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Summary Report of the 2025 Nansen survey in the SIOFA Area

The SIOFA Secretariat

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Abstract

This paper describes the results of a research cruise conducted from 20 November to 10 December 2025 in the SIOFA area, which engaged a total of 24 researchers and technicians from Sweden, New Zealand, Italy, Thailand, the USA, France, Seychelles, China, Spain, Mauritius, South-Africa, Lithuania and Norway. The cruise generated substantial new knowledge on poorly understood seamount ecosystems in the SIOFA area, combining oceanographic, habitat, and biological data across multiple scales to reveal emerging patterns in these complex environments. It significantly advanced understanding of deep-sea biodiversity, including the first-ever video records of certain shark species. By integrating complementary methods—such as eDNA, physical sampling, and BRUV surveys—the expedition filled critical data gaps on species presence, distribution, and life history, while also testing innovative tools like digital identification keys. In addition, observations of seabirds and marine mammals provided valuable indicators of ecosystem health and predator–prey dynamics, strengthening the scientific basis for ecosystem-based management and long-term conservation planning in the region.
In paragraph 423 of the SC11 Report the SIOFA SC "*noted that the survey has been conducted according to the requirements set out by the MoP and the SC and that all necessary data from the cruise have been submitted to SIOFA.*"

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Summary Report of the 2025 Nansen survey in the SIOFA Area

Background

SIOFA is a partner of the FAO-implemented Common Oceans Deep-sea Fisheries (DSF) Project that runs from 2022 to2027. One of the activities of the project included a research survey in the Indian Ocean with the
R/V Dr Fridtjof Nansen, in collaboration with the FAO EAF Nansen Programme.
The plan to include this cruise in project activities was presented to SIOFA at MoP6, MoP7 and MoP8. A draft plan was presented to the SIOFA Scientific Committee (SC9) in 2024, but a more complete plan was only produced with the Nansen Steering Committee in March 2024, as well as the Norwegian agency for development cooperation (NORAD) on 1 June 2024.
In 2024, MoP11 agreed to approve the plan, outlining a number of conditions (para 180 of the MoP11 Report). The plan was further reviewed and approved at SC10 in 2025, and the Nansen survey took place between 20 November and 11 December on the same year.

A total of 24 researchers and technicians from Sweden, New Zealand, Italy, Thailand, the USA, France, Seychelles, China, Spain, Mauritius, South-Africa, Lithuania and Norway participated in the survey. The data collected has been transmitted to SIOFA and to the Nansen Programme, as requested, and a detailed draft report of the survey was presented to SC11 in 2026 (paper SC-11-INFO-10). The report is currently being copy-edited and expected to be published on the SIOFA website this year.

Summary of the work undertaken

The survey targeted seamount features both within and near the Benthic Fishery Closures (BFCs) Banana and Walter's Shoal in the Southern Indian Ocean Fisheries Agreement (SIOFA) area.

Inside the BFCs, where bottom trawling is prohibited, the following non-invasive methods were deployed:

- Baited Remote Underwater Video Systems (BRUVs) in stationary, relocated stationary, and towed configurations, providing live footage of teleosts, chondrichthyans, corals, and other benthic and epifaunal communities across depth gradients, along with detailed observations of bottom substrate type and variability.

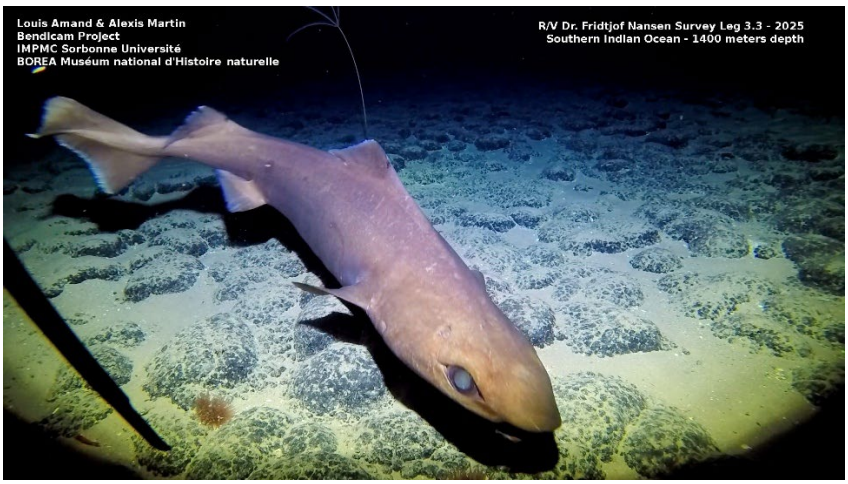

*Figure 1: Deepwater shark observation (*Centrophorus granulosus *gulper shark) and substrate analysis with Bendicam 2 camera at a depth of 1400 m.*

- A CTD rosette equipped with Niskin bottles to record physical and chemical oceanographic parameters and collect water samples for nutrient analysis and environmental DNA (eDNA) extraction, with deep-water sharks as the primary target group.

Figure 2: Bendicam V1 and Bendicam V2 deployed on the CTD rosette.

- Van Veen sediment grabs to collect seabed sediment and associated epifauna for verification of Vulnerable Marine Ecosystem (VME) species models and additional eDNA analysis.

Figure 3: Benthos bycatch specimens sorted by taxonomic category from van Veen Grab.

Outside the BFC boundaries, limited bottom trawling was conducted at varying depths to obtain physical specimens of benthic organisms likely also present within the closures, thereby supporting inference about community composition inside the protected areas.

Figure 4: Bendicam V1 being fitted on the bottom trawl.

Acoustic trial experiments combining wide-swath coverages using the Simrad SU90 omnidirectional sonar and densely spaced 'standard' parallel acoustic transect lines running the Simrad EK80 multifrequency scientific echosounders were conducted to map the presence of Alfonsino schools. The aim was to run repeat detailed acoustic recordings of identified schools for mapping acoustical features such as acoustic backscatter strength (s_A, 'NASC'), frequency response and school aggregation features. Target areas for the acoustic trial experiments were the Capricorn seamount feature (located 20 NM north of the Banana BFC), and Station X (located 100 NM south of the Walter's Shoal BFC).

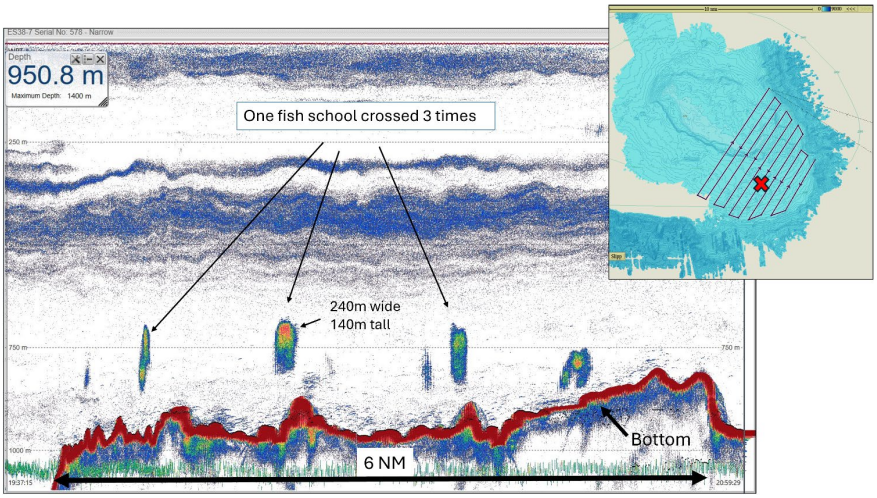

Figure 5: A representative 38 kHz echogram of fish aggregations observed at Station X. One single school residing at ca. 750m water depth was crossed 3 times to map its dimensions and behavior. The map (upper right) shows the small-scale acoustic transect survey grid (ca. 6x4 NM, 0.5 NM spacing) and location of this echogram record.

All seamount features were mapped using Simrad EM302 and EM710 multibeam bottom mapping systems, providing detailed three-dimensional maps of their bathymetric features at a fine scale. The two main BFC focus areas, Banana and Walter's Shoal, were mapped at high resolution and quality (no other sonars running eliminating interference and maximizing transmission ('ping') rates, reduced survey speed for increased spatial resolution, broad overlap between transect lines, etc.) so as to provide a data foundation eligible for publication. However, due to Walter's Shoal being a volcanic crater formation, the shallowness of the rim (approximately 20 m bottom depth) precluded the ability of extending the bottom mapping coverage into and over the central crater feature on this survey. This could however have been accomplished with the assistance of autonomous vehicles and additional survey time.

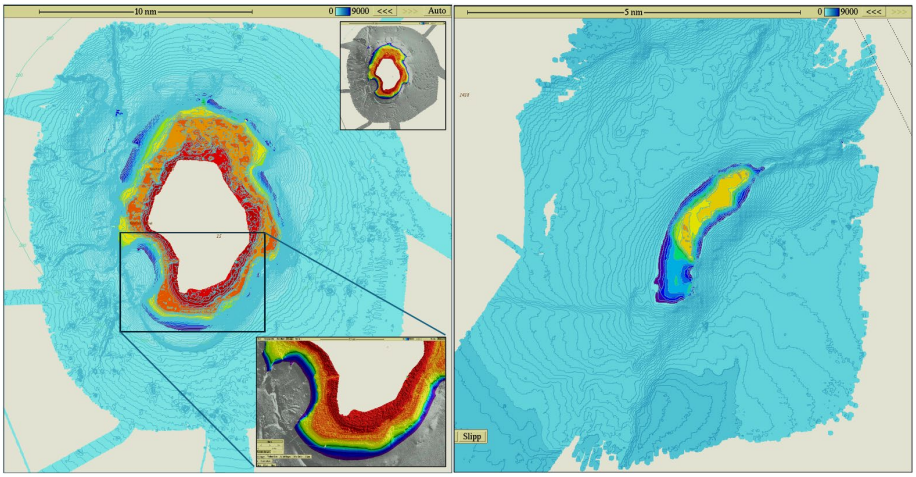

Figure 6: Indicative illustration of the detailed bathymetric mapping that was conducted on the Walter's shoal and Banana features. Walter's shoal (left) was mapped from 800 m to 25 m bottom depth at the volcano rim (detailed in the zoomed-in section). The Banana feature (right) was mapped from 1 700 to 960 m depth at the top of the mountain. Note the scale in NM at the top of the image.

Marine mammals and seabirds were observed, identified, quantified, and recorded during all transits throughout the survey, as well as while the vessel was stationary on the survey sites. This has

provided unique insight into the apex predator community and how it varies between eco-regions, near the seamount features, and the vast ocean spaces between them.

Figure 7: Documented marine mammals i.e. Humpback whale tail splashing, top right shows the blows of 2 fin whales, bottom right, nostrils of a fin whale.

Figure 8: Wandering albatross ringed as a chick by Karine Delord (CEBC CNRS) at Crozet on 30 September 2008.

Conclusions

The survey effort has contributed considerably to documenting and understanding the poorly documented habitats of seamount features in the SIOFA area. The survey collected data on the physical and chemical oceanographic parameters on, near and between seamount features, the habitat characteristics, and on the biota across different spatial scales from substrate to surface, and air, helping to delineate emerging patterns of the complex structuring and dynamics that characterize these highly important but yet poorly described habitats. Video observations included several shark species filmed for the first time, including a number of individuals of species that are discarded in bottom trawl and longline catches.

The shark-related research combined physical sampling, environmental DNA (eDNA), and Baited Remote Underwater Video systems (BRUVs) to assess deepwater shark diversity within the SIOFA area with the aim of filling in knowledge gaps regarding species present, distribution, and the

collection of life history data for sharks in the region. Additionally, tools like the digital smart key for shark identification and Bendicam were tested alongside these surveys.

Figure 9: Participants working with the new digital shark key and providing valuable comments for its improvement.

Physical Sampling was performed using otter trawls outside of benthic fishery closures. A total of 128 fish and shark specimens were collected, along with 144 tissue samples and numerous photographs for further study. These specimens and tissue samples will serve as vouchers for genetic barcodes which will lay the foundation of a future eDNA study. Water samples were collected using a CTD rosette and passed through a fine mesh filter to concentrate genetic material suspended in the water column. eDNA samples were desiccated and frozen for future study. Analysis of the eDNA filters and detailed video annotation will continue at VIMS and/or the Smithsonian to confirm taxonomic identifications and compare findings with trawl data. BRUVs were deployed as stationary cameras and moved between depths and habitats to increase species detection.

At least one shark species was documented on video for the first time, and other species which have been depleted by fishing pressure. Species encountered include those from the genera *Etmopterus*, *Centrophorus*, *Deania*, *Centroselachus, Centroscymnus*, *Carcharhinus, Bythaelurus*, and *Chimaera*.

Across 156 hours of visual effort, we recorded seabirds (14 species), marine mammals (5 species) and one sea turtle, for a cumulative total of 20 species during the survey. In total, 5 569 birds and mammals were counted. Because several seabird species follow vessels, many individuals were recorded repeatedly across consecutive observation periods; the totals are therefore best interpreted as encounter frequencies, not absolute population sizes. Throughout this section, we emphasise relative abundance, species composition, and spatio-temporal patterns.

Seabird and marine mammal observations were a core component of the survey to provide crucial insight into top predator dynamics within the pelagic ecosystem, particularly in data-poor offshore regions like Walter's Shoal. These taxa function as sentinels of ecosystem health, responding rapidly to shifts in prey availability, oceanographic conditions, and anthropogenic pressures. Their presence, abundance, and behavior offer indirect but powerful indicators of underlying food web structure, especially where direct sampling of mid-trophic levels is limited. Including these observations, aligns with ecosystem-based management approaches, which emphasize the importance of apex predators in maintaining ecological balance and resilience. Moreover, many seabird and cetacean species are migratory and IUCN-listed, making their documentation essential for regional biodiversity assessments and for identifying Ecologically or Biologically Significant Areas (EBSAs) under international frameworks. By coupling visual observations with concurrent oceanographic sampling, the survey enhances our understanding of predator-prey coupling and spatiotemporal

patterns of marine productivity, which are vital for long-term conservation planning in the Southern Indian Ocean.

Acknowledgements

This cruise was co-organized by the Common Oceans Deep-sea Fisheries Project, the FAO EAF-Nansen Programme, the Institute of Marine Research Norway, and the officers and crew of the F/V *Dr. Fridtjof Nansen*. The cruise is especially indebted to the dedicated contributions of Dr. Anthony Thompson, CO DSF Project, and Dr. Marco Milardi, SIOFA Secretariat, for their extensive work in organising the cruise, contributing to the research plan, and supervising much of the on-board work. The photographs were provided by cruise participants and are the property of FAO.