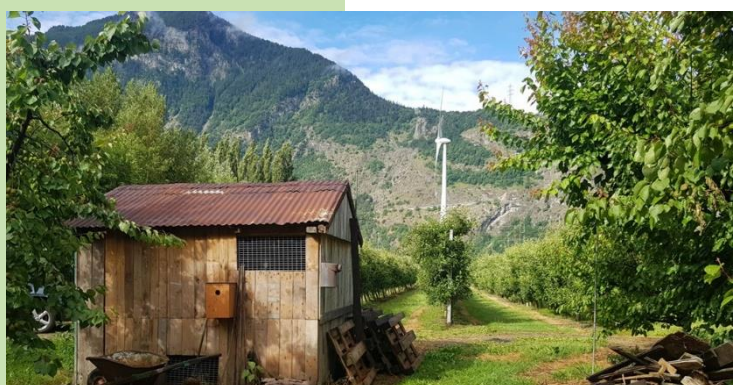


Population dynamics of Hoopoes *Upupa epops* and Wrynecks *Jynx torquilla* in the Valais

Annual report 2022

Irmgard Zwahlen
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Internal report



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Fieldwork

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Cover pictures

Top: With an alphanumeric colour ring marked hoopoe female, at territory A147 © Louis Membrez

Bottom: Territory G11, with a hoopoe and a Schwegler wryneck nest box installed in the middle of an apricot orchard © Irmgard Zwahlen

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Abstract

Since 2002, the populations of hoopoe and wryneck breeding in the more than 600 nest boxes installed in the Rhone Valley between Martigny and Sierre have been monitored. In 2022, fieldwork continued according to the protocol of previous years. The survey consists of the control of all nest boxes every 2nd week, the check of occupied nest boxes every 5th day to gather information about the broods, the capture or resighting of adult breeding birds and the ringing of all nestlings.

In 2022, 100 hoopoe broods were registered, of which 78 were successful, i.e., at least one chick fledged. From these 78 broods, 394 chicks fledged (mean: 5.1 chicks / successful brood). The overall number of broods and the number of successful broods was very similar to the numbers registered in the two previous years. A total of 114 different breeding adult hoopoes were identified, of which 55 were already marked with an alphanumeric colour ring. The already marked individuals were all identified on photos taken by a camera trap installed at the nest box entrance.

For the wrynecks, 24 broods were registered, of which 20 were successful, i.e., at least one chick fledged. From these 20 broods, 125 chicks fledged (mean: 6.25 chicks / successful brood). Similar to the previous year the number of broods was very low.

1. Introduction

By the end of the 20th century, the breeding populations of the Hoopoe *Upupa epops* and Wryneck *Jynx torquilla* in Switzerland have strongly declined. To counter this negative trend, around 700 nest boxes have been installed in the Rhone valley between Martigny and Sierre from 1998 - 2001. The populations of these two species breeding in these nest boxes are monitored annually since 2002.

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

The general survey consists of the control of all nest boxes every second week, the check of occupied nest boxes every fifth day to gather information about the broods, the capture or resighting of adult breeding birds and the ringing of all nestlings. Wrynecks are additionally captured prior to the breeding season by means of tape luring. Standardized field protocols for each species have been developed and were updated for the last time in spring 2020.

As in the previous years, we ringed all physically handled hoopoes and wrynecks with an alphanumeric colour ring in addition to the standard aluminium ring. The marking with the alphanumeric colour ring allows recognition of the individuals on photographs taken by camera traps at the entrance of the boxes and reduces the need for physical captures.

We continued to collect genetic samples from all physically handled birds (adult and nestlings) from which we did not already have a sample. Genetic samples were obtained by buccal swaps that are taken from the mouth. They allow sex determination and insights into the genetic structure of the population.

The division of Conservation Biology (University of Bern) started a new research project to understand post-fledging ecology of hoopoes. Recent demographic analyses of the population indicate that survival of individuals in their first year is a key driver of population dynamics. The 2022 field season was a pilot year with the principal goal of identifying an optimal attachment technique for radio transmitters. For this reason, 31 hoopoe chicks have been tagged and their movement after fledging has been followed by radio telemetry (Hoopoe Fledgling Project Protocol, 2022). The project is led by Ian Ausprey (post doc) and the main field work was conducted by Valentin Debons (field technician) and Rico Felder (BSc Student). The project will continue next season; Rico Felder will do his master thesis on the topic.

2. Fieldwork

In February 2022 Valentin Debons and Irmgard Zwahlen spent a week (21. – 24. 2. 2022) in the study area to check all nest boxes. The aim was to improve the availability of nest boxes for the two target species and to up-date the territory database. All nest boxes were checked for accessibility and were cleaned. Additionally, some were repaired, reorientated, removed or newly installed. All changes were then updated in the database.

The first regular nest box check started on 19th April. All nest boxes were then inspected every second week until the end of July (last check ended on 27th July). Nest boxes occupied by hoopoes or wrynecks were checked about every fifth day to gather information on breeding output and phenology (clutch size, number of hatched eggs, number of fledglings, approximate laying and hatching dates). The nest box control was always conducted from the outside with an endoscope camera through the entrance hole. We also documented the occupation of the nest boxes by other than the focal species.

Tape luring for wrynecks was performed on the 6th April, from 11th – 14th April and on the 22nd April.

We installed a RECONXY camera trap next to the entrance hole of nest boxes (60cm distance) occupied by the target species. We installed cameras only after the clutch was full.

The capture of unmarked hoopoes started the earliest ten days after hatching of the oldest chick. Most hoopoe females that had to be captured were taken by hand directly from the box, while males were caught with a clap trap fixed at the nest box entrance or with a mist net.

The capture of unmarked wrynecks started the earliest seven days after the chicks had hatched. The individuals were caught with a mist net installed in front of the nest box or a clap trap fixed at the nest box entrance. No wryneck was taken from the nest.

We generally tried to avoid the capture of individuals that were identified on the photos. We restricted the catching effort per brood to two hours a day, and to six hours in total (attempts every second day). Captured adults were ringed (standard ring plus an 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 length of tarsus, bill, third primary and weight were measured. Wryneck chicks were ringed (standard ring plus an alphanumeric colour ring) at the age of at least 10 days, and length of tarsus and weight were measured.

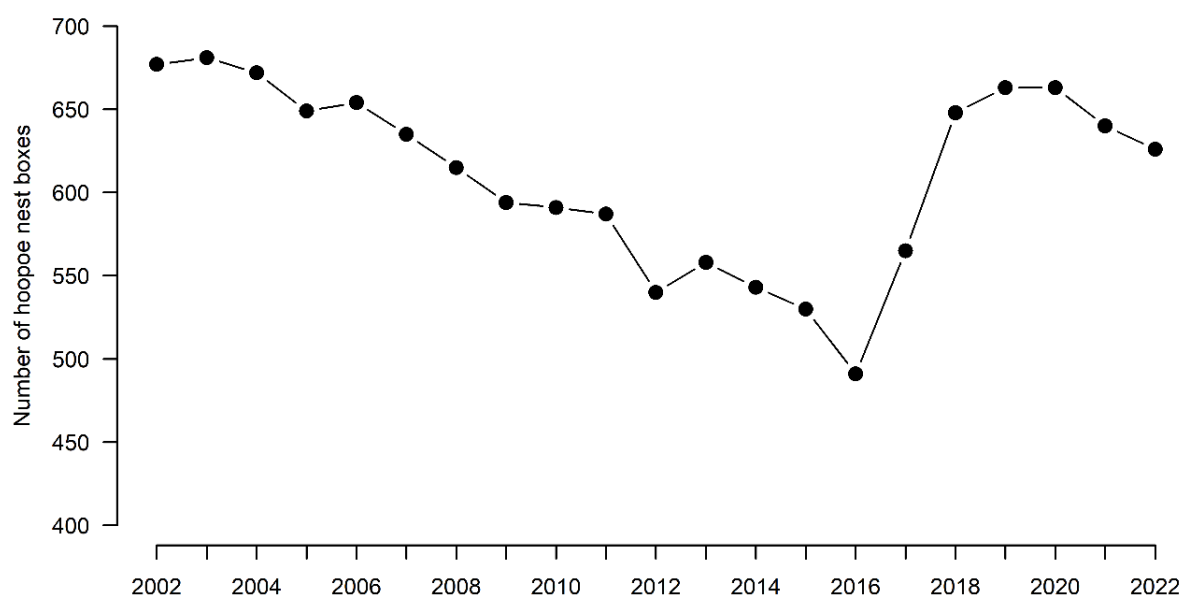
Since the quality of the alphanumeric colour rings that we purchased from interrex was not satisfying, we ordered new rings from TOM-Rings Poland and used them. The quality of these rings was good and the correspondence with TOM-Rings uncomplicated and fast.

Field work was carried out by Louis Membrez and Anouck Brodard and supervised by Irmgard Zwahlen.

3. Nest box availability

The development of the number of boxes since the beginning of the project in 2002 is shown in Figure 1. In 2022 626 hoopoe nest boxes were available. This is slightly less than in the previous years (2019: 663; 2020: 663; 2021: 640). However, as reported in Chapter 2, the database has not been updated every year. Therefore, the number of boxes reported in 2019 and 2020 do not necessarily represent the number of nest boxes available. Hence, even though the number of nest boxes reported in 2022 was lower than in the four previous years, the situation in the field is improved and more nest boxes were available for hoopoes.

Fig. 1. Development of the number of available nest boxes in the study area (Schwegler wryneck boxes are excluded on the graph).



4. Hoopoe: results and discussion

4.1 Overview

In total, 100 broods were registered, of which 78 were successful, i.e., at least one chick fledged (Figure 2). From these 78 broods, 394 chicks fledged (mean: 5.1 chicks / successful brood).

The overall number of broods and the number of successful broods was very similar to the numbers registered in the two previous years (2020: 100 broods, 75 successful; 2021: 106 broods, 81 successful; 2022: 100 broods, 78 successful). Moreover, the number of fledglings was very similar across the last 3 years (2020: 396 fledglings; 2021: 398; 2022: 394).

We identified 114 different adults (52 males, 62 females), of which 59 were already ringed, while 55 (26 males, 29 females) were unmarked. We ringed 399 nestlings, of which 390 finally fledged.

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

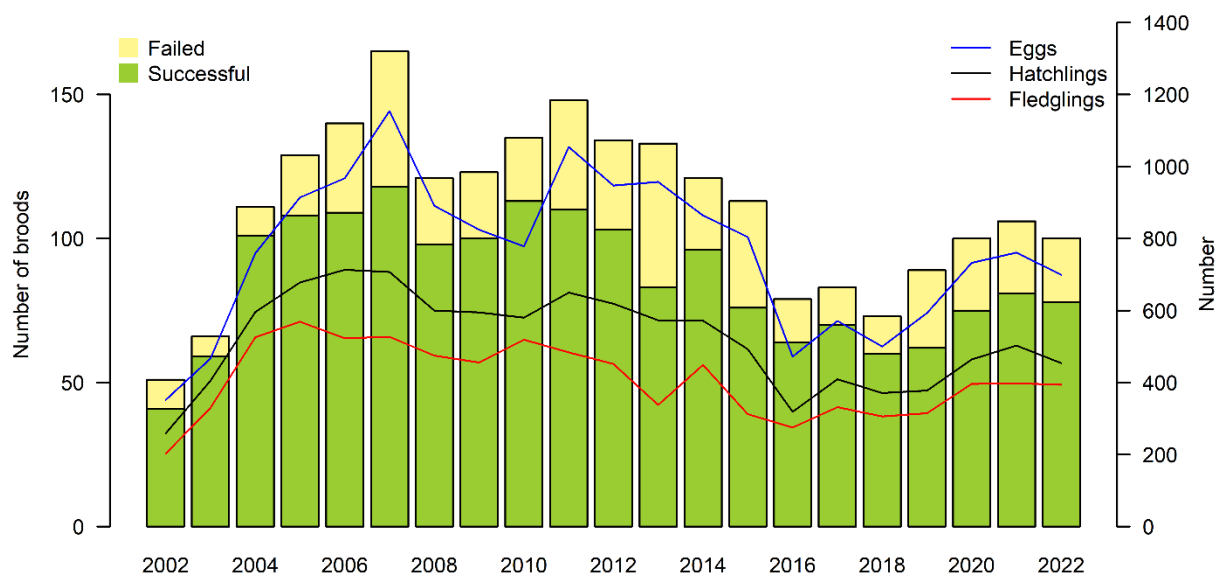


Fig. 2. Development of the hoopoe population. Bars represent the number of successful (green) and failed clutches (khaki) per year (left scale); lines represent the total number of laid eggs (blue), hatched eggs (black) and fledglings (red) per year since 2002 till now (right scale).

4.2 Capture of adults

A current goal of the study is to reduce the need to physically capture adults while still being able to monitor the population. In Table 1 we summarize by which method individuals have been identified and how this has evolved over time. Note that before 2011 all the adults could only be identified when they were physically captured. Since 2011, the encounter of the adults has been performed in four different ways: 1) use of the mist net in front of the nest box, 2) use of the clap trap, 3) bird taken by hand from the nest and 4) resighting by means of a camera. Individual birds might have been encountered several times during the season because they may have conducted several broods.

The proportion of physically handled individuals was almost 100% until 2015 and declined thereafter to a minimal value of 44% in 2021 (Tab. 1).

In 2022 the proportion of physically handled individuals was slightly higher than in 2021. This can be explained by the fact that we had to catch 4 individuals that were ringed as nestlings in 2021 with a standard ring, but they did not receive an alphanumeric colour ring due to their bad quality. Therefore, these individuals could not be identified by camera in 2022. Without these 4 birds the percentage of physically captured individuals would be 45%, almost the same as in 2021.

Moreover, the number of individuals that were physically captured twice during a breeding season was zero in the last four years.

Another way to look at the resulting change in the encounter technique after having 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 taken 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 the two possibilities.

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
Mist net only (M)	18	10	6	4	6	0	1	0	4	1	0	0
Clap trap only (T)	69	56	55	48	29	57	51	36	31	24	29	28
By hand only (H)	65	78	47	54	78	14	19	6	8	18	14	23
Resighted only (R)	0	0	3	3	1	6	16	30	33	56	67	51
M & R	3	3	2	1	2	0	0	1	2	0	0	0
M & T	2	0	0	1	0	0	0	0	0	0	0	0
H & R	0	3	0	4	3	2	9	6	3	5	4	5
T & R	3	5	22	20	9	16	5	10	12	6	6	7
H & T	7	5	1	5	6	2	0	0	0	0	0	0
H & M	2	0	0	0	3	0	0	0	3	0	0	0
H & T & R	0	0	1	0	1	0	0	0	0	0	0	0
M & T & R	1	1	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
% physically captured	100	100	98	98	99	94	84	66	64	49	44	48
% taken by hand	48	40	32	45	65	19	28	13	12	20	15	25
Number of individuals physically captured twice in a year	37	20	13	32	46	9	1	0	0	0	0	0

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
Both captured	92	92	68	66	67	36	29	21	21	13	8	15
1 captured, 1 resighted	8	8	18	31	10	11	14	15	16	22	32	31
1 captured	18	12	8	10	17	13	14	2	5	5	5	2
Both resighted	0	1	14	1	3	4	10	21	28	34	40	27
1 resighted	0	1	2	2	0	6	5	5	4	13	10	13
None identified	29	22	26	11	16	9	11	9	16	13	11	14
Total number of broods	147	136	136	121	113	79	83	73	90	100	106	100
Percent of broods without capture	20%	18%	31%	12%	17%	24%	31%	48%	54%	60%	58%	52%
Percent of broods whose parents (both) were identified without capture	0%	2%	15%	3%	3%	14%	21%	41%	43%	54%	53%	45%

Table 2 summarizes the results since 2011. The percentage of broods where no adult was physically captured increased from between 12-31% in 2011–2017 to between 48-60% since 2018 (Tab. 2). In 2022 it was a little lower than the two previous years, but still for more than half of the broods none of the adults was touched. It happens sometimes that none of the adults of a brood can be identified, either because the brood failed before identification started or because the identification was not successful.

If we only consider broods in which at least one adult could be identified, we see that the percentage of broods without physical capture increased from close to zero to 45% in 2022.

All these results show that the systematic marking of nestlings and adults with alphanumeric colour rings and the subsequent resighting with cameras significantly reduced the handling pressure on the hoopoes.

Until 2018 the proportion of broods for which no physical capture was necessary was increasing. However, the still strong immigration results in the presence of unmarked individuals. Therefore, the proportion of birds that are not physically captured and the proportion of broods without physical capture is not declining significantly anymore. The last five years no larger changes have occurred (Tab. 2).

In 2021, 192 of 398 fledglings had not received an alphanumeric colour ring because of the mentioned quality issues. A total of 24 individuals that hatched in 2021 were resighted in 2022, of which 19 were marked with an alphanumeric colour ring and only 4 without. This is likely the result of differential survival with respect to hatching date. In 2021 primarily nestlings from early broods got alphanumeric rings while nestlings from late broods were generally ringed only with an ordinary metal ring.

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 (not on the immigration rate). The estimates from the model are shown in Figures 3–5. For most parameters of the year 2022 there were no obvious changes compared to the previous years. The reencounter probabilities remained at the same levels (Fig. 3), although the physical capture of hoopoes was much reduced (Tab.1 and 2).

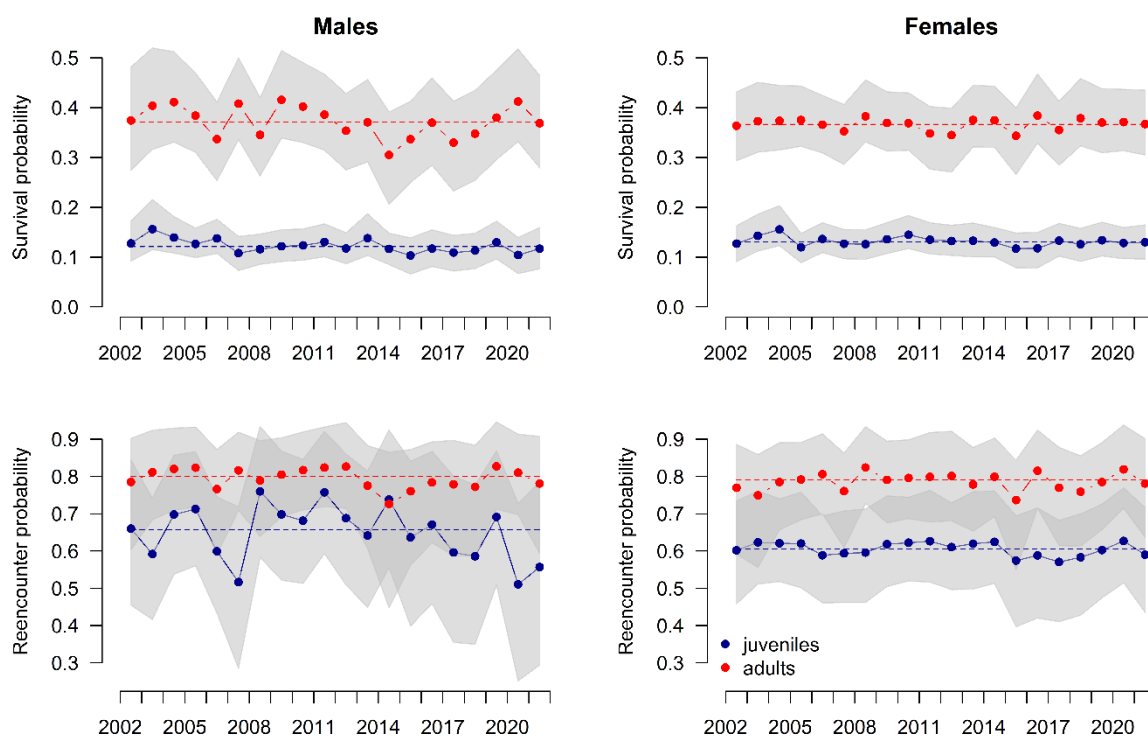


Fig. 3. Estimated annual apparent survival probabilities of juvenile (blue line) and adult hoopoes (red line) (top panels) and estimated reencounter (recapture or resighting) probabilities (bottom panels). Estimates of males are in the left panels, estimates of females in the right panels. Dots are posterior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

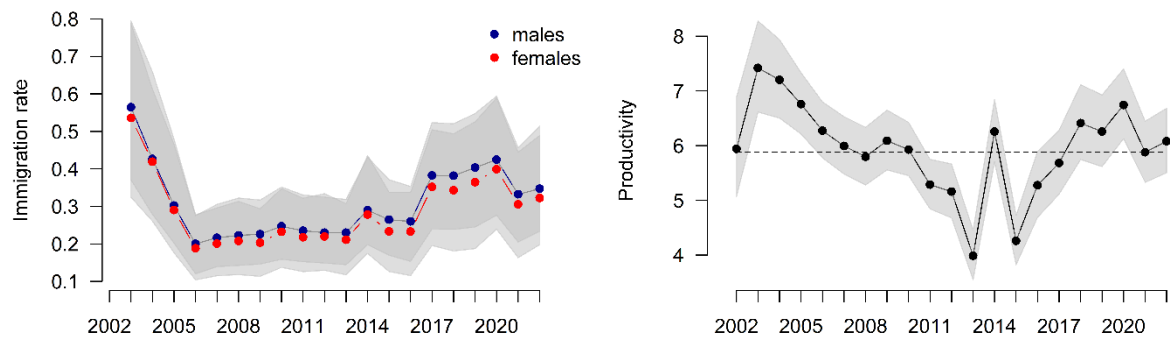


Fig. 4. Estimated immigration rates of hoopoes by sex and the estimated number of fledglings per female (productivity). Dots are posterior means, the polygons show the 95% credible intervals and the broken lines show the mean over time.

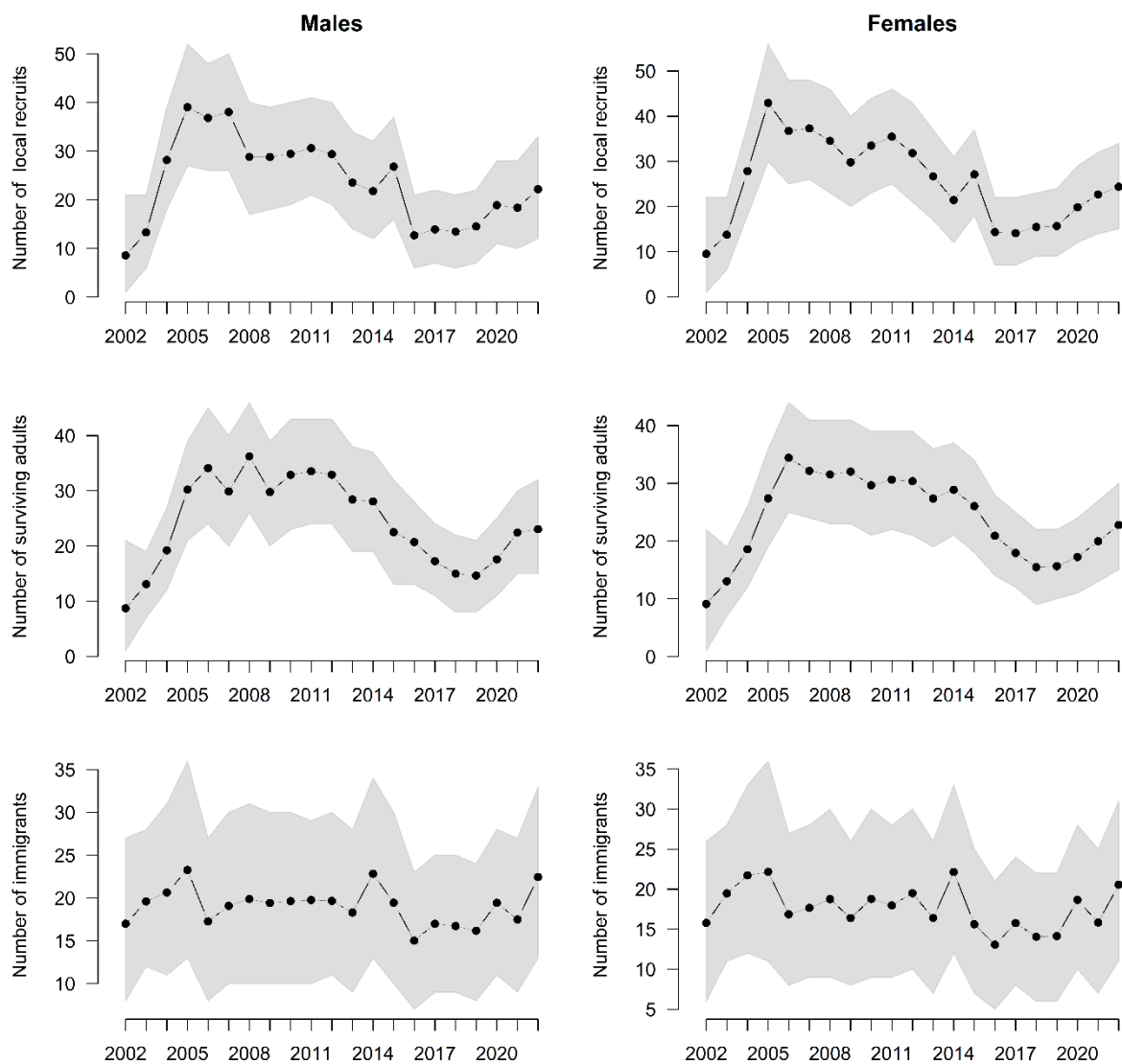


Fig. 5. Hoopoe population composition: estimated number of local recruits, surviving adults and immigrants for each sex. Dots are posterior means, the polygons show the 95% credible intervals and the broken lines show the mean over time.

The overall production of fledglings was almost the same in 2022 as in 2021, although fewer broods were registered in 2022 than in the previous year. To get further insights into productivity, we analysed the development of different components of productivity across time. These different components were in 2022 not very different from 2021 (Fig. 6), the only exception being fledging success (i.e., the probability that a hatchling fledges) that was higher in 2022 than in 2021.

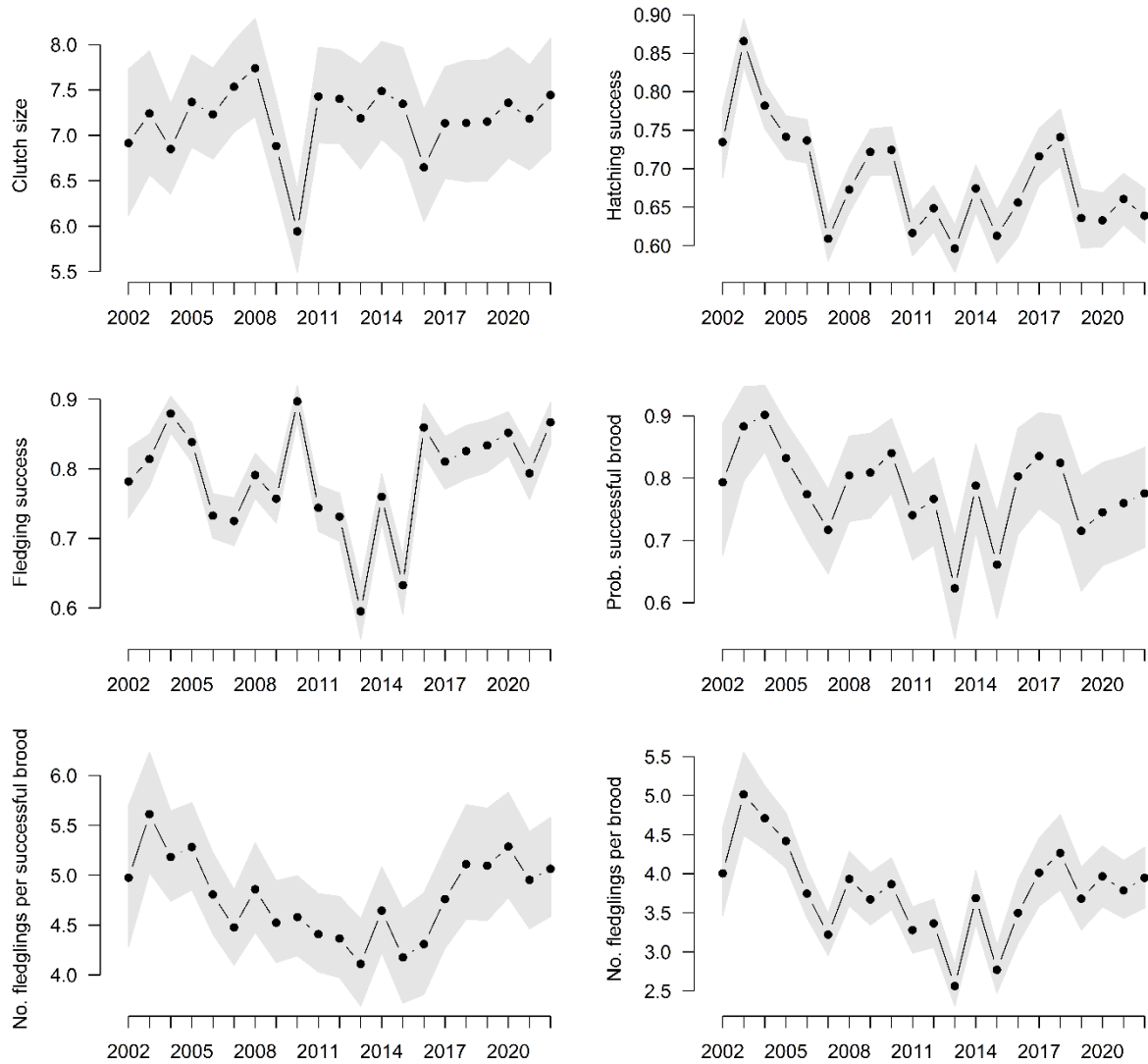


Fig. 6. Development of different components of hoopoe productivity over time: clutch size, hatching success (probability that an egg hatches), fledging success (probability that a hatchling fledges), the probability that an initiated brood was successful (i.e. at least 1 fledgling), the mean number of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

5. Wryneck: results and discussion

In total, 24 broods were registered, of which 20 were successful, i.e. at least one chick fledged (Fig. 7). From these 20 broods, 125 chicks fledged (mean: 6.25 chicks / successful brood).

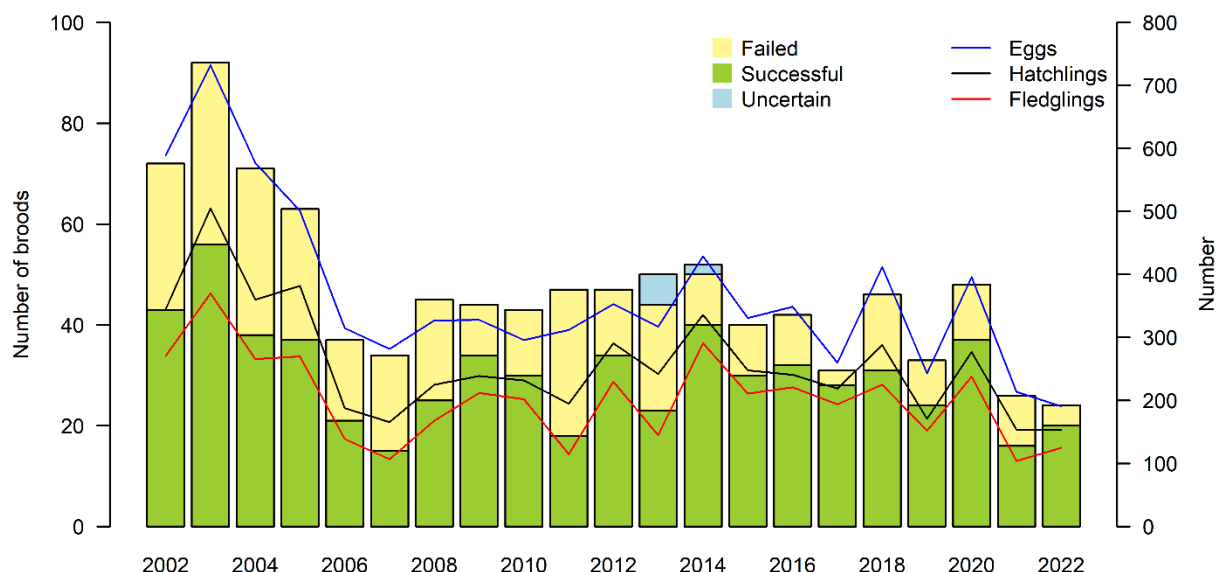


Figure 7. Development of the wryneck population. Bars represent the number of successful (green) and failed clutches (khaki) per year (left scale); lines represent the total number of laid eggs (blue), hatched eggs (black) and fledged chicks (red) per year since 2002 till now (right scale).

With only 20 successful broods, 2022 was again a bad year. However, the proportion of successful broods and the number of fledglings produced both slightly increased.

The 20 successful broods were conducted in 15 different nest boxes, of which 9 were Schwegler nest boxes. All 4 failed broods were conducted in hoopoe nest boxes, two of them were predated.

A total of 102 Schwegler nest boxes were checked every 2nd week in 2022. The vast majority of these boxes (78) were occupied by tree sparrows and great tits, only 15 were empty and 9 were occupied by wrynecks. Many of the tree sparrows and great tits start breeding already in April, hence before wrynecks start breeding. This might be an explanation, why the number of wryneck broods is low.

We identified 34 different adult individuals, of which 8 were already ringed while 26 were unmarked.

16 adults were captured prior to egg laying using tape luring, of which 2 were recaptures from previous years. 3 birds ringed during tape luring were later resighted as breeding bird in one of our nest boxes.

From 24 registered broods, 28 of the theoretically 48 parents could be identified (58%). Individual birds might have been encountered several times during the season because they may have conducted several broods, therefore we use the term 'parent'. 12 parents were ringed at the nest, 16 resighted by camera and 20 were not identified. Failed identification is either because of unmarked birds at locations where capture was impossible, because capture attempts failed, or because the brood failed before identification succeeded.

We ringed a total of 142 chicks of which 125 finally fledged.

Genetic samples were collected from all 26 unmarked adults and from 142 nestlings.

6. Ring recoveries and resightings outside the study area

Here we report dead recoveries and resightings of hoopoes and wrynecks marked in the study area from locations outside the study area. Most of these data were transmitted via the ringing central of the Swiss Ornithological Institute.

6.1 Hoopoe

Addendum for 2021:

Hoopoe **H138978** was ringed as a nestling on 27.06.2018 in Saint-Léonard VS. On 4.07.2019 it was resighted breeding in Zizers, Canton GR. The following year (12.05.2020) it was resighted again at the same location. In 2021 (14.06.2021) it was resighted a third time, now in Igis (village next to Zizers) (Distance 181km, E. Mühlethaler).

Hoopoe **H138916** was ringed as a nestling on 30.05.2018 in Saint-Léonard VS. In 2020 he was resighted by camera on a nest box in Bramois VS and sexed as male. He successfully raised a brood with six fledglings. He was then resighted alive on 04.04.2021 in Zillis, Canton GR (Distance 159 km; A. Brunner), (*already mentioned in annual report 2021*), and a few days later on 09.04.2021 in Cazis (Distance 159km; E. Mühlethaler).

Reencounters from the year 2022:

Grison (Switzerland)

Hoopoe **H140598** was ringed as nestling on 19.05.2021 in Saillon VS. On 09.05.2022 it was resighted in Domat/Ems, Canton GR (Distance 191km, M. Wittmer).

There are now already four hoopoes, which were ringed within our study in the Valais and which have been resighted (some with confirmed breeding) in the canton of Grison.

South Tyrol (Italy):

Hoopoe **H148334**, ringed as nestling on 15.06.2021 in Riddes, was resighted breeding on 20.06.2022 in Feldthruns, Italy (Distance 343 km; M.Bedin).

Hoopoe **H148309** was ringed on 03.06.2021 as an adult breeding male in Riddes, raising 8 chicks to fledge. On 24.05.2022 and 19.07.2022 he was resighted in Burgstall, Bozen, Italy, raising first and second brood in an old willow tree (Distance 314km, E.Gasser). This is very interesting, as it is a breeding dispersal of >300km.

Controlled on a bird ringing station (Italy):

Hoopoe **H148365** ringed as a nestling on 09.06.2021 in Fully, was recaptured and released on 04.04.2022 at the bird ringing station on the island of Ponza, Italy (Distance 748 km; M. Cardinale). It continued its journey safely back to the Valais and was successfully breeding in Fully, raising 4 chicks to fledge. It was identified by camera at the nest and sexed as male.

6.2 Wryneck

No resighting of 'our' wrynecks from outside the study area were recorded. However, three individuals that did not breed in one of our nest boxes in 2022 were resighted alive within the study area:

Wryneck **Y47719** was ringed as a nestling on 14.06.2020 in Fully. On 11.04.2022 it was resighted in Saillon (Distance 3km, O. Lalain).

Wryneck **Y47634** was ringed as a 2nd year bird during tape luring on 13.04.2021. On 08.05.2022 it was resighted on a photo taken by one of our camera traps installed at a hoopoe brood, at the same territory where it was caught and ringed the year before.

Wryneck **Y47798** was ringed as a nestling on 22.07.2020. On 08.05.2022 it was resighted on a photo taken by one of our camera traps installed at a hoopoe brood, at the same nest box where it had hatched two years ago.

7. Molecular Sexing Hoopoe

In November 2021 Marta Burri (Head of Laboratory from the Vogelwarte Sempach) run a PCR analysis of a subsample of 95 genetic samples, collected by buccal swaps from the mouth in 2020.

34 of these samples referred to adults of known sex, 61 were nestlings of unknown sex. 23 of the adult samples could be sexed (32% failure rate), and the sex of all these samples was correctly identified. From the samples of the 61 nestlings, 53 were sexed (13% failure rate). 25 were females and 28 males, hence the sex ratio close to even which was expected.

At the moment, we do not know why a failed sex molecular identification was due to poor DNA or something else. Since the proportion of failures was smaller in nestlings than in adults, it is likely that one of the problems is the collection of the sample. Generally, it is easier to collect genetic samples by buccal swaps from the mouth of nestlings (because of their enlarged gape) than of adults. In the future we need to pay particular attention to collect samples of sufficient quality in adults.