2nd International Indian Ocean Expedition 2015-2025

IIOE-2

Newsletter

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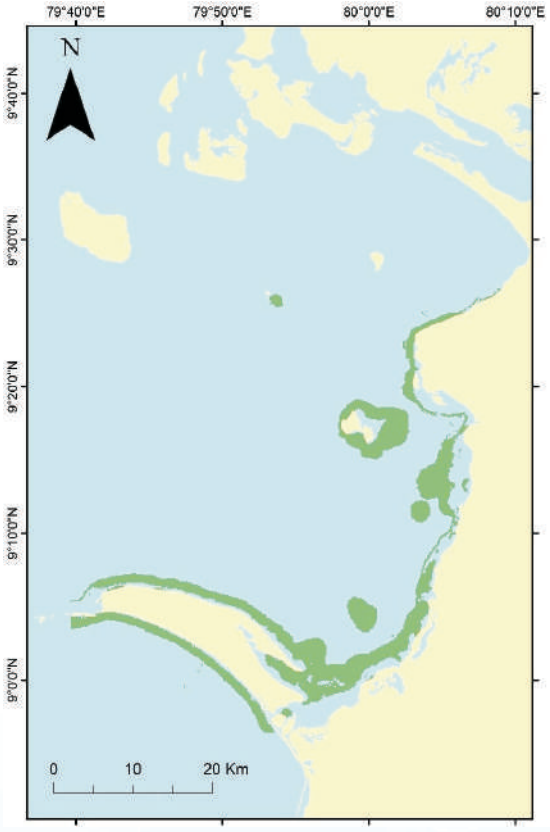
To advance our understanding of interactions between geologic, oceanic and atmospheric processes that give rise to the complex physical dynamics of the Indian Ocean region, and to determine how those dynamics affect climate, extreme events, marine biogeochemical cycles, ecosystems and human populations.

Development of Integrated Coastal and Marine Spatial Planning (MSP) for Sri Lanka

According to growing Sri Lankan Blue economy, the natural assets of ocean and coastal ecosystems will face unparalleled pressures. Competition for ocean space will increase when economic activities such as marine/ coastal aquaculture, renewable energy, and marine/ coastal tourism boost and generate added demand in ocean-related industries. Hence, there is an immediate need to manage the open ocean and coastal areas more coherently and safeguard them against activities that undermine the basis on which ocean industries depend. Only a sustainable blue economy that fits within the boundaries of our ocean and coastal ecosystems is capable of supporting robust growth of ocean-related economic activities. A sustainable blue economy calls for a strategic and integrated approach to planning the development of ocean and coastal ecosystems. Marine Spatial Planning (MSP) is increasingly gaining traction as a powerful instrument to put 'ocean space' on the sustainable development agenda and provide a breeding ground for new development paths towards a sustainable blue economy.

Few coastal districts of Sri Lanka have only land-based spatial planning, with the marine realm almost being neglected. The 'solution' is a novel approach to integrate land, coastal and marine ecosystems into spatial planning. In order to overcome of the administrative obstacles one needs to develop a proper strategy for data collection and more importantly, have discussions with various stakeholders of Sri Lanka. In parallel, there is a need to carry out the geospatial analysis of the coastal and marine areas.Ecosystem links and functions should also be analyzed and mapped. The environmental and socio-economic profiles of Sri Lanka need to be identified and spatially projected on a map based on each topic. Once the main issues have been identified, the root problems, the spatial conflicts, the causes for ecosystem degradation, poverty level, environmental protection efforts, management efforts, etc. should be analyzed. The MSP thus brings together different stakeholders, such as industry, government, conservation and recreation, and enables them to jointly make thoughtful decisions about how to allocate space among competing economic activities while protecting marine ecosystems.



Seagrass distribution map of Palk Bay derived from the WV-2 satellite data

MSP works across sectors to encourage investments. It does so by creating more transparent rules and a more predictable investment climate. At the same time, it aims to ensure that human activities at sea do not further jeopardize the health of our oceans and seas. From a policy perspective, MSP is instrumental in implementing a strategic and integrated approach to developing a sustainable blue economy. And because our ocean connects to sustainable life at so many different levels, we shouldn't underestimate the impact of such an approach. Ultimately, a sustainable blue economy not only just helps us achieve SDG14 (Life below Water) but also enables us to impact a broad set of SDGs. The Project aims to develop a common large-scale marine spatial plan which can be applied within the Sri Lankan EEZ, to ensure protection and sustainable uses of the sea. The main output of the study is an integrated Sri Lanka Coastal Marine Spatial Plan, presented in a single spatial planning map. In the proposed integrated spatial plan of Sri Lanka, coastal and marine entities would be linked to the spatial allocation of economic functions both in land and marine areas.

[Report Courtesy: D.D.G.L. Dahanayka, Department of Zoology, The Open University of Sri Lanka, Sri Lanka. E-mail: dddah@ou.ac.lk]

Biogeochemistry of Mahanadi estuary in the East Coast of India: what we know and what needs further investigation

Mahanadi is the third largest river on Indian Peninsula. It forms a major estuary at Paradip, on the northwest coast of the Bay of Bengal. Mahanadi estuary is known for its contribution to the blue economy being a major hub of capture fisheries, steel and fertilizer manufacture, and maritime transportation. However, it has come at a cost since industrial effluents and untreated municipal sewage ultimately ends up in the estuary. This region also faces the wrath of changing climate as increased frequencies of high-intensity cyclones and floods cause casualties and heavy economic damage. Recently one study has pointed out a gradual decline of sediment load in the estuary due to the construction of hundreds of dams upstream. Hence, the Mahanadi estuary offers an ideal study area to understand how various natural and anthropogenic factors contribute to its biogeochemical dynamics. In view of this, a group of researchers have synthesized the available literature on Mahanadi estuary to understand the state-of-the-art knowledge and identify research gaps for further investigation.

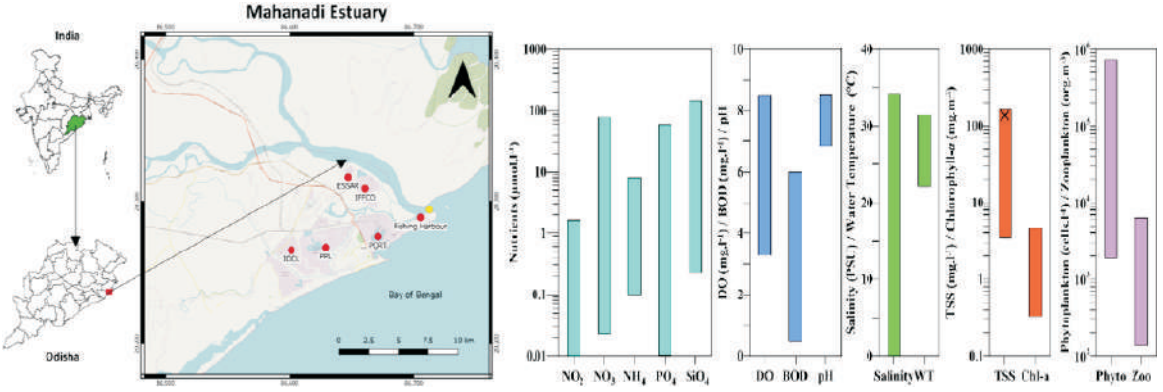


Figure-1: Map showing geographic locations of estuary mouth (yellow) and industries (red) (left panel) and range of biogeochemical parameters (from published literature) in Mahanadi estuary (right panel) (Source: Image reprinted by permission from Springer Nature Book "Estuarine Biogeochemical Dynamics of the East Coast of India", Acharyya et al. 2021))

One outcome of the study is identification of the range of values of various physico-chemical parameters from the estuarine mouth that have been published over the last five decades (Figure-1). The study also revealed that the water quality parameters were generally within the acceptable range; for example, dissolved oxygen in the estuary was almost always above 5mg/l. Few notable high values in nutrients such as nitrate, phosphate and silicate were recorded either due to extreme climatic events or local pollution.The estuarine salinity was highly dynamic, ranging between 0.01-34.1 PSU with slightly acidic to alkaline pH 6.84-8.5, depending on the freshwater flow. A conducive environment supports wide varieties of phytoplankton and zooplankton that

constitutes a healthy food web necessary for the local fishery. This review, in the end, recommends long-term high-frequency observations considering tidal, diurnal, seasonal, annual, interannual variabilities for nowcasting and forecasting the water quality of the Mahanadi estuary.

The human resources for this literature review were supported by the Coastal Monitoring program of INCOIS.

Source: Acharyya T, Sudatta BP, Raulo S, Singh S, Srichandan S, Baliarsingh, SK, Samanta, A, and Lotliker, AA (2021) A systematic review of biogeochemistry of Mahanadi river estuary: Insights and future research direction. In: Estuarine Biogeochemical Dynamics of the East Coast of India. Springer Nature Switzerland AG, pp 57-80.

[Report Courtesy: Susmita Raulo, E-mail: (susmitaraulo6@gmail.com) and Tamoghna Acharyya, E-mail: (acharyyat@xsos.edu.in), XIM University, Bhubaneswar, India]

Variability of monsoon blooms and its implication on the dissolved oxygen: A Bio-Argo study

To understand the inter-annual variability in surface productivity and its impact on the dissolved oxygen concentration in the deeper layer, four years' (2013-2016) record of chlorophyll and dissolved oxygen (DO) concentration from a Bio-Argo float deployed in the central Arabian Sea was analysed. The float has mostly remained confined to a small region [65°E-68.5°E and 17°N-19°N] which enabled us to develop an understanding of the year-to-year variability of the physical and biogeochemical parameters in this region. It was observed that though the surface blooms occur during both the summer and winter monsoons, the intensity and duration of the bloom have been decreasing over the past few years. Also, the winter blooms were more prominent compared to the summer bloom in the study region. A detailed analysis also shows that the observed inter-annual variability in the summer bloom can be attributed to the variability in wind speed, oceanic stratification and advection of nutrient rich water from the western Arabian Sea. It was found that during both the monsoons, stratification has played an important role in reducing the productivity. During the winter monsoon, the upwelling Rossby wave propagating from the west coast of India influenced productivity as north as 15°N. The chlorophyll data from Bio-Argo float shows that the total surface chlorophyll concentration and backscattering (a proxy for particulate flux) in the OMZ region have been decreasing during the study period. Consequently, the DO concentration in the deeper waters has also been increasing. The decrease in surface productivity, lateral advection from the west and their manifestation on the export flux has reduced the oxygen demand in the deeper layer.

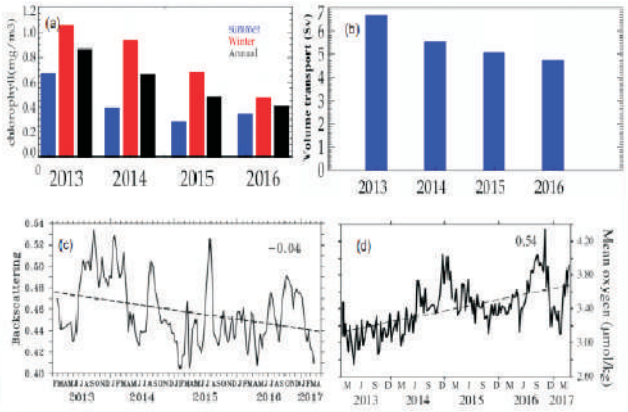


Figure:(a)Bar plot of mean surface chlorophyll in mg/m3 during summer monsoon(blue), winter monsoon(red) and the annually averaged values (black) during 2013-2016; (b) Volume transport (Sv) averaged for Jul-Sep in the upper 100 m across 65°E from 5°N to 20°N during 2013-2016;(c) Time series of integrated backscattering (m^{-1}) in the OMZ and (d)Mean oxygen concentration in the OMZ with trend line overlaid. The slope of trend line per 4years is listed on (c) and (d)

This work was recently published in Deep Sea Research –II (Mathew, T., Prakash, S., Shenoy, L., Chatterjee, A., Udaya Bhaskar TVS and Wojtasiewicz, B. (2021) Observed variability of monsoon blooms in the north-central Arabian Sea and its implication on oxygen concentration: A Bio-Argo study, Deep Sea Research -II (IIOE-2 Special Issue), DOI: 10.1016/j.dsr2.2021.104935).

[Report Courtesy: Teesha Mathew and S atya Prakash, INCOIS, Hyderabad, Inida, E-mail: satyap@incois.gov.in]

POSTPONEMENT of International Indian Ocean Science Conference (IIOSC)-2020

In view of the recent outbreak of COVID-19, the safety of delegates is of paramount importance for the conference organisers. Therefore, upon recommendation of UNESCO-IOC amid concerns raised by many delegates spread across the world, the International Indian Ocean Science Conference (IIOSC)-2020 has been postponed till further notice.

More details on the Conference are available at the website https://iiosc2020.incois.gov.in/

MESSAGE BOARD

- IIOSC-2020 Letter to Airlines
- Instructions for Presenters
- Allowed Poster size A0 (118 cm height x 84 cm width)

Endorse your projects in IIOE-2

Don't miss the opportunity to network, collaborate, flesh out your research project and participate in IIOE-2 cruises!!

The endorsement of your scientific proposal or a scientific activity focusing on the Indian Ocean region is a recognition of the proposal's or activity's alignment with the mission and objectives of IIOE-2, of its potential for contributing to an increased multi-disciplinary understanding of the dynamics of the Indian Ocean, and of its contribution to the achievement of societal objectives within the Indian Ocean region. Over 45 international, multi-disciplinary scientific projects have already been endorsed to date by the IIOE-2. Yours could be the next one!

Visit https://iioe-2.incois.gov.in/IIOE-2/EndorsementForm.jsp for further details and for projects already endorsed by IIOE-2 https://iioe-2.incois.gov.in/IIOE-2/Endorsed_Projects.jsp.

CLIVAR June 2021 Bulletin is available online

The International CLIVAR Project Office distributes a monthly bulletin with announcements, funding opportunities, meeting notifications relevant to the ocean/climate science community.

The latest CLIVAR Bulletin June, 2021 is available at:

https://mailchi.mp/clivar.org/clivar-june-2021-bulletin

Call for Contributions

Informal articles/short notes of general interest to the IIOE-2 community are invited for the next (July-end) issue of the IIOE-2 Newsletter. Contributions referring IIOE-2 endorsed projects, cruises, conferences, workshops, "plain language summary" of published papers focused on the Indian Ocean etc. are welcome. Articles may be up to 500 words in length (Word files) accompanied by suitable figures, photos.(separate.jpg files).

Deadline: **25 July, 2021**

The Indian Ocean Bubble-2

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United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

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