

Distribution, abundance and habitat choice of Whooper Swans *Cygnus cygnus* breeding in Latvia and Estonia, 1973–2021

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Abstract

In recent years the number of breeding Whooper Swans in Latvia and Estonia combined has increased from one pair in 1973 to 900–1,200 pairs in 2021, with a similar growth rate in both countries. Sixty-nine percent of confirmed Latvian breeding sites were located in western Latvia during 2018–2021, a stronghold for the species, while in Estonia breeding sites were more widely distributed across the country. In Estonia, Whooper Swans preferred bogs, lakes and coastal waters whereas the vast majority of pairs in Latvia occurred on fish-pond complexes, natural lakes and ponds created by the Eurasian Beaver *Castor fiber* (“beaver dams”).

Key words: breeding habitat, fish-pond complexes, population increase.

The Whooper Swan *Cygnus cygnus* has a widespread breeding range in the boreal and sub-boreal regions of Eurasia, extending from Iceland across northern Europe to eastern Siberia (Brazil 2003). The Northwest Mainland Europe population, which is one of five currently recognised for this species, breeds in Fennoscandia, western Russia and the southern Baltic (Brazil 2003; Laubek *et al.* 1999). Whooper Swans breeding in Latvia and Estonia form part of this population.

Intense year-round persecution through hunting, trapping and egg collection had a

major adverse impact on Whooper Swans in Europe until the early 20th century (Brusewitz 1971). Regional and national breeding populations became extinct or were pushed close to extinction in many countries, except in Iceland and Russia (Cramp & Simmons 1977). Legal protection of the Whooper Swan throughout Europe has halted and reversed the decline, and numbers of breeding pairs in the Northwest Mainland Europe population have increased since the 1950s (Lammi 1983; Svensson *et al.* 1999; Brazil 2003).

The Whooper Swan started to reoccupy former breeding grounds, sometimes aided by releases and escapes, during the second half of the 20th century (Svensson *et al.* 1999). A recent expansion of its breeding range is likely to be a partial recovery into formerly occupied breeding areas, following a prolonged period of intense human persecution that continued into the early 20th century, which both reduced abundance and restricted the swans' distribution (Haapanen *et al.* 1973; Haapanen & Nilsson 1979; Nilsson 1979; Boiko *et al.* 2014). In recent years, the species has also extended its breeding range to countries where it had been extirpated as a breeding species (Boiko *et al.* 2014). The Whooper Swan has bred regularly in Latvia, Lithuania and Poland since 1973 (Lipsbergs 2000; Švažas *et al.* 1997; Tomiałojć 1990; Tomiałojć & Stawarczyk 2003), breeding attempts in Estonia have known since 1979 (Luigujõe *et al.* 2002), and in Germany nesting was first recorded in 1982 but has become more established there since 1995 (Profus 1999; Bauer & Woog 2008; Gedeon *et al.* 2014). Subsequently, breeding commenced in Belarus and Denmark in 2002 (Abramchuk *et al.* 2003; Grell *et al.* 2004; Nyegaard *et al.* 2014), in Hungary and the Netherlands in 2005 (Szinai 2009; van Dijk 2006), in the Czech Republic in 2017 (Šírek 2018), and Slovakia in 2019 (BirdLife Slovensko 2019).

In this paper, we review the published information on the incidence of Whooper Swans breeding in Latvia and Estonia in recent years (Luigujõe *et al.* 2002; Boiko & Kampe-Persson 2010; Boiko *et al.* 2014) and update these records to 2021, to provide an up-to-date assessment of the current status

of Whooper Swans breeding in the region. Similarities and differences between the two countries in the swans' distribution and choice of breeding habitats are also described.

Methods

Publications providing national estimates of the number of Whooper Swans breeding in Latvia and Estonia from the 1970s onwards were reviewed, along with unpublished records up to 2021, to describe changes in breeding numbers since the late 20th century. Information on the distribution of Whooper Swans breeding in both countries was also obtained from a literature search, as well as during field surveys.

For Latvia, the literature search included published data and also unpublished results from the *Latvian Breeding Bird Atlas 2020–2024* project. Fieldwork was undertaken by one of the authors (D.B.) during the years 2018–2021 inclusive. Data on breeding habitat was recorded during 108 visits made to known and probable Whooper Swan breeding sites between 1 April and 31 August each year, from 2018–2021 inclusive. In line with guidelines put in place for the *Latvian Breeding Bird Atlas 2020–2024* project, for each breeding site (confirmed or probable) the following data were recorded: date of visit, site location (district, parish, name of the water-body and coordinates), breeding habitat, Whooper Swan brood size (number of cygnets) and possible disturbance factors. To gain some measure of the breeding success of the pair, each site was visited as frequently as possible, and at least twice a season.

In addition to the visits made to known and probable Whooper Swan breeding

territories, information about additional nest sites was obtained through appeals made to the public. Data from a citizen science web portal – *www.dabasdati.lv* – developed by the Latvian Fund for Nature and the Latvian Ornithological Society to enable members of the public to report observations of wild plants and animals (including birds), were also included in the review.

For Estonia, the literature review covered papers on Whooper Swans occurring in the country since the early 1990s (e.g. Luigujõe 1994; Luigujõe *et al.* 2002), and the national reports on the numbers and status of Whooper Swans and other species, published at 5-year intervals (*i.e.* Lilleleht & Leibak 1993; Lõhmus *et al.* 1998; Elts *et al.* 2003, 2009, 2013, 2019). Data on Whooper Swan breeding distribution are more fragmentary than those resulting from the mid-winter surveys in Estonia, because they are based mainly on reports made by volunteers to the Estonian Ornithological Society and to local bird clubs, although a comprehensive survey of Estonia's mires was conducted from 1986–2001 (Luigujõe *et al.* 2002). Unpublished data for 2018–2021 were also sourced from a survey programme of the swans in Estonia (L. Luigujõe, pers. comm.).

Twelve estimates of the total national numbers of Whooper Swans breeding in Latvia and Estonia were made between 1973–2021, with some overlap in the time periods covered by the reports, although none were based on a nation-wide survey. Estimates of abundance were available for Latvia for seven time periods: 1973–1975 (Baumanis 1975), 1980–1984 (Priednieks *et al.* 1989), 1980–1989 (Strazds *et al.* 1994),

1997–1998 (Latvian Ornithological Society 1999), 1973–2009 (Boiko & Kampe-Persson 2010), 1973–2013 (Boiko *et al.* 2014) and 1980–2017 (Kõrus *et al.* 2021). Monitoring of breeding Whooper Swans in Estonia was a bit more recent, made for five time periods: 1991–1997 (Lõhmus *et al.* 1998), and 1998–2002, 2003–2008, 2009–2012 and 2013–2017 (Elts *et al.* 2003, 2009, 2013 and 2019, respectively).

Whooper Swans may defend a new territory for one or two summers and not breed until the third or fourth year (Haapanen & Hautala 1991). This gives rise to two different estimates of breeding abundance, namely: “territorial pairs” (occupying a site) and “nesting pairs” (those specifically with a nest). Estimates presented here refer to the number of pairs recorded with a nest during the national surveys in the Baltic states, throughout this article (as in Boiko *et al.* 2014).

Whooper Swan breeding habitats were grouped into five main categories: fishponds (including multi-purpose ponds), bogs, lakes, ponds behind the dams created by the Eurasian Beaver *Castor fiber* (“beaver dams”) and coastal water bodies (for further descriptions of the different habitats, see Luigujõe *et al.* 2002; Boiko & Kampe-Persson 2010; Boiko *et al.* 2014). Breeding habitats of lesser importance included flooded gravel pit workings, flooded meadows, drainage ditches and rivers. Habitat data were compiled from the literature review for nesting sites found in Estonia during 1979–2021 whilst, for Latvia, reports in the literature were augmented by author (D.S.) fieldwork data, recorded during visits made to known and probable

Whooper Swan breeding sites between 1 April–31 August during 2018–2021.

Mean annual increases in the number of nesting pairs were calculated using the estimates made at the beginning and end of the study period: 1979–2021 for Estonia and 1973–2021 for Latvia. When the annual count estimate was given as an interval in the reports, the mid-point of the interval was used in calculating the rate of increase in numbers over time.

Results

Recent breeding numbers and distribution

Four Whooper Swan nest sites were found in Latvia during the 1970s, the first being located in the western part of the county in 1973 (Baumanis 1975, 1980). Subsequent

estimates of the number of breeding pairs indicate a steady increase in Latvia from 1979 onwards (Fig. 1): 10–20 pairs in 1984, 20–30 in 1993, 50–100 in 1998, *c.* 150 in 2004, 170–200 in 2006, *c.* 200 in 2007, *c.* 260 in 2009, *c.* 320 in 2013, 430–600 in 2017 and 600–800 in 2021 (Priednieks *et al.* 1989; Strazds *et al.* 1994; Latvian Ornithological Society 1999; Boiko 2005, 2008; Boiko & K ampe-Persson 2010; Boiko *et al.* 2014;  erus *et al.* 2021; D. Boiko, unpubl. data).

Numbers of Whooper Swans breeding in Estonia increased rapidly, from one breeding pair in 1979 to at least five pairs three years later (Luiguj e *et al.* 2002). As no breeding was recorded in the years 1984–1986 and 1993–1994, Luiguj e *et al.* (2002) assumed that the initial recolonisation of Estonia was the result of successive colonisation by immigration of birds that failed to establish

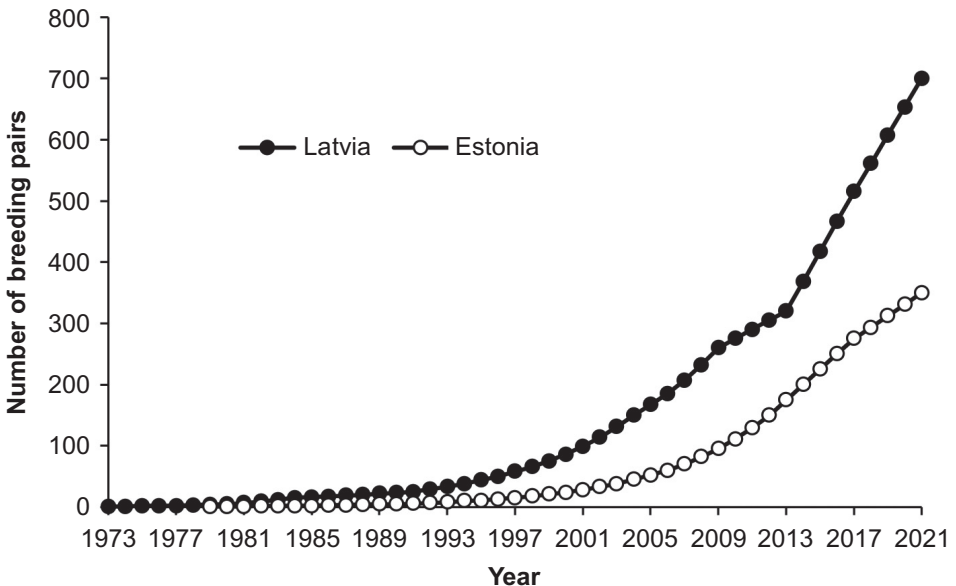


Figure 1. Number of breeding pairs of Whooper Swan pairs recorded in Estonia (1979–2021) and Latvia (1973–2021).

themselves. Estimates of the number of breeding pairs, however, showed a longer-term increase in overall abundance (Fig. 1), from *c.* five pairs in 1982–1992 to 10–20 pairs in 1997, 40–60 in 1998–2002, 70–100 in 2003–2008, 150–200 in 2008–2012, 250–300 in 2013–2017 and 300–400 in 2021 (Lilleleht & Leibak 1993; Rees *et al.* 1997; Lõhmus *et al.* 1998; Luigujõe *et al.* 2002; Elts *et al.* 2003, 2009, 2013, 2019; L. Luigujõe, unpubl. data).

Thus by 2021, the number of Whooper Swans breeding in Latvia and Estonia was estimated at 900–1,200 pairs in total (mid-point = 1,050 pairs): 600–800 pairs in Latvia and 300–400 pairs in Estonia. The rate of change in abundance to reach these numbers appeared to differ between the countries, being higher in Latvia (at 14.3 pairs/year in the 49 years between first nesting and *c.* 700 pairs in 2021) than Estonia (8.1 pairs/year in 43 years between first nesting in 1979 and *c.* 350 pairs in 2021; Fig. 1). From just a single pair recorded in 1973, the mean annual increase in the number of nesting pairs in the two countries combined over the period 1973–2021 was 10.4%.

In Latvia, the first pair of Whooper Swans bred in the western part of the country (Baumanis 1975), and this area has remained the stronghold for the species within Latvia (Boiko & Kampe-Persson 2010; Boiko *et al.* 2014), supporting 250 (69%) of the 362 sites where breeding was confirmed during the years 2018–2021. In Estonia, Whooper Swan breeding sites are more widely dispersed across the country (Luigujõe *et al.* 2002).

Breeding habitat

Whooper Swans in both countries breed on small waters but the choice of habitats in

Latvia and Estonia differed significantly (Chi-squared test: $\chi^2_4 = 354.2$, $P < 0.001$; Fig. 2). The majority of pairs in Latvia were found in fishpond complexes, lakes and beaver dam ponds whereas these habitats were rarely used in Estonia (except for lakes), where the swans preferred to nest in bogs, on small eutrophic lakes and ponds, and on coastal waters.

Discussion

The Northwest Mainland European population of Whooper Swans has shown substantial growth since the 1950s (Laubek *et al.* 1999) and numbers of breeding pairs in northwest European countries continued to increase, although the recent growth rate might be slower now than previously (Laubek *et al.* 2019). The Finnish breeding population was close to extinction in the 1950s, but between 1974–1989 and 2006–2010 its range expanded considerably (Valkama *et al.* 2011). Breeding abundance in Finland increased by *c.* 8.1% *per annum* during 1986–2018 (but by 4.1% *per annum* during 2007–2018; Laaksonen *et al.* 2019), while the Swedish population has also shown a 3.3% increase in abundance during 1998–2018 (Svensk Fågeltaxering 2019), *i.e.* slower than in Latvia and in Estonia (as shown here). Axbrink (1999) suggested that the Swedish breeding population could reach 10,000 pairs, and the most recent estimate of the Swedish population is 5,400 pairs (Ottosson *et al.* 2012; Nilsson 2014). The Finnish breeding population, estimated at 9,000–13,000 pairs, is also still growing (Koskimies 2019). Boiko & Kampe-Persson (2010) previously suggested that the Latvian breeding population could reach 600 pairs,

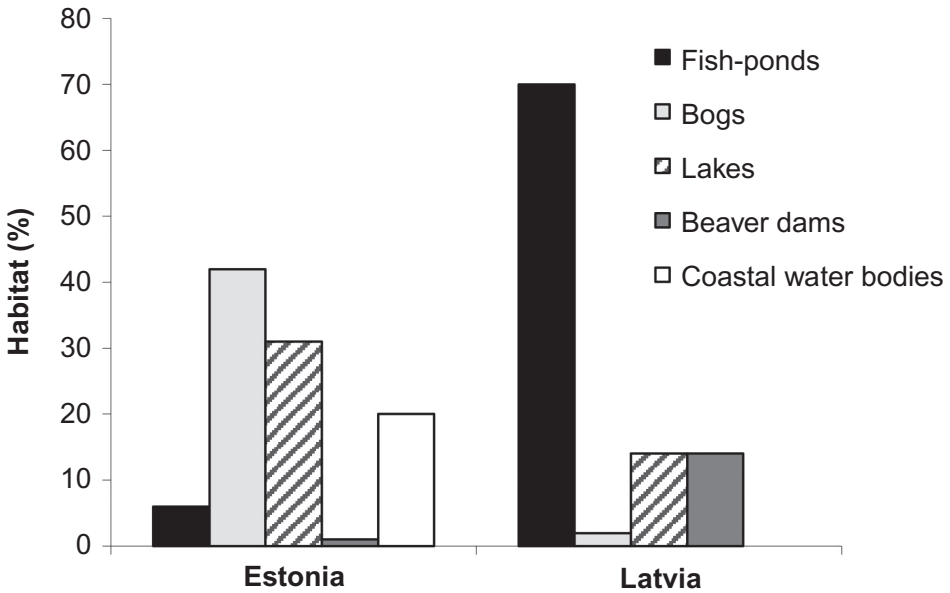


Figure 2. Breeding habitats recorded for Whooper Swans in Estonia in 2021 ($n = 180$) and in Latvia ($n = 362$) in summers 2018–2021.

yet here we show that numbers have now reached 600–800 and will very likely continue to increase, given the availability of suitable breeding sites especially in the eastern part of the country. At present, 69% of breeding pairs occur in western Latvia (this study) compared to 86% in 2009 (Boiko & Kampe-Persson 2010) and 87% in 2013 (Boiko *et al.* 2014). Given habitat availability, with *c.* 80% of fishponds in Latvia now occupied by Whooper Swans, we predict that numbers could increase to 1,200 pairs, but with other habitats (*e.g.* lakes and beaver dams) more likely to be utilised (D. Boiko, unpubl. data). With the current growth rate and the availability of suitable breeding sites in Estonia, the number of Whooper Swans nesting there likewise has the potential to increase, to reach 600–700 pairs in the next 10 years.

The Whooper Swan breeds on small water bodies in a wide range of habitats (Rees *et al.* 1997; Brazil 2003) but, around the Baltic Sea, they show large differences in habitat selection between countries. Whooper Swans show a strong preference for natural habitats, often nesting on small water bodies surrounded by forest in mid and southern Sweden (Holmgren & Karlsson 1982; Svensson *et al.* 1999) and also in Estonia (Luigujõe *et al.* 2002; this paper Fig. 2). They are found mostly on small lakes with lush vegetation or in peatlands and mesotrophic areas, especially in wet mires of the aapa fen type, in northern Sweden (Nilsson *et al.* 1998), Finland (Haapanen *et al.* 1977) and northwest Russia (Bianki 1981). Recently they have also started nesting on offshore islands and coasts of the eastern Baltic Sea (Kouzov *et al.* 2024). In Latvia, Lithuania,

Belarus, Poland and Germany, on the other hand, they mostly breed in fishponds or other small man-made water bodies (Švažas & Stanevičius 2000; Vintchevski & Yasevitch 2003; Boiko & Kampe-Persson 2010; Sikora *et al.* 2012, 2022; Boiko *et al.* 2014; this study). Small natural water bodies are usually heavily overgrown and are therefore unsuitable for Whooper Swans, but these water bodies have partly been replaced by artificial ponds in Baltic states and, in areas with intense agriculture, large fishpond complexes provide the only wetland habitat suitable for breeding (Švažas & Stanevičius 2000; Boiko & Kampe-Persson 2010). Fishpond complexes provide good breeding and feeding conditions for Whooper Swans because they are extensive, comparatively shallow (depth of 1–2 m), fringed with scrub outgrowth of varying width, are subject to low human disturbance levels, and food distributed for the fish is also taken by the birds (Boiko & Kampe-Persson 2010; Boiko *et al.* 2014). The marked difference in habitat choice between Estonia and the other Baltic states can partly be explained by the lack of fishponds in Estonia compared to their availability in Latvia and Lithuania, but the breeding habitat used in Latvia and Estonia today is quite similar to that in 2000 (Luigujõe *et al.* 2002; Boiko *et al.* 2014). The proportion of the nest sites recently found at man-made waters (*i.e.* fishponds) was 70% in Latvia and 6% in Estonia during 2018–2021 (Fig. 2), compared with 77% in Latvia (on artificial ponds; Boiko & Kampe-Persson 2010) and 21% in Estonia (man-made bog pits and eutrophic lakes; Luigujõe *et al.* 2002) at the end of the 20th century.

Since 2004, neck-collaring of 1,610 Whooper Swan cygnets in the core Latvian breeding area has revealed only three cases of these birds moving abroad to breed (one bird settled in Poland and two in Lithuania; D. Boiko, unpubl. data). It is therefore possible that Whooper Swans in eastern northwest Europe are beginning to show two distinct patterns of habitat use. Whooper Swan in the south of the current breeding range (*i.e.* in Latvia, Lithuania, Poland) are tending to nest at fishponds and artificial lakes, whereas more northern birds (in Finland) continue to use more natural habitat, in marshes and forest lakes. It can be assumed that Estonia is the meeting point of southern and northern groups. For now, however, this is only speculation, and genetic analysis along with ringing and tracking studies are required to determine the extent to which the two groups intermingle. Meanwhile, the number of breeding pairs with an “intermediate” choice of nesting site has to some extent increased in Finland, where the swans are inhabiting lakes and water bodies rich in vegetation in the traditional agricultural landscape (Haapanen *et al.* 1973).

The increasing frequency of mild winters may have reduced winter mortality for Whooper Swans, as well as contributed to improved body condition among breeding individuals in spring (Švažas 2001). It is also probable that developments in agriculture, such as changing harvesting methods and new crops, have helped to promote the increase in these populations, because the productivity of the species is very much influenced by the conditions in the winter quarters (Nilsson 1979, 2014). Mild weather

conditions in winter have also benefitted Whooper Swans breeding in the Baltic countries by enabling the birds to spend the winter closer to their breeding grounds (Švažas 2001; Laubek *et al.* 2019). The combination of these environmental and demographic factors may thus have led both to the rapid increase in numbers breeding in the Baltic states, as well as to the overall increase in the Northwest Mainland Europe population in recent decades.

All this suggests that as long as there remains unoccupied habitats suitable for the species, the number of breeding Whooper Swans in Latvia and Estonia will likely continue to increase in future.

Acknowledgements

We thank all participants in the surveys and observers who reported cases of Whooper Swan breeding in both of our countries. We acknowledge financial support for swan research in Latvia from AS Latvijas Finieris, Sia Vidzemīte, Sia Skrunda, the Latvian Swan Research Society, and the Latvian National Museum of Natural History. We are also grateful to the Latvian Ornithological Society, and especially Andris Dekants, for permitting use of data from the Latvian Breeding Bird Atlas 2020–2024 project.

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Photograph: Dmitrijs Boiko with Whooper Swan family colour-marked in Latvia, by Dmitrijs Boiko.



Photograph: Whooper Swans with 4 downy young on a Beaver pond at Ihamaru, Estonia, 6 June 2018, by Leho Luigujõe.



Photograph: Whooper Swan pair with 1 downy young on fishpond habitat at Ilmatsalu, Estonia, 9 June 2018, by Leho Luigujõe.



Photograph: Whooper Swan on its nest at a fishpond site in Latvia, by Dmitrijs Boiko.