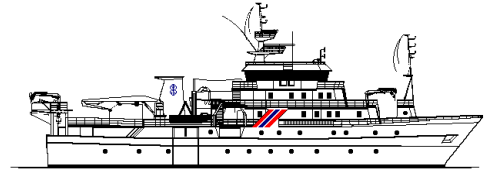


<b>Country:</b> : Namibia, Angola				
<b>Research vessel:</b> R/V DR. FRIDTJOF NANSEN				
<b>Survey number:</b> 2007402				
<b>Number of days:</b> 17				
<b>General objectives:</b> The influence of dissolved oxygen concentrations on the distribution and trophodynamics of pelagic fish larvae and key zooplankton species in the Benguela Current Region				
	<b>Port</b>	<b>Date</b>	<b>Coverage</b>	<b>Specific objectives</b>
<b>Departure</b>	Walvis Bay, Namibia	7 February 2007	Namibia, Angola	<p>The aim of the survey was to map the hydrographical and biological diversity and animal behaviour in the Angola-Benguela frontal zone in order to answer the following key question:</p> <ul style="list-style-type: none"> <li>• How do zooplankton organisms, specifically early life stages of pelagic fish, cope with low DOC?</li> <li>• Is the large-scale distribution of oxygen inhibiting the retention mechanisms and life cycles of planktonic organisms?</li> </ul>
<b>Arrival</b>	Walvis Bay, Namibia	23 February 2007		
<b>Cruise leader:</b> Jens Otto Krakstad				
<b>Participants:</b>				
<p><b>MCM, South Africa:</b>Hans Verheye, Marco Worship and Susan Jones  <b>NatMIRC, Namibia:</b>Anja Kreiner, Twalinothamba Akawa and Allie Gumbo  <b>INIP, Angola:</b>Antonio da Silva, Bernardo Fernandez and Alice Martins  <b>ZMT, Germany:</b>Werner Ekau, Matthias Birkicht, Stefanie Bröhl and Andreas Kunzmann  <b>AWI - Germany:</b>Friedrich Buchholz  <b>MarZoo, Germany:</b>Holger Auel  <b>and IMR, Norway:</b>Jens Otto Krakstad (Cruise Leader), Tor Egil Johannson and Tore Mørk</p>				
<b>Summary of the results:</b>				
<p><b>HYDROGRAPHIC INVESTIGATIONS:</b> Sea surface temperature, salinity and chlorophyll data collection clearly identify the position of the frontal zone with the cooler, less saline surface water masses of the Benguela system in contrast to the Angola Current water masses. Minimum salinity concentrations were observed off the Kunene River mouth and were due to river afflux. The chlorophyll recordings indicate that areas of maximum primary production corresponded with the area of riverine input from the Kunene River and the upwelling region off Cape Frio. Of particular importance are the hypoxic water masses observed at around 150 m depth.</p> <p><b>ZOOPLANKTON STUDIES:</b> During this cruise, no routine estimates of <i>C. carinatus</i> C5 growth rate were obtained, because of the limited deep sampling capabilities present onboard the <i>Dr Fridtjof Nansen</i>. In a few instances, adult females of <i>C. carinatus</i> were found sufficiently abundant in the surface layer to warrant egg production rate (EPR) measurements. However, daily EPRs proved to be zero to very low in most cases. The results obtained during this cruise confirm previous detailed data on the typical diurnal vertical migration (DVM) pattern with a focus on <i>E. hanseni</i>. Total abundances of both fish larvae and fish eggs were very low with 1043 and 27 counted individuals respectively (preliminary result). More than 500 of these were</p>				





## NANSEN PROJECT



belonging to mesopelagic groups such as Myctophidae, Bathylagidae etc. Carangids were the most abundant non-mesopelagic family with c. 200 individuals, followed by gobiids with 88 individuals.

**STUDIES ON ICHTHYOPLANKTON:** The vertical distribution of sardine larvae was restricted to the upper 40 m.

**RESPIRATION, PHYSIOLOGY OF FISH LARVAE AND KRILL:** Because identification of life fish larvae is difficult, only broader taxonomic groups are presently considered in this report. Larvae of flat fish (Soleidae), *Leptocephalus* (Anguilliformes), sardines (Clupeidae) and krill (*Euphausia hansenii*) were measured.

Preliminary results indicate that krill tolerates low oxygen levels down to 30% saturation. Some individuals even survived after several hours of exposure to as low as 10%, while 5% oxygen seems to be the ultimate limit. This is in contrast to *Leptocephalus* larvae, which easily tolerate oxygen saturation levels of 5%. Two individuals were kept for more than three hours at zero oxygen without any harm. Also the flatfish larvae tolerated a low oxygen saturation. At levels of 10% they responded with increased ventilation rates, which at 5% turned to fast pumping. All individuals recovered within minutes after oxygen levels were raised again to 50% and more.

**MULTIFREQUENCY ACOUSTIC SAMPLING AND ANALYSIS:** At all three diel stations the dominant part of the zooplankton backscatter was observed descending into the hypoxic water masses during the day, probably using these layers as a refuge from less tolerant predators.

The first diel station off Angola was conducted north of the front at 14°50'S, 11°30'E. The station was characterised by mainly low-energy backscattering. Several pulses with different zooplankton (not yet identified) can be observed migrating downward in the morning, stabilising at different depths (120 m, 300 m and 400 m, respectively,) before migrating up again in the evening. It is worth noting that animals with the most extensive migration range started descending first in the morning and have the fastest descent rate, and *vice versa* in the evening. In addition to the migrating layers, three layers did not seem to perform diel migration, one seemed stable in the upper 50 m during the entire 24 hour period while the two others were found at 300 m and around 500 m depth (not visible on the echogram). The second diel station was conducted at 17°00'S, 11°15'E in the frontal zone while the third diel station was conducted 18°26'S, 11°15'E, south of the front. These two stations showed similar results with one main scattering layer migrating down to ~250 m depth during the day and a less defined layer staying in the upper 50 m during the entire 24 h period. A stable scattering layer at 500 m (not visible in the echogram) was present in both localities, while diel station III also had a stable scattering layer at 350 m depth (visible on the 38 kHz only). Both stations gave considerably stronger backscattering than was observed during the first diel station and the scattering layer observed during the second diel station was stronger than during the third. The main scattering layer on both echograms are likely to be krill *Euphausia hansenii*, and it is apparent that this species spent the daylight hours within the hypoxic watermasses.

### Report: status: final References:

J.-O. Krakstad, W. Ekau, H. Verheye, A. Kreiner, A. da Silva, F. Buchholz, H. Auel, A. Kunzmann, M. Birkicht, S. Bröhl, M. Worship, S. Jones, T. Akawa, A. Gumbo, B. Fernandez, A. Martins, (2007) **CRUISE REPORTS "DR. FRIDTJOF NANSEN", BENEFIT SURVEYS, The influence of dissolved oxygen concentrations on the distribution and trophodynamics of pelagic fish larvae and key zooplankton species in the Benguela Current region, 7 February - 23 February 2007**

by Institute of Marine Research, Bergen, Norway, Centre for Tropical Marine Ecology, Bremen, Germany, Marine and Coastal Management, Cape Town, South Africa, National Information and Marine Research Centre, Swakopmund, Namibia, Instituto Nacional de Investigação Pesqueira, Luanda, Angola, Alfred Wegener Institute, Bremerhaven, Germany, University of Bremen, Bremen, Germany

### Constraints/Comments:

