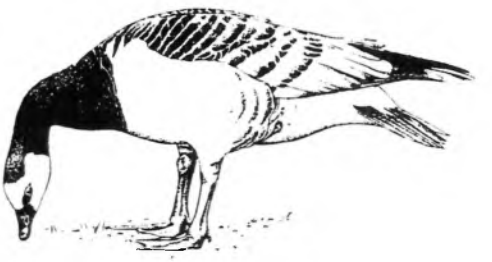
Spring numbers and distribution of Barnacle Goose *Branta leucopsis* staging in Estonia



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Between 1964-89, numbers of spring-staging Barnacle Goose in Estonia increased from 11,000 to 57,500. At the same time the numbers of sites used rose from 20 to 100 and several new staging areas were formed. Due to increasing numbers of geese, damage to arable land was observed in western Estonia at the beginning of the 1980s. We suggest that the capacity of natural Barnacle Goose feeding habitats in western Estonia is approximately 30,000 birds.

The first written records of the occurrence of the Barnacle Goose *Branta leucopsis* in Estonia come from the second half of the 19th century (Russow 1871, 1880). Spring migration in Matsalu Bay was first registered by Loudon & Buturlin (1908) and the spring staging of geese in Saaremaa Island in 1906-10 by Stoll (Kumari 1971). In the first half of this century, spring halting sites were found also in the islands of Hiiumaa, Muhu and Vormsi and on the coast of Haapsalu Bay. Formerly, the Barnacle Goose was an important game bird in western Estonia.

A new stage in the study of migrating Barnacle Geese in Estonia began in the 1950s when the Baltic Commission for the Study of Bird Migration was founded in 1955. Observations in 1956-62 gave a picture of many migrating Barnacle Geese in western Estonia in spring, and of regular but less concentrated autumn migrations along the northern and northwestern coasts. Systematic phenological observations were started in 1958 in Vaika (present Vilsandi) and Matsalu State Nature Reserves. The first complete count of Barnacle Geese numbers occurred in 1964 (Kumeri 1971); since 1974, aerial surveys have been made. Earlier data (up to 1974) were summarized by Kumari (1971) and Jõgi (1976). Since 1980, the foraging ecology, population structure, local movements and migration strategy of the species were also studied (Leito 1985, 1990, Leito & Renno 1983, Leito *et al.* 1986).

The aim of the present paper is to review the numbers and distribution of Barnacle Geese staging in Estonia during the past 30 springs. An attempt has been made to find the capacity of natural feeding habitats of the goose in Matsalu Bay and in the whole of West Estonia.

Material and methods

In Estonia, total counts of staging Barnacle Geese were undertaken in 1964, 1968 and 1970, using observations from the ground. These censuses were carried out by local birdwatchers and professional ornithologists in early May and covered the most important sites in western Estonia. But, as the number of counters necessary for ground censuses is great and owing to difficulties of making simultaneous observations, aerial surveys were started in 1974. These were carried out at the beginning of May when Barnacle Geese reached peak numbers in Estonia. The error in aerial censuses was estimated at ± 10%.

Results

In 1964, 1968 and 1970 10,800, 14,000 and 8000 Barnacle Geese were counted respectively

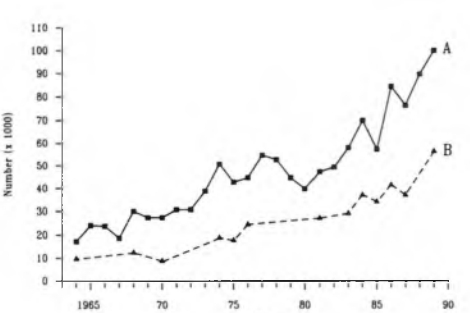

Figure 1. Annual peak numbers of Barnacle Geese in the Netherlands (A) (Ebbinge 1989, Ebbinge *et al.* 1986) and spring peak numbers in Estonia (B).

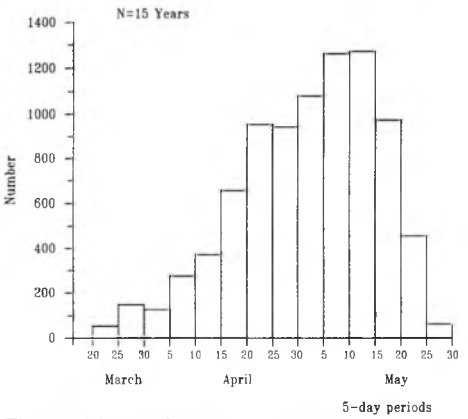

Figure 2. Mean daily numbers of spring-staging Barnacle Geese on Vilsandi Island.

(Kumari 1971) and the total number of passing geese was estimated at 15,000-20,000 (Kumari & Jõgi 1972). Since then, numbers have increased dramatically (Fig. 1). Barnacle Goose counts in Estonia parallel the size of the total population of the Barents Sea, as established in the wintering areas ($r = 0.71$, $P<0.01$. $df = 11$). Of the geese observed in winter, 30-61%, or on average 48 ± 9% (± SD, $n = 13$), have been seen again in spring in Estonia. They stay in Estonia from the beginning of April until the end of May, the peak in numbers being observed at the beginning of May (Fig. 2). The migration-time distribution range in Estonia has widened simultaneously with an increase in numbers (Figs 1 and 3). In the 1960s, about 20 spring staging places were known in western Estonia. In the years 1974-80, aerial censuses revealed 17-36, on average 25 ± 7 (± SD, $n = 6$) separate halting sites while, in 1981-89, the corresponding figures were 44-73, on average 53 ± 10 (± SD, $n = 7$). The number of halting sites used by the geese is closely related to the number of individuals counted ($r = 0.90$, $P<0.001$, $df = 11$). At the same time, the average number of geese per site did not differ essentially during the period compared, being 655 ± 262 (± SD, $n = 6$) and 659 ± 99 (± SD, $n = 7$), respectively. However, in different halting sites, the dynamics of goose numbers have been different (Fig. 4). On Kassari Island at Hiiumaa, the number of geese has decreased, due to marine coastal meadows having been overgrown with brushwood which forced birds to move westward (to Jausa Bay) and eastward (to Kaevatsi Island). In the Vilsandi Archipelago the total number of staging Barnacle Geese has been stable, except for Vilsandi, where they have decreased. The importance of former fields (now grassland) on Vilsandi as feeding habitats for geese has diminished because no hay mowing has taken place in the last years and the fields have become less attractive. In Matsalu, the first peak in Barnacle Goose numbers was observed in 1965-68, which coincided with the growth of the total population (Figs 1 and 4). After that, a decline was noticed, probably because the geese moved from Matsalu to other, not yet occupied, staging places in West Estonia. But as the population increased, other sites became saturated as well, and geese moved back to Matsalu. The second peak in numbers at Matsalu was observed in 1986; and, as both peaks levelled at about 6000, it is suggested that this number must be close to the capacity of Barnacle Goose feeding habitat in Matsalu. No essential changes in total area or condition of feeding habitat in Matsalu have been observed during the last decades. The only area which was formerly used by geese and later abandoned is the Noarootsi Peninsula. The reason for this is, unfortunately, unknown.

Formerly, when the population was low, the geese fed only on natural and semi-natural marine coastal meadows and grasslands. But, because the original areas become saturated with increasing numbers, birds were forced to exploit new resources such as cultivated grasslands and cereals (barley, rye and wheat). As a result, the problem of goose damage on agriculture fields in western Estonia rose at the beginning of the 1980s. And as at that time approximately 30,000 geese were counted, this figure is, in our opinion, close to the actual capacity of natural and semi-natural goose habitat in western Estonia. Unfortunately it is not possible to separate birds stopping on coastal meadows and on cultivated land because the geese exploit both habitats simultaneously. At present there are only a few sites where geese feed on marine coastal meadows, and the importance of such areas (small islets) is low. Practically all potential halting places for geese are occupied. The only way of increasing numbers is to increase the grazing pressure on occupied areas. Exploitation is highest in the original staging areas and lowest in new areas. Especially high grazing pressure, on fields as well as on coastal meadows, can be seen in areas where the geese occurred in olden times: at Rahuste, Karala and Kõrkvere in Saaremaa and at Saastna in Matsalu. In these areas, the exploitation rate reaches 3000 goose days per ha whereas in new areas grazing pressure does not top 1000 goose days/ha. In Vilsandi Archipelago, the mean exploitation rate on coastal meadows and semi-natural grassland was estimated at 234 ± 18 (± SD, $n = 6$) goose days/ha.

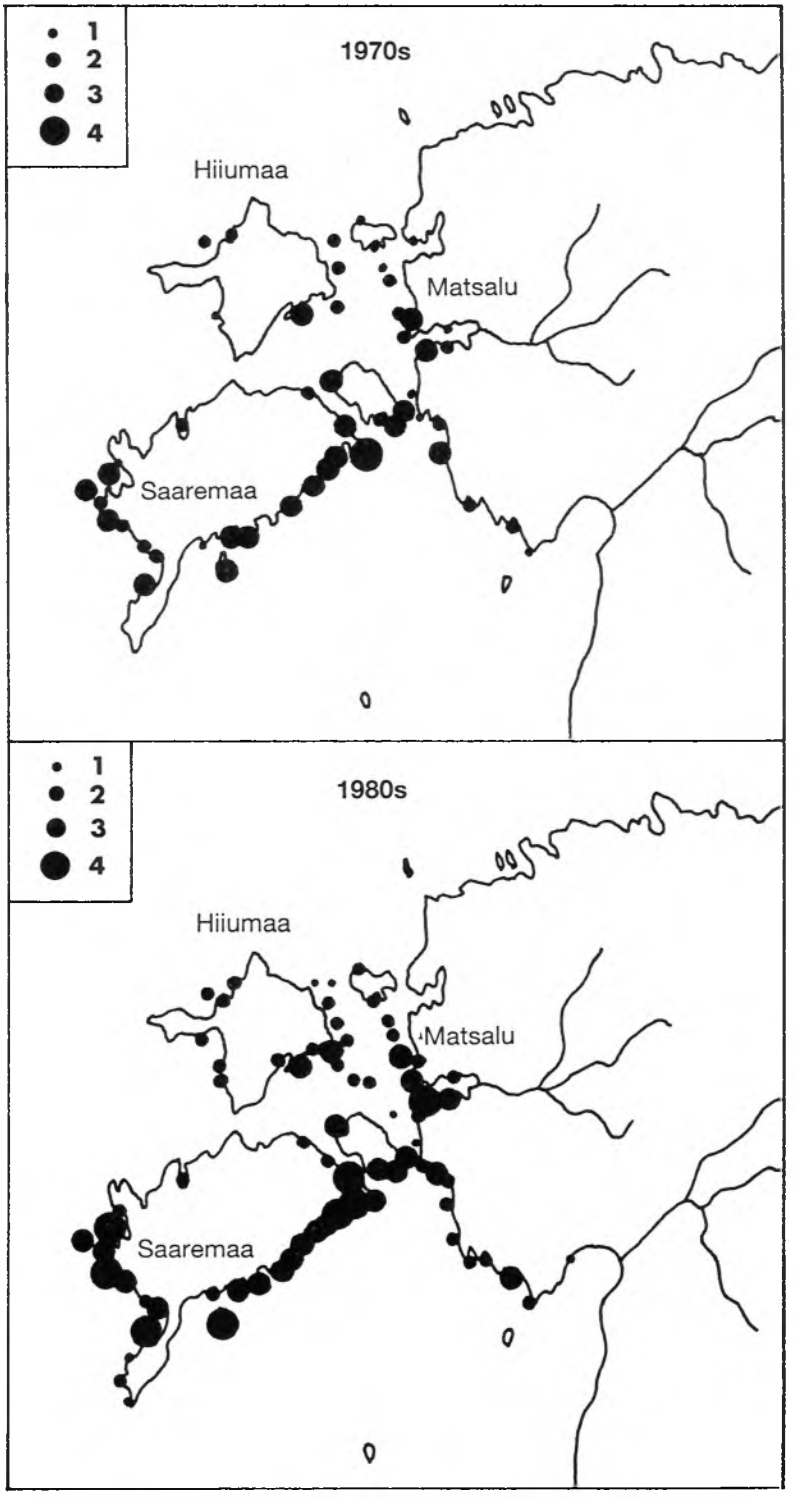

Figure 3. Spring peak numbers and distribution of Barnacle Geese in western Estonia in the 1970s and 1980s: 1 - up to 100; 2 - 100...1000; 3 - 1000...3000; 4 - over 3000.

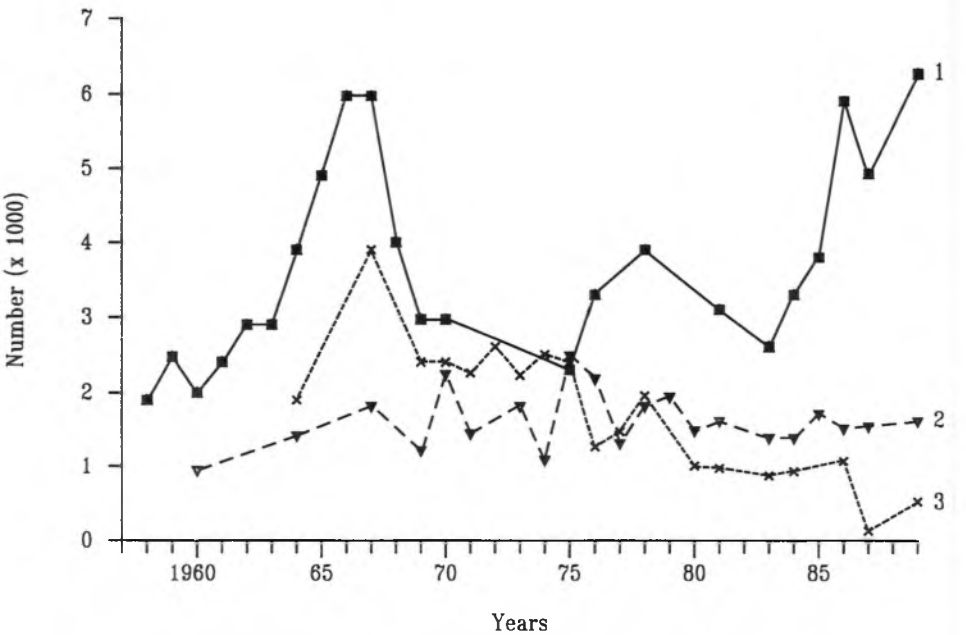

Figure 4. Numbers of Barnacle Geese in three staging sites in western Estonia: 1) Matsalu; 2) Vilsandi; 3) Kassari.

Discussion

Between 1964 and 1989, the Barents Sea population of Barnacle Geese increased approximately five times. In Estonia at the same time, the number of spring-staging Barnacle Geese increased from 11,000 to 57,500. The main reason for the upward trend was low mortality, achieved by better protection and a shooting ban (Ebbinge 1987, Madsen 1987). The breeding success of arctic-breeding geese is, according to the condition hypothesis, largely determined by body condition before breeding and by the reserves built up mainly in spring staging areas (Ryder 1967, Harvey 1971, Ebbinge *et al.* 1982, Gauthier *et al.* 1984).

In Estonia, the Barnacle Goose was protected in 1968. Feeding and roosting sites are protected in the Matsalu and Vilsandi State Nature Reserves, and in the Hiiumaa Islets State Landscape Reserve where up to 12,000 geese rest in spring. Protection is necessary since the spring location of staging Barnacle Geese in Estonia depends on the distribution of suitable coastal meadows (mainly *Juncus gerardii* and *Festuca* spp. associations). These areas are restricted to parts of the west coast of Estonia. The capacity of the natural habitats for spring-staging geese appears to be limited, and the number in these areas is at present restricted to 30,000. Geese in excess to that number move to agricultural fields, where they cause damage. Appropriate management of the nature reserves, which improves the sward and bans human disturbance, should safeguard their essential role for spring-staging Barnacle Geese.

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