

## Distribution and expansion of the breeding population of Goosander *Mergus merganser* in Switzerland

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**Abstract.** A relatively isolated breeding population of Goosander occupies the Alpine region in Europe. Historically, Lake Geneva has played an important role in the spread of the Goosander population, especially after hunting of the species was prohibited in Switzerland and in France. In Switzerland, there has been a marked range expansion, which is well documented by atlas projects and special surveys. An increase in population size of 21% was noted between 1998 and 2013–2016, showing the colonisation ability of Goosander and its higher tolerance of humans than in the past. However, range changes varied between regions, with an important decline in the western bastion and an increase in the northeastern part and south of the Alps. The decrease of some fish populations, and the removal of old nesting trees and increased predation pressure from Yellow-legged Gulls *Larus michahellis* may explain regional declines.

### Introduction

The Goosander *Mergus merganser* lives along lakes and large rivers and breeds in tree cavities, cliffs, large walls or old buildings. Its distribution in Europe stretches broadly from Iceland to northern Russia, with smaller populations in the centre of the continent and in the Balkans. A relatively isolated breeding population of Goosander occupies the Alpine region (Keller 2009). The map produced for the first European Breeding Bird Atlas made it clear that the Alpine population, concentrated in Switzerland, Bavaria and neighbouring Austria was isolated from that further north (Hagemeijer & Blair 1997). Molecular analysis highlighted an important genetic differentiation between the Alpine population and the ones from northern Europe (Hefti-Gautschi et al. 2009, Keller 2009). Population size was estimated at 1000–1400 pairs in 1998 (Keller & Gremaud 2003).

In Switzerland, first breeding records date from the 19<sup>th</sup> century but the species remained rare until the middle of the 20<sup>th</sup> century (overview in Keller & Gremaud 2003). Until then, the breeding population was mostly concentrated on Lake Geneva and its tributaries. Since the 1950s, the species has progressively spread towards the east and northeast, and the Goosander also colonised

the lakes and rivers south of the Alpine chain (Keller & Gremaud 2003). Due to the high responsibility of Switzerland for the Alpine Goosander population, the species received special attention during field surveys for the latest Swiss national breeding bird atlas (Knaus et al. 2018). This paper documents the changes in distribution and population size of the Goosander in Switzerland over time, with a special focus on the changes between the last systematic survey in 1998 and the atlas surveys in 2013–2016.

### Methods

The data collection for the third national atlas (2013–2016) put a special emphasis on scarce waterbirds, and observers were encouraged to systematically check the main rivers and lakes in 2015. On large lakes, the Swiss Ornithological Institute organised specific counts by boat in the same year, partly also in 2016. The results were analysed together with records of confirmed breeding of Goosanders from opportunistic data using a GIS system. Records were attributed to sectors of rivers and lakes manually to avoid possible double entries, because Goosander families are known to move over large distances in a short

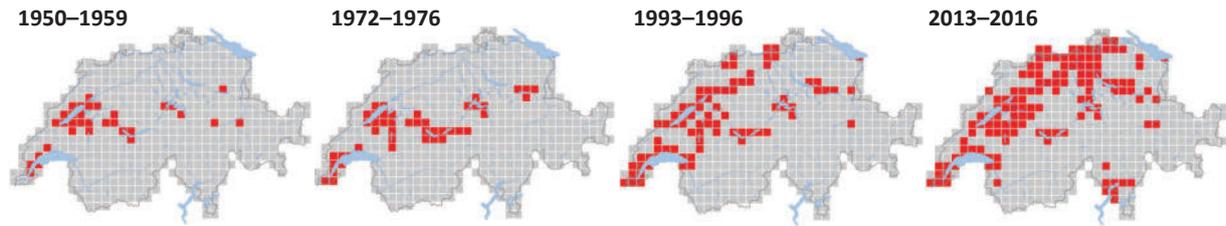


Figure 1. Breeding distribution of Goosander in Switzerland in the four time periods of national atlases, shown at a resolution of 10×10 km (from Knaus et al. 2018). Maps based on records of confirmed breeding only.

Table 1. Number of breeding pairs (min–max) in Switzerland (including French side of Lake Geneva). Data for 1985–1987 and 1998 from Keller & Gremaud (2003), for 2013–2016 from Knaus et al. (2018) and data from LPO Haute-Savoie for the French part of Lake Geneva.

Area	Period of survey		
	1985–1987	1998	2013–2016
Lake Geneva Basin CH / F (including Rhone/Arve)	475–500	381–566	251–331
Lake Neuchâtel	30	40–50	17–20
Lake Biemme (including Suze River)	2	52–66	27–33
Northern Aare Valley	5–9	23–40	61–74
Lakes Thun and Brienz	21–35	35–41	28–35
Lake Lucerne and central rivers (Reuss, Limmat)	14–15	32–37	66–80
Western rivers (Southern Aare Valley, Sarine, Glâne, Singine, Schwarzwasser)	21–30	37–47	49–57
Lakes Zürich and Walen	9	6–8	14–17
Ticino	0	0	25–31
Upper Rhine Valley	1	3–4	79–93
Other	7	12–14	17–19
<b>Total</b>	<b>586–638</b>	<b>621–873</b>	<b>634–780</b>

time. Together with the other records from the atlas period, this provided a good data base for comparison with earlier surveys, in particular the censuses of 1998 and 1985–1987 (Keller & Gremaud 2003). The results of 1998 were derived from four coordinated censuses between April and July; the population estimate of 1985–1987 was based on the number of males counted by boat on Lake Geneva in May and on surveys and expert assessment for other areas. The previous atlases published by the Swiss Ornithological Institute for 1993–1996 (Schmid et al. 1998) and 1972–1976 (Schifferli et al. 1980), the historical atlas of breeding birds of the 1950s (Knaus et al. 2011) and a few other counts were also used to complement the data.

## Results

The maps from the four national atlases document the distribution over 60 years (Fig. 1). In the 1950s, the Goosander occurred mainly in western Switzerland. The population increase observed in the following years (140 pairs in 1965–1966, >200 in 1978–1980) occurred mostly in the his-

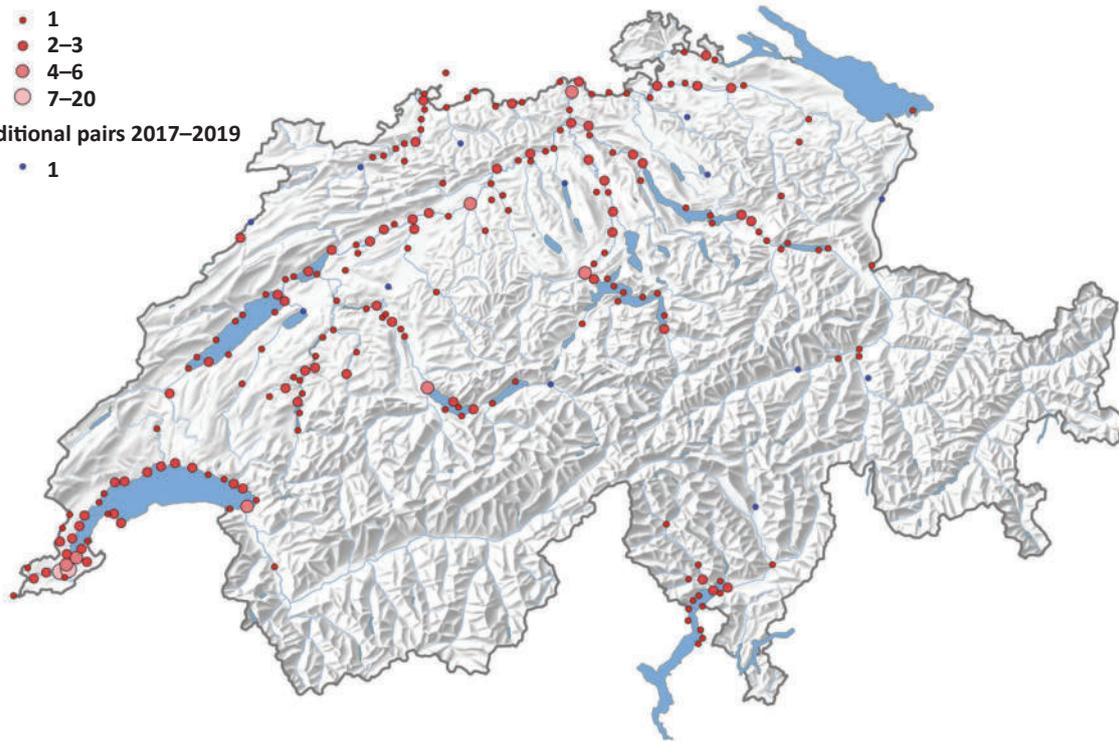
torical strongholds (Géroudet 1985). The north-eastward range expansion appeared more clearly during the 1980s (e.g. on Lake Zürich in 1980; Robin 1980). The mid-1980s witnessed the peak of the population of Lake Geneva, with 700 potential pairs estimated in 1984 on both Swiss and French sides and (more reliably) 475–500 pairs in 1985–1987 (Géroudet 1987). Lake Geneva thus held around 80% of the entire Swiss population. In the following years, two phenomena were observed: a geographical expansion in various directions and a stabilisation (followed by a decrease) of the number of breeding pairs in the former strongholds in western Switzerland. The national survey carried out in 1998 showed that the population of Lake Geneva had stopped increasing and that the growth on some other historically occupied lakes was contained (Table 1, Keller & Gremaud 2003). Meanwhile, Goosanders kept increasing further east and expanded in particular along the river systems of the Aare. The population of Lake Biemme jumped from two pairs in 1985–1987 to 52–66 in 1998. The Northern Aare Valley from Lake Biemme to the German border was colonised, with the first broods observed in

**Breeding pairs 2013–2016**

- 1
- 2–3
- 4–6
- 7–20

**Additional pairs 2017–2019**

- 1



**Figure 2.** Number of breeding pairs of Goosander 2013–2016 grouped for different sectors of lakes and rivers (from Knaus et al. 2018). Blue dots indicate sites with confirmed breeding in 2017–2019 outside the distribution area documented in 2013–2016.

1989 near Brugg and in 1996 at the Klingnau Reservoir. In the area of Basel, broods started in 1993 on the Birse River. The colonisation of new sites continued at the beginning of the 21<sup>st</sup> century (Lake Joux 2002, Doubs river 2007, etc.).

The fieldwork for the third national atlas (2013–2016) and the specific surveys in 2015 and 2016 provided a closer view on the local developments. From 490–670 pairs in 1998, the Swiss breeding population increased by approximately 21% to 600–800 estimated pairs for the period 2013–2016 (Knaus et al. 2018). The comparison with previous surveys highlighted the colonisation of new areas (Figs 1–2), and the growth of formerly small populations. On the southern side of the Alps, the Goosander bred for the first time in 2003 in Canton Ticino (Lake Maggiore), five years after the first reproduction in Piedmont (Italy; Bordignon et al. 2010). Since then, the Ticino population has grown rapidly to 25–31 pairs in 2013–2016. Another prime example is the Upper Rhine Valley (“Hochrhein” between Lake Constance and Basel and its tributaries), whose population jumped from five pairs in 1998 to 79–93 during the period 2013–2016. In contrast, breeding populations showed marked declines on the

western lakes, Geneva (–45% since 1998), Neuchâtel (–55%) and Bienne (–51%) (Table 1).

Important changes in the geographic distribution of the Swiss population were identified (Fig. 3). While the Lake Geneva Basin comprised the vast majority (79%) of the population in 1985–1987, this percentage was reduced to approximately 60% in 1998 and to 40% in 2013–2016. However, this region remains by far the most important stronghold of the country. Meanwhile, the Upper Rhine Valley, which was almost unoccupied in 1998, has become the second largest area in terms of breeding numbers. The most recent data gathered on the platform [www.ornitho.ch](http://www.ornitho.ch) confirm that the expansion in Switzerland is continuing (Fig. 2).

## Discussion

The first growth phase of the Goosander population on Lake Geneva was widely discussed in Géroutet (1985). Like many fish-eating waterbirds, the Goosander was in the past considered as pest and therefore widely persecuted. In Switzerland, it was harvested in any season until 1925, then only during autumn and winter before it came under complete protection in 1962. Parallel

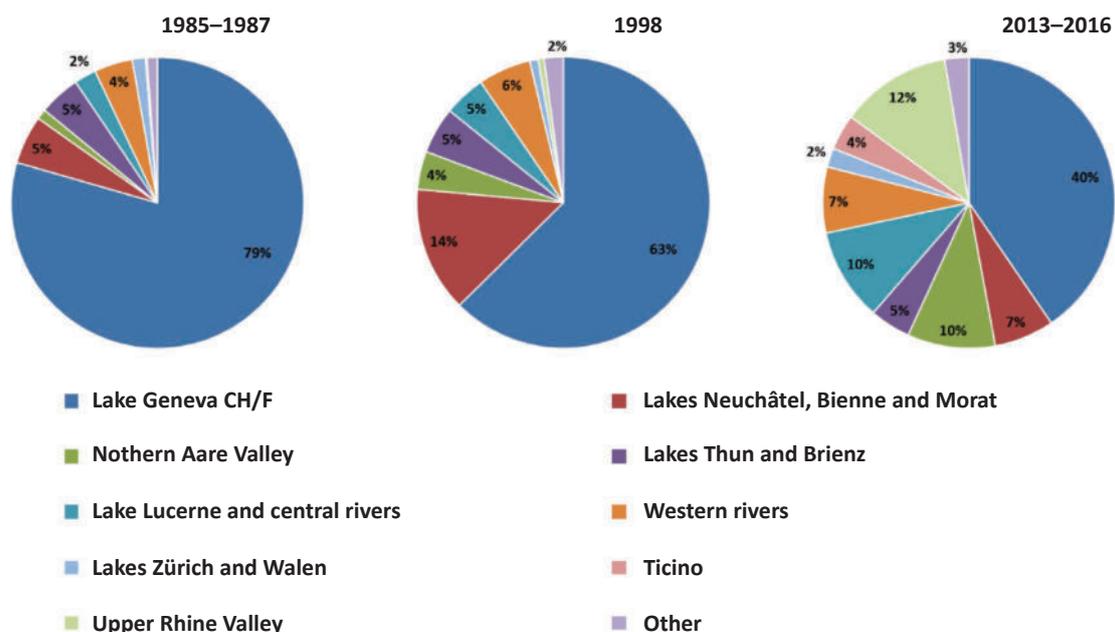


Figure 3. Breeding numbers of Goosander in different regions in percentage of the Swiss population (including French side of Lake Geneva).

to the range expansion, the breeding population also increased strongly in the 20<sup>th</sup> century, from about 15 pairs in 1930 to an estimated 60–100 pairs around 1956 and to 140 pairs 1965–1966 (Géroutet 1985, Knaus et al. 2011). This period corresponds to the first phase of expansion of the species as breeding bird on Lake Geneva, which was also helped by the provision of nestboxes and the creation of several nature reserves. In the decades 1960–1970, the high trophic level of the lake enhanced the population of Perch *Perca fluviatilis*, which probably affected positively the situation of the Goosander.

In the French department of Haute-Savoie, the species was declared protected in 1972. This decision meant the complete protection of the Goosander on Lake Geneva and was instantly followed by an increase of wintering birds. From 100–200 Goosanders estimated in the winters 1950–1970, numbers counted increased to 400–900 birds in 1975–1980 (Géroutet 1985).

Similar expansions of the breeding population were also reported from regions adjacent to Switzerland, for example in southern Germany (Gedon et al. 2014). In Bayern, 420–550 pairs were estimated during the period 2005–2009, almost twice as many as in 1996–1999 (Rödl et al. 2012). In Austria Goosanders spread both north and south of the Alps; Malle & Malle 2015). South of the Alps, Goosanders continued to spread in northern Italy (Bordignon et al. 2018). A noticeable increase was also reported in the neighbour-

ing regions of France (Issa & Muller 2015). At a larger scale, these increases in Switzerland and neighbouring regions are part of a more general expansion of Goosanders in the southern half of Europe (Keller et al. 2020).

The causes for the recent decline noticed on Lake Geneva and other western lakes are, in contrast to the widespread increase, largely unknown. The increasing complaints from the fisheries community against fish-eating waterbirds led to shooting permissions in some cantons, which may have affected local breeding populations although this has not been studied in detail. Human disturbance from recreation activities (canoeing, paddling) or the reduced availability of nesting sites (through removal of trees with cavities, but also renovation of old buildings and construction of brand-new structures) may explain regional declines, but their impact is difficult to quantify. In many areas, Goosanders have become tolerant to humans and have started to nest in towns, indicating that there is currently no lack of nest sites. Predation by Yellow-legged Gulls *Larus micha-*  
*hellis* was put forward to have negative effects on waterfowl on Lake Neuchâtel especially but evidence for real effects on population trends was lacking (Keller & Zbinden 1998). While local effects on breeding Goosanders cannot be excluded in the areas where they breed in close proximity to large Yellow-legged Gull colonies, it is unlikely that predation is a major factor explaining the decline on the large lakes.

The variation of some fish populations, for instance the decrease of small- and middle-sized species (Perch, cyprinid fish, etc.) can also be pointed out. Reduced eutrophication levels have led to a decline in abundance of cyprinid species since a peak in the 1970s, e.g. of *Rutilus rutilus* (Périal et al. 2014), likely to be one of the main prey of Goosanders on the large lakes. Fish communities have generally undergone massive changes, the consequences of which for Goosanders and other fish-eating birds being largely unknown.

The results of the surveys document the dynamic changes in both distribution and abundance of breeding Goosanders in Switzerland. Although the general population trend remains clearly positive at national level, the regional developments in western Switzerland should be more closely

followed, in order to identify the reasons for the decline and to address measures for the safeguard of the populations.

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