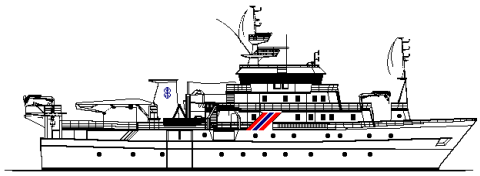
NANSEN PROJECT



Country: Mauritius, Seychelles and Mozambique

Research vessel: R/V DR. FRIDTJOF NANSEN

Survey number: 2008407

Number of days: 50

General objectives: ASCLME Survey

	Port	Date	Coverage	Specific objectives
Departure	Port Louis, Mauritius	8 October 2008	Mauritius, Seychelles and Mozambique	1. To carry out the first multi-disciplinary cruise that encompasses the whole of the Mascarene Plateau and the adjacent basin. 2. To establish the distribution of organisms on a number of trophic levels and how these are affected by the reigning current system. 3. To establish, as far as possible, the productivity, biodiversity and biomass of the pelagic ecosystem. 4. To establish the interaction of the local currents and the ecosystem over the Mascarene Plateau. 5. To determine the nature of the South Equatorial Current as a driving force for the marine ecosystem of the Mascarene Plateau. 6. To investigate demersal fish species diversity. 7. To fulfil the data management agreement contained in Appendix A. 8. To deploy two ATLAS (Autonomous Temperature Line Acquisition System) moorings at 8°S; 55°E and 12°S; 55°E. 9. To deploy four ARGO profiling floats along 55°E.
Arrival	Pemba Mozambique			

Cruise leader: Tore Strømme (until 18 Nov), Åsmund Bjordal (from 19Nov)

Participants:

ACEP: African Coelacanth Ecosystem Programme, Thomas Bornman,
ASCLME: Agulhas Somali Current Large Marine Ecosystem, Lucy Scott,
IMR: Institute of Marine Research, Norway, Tore Strømme, Åsmund Bjordal, Marek Ostrowski, Oddgeir Alvheim, Diana Zaera, Tore Mørk, Ole Sverre Fossheim,
MA-RE: Marine Research Institute, UCT, Emlyn Balarin,
MCM, South Africa: Sharon du Plessis,
NOAA: National Oceanic and Atmospheric Administration, Michael McPhaden, Steven Kunze,
RU: Rhodes University, Sven Kaehler, Jackie Hill,
SAEON: South African Environmental Observation Network, Kim Bernard, Ryan Palmer,
SAIAB: South African Institute for Aquatic Biodiversity, Dennis Tweddle,
SCMRT: Seychelles Centre for Marine Research & Technology, Helena Francourt, Michelle Etienne,
SFA: Seychelles Fishing Authority, Rodney Govinden, Vincent Lucas,
UCT: University of Cape Town, Isabelle Ansorge, Andrea Plos,
UWC: University of the Western Cape, Mark Gibbons, Riaan Cedras

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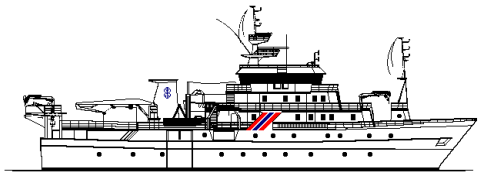


50/50: South Africa, Kyle O'Donaghue, Media (TV) / Scientific watch,

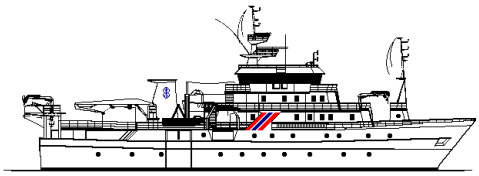
Summary of the results:

In agreement with past observations the SEC, during the survey period, existed as 3 separate branches channelled between the deep channels at 9-8°S, 13°-12°S and 19°-18°S. Velocities exceeded 0.5 ms^{-1} in these channels. From a total of 56 Sv (New et al., 2007), approx. 23 Sv is constricted between the Saya De Malha and Nazareth Banks near 12–13°S, 10 Sv is diverted around the northern side of the Saya De Malha Bank, and the remaining 25% (~10 Sv) flows south-westwards through the gap between the Cargados Carajos Bank and Mauritius. New et al., (2007) have suggested that the flow through the Saya de Malha and Nazareth sill forms the northern core of the SEC downstream of the Plateau between 10°-14°S, while the flow passing through the gap south of the Cargados Carajos Bank forms the southern core of the SEC between 16°- 20°S. The preliminary ADCP results confirm the general current patterns derived from altimetry. The strongest flow was encountered in the gap between the Nazareth and Saya de Molha Banks with velocities exceeding 0.5 m s^{-1} at 30 m depth. The westward flow is also present across the northern gap, between Saya de Molha and Seychelles. The current reversal related to the SECC over the Seychelles bank is also clearly manifested. The results from southern gap, between Mauritius and Cardagos-Carajos are an exception. The ADCP-derived currents have variable magnitude and direction. A southeastwardly flow accelerates just off Mauritius, which is not resolved in the altimetry data. This suggests that this region may have experienced a period of a mesoscale variability, not well resolved by the survey sampling grid and not captured on the 1/3 degree altimetry-derived current maps. Over the shallow banks of Saya de Molha and Nazareth, the currents were typically of the order of 0.1-0.2 m s^{-1}. A stronger current observed over the northern portion of the Nazareth Bank appears to be wind-driven, associated with the strong easterly wind event the survey encountered in this area. Tropical Surface Water (TSW) – this is a broad band of fresh water between 4 and 20°S. Salinities are low (34.7 – 34.9) due to the high levels of precipitation in the tropics. During the survey TSW was observed at all stations occupied south of the Seychelles-Saya de Malha gap, further supporting evidence that the SEC influences the distribution of surface water masses. The change in surface properties from CTD station 1109 (9°S) which is predominantly TSW and CTD station 1121 (5°30'S) which is typical of the high salinity characteristic of Arabian Sea High Salinity Water (ASHWS) to the north. ASHSW is highly saline (>35.5) as a result of excess evaporation over precipitation in the Arabian Sea and is swept eastwards across the Indian Ocean by the SECC. A north-south section along the Mascarene Plateau clearly shows the meridional distribution of the fresher TSW in relation to other water masses. It is clear from the section that the channel separating the Seychelles and Saya de Malha bank acts as a barrier separating fresh TSW from saltier modified ASHSW to the north.

Subtropical Surface Water (STSW) can be found in the subtropical belt between 20°-35°S. STSW displays characteristically high salinity values (>35.4) due to the high levels of evaporation associated with the subtropics. Travelling northwards STSW subducts below the fresher TSW to form a subsurface salinity maximum, which at 18°S is centred at 300m depth. This salinity maximum extends as far north as 14°S, and may be partly carried westward by the SEC. Immediately below TSW between 100-300m, Song et al. (2004) have identified Indonesian Throughflow water (ITF). An important feature of the Indonesian Throughflow is that because the water in the western equatorial Pacific Ocean has a higher temperature and lower salinity than the water in the Indian Ocean, the Throughflow transports large amounts of relatively warm and fresh water to the Indian Ocean. When the Indonesian Throughflow through Lombok Strait and the Timor passage enters the Indian Ocean it is adverted towards Africa within Indian South equatorial current. ITF is slightly more saline (>0.5-0.6 = 35.2) than TSW and in the region of the Mascarene Plateau can be found between 100–250m at 10°S. Carried within the core of the SEC, ITF has been shown to spread across the western boundary of the Indian Ocean, forming a subsurface oxygen minimum of ~2.5 ml/l.

The mean chl-*a* biomass across the Plateau was 0.476 ± 1.562 µg/l. Microplankton (> 20 µm) formed the largest component of the phytoplankton with nano (20 µm - 2 µm) and picoplankton (2 µm - 0.7 µm) biomass rarely exceeding 1 µg/l. Surface biomass was generally < 0.5 µg/l and the fluorescence maximum varied in depth between 30 m and 100 m depending on the depth of the seafloor.

1. No evidence of upwelling.
2. Phytoplankton biomass increase from Mauritius towards Seychelles.
3. Phytoplankton distribution influenced by E-W flowing South Equatorial Current (splits water masses



on the Plateau) and the W-E flowing South Equatorial Counter Current.

4. Microplankton (diatoms) associated with elevated levels of phytoplankton biomass.
5. Highest biomass recorded at depths varying from 30 to 150 m depending on bottom topography. An important result from this is that surface satellite imagery would not be able to pick up the chl-a peaks associated with bottom topography and currents.
6. Nutrient data will be important to further explain sources, processes & distributions.
7. The gaps through the Mascarene Plateau are not characterized by elevated phytoplankton biomass.

A total of 93 multi-net stations were sampled on cruises 2008407 (84 stations) and 2008408 (9 stations), from 60 m - 5000 m in depth. Eighty-two of these stations comprised three or more depth strata, and a total of 365 nets (322 and 43 respectively) were cast altogether. In the first 44 stations, nets were hauled vertically, whilst the latter 49 were oblique. The total volume of water filtered by oblique tows was greater, and the flow rate higher, than that obtained with vertical hauls.

A summary of the multi-net stations shows that there were “problems” with 14 of them. These “problems” were caused either by tears to the nets (subsequently patched) or to the catches on the cod-ends coming loose (it is recommended that these be replaced), and effectively reduce the total number of samples available for analysis.

Along the Mascarene Plateau, zooplankton biomass (mg wet-mass m^{-3}) increases northward by almost an order of magnitude. With only few exceptions, the highest consistent biomass was observed north of –7 degrees South. On the Seychelles Bank, zooplankton biomass seemed to be concentrated over the shallow central shelf region of the plateau. In contrast, in deeper waters, biomass was greatly reduced. In most cases, shelf zooplankton was restricted to smaller size classes (primarily copepods and chaetognaths < 1 to 2 mm). Biomass did not vary much between day and night stations, however, larger species such as euphausids, decapods and ichthyoplankton seemed to be absent from most daytime samples.

Preliminary results suggest that south of the Seychelles Bank, zooplankton biomass was generally low both on and off the shelf and during both day and night stations. Enhanced biomass was observed only at isolated stations, was often due to the predominance of one species and with one exception was located downstream of the plateau (west). Additional analysis in relation to physical, chemical and biological data as well as bathymetry is required to better understand these patterns.

Clupeoid fishes like anchovies and sardinellas are usually fairly easy to distinguish from other types of small pelagic fish such as carangids and scombroids from the type of registrations they form and are therefore in the daily scrutinising of the records roughly classified as Pelagic 1 and Pelagic 2 respectively. No registrations of the Pelagic 1 category were recorded during the survey. Most of the survey area is absent from pelagic fish apart from a few single occurrences around the Nazareth Bank, a low-density aggregation on the northern part of the Saya de Malha Bank and at the south-western edges of the Seychelles Bank

Report: status: final References:

T. Strømme, I. Ansorge, T. Bornman, S. Kaehler, M. Ostrowski, D. Tweddle and O. Alvheim, (2008) FAO PROJECT: CCP/INT/003/NOR Cruise reports “Dr. Fridtjof Nansen”, EAF-N2008/7, 2008 **ASCLME SURVEY NO. 3**, Preliminary cruise report No 7/2008, 8 October – 27 November 2008, Pemba, Mozambique, November 2008

Constraints/Comments: