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Irmi Zwahlen, Michael Schaub



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Population dynamics of Hoopoes *Upupa epops* and Wrynecks *Jynx torquilla* in the Valais

Table of content

Abstract	3
1 Introduction	4
2 Fieldwork	4
3 Nest box availability	5
4 Hoopoe: results and discussion	6
4.1 Overview	6
4.2 Capture of adults	7
4.3 Demographic performance	9
4.4 Post-fledging ecology	11
5 Wryneck: results and discussion	12
5.1 Overview	12
5.2 Tape luring	13
5.3 Demographic performance	13
6 Nest boxes occupied by other species	14
7 Resightings and ring recoveries	15
7.1 Hoopoe	15
7.2 Wryneck	15

IMPRINT

Population dynamics of Hoopoes
Upupa epops and Wrynecks *Jynx torquilla* in the Valais
– Annual report 2024

Authors

Irmi Zwahlen
Michael Schaub

Contribution

Ian Ausprey; 4.4. Post-fledging ecology

Cover picture

Hoopoe chicks at ringing
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Contact

Irmi Zwahlen
Schweizerische Vogelwarte
Seerose 1
6204 Sempach
T 041 462 97 00
T 041 462 97 52 (direkt)
irmi.zwahlen@vogelwarte.ch

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Sempach

Dieser Bericht darf ohne Rück-
sprache mit der Schweizerischen
Vogelwarte Sempach weder als
Ganzes noch auszugsweise
publiziert werden.

Abstract

The fieldwork for the hoopoe and wryneck population ecology project continued, following the protocol of previous years, to monitor the population of the two species breeding in the more than 600 nest boxes installed in the Rhone Valley between Martigny and Sierre.

In 2024, 121 hoopoe broods were recorded, of which 99 were successful. From these 99 broods, 491 chicks fledged (average: 5.0 chicks / successful brood). After temporary lows in 2018 and 2019, the number of successful broods has increased steadily (except in 2022). 138 different breeding adults were identified, of which 89 had already been ringed with an alphanumeric colour ring and could therefore be identified on photos taken by a camera trap installed at the nest box entrance.

13 wryneck broods were recorded, of which 11 were successful. From these 11 broods, 76 chicks fledged (average: 6.9 chicks / successful brood). 2024 was the year with the lowest number of broods in our nest boxes since 2002. 18 different breeding adults were identified. Prior to the breeding season, 28 wrynecks were captured with playback equipment, of which 4 were already marked. 2 of these subsequently bred in our nest boxes.

1 Introduction

At the end of the 20th century, the breeding populations of the Eurasian Hoopoe *Upupa epops* and the Eurasian Wryneck *Jynx torquilla* declined sharply in Switzerland. In order to counteract this negative trend, around 700 nest boxes were installed in the Rhone Valley between Martigny and Sierre between 1998 and 2001, and the populations of these two breeding species have been monitored annually since 2002.

In addition to the local conservation goal of ensuring the long-term survival of these populations in the Valais, we also want to better understand the breeding ecology, demography and population dynamics of the two species.

The general survey consists of checking all nest boxes every two weeks, checking occupied nest boxes every five days to collect information on the broods, capturing or resighting adult breeding birds and ringing all nestlings. In addition, wrynecks are captured with tape luring prior to the breeding season. Standardised field protocols have been developed for each species and were last updated in spring 2020. A new tape luring protocol for wrynecks has been applied since 2023 to standardise spatio-temporal effort.

As in previous years, all physically handled hoopoes and wrynecks were marked with an alphanumeric colour ring in addition to the standard aluminium ring. The alphanumeric ring makes it easier to identify individuals on photographs taken by camera traps at the entrance to the nest boxes and reduces the need for physical capture.

The collection of genetic samples from all physically handled birds (adults and nestlings) that had not previously been sampled was continued. Genetic samples were obtained by buccal swabs taken from the mouth. They allow sex determination and insight into the genetic structure of the population.

The University of Bern Division of Conservation Biology continued its project on post-fledging ecology of hoopoes, with a third year of fieldwork completed in summer 2024. The main goals of the project are (1) estimate the survival of fledgling hoopoes in relationship to environmental and biological covariates, (2) calculate movement rates in relation to behavioral development, and (3) determine habitat associations.

Carla Dréon, a student from University of La Rochelle, France, wrote an internship report as part of her master's degree, for which she analysed "The breeding behaviour and success of *Upupa epops* in artificial cavities in Valais, Switzerland".

2 Fieldwork

Tape luring for wrynecks was carried out between 10th and 29th April 2024, on a total of 11 different days. A new protocol from 2023 was applied for the second year: at each of the 28 defined 500x500m² sample sites within the study area (covering all zones except C) tape luring was preformed twice with at least one week in between.

The first regular nest box check began on 15th April. All nest boxes were then checked every other week until the end of July (last check ended on 23rd July). Nest boxes occupied by hoopoes or wrynecks were checked approximately every fifth day to collect information on breeding output and phenology (clutch size, number of eggs hatched, number of fledglings, approximate laying and hatching dates). Nest boxes were checked from the outside through the entrance hole using an endoscopic camera. Occupancy of the nest boxes by species other than the focal species was also documented.

At all nest boxes occupied by the target species, a camera trap was installed next to the entrance hole after the clutch was full in order to identify the breeding adults.

Capture of unmarked hoopoes began eight days after the oldest chick had hatched. Most female hoopoes were captured by hand directly from the nest box, while males were captured with a clap trap attached to the nest box entrance or with a mist net. Capture of unmarked wrynecks began no earlier than seven days after the chicks had hatched. Individuals were captured using a mist net placed in front of the nest box.

Attempts were made to avoid capturing individuals that had already been identified in photographs. Catching effort per brood was limited to two hours per day and a maximum of six hours in total (attempts every other day). Captured adults were ringed (standard ring plus alphanumeric colour ring) and several morphological measurements were taken (according to the field manuals).

Hoopoe chicks were ringed (standard ring plus an alphanumeric colour ring) at the age of at least 18 days, and the lengths of tarsus, bill, third primary and the weight were measured. Wryneck chicks were ringed (standard ring plus an alphanumeric colour ring) at an age of at least 10 days, and tarsus length and weight were measured.

The fieldwork was carried out by Sidonie Nicole and Carla Dréon under the supervision of Irmi Zwahlen.

3 Nest box availability

The development of the number of boxes since the start of the project in 2002 is shown in Figure 1. In 2024, 619 hoopoe nest boxes were available in 377 different locations. We lost some nest boxes compared to the previous year (2023: 639). This is because whole orchards have been cleared, generator huts have been demolished or owners have changed, and the new owners no longer want nest boxes. However, this has been recorded and we will ensure that new nest boxes are installed during the winter months to keep the availability of nest boxes approximately at a constant level. The installation of new nest boxes will be carried out by Valentin Debons, field technician from the University of Bern.

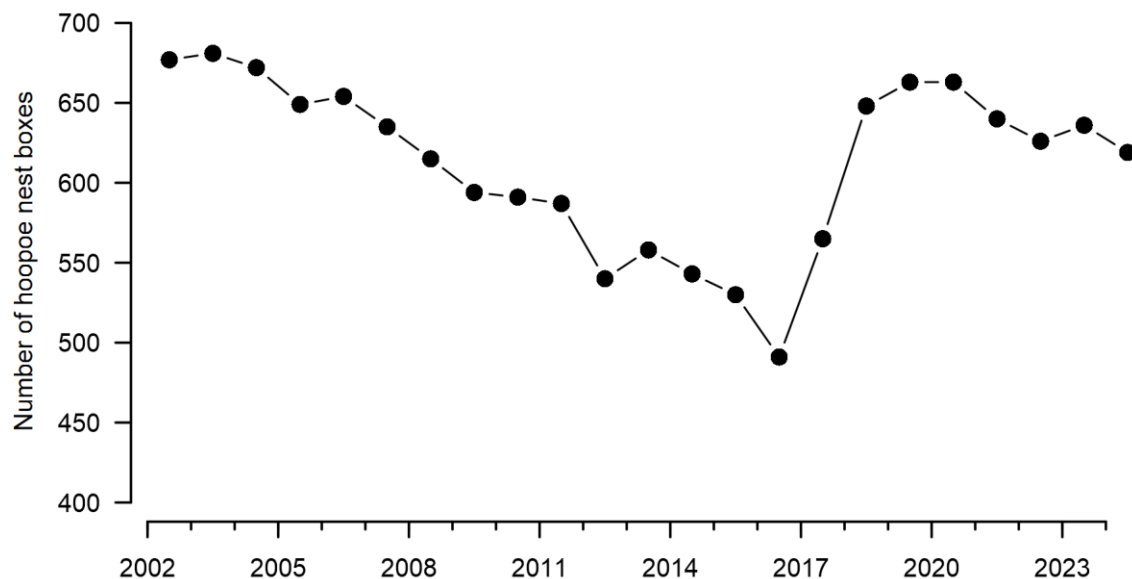


Figure 1 Development of the number of available nest boxes in the study area (Schwegler wryneck boxes are not included in the graph).

4 Hoopoe: results and discussion

4.1 Overview

A total of 121 broods were recorded, of which 99 were successful, i.e., at least one chick fledged (Figure 2). From these 99 broods, 491 chicks fledged (mean: 5.0 chicks / successful brood).

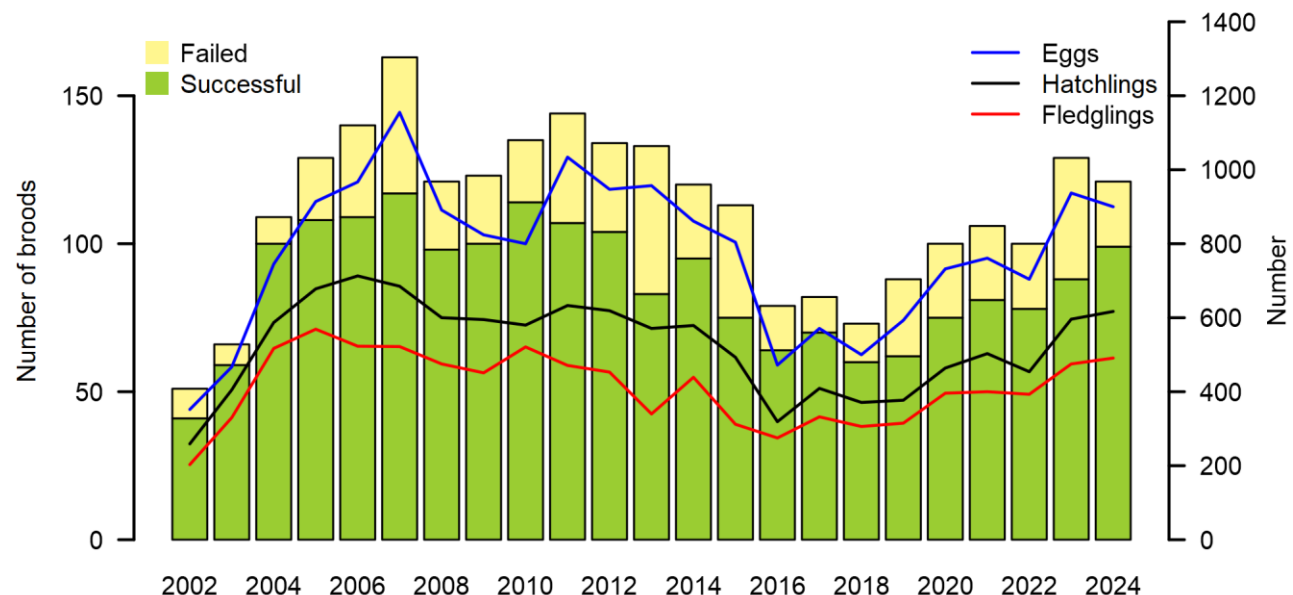


Figure 2. Development of the hoopoe population. Bars represent the number of successful (green) and failed clutches (khaki) per year (left scale); lines represent the total number of eggs laid (blue), eggs hatched (black) and fledglings (red) per year since 2002 till now (right scale).

The increase in the number of successful broods is consistent with the steady increase (except for 2022) since the temporary low in 2018 and 2019. Fortunately, the number of unsuccessful broods in 2024 was low, especially compared to 2023 (18% in 2024 compared to 32% in 2023). Most unsuccessful broods in 2024 were abandoned or predated clutches (15). 7 broods failed after hatching. The true cause of failure is very difficult to determine and remains speculative.

With a total of 491 fledglings in 2024, this is the highest number since 2012. The mean number of fledged chicks per successful brood was 5.0, which is lower than in 2023 (5.4 chicks / successful brood). However, the long-term average number of fledglings per successful is 4.8 ($\bar{x}_{2002-2024}$), indicating that the breeding success in year 2024 was still slightly above the average.

We identified 138 different adults (67 males, 71 females), 89 of which were already ringed, while 49 (25 males, 24 females) were unmarked. We ringed 520 nestlings, of which 491 finally fledged.

Genetic samples were collected from all first captured adults and from all ringed nestlings.

4.2 Capture of adults

A current aim of the study is to reduce the need for physical capture of adults while still being able to monitor the population. Table 1 summarises the methods used to identify individuals and how this has changed over time. Note that prior to 2011, all adults could only be identified if they were physically captured. Since 2011, there have been four different ways of encountering adults: 1) using the mist net in front of the nest box, 2) using the clap trap, 3) removing the bird from the nest by hand, and 4) resighting with a camera. Individual birds may have been seen more than once during the season, as they may have had more than one brood.

Table 1 Summary of the identified adult hoopoes in relation to the encounter technique.

Capture technique	Year													
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Mist net only (M)	18	10	6	4	6	0	1	0	4	1	0	0	2	3
Clap trap only (T)	69	56	55	48	29	57	51	36	31	24	29	28	37	25
By hand only (H)	65	78	47	54	78	14	19	6	8	18	14	23	15	14
Resighted only (R)	0	0	3	3	1	6	16	30	33	56	67	51	73	78
M & R	3	3	2	1	2	0	0	1	2	0	0	0	0	1
M & T	2	0	0	1	0	0	0	0	0	0	0	0	0	0
H & R	0	3	0	4	3	2	9	6	3	5	4	5	7	10
T & R	3	5	22	20	9	16	5	10	12	6	6	7	7	6
H & T	7	5	1	5	6	2	0	0	0	0	0	0	1	1
H & M	2	0	0	0	3	0	0	0	3	0	0	0	0	0
H & T & R	0	0	1	0	1	0	0	0	0	0	0	0	1	0
M & T & R	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Total number identified	170	161	152	141	139	97	101	89	94	110	120	114	147	138
%physically captured	100	100	98	98	99	94	84	66	64	49	44	55	50	43
Number of individuals physically captured twice in a year	37	20	13	32	46	9	1	0	0	0	0	0	3	2

The proportion of physically handled individuals was almost 100% until 2015 and declined thereafter to a minimum of 43% in 2024. In recent years it has stabilized at around 50%.

In 2024 2 individuals were caught twice. This occurred when only one of the two parents was captured on the first attempt, and on the second attempt to capture the unmarked individual, the individual already captured on the first attempt was accidentally recaptured.

Another way of looking at the resulting change in encounter technique after we started marking all individuals with alphanumeric colour rings is to consider the broods as units and only distinguish between physical capture (mist net, clap trap or by hand) and resighting with the cameras. At the brood level it is possible that none, only one or both parents have been identified by physical capture or resighting.

Table 2 *Summary of the identified adult hoopoes in relation to the encounter technique.*

Number of broods	Year													
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Both captured	92	92	68	66	67	36	29	21	21	13	8	15	21	21
1 captured, 1 resighted	8	8	18	31	10	11	14	15	16	22	32	31	32	18
1 captured	18	12	8	10	17	13	14	2	5	5	5	2	3	2
Both resighted	0	1	14	1	3	4	10	21	28	34	40	27	47	62
1 resighted	0	1	2	2	0	6	5	5	4	13	10	13	5	7
None identified	29	22	26	11	16	9	11	9	16	13	11	12	21	11
Total number of broods	147	136	136	121	113	79	83	73	90	100	106	100	129	121
% of broods without capture	20	18	31	12	17	24	31	48	53	60	58	52	57	66
% of broods whose parents were identified without capture	0	2	15	3	3	14	21	41	43	54	53	45	48	63

Table 2 summarizes the results since 2011. The percentage of broods where no adult was physically captured has increased from between 12-31% in 2011–2017 to over 50% since 2019. This year we reached a new maximum with 66% of broods without capture. Sometimes none of the adults in a brood can be identified, either because the brood died before identification began or because identification was unsuccessful. If we consider only those broods where at least one adult could be identified, we see that the percentage of broods without physical capture has increased from almost zero to around 50% since 2019. At 63% this year, this value reached a new maximum. All these results show that the systematic marking of nestlings and adults with alphanumeric colour rings and subsequent camera monitoring has significantly reduced handling pressure on hoopoes. There is an increasing proportion of broods that no longer require physical capture. However, immigration is still high, resulting in the presence of unmarked individuals. It is therefore unlikely that the proportion of birds not physically captured will decrease significantly anymore. This can also be seen by comparing the last five years, where no major changes have occurred.

4.3 Demographic performance

Using a Bayesian integrated population model, we analysed all demographic data sets jointly to get hints about demographic changes in the population. The model is constructed in such a way that temporal random effects in all demographic parameters are imposed. For the immigration the temporal random effect was applied on the number of immigrants. The estimates from the model are shown in Figures 3–5. For most of the parameters, there were no obvious changes in 2024 compared to previous years.

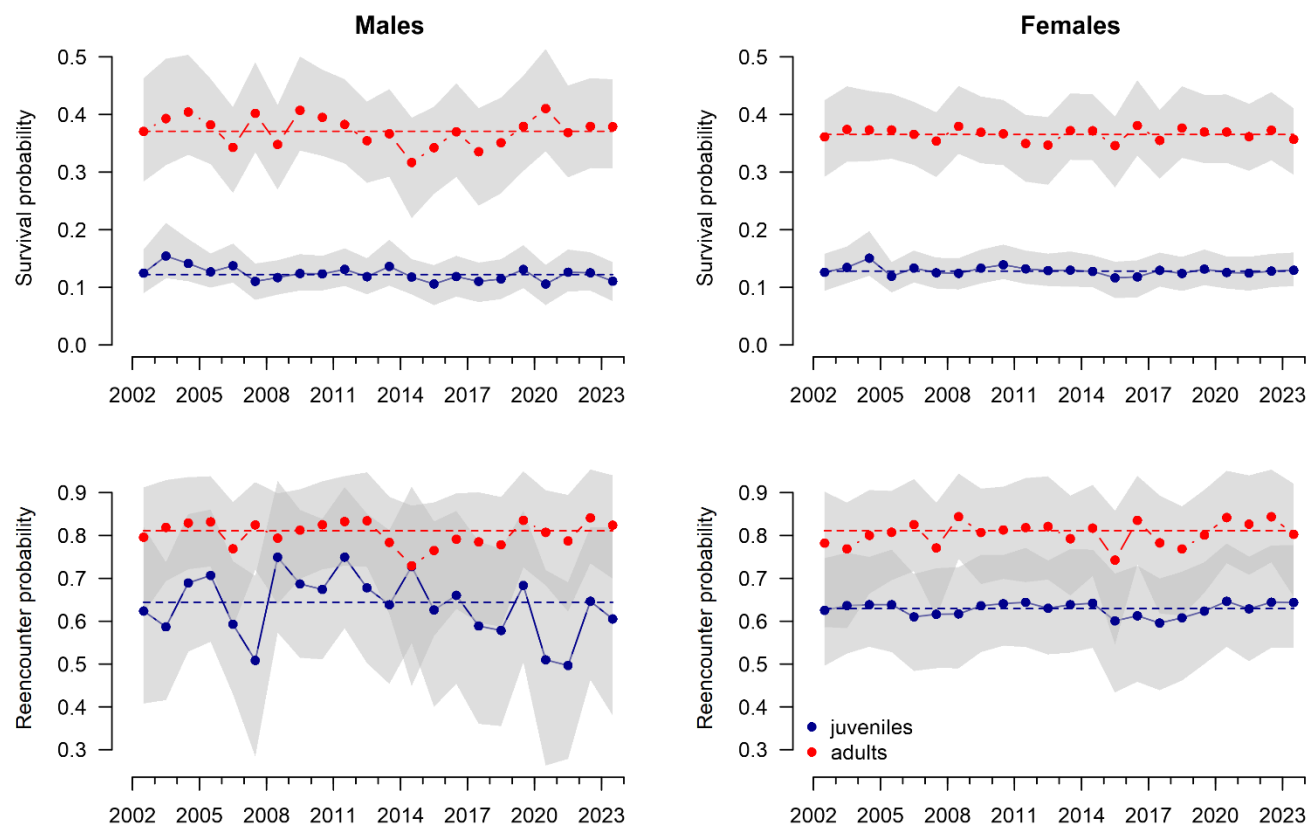


Figure 3 Estimated annual apparent survival probabilities of juvenile (blue line) and adult (red line) hoopoes (top panels) and estimated reencounter (recapture or resighting) probabilities (bottom panels). Estimates for males are in the left panels and estimates for females are in the right panels. Points are posterior means, the polygons show the 95% credible intervals, and dashed lines show the mean over time.

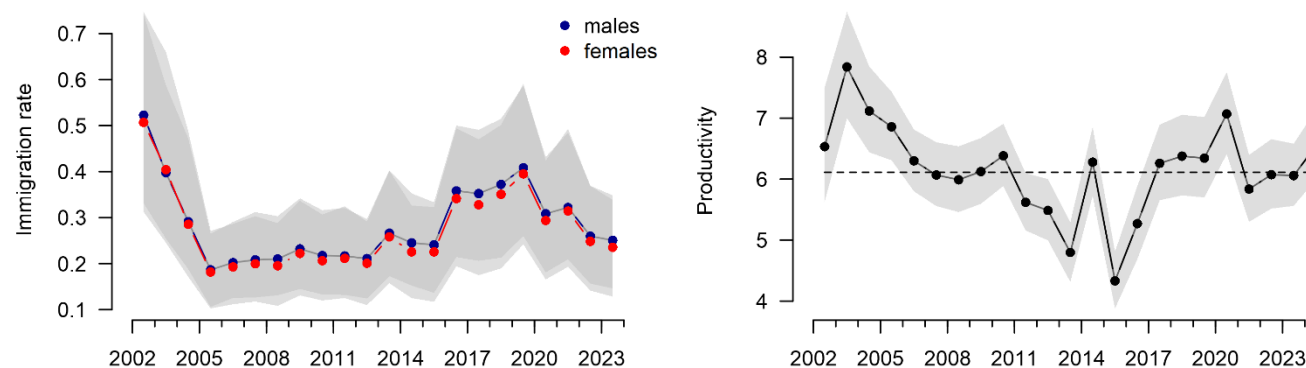


Figure 4 Estimated immigration rates of hoopoes by sex and the estimated number of fledglings per female (productivity). Points are posterior means, the polygons show the 95% credible intervals, and dashed lines show the mean over time.

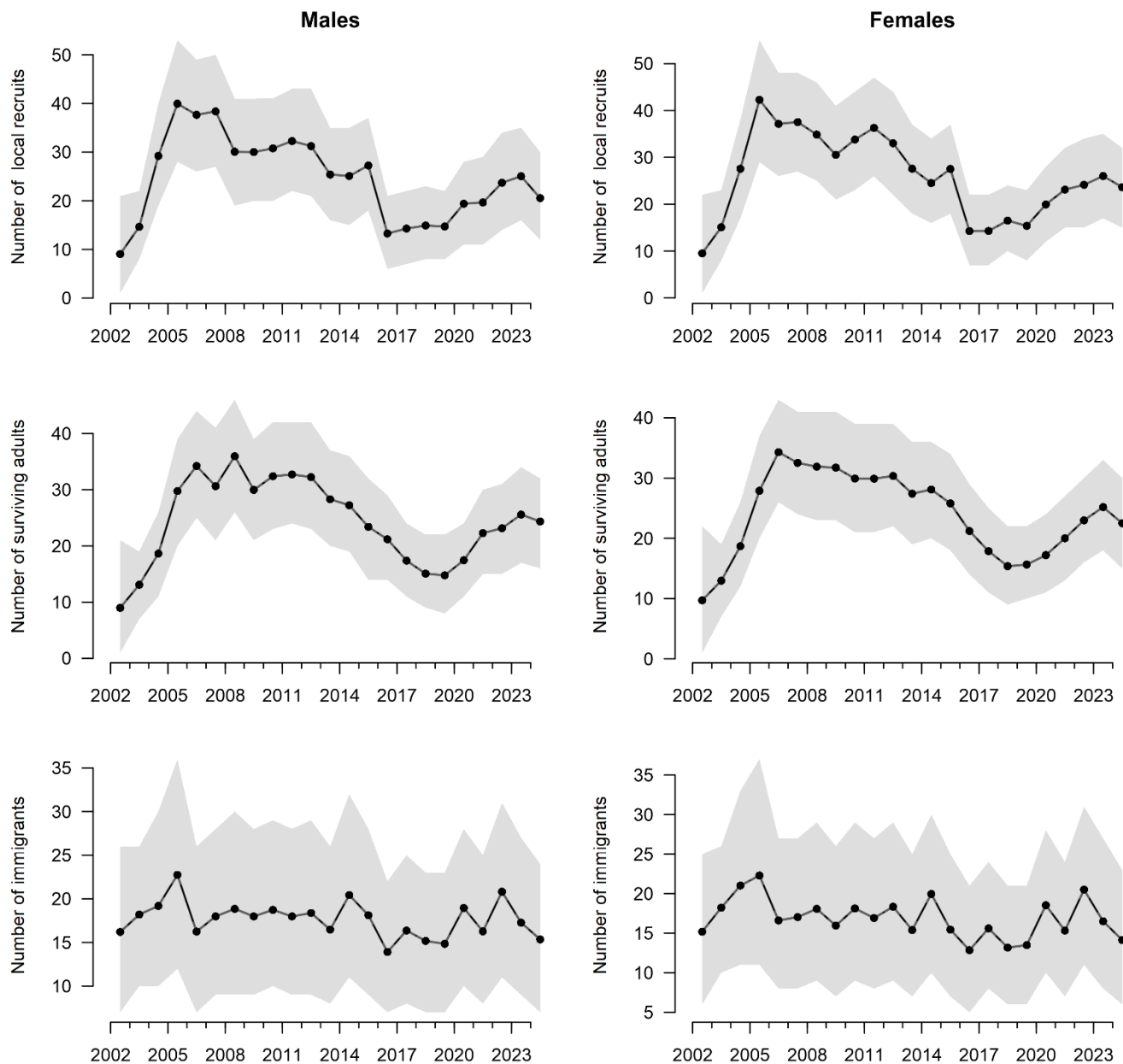


Figure 5 Hoopoe population composition: estimated number of local recruits, surviving adults and immigrants for each sex. Points are posterior means, the polygons show the 95% credible intervals, and dashed lines show the mean over time.

The total production of fledglings was higher in 2024 than in 2023, although there were fewer broods. To gain further insight into productivity, we analysed the development of different components of productivity over time. These different components were not very different in 2024 compared to 2023 (Fig. 6). The biggest difference was the probability of a successful brood, which was significantly higher in 2024 than in 2023. Fledging success (i.e. the probability that a hatchling fledged) was also slightly higher in 2024 than in 2023.

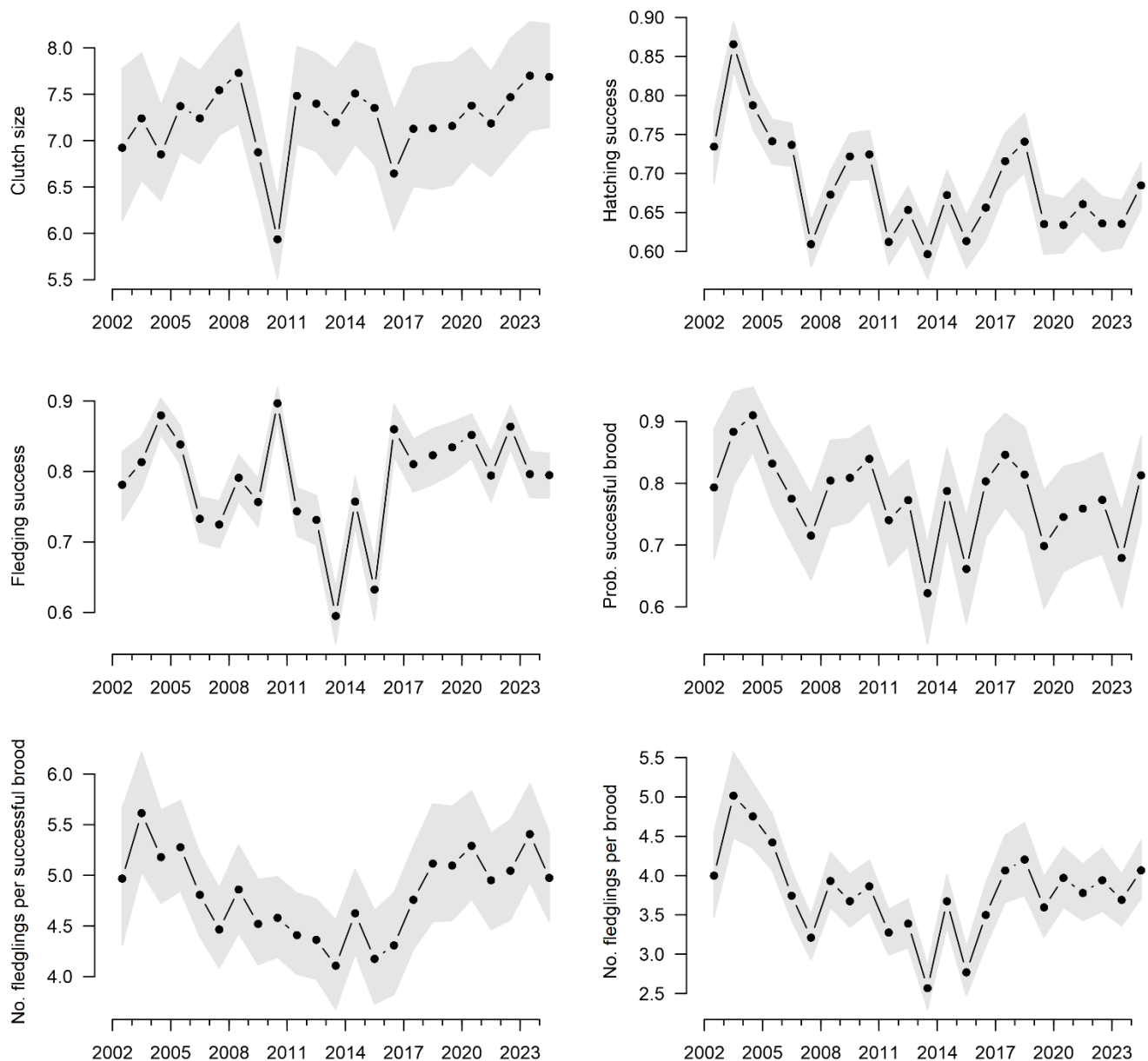


Figure 6 Development of different components of hoopoe productivity over time: clutch size, hatching success (probability that an egg hatched), fledging success (probability that a hatchling fledged), the probability that an initiated brood was successful (i.e. at least 1 fledgling), the mean number of fledglings per successful brood, and the mean number of fledglings per brood. The points are posterior means, the polygons show the 95% credible intervals, and the dashed lines show the mean over time.

4.4 Post-fledging ecology

The post-fledging ecology of hoopoes is studied by a team of the university of Bern division of Conservation Biology led by Ian Ausprey. Fieldwork was led by Laetitia Studer who was completing her MSc thesis on Hoopoe movement behaviour and Pascal Pini who was completing his BSc thesis on Hoopoe fledgling body condition.

In 2024 the team placed radio transmitters on 32 nestlings within 5 days of fledging. Nestling tagging began in mid May and fieldwork was concluded by mid early August, with approximately half the fledglings tagged in May and the remainder in early July.

Preliminary results of a survival analysis from the first year using the Mayfield method show that daily survival rate was lower during the first week (0.937 ± 0.014 SE) compared to the second (0.996 ± 0.004 SE) and third (0.995 ± 0.005 SE) week post-fledging. Hoopoes appear to demonstrate abrupt changes in movement behaviour around 3 weeks after leaving the nest, which is likely due to post-

fledgling dispersal away from the natal range. The ecological factors correlated with such movements are still under investigation as part of Laetitia's MSc thesis.

Fieldwork for the project concluded in 2024, and Rico Felder has returned to Uni Bern for a short-term position to analyse all three years of survival and habitat selection data. He and Ian plan to prepare a manuscript in 2025 that synthesizes all survival, movement and body condition results across the three years of data collection.

5 Wryneck: results and discussion

5.1 Overview

A total of 13 broods were recorded, of which 11 were successful, i.e. at least one chick fledged (Fig. 7). From these 11 broods, 76 chicks fledged (mean: 6.9 chicks / successful brood).

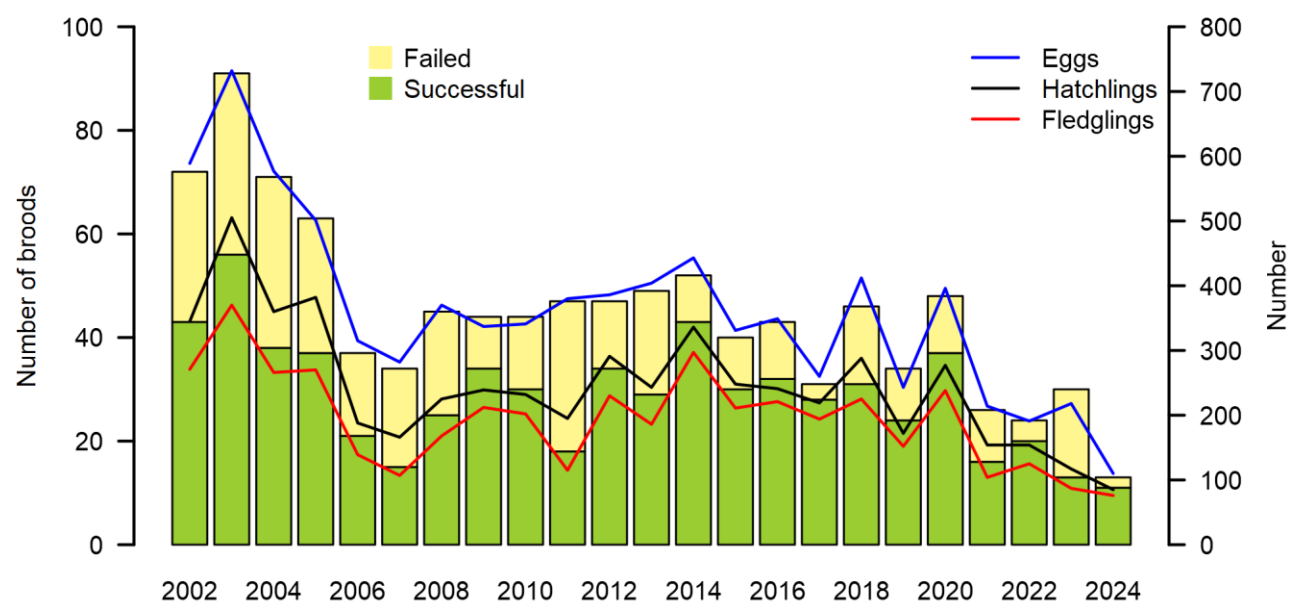


Figure 7 Development of the wryneck population. Bars represent the number of successful (green) and failed clutches (khaki) per year (left scale); lines represent the total number of eggs laid (blue), eggs hatched (black) and chicks fledged (red) per year since 2002 to date (right scale).

With only 11 successful broods, 2024 was the year with the lowest number of successful broods since 2002. Of these 11 successful broods, two were second broods. The 11 successful broods occurred in 11 different nest boxes, of which 5 were Schwegler and 6 were hoopoe nest boxes. The two second broods (same pair breeding for the second time) were both in nest boxes within a short distance of the first brood. The two unsuccessful broods occurred twice in the same nest box, once with only one egg laid and then abandoned, and in a second attempt a clutch of 8 eggs was abandoned.

We identified 18 different breeding adults during the breeding season, of which 7 were already ringed and 11 were unmarked. All adults from successful broods could be identified, except one remained unringed. Identification of the adults from unsuccessful broods failed, because the broods were abandoned before an encounter attempt could be made.

We ringed 77 chicks, of which 76 fledged.

Genetic samples were collected from all first-captured adults and from all ringed nestlings.

5.2 Tape luring

With the decline of wryneck broods in the monitored nest boxes, we are gradually losing the ability to monitor survival. Tape luring offers the possibility of catching wrynecks that are not associated with a brood in our nest boxes, and we therefore use it more systematically since two years. This requires a more defined and systematic sampling design. We therefore defined 28 sampling sites of 500x500m², located in all zones except C. At each site, tape-luring was carried out twice in April, with at least one week in between.

We captured 28 wrynecks using tape luring, of which 24 were unmarked and 4 were recaptures from previous years. The recaptures are listed in Table 3.

Two wrynecks ringed by tape luring later bred in our nest boxes.

Table 3 Recaptures obtained by tape luring 2024 with information on ringing and resight/recapture history.

Ring number	Recapture date	Ringing date	Ringing circumstances	Encountered since marking
Y53763	26.04.2024	06.06.2022	Breeding adult	No
Y53922	12.04.2024	17.04.2023	Tape luring	No
Y53931	12.04.2024	24.04.2023	Tape luring	No
Y53752	11.04.2024	12.04.2023	Tape luring	No

5.3 Demographic performance

We analysed the capture-recapture data with Bayesian Cormack-Jolly-Seber models and the productivity data with Bayesian generalised linear models to gain insight into the temporal dynamics of survival probabilities and components of reproductive success. In contrast to the hoopoe data, we did not run an integrated population model because we cannot use nest box occupancy as an index of population trends.

Annual survival probabilities are shown in Figure 8. They show no long-term trends and, interestingly, adult survival shows stronger temporal patterns than juvenile survival. The recapture probability of adults is much higher than that of juveniles (in fact, this is the probability of catching an individual marked as a nestling when it is 1 year old), which may indicate that the breeding propensity of first year birds is lower than that of older birds.

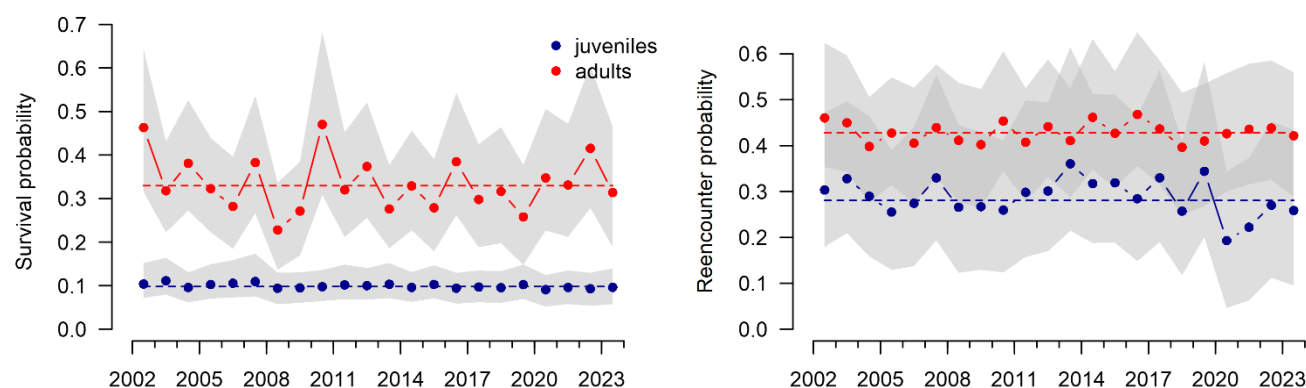


Figure 8 Development of age-specific apparent survival and recapture rates of wrynecks, based on all captures (including tape lured birds).

The components of reproductive success are shown in Figure 9, all of which are quite variable over time. Most components of reproductive success improved significantly in 2024 compared to 2023. They were among the highest since 2002, indicating that 2024 was a very good year for wrynecks.

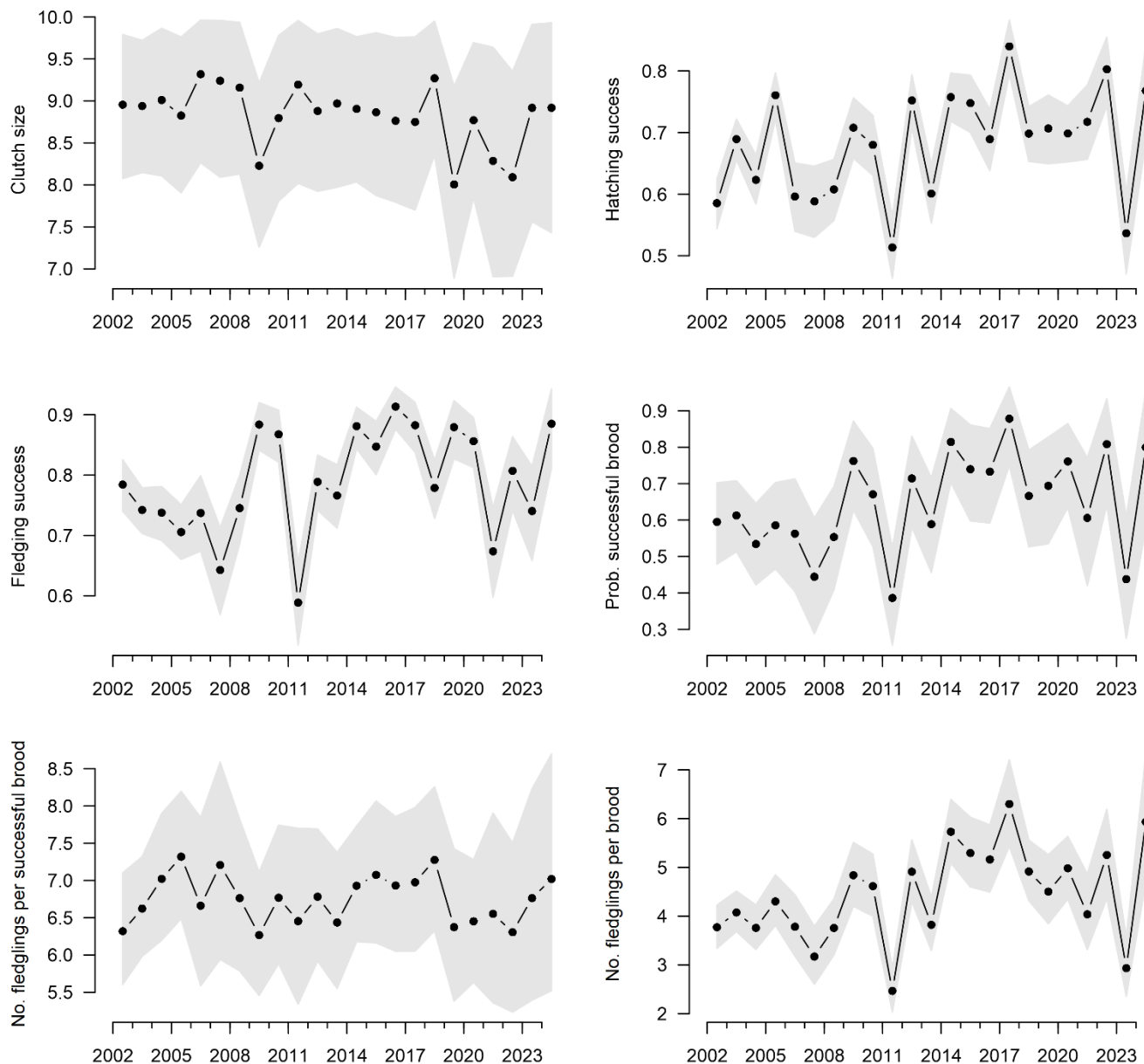


Figure 9 Development of different components of wryneck productivity over time: clutch size, hatching success (probability that an egg hatched), fledging success (probability that a hatchling fledged), the probability that an initiated brood was successful (i.e. at least 1 fledgling), the mean number of fledglings per successful brood, and the mean number of fledglings per brood. The points are posterior means, the polygons show the 95% credible intervals, and the dashed lines show the mean over time.

6 Nest boxes occupied by other species

We continued to record nest box occupancy by species other than the two target species. 169 out of 377 sites, or 284 out of 619 available hoopoe nest boxes were occupied by species other than the two target species: 174 by starlings, 92 by great tits and 26 by tree sparrows. We also recorded 3 broods of the Common Redstart *Phoenicurus phoenicurus* in our hoopoe nest boxes, of which at least one was successful. (Note that the number of nest boxes occupied by species is higher than the absolute number of nest boxes occupied, as more than one species can be found in a nest box during the season.)

Of the 100 Schwegler nest boxes, 82 were occupied by tree sparrows or great tits.

Further users of our boxes other than birds were bumblebees (1 nest), Aesculapian snake *Zamenis longissimus* (one sighting) and edible dormice *Glis glis* (5 sightings in 5 different nest boxes).

7 Resightings and ring recoveries

Here we report on resightings and ring recoveries of hoopoes and wrynecks ringed in our study area from elsewhere, as well as hoopoes and wrynecks resighted in our study area but ringed elsewhere. Most of these data were submitted via the ringing scheme of the Swiss Ornithological Institute.

7.1 Hoopoe

Ringed elsewhere, breeding in our study area:

Hoopoe with a Helgoland ring **71032942**, ringed as a nestling on 18.06.2022 in Flörsheim-Wicker (near Frankfurt am Main), Germany, has bred again (for the second year in a row) in Saint-Leonard VS (distance 425 km).

Ringed in our study area, resighted/recovered elsewhere:

Hoopoe **H 123802** was ringed as a nestling on 15.05.2023 in Sierre VS and was resighted alive on 05.04.2024 in Mörbisch am See (Neusiedler Lake), Austria (distance 716 km).

Hoopoe **H 155955** was ringed as an adult breeding male on 15.07.2023 in Ardon VS and resighted alive on 18.05.2024 in Neudorf, Gafrenz, Upper Austria (distance 593 km).

Hoopoe **H 123812** was ringed as a nestling on 21.05.2023 in Saint-Léonard VS and found dead on 19.04.2024 in Einigen, BE (distance 52 km, A. Fuhrmann).

Hoopoe **H 140656** was ringed as a breeding 2nd year male on 02.07.2020 in Fully VS. One year later, on 05.07.2021, he was resighted in Zizers GR. In 2023, he was breeding again in Fully VS. This year he was resighted on 05.05.2024 in Zizers GR (distance 204km, R. Gadiant). If it is confirmed that this male did indeed breed in Graubünden in 2021 and 2024, it is a very interesting observation of breeding dispersal.

Hoopoe **H 155855** was ringed as a nestling on 16.06.2023 in Riddes VS and resighted alive on 13.05.2024 in Friedrichshafen (Lake Constance), Germany (distance 238 km).

Hoopoe **H 154865** was ringed as a nestling on 09.06.2022 in Charrat VS. On 15.06.2024 it was resighted breeding in Gudo, TI (distance 139 km). This is the first resighting of a hoopoe from the Valais in Ticino.

7.2 Wryneck

Ringed in our study area, resighted/recovered elsewhere:

Wryneck **Y 56169** was ringed as a nestling on 10.06.2024 in Riddes, VS and was recaptured alive on 05.09.2024 in Silves, southern Portugal (distance ~1636km, J. Valkenburg).