

REPORTING FORM 2023

Please return completed form to imber@dal.ca by **10th March** (in order to give everyone enough time to collate and read all the reports before the April SSC meeting)

REPORTING PERIOD: WHAT YOU HAVE DONE since the annual report submitted for the SSC meeting held virtually in August 2022 ([Link to past annual reports](#))

and **PLANNED ACTIVITIES** over the next year (and beyond if details available)

N.B. The form focuses reporting on the research objectives (2022-2025) of the Grand Challenges (in order to align with how we are addressing IMBeR's commitments defined in the 5-year review process to SCOR and Future Earth)

Thank you.

SIBER

G. Cowie and R. Hood (co-chairs), with contributions from multiple SIBER SSC members

1. Ongoing activities, in line with the IMBeR Grand and Innovation Challenges

(Among other uses, information will be used to update the Grand Challenge Factsheets)

1.a. Grand Challenge I

Understanding and quantifying the state and variability of marine ecosystems - with focus on Research Objectives 1 to 3:

Research Objective 1. *Evaluate and predict the cumulative effect of multiple stressors*

Research Objective 2. *Integration of climate change and climate variability*

Research Objective 3. *Impacts on society – preparation for a changed future*

This Challenge, and research objectives 1 and 2, remain the primary focus of SIBER activity over the last year, and will continue in coming years. The activity is centred on the 2nd International Indian Ocean Expedition, (IIOE-2), in the main involving open-ocean processes and research cruises. SIBER members also are heavily involved in IIOE-2 through steering committees and working groups, and through chairing national IIOE-2 committees. Broader ongoing programmes relating to this Challenge include the IIOE-2's Eastern and Western Indian Ocean Upwelling Regime Initiatives (EIOURI and WIOURI).

The WIOURI programme is focused on 9 upwelling regions (Fig. 1), with emphasis on climate change and marine food security. In addition to the ongoing SOLSTICE-WIO programme (co-led by M. Roberts of SIBER; see 2022 SIBER report), 2022 saw completion of a project focused on the Agulhas current upper reaches (CYCLOPS) and launch of another focused on the Mozambique shelf (ReMoTURB;

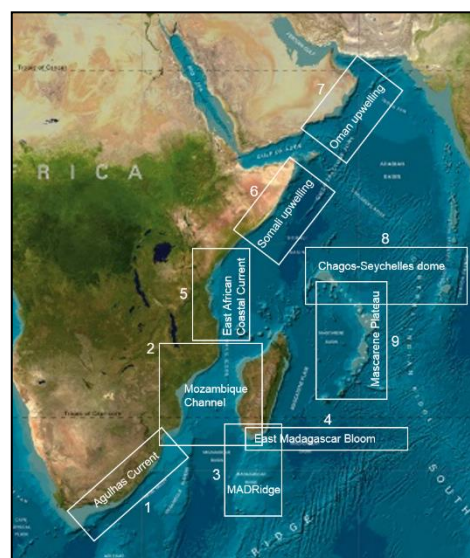


Figure 1. The 9 regions forming the centre of the WIOURI programme.

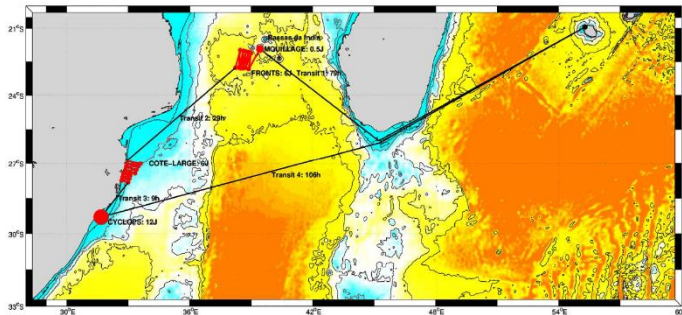


Figure 2. Cruise track of the 3rd RESILIENCE cruise, May 2022, RV *Marion Dufresne*.

project is now fully underway, with a research cruise for linked studies offshore of the Bazaruto Archipelago scheduled for May-June 2023, with the RV *Fridtjof Nansen*.



Also in the Western Indian Ocean, further research/cruise activities, led by and/or involving SIBER SSC members (F. Marsac) and addressing SIBER/IMBeR biogeochemical and ecosystem science themes, included the Monaco Explorations Indian Ocean mission 2022. The RV *Agulhas II* was chartered for a cruise (Oct-Nov 2020; Fig. 3) focused on multidisciplinary pelagic and benthic studies of the Sava de Malha Bank, and 7 other projects (microplastics, sea turtles, BGC-Argo, circulation & connectivity, world coral conservatory, habitat scan) across the adjacent islands and waters. The mission also included an important student training component, as well as major outreach and communication activities.

Figure 3. Cruise track of the RV *Agulhas II* Monaco Explorations Indian Ocean Mission (Oct-Nov 2022).

Two further cross-disciplinary IIOE-2 projects in the western Indian Ocean that followed SIBER/IMBeR science themes focused on drivers of ecosystem variability in the Chagos Archipelago and the role of internal waves in Seychelles coral bleaching (P. Hosegood, Plymouth University UK; Fig. 4). The last of three Chagos research cruises occurred in 2022, and the project has focused on the physical dynamics controlling ecosystem response on atolls and seamounts, mesophotic coral sampling, manta surveys, fisheries acoustics and multibeam surveys. The Seychelles study was carried out via a 2022 research cruise and involved mooring deployments around the SOSF d'Affos field station.

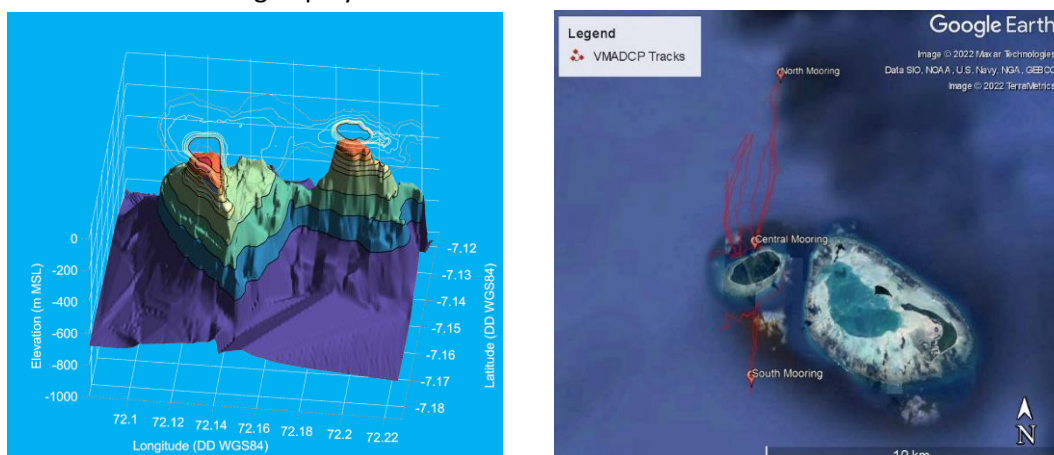


Figure 4. Topography of primary 2022 Chagos study sites (left) and Seychelles mooring locations (right).

In the Eastern Indian Ocean (as elsewhere), a number of EIOURI cruises were cancelled or postponed due to the pandemic during the 2020-22 period, but several of those cruises are now going ahead, with others also in the pipeline. The TRIUMPH (Throughflow Indonesian Seas, Upwelling & Mixing Physics) project, co-led by Dwi Susanto and Ocky Radjasa (SIBER SSC members) and involving a series of cruises, is multidisciplinary (physics, biology, biogeochemistry) and a research cruise originally scheduled for 2021 finally took place in July 2022 (Fig. 5).

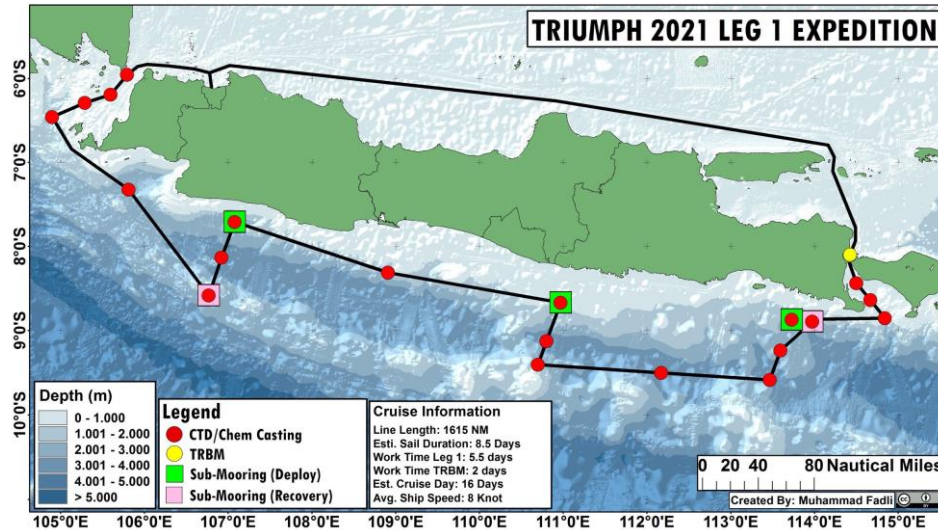


Figure 5. Cruise track for the TRIUMPH 2021 upwelling season cruise, rescheduled to July 2022.

Further IIOE-2 endorsed (and SIBER/IMBeR relevant) projects in the eastern Indian Ocean include an Australian study that aims to value the new Gascoyne Marine Park (Fig. 6; J. Keesing et al; *RV Investigator* cruise in Nov-Dec 2022) through bathymetric and habitat, fish and invertebrate surveys). Another is focused on quantification of vertical and lateral ocean transport due to sub-mesoscale fronts and eddies off northern Australia (Jones et al; *RV Solander* cruises in April/May 2023). Finally, there was continuation of a biodiversity assessment of Australian Indian Ocean territories (O'Hara et al) with a *RV Investigator* cruise in October 2022, that focused on the Cocos Island sector (Fig. 7), following a cruise in 2021 that focused on Christmas Island.

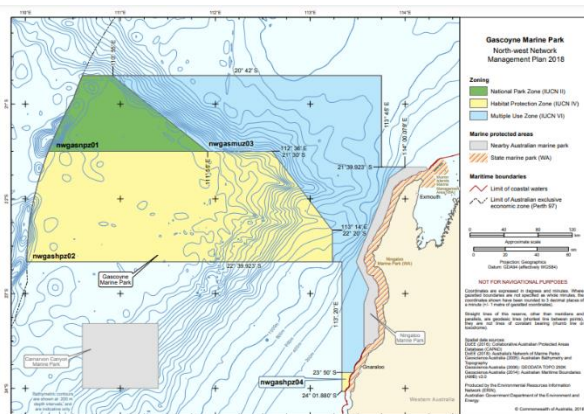


Figure 6. Gascoyne Marine Park study area.

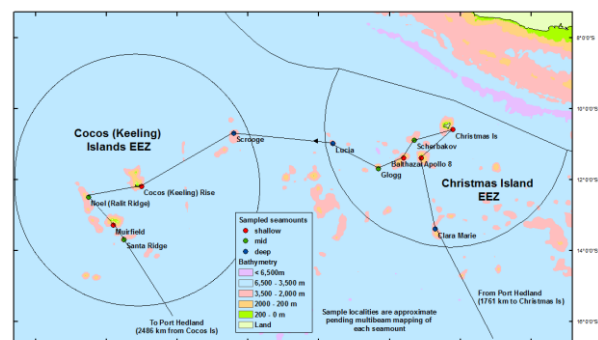


Figure 7. Christmas Island and Cocos Island study areas.

Finally, there has been further development of the Indian MOSAIC coastal observing programme (led by A. Lotliker, SIBER SSC;), which so far has established two of six planned moorings, fitted with an array of physical and biogeochemical sensors (Fig. 8). Sensors have now been secured for the remaining moorings, which will be deployed in 2023 and 2024. The central objectives are to establish sustained coastal observatories to monitor and understand coastal processes, to assess the health of the coastal and estuarine waters, and for model validation, assimilation, and forecasting of water

quality parameters. Stakeholders will include fishermen and fishery resource managers, the tourism industry, ecologists, environmentalists and the wider marine science research community.

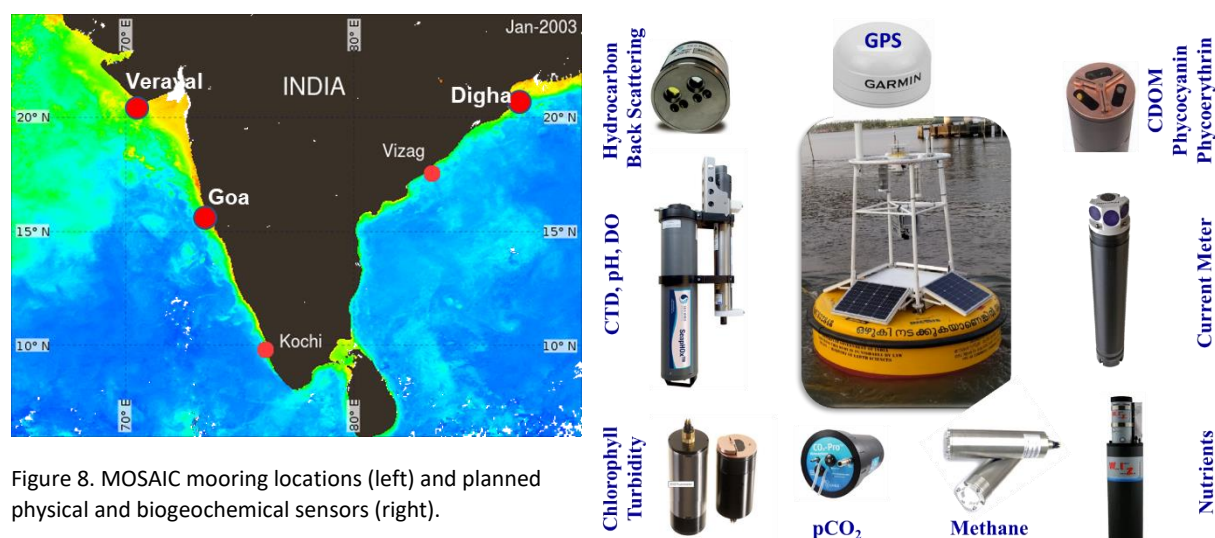


Figure 8. MOSAIC mooring locations (left) and planned physical and biogeochemical sensors (right).

1.b. Grand Challenge II

Improving scenarios, predictions and projections of future ocean-human systems at multiple scales - with focus on Research Objectives 4 to 6:

Research Objective 4. *Development of integrated data systems and approaches for predictions and projections*

Research Objective 5. *Development of predictive models and projections for use at regional scales*

Research Objective 6. *Development of alternative scenarios to bridge the gap between physical climate sciences and humanities*

SIBER activities most relevant to this Challenge have been the deployment of observing/monitoring systems as part of the programmes outlined above (WIOURI, EIOURI and India's MOSAIC programmes) as well as the Australian observing programme (IMOS) and the ongoing multi-national INDOOS programme. Together, these programmes provide essential data for local to regional modelling efforts aimed at the impacts of climate change on processes, ecosystems and resources, and implications for coastal communities. In addition, a new IIOE-2 endorsed Indian Ocean multi-scale numerical modelling effort (P. Hosegood, UK, co-PI; 2022-25) aims to implement numerical models at local (atoll), regional (archipelago) and basin (Indian Ocean) scales and to explore how physical oceanography drives ecosystem response and species behaviour throughout the Indian Ocean.

1.c. Grand Challenge III

Improving and achieving sustainable ocean governance - with focus on Research Objectives 7 to 9:

Research Objective 7. *Develop knowledge on best practices for multilevel governance approaches to ocean climate adaptation and mitigation*

Research Objective 8. *Develop understanding on key ingredients for transformation towards more sustainable, equitable and inclusive governance approaches to fisheries and aquaculture*

Research Objective 9. *Support implementation of post-2020 biodiversity targets for marine spatial planning and marine protected areas*

Relevant activities included the *SOLSTICE-WIO program* (co-led by SIBER SSC member Mike Roberts; <https://www.solstice-wio.org/>), focused on fisheries and food security in the western Indian Ocean. It combines environmental and socio-economic research with state-of-the art techniques and knowledge transfer, to develop policies for sustainable and resilient fisheries. As reported 2021 and 2022, further SIBER activity has been in relation to management of seamounts of the Southwestern Indian Ocean (SWIO). Also, 2022 activities associated with the IIOE2-endorsed NEKTON programme included multiple cruises around the Maldives (Sep-Oct 22; www.nektonmission.org/missions/maldives), which followed a similar previous work in the Seychelles. The mission included extensive 0-1000m biological surveys and seafloor mapping, as well as diverse sampling and instrument deployments. Parallel to these field studies has been NEKTON involvement in development of the Western Indian Ocean Resilience & Prosperity Initiative (WIO-RPI), a new WIO-wide ocean policy and strategy. It has been developed in consultation with regional stakeholders (science, blue economy, governance, policy) and endorsed by all 10 WIO governments (Nairobi Convention COP10, Nov '21). The four main aims are to enhance marine science necessary to inform decisions on sustainable management of marine resources, to harness a sustainable blue economy, to strengthen natural resilience and restoration, and to advance ocean governance.

1.d. Innovation Challenge 3

To advance understanding of ecological feedbacks in the Earth System

Many of the SIBER/IIOE2 research activities and cruises outlined above have understanding of ecosystem response and ecological feedbacks inherently at the core of linked cross-disciplinary projects.

1.e. Innovation Challenge 4

To advance and improve the use of social science data for ocean management, decision making and policy development

Again, the SOLSTICE-WIO programme (co-led by SIBER SCC member Mike Roberts) is an example of SIBER activity relevant to this Challenge. It involves case studies of threatened, emerging and collapsed fisheries, in Tanzania, Kenya and South Africa, respectively, including socio-economic as well as environmental research through to outreach and briefs to stakeholders and policy makers (<https://www.solstice-wio.org/>). The newly launched ReMoTURB project (also co-led by M. Roberts) (see above) has similar objectives in relation to Mozambique's fisheries resources. More widely, collection and use of social science data are written into the IIOE-2 Science plan and implementation strategy, overseen through IIOE-2 Science Theme 1 ("Human Benefits and Impacts") and Working Group 6 ("Translating Science for Society") (<https://iioe-2.incois.gov.in/IIOE-2/index.jsp>).

1.f. Innovation Challenge 5

Interventions to change the course of climate impacts

Add text...

1.g. Innovation Challenge 6

Sustainable management of Blue Carbon ecosystems

The SIBER and IIOE2 science plans have carbon cycling and sequestration in the coastal and open Indian Ocean as core to many of the key science questions and themes. They are central to several

of the ongoing SIBER/IIOE2 activities outlined above and to projects/cruises scheduled for coming years (see below). SIBER (through G. Cowie) is represented on the innovation challenge task team.

2. Selected highlights

2.a. Selected scientific highlights since last report (1-5)

Last report was submitted to SSC meeting, August 2022

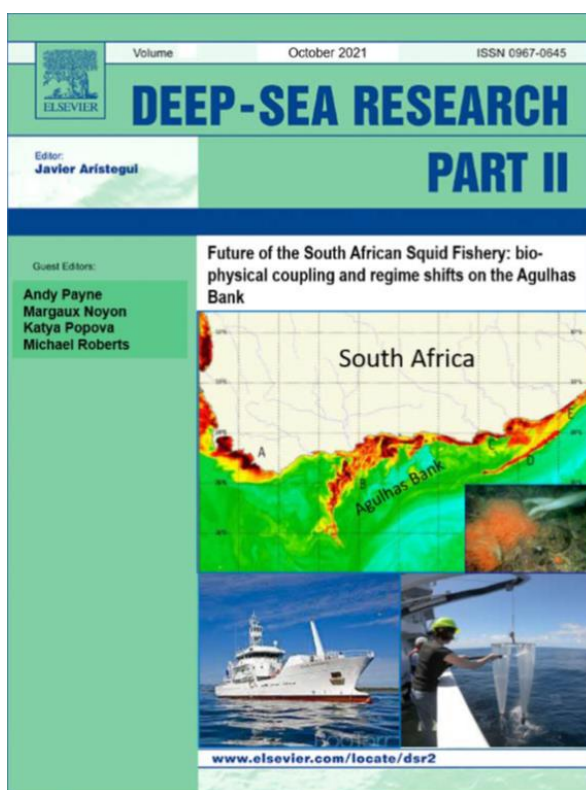
We view the major SIBER to be the following (details of each are provided in this report).

1. Contributions of SIBER SSC members to IIOE-2, both through governance (national committees and involvement in IIOE-2 working groups etc) and through motivating, leading and/or involvement in Indian Ocean research.
2. SIBER-led research cruises/projects, including SOLSTICE-WIO (Roberts), ReMoTurb (Roberts) CYCLOPS/RESILIENCE (WIOURI, Marsac), Monaco Expeditions Indian Ocean Mission (Marsac), TRIUMPH (EIOURI, Susanto and Radjasa), MOSAIC (Lotliker) etc.
3. SIBER continues to lead publication of results of Indian Ocean research. This has included the completion in 2022 of special issue of DSR II focused on the WIOURI/SOLSTICE Agulhas Bank programme and the South African squid fishery (A. Payne, M. Noyon, K. Popoca and M. Roberts, Guest eds).

Another SIBER-led IIOE-2 DSR II special volume completed in 2022 was dedicated to the 2019 *RV Investigator* cruise along 110°E (L. Beckley, R. Hood and P. Thompson, Guest eds.)

The sixth IIOE-2 special volume has a manuscript submittal deadline of May 15, 2023 and a seventh volume is being planned.

Finally, a collection of synthesis papers on the Indian Ocean is being prepared as a 20-chapter book, and is nearing completion (publication within the next year, C. Ummenhofer and R. Hood, eds.)



4. A further SIBER highlight in 2022 (and ongoing) has been continued development of the Coastal Observation Lab in a Box (COLaB) initiative (a collaboration between SIBER and the CLIVAR Indian Ocean Resoure Panel, co-led by G. Cowie and J. Hermes). The project involves development of portable packages of low-cost instrumentation, and protocols for standardised physical, biological and biogeochemical observations, to be applicable in diverse coastal settings (wetlands to shelf edge) and without need of major infrastructure (research vessel or formal laboratory). The instrument packages and methods will be accompanied by modelling and data management tools, and in-person and online training. Important progress has been made over the last year through involvement in and Ocean Best Practices task team and a series of in-person and hybrid workshops. Applications are now being submitted to fund project roll-out, to eventually include a

series of regional training camps (thus far including Mozambique, Indonesia, Seychelles and India as potential locations). In the longer term, COLaB may become part of a *CoastPredict* UN Decade project (PreditOnTime) or become of Decade project in its own right (application submitted).

5. At the recent joint SC meetings of IIOE-2 and SIBER in Perth, Western Australia (Feb 6-10 2023) it was noted that IIOE2/SIBER activities are rebounding strongly after the COVID-impacted period of 2020-2023, with numerous cruises now rescheduled for the 2022-2025 period, and many other projects and cruises in planning, to continue beyond 2025. There was universal agreement that IIOE-2 should extend beyond 2025, and plans are being made to assess progress and gaps in order to create an updated science and implementation strategy for the 2025-2030 period. SIBER will be centrally involved in that process.

2.b. Publications since last report

Please add all publications since last report to the table below (see notes for details on “Class” and “Activity” fields).

Publication with DOI	Class 1, 2, 3	Activity*
Albin, K. J., Jyothibabu, R., Alok, K. T., Santhikrishnan, S., Sarath, S., Sudheesh, V., Sherin C.K., Balachandran K.K; Asha Devi C., R., Gupta G.V.M (2022). Distinctive phytoplankton size responses to the nutrient enrichment of coastal upwelling and winter convection in the eastern Arabian Sea. <i>Progress in Oceanography</i> , 203 doi:10.1016/j.pocean.2022.102779	3	<i>SIBER/IMBeR relevant research</i>
Allegue, H, Guinet, C, Patrick, S, Hindell, M, McMahon, C., et al. (2022). Sex, body size, and boldness shape the seasonal foraging habitat selection in southern elephant seals. <i>Ecology and Evolution</i> , Wiley Open Access, 2022, 12 (1), (10.1002/ece3.8457)	2	<i>Publication resulting from SIBER-led cruise/project</i>
Amelot, M., Plard, F., Guinet, C., Arnould, JPY., Gascon, N., Tixier, P. (2022). Increasing numbers of killer whale individuals use fisheries as feeding opportunities within subantarctic populations. <i>Biology Letters</i>	2	<i>Publication resulting from SIBER-led cruise/project</i>
Anderson, M.P.B.C., Davies, C.H., Eriksen, R.S., 2022. Latitudinal variation, and potential ecological indicator species, in the dinoflagellate genus <i>Triplos</i> along 110°E in the south-east Indian Ocean. <i>Deep-Sea Research Part II</i> . 203, 105150. https://doi.org/10.1016/j.dsr2.2022.105150	2	<i>Publication resulting from SIBER-led cruise/project</i>
Arce, F., Hindell, M.A., McMahon, C.R., Wotherspoon, S.J., Guinet, C., Harcourt, R.G. & Bestley, S. (2022). Elephant seal foraging success is enhanced in Antarctic coastal polynyas. <i>Proceedings of the Royal Society B</i> , 289, 20212452, 10.1098/rspb.2021.2452	2	<i>Publication resulting from SIBER-led cruise/project</i>
Asdar S, Jacobs ZL, Popova E, Noyon M, Sauer W, Roberts MJ (2022) Projected climate change impacts on the ecosystems of the Agulhas Bank, South Africa. <i>Deep-Sea Research II</i> 200, 105092. https://doi.org/10.1016/j.dsr2.2022.105092	2	<i>Research led by/involving SIBER SSC member</i>
Baliarsingh, S.K., Samanta, A., Lotliker, A.A. , Mohanty, P.C., Mahendra, R.S., & Balakrishnan Nair, T.M. (2022). Satellite-Based Marine Ecological Services for the Indian Ocean Region. Chapter in Springer Book “Social and Economical Impact of Earth Sciences”. https://doi.org/10.1007/978-981-19-6929-4_12	2	<i>Research led by/involving SIBER SSC member</i>
Beckley, L.E., Hood, R.R. , Thompson, P.A., 2022. The Second International Indian Ocean Expedition (IIOE-2): Revisiting 110°E. <i>Deep-Sea Research Part II</i> . 206, 105205. https://doi.org/10.1016/j.dsr2.2022.105205	2	<i>Research led by/involving SIBER SSC member</i>

Bennani, Y., Ayouche, A., Carton, X. (2022). 3D Structure of the Ras Al Hadd Oceanic Dipole. <i>Oceans</i> , 3(3): 268-288. doi.org/10.3390/oceans3030019	2	Publication resulting from SIBER-led cruise/project
Bharti, D., Guizien, K., Aswathi-Das, M., Vinayachandran, P. N and Shanker, Kartik, (2022) Connectivity networks and delineation of distinct coastal provinces along the Indian coastline using large-scale Lagrangian transport simulations, <i>Limnology and Oceanography</i> , 10.1101/2021.04.24.441108.	2	Research led by/involving SIBER SSC member
Bizani M, Bornman TG, Campbell EE, Perissinotto R, Deyzel SHP (2023) Mesozooplankton community responses to a large-scale harmful algal bloom induced by the non-indigenous dinoflagellate <i>Lingulodinium polyedra</i> . <i>Science of the Total Environment</i> 860, 161030. http://dx.doi.org/10.1016/j.scitotenv.2022.161030	3	SIBER/IMBeR relevant research
Branch, G.M., Griffiths, C.L., Branch, M.L., Beckley, L.E. , 2022. <i>Two Oceans - A guide to marine life in southern Africa</i> . 5 th Edition. Struik Nature, Penguin Random House. Cape Town. 465pp.	2	Research led by/involving SIBER SSC member
Bruggeman J, Jacobs ZL, Popova E, Sauer WHH, Gornall JM, Brewin RJW, Roberts MJ (2022) The paralarval stage as key to predicting squid catch: Hints from a process-based model. <i>Deep-Sea Research II</i> 202, 105123. https://doi.org/10.1016/j.dsr2.2022.105123	2	Research led by/involving SIBER SSC member
Cotte, C., Ariza, A., Berne, A., Habasque, J., Lebourges-Dhaussy, A., Roudaut, G. et al. (2022). Macrozooplankton and micronekton diversity and associated carbon vertical patterns and fluxes under distinct productive conditions around the Kerguelen Islands. <i>J. Mar. Sys</i> 226, 103650	2	Publication resulting from SIBER-led cruise/project
Davies, C.H., Beckley, L.E. , Richardson, A.J., 2022. Copepods and mixotrophic Rhizaria dominate zooplankton in the oligotrophic Indian Ocean. <i>Deep-Sea Research Part II</i> . 202, 105136. https://doi.org/10.1016/j.dsr2.2022.105136	2	Research led by/involving SIBER SSC member
Du, X, Russell, J M, Liu, Z, Otto-Bliesner, B L, Oppo, D W, Mohtadi, M, Zhu, C, Galy, V V, Schefuß, E, Yan, Y, Rosenthal, Y, Dubois, N, Arbuszewski, J, Gau, Y (2023). North Atlantic cooling triggered a zonal mode over the Indian Ocean during Heinrich Stadial 1. <i>Science Advances</i> 9(1), doi:10.1126/sciadv.add4909	3	SIBER/IMBeR relevant research
Gibbons MJ, Parker Y, Cedras RB, Thibault D (2023) Mesoscale structure of neuston assemblages across the southern Indian Ocean subtropical gyre. <i>Deep Sea Research Part II</i> 208, 105249. https://doi.org/10.1016/j.dsr2.2022.105249	2	Publication resulting from SIBER-led cruise/project
Giering SLC, Noyon M, Godfrey B, Poulton AJ, Carvalho F, Roberts M (2022) Optical particle measurements reveal cross-shelf turbidity gradients on the Agulhas Bank. <i>Deep-Sea Research II</i> 200, 105094. https://doi.org/10.1016/j.dsr2.2022.105094	2	Research led by/involving SIBER SSC member
Govender A, Groeneveld JC, Singh SP, Willows-Munro S (2022) Metabarcoding of zooplankton confirms southwards dispersal of decapod crustacean species in the western Indian Ocean. <i>African Journal of Marine Science</i> , 44:3, 279-289, https://doi.org/10.2989/1814232X.2022.2108144	3	SIBER/IMBeR relevant research
Govender A, Singh S, Groeneveld J, Pillay S, Willows-Munro S (2022) Metabarcoding analysis of marine zooplankton confirms the ecological role of a sheltered bight along an exposed continental shelf. <i>Molecular Ecology</i> , 00, 1–13. https://doi.org/10.1111/mec.16567	3	SIBER/IMBeR relevant research

Hammond ML, Jebri F, Srokosz M, Popova E (2022) Automated detection of upwelling in the Western Indian Ocean: Towards an operational “Upwelling Watch” system. Front. Mar. Sci. 9:950733. https://doi.org/10.3389/fmars.2022.950733	2	<i>Publication resulting from SIBER-led cruise/project</i>
Hancke L, Roberts MJ , Smeed, Jebri F (2023) Cold ridge formation mechanisms on the Agulhas Bank (South Africa) as revealed by satellite-tracked drifters. Deep-Sea Research Part II 208, 105245. https://doi.org/10.1016/j.dsr2.2022.105245	2	<i>Research led by/involving SIBER SSC member</i>
Hindell, M.A., McMahon, C.R., Guinet, C., Harcourt, R., Jonsen, I.D., Raymond, B., Maschette, D. (2022). Assessing the potential for resource competition between the Kerguelen Plateau fisheries and southern elephant seals. Frontiers in Marine Science, section Marine Megafauna. doi: 10.3389/fmars.2022.1006120	2	<i>Publication resulting from SIBER-led cruise/project</i>
Huggett JA , Groeneveld JC, Singh SP, Willows-Munro S, Govender A, Cedras R, Deyzel SHP (2022) Metabarcoding of zooplankton to derive indicators of pelagic ecosystem status. South African Journal of Science 118 (11/12): Art. #12977. https://doi.org/10.17159/sajs.2022/12977	2	<i>Research led by/involving SIBER SSC member</i>
Huggett JA , Noyon M, Carstensen J, Walker DR (2023) Patterns in the plankton – Spatial distribution and long-term variability of copepods on the Agulhas Bank. Deep Sea Research Part II 208, 105265. https://doi.org/10.1016/j.dsr2.2023.105265	2	<i>Research led by/involving SIBER SSC member</i>
Jacobs Z, Roberts M , Jebri F, Srokosz M, Kelly S, Sauer W, Bruggeman J, Popova E (2022) Drivers of productivity on the Agulhas Bank and the importance for marine ecosystems. Deep-Sea Research II 199: 105080. https://doi.org/10.1016/j.dsr2.2022.105080	2	<i>Research led by/involving SIBER SSC member</i>
Jacobs Z, Kelly S, Jebri F, Roberts M , Srokosz M, Sauer W, Hancke L, Popova E (2022) Retention properties of the Agulhas bank and their relevance to the chokka squid life cycle. Deep–Sea Research II 202, 105151. https://doi.org/10.1016/j.dsr2.2022.105151	2	<i>Research led by/involving SIBER SSC member</i>
Jebri F, Raitsos DE, Gittings JA, Jacobs ZL, Srokosz M, Gornall J, Sauer WHH, Roberts MJ , Popova E (2022) Unravelling links between squid catch variations and biophysical mechanisms in South African waters. Deep-Sea Research II 196: 105028. https://doi.org/10.1016/j.dsr2.2022.105028	2	<i>Research led by/involving SIBER SSC member</i>
Jebri F, Srokosz M, Jacobs ZL, Nencioli F and Popova E (2022) Earth Observation and Machine Learning Reveal the Dynamics of Productive Upwelling Regimes on the Agulhas Bank. Front. Mar. Sci. 9:872515. doi: 10.3389/fmars.2022.872515	2	<i>Research led by/involving SIBER SSC member</i>
Jian, Z, Wang, Y, Dang, H, Mohtadi, M, Rosenthal, Y, Lea, DW, Liu, Z, Jin, H, Ye, L, Kuhnt, W, Wang, X (2022). Warm pool ocean heat content regulates ocean-continent moisture transport. Nature 612, 92-99, doi:10.1038/s41586-022-05302-y	3	<i>SIBER/IMBeR relevant research</i>
Sarma, N.S., Baliarsingh, S.K., Pandi, S.R., Lotliker, A.A. , & Samanta, A. (2022). Noctiluca blooms intensify when northwesterly winds complement northeasterlies in the northern Arabian Sea: Possible Implications. Oceanologia https://doi.org/10.1016/j.oceano.2022.06.004	2	<i>Research led by/involving SIBER SSC member</i>
Siyu Jiang, Fuminori Hashihama, Yukio Masumoto, Hongbin Liu, Hiroshi Ogawa, Hiroaki Saito (2022) Phytoplankton dynamics as a response to physical events in the oligotrophic Eastern Indian Ocean, Progress in Oceanography 203 (2022) 102784. DOI: 10.1016/j.pocean.2022.102784	3	<i>SIBER/IMBeR relevant research</i>

Khan, M.A., Kumar, S., Roy, R., Prakash, S., Lotliker, A.A., & Baliarsingh, S.K. (2023). Effects of tidal cycle on greenhouse gases emissions from a tropical estuary. <i>Marine Pollution Bulletin</i> , 189, 114733 https://doi.org/10.1016/j.marpolbul.2023.114733	2	<i>Research led by/involving SIBER SSC member</i>
Kolbusz, J., Langlois, T., Pattiaratchi, C., De Lestang, S. 2022. Using an oceanographic model to investigate the mystery of the missing puerulus. <i>Biogeosciences</i> 19: 517-539.	3	<i>SIBER/IMBeR relevant research</i>
Kobryn, H.T., Beckley, L.E. , Wouters, K., 2022. Bathymetry derivatives and habitat data from hyperspectral imagery establish a high-resolution baseline for managing Ningaloo Reef, Western Australia. <i>Remote Sensing</i> 14, 1827. https://doi.org/10.3990/rs14081827	2	<i>Research led by/involving SIBER SSC member</i>
Kumar, B.S.K, Sarma, V.V.S.S, Cardinal D. (2022). Tracing terrestrial version marine sources of dissolved organic carbon in the largest monsoonal Godavary estuary in India using stable carbon isotopes. <i>Estuar. Coast and Shelf Sci.</i> 276, 108004	3	<i>SIBER/IMBeR relevant research</i>
Landry, M.R. , Selph, K.E, Hood, R.R. , Davies, C, H., Beckley, L.E. 2022. Low temperature sensitivity of picophytoplankton P:B ratios and growth rates across a natural 10°C temperature gradient in the oligotrophic Indian Ocean. <i>Limnology and Oceanography Letters</i> 7, 112-121.	2	<i>Research led by/involving SIBER SSC member</i>
Landry, M.R. , Hood, R.R. , Davies, C.H., Selph, K.E., Antoine, D., Carl, M.C., Beckley, L.E. , 2022. Microbial community biomass, production and grazing along 110°E in the eastern Indian Ocean. <i>Deep-Sea Research Part II</i> . 202, 105134. https://doi.org/10.1016/j.dsr2.2022.105134	2	<i>Research led by/involving SIBER SSC member</i>
Lennartz, S. T., Gauss, M., von Hobe, M. and Marandino, C. A. (2021) Monthly resolved modelled oceanic emissions of carbonyl sulfide and carbon disulfide for the period 2000–2019. <i>Open Access Earth System Science Data</i> , 13 . pp. 2095-2110. DOI 10.5194/essd-13-2095-2021.	3	<i>SIBER/IMBeR relevant research</i>
Leseurre, C., Monaco, C.L., Reverdin, G., Metzl, N., Fin, J., Mignon, C., Benito, L. (2022). Summer trends and drivers of sea surface fCO ₂ and pH changes observed in the southern Indian Ocean over the last two decades (1998–2019). <i>Biogeosciences</i> 19, 2599-2625.	2	<i>Publication resulting from SIBER-led cruise/project</i>
Mazwane SL, Poulton AJ, Hickman AE, Jebri F, Jacobs Z, Roberts M , Noyon M (2022) Spatial and temporal variability of Net Primary Production on the Agulhas Bank, 1998–2018. <i>Deep-Sea Research II</i> 199: 105079. https://doi.org/10.1016/j.dsr2.2022.105079	2	<i>Research led by/involving SIBER SSC member</i>
Mulitza, S, Bickert, T, Bostock, HC, Chiessi, CM, Donner, B, Govin, A, Harada, N, Huang, E, Johnstone, H, Kuhnert, H, Langner, M, Lamy, F, Lembke-Jene, L, Lisiecki, L, Lynch-Stieglitz, J, Max, L, Mohtadi, M, Mollenhauer, G, Muglia, J, Nürnberg, D, Paul, A, Rühlemann, C, Repschläger, J, Saraswat, R, Schmittner, A, Sikes, EL, Spielhagen, RF, Tiedemann, R (2022) World Atlas of late Quaternary Foraminiferal Oxygen and Carbon Isotope Ratios. <i>Earth System Science Data</i> , 14(6), 2553-2611, doi:10.5194/essd-14-2553-2022	3	<i>SIBER/IMBeR relevant research</i>
Narayanan Nampoothiri S, V., Ramu, C.V., Rasheed, K. <i>et al.</i> Observational evidence on the coastal upwelling along the northwest coast of India during summer monsoon. <i>Environ Monit Assess</i> 194 , 5 (2022). https://doi.org/10.1007/s10661-021-09659-x	3	<i>SIBER/IMBeR relevant research</i>
Noyon M, Poulton AJ, Asdar S, Weitz R, Giering SLC (2022) Mesozooplankton community distribution on the Agulhas Bank in autumn: Size structure and production. <i>Deep Sea Research Part II</i> 195, 105015. https://doi.org/10.1016/j.dsr2.2021.105015	2	<i>Publication resulting from SIBER-led cruise/project</i>

O'Brien, J., Focardi, A., Deschaseau, E.S.M., Petrou, K., Ostrowski, M., Beckley, L.E. , Seymour, J.R., 2022. Microbial Dimethylsulfoniopropionate (DMSP) cycling in the ultraoligotrophic eastern Indian Ocean. <i>Deep-Sea Research Part II</i> . 105195. https://doi.org/10.1016/j.dsr2.2022.105195	2	Research led by/involving SIBER SSC member
Olivar, M.P., Beckley, L.E. , 2022a. Latitudinal variation in diversity and abundance of mesopelagic fishes associated with change in oceanographic variables along 110°E, south-east Indian Ocean. <i>Deep-Sea Research Part II</i> . 198, 105053. https://doi.org/10.1016/j.dsr2.2022.105053	2	Research led by/involving SIBER SSC member
Olivar, M.P., Beckley, L.E. , 2022b. Vertical distribution patterns of early stages of mesopelagic fishes along 110°E, south-east Indian Ocean. <i>Deep-Sea Research Part II</i> . 201, 105111. https://doi.org/10.1016/j.dsr2.2022.105111	2	Research led by/involving SIBER SSC member
O'Rorke, R., van der Reis, A., von Ammon, A., Beckley, L.E. , Pochon, X., Zaiko, A., Jeffs, A. 2022. eDNA metabarcoding shows latitudinal eukaryote micro- and mesoplankton diversity stabilizes across oligotrophic region of a >3000 km longitudinal transect in the Indian Ocean. <i>Deep-Sea Research Part II</i> . 105178. https://doi.org/10.1016/j.dsr2.2022.105178	2	Research led by/involving SIBER SSC member
Paquet, F., Zaragosi, S., Jorry, S., Le Lorrec, B., Bernard, J. et al. (2022). Pleistocene Tectono-magmato-volcanic events recorded east of Mayotte - insights for the ongoing seismo-volcanic crisis. ASF 2022 - XVIIIème Congrès Français de Sédimentologie, Sep 2022, Brest, France. (hal-03710649)	2	Publication resulting from SIBER-led cruise/project
Parida, C., Lotliker, A. A. , Roy, R., & Vinayachandran, P. N. (2022). Radiant heating rate associated with chlorophyll dynamics in the upper ocean of Southern Bay of Bengal: A case study during Bay of Bengal Boundary Layer Experiment. <i>Deep Sea Research Part II: Topical Studies in Oceanography</i> , 196, 105026.	2	Research led by/involving SIBER SSC member
Phillips, H.E., Patel, R.S., Benthuyssen, J.A., Duran, E.R., Marin, M. 2022. Watermass characteristics and circulation near 110°E in the southeast Indian Ocean. <i>Deep-Sea Research Part II</i> . 202, 105149. https://doi.org/10.1016/j.dsr2.2022.105149	2	Publication resulting from SIBER-led cruise/project
Poulton AJ, Mazwane SL, Godfrey B, Carvalho F, Mawji E, Wihsgott JU, Noyon M (2022) Primary production dynamics on the Agulhas Bank in autumn. <i>Deep Sea Research Part II</i> 203, 105265. https://doi.org/10.1016/j.dsr2.2022.105153	2	Publication resulting from SIBER-led cruise/project
Prasad, S., Mishra, P. K., Priya, P., Yousuf, A. R., Andersen, N., Anoop, A., Jehangir, A., Yaseen, T., Gaye, B. , and Stebich, M.: (2022) Impact of precipitation and temperature changes on limnology and sediment characteristics in NW Himalaya, <i>Appl. Geochem.</i> , 137, 105200, https://doi.org/10.1016/j.apgeochem.2022.105200 .	2	Research led by/involving SIBER SSC member
Raes, E.J., Hörstmann, C., Landry, M.R. , Beckley, L.E. , Marin M., Thompson, P.A., Antoine, D., Focardi, A., O'Brien, J., Ostrowski, M., Waite, A.M., 2022. Dynamic change in an ocean desert: microbial diversity and trophic transfer along the 110°E meridional in the Indian Ocean. <i>Deep- Sea Research Part II</i> . 201, 105097. https://doi.org/10.1016/j.dsr2.2022.105097	2	Research led by/involving SIBER SSC member
Roy, R., Prakash, S. , Lotliker, A.A. , Sudhakaran, P. S., & Choudhury, S. B. (2022). Response of surface chlorophyll to aerosol dust input in the Central Arabian Sea. <i>Indian Journal of Geo Marine Sciences</i> , 51(04): 297-303. http://nopr.niscpr.res.in/handle/123456789/60195	2	Research led by/involving SIBER SSC member

Samanta, A., Baliarsingh, S.K., Lotliker, A.A. , Joseph, S., & Balakrishnan Nair, T.M. (2022). Satellite-based detection of Noctiluca bloom in the coastal waters of the southeastern Arabian Sea: A case study implicating monitoring needs. National Academy Science Letters, https://doi.org/10.1007/s40009-023-01205-2	2	<i>Research led by/involving SIBER SSC member</i>
Saraswat, R, Suokhrie, T, Naik, D K, Singh, D P, Saalim, S M, Salman, M, Kumar, G, Bhadra, S R, Mohtadi, M, Kurtarkar, S R, Maurya, A S (2023). Large salinity gradient and diagenetic changes in the northern Indian Ocean dominate the stable oxygen isotopic variation in Globigerinoides ruber, Earth System Science Data, doi:10.5194/essd-2022-107	3	<i>SIBER/IMBeR relevant research</i>
Sarma, N.S., Baliarsingh, S.K., Lotliker, A.A. , Pandi, S.R., Samanta, A., & Srichandan, S. (2023). Sea Surface Temperature and Phytoplankton Abundance as Crucial Proxies for Green Noctiluca Bloom Monitoring in the Northeastern Arabian Sea: A Case Study. Ocean Science Journal, 58:2. https://doi.org/10.1007/s12601-022-00096-6	2	<i>Research led by/involving SIBER SSC member</i>
Sato, Mitsuhide; Hirata, Kunioki ; Shiozaki, Takuhei ; Takeda, Shigenobu (2022) Effects of iron and light on microbial nitrogen cycles in the primary nitrite maxima (PNM) of the eastern Indian Ocean, Deep-Sea Research Part I, Volume 185, article id. 103808. July 2022, DOI: 10.1016/j.dsr.2022.103808	3	<i>SIBER/IMBeR relevant research</i>
Silori, S., Biswas, H., Chowdhury, M., Sharma, D., Magloire, M-Y, Cardinal D. (2022). Interannual variability in particulate organic matter distribution and its carbon stable isotopes signatures from the western Indian shelf waters. Sci. Total Env. 844, 157044 https://doi.org/10.1016/j.jmarsys.2021.103650	3	<i>SIBER/IMBeR relevant research</i>
Singh, DP, Saraswat, R, Mohtadi, M, Kumar, P (2022). Warm northern tropical Indian Ocean strengthened the ocean circulation prior to the last glacial termination. Global and Planetary Change, 103733, doi:10.1016/j.gloplacha.2021.103733	3	<i>SIBER/IMBeR relevant research</i>
Sprogis, K.R., Sutton, A.L., Jenner, M-N., McCauley, R.D., Jenner, K.C.S., 2022. Occurrence of cetaceans and seabirds along the Indian Ocean 110°E meridian from temperate to tropical waters. <i>Deep-Sea Research Part II</i> . 105184. https://doi.org/10.1016/j.dsr2.2022.105184	2	<i>Publication resulting from SIBER-led cruise/project</i>
Srichandan, S., Baliarsingh, S.K., Samanta, A., Jena, A.K., Lotliker, A.A. , Balakrishnan Nair, T.M., Barik, K.K., & Acharyya, T. (2022). Satellite-Based Characterization of Phytoplankton Blooms in Coastal Waters of the Northwestern Bay of Bengal. Journal of the Indian Society of Remote Sensing. https://doi.org/10.1007/s12524-022-01597-6	2	<i>Research led by/involving SIBER SSC member</i>
Steiner, Z., Landing, W. M., Bohlin, M. S., Greaves, M., Prakash, S., Vinayachandran, P. N. , & Achterberg, E. P. (2022). Variability in the Concentration of Lithium in the Indo-Pacific Ocean. <i>Global Biogeochemical Cycles</i> , 36(6), e2021GB007184.	2	<i>Research led by/involving SIBER SSC member</i>
V. Sudheesh, G.V.M. Gupta, Yudhishtir Reddy, Kausar F. Bepari, N.V.H.K. Chari, C.K. Sherin, S.S. Shaju, Ch.V. Ramu, Anil Kumar Vijayan, Oxygen minimum zone along the eastern Arabian Sea: Intra-annual variation and dynamics based on ship-borne studies, Progress in Oceanography, Volume 201, 2022, 102742, ISSN 0079-6611, https://doi.org/10.1016/j.pocean.2022.102742 .	3	<i>SIBER/IMBeR relevant research</i>
Sutton, A.L., Beckley, L.E. , 2022. Krill along the 110°E meridian: Oceanographic influences on assemblages in the eastern Indian Ocean. <i>Deep Sea Research Part II</i> . 202, 105133. https://doi.org/10.1016/j.dsr2.2022.105133	2	<i>Research led by/involving SIBER SSC member</i>

Tapia, R, Ho, SL, Wang, HY, Groeneveld, J, Mohtadi, M (2022). Contrasting vertical distributions of recent planktic foraminifera off Indonesia during the southeast monsoon: implications for paleoceanographic reconstructions. <i>Biogeosciences</i> 19, 3185-3208, doi:10.5194/bg-19-3185-2022	3	<i>SIBER/IMBeR relevant research</i>
Tortetotot, M., Samaran, F., Royer, J-Y. (2023). Long-term acoustic monitoring of nonstereotyped blue whale calls in the southern Indian Ocean. <i>Mar. Mammal Sci.</i> , 1-17. doi: 10.1111/mms.12998	2	<i>Publication resulting from SIBER-led cruise/project</i>
Van der Reis, A.L., Beckley, L.E. , Olivar, M.P., Jeffs, A.G., 2022. Nanopore short-read sequencing: A quick, cost-effective and accurate method for DNA metabarcoding. <i>Environmental DNA</i> 1-15. https://doi.org/10.1002/edn3.374	2	<i>Research led by/involving SIBER SSC member</i>
P. N. Vinayachandran , D. C. Seng, F. A. Schmid, 2022, Chapter 12- Climate Change and Coastal Systems, <i>Blue Economy: An Ocean Science Perspective</i> , Springer Nature Singapore, 341-377, 2022.	2	<i>Research led by/involving SIBER SSC member</i>
Yang, M., Bell, T. G., Bidlot, J. R., Blomquist, B. W., Butterworth, B. J., Dong, Y., Fairall, C. W., Landwehr, S., Marandino, C. A., Miller, S. D., Saltzman, E. S. and Zavarisky, A. (2022) Global Synthesis of Air-Sea CO ₂ Transfer Velocity Estimates From Ship-Based Eddy Covariance Measurements. <i>Open Access Frontiers in Marine Science</i> , 9 . Art.Nr. 826421. DOI 10.3389/fmars.2022.826421.	3	<i>SIBER/IMBeR relevant research</i>
Zhang, M. , Marandino, C. A., Yan, J., Lin, Q., Park, K. und Xu, G. (2021) DMS sea-to-air fluxes and their influence on sulfate aerosols over the Southern Ocean, south-east Indian Ocean and north-west Pacific Ocean. <i>Open Access Environmental Chemistry</i> , 18 (6). pp. 193-201. DOI 10.1071/EN21003.	3	<i>SIBER/IMBeR relevant research</i>

Bold Font: SIBER SSC members

All publications resulting from IIOE-2 projects and from SIBER SSC members or their cruises/projects are facilitated by IMBeR.

2.c. Events, Meetings, and Workshops

List all international and national events, meetings and workshops. Describe the level of participation: e.g. chairing session/workshop, organising meeting. Include Regional Programme / Working Group committee meetings and workshops.

Ocean Science Meeting, February 28 through March 4, 2022, Virtual Meeting

- Special Session ID: PL04: “Indian Ocean circulation, air-sea interaction and their impacts on biogeochemistry and ecology”, Conveners: Amit Tandon, Hemantha Wijesekera, Helen Phillips, Pattabhi Rama Rao, Raleigh Hood
- Special Session ID: OC06: “Indian Ocean intraseasonal-to-interdecadal variability and its role in regional and global climate”, Conveners: Shineng Hu, Weiqing Han, Lei Zhang

EGU General Assembly, May 23-27, 2022, in Vienna, Austria

- Session ID: OS1.9/BG4/CL2: “Understanding the Indian Ocean's past, present, and future role in climate variability and predictability”, Conveners: Caroline Ummenhofer, Alejandra Sanchez-Franks, Peter Sheehan, Yan Du, Muhammad Adnan Abid, Chunzai Wang, Stephanie A. Henderson, Roxy Mathew Koll, Cheng Sun

EGU General Assembly, April 23-28, 2023, in Vienna, Austria

- Session ID: OS1.7/BG4/CL2: “Understanding the Indian Ocean's past, present, and future”, Conveners: Caroline Ummenhofer, Alejandra Sanchez-Franks, Peter Sheehan, Yan Du, Muhammad Adnan Abid

Annual Indian Ocean Sessions at Japan Geoscience Union and Ocean Science Japan meetings (M. Honda co-convenor).

COLaB presentations at multiple training, capacity building and low-cost oceanography workshops (Mozambique, Ghana, India, France) (G. Cowie).

3. International collaboration and links

In addition to fostering wide international collaboration through directly leading multidisciplinary and multinational research projects and cruises, and generally through active engagement in IIOE-2, SIBER has been involved in bringing to life two important new collaborative programmes, in the form of the US-India EKAMSAT joint project (multidisciplinary process studies, focused on the Arabian Sea) and the UK-KUDOS joint project (focused on the Seychelles-Chagos Thermocline Ridge). Both programmes are IIOE2-endorsed, have biogeochemistry and ecosystem research at their cores and will involve frequent cruises from this year forward (with both US and Indian vessels in the case of EKAMSAT, and with *RV Isabu* in the case of KUDOS).

4. Input to management, policy and SOCIETY* over the last year

Add anything that is not covered under “1.c. Grand Challenge III”

**As previous reporting forms requested ‘input to management and policy’ only, please add any ‘input to society’ not captured in previous reports*

Add text...

5. Education, Outreach and Capacity Development

As outlined above and in previous reports, multiple SIBER projects (e.g. Monaco Indian Ocean expedition, SOLSTICE-WIO, TRIUMPH etc) have involved education and training through inclusion of students in research cruises etc.

SIBER members have also been involved in various training courses, including COLaB presentations (Cowie) at in-person workshops in Maputo, Mozambique (POGO coastal observation training workshop, June 2022), in Accra, Ghana (GEO Blue Planet meeting, October, 2022) and in Brest, France (Aquathon, January 2023), and a hybrid workshop in Hyderabad, India (POGO ocean observations training workshop, Nov 22; Cowie and Lotliker).

6. Planned activities

Numerous IIOE-2 research cruises led by or involving SIBER members or addressing SIBER science themes are now scheduled or planned for 2023 and coming years, extending beyond 2025. These include multiple Arabian Sea cruises with Indian and US vessels as part of the EKAMSAT joint project and annual cruises with the Korean research vessel *RV Isabu* as part of the KUDOS joint project.

Other upcoming/planned US IIOE-2 projects include:

MINTIE (NSF): ITF Study, Recently Deployed 5 Riser floats in the Banda Sea, Working on research clearance for MINTIE mooring voyage in 2023 on Indonesian Vessel.

TRIUMPH (LIPI/NSF): ITF Study, Cruise in 2022 completed in the upwelling season on Indonesian vessel, More cruises in 2023 and beyond likely with NSF support.

MADAGASCAR BASIN (NSF x 2): Examining shallow and deep currents in the Madagascar Basin, Cruise in April 2023 on *RV Roger Revelle*, RAFOS floats to be deployed.

BIOSCAPE (NASA Applied Sciences Division): Mapping Biodiversity at Southern tip of South Africa, from ocean color data.

Multiple proposals submitted/pending: for example, Mullholldand et al. (NSF), cruise from Madagascar to SW Australia to look at primary production, nitrogen fixation and Fe limitation in the southern Subtropical Gyre of the India Ocean.

Germany has a number of SIBER-led or relevant cruises with *RV Sonne* (e.g. BIOCAT and BIOCAN projects in the Arabian Sea and Bay of Bengal, see 2022 report) now rescheduled for 2024. Other projects and cruises are also pending.

Japanese EIOURI cruises (involving M. Honda, SIBER SSC member) that were cancelled due to COVID (see 2022 report) have now also been rescheduled, and further projects and cruises are in planning.

Similarly, multiple other Australian, Indian, Indonesian and French SIBER/IIOE-2 projects and cruises are either scheduled or in planning, to extend beyond 2025.

6.a. Activities and Outreach and how they link to the Challenges (including, but not limited to convening sessions, meetings, summer schools, workshops, etc)

Add text...

6.b. Upcoming papers (Community-Position-Review-etc)

Add text...

7. Funding

7.a. Funding from external sources

Add text...

7.b. Funding proposals in progress or planned

Add text...

7.c. Funding requested from IMBeR for 2023-2024

Include a brief budget and justify requests

Add text...

8. Changes to Organisational Structure (e.g. SSC) of RP / WG / IMECaN

The SIBER executive and scientific steering committees have recently undergone significant change. Jenny Huggett, a long-time SSC member has stepped up to the EC and we have recently added Ocky Radjasa (BRIN, Indonesia) and Eric Raes (Minderoo Foundation and UWA Ocean Institute, Australia) to the SSC (in place of Somkiat Khokiattiwong, Jerry Wiggert and Zainal Arifin, who have rotated off). We are seeking another ECS (in addition to Eric Raes) to join the SSC in the near future.

9. Images / Figures

*****It is always good to have some recent photos / figures / infographics to create more exposure for the Regional Programmes, Working Groups, etc. These can range from those suitable for a very scientific audience, to those that would engage the general public. IMBeR would use these, on the website (e.g. <http://www.imber.info/> and <http://www.imber.info/en/news>), in tweets (@imber_ipo), in presentations, etc. In addition, Future Earth (one of our sponsors) regularly asks us to provide high quality images for their glossy reports. These can highlight the activities of IMBeR and their other Global Research Projects (see pdfs of past Future Earth reports here <https://futureearth.org/publications/annual-reports/>)*

*So, please provide any images that you might think are useful. These can be pasted in this document or emailed as an attachment to imber@dal.ca.*****

10. Update on Action Items from 2022 SSC meeting

Please update the [table of Action Items](#)

Add text...

11. Anything not covered above

Add text...

12. How to improve this form

Please give suggestions on how to improve this form and make it better next time.

Add text...

13. Appendices

Add appropriate meeting / workshop reports and include URLs (this helps to track where online content is missing)

Add text...