

## Contrasting population trends of Whinchat (*Saxicola rubetra*) and Stonechat (*S. rubicola*) in fens south of lake Chiemsee (Bavaria, Germany)

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The genus *Saxicola* is represented in Bavaria by Whinchat (*Saxicola rubetra*) and Stonechat (*S. rubicola*). These two species are characteristic breeding birds in open areas. In the Bavarian foothills of the Alps, they can sometimes be found breeding in sympatry, especially in fens. Here, we analyse the population trends of both species in fens south of lake Chiemsee since the 1960s. Whinchat breeding populations in the study area have declined by 85-90% since the 1960s. The Stonechat first bred in the area in 1985 and shows a positive population trend. Both Whinchat and Stonechat showed a tendency to arrival earlier in the breeding area since 1980. This tendency was more pronounced in the Stonechat, which might be linked to the short distance migratory behaviour of the species. Its arrival dates correlate significantly with data indicating a tendency to earlier vegetational development in the study area. Flooding events in the breeding grounds increased in frequency in recent decades. The Stonechat is probably better at coping with floods because it starts breeding earlier and the juvenile birds usually fledge before the main flooding period. Evidence for competition between the two closely related species was not very strong. There are however many other possible explanations for the contrasting population trends of the two species. The breeding ecology of the Stonechat, which breeds more often and earlier than the Whinchat might be an advantage. Mortality due to illegal hunting in Southern Europe during the migration period is much higher in Whinchats than in Stonechats. The Stonechat has a higher tolerance to scrub and/or reed encroachment in breeding habitats. Pesticide applications against mosquitoes during the nestling period of Whinchats might also be a reason for the population decline of this species.

### 1 Introduction

The most recent common ancestor of the Whinchat (*Saxicola rubetra*, LINNAEUS 1758) and the Stonechat (*Saxicola torquata*, LINNAEUS 1766) lived about seven to ten million years before the evolution of the two species (ILLERA et al 2008).

In the mediterranean climate of Southern Europe, the Stonechat is widespread and much more common than the Whinchat, which occurs there rather locally. The Stonechat, on the other hand, is largely absent in Northern and Eastern Europe, where the Whinchat is more common. Generally, the Stonechat is rather a thermophilic species with its main distribution in the mediterranean and maritime climate zone. The Whinchat, on the other hand, seems to be a rather psychrophilic species with a predominant distribution in the regions characterized by the continental and sub-polar climate. However, especially in Central and Western Europe, the areas of both species overlap. Bavaria lies in the transitional zone between the maritime climate of Western Europe and the

continental climate of Eastern Europe. The climate is therefore acceptable to both species.

Around 1900, the Whinchat was described as a frequent and very common species in the cultural landscape of the Bavarian Alpine foothills (WÜST 1982), where the species is nowadays threatened with extinction. In the current Red List of Bavaria, the Whinchat has been placed in category 1 - threatened with extinction (RUDOLPH et al 2016). Particularly problematic is the loss of species-rich grassland due to conversion to arable land, to an unfavourable mowing regime, intensive fertilization, the use of pesticides, enlargement and standardization of fields, drainage, management without brownfields and, on less profitable land, by scrub encroachment (FEULNER 2015). Increased disturbance and reduced food availability are further possible causes (LIEBEL 2015).

The second *Saxicola* species in Bavaria, the European Stonechat has shown a steady increase in Europe in recent decades ("EBCC | Atlas of

European Breeding Birds“). Until the 1980s, the main breeding grounds of this species in Germany were in the lowlands of the Northwest. In recent decades, its range has expanded into the climatically more continental East. In the country overall, population trends of the species are positive (SUDFELDT et al 2013).

In the foothills of the Bavarian Alps, new settlements and a significant increase in the population of what was formerly a very rare species have occurred, especially since the mid-1980s (NITSCHKE & RUDOLPH 2014).

The oldest documented observation of a Stonechat in the Chiemsee area was on March 15, 1959, in the flushing seam of the “Hirschauer Bucht”. There was no evidence of breeding at this time.

In 1982, G. HOHLT first observed a singing Stonechat male on the fen “Grabenstätter Moos”. In 1984, G. NITSCHKE documented a pair of Stonechats in a fen near Schnaitsee, about 25 km north of Lake Chiemsee. The first breeding record was in 1985 on a ruderal site near the “Westerbuchberg”, to the south of Lake Chiemsee. One year later, further breeding sites were found in the peat bog “Kendlmühlfilzn” and in the “Schafwaschener Bucht” (LOHMANN 1986). In the following years, the population in the Chiemsee area continued to spread and increase.

Sympatric occurrences of the two species occur regularly in one area. Particularly in the area of litter meadows in fens and extensive pastures, both species occur in immediate vicinity.

## 2 Material and Methods

The study area lies in the southeast of Bavaria (Germany). It is a fen area south of Lake Chiemsee (Bernauer Moos, Schönegaard, Lachsgang, Grabenstätter Moos). Population trends were analysed using the database of the Ornithological Working Group Chiemsee. The current number of breeding pairs was mapped from April 2018 to June 2018, based on the method standards for recording the breeding birds of Germany (SÜDBECK et al 2005). The database of the Ornithological Working Group Chiemsee provides initial arrival data for both bird species, mainly based on the work of M. LOHMANN. The data series was supplemented by records from the internet

platform ornitho.de. Climate and phenology data came from the „Climate Data Center“ platform of the German Weather Service (DWD) for the stations in Trostberg, Ruhpolding and Kolbermoor. Data for flooding events was obtained from the Rothgraben measuring station of the Bavarian Flood Information Service.

## 3 Results

### 3.1 Arrival dates and climate trends in the southern Chiemgau

Since the 1980s, both chat species tend to arrive earlier in the breeding area (Fig. 1) but this change is more pronounced for the Stonechat

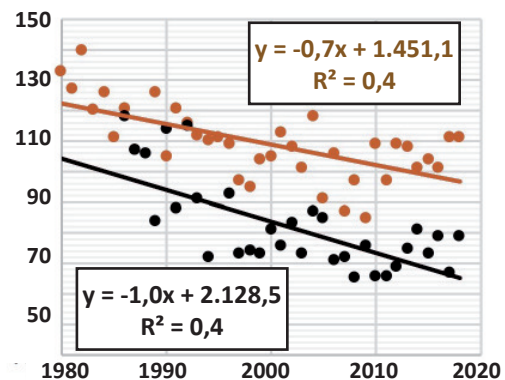


Fig. 1: Arrival dates of Whinchat (brown) and Stonechat (black) [calendar days] in the region.

(slope of regression line: Whinchat -0.7, Stonechat -1.0). In the latter half of the study period, Stonechats have been arriving on average 14 days earlier, while Whinchats arrive seven days earlier than in the 1980s.

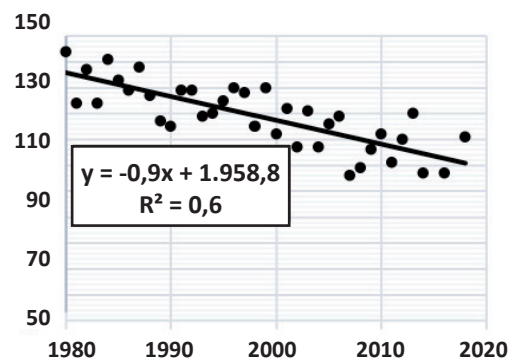


Fig. 2: Beginning of the apple blossom [calendar days] in the region (data from DWD).



Fig. 3: The 5 highest flows measured between 1970 and 2018 at the Rothgraben station (source: Flood Information Service Bavaria).

The timing of the apple blossom is a phenological indicator that spring is in full progress. First arrival dates of the Stonechat correlate positively with the beginning of the apple blossom (Pearson coefficient=0.52, p-value=0.003; Fig. 2).

Flooding events in the study area have increased in recent years (Fig. 3). Most breeding grounds in the fens south of Lake Chiemsee lie within flood hazard areas. During the last flood, at the beginning of June 2013, the entire grassland of the nature reserves “Grabenstätter Moos” and “Lachsgang” was flooded. It is very unlikely that any eggs or nestlings of the grassland birds survived this event. In 2018, the earliest Stonechat



Fig. 4: Water level of the flood in the year 2013 indicated by the red arrow (Photo: © N. THUM).

fledglings in “Grabenstätter Moos” were observed on May 23<sup>rd</sup>. The earlier arrival and onset of breeding may give the Stonechat an advantage over the Whinchat with regard to the floods in the region, which usually occur in early summer.

### 3.2 Behaviour in the breeding grounds

Territorial conflicts between the two species were observed only once during the mapping period: a Stonechat male and a Whinchat male were seen chasing each other on the 25.04.2018 at the “Grabenstätter Moos”. The pair of Whin-

chats bred in this season near to the traditional territory of the Stonechat. However, intraspecific territorial conflicts were also observed in both species. In one case, a Whinchat gave up a territory, following the appearance of a pair of Red-backed Shrike (*Lanius collurio*).

Both in the large fen area south of Lake Chiemsee (1029ha) and in the nature reserve “Grabenstätter Moos” (395ha) contrasting population trends for the two chat species are evident (Figs. 5-6).

While the Whinchat occurred in densities of about 2-3 breeding pairs/10km<sup>2</sup> in the fens south of Lake Chiemsee in the 1960s, the den-

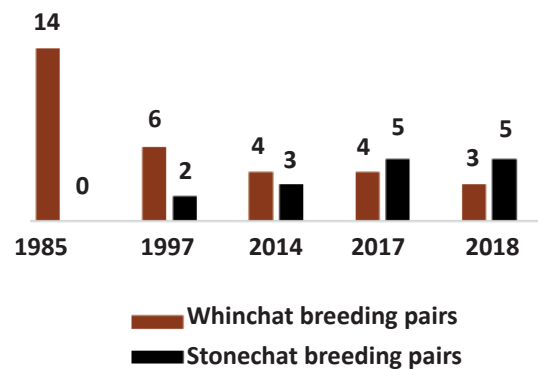


Fig. 5: Population trends of Whinchat and Stonechat in the “Grabenstätter Moos”.

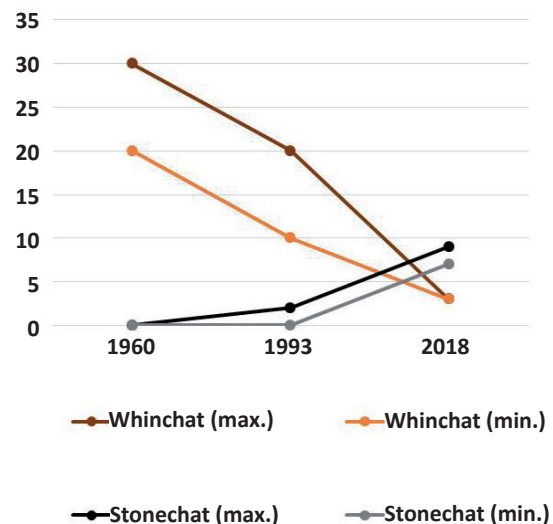


Fig. 6: Breeding pairs in the fens south of Lake Chiemsee (Bernauer Moos, Schönegaard, Lachsgang, Grabenstätter Moos). Estimated by M. LOHMANN in 1960, counted by M. LOHMANN in 1993 and counted in 2018.

sity in 2018 is about 0.3 breeding pairs/10km<sup>2</sup>. The current Stonechat density is 0.5 breeding pairs/10km<sup>2</sup>, which is higher than the Whinchat density. This represents a decline of 85-90% in the Whinchat population in these fens within 50 years.

#### 4 Discussion

We find a strong decline of the Whinchat in the study area, while the Stonechat shows a simultaneous increase in population size. However, the overall increase of the Stonechat is at a low level and although they do occur in sympatry in some places, evidence for direct competition is very rare in the study area.

Both species tend to arrive earlier in the study area than in the 1960s. Earlier arrival in the breeding grounds has also been observed in many other European migratory birds (RUBOLINI et al 2007).

The Stonechat's greater tendency to arrive earlier in the breeding grounds and the observation that its arrival correlates significantly with vegetational phenological data may be explained by the fact that the Stonechat is a short-distance migrant. In the wintering areas in the Mediterranean, which are relatively close to the breeding grounds, it is likely to react faster and more flexibly to weather situations in Europe. In the case of a warm spring, it can migrate earlier to the breeding grounds. It could be shown that the Stonechat has a relatively flexible schedule for brood and moult (FLINKS et al 2008). It may therefore adapt better to changing environmental conditions. Long-distance migrants like the Whinchat, on the other hand, are generally less flexible.

The arrival dates also show that the Stonechat arrives on average about three to four weeks earlier in the breeding grounds on Lake Chiemsee than the Whinchat. Stonechats usually hatch in May, while Whinchats hatch in June. A study in Upper Franconia (Northern Bavaria) found that significantly more invertebrate biomass is available in May than in June in Whinchat breeding grounds (HOLZINGER et al 2017). If the pattern is similar in the Chiemsee region, this could have a positive effect on the reproductive success of the Stonechats or negatively on the reproductive success of the Whinchat. Invertebrates may res-

pond more quickly to climate change in their developmental cycle than the Whinchat. This could lead to an asynchronous development.

The flood events occurring in the area of the fens south of Lake Chiemsee with increasing frequency in early summer could endanger the breeding success of the later hatching and feeding Whinchat in particular, while the Stonechat will be less affected due to earlier and more frequent breeding.

Stonechats usually breed twice per season. A third of the pairs even breed three times (FLINKS et al 2008). Overall it could have a higher reproductive success and a spread of risk over a longer period of time than the Whinchat, which usually only breeds once a year. In a study conducted in the United Kingdom, it could be shown that the reproductive success of the Stonechat is greater than that of the Whinchat (FULLER & GLUE 1977).

Another cause of the contrasting population trends of the two species could be the differences in hunting pressure in Southern Europe. A study examining almost 1000 trapped bird individuals in southern Italy found that the Whinchat makes up the largest proportion of all species with 32% (HEYD 2015). It is estimated that 8,960-13,568 Whinchats are killed each year in Italy during the spring migration (HEYD 2015). This is about ten times the Bavarian breeding population of 910 individuals according to the last state-wide mapping in 2014/2015 (LIEBEL 2015).

In contrast, the Stonechat seems to suffer much less from hunting. Among more than 20,000 illegally caught birds in Italy and Spain, not a single Stonechat was detected. In Cyprus, Stonechats make up less than 1% of the catch. This large discrepancy can be explained by the fact that the bird hunt mainly takes place in April/May and in September/October, at the times of peak migration. Traps in southern Italy are targeted from mid-April to mid-May at catching the long-distance insectivores, which, after crossing the Sahara and the Mediterranean, rest in greater numbers in southern Europe. In winter, which the Stonechat spends in the Mediterranean area, there is almost no hunting, because the winter populations are smaller and the birds are less concentrated. (A. HEYD (2nd Chairman, Komitee gegen den Vogelmord e.V.), pers. comm., 24.05.2018).

Large-scale pesticide application is another potentially damaging factor: since 1997, the pesticide BTI (from *Bacillus thuringiensis israelensis*) has been applied in the Chiemsee region to control mosquitoes. In 1993, prior to the application of BTI, a total of 10-20 Whinchat breeding pairs were counted in the fen belt south of Lake Chiemsee. In 2018, only three pairs remained. In the nature reserve “Bernauer Moos”, the Whinchat disappeared as a breeding species two years after the beginning of BTI application; in the nature reserve “Lachsgang”, the breeding population disappeared three years after the beginning of BTI application. In both areas, there had presumably been a long history of Whinchat breeding. The main reason for the approximately 5000km migration of the Whinchat across the Sahara and the Mediterranean Sea lies in the high food availability in the northern latitudes in the summer half-year, which is caused by the periodic mass occurrence of invertebrates. Mosquitoes occur mostly in large numbers in June, coinciding with the hatching of the Whinchats and thus a high nutritional requirement. Therefore, BTI use may affect the late breeding Whinchat in particular.

Finally, it was observed in the study area that the Stonechat shows a greater tolerance in its choice of breeding habitat for nearby woody areas and reed areas than the Whinchat. It is therefore concluded that the former species is probably better at coping with scrub and reed encroachment.

In summary, the contrasting population trends of Whinchat and Stonechat appear to be caused by a variety of different factors and most likely not simply the result of direct competition between the two species.

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