after additional studies it probably should be also designated as site of international importance). The total estimated number was about 100 males for this area.

50–70 lekking males were counted in the Berezina river floodplain meadows in Berezinski Biosphere State Reserve with the total estimated number of about 120 males in this area. One more group of leks with estimated number of about 50 lekking males was revealed in other protected area – Dikoe Reserve. Approximately the same number of lekking males was found in Vigonoshchanskoye Reserve (about 40-60 lekking males). Two key sites for the Great Snipe were revealed in Mid-Dnieper floodplain meadows. These sites should be additionally studied. Two large leks were found on raised places among inundated floodplain meadows. Not less than 40 lekking males were counted in each lek. The total number was estimated as 200 males for this zone.

Large group of lekking males (up to 40 birds) was found also in Low-Sozh floodplain meadows.

Only small leks with numbers ranging from 3-5 to 15–20 lekking males were registered in the most favourable for the Great Snipe habitats in other parts of Belarus.

Kuresoo and Luigujõe (2000) recorded several Great Snipe leks in forest clear-cuts. These authors pointed out that the temporarily flooded forest clear-cut areas may function for the short period as 'refugee camps' for snipes.



Floodplain meadows of the Svisloch River - breeding habitats of the Great Snipe. Photo E. Mongin

Lekking arena of the Great Snipe at the floodplain meadow of the Dnieper River. Photo E. Mongin

However, the birds were not found in such places in Belarus, but in some sites rather favourable conditions were found for this species.

Thus, 11 key sites for the Great Snipe were designated during this study. Seven of them are located in protected areas.

Morphometric parameters of breeding Great Snipes

About 100 birds were caught and ringed during breeding period in 2000–2001 as part of field studies (Table 10). Females were significantly larger according to majority of measurements and body mass.

In addition to the differences found in this study, Höglund *et al*. (1990) also indicated statistically significant differences between sexes in length of white on the tail and wing length. Probably, the absence of statistically significant differences between birds captured in Belarus should be explained by small number of measurements in females.

It is interesting to note that mean length of white on the tail in Belarussion Great Snipes was closer to Estonian population than to Norwegian birds (Kålås *et al*. 1997).

Breeding phenology and success, egg measurements of the Great Snipe

Females nested solitary, but in one case the nests were situated in *c*. 100 m from each other. In most cases the nests were located not far from lekking arenas. Five nests in floodplain meadows were found in 50-200 m from lekking arenas and two - in 800–1,000 m. Similar results were shown by other authors (Glutz von Blotzheim *et al*. 1977; Cramp & Simmons 1983; Mal'chevskiy & Pukinskiy 1983). Although, probably significant part of nests should be located in remote from the lekking arenas sites, more difficult to access. Low nesting density in study areas with

Nest of the Great Snipe. Photo E. Mongin

large lekking arenas (more than 50 males) could be the evidence of such nest distribution. During the nest search in one case the nesting density was about 3 females/km^2 and in other case – about 2 females/km^2.

First clutches of the Great Snipe were recorded in the third decade of April (Fig. 8). Exact date of the first egg laying was 24 April. Peak for start of first egg laying was in early May. MLP of the Great Snipe was about 35 days. The extend of egg laying period in the Great Snipe is rather small. Approximately the same duration of MLP was found in other wader species breeding in Central Europe and in the Baltic Sea region (Onno 1974; Väisänen 1977).

Data of predation rate were collected in floodplain meadows. About 70% of all nests (n=9) failed. The most clutches were destroyed by grazing cattle (75%) and *Corvidae* (25%). The rate of nest loss was rather high in comparison with our data for the Common Snipe (38%). According to data collected by different authors, the rate of nest loss for the Common Snipe was up to 41–44.4% (Mason & Macdonald 1976; Green 1988 in Svazas *et al*. 2001). In our case such high nest loss in the Great Snipe

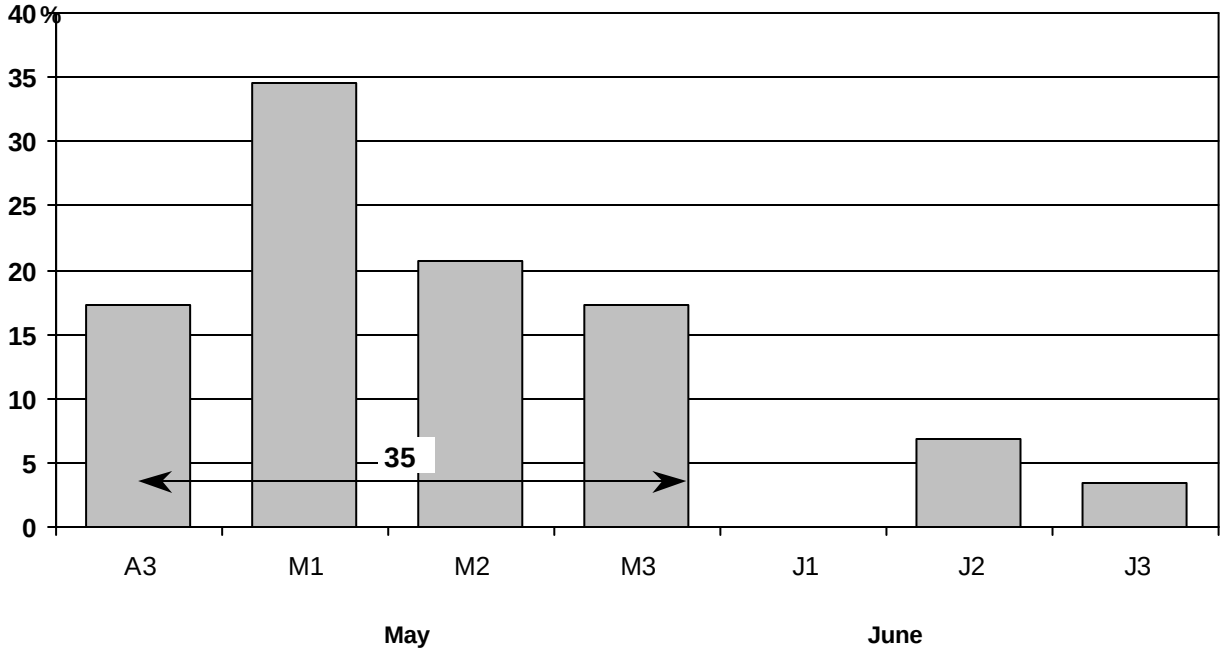


Figure 8. Breeding phenology (laying data of the first egg) and the main laying period (MLP) of the Great Snipe in Belarus (n = 29). The black horizontal line on the histogram shows the length of MLP to the nearest half-class. Data grouped to ten-day periods

Table 10. Morphometric parameters of Great Snipe adults breeding in Belarus

	Mean		Min		Max		SD		Skewness		N	
	f	m	f	m	f	m	f	m	f	m	f	m
Wing, mm	148.6	144.7	135.0	140.0	154.5	154.0	5.02	2.47	-1.45	-0.18	14	91
Tail, mm	59.8	61.8	50.0	51.0	67.0	72.0	5.26	4.70	-0.23	-0.25	13	88
White on tail, mm	19.7	21.0	15.0	14.7	23.2	29.5	2.73	3.84	-0.42	0.52	9	60
Tarsus, mm	38.9	38.0	32.9	35.6	44.0	39.9	2.41	0.90	-0.38	-0.29	14	91
Bill N, mm	60.0	54.6	58.2	47.9	65.0	58.7	1.68	1.69	2.09	-0.92	14	91
Bill F, mm	67.6	61.4	63.9	54.9	70.9	69.0	2.21	2.19	-0.31	-0.15	14	91
Head,mm	99.9	93.6	97.5	87.3	101.8	97.5	1.29	1.87	-0.68	-0.65	14	91
Weight, g	179.4	155.4	143.0	133.5	195.8	206.6	15.33	10.83	-1.47	2.25	12	76

* Bill N - the bill length from the tip to the nostrils. Bill F - the bill length from the tip to the skull

Table 11. Measurements of Great Snipe eggs and the calculated egg volume

	Mean	Min	Max	SD	Skewness	N
Length, mm	44.9	41.4	44.8	1.85	0.05	36
Width, mm	30.9	27.1	32.2	1.31	-1.84	36
Volume, cm^3	18.64	13.43	21.35.	2.04	-1.29	36
Weight, g	21.4	20.7	22.9	1.03	1.84	4

should be explained by peculiarities of places where the counts were carried out. A high cattle grazing rate (up to 30–50 cows per 100 hectares) was found in these localities.

All recorded nests contained four eggs. Detailed egg measurements and calculated egg volume are shown in Table 11. Mean egg size measurements were similar with parameters shown by other authors (Witherby *et al*. 1940; Kozlova 1962; Glutz von Blotzheim *et al*. 1977; Cramp & Simmons 1983).

Egg volume and size are larger than in the Common Snipe, and overlapping was found only in isolated cases. Only in one early clutch (24 April 2001) of the Great Snipe eggs were small in size and the mean volume of eggs (13.9 cm^3) was just the same as in the Common Snipe.

Study and ringing scheme of migratory Great Snipes

All collected data are connected with post-nuptial migration of the Great Snipe. It is connected with rather rapid rate of spring migration of the Great Snipe (Panchenko 1985). These sites are used not only during the breeding period, but also serve as important feeding areas during pre-migration period. Probably, some part of migrating Great Snipes from Northeast regions of Russia stops here to restore fat reserves.

There are three peaks of Great Snipe passage in the Pripyat River floodplain (Fig. 9). Probably during July – August we observed the start of migration mainly of birds

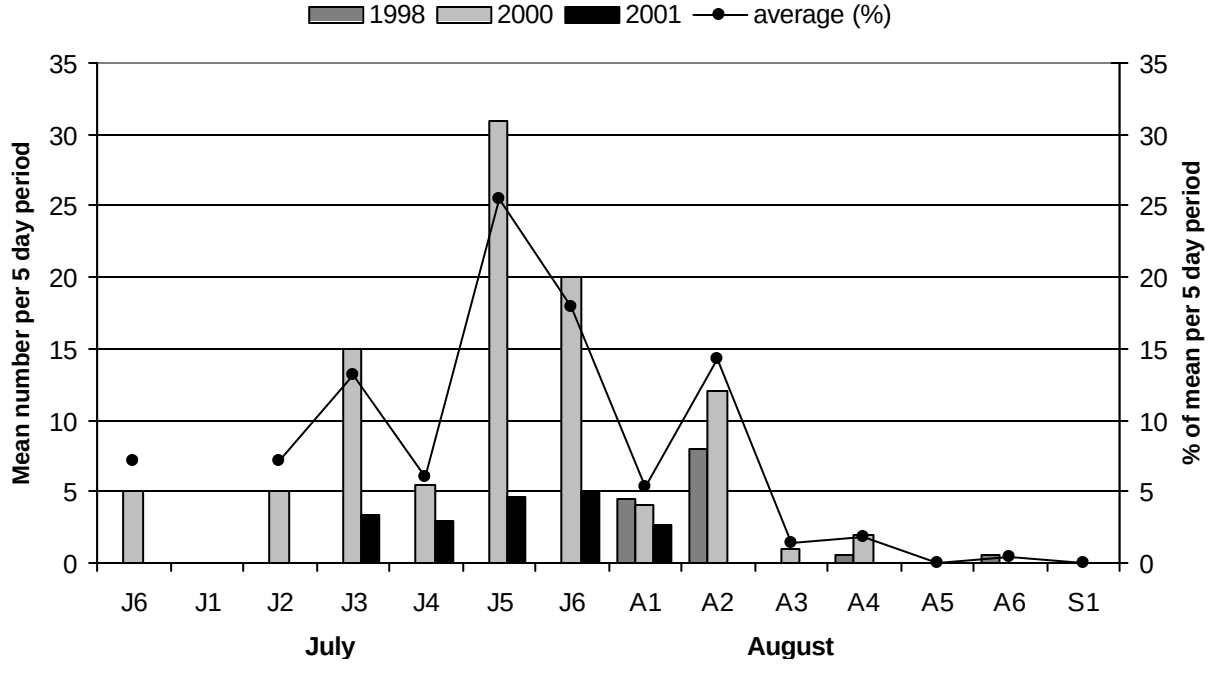


Figure 9. Migratory pattern and numbers of the Great Snipe at census routes in floodplain meadows of the Pripyat River. Data grouped to five-day periods

of local populations. This assumption was confirmed by several recoveries of ringed local Great Snipes.

Probably, the waves of passage were formed due to different terms of the beginning of migration for adult birds and juveniles, as well as movements of birds from different populations. It was confirmed by the changes in ratio of juveniles and adult birds during the passage. According to the results of catching in 2000 (n = 33), the ratio juv/ad was 5 (n = 6) during the first half of July, 1.8 (n = 17) during the second half of July and 2.5 (n = 7) in the first half of August.

The changes in body mass of migrating birds were cyclical. Body mass increased during stay in stopover sites and decreased during active migration (long distance migratory flight). Moreover, the changes in body mass of Great Snipes took place during the breeding period (May – early June) (Fig. 10). The Great Snipe males are able to decrease of their body mass by 5% during each of 4-5 hours of night display period in the lek (Kåås 2000). The largest decrease of body mass was recorded in the Great Snipe females during May. It was connected with egg laying period during May in Belarus.

The body mass increase was observed from July to mid-August both in juveniles and adults. A sharp weight loss was recorded in juvenile males during second half of August. Probably, it was connected with arrival of birds from more eastern and northeast breeding grounds in capturing sites to restore their fat reserves. The same trend was revealed by estimation of fat deposits in juveniles and adults (Fig. 11). These data confirmed the opinion that the Pripyat River floodplain

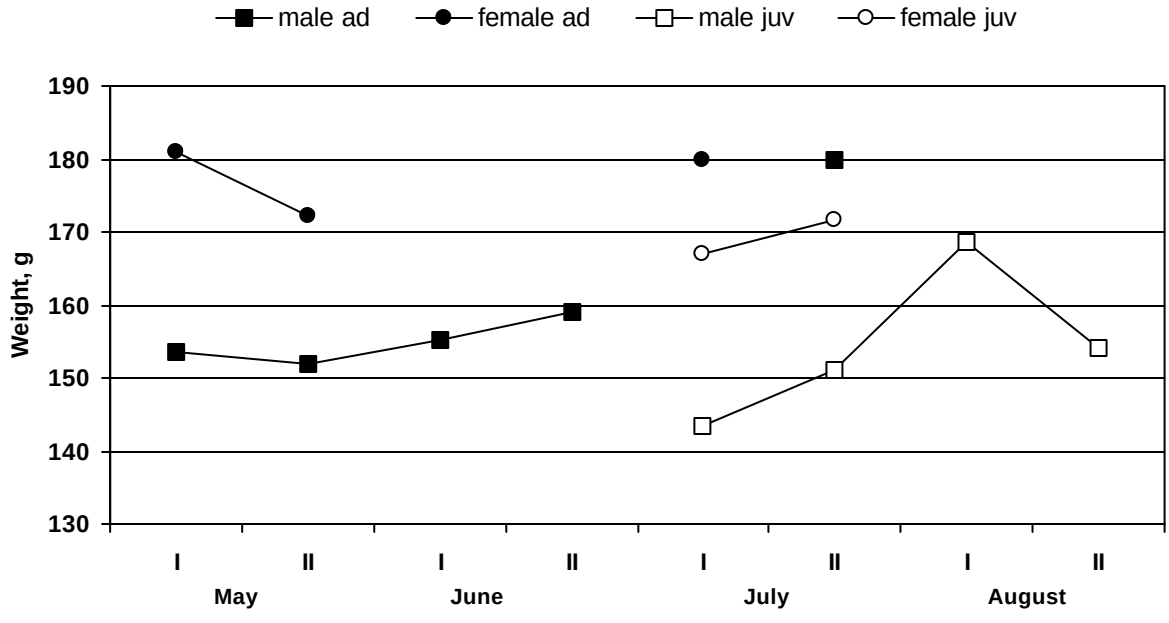


Figure 10. Temporal change in weight of adult and juvenile Great Snipes caught in floodplain meadows of the Pripyat River, 2000-2001. Data grouped to half-month periods

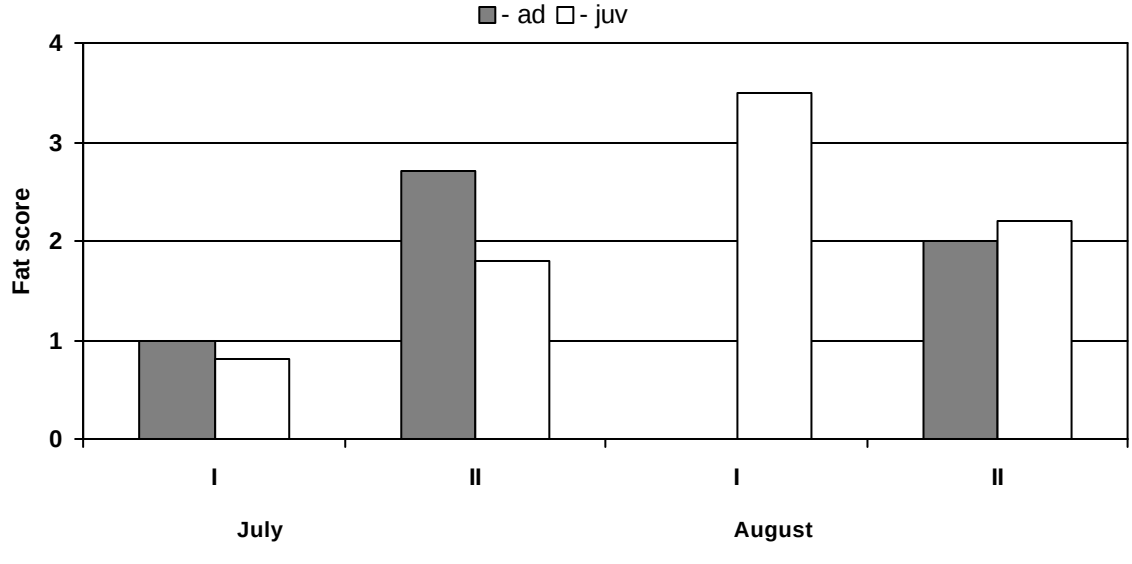


Figure 11. Change of fat reserves in migratory adult (n = 11) and juvenile (n = 22) Great Snipes. Data grouped to half-month periods

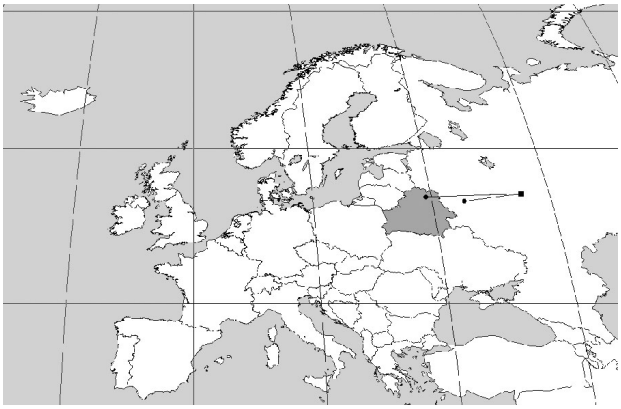
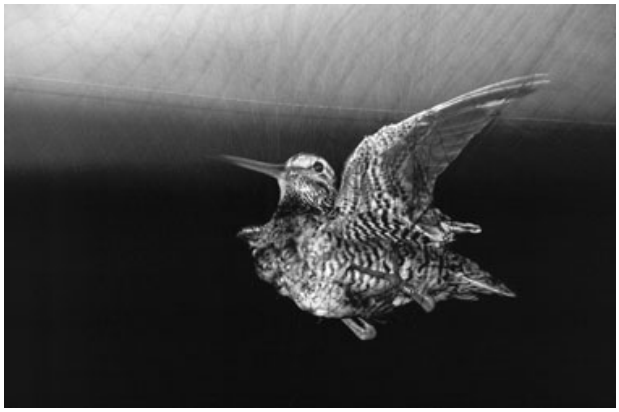


Figure 12. Great Snipe recoveries according to data of Belarus Ringing Center and Panchenko (1971)



The Great Snipe caught at down. Photo E. Mongin

Table 12. Morphometrical parameters of Great Snipe juveniles caught during the autumn migration in 2000-2001

	Mean		Min		Max		SD		Skewness		N	
	f	m	f	m	f	m	f	m	f	m	f	m
Wing, mm	151.0	147.6	145.0	140.5	157.5	153.0	3.94	3.22	0.16	-0.59	8	14
Tail, mm	56.1	56.9	51.0	48.0	62.0	65.5	4.07	4.45	-0.11	-0.39	8	15
Tarsus, mm	39.1	37.7	37.8	36.5	40.8	39.0	1.01	0.84	0.44	0.16	8	15
Bill N, mm	59.9	53.7	58.1	51.2	62.8	57.6	1.34	2.03	1.54	0.95	8	15
Bill F, mm	67.5	61.7	64.7	57.9	71.1	69.7	1.99	3.19	0.57	1.29	8	15
Head,mm	99.6	92.5	98.1	89.3	103.5	96.5	1.69	2.32	2.26	0.60	8	15
Weight, g	167.3	152.9	148.5	137.6	205.0	192.0	19.35	13.71	1.08	1.90	8	15

* Bill N - the bill length from the tip to the nostrils. Bill F - the bill length from the tip to the skull

meadows are important staging areas for Great Snipes from Northwest regions of Russia during migration.

There was no Great Snipe ringing in Belarus before the initiation of this project. According to the data of Belarus Bird Ringing Centre there was only one direct recovery of Great Snipe (Fig. 12).

Intensive ringing scheme was implemented as a part of OMPO program in 2000–2001. During the migration period mainly juvenile birds were caught (Table 13). Significant differences were revealed for all morphometric parameters of males and females (*t*-test, $p < 0.001$). The largest differences were recorded in length of bill up to skull ($t = 41.9$, $p < 0.001$) and head size ($t = 82.7$, $p < 0.001$). In average juvenile females were much larger than males. Only tail feathers were longer in males than in females. Similar sex-related differences (tail, head, weight) were recorded in juvenile Great Snipes in wintering grounds (Devort 2000).

Population estimates and trends

At present the Great Snipe in Belarus is rather numerous species, but less numerous than during the early 1960s.

Detailed data on numbers and distribution of the Great Snipe were obtained only in course of special studies performed in 2000-2001. It is possible to estimate the total Belarus breeding population of the Great Snipe at about 4,600-6,000 lekking males.

There were no published data on changes in numbers in Belarus, but undoubtedly, considerable decline has been occurring during past 40 years. Tucker and Heath (1994) estimated the trends in numbers of the Great Snipe breeding population as large decrease during the last 20 years. Other authors in their recent publications (Rose & Scott 1997; Delany *et al.* 1999) also indicated that total population number of Great Snipe decreased. A significant population decline for this species in Belarus was related to deterioration and loss of main habitats. The same process was recorded in many other European countries, where the Great Snipe was considered as extremely rare species (Poland) or even regionally extinct (Germany, Denmark). Tomkovich (1992) indicated a probable continuation of population decline of this species in Russia. Only Scandinavian population apparently has remained stable since 1945 (Hagemeijer & Blair 1997).

The data on population trends of the Great Snipe are extremely limited in Belarus as well as in Lithuania (Svazas *et al.* 2001). It is well known that one lek in Mid-Pripyat floodplain meadows exists during past 20 years. The number of birds here is probably stable, but this area was not subjected to any significant transformation. Datskevich (1998) recorded decline of breeding population of the Great Snipe since the mid-1950s in Belovezhskaya pushcha. During the 1980s breeding birds disappeared in the Lesnaya River floodplain meadows and fen mire Dikoe (in Belovezhskaya pushcha and surrounding areas). The author connected this process with drainage activities carried out in this region. The Great Snipe leks were not found in these localities in 2000-2001.

Probably, the former inappropriate hunting practice (on leks in spring) had significant negative impact on the Great Snipe population numbers in Belarus.

Some authors connect the decline in numbers of breeding and migrating Great Snipe in Russia with unregulated hunting (Mal'chevskiy & Pukinskiy 1983; Zubakin 1988). According to opinion of the majority of authors (Popov 1977; Mal'chevskiy & Pukinskiy 1983; Zubakin 1988) the main reason for the Great Snipe population decline was the habitat degradation and loss.

Certainly, the loss of main habitat types – fen mires and floodplain meadows – is the main principal reason of the Great Snipe population decline in Belarus. According to Golod (1994) the area of floodplain meadows and fens reduced by 50% during past 40 years. So, it is possible to suppose that during this period a 2–2.5 – fold decline of the breeding population in Belarus was caused by the habitat loss.

No alternative habitats suitable for the Great Snipe were created in Belarus due to human activities. Only single leks were found in polders, but these sites were secondary swamped or located near natural floodplain meadows. Probably, the temporarily flooded forest clear-cuts should be temporary suitable habitats for the Great Snipe in Belarus like in Estonia (Kuresoo & Luigujõe 2000), but the birds were not recorded in such habitats during this study.

Jack Snipe *(Lymnocryptes minimus)*

Population status

The Jack Snipe is very secretive, highly crepuscular species. The status of this species in Belarus was recently estimated as very irregular breeder, transit migrant and irregularly wintering (single birds) species (Nikiforov *et al.* 1997). Four wintering birds were recorded. Fedyushin and Dolbik (1967) wrote about one Jack Snipe shot on 30 January 1966 in unfrozen springs near the Volma River. Kozulin and Shockalo (1994) referred to three new records of wintering birds.

According to published data (Nikiforov *et al.* 1989; Kozlov 2001) most records during the breeding period were in the northern part of the country. The Belarusian breeding population of Jack Snipe was estimated at about 0–20 pairs (Nikiforov & Mongin 1998).

The previous data coincide with results of studies carried out in 2000–2001. Only single birds were recorded in floodplain meadows of the Ptich and Berezina Rivers during spring migration (the end of April – the beginning of May). All Jack Snipes were flushed from dense old (last-year) sedge growth, where water level was 5–10 cm. One bird was recorded on 18 April 2000 in the open fen (Dikoe). Published materials about spring records of the Jack Snipe are very scarce. Fedyushin and Dolbik (1967) referred to the records of Jack Snipes in April, but also indicated that most birds were recorded mainly during autumn passage. Dmitranok and Dombrovski (1999) recorded displaying bird on 22 April 1997 in transitional mire in Mogilev region, but later Jack Snipes were not recorded in the same site.

During the breeding season the Jack Snipe was recorded only once. Three displaying birds were recorded in Berezinsky State Reserve in June 2001. The breeding habitat was situated on a transitional mire in river floodplain with spots of open peat mud. The sites of recorded Jack Snipe nests and displaying birds (Nikiforov *et al.* 1989; Red Data Book 1993; and data collected by author in 2000–2001) are shown in Figure 13.

Most probably, the Jack Snipe breeds in Belarus, but irregularly and sporadically, like in Lithuania (Svazas *et al.* 2001), since the southern border of breeding range passes through Belarus. It is necessary to carry out special large-scale studies in order to define contemporary status of this species more precisely.

According to Kozlov (2001) the Jack Snipe is regular breeder in the territory of Belarus Lakeland (Vitebsk region), but breeding density is low (0.1-0.2 pairs/100 ha). This author estimated the total number of the Jack Snipe

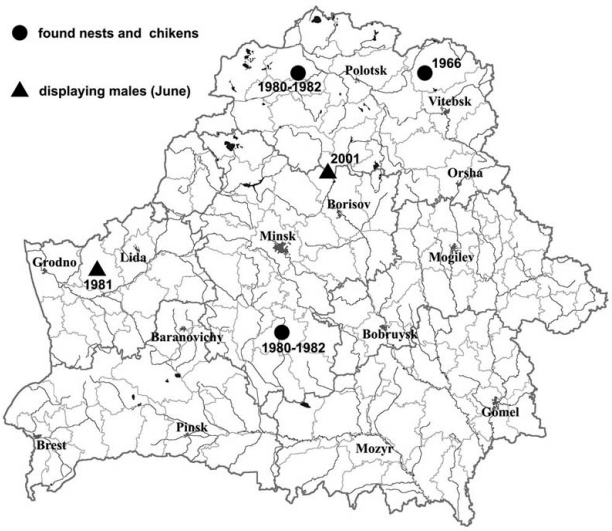


Figure 13. Breeding sites of Jack Snipe in Belarus

The trapped Jack Snipe during autumn migration. Photo E. Mongin

Table 13. Morphometric parameters of Jack Snipes caught during autumn migration

	Min	Max	Mean	SD	Skewness	N
Wing, mm	108.5	120.0	114.9	3.50	-0.68	7
Tail, mm	41.0	50.5	43.6	3.97	1.24	7
Tarsus, mm	23.4	25.1	24.2	0.71	0.13	7
Bill N, mm	36.3	39.0	37.1	0.91	1.67	7
Bill F, mm	41.9	41.0	41.5	0.64	-	2
Head, mm	65.2	65.2	65.2	-	-	1
Weight, g	62.6	45.5	53.7	6.34	0.11	6

* Bill N - the bill length from the tip to the nostrils. Bill F - the bill length from the tip to the skull

in this region at up to 150 pairs. He also described two Jack Snipe nests found in 1980 and 1982 as well as regular records of displaying birds during the last 20 years.

Ringing scheme of migratory Jack Snipes

No Jack Snipes were ringed in Belarus till 1999. Six birds were ringed in the Pripyat River floodplain meadows during 1999–2001. The birds were captured by walk-in traps. All captured birds were weighted and measured (Table 13).

Single birds were recorded in this ringing place from 21 September to 5 October (1999–2000). According to Fedyushin and Dolbik (1967), the main part of migratory Jack Snipes pass Belarus in first part of October.

CONCLUSIONS

Common Snipe

Common Snipe is still one of the most numerous and widely distributed wader species in the territory of Belarus. The total breeding population of Common Snipe in Belarus was estimated at about 80,000 pairs. This species use a wide habitat range, from fens and raised bogs to clearings in wet forests and neglected former peat excavation areas. Key areas with the largest breeding densities (on an average 18-22 pairs/100 ha) were designated in fens and transitional mires. More than half of the total breeding population is concentrated in these types of habitats. The mean breeding density of this species in Belarus is 15.5 pairs/ 100 ha.

The drainage of wetlands and peat-extraction are the main threats for the Common Snipe. According to the data obtained during this study. Common Snipe avoids drained areas with exception of territories where wet or swamped patches still exist during the breeding period. Probably, the decrease of the Common Snipe breeding population (1.5 – fold) took place as a result of drainage activities. The area of open fen mires (the main type of Common Snipe breeding habitats) has been reduced twice during the last 40–50 years.

In less extent the Common Snipe population numbers were influenced by the habitat loss due to their overgrowing by bushes due to the absence of cattle grazing and hay harvesting during the 10 years.

It is possible to use Common Snipe as indicator species to estimate the wetlands status, hydrological conditions and their stability. The Common Snipe monitoring scheme based on results of this project has been proposed for the State Environmental Monitoring Program of the Republic of Belarus. This monitoring scheme should become the basis for development of special protective measures for the Common Snipe.

Special management plans targeted on water level control in large wetlands should be possible measures for Common Snipe protection. Moreover, rehabilitation of mire ecosystems in former peat-excavation areas should play a significant role in increase of the Common Snipe population. The total territory of former peat-excavation areas in Belarus is about 210,500 ha (Yatsukhno *et al.* 1998), and only 9,500 ha are restored up to now.

Great Snipe

The present study confirmed that the Great Snipe is still rather numerous breeding species in Belarus. The breeding population was estimated at 4,600-6,000 pairs. According to the data obtained in the course of this project, floodplain meadows (71% of all records) and open fen mires (20%) are the main breeding habitats. Eleven key areas with estimated numbers reaching up to 200 displaying males were revealed in 2000–2001. Though, many of these key breeding sites are located in protected areas, some large Great Snipe leks are not protected.

Up to now the Great Snipe was not included into the list of protected species in Belarus. The large-scale drainage activity was the main reason of population decrease (Duchits 1972; Datskevich 1998). The area of the Great Snipe breeding habitats has been reduced to a considerable extent (Golod 1994). The Great Snipe population has reduced 2–2.5 – fold during the last 40–50 years.

The development of the scientific background for the inclusion of this species to the list of protected bird species in new edition of the Red Data Book of the Republic of Belarus is one of the main outcomes of this project. In 2001 the Great Snipe was excluded from the list of game species in Belarus. The creation of new protected areas in floodplain meadows of the rivers under natural conditions and the natural fen mires are other possible measures aimed to protection for this species. Ceasing of drainage activities in key areas for the Great Snipe, as well as regulation of cattle grazing and prevention of overgrowing by bushes are among the main management priorities. Hay-mowing

should be the measure preventing overgrowing of habitats. Traditional mowing is the most favourable for this purpose. Burning of reed during autumn or early spring, when water level is rather high, should be one of possible measures to prevent overgrowing by reeds in large tracts of fen mires.

The data obtained as a result of this study should be used for development of monitoring scheme and further population monitoring.

Jack Snipe

The results obtained during this study are in accordance with previous data. Probably, this extremely secretive crepuscular species breeds in Belarus only sporadically. Only single pairs (0-20 breeding pairs) bred during different seasons mostly in northern regions of Belarus.

The Jack Snipe is included in to the Red Data Book of the Republic of Belarus. However, it is difficult to develop special measures for protection and management of this species due to its status. It is essential to define more precisely the status of the Jack Snipe in Belarus. According to Kozlov (2001) there is stable breeding population of the Jack Snipe in Vitebsk region.

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