European Journal of Ecology, 6.2, 2020, pp. 18-22

INDUCED ALLOPARENTAL CARE IN COMMON SWIFTS (*APUS APUS*)

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Abstract.
The Common Swift, despite being considered to be of Least Concern, is declining in many areas of its breeding range. In several countries, nest-box programs have been initiated to counter these declines. In most cases, when nestlings fall out of their nests, they are taken to rehabilitation centers. Raising and caring for Common Swift nestlings is not easy. Altricial nestlings, unlike precocial young, do not eat independently and require individual "force feeding", which can be successfully done only by highly trained and fully dedicated specialists. However, it is not cheap and when not done professionally, usually results in low survival rates. We experimented with introducing the rescued young into active nests, with similarly aged nestlings, and found that they were readily accepted and all five of the young fledged successfully. We recommend alloparenting as the preferred option when precocial nestlings are rescued and active nests of other pairs are available.

Key words: nest-box; rescue; rehabilitation; survival.

Introduction

The Common Swift *Apus apus* (Linnaeus, 1758), contravening its own name, is not common any longer in many places (Harris et al. 2018). Although considered to be of Least Concern by the IUCN Red List (Birdlife International 2016), the species is listed as 'Amber' (Endangered) on both the U.K. and Irish national Red Lists (Lynas et al. 2007; Eaton et al. 2009; Stanbury et al. 2017), and there are additional reports of regional or local declines (Braun 1999; Tigges 2003; Mcdonald et al. 2008; Crowe et al. 2010; Laurance 2010; Sudfeldt et al. 2012; Harris et al. 2018). Based on the data presented on the Pan-European Common Bird Monitoring Scheme website (Pan-European Common Bird Monitoring Scheme 2020), it appears that the long-term trend is stable, but the short-term (10 years) shows a pan European decrease of 21% and a yearly decrease of 0,0036%. Similar to other insectivores, this is most probably a species that has been affected by the global loss of biodiversity and increased urbanization (Luniak & Grzeniewski 2011; Schaub et al. 2016).

To counter the loss of breeding sites to modern architectural techniques and renovations, several Swifts' nest-box projects have been initiated in many countries (e.g. Luniak & Grzeniewski 2011; Schaub et al. 2016; Newell 2019). Similarly, a project was also initiated in Central Israel and has operated since 2007 by the NGO Friends Of The Swifts (FOTS).

Alloparental care and adoption, or fostering of non-kin young, is a phenomenon that has been observed in fish, mammals, and avian species (Riedman 1982; Wisenden 1999). Riedman (1982) thought that individuals that are involved in this altruistic and energetically costly behavior do so to acquire selective advantages of inclusive fitness, gain parental experience, and hope for reciprocal altruism. In contrast, Ligon et al. (2009) regarded the fact that Eastern Bluebirds (Siala sialis) fed abandoned conspecific chicks as a mistake that was an erroneous response to the begging of the juveniles in a neighboring nest. Berggren (2006) found that avian research focused mostly on inter-specific foster feeding and brood parasitism but not intra-specific alloparenting. In a 3-year study of the North Island Robin (*Petroica longipes*) Berggren (2006) found that 4% of the fledglings were fed by adults (mostly males) other than their parents. They concluded that the adults were trapped in a situation where discrimination of nestlings was costlier than any other benefits of kin-recognition. Choudhury et al. (1993) and Larsson et al. (1995), who studied Barnacle Geese (*Branta leucopsis*) found that adoptions accounted for 6-25% of goslings hatched and occurred before parent-offspring recognition was not yet fully developed. However, they suggest that accidental mixing alone cannot explain the phenomenon and that the costs or benefits of caring for extra-pair young are either small or absent in the population.

Cade et al. (1988) described the "add-on" technique wherein an abandoned nestling is introduced into a wild brood of similar age. This has been shown to work in several diurnal raptors like the Spanish Imperial Eagle *Aquila adalberti* (Gonzalez et al. 1986), Lesser Kestrel *Falco naumanni* (Tella et al. 1997), Bonelli's Eagle *Hieraaetus fasciatus* (Pande et al. 2004), nocturnal raptors like Tengmalm's Owl *Aegolius funereus* (Kouba et al. 2017), and Black Swans *Cygnus atratus* (Kraaijeveld 2005). However, the paucity of publications on the subject of the use of this technique as an application for rehabilitation and/or conservation purposes makes it a little-studied and documented phenomenon and which deserves attention owing to the relatively large numbers of Swifts (*Apus* spp.) that fall out of nests, especially in urban areas (reviewed by Reynolds et al. 2019).

Since swifts are highly social and indiscriminate about the nestlings they feed in the nest (Bize & Roulin 2006), we hypothesized that alloparenting would be an effective method for the rehabilitation of orphaned nestlings. We predicted that parents will accept the nestlings inserted in adoptive nests, and reasoned that the chances of survival for these young were greatly increased if raised naturally by foster parents rather than in wildlife rehabilitation centers (A. Hahn, unpublished data).

Methods

In the framework of the nest-box Project initiated in the city of Givatayim, but which has spread to many cities surrounding it, we have many cases of nestlings falling out of their "natural" nests in cracks and holes in buildings, before they can fly. Some of these are successfully rehabilitated and released back into the wild while others succumb to their injuries.

A system has been developed wherein through public outreach programs the finders of such nestlings call a cellular number and A. Hahn on a two-wheeler, called the Swift-Bulance, rushes to the rescue. He collects the fallen nestling in a 12 x 20 cm plastic box padded with paper towels and transports them to the Israeli Wildlife Hospital at the Safari Park in Ramat Gan, or other alternative facilities as deemed in coordination with the Parks & Nature Reserves Authority. The distances are short and can be covered on a two-wheeler in less than 30 minutes.

However, following limited success in rehabilitation and fledging of the nestlings (A. Hahn, unpublished data), we decided to initiate a program that was discussed by Swiftphiles on their website (Swallows-Martins-Swifts-Worldwide, SMSW) of the chances of alloparenting and resultant success. Mark Smith, of the Northern Irleland Swift Group, mentioned that they had introduced abandoned nestlings into other active nests with varying success.

Results

Here we report on five cases of induced alloparenting in Common Swifts that breed in nest-boxes in urban areas. All nestlings were rescued when they were still precocial and after having fallen out of natural nests in buildings. We ascertained that they were healthy and decided to place them in foster care. Common Swifts are known for their epimeletic behavior (Tenow et al. 2008) and for helping strange young which come to conspecifics nests after fledging (Bize & Roulin 2006).

All five induced alloparenting occurred during the 2019 breeding season. The first individual was rescued from a private home on April 26 and the nestling was placed in nest 19M where there were two nestlings of similar age. On May 1st another nestling was found on the ground and rescued at the Shimoni Primary School in Givatayim city and placed in nest 19L. On May 5, in central Tel Aviv at the Schiff House, a nest which was monitored on-line by CCTV and broadcasted live to the Internet, a nestling had choked on a bolous fed to it by a parent and died. We replaced it with a rescued individual of similar age from the Israeli Wildlife Hospital. Further, on 14 May we added two other rescued nestlings to two separate nests at the same Swifts nest-boxes site.

The nest boxes are made from wooden, used ammunition boxes, which measure 110 cm x 30 cm x 18 cm (L x B x H). These are modified by A. Hahn into three, equal-sized cells (of 31 cm x 28 cm x 16 cm) by introducing regularly-spaced 10 mm thick partitions, entrance holes drilled into the sides, and retrofitted in the eaves of schools or other public buildings. A hinged opening at the top or side allows us to monitor the occupancy of the cells and the progress of the breeding attempt.

In the 2019 breeding season, we had CCTV cameras monitoring three of the nests and were able to follow the adoption process of the new nestling by its induced foster family. We were unable to monitor the behavior of the other two nests but periodically ascertained that the nestlings were fed and cared for by the foster parents and subsequently fledged with their

nest-brothers. All five nestlings were color marked on the head for identification (Fig. 1; ESM 1). In all

Figure 1. An introduced nestling settles into the nest with its' two foster siblings in the Common Swift *Apus apus*. The red mark on its forehead allows for individual identification.

three cases, we noted that the parents on their visit to the nest hesitated for a few seconds looking directly at the introduced nestling but then because of the heightened and aggressive feeding calls of the newcomer, fed them before their nestlings (Fig. 2). It ap-

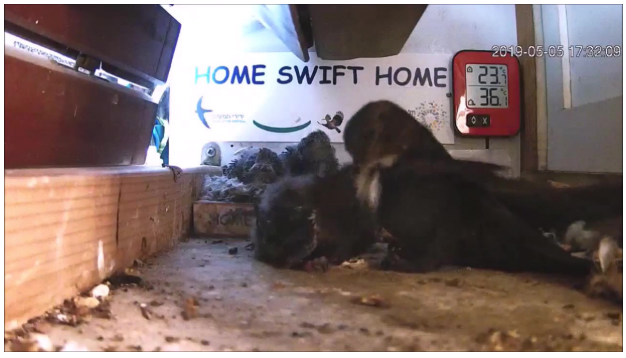

Figure 2. An adult Common Swift feeding the introduced young on the first return to the nest after the introduction. Note the resting foster siblings on the nest in the background.

pears that the foster nestlings are under stress when handled by us and are hungry by the time they are placed in the nest-box. They were very vocal at the entrance of the parent and immediately begged for food by approaching them with their open beaks. In all cases, the nestlings were accepted by the present nestlings and at night were all brooded collectively by both the parents (ESM 1, Fig. 3). All five of the nestlings fledged successfully.

Figure 3. Both parents brood the young at night. The introduced chick heads towards the camera.

Discussion

We were unable to trace any other studies that report alloparenting in the *Apus* genus at the brooding stage. However, Bize and Roulin (2006) demonstrated that in Alpine Swift (*A. melba*) dependent young may opt to return to another family and are accepted by these foster parents. They found that nest switching was probably a result of ectoparasitic load rather than allostatic load.

Common Swifts appear to have a very highly developed altruistic relationship towards all conspecifics (Tenow et al. 2008). Unlike some species where altruism is based on kin selection (Kraaijeveld 2005), in swifts, it appears to be irrelevant (Tenow et al. 2008). The authors describe how adults help fledglings in their maiden flight stay in the air by partially supporting them from underneath while on the wing. Also, Irish colleagues (Mark Smith, Peter Cush, John Young, David Foster of the Northern Ireland Swift Group) have communicated that they have also experimented with induced alloparenting with success in all six cases they induced during 2019.

We recommend that in the many swift nest-box programs that exist (e.g., Cyprus, Switzerland, Germany, Belgium, Italy, Spain, France, Greece, and England) that they consider alloparenting to a much greater extent than assorting to try and rescue abandoned nestlings (cf. Westray & Partridge 2010). The costs and efforts to try and rehabilitate Swift nestlings are extremely high and the success rate is very low compared to other avian species. Hence, we recommend alloparenting to be the preferred option when precocial nestlings are rescued and active nests of other pairs are available.

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Acknowledgments

This is a project supported by the Jane Goodall's Roots & Shoots, North Ireland Swift Group, Actions for Swifts, Swifts Conservation, Swifts without Frontiers, Mauerseglerklinik, Inițiativa Drepneaua Neagră, the Hoopoe Foundation of the Society for Protection of Nature in Israel, and by the Tel Aviv-Yafo Municipal Unit of Environmental Protection & Sustainability.

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