Die Vogelwarte 39, 1997: 61–81

The status of White-fronted Goose *(Anser a. albifrons)* in the Western Palearctic

By Johan H. Mooij

Abstract: MOOIJ, J.H. (1997): The status of White-fronted Goose *(Anser a. albifrons)* in the Western Palearctic. Vogelwarte 39: 61–81.

Data on population size in the wintering and breeding range, annual reproduction and mortality rates as well as breeding densities of Western Palearctic White-fronted Geese were analysed to get an impression about the actual size and development of the population since the 1950s. Based on these data there seems to be no significant change in these parameters over the study period. Since the 1950s the number of White-fronted Geese showed a marked increase at most Western European wintering sites. Based on this increase some authors assumed a general increase of Whitefronts in the Western Palearctic, but it is shown that over the same period the Whitefront numbers at Southeastern Europe, Turkey and the Caspian region seem to decline or to be stable. The analysed data showed that there seems to be no actual increase of the numbers of the species in the Western Palearctic, but that there are a number of hints that the increase of the numbers of White-fronted Geese in Western Europe is the result of a major shift of wintering geese from other Western Palearctic wintering sites to the wintering sites of Western Europe. Therefore the increased hunting pressure at migrating and wintering Whitefronts in the Western Palearctic, as practiced especially in Western Europe, easily could become a threat to the species.

Key words: White-fronted Goose, *Anser albifrons,* population size, population development, reproduction rates, mortality rates, shift of migratory routes, hunting pressure.

Address: Biological Station Kreis Wesel, Diersfordter Straße 9, D–46483 Wesel, Germany

1. Introduction

Since the 1950s the number of the White-fronted Goose has increased at most Western European wintering sites, with exception of the British sites (e.g. EBBINGE et al. 1987, GANZENWERKGROEP 1976, 1977, 1978, 1979, 1980, 1981, 1983, 1984a & b, 1986, 1987a & b, 1989, 1990, 1991, 1992, GERDES 1994, GERDES et al. 1978, 1983, KUYKEN 1975, LEBRET et al. 1976, MADSEN 1991, 1992, MEIRE & KUYKEN 1991, MOOIJ 1991a, b, c & 1993, PHILIPPONA 1972, RUTSCHKE 1987, TIMMERMAN 1976, TIMMERMAN et al. 1976).

Based on this increase some authors assumed that there was a general increase of Whitefronted Goose numbers in the Western Palearctic (e.g. EBBINGE 1991, KALCHREUTER 1991, 1994, RUTSCHKE 1987, 1990), but it may be premature to extend the population development in Western Europe to other Eurasian wintering sites. In Southeastern Europe, Turkey and the Caspian region the numbers of White-fronted Geese seem to be declining or to remain stable (BOYD & PIROT 1989, CRAMP & SIMMONS 1977, DICK 1986,1990,1992, MADSEN 1987,1991,1992, ROSE & SCOTT 1994, STERBETZ 1968, 1971, 1982a & b).

The scope of this paper is to discuss whether the increase in Whitefront numbers in Western Europe is more likely to be the result of a general increase in the Western Palearetic population or the result of a major shift of goose numbers within the Western Palearctic wintering range.

2. Methods

The following methods are used to discuss the population situation of the White-fronted Goose in the Western Palearctic:

- Compilation of data on population size in the literature of the last decades based on counts in the wintering range,
- Compilation of data on breeding densities and the development of breeding populations recorded at the breeding sites and published in the last decades,
- Compilation of the annual reproduction success, based on the percentage of juvenile birds recorded at some Western European wintering sites,
- Estimation of the overall annual mortality based on the estimates of the annual percentage of first-year birds in the breeding area and at the wintering site half a year earlier as well as on the methods described by

EBBINGE (1991):

$$\frac{100\,(N_t - Na_{t+1})}{N_t\,(Na_{t+1} / N_{t+1})}$$

REMMERT (1992):

$$1 + \frac{(N_t - Na_{t+1})}{N_{t+1}} - \frac{N_{t+1}}{N_t}$$

and BELL et al. (1993):

$$100 - \frac{(100\,Na_{t+1})}{N_t}$$

where N_t and N_{t+1} are the total number in years t and t+1 respectively and Na_t and Na_{t+1} the number of birds in adult plumage in the years t and t+1.

Acknowledgements

This publication would not have been possible without intensive discussions with collegues from Russia, especially with IGOR KOSTIN, enabled by improved contacts supported by the „International Association for the Promotion of Cooperation with Scientists from the Independent States of the Former Soviet Union (INTAS)". Also the critical comments from a number of colleagues, especially from RUDI DRENT, BART EBBINGE and TONY FOX, were of great help during the initial phase of the manuscript. I wish to thank them all.

3. Results

3.1. Population estimates

There is only poor information about population size and development of Western Palearctic Whitefronts. To get some indication about the status of the species two data sets are available: Data from winter counts and data from the breeding areas.

3.1.1. Numbers of wintering White-fronted Geese in the Western Palearctic

Data of winter counts in different parts of Europe have been available since the 1950s. Since the middle of the 1960s these counts have been coordinated by Wetlands International (formerly IWRB) and since then there has been a steady increase in coverage and reliability, especially during the 1990s. In spite of this increase the overall quality of the data is still poor, especially for Eastern Europe and from the earlier years, but it still felt to be sufficient to give indications about the status of the species within the wintering range.

Adding the estimated White-fronted Goose numbers in Western, Central and Southeastern Europe since the 1950s, as published in the last decades (BAUER & GLUTZ VON BLOTZHEIM 1968, CRAMP & SIMMONS 1977, LYSENKO 1990, MADSEN 1991 & 1992, PHILIPPONA 1972, PIROT & FOX 1990, ROSE 1995, ROSE & TAYLOR 1993, ROSE & SCOTT 1994, RUTSCHKE 1987, SCOTT 1980, TIMMERMAN et al.1976, USPENSKI 1965), these data suggest that the population size for the Western Palearctic has remained more or less stable at a level of 700 000–1 000 000 Whitefronts (i. e. m = about 850 000).

In spite of the steady increase in count coverage and reliability of the data there is no indication of a large increase in Whitefront numbers. It is more likely that the Whitefront population re-

Tab. 1 Estimated population size of Western Palearctic White-fronted Goose since the 1950s according to estimates on the wintering grounds published by BAUER & GLUTZ VON BLOTZHEIM 1968 (BG 68), CRAMP & SIMMONS 1977 (CS 77), LYSENKO 1990 (L 90), MADSEN 1991 & 1992 (M 91 & 92), PHILIPPONA 1972 (P 72), PIROT & FOX 1990 (PF 90), ROSE 1995 (R 95), ROSE & TAYLOR 1993 (RT 93), ROSE & SCOTT 1994 (RS 94), RUTSCHKE 1987 (Ru 87), SCOTT 1980 (S 80), TIMMERMAN et al. 1976 (Tea 76) and USPENSKI 1965 (U 65) ( )* = incomplete count;) ** = total not intludes counts from Ukraine, where annually 200 000–500 000 geese were counted since the 1990s;)*** = this figure includes c. 330 000 unidentilfied geese).
Geschätzte Bestandsgröße der west-paläarktischen Population der Bläßgans seit den 1950er Jahren, nach Schätzungen von den Winterrastplätzen, Quellen s. oben. ( )* = unvollständige Zählung;)** 1 = in dieser Zahl sind keine Zählungen aus der Ukraine enthalten, wo seit 1990 jährlich 200 000–500 000 Gänse gezählt werden;)*** = in dieser Zahl sind ca. 330 000 unbestimmte Gänse enthalten).

WHITE-FRONTED GOOSE (*Anser albifrons*)					
Period	Baltic-North sea-group	Pannonic group	Pontic Annatolian group	Population size	Author
1950–60	10 000–50 000	400 000–500 000	?	–)*	BG 68, U 65
1960–70	50 000–100 000	100 000–150 000	500 000–600 000	650 000–800 000	BG 68, CS 77 Tea 76, P 72
1970–80	200 000–300 000	100 000–175 000	250 000–300 000)**	550 000–775 000	L 90, PF 90, S 80, Ru 87
1980–90	c. 400 000	c. 100 000	c. 250 000)**	c. 750 000	M 91 & 92
1990–93	400 000–600 000	10 000–40 000	350 000–700 000)***	760 000–1 340 000	RT 93, RS 94, R 95

mained stable and that there has been a major shift of focal points of goose wintering from Central and Eastern Europe to Western Europe during the last 40 years (Tab. 1).

Decreasing Whitefront numbers are reported by PERENNOU et al. (1990), SCOTT & ROSE (1989), VAN DER VEN (1987 & 1988) and YOKOTA et al. (1982) from the winter counts in the Eastern Palearctic.

3.1.2. Breeding densities and estimates of the number of Whitefronts in the breeding areas

In view of the vast extension of the breeding areas, the variability of habitats and breeding densities as well as the transport difficulties for researchers the quality of these data is sure to be poor, but still could be sufficient to give some indications about the status of the species in the breeding areas if monitoring data from the same areas are used. But before discussing the situation in the breeding areas it is necessary to define the breeding area of the population concerned.

The White-fronted Geese wintering in the Western Palearctic breed on the tundra between the July isotherms of 4° C in the north and 10° C in the south, the Kanin Peninsula in the west and the Chatanga river in the east (CRAMP & SIMMONS 1977, ROGACHEVA 1992, RUTSCHKE 1987, VOOUS 1960). ALFERAKI (1904) also reports of breeding Whitefronts in Finland as well as at the Kola Peninsula during the 19th century, but there are no records in this century of breeding White-fronted Geese west of the Kanin Peninsula.

Using the data of Russian biologists and several international expeditions since 1989 it has been possible to compile a series of annual estimates of breeding densities/km^2 of White-fronted Geese of the Taimyr Peninsula between the 1960s and the 1990s. The data were gathered in the river basins of the Pjassina river (western Taimyr) and Taimyra river (eastern Taimyr) at more or less the same sites with annually variable research areas between several 100 and 10 km^2 (Tab. 2). Based on large scale studies during the early 1990s KRIVENKO (1994) estimated the goose density *(An-*

Tab. 2. Nest densities in pairs/km² of White-fronted and Beau Geese since the 1960s at the Taimyr Peninsula according to data of russian biologists (e. g. CHUPIN, KOKOREV, ZYRIANOV pers. comm.) and own data (research area between 10 and several 100 km²). – Brutdichten der Bläß- und Saatgans auf der Taimyr Halbinsel in Paare/km² seit den 1960er Jahren nach Daten Russischer Forscher (u. a. CHUPIN, KOKOREV, ZYRIANOV pers. Mitt.) sowie eigenen Daten (Untersuchungsgebiet zwischen 10 und einigen 100 km²).

Period	Western Taimyr (Pjassina river basin)			Eastern Taimyr (Taimyra river basin)		
	Beeding density in pairs/skm		n	Beeding density in pairs/skm		n
	Anser albifrons	*Anser fabalis*	Years	*Anser albifrons*	*Anser fabalis*	years
1960s	1.2 (0.3–1.7)	2.1 (1.7–2.5)	3	2.5 (1.5–4.0)	3.7 (1.5–6.0)	3
1970s	0.2 (0.1–0.2)	0.2 (0.0–0.3)	3	1.3 (1.0–1.5)	1.8 (1.4–2.1)	2
1980s	0.5 (0.2–0.9)	0.1 (0.0–0.2)	3	0.4 (0.1–0.9)	0.2 (0.1–0.6)	6
1990s	0.3 (0.1–1.0)	0.1 (0.0–0.2)	3	0.3 (0.1–1.0)	0.1 (0.1–0.2)	3

ser albifrons, Anser fabalis, Anser erythropus, Branta bernicla, Branta ruficollis) for the Taimyr Peninsula at 1–2 individuals/km².

Although the estimated breeding densities of the Taimyr Peninsula are probably not representative of the whole breeding area, the densities found at both sites seem to be comparable; there is no increasing tendency in breeding densities of White-fronted Geese (and Bean Geese) in this part of the breeding range between the 1960s and 1990s and the situation since the 1970s has remained stable at a lower level than before. High breeding densities as found up to the end of the 1960s have not been recorded since then.

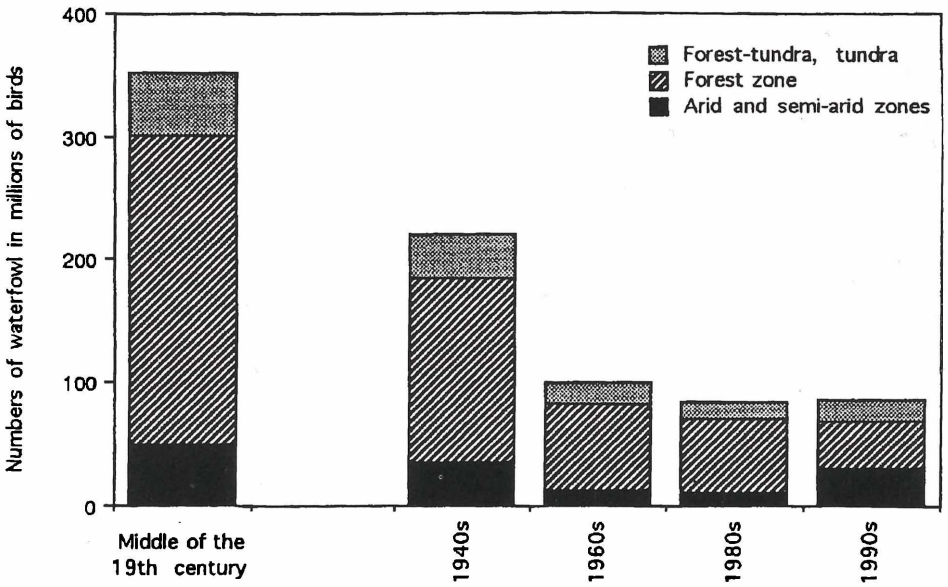

Fig. 1: Changes in the number of waterfowl (Anseriformes) on the territory of the former USSR between 1850 and 1990 according to FLINT & KRIVENKO 1990 and KRIVENKO 1995.
Änderungen in den Wasservogelbestandszahlen (Anseriformes) auf dem Territorium der ehemaligen UdSSR zwischen 1850 und 1990 nach FLINT & KRIVENKO 1990 und KRIVENKO 1995.

In Russian literature there is a uniform picture of the population development in White-fronted Goose. FLINT & KRIVENKO (1990) reported that during the 1980s the population of White-fronted Goose in Russia (estimated size of the whole Eurasian population about 1.3 million birds) seemed to be stable. According to these authors, the present numbers of waterfowl on the territory of the former USSR have generally more than halved since the 1940s and the waterfowl numbers breeding in the forest-tundra and tundra have been reduced by about one third since the 1940s, but they seem to have remained quite stable since the 1960s (Fig. 1). Recently KRIVENKO (1995) estimated the whole Whitefront breeding population of Eurasia, i.e of the Western and Eastern Palearctic together, at about one million birds, based on the results of a recent Russian monitoring project, which would mean that the total Whitefront numbers in Russia are still decreasing. FLINT & KRIVENKO (1990) and KRIVENKO (1995) report a decreasing Whitefront population from the Eastern Palearctic and a stable one from the Western Palearctic.

This general picture is confirmed by recent Russian studies in several parts of the breeding area. For the European part of the Russian tundra MINEYEV (1995) estimated the present number of Whitefronts between 100 000 and 180 000 and recorded an increasing tendency. RYABITSEV (1995) recently found an increase in Whitefront numbers at the Yamal Peninsula, whereas KALYAKIN (1995) recorded an unclear status in the Western Siberian breeding sites.

ROGACHEVA (1992) stated that the Taimyr population of White-fronted Goose (estimated population size about 400 000–450 000 birds, i.e. about 50% of Whitefront numbers counted at the Western Palearctic wintering sites) has undergone a sharp decline since the 1940s and at present has probably stabilized, but at a much lower level than before.

Based on the Whitefront numbers recently estimated by MINEYEV (1995) for the European part of the breeding area and by ROGACHEVA (1992) for the Taimyr Peninsula, the size of these breeding areas as well as an assumed annual recruitment rate of 30%, the mean Whitefront breeding density in European Russia is 0.18 pairs/km^2 and on the Taimyr Penisula 0.16 pairs/km^2 (Tab. 3). For a mean breeding density of 0.17 pairs/km^2 the population of Yamal and Gydan Peninsulas can be calculated at 250 000–300 000 Whitefronts. On the basis of these data and calculations the whole Western Palearctic population of White-fronted Geese has to be estimated at 750 000–930 000 birds (i.e. m = about 850 000).

A clear decrease of the Whitefront populations in the Eastern Palearctic was found by DEGTYAREV (1995), SYROECHKOVSKI Sr. (1995) and SYROECHKOVSKI Jr. (1995). The waterfowl populations of Eastern Sibiria (including geese) at the beginning of the 1990s were estimated by KRIVENKO (1994) at a level that was about half the level that was estimated for the 1980s by FLINT & KRIVENKO (1990).

Tab. 3. Estimated population size and distribution of Western Palearctic White-fronted Goose in the breeding area during the 1980s according to MINEYEV 1995 and ROGACHEVA 1992 as well as own estimates (see text).
Geschätzte Bestandsgröße und -verteilung der west-paläarktischen Bläßgans im Brutgebiet in den 1980er Jahren nach Daten von MINEYEV 1995 und ROGACHEVA 1992 sowie eigenen Schätzungen (siehe Text).

Breeding area	estimated size of breeding area in skm	Size of White-fronted Goose population estimated number	Ø	author	Ø breeding densit in nests/skm
Kanin-Vaygach Isl.	120 000	100 000–180 000	140 000	Mineyev 1995	0.18
Yamal-Gydan	250 000	250 000–300 000	275 000	own estimates	0.17
Taimyr	400 000	400 000–450 000	425 000	Rogacheva 1992	0.16
Western Palearctic	770 000	750 000–930 000	840 000		0.17

Summarizing it can be stated that based on data gathered in the Palearctic breeding areas, the Western Palearctic population seems to be stable at present at a level of about 850 000 Whitefronts (range 700 000–1 000 000), whereas the Eastern Palearctic population seems to be decreasing, which could explain the decreasing tendency for the total Eurasian population found by FLINT & KRIVENKO (1990) and KRIVENKO (1994).

3.2. Reproduction and mortality rates

3.2.1. Reproductive success of White-fronted Geese in Western Europe

The percentage of juvenile White-fronted Geese in the wintering areas varies widely from winter to winter. The average reproduction rate during the period 1977–1995 – deducted from the mean proportion of first-winter birds counted at the wintering sites of the Lower Rhine area – is 27.2% (Tab. 4). In the Netherlands the mean proportion of first-winter Whitefronts during the period 1977–1990 was 28.4% (GANZENWERKGROEP 1979, 1980, 1981, 1983, 1984a & b, 1986, 1987a & b, 1989, 1990, 1991, 1992).

The compilation of the annual proportion of first-year birds 1957–1994 of Figure 2 shows, that the annual proportion of juvenile White-fronted Geese estimated at Western European wintering sites shows a significant decreasing tendency over the last 30 years (from about 34% at the end of the 1950s to about 27% in the first half of the 1990s).

Years with bad reproduction rates followed peak lemming years in 8 out of 12 cases (Fig. 2; MOOIJ et al. 1995).

3.2.2. Estimated mortality of White-fronted Geese in the Western Palearctic

During migration as well as on the wintering grounds White-fronted Geese are heavily hunted. They are fully protected in only a few countries (LAMPIO 1983, LANDRY 1990). According to a conservative estimate of the annual goose bags in the Western Palearctic (DICK 1992, FARAGO 1992, HEDLUND 1992, JEPSEN & MADSEN 1992, LANDRY 1990, MOOIJ 1991b & 1992, MUNTEANU 1992, PRIKLONSKI & SAPETINA 1990, OOSTERBRUGGE et al. 1992, RUTSCHKE 1973, URBANEK 1992, WIELOCH 1992, WIESE 1991; Tab. 5), it can be stated that during the 1960s and 1980s every year about

Tab. 4. Annual proportion of first-winter White-fronted Geese estimated at the goose wintering site of the Lower Rhine between winter 1977/78 and 1995/96.
Jährlicher Jungvogelanteil bei der Bläßgans ermittelt im Gänsewintergebiet am Unteren Niederrhein zwischen Winter 1977/78 und 1995/96.

Winter	% juvenile	n	Winter	% juvenile	n
1977/78	29.4	8082	1987/88	30.3	6874
1978/79	11.3	10921	1988/89	45.5	27276
1979/80	26.8	7314	1989/90	12.8	17784
1980/81	24.3	4535	1990/91	25.0	2440
1981/82	37.2	8286	1991/92	38.0	3625
1982/83	26.9	7511	1992/93	8.7	5713
1983/84	29.7	16458	1993/94	32.1	8842
1984/85	25.6	3246	1994/95	33.2	1542
1985/86	47.7	7543	1995/96	13.9	5069
1986/87	17.7	9397	1977–1995	27.15	162458

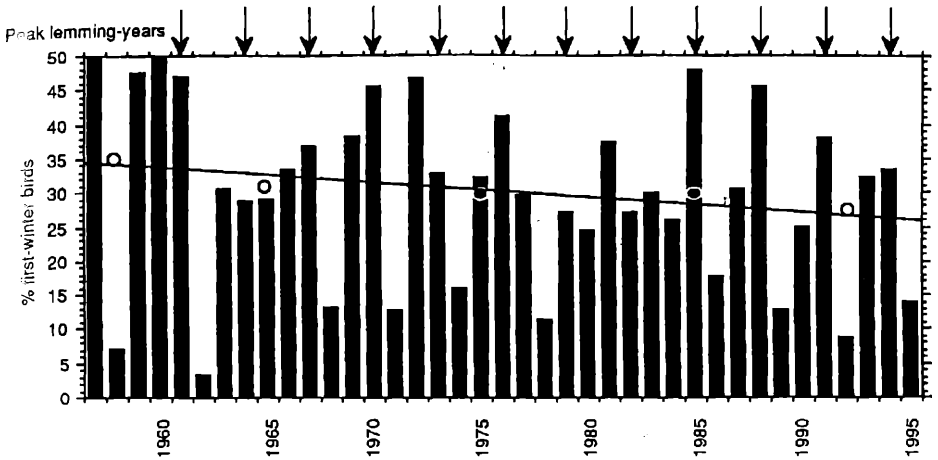

Fig. 2: Estimated proportion of first-winter White-fronted Geese on the goose wintering sites of Western Europe (GANZENWERKGROEP 1976–1992, LEBRET et al. 1976, MOOIJ 1993 and own estimates), the mean values for the 1950s, 1960s, 1970s, 1980s and 1990s (circles), the longyear trend (solid line) and peak lemming years at the Taimyr Peninsula (arrows) according to RYKHLIKOVA & POPOV (1995) as well as KOKOREV and ZYRIANOV (pers. comm.).
Jährlicher Jungvogelanteil bei der Bläßgans ermittelt auf den Winterrastplätzen West-Europas (GANZENWERKGROEP 1976–1992, LEBRET et al. 1976, MOOIJ 1993 und eigene Daten), Mittelwerte für die 1950er, 1960er, 1970er, 1980er, 1990er Jahre (Kreise), der langjährigen Trend (durchgezogene Linie) und Jahre mit einem hohen Lemmingbestand auf der Taimyr Halbinsel (Pfeilen) nach RYKHLIKOVA & POPOV (1995) sowie KOKOREV und ZYRIANOV (pers. Mitt.).

280 000–300 000 geese (mainly *Anser*-geese) were killed by hunters on the migratory routes of the Western Palearctic. There are no data about the species distribution of the goose bags, but based on the numbers of geese and the numbers of Whitefronts in each country as well as hunting regulations it was estimated that during the 1960s and 1980s 50–60% of the annual goose bags of these countries were White-fronted Geese. This would mean that about 165 000 Whitefronts (about 20% of the population) were killed by hunters every year during the 1960s and 1980s.

Not included in these numbers are the birds that die after crippling or lead poisoning, which means that to this mortality rate caused by direct killing by shooting at least another 25% of the total number bagged, i. e. about 5% of the population has to be added, caused by indirect effects of shooting and crippling loss (EBBINGE 1991, KALCHREUTER 1994, MOOIJ 1990 & 1991d, MOREHOUSE 1992).

Based on these data it can be stated that at least about 25% of the Western Palearctic White-fronted Goose population was directly or indirectly killed by shooting during the 1960s and 1980s. The annual rate of natural mortality was estimated by EBBINGE (1991) at 5–6%, which means that the total annual mortality during the 1960s and 1980s must have reached at least about 30%.

Using the formulae of EBBINGE (1991), REMMERT (1992) and of BELL et al. (1993) (see method) as well as the estimated population size of Table 1 to calculate the annual mortality rate we find a mean mortality rate of 26–36% (m = 31%) for the Western Palearctic population of the White-fronted Goose (Tab. 6), of which about 80% is caused by shooting. These figures suggest that hunting is the most important cause of death for the species.

Tab. 5. Estimated annual goose and Whitefront bags in the Western Palearctis during the 1960s and 1980s (Source: DICK 1992 (D 92), DOUDE VAN TROOSTWIJK 1974 (DT 74), EBBINGE 1991 (E 91), Fa 92, HEDLUND 1992 (H 92), JEPSEN & MADSEN 1992 (JM 92), LANDRY 1990 (L 90), MOOIJ 1991 b & 1992 (Mo 91 b & 92), MUNTEANU 1992 (Mu 92), OOSTERBRUGGE et al. 1992 (Oea 92), PRIKLONSKI & SAPETINA 1990 (PS 90), RUTSCHKE 1973 (R 73), URBANEK 1992 (U 92), WIELOCH 1992 (W 92), WIESE 1991 (Wie 91).
Geschätzte jährliche Gänse- und Bläßgansstrecke in der westlichen Paläarktis in den 1960er und 1980er Jahren. (Quellen s. o.)

Country	Estimated goose bag/year 1960s	Author	1980s	Author	Estimatebag/year Whitefronts 1980s
Former USSR (west)	c. 230 000	R 73, PS 90	c. 180 000	PS 90	c. 120 000
Poland	c 6 500	R 73	c. 12 000	L 90, W 92	c. 6 500
Danmark	c. 10 000	R 73	12 000–13 000	J M 92	–
Sweden	c. 2 000	R 73	c. 7 500	H 92	–
Germany	c. 6 000	R 73	c. 10 000	Mo 91b & 92, Wie 91	c. 5 000
The Netherlands	c. 7 000	DT 74, E 91	35 000–50 000	Oea. 92, Wie 91	c. 27 000
Hungary	c. 7 500	R 73	7 000–7 500	Fa 92, L 90	c. 2 000
former Czechkoslovakia	c. 1 500	R 73	c. 1 500	U 92	c. 100
Austria	c. 1 700	R 73	c. 2 000	D 92	c. 400
Rumania	c. 5 000	Mu 92	3 000–5 000	—	c. 4 000
former Yugoslavia	unknown	–	unknown	–	unknown
Bulgaria	c. 7 000	R 73	7 000–14 000	–	unknown
Greece	unknown	–	unknown	–	unknown
Turkey	unknown	–	unknown	–	unknown
TOTAL	c. 285 000		c. 290 000		c. 165 000

Tab. 6. Mean annual propotion of juveniles (recorded at the wintering sites of Western Europe), estimated reproduction rate in the breeding area (estimated mortality of juveniles 10–20 % during autumn migration) and the estimated mean annual mortality rate (1957–1995 calculated according to the formulas of EBBINGE 1991, REMMERT 1992 and BELL et al. 1993, see text) for the Western Palearctic population of the White-fronted Goose since 1957.
Mittlerer jährlicher Jungvogelanteil (ermittelt aus den westeuropäischen Winterrastplätzen), geschätzte Reproduktionsrate in den Brutgebieten (bei einer geschätzten Jungvogelmortalität von 10–20 % während des Herbstzuges) und die geschätzte jährliche Mortalitätsrate (1957–1995 berechnet nach den Formeln von EBBINGE 1991, REMMERT 1992 und BELL et al. 1993, siehe Text) für die west-paläarktische Population der Bläßgans seit 1957.

Period	Juvenile %	estimated reproduction rate	estimated mortality rate according to EBBINGE 1991	REMMERT 1992	BELL et al. 1993	m
1957–1959	34.8	45.2	44.5	34.8	30.8	36.7
1960–1969	30.8	40.0	51.6	30.9	36.5	39.7
1970–1979	29.4	38.2	31.3	29.3	22.0	27.5
1980–1989	29.8	38.7	17.7	29.6	13.2	20.2
1990–1995	25.2	32.8				
Ø	30.0	39.0	36.3	31.2	25.6	31.0

3.2.3. Estimated reproduction and mortality rates of Western Palearotic White-fronted Geese

ROGACHEVA (1992) estimated the population size of White-fronted Geese at the Taimyr Peninsula at about 400 000–450 000 birds, i. e. about 50% of Western Palearctic Whitefronts. With an estimated population size of about 850 000 birds for the total Western Palearctic population and 400 000–600 000 Whitefronts regularly wintering in Western Europe (about 75%, mainly in the Netherlands and Germany) a considerable number of Whitefronts from the Taimyr Peninsula must winter in Western Europe (pure mathematically up to 50%), i. e. that on the Western European wintering sites we find a mixture of Whitefronts from several parts of the breeding area.

This assumption is supported by the results of the Whitefront marking programme at the Taimyr Peninsula which, based on the marking of 838 geese, show that in winter the Taimyr Whitefronts are distributed over several wintering sites of the Western Palearctic and that there is a regular exchange between the breeding/moulting population of White-fronted Geese of the Taimyr Peninsula and the wintering sites of Western Europe (MOOIJ et al. in prep., Fig. 3).

Based on this relatively close connection between the breeding/moulting sites of the Taimyr Peninsula and the Western European wintering sites I tried to get an impression of the annual mortality rates of first-year Whitefronts migrating to Western Europe.

In summer 1989 172 Whitefronts were captured on the Taimyr Peninsula, of which 32% were one year old birds (MOOIJ 1995a, MOOIJ et al. 1995). Half a year earlier the proportion of first-year birds was 45% at the Lower Rhine goose wintering site (Tab. 4) and 44% in the Netherlands (GANZENWERKGROEP 1991). In summer 1992 of 315 birds captured on the Taimyr Peninsula, 21% were one year old birds (MOOIJ et al 1995) and half a year earlier at the Lower Rhine, 38% were first-winter birds (Tab. 4). In both years only small numbers of geese started breeding because of bad weather

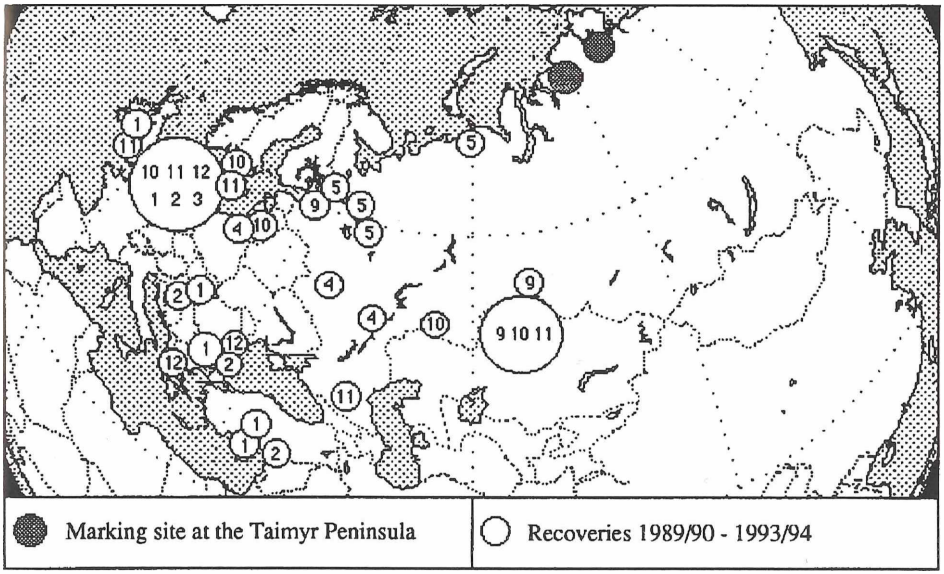

Fig. 3. Recordings of White-fronted Geese marked between summer 1989 and 1992 at the Taimyr Peninsula (The numbers refer to the month of recovery) according to MOOIJ et al. in prep.
Rückmeldungen von Bläßgänsen markiert zwischen Sommer 1989 und 1992 auf der Taimyr Halbinsel (Die Zahlen geben die Monate der Rückmeldungen an) nach MOOIJ et al. in Vorber.

conditions, i. e. in both summers most of the geese gathered on the moulting sites (MOOIJ et al 1995).

These data could indicate that in both seasons investigated at least 30–40% of the first-year birds disappeared between winter and summer within a period of about 6–8 months.

Assuming that this „disappearance rate" and the mortality rate are the same, this would mean that the mortality rate of first-year birds is 30–40% in the period of their first winter and spring migration. Not included in this figure is the juvenile mortality during autumn migration, which means that an annual mortality rate of 40–60% during the first year is probably not unrealistic.

Therefore the percentage of young birds recorded in the wintering area can give an indication of the reproduction rate of the geese in the previous summer, but depending on the annual hunting-kill during autumn migration, the actual reproduction rate is higher. Based on a mortality rate of first-year birds of 30–60% and a mean percentage of first-year Whitefronts of 26–35% (m = 30%) at the wintering site (Tab. 4 & 6), the mean actual annual reproduction rate should be calculated at a level of 33–45% (m = 39%), i. e. about 30% higher than the percentage of young birds recorded in the wintering area.

In this case also the annual mortality rate that was calculated with the formulae of EBBINGE (1991), REMMERT (1992) and BELL et al. (1993) based on the percentage of young birds recorded in the wintering area and the estimated population size of Tab. 1 would also be about 30% higher, i. e. about 40% (34–46%) instead of 31%, of which at least 60% is caused by shooting. An overall mortality rate of about 40% and a first-year mortality rate of 40–60% (m = 50%) means a mortality rate for birds older than one year of 25–40% (m = 33%).

Based on these calculations the mean annual reproduction rate of White-fronted Geese between 1957 and 1995 would be about 39%, the mean annual mortality rate of first-year birds about 50%, of birds older than one year 33%, and the mean overall annual mortality rate about 40% over the same period (Tab. 6). This would mean that since 1957 there has been hardly any reproductive surplus for population growth.

4. Discussion

The basis of all estimates of the size and development of the Western Palearctic population of the White-fronted Goose are international goose counts from the wintering sites. Although data have been available since the 1950s, and there has been international coordination of the counts since the 1960s, the whole monitoring system is still in a phase of development. Since the collapse of the political separation of Europe at the end of the 1980s there has been a marked increase in the area covered by the counts, but still there are problems with regional gaps and difficulties in identifying species, double counts due to border situations, different counting methods and relatively long counting periods (ROSE 1995). In spite of the marked increase in coverage and reliability, especially since the beginning of the 1990s, the available data still only can offer indications about the status of the species if used in combination with data from other sources.

Present hypotheses about the status of White-fronted Geese in the Western Palearctic are discussed now.

4. 1. Hypothesis of an increase in numbers of Western Palearctic Whitefronts

Based on the increase of Whitefront numbers on the wintering sites of Western Europe some authors assumed a general increase of Whitefronts in the Western Palearctic (e. g. EBBINGE 1991, KALCHREUTER 1991, 1994, RUTSCHKE 1987, 1990).

EBBINGE (1991) stated that, as the annual reproduction rate has not increased over the last 30 years, there has been a general increase in Western Palearctic Whitefronts due to an overall reduction in mortality as a result of a reduction of hunting-kill at the end of the 1960s. Based on the re-

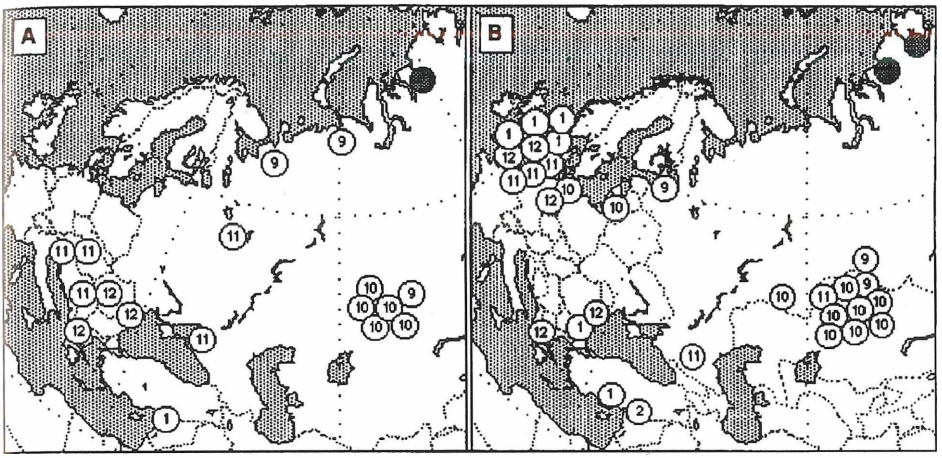

Fig. 4. Autumn and winter recoveries of shot White-fronted geese ringed at Taimyr Peninsula between 1966 and 1970 in the scope of a soviet ringing programme according to BORZHONOV 1975 (A) and between 1989 and 1992 in the scope of Dutch-German-Russian ringing schemes according to MOOIJ et al. in prep. (B) (The numbers refer to the month of recovery).
Herbst- und Winterrückmeldungen geschossener Bläßgänse, die zwischen 1966 und 1970 im Rahmen eines Russischen Beringungsprogrammes durch BORZHONOV 1975 (A) und zwischen 1989 und 1992 im Rahmen der Deutsch-Niederländisch-Russischen Beringungsprogrammen nach MOOIJ et al. in Vorber. (B) beringt wurden (Die Zahlen geben die Monate der Rückmeldungen an).

duced reporting rates of metal rings of White-fronted Geese marked in the Netherlands EBBINGE calculated a reduced mortality rate in the period before and after 1971.

Crucial to his calculations of mortality rates is the assumption that the population wintering in Western Europe is a more or less closed reproductive unit. In such closed reproductive units the difference between the population size of one winter and the population size in the following winter minus the juvenile birds can give an impression of the annual mortality. In more open units, that grow because of the immigration of birds formerly wintering at other sites, this calculation model is invalid.

EBBINGE (1991) found an overall decrease in recovery rates of Whitefronts marked in the Netherlands with metal rings between the periods 1953–1970 and 1971–1986. The total number of recoveries in the second period was about 57% of the number recovered in the first period and the proportion of recoveries from the former USSR dropped from 36% before 1971 to 23% after 1971, i. e. a reduction by about 40%. From these data EBBINGE concluded that this difference was caused by a reduced mortality between the two periods caused by reduced hunting mortality. According to Table 5 hunting mortality in the former USSR only dropped by about 22% between these two periods.

According to GURTOVAYA & LITVIN (1995) a constant decline of the reporting rate in Russia has been observed during the last 15 years, which could also explain a part of the decrease in the number of recoveries.

Recent analysis of the recoveries of Whitefronts marked at the wintering sites of the Netherlands shows that the wintering populations of White-fronted Goose in the Western Palearctic are characterized by a high degree of interchange (MOOIJ et al. in prep.) and that the breeding birds of the Taimyr Peninsula in winter are distributed over several wintering sites (Fig. 3, MOOIJ 1995a, MOOIJ et al. 1995, MOOIJ et al. in prep.). Furthermore the estimated goose numbers from the Taimyr Peninsula (ROGACHEVA 1992) as well as for the whole population (c. 850 000) showed that, at least

since the 1980s, there must have been a mixture of breeding birds of several Western Palearctic breeding areas at the wintering sites of Western Europe. This means that at least since then we have to consider all White-fronted Geese of the Western Palearctic as one reproductive unit, that according to ROGACHEVA (1992) is quite well separated from the Eastern Palearctic breeding population. No Whitefronts ringed or marked at the Taimyr Peninsula or in Western Europe have ever been recovered in the Eastern Palearctic.

Therefore the so-called „Baltic-North-Sea Population" wintering in Western Europe does not represent a closed reproductive unit, but a mixture of families from different parts of the Western Palearctic breeding area and EBBINGE's mortality calculation model cannot function in the way it was used. The reduced mortality found by EBBINGE can easily be explained by the increase of Whitefront numbers caused by immigration of birds formerly wintering elsewhere in Europe as well as a reduced reporting rate in Russia.

The estimation of mortality rates for the periods 1957–1970 and 1971–1989, which were calculated using EBBINGE's mortality calculation formula as well as the formulae given by REMMERT (1992) and BELL et al. (1993), based on the Whitefront numbers of Tab. 1, shows that there was a reduction in the mortality rate of about 10% between these two periods, accompanied by a comparable reduction of the reproduction rate (Tab. 6).

Another weak point in EBBINGE's calculation is the assumption that in the former USSR, Poland, Germany and the Netherlands the hunters are spread equally over the range of the geese and are equally likely to report the rings of shot geese. The hunters of these countries are reponsible for about 88% of the estimated total goose bag (Tab. 5) and for about 70% of the reported recoveries of shot geese (EBBINGE 1991), which seems to support the assumption.

Upon closer inspection, however, it becomes noticeable that there are considerable differences in reporting rates between these countries. In the former USSR about 66% of the goose bag is shot and about 31% of the rings reported, whereas in Germany and Poland about 7% of the goos bag is shot and about 26% of the rings reported and in the Netherlands about 14% of the goose bag is shot and about 34% of the rings reported.

These figures show that the reporting rate in Germany, Poland and the Netherlands is comparatively high, whereas the reporting rate of the former USSR is about six times lower. Moreover, according to GURTOVAYA & LITVIN (1995), a constant decline in the reporting rate in Russia has been observed in the last 15 years. Maybe the reporting rate in Russia declined even earlier because, according to the data of EBBINGE (1991), the proportion of recoveries from the former USSR declined from 36% before 1971 to 23% after 1971, whereas the number of recoveries from the Netherlands increased from 26% to 48% and for the rest of Europe did not show any significant changes.

These differences in reporting rates could be due to the knowledge about the ringing programme. FOG (1965) found that in Mallard the reporting rate by hunters could be as high as about 56% if the ringing programme was well known to them. If not, the reporting rate only reached about 23% although hunting pressure was the same in the areas compared. Comparable data are reported from the USA by KALCHREUTER (1994). COOKE et al. (1995) estimated the reporting rate of hunters in the well-known American Snow Goose banding scheme to be about 33%, and EBBINGE (1991) for the Whitefront ringing scheme, well known to Dutch hunters, at 20–25%.

The hunter density varies greatly within Europe and is much higher in some Western European countries (e. g. about 1.0 hunters/km^2 in the Netherlands and Germany) than in Eastern Europe (e. g. Russia and Rumania 0.2, Poland 0.3 and Hungary 0.4 hunters/km^2) (KOSTIN 1994, LANDRY 1990, WIESE 1995). Also within the countries the distribution of hunters varies greatly. In Russia, for example, the hunter density is high in areas with a high human population density (e .g. more than 2 hunters/km^2 in the Moscow region) and low in the more natural areas (e. g. 0.03–0.08 hunters/km^2 in northwestern Siberia and about 0.1 in northern Russia), but in some goose staging areas that can be reached easily by people, the density of goose hunters can be quite high during the sta-

ging of the geese (e. g. surroundings of Moscow, southern part of the westsiberian lowland, Turgaiskoje Plateau in Kazakhstan, some parts of the breeding areas). Although only about 6% of all hunters of the former USSR live in Kazakhstan, in this country about 34% of the total waterfowl bag of the former USSR was taken between the 1960s and 1980s (PRIKLONSKI & SAPETINA 1990).

These data show that, because hunters are not equally spread over the range of the geese and are not equally likely to report rings, it is not possible to get reliable information about the actual distribution of goose numbers or mortality rates based on the recoveries of ringed geese.

Further EBBINGE's assumption, based on information from RUTSCHKE (1976), that White-fronted Geese have been protected in the spring staging areas from 1971 onwards is only partly true. For goose hunting in Russia there is a traditional spring hunting season, using dummies, for a maximum of 10 days with a daily bag limit of 2 geese per hunter. The opening and closing days vary according to the region, and depend on the presence of goose concentrations in the region. There is a second hunting season beginning on the second Saturday in August or on the first Saturday in September and ending not later than the 30th September. The possibility of opening spring hunting, the season length and opening and closing dates are all fixed by special decree of the regional committees of the hunting board. It is very difficult to control illegal hunting activities in Russia (GUSAKOV 1990, LAMPIO 1983, NOWAK 1995, ROGACHEVA 1992, RUSANOV & KHAKIN 1990, AMIRCHANOV, KOSTIN, pers. comm.) and according to several Russian experts the official estimates of the annual Russian goose bag (Tab. 3) are definitely too low (e. g. AMIRCHANOV, FLINT, KOSTIN, KRIVENKO pers. comm., ROGACHEVA 1992).

One example to illustrate this fact: the authorities in the eastern part of the Taimyr Peninsula (Chatanga district) assured that the legal hunting bag-size of geese at Eastern Taimyr during the 1980s was about 5 000–6 000 birds per year and that the total annual goose bag of the Taimyr Peninsula reaches 10 000 – 15 000 geese. Based on informations gathered by Russian biologists working in the area for many years ROGACHEVA (1992) made an inofficial estimate and states that up to 30 000 Whitefronts were shot at Taimyr Peninsula annually during the 1980s. KOSTIN (1981) estimated the annual goose bag for the Pyassina-river basin at Western Taimyr alone at up to 9 000 geese, mainly Whitefronts, and considers spring hunting in the breeding areas to be one of the most important threats to arctic geese.

KALCHREUTER (1994) stated, based on the inoreasing number of Whitefronts in Western Europe, that there was no decrease in reproduction rate although the size of the Western Palearctic population quadrupled in the past decennia and therefore density dependent factors still do not influence population growth. He further stated that the population shows a marked increase in spite of high hunting pressure and concludes that the formerly low population level was not caused by hunting during migration and in the wintering areas, but by the formerly high hunting pressure in the breeding areas. Also RUTSCHKE (1990) used the increased Whitefront numbers counted on the west-European wintering grounds to postulate a general increase in the Western Palearctic Whitefront population and stated that this increase is due to reduced mortality caused by improved feeding conditions on agricultural crops during winter as well as by reduced hunting pressure and better protection of geese during spring migration and in the breeding areas.

But according to the figures of Tab. 1, there seems to be no general increase in Whitefront numbers in the Western Palearctic and according to Fig. 2 and Tab. 6, there has been a steady decline in reproductive and mortality rates since the 1950s (which could indicate that density dependent factors do influence population growth). Further recent information from the breeding areas and the migratory routes through Russia (KOKOREV pers. comm., KOSTIN 1981 & pers. comm., NOWAK 1989, 1990, 1991, 1995, ZYRIANOV pers. comm.) does not indicate that protection has improved or that hunting pressure has been reduced significantly during the last decades.

Based on information from three arctic expeditions (NOWAK 1989, 1990, 1991, 1995), NOWAK reported that between 1930 and 1960 local hunters and prisoners of the Stalin camps systematically

gathered eggs, caught moulting and juvenile geese and shot great numbers of geese. NOWAK states that as a result of these activities the numbers especially of the Brent Goose decreased in Western Europe but have recovered again since this hunting pressure decreased in the mid 1960s. This intensive use of the food resource „geese" resulted, according to NOWAK, in the elimination of local goose populations.

These traditional hunting practices (ALFERAKI 1904, SEEBOHM 1901) surely could have had a great influence on local populations, especially on colonial breeding species like Red-breasted and Brent Geese, that in addition to their colonial behaviour also show strong social bonds in the moulting groups and can easily be forced out of the protecting water as a closed group. These hunting practices probably never had the same influence on non-colonial breeding species like White-fronted and Bean Goose. The prisoners had only limited possibilities to move over greater distances on the tundra, which made it very difficult for them to gather eggs of solitary breeding goose species (KOSTIN pers. comm., NOWAK 1995). Furthermore, the behaviour of moulting White-fronted and Bean Geese, that in case of danger can hardly be forced to leave the water and do not stay in closed flocks in such situations, also makes it difficult to catch bigger numbers and to put the same hunting pressure on these *Anser* species as can be put on *Branta* species. For these reasons the effect of these goose harvest practices probably never were as threatening to *Anser* species as they were to *Branta* spezies (KOSTIN pers. comm., NOWAK 1995). For the *Anser* species the influence of sport hunting in the breeding areas during spring seems to be more important and this kind of hunting pressure has not changed until the early 1990s (KOSTIN 1981 & pers. comm.).

At the moment there are no signs of reduced goose hunting in the Western Palearctic. In Western Europe, where most of the Western Palearctic geese winter, annual goose bags have increased (Tab. 7), e. g. in the Netherlands from about 7 000 in the 1960s and about 10 000 in the 1970s, to at least 35 000–50 000 in the 1980s and 60 000–70 000 in the 1990s, in Germany from about 6 000 in the 1960s and about 7500 in the 1970s, to about 10 000 in the 1980s and 30 000–40 000 in the 1990s (MOOIJ 1995b). In the states of the former USSR the hunting bag seems to have slightly decreased between the 1960s and 1980s but the overall level for the Western Palearctic seems not to have changed significantly between the two compared periods (Tab. 5). Based on these data there is no evidence to support the thesis that the hunting pressure on White-fronted Geese was considerably lower after 1971 than it was before.

4.2. Hypothesis of a shift of wintering Whitefronts within the Western Palearctic

4.2.1. Estimated number of Western Palearctic Whitefronts

From the compilation of the numbers of White-fronted Geese at the wintering sites of the Western Palearctic during the last decades, that surely have been far from complete in the 1950s and 1960s (which means that the actual numbers could have been higher, Tab. 1) as well as the estimates of the development of the breeding populations in Russia and the data on breeding densities (Tab. 2), there seems to be no indication of a general increase of White-fronted Goose numbers in the Western Palearctic. The fact that the goose counts since the 1960s show no marked increase in Western Palearctic Whitefront numbers in spite of improved coverage, can hardly support the hypothesis of an increasing population of the White-fronted Goose in the Western Palearctic. Instead of a general increase in numbers Tab. 1 suggests a considerable change in the distribution of White-fronted Geese within Europe and Southwestern Asia during winter.

Based on the statement of FLINT & KRIVENKO (1990), KRIVENKO (1994) and ROGACHEVA (1992) that the waterfowl populations of Russia – the Whitefront population included – have shown a sharp decline in the last decades but at present seem to stabilize at a considerably lower level than before

as well as on the present data of the population estimates from the international goose counts, it seems justfiable to consider the Whitefront population as more or less stable.

It is noteworthy that the independent estimates from the wintering sites and breeding areas show a comparable size of the Western Palearctic population of c. 850 000 ± 150 000 White-fronted Geese.

4.2.2. Mortality rates

In the first stage of their lives juvenile geese live in family structures and family break-up occurs in spring or early summer (Owen & Black 1990, Rutschke 1986). At the latest after arrival in the breeding areas the family structure breaks up and the adults start a new breeding cycle. In bad re-

Tab. 7. Numbers of Greylag, Bean and White-fronted Geese wintering in Germany and the Netherlands during January 1988–1994 (midwinter counts) and the estimated annual goose bags in these countries.
Anzahlen Grau-, Saat- und Bläßgänse, die zwischen 1988 und 1994 im Januar in Deutschland und den Niederlanden überwinterten (Midwinterzählungen) sowie die geschätzte jährliche Gänsestrecke dieser Länder.

JANUARY (D) YEAR	1988	1989	1990	1991	1992	1993	1994
SPECIES							
Greylag Goose (*Anser anser*)	9580	3404	10 130	3757	4775	5896	12 372
Bean Goose (*Anser fabalis*)	128 331	106 338	178 782	193 278	233 670	207 945	185 587
White-fronted Goose (*Anser albifrons*)	194 471	203 702	228 043	248 628	319 611	258 634	224 670
TOTAL	332 382	313 444	416 995	445 663	558 056	472 475	422 629
Goose bag	8400	8800	10 300	7660	28 850	27 900	30 600
Proportion of goose numbers D	2.5	2.8	2.5	1.7	5.2	5.9	7.2

JANUARY (NL) YEAR	1988	1989	1990	1991	1992	1993	1994
SPECIES							
Greylag Goose (*Anser anser*)	25 300	23 000	31 000	49 930	49 000	48 000	69 900
Bean Goose (*Anser fabalis*)	66 350	34 000	51 800	31 800	46 000	44 600	43 500
White-fronted Goose (*Anser albifrons*)	339 000	421 000	465 000	470 000	480 000	413 000	483 400
TOTAL	430 650	478 000	547 800	551 730	575 000	505 600	596 800
Goose bag	31 500	49 200	50 900	66 600	71 000	64 250	75 000
Proportion of goose numbers NL	7.3	10.3	9.3	12.1	12.4	12.7	12.6

JANUARY (NL+D) YEAR	1988	1989	1990	1991	1992	1993	1994
SPECIES							
Greylag Goose (*Anser anser*)	34 880	26 404	41 130	53 687	53 775	53 896	82 272
Bean Goose (*Anser fabalis*)	194 681	140 338	230 582	225 078	279 670	252 545	229 087
White-fronted Goose (*Anser albifrons*)	533 471	624 702	693 043	718 628	799 611	671 634	708 070
TOTAL	763 032	791 444	964 755	997 393	1 133 056	978 075	1 019 429
Goose bag	39 900	58 000	61 200	74 260	99 850	92 150	105 000
Proportion of goose numbers NL+D	5.2	7.3	6.3	7.5	8.8	9.4	10.3
Proportion of w. palearctic population	2.5	3.6	3.8	4.6	6.2	5.8	6.6

productive years most birds (juvenile and adult) are gathered on the moulting sites early, but some adults still can be on the breeding sites, with or without goslings. Therefore the juvenile rate found in the goose catches at the Taimyr Peninsula in the poor reproductive summers of 1989 and 1992 is probably over-estimated. Furthermore, there are no data available on the mortality rate during autumn migration. Because of these facts the juvenile mortality since the past winter could be higher than the 40–60% calculated in this study. Although these figures can only give an indication of the actual juvenile mortality they are confirmed by the data of several goose and duck species gathered by BELL et al. (1993), BOYD (in KUIJKEN 1975), COOKE et al. (1995), FRANCIS & COOKE (1993), KALCHREUTER (1994), OWEN (1982) and OWEN & BLACK (1990 & 1991) that show that about 30–70% of the juveniles do not survive the first year of their life.

Compared to the mean annual mortality rate for the whole population of 12–30% as estimated by EBBINGE (1991), 25–36% as estimated by BAUER & GLUTZ VON BLOTZHEIM (1968), BOYD (in KUIJKEN 1975), DOUDE VAN TROOSTWIJK (1966 & 1974) and KUIJKEN (1975) as well as of about 40% calculated in this study, this seems a rather high value, but it supports the assumption in BAUER & GLUTZ VON BLOTZHEIM (1968), BOYD (in KUIJKEN 1975), COOKE et al. (1995) and RUTSCHKE (1987) that the mortality rate of first-year birds is about double the mortality rate of adults.

4.2.3. Indications of an innereuropean shift of wintering geese

Based on the estimated Whitefront numbers in Western Europe (about 600 000), in the Western Palearctic (about 850 000) and on the Taimyr Peninsula (400 000 – 450 000 birds), at least since the beginning of the 1980s, when the number of wintering White-fronted Geese in Western Europe exceeded 350 000 – 400 000 birds, part of the breeding Whitefronts of the Taimyr Peninsula must have been wintering in Western Europe. This would mean that a considerable number of Whitefronts from the Taimyr Peninsula shifted to the wintering sites of Western Europe during the 1980s.

A shift in wintering Whitefront numbers is also indicated by the recoveries of White-fronted Geese ringed at the Taimyr Peninsula since the 1960s (MOOIJ et al. in prep.). Between 1966 and 1970 BORZHONOV (1975) marked 90 White-fronted Geese with metal rings at the Taimyr Peninsula. Up to 1975 nineteen of these birds (21%) had been recovered, all of them shot. Of these Whitefronts 17 were recovered during autumn migration as well as on the wintering sites, of which 15 used the southern flyway to Eastern Europe (88%) and none of these geese was reported from Western Europe. Two geese were shot in the Northern Russian tundra (Bolschesemelskaja Tundra), which according to KRIVENKO (1994) and MINEYEV (1995) is part of an important migratory route to the west, but this route is also used by geese flying to Eastern Europe. To reduce bias these birds were assumed to have been heading for Western Europe. There were no recoveries from the Western European wintering sites (Fig. 4A). A comparison of the results of the marking programmes at the Taimyr Peninsula of BORZHONOV with the results of the German-Netherlands-Russian legring and neck-collar programme since 1989 (Fig. 4B, MOOIJ et al. in prep.) shows significant differences in the distribution of the recoveries. Of the 838 Whitefronts marked until 1992, 30 were reported shot during autumn migration and winter, of which 17 used the southern flyway (57%) heading for Southeastern Europe, 11 birds were reported shot from the Western European wintering sites and two from the flyway to them.

These facts indicate a shift of breeding birds of the Taimyr Peninsula from the wintering sites of Southeastern to Western Europe during the 1980s.

Changes in migratory routes and wintering sites seem to happen frequently in goose species. Red-breasted Geese *(Branta ruficollis),* often associating with White-fronted Geese during migration, have shifted from their traditional wintering sites at the Caspian Sea to the westcoast of the Black Sea since the 1950s. Since the 1960s the number of Redbreasts observed in North Sea countries has increased and one of these birds ringed in the Netherlands January 1972 was shot at theYamal Peninsula two years later (ALFERAKI 1904, CRAMP & SIMMONS 1977, KOSTIN & MOOIJ 1995,

RUTSCHKE 1987, VINOKUROV 1982 & 1990). ALFERAKI (1904) described that the migratory routes of the White-fronted Goose changed frequently and that their most important wintering sites in the last century were in Great Britain, Belgium, the Netherlands and the entire Mediterranean basin, especially Egypt. At present hardly any Whitefronts reach Egypt and bigger concentrations in the Mediterranean basin only can be found in Turkey and Greece.

5. Conclusions

Based on the data and reflections about the population size, reproduction rate and mortality rate discussed in this paper, there seems to be no significant change in population size and a steady decrease in reproduction and mortality rate of White-fronted Geese since the 1950s. There are a number of hints that the increase of the numbers of White-fronted Geese in Western Europe is the result of a major shift of wintering geese from other Western Palearctic wintering sites to the wintering sites of Western Europe. Although there are only few data to support the hypothesis of a major shift there are even less data to support the hypothesis of an increasing Whitefront population in the Western Palearctic. Therefore until more data are available it would be safer to accept the hypothesis that there is no actual increase in the numbers of the species in the Western Palearctic. In view of these reflections the increased hunting pressure on migrating and wintering Whitefronts in the Western Palearctic, as practised especially in Western Europe, could easily become a threat to the species.

6. Zusammenfassung

In der vorliegenden Arbeit wurden Daten zur Bestandsgröße im Winter- und Brutareal, zur Reproduktions- und Mortalitätsrate sowie Brutdichte der westpaläarktischen Population der Bläßgans mit dem Ziel analysiert, einen Eindruck von der gegenwärtigen Bestandsgröße und -entwicklung seit den 1950er Jahren zu gewinnen. Aufgrund der Analyse wurde festgestellt, daß es über diesen Zeitraum keine wesentlichen Änderungen in der Bestandsgröße und eine stetige Abnahme bei der Reproduktions- und Mortalitätsrate gab. Seit den 1950er Jahren hat der Bestand der in West-Europa überwinternden Bläßgänse stark zugenommen. Aufgrund dieser Tatsache wird häufig davon ausgegangen, daß der Gesamtbestand der westpaläarktischen Bläßgans zugenommen hat, aber es zeigt sich, daß über die gleiche Periode die Bläßganszahlen in großen Teilen Südost-Europas, der Türkei und der Kaspischen Region zurückgegangen sind bzw. mehr oder weniger stabil sind. Die analysierten Daten weisen daraufhin, daß die Bläßganszahlen in der westlichen Paläarktis wahrscheinlich nicht angestiegen sind, sondern daß die Zunahme der Bläßganszahlen in West-Europa vielmehr auf eine Schwerpunktverlagerung von überwinternden Gänsebeständen von anderen westpaläarktischen Gänserastplätzen nach West-Europa zurückzuführen ist. Deshalb könnte der zunehmende Jagddruck, wie zur Zeit insbesonders in West-Europa feststellbar, leicht zu einer Existenzgefährdung der westpaläarktischen Bläßgans-Population werden.

7. References

Alferaki, S. (1904): Geese of Russia. Kutschnerew & Co, Moscow (in Russian). * Bauer, K. M., & U. N. Glutz von Blotzheim (1968): Handbuch der Vögel Mitteleuropas. Band 2: Anatidae Entenvögel. 2. Akad. Verlagsges., Frankfurt/Main. * Bell, M. C., A. D. Fox, M. Owen, J. M. Black & A. J. Walsh (1993): Approaches to estimation of survival in two arctic-nesting goose species. In: Lebreton, J.-D. & Ph. M. North (1993): Marked Individuals in the Study of Bird Population. Birkhäuser, Basel/Boston/Berlin.: 141–156. * Bergh, L. M. J. van den (1983): De betekenis van het nederlands-westduitse grensgebied langs de Ne-derrijn als pleisterplaats voor wilde ganzen. RIN-report 83/7. * Ditto (1985): Ganzenpleisterplaatsen in Nederland. RIN-report 85/16. * Borzhonov, B. B. (1975): Migration of Taimyr geese derived from linging results. Materials for the Allunionconference on bird migration, Moscow, 2–5 June 1975 (in Russian). * Boyd, H., & J.-Y. Pirot (1989): Flyways and reserve networks for water birds. IWRB Special publication 9, Slimbridge. * Cooke, F., R. F. Rockwell & D. B. Lank (1995): The Snow Geese of La Pérouse Bay, Natural Selection in the Wild. Oxford Univ. Press, Oxford/New York/Tokyo. * Cramp, S., & K. E. L. Simmons (1977):

Handbook of the birds of Europe, the Middle East, and North Africa: the birds of the Western Palearctic. Vol. 1: Ostrich-Ducks. Oxford Univ. Press, Oxford. * Degtyarev, A. G. (1995): Localisation and status of geese mass moult sites in North Yakutia. Bulletin of Geese Study Group of Eastern Europe and Northern Asia, No.1 167–169 (in Russian). * Dick, G. (1986). Where have all Whitefronts gone? The situation of Anser albifrons in Lake Neusiedl (Fertö-To) area. Proc. 2nd Scientific Meeting of hungarian Ornithol. Soc., Szeged. * Ditto (1990): Decline of *Anser albifrons albifrons* in Central Europe. In: Matthews, G. V. T. (Ed., 1990): Managing Waterfowl Populations. IWRB Spec. Publ. 12, Slimbridge: 63–65. * Ditto (1992): National Report of Austria. In: Roomen, M. van, & J. Madsen (1992). Waterfowl and Agriculture: Review and future perspective of the crop damage conflict in Europe. IWRB Spec. Publ. 21: 112–115. * Doude van Troostwijk, W. J. (1966): Invloed van de jacht op ganzenpopulaties. Het Vogeljaar 14: 203–207. * Ditto (1974): Ringing data on White-fronted Geese *Anser a. albifrons* in the Netherlands, 1953–1968. Ardea 62: 98–110. * Ebbinge, B. S. 1991. The impact of hunting on mortality rates and spatial distribution of geese wintering in the Western Palearctic. Ardea 79: 197–210. * Ebbinge, B. S., & G. C. Boere (1991): Verslag van de Nederlandse deelname aan de internationale Taimyr-expeditie 1990. RIN/ Arnhem, NMF/Den Haag. * Ebbinge, B. S., L. M. J. van den Bergh, A. M. M. van Haperen, C. M. Lok, J. Philippona, J. Rooth & A. Timmerman (1987): Verspreiding en aantalsontwikkeling van in Nederland pleisterende ganzen. De Levende Natuur 88: 162–178. * Farago, S. (1992): National Report of Hungary. In: Roomen, M. van, & J. Madsen (1992): Waterfowl and Agriculture: Review and future perspective of the crop damage conflict in Europe. IWRB Spec. Publ. 21: 143–146. * Ditto (1995): Geese in Hungary 1986–1991. Numbers, Migration and Hunting Bags. IWRB Publ. 36, Slimbridge. * Farago, S., G. Kovac & T. Sterbetz (1991): Goose populations staging and wintering in Hungary 1984–1988. Ardea 79: 161–163. * Flint, V. Ye., & V. G. Krivenko (1990): The present status and trends of waterfowl in the USSR. In: Matthews, G. V. T. (Ed., 1990): Managing Waterfowl Populations. IWRB Spec. Publ. 12, Slimbridge: 23–26. * Fog, J. (1965): The Mallards from the Estate of Kongsdal. Dan Rev. Game Biol. IV(3): 65–94. * Francis, C. M., & F. Cooke (1993): A comparison of survival rate estimates from live recaptures and dead recoveries of lesser snow geese. In: Lebreton, J. D. & North, Ph. M. (1993): Marked Individuals in the Study of Bird Population. Birkhäuser, Basel (Boston/Berlin): 169–184. * Ganzenwerkgroep Rin. (1976): Voorlopige resultaten van de ganzentellingen in Nederland in het winterhalfjaar 1974–75. Watervogels 1(4): 91–102. * Ganzenwerkgroep Nederland (1977): Voorlopige resultaten van de ganzentellingen in Nederland in het winterhalfjaar 1975–76. 2e bericht. Watervogels 2: 102–115. * Ditto (1978): Resultaten van de ganzentellingen in Nederland in het winterhalfjaar 1976–77. 3e bericht. Watervogels 3: 145–163. * Ditto (1979): Resultaten van de ganzentellingen in Nederland in het winterhalfjaar 1977–78. 4e bericht. Watervogels 4: 73–91. * Ditto (1980): Resultaten van de ganzentellingen in Nederland in het winterhalfjaar 1978–79. 5e bericht. Watervogels 5: 65–95. * Ditto (1981): Resultaten van de ganzentellingen in Nederland in het winterhalfjaar 1979–80. 6e bericht. Watervogels 6: 119–142. * Ditto (1983): Ganzentellingen in Nederland in het seizoen 1980/81. Limosa 56: 9–17. * Ditto (1984a): Ganzentellingen in Nederland in het seizoen 1981/82. Limosa 57: 7–16. * Ditto (1984b): Ganzentellingen in Nederland in het seizoen 1982/83. Limosa 57: 147–152. * Ganzenwerkgroep Nederland/Belgie. (1986): Ganzentellingen in Nederland en Vlaanderen in 1983/84. Limosa 59: 25–31. * Ditto (1987a): Ganzentellingen in Nederland en Vlaanderen in 1984/85. Limosa 60: 31–39. * Ditto (1987b): Ganzentellingen in Nederland en Vlaanderen in 1985/86. Limosa 60: 137–146. * Ditto (1989): Ganzentellingen in Nederland en Belgie in 1986/87. Limosa 62: 81–90. * Ditto (1990): Ganzentellingen in Nederland en Belgie in 1987/88. Limosa 63: 71–79. * Ditto (1991): Ganzentellingen in Nederland en Belgie in 1988/89. Limosa 64: 7–15. * Ditto (1992): Ganzentellingen in Nederland en Belgie in 1989/90. Limosa 65: 163–169. * Gerdes, K. (1994): Lang- und kurzfristige Bestandsänderungen der Gänse *(Anser fabalis, A. albifrons, A. anser* und *Branta leucopsis)* am Dollart und ihre ökologischen Wechselbeziehungen. Die Vogelwarte 37: 157- 178. * Gerdes, K., & H. Reepmeyer (1983): Zur räumlichen Verteilung überwinternder Saat- und Bleßgänse *(Anser fabalis u. Anser albifrons)* in Abhängigkeit von naturschutzschädlichen und -fördernden Einflüssen. Die Vogelwelt 104: 54–67. * Gerdes, K., D. Heß, & H. Reepmeyer (1978): Räumliche und zeitliche Verteilungsmuster der Gänse *(Anser fabalis, A. albifrons* und *A. anser)* im Bereich des Dollart (1971–1977). Die Vogelwelt 99: 81–116. * Gurtovaya, E. N., & K. E. Litvin (1995): Recovelies of lings of geese and swans for 1980- 1994. Bulletin of Geese Study Group of Eastern Europe and Northern Asia 1: 20–26 (in Russian). * Gusakov, Ye. S. (1990): Restrictions on waterfowl hunting kill in the Russian Socialist Federated Soviet Republic. IWRB Spec. Publ. 12, Slimbridge: 151. * Hedlund, L. (1992): National Report of Sweden. In: Roomen, M. van, & J. Madsen (1992). Waterfowl and Agriculture: Review and future perspective of the crop damage conflict in Europe. IWRB Spec. Publ.

21: 171–174. * Jepsen, P. U., & J. Madsen (1992): National Report of Denmark. In: Roomen, M. van, & J. Madsen (1992): Waterfowl and Agriculture: Review and future perspective of the crop damage conflict in Europe. IWRB Spec. Publ. 21: 125–128. * Kalchreuter, H. (1991): On the impact of hunting on goose populations – a literature research. Ardea 79: 211- 216. * Ditto (1994): Jäger und Wildtier – Auswirkungen der Jagd auf Tierpopulationen. Hoffmann, Mainz. * Kalyakin, V. N. (I 995): Notes on distribution of goose species in coastal regions of the Barents Sea and in the north of west Siberia. In Bulletin of Geese Study Group of Eastern Europe and Northern Asia, No. l.: 150–157 (in Russian). * Kokorev, J. I. (1985): Number of gamebirds and their dynamics in the typical tundra habitat on Taimyr. Sci.-techn. Bull. of the Siberian Div. of the Acad. of Agri. Sci.: 23: 36–45. (in Russian) * Kostin, I. O. (1981): On goose hunting in western Taimyr. Sci. Techn. Bull., Siberian Sektion of the Acad. Agri. Sci. Novosibirsk 43: 13–14 (in Russian). * Ditto (1994): Subsistence hunting of arctic Anatidae in Russia and adjacent countries. Review at the „Anatidae 2000"-Conference in Strasbourg, December 1994 (in print). * Kostin, I. O., & J. H. Mooij (1995): Influence of weather conditions and other factors at the reproductive cycle of the Red-breasted Goose Branta ruficollis at the Taimyr Peninsula. Wildfowl 46: 45–54. * Krivenko, V. G. (1994): Current numbers of water birds in Russia and adjacent countries. Review at the „Anatidae 2000" Conference in Strasbourg, December 1994 (in print) * Kuyken, E. (1975): Oecologie van overwinterende ganzen te Damme (W. Vl.) in Westeuropees verband. Diss. Univ. Gent. * Lampio, T. (1983): Waterfowl Hunting in Europe, North America and some African and Asian countries in 1980–81. IWRB Spec. Publ. 3, Slimbridge. * Landry, P. (1990): Hunting harvest of waterfowl in the Western Palearctic and Africa. In: Matthews, G. V. T. (Ed., 1990): Managing Waterfowl Populations. IWRB Spec. Publ. 12, Slimbridge: 120–121. * Lebret, T., Th. Mulder, J. Philippona & A. Timmerman (1976): Wilde ganzen in Nederland. Thieme, Zutphen * Lysenko, V. I. (1990): Current status of waterfowl in Ukraine. In: Matthews, G. V. T. (Ed., 1990): Managing Waterfowl Populations. IWRB Spec. Publ. 12, Slimbridge: 43. * Madsen, J. (1987): Status and Management of Goose Populations in Europe, with Special Reference to Populations Resting and Breeding in Denmark. Dan. Rev. Game Biol. 12(4): 1–76. * Madsen, J. (1991): Status and trends of goose populations in the Western Palearctic in the 1980s. Ardea 79: 113–122. * Ditto (1992): Waterfowl causing damage to aglicultural crops: Curent status and habitat use. In: Roomen, M. van, & J. Madsen (1992): Waterfowl and Agriculture: Review and future perspective of the crop damage conflict in Europe. IWRB Spec. Publ. 21: 21–32. * Meire, P., & E. Kuijken (1991): Factors affecting the number and distribution of wintering geese and some implications for their conservation in Flanders, Belgium. Ardea 79: 143–157. * Mineyev, Yu. N. (1995): White-fronted Goose *Anser albifrons* in the tundra of Nenetskiy Autonomous District of Archangelskaya region. Bulletin of Geese Study Group of Eastern Europe and Northern Asia, No.1.: 121–128 (in Russian). * Mooij, J. H. (1990): Bleischrotbelastung bei Wasservögeln. Charadrius 26: 6–19. * Ditto (1991 a): Überwinterungsräume für Wildgänse am Unteren Niederrhein. Natur und Landschaft 66: 151–155. * Ditto (1991b): Crop damage caused by waterfowl in the Federal Republic of Germany National report of the FRG for the workshop „Farmers and Waterfowl", 06/09–10–1991, Lelystad (NL). * Ditto (1991c): Numbers and distribution of grey geese (genus *Anser)* in the FRG, with special reference to the lower Rhine region. Ardea 79: 125–133. * Ditto (1991d): Hunting A questionable method of regulating goose damage. Ardea 79: 219–223. * Ditto (1992): National Report of the Federal Republic of Germany. In: Roomen, M. van, & J. Madsen (1992): Waterfowl and Agriculture: Review and future perspective of the crop damage conflict in Europe. IWRB Spec. Publ. 21: 137–142. * Ditto (1993): Development and management of wintering geese in the Lower Rhine area of North Rhine-Westphalia/Germany. Vogelwarte 37: 55–77. * Ditto (1995a): Rückmeldungen und biometrische Daten von auf Taimyr gefangenen Bläßgänsen *(Anser albifrons albifrons).* Corax 16 (Sonderheft): 160–168. * Ditto (1995b): Bestandsentwicklung der Gänse in Deutschland und der westlichen Paläarktis sowie Bemerkungen zu Gänseschäden und Gänsejagd. Berichte zum Vogelschutz 33: 47–59. * Mooij, J. H., I. O. Kostin & R. Bräsecke (1995): Deutsch-russische Gänseforschung auf der Halbinsel Taimyr – Erste Ergebnisse. Beiträge zur Jagd- & Wildforschung 20: 275–301. * Morehouse, K. A. (1992): Crippling loss and shot-type: the United States experience. In: Pain, D. J. (1992): Lead Poisoning in Waterfowl. IWRB Spec. Publ. 16: 32–37. * Munteanu, D. (1992): National Report of Romania. In: Roomen, M. van, & J. Madsen (1992): Waterfowl and Agriculture: Review and future perspective of the crop damage conflict in Europe. IWRB Spec. Publ. 21: 167–170. * Nowak, E. (1989): Deutsch-sowjetische Taimyr-Expedition 1989. Natur und Landschaft 64: 472–474. * Ditto (l990): Zweite deutsch-sowjetische Taimyr-Expedition (1990). Natur und Landschaft 65: 603–606. * Ditto (1989): Dritte deutsch-sowjetische Taimyr-Expedition (1991). Natur und Landschaft 66: 542–545. * Ditto (1995): Jagdaktivitäten in der Vergangenheit und heute als Einflußfaktor auf Gänsepopulationen und andere Vögel Nordsibiriens. Corax 16 (Sonderheft): 143–159. * Oostenbrugge,

R. van, P. C. A. M. M. Stolk & M. W. J. van Roomen (1992): National Report of the Netherlands. In: Roomen, M. van, & J. Madsen (1992): Waterfowl and Agriculture: Review and future perspective of the crop damage conflict in Europe. IWRB Spec. Publ. 21: 151–158. * Owen, M. (1982): Population dynamics of Svalbard Barnacle Geese 197S–80: the rate, pattern and causes of mortality as determined by individual marking. Aquila 89: 229–247. * Owen, M., & J. M. Black (1990): Waterfowl Ecology. Blackie, London. * Ditto (l991): A note on migration mortality and its significance in goose populations dynamics. Ardea 79: 195–196. * Perennou, Ch., P. Rose & C. Poole (1990): Asian Waterfowl Census 1990. IWRB, Slimbridge. * Philippona, J. (1972): Die Blessgans. Ziemsen, Wittenberg Lutherstadt. * Pirot, J.-Y., & A. D. Fox (1990): Population levels of Waterfowl in the western Palearctic: an analysis of recent trends. In: Matthews, G. V. T. (Ed., 1990): Managing Waterfowl Populations. IWRB Spec. Publ. 12, Slimbridge: 52–62. * Priklonsky, S. G., & I. M. Sapetina, T. M. (1990) Game statistics in the USSR. In: Matthews, G. V. T. (Ed., 1990): Managing Waterfowl Populations. lWRB Spec. Publ. 12, Slimbridge: 113–114. * Rochacheva, H. (1992): The Birds of Central Siberia. Husum Verlag, Husum. * Rose, P. M. (1995): Western Palearctic and South-West Asia Waterfowl Census 1994. IWRB Publication 35 IWRB, Slimbridge. * Rose, P. M., & V. Taylor (1993): Western palearctic and south west asia waterfowl census l993. IWRB, Slimbridge. * Rose, P. M., & D. A. Scott (1994): Waterfowl Population Estimates. IWRB Publication 29 IWRB, Slimbridge. * Rusanov, Ya. S. (1990): Waterfowl hunting methods in the USSR. In: Matthews, G. V. T. (Ed., 1990): Managing Waterfowl Populations. IWRB Spec. Publ. 12, Slimbridge: 148–150. * Rusanov, G. M., & G. V. Khakin (1990): Waterfowl Management Strategy in the USSR. In: Matthews, G. V. T. (Ed., 1990): Managing Waterfowl Populations. lWRB Spec. Publ. 12, Slimbridge: 210–214. * Rutschke, E. (1973): Daten zu den Ergebnissen der Wasservogeljagd in Europa. Mitt. u. Berichte der Zentrale für Wasservogelforschung der DDR 5: 21–22. * Ditto (1976): Wasservogelforschung und Wasservogelschutz in der USSR. Falke 23: 365–373. * Ditto (1987): Die Wildgänse Europas. Aula, Wiesbaden. * Ditto (1990): On the development of the populations of the Bean Goose (*Anser fabalis)* and the White-fronted Goose *(Anser albifrons)* in the western part of their distribution area. Proc. Baltic Birds V: 106–113. * Ryabitsev, V. K. (1995): Short view of geese at Yamal Peninsula. Bulletin of Geese Study Group of Eastern Europe and Northern Asia, No.1.: 164–166 (in Russian). * Rykhlikova, M. E., & I. U. Popov (1995): Lemmings in the North-Western Taimyr Arctic: Population Density, Distribution of Territories and Relationships with Other Animals. Corax 16 (Sonderheft): 169–179. * Scott, D. A. (1980): A preliminary Inventory of Wetlands of International Importance for Waterfowl in West Europe and Northwest Africa. IWRB Spec. Publ. 2, Slimbridge. * Scott, D. A., & P. M. Rose (1989): Asian Waterfowl Census 1989. IWRB, Slimbridge. * Seebohm, H. (1901): The Birds of Siberia. 2 Vol. Reprint of 1985 by Sutton, Gloucester. * Spaans, B. (1992): Reisverslag en overzicht van het onderzoek verricht door de Nederlandse deelnemers aan de internationale expeditie naar het broedgebied van de Rotgans in Noordwest Taimyr in 1991. IBN, Arnhem * Sterbetz, I. (1968): Der Zug der Zwerggans auf der ungarischen Puszta. Ardea 56: 259–266. * Ditto (1971): Die Ernährung der in Ungarn ziehenden und überwinternden Saatgänse. Limosa 44: 54–60. * Ditto (1982a): Migration of Anser erythropus und Branta ruficollis in Hungary 1971–1980. Aquila 89: 107–114. * Ditto (1982b): Peak numbers of geese and cranes on autumn migration in the Kardoskut Nature Reserve, Southeast Hungary. Aquila 89: 193–194. * Syroechkovski Sr., E. E. (1995): On the necessity of co-operation in conservation and rational utilisation of geese of eastern Europe and northern Asia. Bulletin of Geese Study Group of Eastern Europe and Northern Asia, No.1.: 10–16 (in Russian). * Syroechkovski, Jr., E. E. (1995): „Tundra Ecology–94" expedition: urgent conservation action is needed for arctic geese. Bulletin of Geese Study Group of Eastern Europe and Northern Asia, No.1: 36–38 (in Russian). * Syroechkovski Y. V., K. Y. Litvin, & B. S. Ebbinge (1991): Breeding success of geese and swans on Vaygach Island, USSR, 1986–1988: interplay of weather and Arctic Fox predation. Ardea 79: 373–382. * Timmerman, A. (1976): Winterverbreitung der paläarktischen Gänse in Europa, West-Asien und Nord-Afrika, ihre Anzahlen und ihr Management in West-Europa. Vogelweit 97: 81–99. * Timmerman, A., M. F. Mörzer Bruyns & J. Philippona (1976): Survey of the winter distribution of Palaearctic geese in Europe, Western Asia and North Africa. Limosa 49: 230–292. * Urbanek, B. (1992): National Report of Czechoslowakia. In: Roomen, M. van, & J. Madsen (1992): Waterfowl and Agriculture: Review and future perspective of the crop damage conflict in Europe. IWRB Spec. Publ. 21: 121–124. * Uspenski, S. M. (1965): Die Wildgänse Nordeurasiens. Ziemsen, Wittenberg Lutherstadt. * Ven, J. van der (1987): Asian Waterfowl 1987. IWRB, Slimbridge. * Ditto (1988): Asian Waterfowl 1988. IWRB, Slimbridge. * Vinokurov, A. A. (1982): Present status of the *Branta ruficollis* Population and measures for its conservation. Aquila 89: 115–122. * Ditto (1990): *Branta ruficollis* in the USSR. In: Matthews, G. V. T. (Ed.) (1990): Managing Waterfowl Populations. IWRB

Spec. Publ. 12, Slimbridge: 197–198. * Voous, K. H. (1960): Atlas van de europese vogels. Elsevier, Amsterdam/Brussel. * Wieloch, M. (1992): National Report of Poland. In: Roomen, M. van, & J. Madsen (1992). Waterfowl and Agriculture: Review and future perspective of the crop damage conflict in Europe. IWRB Spec. Publ. 21: 163–165. * Wiese, M. (1991–1995): DJV-Handbuch Hoffmann, Mainz. * Wilson, H. J., D. W. Norriss, A. D. Fox & D. A. Stroud (1991): Winter site fidelity in Greenland White-fronted Geese *Anser albifrons flavirostris,* implications for conservation and management. Ardea 79: 287–294. * Yokota, Y. M. Kurechi & M. Otsu (1982): Distribution, numbers and status of geese in Japan, Aquila 89: 209–227.