Status Survey of Endangered Species

Status Survey of Indian Edible-nest Swiftlet *Collocalia unicolor* (Jerdon) in Western Ghats, West Coast and Islands in Arabian Sea, India

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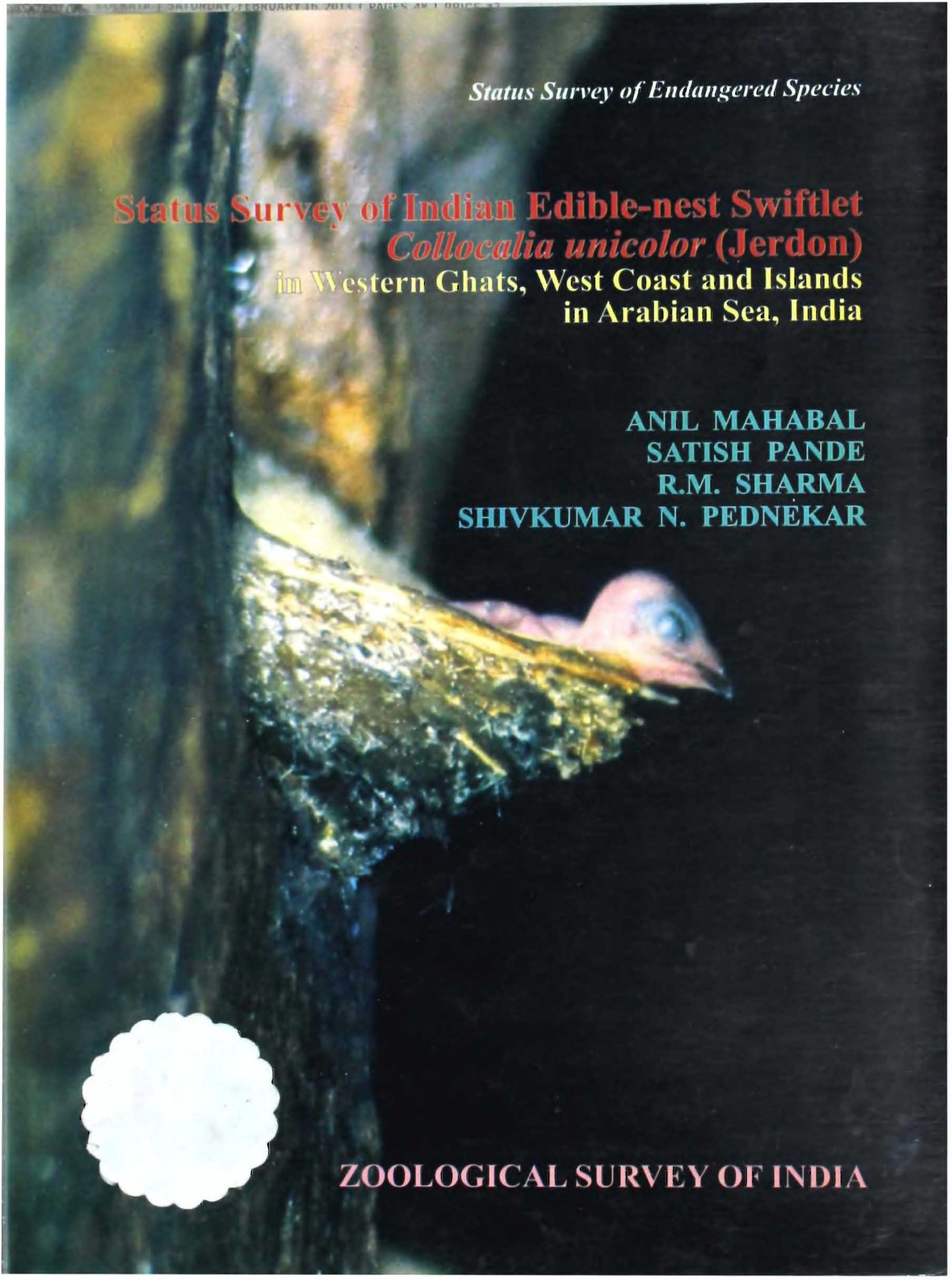

ZOOLOGICAL SURVEY OF INDIA

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Zoological Survey of India
Kolkata

CITATION

Anil Mahabal; Satish Pande, Sharma, R.M.; Pednekar, Shivkumar N. 2007. *Status Survey of Endangered Species,* Status Survey of Indian Edible-nest Swiftlet *Collocalia unicolor* (Jerdon) in Western Ghats, West Coast and Island in Arabian Sea, India : 1-52. (Published by the Director, *Zool. Surv. India,* Kolkata)

Published : May, 2007

ISBN 978-81-8171-145-8

PRICE

Indian Rs. 350.00

Foreign : $ 25; £ 20

Published at the Publication Division by the Director Zoological Survey of India, 234/4, AJC Bose Road, 2nd MSO Building, 13th floor, Nizam Palace, Kolkata 700020 and printed at M/s Shiva Offset Press, Dehra Dun 248 001 (Uttarakhand).

ACKNOWLEDGEMENTS

The authors are thankful to Director, Zoological Survey of India, Kolkata and the Officer-in-Charge, Zoological Survey of India, W.R.S., Pune for permitting to undertake the studies and providing the necessary facilities to carry out the field work. We acknowledge the support of the officers and other staff members of W.R.S., Pune, particularly Shri P.W. Garde, Artist for drawing the maps and Shri Sunil Salunke for skillful driviing. We also thank Shri Rati Ram Verma, Publication Production Officer, ZSI, Kolkata for accomplishing the work of publication in time and Shri Nikhil Bhowmik, Senior Artist, ZSI, Kolkata for help for drawing of maps.

We thank the forest department and the PCCF (Forest and Wildlife), Nagpur, Maharashtra state, CCF (T), Pune, CF, Kolhapur and especially Vikas Gupta, IFS, DCF, and RFO's, Sawantwadi for the necessary permission and assistance in field surveys and Dr. P. G. Diwakar, Scientist 'D' of Botanical Survey of India, WRC, Pune for identification of flora.

We (SP, SNP) thank Vice Admiral M.P. Awati (Retd) Chairman Ecological Society, for facilitating the Ocean Bird Surveys and Pelagic Survey in the Arabian Sea off the west coast of India and of the Lakshadweep Archipelago. We thank Director General Coast Guard, New Delhi and Commander Coast Guard, Western Region, Worli, Mumbai for providing the ships for the surveys. We thank Commanding Officer ICGS AMRIT KAUR CO L. S. Pangtey and Commanding Officer ICGS ANNAE BESANT CO S. Paramesh for extending all the cooperation during the actual pelagic surveys and making them successful.

We (SP, SNP) thank ELA Foundation, Pune, for supporting the survey especially the members of ELA Foundation for participating in the Pelagic and other surveys. They are Niranjan Sant, Satish Ranade, Premsagar Mestri, Prashant Deshpande, Vaibhav Deshmukh, Sanjay Kharat, Nitin Sakhdeo, Pranav Pandit, Adity Ponkshe, Dr. Chandrakant Shete, Shri. Bhosale and Amit Pawashe. We thank Prakash Gole of Ecological Society, Pune for the encouragement and necessary support during the pelagic surveys. Participation of Manasi Karandikar, Pune and of Sahyadri Nisarg Mitra, Chiplun, Maharashtra was noteworthy in surveys of Burnt Island and Sindhudurg district and following members participated, Vishwas Katdare, Ram Mone, Vishwas Joshi and Sachin Palkar. Other NGO's like Paryavarni, Belgaum, Karnataka; Prakruti Prayog Parivar, Kolhapur, Nature Conservation Society of Nashik, Sahyadri Mitra, Mahad and Dr. Ramesh Godbole and Advocates Mrs. Sheela and Mr. P.P. Paralikar of Nisarga Sewak, Pune deserve special mention for their support.

We acknowledge the assistance of Dr. Dayanand D. Shetty, Director Academics, Professor and Head, Department of Radiology and Imaging, and Dr. Kurus Coyaji,

C.M.O., K.E.M. Hospital, Pune for allowing author SP to obtain excellent digital radiographs of the specimen of *Collocalia unicolor*.

We acknowledge the assistance from Bombay Natural History Society, Mumbai, particularly J.C. Daniel (Hon. Secretary) and Asad Rahmani (Director); Zafar Futehally past editor, *Newsletter for Birdwatchers*; Aasheesh Pitti, editor, *Pitta*; Bittu Sahagal, editor *Sanctuary Asia*; Ulhas Rane and Clement Francis, M of e-mail groups related to birds and nature, for their support.

Thanks are due to various information media and agencies in India like newspapers, TV and AIR; also National Geographic Society and Oriental Bird Club Bulletin for publishing articles and carrying news regarding poaching activity and conservation measures taken for Indian Edible-nest Swiftlet, *Collocalia unicolor*.

Last but not the least we like to acknowledge the cooperation of fishermen folk from the coastal hamlet of Niwati-Medha, district Sindhudurg, Maharashtra and specially thank Shridhar Metar and his entire family who continue to extend full support to the conservation of Indian Edible-nest Swiftlets of Burnt Island from 2001 till date.

Anil Mahabal
Satish Pande
R.M. Sharma
Shivkumar N. Pednekar

CREDITS FOR PHOTOGRAPHS

Photographs included in this report are taken by Dr. Satish A. Pande, Anil Mahabal, Shivkumar Pednekar and Niranjan R. Sant. Video photography is also done by Vishwas Katdare, Ram Mone, Dr Satish Pande, Shivkumar Pednekar, Amit Pawashe and Prashant Deshpande. The relevant CD is with the authors. Anand Abhyankar of Soft Lab, Pune assisted in making the video-CD.

CONTENTS

1. INTRODUCTION

Swifts and Swiftlets (Apodidae) are the most aerial of all birds. True to their name they are exceptionally fast fliers and are found worldwide. Of the total 94 species, 16 occur in the Indian subcontinent (Manakadan and Pitti, 2001). They are capable of sustained high-speed flight spending most of the daytime and sometimes even the night on their wings. With the exception of Crested Tree Swift (Hemiprocnidae), they rest by clinging to the rough vertical surfaces. They are unable to walk. The various species are difficult to identify in flight because of close resemblance with one another, flight at higher elevations giving a sub optimal view and differing sunlight conditions (Rasmussen and Anderton, 2005). They feed entirely on insects, that they catch high up in the air, unlike swallows (Hirundinidae), whom they resemble, which feed much closer to the ground.

The family Apodidae is further divided into six genera, *Collocalia, Zoonavena, Hirundapus, Cypsiurus, Tachymarptis and Apus* (Manakadan and Pitti, 2001) on the basis of length of wings, tail feathers and structure of the toes. All the Edible-nest Swiftlets are grouped in to the genus *Collocalia* G. R. Gray. Five species of swiftlets are known from India (Ali and Ripley, 1970; Manakadan and Pitti, 2001) :

1. White-bellied Swiftlet (Beavan's Swiftlet) *Collocalia esculenta* (Linnaeus, 1758).
2. Indian Edible-nest Swiftlet (Edible-nest Swiftlet) *Collocalia unicolor* (Jerdon, 1840).
3. Himalayan Swiftlet *Collocalia brevirostris*, (Horsfield, 1840).
4. Black-nest Swiftlet (Indomalayan Swiftlet) *Collocalia maxima* Hume, 1878; and
5. Common Edible-nest Swiftlet (Andaman Greyrumped or 'White-nest' Swiftlet) *Collocalia fuciphaga* Thunberg, 1812.

All these species are gregarious, nest in colonies inhabiting natural rock caves and grottos in the cliffs of hills. They nest in dense clusters adhering to the vertical rock wall of the caves. These swiftlets produce long gelatinous strand from sublingual salivary glands and from these mucilaginous and sticky secretions they make their nests. Depending on the absence or presence of admixtures like grass, twigs, moss, feathers, etc. the nests are either pure or impure. The nests of Indian Edible-nest Swiftlet (*C. unicolor*) and Common Edible-nest Swiftlet (*C. fuciphaga*) are 'white' nests, where as the remaining three species have 'black' nests with an admixture of a lot extraneous matter.

The 'white' nests are harvested for consumption as food, tonics, aphrodisiacs, medicines and other commercial purposes. The nests being intrinsically tasteless they are prepared in soup or jelly and in more than a hundred kinds of recipes and are often

sold in preserved form in tins and cans. Because of their alleged aphrodisiacal properties they fetch a very high commercial value in the SE Asian countries. Such markets do not exist in India in any significant amount. Both the species, *Collocalia unicolor* and *Collocalia fuciphaga*, have become threatened due to clandestine over exploitation of the nests for their export to SE Asian countries.

The entire family Apodidae in which the 'white nest' building *Collocalia unicolor* and *Collocalia fuciphaga* are included was legally neglected, to the extent that neither the family nor the species were included in the Indian Wildlife (Protection) Act, 1972. Due to lack of legal protection, the poaching of nests was not only uncontrolled but undetected till March 2001, after which the poachers were arrested and the trade in nests was discontinued.

We conducted several surveys in 2001 at the known nesting colony of Indian Edible-nest Swiftlet at Vengurla Rocks Archipelago. On the basis of serious studies the recommendations from various NGO's and government organizations eventually led to inclusion of the two species *Collocalia unicolor* and *Collocalia fuciphaga* in Schedule I, Part III (Birds) of Wildlife (Protection) Act, 1972 as amended in year 2002. We undertook detailed surveys to find out the status of Indian Edible-nest Swiftlet *Collocalia unicolor* along the west coast of India, with emphasis on Vengurla Rocks the largest known breeding colony of this species; the Western Ghats; the offshore marine islands and the Lakshadweep Archipelago in Arabian Sea.

We present in this report our findings from the aforementioned surveys during 2001 to 2006 and review of the relevant literature. We also present our findings regarding assessment of the status and distribution, taxonomy, morphology, radiological osteometry for the first time, nidification, ecology and behaviour, threat assessment, conservation measures undertaken and recommendations for conservation of Indian Edible-nest Swiftlet *Collocalia unicolor*.

2. HISTORICAL ASPECTS AND REVIEW OF LITERATURE

In 1800's several British naturalists including famous personalities like A.O.Hume and members of Indian Civil Services visited the Vengurla group of Islands in February 1875 and collected scientific information from the Island (Hume, 1876). Then in India till about the turn of the century, the right to collect the nests of Indian Edible-nest Swiftlets for export to China was auctioned by the Government of Bombay from 1865 to 1895. Though the trade was never significant, the nests fetched an annual fee from Rs. 200 to Rs. 250 in 1865 and dwindled to only Rs. 41 in 1895. Consequently the business reduced due to diminishing returns, overexploitation of colonies, increasing and disproportionate risks and improper organization involving nest collection. The main localities of nest collection were Vengurla Rocks or Burnt Island off the Malavan coast in Maharashtra, Pigeon Island or Netrani off the coast of North Canara in Karnataka

and Sacrifice Rocks off the west coast in Kerala (Ali and Ripley, 1970; P. Setu Madhava Rao, 1962; Jerdon, 1862). There are some records from the Diaries of B. B. Osmaston who visited the Island during 1904-1907 (Editorial Article, 2001).

After a gap of about 40 years, Humayun Abdulali a naturalist from Bombay Natural History Society visited the Vengurla Rocks in February 1938 and again in March 1941 along with Salim Ali and a few others. They estimated about 5000 Indian Edible-nest Swiftlets and about a thousand nests in all stages of construction (Abdulali, 1940 and 1942). Again, after a gap of 40 years he revisited the Vengurla Rocks in May 1981 and noticed Indian Edible-nest Swiftlets flying near the entrance of the cave, both over the sea and the island (Abdulali, 1983). In May 1988, Stig Toft Madsen and his party members counted a few dozen Indian Edible-nest Swiftlets wheeling around over the water near Vengurla Rocks (Madsen, 1988) apart from various species of Terns. Lainer (1999 and 2004) has pointed out that from 1989 onwards the numbers of Indian Edible-nest Swiftlet *Collocalia unicolor* declined sharply, probably due to the illegal commercial over- exploitation of the breeding colony on the Burnt Island. However this was unheeded by naturalists. Then again in late 1998 their population had shown signs of a recovery. Thereafter, there are no authentic records of visits to Vengurla Rocks by any naturalist from 1988 till year 2001.

Dr. Satish Pande of ELA Foundation, Pune and Vishwas Katdare and Ram Mone of Sahyadri Nisarga Mitra, Chiplun, Maharashtra, representatives of two NGO's undertook the task to identify the threats to the nesting population of Indian Edible-nest Swiftlets, besides the studies on their nesting status and photographic documentation of their nesting activity on the Vengurla Rocks Archipelago, district Sindhudurg, Maharashtra, in March 2001. They found that a huge bamboo structure was erected in the cave for poaching the nests attached to the wall of the cave and further estimated about 1800 nests of Indian Edible-nest Swiftlets (*Collocalia unicolor*) from Burnt Island and few more from Old Lighthouse Island for the first time by the author SP. After identifying the threats they also initiated concrete conservation measures by informing the forest department of Maharashtra and Karnataka, Indian Coast Guard, Ministry of Environment and Forests, New Delhi and the Zoological Survey of India, Kolkata and publication of scientific literature for protection of the Indian Edible-nest Swiftlets (Katdare, 2001; Pande, 2001 and 2002a, b; Pande *et. al.*, 2001 a, b, c and 2002; Chhokar and Pande, 2002).

Public opinion generation and awareness creation for initiating conservation measures regarding the poaching of the Indian Edible-nest Swiftlet nests was also undertaken on a wide scale by the NGO ELA Foundation through several articles in local English (Pune Newsline, 19-04-2001; Deccan Herald, Sunday, Bangalore, by Futehaly, 2001) and Marathi newspapers (Sakal, 14-05-2001) and magazines, All India Radio and TV interviews, etc.

Further, a team comprising of authors Anil Mahabal and R.M. Sharma of the Zoological Survey of India (hereto referred as ZSI) , Pune, as per the instructions from

Director, Zoological Survey of India, Kolkata, along with Dr. Satish Pande of ELA Foundation and Vishwas Katdare and Vishwas Joshi of Sahyadri Nisarga Mitra, visited the Vengurla Rocks Archipelago and various places in the coastal and hilly areas of district Sindhudurg during 18 to 23 November, 2001 for conducting the status survey of the Indian Edible-nest Swiftlets (Mahabal and Sharma, 2002, unpublished report).

The outcome of all this resulted in arrest of the poachers and the trade was discontinued. Edible-nest Swiftlets of two species (*Collocalia unicolor* and *Collocalia fuciphaga)* were included in the Schedule I part III (Birds) of Wildlife (Protection) Act, 1972 amended vide the Government of India notification dated 30th September 2002. Interestingly before this time neither the family Apodidae nor the swiftlets were included in any of the schedules of the Wildlife (Protection) Act, 1972 as amended in 1990, although the poaching was going on even before 1989 (Lainer, 1999 and 2004). In an editorial comment fear of extinction of these swiftlets was expressed and wisdom of the decision of including the Edible-nest Swiftlets in Schedule I and not in Schedule IV was voiced (Daniel, 2003). The Burnt Island was included as an Important Bird Area (IBA) in 2004 (Islam and Rahmani, 2004).

3. TAXONOMY

3.1. **The systematic position of the Indian Edible-nest Swiftlet is** :

Kingdom	**ANIMALIA**
Phylum	CHORDATA
Class	AVES
Order	APODIFORMES
Family	APODIDAE (Swifts and Swiftlets)
Genus	***Collocalia***

Species ***Collocalia unicolor*** (Jerdon, 1840)

Order : Insessores, Family : Hirundinidae, Subfamily : Cypselinae (Swifts), Genus : COLLOCALIA, Gray;. Hirundo, apud LATHAM-BLYTH, Cat. 428-HORSF., Cat. 122-H. brevirostris, McLelland, P. Z. S. 1839-H. unicolor, JERDON, Cat. 262; subsequently changed to Cypselus unicolor, Suppl. Cat.-C. concolor, Blyth, J. A. S. XI, 886, The INDIAN EDIBLE-NEST SWIFTLET, Collocalia nidifica, LATHAM (Jerdon, 1862).

Order Coraciiformes; Suborder Cypseli; Family Micropidae; Subfamily Chaeturinae; Genus : COLLOCALIA. Gray. *Hirundo unicolor* Jerdon, Madr. Jour. L. & S., xi, p. 238 (1840) (Coonoor Pass, Nilgiris). *Collocalia fuciphaga*. Blanf. & Oates, iii, p. 176 (No. 1608). The INDIAN EDIBLE-NEST SWIFTLET, *Collocalia unicolor unicolor* (Baker, 1927).

Order APODIFORMES (Swifts); Family APODIDAE (Swifts); Subfamily Apodinae (Swifts); Genus COLLOCALIA G. R. GRAY. *Hirundo unicolor*, Jerdon 1840, *Madras Jour. Lit. Sci.*, **11** : 238 (Coonoor Pass) Collocalia fuciphaga (Thunberg). Malaysian Edible-nest Swiftlet (No. 685) *Collocalia fuciphaga unicolor* (Jerdon). (Ripley, 1961).

Hirundo unicolor, Jerdon 1840, *Madras Jour. Lit. Sci.*, **11** : 238 (Coonoor Pass) Baker, FBI NO. 1608, Vol. 4 : 346. Indian Edible-nest Swiftlet *Collocalia unicolor* (Jerdon) (Ali and Ripley, 1970 H. B. No. 685, Vol.4 : 29).

Order Apodiformes; Family Apodidae; Indian Edible-nest Swiftlet (No. 685) *Collocalia unicolor* (Jerdon, 1840), (Manakadan and Pitti, 2001, *Buceros*, Vol. 6. No.1 : 11).

(*Note* : David and Gosselin, (2002a,b, *In* : Rasmussen and Anderton, 2005) have changed the genus *Collocalia* to *Aerodramus* for the species *unicolor, fuciphagus and brevirostris* and Indian Edible-nest Swiftlet *Collocali unicolor* sometimes treated as conspecific with *Collocalia fuciphaga* and/or *Collocalia brevirostris*).

3.2. Local Names

Pakoli, Abholi (Marathi); Vatashin and Chirilli (Sanskrit names for swifts); Sarappakshi, Chitrakootan Sarappakshi (Malayalam); Kudukaraya (veddah); Wehi lihiniya (Sinhala)

3.3. Size

Sparrow (-); Smaller and also slender than House Swift (Ali, 1953; Ali and Ripley, 1970).

3.4. Weight

11 g (2 males). (Ali and Ripley, 1970).

3.5. Length

120 mm.

3.6. Field Characters

A small, slender, blackish brown swiftlet with a slightly forked tail and rump concolorus with back. Flight peculiar rapidly flapping pippestrel-bat like. Sexes alike. Juveniles are similar to adults. Pale, less glossy on the upper parts and smaller in size than the Himalayan Swiftlet. Closely resembles the all-dark Dusky Crag Martin (*Hirundo concolor*, Sykes). Iris is dark

Swiftlet clinging vertically to the edge of the nest.

brown, bill black and much hooked, legs and feet purplish black. (Ali and Ripley, 1970). Body aerodynamically designed streamlined to sustain it in air with minimum effort and for prolonged duration, with sharply pointed curved wings and forked tail designed for speed and navigation. The legs are short and tarsus are bare and all toes point forwards hence they are incapable of perching, walking and lifting themselves off the plain ground. Sharp claws help clinging on vertical rough surfaces. Its swift and high-speed flight has accorded it the name of Swift. Swiftlets are smaller in size than swifts. They fly high up in the air and hawk aerial insects. They can maneuver through the small openings of the caves and effortlessly and accurately negotiate through dark narrow crevices in rocky cliffs at tremendous speed and the feat should be seen to be believed. From prolonged exposure to sunlight their feathers bleach significantly (Rasmussen and Anderton, 2005).

3.7. **Comparison between 'white-nest' building Edible-nest Swiftlets**

Out of the five species of Edible-nest Swiftlets, only two species viz. Indian Edible-nest Swiftlet *Collocalia unicolor* and Common Edible-nest Swiftlet *Collocalia fuciphaga* build pure and white nests, which have a commercial culinary value and are at risk of exploitation by poaching. Differentiating features and distribution of these two species are tabulated below (Baker, 1927; Ali, 1953; Ali and Ripley, 1970; Smythies, 1975; Grimmett, *et al*, 1998; Kazmierczak, 2000; and authors' observations. Also refer Radiography and Wing Formula sections 4.1 & 4.2).

Table-1

Feature/Species	*C. unicolor*	*C. fuciphaga*
Colour	Blackish brown and rump concolorus with back	Blackish brown and rump paler than back
Bare Parts	Legs and feet purplish black	Legs and feet dark brown
Size	120 – 121.76 mm	120 mm
Wing	113-117 mm	113-121 mm
Bill	8-9 mm (from skull)	4-5 mm (from feathers)
Tarsus	8-9 mm (Baker, 1927)	9 mm
Tail	41-45 mm (central)	49-53 mm
Tail fork depth	7-10 mm	6-8 mm
Weight	11 g (male)	?
Distribution	Coastal and Western Ghats from about south of Ratnagiri (c. 16^{0}N lat) up to Kerala, Tamil Nadu through Goa and Karnataka and Sri Lanka	Andaman, Nicobar and Car Nicobar Islands

3.8. **Nidification and Commercial Value**

Differentiating characters between nidification of *Collocalia unicolor and Collocalia fuciphaga* are tabulated below. (Baker, 1934; Ali, 1953; Ali and Ripley, 1970; Walkey, 1978; Grimmett, *et al*, 1998 and authors' observations).

Table-2

Feature/Species	*C. unicolor*	*C. fuciphaga*
Season	Chiefly March to June	Chiefly March to April
Nest	Whitish, translucent to opaque with some admixture of extraneous matter	Pearly white, translucent to opaque with little or no admixture of extraneous matter
Nest Size	55-75 mm (wide) 50-55 mm (front to back) 15-27 mm (depth)	60 mm (wide) 15 mm (depth)
Shape	Half-cup shaped	More or less half-cup shaped
Weight	10 g (6-14g)	14 g
Eggs	1-3, white long, blunt ovals	1-2, white, long ovals
Egg Size	20.9 x 13.5 mm	20.2 x 13.6 mm
Commercial value	Edible and good value	Best edible and high value

4. RADIOGRAPHY AND WING FORMULA OF *COLLOCALIA UNICOLOR*

4.1. **Digital Radiological Osteometry**

The specimen collected from Burnt Island, Vengurla Rocks Archipelago, on 18th April 2001, by RFO, Kudal, Mr. S. T. Jagtap of Forest Department, Sawantwadi, Sindhudurg district, Maharashtra was handed over to ZSI, Pune for identification. It was identified by the author (AM) as Indian Edible-nest Swiftlet, *Collocalia unicolor* (Apodidae : Apodiformes). The specimen is now in the collection of ZSI, WRS, Pune, bearing

Digital Radiograph of Indian Edible-nest Swiftlet, *Collocalia unicolor.*

Identified Registration number B/1027. Digital high definition radiograph of this adult specimen was carried out at Department of Radiology and Imaging, K.E.M. Hospital, Pune. The findings are stated as follows :

Skull :

Tip of beak to posterior occipital convexity – 23.64 mm.
Maximum cranio-caudal diameter of the cranial vault – 10.66 mm.
Orbital cavity – 9.17 x 8.49 mm.
Eye Ball – 6.5 x 5.9 mm (Antero-posterior x Lateral)

Upper Limb :

Humerus – 11.33 mm.
Radius/Ulna – 12.54 mm.
Carpo-metacarpals – 5.87 mm.
Thumb or hallux – 6.88 mm.

Lower Limb :

Femur – 11.55 mm.
Tibia/Fibula – 18.35 mm.
Tarso-Metatarsus – 7.84 mm.

Scapula :

Length – 12.63 mm.

Keel :

Triangular in shape with apex inferiorly.
Superiorly – 5.90 mm
Middle – 4.13 mm.

4.2. **Wing Formula**

Remiges :

Primaries – 10.
(Digital –2, Carpo-Metacarpal – 2, Radius-Ulnar – 6)
Wing chord - 113 mm.

Rectrices :

Tail is deeply forked.
Number of feathers – 10.

Length of outer feather – 44 mm

Length of inner feather – 34 mm.

Body Length :

From tip of bill to tip of tail – 121.76 mm.

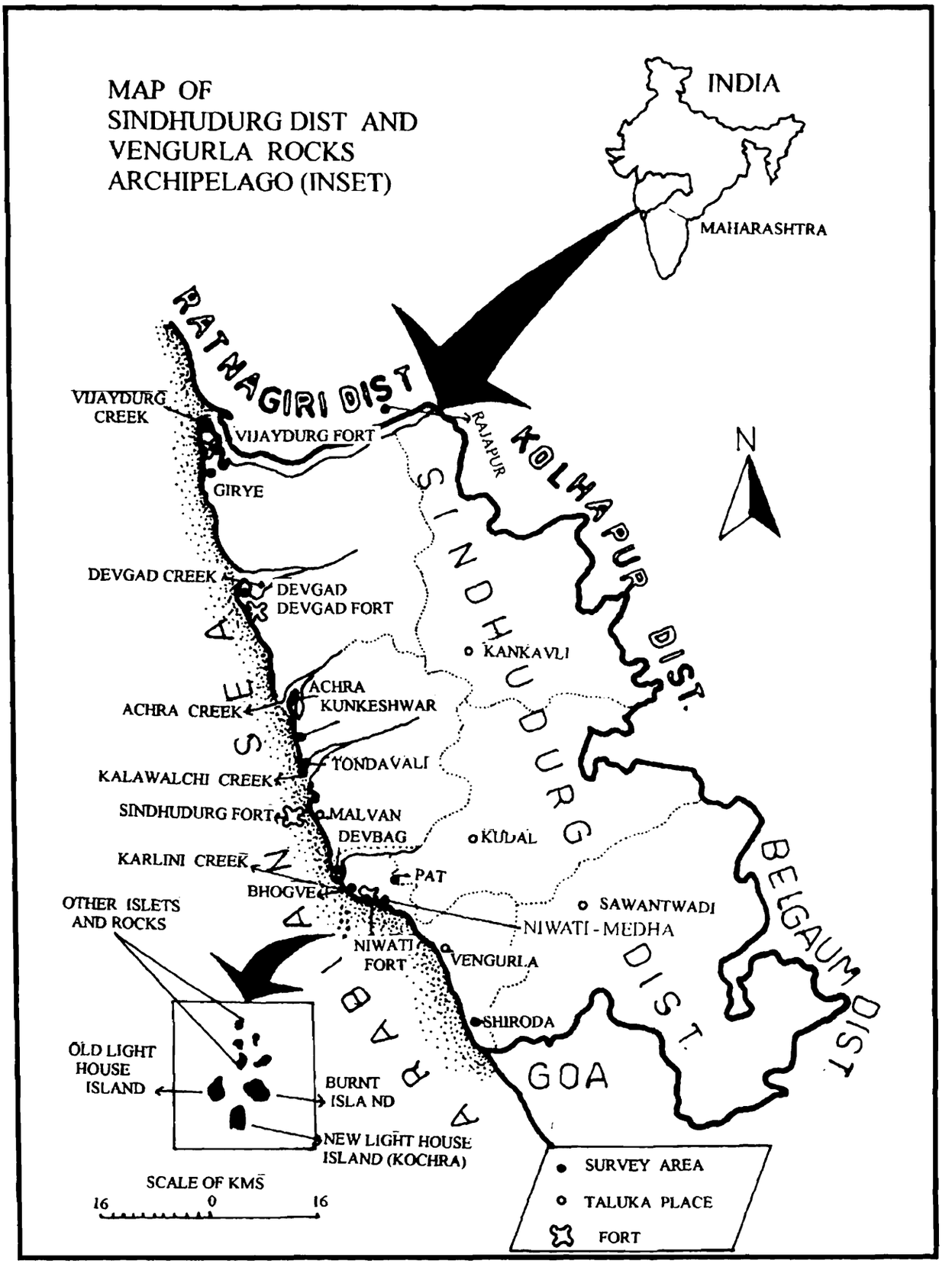
5. KNOWN DISTRIBUTION

The Indian Edible-nest Swiftlet *Collocalia unicolor* occurs in India in the coastal region and Western Ghats complex from about Ratnagiri (16°N Latitude) in south Konkan of Maharashtra southward through Goa, western part of Karnataka, western TamilNadu and Kerala including Nilgiri, Palni, Brahmagiri, Connor, Coorg, Travancore, Wynaad, Peermade and associated hill ranges of south India and rocky offshore islets in the Arabian Sea having natural caves and grottoes; from sea level to 2200 m altitude. It is also abundant in Sri Lanka (Jerdon, 1862; Baker, 1927; Ali, 1949; Ali, 1953; Ali and Ripley, 1970; Henry, 1971; Daniels, 1997; Pande, *et al.*, 2003). Several offshore islets in the Arabian Sea where the colonies of swiftlets are recorded in the past (Davison and Cardew, Vidal, Jerdon, Terry, Bourdillon from Hume's '*Nest and Eggs*' *In* : Baker, 1934) include Vengurla Rocks (or Burnt Island, Maharashtra) and Pigeon Island (or Netrani) in north Kanara, Karnataka (Ali and Ripley, 1970). In TamilNadu they are recorded from Tiger Caves near Ooty (Jerdon, 1862; Walkey, 1978; Katdare, 2002). They are also recorded from Sacrifice Rock 32 km (20 miles) south of Tellicherry. (Jerdon, 1862; Baker, 1934) and near Ooty (Baker, 1934).

6. STUDY AREA

The study of the Indian Edible-nest Swiftlet *Collocalia unicolor* was mainly undertaken at a group of rocky islands, Vengurla Rocks Archipelago, situated in the Arabian Sea (10°55'N latitude and 73°30'E longitude) on the west coast of Sindhudurg district, Maharashtra. The Archipelago is about 14 Km. west-northwest of Vengurla Port and about 8.3 Km. from the fishing hamlet of Niwati-Medha port, in taluka Vengurla, district Sindhudurg, Maharashtra. These islets, about 20 in number, stretch about 5 km. from north to south and about 1.6 km. from east to west (**See Map-1**).

Vengurla Rocks Archipelago with Burnt Island (Left) and New Light House Island (Centre)



Map-1 : Map showing Vengurla Rocks Archipelago in the Arabian Sea and the survey areas of Indian Edible-nest Swiftlet, *Collocalia unicolor* in Sindhudurg district, Maharashtra. (Map not to scale).

Out of these 20, only three islands are slightly larger. The names of the islands, also in local Koli dialect are mentioned here for ready reference :

6.1. Larger Islands, Vengurla Rocks Archipelago (See Map-1)

1) New Lighthouse Island or Deepagruha or Kochra

2) Old Lighthouse Island or Kambra

3) Burnt Island or Bandra **(See Map-2)**

6.2. Other smaller Islets, Vengurla Rocks Archipelago

4) Maad

5) Mhasra

6) Ovala

7) Mharkasa

8) Mhalkumi

9) Devla-this conical rock resembles a temple

10) Gobra

11) Karla

12) Dala

Vengurla Rocks – Old Light House Island.

6.3. Submerged rocks at high tide, Vengurla Rocks Archipelago

13) Vagli

14) Dhorga

15) Dhorgyachi Chaal, and

16-20) the remaining five are smaller and un-named rocky islets.

Rocks around Burnt Island.

6.4. West Coast and Western Ghats from Gujarat to Karnataka (See Map-3)

Besides the Vengurla Rocks Archipelago, the areas in

Gujarat (Jamnagar district), Maharashtra (Mumbai and Thane, Raigad, Ratnagiri and Sindhudurg districts), Goa and Karnataka (North Canara) states were surveyed along the coastal regions by the authors mainly SP and SNP. Coastal area of Sindhudurg district particularly from Niwati-Medha to Vijaydurga Fort was surveyed by Zoological Survey of India, Western Regional Station, Pune by authors AM and RMS.

6.5. 1st Oceanic Survey

1st Oceanic survey in the Arabian Sea from Mumbai to New Mangalore port and back was also undertaken by authors SP and SNP of ELA Foundation, Pune. The south voyage was made 15 km from the coast and the northwards voyage was 50 km from the west coast of India. The offshore marine islands and waters up to 50 km from the coast in high sea were surveyed by the same authors (Pande, 2005, unpublished report).

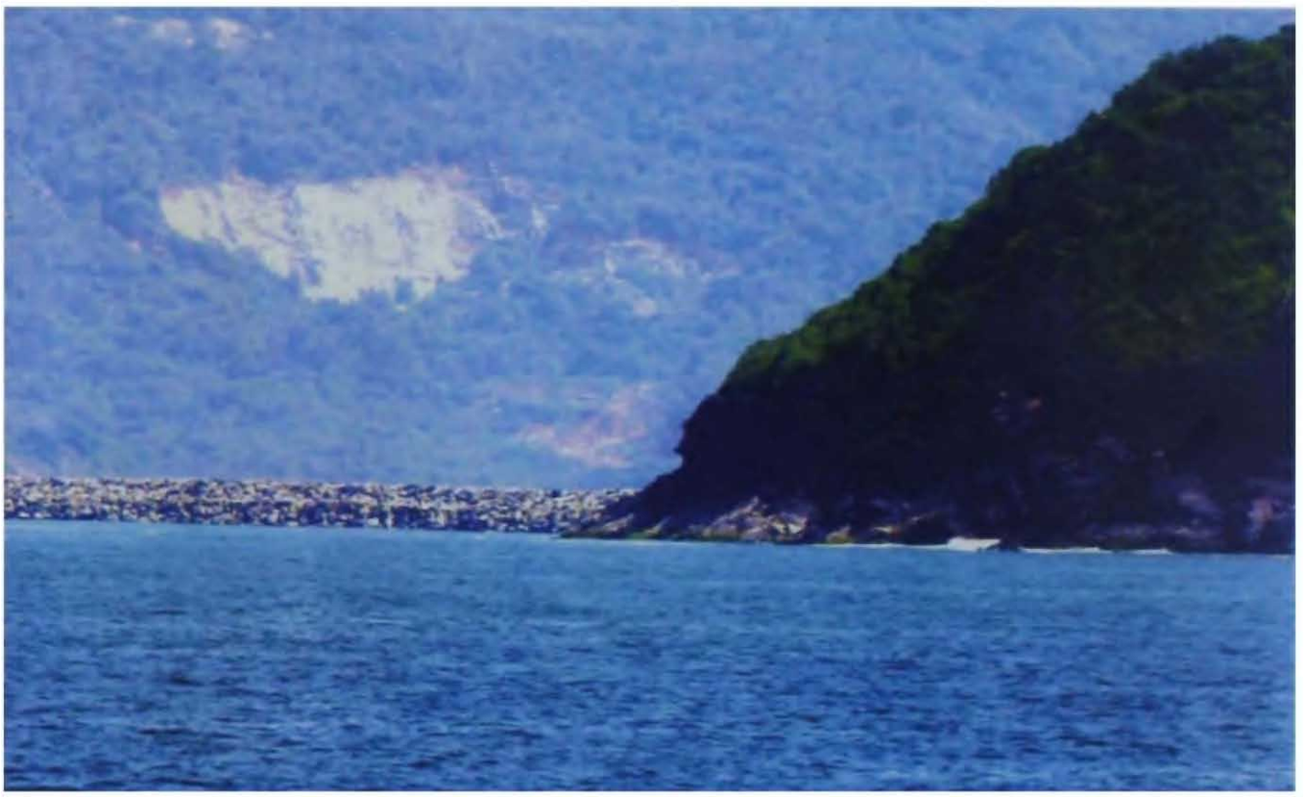
The islands surveyed were :

i) **Maharashtra** :

Elephanta or Gharapuri Is.

Gull Is. Off Mandve

Khanderi Is.



Anjadeep Island, Karnataka.

Underi Is.

Alibag Fort or Kolaba Fort

Korlai Rocks

Murud Janjira Fort

Harne Fort-Suvarnadurga

Burnt Is.

Sindhudurg Fort

ii) **Goa** :

Grandi Is.

St. George Is.

iii) **Karnataka** :

Anjadeeva or Anjadeep Is.

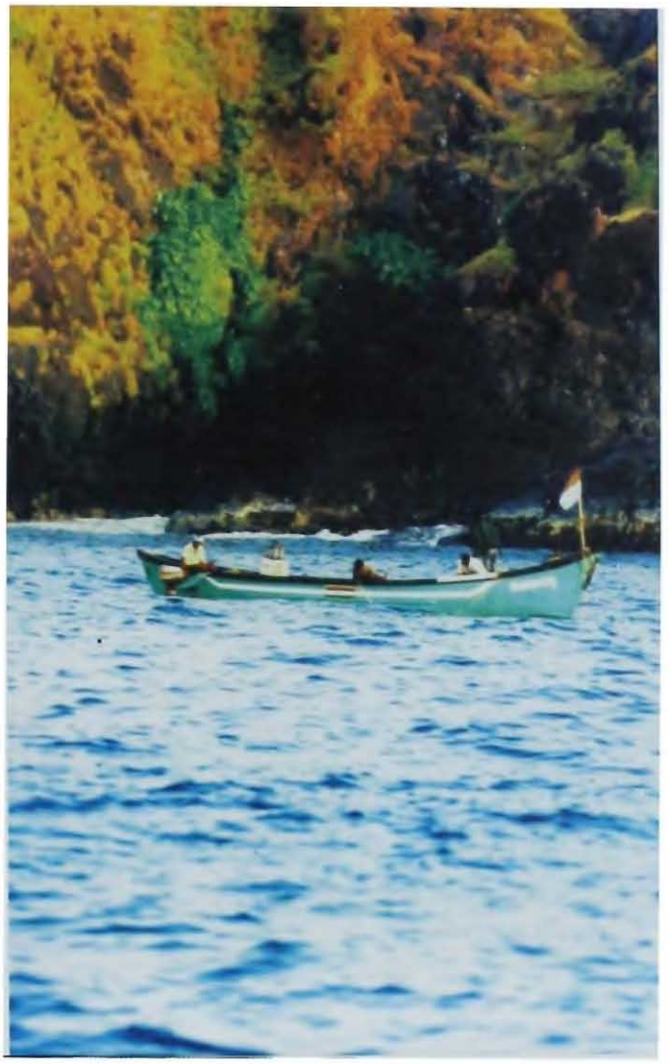
Mugaregudda Is.

Devagudda Is.

Netrani Is. or Pigeon Is. and

Coconut Is.

50 km waters in high sea were also surveyed from Mumbai to New Mangalore and the to and from journeys were as stated above.



Netrani Island, Karnataka.

6.6. 2nd Pelagic Survey :

So also the 2nd Pelagic survey of Lakshawdeep Archipelago was also sundertaken beginning from New Mangalore port by ELA Foundation (Pande, 2006, unpublished report). Islands and reefs surveyed by author SP and SNP of ELA Foundation, Pune, in the Lakshadweep Archipelago were :

Cherbaniani,

Byramgore,

Bitra,

Pitti,

Bangaram,

Tinnakara,

Parli 1&2,

Agatti, Suheli Pitti,

Suheli Cheriyakara,

Veliyakara and

Kavaratti.

7. TOPOGRAPHY AND CLIMATE OF THE STUDY AREA

The vegetation in the study area consists of tropical moist-deciduous forest, tropical semi-evergreen forest and tropical wet evergreen forest in the Western Ghats; tropical thorn forest in the northern region in Gujarat and littoral swamp forest in the coastal areas. The four bio-zoogeographic zones, as per Rodgers and Panwar's scheme, in the study area are Western Ghats, coasts, islands and semi-arid region (Pande *et al.*, 2003). The annual rainfall in Gujarat is 1000 mm, in the Ghats it ranges from 1500 to 2500 mm and along the coasts it exceeds 2500 mm. The rainfall is derived from SW monsoon from June till September and the date of arrival of monsoon varies from year to year. Strong currents, tall waves, breakers and rough sea are encountered during the pre-monsoon and monsoon period. The annual average temperature in the study area is about 24^0 C, the lowest winter temperature is about 3^0 to 4^0 C and the highest summer temperature is up to 45^0 C. Strong winds blow during monsoon and the climate is generally pleasant.

8. STUDY PERIOD

The status survey of Indian Edible-nest Swiftlets was undertaken as follows :

1. Gujarat, Jamnagar district, in March, 2003;

2. Maharashtra (Mumbai and Thane, Raigad, Ratnagiri and Sindhudurg districts) from 2001 to 2006; Vengurla Rocks Archipelago in March (landing on Burnt Island was not possible during this visit), April, June, September and November, 2001; April and May, 2002; September, 2003; May, 2004; September, 2005 and May, 2006. Sindhudurg district from 19 to 23rd November, 2001.

3. Goa in 2001-2003;

4. Karnataka in 2005-2006;

5. 1st Oceanic survey of offshore islands and forts in Arabian Sea in October, 2005

6. 2nd Pelagic survey of Lakshadweep Archipelago in March, 2006.

9. METHODOLOGY

9.1. Vengurla Rocks

To reach the study area of Vengurla Rocks, particularly Burnt Island, New and Old Lighthouse Islands, help of local fishermen of Niwati-Medha was taken, as the islands are difficult to reach due to strong winds, currents and high waves in rough sea. Every time an engine driven fiberglass motor-boat was hired from Niwati-Medha. It took about an hour to reach the island. It was difficult to land on the island due to the vertical sharp latterite rocks laden with goose barnacles. Sometime, it prevented a closer approach of the fiber boat. Hence, few party members had to jump in the sea, swim a few meters to reach the island, and then gently pull and push the heaving boat with a long bamboo pole from the rocks, in unison with the boatmen. This always took quite some time considering the strength of waves and the unstable conditions. We could with difficulty, successfully transfer the photographic equipment to the islands.

Descending the cliff on Burnt Island with ropes during nesting period.

On this island, the nests and nesting pairs of swiftlets were counted on vertical sides of the cave by following quadrate method. A square meter area was measured on each vertical side and this was easy due to the huge bamboo framework erected by the poachers along the vertical walls of the cave. Eggs and chicks in higher nests could be counted only till the bamboo framework was present. After the demolition and removal of bamboo framework the nests counts were taken by quadrate sampling but the eggs and chicks in higher nests could not be counted.

Nests were actually counted along with swiftlets, if any, by climbing on the bamboo structure from bottom to the top. A general rough sketch of the cave was drawn to enter the number of nests and nesting pairs of swiftlets if any, in each quadrate. Besides this, flying Indian Edible-nest Swiftlets were counted which were entering through the skylights of the cave. Photographic documentation of nesting activity of the swiftlets was also made with still and video cameras.

9.2. **Other Areas**

Various coastal caves, grottos, rocky areas, forts, creeks, and ports in Gujarat, Maharashtra, Goa and Karnataka states were surveyed using vehicles like jeep and car. Boats were used to survey island forts and islets. Surveys were also conducted on foot.

9.3. **1st Oceanic and 2nd Pelagic Surveys**

Oceanic and Pelagic surveys were conducted as a part of another ongoing pelagic bird survey jointly undertaken by ELA Foundation, Ecological Society and Indian Coast Guard, particularly by the authors SP and SNP. The ships used for the surveys were ICGS AMRIT KAUR and ICGS ANNAE BESANT. Speed boats and Gemini boats and also rafts were used to land on the various islands and forts (Pande, 2005 and 2006; unpublished reports).

10. ECOLOGY AND BEHAVIOUR

10.1. **Residential Status**

The Indian Edible-nest Swiftlet *Collocalia unicolor* is a resident diurnal bird showing local seasonal movements (Ali and Ripley, 1970). Population at the breeding places is significantly augmented from May till September. The species has been considered as endemic to South-west India and in Sri Lanka (Lainer, 2004; Rasmussen and Anderton, 2005).

Nesting colony of Swiftlets with nests attached to the cave-wall.

10.2. **Habitat**

The colonies of Indian Edible-nest Swiftlet inhabit undisturbed natural caves and grottos in the cliffs of hills of the Western Ghat complex, rocky hilly areas along the Konkan and Malabar coasts and rocky off shore islets having caverns and

caves, in the Arabian Sea (Ali and Ripley, 1970). Nests were also recorded under bridges, though this is more common in Sri Lanka (Baker, 1934; Henry, 1971). They are noted up to 2200 m altitude in mountains (Daniels, 1997; Grimmett *et al.*, 1998; Rasmussen and Anderton, 2005). They hawk over coastal palm groves, mango topes, paddy fields and forested areas of Western Ghats (Lainer, 2004).

10.3. **Habits**

They are generally found in scattered small flocks from January till April during the pre-breeding season when the flocks are widely dispersed. From May till September large congregations of these swiftlets are seen at breeding colonies. The congregations further augment in the immediate post-breeding season due to recruitment of newly fledged chicks from October till December. In Goa they are recorded throughout the year in the coastal belt and are more numerous in pre and post-breeding seasons (Lainer, 2004). During the days foraging the flocks wander over a considerable radius from the roosting or nesting places both on the land and sea. The swiftlets often spend the entire day and sometimes the night on their wings and they even mate in flight.

10.4. **Roosting Behaviour**

The authors have observed that even during the non-breeding season the caves and caverns used for nesting are also utilized for roosting, but by fewer number of swiftlets. They all leave the roost sites before dawn and return after dusk after spending the whole day on wings. Therefore an erroneous impression may be obtained that in the non-breeding season all the swiftlets have deserted the nesting sites since no activity is visible here during daytime. Besides the nesting swiftlets, others roost by clinging upright on vertical surfaces of high rocky cliffs on the coasts and hilly areas of Western Ghats during the night. During the non-breeding period the swiftlets disperse and are seen everywhere in small groups and hence are difficult to locate and observe. Therefore the roosting sites remain little known. Large collections of droppings in the form of small pellets are found below the traditional roosting sites in the dry non-monsoon periods. Authors have recorded one such site in Raigad district of Maharashtra.

In the breeding season the swiftlets intermittently return to the nests. They suddenly drop from the sky in to the underground caves through the skylights, small holes or narrow fissures with remarkable skill utilizing the echolocation and rapid steering and maneuvering skills. At this time the nesting colonies are significantly noisy due to their shrill and high-pitched calls and the noise of wing beats. The colonies are very smelly due to the large accumulation of guano on the floor at the traditional nest sites.

10.5. **Flight Patterns and Directional Routes**

10.5.i. **Individual** :

A zig-zag, rapid and almost erratic flight pattern is exhibited by individual swiftlets especially while entering the caves through narrow entrances. The flight at such times is accompanied by shrill noises that the swiftlets emit for echolocation (Ali and Ripley, 1970) and navigation. Importance of echolocation is obvious particularly because the swiftlets are subjected to the blinding effect after suddenly entering the dark cave from broad ambient daylight. Sometimes however the swifts have been observed to partially collide against the back of observers standing in then cave.

At the time of gently landing on their nests the swiftlets approach the nests from below, surge upwards and with tail fanned and wings spread land on the edge of the nest. The swiftlets in the adjacent nests are apparently not bothered by the approaching birds, which arrive with a whooshing noise of the wings.

10.5.ii. **Flocks** :

a) **Vertical** : Another movement noticed by the authors during breeding period is the circular ascending flight of large flocks to higher levels till the flocks become invisible. After some time the flocks rapidly descend and enter the nesting caves.

b) **Circular** : One more movement pattern observed by the authors is the radial flight executed in large circles keeping above the entrance of the nesting cave. This behaviour is commonly recorded and the focal persistent congregation of the swiftlets gives a clue to the hidden best site.

c) **West-East** : Shorter but clearly appreciable and visible routes taken by the swiftlets during the breeding season are to and from the nesting colony on the offshore islets and the adjacent shore.

d) **North-South** : Two-way directional flight pattern of these swiftlets southwards to Goa at dawn and northwards to Malawan at dusk (in observations made at Tiracol and Anjuna in Goa) possibly to and from the nesting colony of Burnt Island Vengurla Rocks is reported (Lainer, 1999 and 2004). He reports of flocks of 1500 birds in December-January (post-breeding period) prior to 1989, after which the numbers decline due to the unchecked poaching of the edible-nests. During May and September singles and small groups are seen to make the same movement in north-south directions (Lainer, 2004). We have observed flock sizes of more than 3000 birds at Burnt Island in 2004, 2005 and 2006, after we actively intervened and stopped the poaching activity in 2001.

10.6. **Feeding Behaviour**

The Indian Edible-nest Swiftlets are chiefly insectivorous birds and they feed on their wings often high up in the air. Most aerially insect hawking birds like swallows,

swifts and bee-eaters nest in large colonies (Lack, 1968). Hawking of insects at lights in urban areas to feed the young ones during the night is also reported from Sri Lanka (cited by Ali and Ripley, 1970 from E. Kershaw, June 1967, *Ceylon Birdclub Newsletter*). Their main diet comprises dipterous, hemipterous and hymenopterous insects. About 80 % of stomach contents of four examples taken in the roosting cave of Vengurla Rocks in February comprised two species of harmful jassids 'Mango-hopper' (*Ideocerus niveosparus* and *Ideocerus atkinsoni*) obviously captured on the famous mango orchards on adjoining mainland of Ratnagiri and Sindhudurg districts of Maharashtra (Ali and Ripley, 1970). The other food items reported are, Small Pulse Beetle (*Bruchus theobrome*), Hemiptera, Lygaedae (*Pamera pallicornis*) and Pentatomidae, Geranium Bug (*Cydnus varians*); Coloptera, Wood Borer (*Sinoxylon anale*), Scavenger Beetle (Nidilulidae), Elateridae, Click Beetle (*Acolus brachmana)*; Coccinellidae, Ladybird Beetle; Staphylinaedae, Rove Beetle; Chrysomelidae, Flea Beetle (*Chaetocnema* sp.); Odonata, Zygoptera, Dragon Flies; Hymnenoptera, Chrysidae, Cuckoo Wasps; Formicidae (Myrmicinae); Diptera Flies and Trichoptera or Caddis Flies (Abdulali, 1942).

10.7. **Economic Importance**

The harmful Homopterous insect which wrecks havoc in the economically important mango plantations in the coastal Konkan (Ratnagiri and Sindhudurg districts) is the jassid 'Mango-hopper' (*Ideocerus niveosparus* and *Ideocerus atkinsoni*). These are taken in large quantities by the Indian Edible-nest Swiftlets and hence they play an important role in the biological control of this pest. They also fed on other Hemipteran, Dipteran, Colopteran and Hymenopteran insects but the economic significance is not known.

10.8. **Calls**

Swiftlets have very harsh call notes reminiscent of calls of Whiskered Terns (Ali and Ripley, 1970). During night roost a low volume, high pitched, shrill chirping and clicking noise, 'chit, chit' is emitted, accompanied by brief intervals of what may be called a chorus (Chantler and Driessens, 1995; and personal observation by authors). A wide range of calls used in echolocation may not be audible to human ear. Main call is metallic, indistinct, 2-3 noted, jolty twittering, buzzy, BZ-ip or bz-IP Pitch 4.7-5.1 kHz, note d<0.1s, strophe d 0.35, repeated frequently (Rasmussen and Anderton, 2005).

10.9. **Breeding**

i. **Period** : The nesting season is chiefly March to June in south and March to September in Sri Lanka (Ali and Ripley, 1970; Henry, 1971). We have observed that the nesting period is rarely prolonged up to July at Burnt Island, Vengurla Rocks and Netrani Islands in India in case of late arrival of monsoon. The exact time and pattern of

Densely congregated nests attached to the roof of cave with swiftlets in few nests.

departure of fledglings and parents from the nest colonies is not well documented. This is largely because of difficulty in observations at the nest caves in offshore islets since they become inaccessible due to strong winds and turbulent sea with the arrival of SW monsoon in June.

ii. **Nest** : It is a tiny, mostly unlined half cup, pearly white, translucent to opaque with little admixture of extraneous matter like grass, twigs, lichen, moss and feathers and made from coagulated saliva secreted from the salivary glands by the swiftlet and with the salivary fibers as if it were crossed and interlaced (Jerdon, 1862; Ali and Ripley, 1970; Walkey, 1978, Pande, 2001). The sticky gelatinous nest is attached 'bracket-wise' to the vertical rocky wall of the cave and appears like a deep oyster shell. The nests are built in colonies or large clusters about 5 to 15 cm or more apart depending on the available space and number of nesting birds. Nest colonies vary from a dozen to more than thousand nests. The nests on mainland are beyond the reach of arm while those on islands are reachable. Some nests are very sticky and we have observed on a few occasions the dislodged egg stuck on the outer surface of the nest. We have observed (and it has also been reported by Ali and Ripley, 1970) many nests infested by Bed Bugs (*Cimex rotundatus*) and tiny maggots. The nest dimensions were (n=6) 55-75 mm wide, 50-55 mm front to back and 15-27 mm deep (recorded by authors).

Nests built on un-even rocky surface and in crevices.

iii. **Weight of nest** : The nest weighs 10 g. (6-14 g; n=6) (recorded by authors). The nests have a good culinary commercial value in markets of SE Asia and hence they face the risk of poaching and the value of nests not only depends on their 'whiteness' but also on the weight of nests (Baker, 1934).

iv. **Other information of nests** : It was observed by the author (SP) that some nests are found lying on the floor of the cave. Such nests have a high quantity of extraneous matter and hence are less sticky while those that remain firmly attached to the wall have less or no extraneous matter. Nests with medium quantity of extraneous matter sometimes fall after the eggs are laid or the chicks hatch, since they give way when the weight of occupants increases. Some nests were found to be reused by swiftlets for nesting in the next breeding cycles after some alterations. Usually the birds build new nests each year. During 2001 when poachers removed a large number of nests, the swiftlets built a second generation of nests and these were seen to have a much larger amount of extraneous admixture. Similar observations are previously reported (Ali and Ripley, 1970). Few of the third-generation nests of *Collocalia fuciphaga* in Andaman Islands were stained with the blood of birds from morbid and non-physiological hypertrophy of salivary glands and undue strain for the third time in the same season (B. B. Osmaston *In* : Futehally, 2001).

v. **Nest site fidelity** : The nest sites are traditional and the swiftlets use the same sites in spite of disturbances. The colony at Burnt Island, Vengurla Rocks is known at least since 1865, for more than 140 years now. The nest sites may be abandoned either due to over exploitation of nests or destruction of nest site due to geographical reason such as collapse of the cave as noted in Anjadeeva Island south west of Karwar (North Canara) which falls in Goa territory (Lainer, 1999). We have also observed another known colony at Tiracol, Goa being deserted for the past several years as confirmed by local people, during our visit in 2002, probably due to a land slide adversely affecting the nest site. At that time there was a painted board at this site mentioning the previous colony of Indian Edible-nest Swiftlets (erroneously referred as swallows) at Tiracol, Goa.

Second generation nest with impurities like straw and grass twigs with one egg.

vi. **Eggs** : One or two eggs are laid in a clutch at an interval of two to three days. Clutch with three eggs was recorded at Tiger Caves (Walkey, 1978). Eggs are white, long and blunt oval in shape. The average size of 80 eggs was 20.9 x 13.5 mm (Baker, 1934; Ali and Ripley, 1970). Hundreds of nests attached bracket-wise to the rocky walls

of the cave and each nest occupied by white shiny eggs is an exquisite site when a beam of torch suddenly illuminates the hidden scene in the dark recesses of the cave. A heap of pearls would not impress one more than this rare and charming site. We have been lucky to watch this nature's beauty on several occasions. Predation of eggs by other natural creatures except human poachers who throw away the eggs for the lust of nests is not known. Unlike the nests these eggs have no gastronomic value for humans.

First generation nest with impurities with two eggs.

vii. **Incubation** : The incubation period, data on development of young, nesting success, fledging period, etc. are not known in Indian Edible-nest Swiftlet. In family Apodidae, to which these swiftlets belong, the usual clutch size as in Indian Edible-nest Swiftlets is 1-2 eggs. The annual adult mortality in this family is medium (20 to 40%) and usual age of first breeding is 2 years (Lack, 1968). As mentioned earlier, eggs are laid asynchronously and we have observed egg and chick in the same nest on several nests, and since incubation starts with the laying of the first egg, the hatching is also asynchronous. Author (SP) has observed the hatching of two eggs in an interval of 2 days in a few instances. However, in family Apodidae, the incubation period ranges from 17 to 23 days, the weight of egg varies from 2 to 7 gm and fledging period is prolonged for up to 44 days (Lack, 1968).

Swiftlet incubating on pure 'white' nest with surrounding empty nest.

viii. **Chicks** : The chicks are nidicolous and at birth have closed eyes and ears. They are flesh coloured with black bill and legs. They appear to be eternally hungry and continually open the beak and stretch the neck and while chirping beg for food on slightest movement in the vicinity of nest. Whether several birds in the colony feed the chicks or if this duty is confined only to one or both the parents remains unknown. We have seen parents feed the chicks by regurgitating previously eaten insects. Usually all chicks in the nest are fed in each session. The chicks become independent after fledging. The interesting physiological aspect is that during the early life the chicks remain in the dark cave and do not receive any sunlight till they fledge and leave the cave. One Mr. Legge had procured some young birds for E. C. Stuart Baker, which he kept for the night in their nests. The young scrambled out of the exterior of the nests and slept in an upright position, a normal mode of roosting of this species (Baker, 1934).

Pure 'white' nest attached 'bracket-wise with one nidicolous chick.

ix. **Swiftlet populations** The populations are likely to be controlled by limited availability of nest sites and space and hence these appear to be 'K' selected birds. This is an unusual selection for the small-sized swiftlets, since such selection is usually applicable to larger birds of prey (Cade and Burnham, 2003). The reason is scarcity in the availability of the suitable nest sites as required by the swiftlets. We think that another possible limiting factor could be the nesting period of these swifts in India from May to June and immediate occurrence of SW monsoon from the first week of June. Food finding at this time is difficult for the aerial hawkers of insects.

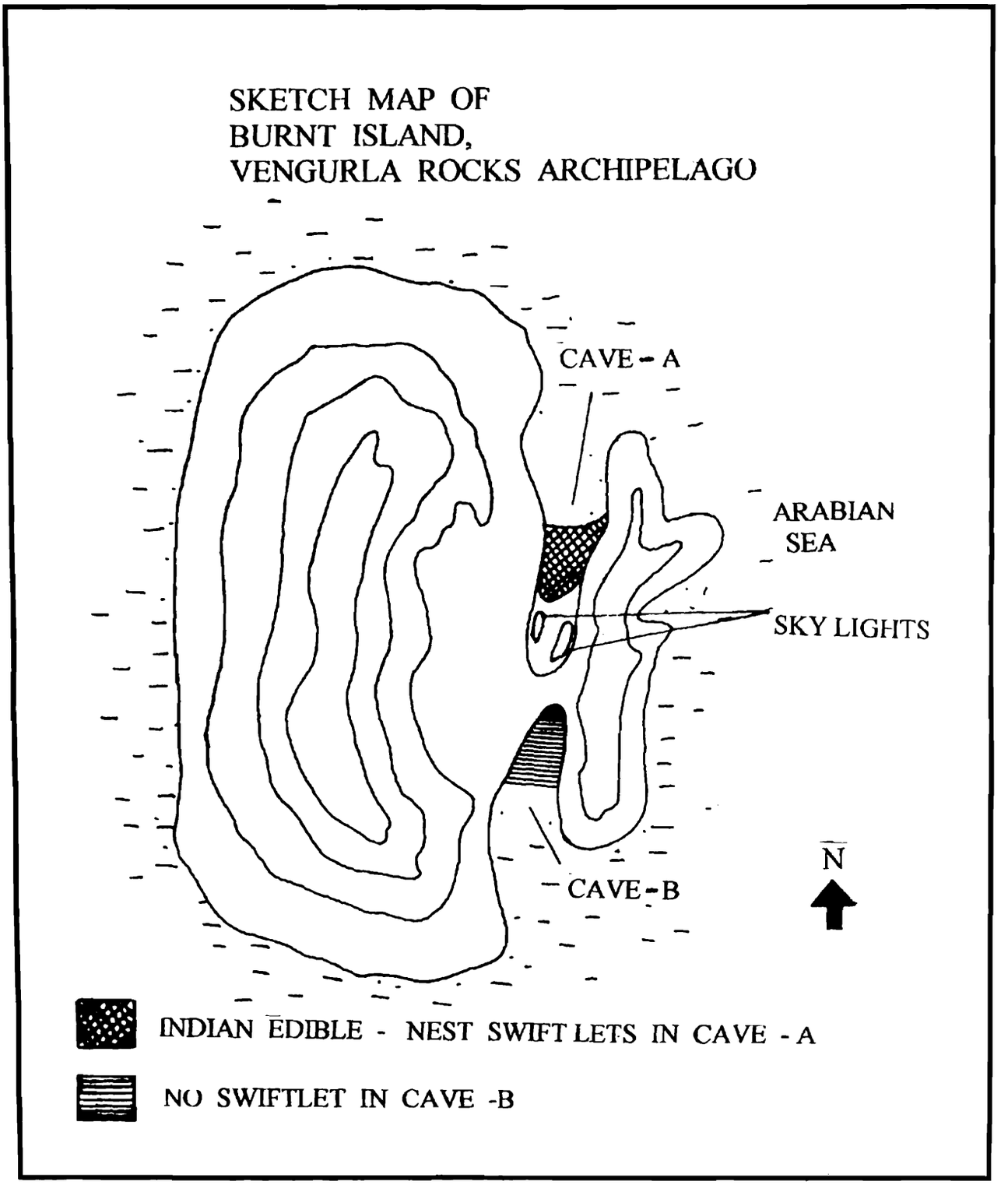
11. RECENT OBSERVATIONS AND RESULTS

We started the study of status of Indian Edible-nest Swiftlets *Collocolia unicolor* from 2001 to 2006. Our findings and report are mainly based on our surveys and we have taken cognizance of the previously published and unpublished reports. We shall present the brief details of the newly discovered and known nesting sites followed by the newly discovered and known roosting sites. We shall also present our observations in Table 3, 4 and 5 under the following categories, viz. Table 3 : Entire coastal area of the west coast of India including islands and forts, Western Ghats and two oceanic and pelagic surveys, one of the offshore marine islands and the second of the Lakshadweep Archipelago; Table 4 : Surveys for six years from 2001 to 2006 at the Burnt Island, Vengurla Rocks and Table 5 : Details of surveys of Burnt Island Vengurla Rocks in different months for the year, 2001-2002.

11.1. **Brief description of newly discovered and known nesting sites of Indian Edible-nest Swiftlet *Collocalia unicolor* : (Map-3)**

i. **Old Lighthouse Island, Maharashtra (Newly discovered colony; Poahing not recorded)** : From Niwati-Medha one reaches the Old Lighthouse Island after an hour and ten minutes of sailing by motor boat, and it is the farthest island of the Vengurla Rocks Archipelago also called Kambra **(Map-1)**. It is difficult and risky going on this island. On the underside of the dome in the crumbling but majestic building of the old lighthouse more than 30 nests of Indian Edible-nest Swiftlets *Collocalia unicolor* were observed in April 2001. This is a new hitherto un-described site. The actual room with the dome is about 5 X 5 m in size and about 5 m high. A window looks out giving a majestic glimpse of the churning waves as they strike the rocky cliffs of the island. The roof of the dome is made of cobblestones. The swiftlets were flying and actively making nesting. No eggs were recorded during the visit. There was no bamboo structure and no evidence of poaching.

ii. **Burnt Island, Maharashtra (Known nest site; Poaching recorded till 2001)** : The eastern most square shaped Burnt Island or Bandra is close to the Old Lighthouse Island and separated from it by about 500 m. The Burnt Island is about 25 to 45 m above the sea level and edges of the island are a sheer vertical drop to the sea. The entrance of the nest cave is at sea level and to reach it means a vertical climb down a 17 m cliff-face. Direct access to the cave is denied when the sea is turbulent. The cave 'A' can be entered by negotiating the cliff by climbing down or by swimming around the island **(Map-2)**. The rocks in the sea in front of the cave 'A' are studded with goose barnacles and sea urchins amidst angry waves that are turbulent in monsoon season. When the sea is calm the motor-boat can reach the cave. Many times the island becomes inaccessible and landing is not possible especially from late May till early September when SW monsoon begins. The cave measures about 33 m in length, 4 to 5 m in width and 15 m in height. This tunnel like cave has two skylights from the top.

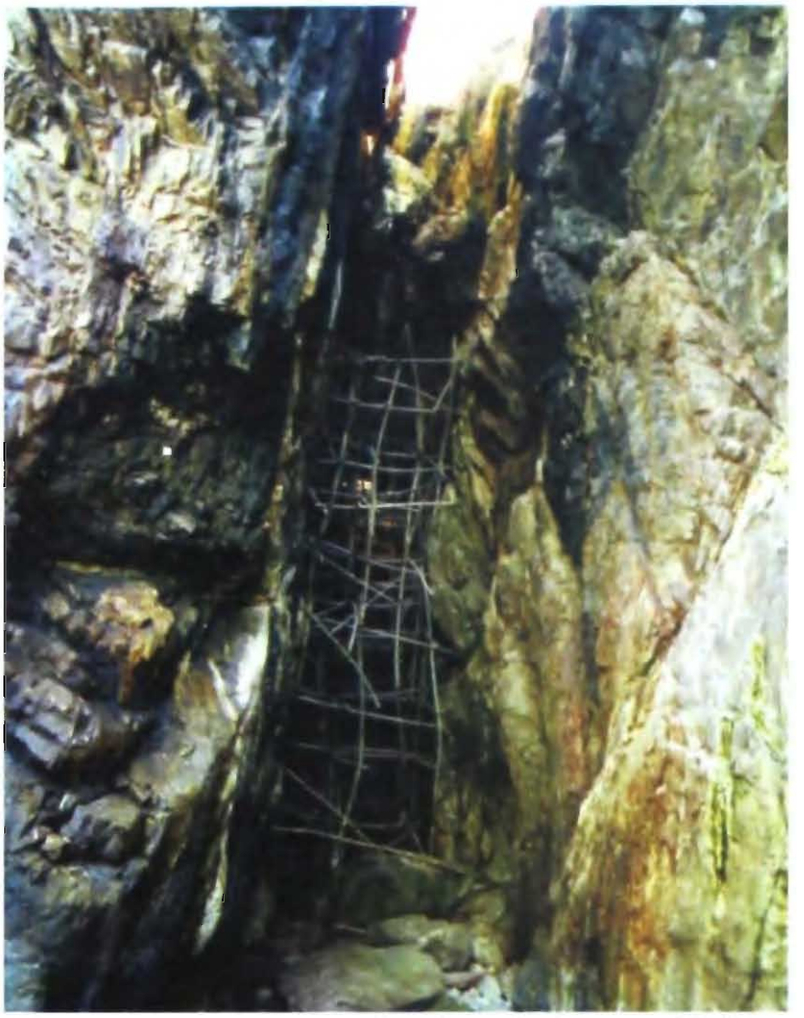


Map-2 : Sketch map of Burnt Island, Vengurla Rocks Archipelago,Sindhugurg District, Maharashtra showing two caves.

CAVE-A : Nesting and roosting of Indian Edible-nest Swiftlets, *Collocalia unicolor*, and

Cave-B : Not used by Indian Edible-nest Swiftlets. (Not to the scale)

The party members of the two NGO's ELA Foundation, Pune and Sahyadri Nisarga Mitra, Chiplun, first noticed in 2001 that the cave was filled with an enormous maze of bamboo framework reaching up to the very roof of the cave. Nests are plastered on the walls and roof of the cave. Inside the cave nest density per sq. m was counted and it was found to be variable. At some places it was 4/sq.m and at other places it was 22 to 38/ sq. m (Pande, *et al.*, 2001 c). The density and the locations of the nests differ from year to year. Rainwater enters the cave through the two skylights. The walls become wet and the floor is muddy and murky in monsoon. After the nesting is over authors have observed that several nests fall down. The floor of the cave is carpeted with a layer of guano.



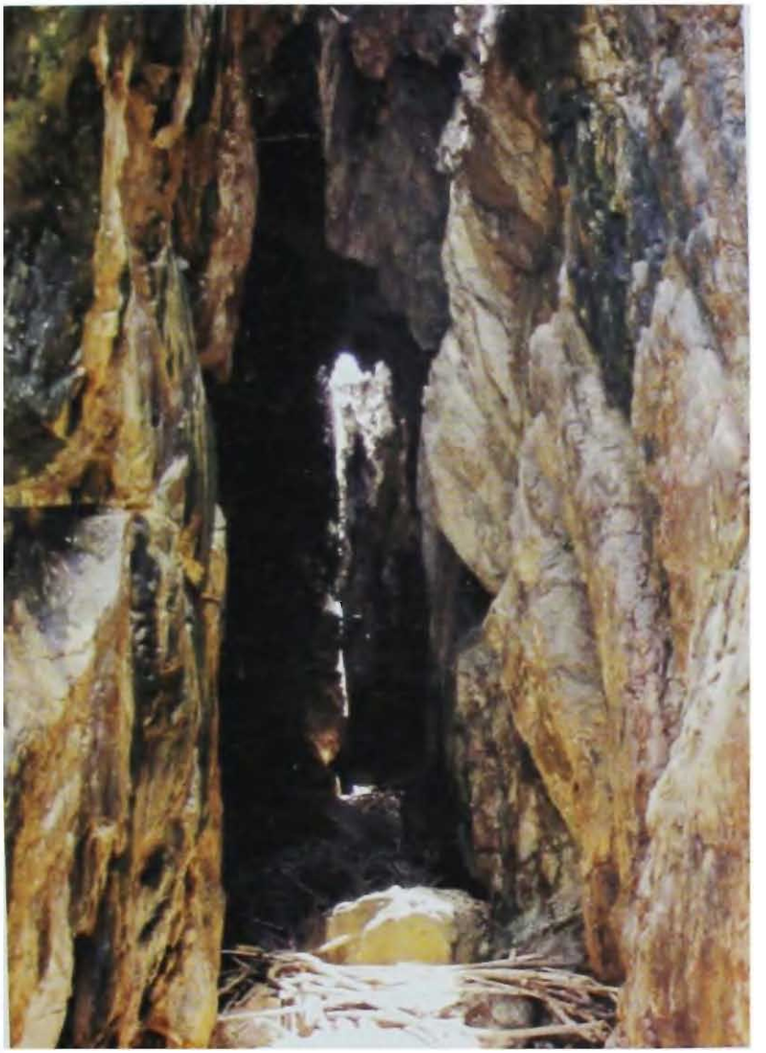
Cave on Burnt Island with bamboo structure erected by poachers.

Bamboo structure inside the cave extending upto the roof.

In April 2001 there was not a single place in the cave that was free of the bamboo framework, for such was the massive structure. It meant that the poaching activity was going on for the past several years. There were new bamboos and old ones tied with strong ropes. All were coated with a thick layer-4 to 5 cm. of bird droppings. This meant that the frame was erected to poach the bird nests that were on the

walls of the cave and on the roof since a considerable time. A truckload of rotten bamboos lay scattered on the floor of the cave. Only after the arrest of the poachers and removal of the bamboo structure was the cave truly rendered safe and bestowed to its original atmosphere. Presently this cave 'A' does not have any erected bamboo structure though rotting bamboos still lie on the floor. Some nests of Blue Rock Pigeon are also recorded in the cave 'A' Another cave 'B' is also seen on the southern side of the island but it does not have any swiftlet's nests (**Map-2**).

iii. **Tiracol, Goa (Known nesting colony)** : Once a small breeding colony existed in a crevice in the cliff face near Tiracol Fort. The cliff was damaged in a landslide. No swiftelts were recorded here during our surveys from November 2001 to 2003.



Nesting and roosting cave on Burnt Island after the removal of bamboo structure.

iv. **Anjadeeva or Anjadeep Island, Karnataka (Known nesting colony)** : At Anjadeeva a small islet south-west of Karwar in North Canara, a small cave once existed where Indian Edible-nest Swiftlets used to breed. Presently this cave has collapsed and it existed till the early 20th century (Telles, 1938; Lainer, 1999 and 2004). In our survey during October 2005 we did not record any swiftlets on this island (Pande, 2005; unpublished report). The new development is that the island is now connected with the mainland by a stone bund.

v. **Netrani Island (Pigeon Island), Karnataka (Known nest site; Poching recorded till 2001)** : Jerdon recorded this colony in 1846 (Jerdon, 1862). The cave is at the sea level on south face of the island. At high tide one can enter the cave in a boat, which is about 3.5 m high at the entrance and it curves after a few meters. Local fishermen told us that poachers removed nests from the boat, since the nests are located on either wall and the roof of the cave, but at times few bamboos were used

for approaching higher nests. There is no permanent bamboo structure in this cave now. During our visit in October 2005 about 100 + swiftlets were seen flying near the cave and were entering the cave. Since we did not enter the cave the nests were not evaluated (Pande, 2005; unpublished report).

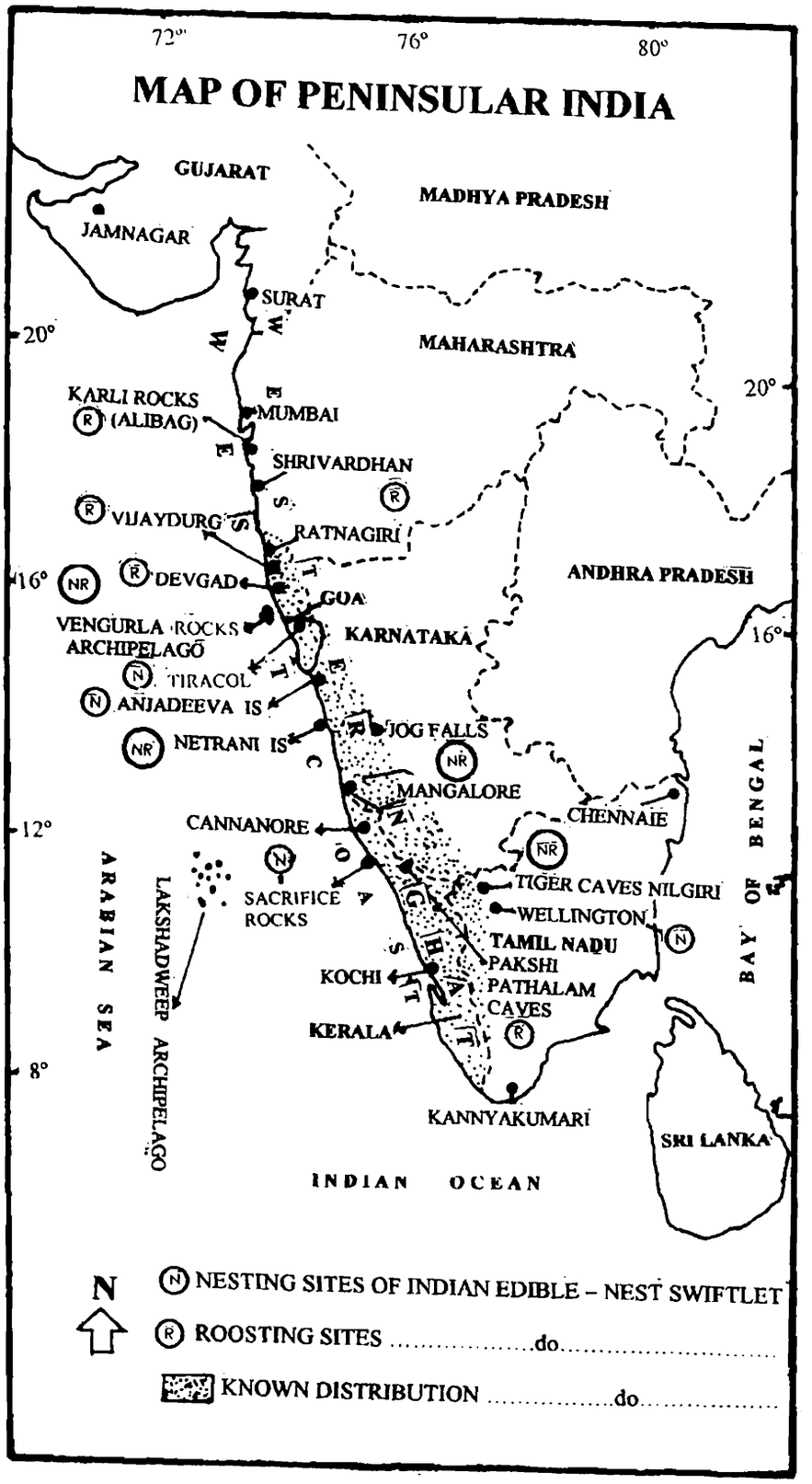
vi. **Jog or Gersoppa Falls, Karnataka (Probable nesting and roosting site)** : Ali mentions that the race *bakeri* of the Alpine Swift *Apus melba* nests here in December-January in the cliffs flanking these falls in Mysore (Ali, 1949). The nest is half-saucer shaped and is stuck against rock face. It is made from straw and feathers collected in the air and agglutinated with birds' saliva. It is likely that the Indian Edible-nest Swiftlets also nest in this region but further surveys are needed.

vii. **Wellington-Coonoor Road, Tamil Nadu** : In April 1926 Williams has recorded a colony breeding under the Wenlock Bridge (Baker, 1934). Current status is unknown.

viii. **Tiger Caves, Nilgiris, Tamil Nadu (Known nest site; Poaching recorded in the past)** : These are located near Ooty in the Nilgiris (**Map-3**). A fairly steep and short climb from the Ooty-Coonoor road takes one to these caves. The labyrinthine caves have been carved out in a huge rock face by action of water over a period of several centuries. The rocky floor is uneven and the height of the cave is low and a person cannot stand upright inside the cave without bending the neck. Since the cave is pitch-dark torch light are necessary to explore the caves. During the breeding season the clicking sound of the swiftlets resonates in the cave. The nests are situated on the walls and the roof of the cave. The unusual aspect of the birds here is the larger clutch size of 3 eggs as against of 1-2 eggs elsewhere (Walkey, 1978). At present a temple is located at this site and the entrance to the nest cave is through it. No poaching activity was evident in 2002. The nests at this site have a high quantity of admixture with straw and lichen and hence have a poor culinary value. The colour of these swiftlets is more ashy-gray than those seen at Vengurla Rocks (Ram Mone, *per com*). Davis and Cardew have described its breeding in the Nilgiris in 1930's and probably Baker also visited the same site in the same year (Baker, 1934). Active and undisturbed breeding colony of 125 nests with eggs, just hatched nestlings and juveniles were recorded in two small caves of Tiger Hill (Katdare, 2002).

ix. **Sacrifice Rock, Tellicherry, Kerala** : The colony was first recorded by Jerdon in March 1849. There is one cave here about 20 miles from Tellicherry (Thalassery), north of Mahe, Kannur district, Kerala, which at that time had 50-100 nests and few eggs in them. The Moplahs from the main land took away the nests annually for commercial use (Jerdon, 1862). Current status is unknown.

x. **South Travancore, Kerala** : In a cave in this region at an elevation of 700 m Bourdillon once counted over 250 nests (Baker, 1934; Ali, 1953). There are no recent records about this site.



Map-3 : Map of West Coast, Western Ghat and Lakshadweep Archipelago in Arabian Sea showing distribution, nesting and roosting sites of Indian Edible-nest Swiftlet, *Collocalia unicolor*.
(Map : Not to scale)

11.2 Brief description of newly discovered and known roosting sites of Indian Edible-nest Swiftlet *Collocalia unicolor* : (Maps-1 and 3)

i. Karli Rocks (Motha Kawada cliff, near Alibag, Raigad district), Maharashtra : A small roosting population of about 40-50 swiftlets was recorded for the first time on the seaward facing cliff face at a height of about 90 m above sea level in May 2006. The swiftlets were sighted in flight and localized droppings of the birds were found under the roosting cliff face after climbing the vertical cliff.

ii. Shrivardhan Coast with tall rocky cliffs, Ratnagiri district, Maharashtra. A flock of about 100 + swiftlets was recorded flying during our visits from 2004 to 2005.

iii. Vijaydurga Fort, Sindhudurg district, Maharashtra. A flock of 15 to 20 swiftlets was seen in flight during November 2001.

iv. Devgad Fort and Devgad town, Sindhudurg district, Maharashtra : In the area surrounding the crevice in fortification of the fort a mixed flock of about 100 Wire-tailed Swallows and about 80 House Swifts was recorded in flight. This could be a possible roost of Indian Edible-nest Swiftlets also since about 30 swiftlets were seen in the adjacent Davgad town during November 2001.

v. Burnt Island, Sindhudurg district, Maharashtra. Several visits were made during 2001 to 2006.

vi. Old Lighthouse Island, Vengurla Rocks, Sindhudurg district, Maharashtra. Visits during 2001 to 2004.

vii. Netrani Island, North Canara, Karnataka. About 100 + swiftlets were seen near the cave.

viii. Jog Falls, Shimoga district, Karnataka.

ix. Tiger Caves, Nilgiris near Ooty, Tamil Nadu.

x. Pakshi Pathalam caves, Wynaad district, Kerala. Nesting as well as roosting of swiftlets was recorded by Pravin Jayadevan in 2006 (*per. com*).

Several other roosting and also a few more nesting sites are likely to be present along the West Coast and in the Western Ghats foothills. Detailed and extensive surveys need to be undertaken for better understanding of their distribution and population status.

12. TABULATION OF RECENT OBSERVATIONS AND PUBLISHED RECORDS OF OCCURRENCE AND STATUS OF *COLLOCALIA UNICOLOR*.

12.1. Table 3 : Status of *Collocalia unicolor* in Western Ghats, the West Coast, offshore waters, marine islands and Lakshadweep Archipelago of India.

Status in Gujarat, Maharashtra, Goa, Karnataka, TamilNadu, Kerala, oceanic survey of offshore waters, marine islands and the Pelagic Survey of Lakshadweep Archipelago is shown in separate sub-tables i to viii, for the sake of convenience.

12.1.i . **Gujarat**

Place	Date	District	Status	Reference
Jamnagar 22^0,26'N; 70^0,05'E	March, 2003	Jamnagar	Not recorded	SP, SNP
Pirotan Is.	March, 2003	Jamnagar	Not recorded	SP, SNP

12.1.ii. **Maharashtra**

Place	Date	District	Status	Reference
Vasai to Gateway of India (Coastal Bird surveys)	Several visits from 2001 to 2004	Thane	Not recorded	SP, SNP
Elephanta Caves, Gharapuri, Khanderi, Underi and Gull Is.	Feb. 2004 and October, 2005	Mumbai, Raigad	Not recorded	SP, SNP
Revas, Mandve, Kihim to Alibag Fort (Coastal Bird surveys)	February, 2006	Raigad	Not recorded	SP, SNP
Akshi, Choul, Nagao, Revdanda, Karli to Murud Janjira (Coastal Bird surveys)	6-7 May, 2006	Raigad	50+ swiftlets near Karli Rocks (Motha Kawada cliff near Alibag) Roost site	SP, AM
Dighi, Mhasala, Shrivardhan to Harnai-Murud, Harnai Fort to Guhagar (Coastal Bird surveys)	Several visits 2004-2005	Raigad Ratnagiri	Flock of 100+ swiftlets recorded flying on coastal Shrivardhan. Roost site	SP, SNP

Place	Date	District	Status	Reference
Western Ghats foothills from Mahad to Chiplun	Several visit 2002-2006	Raigad Ratnagiri	Not recorded	SP, SNP
Guhagar, Velneshwar, Hedawi (Coastal Bird surveys)	Several visits from 2003-2005; 27-29 May, 2006	Ratnagiri	Not recorded	SP, AM

12.1.ii. **Maharashtra**

Place	Date	District	Status	Reference
Ratnagiri to Rajapur	several visits 2003-2005	Ratnagiri	Not recorded	SP, SNP
Rajapur Hills 16°,35'N; 73°,30'E	23-11-2001	Ratnagiri	Not recorded	AM, RMS
Vijaydurga Fort 16°,34'N; 73°,22'E	22-11-2001	Sindhudurg	15-20 swiftlets in flight	AM, RMS
Girye village, Karela Cave	22-11-2001	Sindhudurg	Not recorded	AM, RMS
Deogad Fort 16°,23'N; 73°,27'E	21-11-2001	Sindhudurg	Not recorded	AM, RMS
Deogad town	21-11-2001	Sindhudurg	About 30 swiftlets, flying	AM, RMS
Achra Bandar 16°,17'N; 73°,55'E	21-11-2001	Sindhudurg	Not recorded	AM, RMS
Kunkeshwar 16°,15'N; 73°,22'E	22-11-2001	Sindhudurg	Not recorded	AM, RMS
Tondavali Varchi Cave 16°,13'N;	21-11-2001	Sindhudurg	Not recorded	AM, RMS
Sindhudurg Fort 16°,09'N; 73°,40'E	21-11-2001	Sindhudurg	Not recorded	AM, RMS
Pandav Cave, Korjai 15°,57'N;73°,46'E	20-11-2001	Sindhudurg	Not recorded	AM, RMS

Place	Date	District	Status	Reference
Niwati Fort 15°,56'N;73°,30'E	20-11-2001	Sindhudurg	10-15 swiftlets flying with House Swifts	AM, RMS
Niwati-Medha 15°,56'N;73°,32'E	20-11-2001	Sindhudurg	Flock of 300+ swiftlets, flying	SP, AM, RMS, SNP
Vengurla Rocks Archipelago Old Lighthouse Is. & Burnt Island 15°55'N;73°30'E	2001-2006	Sindhudurg	For details see Table 4 & 5 Nesting and roosting population	SP, AM, SNP, RMS
Vengurla to Banda	Several visits 2001-2003	Sindhudurg	Small flocks along rocky coasts in flight	SP, SNP

12.1.iii. **Goa**

Place	Date	District	Status	Reference
Tiracol	November 2001 - 2003	Goa	No recent record; Past nesting. Cliff collapsed	SP, SNP
Goan Western Ghats	?	Goa	Possible occurrence	Lainer, 1999
Grandi Is. St. George Is.	Oct., 2005	Goa	50+ in flight	SP, SNP Pande, 2005

12.1.iv. **Karnataka**

Place	Date	District	Status	Reference
Anjadeeva Is. or Anjadeep	October, 2005	North Canara	Not recorded. past nesting, cave has collapsed	Telles, 1938; Lainer, 1999 & 2004; Pande, 2005
Mugaregudda Is. Devagudda Is.	October, 2005	–	Not recorded	SP, SNP Pande, 2005

Place	Date	District	Status	Reference
Netrani Is. or Pigeon Is.	October, 2005	North Canara	100+ swiftlets near cave. Nesting and roosting site	Jerdon, 1862 Pande, 2005,
Coconut Is.	October, 2005	South Canara	Not recorded	Pande, 2005
New Mangalore 12°54'N;74°48'E	October, 2005 March, 2006	Mangalore	Not recorded	Pande, 2005 & 2006
Jog Falls or Gersoppa Falls	-	Mysore but in Shimoga	Possible nesting and roosting site	Ali, 1949

12.1.v. **Tamil Nadu**

Place	Date	District	Status	Reference
Wellington-Coonoor Road Under Wenlock Bridge	April 1926	Coimbatore	Nesting likely; Breeding colony underbridge, no recent record.	Baker, 1934
Tiger Caves, Nilgiris	In 1930's	Coimbatore	Breeding	Baker, 1934
Tiger Caves, Nilgiris	May, 1978	Coimbatore	Several nests; Mainly 3 eggs per nest and chicks	Walkey, 1978
Tiger Caves, Nilgiris, near Ooty	2002	Coimbatore	125 nests, also eggs and chicks. Active and undisturbed nesting colony and roosting site	Katdare, 2002 & Ram Mone (*per. com.*)

12.1.vi. **Kerala**

Place	Date	District	Status	Reference
Sacrifice Rock Is. (Near Tellicherry) 11°40'N;75°30'E	March, 1849	Kannur	Nesting but no recent records	Jerdon, 1862

Place	Date	District	Status	Reference
Pakshi Pathalam Caves	2006	Wynaad	Nest site and roosting	Pravin Jaydevan, 2006 (*per. com.*)
South Travancore, cave	—	—	Nesting but no recent records	Baker, 1934; Ali, 1953

12.1.vii. **1ST Oceanic survey of offshore waters and marine islands**

Place	Date	District	Status	Reference
Oceanic survey off the west coast in the Arabian Sea from Mumbai to New Mangalore and back. (Refer chapter 6.5 for details)	October, 2005	Marine waters	400+ about 18 nautical miles from the coast near Vengurla Rocks and not elsewhere	Pande, 2005

12.1.viii. **2ND Pelagic survey of Lakshadweep Archipelago**

Place	Date	District	Status	Reference
Lakshadweep Archipelago : Cherbaniani, Byramgore, Bitra, Pitti, Bangaram, Tinnakara, Parli 1&2, Agatti, Suheli Pitti, Suheli Cheriyakara & Veliyakara, Kavaratti. 8^0-21^0N; 71^0-74^0E	March, 2006	Lakshadweep	Not recorded any where	Pande, 2006

Key to abbreviations :

AM-Anil Mahabal, SP-Satish Pande, RMS-R. M. Sharma and SNP-Shivkumar (*alias* Banda) N. Pednekar.

12.2. **Table 4 : Status of *Collocalia unicolor* on Burnt Island, Vengurla Rocks, Maharashtra, for six years from c. 2001 to 2006.**

Status/ Year	2001	2002	2003	2004	2005	2006
Month	March, April, June, September, November	April, May	September	May	September	May
No. of swiftlets (Approx)	See table 5	>4000 in April >5,000 in May	500+	5000 +	400+	5000 +
No. of nests (Approx)	See table 5	2000- April 2500-May	2000+ intact nests on walls. 500+ broken nests on ground.	2500. Dense cluster on right than on left wall of the cave	Could not enter the cave. Rough sea.	2500+. Very dense cluster on right and hind wall than on left wall of cave
No. of Eggs/ Chicks (Approx)	See table 5	500+ in lower level nests. Upper nests status not visible	None	700 in lower level visible nests	Could not enter the cave	400+ visible eggs and 100+ chicks in lower level nests.
Activity of swiftlets	Flying; Incubating; Feeding; Nest repair	Flying; Incubating; Feeding; Nest repair	Flying above island and inside the cave	Flying; Incubating; Feeding; Nest repair	Flying above island and inside the cave	Flying; Incubating; Feeding; Nest repair
Bamboo structure	Present till Dec. 2001 Removed in January, 2002	Removed Scattered debris on floor.	Removed Rotting bamboos on damp floor.	Removed Cave floor filled with guano.	Removed No new activity visible from outside.	Removed The two bamboos on roof not seen
Poaching activity	Ongoing till Mar. 2001. Poachers arrested on 17-4-2001	No poaching	No poaching	No poaching	No poaching	No poaching

12.3. **Table-5 : Status of *Collocalia unicolor* on Burnt Island, Vengurla Rocks, Maharashtra, during the poaching activity and just after the arrest of poachers.**

Status/ Year	March-2001	18-4-01	6-6-01	8 & 9-09-01	19-11-01	2-4-02	18-5-02
No. of Swiftlets	300+	2000+	2000+	500+	200+	4000+	5,000
No. of Nests (Approx)	1800 nests.	1200+ nests. Density : 4/sq. m to 22-38/ sq m.	1200+ nests Rebuilt with grass, twigs, etc.	1200+ empty nests. Few nests on ground .	About 1200 empty nests	2000+ nests	2500+ nests. Nest density : 24-64/ sq. m.
No. of Eggs/ Chicks (Approx)	None	No eggs.	100 eggs. Few chicks.	No eggs. No chicks.	No eggs No chicks.	400 eggs and no. of chicks in lower nests; Upper nests could be surveyed.	500+ eggs in lower nests
Activity of swiftlets	Flying.	Incubation; Flying; Nest building. Nest repair	Incubation; Flying; Nest building; Feeding chicks.	Flying above island and in cave.	Flying above island and in cave.	Incubation; Flying; Nest building; Feeding chicks.	Incubation; Flying; Nest building; Feeding chicks.
Bamboo structure	Present.	Present.	Present	Present	Present; Removed in Dec., 01 to Jan., 02.	Absent	Absent
Poaching activity	Present.	Poachers arrested on 17-4-01	Poaching stopped.	Poaching stopped.	Poaching stopped.	Poaching stopped.	Poaching stopped.

13. OTHER FAUNA AND FLORA ON THE VENGURLA ROCKS ARCHIPELAGO AND NETRANI ISLAND

During our several visits to the Vengurla Rocks Archipelago (2001-2006) we recorded a few species of fauna and flora other than the Indian Edible-nest Swiftlets.

13.1. **Fauna on Old Lighthouse Island** :

On 8th April, 2001 the following fauna was seen on the Island, *viz.*

i. Number of Blue Rock Pigeons-*Columba livia* with their two active nests on the ground and on the steps of the lighthouse tower.

ii. A juvenile Whitebellied Sea Eagle (*Haliaeetus leucogaster*).

iii. Jungle Crow (*Corvus macrorhynchos*).

iv. Common Sandpipers (*Actitis hypoleucos*), few in number and

v. Western Reef Egret (*Egretta gularis*).

13.2. **Fauna on and around Burnt Island** :

Following fauna and flora was seen during the various visits from 2001 to 2006.

i. Spinner Dolphins *Stenella longirostris* (Gray) were sighted on the way to the Burnt Island.

ii. Field mice.

Top view of Burnt Island with Birdled Terns.

iii. Nine species of terns *viz.* Common (*Sterna hirundo*), Roseate (*Sterna dougalli*), White-cheeked (*Sterna repressa*), Bridled (*Sterna anaethetus*), Sooty (*Sterna fuscata*), Large Crested (*Sterna bergi*), Lesser Crested (*Sterna bengalensis*), Brown Noddy (*Anous stolidus*) and Indian River Terns (*Sterna aurantia*) (Pande, 2002a and b). So also Parasitic Jaegers (*Stercorarius parasiticus*) and Shearwater sp. were recorded on the marine waters between coast and the Burnt Island. Authors saw a flock of Storm Petrel (Family : Hydrobatidae) in May 2006.

iv. A pair of Ruddy Turnstones (*Arenaria interpres*).

v. Few Common Sandpipers (*Actitis hypoleucos*), the above two are probably non-breeding stay backs.

vi. Western Reef Egret (*Egretta gularis*).

vii. Two pairs of White-bellied Sea-Eagles (*Haliaeetus leucogaster).* These were confirmed predators of the chicks of the nesting terns. They carried the chicks to the adjacent Old Lighthouse island for eating them. The remnants of the chicks were seen on this island.

viii. Several Blue Rock Pigeons (*Columba livia*) and one partial albino were seen on the island (Mahabal and Pande, 2006). Jungle crows were also seen on the island. Hume also reported the Blue Rock Pigeons and White-bellied Sea Eagles as early as 1876 (Hume, 1876).

ix. A Shikra (*Accipiter badius*), a Common Kestrel (*Falco tinnunculus*) and a pair of Indian Robins (*Saxocoloides fulicata*) were seen on the New Lighthouse Island.

x. A carapace of Olive Ridley Turtle (*Lepidochelys olivacea*) was seen on the coast of Niwati-Medha, from where we approach the Burnt Island from a boat.

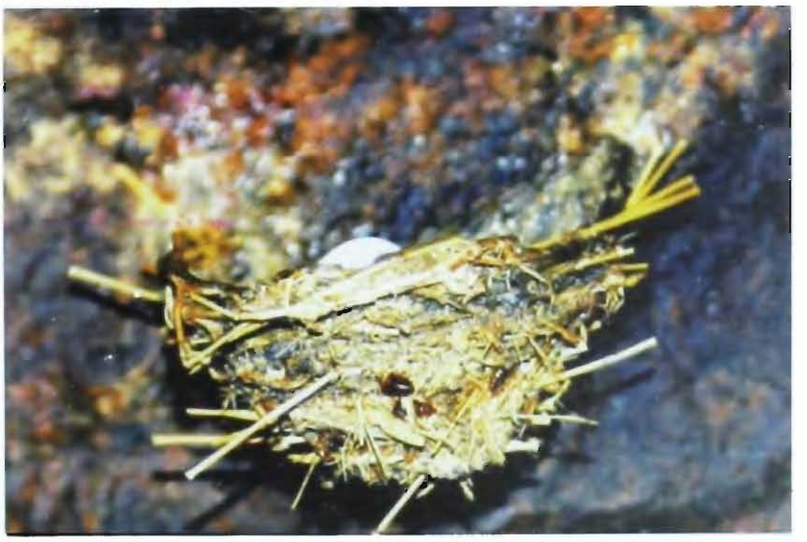
xi. Sea Snakes

xii. Marine life in the form of Squids was particularly plentiful during September and a catch of 75 kg by fishermen at one go lasting a few hours was seen.

xiii. Crabs, Goose Barnacles, Sea-Urchins, Sea Slug (*Holothuria atra*).

xiv. Black coloured scorpion.

xv. Bed bugs and maggots in the swiftlet nests.



Impure nest with one egg and bed-bugs.

xvi. Guano eating cockroaches of *Periplaneta* spp

'White' nest with chick and a cockroach near the nest.

13.3. **Flora on Burnt Island** :

Shrubs and grass – *Ifchaemum commutatum*, Hack (Fam : Poaceae), *Celosia argentea* and *Celosia argentea cristata* (Fam : Amarantheceae).

13.4. **Fauna around Vengurla Rocks** :

Humayun Abdulali (1940 and 1942) has also described this and other faunal and floral species on and around the Vengurla Rocks during his visit in February 1938 and March 1941. Interesting fauna seen by him include a flock of Greater Flamingos (*Phoenicopterus ruber*) in flight, a semi-albino Blue Rock Pigeon (*Columba livia*), a pair of Blue Rock Thrush (*Monticola solitarius*) besides various species of gulls and terns; and *Hemidatylus* species of lizard was also recorded.

13.5. **Fauna on Netrani Island, Karnataka** :

White-bellied Sea Eagles (*Haliaeetus leucogaster)* were recorded nesting in significant numbers on this island. Large and Lesser Crested Terns (*Sterna bergi* and *Sterna bengalensis*) were also seen.

14. FACTS ABOUT NEST TRADE FROM 1990'S ONWARDS

(Chief references are : Menon *et al.*, 1994; Sankaran, 1995 and 1998; Menon and Kumar, 1998)

1. Of the four swiftlet species whose nests are commercially valued globally, two are found in India, particularly Indian Edible-nest Swiftlet *Collocalia unicolor* and Common Edible-nest Swiftlet *Collocalia fuciphaga*.

2. The 'black' nests are made from saliva of the swiftlet and are mixed with extraneous matter and 'white' nests are made from pure saliva of the swiftlet.

3. The nests are harvested or poached and utilized commercially as food, tonic and aphrodisiac mainly in SE Asian countries.

4. In HongKong 1 kg of nests fetches about Rs. 36,000.

5. It is estimated that about 20 million swiftlet's nests are annually traded in global market.

6. Nests are transported sun-dried or press-dried and they resemble gelatinous plastic sheets with embedded fibres.

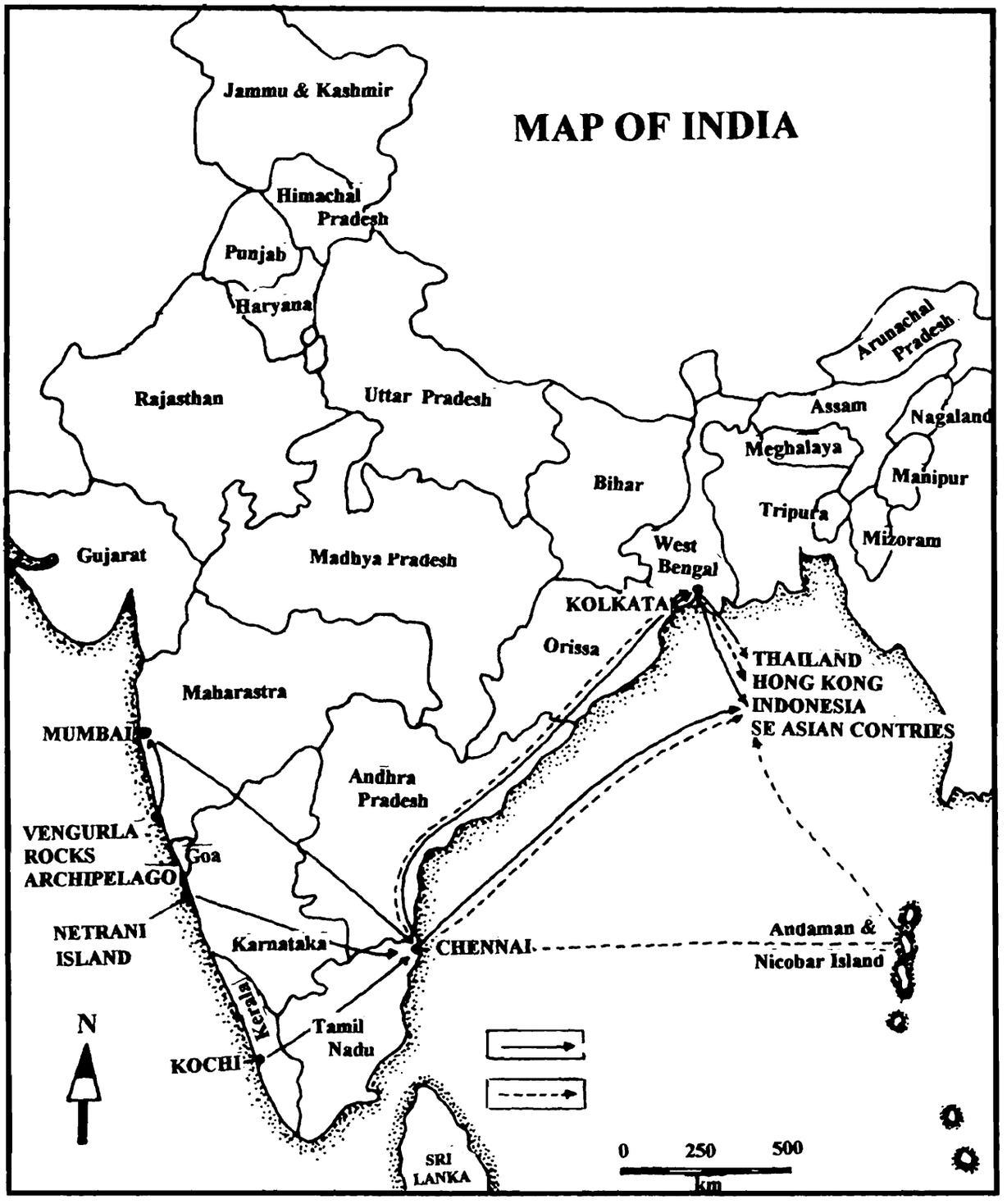
7. Collection of edible nests is reported from Andaman and Nicobar Islands, Vengurla Rocks Archipelago in Maharashtra, Netrani Island in Karnataka, Trichi in Tamil Nadu and Kerala (Menon, *et al.*, 1994; Pande, 2002 b; personal observation of author SP. This information was also obtained from the arrested poachers at Vengurla Rocks by author SP).

8. Nest collection season by poachers in Nicobar was December, end of February and also April-May. In Vengurla Rocks Archipelago it was May-June and September.

9. The trade route of *Collocalia unicolor* nests was from Vengurla Rocks and Netrani Island to Mumbai to Trichy and Chennai in TamilNadu from where they were sent either to Kolkata, then to Thailand, HongKong and other SE Asian Countries; or directly from Chennai to SE Asian countries. Possible transport of nests is via illegal Thai fishing boats in Indian waters. **(See Map-4)**

10. The trade route of *Collocalia fuciphaga* nests is from Andaman and Nicobar Islands to Chennai from where they were sent to Kolkata, then to Thailand, Hong Kong and SE Asian Countries or to Far East countries; or from Andaman and Nicobar directly to Thailand and Indonesia. Possible transport of nests via illegal Thai fishing boats in Indian waters is also likely. **(See Map-4)**

11. Nests of swiftlets are made from their saliva, which is a biological derivative. Hence the nest trade is considered under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).



Map-4 : Map of India showing trade routes of *Collocalia unicolor* and *Collocalia fuciphaga* from West Coast, East Coast and Andaman & Nicobar Island to Southeast Asian countries.
(Map : Not to scale)

12. Surprisingly, in spite of the ongoing trade in nests of both the Indian species of Edible-nest Swiftlets, *Collocalia unicolor* and *Collocalia fuciphaga*, for several years and brought to notice by several authors (Sankaran, 1998; Lainer, 1999 and 2004; Pande, 2001, Pande *et al.*, 2001 a, b, c and Pande, 2002 b) there is no mention of this trade in the chapter 'Some Burning Issues' on Illegal Bird Trade in the book 'Important Bird Areas in India, Priority Sites for Conservation' (Islam and Rahmani, 2004).

13. Both the Indian species *Collocalia unicolor* and *Collocalia fuciphaga* are protected under Wildlife (Protection) Act, 1972 WL(P) Act as amended in September 2002. Both the species were not included in Red Data Book on Indian Animals by ZSI (Director, ZSI, 1994). The species were also not included in IUCN Red Data Book (2001, 2002, 2004, 2005 & 2006) under any of IUCN categories for threatened species (Islam and Rahmani, 2002; Arun Kumar and Khanna, 2003; BirdLife International, 2004 & 2006, respectively). Neither the family Apodidae nor any of the swiftlet species were protected before 2002 (Buceros, 2002) when the trade in nests flourished in India. The species was included in Appendix II of CITES in 1997 (Menon and Kumar, 1998). However, the species is not presently included in CITES, 2002, 2004 and 2005 (http : //www.cites.org).

14. Poachers have been arrested at Kolkata and at Burnt Island, Vengurla Rocks in April 2001.

15. In Nicobar Islands the population of swiftlets, *Collocalia fuciphaga* is estimated to be less than 2000 breeding pairs and the study by Sankaran states that the population is 'Critically Threatened' (Sankaran, 1995). But the swiftlets do not feature in the threatened species list (Islam and Rahmani, 2002).

16. Authors have estimated a breeding population of about 900 pairs just before poaching of nests in April 2001 at Burnt Island, Vengurla Rocks Archipelago; dwindling to 600 pairs just after poaching in June 2001 and then gradually increasing to 2500 pairs in May 2006.

17. It may appear harmless to collect the nests after breeding is over, without affecting the breeding success. But the poaching of nests as was practiced in our country resulted in poor breeding success of swiftlets because nests were collected during the active breeding period.

18. Presently the nest trade of *Collocalia unicolor* is not ongoing either at Burnt Island, Vengurla Rocks Archipelago or at Netrani Island.

19. The present status of nest trade of *Collocalia fuciphaga* in Nicobar Islands is uncertain.

20. There appears to be no market for the edible nests in India. Presently there is a ban on removal of nests in India by the provisions of WL(P) Act, 1972 as amended in 2002.

15. PROTECTION MEASURES TAKEN

1. Detection of poaching of nests of Indian Edible-nest Swiftlets *Collocalia uniclor* at Burnt Island, Vengurla Rocks Archipelago by NGO's ELA Foundation, Pune and Sahyadri Nisarga Mitra, Chiplun, Maharashtra in March, 2001 and creating public awareness about this issue, was the first important step towards conservation of this species.

2. Whole-hearted, selfless and committed support of a young dynamic local fisherman Mr. Shridhar Metar from Niwati-Medha, Sindhudurg district, Maharashtra requires special mention here. It was due to his continued vigilance and understanding of the seriousness of poaching by unknown persons that the timely information about the arrival of poachers to the Burnt Island was conveyed to NGO's. This culminated in the arrest of poachers. He was instrumental in getting help from local fishermen during the removal of the massive bamboo framework from the island cave. He always extended support in ferrying conservationists to the Burnt Island on all occasions without any intention of monetary gains. Shridhar Metar and his family continue to extend full support to the conservation of Indian Edible-nest Swiftlets of Burnt Island till 2006. Support of local people like Mr. Metar is crucial for true long-term conservation.

3. Arrest of the poachers by the officials of the Maharashtra state Forest Department, Sawantwadi, Sindhudurg district on 17th April, 2001 and award of custody to the poachers by competent authorities was the second important step.

4. Surveillance visit to the Burnt Island by officers of the Indian Coast Guard in 2001.

5. Survey of the Burnt Island and coastal areas of Sindhudurg district, Maharashtra was undertaken by the Zoological Survey of India, W.R.S., Pune as per the instructions of Director, ZSI, Kolkata, in November 2001.

6. Removal of the massive bamboo framework from the cave on the Burnt Island, by Forest Department, Sawantwadi with the help of fishermen from the village of Niwati-Medha, in December 2001 and January 2002.

7. Reports of poaching from NGO's ELA Foundation, Pune and Sahyadri Nisarga Mitra, Chiplun, were sent independently as well as through Bombay Natural History Society, Mumbai, to Ministry Of Environment and Forests (MOEF) and Wildlife Board of India, New Delhi.

8. Zoological Survey of India, W.R.S., Pune sent its report to MOEF, New Delhi through the Director, Zoological Survey of India, HQ, Kolkata in early 2002, for initiation of the necessary action for protection and conservation of the swiftlets.

9. Meeting of the Indian Wildlife Board and inclusion of Swiftlets *Collocalia unicolor* and *Collocalia fuciphaga* in the Schedule I of Part III (Birds) after the entry 18 as

entry 19 of Wildlife (Protection) Act, 1972, amended as on 30th September 2002 vide the Gazette of India notification issued on 11th October 2002. This was the third important step.

10. Inclusion of Burnt Island as an IBA (Important Bird Area) Site, under Important Bird Areas Program of Bombay Natural History Society, Mumbai and BirdLife International, UK, as IBA Site code : IN-MH-02 and IBA criteria : A4 iii (Islam & Rahmani, 2004).

11. Repeated visits, surveillance of Burnt Island and other nesting areas with maintenance of rapport with local fishermen from 2001 to 2006 by authors and other NGO's.

12. Ongoing surveillance by Forest Department, Sawantwadi, Sindhudurg district, Maharashtra and Indian Coast Guard, Western Region, Mumbai.

16. RECOMENDATIONS FOR CONSERVATION

1. Only four important sites of active nesting of Indian Edible-nest Swiftlets *Collocalia unicolor* are recorded on the entire west coast of India. These are Burnt Island and Old Lighthouse Island in Vengurla Rocks Archipelago, Maharashtra; Netrani Island, North Kanara in Karnataka and Tiger Caves, Nilgiris in TamilNadu. All these **sites need immediate protection.**

2. As the Vengurla Rocks Archipelago and Netrani Island are away from the West Coast in the Arabian Sea, and Tiger Caves is in a mountain area there is less disturbance from human beings particularly fishermen and local people respectively. There is no tourist activity at all. The fauna and flora of the islands is certainly unique. Besides the nesting colony of various species of terns and of the Indian Edible-nest Swiftlets, there are many interesting marine invertebrate forms that need to be protected and conserved. Hence, the entire Vengural Rocks Archipelago and Netrani Island along with Tiger Caves should be declared as **Special Protected Areas.** Tiger Caves can be further protected by construction of metal frame barrier on the entrance.

3. There is a need to define the status of the marine offshore islands in Vengurla Rocks Archipelago and Netrani Island with the Revenue Department. After this is done the information should be given to the local police departments about the importance and protection of the nesting colonies.

4. The Lighthouses and Lightships Authority of India should be informed about the nesting swiftlets and their protected status under WL(P)Act, 1972 and about the role played by one of their staff in the helping the poachers at Burnt Island, prior to the detection of poaching in 2001. Strict vigilance from their part will be crucial to prevent recurrence of poaching activity on offshore islands.

5. The entry to the Rocks and Islands should be restricted in cooperation with administration of Sindhudurg district and Divisional Forest Office Maharashtra state at Sawantwadi.

   Active periodical vigilance of the Islands by these departments is solicited. This will not only protect the Indian Edible-nest Swiftlets but also prevent any disturbance to the various species of nesting terns that come here to nest in large numbers.

6. There is also a need for patrolling in the adjacent coastal area and these rocky islands by the Indian Coast Guard especially during nest building period from March till June and in September after nesting is over, by actually visiting the island cave.

7. Education and involvement of local people from the fishing hamlets is very essential because they are the backbone of any conservation efforts in these remote coastal areas. A fund facility is also needed in this context to enable NGO's for continued vigilance and survey of the islands where nesting of *Collocalia unicolor* is recorded presently or later.

8. Continued educational activities through newspaper write ups, radio and television programs will be crucial in keeping people involved in conservation activity.

Indian Edible-nest swiftlets, *Collocalia unicolor* flying over the Burnt Island.

9. A long term but restricted monitoring of the nesting activity of swiftlets by NGO's and local people and government organizations is also required.

10. Detailed survey of the West Coast and Western Ghats of India especially south of Goa, through Karnataka, TamilNadu and Kerala is essential to evaluate the overall status and additional nesting and roosting sites of *Collocalia unicolor*.

11. Restrictions should be strictly imposed not only on export but also on import in India, of nests of any species of Edible-nest Swiftlets.

12. The family Apodidae **should be included in the Wildlife (Protection) Act, 1972** in appropriate Schedule. This has also been recommended in by B. N. H. S. (Buceros 2002).

13. The two species of swiftlets, *Collocalia unicolor* and *Collocalia fuciphaga* **should be included in CITES** under appropriate appendix since there is an international trade in their nests for the past several years.

14. The two species of swiftlets, *Collocalia unicolor* and *Collocalia fuciphaga* **should be included in IUCN Red Data Book** of BirdLife International under the appropriate category of threatened species.

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