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.

IIOE-2 2nd International Indian Ocean Expedition 2015-2025

Wish you a Happy & Prosperous New Year 2025

Investigating the role of the Agulhas Current in the coastal environment

The Agulhas Current is one of the most powerful ocean currents in the world. Flowing along Africa's southeastern coast, it shapes the region's coastal and shelf environments. While past research has shed light on its global climate role, these studies have been limited in duration and focus. The current's sheer strength and high observational costs have made long-term in situ observations challenging, leaving the current's impacts on South Africa's coastal communities largely unaddressed.

This project aims to change that by focusing on the inshore of the Agulhas Current where it directly interacts with the coast. By studying the physical, biogeochemical, and biological processes in this region, we hope to bridge critical knowledge gaps and support local communities in responding to oceanic changes. For now, our work centres on the southern Agulhas region, with plans to expand northward as funding allows.
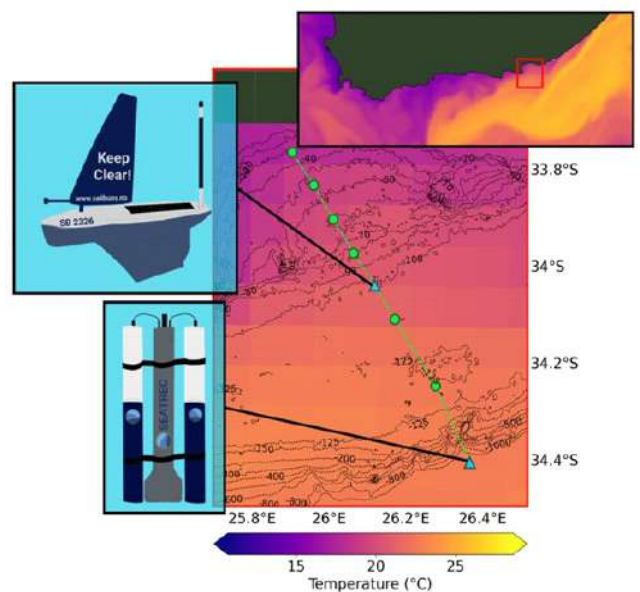

Figure-1: Map showing the transect stations (green dots) sampled and deployment locations (blue triangles) of the Sailbuoy and Seatrec Argo float deployed during the first ACEP survey out of Algoa Bay (inset), off the southeast coast of South Africa. Bathymetry is indicated by the dotted black lines and the satellite derived sea surface temperature scale bar is shown at the bottom (Source: Riesna R. Audh)

Surveying the Agulhas Current

Our study area spans the greater Algoa Bay region near the city of Gqeberha (formerly Port Elizabeth). Sampling is conducted at 7 stations distributed along a transect extending southeastwards from the 30-metre isobath off the Sundays River mouth, to a distance 40 nautical miles offshore. These stations are sampled quarterly, with each survey including:

- CTD profiles (to measure temperature, salinity, and depth)
- Phytoplankton and zooplankton net tows
- Water sampling for chlorophyll-a, nutrients, microbes and eDNA analysis

Key Insights

1. Survey 1 (Autumn): The first survey introduced PimPim, an unmanned surface vehicle carrying a CTD, ADCP, and weather station, in collaboration with the University of Gothenburg, Sweden. A Seatrec Argo Float (part of Project FIND) was also deployed offshore. Despite the current's strength, the team was able to collect essential baseline data.

2. Survey 2 (Winter): Winter conditions saw the Agulhas Current push further into Algoa Bay. Offshore waters showed warmer sea surface temperatures, reduced productivity, and increased water clarity, reflecting the current's extended influence.

3. Survey 3 (Spring): Calm seas and a weighted CTD allowed sampling down to 400 meters for the first time (previous surveys were limited to 120 meters). This survey revealed pockets of both high and low productivity, highlighting the region's dynamic nature.

Why It Matters

These surveys underscore the complexity of the Agulhas Current and its far-reaching impacts. Sustained monitoring will:

- Improve understanding of regional and global ocean systems
- Support coastal communities by identifying trends affecting ecosystems and livelihoods

Thus far these surveys have highlighted the complex and dynamic nature of the Agulhas Current, underscoring the need for sustained monitoring efforts to better understand its influence on regional and global ocean systems, as well as its impacts on local coastal communities.
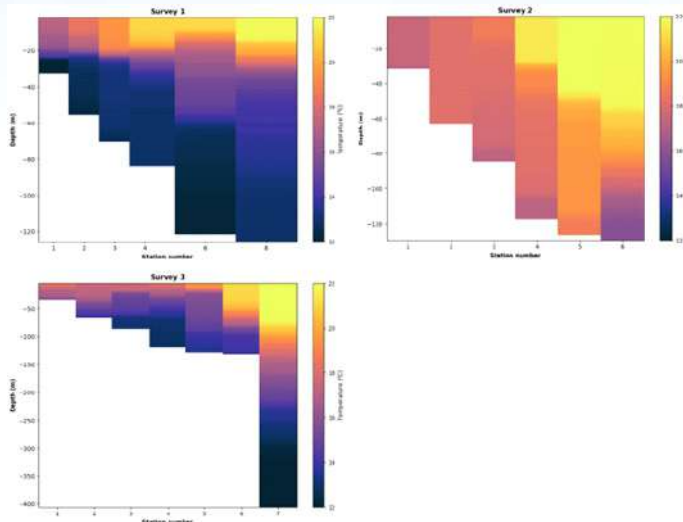

Figure-2: Vertical temperature sections obtained from the CTD data collected during the three surveys

Report Courtesy: Jethan d'Hotman, Department of Forestry, Fisheries and the Environment, South African Environmental Observation Network, South Africa; Email: js.dhotman@saeon.nrf.ac.za

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A joint collaboration under the international research project
VOKCE (Vulnerability Of Kenyan Coastal Ecosystems) supported by CNRS and IRD,
COLaB (Coastal Observation Lab in a Box)

VOKCE-COLaB TRAINING CAMP – WATAMU BAY/MIDA CREEK
SEPTEMBER 8-14, 2024

Making Coastal Water Quality Assessment Accessible

A "Field School on Affordable and Standardised Practices for Coastal Water," was organized in Watamu, Kenya, September 8-14, 2024 with post-graduate early career scientists alongside experts in marine science. This camp aimed at enhancing coastal water monitoring capability by providing participants with practical skills in using low-cost, open-source tools for hydrographic measurements (water circulation and structure) and for sampling and water quality analyses, including nutrients, pigments and dissolved organic matter, as well as organic pollutants (Poly-Aromatic Hydrocarbons, PAHs). The training brought together a cohort of Kenyan trainees alongside experts in global and regional ocean science, marking a significant step towards democratising access to oceanographic research.

In the Western Indian Ocean region, continuous coastal monitoring has been hindered by the high costs associated with advanced equipment and formal research vessels. The first of its kind in Kenya, this initiative aimed at providing accessibility to affordable practices in coastal water monitoring through the UN Decade-endorsed Coastal Observatory Laboratory in a Box (COLab) initiative (https://incois.gov.in/portal/siber/COLaB/index.html).

The field camp was a collaborative effort under the Vulnerability of Kenyan Coastal Ecosystems (VOKCE) project and was spearheaded by Dr. Marie-Alexandrine Sicre from the Centre National de la Recherche Scientifique (CNRS) and Dr. Jacqueline Uku from the Kenya Marine and Fisheries Research Institute (KMFRI). Prof. Agnes Muthumbi from the University of Nairobi (UoN) was also involved alongside the COLaB international initiative led by Dr. Gregory Cowie from the University of Edinburgh with additional support from Institut de Recherche pour le Développement (IRD).

The purpose of the training camp was to illustrate the potential of "old-school" methods and affordable instrumentation for physical, biological and biogeochemical observations and studies in coastal environments. Through a hands-on approach, the participants used a variety of methods from COLaB to assess the hydrodynamics and chemical composition of Mida Creek in Watamu selected as a pilot site. This was done by simultaneous (low and high volume) water filtering activities for further chemical analyses and the deployment of acoustic and drifter current metres to collect data on tidal flows and hydrography of Mida Creek. The trainees learned how to conduct water quality assessments in the Creek's water column, measuring parameters such as chlorophyll, phosphates, fluorescent dissolved organic matter (FDOM), total suspended matter (TSM) and water sampling of PAHs under clean conditions. After three days of field and laboratory work, the trainee cohort had the opportunity to process their samples and gain insights into data analysis and visualisation through software like Ocean Data View (ODV) and Google Earth. To further demonstrate how coastal water quality relates with the wellbeing of oceanic species, the participants paid a visit to Local Ocean Conservation (LOC) in Watamu to learn about sea turtle conservation in Kenya and discuss opportunities for future environmental monitoring with them.

A further emphasis of COLaB is that good coastal oceanography is possible without major research infrastructure but the deployment of small boats using manual deployment and sampling techniques and chemical analyses in a makeshift "laboratory" at a nearby hotel aiming at illustrating how the Creek varies under rising and falling tidal conditions. Comparison of the capabilities of low-cost, open-source instruments to commercial counterparts was also a key focus of the field camp. Overall, this pioneering training initiative in Kenya represents a significant advancement in capacity development for regional coastal resource management aimed at utilising water monitoring practices that can be of benefit both to local stakeholders and the marine environment.

Report Courtesy: Dr. Marie-Alexandrine Sicre, Directrice de Recherche CNRS, LOCEAN Sorbonne Université Intergovernmental Oceanographic Commission (IOC), Paris, France; Email: marie-alexandrine.sicre@locean.ipsl.fr

Towards Sustainable Skipjack Tuna Fisheries: Mapping Habitats in the Sri Lankan EEZ with Machine Learning and Satellite Data

Within the Exclusive Economic Zone (EEZ) of Sri Lanka, the skipjack tuna (Katsuwonus pelamis) is an important mixture of ecology and economy, supporting both the fishing industry and livelihoods. This study incorporated satellite-derived environmental data and machine learning to map sustainable skipjack tuna habitats. Data gaps were successfully filled by combining fisheries catch data with high-resolution datasets of sea surface temperature (SST) and chlorophyll-a (Chl-a) concentrations from Aqua MODIS (2018–2022), utilizing sophisticated data interpolation techniques such as DINCAE and DINEOF. The low Mean Absolute Error (MAE = 0.6336) and high R-squared values (R^2 = 0.9840) of predictive models, such as Artificial Neural Networks (ANN) and ensemble techniques, demonstrated strong reliability. This was further confirmed by prediction of 2023 catch-per-unit-effort (CPUE) data, which produced an R^2 of 0.9796.

The fisheries catch data of EEZ indicated abundant seasonal patterns in the productivity of skipjack tuna. The habitat sustainability map for skipjack tuna fish catch in EEZ of Sri Lanka is displayed in Figure -1.
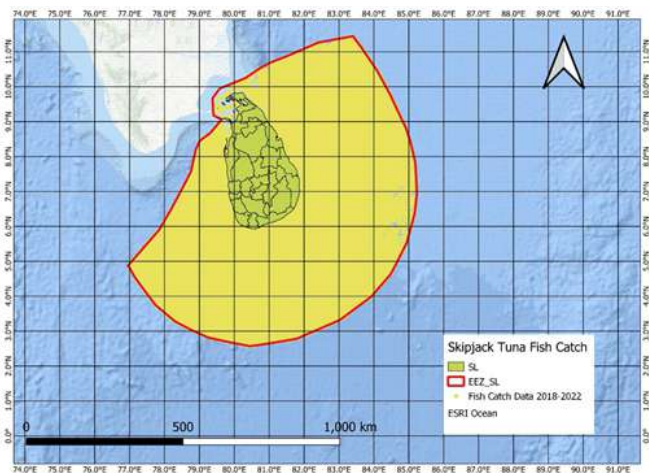

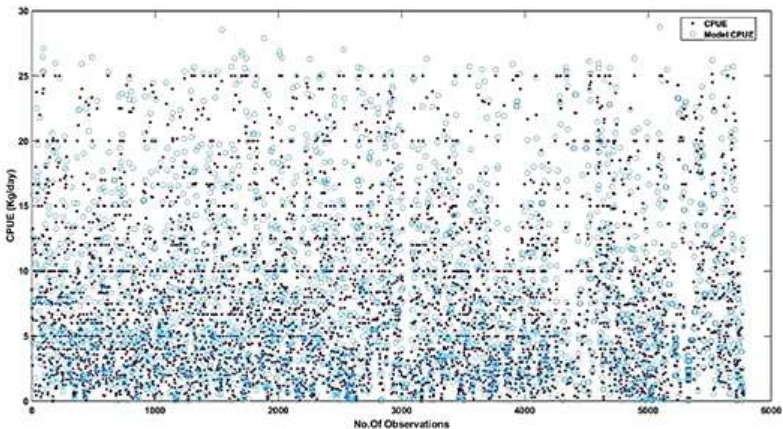Figure-1: Skipjack Tuna Fish Catch habitat sustainability map within Sri Lankan EEZ zone.

Figure-2: Validation of CPUE Model Estimate.

During the southwest monsoon (May–September), high suitability zones with SST of 28–30°C and Chl-a concentrations of 5-7 mg/m³ were mainly identified in the southern and south-eastern EEZ. These zones were correlated with CPUE values of 20.4-34 tons and nutrient-rich waters from monsoonal upwelling. On the opposing combination, the northeast monsoon (December-February) had lower Chl-a levels (1.48-2.86 mg/m³), cooler SST (28.8-29.6°C), and CPUE values of 10.2-17 tons, indicating decreased productivity. The relationship between SST, Chl-a, and skipjack tuna distribution has been highlighted by seasonal analyses; transitional periods (March-April and October-November) demonstrated moderate CPUE values of 13.6–27.2 tons. While CPUE model estimates (Figure-2) effectively represented temporal variability, scatterplots and regression analyses (Figure-3) validated the models. Habitat classifications were further visualized via QGIS tools, highlighting how fishing operations should be in alignment with environmental dynamics.

A decision supporting dashboard for fisheries management and real time habitat monitoring has been proposed by this investigation. The research delivered a scalable framework to improve resource utilization while maintaining marine biodiversity in the Sri Lankan EEZ by incorporating machine learning with data from satellites. In order to address the complexity of marine ecosystems and advance sustainable fisheries management in accordance with commitment of Sri Lanka to responsible marine conservation, future efforts should concentrate on extending temporal coverage, incorporating additional environmental factors, and improving predictive models.

Report Courtesy: Ranmini T.A.P.,Department of Fisheries and Aquatic Resources (DFAR), Ministry of Fisheries, Aquatic and Ocean Resources, Colombo, Sri Lanka. Pavan Kumar Jonnakuti, TVS Udaya Bhaskar, Indian National Centre for Ocean Information Services (INCOIS), Ministry of Earth Sciences (MoES), Hyderabad, India. Email: ranminipeshala@gmail.com
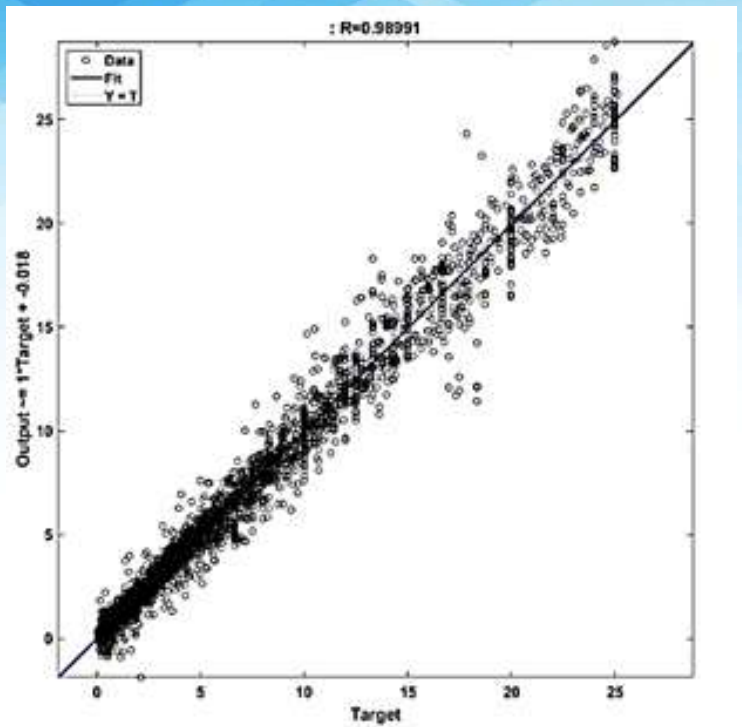

Figure-3: Regression Analysis for Validation Dataset

14th International Conference on Southern Hemisphere Meteorology and Oceanography

The NRF-SAEON, along with partner institutions in South Africa, are hosting the 14th International Conference on Southern Hemisphere Meteorology and Oceanography (ICSHMO) from 31 March to 4 April 2025. The conference will take place at the Cape Town International Convention Centre (CTICC). The Conference Theme is "Interconnected Earth System and Society". For details visit the website: https://icshmo2025.com/

We are encouraging the submission of abstracts and early bird registrations at this stage. We have a number of oceanography sessions that may be of interest to you and your networks, including Southern Hemisphere Boundary Currents, Air-Sea interactions, Marine Heatwaves, Emerging Technologies, Ocean and Cryosphere interactions, Mesoscale and Submesoscale processes, ocean and ecosystem modelling and prediction. In addition, a number of sessions dedicated to atmospheric interactions are planned including extreme events, extratropical processes, and climate change to list only a few.

Should you have any further questions, please contact the local organising team: icshmo2025@saeon.nrf.ac.za.

2025 ASI & IPFC 12 Annual Meeting

There will be Themed and Special Sessions. For **Themed Sessions,** there are
- Systematics (covering evolution, taxonomy, and biogeography)
- Ecology (including larval fish ecology)
- Sustainable Fisheries
- General Fish Biology (encomp

Whereas for **Special Sessions,** there will be **8 sessions:**
1. Investigating the biogeography of freshwater fishes of Asia
2. Exploring the diverse roles of fish parasites in taxonomy, evolution and ecological interactions
3. Choral reefs: fish communication
4. Diadromous fishes: biodiversity, life traits and conservation
5. Resilience and sensitivity of fishes to climate change and environmental stressors: from genes to ecosystems
6. Charting the Future of Indo-Pacific Shark and Ray Research and Conservation: Emerging Trends, Critical Needs, Practical Solutions
7. Gateway to the Past: Fish fossils and otoliths of the Indo-Pacific and their relation to fish biodiversity in time and space
8. Coral Reef Fishes as models for Eco-Evo-Devo

Please submit your abstract here.
The Call for Abstracts has opened on November 8, 2024, and will close on January 20, 2025. Should you have any further questions, please contact e-mail 2025.asiipfc12@gmail.com

DEEP-SEA RESEARCH PART II

THE SUBMISSION PORTAL FOR VOL. 7 OF THE DEEP-SEA RESEARCH II SPECIAL ISSUE SERIES ON THE IIOE-2 IS NOW OPEN

Submission of manuscripts that describe the results of studies related to the physical, chemical, biological, and/or ecological variability and dynamics of the Indian Ocean (including higher trophic levels) is encouraged.

Submission of manuscripts from students and early career scientists is also encouraged.

If you are interested in submitting a manuscript, please contact Raleigh Hood (rhood@umces.edu).

Important Dates:
Editorial Acceptance Deadline: February 15, 2025

For more details please visit

https://www.sciencedirect.com/journal/deep-sea-research-part-ii-topical-studies-in-oceanography/about/call-for-papers#the-2nd-international-indian-ocean-expedition-iioe-2-motivating-new-exploration-in-a-poorly-understood-basin-volume-7

The Indian Ocean Bubble, Issue No. 19 is now available online

Web Link: https://iioe-2.incois.gov.in/IIOE-2/pdfviewer_pub.jsp?docname=IIOE-2-DOC_OM_301.pdf

Informal articles are invited for the next issue. Contributions referring Indian Ocean studies, cruises, conferences, workshops, tributes to other oceanographers etc. are welcome.

Articles may be up to 1500 words in length (MS-Word) accompanied by suitable figures, photos (separate .jpeg files).

Deadline extended upto: 15 January, 2025

Send your contributions as usual to iioe-2@incois.gov.in

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 57 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

Call for Contributions

Informal articles/short notes of general interest to the IIOE-2 community are invited for the next (January-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 January, 2025

Send your contributions to iioe-2@incois.gov.in

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