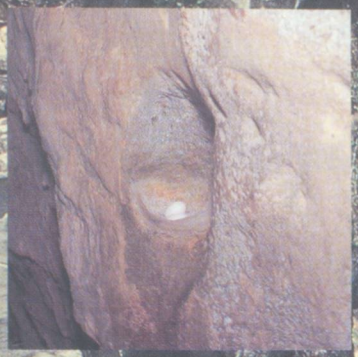
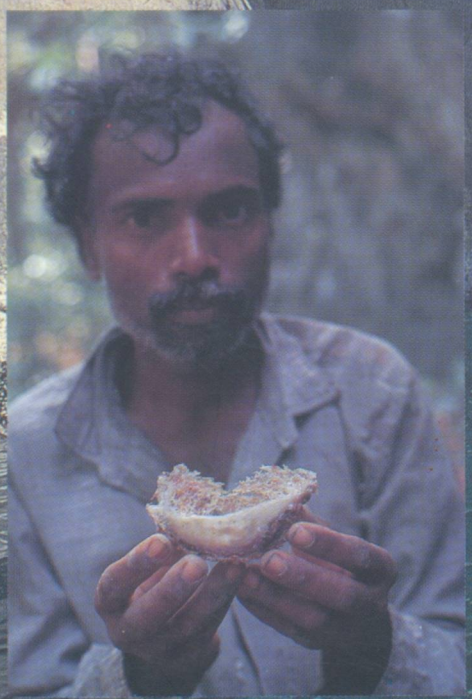
The impact of nest collection on the Edible-nest Swiftlet *Collocalia fuciphaga* in the Andaman & Nicobar Islands





R Sankaran

Sálim Ali Centre
for Ornithology & Natural History

The impact of nest collection on the Edible-nest Swiftlet *Collocalia fuciphaga* in the Andaman & Nicobar Islands

R Sankaran

A study funded by

WWF INDIA

TRAFFIC INDIA

IUCN The World Conservation Union

SACON

Sálim Ali Centre for Ornithology & Natural History
Coimbatore - 641 010, India

1998

R Sankaran is a scientist in the Division of Avian Ecology. He was awarded a doctorate from the Bombay University for his studies on the breeding behaviour of the Lesser Florican *Sypheotides indica* and the Bengal Florican *Houbaropsis bengalenis*. He has worked in diverse habitats that include the *terai* of Uttar Pradesh, the subhumid grasslands of western India, the Thar desert, the Himalayas, and the Andaman & Nicobar islands. The other species that he has studied include the Nicobar Megapode *Megapodius nicobariensis*, the Red Junglefowl *Gallus gallus*, the swamp deer *Cervus duvauceli* and the hog deer *Axis porcinus*. He is currently studying the endemic avifauna of the Andaman & Nicobar islands and is also involved in the conservation of the Lesser Florican.

Published by : Director
Sálim Ali Centre for Ornithology & Natural History
Kalampalayam P.O., Coimbatore 641 010, India.
Phone: (91) (422) 807973, 807983; Fax: (91) (422) 807952;
Grams: SACON

Typesetting by : K.K. Ramakrishnan

Printed at : Kalaikathir Achchagam, Coimbatore - 641 037

Photographs : Front cover main - An Edible-nest Swiftlet cave at Murray Point, Great Nicobar Island.
Front cover top inset - An Edible-nest Swiftlet nest with eggs, Baratang Island.
Front cover bottom inset - Nest Collector with nest.
Back cover - Rainforests, like that on Great Nicobar, are probably critical to the Edible-nest Swiftlets as they provide an abundant source of aerial insects.

Photo credits : All photographs by R Sankaran

Contents

List of tables

List of figures

Acknowledgments

I wish to thank the Forest Department, Andaman & Nicobar islands, without whose active involvement this study would not have been possible. I wish to particularly thank Mr C P Oberoi IFS, PCCF, now Inspector General of Forests, MoEF, Mr R D'Souza IFS, Chief Wildlife Warden, Mr I H Khan IFS, CF Planning and Utilisation, and Mr Tarun Coomar IFS, DCF Head Quarters, for their help and support.

Special thanks are due to Mr B P Yadav, ACF Wildlife, Nicobar district, and Mr T Nautiyal, ACF Wildlife, Wandoor, for their help. I also thank Mr Pankaj Agrawal IFS, DCF, Mr N Tam IFS, DCF WL Mayabunder, and Mr George Jacob, DCF Mayabunder. I thank the Andaman and Nicobar Islands District Administration, and the Public Works Department, for their support and help. The Forest Department Staff were extremely helpful, and I wish to particularly acknowledge the assistance given to me by Mr Ayub Hassan, Mr Martin, Mr Vijayan, Mr Ganeshan, Mr Boney, Mr Alan, Jonal and Albert.

The information and help I received from several people proved invaluable to this study. Of special mention are Mr Sameer Acharya, Maj. K Varadha, Capt. Shetty, Jugulu Maheto, Lamboo, Benjamin Paul, Mark Paul, Jugnu Ulysses, David Owen, Rev. Sylvanus Wilifred, Inkainla, Crispin Harry, Amber, Victor Roh, Tapang, Abi Ho, Moses, J B Daniel, Rajinder, Joseph Khujoor, Prakash Lakda, James Walter Kindo, Rajinder Lakda, Dhiren Das and Balasubramaniam.

This study would not have been possible but for the interest shown by TRAFFIC-India. Discussions with Vivek Menon and subsequent follow up by Brig. R Talwar, Mr Manoj Mishra and Mr Ram Veer Singh, have been largely responsible for initiating the conservation of the Edible-nest Swiftlet in India, of which this study is but the beginning. I also thank Mr Steven Broad and Ms Bobbie Jo Kelso for commenting on an early draft of this manuscript.

I wish to particularly thank Alexander and Nelson, sailing and working with whom was a marvellous experience. The survey of the Andamans would not have been as successful and as pleasurable without them. I wish to thank their families for their hospitality, that made the days off between phases of the survey so rejuvenating and healing. I also wish to thank Uncle and Aunty Pau, and Shwetha, for their help.

All my colleagues at SACON were very supportive, and I thank Drs V S Vijayan, Lalitha Vijayan, Ajith Kumar, P A Azeez, H S Das, K Sivakumar and K K Ramakrishnan who have contributed in to this study. I wish to thank Mr J C Daniel for his comments on an earlier draft of this manuscript. I also thank Mr Harry Andrews of the Madras Crocodile Bank, Manish, John and others at ANET for their help. I thank Mr P S Sivaprasad who helped me with the maps.

I would like to thank my wife, R Rajyashri, who not only puts up with my extended absences from the hearth, but is also a constant source of encouragement.

Preface

At the end of a survey of the Nicobar islands in 1995 to assess the impact of nest collection on the Edible-nest Swiftlet, I concluded that the Edible-nest Swiftlet was endangered, probably critically so, and ranked amongst India's most threatened species. Considering the urgency of the situation, SACON published a report in which, I called for the inclusion of the Edible-nest Swiftlet in Schedule I of the Wildlife (Protection) Act, 1972, and in Appendix II, if not Appendix I, of CITES (Sankaran, 1995). I argued that as protection of caves is near impossible, the only way to effectively protect swiftlets is by putting in place a mechanism that prevents trade and the movement of swiftlet nests from the islands and to receiving countries.

The survey of the Andaman islands to assess the status of the swiftlets there has reinforced the conclusion that the Edible-nest Swiftlet is endangered, critically so, from an excessive and uncontrolled nest collection regime (this report). It also reinforced my belief that urgent protection measures need to be implemented if the species has to survive.

However, there are two developments that require a rethink on how we are to go about swiftlet conservation.

First, at the 'Technical workshop on conservation priorities and actions for Edible-nest Swiftlets' at Surabaya, Indonesia, 4-7 November 1996, it was decided that the solutions for swiftlet conservation should be found outside the purview of CITES. As a result of which, India, whose swiftlet problem emanates from consumer demands beyond our borders, has no international support in solving a problem that is international in nature. International demand of swiftlet nests will continue to deplete Indian populations of swiftlets.

Second, the Indonesians have developed a remarkable method of managing swiftlets: house ranching. Nearly 65,000 kg of swiftlet nests are being produced in Indonesia from colonies that reside within human habitation, and for which the houses / rooms are optimally managed. The swiftlet population to produce these nests is probably about 5.5 million birds! Thus, while swiftlet populations in caves will continue to decline, or become extinct, because of collection pressures, the species will survive simply because there are hundreds of thousands of birds that reside within human habitation, all optimally managed.

Pragmatic swiftlet conservation can only be done the Indonesian way. While short-term conservation in the Andaman & Nicobar islands demands that the species, whose populations have been severely depleted, receives as much protection as possible, a realistic long-term strategy needs to work towards developing an ex-situ conservation programme, house ranching , for this species.

This report is built upon an earlier one: Sankaran R. 1995. The impact of nest collection on the Edible-nest Swiftlet in the Nicobar islands. SACON Occasional Report 1. Salim Ali Centre for Ornithology & Natural History, Coimbatore.

Foreword

Misconceived beliefs and the general human avarice have led to a burgeoning trade in animal and animal products, endangering many a species. The Musk Deer, rhinoceros, elephant and tiger are a few of the glaring examples. Added to this growing list of species that are critically endangered because of trade is the Edible-nest Swiftlet.

Although collection of Edible-nest Swiftlet nests dates back to antiquity, these nests became an important commercial item only since the 16th century when the Chinese began to value the culinary delicacy of the bird's nest soup. Today, the wholly white edible nests of swiftlets rank amongst the world's most expensive animal products. That populations of Edible-nest Swiftlet are now unable to withstand the magnitude of exploitation is reflected both in the decline of populations as well as the quantum of nests that are harvested annually. This is true of the Andaman and Nicobar islands as well, where there has been a decline of over 80% of the population of the Edible-nest Swiftlet over the last few decades.

Realizing the rapid decline of the population of the Edible-nest Swiftlet, SACON undertook a project under the endangered species programme of the Avian Ecology Division to assess the impact of nest collection on the Edible-nest Swiftlet. The first part of this study was confined to the Nicobar islands, and subsequently extended to the Andaman islands. Field work on this species is a hazardous occupation as one has to collect data of the nests in high, dark and dank caves. I record my appreciation on the determination and hard work of Dr R Sankaran, of our Avian Ecology Division, who could successfully complete the study and give useful suggestion for the conservation of this species.

Dr V S Vijayan
Director

Abstract

1. Ever since swiftlet nests became an important item in Chinese cuisine and pharmacy, Edible-nest Swiftlets have been exploited throughout their range, and now rank amongst the world's most expensive animal products.

2. The Edible-nest Swiftlet are currently not covered by International Trade Laws, and in India receives no protection under the Wildlife (Protection) Act, 1972.

3. Based on nest counts, the population of the Edible-nest Swiftlet was estimated to be about 2010 breeding pairs in the Nicobar islands, and about 4620 breeding pairs in the Andaman islands.

4. The Edible-nest Swiftlet in the Andaman & Nicobar Islands is Critically Threatened (Revised IUCN criteria A1c), as it has undergone significant losses in populations, to the tune of 80% or more, due to indiscriminate and unrestricted nest collection. The present populations cannot sustain nest collection.

5. In the short term, the species urgently requires protection, and should be included in Schedule I of the Indian Wildlife Protection Act (1972). As protection of caves is near impossible, a mechanism that effectively stops trade in swiftlet nests, by checking people and cargo embarking or disembarking at all sea and air ports, from the islands to the mainland, needs to be established. Though other range states of the Edible-nest Swiftlet are against the inclusion of this species into the Appendices of CITES, the decline warrants formal international regulation in its trade.

6. An ex-situ conservation programme, house farming, by cross fostering eggs of the Edible-nest Swiftlet with those of the Whitebellied Swiftlet needs to be established. This can be effected by the following process:
   a) A cave should be rigorously protected to ensure an adequate source of Edible-nest Swiftlet eggs. Only one cave, on Interview Island Wildlife Sanctuary, has both an adequate number of nests, and is so located that protection is feasible. This cave must be rigorously protected, and would yield over 1200 Edible-nest Swiftlet eggs per season.
   b) Identification of existing man-made structures, preferably close to Mayabunder, where colonies of Whitebellied Swiftlet already exist. The Bakultala Forest Rest House is one such.
   c) Development of houses to attract Whitebellied Swiftlet. The old PCCF office at Port Blair, and the DCFs residence at Mayabunder are both very close to jetties / bridges under which Whitebellied Swiftlet nest. With a little modification, these buildings would easily attract colonies of Whitebellied Swiftlet.
   d) Cross foster the eggs of Edible-nest Swiftlet which are collected from Interview island, into the nests of the Whitebellied Swiftlet which are present in the houses / man made structures.
   e) Encourage the spread of Edible-nest Swiftlet into other houses by following steps a to d above.

7. After 5-8 years, evaluate the status of the Edible-nest Swiftlet in caves and in houses. If house populations have reached harvestable sizes, bring the Edible-nest Swiftlet into Schedule IV of the Wildlife (Protection) Act, 1972, and encourage the sustainable exploitation of the nests of the Edible-nest Swiftlet from farmed conditions.

Keywords: Edible-nest Swiftlet, Andaman & Nicobar islands, Conservation, trade, Sustainable use.

Introduction

If it were not for a fascinating biological quirk, that of building their nests entirely out of saliva, the Edible-nest Swiftlets of the genus Collocalia would not have been threatened today. Ever since the 16th century, when swiftlet nests became an important item in Chinese cuisine and pharmacy, the edible nests of swiftlets have been exploited throughout their range (Medway 1963, Lau & Melville 1994). By the 18th century the volume of trade was enormous, and early this century, about 9 million nests weighing some 76 tonnes were imported into China each year (Lau & Melville 1994). At US $ 2620-4060 a kilogram in the retail market in Hong Kong (Lau & Melville 1994), the wholly white edible nests of swiftlet rank amongst the world's most expensive animal products.

Like other members of the Apodidae, the swiftlets construct nests by using saliva to bind materials together (Kang *et al.* 1991). While most species use saliva to bind leaf, moss or feathers into nests, the 'Edible-nest Swiftlets' build nests wholly of mucilaginous secretion of the paired sublingual glands (Marshall & Folley 1956), which enlarge during the breeding season (Medway 1962a). Upon drying, the saliva forms a hard cement, and secures the bracket shaped nest to the cave wall as well as forming the cup (Kang *et al.* 1991).

Swiftlet nests have long been believed to have both aphrodisiac and medicinal properties. 'Traditionally, swiftlet nest material has been eaten for recuperative purposes after consumptive diseases such as tuberculosis, or for treating debility...' 'Swiftlet nests are believed to reinforce body fluids, nourish blood and moisten the respiratory tract and skin; they are believed to replenish the vital energy of life, build up health and aid metabolism, digestion and absorption of nutrients...' 'There are also claims that the birds' nests can prolong life and ageing...' 'Traditionally birds' nests are regarded as a powerful aphrodisiac..'. There is a paucity of scientific research on the medicinal properties of birds' nests, and whether there is in reality any medicinal value is still open to question (from Lau & Melville 1994).

The nests of four species of *Collocalia* are commercially exploited: *C. fuciphaga* and *C. germani* make nests purely of saliva and are called White-nest Swiftlets; the nests of *C. maxima* and *C. unicolor* have an admixture of feathers and vegetation, and are called Black-nest Swiftlets. These nests require processing before they can be consumed and are therefore of a lesser commercial value. Limited quantities of nests of other species are reported to be collected (Lau & Melville 1994), particularly during times of high demand.

Considerable confusion exists in the taxonomy of swiftlets, including the segregation of genera. The generally accepted genus *Collocalia* consists of 30 species, all cave dwellers, that range from the islands of the western Indian Ocean, through southern continental Asia, the Philippines, and the Indo-Australian archipelago, to north Australia and the west and southwest pacific (Sibley & Monroe 1990, 1993). India has five species of the genus *Collocalia*. The Himalayan Swiftlet *C. brevirostris* breeds across the Himalayas and occurs as a winter migrant in the Andaman &

Figure 1. Partly built nest cups of the Edible-nest Swiftlet. The nest on top is at a more advanced stage of construction.

Nicobar islands, or may even breed there (Ali & Ripley 1983, Osmaston 1906). The Black-nest Swiftlet *C. maxima* occurs in Bhutan and probably in northeastern India. The Indian Edible-nest Swiftlet *C. unicolor* is found in the Western Ghats, the Malabar coast in southwestern India and Sri Lanka (Ali & Ripley 1983). The Whitebellied Swiftlet *C. esculenta* is present in the Andaman & Nicobar islands. The Edible-nest Swiftlet *C. fuciphaga*, which ranges from the Andaman & Nicobar Islands in the west through Indonesia and to Philippines in the east, is considered to be a subspecific endemic *C. f. inexpectata* to the Andaman & Nicobar Islands (Abdulali 1964, 1967; Ali & Ripley 1983).

India has two species of swiftlet that make edible nests. The Indian Edible-nest Swiftlet *C. unicolor*, which makes 'black nests', nests in natural caves and grottoes in the cliffs of the Western Ghats and rocky islets of the Malabar coast in southwestern India and Sri Lanka (Ali & Ripley 1983). The Edible-nest Swiftlet *C. fuciphaga* occurs in the Andaman & Nicobar islands, and nests in caves on cliffs or rock faces on the shore and on the hills to the interior of the islands. *C. fuciphaga* makes the highly sought after 'white nests', wholly of saliva, and is of high commercial value.

Though Medway (1966) believed that rigorous and repeated nest collection did not significantly reduce the size of the breeding population, it is unlikely that present populations can continue to sustain indiscriminate nest harvesting indefinitely (Lau & Melville 1994). That populations of Edible-nest Swiftlet are now unable to withstand the magnitude of exploitation, is reflected both by marked declines in some populations of swiftlets (Narayan 1991, Leh 1993, Lau & Melville 1994, Sankaran 1995a,b, Corpuz & De Leon 1996, Fan & He 1996, Nugruho & Whendrato 1996, Wirjoatmodjo & Samedi 1996, Yatim *et al.* 1997) and extinction of others, and by the slump over recent years of bird nests being imported into Hong Kong (Lau & Melville 1994). However, under optimally managed conditions, exploitation is believed not to have significantly affected swiftlet populations, and in certain cases, exploited populations are believed to be on the increase (Phach 1996).

The history of nest collection

The history of trade in nests of swiftlets in India is unclear. It is certain, however, that nests became a regular traded item by the early 1800s, when under British colonialism, contracts were annually auctioned for the export of *C. unicolor* nests to China. This trade faded out at the turn of the 1900s, as a result of 'over-exploitation of the colonies and the disproportionate risks and organization involved in collecting the nests' (Ali & Ripley 1983). There are now reports that the trade in nests of *C. unicolor* has recommenced, both in the Western Ghats (Balasubramaniam pers. comm.) and in Sri Lanka (Anon. 1996, Gunawardena 1997).

The history of trade in nests of *C. fuciphaga* from the Andaman & Nicobar islands is also uncertain, but has been going on for at least the last two or three centuries (Barbe 1846, Beavan 1867, Anon. 1892). Amongst the earliest references to trade of any kind in the Andaman and Nicobar islands is from 851 A.D., when two Arab voyagers traded cloth and iron for copra and ambergris in the Nicobars (Kloss 1903), but there was no mention of the Edible-nest Swiftlet. The earliest reference to trade in swiftlet nests appears to be from the late 17th and 18th century, when Malay and Burmese procured considerable quantities of these nests from the Andamans, either collecting it themselves or trading for it with the natives who later turned hostile as a few were taken off as slaves (Barbe 1846, Mouat 1863). After the doubling of the cape of Good Hope in 1497, the number of vessels trading in the Nicobar islands increased considerably, and by the 17th and 18th century this was a regular trading area for Chinese, Malay, Burmese, European and mainland Indian vessels. While the primary trade product was copra and rattan, swiftlet nests, ambergris and trepan (sea cucumbers) were sought after as well.

Though the British attempted to colonise the Andaman islands as early as 1789, it was only in 1858, that a colony was established, primarily as a penal settlement after India's First War of Independence. Between 1869 and 1888, the British took over the governance of the Nicobar islands and established a penal settlement at Camorta. One of the products exported by the settlement authorities was swiftlet nests. During this period, the trade in Swiftlet nests was apparently through a process of

government contracts. No documentation on the trade and the regulation of trade during the British period, could be located, and whether the rights of trading, or the rights of collection from caves or cave complexes were auctioned is uncertain. Between 1942 and 1945, the Japanese occupied the Andaman & Nicobar islands during which period whether or not swiftlet nest continued to be traded is uncertain.

Trade in Edible-nest Swiftlet nests recommenced after the Japanese surrendered. The documentation on the status of Edible-nest Swiftlet trade post India's Independence in 1947 could not be located, but collection and trade continued with Governmental sanction until about the mid 1950s, or later, when trading or collection rights were apparently auctioned (Mohammed pers. comm.). Nest collection in the biggest cave complex in the Andamans (Rafters creek) was given on Government contract / tender, under which system, collection of nests was prohibited after April 15th each year (Mohammed pers. comm.). By the 1960s the trade had no official sanction i.e. contracts were no longer given, but the trade was not prohibited by law.

In the Andamans, the location of swiftlet caves was known to the Great Andamanese, though how long this was known to them, and how long they have been collecting nests is uncertain. The oldest surviving Great Andamanese felt that his people were collecting swiftlet nests well before the British times. The presence of shell middens at certain swiftlet cave complexes was also indicative of a long history of collection of nests by the Andamanese.

By the early 1900s, the Great Andamanese had been introduced to opium by the Burmese, who had been brought into the islands by the British. By the late 1930s, the Great Andamanese had shown at least two main cave complexes to the Burmese and Karens, who then started collecting from these sites in the early 1940s (Pau pers. comm). The Maplahs learned of the swiftlet colonies from the Burmese, and in turn this knowledge spread to the Biharis, and finally to the Bengalis (Pau, Prakash Lakda pers. comm). Today, the major collectors are Biharis and Bengalis, and the Karens only collect from those sites whose location is not yet in public knowledge.

Though traders and trading outposts were present in the Nicobar islands through these centuries, much

Figure 2. The terrain at the cave complex at Rafter's Creek is rocky, with several fissures, cracks and caverns within which the Edible-nest Swiftlet nests. The Great Andamanese have collected nests from this area from historical times.

of these were apparently seasonal, and the islands largely remained populated by Nicobaris, and swiftlet nest collection was apparently done by the Nicobaris or the crew of passing vessels.

In the early 1950s, the Indian Government began settling people in the Andaman islands largely to settle displaced people as a result of the Partition of India. By the late 1960's, a settlement programme began on Great Nicobar and Katchall, as a result of which, a considerable mainland Indian resident and floating population was established in the Andaman & Nicobar islands. It was only in the subsequent decades that nest collection of the Edible-nest Swiftlet became excessive and uncontrolled, and a species that had apparently withstood exploitation successfully for over two and a half centuries began declining rapidly.

The use of Edible-nest Swiftlet in Indian Medicine

Few Indian communities use the nests of swiftlets. In the Andaman & Nicobar islands, all tribal and non-tribal communities know of the Edible-nest Swiftlet. The Great Andamanese, who know and have collected nests of the Edible-nest Swiftlet for centuries have had no use for the swiftlet nests other than its commercial value. The Onge claim to use the nests in their medicine, but this needs further verification. The Shompen do not use the nest. Some Nicobaris use the eggs of both species of swiftlet to cure respiratory disorders, and the nests of the Edible-nest Swiftlet for general health. How widespread this is in Nicobari medicine needs verification. The Karen, whose origins are in Myanmar, use swiftlets nests as medicine, and so do the Biharis, whose origins are in mainland India.

None of the traditional medicine systems in mainland India are known to use the nests of swiftlet. However, the communities of Chinese origin in Calcutta and elsewhere do use the nests of swiftlets in their medicines, and Indians who have been exposed to Chinese and Southeast Asian cultures and cuisines may do so as well.

Local Names

The vernacular names for the Edible-nest Swiftlet (and the Whitebellied Swiftlet: as both are often believed to be the same) are:

Hindi: *Havabil.* This name is used and known by all people in the Andaman & Nicobar islands.
The Onge: *Tugegoore.*
The Great Andamanese: ?
The Karen: *Biblok* for the bird, *Tohtwi phawa* for the edible-nest swiftlet nest, and *Tohtwi pahthu* for the Whitebellied Swiftlet nest.
Car Nicobar: *Likup*
Nancowry: *Hikai*
Chaura: *Linkeh*

Legal Status

The Edible-nest Swiftlet is currently not covered by international trade laws, though proposals to include them in Appendix II of CITES have been mooted (Lau & Melville 1994, Sankaran 1995a,b). Subsequently, the ninth meeting in 1994 of the Conference of Parties of CITES directed the CITES Secretariat to convene a technical workshop to establish conservation priorities and action for the sustainability of swiftlet nest harvesting (CITES 1994). This workshop was held in November 1996 at Surabaya, Indonesia. The workshop did not recommend the inclusion of swiftlets in the CITES Appendices (Anon. 1996).

In India, the Edible-nest Swiftlet does not receive protection by law under the Indian Wildlife (Protection) Act (1972), as a result of which trade in its nest is not illegal. In the Andaman & Nicobar islands, however, some protection is afforded as both the Forest Department and the Police seize consignments and make arrests whenever they can. However, as the rights given by the Protection of Aboriginal Tribes Act (1957) exempt the scheduled tribes of the Andaman & Nicobar islands from the Indian Wildlife (Protection) Act (1972), they can legally collect nests.

Objectives of this study

1. To locate, enumerate and assess the size of nesting colonies of the Edible-nest Swiftlet *Collocalia fuciphaga* in the Andaman & Nicobar islands.
2. To assess the extent of nest collection in these colonies.

Methods

I surveyed the Andaman & Nicobar islands to assess the status of the Edible-nest Swiftlet between 9 March and 16 May 1995, 18 and 23 March 1996, and 26th February - April 25th 1997. Swiftlet caves were located using nest collectors as guides or by boating along the coast and looking for caves, and 385 caves were surveyed. Population data of 137 caves of the 385 surveyed were ascertained from nest collectors, as turbulent seas, excessive danger of access, or paucity of time, resulted in my not being able to enter and survey the cave. Data of past population sizes, and trade were ascertained from nest collectors and traders. As a rule, this information was very reliable.

A total count of the nests was made, and when there were too many nests (as in the case of Whitebellied Swiftlet), the number of nests were counted in groups of 10. The nests of the Edible-nest Swiftlet can be easily distinguished from that of the Whitebellied Swiftlet, as the former is made purely of saliva, and is white in colour, while the latter is composed mainly of vegetation. The nests of the

Edible-nest Swiftlet were differentiated into several size classes. Foundation: where nest construction has just been initiated, typically nests 1-2 days old, or nests which have been very recently removed (evidenced by a shiny semicircular stain on the rock, with or without a few strands of nest cement); nests beyond the foundation stage, but less than a quarter cup size; nests a quarter to half cup size; full cup: a completed or near complete nest cup without eggs; incubating bird, eggs or chicks present. Old nest marks were differentiated into: Old: where traces of previous year(s) nests were present usually black or brown; Very Old: these were shallow indentions in the cave wall shaped like the nest cup, and probably caused by repeated nesting by swiftlets at the same site.

The population estimate of the Edible-nest Swiftlet is based on the total number of nests of the current season present in a cave. There were however, certain problems in estimating populations of Edible-nest Swiftlet based on nest counts.

a) The duration over which the marks of plucked nests persist is not known. If the marks of the previous year remain, then the number of nests counted as plucked this season, and subsequently the population estimate will be incorrect.

   Nest deterioration is accelerated in damp sites, or where there is a film of water on the rock face; in less humid sites the base of the nest remains; in dry chambers nests persist for several seasons (Medway 1962b). In caves that were on the coast, with waves entering them, it is probable that nest marks get obliterated before the next season because of sea and wind action. In caves in the forest, these marks would persist over seasons. As old nest marks could have been confused with new nests, a bias in the population estimate would have occurred.

b) The population estimate is based on the number of nests. This would be accurate if swiftlets rebuilt on the same site of a nest plucked earlier, and if a new nest (i.e. not a repeat nesting) was built on a fresh site. If nests were rebuilt on a fresh site this would result in two nests (one being built and one from marks) being assigned to a single pair. Similarly, a first nest built upon a site where a nest had been plucked would obliterate the marks and thus exclude it from the count.

   Nest-site fidelity has been demonstrated in the Chimney Swift *Chaetura pelagica* (Dexter 1977), and has been assumed by Medway (1962b) and Kang *et al.* (1991), based on renesting at the same spots. Nests are deserted because of disturbance (Kang *et al.* 1991), and this could also result in renesting at different spots. Clearly, the question on whether all renesting due to nest destruction is on the same spot as the previous nest needs to be resolved.

c) Nest collection in most caves is so intense that swiftlets could barely build even a part of their nests before they are plucked. It is possible that a pair may make several nest building attempts during a season and if, as mentioned above, the pairs use a new site for each nest building attempt, then it is likely that the population would be grossly overestimated.

In the report on the Nicobar survey (Sankaran 1995), I had used a lower figure in the population estimate, based on a comparison between the number of birds which roosted and the nests present in one cave. However, in another cave in the Andamans, Edible-nest Swiftlet kept returning to the cave till well after 2000 hrs (over 2 hrs after darkness), indicating that counts of Edible-nest Swiftlets that returned to roost at dusk was not reliable.

I also attempted to count birds flying outside the cave, but this proved to be ineffective as differentiating between the Whitebellied and Edible-nest Swiftlet, particularly when several hundred birds were swarming was impossible. Moreover, counts of large swarms of swiftlet are at best nebulous.

Adequate data on the presence of egg and young could not be collected, as in most cases it was not possible to look into the nest. I also did not make particular attempts to do so primarily because of the considerable disturbance caused to the birds by human presence.

The Andaman & Nicobar Islands

The Andaman and Nicobar Islands in the Bay of Bengal are peaks of a submerged mountainous hill range, arching from Arakan Yoma in Myanmar in the north to Sumatra in Indonesia in the south, between latitudes 6° 45' and 13° 41' N and longitudes 92° 12' and 93° 57' E (Saldanha 1989, Dagar *et al.* 1991), and are a southern extension of the Arakan Yoma mountain range. The island group comprises

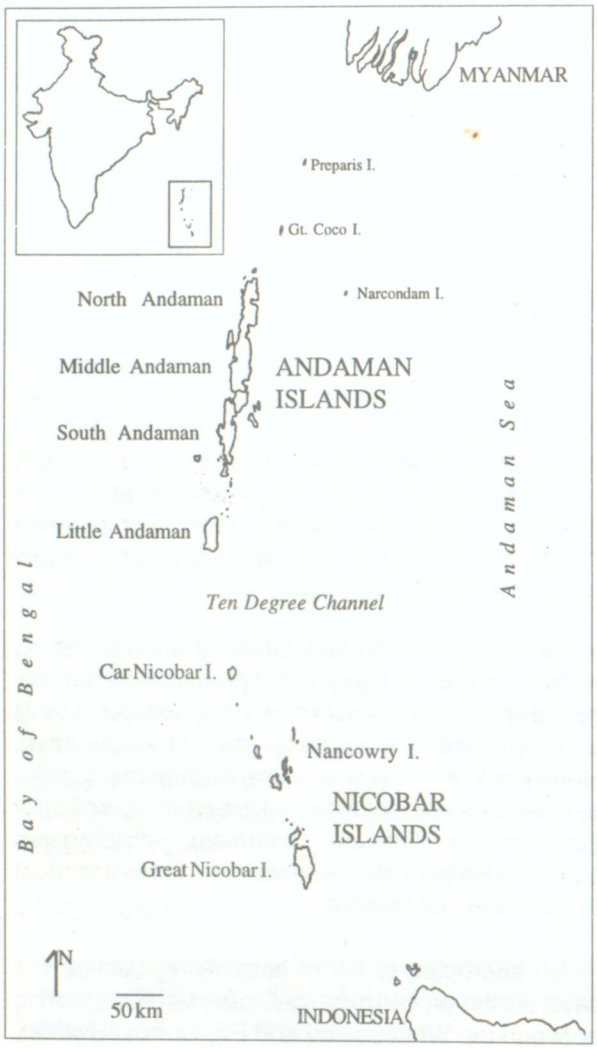


Figure 3. The Andaman & Nicobar Islands

of over 300 named and unnamed islands and over 260 named and unnamed rocks (Singh 1981), with a total coastline of about 1962 km. The entire island group covers 8,249 km²; the Andaman group with over 325 islands (21 inhabited) covering 6,408 km², and the Nicobar group with more than 24 islands (12 inhabited) with an area of 1,841 km2 (Anon. 1994).

The climate of the islands can be defined as humid, tropical coastal climate. Proximity to the equator and the sea ensures a hot, humid, uniform climate (Saldanha 1989). The islands receive rainfall from both the southwest and northeast monsoons. Maximum precipitation is between May and December, the driest period being between January and April. The mean annual rainfall is about 3800 mm (Saldanha 1989). Despite abundant rainfall, the only perennial river is on Great Nicobar. Temperature variations are low; minimum 20° C to a maximum of about 32° C (Dagar *et al.* 1991).

The forest type of the Andaman & Nicobar Islands can be broadly classified as tropical evergreen (Balakrishnan 1989). About 15% of the total area of the islands are mangroves, dominated by *Rhizophora mucronata*, *R. conjugata*, *Bruguiera gymnorhiza*, *B. parviflora* and *Ceriops tagal*. Strand vegetation is dominated by *Ipomoea pes-caprae*, *Scaevola sericea* and its associate species. Where *I. pes-caprae* formations are absent, as in retreating coast lines, *Baringtonia* formations are seen. The beach forest which occurs behind the sand-dune zone is dominated by trees such as *Hernandia peltata*, *Thespesia populnea*, *Manilkara littoralis*, *Intsia bijuga*, *Syzigium samaragense*, *Sophora tomentosa* and *Glochidion calocarpum*. The tidal or swamp forests occur in lowland coastal areas, and the dominant trees in this forest type are *Cerbera odollam*, *Heritiera littoralis*, *Barringtonia racemosa*, and their associates like *Ficus retusa*. Inland forests are comprised of two types. Evergreen forests are dominated by species like *Dipterocarpus griffithii*, *D. turbinatus*, *Hopea odorata*, *Sideroxylon longepetiolatum*, *Endospermum malaccense* and *Planchonia andamanica*, with an understorey of smaller trees such as *Baccaurea sapida*, *Myristica glaucescens*, *M. andamanica* and *Buchanania platyneura*. Deciduous forests occupy hilly region, and are dominated by *Pterocarpus dalbergiodes* or the Padauk. Species of *Terminalia*, *Canarium euphyllum*, *Ailanthus kurzii*, *Parishia insignis* and *Albizzia lebbek* are also common. The vegetation of the Nicobars shows striking dissimilarities with that of the Andamans. The genera *Dipterocarpus* and *Pterocarpus*, wide spread in the Andamans are not present in the Nicobars. Genera such as *Cyathea*, *Otanthera*, *Astronia*, *Cyrtandra*, *Stemonurus*, *Bentinckia* and *Rhopaloblate* present in the Nicobars are absent in the Andamans (Balakrishnan 1989).

Chapter 2

The distribution and status of the Edible-nest Swiftlet in the Andaman & Nicobar Islands

Habitat

The majority of swiftlet nesting sites in the Andaman & Nicobar islands are caves, cracks, tunnels or overhangs in calcareous rock formations. Of the 342 nesting sites in the Andaman & Nicobar islands, 217 (63.5%) were present within the forest, and 124 (36.3%) were on the shore (Table 1). Man-made structures in which the Whitebellied Swiftlet nests in large numbers, was not adequately surveyed, and have been excluded from this analysis.

Of nesting sites within the forest, 83% were caves or cracks in the rock, (Cave type Cii in Table 1, Appendices 1 & 2), in undulating rocky terrain, and below ground. 94% of these nesting sites occurred in two distinct clusters of 152 and 18 nesting sites respectively. About 13% of nesting sites within the forest were present on an inland hill (Cave type D, n= 29), where they occurred as a warren of clefts, cracks and caverns, usually below ground, under a single large rocky hill. A few caves occurred at the origin of a stream, or as a cave above ground in the forest.

Caves on the shore could be categorized into four broad types. 22.6% were on the shore and approachable on foot (cave type A), usually at low tide. The opening of 50.8% shore caves, were partially submerged, and entry into the cave was either by swimming or wading into it (cave type B). Entry into 24.2% of the shore caves was on foot after swimming ashore (cave type AB). 2.4% of the shore caves were located above sea level on sheer cliffs (cave type BD).

The Whitebellied Swiftlet commonly nests in man-made structures. Thousands of birds are to be found under jetties, bridges and a few old buildings, and small colonies are also present in bunkers built by

Table 1. Types of caves occupied by the Edible-nest Swiftlet and the Whitebellied Swiftlet in the Andaman & Nicobar islands

	Both spp.		Edible-nest		Whitebellied	
Cave type	And.	Nic.	And.	Nic.	And.	Nic.
A	2	26	1	17	2	20
AB	23	7	19	5	4	3
B	51	12	26	11	35	7
BD	0	3	0	3	0	0
Ci	0	2	0	2	0	2
Cii	178	2	172	2	12	2
Ciii	0	1	0	0	0	1
D	32	2	31	2	4	0
E	0	1	0	0	0	1
Total	286	56	249	42	57	36

Key

Cave type: **A**= On coast, approachable on foot; **AB**= On coast, approachable on foot after swimming ashore; **B**= On coast, entrance partially submerged and access by swimming into cave; **BD**= Cave above sea level on cliff face ending in the sea; **Ci**= In the forest, at the origin of stream; **Cii**= In the forest, cavern below the ground; **Ciii**= In the forest, above ground; **D**= On inland cliff; **E**= Japanese bunker (man made tunnel).

the Japanese during World War II. The Edible-nest Swiftlet is also said to nest, albeit rarely, in some of these man made structures.

There are two striking differences in caves between the Andaman islands and the Nicobar islands (Table 1). First, major cave clusters or complexes, where a number of caves are located close to each other, are absent in the Nicobar islands. The mean cave cluster size in the Andamans is 6.6 (sd ± 24.1 range 1-170), while in the Nicobars it is 1.8 (± 1.5, range 1-7). Second, the majority of swiftlet nesting sites (85.7%) in the Nicobar islands are on the shore, while in the Andaman islands, 73% are within the forest.

There are differences between the habitats used by the Edible-nest Swiftlet and Whitebellied Swiftlet (Table 1). The majority of Whitebellied Swiftlet nesting sites (76%) were on the shore, while the majority of the Edible-nest Swiftlet nesting sites (72%) were within the forest. Of the 342 caves in which swiftlets nested, only 42 (12.3%), were shared by both species of swiftlets. Here too, there are differences between the Andaman islands and the Nicobar islands, where in the former only 7% of the nesting sites are shared, while in the latter 39.3% are shared.

Even in those caves where all cave dwellers (swiftlets and bats) were found to coexist, there appeared to be a tendency to segregate. The Whitebellied Swiftlet, which cannot echo-locate and limits its incursion into caves till the twilight zone (Medway 1962c), nested closer to the mouth of the cave, the Edible-nest Swiftlet which echolocates (Medway 1962c, Langham 1980), tended to nest deeper inside the cave, while the deepest reaches were occupied by bats. Even though nests of both species of swiftlets were often intermixed, there was apparently a strong tendency for conspecifics to cluster their nests together. Segregation was most marked between the areas where swiftlets nested and where bats roosted, although some intermixing was discernible. It was also reported by nest collectors that when populations of Edible-nest Swiftlets were higher, entire sections of the walls of caves would be occupied by Edible-nest Swiftlet, while other parts would be occupied by Whitebellied Swiftlet, and yet others by bats.

Nesting Season

The exact nesting season of the Edible-nest Swiftlet could not be determined. In the Andaman & Nicobar islands, they probably begin building nests in mid November, and continue till May. There were reports of it continuing through June and even later, a period of about seven months. This is less than the breeding season of *C. fuciphaga* in Singapore, which nests year round but peaks from October to December and in February (Langham 1980). Breeding peaks coincide with the dry season when aerial arthropods are abundant (Langham 1980, Medway 1962c), and it is probable that the reduced nesting season in *C. fuciphaga* in the Andaman & Nicobar islands is due to the monsoons between May and December (both the South-West as well as the North-East), during which prey is probably reduced.

There was no synchronisation of nesting in the Edible-nest Swiftlet (Table 2). Nests were being built, or had eggs or young from end of February, until early May. This can be attributed both to a protracted

Table 2. Dates of nest construction and presence of eggs or young in the Edible-nest Swiftlet and Whitebellied Swiftlet in the Andaman and Nicobar islands, during the surveys

	Edible-nest Swiftlet				Whitebellied Swiftlet			
Dates	UC	C	E	Y	UC	C	E	Y
24/02-5/03	+	+	?	-	+	-	-	-
6/03-15/03	+	-	-	-	+	+	+	+
25/03-5/04	+	+	+	+	-	+	+	+
6/04-15/04	+	-	-	-	-	+	+	-
16/04-25/04	+	+	+	-	-	-	-	+
26/04-5/05	+	+	+	+	-	-	+	+

Key:
UC = Nest under construction; **C** = Nest completed but eggs not laid; **E** = Eggs present; **Y** = Young present

breeding season within which the species exhibits asynchronous hatching (Langham 1980), as well as the nest collection regimes which would result in staggered nesting phases. This may indicate that a significant proportion of the chicks in successful nests in the Edible-nest Swiftlet would fledge at or after the onset of the monsoon (mid May). In contrast, the Whitebellied Swiftlet, had eggs and young in early March, in some cases nearly fledged young, and by early May, the chicks had fledged or were about to in most caves.

Distribution and status in the Andaman Islands

Of the 325 caves surveyed in the Andaman islands, cave dwelling species (Edible-nest Swiftlet, Whitebellied Swiftlet and bats) were present in 298. The Edible-nest Swiftlets were nesting in 249 caves (Table 3), exclusively occupying 209 caves and in 12 caves together with the Whitebellied Swiftlet. Bats were present in 51 caves, in 28 of which Edible-nest Swiftlets were also present. 12 caves were occupied exclusively by bats (Table 3).

Edible-nest Swiftlet nesting sites are present on 24 islands in the Andaman group of islands. The majority of the nesting sites (89%) occur as distinct cave complexes on five islands, and the rest are scattered over 21 islands. All cave numbers referred to in the text for the Andaman islands correspond to the cave numbers in Appendix 1. The distribution of caves in the Andaman islands is as follows.

1. Point, Reef, White Cliff, and Landfall islets

A total of 12 caves are located on these four islets, seven of which are on the shore and five in the interior (Fig. 4, Appendix 1). Only one cave (CN 37) had a small population of Edible-nest Swiftlet, in which nest collection also took place. In one other cave (CN 40), the small population of swiftlets that were present no longer exist. Three more (CN 43 - 45), which were not entered due to the risk involved, probably also have small populations.

Table 3. Number of caves occupied by swiftlets and bats in the Andaman islands

Species	Number of caves
Swiftlets (both spp.)	286
Edible-nest Swiftlet (total)	249
Whitebellied Swiftlet (total)	57
Exclusively Edible-nest Swiftlet	209
Exclusively Whitebellied Swiftlet	26
Edible-nest and Whitebellied Swiftlet	12
Edible-nest, Whitebellied Swiftlet and Bats	8
Only Edible-nest Swiftlet and Bats	20
Only Whitebellied Swiftlet and Bats	11
Exclusively bats	12

The Edible-nest Swiftlet has ceased to breed in one cave each on White Cliff, Reef and East island.

2. Chalis Ek (Ramnagar, North Andaman Island)

Chalis Ek is amongst the four most important cave complexes in the Andaman and Nicobar islands. Historically, the Great Andamanese used to collect nests from this site, and by the 1940s, the Karens were the main nest collectors. By the 1970s some Biharis had started collecting nests from here, and in the last decade or so, the Bengalis learned of this site and nowadays, collection pressures are intense, with caves being visited as often as once a day!

Chalis Ek, or 41, is a warren of caves within a single limestone hillock (Fig. 4, Appendix 1). It is reported to have had 41 caves (hence the name), though all caves do not have Edible-nest Swiftlet. Current day knowledge is limited to 30 caves, with an adjoining hillock having three more. Many of the caves in Chalis Ek are large caverns, where bamboo poles are required to knock the nests off the walls. Some of these caves are very difficult to enter, and one of the caves (CN 72) is a deep well which is descended into by means of a 100 plus feet rope ladder.

The Edible-nest Swiftlet population in Chalis Ek has seriously declined, and has disappeared from at least one cave (CN 70). The per harvest yield about 15 years ago was about 30 - 35 kg indicative of a population not less than 4000 breeding pairs. The population is now less than a 1000 breeding pairs, and the Edible-nest Swiftlet has ceased to breed in one cave. Chalis Ek is now to be declared as the Cliff Bay Sanctuary. Protection has however had little success in preventing nest collection.

3. Interview island

There were more than 34 caves on Interview island, 13 of which are present on the shore and over 21 to the interior of the island (Fig. 5, Appendix 1). The Whitebellied Swiftlet nests in nine of the caves on the shore, only two of which probably had Edible-nest Swiftlet as well. One very large cave (CN 14) is just off the west coast. This cave, which is widely

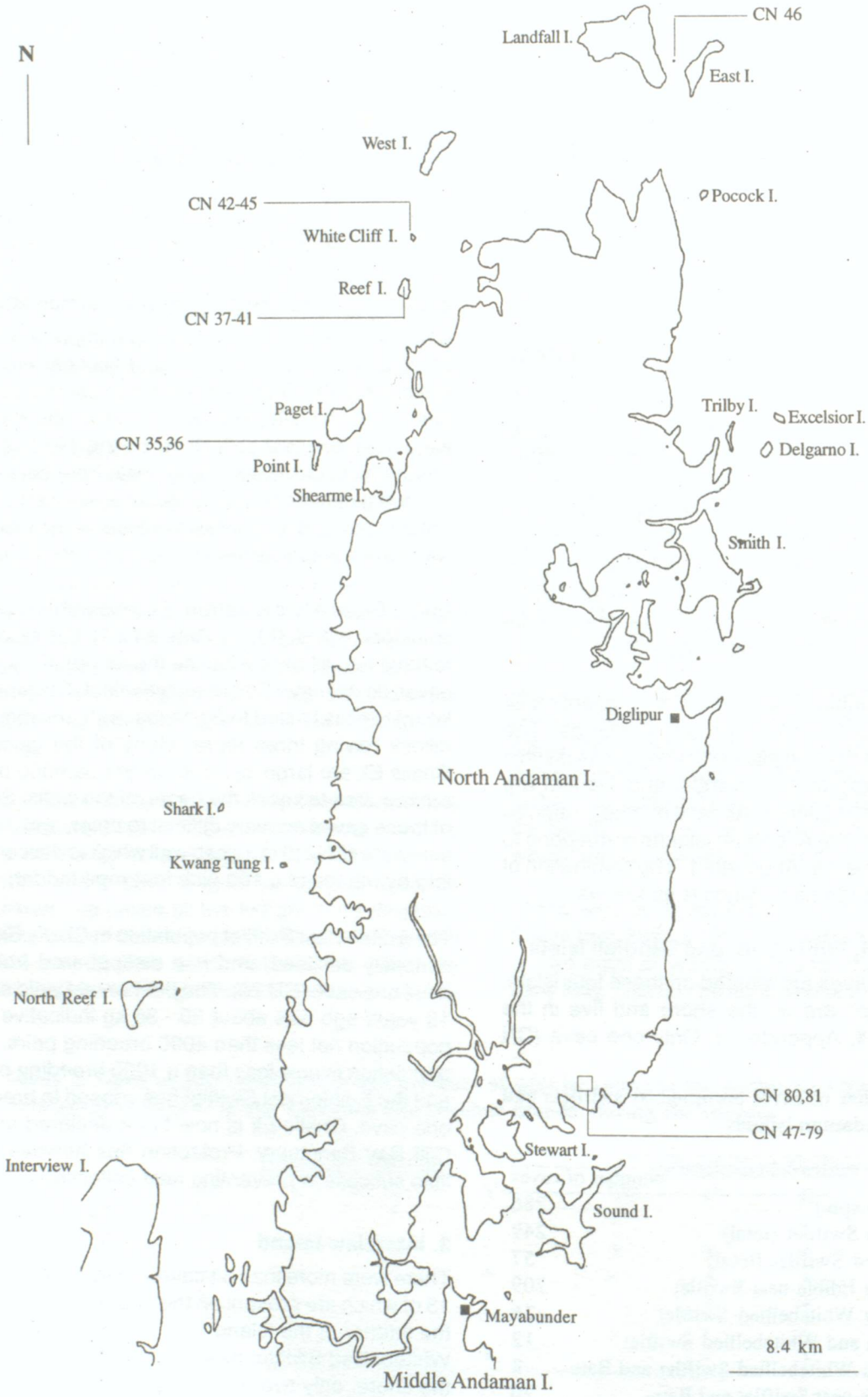


Figure 4. Distribution of the Edible-nest Swiftlet in the North Andaman Island and adjoining islands. Cave numbers correspond to those in Appendix 1.

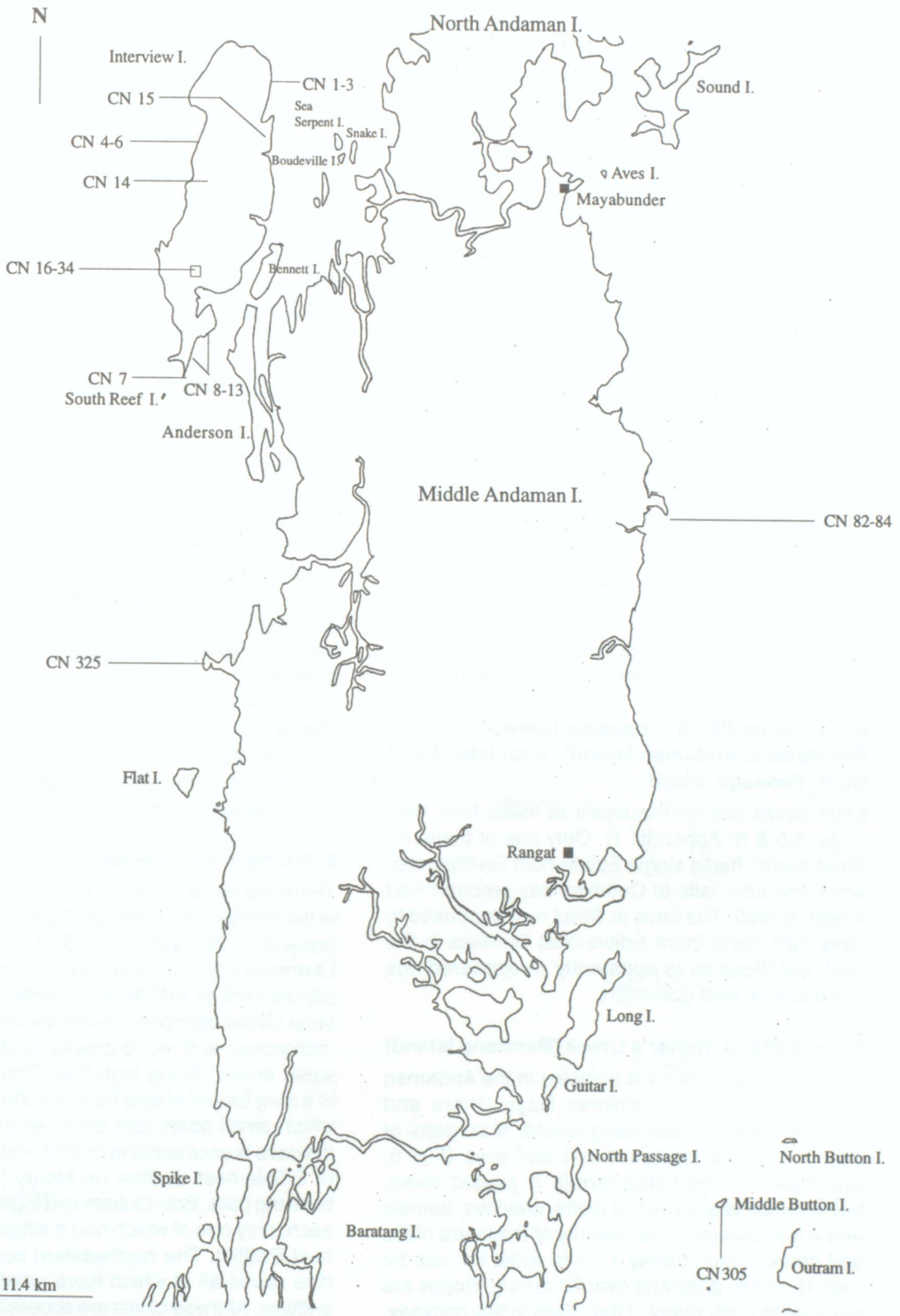


Figure 5. Distribution of the Edible-nest Swiftlet in the Middle Andaman Island and adjoining islands. Cave numbers correspond to those in Appendix 1.

known, has had intense nest collection pressures for several years now, and the population of Edible-nest Swiftlet has undergone serious declines. The majority of the caves (n=18: CN 16 - 33) that have Edible-nest Swiftlet were all underground and within an area of about 0.5 km^2 in a single cave complex. Most of these caves were tunnels or cracks in the rocks, and all nests could be plucked by hand. Only one cave (CN 17) was large, and nest collectors had built scaffolding from which bamboo poles were used to collect nests. This cave complex was discovered only four or five years ago, and were still several small crevices and tunnels that could have small populations of Edible-nest Swiftlet.

The location of the main cave complex on Interview Island was known only to a few Karen nest collectors. Although nest collection is fairly rigorous and unsustainable, there has not been an apparent decline because nest collection had begun only recently.

Interview island has an Edible-nest Swiftlet population of about 2000 adult birds, and probably possesses the most important cave complex for swiftlet conservation in the Andaman Islands.

4. Ramnagar (North Andaman Island), Cuthbert Bay (Middle Andaman Island), Srait Island and North Passage Island.

Eight caves are on the shore at these four sites (Figs. 4,5 & 6, Appendix 1). Only one of them, on Strait island, had a single Edible-nest Swiftlet nest, while one other site at Cuthbert Bay probably had a nest as well. The cave at Strait was supposed to have had many more Edible-nest Swiftlets in the past, but these have apparently disappeared due to excessive nest collection.

5. Naya Dhera, Rafter's Creek (Baratang Island)

The most important cave complex in the Andaman & Nicobar island is between Naya Dhera and Rafter's Creek on Baratang Island. It consists of over 170 caves located in a 1 km^2 area (Fig. 6, Appendix 1). The entire terrain is jagged rocks, below which is a warren of clefts, crevices, tunnels and a few caverns. The majority of these are clefts and cracks, each barely 1 - 2 m wide, but can be over 10 - 12 m deep and over 20 m long. Ropes are required to enter many of the caves in this complex.

The Great Andamanese were known to collect nests here from historical times. They were followed by the Burmese and subsequently by the Maplahs of Wimmerlygunj area. Nowadays over 50 nest collectors are active in this cave complex, and the knowledge has become so widespread that even school children come and collect from some caves. Nest collection pressures are excessive at Naya Dhera, and nests are collected as frequently as once in two or three days.

Historically, only from a few, easy to access, caves was nest collection done. Subsequent to declines in populations due to excessive and uncontrolled nest collection, and an increase in nest collectors, more caves were sought and discovered. It is therefore difficult to estimate historical yields at Naya Dhera. Declines in annual yields are however indicative. In 1994, 200 kg was produced from this cave complex. In 1996, only about 120 kg was produced. Declines over time have been enormous in some caves. For instance, in one cave (CN 88) which used to have about 200 nests 10 years ago, now had only six nests; a decline of 97%. In 18 caves swiftlets no longer breed. A few caves (other than the ones reported here), were lost when a part of the forest was clear-felled, burnt and planted with teak *Tectona grandis*.

The cave complex at Rafters Creek has a population of about 1800 breeding pairs of Edible-nest Swiftlet (Table 5). It is likely that the historical population in this cave complex was over 15000 breeding pairs.

6. Ritchie's Archipelago

There are about 48 caves on the coast of six islands in the Ritchie's Archipelago. Edible-nest Swiftlet are present in 26 caves (Fig. 6, Appendix 1). Henry Lawrence has at least 20 caves, in six of which small populations of Edible-nest Swiftlet were present. Most caves on Henry Lawrence are at the edge of mangroves and along creeks, and into which sea water enters during high tide. One cave (CN 267) is a long tunnel whose floor is submerged, and into which small boats can enter, whereby the roof of the cave is accessible to one's hand. The population of Edible-nest Swiftlet on Henry Lawrence is 51 breeding pairs. Both Outram and Inglis have two caves each, only one of which had a single nest of Edible-nest Swiftlet. The northeastern corner of Neil has nine caves all of which have small populations of swiftlets. All these caves are accessible by swimming in from the sea. I was unable to survey 8 of these caves due to turbulent seas. Local nest collectors say that this cave complex has about 140 breeding

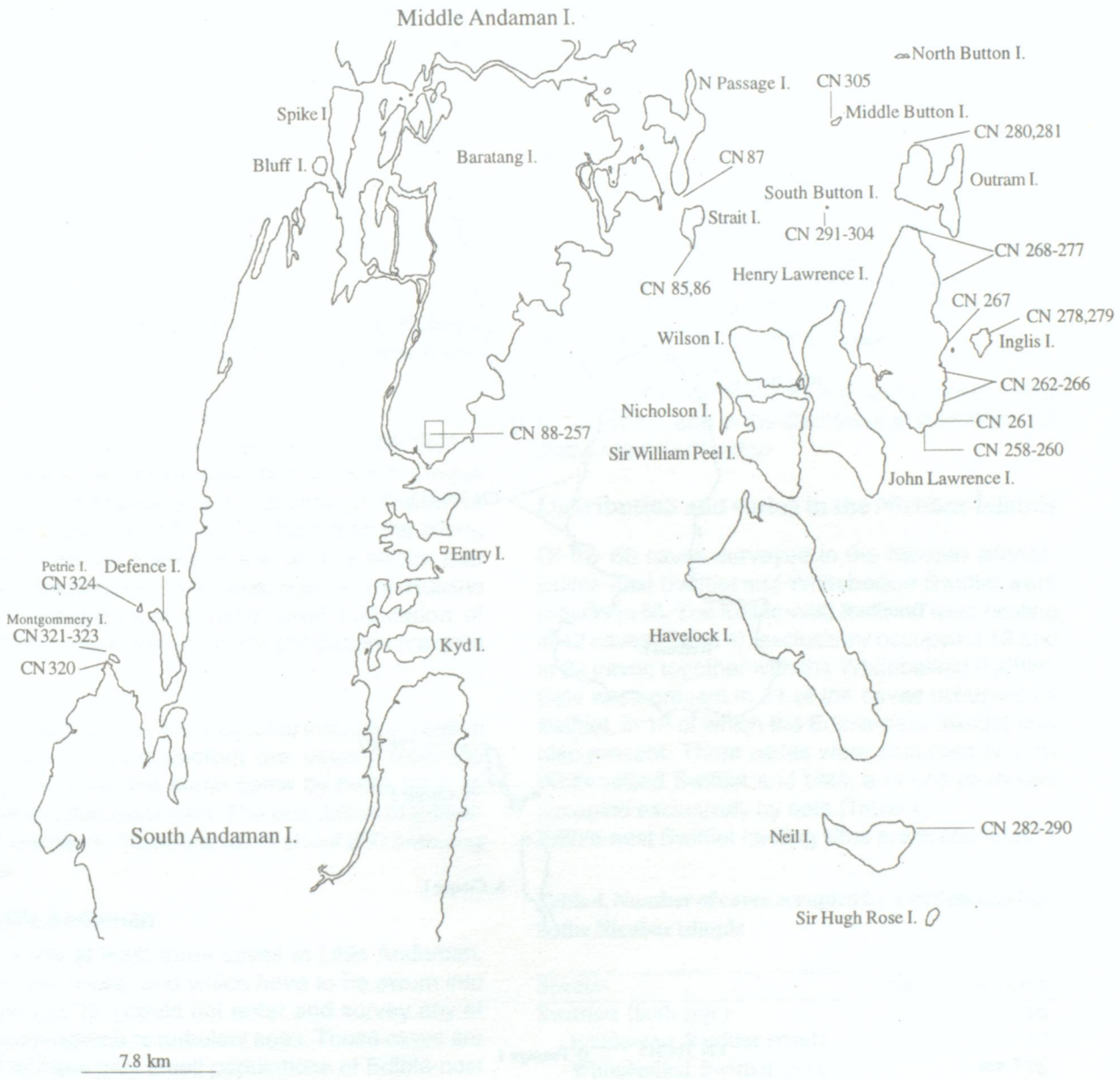


Figure 6. Distribution of the Edible-nest Swiftlet in South Andaman Island, Baratang Island, and the Ritchie's Archipelago. Cave numbers correspond to those in Appendix 1.

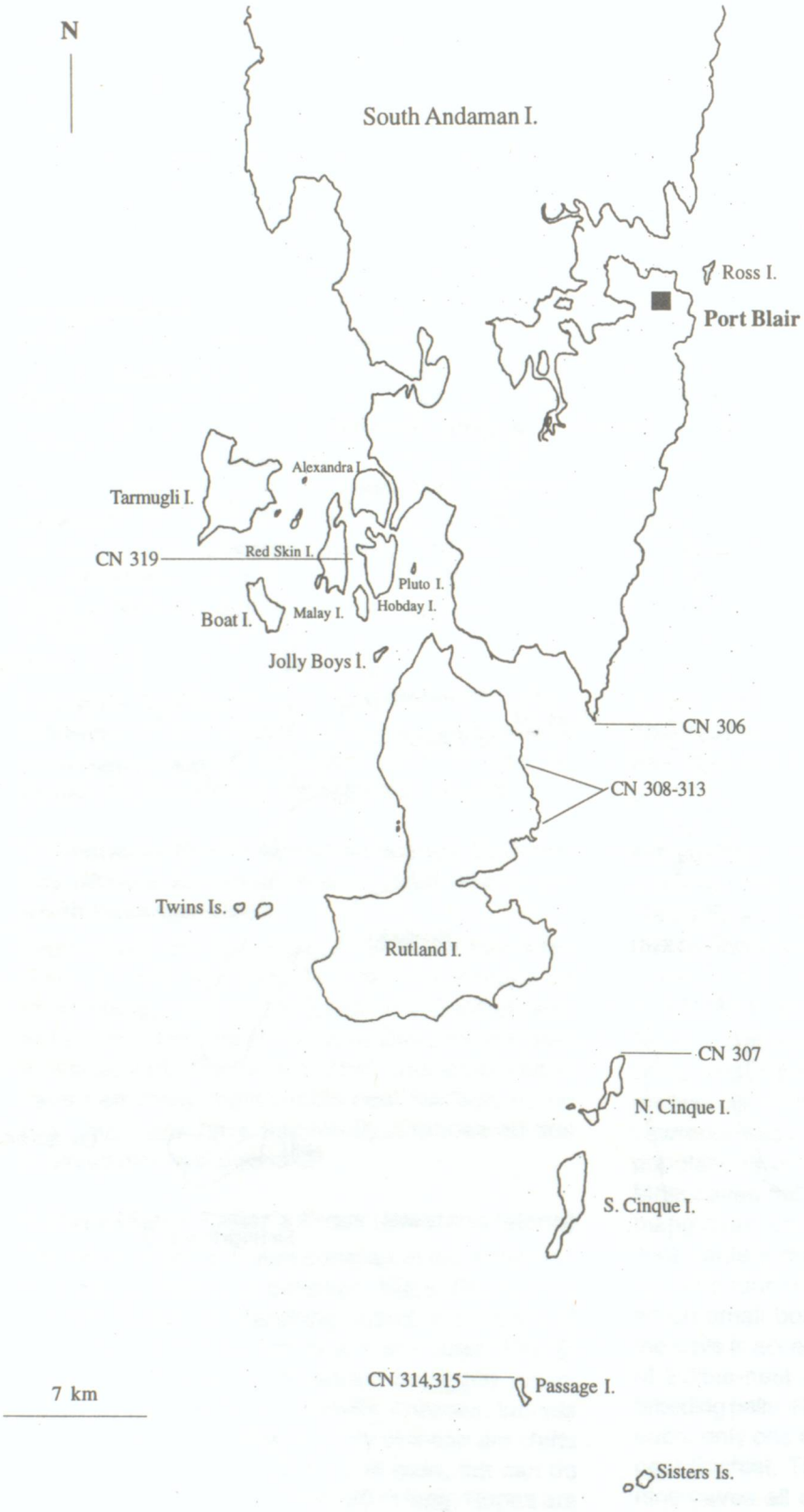


Figure 7. Distribution of the Edible-nest Swiftlet in the South Andaman Island and adjoining islands. Cave numbers correspond to those in Appendix 1.

pairs. The most important cave complex in the Ritchie's Archipelago is on South Button, which is a very small islet, composed mainly of a single large rock. This rock has about 14 clefts within which swiftlets nest. The population of Edible-nest Swiftlet on South Button is about 295 breeding pairs. South Button is a National Park.

Nest collection in the Ritchie's Archipelago was initially done by the Great Andamanese followed by the Burmese and Karens and also by the Maplahs of Wimmerly Gunj. Currently, all nest collectors are Bengali settlers of Havelock and Neil. The Ritchie's Archipelago has about 486 breeding pairs of Edible-nest Swiftlet. The species has ceased to breed in three caves on Henry Lawrence, and in one cave each on Inglis and Outram, and four caves on South Button.

7. Chidiya Tapu (South Andaman Island), Rutland Island, North Cinque Island, Passage Island and Redskin Island

At least eleven caves are present at these five sites, of which Edible-nest Swiftlets are present only in five caves: two on Rutland, one on North Cinque and two on Passage (Fig. 7, Appendix 1). The caves on both Rutland and North Cinque are on the shore, while those on Passage are on the hillock that comprises this islet. Two caves, one each on Rutland and Passage have a fairly large population of swiftlets, while in the others the populations are quite small.

These populations are subject to intense collection pressures. The collectors are usually from the Wandoor area, but some come by boats from as far off as Little Andaman. The population of Edible-nest Swiftlet in these islands is about 290 breeding pairs.

8. Little Andaman

There are at least three caves in Little Andaman, all on the shore, and which have to be swum into (Appendix 1). I could not enter and survey any of these caves due to turbulent seas. These caves are said to have only small populations of Edible-nest Swiftlets.

9. Montgommery Island, Petrie Island, South Andaman Island (Jarawa territory)

There are at least six caves in the Jarawa Territory, five of which have Edible-nest Swiftlet (Map 4, Appendix 1). The Jarawas are a hostile aboriginal tribe, and entering these caves is exceedingly dangerous as there is likelihood of a Jarawa attack. Despite this, these caves are subject to intense nest collection pressures and a few nest collectors have been killed by Jarawas, while collecting nests. These caves were not surveyed by me due to turbulent seas and the probable presence of Jarawas.

10. Jetties, culverts and buildings

In addition to natural habitats, the Whitebellied Swiftlet and rarely the Edible-nest Swiftlet nests in man-made structures. A few tens, hundreds or several thousand Whitebellied Swiftlet are present under most jetties in the Andaman islands. A few culverts also have Whitebellied Swiftlet. Some buildings such as the guest house at Bakultala, the cathedral at Port Blair, and a few godowns also have Whitebellied Swiftlet. It is likely that over 80-90% of the Whitebellied Swiftlet population in the Andaman islands are in man-made structures.

A few Edible-nest Swiftlets are said to occur under some jetties, and in the Cathedral at Port Blair, but these need verification.

Distribution and status in the Nicobar Islands

Of the 60 caves surveyed in the Nicobar islands, Edible-nest Swiftlet and Whitebellied Swiftlet were present in 56. The Edible-nest Swiftlets were nesting in 42 caves (Table 4), exclusively occupying 19 and in 22 caves together with the Whitebellied Swiftlet. Bats were present in 21 of the caves occupied by swiftlet, in 18 of which the Edible-nest Swiftlet was also present. Three caves were occupied only by Whitebellied Swiftlet and bats, and one cave was occupied exclusively by bats (Table 4).
Edible-nest Swiftlet nesting sites are present on 11

Table 4. Number of caves occupied by swiftlets and bats in the Nicobar islands

Species	Number of caves
Swiftlets (both spp.)	56
Edible-nest Swiftlet (total)	42
Whitebellied Swiftlet (total)	36
Exclusively Edible-nest Swiftlet	19
Exclusively Whitebellied Swiftlet	11
Edible-nest and Whitebellied Swiftlet	5
Edible-nest, Whitebellied Swiftlet and Bats	17
Only Edible-nest Swiftlet and Bats	1
Only Whitebellied Swiftlet and Bats	3
Exclusively bats	2

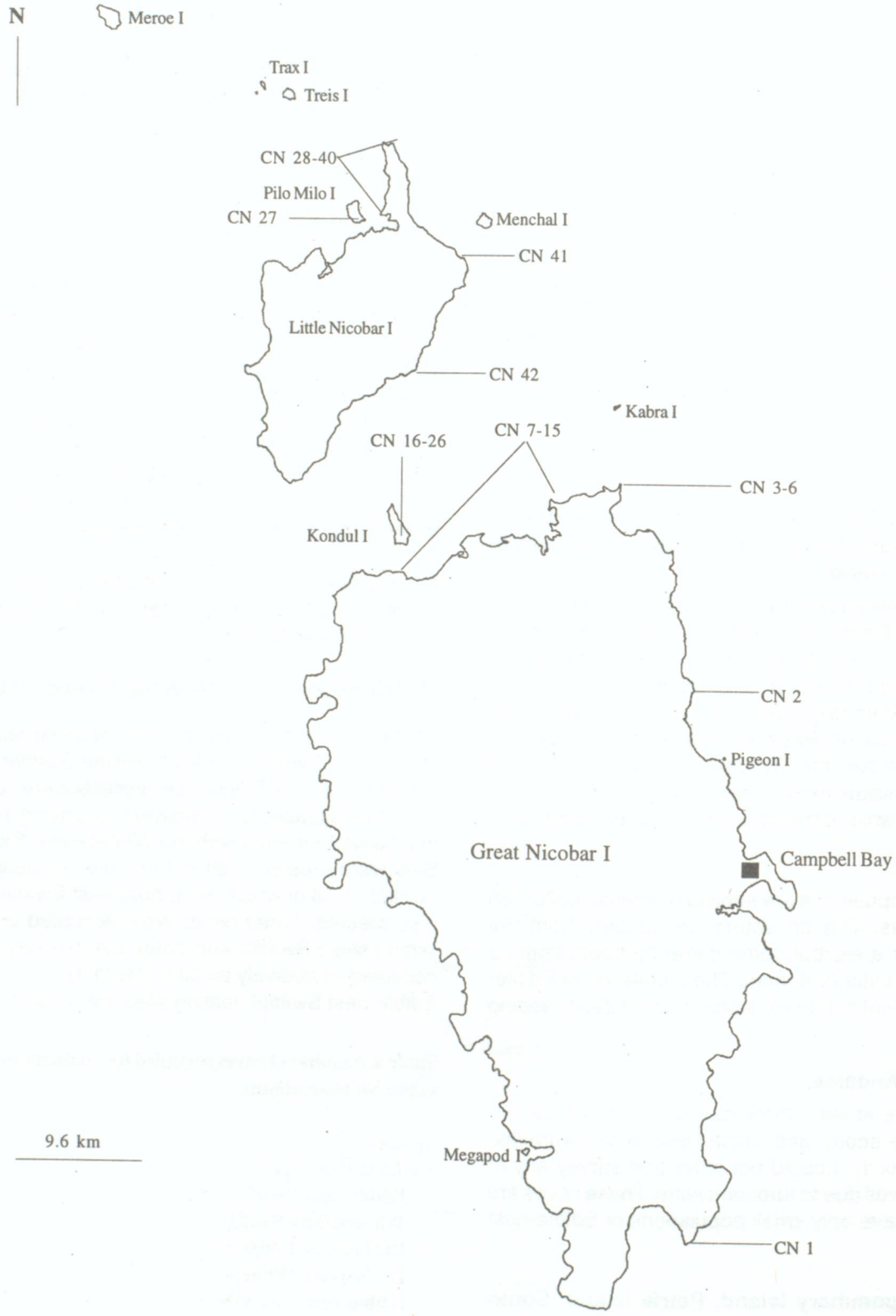


Figure 6. Distribution of the Edible-nest Swiftlet in the Great Nicobar subgroup of islands. The numbers in the map correspond to the cave numbers in Appendix 2.

of 23 islands in the Nicobar group of islands. The Nicobar islands have been divided into three distinct subgroups based on avifaunal assemblages (Sankaran 1997), and the majority of Edible-nest Swiftlet nesting sites (64%) are present in the Great Nicobar subgroup, followed by the Nancowry subgroup (31%), with only two nesting sites in the Car Nicobar subgroup. The locations of some caves are not given because of commitments of secrecy to cave owners. All cave numbers referred to in the text in the context of the Nicobar islands correspond to the cave numbers in Appendix 2. The distribution of caves within the Nicobar islands is as follows.

1. Great Nicobar subgroup of islands

The Great Nicobar group of islands is comprised of 11 islands and islets (Sankaran 1997). Swiftlets caves occur on Great Nicobar, Kondul, Little Nicobar and Pilo Milo.

Great Nicobar is the largest island in the Nicobar group of islands. 15 caves are present where ever rocky shorelines or cliffs end in the sea. Such shores are present at the start of south bay (1 cave), mid way along the east coast (1 cave), at the north eastern tip (three caves), and intermittently along the northern coast (10 caves) (Fig. 8, Appendix 2). There is one important cave and one cave complex on Great Nicobar. The first (CN 2), is the largest cave on Great Nicobar. Historically it had a population of not less than 3500 breeding pairs of Edible-nest Swiftlet, but excessive nest collection has resulted in the population being reduced to about 30 pairs. The most important cave complex (CN 3 - CN 5) is at the north eastern tip of Great Nicobar at Murray Point, where despite continued nest collection a population of about 115 pairs continues to exist. A population of about 60 pairs occurs in six caves along the northern coast. There are reports of a large swiftlet cave to the interior of the island, but this could not be located.

Nest collection has been going in Great Nicobar for several decades or centuries, with nest collectors during the early periods being either South East Asians, Chinese or Nicobaris. However, it was only subsequent to the colonisation of Indian mainlanders post 1970 that severe declines have taken place on Great Nicobar. The population of Edible-nest Swiftlet in Great Nicobar now is probably about 220 breeding pairs.

Kondul is a hilly islet with cliffs and rocks at the shore. There are 11 Edible-nest Swiftlet nesting sites on Kondul, making it one of the most important sources of swiftlet nests from the Nicobar islands. The caves of Kondul are 'owned' by the Nicobaris, and while declines have occurred, these have not been as high as on Great Nicobar. Kondul has a population of a little under 350 pairs of Edible-nest Swiftlet.

Little Nicobar and Pilo Milo have 15 and one cave respectively. Edible-nest Swiftlet are present in 6 of these caves, but the populations are small and total about 30 pairs. These nests are collected, but pressures do not appear to be intense.

2. Nancowry subgroup of islands

The Nancowry subgroup consists of 10 islands and islets, six of which have Edible-nest Swiftlet caves. Most caves in the Nancowry subgroup are 'owned' by single families, and the nest collectors are mainly Nicobaris, or Thais. The locations of these caves are not given in this report, as a precondition to my being shown the caves was that the locations of the caves remain confidential.

Some form of sustainable harvesting takes place in a few of the 'owned' caves of the Nancowry subgroup, and major declines have not taken place. The single largest surviving population of Edible-nest Swiftlet, where sustainable harvesting takes place is in one such cave. However, in caves that are not owned like the two on Nancowry and Camorta (CN 43 & 44) or where the owner was unable to protect the site adequately (CN 46 & 50) significant declines have taken place.

3. Car Nicobar

Car Nicobar has only two sites where Edible-nest Swiftlet occur (Appendix 2). Both populations are very small, and are also subject to collection.

Population estimate

Based on the number of nests counted, the minimum population of breeding pairs of Edible-nest Swiftlet in the Andaman group of islands is 4621 breeding pairs (Table 5). The cave complex with the highest number of Edible-nest Swiftlet is Rafters Creek which has a population of about 1800 breeding pairs, followed by Pathi Level (941), Interview island (910) South Button (296) and the Jarawa caves (260).

The minimum population of breeding pairs of Edible-nest Swiftlet in the Nicobar group is 2010 breeding pairs (Table 6). Although the Great Nicobar subgroup has the largest number of caves (27) with Edible-nest Swiftlet breeding in them, the population (580 pairs) is less than that of the Nancowry subgroup (1427 pairs) which had only 14 caves with Edible-nest Swiftlets (Table 4). Car Nicobar has only two sites with Edible-nest Swiftlet, one of which could not be adequately surveyed due to rough seas. This island probably has a population of not more than 15-20 pairs.

Whitebellied Swiftlet

The Whitebellied Swiftlet was found in 57 caves in the Andaman islands and 36 caves in the Nicobar islands (Tables 3 & 4). The population of nesting Whitebellied Swiftlet based on nest counts was estimated to be a minimum of 8035 breeding pairs in the Andaman islands, and that of the Nicobar islands to be 8969 breeding pairs. However, the majority of the population of Whitebellied Swiftlet, particularly in the Andaman Islands nest under jetties and culverts which were not surveyed. Thus the

Table 5. Nest counts of the Edible-nest Swiftlet and the number of caves they occur in different islands in the Andaman Islands.

Island	# caves Surveyed	# caves with ES	Total # nest	Stages of nest construction					
				Marks	Foun.	¼	½	1	E
Interview I.	34	21	910	6	84	813	5	2	0
Point I.	2	0	0						
Reef I.	5	1	8	0	6			2	
White Cliff I.	4	3	?						
East I.	1	0	0						
Chalis Ek, N. Andaman	33	31	941	10	858	13	35	16	9
Ramnagar, N. Andaman	2	0	0						
Cuthbert Bay, M. Andaman	3	1	1	1					
Strait I.	2	1	1					1	
North Passage I.	1	0	0						
Rafters Creek, Baratang	170	152	1799	1057	701	35	3	1	2
Henry Lawrence I.	0	6	51	8	0	41	0	1	1
Inglis I.	2	0	0						
Outram I.	2	1	1		1				
Neil I.	9	9	139						
South Button I.	14	10	296	0	0	0	291	4	1
Middle Button I.	1	0	0						
Chidiya Tapu, S. Andaman	1	0	0						
North Cinque I.	1	1	15		15				
Rutland I.	6	2	89		89				
Passage I.	2	2	105			105			
Little Andaman I.	3	3	?						
Redskin I.	1	0	0						
Jarawa Territory									
Middle Andaman I.	1	0	0						
South Andaman I.	1	1	20						
Montgommery I.	3	3	240						
Petrie I.	1	1	5						
Total	325	249	4621	1082	1754	1007	334	27	13

Key:
Marks= nests recently plucked; **Foun.** = nests 2-3 days old; ¼ = nests built less than quarter cup size; ½ = quarter to half cup size; **1** = nest completed, eggs not laid; **E** = eggs present.

Table 6. Nest counts of the Edible-nest Swiftlet and the number of caves they occur in different islands in the Nicobar Islands.

Island	# caves Surveyed	# caves with ES	# nest	Stages of nest construction				
				M + F	>¼	>½	E	C
Great Nicobar I.	15	11	218	188	18	12		
Kondul I.	11	10	333	297		18	17	1
Little Nicobar I.	15	5	26	14	6	4	2	
Pilo Milo I.	1	1	3	0		3		
Nancowry I.	1	1	15	15	0			
Camorta I.	1	1	42	38	4			
Tillanchong I.	7	6	205+	200+	5			
Other Nancowry Is	6	5	1165	318	7	840		
Car Nicobar I.	3	2	3+	0	0	1	1	1
Total	60	42	2010	870	235	878	20	2

Key:
M + F. = nests recently plucked or a few days old; **>¼** = nests built more than quarter cup size; **>½** = nests built more than half cup size; **E** = eggs present; **C** = chicks present.

population of Whitebellied Swiftlet in the Andaman islands is probably several times the figure given here.

During the survey of the Nicobar islands in 1995 (Sankaran 1995, I had come across instances where nests of Whitebellied Swiftlet had been removed. I had then thought that this was due to an erroneous belief of nest collectors that both the species of swiftlets were the same, and by removing nests made of vegetation, the birds would start making wholly white nests. This probably accounts for only some of the destroyed colonies that I saw.

In 1997, I found that the Whitebellied Swiftlet nests were also collected. In some caves, the Whitebellied Swiftlet uses a considerable amount of saliva in the nest, and in some cases, the basal pad that adheres to the wall is thick and virtually entirely of saliva, upon which the nest of grass, casuarina needles, moss etc. is built. The nest cup itself may or may not have significantly more saliva. The collectors usually spend a great deal of time and effort in separating the saliva from the vegetation, but I have also heard of the nests being sold whole. At least eight caves with Whitebellied Swiftlet in the Andaman islands, and three in the Nicobar islands, had signs of nest collection.

In contrast to those nests of Whitebellied Swiftlet which are collected, nests of this species under jetties and in most caves usually do not have a thick basal pad of saliva. I am unsure whether this is a species or a racial difference, or whether there are two forms of Whitebellied Swiftlet nests, depending on the kind of cave that the colony is in.

Threats to the Swiftlets

Predators of swiftlets include the Andaman Brown Hawkowl *Ninox scutulata*, which may kill birds within the cave as evidenced by feathered remains on the ground of two caves and a sighting of a Brown Hawkowl, perched outside a cave at day break and hawking a swiftlet on the wing just as it flew out of the cave. Snakes are often present in swiftlet caves, and include the reticulate python *Python reticulatus* (Nicobar islands only), the King Cobra *Ophiophagus hannah* (Andaman islands only), Red-tailed Trinket snake *Gonyosoma oxycephalum* (Andaman islands only) and pit vipers *Trimeresurus* spp. (both Andaman & Nicobar islands). These prey on bats, and adult swiftlets or their chicks and eggs. One species of bat may also prey on swiftlets. A few caves have cockroaches, which feed on the nest of the Edible-nest Swiftlet.

Stone quarries are a threat to swiftlets, as these destroy cave and rock formations. At least one Edible-nest Swiftlet cave has been destroyed so far. This could be a major problem in future years with an increase in construction activities in the islands. At least two Edible-nest Swiftlet caves have been obliterated by landslides.

However, nest collection is the single biggest threat to the Edible-nest Swiftlet in the islands.

Status of the Edible-nest Swiftlet in the Andaman & Nicobar islands

The Edible-nest Swiftlet continues to breed in about 92% of the caves which had swiftlets in the past, albeit in much reduced numbers. The reduction in population in the Andaman & Nicobar islands indicates that this species easily ranks amongst India's most threatened species of avifauna. The application of the IUCN revised criteria that designated threat status (Collar *et al.* 1994), indicates that in the Andaman & Nicobar islands this species is Critically Threatened (A1c), as it has undergone a reduction in numbers of greater than 80% over the last 10 years, due to nest collection.

The long-term perspective for this species is bleak. Unless urgent measures are undertaken, it is likely that the Edible-nest Swiftlet will become extinct in most places in the Andaman & Nicobar islands in a few years.

Figure 9. Nest collectors, Rafter's Creek, Baratang Island.

Chapter 3

Nest Collection and Trade

Nest Collectors

Three groups of people collect nests: Indian mainlanders, which includes all people other than the ethnic tribes, ethnic tribes which include (or included) the Great Andamanese, the Onge, the Nicobaris and the Shompen, and Burmese and Thai poachers.

Where Indian mainlanders are the nest collectors, as in all sites in the Andaman islands, and at least 13 sites in the Nicobar islands, nest collection is extremely intense. In such caves, nest collection is carried out throughout the breeding season, as frequently as once every two to three days (or even every day) as at Chalis Ek and Rafter's Creek, or once every eight to 15 days as at Interview island, South Button, Passage and Great Nicobar. Even school going boys collect nests. One cave in Rafter's Creek is locally known as *Bacha separate* (CN 124, Appendix 1), as it was discovered by school going children. In all caves visited by Indian mainlanders, there is very little recruitment to the population of swiftlets due to the intensity of nest collection. The steepest declines in populations have been in caves where the collectors are Indian mainlanders.

Nest collection by the Nicobaris is less intense and destructive than by the mainlanders, though they also pluck nests irrespective of whether or not there are chicks or eggs in them. However, the recruitment to the population in caves which are exclusively collected by Nicobaris is probably somewhat better than that in the previous case. Moreover, there are traditional nest collection rights among the Nicobaris. Cave numbers 43, 44, 45, 47, & 48 (and probably CN 16 - 26), are 'owned' by single families who have exclusive rights over the nest collection (for details of caves see Appendix 2). However, here too there have been crashes in populations (CN 43, 44, 47 & 48; Table 8) due to theft by other Nicobaris and probably non-tribals as well. In fact, the owners of CN 47 (Table 8) have begun camping below the cave to protect it from theft. In this particular case, they apparently wait for the birds to complete nesting before collecting the nests, and do not pluck nests with eggs or chicks in them. Only in one cave (CN 45; Table 8) were any traditional rituals attached to nest collection, and this was the only cave where a largely intact population existed. Only a few Nicobaris collect nests as they intensely fear snakes (reticulate pythons and pit vipers are occasionally found in caves) and spirits.

The Great Andamanese and the Onge, probably do not collect nests any longer. As the access to some caves is by boat, some mainland Indians induce the Shompen with tobacco and other gifts to either lend them their canoes, paddle them across or collect nests for them (CN 3, 4 & 5, Table 4). The Shompen have no use for money yet, and they do not collect nests to sell.

Thai poachers, who come to the Nicobar islands between November and April-May, also collect nests, though they mainly dive for shell, and capture crocodiles which are taken back live. Caves which are particularly affected by them include CN 3 to 26, and CN 51 to 57 (Appendix 2, Fig. 8). The patterns of nest collection by Thais could not be ascertained, but presumably they too have little regard for nests with eggs or chicks in them. There is one reported instance of Thais mist-netting adult swiftlet and taking them live back to Thailand. Whether these survived, or for what purpose they were taken is not known. Burmese poachers also come to the Andaman islands in large numbers. They are mainly involved in diving for sea cucumbers (Trepan) but are also reported to collect swiftlet nests.

Methods of Nest Collection

Nest collectors in the Andaman & Nicobar islands are all men. I have heard of only two women nest collectors. Edible-nest Swiftlet nest collection involves a great deal of treacherous climbing on rock faces in the dark. Nest collectors are superb rock climbers, and in the Andaman & Nicobar islands do not use safety harnesses or any other rock climbing gear. Where the climb is unusually difficult, ropes or thick poles are used to descend, or give additional

support. In one cave, a 125 - 150 ft. rope ladder is used to descend into the cave. When ropes were unavailable, vines were used. Illumination is by means of a battery operated torch, usually held between the teeth of the collector leaving his hands free to collect or climb. Prior to the availability of electric torches, flame torches were used. This continues to be the practice, due to traditional reasons, in only one cave in the Andaman & Nicobar islands.

In the majority of caves in the Andaman & Nicobar islands, Edible-nest Swiftlet nests are easily accessible by hand. Hence, the method of nest collection is mainly by climbing or descending to the wall face where the nests are present, and peeling them off by hand. Nest collection pressures are so intense in some caves and cave complexes, that the nests are barely two to three days old before nest collection takes place. Here, the nests, barely a few millimetres thick are scraped off the wall with a thumb nail or a small knife.

In larger caves, where nests are beyond reach, thick poles are kept in place, on which the collectors climb, much in the manner of climbing a coconut palm, and pluck the nests with the hands. Where this is not possible, bamboo poles with a notch cut in at the end are used to tease the nests off the walls, which is a delicate and tiring operation. Scaffolding had been built only in one cave.

All nests are plucked off the walls irrespective of whether or not there are chicks or eggs in them, or the size that the nest has attained. The guiding philosophy appears to be 'if I don't, some one else will'. In one reported case, a pile of chicks and eggs about a foot or more high, was left behind by nest collectors.

Intensity of Nest Collection

Andaman Islands

Nest collection had taken place in 246 out of 249 caves (98%) in which Edible-nest Swiftlet nested. Caves where nests had not been collected had very few nests (n=3, range = 1-2) in contrast to caves where collection took place (n=238, mean= 19 ± s.d. 50, range = 1-600). The intensity of nest collection is evident from the proportion of nests which were nearing completion, or with eggs or chicks to the total nests present. Of 4621 nests counted only 334 (7%) had reached the half nest size, 27 (0.6%) had reached full nest size, and only 13 (0.3%) had eggs in them (all nests were not examined for eggs / chicks). None of the nests had chicks in them. In the Andaman islands, there was absolutely no evidence that there was any form of sustainable exploitation, and there was no evidence that nests with either eggs or chicks were left during collection. However, as collection pressures are so intense, often at collection intervals of less than 3-4 days, only a very few pairs would be able to build nests to a sufficient size where egg laying can be initiated.

Nicobar Islands

Nest collection had taken place in 24 out of 36 caves in which Edible-nest Swiftlet nested. Caves where nests had not been collected had very few nests (n=12, mean=4 ± 5.3, range = 1-21), in contrast to caves where collection took place (n=27, mean= 70 ± 155, range = 3-800). Of the 2010 nests counted in the Nicobar islands, 882 (43%) were bigger than half nest size, 20 (0.9%) had eggs and only 2 (0.1%) had chicks in them. However, it is likely that far more nests had eggs / chicks in them, particularly in the cave with the least collection pressures (CN 45; Appendix 2).

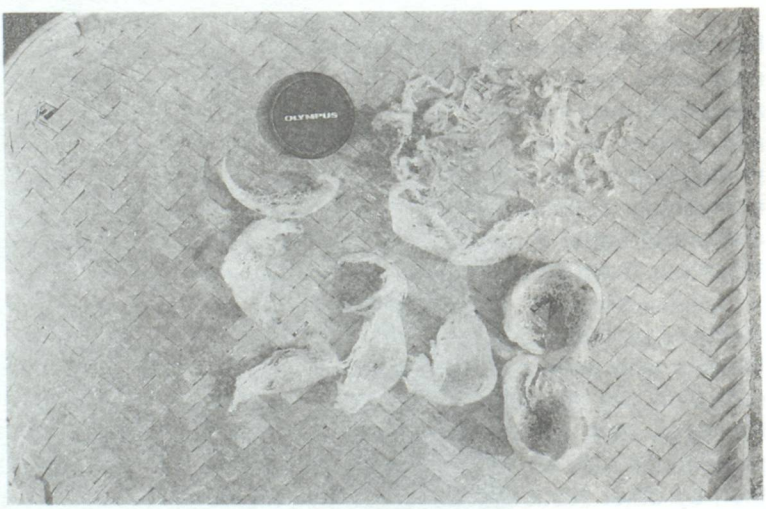


Figure 10. With nest collection taking place once every two or three days, the majority of the nests collected are merely scrappings. Large sized nest cups are infrequently collected, as the interval between collections should be atleast four weeks.

Decline in number of nests

Andaman Islands

The decline in population of the Edible-nest Swiftlet, over the last decade or so, was also evidenced by a decline in yields. Reliable information on past nest yields was available from nest collectors for 253 caves in the Andaman islands for three past time frames (Table 7). The decline in swiftlet nest yields between the present and 2-5 years ago (n = 13 caves) has been 46%, between the present and 5-8 years ago (195 caves) 61%, and the decline in nest yields over the past 10-15 years (45 caves) has been 83%. For 17 caves, data is available for past yields for both 5-8 years and 10-15 years ago. The decline between 10-15 years ago and 5-8 years ago was 53% which is significantly lower than the decline between 5-8 years ago and now, which was 69%. The decline in overall yield is also reflected at Rafter's Creek. In 1994 it was about 200 kg, which had declined to about 110-120 kg in 1996. The expected yield in 1997 was only about 80 kg.

Nicobar islands

Data of past nest yields is available only for six caves in the Nicobar islands. Depending on the patterns of nest collection, declines in yield range between 40% and 95%, with only one cave apparently not having undergone a significant loss in yield (Table 8).

Quantum of swiftlet nests collected in the Andaman & Nicobar islands

The quantum of nests collected in the Andaman & Nicobar islands is uncertain. The various reports from traders indicate that total nest collection was now anywhere between 400 - 700 kg per annum.

The minimum adult breeding population of Edible-nest Swiftlet in the Andaman & Nicobar islands is 6,630 pairs. Based on which it is possible to estimate the potential nest yield in the Andaman & Nicobar islands.

Table 7. Decline in number of nests in some caves in the Andaman Islands. Data of earlier periods from nest collectors, and the present number from this survey

Island	CN	# caves	Present nest count	Past nest counts P2-3	P5-8	P10-15	% decline
Interview	16	1	8		60		87
Reef	38	1	0			15	100
White Cliff	42	1	0		25		100
East	46	1	0		15		100
Pathi Level		28	368		743		51
		29	461			1565	71
Rafters Creek	88	1	6	45			87
		158	1642		4194		61
		12	168			2835	95
Henry Lawrence		3	40	56			29
		3	47		222		79
		3	21			165	88
Inglis	278	1	0	2			100
Outram	280	1	0		6		100
	281	1	0	3			100
South Button	291	7	58	84			31
North Cinque	307	1	15		15		0
Rutland	309	1	80		200		60
Totals		253					

Key:
CN = Cave number in Appendix 1; **# caves** = number of caves from which the data has been pooled. **T** = present nest count; **P2-3** = Number of nests present two or three years ago; **P5-8** = Number of nests present five to eight years ago; **P10-15** = Number of nests present 10 to 15 years ago.

Table 8. Decline in nest yields in some caves in the Nicobar Islands. Data of earlier periods from nest collectors, and the present number from this survey.

		Nest Collectors		Ownership	Yield in kg/year		Percentage
Island Group	Cave Nos	Non tribal	Tribal	Status[1]	8+yrs ago	Now	Decline
Great Nicobar	CN 2	Yes	No	Common	30-50+	<1.5-2	95
	CN 3,4,5	Yes	Yes	Common	20+	<4	80
	CN 6,7,8	Yes	Yes	Common	2-4	<0.5	75-90
Nancowry	CN 43	Yes?	Yes	One family	5-6	<0.25	95
	CN 45	No	Yes	One family	4-5	4-5	0
	CN 47	No	Yes	One family	8-10	3-4	40-70

[1] Very few caves are 'owned' in the Nicobar islands. Those noted as 'common' in the table indicate that any nest collector who has access to the cave collects nests from it. Those that have been noted as one 'family' indicate that only the members of a single family have collection rights; rights are based on who discovered the colony and are hereditary (apparently matriarchal).

The average weight of a nest is said to be about 14 g, i.e. 70 nests per kg (Ali & Ripley 1983), and 8 g i.e. 125 nests per kg (Lau & Melville 1994). Accounting for a 41% renesting after the first and second harvest (Lau & Melville 1994), a population of 100 pairs would yield 1.5 to 2.5 kg of nests, providing that only completed nests are harvested. However, it is likely that by a greater frequency of harvests, and the collection of incomplete nests, more can be 'milked' out of the birds. I therefore, calculate the nest yield by assuming that there are five harvests of full nest cups per season, and that renesting after the first is 100% and subsequently 41%. A population of 100 pairs of Edible-nest Swiftlet should produce between 2.6 and 4.6 kg per season.

Thus, the nest yield in the Andaman islands which has a population of 4620 pairs should be between 120 and 212 kg, and in the Nicobar islands which has a population of 2010 pairs should be between 52 and 92 kg. Thus the minimum potential nest yield from the Andaman & Nicobar islands is between 170 and 300 kg per annum.

In caves where the approximate yield was known (Table 8), for a population of about 578 pairs, the yield was 15.78 kg. Using this ratio, for a population of 6730 pairs in the Andaman & Nicobar islands, the nest yield is about 184 kg.

Thus, comparing data from the nest survey, and information collected from traders, and assuming that yields assessed from nest counts are on the lower side, it is probable that the annual nest yield from the Andaman & Nicobar islands as reported by traders is not more than 400 kg.

Value

In 1995, the purchase price of one kg of swiftlet nests for whole nests or almost whole nests at Port Blair was between Rs 20,000 and 22,000 (1 US$ = Rs 36). At Campbell Bay, on Great Nicobar, the purchase price was about Rs 17,000, while in the Nancowry group, it was between Rs 15,000 and Rs 17,000. At these prices, a single whole nest would fetch a collector between Rs 120/- and Rs 220/-, equivalent to the earnings of three to six days of manual labour. There had been a 75 to 100% increase in the purchase price of nests from 1994 when purchase prices ranged between Rs 12,000 and 15,000 a kg at Port Blair, and between Rs 7,000 and Rs 10,000 a kilogram at Campbell Bay.

In 1997, the prices had crashed. Traders were offering collectors between Rs 3,000 and Rs 5,000 per kg for nest scrapings, which form the bulk of the trade, and Rs 7,000 to Rs 10,000 per kg for whole or almost whole nests. This is probably a reflection of falls in international prices, subsequent to the boom in house ranching of swiftlets in Indonesia.

Trade & Trade Routes

The Edible-nest Swiftlet nest trade is well entrenched in the Andaman & Nicobar islands. The collectors generally sell their nests to middle men, who are usually shop keepers or rarely employees in a

Government department, both of whom usually are present on the island where the swiftlet cave(s) is, or in a town on a nearby island. Some dealers in animal products periodically visit collectors and make purchases, or visit the shop keepers who locally purchase to pick up consignments. In a few cases, nest collectors themselves may act as commission agents and purchase from other collectors and supply big traders, or a few nest collectors may sell their nests at Port Blair. There were reports that traders from Calcutta and Chennai (Madras) do come occasionally to purchase nests from Port Blair, or from the smaller islands directly.

Most primary and secondary purchasers of Edible-nest Swiftlet nests sell their merchandise in Port Blair, where all such consignments are picked up by a cartel of three to four big traders. It is this cartel which is involved in smuggling Edible-nest Swiftlet nests from Port Blair to Calcutta and Chennai. Whether they actually take the nests to its next destination in South East Asia, or whether it is handled by somebody in Chennai and Calcutta could not be ascertained.

While Chennai was until recently apparently the major destination for Edible-nest Swiftlet nests from Port Blair, in recent years Calcutta has become the major destination. Only full sized nest cups are taken to Chennai now. Singapore is the major destination for all nests from Andaman & Nicobar islands.

Impact of nest collection

The decline in populations of Edible-nest Swiftlet has been more than 80% over the last decade in most caves in the Andaman & Nicobar islands. In only 19 (5%) caves out of 385 has the population remained more or less stable over the years, in 18 of which it was due to the recent discovery of the caves. It is clear that nest collection regimes in the Andaman & Nicobar islands has resulted in decline of populations, as it has elsewhere (Lau & Melville 1994).

Nest collection affects the swiftlet by significantly reducing recruitment to the population. Even optimistically assuming that all pairs with nests more than half complete would have successfully raised young, the breeding success in the Andaman islands would have been as low as 9%. More pessimistically, if we consider only those pairs whose nests were either completed, or had eggs or chicks in them would successfully raise a brood, then the breeding success would be less than 1% in the Andaman islands. In the Nicobar islands the breeding success would have been as high as 45% when we consider nests more than half completed. However, this relatively high value is because of CN 47 where harvesting affects only about 6% of the population of about 800 pairs, which constitutes 40% of the population of the Nicobar islands. The poor breeding success is reflected when we examine each island subgroup separately. In the Great Nicobar subgroup, breeding success would be only 14%, while in the Nancowry subgroup it would be 58%. If we exclude CN 47 from the Nancowry subgroup, then here too breeding success would be only about 15%. If we consider only those pairs which had eggs or young in them, then in the Nicobar islands the breeding success would be about 1%. If we include CN 47 the breeding success would be about 38%. Over all, for the Andaman & Nicobar islands for nests more than half completed, the breeding success would be about 20%, and for complete nests, or with eggs and chicks, would be about 13%.

In contrast, under virtually unharvested conditions, the overall breeding success is as high as 48%, with as many as 68% of the birds renesting after successfully raising one brood, and 16% after the second (Langham 1980). Juvenile mortality in swiftlets is probably quite high, as the young are not

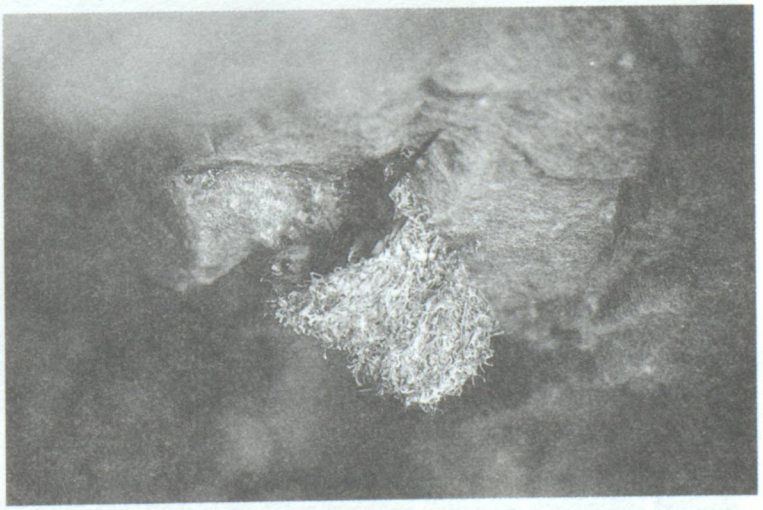


Figure 11. Whitebellied Swiftlet on the nest.

tended by the parents when they leave the nest, and have to learn to forage, about feeding areas and predators by themselves (Francis 1987). Clearly, for populations to remain stable or to show growth, a high breeding success is required, which is not the case in the Andaman & Nicobar islands because of heavy nest collection pressures.

There is a sharp decline in the percentage of birds that renest after nests are removed (Kang *et al.* 1991), or eggs or chicks lost (Langham 1980). Thus, protracted and continuous nest collection, as is the case in the Andaman & Nicobar islands, would result in a very small proportion of the swiftlets actually raising a brood. Continuous nest collection also results in the nest building phase of the breeding season being unduly prolonged, with the result that young would fledge only after the onset of the southwest monsoon. Inclement weather and presumably a decreased prey base would probably increase the mortality rates of the fledglings.

There are ecological problems too with a reduction in population. As swiftlets and bats compete for space within caves (see also Burder 1961), and as each tend to cluster with conspecifics (see also Medway 1962b), a reduction in population of one species apparently results in its space being occupied by another species. This was evidenced in those caves in the Nicobar islands where some light filters through. Entire walls of caves which once were covered with nests of Edible-nest Swiftlet, were now occupied by either Whitebellied Swiftlet or by bats (e.g. CN 2) so much so that a commonly heard explanation for the reduction in swiftlet populations is because of an increase in bat numbers! CN 46, the largest cave in the Nicobars, illustrates this point very well. The roof of CN 46 is comprised of a series of domes, and almost every dome is occupied by bats. Only two domes had swiftlet, one with about 125 Whitebellied Swiftlet and the other with one Edible-nest Swiftlet nest, and three or four other domes were empty. One dome which had 8-10 Edible-nest Swiftlet nests in 1994, was now occupied by bats, and apparently this has been the case with several other domes within that cave. Thus the major ecological problem due to nest collection is that when the species declines, its space is occupied by other cave dwellers. This suggests that even protection alone may not help this species because an increase in numbers will be possible only if the Edible-nest Swiftlet out competes the other species and regains nesting space in the caves.

Most importantly, because swiftlet pairs are sedentary, pair for life, are faithful to their nest sites, and live in groups or colonies, it will be many years before the effects of over harvesting become apparent. Ultimately, however, there would be a disastrous crash as the aged birds finally die (Nugroho & Whendrato 1996). This is the scenario in the Andaman & Nicobar islands.

Figure 12. Indiscriminate nest collection, with little regard to ensuring that atleast one brood is raised by a pair each year has resulted in a severe reduction in the population of the Edible-nest Swiftlet.

Other traded animal products

Animal trade is a flourishing business in the Andaman & Nicobar islands. Species which have declined as a result of commercial interests include sea cucumber or Trepan (both by Indians and Burmese poachers), crocodiles (now mainly by Thai poachers), sea shells particularly turbo, tockus, and giant clams (the last purchased as curios by the Government officials posted to the islands), and shark fin. Red coral is also collected and smuggled out of the islands in large quantities. There are reports that sea urchins and sea horses are also traded.

Chapter 4

Conservation

Can there be sustainable exploitation?

Nest harvest of Edible-nest Swiftlet can be a remunerative and sustainable way of exploiting a natural resource (Medway 1966). Swiftlet nest harvesting, particularly in small populations that occupy caves where all nests can be easily plucked, has to be carefully managed. The nest building phase in *C. fuciphaga* is about 45 days, with a further 72 days to lay eggs, incubate and raise the young, making a total of 117 days (Kang *et al.* 1991). Thus, Kang *et al.* (1991), recommended an interval of a minimum 130-135 days (*c.* 4 months) between harvests, if sustainable-yield harvesting was to have a chance of being maintained.

Can such a harvest regime be implemented in the Andaman & Nicobar islands? Sustainable harvest regime can only exist where some form of ownership of the cave(s) exists. This is clearly evidenced in the islands, where the only caves which have not had a significant decline in populations, or had the largest number of nests with eggs and chicks, are owned and protected by the owners (see also Table 8). Severe population declines have taken place only in those caves where nest collection is free for all. Thus, for sustainable harvest regimes to be implemented ownership rights will have to be conferred onto nest collectors by, for instance, a system of contracts. Short term contracts, however, will be ineffective, as the contractor would not adhere to sustainable exploitation schedules, and would attempt getting the maximum benefit from the contract period. Short term contracts have also been identified as a major problem in managing caves in Indonesia (Raharjo *et al.* 1996). To serve any meaningful purpose, the contracts should be awarded for periods of at least 10 to 15 years.

There are practical problems to the implementation of sustainable harvest regimes in the Andaman & Nicobar islands.

As the majority of swiftlet nesting sites are accessible only from the sea, or involve rock climbing in caves within the forest, nest collection becomes very risky during the monsoon months, when the seas are rough and the rocks slippery. It therefore seems unlikely that nest collectors would adhere to a system as set out by Kang *et al.* (1991), either due to inaccessibility, or due to increased risks involved in nest collection. But the most significant hurdle in implementing a sustainable harvest regime from caves is India's unique approach to the exploitation of natural animal resources. It is extremely unlikely that, given the belief that life-forms are not necessarily meant for commercial gain, the required clearances for the sustainable exploitation of swiftlet nests would ever be given.

Under the existing systems, and attitudes of nest collectors, and considering that the populations of Edible-nest Swiftlet have declined considerably, nest collection, sustainable or otherwise, cannot be permitted in the Andaman & Nicobar islands until swiftlet populations have recovered.

Protection of Edible-nest Swiftlet in India

The decline of the Edible-nest Swiftlet warrants its inclusion into Schedule I of the Indian Wildlife Protection Act (1972). This will necessarily be a short term measure for about 10 years, till such time the ex-situ conservation measure proposed below is established. The inclusion of swiftlets in Schedule I is to primarily serve as a powerful deterrent.

Protection of swiftlet caves is a near impossible task, as most caves are in remote and difficult to access places. Moreover, the placement of guards does not solve the problem, as nest collectors can always bypass the guard post or raid the cave at night. The caves in the Jarawa territory are a striking example of how ineffective protection is. Despite a real threat of being killed by Jarawas, nest collectors still enter these caves and collect nests.

There is only one possible way of ensuring that nest collection stops or is significantly reduced, and that is by effectively stopping the trade. As all consignments of nests that move between the islands do so by inter-island ships, and move from the island to the mainland by ship or flight, trade in the swiftlet nests can be effectively reduced by regular checks on the cargo and personal baggage leaving the islands, and entering the mainland. Essentially, a

'customs check for animal products' needs to be established at the sea ports of Car Nicobar, Diglipur, Mayabunder and Vishakapatnam, and the sea ports and airports of Port Blair, Chennai and Calcutta. Moreover, this will effectively reduce the currently very high trade in other animal products like sea shells, red coral and sea cucumber.

The major obstacle in having a 'customs check for animal products' is the lack of manpower and the difficulty in implementing such a system as there is a substantial passenger and cargo traffic. However, the level of animal product trade, including that of swiftlet nests, is sufficiently alarming in the Andaman & Nicobar islands to warrant the development of the necessary infrastructure to effectively check this trade.

Swiftlets, CITES & India

Since the Edible-nest Swiftlet is critically endangered in India, and since populations elsewhere in Southeast Asia have undergone declines (e.g. Narayan 1991, Leh 1993, Lau & Melville 1994, Sankaran 1995a,b, Corpuz & De Leon 1996, Wirjoatmodjo & Samedi 1996, Yatim *et al.* 1996), with some declines as severe as that in the Andaman & Nicobar islands (e.g. Java: Nugruho & Whendrato 1996), there is a strong case for the inclusion of swiftlets into the CITES appendices. The case becomes particularly strong when we consider that the bulk of the Edible-nest Swiftlet nests are traded across international boundaries.

However, while wild populations of the Edible-nest Swiftlet are declining across most parts of their range, due to collection pressures and habitat loss, the enormous success of house farming of Swiftlets in Indonesia (see below) has resulted in a phenomenal growth in the population of Edible-nest Swiftlets under farmed conditions (Mardiastuti & Soehartono 1996, Nugroho & Whendrato 1996). This reason above all else, probably prevented the inclusion of the Edible-nest Swiftlet into the Appendices of CITES (see also page 4), even though populations declines in natural habitats warrant formal regualtion in the trade of its nest. The inclusion of the species into Appendix II or Appendix III of CITES still needs to be considered.

The non-inclusion of the Edible-nest Swiftlet into CITES appendices has major ramifications to the conservation of the Edible-nest Swiftlet in India, as consumer nations will continue to import nests irrespective of the source of the nests. The lack of meaningful international cooperation in regulating trade, will render any Indian endeavour to control trade ineffective.

The impracticality of protecting caves, and the difficulty in controlling trade indicates that an alternate conservation strategy is necessary.

House Ranching

House ranching of the Edible-nest Swiftlet can be likened to apiculture, where bees are reared for their honey. House ranching of swiftlets cannot be likened to the farming of animals for skin or meat.

The process of establishing an Edible-nest Swiftlet colony inside a house occupied by humans is easy, but requires careful management. Since it is difficult to attract the Edible-nest Swiftlet into houses, the environment within a house with an existing colony of Whitebellied Swiftlet is developed. The process of introducing Edible-nest Swiftlet is by cross fostering, whereby the eggs of the Whitebellied Swiftlet are replaced with the eggs of the Edible-nest Swiftlet. The Whitebellied Swiftlet raises the young of the Edible-nest Swiftlet and if properly managed a new population of Edible-nest Swiftlet is soon established. (See Information Sheet on house ranching pp 40,41).

The survival of the Edible-nest Swiftlet in any part of its range is dependent on the introduction of house farming. In the Indian scenario, it is a crucial ex-situ conservation method, whereby not only can the species be saved in the islands, but can become of significant commercial importance.

To establish significant populations of Edible-nest Swiftlets in houses, it will take a minimum of 5-8 years. This should be closely supervised by the Forest Department. Once populations have been established, and exploitation of house ranched swiftlets is potentially sustainable, the programme can be privatised, The species which would be protected under Schedule I of the Wildlife (Protection) Act, 1972, can then be brought into Schedule IV.

The Conservation of the Edible-nest Swiftlet in the Andaman & Nicobar islands

1. The Edible-nest Swiftlet in the Andaman & Nicobar islands has undergone significant losses in populations to the tune of 80% or more, due to

indiscriminate and unrestricted nest collection. The present populations cannot sustain the present level and intensity of nest collection.

2. In the short term, the species urgently requires protection, and there is a need to include this species in Schedule I of the Indian Wildlife Protection Act (1972). A mechanism that effectively stops the movement of swiftlet nests between and out of the islands, by checking people and cargo embarking or disembarking at all ports, including ships and flights to the mainland, needs to be established.
3. House farming needs to be established. This can be effected by the following process:

a) A cave needs to be protected to ensure the supply of the eggs of the Edible-nest Swiftlet. Only one cave, CN 17 on Interview Island Wildlife Sanctuary, has both an adequate number of nests and is so located that protection is feasible. This cave must be rigorously protected. We would then have a source of about 1200 to 1600 eggs.

b) Identification of existing man-made structures, preferably close to Mayabunder, where colonies of Whitebellied Swiftlet already exist. The Bakultala Forest Rest House is one such.

c) Development of houses to attract Whitebellied Swiftlet. The old PCCF office at Port Blair, and the DCFs residence at Mayabunder are both very close to jetties / bridges under which Whitebellied Swiftlet nest. With a little modification, these would easily attract colonies of Whitebellied Swiftlet.

d) Cross foster the eggs of Edible-nest Swiftlet which are collected from CN 17 on Interview island, into the nests of the Whitebellied Swiftlet which are present in the houses / man made structures.

e) Encourage the spread of Edible-nest Swiftlet into other houses by following steps a to d above.

4. After 5-8 years, evaluate the status of the Edible-nest Swiftlet in caves and in houses. If house populations have reached harvestable sizes, bring the Edible-nest Swiftlet into Schedule IV of the Wildlife Protection Act (1972) and encourage the sustainable exploitation of the nests of the Edible-nest Swiftlet from farmed conditions.

Figure 13. Urgent protection and ex-situ conservation measures need to be undertaken in the Andaman & Nicobar islands if the Edible-nest Swiftlet is to survive.

References

Abdulali, H. 1964. The birds of the Andaman & Nicobar islands. *J. Bombay nat. Hist. Soc. 61:* 483-571.

---------- 1967. The birds of the Nicobar islands, with notes on some Andaman birds. *J. Bombay nat. Hist. Soc. 64:* 139-190.

Ali, S. & Ripley, S.D. 1983. *The Handbook of the Birds of India and Pakistan*. Oxford University Press, Delhi.

Anonymous, 1892. Edible-birds' nests in the Andaman islands. *Ibis 6:* 578-579.

Anonymous, 1994. Andaman & Nicobar islands. Island-wise statistical outline. Directorate of statistics, Port Blair.

Anonymous, 1996. Country Report 1992 to 1996. Sri Lanka. Field Ornithology group of Sri Lanka, Univ. of Colombo.

Anonymous, 1996. Technical workshop on the conservation priorities and action for Edible-nest Swiftlets. 4-7 November 1996, Surabaya.

Balakrishnan, N.P. 1989. Andaman Islands - vegetation and floristics. Pp 55-61 in Andaman, Nicobar & Lakshadweep. An environmental impact assessment (Saldanha C.J.). Oxford & IBH Publ. Co. New Delhi.

Barbe, P. 1846. Notice of the Nicobar islands. *J. Asiatic Soc. Bengal 15:* 344-367.

Beavan, R.C. 1867. The avifauna of the Andaman & Nicobar islands. *Ibis 2:* 314-334.

Burder, J.R.N. 1961. The birds' nest caves at Gomantong, North Borneo. *Malay Nat. J. Special Issue:* 172-177.

CITES, 1994. Ammendments to Appendices I & II of the convention. Proposal: Inclusion of Collocalia spp. in Appendix II. Pp 1-17. CITES.

Collar, N.J., Crosby, M.J. and Stattersfield, A.J. (1994) *Birds to watch 2. The world list of threatened birds.* Cambridge: BirdLife International.

Corpuz, L.B. & De Leon J.L. 1996. Harvesting of edible nests and national policies governing Edible-nest Swiftlets in the Philippines. (Ed.) In proceedings of the workshop on conservation of swiftlets of the genus Collocalia. 4-7 November 1996. Surabaya, Indonesia.

Dagar, J.C., Mongia, A.D. & Bandopadhyay, A.K. 1991. Mangroves of Andaman and Nicobar Islands. Oxford & IBH Publ. Co. New

Dexter, R.W. 1977. Chimney Swifts use same nests for five consecutive years. *Bird Banding 49:*278-279.

Francis, C.M. 1987. *The management of edible bird's nest caves in Sabah.* Wildlife Section, Sabah Forest Department.

Gunawardena, J. 1997. The collection of the Indian Swiftlet *Collocalia unicolor* for the bird-nest trade in Sri Lanka. *Oriental Bird Club Bulletin 26:* 23-25.

Kang, N., Hails, C.J. & Sigurdsson, J.B. 1991. Nest construction and egg-laying in Edible-nest Swiftlets Aerodramus spp. and the implications for harvesting. *Ibis 133:* 170-177.

Kloss, B. 1903. *In the Andamans and Nicobars*. John Murray, London.

Langham, N. 1980. Breeding biology of the Edible-nest Swiftlet *Aerodramus fuciphagus. Ibis 122:* 447-461.

Lau, A.S.M. & Melville, S. 1994. International trade in swiftlet nests with special reference to Hong Kong. TRAFFIC International, Cambridge.

Leh, C.M. U. 1993. A guide to the birds' nest caves and birds' nests of Sarawak. The Sarawak Museum, Sarawak.

Mardiastuti, A. & Mranata, B. 1996. Biology and distribution of Indonesian swiftlets with a special reference to *Collocalia fuciphaga* and *Collocalia maxima.* (Ed.) In proceedings of the workshop on conservation of swiftlets of the genus Collocalia. 4-7 November 1996. Surabaya, Indonesia.

Mardiastuti, A. & Soehartono, T. 1996. Current situation of the Edible-nest Swiftlets in Indonesia: A revision. (Ed.) In proceedings of the workshop on conservation of swiftlets of the genus Collocalia. 4-7 November 1996. Surabaya, Indonesia.

Marshall, A.J. & Folley, S.J. 1956. The origin of nest-cement in edible-nest swiftlets (*Collocalia* spp.). *Proceedings of the Zoological Society of London 126:* 383-389.

Medway, Lord 1962a. The relation between the reproductive cycle, moult and changes in the sublingual salivary glands of the swiftlet *Collocalia maxima* Hume. *Proceedings of the Zoological Soc. London 138:* 305-314.

Medway, Lord 1962b. The swiftlets (*Collocalia*) of Niah Cave, Sarawak. Part 1, Breeding Biology. *Ibis 104:* 45-66.

Medway, Lord 1962c. The swiftlets (*Collocalia*) of Niah Cave, Sarawak. Part 2, ecology and the regulation of breeding. *Ibis 104:* 228-245.

Medway, Lord 1963. The antiquity of trade in edible birds'-nests. *Federation Museums Journal VIII:* 36-47.

Medway, Lord 1966. Field characters as a guide to the specific relations of swiftlets. *Proceedings of the Linnean Society of London 177:* 151-177.

Mouat, 1863. The Andaman & Nicobar islands.

Narayan, G. 1991. Birds in a soup. *Hornbill 1:* 8-11.

Nugroho, E. & Whendrato, I. 1996. The farming of Edible-nest Swiftlets in Indonesia. (Ed.) In proceedings of the workshop on conservation of swiftlets of the genus Collocalia. 4-7 November 1996. Surabaya, Indonesia.

Osmaston, 1906. Notes on the Andaman birds, with accounts of the nidification of several species whose nests and eggs have not hitherto been described. *J. Bombay Nat. Hist. Soc. 17:* 156-163.

Phach, N. Q. 1996. Some major factors influencing the breeding success of white-nest swiftlets *Collocalia fuciphaga germani* Oustalet in Vietnam. (Ed.) In proceedings of the workshop on conservation of swiftlets of the genus Collocalia. 4-7 November 1996. Surabaya, Indonesia.

Raharjo, Y.C., Hoo, A., Wiryoatmodjo, S. & Subrata, M. 1996. Nest production and management systems of cave-inhabiting *Collocalia fuciphaga* and *C. maxima* from some known areas in Indonesia. (Ed.) In proceedings of the workshop on conservation of swiftlets of the genus Collocalia. 4-7 November 1996. Surabaya, Indonesia.

Saldanha, C.J. 1989. *Andaman, Nicobar & Lakshadweep. An environmental impact assessment.* Oxford & IBH Publ. Co., Delhi.

Sankaran, R. 1995a. The impact of nest collection on the Edible-nest Swiftlet in the Nicobar islands. SACON-Occasional Report 1, Salim Ali Centre for Ornithology and Natural History, Coimbatore.

Sankaran, R. 1995b. The decline of the Edible-nest Swiftlet in the Nicobar islands. Oriental Bird Club Bulletin 22: 51-54.

Sankaran, R. 1997. Developing a protected area network in the Nicobar islands: The perspective of endemic avifauna. *Biodiversity & Conservation 6:*

Sibley, C.G. & Monroe, B.L. 1990. *Distribution and Taxonomy of Birds of the World.* Yale Univ. Press.

---------- 1993. *Supplement to Distribution and Taxonomy of Birds of the World.* Yale Univ. Press

Singh, B.K. 1981. Census of India 1981. Series-24. Andaman & Nicobar islands. Govt. of India.

Wirjoatmodjo, S. & Samedi 1996. Sustainable management programme of Indonesian swiftlet nest production (revised). In 'Technical workshop on conservation priorities and actions for Edible-nest Swiftlets' Surabaya, Indonesia, 4-7 November 1996.

Fan, Z. & He, F. 1996. The status and trade of Edible-nest Swiftlets genus *Collocalia* in China. In 'Technical workshop on conservation priorities and actions for Edible-nest Swiftlets' Surabaya, Indonesia, 4-7 November 1996.

Yatim, S. H., Mamat, I. Hj. & Hamid, M. R. A. 1997. Population estimates for the Edible-nest Swiftlet and Black-nest Swiftlet in Trengganu and Johor. *J. Wildlife & Parks* 48-56.

Appendix 1. Nest Count of Edible-nest Swiftlet in the Andaman Islands

CN	Island	CT	T	Fo	0.25	0.5	1	E	OS	VOS	WBS	Bts	CRH	P2-3	P5-8	P10-15	S
1	Interview	B	0								200						
2		B	0														
3		B	0									800					
4		B	0								300						
5		B	0									2					
6		B	0									15					
7		B	0								45						
8		B	?								134	100					
9		B	0								30						
10		B	0								39						
11		B	?								200	100					
12		B	0								30						
13		B	0								70						
14		Cii	80	80								3000					
15		Cii	0								20	500					
16		Cii	8		8						0	500	+		60		
17		Cii	600		600						55	0					
18		Cii	9		9						0	0	+				
19		Cii	35		35						0	+					
20		Cii	32		32							0					
21		Cii	31		28	2	1					1					
22		Cii	7		7				2								
23		Cii	17		17								+				
24		Cii	2		2				1		1						
25		Cii	6		6				1								
26		Cii	18		18												
27		Cii	6														ns
28		Cii	18		17	1											
29		Cii	13		11	1	1					+					
30		Cii	5		5								+				
31		Cii	5		5								+				
32		Cii	14	4	9	1			2								
33		Cii	4		4												
34		Cii	0								1	4					
35	Point	B	0									100					
36		B	0								40	200					
37	Reef	Cii	8	6			2										
38		Cii	0								100					15	
39		Cii	0									2					
40		Cii	0							6	7						
41		Cii	0								21						
42	White Cliff	AB	0								2				25		
43		BD	?														ns
44		BD	?														ns
45		BD	?														ns
46	East	B	0									+			15		
47	Chalis ek	D	32	32					5			100			55		
48		D	7	7					2			+			25		
49		D	8	5				3			65	250			60	80	
50		D	5	4		1			5			2000			20	50	
51		D	49	49					72	150		+				350	
52		D	9	9					4							30	
53		D	17	17					8			400				30	
54		D	15	13			2		8						60	80	
55		D	15	12		2		1	19						35	55	

CN	Island	CT	T	Fo	0.25	0.5	1	E	OS	VOS	WBS	Bts	CRH	P2-3	P5-8	P10-15	S
56	Chalis ek	D	9	9					4						15	25	
57		D	39	39					10							50	
58		D	8	8					12						20		ns
59		D	9	9					5			200			15	20	
60		D	28	28					11			100			30		
61		D	9	9							300				16	22	
62		D	12	12					6						20		
63		D	8	8					6								
64		D	2						5						3	15	
65		D	9	6	3				2							16	
66		D	119	119		1			40	50	13					500	
67		D	46	25		16	5		8			+			40	70	
68		D	6	6					1						7	10	
69		D	15	15					14						20		
70		D	0							8							
71		D	0								22						
72		D	390	364		15	8	3									
73		D	9						5						16		
74		D	36	25	10		1		25							100	
75		D	1	1					10							25	
76		D	10	10					8								
77		Cii	12	12					1								
78		Cii	5	5					6								
79		Cii	2					2									ns
80	Ramnagar	B	0								58	+					
81		B	0								2	40					
82	Cuthbert Bay	B	0									1000					
83		B	1?								1500	+					
84		B	0														
85	Strait	B	0														
86		B	1				1				150	+					
87	Opp. Strait	B	0								60	+					
88	Rafters Creek	Cii	6	6					50	200		+		45	200	500	
89		Cii	0						24						30		
90		Cii	0						35			200			25		
91		Cii	0						2			2			6		
92		Cii	2	2					135						45	400	
93		Cii	2	2					12								
94		Cii	6	6					8							40	
95		Cii	0						13								
96		Cii	11	11					8		2						
97		Cii	13	13					8		15						
98		Cii	2			2			3								
99		Cii	13	13					2						20		
100		Cii	1	1					6						25		
101		Cii	18	18					6							45	
102		Cii	0						17		15						
103		Cii	6												25		ns
104		Cii	5		5				3								
105		Cii	18	18					15						30		
106		Cii	31	31					11						50		
107		Cii	52	52													
108		Cii	18	18													
109		Cii	4	3				1									
110		Cii	50	50					15						71		
111		Cii	10	10					6						30		
112		Cii	2	2					12						13		
113		Cii	5	5					2						10		

CN	Island	CT	T	Fo	0.25	0.5	1	E	OS	VOS	WBS	Bts	CRH	P2-3	P5-8	P10-15	S
114	Rafters Creek	Cii	25	25							2000				200		
115		Cii	35	35								3000			50		
116		Cii	30	30					+						50		
117		Cii	19	19											25		
118		Cii	36	36						35	7				75		
119		Cii	32	32					25						75		
120		Cii	6	6					4						15		
121		Cii	4		4										10		
122		Cii	1					1							2		
123		Cii	8	8					5						15		
124		Cii	10	10					4						45		
125		Cii	8	8											13		
126		Cii	5	5											10		
127		Cii	2												5		ns
128		Cii	10												5		ns
129		Cii	6												20		ns
130		Cii	11							+					25		ns
131		Cii	14												25		ns
132		Cii	15												20		ns
133		Cii	2												5		ns
134		Cii	29	29					10						40	70	
135		Cii	34	33		1									70		
136		Cii	7	7											12		
137		Cii	27	27					12						40	80	
138		Cii	7	7											7		
139		Cii	18	18					8				+		40		
140		Cii	0												12		ns
141		Cii	20												30		ns
142		Cii	1												3		ns
143		Cii	7												12		ns
144		Cii	5												12		ns
145		Cii	12												32		ns
146		Cii	4												4		ns
147		Cii	5												15		ns
148		Cii	23												65		ns
149		Cii	4	3			1		7						7		
150		Cii	26		26										40		
151		Cii	4												7		ns
152		Cii	19	19					8						35		
153		Cii	6												12		ns
154		Cii	6												8		ns
155		Cii	10												15		ns
156		Cii	12												20		ns
157		Cii	5												7		ns
158		Cii	4												7		ns
159		Cii	12												15		ns
160		Cii	3												3		ns
161		Cii	6												10		ns
162		Cii	8												50		ns
163		Cii	14														ns
164		Cii	6												8		ns
165		Cii	1												10		ns
166		Cii	4												6	25	ns
167		Cii	2												17		ns
168		Cii	1												3		ns
169		Cii	3												14		
170		Cii	9												15		ns
171		Cii	6												12		ns

CN	Island	CT	T	Fo	0.25	0.5	1	E	OS	VOS	WBS	Bts	CRH	P2-3	P5-8	P10-15	S
172	Rafters Creek	Cii	2									4			3		
173		Cii	22												30		
174		Cii	2												2		ns
175		Cii	6												8		ns
176		Cii	6												12		ns
177		Cii	6												6		ns
178		Cii	3												5		ns
179		Cii	0												10		ns
180		Cii	30												45		
181		Cii	6												13		ns
182		Cii	5												5		ns
183		Cii	8												8		ns
184		Cii	6												6		ns
185		Cii	10												51		ns
186		Cii	6												18		
187		Cii	0												3		
188		Cii	5						6						21		
189		Cii	11	11					7			+	+		100		
190		Cii	0												12		ns
191		Cii	5												11		ns
192		Cii	15	15					5						25		
193		Cii	2												2		ns
194		Cii	7												10		ns
195		Cii	15												20		ns
196		Cii	3												7		ns
197		Cii	2												5		ns
198		Cii	40									+			150		
199		Cii	7												20		ns
200		Cii	5												20		ns
201		Cii	3												9		ns
202		Cii	3												13		ns
203		Cii	6												6		ns
204		Cii	6												18		ns
205		Cii	3												3		ns
206		Cii	3												3		ns
207		Cii	10												10		ns
208		Cii	6												13		ns
209		Cii	1												3		ns
210		Cii	10												30		ns
211		Cii	35												40		ns
212		Cii	50												200		ns
213		Cii	0												12		ns
214		Cii	0												6		ns
215		Cii	2												6		ns
216		Cii	0												15		ns
217		Cii	20												40		ns
218		Cii	0												8		ns
219		Cii	20												70		ns
220		Cii	5												8		ns
221		Cii	3												11		ns
222		Cii	8												20		ns
223		Cii	3												4		ns
224		Cii	5												11		ns
225		Cii	15												140		ns
226		Cii	25												45		ns
227		Cii	12												20		ns
228		Cii	5												5		ns
229		Cii	6												8		ns

CN	Island	CT	T	Fo	0.25	0.5	1	E	OS	VOS	WBS	Bts	CRH	P2-3	P5-8	P10-15	S
230	Rafters Creek	Cii	23	23											40		
231		Cii	34	34					8						45		
232		Cii	8														ns
233		Cii	3												6		ns
234		Cii	1												3		ns
235		Cii	6												6		ns
236		Cii	24												40		ns
237		Cii	10												25		ns
238		Cii	8												12		ns
239		Cii	5												10		ns
240		Cii	18												50		ns
241		Cii	11												11		ns
242		Cii	25									2000			40		
243		Cii	5												22		
244		Cii	7												100		ns
245		Cii	14												30		ns
246		Cii	8												15		ns
247		Cii	2														ns
248		Cii	0												12		ns
249		Cii	3												3		ns
250		Cii	0												35		ns
251		Cii	0												15		ns
252		Cii	12												0		ns
253		Cii	0												3		ns
254		Cii	0												5		ns
255		Cii	78												45		ns
256		Cii	35														ns
257		Cii	35														ns
258	Henry Lawrence	B	0								10	+				15	
259		B	0								1	150					
260		B	0									+					
261		B	0								32						
262		B	0								75	+					
263		B	0									+					
264		B	16		16				2		105	200				100	
265		B	5		5						20	+				50	
266		B	0								5						
267		B	20		20						500	+		25	100		
268		B	0								9	200		3			
269		B	3														ns
270		B	5									+			16		
271		B	0								26						
272		B	2				1	1			10				6		
273		B	0								2			3			
274		B	0								6						ns
275		B	0								9						
276		B	0								11						
277		B	0								91						
278	Inglis	B	0											2			
279		B	0								81						
280	Outram	B	0								41				6		
281		B	1	1					1		35			3			
282	Neil	B	60								200						
283		B	2														ns
284		B	30														ns
285		B	1														ns

CN	Island	CT	T	Fo	0.25	0.5	1	E	OS	VOS	WBS	Bts	CRH	P2-3	P5-8	P10-15	S
286	Neil	B	3														ns
287		B	2														ns
288		B	1														ns
289		B	20														ns
290		B	20														ns
291	South Button	B	8			8								18			
292		B	70			70		1	40								
293		B	18			18			5					22			
294		B	16			16			2					10			
295		B	16			16			12					25			
296		B	6			2	4		3								
297		B	5			5			+								
298		B	150			150			40								
299		B	0						6								
300		B	0											3			
301		B	0											3			
302		B	2			2			3								
303		B	4			4			5								
304		B	0						3					3			
305	Middle Button	B	0											?			
306	Chidiya tapu	B	0								125	+					
307	North Cinque	B	15	15											15		
308	Rutland	B	9	9					2								
309		B	80	80							450				200		
310		B	0								125						
311		B	0									500					
312		B	0														
313		B	0														
314	Passage	B	90		90				6								
315		B	15		15				2								
316	Little Andaman	B	?														ns
317		B	?														ns
318		B	?														ns
319	Redskin	B	0								62						
320	Jarawa (main)	B	20														ns
321	Jarawa Island 1	B	20														ns
322		B	200														ns
323		B	20														ns
324	Jarawa Island 2	B	5														ns
325	Jarawa (main)	B	0								500						ns
Totals			4621	1754	992	334	27	13	942	449	8035	15670	0	165	4863	2868	

Key: **CN**: Cave number, **CT**= Cave type; **ES#**= Total number of Edible-nest Swiftlet nests; **Fo**= Fresh nests with only marks or foundation; **<¼** = Nests less than quarter completed; **<½** = Nests less than half completed; **1** = nests fully completed but without eggs; **E** = Eggs present; **OS** = old signs; **VOS** = very old signs; **WBS** = Number of Whitebellied Swiftlet nests; **Bats** = Number of bats; **CRH** = Cockroaches; **P2-3** = number of nests 2-3 years ago; **P10-15** = number of nests 5 to 8 years ago; **P10-15** = Number of nests 10 -15 years ago; **S** = ns indicates that the cave was not entered by me and the nest counts in such cases will be information based on discussions with nest collectors.

Key: Cave type, **A**= On coast, approachable on foot; **B**= On coast, entrance partially submerged and access by swimming into cave; **AB**= On coast, approachable on foot after swimming ashore; **BD**= Cave above sea level on cliff face ending in the sea; **Ci**= In the forest, at the origin of stream; **Cii**= In the forest, cavern below the ground; **Ciii**= In the forest; **D**= midway on inland cliff; **E**= Japanese bunker (man made tunnel).

Note:

1. The cave numbers correspond to specific caves referred to in the text and in the maps.

Appendix 2. Nest Count of Edible-nest Swiftlet in the Nicobar islands

CN	Island	CT	ES#	M+Fo	>¼	>½	E	C	WBS	Bats
1	Great Nicobar	A	18					0	0	0
2		A	31	31					3000	>2000
3		B	91	91					1000	+
4		B	17	17					0	+
5		B	4		4				150	+
6		AB	0						200	0
7		AB	0						18	0
8		B	21		14	7			1	0
9		A	4	4					27	200+
10		A	0						91	0
11		A	7	7					300	+
12		A	20	20					0	0
13		A	1			1			45	+
14		A	0						350	0
15		B	4			4			60	+
16	Kondul	A	3			1	1	1	0	0
17		A	12	12					150	+
18		A	1	1					100	+
19		A	1			1			0	0
20		AB	15	15					8	0
21		AB	65	49			16		0	0
22		AB	30	26		4			0	0
23		AB	16	10		6			0	0
24		B	6	3		3			0	0
25		B	0						4	0
26		B	184	181		3			0	0
27	Pilo Milo	A	3			3			350	+
28	Little Nicobar	A	0						47	0
29		A	3			1	2		200	+
30		A	6	3		3			2	0
31		A	5	5					0	0
32		A	6	6					14	1
33		A	6		6				0	0
34		A	0						0	25-30
35		A	0						4	0
36		A	0						37	+
37		A	0						1	0
38		A	0						1	0
39		A	0						0	+
40		A	0						0	0
41		A	0						400	+
42		A	0						120	0
43	Nancowry group of islands	A	15	15					500	40-50
44		B	42	38	4				800	0
45		Ci	14	14					150	5-6000
46		Cii	1		1				125	10000+
47		Ci	800	50	750			0	1500	+
48		Ciii	0						175	500+

CN	Island	CT	ES#	M+Fo	>¼	>½	E	C	WBS	Bats
49	Nancowry group of islands	D	300	210		90			0	0
50		D	50	44	6				0	0
51		BD	50		50				0	0
52		BD	12		6	6			0	0
53		AB	140		140				0	0
54		BD	0						0	0
55		BD	3		3				0	0
56		B	?						0	0
57		B	?						0	0
58	Car Nicobar	Cii	3			1	1	1	60	0
59		E	0						29	0
60		B	?						450	?

Key: Cave type, **A**= On coast, approachable on foot; **B**= On coast, entrance partially submerged and access by swimming into cave; **AB**= On coast, approachable on foot after swimming ashore; **BD**= Cave above sea level on cliff face ending in the sea; **Ci**= In the forest, at the origin of stream; **Cii**= In the forest, cavern below the ground; **Ciii**= In the forest; **D**= midway on inland cliff; **E**= Japanese bunker (man made tunnel).
⁺= As these caves were sheltered, marks of plucked nests probably persists from the previous season.

Note:

1. The locations of some caves in the Nicobar islands are not given because of commitments of secrecy to cave owners.
2. The cave numbers correspond to specific caves referred to in the text and in the maps.

Key: **CN**= Cave number, **CT**= Cave type; **ES#**= Total number of Edible-nest Swiftlet nests; **M+Fo**=fresh nests with only marks or foundation; **>¼** = Nests more than quarter completed; **>½** =nests more than half completed; **E** = Eggs present; **C** = Chicks present; **WBS** = Number of Whitebellied Swiftlet nests; **Bats** = Number of bats
+ = Present

Information Sheet : House Ranching

(From Nugroho and Whendrato 1996, and from Mardiastuti and Soehartono 1996).

The farming of swiftlets in human habitation began in Indonesia in the 1800s. Initially, the approach was passive, with little effort on the part of the house owners to improve conditions for swiftlets, as the colonisation of swiftlets in houses was considered to be merely a matter of luck. During this period, *C. esculenta* was considered a nuisance, as its use in the house farming of *C. fuciphaga* was not known. Subsequent to the 1950s, there was a distinct improvement in the house farming of swiftlets, with owners making significant efforts to improve productivity of their 'farms', but many of these efforts were not scientific, or based on an adequate knowledge of the species. Most importantly, the role of *C. esculenta* in developing house farms of *C. fuciphaga* had been recognized, and was being treated accordingly. Post 1990, there has been a considerable dissemination of information on house farming of swiftlets, based on the experiences of earlier periods, with the result that there has been a rapid development of swiftlet farming in Java, followed by Sumatra, Bali, Kalimantan, Sangihe and Sulawesi. Many of the smaller cities have between 60 and 150 swiftlet houses now, and the population of Edible-nest Swiftlet in farmed conditions is at a minimum of 5.5 million breeding pairs (derived from Mardiastuti & Mranata 1996). The Edible-nest Swiftlet in Indonesia is the most significant semi-domestication to have happened to mankind in the 20th century.

The process of establishing an Edible-nest Swiftlet colony inside a house is easy, but requires careful management. A house without swiftlets can be developed to attract swiftlets, or one that already has a colony of the non commercial species (e.g. the Whitebellied Swiftlet), can be improved upon. Since it is difficult to attract the Edible-nest Swiftlet into houses, the environment within a house with an existing colony of Whitebellied Swiftlet is developed. Once a colony of about 100 pairs of the Whitebellied Swiftlet is established, the process of introducing Edible-nest Swiftlet begins. This is through a process of cross fostering, whereby the eggs of the Whitebellied Swiftlet are replaced with the eggs of the Edible-nest Swiftlet. The Whitebellied Swiftlet looks after the eggs and young of the Edible-nest Swiftlet as if they were its own, and if the micro-habitat of the house is properly managed, a new population of Edible-nest Swiftlet is established.

Potential habitats for swiftlet farming are:

1. Areas with low grown plants (*c.* 1 m high), irrigated rice fields, dry fields, grasslands etc.
2. Areas with tall vegetation that include plantations of rubber, coffee and coconut
3. Aquatic areas including rivers, swamps, seas, lakes and ponds.

The management of the environment around the swiftlet houses include the following:

1. Providing space for flying routes in front of the 'roving room' or the main chamber of the swiftlet house through which the birds enter other rooms, and removing everything that restricts the flight paths.
2. Providing extra foraging area around the swiftlet house especially during the dry season.
3. Providing moisture around the house by the use of water misters.
4. By growing plants which attract or increase the number of aerial insects, the main food of swiftlets. Such plants include *Leucaena leucocephala*, banana, banyan, *Hibiscus tiliaceus*, acacia, pineapple, grasses etc.

5. Providing large ponds around the swiftlet farm for ephemeral flies, which are a favoured swiftlet food.
6. Providing a dough or mixture of special ingredients as a breeding medium for insects around swiftlet farms, particularly during the dry season when insect populations are low.

The management within the house to be developed for swiftlets include the following:

1. The boarding up of windows and doors to simulate cave like conditions with a light intensity of 2Ef or less.
2. The introduction of water in pans and pots into the rooms to increase and stabilise relative humidity at 80-90%, and also to bring down temperature which should be maintained at 24-26°C.
3. Providing and arranging beams of wood on the ceilings and walls of the darkened rooms on which the swiftlets will nest or roost.
4. Restricting or preventing predators of swiftlets from entering the swiftlet house, which include rats, geckos, snakes, cockroaches, ants and fleas.
5. Following strict and careful harvest regimes.
6. Maintaining a population of Whitebellied Swiftlet within the house so as to continuously transfer eggs of the Edible-nest Swiftlet into them, thereby ensuring an increase in the population of the Edible-nest Swiftlet while nest harvesting is done.

Swiftlet houses can be relatively quickly established. Cases from Indonesia include:

1. A house containing 216 nests of the Whitebellied Swiftlet was renovated in May 1993. Subsequently the house contained 618 nests of the Whitebellied Swiftlet and 105 nests of the Edible-nest Swiftlet.
2. A house containing 29 nests of Whitebellied Swiftlet was renovated. Seven months later the house contained 41 nests of Whitebellied Swiftlet and 90 nests of Edible-nest Swiftlet.
3. A swiftlet house containing 300 nests of Whitebellied Swiftlet and 20 nests of Edible-nest Swiftlet was renovated. The house subsequently contained 750 Whitebellied Swiftlet nests and 250 Edible-nest Swiftlet nests.

About SACON

Sálim Ali Centre for Ornithology & Natural History (SACON) is a society registered under the Society Registration Act, 1960. The objectives of SACON are: (1) to study India's biological diversity so as to promote its conservation and sustainable use; (2) to study the ecology of the Indian avifauna with special reference to its conservation; (3) to foster the development of professional wildlife research, in India, by training post graduates and forest managers; and (4) to function as a regional nodal agency for the dissemination of information on biodiversity and its conservation. The centre is an autonomous Centre of Excellence, aided by the Ministry of Environment and Forests, Government of India. The administration of SACON is vested in a Governing Council which includes the Secretary, and Financial Advisor to the Ministry of Environment and Forests, Government of India. SACON's research activities are moderated by a Research Advisory Council, constituted by renowned wildlife scientists, forest managers and policy makers.

The scientific staff are organized into the Divisions of Avian Ecology, Conservation Biology, Ecotoxicology, Environment Impact Assessment, Extension and Education, Library and Information, Modelling and Simulation, Terrestrial Ecology and Wetland Ecology. The research project of each division come under a few major themes or initiatives to which the division is committed. SACON is presently located at Kalampalayam, nine kilometres northwest of Coimbatore City, but will shift to its own campus at Anaikatti shortly.