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

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IMPRINT

Population dynamics of Hoopoes
Upupa epops and Wrynecks *Jynx torquilla* in the Valais – Annual report 2025

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Contribution

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Cover picture

A hoopoe perched on its home in the study area. There is a camera trap visible on the left side of the hut. © I. Zwahlen

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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 650 nest boxes installed in the Rhone Valley between Martigny and Sierre.

In 2025, 123 Hoopoe broods were recorded, of which 101 were successful. From these 101 broods, 569 chicks fledged (average: 5.6 chicks / successful brood). 154 different breeding adults were identified, of which 93 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.

29 Wryneck broods were recorded, of which 16 were successful. From these 16 broods, 93 chicks fledged (average: 5.8 chicks / successful brood). 24 different breeding adults were identified. Prior to the breeding season, 45 Wrynecks were captured with playback equipment, of which 10 were already marked. Two 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.

An informational event about arboriculture and biodiversity was held in Fully on 21 February 2025. All owners of Hoopoe nest boxes involved in our study were invited, and around 40 people attended.

The University of Bern's Conservation Biology Division has begun initial fieldwork to evaluate whether it is feasible to study how human disturbances affect Hoopoe breeding in nest boxes.

2 Fieldwork

Tape luring for Wrynecks was carried out between 9th and 25th April 2025, on a total of seven different days. The protocol from 2023 was applied for the third year: at each of the 28 defined 500 x 500 m² sample sites within the study area tape luring was performed twice with at least one week in between.

The first regular nest box check began on 13th April. All nest boxes were then checked every second 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 complete in order to identify the breeding adults.

Capture of unmarked Hoopoes began the earliest nine days after the oldest chick had hatched. Most female Hoopoes were captured by hand directly from the nest box, while males were captured later (i.e. earliest 12 days after the oldest chick had hatched) 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 ten days, and tarsus length and weight were measured.

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



Picture 1 and 2 Examples of camera trap installation at the nest entrance for identification of marked individuals. © I. Zwahlen



Picture 3 Illustration of how a camera trap image enables the identification of marked individuals, here Hoopoe 1U4.

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 2025, a total of 652 Hoopoe nest boxes were available at 386 different locations. This represents a slight increase compared to the previous four years. Furthermore, we monitored 101 Schwegler Wryneck boxes in the study area in 2025.

Every year, some nest boxes are lost when entire orchards are cleared, huts are demolished, or property changes hands and new owners choose not to keep them. These losses are tracked, and efforts are made each winter to install replacement nest boxes so availability remains stable. This task is managed by Valentin Debons, a field technician from the University of Bern.

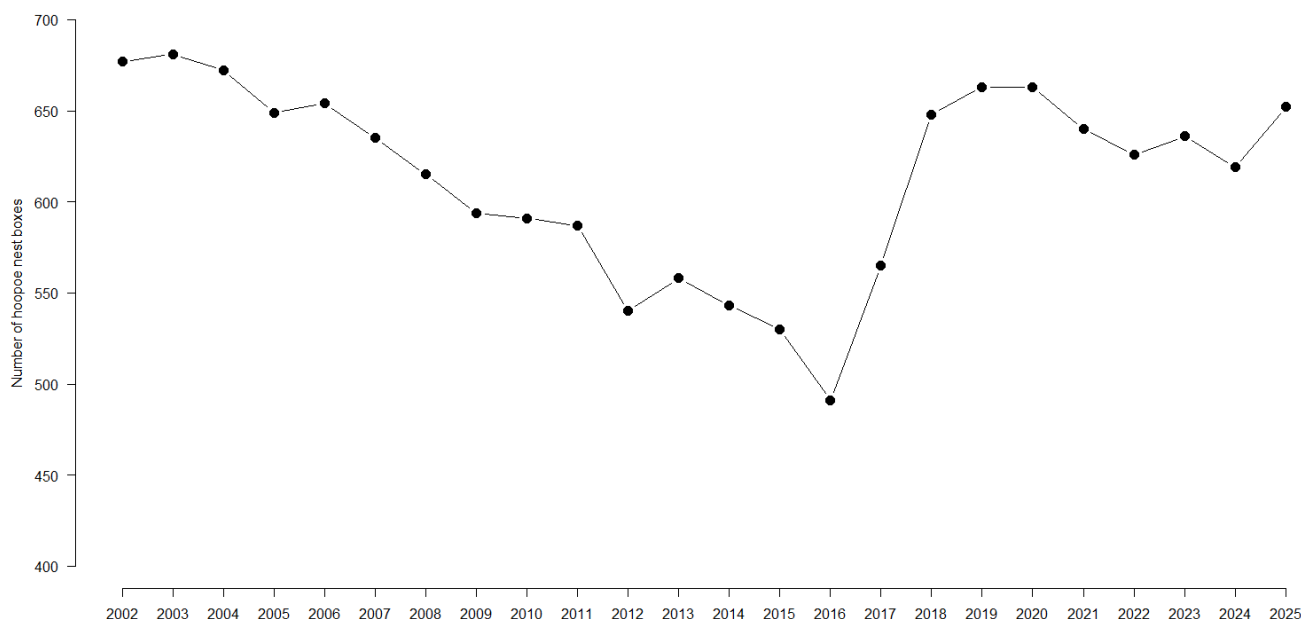


Figure 1 Development of the number of available nest boxes in the study area (Schwegler Wryneck boxes are not included in the graph).

4 Hoopoe: results and discussion

4.1 Overview

A total of 123 broods were recorded, of which 101 were successful, i.e., at least one chick fledged (Figure 2). From these 101 broods, 569 chicks fledged (mean: 5.6 chicks / successful brood).

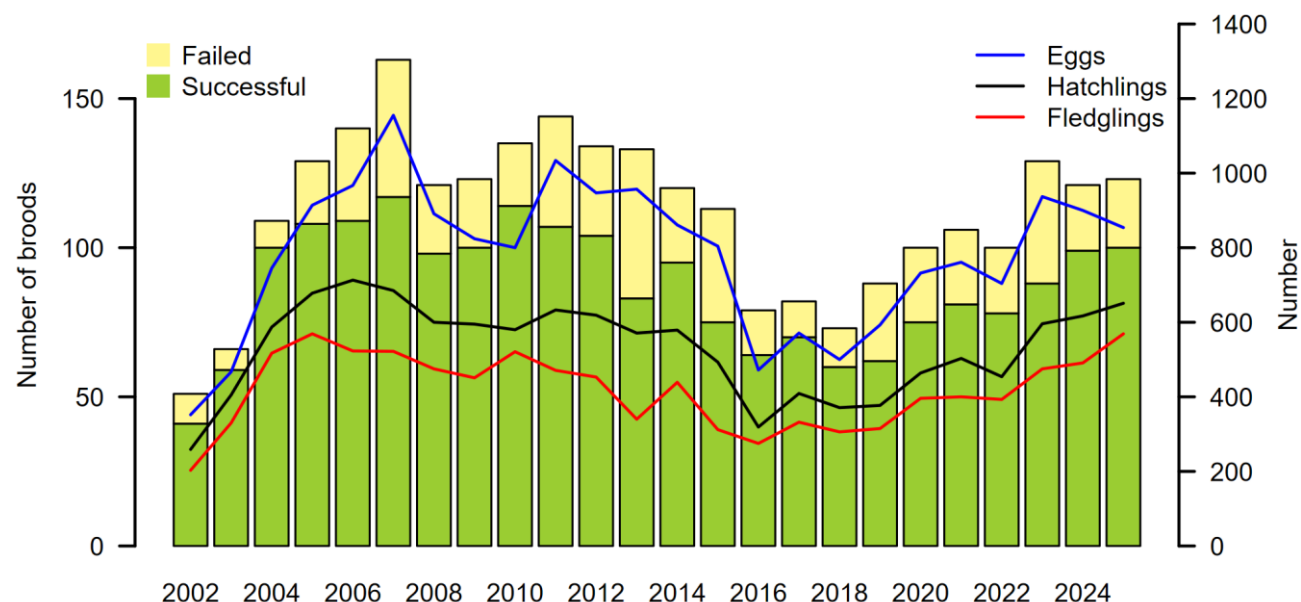


Figure 2. Development of the Hoopoe population. Bars represent the number of successful (green) and failed broods (yellow) per year (left scale); lines represent the total number of eggs laid (blue), eggs hatched (black) and fledglings (red) per year since 2002 till now (right scale).

Regarding the number of broods, both successful and unsuccessful, this year closely resembled last year. Notably, we observed an increase in the number of fledglings despite a decrease in the total number of eggs laid.

In 2025, a new record was set with 569 fledglings observed since the start of the study. This notable increase resulted in a mean of 5.6 fledged chicks per successful brood, again marking the highest value documented for this population to date. It should be noted that fledgling numbers are determined indirectly – approximately one to two weeks following the ringing of nestlings (at day 18–21), each nest box is re-examined, and all nestlings absent from the box are recorded as having fledged.

Of the 22 unsuccessful broods, 18 were abandoned before hatching, while only four failed after the eggs had hatched. Although the precise causes for most failures are unknown, human activity near the nest boxes may have contributed. On April 17 2025, a major snowfall deposited over 20 cm of snow across the study area in a single day. Out of the 18 ongoing broods at that time (no hatchlings yet), six were abandoned.

After the female from the brood in nestbox A73 has died (the absence of the female was confirmed by a camera trap), the six nestlings were about to die. They were therefore taken to the care station *Nouvel Envol* where they were hand-raised and released back into the wild. Five of these nestlings were ringed prior to their release. One remained unringed because it escaped from *Nouvel Envol*. In our records, this brood was classified as a failure and the chicks are not included in the number of fledglings shown in Figure 2.

We identified 154 different breeding adults (81 males, 73 females), 93 of which were already ringed, while 56 (21 males, 35 females) were unmarked. We ringed 580 nestlings, of which 557 finally fledged. 12 chicks from two broods fledged without being ringed due to the inaccessibility of the nest boxes. Additionally, five chicks were ringed before being released from the rescue center *Nouvel Envol*.

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

We recorded a brood with ten fledglings (a clutch size of ten), marking only the third time we have documented this many fledglings (previously in 2007 and 2008). While having ten eggs in a clutch isn't rare in our study population, it's uncommon for all ten chicks to fledge. In 2025 there were four broods with ten eggs; however, of these, one brood had nine chicks fledge, and two broods had seven fledge each.



Picture 4 At nestbox B41, one out of seven chicks showed a pigmentation deficiency leading to its unique appearance. © Sidonie Nicole

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	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Mist net only (M)	18	10	6	4	6	0	1	0	4	1	0	0	2	3	1
Clap trap only (T)	69	56	55	48	29	57	51	36	31	24	29	28	37	25	19
By hand only (H)	65	78	47	54	78	14	19	6	8	18	14	23	15	14	20
Resighted only (R)	0	0	3	3	1	6	16	30	33	56	67	51	73	78	91
M & R	3	3	2	1	2	0	0	1	2	0	0	0	0	1	0
M & T	2	0	0	1	0	0	0	0	0	0	0	0	0	0	1
H & R	0	3	0	4	3	2	9	6	3	5	4	5	7	10	14
T & R	3	5	22	20	9	16	5	10	12	6	6	7	7	6	6
H & T	7	5	1	5	6	2	0	0	0	0	0	0	1	1	1
H & M	2	0	0	0	3	0	0	0	3	0	0	0	0	0	0
H & T & R	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0
M & T & R	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
H & T & M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total number identified	170	161	152	141	139	97	101	89	94	110	120	114	147	138	154
% physically captured	100	100	98	98	99	94	84	66	64	49	44	55	50	43	41
Number of individuals physically captured twice in a year	37	20	13	32	46	9	1	0	0	0	0	0	3	2	4

The proportion of physically handled individuals was almost 100 % until 2015 and declined thereafter to a minimum of 41 % in 2025. In recent years it has stabilized at around 50 %.

In 2025, four individuals were recaptured on multiple occasions. This occurred in instances where only one of two parents was initially captured, and subsequent attempts to capture the previously unmarked individual inadvertently resulted in the recapture of the parent previously apprehended during the first attempt.

Another way of looking at the resulting change in encounter technique after we started marking all individuals with alpha-numeric 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	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Both captured	92	92	68	66	67	36	29	21	21	13	8	15	21	21	14
1 captured, 1 resighted	8	8	18	31	10	11	14	15	16	22	32	31	32	18	36
1 captured	18	12	8	10	17	13	14	2	5	5	5	2	3	2	0
Both resighted	0	1	14	1	3	4	10	21	28	34	40	27	47	62	57
1 resighted	0	1	2	2	0	6	5	5	4	13	10	13	5	7	4
None identified	29	22	26	11	16	9	11	9	16	13	11	12	21	11	12
Total number of broods	147	136	136	121	113	79	83	73	90	100	106	100	129	121	123
% of broods without capture	20	18	31	12	17	24	31	48	53	60	58	52	57	66	59
% of broods whose parents were identified without capture	0	2	15	3	3	14	21	41	43	54	53	45	48	63	55

Table 2 summarizes the results since 2011. The percentage of broods where no adult was physically captured has increased to over 50 % since 2019.

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 over 40 % since 2018. 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 2025 compared to previous years.

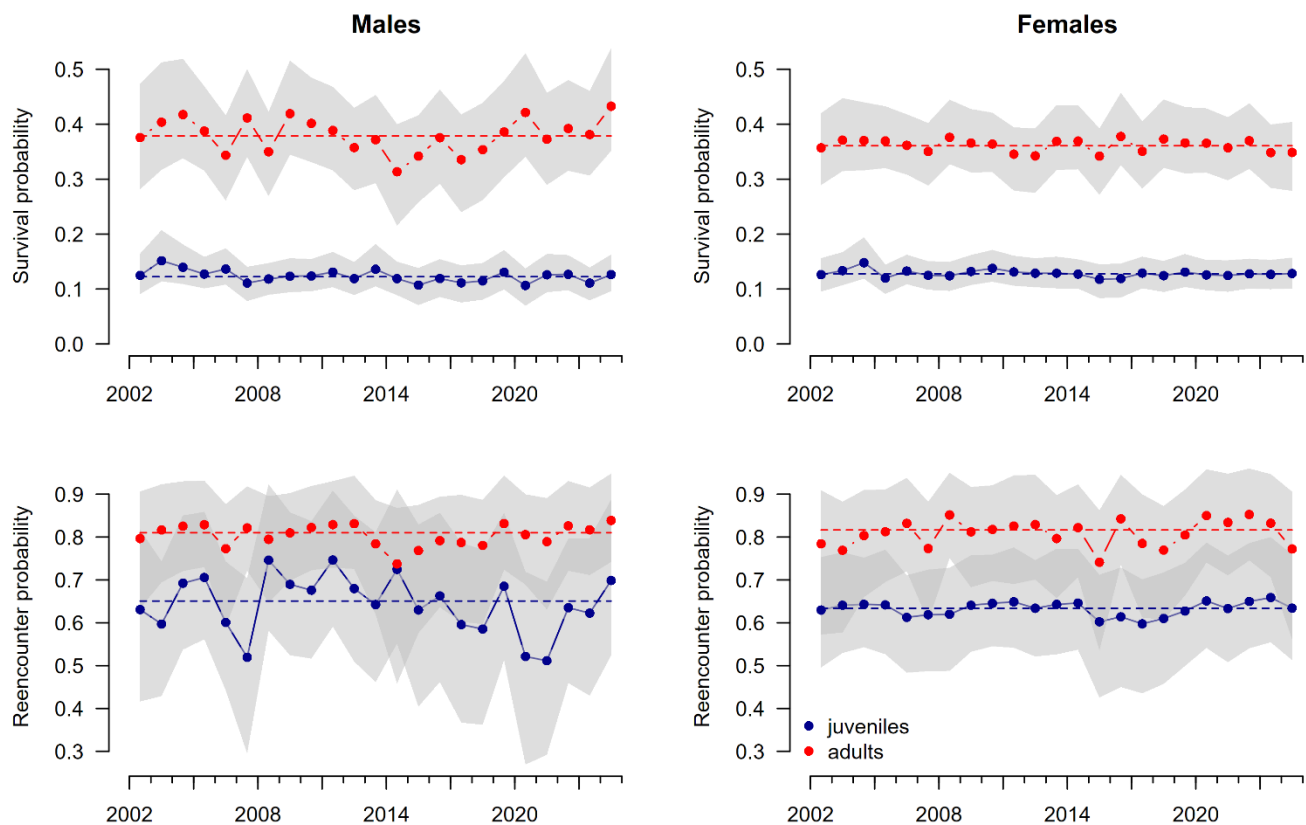


Figure 3 Estimated annual apparent survival probabilities of juvenile (blue line) and adult (red line) Hoopoes (top panels) and estimated reencounter (recapture or resighting) probabilities (bottom panels). Estimates for males are in the left panels and estimates for females are in the right panels.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

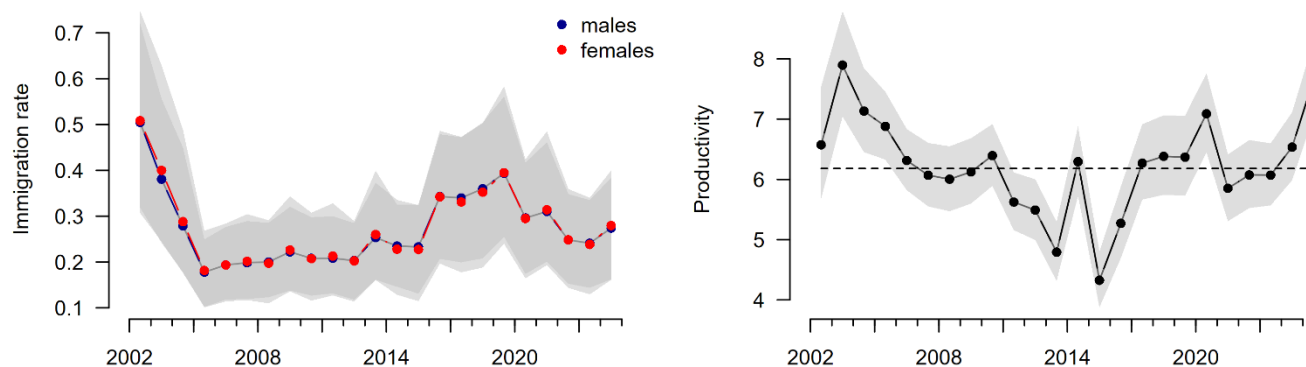


Figure 4 Estimated immigration rates of Hoopoes by sex and the estimated number of fledglings per female (productivity). Points are posterior means, the polygons show the 95 % credible intervals, and dashed lines show the mean over time.

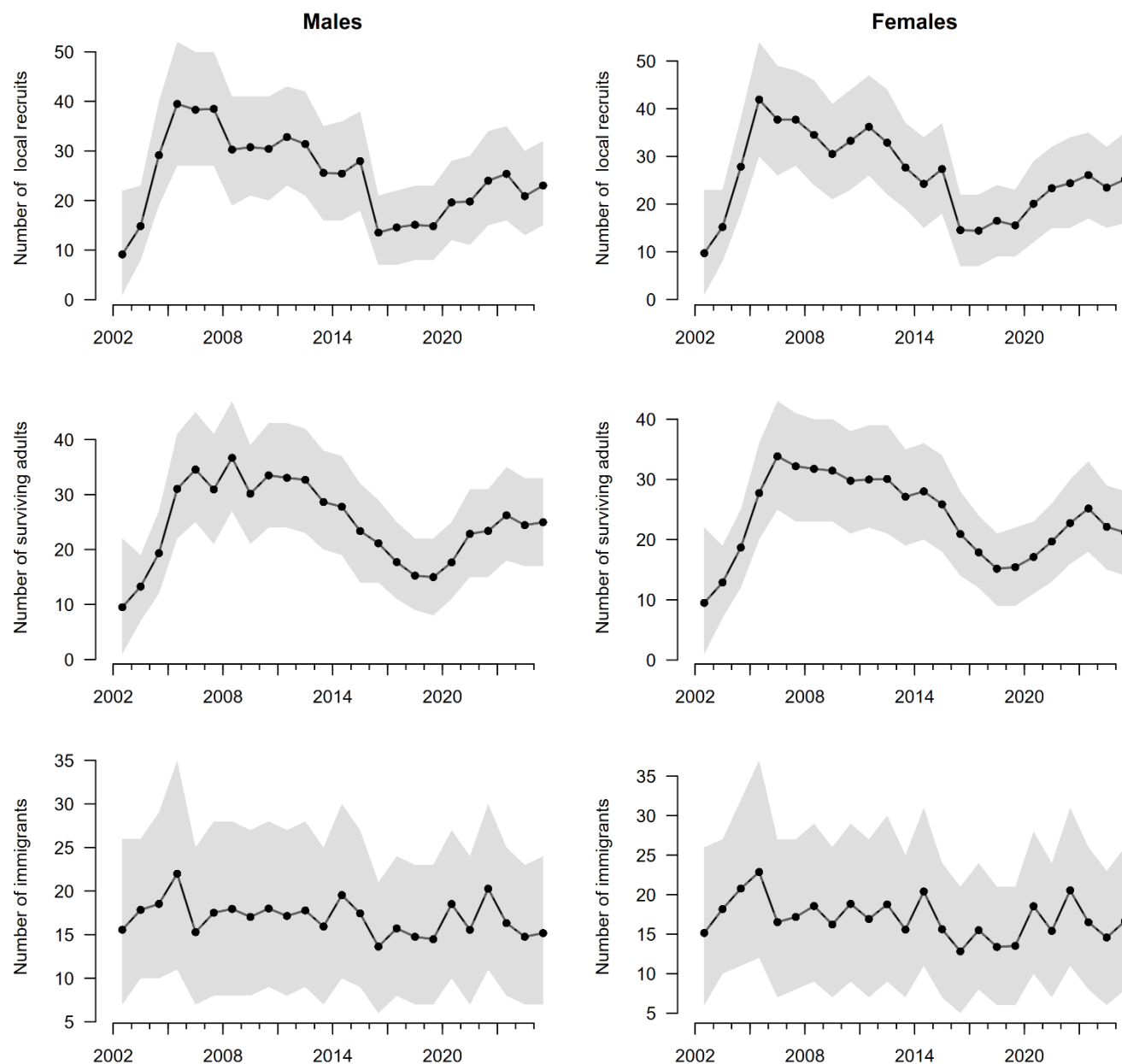


Figure 5 Hoopoe population composition: estimated number of local recruits, surviving adults and immigrants for each sex. Points are posterior means, the polygons show the 95 % credible intervals, and dashed lines show the mean over time.

The total number of fledglings produced in 2025 was higher (569 fledglings) than in 2024 (491 fledglings), despite a similar number of broods in both years (121 in 2024, of which 99 were successful; and 123 in 2025, with 101 successful). To further examine productivity, we analysed the trends of specific productivity components across this period. Although average clutch size decreased slightly in 2025, both hatching and fledging success rates improved compared to 2024 (Figure 6). These factors contributed to an increase in the number of fledglings per brood and per successful brood relative to the previous year.

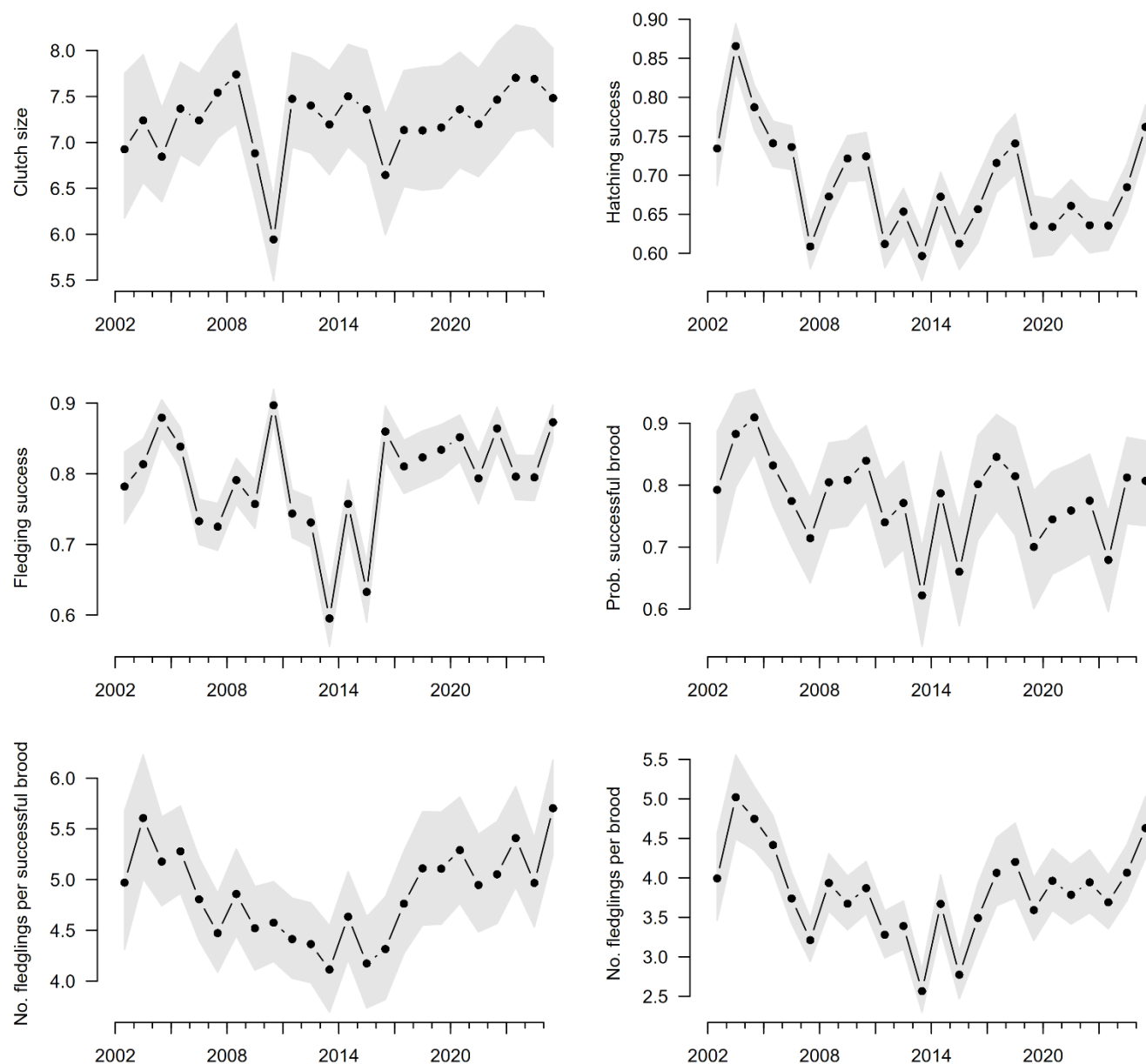


Figure 6 Development of different components of Hoopoe productivity over time: clutch size, hatching success (probability that an egg hatched), fledging success (probability that a hatchling fledged), the probability that an initiated brood was successful (i.e. at least one fledgling), the mean number 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 Experiences with human disturbance, camera traps and thermologgers

The Conservation Biology research group of the University of Bern has started a new project under the lead of Miguel Silva-Moneiro which aims to investigate the impact of anthropogenic disturbances on the local Hoopoe breeding population. For this, some preliminary fieldwork was conducted during June and July. The activities focused on exploring and improving the project design and methods. More specifically, the activities aimed to:

1. Verify the camera trap suitability in recording the feeding frequency and the aptness of a disturbance experiment on breeding Hoopoes.
2. Capture visual proof of human disturbance on the nestboxes by wildlife photographers.
3. Explore the temperature fluctuations inside and outside nestboxes in relation to nestbox characteristics (e.g. materials, location).

The RECONYX camera traps deployed around eight nestboxes were not suitable to detect the birds flying to deliver food if they were further than one meter from the entrance or under the shed or tree shadow. The thermologgers deployed in 13 nestboxes suggested that the location of the nestbox (inside or outside the shed) or its material (wood or concrete) influenced the inside temperatures during the sampled interval (the last week of brood rearing). The human disturbance experiment conducted in four nestboxes demonstrated that the birds had different responses to human presence nearby the nestbox, but overall were not as potentially impactful as hypothesized. We could not detect any wildlife photographer approaching the single nestbox sampled, known to be frequently visited. Nevertheless, the camera traps were suitable to detect other types of potential disturbance, such as cars and pedestrians.

5 Wryneck: results and discussion

5.1 Overview

A total of 29 broods were recorded, of which 16 were successful, i.e. at least one chick fledged (Figure 7). From these 16 broods, 93 chicks fledged (mean: 5.8 chicks / successful brood).

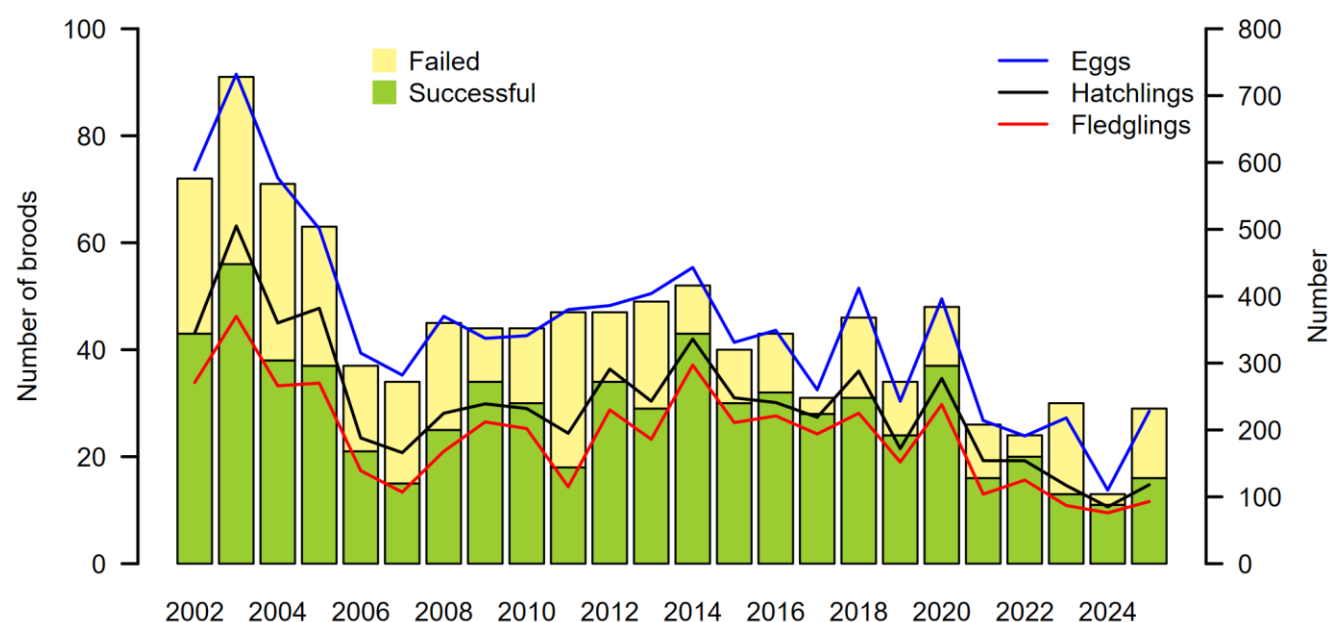


Figure 7 Development of the Wryneck population. Bars represent the number of successful (green) and failed broods (yellow) per year (left scale); lines represent the total number of eggs laid (blue), eggs hatched (black) and chicks fledged (red) per year since 2002 to date (right scale).

The total number of broods nearly doubled compared to 2024; however, the proportion of successful broods remained low (see Figure 7). Of the 16 successful broods observed, three represented second broods, while two were replacement broods following unsuccessful initial attempts. These 16 broods occurred in 14 unique nest boxes, with two pairs utilizing the same box for their second brood; five successful broods were recorded in Schwegler nest boxes and nine in Hoopoe nest boxes. Among the 13 unsuccessful broods, nine failures took place during incubation and five after chick hatching. The specific causes of failure are difficult to ascertain, though predation is suspected in at least three instances. Only two unsuccessful broods were associated with Schwegler nest boxes, whereas the remainder occurred in Hoopoe nest boxes. During the breeding season, a total of 24 distinct breeding adults were observed: ten previously ringed individuals and 14 unmarked. Identification was achieved for nearly all adults associated with successful broods, with only three remaining unringed. Conversely, most adults from unsuccessful broods could not be identified, either due to brood abandonment prior to any encounter attempts or because the birds were unringed and the brood failed before capture efforts commenced.

We ringed 96 chicks, of which 93 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 three years. This requires a more defined and systematic sampling design. We therefore defined 28 sampling sites of 500 x 500 m², located in all zones except C. At each site, tape-luring was carried out twice in April, with at least one week in between.

A total of 45 Wrynecks were captured using tape luring, representing the highest annual count since 2014. Of these, 35 were unmarked individuals, and ten were recaptures from earlier years; details of these recaptures are provided in Table 3. Additionally, two Wrynecks ringed via tape luring subsequently bred in our nest boxes.

Table 3 Recaptures obtained by tape luring 2025 with information on ringing and resight/recapture history.

Ring number	Recapture date	Ringing date	Age at ringing (Euring code)	Ringing circumstances	Encountered since ringing
Y53922	11.04.2025	17.04.2023	6	tape luring	yes, during tape luring 2024
Y53962	24.04.2025	19.06.2023	5	breeding adult	no
Y53972	09.04.2025	20.06.2023	1	nestling	no
Y53839	23.04.2025	01.07.2023	5	breeding adult	yes, breeding adult 2024
Y56137	11.04.2025	12.04.2024	5	tape luring	no
Y56145	10.04.2025	25.04.2024	5	tape luring	yes, breeding adult 2024
Y56156	11.04.2025	05.06.2024	5	breeding adult	no
Y53860	10.04.2025	16.06.2024	8	breeding adult	no
Y56187	23.04.2025	08.07.2024	8	breeding adult	no
Y56006	10.04.2025	30.07.2024	6	breeding adult	no

5.3 Demographic performance

We analysed the capture-recapture data with a Bayesian multistate capture-recapture model that allowed the separate estimation of reencounter probabilities based on the survey method (tape luring versus captures at the nest) and of survival. The productivity data were analysed with Bayesian generalised linear models to gain insight into the temporal dynamics of 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, likely due to strong shrinkage. The reencounter probabilities of adults were generally higher than those of one-year old birds, and they were slightly higher at the nest than with tape luring. The age difference may indicate that the breeding propensity of first year birds is lower than that of older birds, and/or that they arrive later in the breeding areas than older individuals.

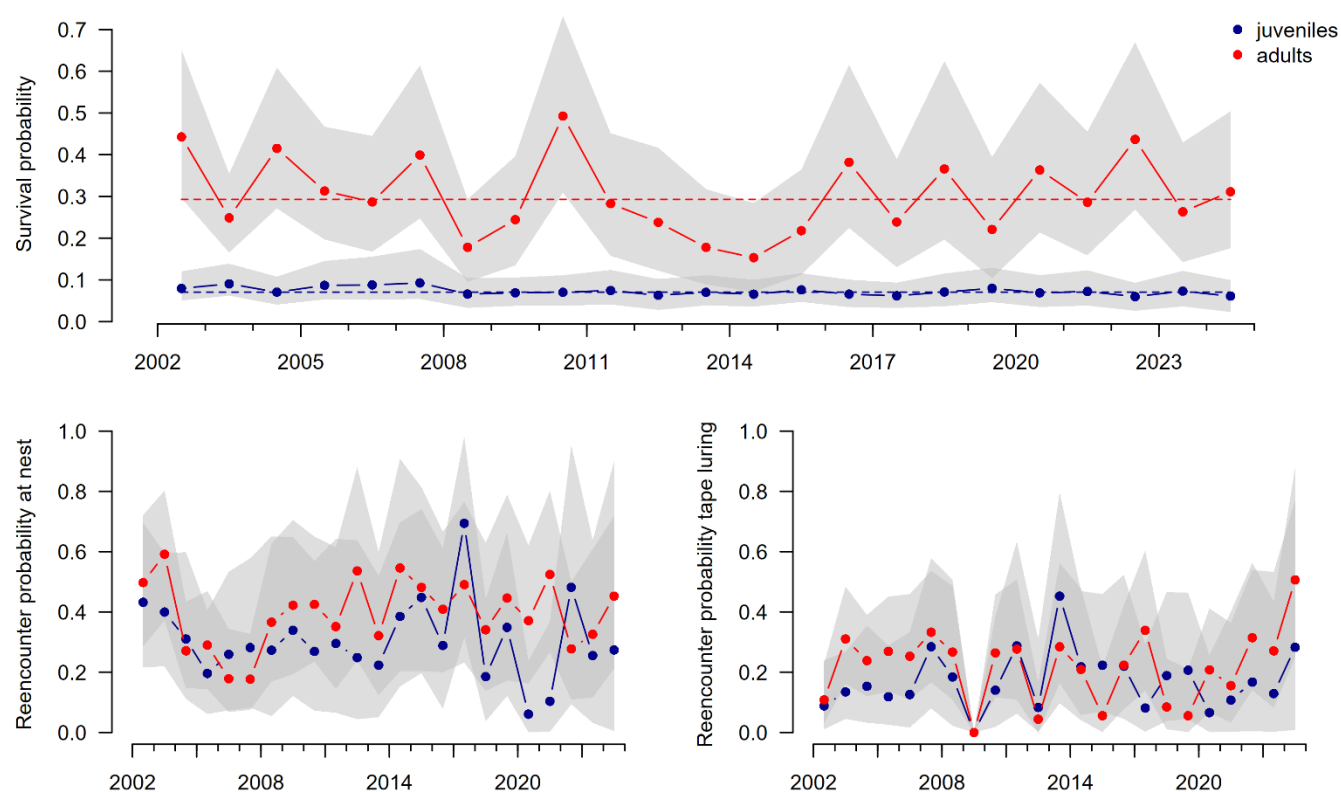


Figure 8 Development of age-specific apparent survival and recapture rates of Wrynecks, based on all captures. The recapture probabilities are separated based on the capture technique (at the nest during breeding and using tape luring).

Figure 9 illustrates the components of reproductive success, each of which varies considerably over time. In 2025, most of them were lower than in 2024, with the probability of a brood being successful dropping noticeably from 0.8 to 0.55. Additionally, the number of fledglings per brood was just 3.2, which is nearly the lowest recorded since the study began.

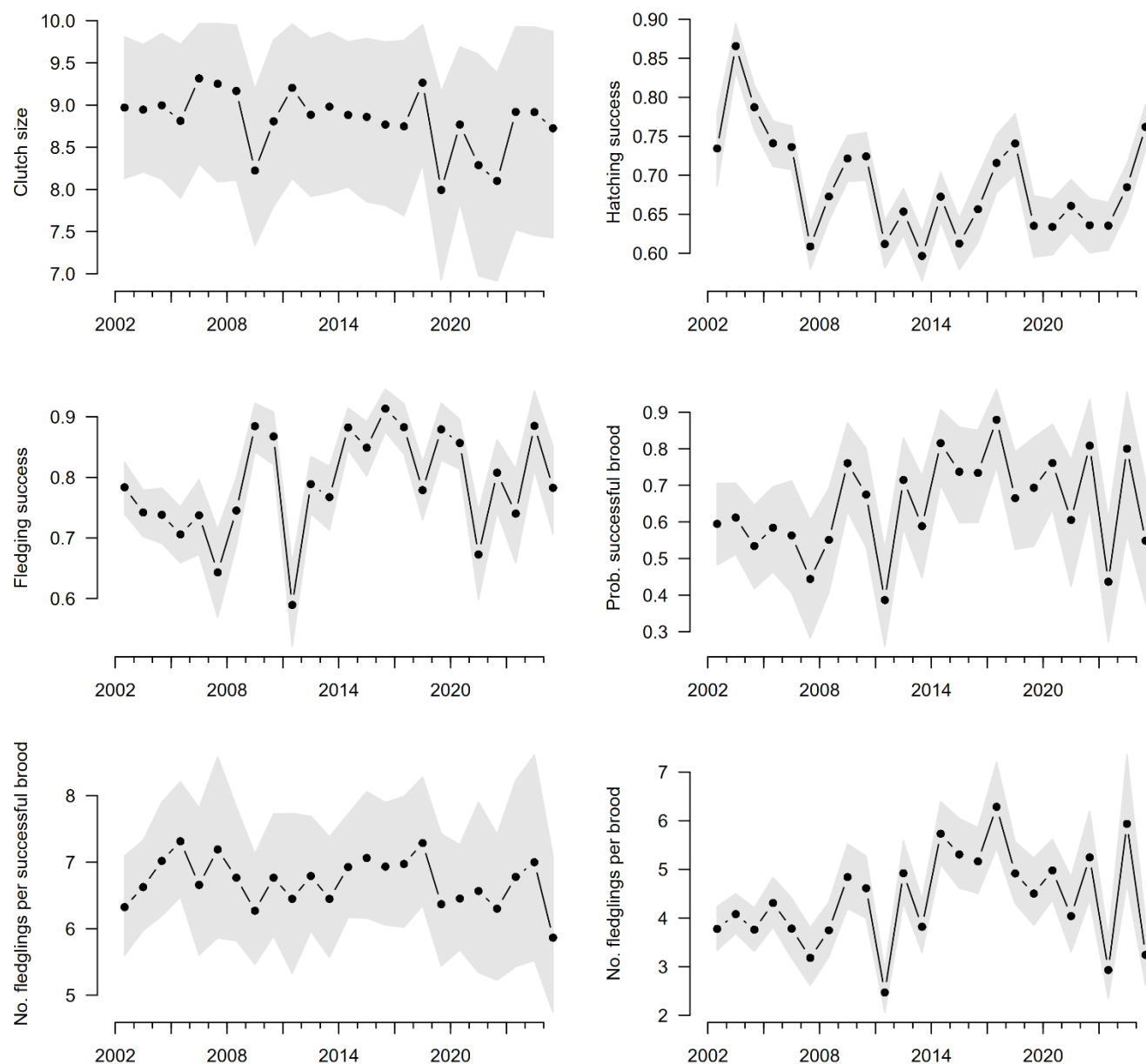


Figure 9 Development of different components of Wryneck productivity over time: clutch size, hatching success (probability that an egg hatched), fledging success (probability that a hatchling fledged), the probability that an initiated brood was successful (i.e. at least 1 fledgling), the mean number 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. 231 out of 386 nest box locations, or 326 out of 652 available Hoopoe nest boxes were occupied by species other than the two target species: 173 by Starlings, 129 by Great Tits and 24 by Tree Sparrows. We also recorded five broods of the Common Redstart *Phoenicurus phoenicurus* in our Hoopoe nest boxes and one brood of a European Nuthatch *Sitta europaea*. (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 101 Schwegler nest boxes, 81 were occupied by Tree Sparrows or Great Tits.

Further, temporary users of our boxes other than birds were an Aesculapian Snake *Zamenis longissimus* (one sighting), Edible Dormice *Glis glis* (eight sightings, five nest boxes), a Hazel Dormouse *Muscardinus avellanarius* (one sighting, unconfirmed) and an undetermined mouse species (three sightings, one nest box).

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 in our study area, resighted/recovered elsewhere:

Hoopoe **H 150108** was ringed as a nestling on 30.06.2023 in Saillon VS and was resighted alive on 04.05.2025 in Domat/Ems, GR (distance 192 km, R. Reber).

Ringed and resighted in our study area:

We resighted 18 Hoopoes on camera traps installed at occupied nest boxes which were individuals not belonging to that brood. It is not unusual for Hoopoes to check out nest boxes that are already occupied and that we resight them with our camera traps, but most of them are adults that end up breeding in another of our boxes or are young birds (fledglings) from the same year.

But this year we had four resighting of adult Hoopoes, which did not end up breeding in our nest boxes. These were:

Hoopoe **H150058** (4U9) resighted on 22.04.2025, ringed as a breeding 2cy female on 18.05.2024.

Hoopoe **H154769** (0D3) resighted on 24.05.2025, ringed as a nestling on 01.06.2022 and resighted as a breeding male in 2023 & 2024.

Hoopoe **H150211** (11N) resighted on 14.05.2025, ringed as nestling on 22.05.2024.

Hoopoe **H150618** (12A) resighted on 09.05.2025, ringed as nestling on 01.07.2024.

It remains uncertain whether these birds did not reproduce or if they found another nesting place outside of your nest boxes.

7.2 Wryneck

Wryneck **Y 54000** was ringed as a nestling on 25.06.2023 in Riddes and was resighted alive on 15.06.2025 in Riddes (F. Lovey). The bird has not been resighted since it was ringed.