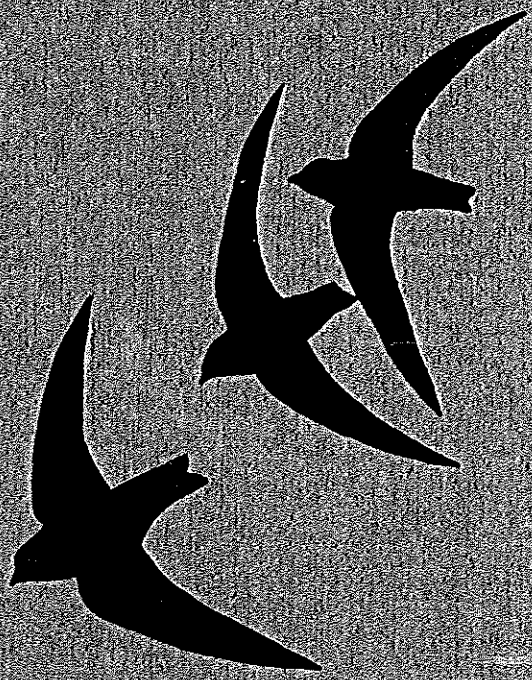
Impact assessment of nest collection on the Edible-nest Swiftlet in the Nicobar islands



R Sankaran

Sálim Ali Centre for Ornithology & Natural History

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A study funded by TRAFFIC-India / WWF-India

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Foreword

Misconceived beliefs and human avarice have lead 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 swiftlets 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 swiftlet rank amongst the world's most expensive animal products, being US $ 2629-4060 for a kilogram in Hong Kong. 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 Nicobar islands as well, where there has been a decline of nearly 85% of the population of the Edible-nest Swiftlet over the last few decades.

Realizing the rapid decline of the population of 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 has been confined to the Nicobar 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 suggestions for the conservation of this species.

Dr V.S. Vijayan
Director

Abstract

Ever since swiftlet nests became an important item in Chinese cuisine and pharmacy, Edible-nest Swiftlet have been exploited throughout their range. Today, at US $ 2629-4060 a kg, the edible nests of swiftlet rank amongst the world's most expensive animal products. India has two species of swiftlet that make edible nests. The Indian Edible-nest Swiftlet *Collocalia unicolor* is found in the Western Ghats, the Malabar coast and in Sri Lanka. The Edible-nest Swiftlet *C. fuciphaga* occurs in the Andaman & Nicobar islands. The nests of *C. unicolor* have an admixture of grass, moss or feathers, and is of a lesser value. *C. fuciphaga* makes nests wholly of saliva, which is of a very high commercial value. The Edible-nest Swiftlet are currently not covered by International Trade Laws, and in India receives no protection by Law as it is not even in Schedule IV of the Indian Wildlife (Protection) Act.

The population of *C. fuciphaga* was estimated to be between 2500 and 3600 breeding birds. Nest collection had taken place in 24 of 36 caves in the Nicobar islands; in 23 it was very intense. In 16 of these, the proportion of plucked nests to the total nests was 90% or more, and in 12 it was 100%. In only one cave was it very low (6 %). Intensity of nest collection was the greatest in the Great Nicobar group where only 14% of the nests were intact. In the Nancowry group, 24% of the nests were intact (excluding the one cave where nest collection pressures were unusually low). The decline in population was evidenced through a decline in yields, which ranged between 40% and 95% over the last decade or two, with only one cave not having undergone a significant loss in yield.

The Edible-nest Swiftlet in the Nicobar islands is Critically Threatened (IUCN criteria A1c), as it has undergone a reduction in numbers greater than 80% over the last 10 years. The immediate measure to be taken is to include this species in Schedule I of the Indian Wildlife Protection Act (1972). The only practical way of conserving the species is by effectively stopping the movement of swiftlet nests between and out of the islands, by checking people and cargo embarking or disembarking on all ships and flights to the mainland. Inclusion in at least Appendix II of CITES, will result in importing countries not accepting consignments from India, which would help the conservation of the endangered Indian populations of the Edible-nest Swiftlet.

Keywords: Edible-nest Swiftlet, Andaman & Nicobar islands

Introduction

If it were not for a fascinating biological quirk, that of building their nests entirely out of saliva, the Edible-nest Swiftlets would not have been threatened today. Ever since the 16th century, when swiftlet nests became an important item in Chinese cuisine and pharmacy, Edible-nest Swiftlet 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). Today, 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 (nest 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..' (Lau & Melville 1994). There is little scientific research on the medicinal properties of birds' nests, and whether there is in reality any medicinal value is still open to question (Lau & Melville 1994).

The genus *Collocalia* consists of 30 species 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 south-west pacific (Sibley & Monroe 1990, 1993). The nests of four species of *Collocalia* are commercially exploited: *C. fuciphaga*[1] and *C. germani* make nests purely of saliva and are called White-nest Swiftlets; *C. maximus* and *C. unicolor* have admixture of feathers and vegetation, are called Black-nest Swiftlets, and require processing before they can be consumed and are of a lesser value. Limited quantities of nests of other species are reported to be collected (Lau & Melville 1994), particularly during times of high demand.

Even though rigorous (search & collect?) and repeated nest collection does not significantly reduce the size of the breeding population (Medway 1966), 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 and extinction of others and by the slump over recent years of bird nests being imported into Hong Kong (Lau & Melville 1994).

Edible-nest Swiftlets in India

India has two species of swiftlet that make edible nests. The Indian Edible-nest Swiftlet *Collocalia unicolor* 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. The nests of *C. unicolor* have some admixture of grass, moss or feathers, which necessitates

[1]Considerable confusion exists in the taxonomy of swiftlets, including the segregation of genera. The Edible-nest swiftlet in the Andaman and Nicobar islands was thought to be a subspecies endemic, *Collocalia fuciphaga inexpectata* (Abdulali 1964, 1967, Ali & Ripley 1983). However, Howard & Moore (1991) considered the Edible-nest swiftlet from the Andaman and Nicobar islands to be *Aerodramus fuciphagus*, which ranges over much of Indonesia. Lau & Melville (1994) called it *Collocalia fuciphaga*. In this report, I follow Abdulali (1964, 1967), Ali & Ripley (1983) and Lau & Melville (1994). All references of the genus *Aerodramus*, from the literature quoted here, have been referred to as *Collocalia*.

processing before consumption, thereby reducing its commercial value. *C. fuciphaga* makes the highly sought after 'white' nests, wholly of saliva, and is of high commercial value.

History of nest collection in the Nicobar islands

During the British Raj, contracts were annually auctioned for the export of *C. unicolor* nests to China, but this trade faded out at the turn of this century, as a result of 'over-exploitation of the colonies and the disproportionate risks and organization involved in collecting the nests' (Ali & Ripley 1983). The history of trade in nests of *C. fuciphaga* from the Andaman & Nicobar islands is uncertain, but has been going on since at least two to three centuries (Barbe 1846, Beavan 1867, Anon. 1892). Amongst the earliest references to trade of any kind in the Nicobar islands was from 851 A.D., when two Arab voyagers traded cloth and iron for copra and ambergris (Kloss 1903), but there is 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 tobacco 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 and ambergris were sought after as well. 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. Though traders and trading outposts were present in the Nicobar islands through these centuries, much 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 late 1960's, the Indian Government began settling people on Great Nicobar and Katchall and by the early 1970's a considerable mainland Indian traffic, and resident population were established. 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 over a few decades.

Local Names

The Edible-nest Swiftlet (and the Whitebellied Swiftlet: as both are believed to be the same) is called *Likup* on Car Nicobar, *Hikai* in Nancowry and *Linkeh* in Chaura. I was unable to ascertain its Nicobari name in the Great Nicobar group of islands. The common name for this species used and known by all people in the Andaman & Nicobar islands is *Havabil*.

Legal Status

The Edible-nest Swiftlets are currently not covered by international trade laws, though proposals to include them in Appendix II of CITES have been mooted (Lau & Melville 1994). In India, the Edible-nest Swiftlet receives no 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 tribes of the Andaman & Nicobar islands from the Indian Wildlife (Protection) Act (1972), they can legally collect nests.

Little has been recorded about the biology or ecology of Edible-nest Swiftlets found in India. The only article in recent times about the trade of these highly persecuted species was by Narayan (1991). Such basic information as the number of colonies and their locations does not exist; the extent of trade is unknown. Such information is important for the conservation of the species, and perhaps the sustainable exploitation of this natural resource.

Objectives

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

Methods

The survey of the Nicobar islands for the Edible-nest Swiftlet was conducted between 9 March 1995 and 16 May 1995. Swiftlet caves were located by the help of nest collectors or by boating along the coast and looking for caves. A total count of the nests was made, and in those cases where there were too many nests (as in the case of Whitebellied Swiftlet *Collocalia esculenta*), the number of nests were counted in groups of 10. The nests of the Edible-nest Swiftlet were differentiated into two categories. Those where the nest cup was partially constructed or complete were considered to be intact, while those where only the marks of the nest (evidenced by a shiny semicircular stain on the rock), or where a few white strands of nest cement were present were considered to have been plucked.

The upper limit of the population estimate of the Edible-nest Swiftlet was arrived at by adding the number of plucked nests and intact nests, and a lower limit for the population estimate as 36% of the number of plucked nests plus the number of intact nests (see below). There were however, certain problems in estimating populations of Edible-nest Swiftlet based on nest counts. The more troublesome ones were:

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.

   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). As most caves (30 of 36) 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. Six caves were inland and sheltered from the elements, and in at least one of these marks from the previous seasons persisted. I have assumed that the marks of nests plucked in the previous season get obliterated by the subsequent season, but have noted the exceptional caves in the relevant table.

b) New nests under construction or rebuilding of nests after nest collection, were present in most caves, and were

evident from strands of salivary cement attached to the walls. This led to problems of differentiating between nests in the very early stages of building and rebuilding with those recently plucked, as the entire nest is often not removed from the wall and bits of nest cement remain. I have assumed that all nests with only bits of nest cement present are nests which had been recently plucked. It is likely that this would have resulted in a bias towards plucked nests .

c) The population estimate is based on intact and plucked 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 its inclusion in the count.

Nest-site fidelity has been demonstrated in the Chimney Swift *Chaetura pelagica* (Dexter 1977), and has been assumed for swiftlets by Medway (1962b) and Kang *et al.* (1991), based on renesting at the same spots. However, in one cave surveyed by me, there were 18 marks of plucked nest, but only 13 birds roosted, which indicated that renesting does not necessarily take place at the same spot. 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. To arrive at a range for the population estimate, I have used total nests (both intact and plucked) for the upper limit, and 36% of number of plucked nests plus the number of intact nests for a lower figure; 36% was arrived at based on observations at the above mentioned cave.

d) Nest collection in some caves is so intense that swiftlets barely build 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 overestimated.

I 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 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 did not make particular attempts to do so primarily because of the considerable disturbance caused to the birds by human presence.

The 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 Burma in the north to Sumatra in Indonesia in the south, between latitudes 6° 45' and 13° 41' and longitudes 92° 12' and 93° 57' (Saldanha 1989), and are a southern extension of the Arakan Yoma mountain range. The island group consists of over 300 named and un-named islands and over 260 named and un-named rocks (Singh 1981), with a total coastline of about 1962 km. The entire island group covers 8,249 sq km; the Andaman group with over 325 islands (21 inhabited) covering 6,408 sq km, and the Nicobar group with 23 islands (12 inhabited) with an area of 1,841 sq. km.

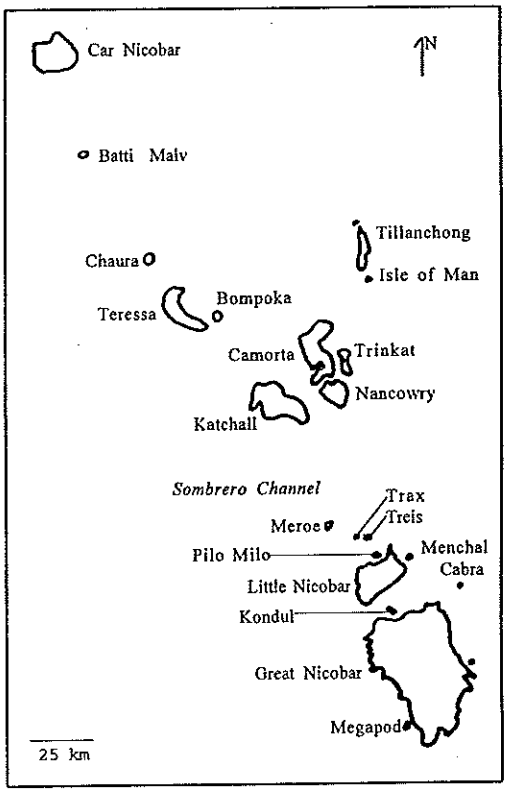

Figure 1. The Nicobar group of islands

The Nicobar islands can be divided into three distinct subgroups. To the south is the Great Nicobar group consisting of 11 islands four

of which are inhabited. The Nancowry group is 58 km north of the Great Nicobar group, and consists of 10 islands , seven of which are inhabited. 88 km north is the Car Nicobar subgroup. Only Car Nicobar is inhabited. (See also Sankaran 1995).

The topographical characteristics of the islands vary. Both Great and Little Nicobar have steep hills, with rocky shores and cliffs at several places along the coastline, and the smaller outlying islets are often a single low hill. The islands in the Nancowry group are undulating with a few rounded hills. Only Bompoka and Tillanchong in this group have steep hills. Chaura is flat with a steep mesa at one corner. Car Nicobar is flat.

The Nicobar group was colonised by people of mongoloid origins 'sometime before the Christian era' (Singh 1978). Two distinct groups of indigenous people are present. The Nicobaris inhabit the coast of 12 islands while the Shompen, who are essentially an interior forest dwelling tribe, only inhabit Great Nicobar. The colonisation of these islands by Indian mainlanders began in 1969 when 337 families were settled on Great Nicobar, and in the early 70s when 268 families of Sri Lankan repatriates were settled on Katchall. Subsequently, there has been a rapid growth of population in the labour, fishing and trading sector.

Results & Discussion

Status

Of the 60 caves surveyed in the Nicobar islands, cave dwelling species (Edible-nest Swiftlet, Whitebellied Swiftlet and bats) were present in 51. The Edible-nest Swiftlets were nesting in 36, exclusively occupying 15 caves and in 21 caves together with the Whitebellied Swiftlet (Table 1). Bats were present in 20 of the caves occupied by swiftlet, in 17 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 1).

The population of breeding pairs of Edible-nest Swiftlet in the Nicobar group was estimated to be between 1244 and 1791 (Table 2). Although the Great Nicobar group has the largest number of caves (27) with Edible-nest Swiftlet breeding in them, the population is less than that of the Nancowry which

Table 1. Number of caves occupied by cave dwelling species (swiftlets and bats) in the Nicobar islands.

Species	Number of caves
Swiftlets	50
Exclusively Edible-nest Swiftlet	15
Exclusively Whitebellied Swiftlet	14
Edible-nest Swiftlet and Whitebellied Swiftlet	21
Bats	21
Edible-nest, Whitebellied Swiftlet and Bats	17
Only Edible-nest Swiftlet and Bats	0
Only Whitebellied Swiftlet and Bats	3
Exclusively bats	1

had only seven caves with Edible-nest Swiftlets (Appendix). The Nancowry group had the largest population of breeding pairs (980-1222), followed by the Great Nicobar group (261-580). 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. The population of breeding birds in the Nicobar group of islands is therefore between 2500 and 3600 birds.

Nest collection had taken place in 24 caves out of the 36 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), and only one cave (CN 8 in Appendix) had 21 nests. The intensity of nest collection is evident from the proportion of plucked nests to total nests present. In 23 of 24 caves where nest collection had taken place, the ratio of plucked nests to the total was 50% or more (mean 89% ± 16, range 50-100%). In 16 of these, the ratio of plucked nests to the total nests

Table 2. Population estimate of breeding pairs of the Edible-nest Swiftlet in the Nicobar group of islands.

Island Group	No. of Caves	Swiftlet nests		Estimated no. of breeding pairs
		Intact	Plucked	
Great Nicobar	27	82	498	261 - 580
Nancowry	7	851	357	980 - 1222
Car Nicobar	2	3	0	3 - 3+
Total	36	936	855	1244 - 1791

was 90% or more, and in 12 caves it was 100%. The number of nests in caves where nest collection took place was higher than those in which it did not (n=23, mean=41 ± 66, range = 4-290). In only one cave (CN 45 in Appendix) was the ratio of nests collected to those present very low (6 %). This cave had the largest number of intact nests.

Of the total nests seen, 53% were intact. However, it is only 19% if the one exceptional cave (CN 45) is excluded. Intensity of nest collection was the highest in the Great Nicobar group where only 14% of the nests seen were intact. In contrast, in the Nancowry group 70% of the nests seen were intact. This however was due to one cave (CN 45), where nest collection pressures were unusually low. If this cave is excluded from the analysis, then only 24% of the nests were intact.

The decline in population of the Edible-nest Swiftlet, over the last decade or so, was evidenced through a decline in yields. Reliable information was available only for 6 caves (Table 3). 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 3).

Table 3. Past and present nest yields for some caves.

Cave	Nest Collectors		Ownership[1]	Yield (kg)		%
	Non-tribal	Tribal	Status	8+yrs ago	Now	Decline
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
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 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).

Nesting Season

The exact nesting season of the Edible-nest Swiftlet could not be determined. In the Nicobar group of islands, they probably

begin building nests in mid November and continue till May, and 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). Onset of nesting in *C. fuciphaga* in the Nicobar islands corresponds to that of *C. maxima* (Black-nest Swiftlet) which begins nesting in November, but its duration is shorter as the latter's nesting period continues over nine or more continuous months (Medway 1962b). 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 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. Moreover, caves on the coast are subject to tidal action, and these would be subject to considerable sea spray which may inhibit nesting.

There was no synchronisation of nesting in the Edible-nest Swiftlet (Table 5). Nests were being built, or had eggs or young from end of March, until early May. This can be attributed both to a protracted breeding season (as compared to most other species) within which the species exhibits asynchronous hatching (Langham 1980), as well as the nest collection regimes which would result in staggered nesting phases. In contrast, the Whitebellied Swiftlet had eggs and young in early April, in some cases nearly fledged young, and by early May the chicks had fledged or were about to in most caves. This may indicate that a significant proportion of the chicks in successful nests in the Edible-nest Swiftlet in the Nicobar islands would fledge at or after the onset of the monsoon (mid May).

Table 4. Dates of nest completion and presence of eggs or young in swiftlets during the survey.

Dates	Edible-nest Swiftlet				Whitebellied Swiftlet		
	UC	C	E	Y	C	E	Y
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

Habitat

Both species of swiftlet nested in caves with uneven walls whose surface was either smooth or slightly rough, and did not use those in which the walls were jagged. The nesting habitats available to the swiftlets in the Nicobar islands were of three broad types. The type most commonly encountered were caves on cliff or rock faces along the shore (n=43), where sea water either entered it during high tide (n=32), or the floor of the cave was submerged (n=11). The latter type had to be swum into while the former could be approached during low tide. In a few cases rock arches in the sea or on the shore (3 of 32) were used by swiftlets to nest in.

The second type of cave was found in hilly or undulating forest, often some distance away from the shore. These were less frequently encountered (n=7), probably because of the difficulty in finding them, and it is likely that a few such caves remain undiscovered. Caves within the forest were of two types. The first were caves on cliff or rock faces within the forest (n=5). Two of these were at the origin of streams, and the floor in one was submerged in dank guano rich water. The second type was considerably more interesting. These (n=2) were present in undulating terrain, below ground, and were approached by descending into the cave. These appear to be limestone caves as indicated by the presence of stalactites and stalagmites.

The third type of habitat in which swiftlets nested was man made. These were bunkers made during the II World War by the Japanese occupation forces. Only the Whitebellied Swiftlet was seen in these bunkers (n=1, but more were reported).

The size of the caves varied considerably. The width of the caves varied between one and 15 m (mean 5 m ± 4 m), the length between three and 60 m (mean 15 m ± 13 m) and the height between two and 15 m (mean 5 m ± 3 m). The largest were the underground caverns.

The Edible-nest Swiftlet uses echo-location to find its nesting and roosting site (Langham 1980, Medway 1962c), and apparently had distinct preferences of cave type and location within the cave for nesting, though there were several exceptions to this. Generally, caves in which Edible-nest Swiftlet nested were deeper with little or no light entering it.

These swiftlets preferred to nest deeper in the cave, though some nests were found at the mouth, inside well lit caves or in some cases in a crack in the rock above or beside a cave (see also Francis 1987). A couple of nests were in a crack, just within the mouth of a cave, that was barely two to three inches wide; to reach the nests, the birds would virtually have to scramble up the 'chimney'!

Though the three cave dwellers were found to co-exist, there appeared to be a tendency to segregate. While the Whitebellied Swiftlet, which cannot echo-locate and hence must limit its incursion into the cave only till the twilight zone (Medway 1962c), nested closer to the mouth of the cave, the Edible-nest Swiftlet tended to nest deeper inside the cave, while the deepest reaches were occupied by bats. Though nesting aggregations of both species of swiftlets were often intermixed, there was apparently a strong tendency for conspecifics to cluster together. Segregation was most marked between the areas where swiftlets nested and where bats roosted, although some intermixing was discernible. It was also reported 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.

Nest Collection

Nest collection was said to begin by the end of February. There were three patterns of nest collection, depending on who collected it. Three groups of people collect nests: Indian mainlanders, both settlers as well as people in the labour workforce and fishing sectors, the Nicobaris, and Thai poachers. As the access to some caves is by boat only, 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). The Shompen have no use for money yet, and they do not collect nests to sell, but only do it as a favour to their Indian mainlander 'friends'.

Where Indian mainlanders are the nest collectors, nest collection is extremely intense. In such caves, nest collection is carried out throughout the breeding season, at least once in eight to 10 days or even less, and all nests are plucked off the walls irrespective of whether or not there are chicks or

eggs in them. In one reported case, a pile of chicks and eggs about a foot or more high, was left behind by nest collectors. Nest collection by Indian mainlanders goes on in at least nine caves in the Great Nicobar group and at least two caves in the Nancowry group. An alarming trend in recent times is that even school going boys from Campbell Bay, Great Nicobar are now engaged in nest collection. In all caves visited by Indian mainlanders, there is very little recruitment to the population of swiftlets due to the intensity of nest collection, and the steepest declines in populations have been in caves where the collectors are Indian mainlanders.

Nest collection by Nicobaris is less intense and destructive than by 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 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. However, here too there have been crashes in populations (CN 43, 44, 47 & 48) due to theft by others (other Nicobaris and probably non-tribals), and the owners of CN 47 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), were any traditional rituals attached to nest collection, and this was the only cave where a largely intact population existed.

Thai poachers, who come to the Nicobar islands between November and April-May, also collect nests. Caves which are particularly affected by them include CN 3 to 26, and in Tillanchong island (which was not surveyed by me). 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.

Nest Yield

The quantum of nests collected in the Nicobar group of islands is uncertain. It was reported that total nest collection was about 100 kg per annum. 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 1.25 to 2.25 kg of nests. Assuming that only completed nests are collected in three harvests, then to produce 100 kg of nests the population base should be between 4375 and 7800 pairs (depending on whether we take 70 or 125 nests per kg). Even accounting for a greater proportion of renesting after loss of nests (Medway 1962 a), or that by a greater frequency of harvests more can be 'milked' out of the birds, (at 100 pairs yielding 2.12 kg per season in five harvests with renesting after the first at 100% and subsequently 41%), the reported nest yield from the Nicobar islands appears to be much too high.

In the Nicobar islands, in caves where the approximate yield was known (Table 3), for a population of about 578 pairs, the yield was 15.78 kg. Using this ratio, if we estimate for caves where the nest yield is not known, then the annual yield of swiftlet nests in the Nicobar islands is about 30 kilograms. Alternately, for a population of between 544 and 1091 birds (Table 2; excluding unharvested population in CN 45), and at 70 nests per kg, the yield in the Nicobar islands is between 20 and 40 kg (at 125 nests per kg the yield is between 11 and 23 kg). In my opinion, the total nest yield in the Nicobar islands is between 30 and 40 kilograms.

Value and Trade

In 1995, the purchase price of one kg of swiftlet nests at Port Blair was between Rs 20,000 and 22,000 /-. 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 has been between a 75 and 100% increase in the purchase price of nests over the last one year. The 1994 purchase prices ranged between Rs 12,000 and 15,000 a kg at Port Blair, while at Campbell Bay, the price was between Rs 7,000 and Rs 10,000 a kg.

At such profit margins, it is not surprising that there is no dearth of collectors and traders of swiftlet nests. On most islands several general merchants, shop keepers, traders, and *paan wallahs* trade in nests. The inter-island ships which ply through the Nicobar islands at least once every 10 days invariably have traders on them, many of whom deal in swiftlet nests, some exclusively in animal products.

Conservation Perspectives

Impact of nest collection

The decline in populations of Edible-nest Swiftlet has been enormous over the last decade in most caves, probably to the tune of 85 % or more (Table 3). In only one cave out of 36 in the Nicobar islands has the population remained more or less stable over the years. It is clear that in the Nicobar islands nest collection 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 assuming that all pairs with intact nests would have successfully raised young, the breeding success in the Great Nicobar group would have been as low as 14%, and in the Nicobar islands merely 19%. In contrast, under virtually unharvested conditions, the overall breeding success is as high as 48%, that is 0.94 young per pair per annum 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 tended by the parents when they leave the nest, nor are they taught to catch food, about feeding areas and about predators (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 Nicobar islands because of heavy nest collection pressures. Thus, the decline in population in the Edible-nest Swiftlet has probably been due to annual mortality being greater than annual recruitment to the population.

There is a sharp decline in the percentage of birds that renest after nests are removed (Kang *et al.* 1991), or where eggs or chicks were lost (Langham 1980). After the loss of the first

nest due to removal, only 71% of the birds renested, but only 41% renested after the second harvest (Kang *et al.* 1991). Similarly Langham (1980) documented a 55% renesting after the first loss of eggs or young, and only 19% at a second attempt. Thus, protracted and continuous nest collection, as is the case in the 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 south-west monsoon. Inclement weather, and presumably a decreased prey base would probably increase the mortality rates of the fledglings.

Intensive and sustained nest collection has other repercussions as well. Though Kang *et al.* (1991) found that nest size and weight are not significantly compromised between the first and second renesting attempts, I made a few observations which were contrary to this. The eggs and chicks in two nests in CN 49 were in incompletely built nests, posing a greater risk of the chicks or eggs falling out. At least three pairs of Edible-nest Swiftlet had merely lined the nest of a Whitebellied Swiftlet with salivary cement, indicating inability to sustain nest building, and it is probable that under heavy nest collection pressures, nest size and quality are compromised.

There are ecological problems too with a reduction in populations. As there are three species competing 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 one or both of the other two species. This was evidenced in those caves where some light filters through. Entire walls of caves which once were covered with nests of Edible-nest Swiftlet, are 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 two species and regains nesting space in the caves.

Status

Although most caves which had Edible-nest Swiftlet in the past continued to have them, albeit in much reduced numbers, the reduction in population in the Nicobar islands indicates that this species ranks amongst India's most threatened species of avifauna. The application of the IUCN criteria that designated threat status (Collar *et al.* 1994), indicates that 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, and unless urgent measures are undertaken, it is likely that the Edible-nest Swiftlet will become extinct in most islands in the Nicobars in a few years.

Can there be sustainable exploitation?

As even rigorous and repeated nest collection does not significantly reduce the size of the breeding population (Medway 1966), nest harvest of Edible-nest Swiftlet can be a remunerative and sustainable way of exploiting a natural resource. This has largely been the reasoning behind the non-inclusion of Swiftlets in Appendix II of CITES.

Swiftlet nest harvesting, particularly in small populations that occupy caves where all nests can be easily plucked, has to be very 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 (Langham 1980, Kang *et al.* 1991). Thus, Kang *et al.* (1991), recommended an interval of a minimum 130-135 days (*c.* 4 months) between harvests. Further, Kang *et al.* (1991),

recommended that '.. the first nest of the season can be taken, preferably within 40 days of the start of the season so that few nests will contain eggs. The colonies should then be closed for a period of 135 days, after which harvesting may continue till the end of the breeding season. Under no circumstances can nests with eggs or chicks be removed....' `In effect three sets of nests could be obtained, but the 135 day 'closed' season would allow for time for both species to fledge young in the middle of the breeding season when chances of survival are presumably still good...' `Only in this way could sustainable-yield harvesting have a chance of being maintained.' Can such a harvest regime be implemented in the Nicobar islands? I believe not, because:

1. Assuming that the nesting season of the Edible-nest Swiftlet begins in early November, then according to prescribed harvest regimes (Kang *et al.* 1991), the first harvest of the season should take place until the end of December, after which, there should be a closed season for 135 days, or till the first week of May. As 14 Edible-nest Swiftlet caves (58% of the caves where collection takes place) in the Nicobar islands, are accessible by swimming into the cave or near it, and a few more in fairly dry weather, these caves are approachable only when the sea is calm (mid January to April. Therefore, harvesting in most caves in the Nicobar islands can take place only during the peak nesting period.

2. If early season harvesting is not possible due to inclement seas, then an alternate sustainable harvesting regime would be a 135 to 140 day closed early nesting period, that is November to March, with harvesting commencing in April. However, in the Nicobar islands nest collection starts as soon as the caves are approachable, approximately 70-75 days into the breeding season, when the nests have eggs or young (see 4 below).

3. Renesting declines significantly with successive harvests (Kang *et al.* 1991, Langham 1980). The populations of the Edible-nest Swiftlet in most caves in the Nicobar islands are low and too small to remain stable, or grow, even by well managed nest harvesting regimes, because significantly reduced renesting success will result in only a very few pairs of each cave breeding successfully.

4. Sustainable harvest of nests is possible only in caves where some form of ownership or traditional harvest regime exists. In those cases, as sustainable harvest regimes make long-term commercial sense, it would be possible to regulate nest collection along desirable lines by educating and motivating owners. However, in the Nicobar islands, only five caves of 36 are 'owned', only two of which have fairly high populations of swiftlet. Thus, while it may be possible to effect sustainable harvest regimes in those two caves, it is not possible in any of the other caves because the nests in these are collected by a number of independent collectors (the avarice of the few whom I met clearly outweighed their concern for declining yields). As the swiftlet populations are small, there are not enough nests to go around and every bit of nest cement is plucked in frequent visits so as to get something before the next collector does.

I therefore believe, that the current populations cannot sustain further collection, and that in the present scenario, sustainable harvesting of nests in the Nicobar islands is not possible.

Conservation

The immediate measure to be taken is to include this species in Schedule I of the Indian Wildlife Protection Act (1972), as the species meets necessary criteria for inclusion, that is declining numbers and exploitation.

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 raid the cave at night.

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, all cargo and baggage leaving the islands or entering the mainland, that is at the ports of Car Nicobar and Vishakapatnam, and the ports and airport of Port Blair, Madras and Calcutta, must undergo a

'customs check for animal products'. 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, particularly that of swiftlet nests, is sufficiently alarming in the Andaman & Nicobar islands to warrant the development of the necessary infrastructure to effectively check the trade in swiftlet nests.

While there is need to tackle the swiftlet nest trade within the Andaman & Nicobar islands, there is also a need to ensure that the trade is regulated if not banned in the importing countries. The best possible way that this can be achieved, is by including the Edible-nest Swiftlet in Appendix I of CITES. That this has not been recommended (Lau & Melville 1994), is largely due to the existence of certain enormous colonies (e.g. Niah Cave, Sumatra) in south-east Asia, where it is possible to sustainably harvest this valuable resource. However, continuing trade in the species is resulting in localised rarity and possibly extinction in smaller populations, which undoubtedly is a precursor to much greater declines every where.

Even an inclusion into Appendix II of CITES will prove beneficial to declining populations like those in the Nicobar islands (and possibly the Andamans as well). As Lau & Melville (1994) have said in their recommendation to include the swiftlets in Appendix II of CITES, 'Importing countries could only accept nest shipments which were accompanied by export permits issued by a specific government agency.' Thus, the inclusion of swiftlets in Appendix II of CITES, would result in a much needed curb on nests of Indian origin in the importing countries which would greatly help in the conservation of the Edible-nest Swiftlet in India.

Conclusions

The Edible-nest Swiftlet in the 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 current level and intensity of nest collection. Moreover, because most caves in the Nicobar islands are not owned and nest collection is done by several independent collectors, sustainable harvesting regimes cannot be established. The only way that extinction of this species in most caves in the Nicobar islands can be prevented is by: (1) including this species in Schedule I of the Indian Wildlife Protection Act (1972); (2) effectively stopping 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; (3) inclusion of the swiftlets in Appendix II, if not Appendix I of CITES, to prevent or regulate international trade.

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

No.	Cave type	Edible-nest swiftlet No. of nests counted			Whitebellied Swiftlet	Bats
		Total	Intact	Plucked	No. of Nests	No.
Island Group: Great Nicobar						
1	A	18	0	18	0	0
2	A	31	2-3	27-28	2500-3000+	>2000
3	B	91	0	91	750-1000+	+
4	B	17	1	16	0	+
5	B	4	0	4	100-150	+
6	AB	0	0	0	150-200	0
7	AB	0	0	0	18	0
8	B	21	21	0	6	0
9	A	4	0	4	27	200+
10	A	0	0	0	91	0
11	A	7	0	7	250-300	+
12	A	20	0	20	0	0
13	A	1	1	0	40-45	+
14	A	0	0	0	250-350	0
15	B	4+	4+	0	50-60	+
16	A	3	3	0	0	0
17	A	12	0	12	125-150	+
18	A	1?			80-100	+
19	A	1	1	0	0	0
20	AB	15	0	15	8	0
21	AB	65	16	49	0	0
22	AB	30	4	26	0	0
23	AB	16	6	10	0	0
24	B	6	3	3	0	0
25	B	0	0	0	4	0
26	B	184	3	181	0	0
27	A	3	3	0	300-350	+
28	A	0	0	0	47	0
29	A	3	3	0	175-200	+
30	A	6+	3+	3	2	0
31	A	5	0	5	0	0
32	A	6	0	6	14	1
33	A	6	6	0	0	0
34	A	0	0	0	0	25-30
35	A	0	0	0	4	0
36	AB	0	0	0	37	+
37	AB	0	0	0	1	0
38	A	0	0	0	1	0
39	A	0	0	0	350-400	+
40	A	0	0	0	120	0

Appendix contd...

No.	Cave type	Edible-nest swiftlet No. of nests counted			Whitebellied Swiftlet No. of Nests	Bats No.
		Total	Intact	Plucked		
Island Group: ***Nancowry***						
41	B	12-15	0	12-15	400-500	40-50
42	B	42	4	38	600-800	0
43*	Ci	14	0	14	125-150	5-6000
44	Cii	1	1	0	110-125	10000+
45*	Ci	750-800	700+	50-100	0	1500+
46	Ciii	0	0	0	150-175	500+
47*	D	<300	85-90	200+	0	0
48*	D	<50	6	40+	0	0
Island Group: ***Car Nicobar***						
49	Cii	3	3	0	50-60	0
50	E	0	0	0	29	0
51	B	?	?	?	400-450+	?

Key: Cave type, A= On coast, approachable on foot; B= On coast, entrance partially submerged and must be swum into; AB= On coast, approachable on foot after swimming ashore; Ci= In the forest, at the origin of stream; Cii= In the forest, cavern below the ground; Ciii= In the forest; D= On inland cliff; E= Japanese bunker (man made tunnel).

*= As these caves were sheltered, marks of plucked nests probably persists from the previous season (see methods).

Note: The locations of caves are not given because of the risk of the data presented here being misused. The cave numbers correspond to specific caves referred to in the text.

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 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 adminstration 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.