

Marine algal herbarium: a national repository

The marine macrophytic algae ('seaweeds') represent one of the important living renewable resources of the marine ecosystem. They have been an integral part of human civilization and the records of their utilization date to 1300 years ago at a late Pleistocene settlement in Chile¹. The marine algal biomass has been primarily utilized as edibles and as phycocolloid, feed, fertilizers, specialty chemicals and in the personal care industry as well². A recent enumeration reported the presence of 1019 species of marine algae from Indian waters³. The National Academy of Agricultural Sciences, India has recommended creation of a facility for marine algae herbarium in the country as one of the national R&D priorities⁴. CSIR-Central Salt and Marine Chemicals Research Institute (CSMCRI) under the 11th Five-Year Plan project on 'Mapping of marine biodiversity of Indian coast' has established a herbarium at the Marine Algal Research Station, Mandapam Camp in April 2015. The old marine algal herbarium collection has been refurbished and designated as reference repository at the national level.

This unique facility holds over 5000 herbarium sheets representing 253 species (Figure 1) which include type specimens of several taxa encompassing the largest collection of marine algae in the country, including islands of the Gulf of Kutch, Gulf of Mannar, and Andaman and Nicobar archipelago.

Two checklists of marine algae have already been published by CSMCRI^{3,5}. The prime aim of the facility is to provide authentic identification service to students, researchers and industries while

continuing taxonomic revision of Indian marine algal flora, which is part of the mandate of the Institute. The herbarium specimens are being received and accession number given to each collection that is deposited there. It has been proposed to barcode all specimens for databasing and easy accessibility and wider dissemination of information. The herbarium located at CSMCRI, Bhavnagar, which is now part of this new facility, is indexed in the *Handbook on Herbaria in India and Neighbouring Countries*⁶ and also registered in Index Herbariorum⁷. This is the only herbarium housing exclusively marine algal collections. Besides having a role in authentication and reference for describing new species, herbaria play a critical role in studies pertaining to climate change, ethanobotany, ecology, DNA bar coding, etc. Recognizing the National Facility for Marine Algal Reference Herbarium is critical at this juncture. The herbarium is planning capacity-building programmes in the near future for students and researchers and to also undertake complete digitization of its collection for database and



Figure 1. View of compactors housing herbarium sheets.

linking it to leading global biodiversity databases. We are in process of obtaining recognition from National Biodiversity Authority of India for this facility as a 'national repository' of marine algal collections.

1. Fakoya, K. A., Owodeinde, F. G., Akin-tola, S. L., Adewolu, M. A., Abass, M. A. and Ndimiele, P. E., *J. Fish. Aquat. Sci.*, 2011, 6, 37–47.
2. Cai, J., Hishamunda, N. and Ridler, N., In *Social and Economic Dimensions of Car-rageenan Seaweed Farming* (eds Valder-rama, D. et al.), Fisheries and Aquaculture Technical Paper No. 580, FAO, Rome, 2013, pp. 5–59.
3. Rao, P. S. N. and Gupta, R. K., *Algae of India: A Checklist of Indian Marine Algae (excluding Diatoms & Dinoflagellates)*, Botanical Survey of India, Kolkata, 2015, p. 93.
4. Anon, *Seaweed Cultivation and Utilisa-tion*, National Academy of Agricultural Sciences, India, Policy Paper No. 22, 2003, p. 6.
5. Krishnamurthy, V. and Joshi, H. V., *A Checklist of Indian Marine Algae*, Central Salt and Marine Chemicals Research Insti-tute, Bhavnagar, 1970, p. 36.
6. Viswanathan, M. V., Singh, H. B. and Bhagwat, P. R., *Handbook on Herbaria in India and Neighbouring Countries*, National Institute of Science Communication, New Delhi, 2000, p. 258.
7. <http://sciweb.nybg.org/science2/IndexHerbariorum.asp>

VAIBHAV A. MANTRI

Marine Algal Research Station,
CSIR-Central Salt & Marine Chemicals
Research Institute,
Mandapam Camp 623 519, India
e-mail: vaibhav@csmcri.org

Is climate change triggering coral bleaching in tropical reef?

Elevated sea-surface temperatures (SST) caused by global warming is having serious detrimental effects on reef-building corals, because of expulsion of the symbiotic colourful dinoflagellate *Symbiodinium*. This causes coral bleaching or 'whitening of coral tissue', which leads to large-scale mortality of coral species and poses a major threat to future sustainability of coral reefs¹. Malvan Marine Sanctuary (MMS), Maharashtra, har-

bours a patchy coral reef in the Central West, coast of India. The reef was surveyed from October 2014 to January 2015 for comprehensive assessment of coral bleaching. Four belt transects (50 m × 2 m) were deployed² at a depth of 3–6 m, covering a total area of 400 m² each of the sub-tidal reef flat (Figure 1). We have estimated mean bleaching of 15% coral colonies in the area surveyed, comprising bleached colonies of

Porites lichen, *Porites compressa*, *Favites melicerum*, *Turbinaria mesenterina*, *Pseudosiderastrea tayami*, *Cyphastrea serailia* and *Plesiastrea versipora* (Figure 1). Partial bleaching was also observed in *Siderastrea savignyana* and *Goniopora* spp. Though many hypotheses for coral bleaching exist, elevated SST is generally considered as the most important factor³ and prolonged increase of ~1–2°C in SST in a region leads to loss of Zooxanthellae⁴.

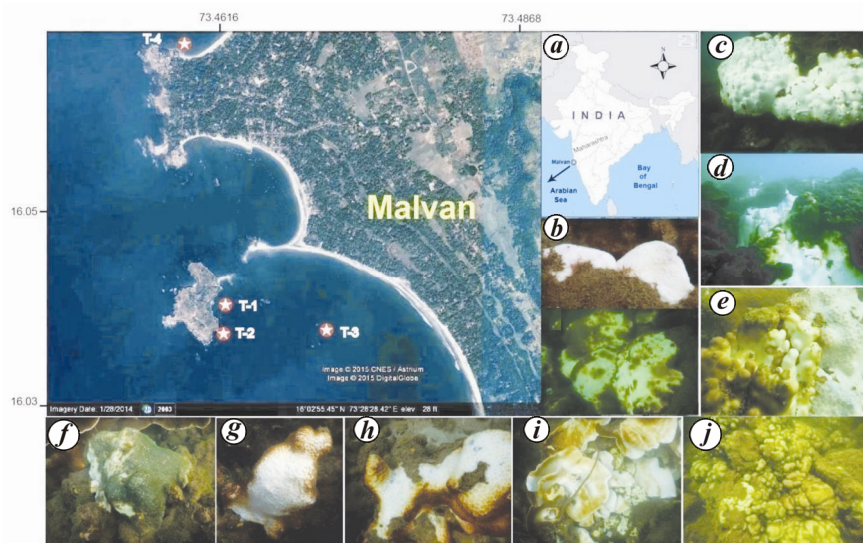


Figure 1. Location of the study sites (T, transect) and bleached corals at Malvan Marine Sanctuary. **a**, Completely bleached *Plesiastrea versipora*; **b**, Bleached and dead *P. lutea* covered by turf algae; **c**, *Porites compressa*; **d**, Bleached colonies of *Porites compressa*; **e**, Partially bleached *Porites* sp. with completely bleached *Pseudosiderastrea tayami*; **f**, *Cyphastrea serailia*; **g**, *Pseudosiderastrea tayami*; **h**, *Favites melicerrum*; **i**, *Turbinaria mesenterina*; **j**, *Porites lichen*.

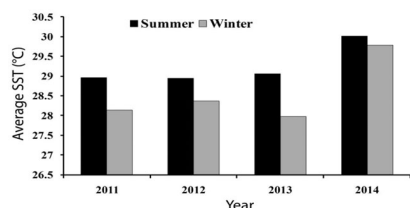


Figure 2. Average summer and winter sea-surface temperature time data (11 $\mu\text{m}/\text{day}$ at 4 km level) analysed during the past 4 years (data courtesy: NASA, USA).

Analysis of SST data of this region, derived from the Giovanni on-line data system⁵, developed and maintained by

NASA GESDISC, revealed 1.02°C and 1.61°C rise in temperature above normal during 2014, in summer and winter respectively, could trigger coral bleaching (Figure 2). The present study indicates that the reef is under stress; however, a detailed study is required to understand coral bleaching more precisely.

Fishing and eco-tourism related to the reef are the main source of livelihood for the local population at Malvan. The present study suggests that if this event continues, it will ruin the marine biodiversity as well as economy of the region in the future.

1. Hoegh-Guldberg, O., *Mar. Freshwater Res.*, 1999, **50**(8), 839–866.
2. Hill, J. and Wilkinson, C. R., In *Method for Ecological Monitoring of Coral Reef: A Resource for Managers. Version 1*, Australian Institute of Marine Science, Townsville, Australia, 2004, pp. 47–48.
3. Cantin, E. N., Cohen, L. A., Karnauskas, B. K., Tarrant, M. A. and McCorkle, C. D., *Science*, 2010, **329**(5989), 322–325.
4. Jokiel, L. P. and Coles, L. S., *Coral Reefs*, 1990, **8**(4), 155–162.
5. Acker, J. G. and Leptoukh, G., *EOS Trans. Am. Geophys. Union*, 2007, **88**(2), 14–17.

ACKNOWLEDGEMENTS. We thank the Director, CSIR-NIO, Goa for providing the necessary facilities. K.D. thanks DST, New Delhi for DST-Inspire fellowship. We thank CSIR, New Delhi (grant PSC0206) and RGSTC, Government of Maharashtra (grant GAP2871) for financial support. This is NIO contribution number 5802.

KALYAN DE¹
 SABYASACHI SAUTYA²
 SAMBAHAI MOTE¹
 LOBSANG TSERING³
 VISHAL PATIL¹
 RAHUL NAGESH¹
 BABAN INGOLE^{1,*}

¹CSIR-National Institute of Oceanography, Goa 403 004, India

²CSIR-National Institute of Oceanography, Regional Centre, Mumbai 400 053, India

³New Camp No. 14, Baylakuppe, Mysore 571 104, India

*e-mail: baban@nio.org

NEWS

Nobel Prizes 2015

Nobel Prize winners in the area of science, medicine or physiology and economics for the year 2015 have been announced.

Nobel Prize in Physiology or Medicine was awarded to three scientists. One half was shared by Prof. William C. Campbell of Drew University, Madison, NJ, USA and Satoshi Omura, Kitasato University, Japan 'for their discoveries concerning a novel therapy against infec-

tions caused by roundworm parasites'. The other half was announced in favour of Youyou Tu of the China Academy of Traditional Chinese Medicine, Beijing China 'for discoveries concerning a novel therapy against malaria'.

Nobel Prize in Physics was shared by Prof. Takashi Kajita, University of Tokyo, Kashiwa, Japan and Prof. Arthur B. McDonald of Queen's University, Kingston, Canada 'for the discovery of neutrino oscillations which shows that neutrinos have mass'.

Nobel Prize in Chemistry was awarded to three scientists for their 'mechanistic studies of DNA repair'. The three scientists are Prof. Thomas Lindahl of Francis

Crick Institute, Hertfordshire, UK; Prof. Paul Modrich, Howard Hughes Medical Institute and Duke University of Medicine, Durham, NC, USA and Prof. Aziz Sancar, University of North Carolina, Chapel Hill, NC, USA 'for mechanistic studies of DNA repair'.

The Sveriges Riksbank Prize in Economics was announced in favour of Angus Deaton of Princeton University, NJ, USA 'for analysis of consumption, poverty and welfare'. These studies have great relevance to India.

Current Science has planned to publish more detailed account of some of these prizes in the subsequent issues of the journal.