In-situ and Ex-situ conservation of Endemic Andaman Edible-nest Swiftlet in the Andaman and Nicobar Islands

SACON Technical Report – PR219

Report Submitted by

Principal Investigator

Dr. Manchi Shirish S., Principal Scientist

Co-Investigators

DFO (WL)/DCF (Mayabunder, South Andaman, Havelock and Nicobar Divisions)

Research personnel

Dhanusha Kawalkar, Prathamesh Gurjarpadhye, Amruta Dhamorikar, Sudheer Kumar Jena

In collaboration with

Andaman and Nicobar Forest Department

Funding agency

Ministry of Environment, Forest and Climate Change, Government of India

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Anaikatty (Post), Coimbatore – 641108

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LIST OF ACRONYMS USED IN THE REPORT

ACF	Assistant Chief Conservator of Forests
AENS	Andaman Edible-nest Swiftlet
ANF	Department of Environment and Forest, Andaman and Nicobar Islands
ANI	Andaman and Nicobar Islands
BBNT	Brown-backed Needletail
ENS	Edible-nest Swiftlet
GPS	Global Positioning System
GS	Glossy Swiftlet
IS	Indian Swiftlet
IUCN	International Union for Conservation of Nature
MaxEnt	Maximum Entropy
MoEF&CC	Ministry of Environment, Forests and Climate Change
N&MA	North and Middle Andaman
NA	North Andaman
NBWL	National Board for Wildlife
PCCF	Principal Chief Conservator of Forests
R&D	Research and Development
SA	South Andaman
SACON	Sálim Ali Centre for Ornithology and Natural History
SDM	Species Distribution Model
WLPA	Wildlife Protection Act

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ABSTRACT

The over-exploitation of the edible-nest to satisfy the increasing demand for Chinese pharmacy and cuisine led to severe global population declines of the Edible-nest Swiftlets (*Aerodramus sp.*). Realising the urgency, the Andaman Nicobar Forest Department (ANF) and the Sálim Ali Centre for Ornithology and Natural History (SACON) are continuously conserving the Andaman Edible-nest Swiftlet (AENS) (*Aerodramus inexpectatus* earlier known *Aerodramus fuciphagus inexpectatus*) for more than two decades. The continuous conservation efforts have resulted in multifold population increase in the *in-situ* and *ex-situ* populations of AENS, which is counted over 10,000 birds and the urban population alone being over 22%. The majority of the AENS population is protected. The current project (October 2017 to March 2021), along with *in-situ* protection, contributed to identifying the urban colonies with potential in the systematic swiftlet ranching, ensuring the creation of livelihood opportunities for the islanders' economic development. Among the existing swiftlet houses, only the Tugapur house with required renovation is suggested to use further to attract the AENS for nesting. The species and the habitat studies have provided suggestions for the cross-fostering, habitat requirements and the maintenance of the *ex-situ* house surroundings for viable *ex-situ* populations in the urban landscapes. The *in-situ* habitat selection of the AENS is purely arbitrary but depicted avoidance towards lengthier and larger caves. However, the bird prefers cave features such as avons, bell-holes and blind cupola (hollow cavity in cave ceiling) for nesting. Hence, it is essential to create and maintain such specific micro-habitats while planning the construction of the *ex-situ* swiftlet house. Additionally, the location of the *ex-situ* house is a crucial factor influencing its success. According to the climate change model, the North and Middle Andaman Islands (N&MA) is predicted to be suitable for the AENS and Glossy or Plum-toed Swiftlet (GS) (*Collocalia affinis*). Therefore, all the *ex-situ* conservation efforts are recommended to focus on the N&MA for the long-term returns. Further, based on the *in-situ* habitat studies, an improved plan design of *ex-situ* swiftlet houses is suggested initially at the identified potential sites under the *ex-situ* conservation efforts. Furthermore, to manage both the *in-situ* and *ex-situ* AENS populations, we propose a marketing and sharing mechanism through a swiftlet cooperative society. The swiftlets are of economic importance and play a significant role as an "umbrella species" in the cave ecosystem. Finally, it is now established that this program is a model species recovery program that has safeguarded and extended the survival of the AENS for the next 100 years and the associated undiscovered subterranean fauna.

EXECUTIVE SUMMARY

The karst regions in the Andaman and Nicobar Islands are one of the unique habitats in the country. The subterranean karst landforms a unique habitat for various fauna and flora. Faunal species have particular adaptations to survive in such a habitat and thus form a magnetic component to study. The Edible-nest Swiftlet itself is an example of a unique adaptation for life in caves. The bird uses echolocation to navigate the dark zone of caves. With this in mind, the project also focuses on studying this unique habitat, diversity, and structure. Endemic to Andaman Nicobar Islands, the Andaman Edible-nest Swiftlet (AENS, *Aerodramus inexpectatus*) produces an edible-nest exclusively made of its regurgitated saliva.

After realising the severe threat of nest collection to the species and loss of more than 80% of the population within a decade during 1999, the Andaman Nicobar Forest Department (ANF) and Sálim Ali Centre for Ornithology and Natural History (SACON) initiated the innovative Participatory Conservation program to save AENS in the Andaman and Nicobar Islands. The local managers, scientists, and motivated people (the nest collectors converted into nest protectors) depicted the best way to conserve the species with high economic value. In 2012-13, a detailed survey of 314 limestone caves in the Andaman Islands showed that more than 90% of the AENS population is protected under the Conservation program. Simultaneously, efforts were made to breed the species in the human-dominated landscape by creating artificial habitats at the experimental site. Recognising the continuous efforts and success of the program, including successful population recovery and identifying the importance of the participatory approach, the Government of India, during 2013, removed a Scheduled-I species from the Schedules of Wildlife Protection Act (WLPA), 1972 for the betterment of people and the species. However, since the species was out of the national list of priority species, raising the grants to continue the program was challenging.

The current collaborative project was implemented between October 2017 and March 2021 by SACON and ANF with the primary objective to continue the *in-situ* and *ex-situ* conservation and research and develop the marketing and sharing of the benefits. However, using the state grant, ANF continued the *in-situ* protection of the AENS at all the three protection sites, Interview Island, Chalis-Ek on North Andaman Island and Baratang Island, during the current period. With the help of the trained nest protectors, we monitored the populations of the AENS at all three protection sites. As a result, the AENS population in the protected caves was almost stable with a slight increase. The total breeding population count summed up to 3523 nests/

breeding pairs in all three locations. Further using the formula developed, during the last phase of the program, to estimate the total population of the cave-dwelling birds, we calculated the total AENS population as 7734 Individuals. Though the population increase was not significant, the population stability without any decline was due to the continued *in-situ* conservation efforts.

Most efforts during the current project were concerned with understanding the status of the urban populations of AENS and improving the strategies towards expanding the *ex-situ* conservation of AENS in the islands.

The *ex-situ* populations of the AENS in the Andaman Islands were divided into two broad categories: 1) existing *ex-situ* swiftlet houses and 2) other human-made structures in urban areas.

We revisited the existing four *ex-situ* houses constructed and improved to attract and breed the swiftlets. Unfortunately, the houses could not be maintained because of the unavailability of the grants from 2014 onwards. None of these three cost-effective houses constructed near Baratang jetty, Kharanallha and Ramnagar were in a condition to using. Therefore, they were recommended to be condemned. Since the fourth *ex-situ* house at Tugapur was constructed with a concrete roof and columns, standing in a repairable shape with the small population (7 nests or breeding pairs) of the AENS and huge Glossy or Plum-toed Swiftlet (GS) (*Collocalia affinis*) breeding colony. Immediate repairing of the house was recommended and implemented during 2018. The temperature observed was between 28.2°C and 30.4°C, higher than the natural swiftlet caves. Also, the maximum relative humidity at the nesting sites inside the house was 81.1%, which is lower than required. By installing the humidifier, we could maintain the maximum temperature to 21.5°C and the relative humidity was increased to 88.2%. However, during 2019, the other old parts of the house were damaged. A plan was drafted with the assistance of the draftsman, Mayabunder (WL). A further repair could not be taken up because of the COVID-19 pandemic and movement restrictions imposed. We also identified a raptor species, Besra (*Accipiter virgatus*), as a GS predator in the Tugapur house. As recommended, regular maintenance of the undergrowth around the house, managing the perches that may support predators, and continuous monitoring by the ANF staff could successfully arrest the predation of the swiftlets around the Tugapur house.

The earlier known (n=9) and newly identified (n=5) urban colonies of the AENS depict a significant increase in population, except in four sites where the population is no more because

of human interference. The urban breeding population summed up to 1043 nests/breeding pairs, i.e., 2086 breeding individuals in 2019. Therefore, the total estimated population, including non-breeding individuals, was 2290.

The largest known urban colony (n=873 nests or breeding pairs) is at the Cellular Jail, Port Blair. The location is continuously monitored. We also improved the habitat of an urban colony at the Hotel Shompen, Port Blair, identified in June 2018. Therefore, the population has grown from 31 to 50 nests between 2018 and 2020.

Among the urban areas, Mayabunder town holds the maximum (four colonies) active urban colonies of AENS. There might be additional unexplored colonies in the region. This place has the potential to become a pilot in swiftlet farming. Moreover, potential locations should be found to build an *ex-situ* house. We presume this *ex-situ* population is healthy and is growing, possibly due to the efforts made at Tugapur house from 2001 onwards. A meeting with the Sarpanch (Village Head) and the committee took place in December 2019 to make aware the Panchayat committee of the birds' ecological and economic importance. A possibility of swiftlet farming with community involvement was presented to the group at the Panchayat Bhavan, Mayabunder. The authority has shown interest in the farming business as it has no investment cost involved and can help in the economic growth of the people in Mayabunder. The town authority has also agreed to protect this crucial urban colony with ~75 AENS individuals.

Cross fostering is an ancient management technique to save endangered birds with an excellent success rate. In some parts of South-East Asian countries, the GS colonies breeding in houses are used for cross-fostering the AENS eggs and fledging AENS chicks. It can also help increase the population of the AENS for commercial purposes. Hence, GS hold much greater importance for the economic development of the local people. If the cross-fostering process is designed scientifically, the process can yield better results. We noted the asynchronous behaviour in the wild and urban GS colonies during the study. Hence, we understand that proper examination of the suitable colony is required before commencing the transfer of eggs of the AENS eggs into the urban colonies of GS.

As swiftlets are known to forage near their nesting sites during early morning and late evening hours, identifying their foraging grounds helps identify unknown breeding locations. As per the swiftlet farming experts, the *ex-situ* sites in the AENS foraging zone will have a significantly better chance of successfully farming the swiftlets. Therefore, foraging surveys

conducted in the N&MA and the South Andaman Islands (SA) helped us identify the potential location for *ex-situ* houses for people and the communities in the islands. We documented 40 foraging grounds, out of which four potential sites were suggested for *ex-situ* house construction, 3 in N&MA and 1 in SA. Out of all, Kadamtala in N&MA harbours the highest number of AENS population it is considered for the further experiments. Therefore, several visits were made to Kadamtala between May 2019 and December 2019 to find suitable land for constructing the house. After the voluntary consent of the community, a piece of Panchayat land is identified to build the swiftlet house. The call playback method results indicated that *ex-situ* house has a high chance of success in the Kadamtala area.

After the surveys, the design of the *ex-situ* house was finalised. The plan of the *ex-situ* house was made using AUTOCAD ver. 2014 software by the AENS research team with the help of ANF staff. Using the available breeding location data and foraging data, we also modelled breeding and foraging habitat distribution of the AENS using Maximum Entropy (MaxEnt). Results showed that the AENS foraging habitat distribution highly depends on the monthly temperature. Its fluctuation leads to the shrinkage of suitable foraging habitats in SA. Whereas, in N&MA, the habitat remains suitable even in the yr. 2100. Which hints that the conservation of the species should be primarily focused in N&MA. Moreover, the most potential location of the *ex-situ* house is also located in Kadamtala, N&MA. It further confirms that the *ex-situ* conservation can be successful here. From the climate modelling, we conclude that protecting the species is essential, but at the same time, their breeding and foraging habitats are of utmost significance. However, further measures should be taken to protect the species' habitat in the Andaman and Nicobar Islands.

Further to the conservation of the AENS, the natural resource producer, it is essential to have the appropriate marketing and sharing system. So, the objective was included in the program. The ANF initiated auctioning the edible nests harvested from the protected caves under the *in-situ* conservation program. However, the response of the buyer was not as expected. Maybe because the produce was meagre (~35 kg) given the international market and buyers, only local buyers came ahead with a very nominal price per kilo of the edible nest.

Further, as presently over 22% of the known AENS population is from the urban areas (n=10024; *in-situ* = 7734 and *ex-situ* = 2290 individuals), it is suggested that all the possible urban colonies (public and private) be taken under the conservation program. It will increase sales production, which might help attract international buyers with a better nest price. Until

then, the idea of hiring the nest protectors on daily wages during the breeding season can be considered the best return to the people involved. Because the amount spent on wages/salaries is much higher than the share the protectors might get after selling the nests at a local price. Simultaneously, the marketing and sharing system needs to be developed case-by-case with the owners (public and private) of the urban sites with breeding populations of AENS.

Research and development have always been an essential part of the Swiftlet Conservation program, as it regularly provided direct inputs to strengthen the conservation strategies of the program.

We studied morphometry of 79 caves to understand the role of cave structure in habitat selection by AENS. Further, the Multi-regression modelling depicted that cave structure does not influence the habitat (cave and nest-site) selection of the AENS. However, the preference index highlighted that the AENS avoids the large and small caves and long and short caves, which is an output based on the type of caves available in the islands ($R2=0.42$, $p>0.05$). However, based on the findings, we improved the basic design of the *ex-situ* houses to be built in the Andaman and Nicobar Islands.

Additionally, we tried to understand the habitat availability and usage by the AENS, GS, and bats (Chiroptera) in the caves of Baratang Island. The caves in Baratang Island are structurally diverse, thereby providing the swiftlets with a suitable habitat. The findings showed that the cave features affect the nests and roost site section of AENS, GS and bats. Overall, it was observed that the birds tend to prefer bell holes, avons, and blind cupolas inside the caves. It suggests that the preferred modification can be included in the internal design of the *ex-situ* house.

After more than two long decades and with significant knowledge about the swiftlets (AENS and GS) and their habitat, we now tried to understand the role of the swiftlets (AENS and GS) in the cave ecosystem to ascertain their importance. The primary function of the swiftlets and bats in caves is to provide energy to the oligotrophic environment in the form of guano. Swiftlet guano offers an entirely different environment as compared to bats. The Organic energy in the guano is in the form of digested food material and carcasses of birds, nestlings, fallen eggs, eggshells, and feathers. AENS guano is more granular as compared to the bat guano. Therefore, it can attract and support a different faunal diversity. From the study of guanobionts, we understood that 13 orders of invertebrates survive on the bird and bat guano in the caves of the Andaman Islands. Of these four orders (Scolopendromorpha, Hemiptera, Archeognatha and

Araneae) are dependent only on the swiftlet guano, which is a significant contribution to the cave system by the swiftlets as the findings indicate that these four orders might vanish from these caves if there are no more swiftlets.

Further, the rare primary producers (algae and fungi) in the cave ecosystem's trophic structure may grow well on swiftlet guano, leading to a unique trophic structure. Cave dwellers like beetles, cockroaches, ants, bugs feed on Swiftlet guano. These guano eaters are essential food items for predators like Spiders, Centipedes, and Whip-scorpions. According to our observations, the most frequent species in the AENS guano were millipedes. The cockroach is a burrowing species found inside the guano layer, having a flat body suited for the burrowing character. The fantastic adaptations displayed by the guano-dependent fauna have long intrigued bio-speleologists. Coupled with their island habitats, these animals are considered to be of high conservation value. As swiftlet guano plays a vital role in adding nutrition into caves, it is a significant niche in the cave ecosystem. Therefore, we recognise that the swiftlet presence in a cave affects the existence of the related fauna.

Discoveries have complemented our understanding of cave life and various forms. Still, most of the cave endemic species remain mysterious and undiscovered. Other cave fauna surveys recorded a total of 80 species of invertebrates. Two species of shrimps (one is new to science) and amphipods have been documented from the swiftlet caves. Ultimately, the cave fauna assessment has helped understand the cave ecosystem as the breeding and roosting habitat of the AENS. As the AENS is one of the vital resource providers in the subterranean ecosystem, it is proven that if the bird is not given sufficient protection, the entire guanobiont food web might collapse.

Moreover, the conservation program for the AENS has directly conserved all these unknown creatures and their habitat in the swiftlet caves, which is an unclaimed achievement of the AENS Conservation Program. Therefore, it will not be an unjustified act if we take the liberty to declare the AENS as an "Umbrella Species" for conservation of the cave fauna and their habitat in the Andaman and Nicobar Islands.

Finally, the Population Viability Analysis unveiled that the species predicted to be extinct from the islands by 2020-22 in case of no conservation efforts now has assured survival at least until 2120, even in the absence of further conservation efforts. It is now established that this program is a model species recovery program that has safeguarded and extended the survival of the AENS for the next 100 years and the associated undiscovered subterranean fauna.