



Open Access

10.11609/jott.2022.14.1.20311-20538  
[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

26 January 2022 (Online & Print)  
14(1): 20311-20538  
ISSN 0974-7907 (Online)  
ISSN 0974-7893 (Print)





ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher  
**Wildlife Information Liaison Development Society**  
[www.wild.zooreach.org](http://www.wild.zooreach.org)

Host  
**Zoo Outreach Organization**  
[www.zooreach.org](http://www.zooreach.org)

No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road, Saravanampatti,  
Coimbatore, Tamil Nadu 641035, India  
Ph: +91 9385339863 | [www.threatenedtaxa.org](http://www.threatenedtaxa.org)  
Email: [sanjay@threatenedtaxa.org](mailto:sanjay@threatenedtaxa.org)

#### EDITORS

##### Founder & Chief Editor

**Dr. Sanjay Molur**

Wildlife Information Liaison Development (WILD) Society & Zoo Outreach Organization (ZOO),  
12 Thiruvannamalai Nagar, Saravanampatti, Coimbatore, Tamil Nadu 641035, India

##### Deputy Chief Editor

**Dr. Neelesh Dahanukar**

Noida, Uttar Pradesh, India

##### Managing Editor

**Mr. B. Ravichandran**, WILD/ZOO, Coimbatore, India

##### Associate Editors

**Dr. Mandar Paingankar**, Government Science College Gadchiroli, Maharashtra 442605, India

**Dr. Ulrike Streicher**, Wildlife Veterinarian, Eugene, Oregon, USA

**Ms. Priyanka Iyer**, ZOO/WILD, Coimbatore, Tamil Nadu 641035, India

**Dr. B.A. Daniel**, ZOO/WILD, Coimbatore, Tamil Nadu 641035, India

##### Editorial Board

**Dr. Russel Mittermeier**

Executive Vice Chair, Conservation International, Arlington, Virginia 22202, USA

**Prof. Mewa Singh Ph.D., FASc, FNA, FNAsc, FNAPsy**

Ramanna Fellow and Life-Long Distinguished Professor, Biopsychology Laboratory, and  
Institute of Excellence, University of Mysore, Mysuru, Karnataka 570006, India; Honorary  
Professor, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore; and Adjunct  
Professor, National Institute of Advanced Studies, Bangalore

**Stephen D. Nash**

Scientific Illustrator, Conservation International, Dept. of Anatomical Sciences, Health Sciences  
Center, T-8, Room 045, Stony Brook University, Stony Brook, NY 11794-8081, USA

**Dr. Fred Pluthero**

Toronto, Canada

**Dr. Priya Davidar**

Sigur Nature Trust, Chadapatti, Mavinahalla PO, Nilgiris, Tamil Nadu 643223, India

**Dr. Martin Fisher**

Senior Associate Professor, Battcock Centre for Experimental Astrophysics, Cavendish  
Laboratory, JJ Thomson Avenue, Cambridge CB3 0HE, UK

**Dr. John Fellowes**

Honorary Assistant Professor, The Kadoorie Institute, 8/F, T.T. Tsui Building, The University of  
Hong Kong, Pokfulam Road, Hong Kong

**Prof. Dr. Mirco Solé**

Universidade Estadual de Santa Cruz, Departamento de Ciências Biológicas, Vice-coordenador  
do Programa de Pós-Graduação em Zoologia, Rodovia Ilhéus/Itabuna, Km 16 (45662-000)  
Salobrinho, Ilhéus - Bahia - Brasil

**Dr. Rajeev Raghavan**

Professor of Taxonomy, Kerala University of Fisheries & Ocean Studies, Kochi, Kerala, India

##### English Editors

**Mrs. Mira Bhojwani**, Pune, India

**Dr. Fred Pluthero**, Toronto, Canada

**Mr. P. Ilangoan**, Chennai, India

##### Web Development

**Mrs. Latha G. Ravikumar**, ZOO/WILD, Coimbatore, India

##### Typesetting

**Mr. Arul Jagadish**, ZOO, Coimbatore, India

**Mrs. Radhika**, ZOO, Coimbatore, India

**Mrs. Geetha**, ZOO, Coimbatore India

#### Fundraising/Communications

**Mrs. Payal B. Molur**, Coimbatore, India

#### Subject Editors 2018–2020

##### Fungi

Dr. B. Shivaraju, Bengaluru, Karnataka, India

Dr. R.K. Verma, Tropical Forest Research Institute, Jabalpur, India

Dr. Vatsavaya S. Raju, Kakatiya University, Warangal, Andhra Pradesh, India

Dr. M. Krishnappa, Jnana Sahyadri, Kuvempu University, Shimoga, Karnataka, India

Dr. K.R. Sridhar, Mangalore University, Mangalagangothri, Mangalore, Karnataka, India

Dr. Gunjan Biswas, Vidyasagar University, Midnapore, West Bengal, India

##### Plants

Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India

Dr. N.P. Balakrishnan, Ret. Joint Director, BSI, Coimbatore, India

Dr. Shonil Bhagwat, Open University and University of Oxford, UK

Prof. D.J. Bhat, Retd. Professor, Goa University, Goa, India

Dr. Ferdinando Boero, Università del Salento, Lecce, Italy

Dr. Dale R. Calder, Royal Ontario Museum, Toronto, Ontario, Canada

Dr. Cleofas Cervancia, Univ. of Philippines Los Baños College Laguna, Philippines

Dr. F.B. Vincent Florens, University of Mauritius, Mauritius

Dr. Merlin Franco, Curtin University, Malaysia

Dr. V. Irudayaraj, St. Xavier's College, Palayamkottai, Tamil Nadu, India

Dr. B.S. Kholia, Botanical Survey of India, Gangtok, Sikkim, India

Dr. Pankaj Kumar, Kadoorie Farm and Botanic Garden Corporation, Hong Kong S.A.R., China

Dr. V. Sampath Kumar, Botanical Survey of India, Howrah, West Bengal, India

Dr. A.J. Solomon Raju, Andhra University, Visakhapatnam, India

Dr. Vijayasankar Raman, University of Mississippi, USA

Dr. B. Ravi Prasad Rao, Sri Krishnadevaraya University, Anantpur, India

Dr. K. Ravikumar, FRLHT, Bengaluru, Karnataka, India

Dr. Aparna Watve, Pune, Maharashtra, India

Dr. Qiang Liu, Xishuangbanna Tropical Botanical Garden, Yunnan, China

Dr. Noor Azhar Mohamed Shazili, Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia

Dr. M.K. Vasudeva Rao, Shiv Ranjani Housing Society, Pune, Maharashtra, India

Prof. A.J. Solomon Raju, Andhra University, Visakhapatnam, India

Dr. Mandar Datar, Agharkar Research Institute, Pune, Maharashtra, India

Dr. M.K. Janarthanam, Goa University, Goa, India

Dr. K. Karthigeyan, Botanical Survey of India, India

Dr. Errol Vela, University of Montpellier, Montpellier, France

Dr. P. Lakshminarasimhan, Botanical Survey of India, Howrah, India

Dr. Larry R. Noblick, Montgomery Botanical Center, Miami, USA

Dr. K. Haridasan, Pallavur, Palakkad District, Kerala, India

Dr. Analinda Manila-Fajard, University of the Philippines Los Banos, Laguna, Philippines

Dr. P.A. Sinu, Central University of Kerala, Kasaragod, Kerala, India

Dr. Afroz Alam, Banasthali Vidyapith (accredited A grade by NAAC), Rajasthan, India

Dr. K.P. Rajesh, Zamorin's Guruvayurappan College, GA College PO, Kozhikode, Kerala, India

Dr. David E. Boufford, Harvard University Herbaria, Cambridge, MA 02138-2020, USA

Dr. Ritesh Kumar Choudhary, Agharkar Research Institute, Pune, Maharashtra, India

Dr. Navendu Page, Wildlife Institute of India, Chandrabani, Dehradun, Uttarakhand, India

##### Invertebrates

Dr. R.K. Avasthi, Rohtak University, Haryana, India

Dr. D.B. Bastawade, Maharashtra, India

Dr. Partha Pratim Bhattacharjee, Tripura University, Suryamaninagar, India

Dr. Kailash Chandra, Zoological Survey of India, Jabalpur, Madhya Pradesh, India

Dr. Ansie Dippenaar-Schoeman, University of Pretoria, Queenswood, South Africa

Dr. Rory Dow, National Museum of Natural History Naturalis, The Netherlands

Dr. Brian Fisher, California Academy of Sciences, USA

Dr. Richard Gallon, Llandudno, North Wales, LL30 1UP

Dr. Hemant V. Ghate, Modern College, Pune, India

Dr. M. Monwar Hossain, Jahangirnagar University, Dhaka, Bangladesh

Mr. Jatishwor Singh Irungbam, Biology Centre CAS, Branišovská, Czech Republic.

Dr. Ian J. Kitching, Natural History Museum, Cromwell Road, UK

Dr. George Mathew, Kerala Forest Research Institute, Peechi, India

For Focus, Scope, Aims, and Policies, visit [https://threatenedtaxa.org/index.php/JoTT/aims\\_scope](https://threatenedtaxa.org/index.php/JoTT/aims_scope)

For Article Submission Guidelines, visit <https://threatenedtaxa.org/index.php/JoTT/about/submissions>

For Policies against Scientific Misconduct, visit [https://threatenedtaxa.org/index.php/JoTT/policies\\_various](https://threatenedtaxa.org/index.php/JoTT/policies_various)

continued on the back inside cover

Caption: *Cyrtodactylus myintkyawthurai*, endemic to Myanmar. Medium: Water colours on watercolor sheet. © Aakanksha Komanduri



## New distribution record of globally threatened Ocean Turf Grass *Halophila beccarii* Ascherson, 1871 from the North Andaman Islands highlights the importance of seagrass exploratory surveys

Swapnali Gole<sup>1</sup> , Prasad Gaidhani<sup>2</sup> , Srabani Bose<sup>3</sup> , Anant Pande<sup>4</sup> , Jeyaraj Antony Johnson<sup>5</sup>   
& Kuppusamy Sivakumar<sup>6</sup>

<sup>1–6</sup> Wildlife Institute of India, P.O. Box 18, Chandrabani, Dehradun, Uttarakhand 248001, India.

<sup>1</sup>gole.swapnali@gmail.com, <sup>2</sup>prasadgaidhani10@gmail.com, <sup>3</sup>sranibose11081995@gmail.com, <sup>4</sup>anant@wii.gov.in,

<sup>5</sup>jaj@wii.gov.in, <sup>6</sup>ksivakumarwii@gmail.com (corresponding author)

**Abstract:** *Halophila beccarii*, listed as 'Vulnerable' on the IUCN Red List, aids in seagrass and mangrove succession, acts as a substrate stabilizer and provides feeding grounds for mega-herbivores like dugongs. This species was first recorded from the Andaman & Nicobar Islands in 2015, and its distribution status within the archipelago remains under-investigated. We report a new distribution record of *H. beccarii* from the North Andamans and shed light on its inter-island distribution. *H. beccarii* was recorded from a mixed meadow comprising of *Cymodocea rotundata* (20.5 ± 28.8%, mean seagrass cover), *Thalassia hemprichii* (16.3 ± 23.3%, mean seagrass cover), and *Halodule pinifolia* (6.3 ± 12.1%, mean seagrass cover) at Pokkadera, North and Middle Andaman district. *H. beccarii* had the highest mean seagrass cover (30 ± 34.7%) and shoot density (103.5 ± 68.3 shoots/m<sup>2</sup>) among sympatric seagrass species. We also recorded eight seagrass-associated macrofaunal groups (gastropods, bivalves, polychaetes, foraminiferans, nematodes, brachyurans, decapods and asteroids) from the infaunal and epibenthic micro-habitats within the meadow. Infaunal macrobenthos had a much higher density (73.5 ± 129.7 individuals/m<sup>2</sup>) than the epibenthic macrofauna (0.4 ± 1.5 individuals/m<sup>2</sup>), possibly influenced by the seagrass canopy structure and biomass. Overall, gastropods were the most dominant macrobenthic faunal group (overall mean 95.0 ± 106.1 individuals/m<sup>2</sup>). The present findings emphasize the need for more exploratory surveys to understand *H. beccarii* distribution in the Andaman & Nicobar archipelago to identify priority conservation areas.

**Keywords:** Andaman & Nicobar Islands, Dugongs, epifauna, habitat conservation, macrobenthos, seagrass associated.

**Abbreviations:** ANI—Andaman & Nicobar Islands | LIT—Line Intercept Transect.

**Editor:** Anonymity requested.

**Date of publication:** 26 January 2022 (online & print)

**Citation:** Gole, S., P. Gaidhani, S. Bose, A. Pande, J.A. Johnson & K. Sivakumar (2022). New distribution record of globally threatened Ocean Turf Grass *Halophila beccarii* Ascherson, 1871 from the North Andaman Islands highlights the importance of seagrass exploratory surveys. *Journal of Threatened Taxa* 14(1): 20406–20412. <https://doi.org/10.11609/jott.7719.14.1.20406-20412>

**Copyright:** © Gole et al. 2022. Creative Commons Attribution 4.0 International License. JoTT allows unrestricted use, reproduction, and distribution of this article in any medium by providing adequate credit to the author(s) and the source of publication.

**Funding:** National CAMPA Advisory Council (NCAC), Ministry of Environment, Forest and Climate Change, Government of India (Grant/Award Number: 13-28(01)/2015-CAMPA).

**Competing interests:** The authors declare no competing interests.

**Author details & Author contributions:** See end of this article.

**Acknowledgements:** This study was sponsored by National CAMPA Advisory Council (NCAC), Ministry of Environment, Forest and Climate Change, Government of India (Grant/Award Number: 13-28(01)/2015-CAMPA). We acknowledge D.M. Shukla (CWLW, Department of Environment and Forests, Andaman & Nicobar) for granting necessary work permits and assistance provided by K.G. Rassogi, divisional forest officer (Mayabunder Wildlife Division). Our special thanks to the frontline staff of the Mayabunder Wildlife Division; Alagar Gopi (Forest guard), Charlice Kullu (Forest guard), Saw Tubo, Saw Johnson, Saw Immui, Thomas, and Sumra Rao. Lastly, we thank Sohini Dudhat (Wildlife Institute of India), Dr. Himansu Das (Environment Agency, Abu Dhabi), Dr. Nehru Prabhakaran (Wildlife Institute of India), and Sohom Seal (Wildlife Institute of India) for their valuable inputs on the manuscript.



## INTRODUCTION

Seagrasses are ecosystem engineers (Hoegh-Guldberg & Bruno 2010) that stabilize sediments (Ondiviela et al. 2014), modify habitats they colonize (Koch 2001) and contribute to coastal protection (Ondiviela et al. 2014). Seagrass meadows contribute to local carbon sinks (Suchanek et al. 1985), trophic transfer within habitats (Costanza et al. 1997), and primary production (Waycott et al. 2009), and they support a diversity of associated invertebrate fauna (Orth et al. 1984; Lee et al. 2001; Leopardas et al. 2014; Su et al. 2020).

In India, seagrasses are distributed along the coastlines of Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Odisha states, and the Lakshadweep and Andaman & Nicobar archipelagos (Thangaradjou et al. 2018). These ecologically valuable and fragile coastal habitats are threatened in Indian waters by high anthropogenic dependency, destructive practices like boat anchorage, extractive fishing, and nutrient enrichment through agricultural run-offs or domestic sewage disposal (Thangaradjou et al. 2008; Sridhar et al. 2010; Nobi & Thangaradjou 2012). Despite being protected under the 'Coastal Regulation Zone Act' (Dhiman et al. 2019), seagrasses have received less attention than other marine ecosystems (Jagtap et al. 2003).

Seagrass research in the Andaman & Nicobar Islands (ANI) has been sporadic. Pioneering work by Jagtap (1991, 1992) and Das (1996) collectively reported nine species. *Halodule uninervis*, *Thalassia hemprichii*, and *Halophila ovata* were the first seagrass records from ANI (Jagtap 1991), followed by new regional records of *Halophila ovalis*, *Cymodocea rotundata*, *Enhalus acoroides*, and *Syringodium isoetifolium* (Jagtap 1992). Pan-Island seagrass exploratory surveys by Das (1996) reported *Cymodocea serrulata* and *Halodule pinifolia*, followed by a two decadal gap in investigating species distribution status in ANI. Later, *Halophila minor* and *Halophila decipiens* were reported from the island waters (D'Souza et al. 2015).

The most recent addition to the species checklist from Andaman waters is *Halophila beccarii* reported from the Haddo Bay of South Andaman (Savurirajan et al. 2015). Globally, *H. beccarii* has a fragmented distribution range in the Indo-Pacific region which extends from the eastern coast of Africa up to southeastern Asia (Green & Short 2003). Although the species was first reported from Indian waters in 1991 (Jagtap 1991), its distribution was not known from the Andaman Islands till 2015. Furthermore, little is known about its inter-island

distribution, as records post the first report (Savurirajan et al. 2015) are restricted to South Andaman (Ragavan et al. 2016).

In this study, we report a new distribution site for *Halophila beccarii* in the Andaman Islands and update its current distribution status for the Andaman group. Our study provides detailed meadow characteristics and associated macrofaunal assemblages, and highlights the habitat importance of seagrass meadows.

## STUDY AREA

The Andaman and Nicobar archipelago is situated in the Bay of Bengal (6.750–13.683 °N and 92.2–93.95 °E) and encompasses 836 islands, islets, and rocky outcrops with a total geographical area of 8,249 km<sup>2</sup> (<http://andaman.gov.in>) and a 1,962 km long coastline (Census Directorate 2011). The shallow waters of the archipelago support 830 hectares of seagrass cover (Ragavan et al. 2016).

The present study was carried out in May 2019 as a part of a pan-island seagrass mapping survey at Pokkadera (12.902°N & 92.910°E). Pokkadera is situated on the East coast of Mayabunder (North & Middle Andaman district) in the Andaman archipelago. It's a large intertidal unprotected area, with a vertical zonation expanse (distance between high to low tide when exposed) in low tide, up to ~ 400 m. The benthic substrate profile is characterized by mixed muddy-sandy sediment in the upper and lower intertidal zones and exposed sand bars in the mid-intertidal area (Figure 1). Pokkadera is an ecologically diverse site, which supports critical coastal ecosystems like seagrass meadows, mangroves, sandy, and rocky intertidal habitats, along with tropical littoral vegetation.

## METHODS

### Field sampling

We carried out on-foot exploration during low tide in the upper intertidal zone of Pokkadera. After locating a seagrass meadow we walked the perimeter and GPS marked the points at the edges (transition of seagrass habitat and adjacent unvegetated sediments). Later, we plotted the coordinates on Google Earth Pro version 7.3 to calculate the total area of the sampled study site. We used systematic line intercept transects (LIT) to assess seagrass meadow characteristics such as species composition, seagrass cover, shoot density, shoot length,

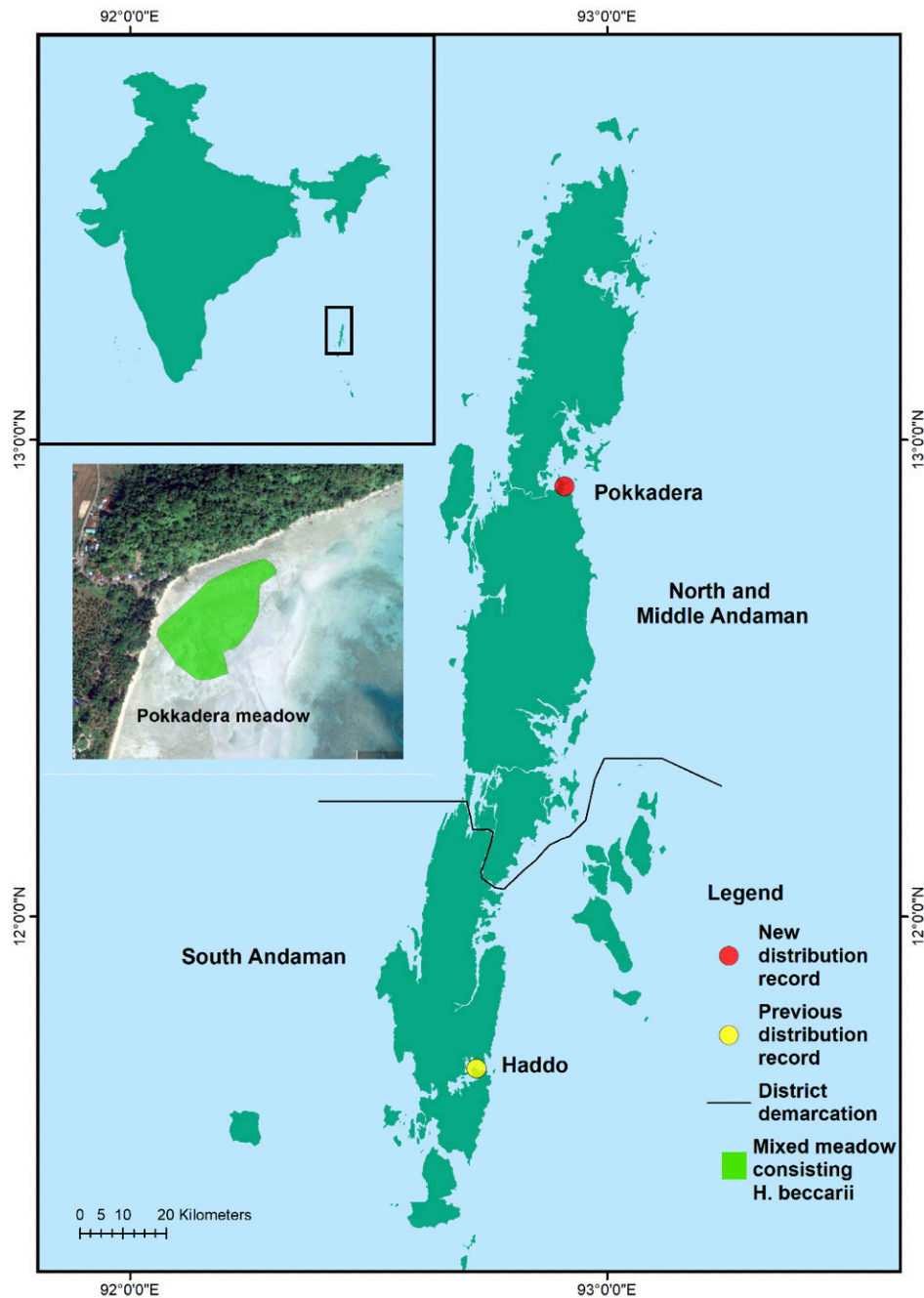


Figure 1. *Halophila beccarii* distribution records from Pokkadera seagrass meadow, Mayabunder, North and Middle Andaman district and Haddo seagrass meadow, South Andaman district at Andaman & Nicobar Islands.

total biomass (above and below ground; dry weight), and non-epiphytic algal cover (English et al. 1997). We deployed four 50 m long LITs inside the meadow, spaced apart at a distance of 150–200m. A 50 x 50 cm quadrat was placed after every 5 m interval on the LIT to record meadow characteristics (percentage seagrass cover, species composition, non-epiphytic algal cover). Algal shoots, independent of seagrass blades with distinct substratum penetration, were quantified to estimate

non-epiphytic algal cover within the quadrat. We recorded seagrass-associated epibenthic macrofaunal groups within the quadrat to estimate group densities (ind./m<sup>2</sup>).

We collected seagrass samples from a 20 X 20 cm quadrat within the larger (50 x 50 cm) quadrat in each transect (n= 3/ transect) to estimate seagrass shoot density, shoot length, and total biomass (above and below ground; dry weight) in the laboratory. To assess



the seagrass-associated infaunal (within the sediments) macrobenthic communities, we hand-scooped (up to 10 cm) sediment samples in triplicates from 20 X 20 cm area, randomly from each transect ( $n = 3$ / transect). Seagrass and macrobenthic sediment samples were stored in ziplock bags on the field and transported to the laboratory for further analysis.

We also recorded environmental parameters on the field, like pH and sea surface temperature using a hand-held multi-parameter tester (Eutech Oaklon- PCS Testr 35) and salinity with a handheld refractometer (LABART).

### Laboratory analysis

In the laboratory, we rinsed seagrass samples with fresh water to remove sediment particles from the shoots and roots. We discarded any algal shoots within the samples and thoroughly rinsed them again. Later, we counted seagrass shoots (species-specific) present in the samples to estimate shoot density (shoots/  $m^2$ ). Further, using a measuring scale (cm), we recorded the length of randomly picked ten shoots to give species-specific shoot length. For *Halophila beccarii*, we noted additional measurements (shoot width,  $n=9$ , and internodal length,  $n=6$ ), species characteristics, and natural history observations. Lastly, we sun-dried the seagrass samples (whole plant, shoots, and roots) and calculated total biomass above and below ground by dry weight ( $g/m^2$ ) on a micro-scale weighing balance (WENSAR PGB-220/ 0.001 to 200 g).

### Infaunal macrobenthic analysis

We immediately preserved the macrobenthic sediments in 4% (buffered) formalin-Rose Bengal solution and later sieved them on a 500 micron mesh to retain macrobenthic fauna (0.5mm and above; Ingole et al. 2009). We identified the seagrass associated macrofauna up to group level under a stereoscope (Zeiss discovery V.8) and, groups were validated using standard identification manuals (Fauchald 1977; Keppner & Tarjan 1989; Sturm et al. 2006; Sasaki 2008). Lastly, we counted individuals of each group to estimate their abundances.

## RESULTS

We recorded four seagrass species and eight macrobenthic groups associated with seagrass habitats from the present study. We report a new distribution record of globally threatened seagrass species, *Halophila beccarii*, from the North Andaman region. Pokkadera seagrass meadow spreads across ~8.2 hectares (Figure

1), comprising early-successional species like *H. beccarii*, *Halodule pinifolia*, and *Cymodocea rotundata*; and late-successional species like *Thalassia hemprichii* (Vonk et al. 2015; Nowicki et al. 2017).

The mean seagrass cover in the meadow was  $18.3 \pm 24.7 \%$ , with a non-epiphytic algal cover of  $18.3 \pm 35 \%$ . *H. beccarii* ( $30 \pm 34.7 \%$ ) and *H. pinifolia* ( $6.3 \pm 12.1 \%$ ) contributed to the highest and lowest seagrass cover. *H. beccarii* had the highest shoot density ( $103.5 \pm 68.3$  shoots/  $m^2$ ), whereas *C. rotundata* added to maximum total biomass ( $44.0 \pm 56.1$  g/  $m^2$ ; Table 1).

### *Halophila beccarii*

*Halophila beccarii* belongs to the family Hydrocharitaceae in the order Alismatales. The specimen recorded at the Pokkadera meadow had 4–8 lanceolate leaves with no cross venation (Image 1B & C). The mean shoot length was  $1.3 \pm 0.4$  cm ( $n = 10$ ), mean shoot width was  $1.3 \pm 0.5$  mm ( $n = 9$ ) with a mean internodal length of  $1.7 \pm 0.3$  cm ( $n = 6$ ). Rhizomes were smooth as observed for the species (Image 1B).

### Habitat

*Halophila beccarii* was distributed in the upper intertidal zone, either as monospecific strands on sand flats or was found associated with *T. hemprichii*, *C. rotundata*, and *H. pinifolia* in a mixed species meadow (Image 1A). The species was present in intertidal puddles or exposed on sand bars in line with previous observations (Waycott et al. 2004) and here was dominantly distributed at the fringes of the intertidal zone, adjacent to littoral vegetation.

### Associated macrobenthic fauna

We recorded a total of eight macrofaunal groups, both epibenthic ( $n = 5$  groups; number of quadrats = 44) and infaunal ( $n = 5$  groups; number of sediment samples = 12) belonging to six phyla, associated with the seagrass beds at Pokkadera viz; gastropods, bivalves, polychaetes, nematodes, brachyuran, decapods, asteroids, and foraminiferans. Gastropods and bivalves were common groups found in both the micro-habitats.

In order of abundance, gastropods (51.4%) dominated the infaunal assemblages, followed by bivalves (35.2%) and polychaetes (7.4%), while the least dominant groups were nematodes (3%) and foraminifera (3%). Gastropods were dominant in epibenthic assemblages (50%), followed by brachyurans (31.3%; Table 2). The total mean density of epibenthic groups ( $0.4 \pm 1.5$  ind. /  $m^2$ ) was much lower than infaunal assemblages ( $73.5 \pm 129.7$  ind. /  $m^2$ ; Table 2).

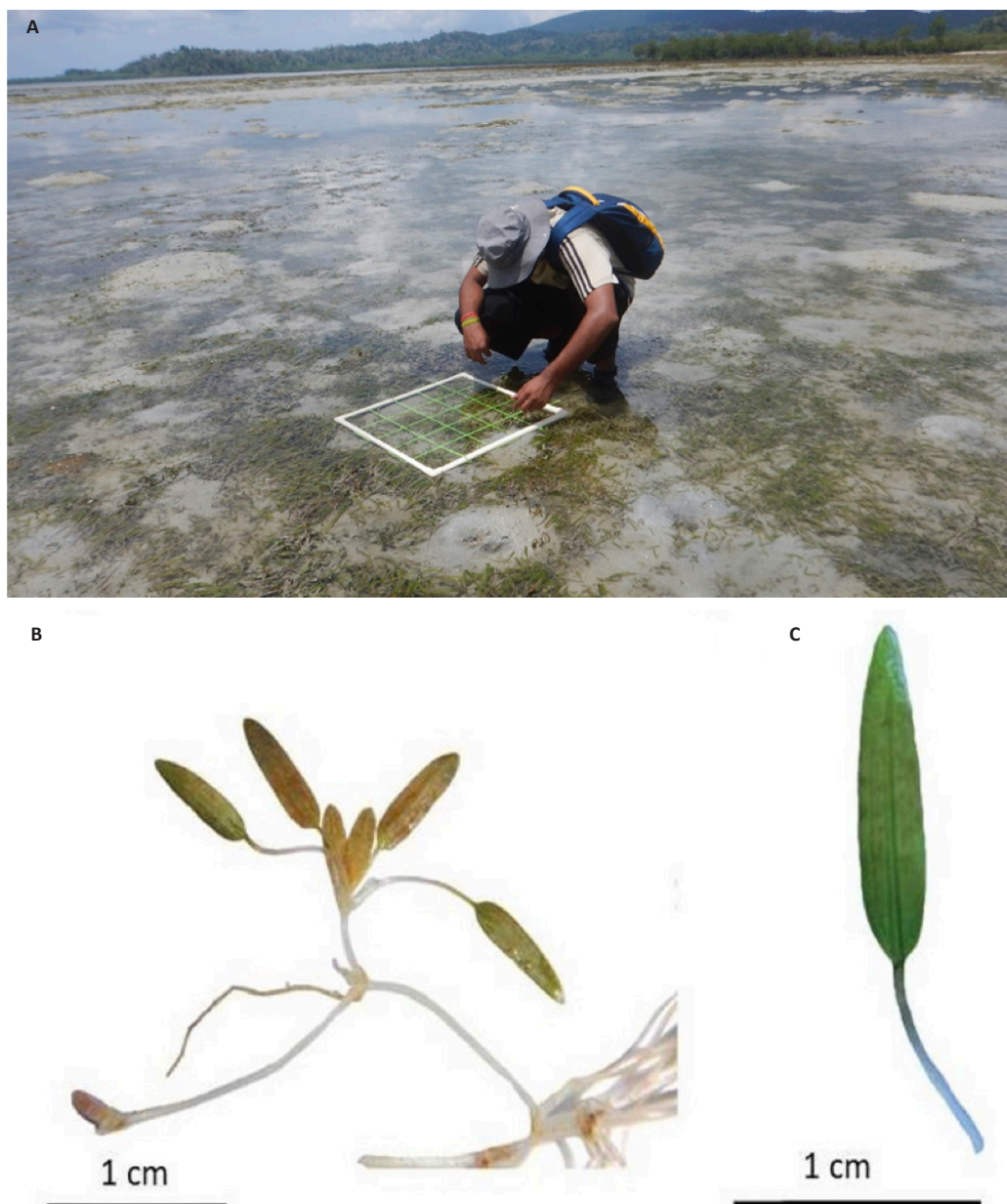


Image 1. A—Habitat characterization of seagrass meadow at Pokkadera, Mayabunder coast, North and Middle Andaman | B—*Halophila beccarii* species specimen | C—*H. beccarii* leaf structure. © Swapnali Gole.

Table 1. Seagrass meadow characteristics of Pokkadera seagrass meadow, Mayabunder, North and Middle Andaman district of Andaman & Nicobar Islands.

Meadow characteristics	Seagrass species			
	<i>Halophila beccarii</i>	<i>Cymodocea rotundata</i>	<i>Thalassia hemprichii</i>	<i>Halodule pinifolia</i>
Mean seagrass cover (%)	30 ± 34.7	20.5 ± 28.8	16.3 ± 23.3	6.3 ± 12.1
Shoot density (shoots/ m <sup>2</sup> )	103.5 ± 68.3	45.5 ± 24.4	40.6 ± 30	42.5 ± 12
Shoot length (cm; n= 10)	3.2 ± 2.8	6.9 ± 1.7	5.1 ± 3.5	4.3 ± 1.4
Total Biomass (above and below; dry weight) (g/ m <sup>2</sup> )	1.3 ± 2.2	44.0 ± 56.1	14.1 ± 25.1	0.6 ± 1.8
Sea surface temperature- (°C) 37.3 ± 0.7	Salinity- (ppt) 29.0 ± 1.0		pH- 8.8 ± 0.1	

(Values expressed as mean ± standard deviation).

**Table 2.** Mean densities of major seagrass-associated macrobenthic taxonomic groups recorded at Pokkadera seagrass meadow.

Faunal groups	Infaunal (ind. / m <sup>2</sup> )	Epifaunal (ind. / m <sup>2</sup> )
Gastropods	188.9 ± 151.8	1 ± 1.7
Bivalves	129.2 ± 391	0.1 ± 0.7
Polychaetes	27.1 ± 52.2	not recorded
Nematodes	11.1 ± 26	not recorded
Foraminiferans	11.1 ± 27.4	not recorded
Asteroids	not recorded	0.1 ± 0.7
Brachyurans	not recorded	0.6 ± 3.5
Decapods	not recorded	0.1 ± 0.7

## DISCUSSION

*Halophila beccarii* is a euryhaline species found associated with mangrove vegetation (Jagtap 1991) that provides numerous ecosystem services. Studies have highlighted the role of *H. beccarii* meadows as sediment stabilizers, refugia to macrobenthic and fish diversity (Mathews et al. 2010), and pioneers for seagrass succession (Aye et al. 2014). The species is presently listed as 'Vulnerable' in the IUCN Red List (Short et al. 2010) and some of the major threats are coastal infrastructure development, marine pollution, and exploitative fishing practices, leading to modifications of its natural habitat (Short et al. 2010).

In addition to reporting a new distribution record, our study emphasizes the importance of mixed seagrass beds for associated species thus, highlights the value of these coastal ecosystems. Studies have highlighted habitat importance of *H. beccarii* meadows in supporting macrobenthic diversity (Su et al. 2020). Our findings suggest high numerical dominance of infaunal assemblages which needs further investigation, as epifaunal and infaunal abundance in seagrass meadows is influenced by meadow characteristics like structural complexity, canopy height, leaf morphology, shoot density, and above and below ground biomass (Orth et al. 1984; Lee et al. 2001; Leopardas et al. 2014).

The intertidal region at Pokkadera is an unprotected area, and the seagrass habitats are open ground for shoreline fishing activities and cattle trampling during ebb tide, posing a threat to the existing seagrass beds, and in turn associated fauna. Based on few anecdotal reports by local fishers, Pokkadera is a dugong feeding habitat, which signifies the importance of the site and adds to the necessity for habitat and species conservation.

Scientists have emphasized the need for integrating

research with policy-making to conserve *H. beccarii* habitats (Ramesh et al. 2018). Our work highlights *H. beccarii* distribution for prioritizing its conservation in the Andaman and Nicobar Islands, in line with recommendations to aid ecological assessments globally (Short et al. 2010). Lastly, we strongly recommend the need for more seagrass exploratory surveys and long-term monitoring of critical meadows to form a robust baseline for seagrass management in the Andaman Islands.

## REFERENCES

- Aye, A., A. Hsan & U. Soe-Htun (2014). The Morphotaxonomy and Phytosociology of *Halophila beccarii* (Family: Hydrocharitaceae) in Kalegauk Island, Mon State. *Mawlamyine University Research Journal* 5(1): 1–15.
- Census Directorate (2011). Provisional population total: rural-urban distribution, Andaman and Nicobar Islands, 18 pp.
- Das, H. (1996). Status of Seagrass habitats of Andaman and Nicobar Coast. SACON, Coimbatore, India, Technical Report No. 4, 32 pp.
- Dhiman, R., P. Kalbar & A.B. Inamdar (2019). Spatial planning of coastal urban areas in India: current practice versus quantitative approach. *Ocean & Coastal Management* 182: 104929. <https://doi.org/10.1016/j.ocecoaman.2019.104929>
- D'Souza, E., V. Patankar, R. Arthur, N. Marbà & T. Alcoverro (2015). Seagrass Herbivory Levels Sustain Site-Fidelity in a Remnant Dugong Population. *PLoS ONE* (10): 1–18. <https://doi.org/10.1371/journal.pone.0141224.t001>
- English S., C. Wilkinson, & V. Baker (1997). *Survey manual of Tropical Marine Resources: 2nd Edition*. Australian Institute Resources, Townsville, 385 pp.
- Fauchald, K. (1977). *The Polychaete worms. Definitions and keys to the orders, families and genera*. Natural History Museum of Los Angeles County, Science Series, 28: 188.
- Green, E.P. & F. T. Short (2003). *World Atlas of Seagrasses*. University of California Press, Berkeley, USA, 324 pp.
- Ingole B., S. Sivadas, M. Nanajkar, S. Sautya, & A. Nag (2009). A comparative study of macrobenthic community from harbours along the central west coast of India. *Environmental Monitoring and Assessment* 154(1–4): 135–146. <https://doi.org/10.1007/s10661-008-0384-5>
- Jagtap, T. (1991). Distribution of seagrass along the Indian coast. *Aquatic Botany* 40: 379–386.
- Jagtap, T. (1992). Marine flora of Nicobar group of Islands, Andaman Sea. *Indian Journal of Marine Sciences* 22: 56–58.
- Jagtap, T., D. Komarpant & R. Rodrigues (2003). Status of a seagrass ecosystem: An ecologically sensitive wetland habitat from India. *Wetlands* 23(1): 161–170. [https://doi.org/10.1672/0277-5212\(2003\)023\[0161:SOASEA\]2.0.CO;2](https://doi.org/10.1672/0277-5212(2003)023[0161:SOASEA]2.0.CO;2)
- Kaladharan, P., P.U. Zacharia & K.V. Kumaran (2011). Coastal and marine floral biodiversity along the Karnataka coast. *Journal of Marine Biological Association of India* 53(1): 121–129.
- Keppner, E. & A. Tarjan (1989). Illustrated Key to the Genera of Free-Living Marine Nematodes of the Order Enoplida. NOAA Technical Report NMFS 77, 26 pp.
- Lee, S., C. Fong & R. Wu (2001). The effects of seagrass (*Zostera japonica*) canopy structure on associated fauna: a study using artificial seagrass units and sampling of natural beds. *Journal of Experimental Marine Biology and Ecology* 259(1): 23–50. [https://doi.org/10.1016/S0022-0981\(01\)00221-0](https://doi.org/10.1016/S0022-0981(01)00221-0)
- Leopardas, V., W. Uy & M. Nakaoka (2014). Benthic macrofaunal assemblages in multispecific seagrass meadows of the southern Philippines: Variation among vegetation dominated by different



- seagrass species. *Journal of Experimental Marine Biology and Ecology* 457: 71–80. <https://doi.org/10.1016/j.jembe.2014.04.006>
- Mathews, G., D. Raj, T. Thinesh, J. Patterson, J.K. Edward & D. Wilhelmsson (2010). Status of seagrass diversity, distribution and abundance in Gulf of Mannar Marine National Park and Palk Bay (Pamban to Thondi) south eastern India. *South Indian Coastal and Marine Bulletin* 2: 1–21.
- Nobi, E. & T. Thangaradjou (2012). Evaluation of the spatial changes in seagrass cover in the lagoons of Lakshadweep Islands, India, using IRS LISS III satellite images. *Geocarto International* 27(8): 647–660. <https://doi.org/10.1080/10106049.2012.665501>
- Nowicki, R., J. Thomson., D. Burkholder, J. Fourqurean & M. Heithaus (2017). Predicting seagrass recovery times and their implications following an extreme climate event. *Marine Ecology Progress Series* 567: 79–93. <https://doi.org/10.3354/meps12029>
- Orth, R., K. Heck & J. Montfrans (1984). Faunal Communities in Seagrass Beds: A Review of the Influence of Plant Structure and Prey Characteristics on Predator-Prey Relationships. *Estuaries* 7(4A): 339–350.
- Ragavan, R., R. Jayaraj, M. Muruganatham, C. Jeeva, V. Ubare, A. Saxena & P. Mohan (2016). Species Composition and Distribution of Sea grasses of the Andaman and Nicobar Islands. *Vegetos* 29: 78–87.
- Ramesh, R., K. Banerjee, A. Paneerselvam, A. Lakshmi, P. Krishnan & R. Purvaja (2018). Legislation and policy options for conservation and management of seagrass ecosystems in India. *Ocean and Coastal Management* 159: 46–50. <https://doi.org/10.1016/j.ocecoaman.2017.12.025>
- Sasaki, T. (2008). Micromolluscs in Japan: Taxonomic composition, habitats, and future topics. *Zoosymposia* 1: 147–232. <https://doi.org/10.11646/zoosymposia.1.1.12>
- Savurirajan, M., R.K. Lakra & T. Ganesh (2015). A new record of the seagrass *Halophila beccarii* Ascherson from the Port Blair coast, Andaman and Nicobar Islands, India. *Botanica Marina* 58: 409–413. <https://doi.org/10.1515/bot-2014-0076>
- Short, F.T., R. Coles, M. Waycott, J.S. Bujang, M. Fortes, A. Prathep, A.H.M. Kamal, T. Jagtap, S. Bandeira, A. Freeman, P. Erftemeijer, Y. La Nafie, S. Vergara, H.P. Calumpong & I. Makm (2010). *Halophila beccarii*. The IUCN Red List of Threatened Species. <https://doi.org/10.2305/IUCN.UK.2010-3.RLTS.T173342A6995080.en>
- Sridhar, R., T. Thangaradjou, L. Kannan & S. Astalakshmi (2010). Assessment of coastal bio resources of the Palk Bay, India, using IRS LISS-III data. *Journal of the Indian Society of Remote Sensing* 38: 565–575. <https://doi.org/10.1007/s12524-010-0040-8>
- Sturm, C.F., T.A. Pearce & A. Valdés (eds.) (2006). *The Mollusks: A Guide to Their Study, Collection, and Preservation*, Vol. 2. American Malacological Society, Pittsburgh and Universal Publishers, U.S.A, xii+445 pp.
- Su, Z., G. Qiu, H. Fan & C. Fang (2020). Seagrass beds store less carbon but support more macrobenthos than mangrove forests. *Marine Environmental Research* 162: 105162. <https://doi.org/10.1016/j.marenvres.2020.105162>
- Thangaradjou, T., R. Sridhar, S.S. Kumar & S. Kannan (2008). Seagrass resource assessment in the Mandapam coast of the Gulf of Mannar Biosphere reserve, India. *Applied Ecology and Environmental Research* 6(1): 139–146. [https://doi.org/10.15666/aer/0601\\_139146](https://doi.org/10.15666/aer/0601_139146)
- Thangaradjou, T. & J. Bhatt (2018). Status of seagrass ecosystems in India. *Ocean & Coastal Management* 159: 7–15. <https://doi.org/10.1016/j.ocecoaman.2017.11.025>
- Vonk, J., J. A. Christianen, J. Stapel & K. O'Brien (2015). What lies beneath: Why knowledge of belowground biomass dynamics is crucial to effective seagrass management. *Ecological Indicators* 57: 259–267. <https://doi.org/10.1016/j.ecolind.2015.05.008>
- Waycott, M., K. Mc Mahon, J. Mellors, A. Calladine & D. Kleine (2004). *A guide to tropical seagrasses of the Indo-West Pacific*. James Cook University Townsville, Queensland, Australia, 72 pp.

**Author details:** SWAPNALI GOLE is working on dugongs and seagrasses in the Andaman Islands, as a part of the CAMPA\_Dugong Project, Wildlife Institute of India. Her doctoral research is on the ecology of seagrass habitats and associated macro-benthic invertebrates in the Andaman Islands. PRASAD GAIDHANI worked as an intern with the Wildlife Institute of India's CAMPA\_Dugong Project in the Andaman Islands. His primary research interests encompass species research, community-based conservation with special emphasis on human-wildlife conflict, across different sea/landscapes. SRABANI BOSE is working on seagrass and its associated microbenthic fauna, as a part of the CAMPA Dugong Project, Wildlife Institute of India. Her research interest is on understanding the role of benthic fauna in the critical dugong habitat and also taxonomical study of microbenthic fauna. ANANT PANDE's work is focused on understanding drivers of population decline of marine mammal and seabird populations, developing strategies for their conservation and management. His work involves conducting field assessments of marine megafauna populations to provide evidence-based inputs to policy makers. JEYARAJ ANTONY JOHNSON has been working on taxonomy, ecology and biology of Indian fishes. His research included species distribution patterns, community structure, spatio-temporal changes in resource (food and space) partitioning among co-existing species, conservation of rare and threatened species, e-flow assessment and effects of human disturbance on aquatic resources. Currently he is coordinating the freshwater fish monitoring project under MoEFCC's Long-term Ecological Observation (LTEO) programme. SIVAKUMAR KUPPUSAMY has been working on conservation and management of aquatic biodiversity especially marine biodiversity of India as well as of Antarctica. His research involves understanding species distribution pattern, species ecology and behavioural ecology. Currently he is coordinating the MoEFCC-CAMPA funded project on the recovery of Dugong and its habitats in India. He has also involved in the developing a detail project report for the Project Dolphin.

**Author contributions:** SG—conceptualisation and drafting of manuscript, field work, sample collection and post processing, data entry and analysis. PDF—field work, sample collection and post processing. SB—laboratory work of infaunal macrobenthic samples. AP—supervision of the field work, conceptualisation and reviewing the manuscript. JAJ—supervision of the field work, reviewing the manuscript. SK—study design, supervision of the field work and data analysis, reviewing the manuscript







Dr. John Noyes, Natural History Museum, London, UK  
Dr. Albert G. Orr, Griffith University, Nathan, Australia  
Dr. Sameer Padhye, Katholieke Universiteit Leuven, Belgium  
Dr. Nancy van der Poorten, Toronto, Canada  
Dr. Kareen Schnabel, NIWA, Wellington, New Zealand  
Dr. R.M. Sharma, (Retd.) Scientist, Zoological Survey of India, Pune, India  
Dr. Manju Siliwal, WILD, Coimbatore, Tamil Nadu, India  
Dr. G.P. Sinha, Botanical Survey of India, Allahabad, India  
Dr. K.A. Subramanian, Zoological Survey of India, New Alipore, Kolkata, India  
Dr. P.M. Sureshan, Zoological Survey of India, Kozhikode, Kerala, India  
Dr. R. Varatharajan, Manipur University, Imphal, Manipur, India  
Dr. Eduard Vives, Museu de Ciències Naturals de Barcelona, Terrassa, Spain  
Dr. James Young, Hong Kong Lepidopterists' Society, Hong Kong  
Dr. R. Sundararaj, Institute of Wood Science & Technology, Bengaluru, India  
Dr. M. Nithyanandan, Environmental Department, La Ala Al Kuwait Real Estate. Co. K.S.C., Kuwait  
Dr. Himender Bharti, Punjabi University, Punjab, India  
Mr. Purnendu Roy, London, UK  
Dr. Saito Motoki, The Butterfly Society of Japan, Tokyo, Japan  
Dr. Sanjay Sondhi, TITLI TRUST, Kalpavriksh, Dehradun, India  
Dr. Nguyen Thi Phuong Lien, Vietnam Academy of Science and Technology, Hanoi, Vietnam  
Dr. Nitin Kulkarni, Tropical Research Institute, Jabalpur, India  
Dr. Robin Wen Jiang Ngiam, National Parks Board, Singapore  
Dr. Lionel Monod, Natural History Museum of Geneva, Genève, Switzerland.  
Dr. Asheesh Shivam, Nehru Gram Bharti University, Allahabad, India  
Dr. Rosana Moreira da Rocha, Universidade Federal do Paraná, Curitiba, Brasil  
Dr. Kurt R. Arnold, North Dakota State University, Saxony, Germany  
Dr. James M. Carpenter, American Museum of Natural History, New York, USA  
Dr. David M. Claborn, Missouri State University, Springfield, USA  
Dr. Kareen Schnabel, Marine Biologist, Wellington, New Zealand  
Dr. Amazonas Chagas Júnior, Universidade Federal de Mato Grosso, Cuiabá, Brasil  
Mr. Monsoon Jyoti Gogoi, Assam University, Silchar, Assam, India  
Dr. Heo Chong Chin, Universiti Teknologi MARA (UiTM), Selangor, Malaysia  
Dr. R.J. Shiel, University of Adelaide, SA 5005, Australia  
Dr. Siddharth Kulkarni, The George Washington University, Washington, USA  
Dr. Priyadarsanan Dharma Rajan, ATREE, Bengaluru, India  
Dr. Phil Alderslade, CSIRO Marine And Atmospheric Research, Hobart, Australia  
Dr. John E.N. Veron, Coral Reef Research, Townsville, Australia  
Dr. Daniel Whitmore, State Museum of Natural History Stuttgart, Rosenstein, Germany.  
Dr. Yu-Feng Hsu, National Taiwan Normal University, Taipei City, Taiwan  
Dr. Keith V. Wolfe, Antioch, California, USA  
Dr. Siddharth Kulkarni, The Hormiga Lab, The George Washington University, Washington, D.C., USA  
Dr. Tomas Ditrich, Faculty of Education, University of South Bohemia in Ceske Budejovice, Czech Republic  
Dr. Mihaly Foldvari, Natural History Museum, University of Oslo, Norway  
Dr. V.P. Uniyal, Wildlife Institute of India, Dehradun, Uttarakhand 248001, India  
Dr. John T.D. Caleb, Zoological Survey of India, Kolkata, West Bengal, India  
Dr. Priyadarsanan Dharma Rajan, Ashoka Trust for Research in Ecology and the Environment (ATREE), Royal Enclave, Bangalore, Karnataka, India

Fishes

Dr. Neelesh Dahanukar, IISER, Pune, Maharashtra, India  
Dr. Topiltzin Contreras MacBeath, Universidad Autónoma del estado de Morelos, México  
Dr. Heok Hee Ng, National University of Singapore, Science Drive, Singapore  
Dr. Rajeev Raghavan, St. Albert's College, Kochi, Kerala, India  
Dr. Robert D. Sluka, Chiltern Gateway Project, A Rocha UK, Southall, Middlesex, UK  
Dr. E. Vivekanandan, Central Marine Fisheries Research Institute, Chennai, India  
Dr. Davor Zanella, University of Zagreb, Zagreb, Croatia  
Dr. A. Biju Kumar, University of Kerala, Thiruvananthapuram, Kerala, India  
Dr. Akhilesh K.V., ICAR-Central Marine Fisheries Research Institute, Mumbai Research Centre, Mumbai, Maharashtra, India  
Dr. J.A. Johnson, Wildlife Institute of India, Dehradun, Uttarakhand, India

Amphibians

Dr. Sushil K. Dutta, Indian Institute of Science, Bengaluru, Karnataka, India  
Dr. Annemarie Ohler, Muséum national d'Histoire naturelle, Paris, France

Reptiles

Dr. Gernot Vogel, Heidelberg, Germany  
Dr. Raju Vyas, Vadodara, Gujarat, India  
Dr. Pritpal S. Soorae, Environment Agency, Abu Dhabi, UAE.  
Prof. Dr. Wayne J. Fuller, Near East University, Mersin, Turkey  
Prof. Chandrashekhar U. Rivonker, Goa University, Taleigao Plateau, Goa. India  
Dr. S.R. Ganesh, Chennai Snake Park, Chennai, Tamil Nadu, India  
Dr. Himansu Sekhar Das, Terrestrial & Marine Biodiversity, Abu Dhabi, UAE

Birds

Dr. Hem Sagar Baral, Charles Sturt University, NSW Australia  
Dr. Chris Bowden, Royal Society for the Protection of Birds, Sandy, UK  
Dr. Priya Davidar, Pondicherry University, Kalapet, Puducherry, India  
Dr. J.W. Duckworth, IUCN SSC, Bath, UK  
Dr. Rajah Jayapal, SACON, Coimbatore, Tamil Nadu, India  
Dr. Rajiv S. Kalsi, M.L.N. College, Yamuna Nagar, Haryana, India  
Dr. V. Santharam, Rishi Valley Education Centre, Chittoor Dt., Andhra Pradesh, India  
Dr. S. Balachandran, Bombay Natural History Society, Mumbai, India  
Mr. J. Praveen, Bengaluru, India  
Dr. C. Srinivasulu, Osmania University, Hyderabad, India  
Dr. K.S. Gopi Sundar, International Crane Foundation, Baraboo, USA  
Dr. Gombobaatar Sunde, Professor of Ornithology, Ulaanbaatar, Mongolia  
Prof. Reuven Yosef, International Birding & Research Centre, Eilat, Israel  
Dr. Taej Mundkur, Wetlands International, Wageningen, The Netherlands  
Dr. Carol Inskipp, Bishop Auckland Co., Durham, UK  
Dr. Tim Inskipp, Bishop Auckland Co., Durham, UK  
Dr. V. Gokula, National College, Tiruchirappalli, Tamil Nadu, India  
Dr. Arkady Lelej, Russian Academy of Sciences, Vladivostok, Russia  
Dr. Simon Dowell, Science Director, Chester Zoo, UK  
Dr. Mário Gabriel Santiago dos Santos, Universidade de Trás-os-Montes e Alto Douro, Quinta de Prados, Vila Real, Portugal  
Dr. Grant Connette, Smithsonian Institution, Royal, VA, USA  
Dr. M. Zafar-ul Islam, Prince Saud Al Faisal Wildlife Research Center, Taif, Saudi Arabia

Mammals

Dr. Giovanni Amori, CNR - Institute of Ecosystem Studies, Rome, Italy  
Dr. Anwaruddin Chowdhury, Guwahati, India  
Dr. David Mallon, Zoological Society of London, UK  
Dr. Shomita Mukherjee, SACON, Coimbatore, Tamil Nadu, India  
Dr. Angie Appel, Wild Cat Network, Germany  
Dr. P.O. Nameer, Kerala Agricultural University, Thrissur, Kerala, India  
Dr. Ian Redmond, UNEP Convention on Migratory Species, Lansdown, UK  
Dr. Heidi S. Riddle, Riddle's Elephant and Wildlife Sanctuary, Arkansas, USA  
Dr. Karin Schwartz, George Mason University, Fairfax, Virginia.  
Dr. Lala A.K. Singh, Bhubaneswar, Orissa, India  
Dr. Mewa Singh, Mysore University, Mysore, India  
Dr. Paul Racey, University of Exeter, Devon, UK  
Dr. Honnavalli N. Kumara, SACON, Anaikatty P.O., Coimbatore, Tamil Nadu, India  
Dr. Nishith Dharaiya, HNG University, Patan, Gujarat, India  
Dr. Spartaco Gippoliti, Socio Onorario Società Italiana per la Storia della Fauna "Giuseppe Altobello", Rome, Italy  
Dr. Justus Joshua, Green Future Foundation, Tiruchirappalli, Tamil Nadu, India  
Dr. H. Raghuram, The American College, Madurai, Tamil Nadu, India  
Dr. Paul Bates, Harison Institute, Kent, UK  
Dr. Jim Sanderson, Small Wild Cat Conservation Foundation, Hartford, USA  
Dr. Dan Challender, University of Kent, Canterbury, UK  
Dr. David Mallon, Manchester Metropolitan University, Derbyshire, UK  
Dr. Brian L. Cypher, California State University-Stanislaus, Bakersfield, CA  
Dr. S.S. Talmale, Zoological Survey of India, Pune, Maharashtra, India  
Prof. Karan Bahadur Shah, Budhanilakantha Municipality, Kathmandu, Nepal  
Dr. Susan Cheyne, Borneo Nature Foundation International, Palangkaraja, Indonesia  
Dr. Hemanta Kafley, Wildlife Sciences, Tarleton State University, Texas, USA

Other Disciplines

Dr. Aniruddha Belsare, Columbia MO 65203, USA (Veterinary)  
Dr. Mandar S. Paingankar, University of Pune, Pune, Maharashtra, India (Molecular)  
Dr. Jack Tordoff, Critical Ecosystem Partnership Fund, Arlington, USA (Communities)  
Dr. Ulrike Streicher, University of Oregon, Eugene, USA (Veterinary)  
Dr. Hari Balasubramanian, EcoAdvisors, Nova Scotia, Canada (Communities)  
Dr. Rayanna Hellem Santos Bezerra, Universidade Federal de Sergipe, São Cristóvão, Brazil  
Dr. Jamie R. Wood, Landcare Research, Canterbury, New Zealand  
Dr. Wendy Collinson-Jonker, Endangered Wildlife Trust, Gauteng, South Africa  
Dr. Rajeshkumar G. Jani, Anand Agricultural University, Anand, Gujarat, India  
Dr. O.N. Tiwari, Senior Scientist, ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India  
Dr. L.D. Singla, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India  
Dr. Rupika S. Rajakaruna, University of Peradeniya, Peradeniya, Sri Lanka  
Dr. Bahar Baviskar, Wild-CER, Nagpur, Maharashtra 440013, India

Reviewers 2018–2020

Due to pausity of space, the list of reviewers for 2018–2020 is available online.

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the political boundaries shown in the maps by the authors.

Print copies of the Journal are available at cost. Write to:  
The Managing Editor, JoTT,  
c/o Wildlife Information Liaison Development Society,  
No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road,  
Saravanampatti, Coimbatore, Tamil Nadu 641035, India  
ravi@threatenedtaxa.org

**Journal of Threatened Taxa** is indexed/abstracted in Bibliography of Systematic Mycology, Biological Abstracts, BIOSIS Previews, CAB Abstracts, EBSCO, Google Scholar, Index Copernicus, Index Fungorum, JournalSeek, National Academy of Agricultural Sciences, NewJour, OCLC WorldCat, SCOPUS, Stanford University Libraries, Virtual Library of Biology, Zoological Records.

NAAS rating (India) 5.64



OPEN ACCESS



The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at [www.threatenedtaxa.org](http://www.threatenedtaxa.org). All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

January 2022 | Vol. 14 | No. 1 | Pages: 20311–20538

Date of Publication: 26 January 2022 (Online & Print)

DOI: 10.11609/jott.2022.14.1.20311-20538

[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

#### Articles

**Estimating the completeness of orchid checklists and atlases: a case study from southern Italy**

– Antonio Croce, Pp. 20311–20322

**A floristic survey across three coniferous forests of Kashmir Himalaya, India – a checklist**

– Ashaq Ahmad Dar, Akhtar Hussain Malik & Narayanaswamy Parthasarathy, Pp. 20323–20345

**Associations of butterflies across different forest types in Uttarakhand, western Himalaya, India: implications for conservation planning**

– Arun Pratap Singh, Pp. 20346–20370

**Comparison of bird diversity in protected and non-protected wetlands of western lowland of Nepal**

– Jagan Nath Adhikari, Janak Raj Khatiwada, Dipendra Adhikari, Suman Sapkota, Bishnu Prasad Bhattarai, Deepak Rijal & Lila Nath Sharma, Pp. 20371–20386

**Local hunting practices and perceptions regarding the distribution and ecological role of the Large Flying Fox (Chiroptera: Pteropodidae: *Pteropus vampyrus*) in western Sarawak, Malaysian Borneo**

– Jayasilan Mohd-Azlan, Joon Yee Yong, Nabila Norshuhadah Mohd Hazzrol, Philoveny Pengiran, Arianti Atong & Sheema Abdul Aziz, Pp. 20387–20399

#### Communications

**Macrolichens of Mathikettan Shola National Park, Western Ghats: a preliminary investigation with some new records**

– Aswathi Anilkumar, Stephen Sequeira, Arun Christy & S.M. Arsha, Pp. 20400–20405

**New distribution record of globally threatened Ocean Turf Grass *Halophila beccarii* Ascherson, 1871 from the North Andaman Islands highlights the importance of seagrass exploratory surveys**

– Swapnali Gole, Prasad Gaidhani, Srabani Bose, Anant Pande, Jeyaraj Antony Johnson & Kuppusamy Sivakumar, Pp. 20406–20412

**An inventory of new orchid (Orchidaceae) records from Kozhikode, Kerala, India**

– M. Sulaiman, C. Murugan & M.U. Sharief, Pp. 20413–20425

**Abundance and spatial distribution analyses of *Stemonoporus moonii* Thwaites (Dipterocarpaceae) - a critically endangered species endemic to Sri Lanka**

– K.A.M.R.P. Atapattu, H.D.D.C.K. Perera, H.S. Kathirarachchi & A.R. Gunawardena, Pp. 20426–20432

**Plant diversity of Point Calimere Wildlife Sanctuary and fodder species grazed by the Blackbuck *Antelope cervicapra* L.**

– Ashutosh Kumar Upadhyay, A. Andrew Emmanuel, Ansa Sarah Varghese & D. Narasimhan, Pp. 20433–20443

**Raptors observed (1983–2016) in National Chambal Gharial Sanctuary: semi-arid biogeographic region suggestions for parametric studies on ecological continuity in Khatiar-Gir Ecoregion, India**

– L.A.K. Singh, R.K. Sharma & Udayan Rao Pawar, Pp. 20444–20460

**Nesting success of Sharpe's Longclaw (*Macronyx sharpei* Jackson, 1904) around the grasslands of lake Ol'bolossat Nyandarua, Kenya**

– Hamisi Ann Rispe, Charles M. Warui & Peter Njoroge, Pp. 20461–20468

**Population, distribution and diet composition of Smooth-coated Otter *Lutrogale perspicillata* Geoffroy, 1826 in Hosur and Dharmapuri Forest Divisions, India**

– Nagarajan Baskaran, Raman Sivaraj Sundarraj & Raveendranathanpillai Sanil, Pp. 20469–20477

**Utilization of home garden crops by primates and current status of human-primate interface at Galigamuwa Divisional Secretariat Division in Kegalle District, Sri Lanka**

– Charnalie Anuradhi Dona Nahallage, Dahanakge Ayesha Madushani Dasanayake, Dilan Thisaru Hewamanna & Dissanayakalage Tharaka Harshani Ananda, Pp. 20478–20487

**Revival of Eastern Swamp Deer *Rucervus duvaucelii ranjitsinhi* (Groves, 1982) in Manas National Park of Assam, India**

– Nazrul Islam, Aftab Ahmed, Rathin Barman, Sanatan Deka, Bhaskar Choudhury, Prasanta Kumar Saikia & Jyotishman Deka, Pp. 20488–20493

**Trypanosoma evansi infection in a captive Indian Wolf *Canis lupus pallipes***

– molecular diagnosis and therapy

– Manojita Dash, Sarat Kumar Sahu, Santosh Kumar Gupta, Niranjana Sahoo & Debarat Mohapatra, Pp. 20494–20499

#### View Point

**COVID-19 and civil unrest undoing steady gains in karst conservation and herpetological research in Myanmar, and an impediment to progress**

– Evan S.H. Quah, Lee L. Grismer, Perry L. Wood, Jr., Aung Lin & Myint Kyaw Thura, Pp. 20500–20502

#### Short Communications

**Morphological characterization and mt DNA barcode of a tiger moth species, *Asota fics* (Fabricius, 1775) (Lepidoptera: Noctuoidea: Erebiidae: Aganainae) from India**

– Aparna Sureshchandra Kalawate, K.P. Dinesh & A. Shabnam, Pp. 20503–20510

**Distribution of Smooth-coated Otters *Lutrogale perspicillata* (Mammalia: Carnivora: Mustelidae): in Ratnagiri, Maharashtra, India**

– Swanand Patil & Kranti Yardi, Pp. 20511–20516

**Wildlife at the crossroads: wild animal road kills due to vehicular collision on a mountainous highway in northwestern Himalayan region**

– Muzaffar A. Kichloo, Asha Sohil & Neeraj Sharma, Pp. 20517–20522

#### Notes

***Robiquetia gracilis* (Lindl.) Garay—a new record to the flora of Anamalai Hills, Tamil Nadu, India**

– B. Subbaiyan, V. Ganesan, P.R. Nimal Kumar & S. Thangaraj Panneerselvam, Pp. 20523–20525

***Ipomoea laxiflora* H.J. Chowdhery & Debta (Convolvulaceae): new records for the Western Ghats and semiarid regions**

– Sachin M. Patil, Ajit M. Vasava, Vinay M. Raole & Kishore S. Rajput, Pp. 20526–20529

**Counting the cost: high demand puts *Bunium persicum* (Boiss.) B.Fedtsch. in jeopardy**

– Monika Sharma, Manisha Mathela, Rupali Sharma, Himanshu Bargali, Gurinderjit S. Goraya & Amit Kumar, Pp. 20530–20533

**First record of Parasitic Jaeger *Stercorarius parasiticus* (Aves: Charadriiformes: Stercorariidae) from inland freshwater Inle Lake, Myanmar**

– Sai Sein Lin Oo, Myint Kyaw, L.C.K. Yun, Min Zaw Tun, Yar Zar Lay Naung, Soe Naing Aye & Swen C. Renner, Pp. 20534–20536

#### Book Review

***Capparis* of India**

– V. Sampath Kumar, Pp. 20537–20538

Publisher & Host

