MARIA S. MERIAN-Berichte

Geochemistry and Ecology of the Namibian Upwelling System

Cruise No. 17, Leg 3

January 30 - March 07, 2011

Walvis Bay (Namibia) - Dakar (Senegal)

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1 Summary

Cruise MSM 17/3 onboard MARIA S. MERIAN was dedicated to the GENUS (Geochemistry and Ecology of the Namibian Upwelling System) project and represented the third field campaign within this program since 2009. The scientific work focussed on the northern Benguela region between Lüderitz (26.6°S) and Kunene (17.25°S) under low to moderate upwelling conditions during austral summer and aimed to clarify relationships between climate change, biogeochemical cycles of nutrients, and ecosystem structure in one of the largest upwelling ecosystems. The cruise comprised empirical studies of processes and rates of ocean circulation, biogeochemical cycling of nutrients between the water column, biota and the sediments, trophic interactions and energy flows. Overall, the cruise was highly successful as we were able to conduct sampling at 97 stations without any technical or instrumental failure throughout the expedition. As a result it was possible to incorporate a number of additional stations into the initial cruise plan which allowed some of our research tasks to be supplemented. In addition to routine shipboard operations such as CTD casts and the deployment of various plankton nets and a multicorer we also recovered and redeployed a long-term mooring off Walvis Bay (23°S) and we were also able to deploy and recover a short-term oceanographic mooring and drifter system equipped with oceanographic sensors and a sediment trap. Unusual weather conditions prevailed, which led to a poleward shift of the Angola-Benguela Frontal Zone in the northern part of our study area, evidenced by the presence of subtropical water masses of Angola-Gyre origin at the northern stations off the Kunene River, accompanied by a shift in biota.

Zusammenfassung

Die Forschungsfahrt MARIA S. MERIAN 17/3 war bereits die dritte Feldstudie im Rahmen des Verbundprojekts GENUS (Geochemistry and Ecology of the Namibian Upwelling System). Der Schwerpunkt der Reise lag auf der Erforschung des nördlichen Benguela Auftriebsgebiets zwischen Lüderitz (26.6°S) und Kunene (17.25°S) unter abgeschwächten Auftriebsbedingungen während der Sommermonate auf der Südhalbkugel. Grundlegendes Ziel war die Untersuchung der Zusammenhänge zwischen Klimawandel, biogeochemischen Zyklen von Nährstoffen und das Zusammenspiel des Ökosystems in einem der größten Auftriebsgebiete weltweit. Die Fahrt umfasste demzufolge Untersuchungen bezüglich der vorherrschenden Meeresströmungen, des Nährstoff-Kreislaufs in der Wassersäule und in Oberflächensedimenten sowie in ausgewählten Organismen einschließlich deren trophischer Wechselwirkungen. Insgesamt war die Fahrt mit 97 durchgeführten Stationen äußerst erfolgreich; es gab keine nennenswerten technischen oder instrumentellen Probleme, sodass an einigen Stationen noch zusätzliche Geräteeinsätze eingebaut werden konnten. Neben den Routinearbeiten vom Schiff aus konnten auch geplante Verankerungsarbeiten sowie der Einsatz eines ozeanographischen Driftsystems mit angegliederter Sinkstofffalle erfolgreich durchgeführt werden. Ungewöhnliche Witterungsbedingungen führten zu einer Verschiebung der *Angola-Benguela-Frontal-Zone*, sodass im nördlichen Bereich des Arbeitsgebietes bereits tropische Wassermassen aus der Angola-Wirbel Region einsickerten, was sich auch deutlich in einer veränderten biologischen Zusammensetzung widerspiegelte.

2 Participants

Name	Working Group	Affiliation	Participation
Lahajnar, Niko, Dr.	Chief Scientist	IfBM	17/3 a+b
Ankele, Markus	Biogeochemistry/Ferry Box	HZG	17/3 a+b
Annighöfer, Meike	Biogeochemistry/Filtration	IfBM	17/3 b
Bode, Maya	Marine Zoology	MarZoo	17/3 a
Bohata, Karolina	ROV/Multinet/MOCNESS	IHF	17/3 b
Buchholz, Friedrich, Prof. Dr.	Krill/MOCNESS	AWI	17/3 a+b
Eckhardt, André	ROV	IHF	17/3 b
Ekau, Werner, Dr.	Ichthyoplankton	ZMT	17/3 a
Flohr, Anita	Water Biogeochemistry	ZMT	17/3 a+b
Geist, Simon	Ichthyoplankton	ZMT	17/3 b
Gumbo, Allie	Ichthyoplankton	NatMIRC	17/3 a
Hansen, Anja	Phytoplankton	IOW	17/3 a
Heene, Toralf	CTD/Moorings/MSS	IOW	17/3 a+b
Hünerlage, Lara Kim	Krill/MOCNESS	AWI	17/3 a+b
Jung, Alexa Sarina	Mesoplankton/MOCNESS	IHF	17/3 a
Koppelmann, Rolf, Dr.	ROV/MOCNESS	IHF	17/3 b
Kullmann, Björn	Mesoplankton/MOCNESS	IHF	17/3 a
Kutter, Juliane	Marine Zoology	MarZoo	17/3 b
Langenberg, Frauke	Biogeochemistry/Filtration	IfBM	17/3 a
Martin, Bettina, Dr.	ROV/Multinet/MOCNESS	IHF	17/3 a+b
Mohrholz, Volker, Dr.	CTD/Moorings/MSS	IOW	17/3 a+b
Muller, Annethea	CTD/Moorings/MSS	IOW	17/3 a+b
Neumann, Andreas	Sediment Biogeochemistry	IfBM	17/3 a+b
Schukat, Anna	Marine Zoology	MarZoo	17/3 a+b
Steigüber, Claas	Water Biogeochemistry	ZMT	17/3 a+b
Teuber, Lena	Marine Zoology	MarZoo	17/3 b
Verheye, Hans, Dr.	Zooplankton/Ichthyoplankton	DEA	17/3 b
von Waldthausen, Constanze	Ichthyoplankton	ZMT	17/3 b
Wencke, Petra	Marine Zoology	MarZoo	17/3 a
Werner, Thorsten	Krill/MOCNESS	AWI	17/3 a
Kandjii, Isabella	Observer Namibia	Min M&E	17/3 a+b

Leg 17/3 a: Walvis Bay - Walvis Bay (30.01.-10.02.11)
Leg 17/3 b: Walvis Bay - Dakar (10.02.-07.03.11)

Participating Institutions

AWI Alfred-Wegener-Institut für Polar- und Meeresforschung,
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DEA	Department of Environmental Affairs, Branch: Oceans and Coasts, Private Bag X2, Rogge Bay, 8012, Cape Town, South Africa
HZG	Helmholtz Zentrum Geesthacht, Institut für Material und Küstenforschung, Max-Planck-Straße 1, D-21502 Geesthacht, Germany
IfBM	Institut für Biogeochemie und Meereschemie, Universität Hamburg, Bundesstraße 55, D-20146 Hamburg, Germany
IHF	Institut für Hydrobiologie und Fischereiwissenschaft, Universität Hamburg, Große Elbstraße 133, D-22767 Hamburg, Germany
IOW	Leibniz-Institut für Ostseeforschung Warnemünde, Seestraße 15, D-18119 Rostock-Warnemünde, Germany
MarZoo	Marine Zoologie, FB-02, Universität Bremen, Leobener Straße, D-28359 Bremen, Germany
Min M&E	Namibian Ministry of Mines & Energy, Private Bag 13297, 1 Aviation Road, Windhoek, Namibia
NatMIRC	National Marine Information and Research Centre Strand Street, Swakopmund, Namibia
ZMT	Leibniz-Zentrum für Marine Tropenökologie Bremen, Fahrenheitstraße 6, D-28359 Bremen, Germany

3 Research Program

Coastal upwelling systems react directly to changes in external (climatic) forcing, and observed changes at lower trophic levels of upwelling ecosystems primarily reflect changes in this external physical forcing. In the Benguela Current coastal upwelling system off Namibia, the supply of oxygen to the shelf environment is directly coupled to hydrodynamic conditions (e.g., Emeis et al., 2009: Leduc et al., 2010). Fluctuating oxygen levels over the shelf have significant consequences for nutrient levels and nutrient ratios, for rates of exchange at the sediment-water interface, for gas exchange between the ocean and the atmosphere, and for biological production, and therefore for the entire ecosystem (e.g., Bakun et al., 2010; Finney et al., 2010). Work of expedition MARIA S. MERIAN 17/3 in the coastal upwelling area off Namibia, funded by the BMBF (German Federal Ministry of Education and Research) and carried out within the GENUS (Geochemistry and Ecology of the Namibian Upwelling System) project was dedicated to clarify which physical processes drive the oxygen dynamics on the shelf, and what consequences arise from variations of the physical processes for biogeochemical cycles and the entire biological production and its food-web structure. The targeted working area included the weak upwelling cell off Walvis Bay, the Rocky Point / Kunene cell in the north and the very stable upwelling cell off Lüderitz in the south. We conducted a combined oceanographic, biogeochemical, biological, and sediment sampling programme on a total of 6 transects perpendicular to the coast, which were connected with several stations between each transect including mooring and drift system deployments and recoveries. In addition, during transit time, we employed two vessel-mounted

ADCP for the measurement of currents and a ferrybox-system for en-route determinations of temperature and salinity as well as nutrient concentrations plus pCO_2 of the atmosphere and the ocean surface. Station work comprised sampling in water depths between 30 and 3900 m in the working area and at three additional open-ocean stations during the transit to Dakar (Senegal) between 4600 and 4800 m water depth. In total we performed 97 stations with 569 gear and instrument operations during a cruise of 5271 nautical miles. In summary, all research goals were fully met and therefore cruise MSM 17/3 can be considered as very successful.

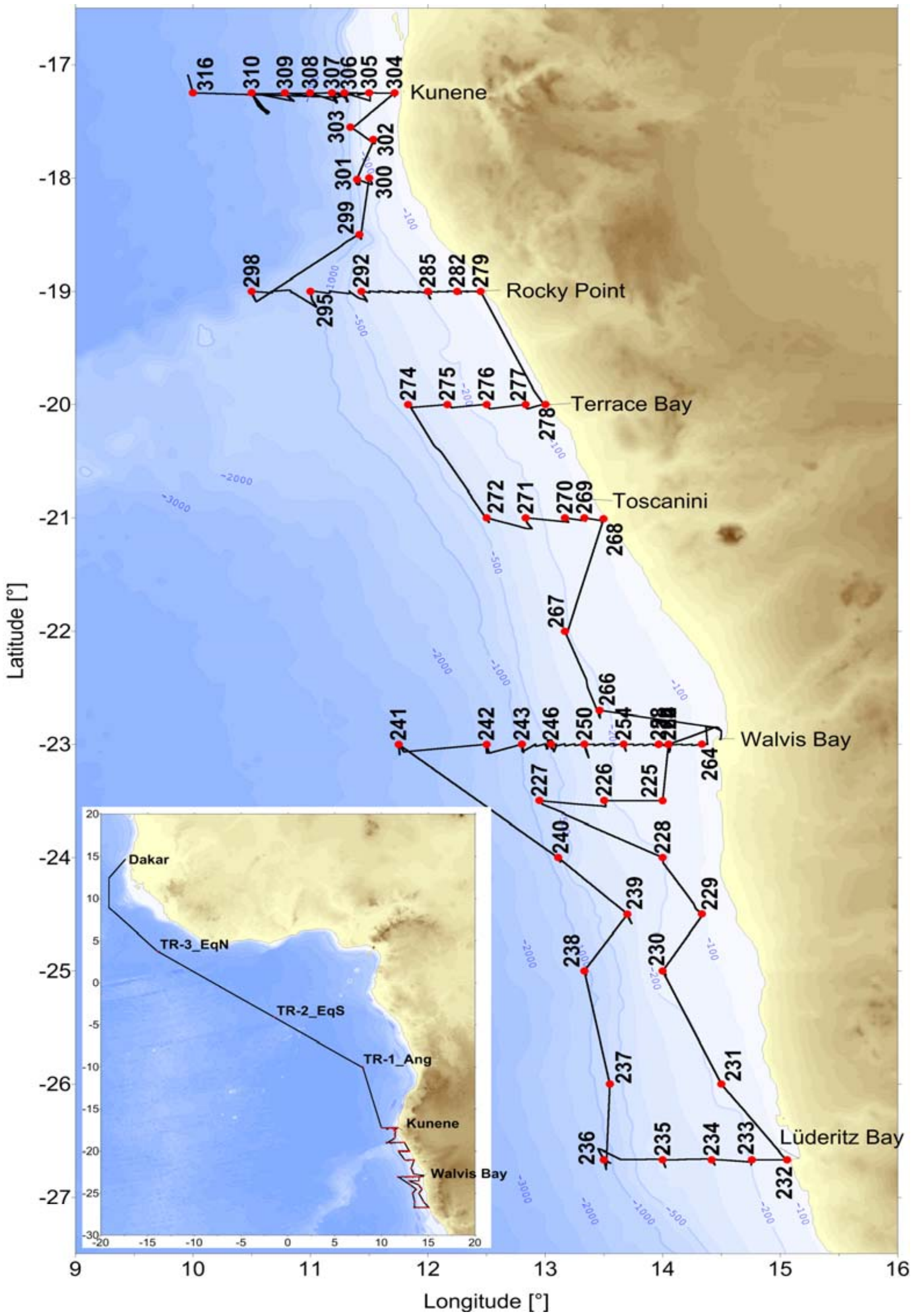

Fig 3.1 Station map of MSM 17/3. Large map shows station work in the Benguela upwelling region; inserted map shows open-ocean stations and transit route from Namibian waters to Dakar, Senegal

4 Narrative of the Cruise

On January 29 2011, 21 scientists from Germany and Namibia and one observer from the Namibian Ministry of Mines and Energy boarded RV MARIA S. MERIAN for cruise MSM 17/3. For this cruise six 20' containers with scientific equipment had been sent to the harbour of embarkation in Walvis Bay, Namibia. All containers were already supplied on Jan 27 so that the cruise preparation could start as early as possible for the upcoming cruise. In addition, three airfreight cargos from Germany and Mindelo (RV METEOR), respectively, were also delivered on Jan 28.

With this successfully planned and performed cruise organisation RV MERIAN casted off from the port of Walvis Bay on Jan 30 at 08:15 local time. The first destination was a long-term mooring station on the so-called Walvis Bay transect at 23°'S in approx. 130 m water depth. The ship reached this first station in the early afternoon on the same day where the mooring with oceanographic sensors as well as a sediment trap were recovered. All sensors and the sediment trap had been working according to their schedules. After their successful recovery the station was sampled using a variety of different gears such as CTD, multicorer and several types of nets (e.g., plankton net, MOCNESS, Multinet, and Tucker Trawl). Sampling with all these gears and nets subsequently became the standard program for the entire cruise. Later on a short-term mooring with oceanographic sensors was deployed a few miles to the west of the long-term station; it was intended to recover this mooring before the intermediate harbour call at Walvis Bay. In addition to the fixed moorings a free-floating drift-system was deployed, which was equipped with oceanographic sensors as well as a sediment trap in order to sample the evolution of a specific water mass. In the morning of Jan 31 the long-term mooring that had been recovered one day before was redeployed at the initial mooring station and is intended to be recovered with the local RV WELWITSCHIA in cooperation with the NatMIRC Institute in Swakopmund, Namibia.

After this successful start RV MERIAN headed south. Several stations were sampled on the short transit to 26°40'S (the Lüderitz line) which was reached on Feb 02 at noon. The Lüderitz cell is a very stable upwelling region and represents the boundary between the southern and northern Benguela system. The Lüderitz transect was sampled to a depth of 1120 m. Then the ship headed north again at the outer continental margin. The outermost station (3000 m water depth) of the Walvis Bay transect was reached on Feb 05. We then returned stepwise back to the inner shelf; in particular a very detailed physical oceanographic study with a microstructure probe was performed on a grid of 5 nautical miles. At 23°00.0'S 13°03.35'E attempts were made to locate a lost mooring, which should have been retrieved during RRS DISCOVERY Cruise D-356 in Sep 2010. However, it proved that the mooring - if still present at all - could not be detected using any of the ship's acoustic systems. RV MERIAN arrived at the final station close to Pelican Point in the evening of Feb 09.

On Feb 10 a short port call in Walvis Bay was used to exchange local and German participants. Especially the ROV group from Hamburg University boarded the ship for the second leg. RV MERIAN went alongside at 09:00 local time. Exactly six hours later, at 15:00 sharp, RV MERIAN left Walvis Bay and headed to the northern part of our study area. Our first task was to find and recover the drift-system, which had been moving about 34 nautical miles to the north-west from the initial deployment position. In the evening of Feb 10 the drifter was spotted at the expected position and was recovered two hours later at about 22:00 ship time.

During the following days three additional transects were sampled according to our cruise plan: Toscanini at 21°S, Terrace Bay at 20°S and Rocky Point at 19°S. On Feb 12 a first test station for the ROV was successfully conducted. Then on Feb 14 the ROV was included in the regular station work and provided us with valuable visual impressions of the local water column and ocean floor conditions. The final transect in the Namibian upwelling system was located at the nautical border with Angola off the Kunene river mouth at 17°15'S. There we found clear evidence of a shift of water masses during this year's austral summer as sampling at all stations on this transect was conducted in tropical Southern Atlantic Central Water from the Angola Dome region. Altogether eight stations in water depths ranging between 30 and 3920 m were sampled on this transect, including three ROV deployments. On Feb 24 at 09:45 RV MERIAN left the study area of the GENUS project and started her transit to Dakar. On this transit three open-water stations were included in order to sample the adjacent water masses of the southern Atlantic region: (1) Centre of the Angola Dome at 10°00'S 08°00'E, approx. 4800 m water depth, which is also relevant for the Namibian upwelling region because of the poleward undercurrent; (2) Equatorial South Station at 04°09'S 01°23'W, approx. 4600 m and (3) Equatorial North Station at 03°47'N 13°58'W, approx. 4700 m water depth.

RV MARIA S. MERIAN then headed towards the port of disembarkation in Dakar, Senegal. After 97 stations and 5271 nautical miles she went alongside on March 07 at 10:00 local time. The majority of the participants left the ship the same evening, while the remaining stayed onboard until March 08 lunch time for final logistical operations of MSM 17/3.

5 Preliminary Results

5.1 Large Scale Distribution of Water Masses and Hydrographic Parameters (GENUS SP-2)

(V. Mohrholz, T. Heene, A. Muller)

The cruise provided large scale distributions of key physical parameters and phytoplankton in late austral summer. This season was not covered by previous GENUS expeditions. Furthermore, at two transects measurements with a microstructure probe were conducted at a higher spatial resolution, in order to obtain information about hotspots of turbulent mixing on the shelf. In addition to other objectives, the cruise will contribute to answering the key physical oceanography and modeling research questions in GENUS, which are:

1. How does atmospheric forcing control the variations in eastern boundary currents?
2. To what extent do oxygen budgets, nutrient dynamics and lower trophic levels of the Benguela upwelling area depend on the advection of water masses? (Quantification of matter fluxes between the Benguela-upwelling area and adjacent ocean)
3. What turbulent mixing processes control vertical fluxes of matter in the bottom boundary layer on the shelf? How can these processes be parameterized in numerical models?
4. How do upwelling ecosystems respond to climate variability in atmospheric forcing? (using three scenarios: present, Medieval Warm Period, Little Ice age)

Sea surface temperature

Sea surface temperature distributions in the investigation area were compiled daily from data of TMI and AMSRE satellite. During Leg 1 the SST data depicted a relaxation of upwelling at the Lüderitz upwelling cell. In the transition zone between cold upwelled water and warm open ocean water a number of cold upwelling filaments were visible. Warm water from the Angola Gyre was observed off the Kunene mouth. However, no significant southward movement of this water mass was detected. One remarkable observation was a plume of warm water off Walvis Bay. This pattern disappeared by the end of leg 1, most probably due to warming of surface waters. During the first days of leg two there was only weak upwelling off Lüderitz, whereas no active upwelling was observed north of Walvis Bay. There surface water temperatures were well above 21°C. The onset of strong SE trade winds during the second half of leg 2 caused an upwelling event off the Kunene mouth, which is not visible in the TMI-AMSRE composite. The satellite image from 24rd February showed cold water in a narrow coastal belt off Cape Frio and Terrace Bay, and an intensification of the Lüderitz upwelling cell.

CTD data

The CTD data were used to characterize the hydrographic conditions during the cruise. Although the horizontal distributions of the physical parameters provided a consistent picture, these figures should be interpreted with caution, since the data were collected over a longer period of 26 days (Fig. 5.1).

In the surface layer at 20 m depth the temperature distribution shows a west east gradient with the cooler water at the coast indicating recent or active coastal upwelling along the entire coast. This pattern is superimposed by a north south gradient due to the transition from tropical conditions near the Kunene to the subtropics in the south of the investigation area. The off shore waters north of 20°S depicted a higher temperature than usual for this season, pointing to an intensified southward transport of tropical waters

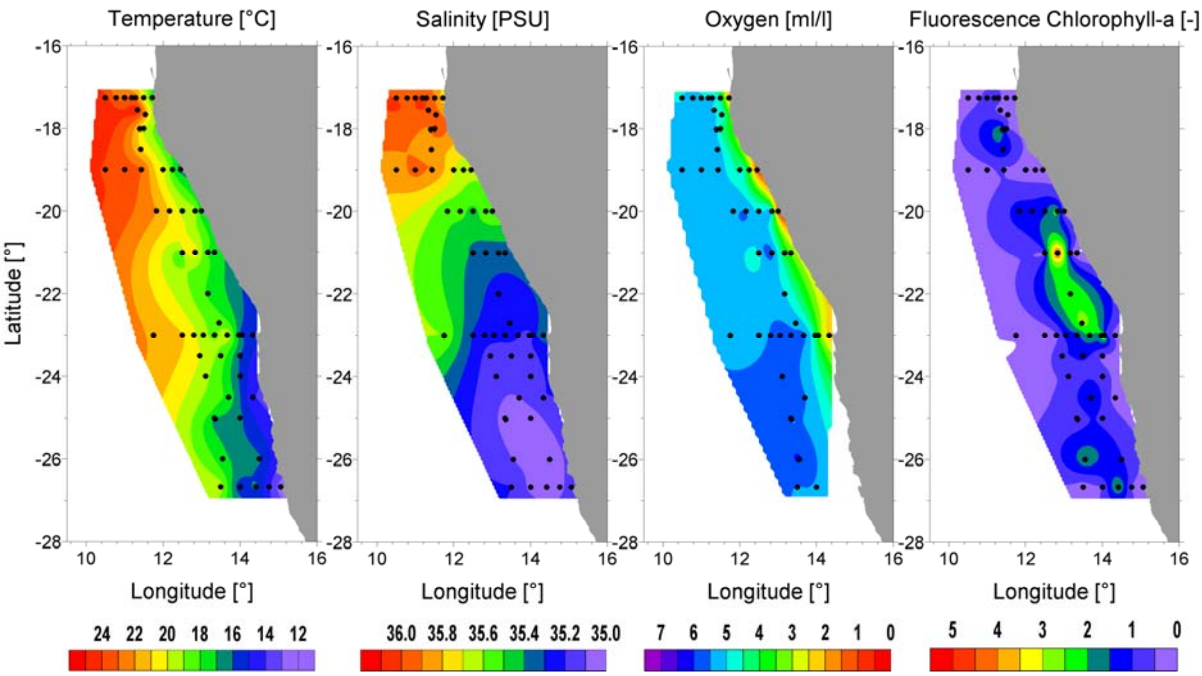

Fig. 5.1 Horizontal distribution of temperature, salinity, oxygen and chlorophyll-a fluorescence off Namibia at 20m depth (based on CTD data)

The salinity distribution was characterized by a southward decrease in salinity from 36 psu at the Kunene mouth down to 35 psu near Lüderitz. This depicts the distribution of the two dominating central water masses. High salinities in the north are associated with SACW, the low saline water in the south is ESACW (Mohrholz et al., 2007). The transition zone between both water masses stretches from the Rocky Point transect southward to at least Walvis Bay. Surface oxygen concentrations were reduced in a narrow coastal belt along the entire coast, indicating coastal upwelling of water from subthermocline layers. The maximum chlorophyll-a fluorescence in the surface layer was located in a belt 40 to 80 nautical miles off the coast. This shift is caused by the temporal delay between the physical process of upwelling and the development of phytoplankton bloom in the upwelled waters.

An example of the vertical hydrographic structure on the central Namibian shelf is given in Fig. 5.2. The Walvis Bay transect is one of the key transects for the field investigations. It was worked during moderate upwelling conditions from 05 to 09 February 2010. The collected data set consists of 9 CTD stations and 16 additional Microstructure Probe (MSS) stations. Although the wind forcing supported coastal upwelling, the stratification depict only weak active upwelling pattern of water at the coast in a very thin layer of about 40 m. Along the transect the surface layer was covered by unusual warm water. The temperature ranges from approximately 22°C at the open ocean down to 18°C near the coast. Contemporary(?) the depth of mixed layer decreases eastwards from 50 m to 20 m. Maximum salinity was found in the warm surface layer at the westernmost station. In the central part the salinity maximum was located at a depth around 70 m. The less saline water in the surface layer may have originated from recent upwelling events. In the bottom layer on the shelf oxygen concentrations were at a very low level, but above zero. This is unusal for the summer season, which is often characterized by anoxic bottom waters and H_2S outbreaks (Ohde and Mohrholz, 2011). The surface mixed layer was well ventilated. The maximum oxygen concentrations correlate with the depth of chlorophyll-a fluorescence maximum, which was found near the surface at the coast and in a subsurface layer at about 50 m depth at off shore stations. The western-most station of the transect consisted exclusively of ESACW in the central water layer. Towards the coast the fraction of SACW was increasing. However, only at profile 28 (station 264) the SACW fraction depict high values of about 80%.

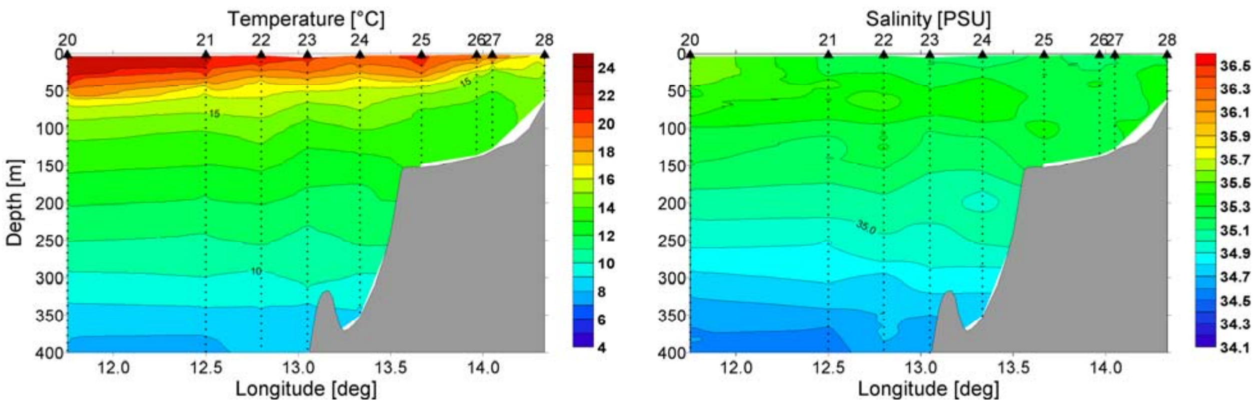

Fig. 5.2 Distribution of temperature and salinity at the Walvis Bay transect (06. - 09.02. 2011)

Drifter

During the first leg of MSM 17/3 a drifter experiment was carried out. The main goal was to test the equipment, since drifter deployments will be carried out regularly during the second phase of the GENUS project. The drifter was equipped with an SBE37 thermosalinometer 10 m below the surface and a sediment trap at approximately 50 m depth. On 30.01.2011 at 14:14 UTC the drifter was deployed 25nm off Walvis Bay at position 23.00459°S 13.96574°E. Four times a day the drifter posted its position via Iridium. The drifter was recovered successfully on 10.02.2011 at 18:30 UTC at position 22.70298°S 13.45795°E. The general drifter path was towards the northwest, with a mean speed of about 0.1 ms^{-1}. This points to the dominance of Ekman offshore transport in the surface layer, as is expected durning upwelling favourable wind conditions. During the first half of the deployment the drifter path was superimposed by inertial motions (Fig. 5.3).

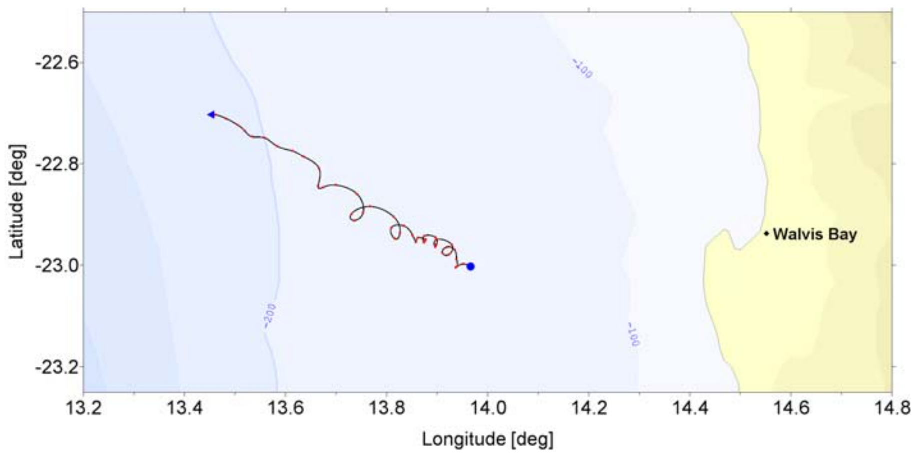

Fig. 5.3 Drifter pathway off Walvis Bay (30.01. - 10.02. 2011)

Currents

During the entire cruise the two VMADCPs (38 kHz and 75 kHz) of the RV Merian were operated in order to obtain current data in the upper 700 m of the water column. Additionally, an LADCP system was mounted on the CTD frame to measure full vertical current profiles at each CTD cast. The gathered data revealed complex current patterns, which consist of a superposition of wind driven currents, tides, inertial motions and other processes, all of nearly the same order of magnitude. Together with the ships pathway through the investigation area this caused a mixture of different temporal and spatial scales, which cannot be separated. Thus, a reliable interpretation of the observed current patterns is not possible at the actual state. For example: a cross shelf transect of two days duration contains four tidal cycles, one and a half inertial cycle and the background current pattern, that change with the topography. It is impossible to relate the observed band like current patterns, parallel to the coast, either to temporal changing tide and inertial motion or to the spatial changing background flow. An example for the observed patterns is given in Fig. 5.4.

The separation between the single processes might be possible for the along shore component of the currents by using the geostrophic flow field, calculated from the density data. However, this is a laborious task, which has not been carried out yet.

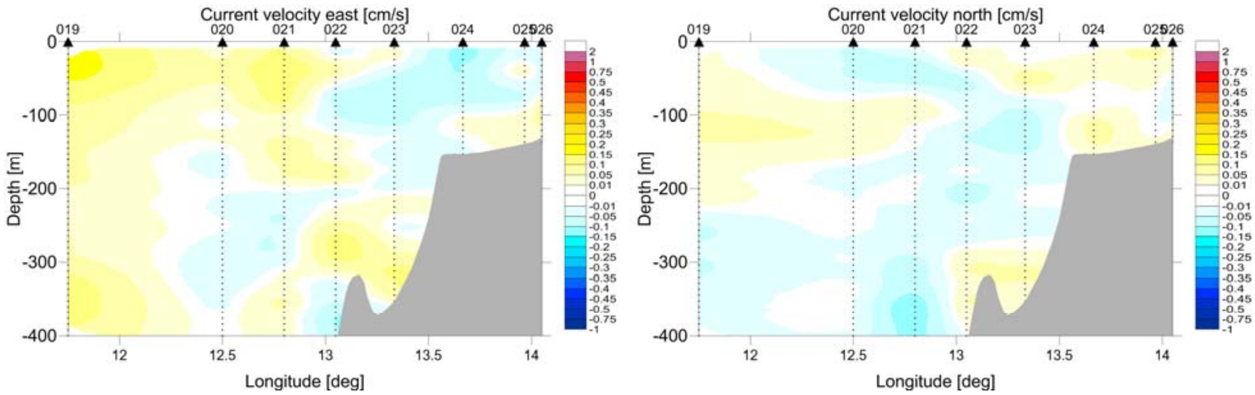

Fig. 5.4 Pattern of current velocity at the Walvis Bay transect (06. - 09.02. 2011), measured with the LADCP

Moorings

On 30.01.2011 19:00 a short term mooring was deployed at 21° 00.1538'S, 013° 09.9557'E. Main purpose of this mooring was to obtain hydrographic data from the lower water column with a high temporal resolution. This data is used for the detection of internal waves and other short term processes that control the vertical mixing and resuspension of SPM. The mooring consisted of a bottom mounted Workhorse ADCP 600 kHz, 4 MICROCAT thermosalinometers SBE37, five RBR TR1060 temperature recorder, and an RBR TRD2050 temperature pressure recorder. The mooring was successfully recovered on 09.02.2011 07:00 UTC.

A second mooring, which was deployed in October 2010 during the Discovery cruise, was recovered and redeployed after maintenance. This mooring consists of two strings connected via a 200m long ground rope. An upward looking Workhorse ADCP 300 kHz, 2 MICROCAT thermosalinometers SBE37, 2 SBE16 thermosalinometers (with AANDERAA optode), four RBR TR1060 temperature recorders, and four RBR TRD2050 temperature-pressure-recorders were mounted at one string. These instruments cover nearly the entire water column. On the second string a sediment trap was fixed at 70 m depth.

5.2 Turbulent mixing on the shelf (GENUS SP-2)

(V. Mohrholz, T. Heene, A. Muller)

Microstructure profiles were taken at almost each CTD station. In order to reduce the impact of intermittency three to five subsequent measured profiles were averaged into a mean profile for each station. At the transects off Walvis Bay and the Rocky point the microstructure profiles were taken at a higher spatial resolution of about 5 to 10 n.m. The aim was to identify hot spots of mixing across the shelf. Figure 5.5 depicts the TKE dissipation rate on the Walvis Bay transect.

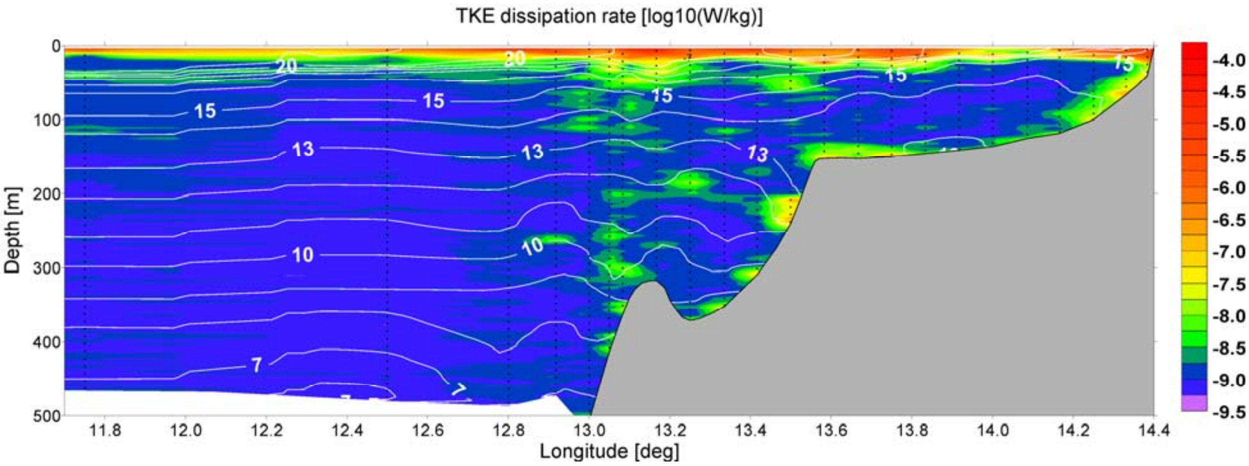

Fig. 5.5 Patterns of TKE dissipation rate (contour plot) and temperature stratification (isolines) along the Walvis Bay transect

Along the entire transect the surface layer shows high dissipation rates caused by wind mixing and ship induced disturbances. Below the thermocline the dissipation rate in the open ocean was very low (10^{-9} Wkg^{-1}), close to or at the noise level of the instrument. At the shelf break the vertical displacement of isotherms point to instability of shoaling internal tides, which enhance the dissipation rates in the entire water column by an order of magnitude. On the shelf high dissipation rates were found at sloping bottom. This may be caused by critical angles for internal wave reflection and/or by the action of swell. The flat areas of the inner shelf depict low dissipation rates. The general distribution of hot spots in turbulence coincides with the areas of low total organic carbon (TOC) concentrations in the mud belt (Inthorn et al., 2006). The Kunene transect depict a very different bathymetry. The shelf is narrow with a steep slope at the shelf edge. Thus, no clear separation between the shelf and shelf break is visible in the pattern of dissipation rate. However, the area with high dissipation rates at the shelf break is located at nearly the same isobaths (400-500 m) as on the Walvis Bay transect.

At the inner shelf break of the Walvis Bay transect an active mixing event was observed in the bottom layer. Most probably this was caused by a passing internal bore (or bolus). The initial stable stratification was destroyed in a 40 m thick bottom layer. During the event the TKE dissipation rate increased by three orders of magnitude from 10^{-9} to 10^{-6} W/kg. The water in the bottom layer was replaced by cooler and less saline water. This indicates an on shelf transport of water from a deeper layer. Figure 5.6 depicts four subsequent MSS profiles covering the mixing event.

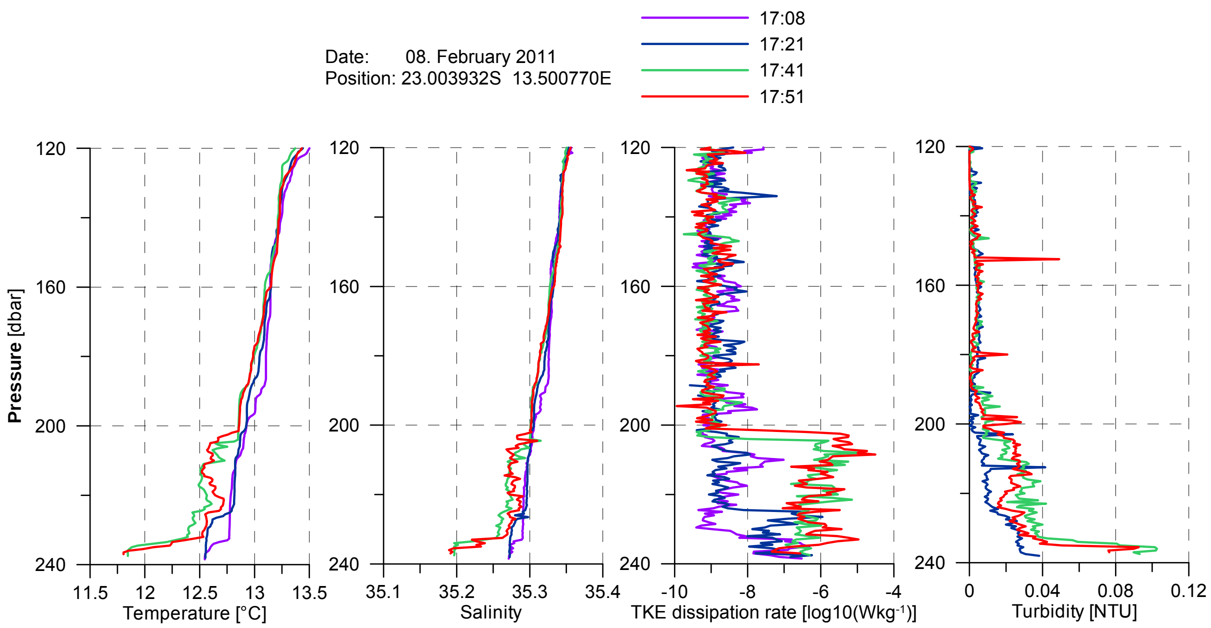

Fig. 5.6 Mixing event in the bottom layer at the inner shelf break off Walvis Bay

The enhanced turbulence at the shelf break and at some hotspots on the shelf enforces resuspension of particulate matter within the bottom layer. Both have an impact on the spatial sediment distribution and on the export of organic matter into the deep ocean, which are not fully understood yet.

5.3 Meteorological conditions (GENUS SP-2)

(V. Mohrholz, A. Muller)

During the first week of the cruise two pulses of southerly winds forced weak upwelling at the west coast of southern Africa. From the 4th of February onwards moderate upwelling favorable winds (Fig. 5.7.) were observed again, and lasted for the entire five days during which the Walvis Bay transect was worked. After that the wind pattern was characterized by weak southerly winds until the 16th of February. Following this date, stronger southeast winds were observed again and these forced moderate upwelling until the end of our investigations in the northern Benguela on the 23rd of February.

Maximum wind speed reached about 15 ms^{-1} on 18th and 19th February. Mean wind speed during the cruise varied between 5 to 10 ms^{-1}. The main wind direction was southeast, as expected in the SE trade region. On 24th February the wind speed decreased rapidly to a mean value of about 4 ms^{-1} subsequent to passing the Kunene transect and heading northwards.

The air pressure depicted a semi diurnal cycle, with only minor excursions around a mean value of 1012 hPa. The air temperature varied according the geographical position between 14 and 23°C. Due to high cloud coverage only a weak day and night cycle was observed, which became more expressed near the ABFZ. The humidity was relatively high, between 75% and 100% during the entire cruise. However, the humidity sensor depicted an upper limit of 95%, which seemed to be have been caused by an artificial cut off. The global radiation was strongly related to the cloud coverage. Maximum values, at noon on sunny days, were about 1100 Wm^{-2}.

More than 90% of clouds observed during the cruise were classified as low stratus (100-600m high). Persistent cloud coverage was observed during the first leg from Walvis Bay to Lüderitz, with eight of the ten days showing cloud coverage of 80% or more during both the 8:00 and 12:00 sampling. There was an average dissipation in cloud coverage of 10-20% from 8:00 to 12:00. During the second leg from Walvis Bay to the Kunene there was no clear dissipation of cloud coverage visible between mornings and afternoons, with some days in fact showing an increase in cloud coverage throughout the day. Overall however cloud coverage was lower during the second leg of the cruise. Only three days of fog (<1km visibility) were observed throughout the entire period.

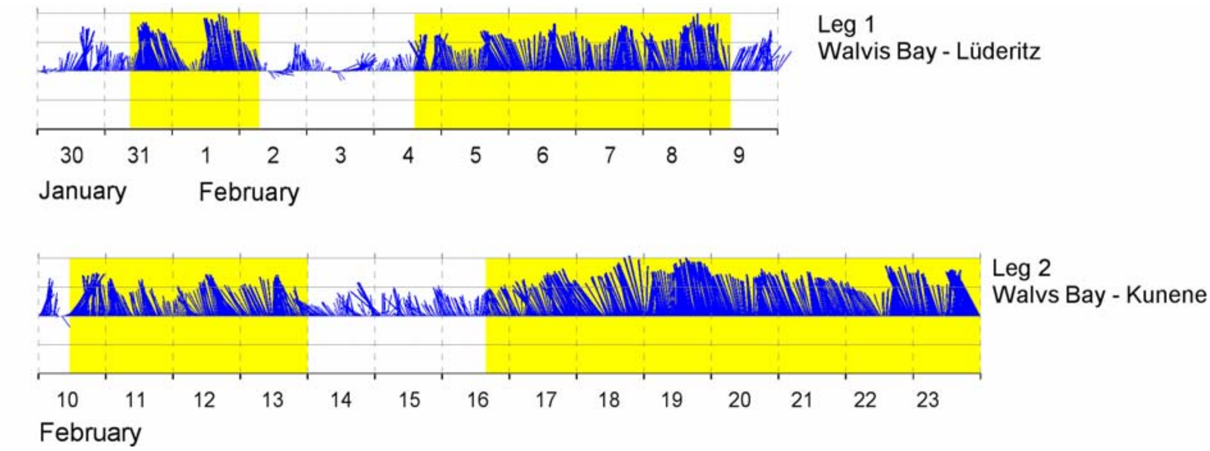

Fig. 5.7 Stick plot of wind vector during the investigations in the northern Benguela. Yellow shaded periods indicate upwelling favorable wind conditions

5.4 Phytoplankton (GENUS SP-2)

(N. Wasmund, A. Hansen)

Sampling

Samples for measurements of nitrogen fixation and primary production rates were taken on and in between the Walvis Bay (WB)- and Lüderitz transects as well as along the coast. The sampled habitat water was enriched with ^{15}N-gas and ^{13}C and incubated under defined light conditions. After filtration, the samples were frozen and will be analysed in a mass spectrometer according to the method of Montoya et al. (1996). Samples for the qualitative and quantitative determination of the phytoplankton biomass were taken at every station of the cruise from the surface water and from deeper water, mostly from the fluorescence maximum, by means of a rosette sampler. Integrated samples of the mixed surface layer were produced by mixing the water from 4-6 depths. As the best fixing solution for our purposes serves non-acidic Lugol solution as it preserves diatoms, flagellates and coccolithophorids as well. Species composition and biomass are calculated by the Utermöhl method (Utermöhl, 1958). Additionally, phytoplankton net samples were taken by a "dip net" (mesh size 25µm) for a first screening of the species composition in the upper 20 m of the water column as well as for future scanning electron microscopy if species of special interest are detected. Chlorophyll *a* filters were taken from different depths in the mixed layer and from the fluorescence maximum. The samples are fluorometrically analyzed in the lab by the method described by Wasmund et al. (2006). Secchi Depth, as an indicator for transparency, was measured at every station except night time.

Preliminary Results

The highest transparency occurred at the deep, outermost stations of the WB and the Lüderitz transect. As a result of dilution nutrient concentrations in the surface water are decreasing seawards. Plankton growth gets less for this reason and especially phytoplankton starts to sink down. If there are enough light and nutrients, phytoplankton might live and grow in deeper waters down to 100 m. With decreasing concentrations of plankton and / or particles in the water column, light attenuation decreases as well. The Secchi Depth maxima were measured at the outermost station of the WB transect (19 m) and at the outermost station on the Lüderitz transect (21 m) which indicates a high transparency of the water. So far, the deepest chlorophyll maximum also occurred at the outermost station off WB at 65 and 75 m. At the other WB offshore stations (St. 241, St. 242, St. 243) and south of WB (St. 227, St. 240), chlorophyll *a* concentrations were about 2 times higher at 20 - 40 m depth than at the surface. In contrast the chlorophyll *a* concentrations at the coastal stations decrease with increasing depths as the light might be the limiting factor. The most abundant phytoplankton species in deep chlorophyll maximum seems to be *Guinardia cylindrus*, which is a centric diatom of the Rhizosoleniaceae family. *Guinardia cylindrus* appears in a few integrated samples of the WB coastal stations beside other Rhizosoleniaceae species which is a characteristic population for the Namibian coastal phytoplankton. Diatoms of this group e.g. *Rhizosolenia* sp. and *Proboscia alata* belong to the larger microplankton fraction. According to its size phytoplankton can be divided into microplankton (20-200 µm), nanoplankton (2-20 µm) and picoplancton (singular cells of 0-2 µm). *Thalassionema sp.* and *Pseudo-nitzschia spp.* belong also to the characteristic coastal microphytoplankton.

Against our expectations the phytoplankton of the upwelling area of Lüderitz mostly consists of dinoflagellates e.g. of the genera *Protoperidinium*, *Ceratium*, *Diplopsalis* and *Dinophysis* (Fig. 5.8), as well as many unidentified dinoflagellates and flagellates of the nanoplankton fraction. Another important dinoflagellate species which occurred in higher abundances is of the genus *Gonyaulax*. Scanning electron microscopy will be done for determination down to the species level.

Fig. 5.8a *Protoperidinium sp.*

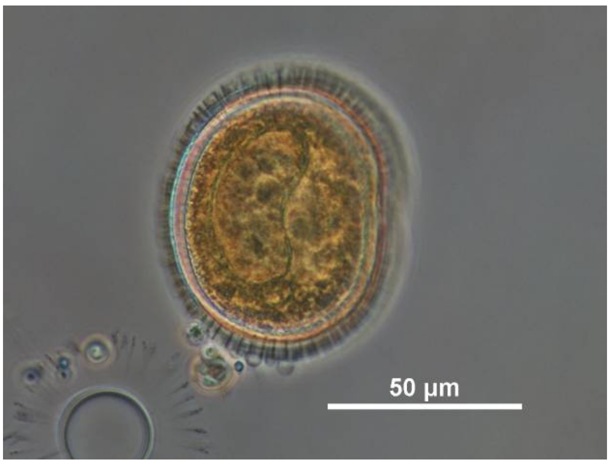

Fig. 5.8b *Diplopsalis sp.*

Fig. 5.8c *Ceratium pentagonum*

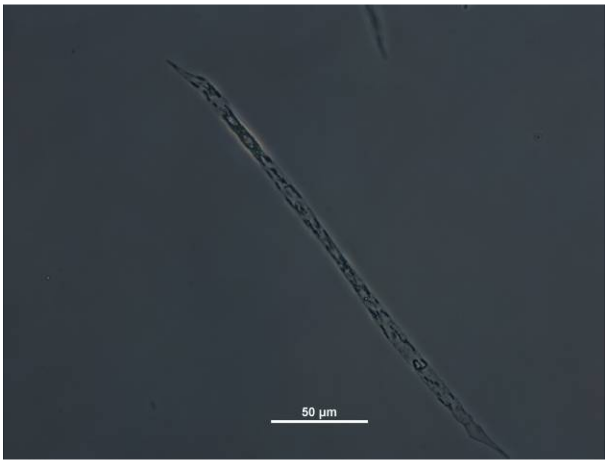

Fig. 5.8d *Proboscia alata*

Fig. 5.8e *Guinardia cylindrus*

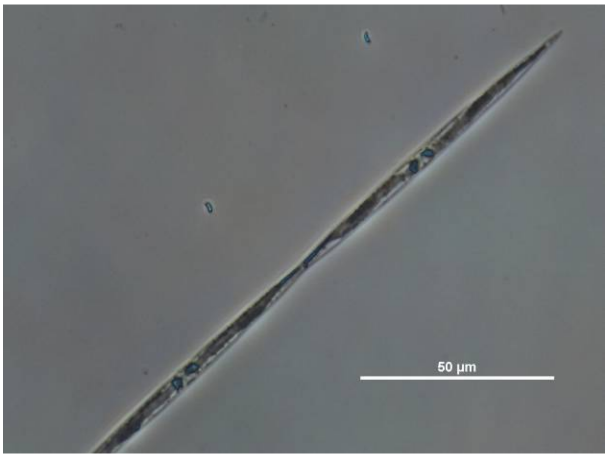

Fig. 5.8f *Pseudonitzschia sp.*

5.5 Biogeochemical Composition of the Water Column and Surface Sediments (GENUS SP-3)

(N. Lahajnar)

Major goals of this research campaign were to measure and decipher the biogeochemical cycling of particulate matter and nutrient elements between the atmosphere, water column, biota and sediments during austral summer (reduced upwelling intensity). These results are prerequisites to understand the trophic interactions and energy flows within the biotic system and to validate and improve existing models, which are part of other sub-projects within the GENUS frame work. In particular we focused our work on three subjects:

(1) Automatic detection of physical variables and nutrient composition in the surface water throughout the entire cruise (Ferrybox and SYSTEA autoanalyzer)
(2) Sampling and filtration of particulate matter (*seston)* and dissolved components (nutrients and other organic and inorganic substances for stable isotopes)
(3) Surface sediment sampling (Multicorer and Membrane Inlet Mass Spectrometry - MIMS)

5.5.1 Online Measurements of Surface Water Composition (Ferrybox and SYSTEA)

(N. Lahajnar, M. Ankele)

The Ferrybox including an auto-analyzer SYSTEA MICROMAC 1000 was attached to a continuous flow (ca. 5 litres per minute) of surface seawater and measured every minute (every 30 minutes for nutrients) the following variables: conductivity, temperature, salinity, oxygen (content and saturation), fluorescence, turbidity, pH, phycoerythrin, CDOM, NO_2, NO_x, PO_4 and SiO_2. Precision of nutrient measurements was checked against fresh calibration standards on a daily basis. In addition, samples for re-calibration in our home laboratories were taken every day. Thus, we state that some of the results shown in the figures below should be treated as preliminary and have to be validated after the cruise. Nonetheless the results show - in accordance with the findings of SP-2 during leg 2 (see 5.1) - clear trends where, for example, upwelling in terms of changing water temperature and conductivity as well as enhanced nutrient concentrations (Fig. 5.9) occurred very close to the coastline from approx. 19° to 21°S, at 23°S (Walvis Bay) and 26.6°S (Lüderitz upwelling cell). Deduced from physical properties such as salinity and temperature it also became clear that tropical water masses from the north (Angola Dome region) already dominated the northern Namibian shelf region during February 2011.

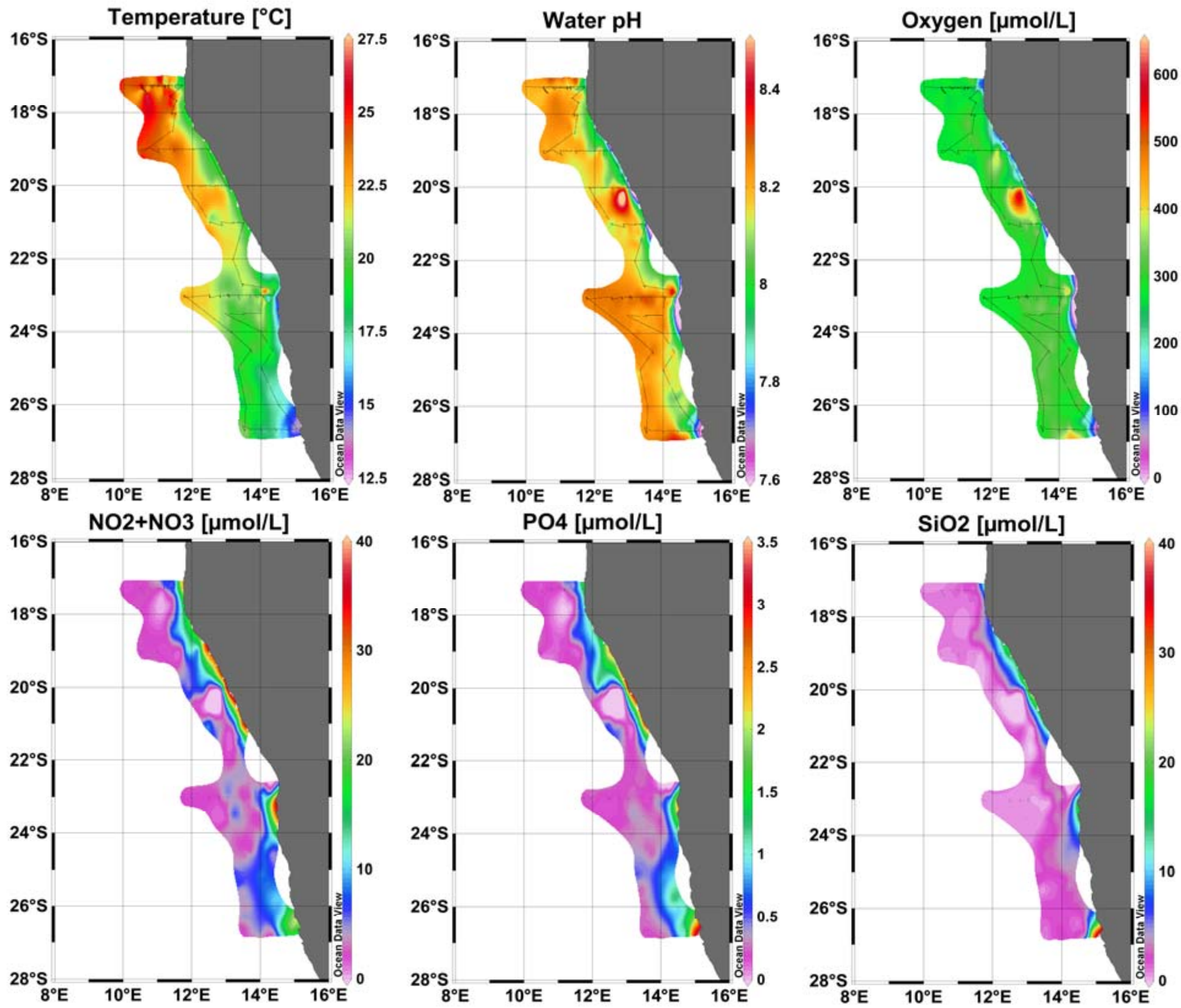

Fig. 5.9 Physical and chemical properties of the Benguela upwelling area in Jan/Feb 2011 derived from continuous measurements (>33,000 data points) of a Ferrybox and SYSTEA autoanalyzer installed on RV Maria S. Merian

5.5.2 Suspended Particulate Matter and Nutrient Isotopes

(N. Lahajnar, F. Langenberg, M. Annighöfer)

Water samples at 50 stations were taken from almost every CTD cast from various depths (see Tab. 5.1). The particulate matter fraction was filtered on pre-combusted and pre-weighted GF/F filters. Further analytical investigations of this particulate fraction will be carried out for bulk geochemical content, isotopic composition (^{13}C and ^{15}N) and biogeochemical proxies such as, for example, amino acid spectra. Filtrated water will be analysed on the isotopic composition of nutrients (^{15}N and ^{18}O) of NO_3, NO_2 and DON. These results are a prerequisite for understanding nutrient cycling and biotic interactions. Moreover, one major aim is to establish empirical fractionation factors of dissolved inorganic nitrogen and diagenetic alteration by paired analyses of δ^{15}N in dissolved components compared to chlorophyll, bulk particulate mater, and surface sediments. Analogous analyses at higher trophic levels will be done by other sub-projects.

Tab. 5.1 Sampling of supended particulate matter and nutrients for isotopic measurements

Station#	Longitude	Latitude	Water Depth [m]	Bottle Depth [m] derived from pressure sensor	Methods	Remarks
222	23° 00.05'S	14° 02.92'E	133.9	0,10,20,30,50,75,100,126	S, Nu, ^{15}N	
225	23° 30.02'S	13° 59.97'E	169.2	0,10,20,30,50,75,100,160	S, Nu, ^{15}N	
228	24° 00.02'S	13° 59.97'E	218.6	0,10,206	S, Nu, ^{15}N	
229	24° 29.94'S	14° 20.04'E	126.5	0,10,50,112	S, Nu, ^{15}N	
230	24° 59.99'S	14° 00.00'E	180.4	0,10,50,170	S, Nu, ^{15}N	
231	25° 59.98'S	14° 30.02'E	193.8	0,10,180	S, Nu, ^{15}N	
232	26 °40.08'S	15° 03.51'E	39.7	0,10,20,30,35	S, Nu, ^{15}N	
233	26 °39.99'S	14° 45.63'E	192.5	0,10,20,30,50,75,100,182	S, Nu, ^{15}N	
234	26 °39.95'S	14° 25.00'E	329.8	0,16,314	S	
235	26 °39.97'S	13° 59.98'E	421.5	0,10,20,30,50,75,100,410	S, Nu, ^{15}N	
236	26 °39.96'S	13° 30.00'E	1106.9	0,10,20,30,50,75,100,500,800,1060	S, Nu, ^{15}N	
237	25 °59.96'S	13° 33.00'E	758.1	0,30,735	S, Nu, ^{15}N	
238	25 °02.01'S	13° 20.98'E	1061.8	0,25,1072	S, Nu, ^{15}N	
240	23 °59.98'S	13° 06.61'E	740.9	0,45,733	S, Nu, ^{15}N	
241	23 °00.02'S	11° 45.03'E	3004.5	0,10,20,50,65,75,100,500,800,1000,2000,3012	S, Nu, ^{15}N, DON	
242	22 °60.00'S	12° 29.98'E	1648.3	0,45,800,1638	S, Nu, ^{15}N	
243	22 °59.98'S	12° 48.01'E	910.0	0,28,500,902	S, Nu, ^{15}N	
246	22 °59.96'S	13° 02.96'E	412.9	0,40,402	S, Nu, ^{15}N	
250	22 °59.95'S	13° 20.08'E	354.6	0,10,20,30,50,75,100,347	S, Nu, ^{15}N	20 m Filter broken
254	22 °59.95'S	13° 40.03'E	155.3	0,10,20,30,50,75,100,146	S, Nu, ^{15}N, DON	
260	22 °59.99'S	14° 02.99'E	139.2	0,20,30,50,75,100,126	DON	
264	22 °59.98'S	14° 20.02'E	67.7	0,10,20,30,60	S	
266	22 °42.12'S	13° 27.62'E	251.0	0,10,20,30,50,75,100,240	S, Nu, ^{15}N	
267	22 °00.01'S	13° 09.99'E	211.0	0,20,202	S	
268	21 °00.58'S	13° 29.80'E	15.0	0,10,13	S, Nu, ^{15}N	
269	20 °59.98'S	13° 20.00'E	95.3	0,10,20,30,50,75,88	S, Nu, ^{15}N	
270	20 °59.96'S	13° 10.01'E	127.8	0,30,118	S	
272	21 °00.05'S	12° 29.99'E	435.3	0,10,20,30,50,75,100,125,150,200,300,427	S, Nu, ^{15}N	
274	19 °59.94'S	11° 49.98'E	411.4	0,10,20,30,50,75,100,200,300,403	S, Nu, ^{15}N	20 m Filter lost
275	19 °59.97'S	12° 09.96'E	284.6	10,273	S	
276	19 °59.98'S	12° 29.97'E	153.7	0,10,20,30,50,75,100,125,149	S, Nu, ^{15}N	

Station#	Longitude	Latitude	Water Depth [m]	Bottle Depth [m] derived from pressure sensor	Methods	Remarks
277	19 °59.98'S	12° 50.00'E	103.2	0,10,97	S	
278	19 °60.00'S	12° 60.00'E	17.0	0,10,20,29	S, Nu, ^{15}N	
279	18 °59.98'S	12° 27.00'E	39.2	0,10,20,30	S, Nu, ^{15}N	
282	18 °59.96'S	12° 15.01'E	113.1	0,10,20,30,50,75,105	S, Nu, ^{15}N	
285	18 °59.98'S	12° 00.01'E	209.7	0,10,20,30,50,75,100,125,150,200	S, Nu, ^{15}N	
292	18 °59.93'S	11° 26.07'E	418.3	0,10,20,30,50,75,100,125,150,200,300,415	S, Nu, ^{15}N	
295	18 °59.99'S	11° 00.05'E	1303.4	0,10,20,30,50,75,100,500,800,1000,1295	S, Nu, ^{15}N	
298	18 °60.00'S	10° 30.00'E	2081.5	0,10,20,30,50,75,100,500,800,1000, 2065	S, Nu, ^{15}N	
299	18 °29.99'S	11° 24.97'E	443.2	0,10,437	S	
300	17 °59.96'S	11° 29.94'E	241.0	0,10,20,30,50,75,100,125,150,236	S, Nu, ^{15}N	
304	17 °15.00'S	11° 43.00'E	35.0	0,10,20,30	S, Nu, ^{15}N	
305	17 °15.00'S	11° 29.99'E	149.1	0,10,20,30,50,75,100,125,141	S, Nu, ^{15}N	
306	17 °15.01'S	11° 17.25'E	497.5	0,10,20,30,50,75,100,150,200,300,495	S, Nu, ^{15}N, DON	
307	17 °15.01'S	11° 10.97'E	924.3	0,30,921	S, Nu, ^{15}N	
308	17 °15.01'S	10° 59.88'E	2069.2	0,10,20,30,50,75,100,500,800,1000,2140	S, Nu, ^{15}N	
309	17 °14.99'S	10° 46.99'E	2997.1	0,10,100,200,500,1000,2970	S	
310	17 °15.00'S	10° 30.00'E	3271.4	0,10,20,30,50,75,100,300,500,800,1000,2000,3000	S	
316	17 °15.00'S	10° 00.00'E	3879.7	0,40,100,300,1000,3000	S	
317	10 °07.00'S	08° 03.19'E	4825.7	0,10,20,30,50,75,100,300,500,800,1000,2000,3000	S	

5.5.3 Remineralisation Rates in Surface Sediments Along the Namibian Shelf

(A. Neumann, N. Lahajnar, M. Ankele)

The remineralisation processes in the surface sediments of the Namibian shelf alter the chemical composition of the bottom water, which reaches the sea surface by upwelling at the coast. Thus, the processes in the sediment potentially impact the biomass production of the Benguela Current. As for a very brief example, anoxic sediments either promote the biological production by the release of phosphate and dissolved iron, or restrict the biological production by the consumption of oxygen and nitrate. Previous results suggest high nitrate consumption rates even in sediments of the continental slope. Hensen et al. (2000) examined the surface sediments of the continental margin off Namibia between the 1300 m isobath and the abysal plain of the Cape Basin. They reported nitrate fluxes between 0.2 and 0.6 mmol m^{-2} d^{-1}. The link between sediment and water column off Namibia was examined by van der Plas et al. (2007). They concluded that sediment anoxia is determined externally by the initial oxygen concentration of the water column. Thus, the source of the water on the Namibian shelf and its characteristics determine, whether the underlying surface sediment is a sink or source for compounds such as nitrate, phosphate and iron- all of them crucial nutrients for primary production. We examined this interplay between the hydrographic boundary conditions and benthic remineralisation during the cruise MSM 17/3 by sampling the surface sediments with a multicorer and analyzing the sediment with nutrient analysis, isotope-pairing incubation and pore-water gas analysis. The measurements are supported by water content measurements and CHN-analysis of the sediment and macrozoobenthos obervations. These results will be combined with the results of GENUS SP-2 to further elucidate the coupling between sediment and water column in the Benguela upwelling system.

Sampling

The surface sediment of the continental shelf and the adjacent slope off the Namibian coast was sampled with a multicorer. Directly after the retrieval of the sediments cores, we measured concentration profiles of dissolved gases across the water- sediment interface. The oxygen profiles have been measured with microoptodes (PRESENS) and an automated micromanipulator (PYRO SCIENCE). The profiles of nitrogen, carbon dioxide, methane and hydrogensulphide were simultaneously measured with a quadrupole mass spectrometer (INPROCESS INSTRUMENTS) equipped with a needle-type membrane inlet and a second micromanipulator (PYRO SCIENCE). Both setups were placed in temperature controlled labs to prevent instabilities and to avoid increased reaction rates caused by the warming of the sediment.

The pore water was sampled with rhizon core solution samplers (RHIZOSPHERE RESEARCH) using cores liners prepared with sealed sampling ports. The pore water samples dedicated for nutrients analysis and $\delta^{15}N$ measurements were transferred to evacuated exetainers (LABCO) and stored at -20 °C. For selected stations, additional aliquots were fixated with $HgCl_2$ in exetainers without headspace for DIC and $\delta^{13}C$ analysis. A third set of aliquots was fixated with nitric acid for trace metal analysis. The overlying water of the sediment cores was sampled in parallel by GENUS SP-4 in order to obtain overlapping profiles of nutrients and DIC. Additional cores were sliced in 1 cm intervals and stored at -20 °C for CHN-analysis in order to establish porosity and grain size distribution. The obtained concentration profiles of oxygen and dissolved inorganic nitrogen across the sediment-water interface are the basis of flux calculations according Berg et al. (1998).

The calculated reaction rates of nitrate will be evaluated with Isotope-Pairing Incubations (IPI) according to (Risgaard-Petersen et al., 2003). We decided to conduct all IPI at 15 °C, so the stations for IPI were selected depending on the temperature of the bottom water. Briefly, subcores with 4 cm diameter were sampled from the multicores, amended with 98% ^{15}N-Nitrate and incubated. The supernatant was constantly mixed with magnetic stirrers. After six hours, the subcores were homogenised to slurries, and the produced $^{29}N_2$ and $^{30}N_2$ was measured onboard using a quadrupole mass spectrometer (INPROCESS INSTRUMENTS) equipped with a flow-through membrane inlet developed at HZG Geesthacht.

Whenever the work load allowed, the uppermost 7 cm of one sediment core per station were sieved through a 500 µm mesh for a small scale survey of the macrozoobenthos, because it potentially impacts the remineralisation rates. The residuals in the sieve were photographed for later analysis. Selected specimens were frozen in liquid nitrogen and stored at -80 °C for molecular taxonomy. A secondary objective was to map the distribution of the bivalve *Nuculana cf. bicuspidata*, which was identified as a unique specialist of oxygen-depleted water (Zettler et al., 2009). As we successfully retrieved living individuals of *N. bicuspidata*, we tested their denitrification activity. The bivalves were placed in 50 ml screw-cap glasses equipped with a gastight gasket and incubated in oxygen-depleted water amended with ^{15}N-Nitrate for 48 hours. The produced $^{29}N_2$ and $^{30}N_2$ was measured directly with a GAM-200 mass spectrometer equipped with a flow-through membrane inlet.

Tab. 5.2 Overview of Multicorer stations. Slice: Sediment sliced in 1 cm intervals, PW: Pore water sampling; Oxy: Oxygen concentration profiles; MIMS: Concentration profiles of N_2 , CO_2, CH_4, H_2S; IPT: Isotope pairing incubation with ^{15}N-nitrate; Benthos: Survey of Macrozoobenthos

Station#	Latitude	Longitude	Depth	Cores	Processing
224	23° 00.00'S	14° 03.00'E	135	X	slice, PW, Benthos
225	23° 30.00'S	14° 00.00'E	165	X	slice, Benthos
226	23° 30.77'S	13° 30.27'E	228	X	slice, PW, Oxy, Benthos
228	24° 02.68'S	14° 00.32'E	212	X	slice, Benthos
229	24° 30.72'S	14° 20.10'E	120	X	slice, PW
230	25° 00.00'S	14° 00.00'E	180	--	
231	26° 00.00'S	14° 30.00'E	190	X	slice, PW, Oxy, Benthos
232	26° 40.00'S	15° 03.60'E	39	--	
233	26° 40.00'S	14° 45.59'E	180	X	slice, PW, IPT, Benthos
234	26° 40.00'S	14° 25.00'E	325	X	Slice
235	26° 40.00'S	14° 00.00'E	417	X	slice, PW, Oxy, Benthos
236	26° 40.00'S	13° 30.00'E	1100	X	slice, Oxy, IPT, Benthos
237	26° 00.00'S	13° 33.00'E	750	X	slice, Oxy
238	25° 00.00'S	13° 19.99'E	1080	X	slice, PW, Oxy
239	24° 30.00'S	13° 42.00'E	356	--	
240	24° 00.00'S	13° 06.60'E	735	X	slice, PW, Oxy, Benthos
241	23° 00.00'S	11° 45.00'E	2970	X	slice, PW, Oxy, MIMS
242	23° 00.00'S	12° 30.00'E	1640	X	slice, PW, Oxy
243	23° 00.00'S	12° 48.00'E	905	X	slice, PW, Oxy, IPT, Benthos
246	23° 00.00'S	13° 03.00'E	410	X	slice, PW, Oxy, Benthos
250	22° 59.98'S	13° 20.01'E	350	X	slice, PW, Oxy, MIMS, Benthos
254	23° 00.00'S	13° 40.00'E	155	X	slice, PW, Oxy, MIMS, Benthos
264	22° 59.98'S	14° 20.02'E	66	X	slice, PW, MIMS
266	22° 45.90'S	13° 28.08'E	250	X	slice, Oxy
267	22° 01.16'S	13° 10.78'E	205	X	slice, Oxy, MIMS
268	21° 01.75'S	13° 29.18'E	23	X	slice, PW, Oxy, MIMS, IPT, Benthos
269	20° 59.98'S	13° 20.00'E	98	X	slice, PW, Oxy, MIMS, Benthos
270	20° 59.93'S	13° 10.05'E	125	X	Slice
271	20° 59.99'S	12° 50.01'E	296	X	slice, PW, MIMS, Benthos
272	21° 00.00'S	12° 30.00'E	425	X	slice, PW, Oxy, MIMS, Benthos
274	20° 00.00'S	11° 50.00'E	408	X	slice, PW, Oxy, MIMS, Benthos
275	20° 00.00'S	12° 10.01'E	275	X	Slice
276	20° 00.00'S	12° 30.00'E	153	X	slice, PW, Oxy, MIMS, Benthos
277	20° 00.00'S	12° 50.00'E	99	X	slice, IPT
278	20° 00.00'S	13° 00.00'E	30	X	slice, PW, Oxy, MIMS, Benthos
279	19° 00.08'S	12° 27.05'E	35	X	slice, PW, MIMS, Benthos
292	19° 00.00'S	11° 26.00'E	416	X	slice, PW, Oxy, MIMS, IPT
295	19° 00.00'S	11° 00.00'E	1290	X	slice, PW, Oxy, MIMS
298	19° 00.00'S	10° 30.00'E	2063	X	slice, PW, Oxy, MIMS, Benthos
299	18° 30.00'S	11° 25.00'E	436	X	slice, PW, Oxy, MIMS, IPT, Benthos
300	18° 00.00'S	11° 30.00'E	237	X	slice, Oxy, MIMS, Benthos
304	17° 15.00'S	11° 43.00'E	35	X	slice, PW, Oxy, MIMS, Benthos
305	17° 15.24'S	11° 30.39'E	142	X	slice, PW, Oxy, MIMS, Benthos
306	17° 15.00'S	11° 17.30'E	500	X	slice, PW, Oxy, MIMS, IPT
307	17° 15.00'S	11° 11.00'E	915	--	
308	17° 15.00'S	11° 00.00'E	2103	X	slice, PW, Oxy, MIMS, Benthos
309	17° 15.00'S	10° 47.00'E	2939	X	slice, PW, Oxy, MIMS, Benthos
310	17° 15.00'S	10° 30.00'E	3247	X	slice, PW, Oxy, MIMS, Benthos
311	17° 15.00'S	11° 11.00'E	922	X	slice, PW, Oxy
316	17° 15.00'S	10° 00.00'E	3921	X	slice, PW, Oxy, MIMS, Benthos
317	10° 07.00'S	08° 03.19'E	4825	X	slice, Oxy, MIMS

Preliminary results

The oxygen concentrations at the sediment-water-interface are lowest at the coast and become anoxic where upwelling is most intensive. Due to the high respiration rates, oxygen concentrations and respiration are limited by the supply of oxygenated water (Fig. 5.10a). In contrast, the sediments of the deep stations show higher oxygen concentrations and low respiration rates and thus, benthic oxygen consumption is probably restricted by the supply of degradable biomass or by temperature. The oxygen fluxes will be calculated as soon as the results of the sediment analysis become available and will allow a correlation of respiration with temperature and organic carbon content. The oxygen concentrations measured in the multicore supernatant are in good accordance with the oxygen concentrations measured with the CTD by GENUS SP-2 (Fig. 5.10b)

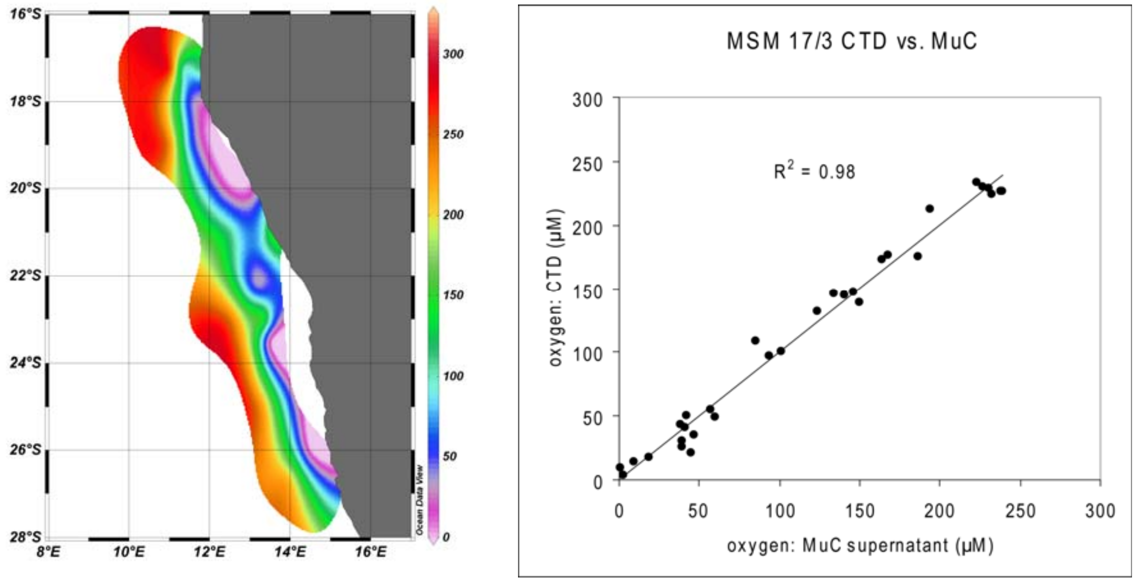

Fig. 5.10 Fig 5.10a (left): Distribution of oxygen concentrations (in µmole per liter) at the water-sediment interface measured with a microoptode directly above the sediment. Fig. 5.10b (right): Comparison of the oxygen measurements in the multicore (MuC) supernatant and the oxygen measurements of the CTD 5 m above sediment

Membrane inlet mass spectrometry (MIMS)

The needle-type membrane inlet developed at the IfBM was deployed in various sediments and proved being reliable enough to omit the guard cryotrap. The purpose of this cryotrap inline between inlet and mass spectrometer is to reduce water vapour and to stop liquid water in case of a membrane failure, but it also traps gases like carbon dioxide and methane. By omitting the cryotrap, it became possible to measure N_2, Ar, CO_2, CH_4, H_2S simultaneously and with high signal stability (Fig. 5.11). These concentration profiles will be used together with the sediment analysis to calculate the fluxes of these gases across the sediment-water interface.

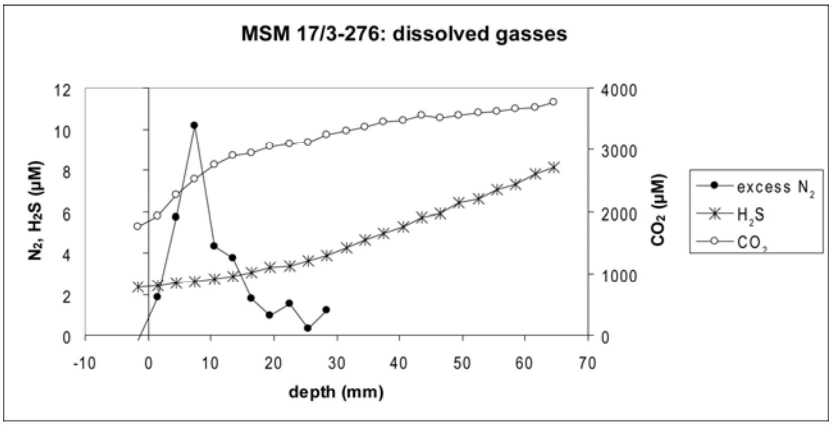

Fig. 5.11 Concentration profiles of dissolved gases in pore water at station 276. Biologically produced (excess) N_2: black dots, H_2S: grey dots, CO_2: white dots. CH_4 was not detected. Note: secondary axis for CO_2. Data are not validated and preliminary

Macrozoobenthos survey

Although the multicorer is not the best choice for macrozoobenthos observations, it is still possible to identify species, which have to be considered when estimating solute fluxes across the sediment-water interface. At first glance, especially the less hypoxic sediments below 400 m seem to be dominated by tube constructing polychaets, which can enhance the exchange between water and sediment as observed by Fossing et al. (2000) in slope sediments off Namibia. The shallow sediments off Kunene and Rocky Point harbour dense populations of the bivalve *Nuculana* and other not yet identified bivalves (Fig. 5.12). These macrozoobenthos obervations will be used in an Aller-type model of bioirrigation (Aller 1980) in order to estimate the solute fluxes across the sediment-water interface.

Fig. 5.12 Residuals of the uppermost 7 cm sediment of a single core after sieving through a 500 µm mesh; a) Station 225, 169 m deep, without macrozoobenthos and entirely diffusive solute transport. b) Station 305, 150 m deep, dominated by *Nuculana* and high bioirrigation

Living animals of the bivalve *Nuculana cf. bicuspidata* were found only at station 305 with a mean abundance of 4.8 ± 2.6 (n=9) living animals per sediment core and 6,000 individuals per square meter, respectively. Empty shells were also found at stations 279 and 304. The accompanying gastropod resembling *Nassarius vinctus* was found regularly in the shallow, muddy sediments between Kunene and Walvis Bay. Thus it appears, that the coupling between the presence of *Nuculana* and *Nassarius* is not as close as Zettler et al. (2009) suggested.

5.6 Carbon – Biogeochemistry (GENUS SP-4)

(A. Flohr, C. Steigüber)

Introduction

Within GENUS the subproject SP4-Biogeochmistry aims to study the functioning of the biological pump which is referred to as the uptake of carbon through the photosynthesis of organic matter, the precipitation of calcium carbonate and the subsequent transport of carbon from the surface ocean into the sediments. The biological pump strongly influences CO_2 fluxes across the air-water interface and the distribution of dissolved oxygen in the water column. Furthermore it plays an important role for the long-term sequestration of atmospheric CO_2 by linking the three major carbon reservoirs: atmosphere, ocean, and lithosphere.

Aims

The cruise MSM17/3 was the third GENUS cruise in which we participated. The collected data will complement our knowledge which up to now is based on data collected during March 2008 (RV MARIA S. MERIAN), December 2009 (FRS AFRICANA) and September 2010 (RRS DISCOVERY).
Our aims during the cruise MSM17/3 were:

1. to quantify CO_2 fluxes across the air-water interface along the cruise track
2. to measure total Alkalinity (TA) and dissolved inorganic carbon (DIC) concentrations in water samples collected along vertical profiles,
3. to take samples for the determination of nutrients (PO_4, NO_3, NO_2, Si), DOC and stable carbon isotope ratios of DIC ($\delta^{13}C_{DIC}$)
4. to deploy a drifter and a long term sediment trap

Methods

The mole fraction of CO_2 (xCO_2) was continuously measured in the ocean and the atmosphere by using an *Underway Carbon Dioxide Analyzer* (SUNDANS, Marianda). The system was calibrated every 3-7 hours by measuring pure nitrogen and 2 different standard gases with mixing ratios of CO_2 in air covering the range of the expected xCO_2 range. Pure seawater was continuously pumped from 6.5 m depth with a constant flow rate of 5 l min^{-1}. Sea water temperature, salinity, wind speed and the atmospheric pressure were continuously recorded. The collected data will be evaluated and used to convert xCO_2 to the fugacity of CO_2 (fCO_2) which is required to calculate the CO_2 flux across the sea water interface.

Vertical profiles were obtained by CTD casts along distinctive cross shelf transects at 26°S, 23°S, 21°S, 19°S and 17°S. Sampling was done at 5 stations per transect. About 400 water samples were taken for later analysis on nutrients, dissolved organic carbon (DOC) and stable isotope ratio of $\delta^{13}C_{DIC}$. The measurements of Alkalinity and DIC were performed on board with a VINDTA 3C system according to Dickson (2007).

A long term mooring was retrieved that had been deployed on 09.10.2010 and was recovered on 30.01.2011 off Walvis Bay. At the same spot a new long term mooring equipped with a sediment trap at 70 m depth was deployed and will be retrieved in July 2011. The cups will be opened for 18 days each. Furthermore a drifter buoy was released and equipped with a sediment trap at 60 m depth, additional temperature- and oxygen sensors and a positioning system. It was picked up 10 days later on the 10^{th} of February.

Preliminary results

The xCO_2 measurements were conducted along the cruise track with a latitudinal extent of 3°S to 26°S. The xCO_2 in the surface water revealed an extreme spatial variability caused by the complex interplay of CO_2 enriched upwelled deep water, biological uptake and CO_2 emission. Highest coastal CO_2 values of surface water were observed in the vicinity of the Lüderitz upwelling cell and along the coast up from Walvis Bay to the Kunene area reaching maximum concentrations of 1300 µatm. This is in line with the distribution of sea surface temperature (see chapters 5.1 and 5.5.1) where decreased temperatures indicated upwelling and hence strongly elevated xCO_2 concentrations. At first sight, the variability of xCO_2 was positively correlated to the online nutrient measurements of surface water (see 5.5.1). Elevated nutrient concentrations matched with an increase in xCO_2 suggesting upwelling, whereas regions with depleted nutrient values showed low and partly undersaturated xCO_2 with respect to atmospheric CO_2 concentrations indicating strong biological activity. Nevertheless, the results will still have to be complemented by meteorological background data.

In addition to the surface distribution of xCO_2, vertical profiles of TA and DIC are supposed to give a general idea of the carbonate system along the Namibian shelf. The biogeochemical setting of the Namibian shelf is known to be influenced by two central water masses: the South Atlantic Central Water (SACW) and the Eastern South Atlantic Central Water (ESACW) (Mohrholz et al., 2008). The SACW originates in the Angola Dome and intrudes onto the Namibian shelf from the north carrying nutrient rich and hypoxic water. Preliminary results of the CTD data and carbonate system parameters show a positive correlation between the amount of SACW, the DIC distribution and the apparent oxygen utilization (AOU) implying a water mass specific DIC signature (Fig. 5.13). More detailed analysis will provide valuable information about the water mass derived biogeochemical precondition set by (E)SACW intrusion along the shelf. Highest DIC concentrations (>2300 µmol kg^{-1}) were measured in bottom waters and particularly on the shelf. Especially in hypoxic to anoxic bottom waters the DIC concentrations were increased. These results will later be correlated to the findings of SP-3 (see 5.5.3) concerning the pore water fluxes across the sediment-water interface.

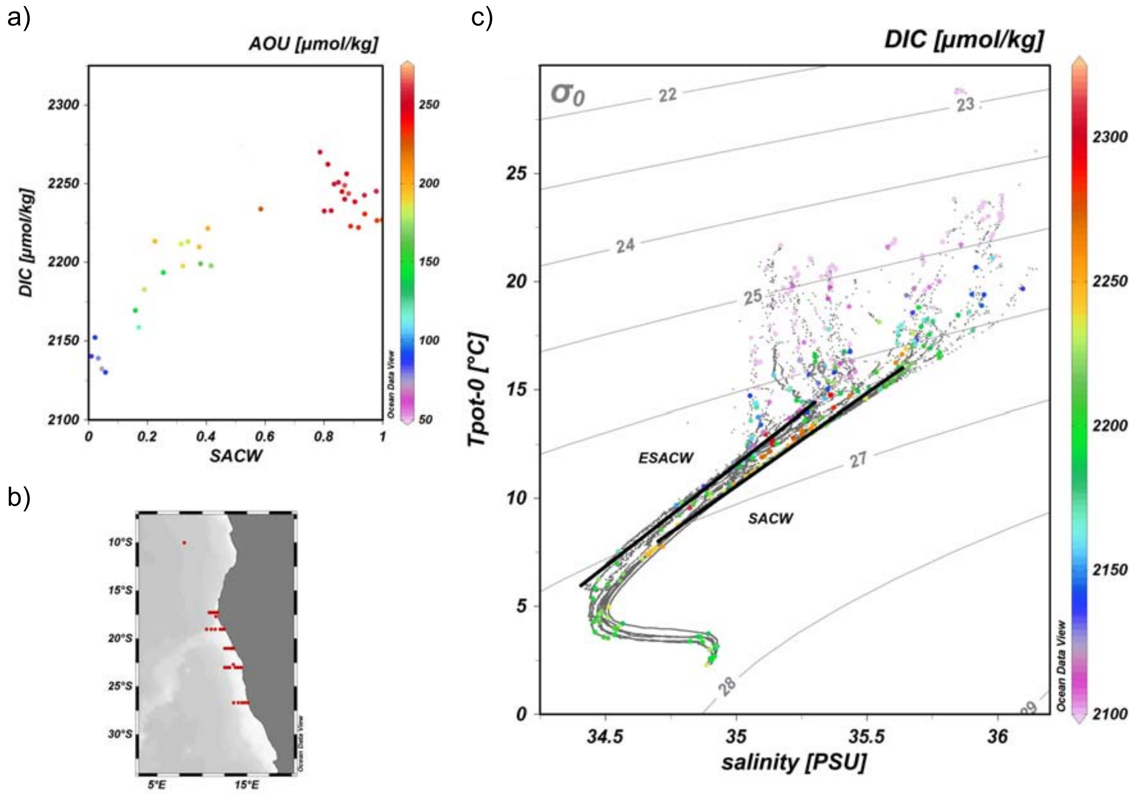

Fig. 5.13 a) Correlation between the amount of SACW (1.0 is equivalent to 100%), DIC [µmol kg^{-1}] and the apparent oxygen utilization AOU [µmol kg^{-1}]; b) Map with all stations being sampled; c) Temperature versus salinity and measured DIC [µmol kg^{-1}] values; the water masses SACW and ESACW are indicated by black lines

For determination of the carbon budget of the Namibian shelf it is necessary to assess the amount of material that sinks through the water column and reaches deeper water depths. A sediment trap was deployed from 09.10.2010-30.01.2011 approximately 20 nautical miles off Walvis Bay at 60 m depth. It was part of a mooring which also was equipped with several oxygen and salinity probes and an ADCP. The collecting cups of the sediment trap opened for 12 days each.

The sampled material will be analyzed for bulk components (organic carbon, biogenic silicate) phyto-, zooplankton composition and fluxes in close coorporation with SP-2 and SP-6. The hydrographical background data will be provided by SP-2. A first impression of the obtained samples suggests enhanced fluxes during late October to November and during January. Those samples consist mainly of algae whereas zooplankton species dominate the December cups (Fig. 5.14).

Table 5.3 Listed stations and amount of water samples that were taken during the cruise MSM17/3

				Amount of Water Samples			
Date	**Station#**	**Position**	**Bot. Depth [m]**	**AT/DIC**	**Nutrients**	**DOC**	**$\delta^{13}C_{DIC}$**
30.01.2011	222	23° 00.00'S 14° 03.00'E	134	10	-	-	10
30.01.2011	223	23° 00.00'S 13° 57.98'E	136	11	11	-	11
02.02.2011	232 (L4)	26° 40.08'S 15° 03.51'E	40	6	6	6	6
02.02.2011	233 (L3)	26° 39.99'S 14° 45.63'E	200	12	11	11	12
02.02.2011	234 (L2)	26° 39.95'S 14° 25.00'E	320	14	14	14	14
02.02.2011	235 (L1)	26° 39.97'S 13° 59.98'E	420	12	12	12	12
02.02.2011	236 (L1a)	26° 39.96'S 13° 30.00'E	1110	20	20	20	20
05.02.2011	241 (T8-1a)	26° 00.02'S 11° 45.03'E	3013	20	20	17	20
06.02.2011	242 (T8-1b)	23° 00.00'S 12° 29.97'E	1640	18	18	18	18
07.02.2011	243 (T8-1c)	23° 00.00'S 12° 48.00'E	910	15	14	14	15
07.02.2011	246 (T8-1d)	23° 00.00'S 13° 02.95'E	412	14	13	13	14
08.02.2011	250 (T8-1)	23° 00.00'S 13° 20.01'E	355	12	12	12	12
08.02.2011	254 (T8-3)	23° 00.00'S 13° 40.03'E	150	11	10	10	11
09.02.2011	265 (T8-5)	23° 00.00'S 14° 20.02'E	67	8	8	8	8
10.09.2011	266 (Drifter)	22° 42.13'S 13° 27.62'E	250	12	12	12	12
11.02.2011	268 (T7-5)	21° 00.58'S 13° 29.79'E	20	3	3	3	3
11.02.2011	269 (T7-4)	21° 00.00'S 13° 19.99'E	95	9	9	9	9
11.02.2011	270 (T7-3)	21° 00.00'S 13° 10.01'E	130	10	10	10	10
12.02.2011	271 (T7-2)	21° 00.00'S 12° 50.03'E	300	15	14	14	15
12.02.2011	272 (T7-1)	21° 00.52'S 12° 29.98'E	433	12	12	12	12
14.02.2011	279 (T5-5)	19° 00.00'S 12° 27.00'E	40	5	5	5	-
14.02.2011	280 (T5-4)	19° 00.00'S 12° 15.01'E	113	10	10	10	-
14.02.2011	285 (T5-3)	19° 00.00'S 12° 59.97'E	211	10	10	10	-
15.02.2011	292 (T5-2)	19° 00.00'S 11° 25.99'E	420	13	12	12	-
15.02.2011	295 (T5-1)	19° 00.00'S 11° 00.04'E	1310	18	17	17	-
17.02.2011	298 (T5-1a)	19° 00.00'S 10° 30.01'E	2230	16	16	16	-
19.02.2011	304 (T1-5)	17° 14.99'S 10° 43.01'E	40	6	5	5	6
19.02.2011	305 (T1-4)	17° 14.99'S 11° 30.00'E	150	11	10	10	11
20.02.2011	306 (T1-4a)	17° 15.00'S 11° 17.27'E	500	13	13	13	13
20.02.2011	307 (T1-3a)	17° 15.01'S 11° 10.97'E	924	15	15	15	15
20.02.2011	308 (T1-3)	17° 15.00'S 10° 59.90'E	2125	17	16	16	17
21.02.2011	309 (T1-2)	17° 15.00'S 10° 46.98'E	3018	17	16	16	11
26.02.2011	317 (Tr1_Ang)	09° 59.98'S 07° 59.95'E	4850	18	18	18	10
		Sum		**413**	**374**	**360**	**317**

Fig. 5.14 Samples of the sediment trap that was deployed in October 2010 off Walvis Bay and recovered during MSM 17/3 cruise

5.7 Ichthyoplankton, Fish Studies and Copepod Studies (GENUS SP-4)

(W. Ekau, S. Geist, C. von Waldthausen, H. Verheye)

The objectives of the ichthyoplankton work during cruise MSM 17/3 are aligned with investigations during preceding cruises in the study area on board RV MARIA S. MERIAN (2008), FRS AFRICANA (2009) and RRS DISCOVERY (2010), completing the seasonal coverage of data collection for investigating condition and feeding of fish larvae. The cruise is also one of a sequence of earlier cruises in 2008, 2007 (FRS Dr. FRITJOF NANSEN), 2004 (FS A. v. HUMBOLDT) and 2002 (FRS AFRICANA), providing a valuable time series of the distribution pattern of ichthyoplankton in the Northern Benguela system during late summer. The first aim was to collect a wide range of size classes of key species in the ecosystem to describe horizontal and vertical distribution patterns of the fish larvae, their condition and growth under different environmental conditions. The second aim was to catch and maintain early life stages of fish alive to measure oxygen consumption and tolerance as a proxy for food consumption and environmental constraints using on-board experiments. Besides these general investigations on the distribution of fish larvae and the measurement on their oxygen consumption, validation of daily increment deposition in otoliths was also performed by marking the fish with tetracycline and calcein. A third objective of the working group was the experimental measurement of egg production rates of dominant copepod species, in an attempt to obtain an estimate of secondary production.

Ichthyoplankton

Ichthyoplankton collections were made at stations on the shelf and slope up to water depths of 1400 m. Four different nets were used to catch fish eggs, larvae and juveniles and adult female copepods: an obliquely towed Multinet (MN_{obl}), a Tucker Trawl (TT), a Ring Trawl (RT) and a Driftnet. The Multinet (HYDROBIOS, type Midi: 0.25 m^2 mouth area) was equipped with five nets of 500 µm-mesh size, temperature and oxygen probes, and an inner and outer flowmeter to monitor the net's trajectory (for volume filtered calculations) as well as net clogging. It was towed obliquely over the side at 38 stations, usually in five different depth strata (or <5 at very shallow stations). The upper two nets were equipped with smaller net inlays with a mouth diameter of 12 cm and 55 µm mesh size, to simultaneously catch potential food organisms of the fish larvae as they were caught in these two nets. The Tucker Trawl has an effective mouth area of 1 m^2 and a large cod-end bucket; two mesh sizes were used: 500 and 1000 µm. Its opening/closing mechanism allows the collection of larvae in a targeted depth stratum of the water column without contamination with organisms (including jellies) above it. A total of 30 TT hauls were made within the upper 70 m of the water column. Short hauls of 0.5-5.0 min opening time provided the best results for catching live fish. The Ring Trawl has a diameter of 1.6 m and a mesh size of 1000 µm. It was deployed 12 times.

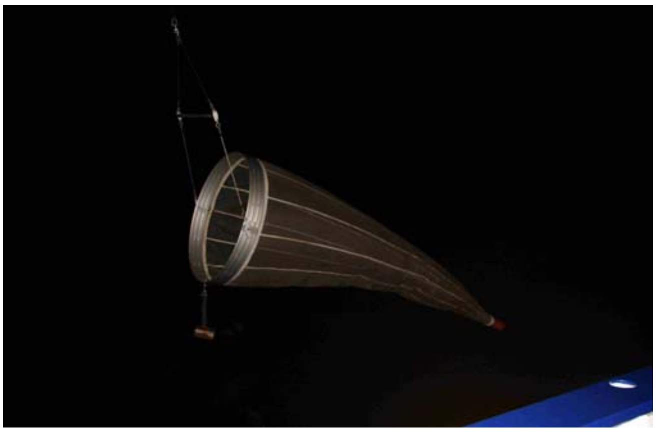

Fig 5.15 Modified Ring Trawl aka Verheye Driftnet

However, the Tucker Trawl catches did not yield the expected amounts of live fish larvae, most probably due to too high pressure in the cod end. Therefore, the Ring Trawl was modified during the cruise to a bigger version of the Driftnet, which has proved to be the most gentle way to catch zooplankton in the upper 15 m and therefore provides live animals in very good condition. This modified Ring Trawl (aka Verheye Driftnet) was deployed more than 10 times for a few minutes each at the inner Kunene transect stations and expectedly provided very good catches of surviving fish larvae from 4 to 20 mm. All nets were handled over the side, either towed horizontally at 2 knots (MN_{obl} and TT) or drifting in the upper 20 m with the ship stationary. Tucker and Ring Nets were not meant to catch quantitatively but rather used to collect larger quantities and/or live material in superior condition for experimental work.

All samples were analysed roughly for their content of fish larvae. All fish of the target species (Horse Mackerel, Clupeids, Flatfish, Gobies and Blenniidae) that were caught alive were transferred to temperature controlled fish keeping tanks for subsequent respiration experiments. Live female copepods in good condition were sorted out of the Drift nets for subsequent incubation experiments to study egg production rates. Dead fish larvae of the target species in good condition were sorted out, measured for standard length and immediately frozen to -80 °C for age determination and trophic analysis (stomach, fatty acid and isotope studies) in Germany. All remaining MN_{obl} samples were preserved in buffered formalin (4% in seawater) for quantitative community studies, which are part of a more then ten years long time series.

Live fish larvae were kept in a modified temperature controlled fridge and within the temperature controlled lab container at temperatures around 17-19°C, according to the water temperatures of the water bodies they were caught in. In the specially equipped 20’ Lab-Container owned by ZMT respiratory equipment for batch and intermittent flow through systems was set up during leg 2. Three during the GENUS project, newly developed systems for the measurement of oxygen consumption of fish larvae from 5 mm to 20 mm were used successfully during this cruise for the first time: (1) a batch system equipped with 20 ml respiration chambers containing a glass coated stirring bar and operated with the sensor spot system (PRESENS) and, (2) a Mini intermittent flow system consisting of a 35 ml respiration chamber, a Microx Flow Though Cell Oxygen sensor (PRESENS), a Tubing Pump and a ZMT-own built controlling box and software and (3) a Midi intermittent flow system consisting of a 350 ml chamber, a larger tubing pump and a Fibox Dipping Probe oxygen sensor (Presens). Additionally the already existing (4) large intermittent flow system for juvenile and adult fish was used during the cruise. Systems (2) and (3) are adaptations from system (4).

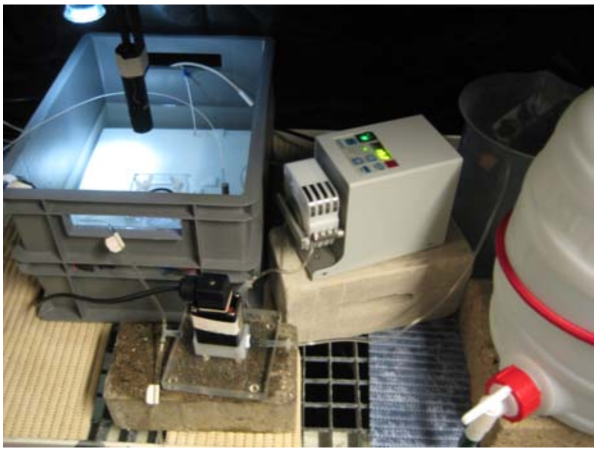

Fig. 5.16 Mini Intermittent Flow-Through Respiration

All intermittent flow systems are equipped with an online camera system to record fish movements, which allows a subsequent correlation of oxygen consumption to swimming activity. All four systems worked successfully during the cruise. In the future, efforts should be made to further optimize and improve the intermittent flow system in regard to miniaturisation and the quality of video images (lighting and cameras) since these setups provide much more information seem to stress the fish less than the batch systems, which basically record oxygen consumption without any knowledge what the animal is doing at the same time. Regarding the batch system, a solution to capture fish movements would be the most urgent improvement.

Preliminary results

During part 1 of the cruise leg, mainly stations south of Walvis Bay and the Walvis Bay line have been worked. The abundance of eggs and larvae was generally low in the whole area except some few stations on the inner part of the Walvis Bay line and some nautical miles south of it. The first station the ship called was T8-4 (MSM #224), known from former cruises to be a good site for fish larvae. Large amounts of sardine larvae were encountered also this year, and a replication of the station was done at the end of part 1 of the leg, when the Walvis Bay line was worked up. T8-3 and T8-4 revealed high numbers of sardine and horse mackerel larvae indicating recent spawning of the two species in the area. The shelf edge station L3 on the Lüderitz line (MSM #233; water depth 195 m) resulted in unexpected high numbers of pelagic goby larvae indicating this area to be a spawning place for the species.

During part 2 of the cruise leg four transects (Toscanini, Terrace Bay, Rocky Point, Kunene) and a few transit stations in between have been worked. At several stations large numbers of pelagic fish larvae were caught. Clupeids were found in big numbers at Station #266 (mainly Pilchard), T6-2, T5-2, WKT2c, T1-5 and T1-4 (mainly Anchovy, but Pilchard and Sardinella occurred especially at Kunene, as well). Cape Horse Mackerel were caught in sizes from 3 mm to 6cm. Larger individuals were mainly caught at T7-5 and T7-4, smaller specimen up to 20 mm were abundant in larger numbers at the Drifter station (#266), T6-3, T5-4, T5-3 and T1-4. At the latter station *Trachurus trecae*, the tropical sister species, occurred as well.

A fair number of about 200 live Horse Mackerel larvae were caught during this cruise. Even very fragile clupeid larvae could be caught alive with the modified Ring Trawl, but died within a few hours after catching. A further further technical improvement of the Driftnet could allow catching more specimen alive and in good condition. At the moment, the only way to get live larvae for experiments is the time, cost and labour intensive rearing of wild caught eggs. Some Goby larvae were caught alive at inner shelf stations (Drifter, T1-5) and several species of flatfish larvae were caught in a total number of about 100 at the innermost station of the Kunene transect (T1-5).

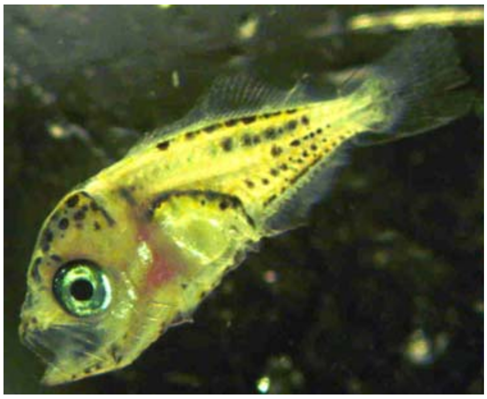

Fig. 5.17 Larva of *Trachurus trachurus*

More than 1000 fish larvae mainly from horse mackerel and clupeid species were frozen either directly after the catch or after they died in captivity. Otolith marking with Calcein and/or Tetracyclin was done for more than 60 fish, mainly horse mackerels and flatfish.

Mortality of fish caught alive is usually high within the first day after catch and then after several days, if no appropriate food can be provided. Especially for the very small horse mackerel larvae food supply is very difficult. Wild catches are usually mixed with other gelatinous zooplankton, which affects water quality in fish keeping tanks very quickly and a sorting of mikrozooplankton is limited by time constraints. Thus wild food could only provided for larger larvae from 10 mm, but still this depends on the abundance of potential food since the ship does only stay for a very short time in the water body where the larvae occur during such a cruise. We therefore raised copepod nauplia (Acartia tonsa) and Artemia salina from eggs brought from Germany during the cruise and enriched them with deep frozen Nannochloropsis algae or Selco. Artemia was successfully fed to larger larvae and juveniles, but Acartia did not work very well for 5 mm larvae even they are of appropriate size which caused high mortalities 3-5 days after catching.

In total 65 respiration experiments were conducted with larvae of the two horse mackerel species during leg 2 to assess routine metabolism at different sizes (age). Experiments lasted from 3-36 hours per fish. Since the larger portion of all live fish caught were rather small the majority of experiments was conducted either with the batch system or the mini intermittent flow through system, but all four sytems described above were used.

Secondary production

Secondary production work in the northern Benguela Current region off Namibia has been conducted during several cruises since 1997. It is defined as the conversion by heterotrophs of assimilated energy derived from primary producers into body tissue, or the amount of tissue (= biomass) accumulated by zooplankton (and zoobenthos) per unit time and per unit area, regardless of its fate. It also includes production lost to predators and other loss sources in addition to reproductive products (i.e. eggs). Copepods are very suitable for estimating zooplankton production because of their abundance and life history features. Calculation of copepod production requires data on biomass (obtained from net tows) and growth rate. The latter comprises somatic growth (weight gain) of larvae (naupliar stages N1-N6) and juveniles (copepodite stages C1-C5) plus reproductive growth (fecundity or egg production) of adult females, with the contribution by adult males considered negligible.

The focus during Leg 2 of the cruise was on the measurement of female fecundity of dominant broadcast-spawning calanoid copepods. Usually, lively, undamaged specimens were gently sorted from 5-minute Driftnet collections made in the upper 10-15 m, within 15 minutes after collection ensuring that the animals remain in a pristine condition. Daily egg production rates (EPR) were measured using bottle incubations. Typically, adult female copepods were placed singly (on a few occasions in pairs or triplets depending on species and body size) into opaque 1-litre incubation bottles, filled with ambient surface water filtered through a 63-µm mesh to exclude possible contamination with eggs present therein. The bottles were maintained at ambient sea surface temperature in a dark on-deck incubator with continuous flow-through of surface seawater. After 24 hours, the incubations were terminated, the condition of the female(s) was assessed and the eggs spawned (and the nauplii that had hatched) during the incubation period were enumerated under a microscope. The number of eggs + nauplii per female produced during a 24-h period is a measure of fecundity or daily EPR. Experiments where females were found dead or moribund are not considered for further analysis.

In total, 138 EPR experiments (8 of which were unsuccessful) were conducted during the cruise. Driftnet catches were obtained from 32 station positions and a total of 168 adult females of 9 identified, 2 to be verified, and 6 as yet unidentified copepod species were incubated and their EPR measured. The minimum, maximum and mean EPR for each of the 17 taxa are summarized in the Summary Table below. Taxonomic identification of a number of taxa remains to be done or verified and more rigorous analysis of the data is required, so that the EPRs reported here should be viewed as preliminary. In particular, EPRs are often a reflection of recent feeding history and therefore usually related to either or both the quantity and quality of ingested food, which together with other environmental conditions (e.g. temperature) vary between the water masses encountered during the cruise; these include water masses of Benguela, Angola and Guinea Current origin, various maturity states of nutrient-enriched coastal upwelling water, oligothrophic oceanic water, etc.). Thus far, no such relational analyses have been performed and the mean EPRs shown here are simply values averaged over the entire study area covered; hence, their interpretation ought to be treated with utmost caution.

Table 5.4 Daily EPR (eggs female^{-1} day^{-1}) during Feb.-Mar., 2011

Species	n	min	max	mean
Calanoides carinatus	31	0.0	157.4	44.6
Candacia pachydactyla	2	0.0	0.0	0.0
Centropages brachiatus **	8	0.0	53.4	9.0
Eucalanus hyalinus ?	2	6.8	27.3	17.1
Labidocera acutifrons	31	0.0	141.0	36.3
Nannocalanus minor	8	0.0	52.1	25.3
Pareucalanus sewelli	15	0.0	16.8	3.3
Pontella securifer	3	1.9	44.3	27.4
Pontellid (small species)	2	0.0	1.0	0.5
Scolecithrix danae	14	0.0	1.7	0.6
Undinula vulgaris	8	0.0	1.5	0.2
unidentified sp. 1	1	0.0	0.0	0.0
unidentified sp. 2	1	0.0	0.0	0.0
unidentified sp. 3	1	0.0	0.0	0.0
unidentified sp. 4	1	0.0	0.0	0.0
unidentified sp. 5	1	13.6	13.6	13.6
unidentified sp. 6	1	53.0	53.0	53.0
Total No. of successful experiments	130			

** eggs/nauplii in one experiment remain to be enumerated

Of particular interest are the EPRs of *Calanoides carinatus* and *Centropages brachiatus*, two typical upwelling species, and *Labidocera acutifrons*, a member of the family Pontellidae, which are neustonic rather than planktonic. For *C. carinatus*, a typical upwelling species, a maximum EPR of 157.4 eggs spawned female^{-1} day^{-1} was measured at station #269 (T7-4), with a mean EPR of 44.6 eggs female^{-1} day^{-1}. Notwithstanding seasonal variability, both values are considerably higher compared with measurements during any of the aforementioned previous cruises in the northern Benguela/Angola Benguela Frontal region. While a maximum rate of 143.0 eggs female^{-1} day^{-1} (mean = 24.0 eggs female^{-1} day^{-1}) has been reported for this species in the southern Benguela off South Africa, where egg production rates have been measured since 1988, the maximum EPR of 157 eggs female^{-1} day^{-1} measured during this cruise is the highest ever recorded for this species for the Benguela Current region (or elsewhere according to the literature).

Egg production rates of *C. brachiatus*, another typical upwelling species, were maximally 53.4 eggs female^{-1} day^{-1}, with a mean of 9.0 eggs female^{-1} day^{-1}. Although eggs and nauplii remain to be enumerated from one experiment at Station 274 (T6-1), these values are very low compared to most previously measured rates in the region (e.g., 224.0 (max.) and 75.7 (mean) in

April 1997, and 231.2 (max.) and 86.7 (mean) in September 2010), except for July 1999 when record low EPRs (max. 17.5 and mean 7.4) were measured for this species.

L. acutifrons is one of three pontellid species commonly observed in the study area. Pontellids are neustonic copepods typically living at the sea-air interface, where they provide a food source for certain seabirds. They are usually of a blue coloration, and are therefore by some referred to as ‘smurfs’. Some pontellid species are regarded as useful indicators of particular water masses, and in the Benguela region they are usually found in association with the warmer waters of Angola Current origin. During the cruise, this – and two other pontellid species – started appearing in the Driftnet catches as from station 295 (T5-1) onward and were present throughout the remainder of the survey up to the last station (319) north of the Equator. The max. EPR of 141 eggs female^{-1} day^{-1} measured for *L. acutifrons* during this cruise was well below the record value of 228.4 eggs female^{-1} day^{-1} (February 2002), but its mean EPR of 36.3 eggs female^{-1} day^{-1} is of the same order of magnitude as previously measured.

Finally, it is noteworthy that otherwise commonly observed species such as *Metridia lucens* and *Rhincalanus nasutus* were not prominent/present in any of the Driftnet catches.

5.8 Micro- and Mesozooplankton Sampling and ROV Surveys (GENUS SP-5)

(R. Koppelmann, B. Martin, K. Bohata, A. Eckhardt, S. Jung, B. Kullmann)

Zooplankton organisms are important for the transfer of organic material from primary producers into higher trophic levels and into greater depths; and they play an important role for the re-mineralization of organic matter (Robinson et al., 2010). The main goals of the GENUS SP-5 are to examine the horizontal and vertical distributions of different groups of meso- and macrozooplankton, their trophic role, and their contribution to the oceanic carbon cycle in the high productive Benguela Upwelling region. Organic material produced in this region is transferred into higher trophic levels, remineralised in the pelagic environment and sinks to the bottom. The variability of these processes and the involvement of different zooplankton groups will be assessed in the GENUS project. A synoptic sampling of mesozooplankton was performed with a 1m^2-Double-MOCNESS (Wiebe et al., 1985) to analyse the role of different zooplankton groups in biogeochemical processes. This is part of time-series sampling already performed in March/April 2008 (RV MARIA S. MERIAN), December 2009 (FRS AFRICANA) and September/October 2010 (RRS DISCOVERY). Little is known so far about the contribution of microzooplankton to the pelagic remineralisation and its general role in the food web. This faunal element was sampled in addition to the mesozooplankton with water bottles and multinets. A fraction of the sinking organic material reaches the sea bottom, where it is consumed by benthic organisms, or decomposed by bacteria. A first overview about the structure of the sediment and the benthic megafauna was obtained by surveys with a remotely operated vehicle (ROV).

Microzooplankton sampling

Microzooplankton organisms are defined as organisms <200 µm in this study (see Sieburth et al., 1978) and consist of Protozoa and small Metazoa. These organisms are important in pelagic food webs. Until now, they have been investigated only sparsely in the Namibian Upwelling Region despite their importance for the microbial loop and their potential relevance as food for larger zooplankton.

Water samples for later analyses of bacteria and protozoa were collected with a CTD at 7 stations in different depths. Depending on the depth of the sample, between 1 l and 10 l of water were fixed with formaldehyde buffered with sodium-tetraborate at an end-concentration of 2 %. The deepest station was in Angola Dome, where samples at 5, 50, 200, 500, 1000, 2000, 3000 m depth and close to the bottom (ca. 4830 m) were taken.

Microzooplankton and small mesozooplankton was collected by stratified vertical hauls with a multinet (HYDROBIOS, Kiel, Germany). The Multinet was equipped with four nets with 55 µm mesh aperture which can be opened and closed in distinct water depths. The Multinet was deployed at 29 stations down to the maximum sampling depth where the first net was opened. It was deployed twice at stations deeper than 200 m. Sampling intervals were 200-100-50-25-0 m depth for the shallow hauls and 1000-600-400-200-0 m depth for the deep hauls. All material was preserved in a 4% formaldehyde-seawater solution buffered with sodium-tetraborate for later analyses.

Mesozooplankton sampling

Like in former years (2008, 2009, 2010), mesozooplankton was sampled at the two main transects, off Walvis Bay and off the the Kunene river mouth, to obtain a synoptic picture of the composition and distribution of the main taxonomic groups of the mesozooplankton. During this expedition, a southern transect off Lüderitz as well as the Rocky Point transect were additionally sampled. Furthermore, one station was sampled in Angola Dome waters.

The 1 m² Double-MOCNESS is equipped with 18 nets with a mesh size of 330 µm. The nets can be opened and closed sequentially. The sampling intervals on this cruise were 25 m in the top 50 m, 50 m down to 100 m, and 100-200 m at greater depths. Samples were collected with parallel nets down to a maximum depth of 1000 m at the offshore stations and close to the bottom at the inshore stations, with the exception of the offshore station at the Kunene transect, where two deep hauls were conducted down to 3000 m and 2900 m depth. If possible, stations were sampled during day and night. In total, 30 hauls were taken with the Double-MOCNESS.

The volume filtered by each net is calculated from a flow-meter mounted in the net system's mouth. Upon recovery of the MOCNESS, the nets were rinsed with seawater and half of the nets were sorted for gelatinous species, special copepod taxa, krill and fish larvae; the remaining samples were frozen at -80°C for subsequent stable isotope analyses. The other half of the catch was preserved immediately in a 4% formaldehyde-seawater solution buffered with sodium-tetraborate for future taxonomic and biomass analyses.

Quantification and qualification of major zooplankton groups will be undertaken in the home-laboratory, as well as stable isotope analyses of N and C for further insights in the food web structure. Migrating taxa will be determined and quantified and certain groups like chaetognaths, pteropods and medusa will be studied more intensively concerning their abundance, composition, distribution, predation pressure and level in the food web.

Medusae of *Chrysaora* spp., *Aequorea* spp. and *Atolla* spp. as well as other gelatinous organisms were common at the onshore stations of the Lüderitz transect, possibly indicating an active upwelling cell. The abundance of gelatinous organisms was lower on the northern transects.

At the shelfbreak off Kunene a strong stratification was found during daytime with high amounts of krill in 600–400 m depth, very few planctonic organisms in 400-100 m depth and an increasing number of organisms in the upper 100 m. At the onshore stations decaying phytoplankton was found in the upper water column.

ROV surveys

Different structures of sediments and differences in benthic megafauna are expected along the coast on the Namibian shelf and on the continental slope. These differences will be examined by surveys with an ROV, optically mapping the seafloor. This information together with data on currents, particle fluxes and zooplankton abundance and composition in the overlaying water column will help to understand the processes forming the benthic community and will give insights into the transport of organic material from the shelf into the deeper ocean.

A modified MOHAWK ROV was used at six stations in the northern Namibian Upwelling System. The ROV has a depth rating of 1000 m and is equipped with colour zoom and black and white cameras. Environmental data were measured with a CTD and an oxygen optode. The ROV was deployed at four shelf stations between water depths of 100 to 200 m and at two slope stations at water depths of 500 and 800 m. After paying out 50 m of the tether, the umbilical was connected by tie raps to a wire which was paid out concomitantly with the diving progress of the ROV down to 20 m above bottom. This method enabled a save manoeuvring of the ROV above the bottom. The ship followed the ROV by getting its position from the POSIDONIA system.

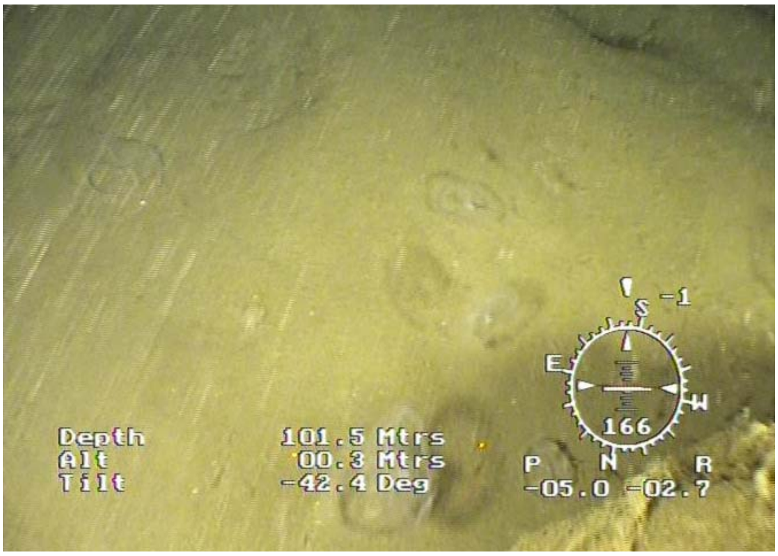

Fig. 5.18 Gelatinous organisms at the sea-bottom

All stations showed differences in the structure of the sediments. At the southern station (T6-3), the sediment was very muddy and each movement of the ROV caused a cloud of resuspended particles which hampered the visibility. Many Medusae were detected close to the bottom at this station (Fig. 5.18). Their orientation was upside-down, giving the impression that they act as living sediment traps catching the rain. Farther north, at both stations on transect T5, the bottom was covered with patches of bacteria mats, decreasing with increasing depth. Between these patches, gobyid fishes were sitting at the bottom. On the northernmost transect, off the Kunene River, high densities of particles were detected at all stations throughout the water column. Polyps covered the sea bottom at the 150 m deep station T1-4. Pennatularia, shrimps and snails dominated the benthic megafauna at the 500 m deep station T1-4a (Fig. 5.19). At the deepest station T1-3a (800 m), different fishes could be observed. Close to the bottom, the concentration of zooplankton and particles was higher than at the 500 m deep station.

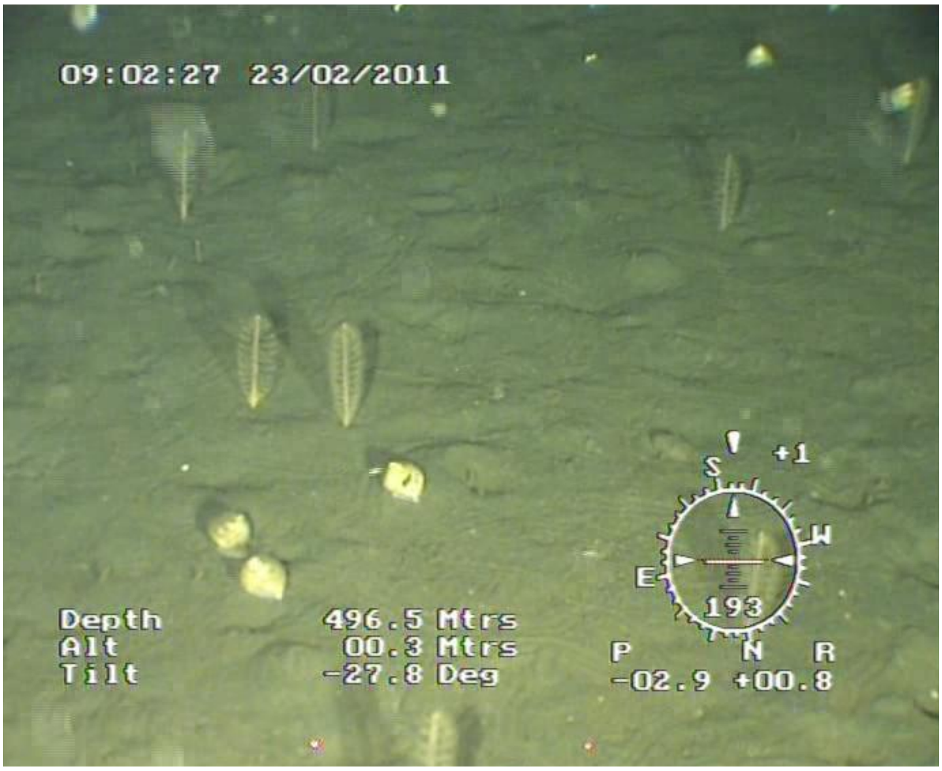

Fig. 5.19 Pennatularia and snails at 500 m depth

Conclusion and synthesis

Overall, the sampling and ROV program was very successful. The collected material will enhance our knowledge about the temporal and spatial distribution of zooplankton and its composition. In addition to the routine mesozooplankton sampling program of GENUS I, microzooplankton material was sampled and bottom surveys were undertaken, which provide the basis for future Bachelor and Master of Science and PhD-theses. After a detailed analysis of the biological samples (composition, abundance, distribution, stable isotopes) in the home-laboratory within the next two years, the abiotic parameters provided by the physical oceanographers (SP-2) will be used to interpret the distribution patterns of different zooplankton groups. The stable isotopic composition of seston as a trophic baseline measured by SP-3 will be used to investigate trophic interactions together with data about primary producers (SP-2), other zooplankton (SP-6 and SP-7) and ichthyoplankton (SP-4) taxa. The results of the ROV surveys will be compared with data about the sediment structure provided by SP-3.

Tab. 5.5 Water samples from CTD for microzooplankton analyses

Station#	Date	Daytime	Water Depth [m]	Sample Depth [m]	Transect
241	05.02.11	Day	2963	1000, 500,200,50,5	Walvis Bay
250	08.02.11	Day	350	deep, 200, 50, 5	Walvis Bay
264	09.02.11	Day	66	5, 50	Walvis Bay
304	19.02.11	Night	35	deep, 5	Kunene
305	19.02.11	Day	500	deep, 200, 50, 5	Kunene
310	22.02.11	Night	3270	1000, 500,200,50,5	Kunene
317	26.02.11	Night	4830	deep, 3000, 2000, 1000, 500, 200, 50, 5	Angola Dome

Tab. 5.6 Sampling data of Double-MOCNESS hauls. WB = Walvis Bay transect, LÜ = Lüderitz transect, RP = Rocky Point transect, KR = Kunene River transect, AD = Angola Dome

Haul	Station#	Date	Start Time UTC	Water Depth [m]	Region	Sample intervals [m depth]
01	222	30.01.11	14:10	134	WB	100-50-25-0
02	224	30.01.11	20:45	134	WB	100-50-25-0
03	233	02.02.11	15:05	197	LÜ	150-100-50-25-0
04	233	02.02.11	18:35	195	LÜ	150-100-50-25-0
05	236	03.02.11	13:00	1130	LÜ	1000-800-600-400-200-100-50-25-0
06	236	03.02.11	23:29	1130	LÜ	1000-800-600-400-200-100-50-25-0
07	241	05.02.11	19:14	2960	WB	1000-800-600-400-200-100-50-25-0
08	241	06.02.11	6:23	2950	WB	1000-800-600-400-200-100-50-25-0
09	242	06.02.11	15:26	1700	WB	1000-800-600-400-200-100-50-25-0
10	242	06.02.11	21:23	1650	WB	1000-800-600-400-200-100-50-25-0
11	243	07.02.11	01:17	930	WB	800-600-400-200-100-50-25-0
12	243	07.02.11	10:34	930	WB	800-600-400-200-100-50-25-0
13	250	08.02.11	09:27	350	WB	300-200-100-50-25-0
14	254	08.02.11	21:32	155	WB	140-100-50-25-0
15	285	14.02.11	14:22	200	RP	150-100-50-25-0
16	285	15.02.11	03:05	200	RP	150-100-50-25-0
17	292	16.02.11	01:00	420	RP	380-200-100-50-25-0
18	295	16.02.11	12:11	1320	RP	1000-800-600-400-200-100-50-25-0
19	295	16.02.11	19:55	1220	RP	1000-800-600-400-200-100-50-25-0
20	298	17.02.11	11:21	2000	RP	1000-800-600-400-200-100-50-25-0
21	298	17.02.11	18:10	2000	RP	1000-800-600-400-200-100-50-25-0
22	305	19.02.11	12:26	150	KR	100-50-25-0
23	306	19.02.11	23:41	460	KR	400-200-100-50-25-0
24	307	20.02.11	02:42	870	KR	600-400-200-100-50-25-0
25	307	20.02.11	11:00	900	KR	600-400-200-100-50-25-0
26	309	21.02.11	00:02	3590	KR	1000-800-600-400-200-100-50-25-0
27	309	21.02.11	11:42	3890	KR	1000-800-600-400-200-100-50-25-0
28	310	21.02.11	17:35	3250	KR	3000-2500-2000-1750-1500-1250-1000-800-600-400-200-100-50-25-0
29	310	22.02.11	06:15	3250	KR	2900-2500-2000-1750-1500-1250-1000-800-600-400-200-100-50-25-0
30	317	25.02.11	23:55	4830	AD	1000-800-600-400-200-100-50-25-0

Tab. 5.7 Multinet samples for microzooplankton and small mesozooplankton analyses

Haul	Station#	Date	Start Time [UTC]	Coordinates	Water Depth [m]	Sample intervals [m depth]
1	233	02.02.11	16:43	26°41'S, 14°45'E	195	150-100-50-25-0
2	235	03.02.11	07:49	26°43'S, 14°01'E	460	380-200-100-50-25-0
3	236	03.02.11	17:36	26°40'S, 13°30'E	1092	1000-600-400-200-100
4	236	03.02.11	19:00	26°40'S, 13°30'E	1092	100-50-25-0
5	241	06.02.11	04:35	22°59'S, 11°45'E	2963	1000-600-400-200-0
6	241	06.02.11	06:04	22°59'S, 11°45'E	2963	100-50-25-0
7	242	06.02.11	13:41	23°00'S, 12°29'E	1650	1000-600-400-200-0
8	242	06.02.11	15:00	23°00'S, 12°29'E	1650	200-100-50-25-0
9	243	07.02.11	07:46	23°04'S, 12°49'E	919	850-600-400-200-0
10	244	07.02.11	08:46	23°04'S, 12°49'E	920	200-100-50-25-0
11	250	08.02.11	13:08	23°07'S, 13°22'E	336	300-200-100-50-25-0
12	254	09.02.11	22:45	23°02'S, 13°41'E	158	100-50-25-0
13	260	09.02.11	10:11	23°01'S, 14°03'E	136	100-50-25-0
14	264	09.02.11	15:12	22°59'S, 14°20'E	66	50-25-0
15	269	11.02.11	15:23	20°59'S, 13°20'E	95	80-50-25-0
16	271	12.02.11	00:27	20°59'S, 12°50'E	300	290-100-50-25-0
17	272	12.02.11	09:11	21°00'S, 12°30'E	433	400-200-100-0
18	272	12.02.11	09:49	21°00'S, 12°30'E	433	100-50-25-0
19	274	12.02.11	21:09	20°00'S, 11°50'E	410	400-200-100-0
20	274	12.02.11	21:44	20°00'S, 11°50'E	410	100-50-25-0
21	275	13.02.11	03:02	20°00'S, 12°10'E	278	200-100-50-25-0
22	276	13.02.11	08:09	20°00'S, 12°10'E	156	150-100-50-25-0
23	282	14.02.11	05:25	19°00'S, 12°13'E	109	100-50-25-0
24	285	14.02.11	13:41	18°59'S, 12°00'E	206	180-100-50-25-0
25	292	15.02.11	23:29	19°00'S, 11°26'E	411	380-200-100-0
26	292	15.02.11	00:06	19°00'S, 11°26'E	411	100-50-25-0
27	295	16.02.11	14:35	19°05'S, 11°12'E	1200	1000-600-400-200-0
28	295	16.02.11	14:35	19°05'S, 11°12'E	1200	200-100-50-25-0
29	298	17.02.11	07:12	19°00'S, 10°29'E	2054	1000-600-400-200-0
30	298	17.02.11	07:12	19°00'S, 10°29'E	2058	200-100-50-25-0
31	305	19.02.11	10:00	17°15'S, 11°30'E	143	130-100-50-25-0
32	306	19.02.11	20:32	17°19'S, 11°19'E	427	400-200-100-0
33	306	19.02.11	21:14	17°19'S, 11°19'E	447	100-50-25-0
34	307	20.02.11	08:17	17°16'S, 11°11'E	820	800-600-400-200-0
35	307	20.02.11	09:25	17°56'S, 11°11'E	820	200-100-50-25-0
36	306	20.02.11	17:30	17°15'S, 11°00'E	2005	1000-600-400-200-0
37	306	20.02.11	18:50	17°15'S, 11°00'E	2035	200-100-50-25-0
38	309	21.02.11	07:33	17°15'S, 10°47'E	3384	1000-600-400-200-0
39	309	21.02.11	08:57	17°15'S, 10°47'E	2982	200-100-50-25-0
40	310	22.02.11	14:48	17°15'S, 10°29'E	3267	1000-600-400-200-0
41	310	22.02.11	16:07	17°15'S, 10°29'E	3269	200-100-50-25-0
42	317	26.02.11	04:39	10°07'S, 08°03'E	4829	1000-600-400-200-0
43	317	26.02.11	06:01	10°07'S, 08°03'E	4819	200-100-50-25-0
44	317	26.02.11	10:39	10°06'S, 08°03'E	4828	1000-600-400-200-0
45	317	26.02.11	12:11	10°06'S, 08°03'E	4830	200-100-50-25-0

Tab. 5.8 ROV Deployments

Station#	No.	Date	Start UTC	End UTC	Coordinates	Water depth	Remarks
273	28	12.02.11	14:18	14:43	20°46'S, 12°21'E	ROV 40 m	Blue water test
277 (T6-3)	29	13.02.11	14:11	15:36	20°02'S, 12°50'E	100 m	
282 (T5-4)	30	14.02.11	07:02	09:19	19°00'S, 12°15'E	110 m	
285 (T5-3)	31	15.02.11	06:59	09:45	19°00'S, 12°00'E	206 m	
305 (T1-4)	32	19.02.11	07:19	09:44	17°15'S, 11°30'E	149 m	
306 (T1-4a)	33	19.02.11	15:02	16:13	17°15'S, 11°17'E	500 m	Winch failed
314 (T1-4a)	34	23.02.11	07:16	10:35	17°15'S, 11°17'E	500 m	
315 (T1-3a)	35	23.02.11	13:24	16:58	17°15'S, 11°12'E	813 m	

5.9 Distribution and Physiology of Calanoid Copepods and Decapods in the Benguela Upwelling System and the Tropical Atlantic (GENUS SP-6)

(A. Schukat, L. Teuber, M. Bode, P. Wencke, J. Kutter)

The main work of SP-6 deals with the impact of the dominant calanoid copepods and decapods on the carbon flux in the Benguela upwelling system. Especially copepods play an important role within the zooplankton community linking primary production with higher trophic levels in the food web. Pelagic decapods are also widely distributed in the Benguela ecosystem, but their ecology and physiology is scarcely known. The team of this sub-project had extensively sampled Zooplankton during preceding cruises in the study area on board RV MARIA S. MERIAN (2008), FRS AFRICANA (2009) and RRS DISCOVERY (2010). To complement the existing data sets, the sampling programme was continued on this cruise. Besides collecting zooplankton for distribution and abundance studies, the main focus this time was put on experimental work. In order to quantify the carbon flux, respiration measurements of dominant copepods and decapods were conducted. Individual respiration rates of these organisms lead to estimations of their metabolic rate and thus ingestions rates and energy fluxes can be calculated.

Sampling

On the first part of this cruise, copepods and decapods were collected for respiration measurements on board and enzyme activity determination in the home lab. The animals were sampled by different net types (Multinet obligue, MOCNESS double and single) operated by other GENUS teams. The objectives were to characterise the influence of temperature shifts on respiration rates and enzyme activities of chosen copepod species.

On the transit through the tropical Atlantic, different mesozooplankton species were sampled by stratified vertical hauls with a Multinet Midi (HYDROBIOS, Kiel, Germany; mouth opening: 0.25 m^2: mesh size: 300 µm). In total, five stations were sampled: the two outer stations of the Kunene transect (17°15’S, 10°30’E; 17°15’S, 10°00’E) and three stations during the transit to Dakar (Angola Dome (9°60’S, 8°00’E), south (4°07’S, 1°26’W) and north (3°47’N, 13°58’W) of the equator. The Multinet was lowered to a maximum sampling depth of 1000 m. A set of five discrete depth layers was sampled according to the oxygen profile derived from preceding CTD casts. Exact sampling intervals were chosen with respect to the local hydrographic regime, especially the vertical extend of the oxygen minimum zone (OMZ). Starting at the northern most Kunene transect, where waters had already tropical temperatures, the focus of the respiration measurements shifted from temperature influences to effects of hypoxia on individual respiration rates.

Experimental work
Net samples were analysed under a dissecting microscope and specimens of different copepod species were sorted out for respiration measurements. The remains of the vertical Multinet samples were preserved in a 4% formaldehyde in seawater solution for later analyses of mesozooplankton abundance, biomass, vertical distribution and species composition.

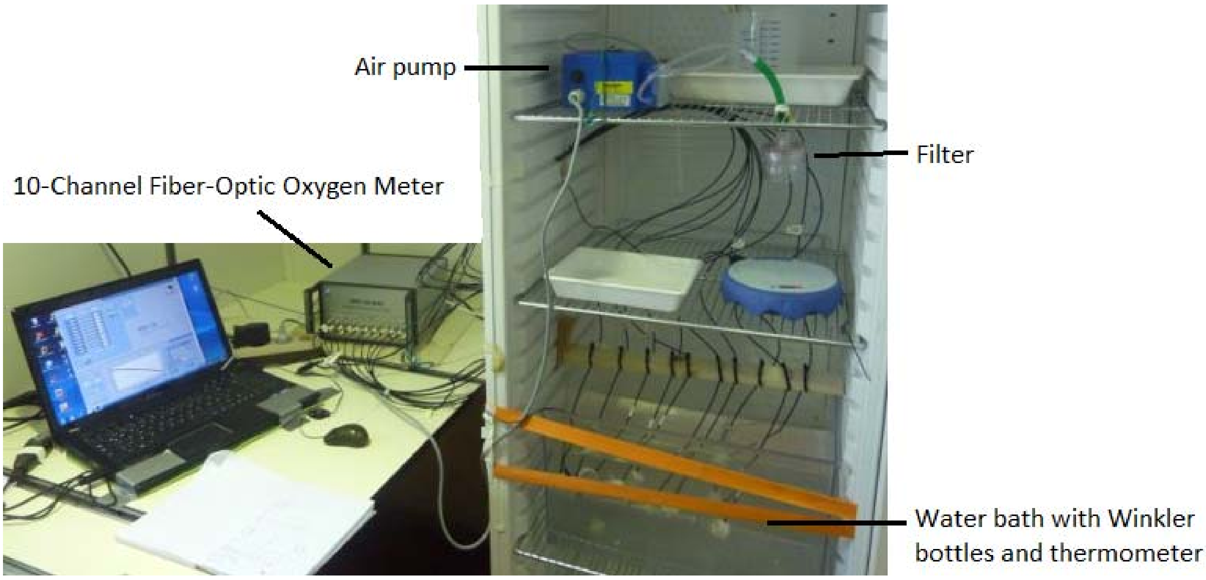

Fig. 5.20 Experimental set-up of the 10-channel fiber-optic oxygen meter

Respiration rates of different copepod species were measured by optode respirometry with a 10-channel optode respirometer (PRESENS Precision Sensing Oxy-10 Mini, Regensburg, Germany) in temperature controlled fridges on board (Fig. 5.20). This method of oxygen consumption measurements has several advantages towards the traditional Winkler-technique, especially for small organisms like copepods (Köster et al., 2008). Depending on body size, even single individuals can be used and oxygen consumption is measured continuously. The method was specifically adapted to copepods and to the suitability for onboard experiments. The incubation of specimens during experiments was performed in small 10 ml gas-tight glass bottles. In contrast to the very delicate fish larvae and larger krill that need a different experimental design (see chapters 5.7 and 5.10), copepods are rather robust and easier to handle.

The parameters of each measurement were determined according to the different objectives; simulated *in situ* conditions, a chosen temperature shift (*In situ* temperature ± 5°C) or hypoxic start-concentrations. Depth profiles of temperature derived from the CTD sensor at each station were used to set the fridges to the ambient temperature at sampling depth. Seawater with less than 100% oxygen saturation was prepared either by bubbling nitrogen into a water tank or it was taken from a CTD water sampler of the needed oxygen concentration. Experiments were run in glass bottles filled with sterilised and filtered seawater to avoid bias by microbial respiration. For each set of experiments, two animal-free controls were measured under exactly the same conditions to compensate potential errors. In total, 56 respiration measurements were conducted with around 25 calanoid copepods species which sum up to more than 450 individual respiration measurements. After the experiments, all specimens were deep-frozen at -80°C for later dry-mass determination in the home lab. Additionally, the respiration rates of the most common decapod species were determined by Winkler titration in a temperature controlled container (11°C).

Furthermore, around 450 copepod and decapod samples were collected for enzyme activity analyses (Lactate dehydrogenase (LDH) and Electron transport system (ETS)) as well as stable isotope ratios ($\delta^{15}N$ and $\delta^{13}C$, see 5.5.2) and deep frozen at -80°C. Additional zooplankton samples were collected and preserved in different ways (formaldehyde, ethanol, RNA later, -80°C, liquid nitrogen) in order to find out if there are differences in dry mass and fatty acid composition according to the preservation method.

Preliminary results

Preliminary results of this cruise can only be given compared to the general distribution of copepods in the sampled region of the Eastern South Atlantic. All further analyses of abundance and distribution patterns as well as final respiration rates and enzyme activities can only be conducted in the home lab. The dominant copepod of the Benguela upwelling system was, as expected, *Calanoides carinatus* (Fig. 5.21). This copepod showed the typical bimodal distribution pattern (copepodite stages C5 in greater depths during diapause and females in surface waters of shallow regions) (Auel et al., 2005; Verheye et al., 2005). The distribution of *C. carinatus* can be related to high abundances of diatoms in coastal, freshly upwelled water, whereas the small copepod *Nannocalanus minor* is principally found in offshore waters where dinoflagellates dominate the phytoplankton community (SP-2: A. Hansen, pers. comm.; Gibbons and Hutchings, 1996; Probyn et al., 2000). Another dominant species in this region is *Metridia lucens*. On this cruise, this copepod was mainly found in the area off Lüderitz and Walvis Bay, whereas it was unusually scarce in the samples of the northern stations (see chapter 5.7 *Secondary production*). Despite of that, many tropical species (e.g., *Euchaeta marina, Scolecithrix danae*, *Undinula vulgaris*, *Temora stylifera*) were found in the Benguela upwelling region. These observations correlate with the oceanographic situation (see Fig. 5.1) of unusually warm offshore water north of 20°S. This stands in contrast to the previous cruises where only a very small number of tropical copepod species were found in this area.

Fig. 5.21 Different copepod species

Concerning the vertical distribution of copepods in the tropical Atlantic, highest abundances of total zooplankton were observed in the surface layers, whereas minimum numbers were found within the oxygen minimum zone (OMZ). The OMZ at the sampled stations vertically extended from around 300 to 600 m with minimum concentrations of less than 1 ml l^{-1} (SP-2: V. Mohrholz, pers. comm.). The influence of the OMZ on distribution, vertical migration and on the physiology of zooplankton species has been confirmed in many studies (e.g., Auel and

Verheye, 2007, Ekau et al., 2010). In the context of expanding OMZ in tropical oceans in the future (Stramma et al., 2008 and 2010; Karstensen et al., 2008) it is crucial to study the effects of hypoxic conditions on zooplankton eco-physiology.

5.10 Euphausiids (Krill) in Upwelling Areas of the Benguela-Angola Current System: A Late Summer Study (GENUS SP-7)

(F. Buchholz, K. Hünerlage, Th. Werner)

Within the GENUS – Project, the work on krill complements the study of the ecological role of ichthyo- and zooplankton under food web aspects as well as in eco-physiology. Equally, data on nutrients and primary production are essential to assess krill distribution and physiology. The cruise was tuned to the usual upwelling minimum expected at the time of the cruise in late summer. A direct comparison is intended to results of the late Discovery cruise in late winter in September – October 2010. The described krill approach refers to three linked topics: functional biodiversity, life cycle strategies and physiological/biochemical adaptation:

Functional Biodiversity

Eight major species found or to be expected in samples of MOCNESS- and Multinet-catches will be related to neritic and oceanic water masses. Such zoo-geographical considerations will be evaluated under distributive, adaptive and food web aspects. The current cruise gave the opportunity to compare three of the four major compartments of the Benguela system, covering the area just north of the 27th to almost the 17th °Latitude S. The regions are the Lüderitz-Cell in the South, which separates the Southern Benguela current from the NW-Benguela system, and the Kunene-transect in the fourth region which clearly was dominated by the typical Angola-Benguela confluence. The transit starting at the Kunene transect to Dakar allowed to take two additional net-samples in the tropical – oceanic realm, at the Angola Basin (10° S) and at the S-equator station (3° S). Overall, it was confirmed that the largest euphausiid of the area, *Euphausia hanseni* dominated the species composition. Highest numbers were again found at the T2-2/T1-3a station of the Kunene transect (17° S). However, the species was found in large numbers also at the farthest south Lüderitz transect, where previously the Walvis Bay line (23° S) appeared as the southern limit at the same time of year. Conversely, *Euphausia lucens*, a species typical of the Southern Benguela current, was not present. The pattern of occurrence of the two *Euphausia* species indicated a previous southward shift of warm water masses stemming from the Angola current. Such a water mass distribution was clearly visible on SST satellite images on the microwave band: a transition zone appeared between 20st and 21st parallel S. Apparently, the Euphausiid distribution indicated the intrusion of the warm current from the north possibly unusually far south. A comparison and data exchange with the oceanographic and other taxa data from the GENUS SPs is intended.

It became clear again, that *E. hanseni* seems to be associated with the continental slope at depths between 400 and 900 m. The large data set on the basis also of the previous cruises will help to verify such a distribution.

The second largest species, *Nematoscelis megalops* appeared again in larger numbers, but mostly on the outer stations of the transects and increasingly towards the north, i.e. tropical waters. It was confirmed that the species does not migrate vertically and remains permanently in the oxygen depleted zone, between 400 and 100 m depth. The third target species of SP-7, *Nyctiphanes capensis,* appeared only in relatively low numbers and as usual, close to the coast, confirming its neritic preference.

A third Euphausia species, *E. tenera*, was found, also typical of the Benguela system. At the Angola dome, a fourth species, *E. gibboides*, was caught, i.e. a widely distributed species, typical of the open ocean, probably in seaward succession to *E.* hanseni which is thought to be confined to the shelf near upwelling waters. *Thysanopoda tricuspidata* appeared in the near equator sample, also a species of the high (tropical) seas.

In terms of vertical distribution, the images from the ROV from SP-5 were scanned live for traces of krill. Previous similar ROV – runs, e.g. in the Arctic Kongsfjorden at Spitzbergen showed Euphausiid species directly at the bottom of the sea, probably making use of the enriched bottom-near nepheloid layer and feeding on detritus. A similar behaviour of Benguela krill would be most interesting to note, particularly in view of food web dynamics and adaptation to the oxygen depleted zone. The resolution of the ROV camera was apparently not optimal, but krill were possibly detected in a mid layer of the water column, as well as near the bottom at the Kunene transect at 500 m. A closer analysis of the images will follow making use also of parallel catches with the MOC-1. Here, decapod shrimp were seen at the sea floor and the net catches will allow identifying these.

Life Cycle Strategies

Krill generally closely relate the egg maturation/spawning cycle to the moult cycle. Both cycles may be synchronized by external factors, and as new results show, by nutritional pulses, like plankton blooms. A close coordination of growth and reproductive processes may be considered a specific adaptation to the seasonal upwelling regime. How this in turn relates to the specific trophic environment of the area is again valuable to study under food web aspects. A large sample set for histology and biochemical analysis, partly on lipids in cooperation with W. Hagen (MarZoo), was completed. These were moult and reproductive phase staged specimens. Furthermore, from moult staged krill, current growth intensity as well as spawning activity can be derived. The samples to be evaluated will also tell in how far synchronisation of both physiological cycles indicates current upwelling activity, i.e. as a reaction to fast changes of food quality and quantity.

Physiological/Biochemical Adaptation

The current results confirm previous detailed data on the typical diurnal vertical migration pattern with a focus on *E. hanseni*. The summer range was determined at 400 m reaching to the very surface. In this way krill stays in the oxygen depleted layer of ca. 500 m and experiences a temperature differential of up to 10°C. How this behaviour is related to respiration capacity and thermal tolerance is being studied. Respiration measurements indicated a high oxygen depletion tolerance and will be flanked by determination of key aerobic and an-aerobic metabolic enzymes, and their adaptive capacity, according to Buchholz (2003). The comparison to temperate and polar krill species will be helpful, because these are considered extremely oxygen dependent species. A further food web relationship may be added by determining the specific induction of various digestive enzymes in conjunction with stable isotope measurements. Physiological data will be used for parameterization of the Ecopath model.

Respiration measurements (Tab. 5.9) under ambient temperature of three euphausiid species were used to estimate standard metabolic rates (SMR). A 4-channel optode respirometer (PRESENS, Germany) and special respiration chambers, optimized for krill, were employed. Results will be compared with those from the previous cruises to clarify seasonal effects. Starvation experiments were conducted on board to assess effects on respiration rate, excretion rate (NH_4) and the moulting frequency. Furthermore, growth rates were determined for all three species by incubation experiments with the IGR (Instantaneous Growth Rate) method and related to the size/gender relationship in the field. Krill samples stored at -80°C will be analysed for metabolites produced under different conditions (ambient and both normoxic and hypoxic conditions in captivity). Stable isotope analysis together with C/N ratio and the lipid content will be done for all euphausiid species.

Tab. 5.9 On board respiration experiments conducted on research cruise MSM17/3

Starvation experiments MSM17/3 Leg 1			
Species	T [°C]	n	n (respiration measurements)
E .hanseni	5	48 each	18
	10		47
	15		44
Starvation experiments MSM17/3 Leg 2			
Species	T[°C]	n	n (respiration measurements)
E. hanseni	5	48 each	18
	10		25
	15		32
	20		17
Additional respiration measurements on field animals			
Species	T[°C]		n (respiration measurements)
E. hanseni	5		9
	10		30
	12		16
	15		9
	20		22
N. capensis	18		7
N.megalops	5		8
	10		15
	10	hypoxia	8
	15		12
	20		6
E.gibboides	15		9
	20		6
		Σ	358

Part of the measurements were conducted with a 10-channel point-optode respirometer (PRESENS, Germany) which was developed and used for zooplankton by our colleagues from MarZoo, Bremen (SP-6). The smaller *N. megalops* and juvenile *E. hanseni* were well suited for the associated size of the Bremen measuring chambers. We are very grateful for this kind support.

Results will be related to life cycle parameters, i.e. growth rates, spawning rates and determinations of biochemical composition and used to assess possible dependencies of species specificity, regional and water mass effects, seasonality – including upwelling activity, temperature constraints and oxygen deficiency. Carbon turn-over rates will be calculated. The krill indication will be taken to assess effects within the mesozooplankton as a whole.

In parallel, samples were taken for genetic comparison of the species from the different regions, with a focus on the genus *Euphausia*.

6 Ship's Meteorological Station

No meteorologist from Deutsche Wetterdienst onboard Maria S. Merian during MSM 17/3.

7 Station List

Abbreviations:

CTD/RO:	CTD/Rosette
SD:	Secchi-Disk
PLA:	Plankton-Net
MOR:	Mooring (long-term)
APSN:	Apstein-Net
MOC-D:	Double MOCNESS
MORST:	Mooring (short-term)
TD:	Drifter
TT:	Tucker Trawl
MN:	Multinet
MUC:	Multicorer
MOCN:	Sinlge MOCNESS
MSS:	Microstructure Probe
PAR-IOW:	Parasound (used for IOW mooring search)
EM-120:	12 KHz Sounder (used for IOW mooring search)
ROV:	Remotely Operated Vehicle
D-NET:	Drift-Net
RT :	Ring-Trawl
RL :	Rope length

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/222	**T8-4**								
MSM17/222-1	T8-4	30.01.2011	10:46	23° 0.03' S	14° 2.95' E	133.5	SSW 4	CTD/RO	RL max 126m
MSM17/222-2	T8-4	30.01.2011	11:02	22° 59.98' S	14° 3.00' E	134.0	SSW 4	SD	
MSM17/222-3	T8-4	30.01.2011	11:06	23° 0.00' S	14° 3.02' E	133.2	SSW 4	PLA	
MSM17/222-4	T8-4	30.01.2011	11:20	22° 59.99' S	14° 2.99' E	134.0	SSW 5	MOR	
MSM17/222-4	T8-4	30.01.2011	12:07	22° 59.91' S	14° 3.01' E	134.2	SSW 5	MOR	Top buoy on deck
MSM17/222-4	T8-4	30.01.2011	12:39	23° 0.07' S	14° 2.92' E	134.2	SSW 6	MOR	Sedimentrap on deck
MSM17/222-4	T8-4	30.01.2011	12:59	23° 0.01' S	14° 3.00' E	131.4	SSW 6	MOR	2 Floats / topfloat on deck
MSM17/222-5	T8-4	30.01.2011	13:27	23° 0.00' S	14° 3.00' E	133.5	SSW 7	APSN	
MSM17/222-6	T8-4	30.01.2011	14:18	23° 0.44' S	14° 2.72' E	134.5	SSW 8	MOC-D	RL max. 148m. Cancelled due to technical problems

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/223	**T8-4a**								
MSM17/223-1	T8-4a	30.01.2011	15:31	22° 59.95' S	13° 58.02' E	140.4	SSW 10	CTD/RO	RL max. 134m
MSM17/223-2	T8-4a	30.01.2011	16:11	23° 0.04' S	13° 57.99' E	145.2	S 11	MOORST	Topfloat in water
MSM17/223-2	T8-4a	30.01.2011	16:17	23° 0.11' S	13° 57.98' E	145.4	S 10	MOORST	Anchorweight in water
MSM17/223-3	T8-4a	30.01.2011	17:13	23° 0.28' S	13° 57.95' E	145.7	S 11	TD	Holey sock. 2x Seacat and sediment trap in water
MSM17/223-3	T8-4a	30.01.2011	17:14	23° 0.29' S	13° 57.95' E	147.5	S 10	TD	Melo and Spiere in water
MSM17/224	**T8-4**								
MSM17/224-1	T8-4	30.01.2011	18:31	23° 0.23' S	14° 3.13' E	141.4	S 7	TT	RL max. 133 m
MSM17/224-2	T8-4	30.01.2011	18:52	23° 0.82' S	14° 3.40' E	140.9	S 6	TT	RL max. 124 m
MSM17/224-3	T8-4	30.01.2011	19:23	23° 1.76' S	14° 3.75' E	136.4	SW 6	TT	RL max. 40 m
MSM17/224-4	T8-4	30.01.2011	20:05	23° 2.55' S	14° 3.81' E	136.5	SW 6	MN	RL max. 150 m
MSM17/224-5	T8-4	30.01.2011	20:40	23° 2.89' S	14° 3.80' E	142.3	SSW 7	MOC-D	Speed 2 Kn
MSM17/224-5	T8-4	30.01.2011	21:02	23° 3.63' S	14° 3.55' E	140.1	SSW 7	MOC-D	RL max. 185 m
MSM17/224-6	T8-4	30.01.2011	22:34	23° 0.00' S	14° 3.00' E	136.7	S 6	MUC	RL max 147m
MSM17/224-7	T8-4	30.01.2011	23:07	23° 0.00' S	14° 3.00' E	138.4	S 4	MUC	RL max 131m
MSM17/224-8	T8-4	30.01.2011	23:29	23° 0.00' S	14° 3.00' E	138.7	S 4	MUC	RL max 130m
MSM17/224-9	T8-4	30.01.2011	23:52	23° 0.00' S	14° 3.00' E	140.2	S 5	MUC	RL max 136m
MSM17/224-10	T8-4	31.01.2011	00:35	23° 0.00' S	14° 3.00' E	140.7	S 6	MUC	RL max 130m
MSM17/224-11	T8-4	31.01.2011	00:50	23° 0.00' S	14° 3.00' E	143.1	S 6	MUC	RL max 131m
MSM17/224-12	T8-4	31.01.2011	01:11	23° 0.00' S	14° 3.00' E	141.6	S 6	MUC	RL max 136m
MSM17/224-13	T8-4	31.01.2011	04:43	22° 59.07' S	14° 2.80' E	137.3	SSW 4	MOR	Topfloat in water
MSM17/224-13	T8-4	31.01.2011	05:10	22° 59.36' S	14° 2.86' E	137.3	SSW 4	MOR	3 floats 1 instrument in water
MSM17/224-14	T8-4	31.01.2011	05:39	22° 59.99' S	14° 2.95' E	136.7	SSW 4	CTD/RO	RL max. 124m
MSM17/225	**WLT-1**								
MSM17/225-1	WLT-1	31.01.2011	08:38	23° 30.02' S	13° 59.97' E	168.9	S 4	CTD/RO	RL max. 157 m
MSM17/225-2	WLT-1	31.01.2011	08:53	23° 30.02' S	13° 59.97' E	171.1	S 4	SD	
MSM17/225-3	WLT-1	31.01.2011	08:57	23° 30.02' S	13° 59.97' E	170.2	S 3	PLA	
MSM17/225-4	WLT-1	31.01.2011	09:11	23° 30.08' S	14° 0.02' E	170.8	S 3	MN	Speed 2 Kn
MSM17/225-4	WLT-1	31.01.2011	09:17	23° 30.24' S	14° 0.11' E	0.0	S 3	MN	RL max. 189 m
MSM17/225-5	WLT-1	31.01.2011	10:18	23° 30.70' S	14° 0.31' E	170.9	SSW 5	TT	Netfailure - Cancelled
MSM17/225-6	WLT-1	31.01.2011	10:59	23° 30.00' S	14° 0.00' E	169.1	SSW 6	MUC	RL max 164m
MSM17/226	**WLT-2**								
MSM17/226-1	WLT-2	31.01.2011	13:57	23° 29.82' S	13° 30.06' E	229.9	S 9	CTD/RO	RL max 219m
MSM17/226-2	WLT-2	31.01.2011	14:09	23° 29.80' S	13° 30.07' E	229.4	S 9	SD	
MSM17/226-3	WLT-2	31.01.2011	14:11	23° 29.80' S	13° 30.06' E	231.4	S 9	PLA	
MSM17/226-4	WLT-2	31.01.2011	14:21	23° 29.88' S	13° 30.08' E	230.8	S 11	MN	Speed 2 Kn
MSM17/226-4	WLT-2	31.01.2011	14:31	23° 30.21' S	13° 30.15' E	233.3	S 10	MN	RL max. 293m
MSM17/226-5	WLT-2	31.01.2011	15:10	23° 30.77' S	13° 30.27' E	231.8	S 12	MUC	RL max. 225m
MSM17/226-6	WLT-2	31.01.2011	15:30	23° 30.77' S	13° 30.27' E	230.5	S 11	MUC	RL max. 236m
MSM17/226-7	WLT-2	31.01.2011	15:56	23° 30.77' S	13° 30.27' E	230.4	S 12	MUC	RL max. 231m
MSM17/226-8	WLT-2	31.01.2011	16:19	23° 30.77' S	13° 30.27' E	230.8	S 10	MUC	RL max. 232 m
MSM17/226-9	WLT-2	31.01.2011	16:35	23° 30.91' S	13° 30.32' E	230.7	S 10	MOCN	Speed 2 Kn
MSM17/226-9	WLT-2	31.01.2011	16:54	23° 31.51' S	13° 30.55' E	0.0	S 10	MOCN	RL max. 309m
MSM17/227	**WLT-2a**								
MSM17/227-1	WLT-2a	31.01.2011	20:55	23° 29.90' S	12° 57.03' E	789.1	SSE 9	PLA	
MSM17/227-2	WLT-2a	31.01.2011	20:57	23° 29.90' S	12° 57.04' E	785.5	S 9	CTD/RO	RL max. 744 m
MSM17/227-3	WLT-2a	31.01.2011	21:27	23° 30.18' S	12° 57.22' E	783.9	SSE 9	MOCN	Speed 2 Kn
MSM17/227-3	WLT-2a	31.01.2011	22:06	23° 31.15' S	12° 58.02' E	762.0	SSE 11	MOCN	RL max. 768m
MSM17/227-4	WLT-2a	01.02.2011	00:33	23° 36.69' S	13° 9.48' E	424.5	SSE 9	MOCN	RL max 163m
MSM17/228	**WLT-3**								
MSM17/228-1	WLT-3	01.02.2011	05:45	24° 0.02' S	13° 59.95' E	217.3	SSE 3	CTD/RO	RL max. 205m
MSM17/228-2	WLT-3	01.02.2011	06:01	24° 0.02' S	13° 59.90' E	218.2	SE 3	PLA	
MSM17/228-3	WLT-3	01.02.2011	06:04	24° 0.03' S	13° 59.89' E	218.3	SE 2	SD	
MSM17/228-4	WLT-3	01.02.2011	06:22	24° 0.17' S	13° 59.87' E	218.4	SE 2	MN	Speed 2 Kn
MSM17/228-4	WLT-3	01.02.2011	06:29	24° 0.37' S	13° 59.90' E	0.0	SE 3	MN	RL max. 222 m
MSM17/228-5	WLT-3	01.02.2011	07:27	24° 2.03' S	14° 0.20' E	217.0	SSE 3	MOCN	273 m
MSM17/228-6	WLT-3	01.02.2011	08:09	24° 2.68' S	14° 0.32' E	218.0	SSE 2	MUC	RL max. 216 m
MSM17/228-7	WLT-3	01.02.2011	08:32	24° 2.68' S	14° 0.32' E	215.6	SSE 3	MUC	RL max. 218 m
MSM17/229	**WLT-5**								
MSM17/229-1	WLT-5	01.02.2011	11:40	24° 29.95' S	14° 20.02' E	126.4	S 6	CTD/RO	
MSM17/229-2	WLT-5	01.02.2011	11:46	24° 29.94' S	14° 20.05' E	125.3	S 6	SD	
MSM17/229-3	WLT-5	01.02.2011	11:47	24° 29.94' S	14° 20.05' E	126.3	S 7	PLA	
MSM17/229-1	WLT-5	01.02.2011	11:48	24° 29.95' S	14° 20.04' E	124.6	S 6	CTD/RO	RL max 218m
MSM17/229-4	WLT-5	01.02.2011	12:15	24° 30.17' S	14° 20.02' E	125.6	S 7	MN	Speed 2 Kn
MSM17/229-4	WLT-5	01.02.2011	12:19	24° 30.32' S	14° 20.03' E	126.8	S 7	MN	RL max 130m
MSM17/229-5	WLT-5	01.02.2011	12:44	24° 30.72' S	14° 20.10' E	125.4	S 8	MUC	RL max 124m

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/230	**WLT-6**								
MSM17/230-1	WLT-6	01.02.2011	16:05	24° 59.98' S	14° 0.00' E	182.4	S 11	CTD/RO	RL max. 169 m
MSM17/230-2	WLT-6	01.02.2011	16:20	24° 59.98' S	14° 0.00' E	181.3	S 10	PLA	
MSM17/230-3	WLT-6	01.02.2011	16:26	24° 59.98' S	14° 0.00' E	182.1	S 10	SD	
MSM17/230-4	WLT-6	01.02.2011	16:32	25° 0.05' S	14° 0.05' E	181.6	S 11	MN	Speed 2kn
MSM17/230-4	WLT-6	01.02.2011	16:40	25° 0.26' S	14° 0.23' E	183.2	S 11	MN	RL max. 221m
MSM17/230-5	WLT-6	01.02.2011	17:11	25° 0.89' S	14° 0.71' E	185.2	SSE 11	MOCN	Speed 2Kn
MSM17/230-5	WLT-6	01.02.2011	17:27	25° 1.31' S	14° 1.06' E	186.7	SSE 12	MOCN	RL max. 247m
MSM17/230-6	WLT-6	01.02.2011	18:49	25° 0.00' S	14° 0.00' E	180.3	S 12	MUC	RL max. 183 m
MSM17/230-7	WLT-6	01.02.2011	19:08	25° 0.00' S	14° 0.00' E	180.9	S 11	MUC	RL max. 181 m
MSM17/231	**WLT-7**								
MSM17/231-1	WLT-7	02.02.2011	03:09	25° 59.96' S	14° 30.03' E	193.0	SSE 7	CTD/RO	RL max 182m
MSM17/231-2	WLT-7	02.02.2011	03:23	25° 59.96' S	14° 30.07' E	193.9	S 7	PLA	
MSM17/231-3	WLT-7	02.02.2011	04:09	26° 0.49' S	14° 30.38' E	193.5	SSE 5	MOCN	RL max. 234m
MSM17/231-4	WLT-7	02.02.2011	05:11	26° 0.00' S	14° 30.00' E	193.7	SSE 6	MUC	RL max. 192m
MSM17/231-5	WLT-7	02.02.2011	05:26	26° 0.09' S	14° 30.06' E	193.2	SSE 6	MN	Speed 2 Kn
MSM17/231-5	WLT-7	02.02.2011	05:35	26° 0.33' S	14° 30.25' E	192.8	SSE 7	MN	RL max. 239m
MSM17/232	**L-4**								
MSM17/232-1	L-4	02.02.2011	10:45	26° 40.08' S	15° 3.50' E	41.2	NNW 2	CTD/RO	RL max 34m
MSM17/232-2	L-4	02.02.2011	10:54	26° 40.04' S	15° 3.48' E	72.1	NW 2	SD	
MSM17/232-3	L-4	02.02.2011	10:56	26° 40.04' S	15° 3.48' E	43.9	NW 2	PLA	
MSM17/232-4	L-4	02.02.2011	11:04	26° 40.01' S	15° 3.46' E	45.0	NNW 2	APSN	
MSM17/232-5	L-4	02.02.2011	11:20	26° 39.98' S	15° 3.46' E	44.9	NNW 2	MSS	Speed 0.5kn
MSM17/232-6	L-4	02.02.2011	11:56	26° 40.30' S	15° 3.27' E	43.4	WNW 3	MN	Speed 2kn
MSM17/232-6	L-4	02.02.2011	11:58	26° 40.38' S	15° 3.25' E	44.7	WNW 3	MN	RL max 49m
MSM17/232-7	L-4	02.02.2011	12:31	26° 40.00' S	15° 3.60' E	39.3	WNW 3	MUC	RL max 40m
MSM17/232-8	L-4	02.02.2011	12:39	26° 40.00' S	15° 3.60' E	39.8	WNW 3	MUC	RL max 43m
MSM17/233	**L-4**								
MSM17/233-1	L-4	02.02.2011	14:25	26° 40.00' S	14° 45.65' E	193.8	W 3	CTD/RO	RL max. 179m
MSM17/233-2	L-3	02.02.2011	14:36	26° 40.01' S	14° 45.67' E	192.9	W 2	PLA	
MSM17/233-3	L-3	02.02.2011	15:04	26° 40.28' S	14° 45.61' E	193.5	WSW 2	MOC-D	Speed 2Kn
MSM17/233-3	L-3	02.02.2011	15:24	26° 40.94' S	14° 45.47' E	195.9	WSW 3	MOC-D	RL max. 234m
MSM17/233-3	L-3	02.02.2011	15:30	26° 41.12' S	14° 45.43' E	197.1	WSW 3	MOC-D	Speed to 1.5 Kn reduced
MSM17/233-4	L-3	02.02.2011	15:42	26° 41.34' S	14° 45.39' E	197.7	SW 2	APSN	
MSM17/233-5	L-3	02.02.2011	15:56	26° 41.37' S	14° 45.39' E	198.1	SW 2	MSS	Speed 0.5 Kn
MSM17/233-6	L-3	02.02.2011	16:48	26° 41.70' S	14° 45.34' E	197.2	SSW 1	MN	RL max. 147m
MSM17/233-7	L-3	02.02.2011	17:05	26° 41.79' S	14° 45.33' E	198.0	SSE 2	MN	Speed 2Kn
MSM17/233-7	L-3	02.02.2011	17:13	26° 42.02' S	14° 45.31' E	199.1	S 2	MN	RL max. 215m
MSM17/233-8	L-3	02.02.2011	18:08	26° 40.00' S	14° 45.59' E	192.7	S 3	MUC	RL max 189 m
MSM17/233-9	L-3	02.02.2011	18:32	26° 40.13' S	14° 45.62' E	193.0	SSW 5	MOC-D	Speed 2 Kn
MSM17/233-9	L-3	02.02.2011	18:46	26° 40.57' S	14° 45.49' E	193.5	S 6	MOC-D	RL max. 189 m
MSM17/234	**L-2**								
MSM17/234-1	L-2	02.02.2011	21:04	26° 39.95' S	14° 25.00' E	327.0	SSE 3	CTD/RO	RL max. 314 m
MSM17/234-2	L-2	02.02.2011	21:06	26° 39.95' S	14° 25.00' E	326.9	SSE 3	PLA	
MSM17/234-3	L-2	02.02.2011	21:22	26° 39.95' S	14° 25.00' E	327.6	S 4	APSN	
MSM17/234-4	L-2	02.02.2011	21:45	26° 39.82' S	14° 25.10' E	327.7	S 4	MSS	Speed 0.5 kn
MSM17/234-5	L-2	02.02.2011	22:54	26° 40.38' S	14° 25.28' E	327.8	S 5	MN	Speed 2kn
MSM17/234-5	L-2	02.02.2011	23:03	26° 40.64' S	14° 25.45' E	330.2	S 5	MN	RL max 254m
MSM17/234-6	L-2	02.02.2011	23:40	26° 41.37' S	14° 25.90' E	331.4	S 5	MOCN	Speed 2kn
MSM17/234-6	L-2	02.02.2011	23:54	26° 41.75' S	14° 26.14' E	326.3	SSE 4	MOCN	RL max 429m
MSM17/234-7	L-2	03.02.2011	01:13	26° 40.00' S	14° 25.00' E	330.5	SSE 4	MUC	RL max 326m
MSM17/234-8	L-2	03.02.2011	01:34	26° 40.00' S	14° 25.00' E	328.2	SSE 3	MUC	RL max 328m
MSM17/235	**L-1**								
MSM17/235-1	L-1	03.02.2011	04:22	26° 39.97' S	13° 59.98' E	423.0	S 2	CTD/RO	RL max. 404m
MSM17/235-2	L-1	03.02.2011	04:35	26° 39.96' S	13° 59.99' E	426.5	S 2	PLA	
MSM17/235-3	L-1	03.02.2011	04:38	26° 39.96' S	13° 59.99' E	423.7	S 2	APSN	
MSM17/235-4	L-1	03.02.2011	04:44	26° 39.95' S	13° 59.99' E	422.3	SSW 2	SD	
MSM17/235-5	L-1	03.02.2011	04:49	26° 39.95' S	13° 59.99' E	421.6	S 2	MSS	
MSM17/235-6	L-1	03.02.2011	06:10	26° 40.70' S	14° 0.15' E	424.1	SSW 1	MOCN	Speed 2 Kn
MSM17/235-6	L-1	03.02.2011	06:46	26° 41.72' S	14° 0.56' E	419.4	WSW 1	MOCN	RL max. 599 m
MSM17/235-7	L-1	03.02.2011	07:48	26° 43.15' S	14° 1.13' E	420.9	SSW 0	MN	Speed 0 Kn
MSM17/235-7	L-1	03.02.2011	08:05	26° 43.15' S	14° 1.13' E	424.8	SSE 1	MN	RL max. 377 m
MSM17/235-8	L-1	03.02.2011	08:25	26° 43.25' S	14° 1.15' E	420.5	SW 0	MN	Vertically operated
MSM17/235-8	L-1	03.02.2011	08:34	26° 43.45' S	14° 1.24' E	423.6	WNW 1	MN	RL max. 242 m
MSM17/235-9	L-1	03.02.2011	09:42	26° 40.00' S	14° 0.00' E	420.4	W 1	MUC	RL max. 422 m
MSM17/236	**L-1a**								
MSM17/236-1	L-1a	03.02.2011	12:59	26° 34.56' S	13° 27.07' E	1210.5	W 3	MOC-D	Speed 2 kn

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/236-1	L-1a	03.02.2011	14:05	26° 36.56' S	13° 28.15' E	1160.2	WSW 5	MOC-D	RL max. 1772m
MSM17/236-2	L-1a	03.02.2011	15:51	26° 39.98' S	13° 30.06' E	1102.8	W 6	CTD/RO	RL max. 210 m
MSM17/236-3	L-1a	03.02.2011	16:06	26° 40.00' S	13° 30.09' E	1102.0	WSW 5	SD	
MSM17/236-4	L-1a	03.02.2011	16:09	26° 40.00' S	13° 30.09' E	1104.1	WSW 5	PLA	
MSM17/236-5	L-1a	03.02.2011	16:19	26° 40.00' S	13° 30.09' E	1106.3	WSW 5	APSN	
MSM17/236-6	L-1a	03.02.2011	17:02	26° 39.97' S	13° 30.23' E	1094.9	WSW 6	CTD/RO	RL max. 1069m
MSM17/236-7	L-1a	03.02.2011	17:35	26° 40.00' S	13° 30.27' E	1089.4	SW 7	MN	Vertically operated
MSM17/236-7	L-1a	03.02.2011	18:13	26° 40.04' S	13° 30.37' E	1085.9	SW 6	MN	RL max. 990 m
MSM17/236-8	L-1a	03.02.2011	19:08	26° 40.11' S	13° 30.56' E	1074.3	SSW 4	MN	RL max. 98 m
MSM17/236-9	L-1a	03.02.2011	19:30	26° 40.13' S	13° 30.59' E	1075.1	SSE 3	MSS	
MSM17/236-10	L-1a	03.02.2011	21:30	26° 41.32' S	13° 32.34' E	1008.0	SSW 3	MOCN	RL max. 635m
MSM17/236-11	L-1a	03.02.2011	22:56	26° 40.00' S	13° 30.00' E	1112.8	SE 2	MUC	RL max. 1082m
MSM17/236-12	L-1a	04.02.2011	00:41	26° 42.52' S	13° 30.56' E	1113.9	S 1	MOC-D	RL max. 1752m
MSM17/237	**WLT-8**								
MSM17/237-1	WLT-8	04.02.2011	05:55	25° 59.95' S	13° 33.01' E	758.8	S 2	CTD/RO	RL max. 730m
MSM17/237-2	WLT-8	04.02.2011	06:24	26° 0.00' S	13° 33.00' E	758.3	SW 4	SD	
MSM17/237-3	WLT-8	04.02.2011	06:27	26° 0.00' S	13° 33.00' E	756.4	SW 4	PLA	
MSM17/237-4	WLT-8	04.02.2011	06:48	26° 0.00' S	13° 33.00' E	759.5	S 2	MUC	RL max. 746 m
MSM17/238	**WLT-9**								
MSM17/238-1	WLT-9	04.02.2011	12:32	25° 0.00' S	13° 20.01' E	1101.7	S 4	CTD/RO	RL max 1065m
MSM17/238-2	WLT-9	04.02.2011	12:56	24° 59.98' S	13° 20.08' E	1104.6	SSE 4	PLA	
MSM17/238-3	WLT-9	04.02.2011	13:01	24° 59.97' S	13° 20.08' E	1096.1	SSE 4	SD	
MSM17/238-4	WLT-9	04.02.2011	13:09	25° 0.10' S	13° 20.11' E	1100.2	S 4	MOCN	Speed 2kn
MSM17/238-4	WLT-9	04.02.2011	13:37	25° 0.74' S	13° 20.44' E	0.0	SSW 6	MOCN	RL max 540m
MSM17/238-5	WLT-9	04.02.2011	14:31	25° 2.01' S	13° 21.00' E	1104.4	SSW 6	CTD/RO	RL max. 100m
MSM17/238-6	WLT-9	04.02.2011	15:25	25° 0.00' S	13° 19.99' E	0.0	S 7	MUC	RL max. 1076m
MSM17/238-7	WLT-9	04.02.2011	16:12	25° 0.00' S	13° 19.99' E	1082.7	SSW 10	MUC	RL max. 1077 m
MSM17/239	**WLT-4**								
MSM17/239-2	WLT-4	04.02.2011	19:53	24° 29.93' S	13° 42.04' E	354.0	S 7	PLA	
MSM17/239-1	WLT-4	04.02.2011	19:56	24° 29.92' S	13° 42.07' E	355.3	S 7	CTD/RO	RL max. 350 m
MSM17/239-3	WLT-4	04.02.2011	20:16	24° 30.13' S	13° 42.20' E	356.8	SSW 9	MOCN	Speed 2 Kn
MSM17/239-3	WLT-4	04.02.2011	20:34	24° 30.73' S	13° 42.34' E	355.8	SSW 10	MOCN	RL max. 483 m
MSM17/239-4	WLT-4	04.02.2011	21:20	24° 32.13' S	13° 42.67' E	359.0	S 10	MN	Speed 2 Kn
MSM17/239-4	WLT-4	04.02.2011	21:33	24° 32.54' S	13° 42.80' E	360.5	S 7	MN	RL max. 282 m
MSM17/239-5	WLT-4	04.02.2011	22:18	24° 33.88' S	13° 43.56' E	355.2	S 7	MOCN	RL max 139m
MSM17/239-6	WLT-4	04.02.2011	23:37	24° 30.00' S	13° 42.00' E	356.3	S 7	MUC	RL max 361m
MSM17/240-1	WLT-10	05.02.2011	03:42	23° 59.98' S	13° 6.63' E	742.2	S 7	CTD/RO	RL max. 728m
MSM17/240	**WLT-10**								
MSM17/240-2	WLT-10	05.02.2011	04:08	24° 0.07' S	13° 6.66' E	739.2	SSE 6	MOCN	Speed 2Kn
MSM17/240-2	WLT-10	05.02.2011	04:39	24° 0.92' S	13° 7.07' E	739.9	SSE 6	MOCN	RL max. 586m
MSM17/240-3	WLT-10	05.02.2011	05:51	24° 0.00' S	13° 6.60' E	739.7	SSE 7	PLA	
MSM17/240-4	WLT-10	05.02.2011	05:56	24° 0.00' S	13° 6.60' E	743.1	SSE 7	SD	
MSM17/240-5	WLT-10	05.02.2011	06:19	24° 0.00' S	13° 6.60' E	742.9	SSE 5	MUC	RL max. 740 m
MSM17/240-5	WLT-10	05.02.2011	06:35	24° 0.00' S	13° 6.60' E	742.1	SSE 3	MUC	MUC did not release
MSM17/240-6	WLT-10	05.02.2011	06:53	24° 0.00' S	13° 6.60' E	739.5	S 3	MUC	RL max. 746 m
MSM17/241	**T8-1a**								
MSM17/241-1	T8-1a	05.02.2011	15:07	23° 0.02' S	11° 45.04' E	3029.7	S 7	CTD/RO	RL max.110m
MSM17/241-2	T8-1a	05.02.2011	15:19	23° 0.02' S	11° 45.03' E	3002.5	SSW 8	SD	
MSM17/241-3	T8-1a	05.02.2011	15:22	23° 0.02' S	11° 45.04' E	3014.2	SSW 8	PLA	
MSM17/241-4	T8-1a	05.02.2011	15:29	23° 0.03' S	11° 45.04' E	3003.6	S 8	MSS	
MSM17/241-5	T8-1a	05.02.2011	16:43	23° 0.64' S	11° 45.02' E	2974.0	S 9	APSN	
MSM17/241-6	T8-1a	05.02.2011	18:04	23° 0.63' S	11° 45.12' E	2975.8	S 9	CTD/RO	RL max. 2977 m
MSM17/241-7	T8-1a	05.02.2011	19:12	23° 0.85' S	11° 45.18' E	2967.2	SSE 10	MOC-D	Speed 2 Kn
MSM17/241-7	T8-1a	05.02.2011	20:22	23° 3.18' S	11° 45.44' E	2964.2	SSE 10	MOC-D	RL max. 1773 m
MSM17/241-8	T8-1a	05.02.2011	23:16	23° 0.00' S	11° 45.00' E	2974.0	SSE 9	MUC	RL max 2980m
MSM17/241-9	T8-1a	06.02.2011	01:24	23° 0.00' S	11° 45.00' E	2973.7	SSE 9	MUC	RL max 2995m
MSM17/241-10	T8-1a	06.02.2011	03:34	23° 0.00' S	11° 45.00' E	2951.0	SSE 8	MUC	RL max. 2994m
MSM17/241-11	T8-1a	06.02.2011	04:33	23° 0.00' S	11° 45.00' E	2977.6	SSE 8	MN	vertically operated
MSM17/241-11	T8-1a	06.02.2011	05:09	22° 59.95' S	11° 45.11' E	2951.7	SSE 8	MN	RL max. 993m
MSM17/241-12	T8-1a	06.02.2011	06:04	22° 59.97' S	11° 45.27' E	2954.3	SSE 8	MN	vertically operated
MSM17/241-12	T8-1a	06.02.2011	06:09	23° 0.02' S	11° 45.30' E	2953.8	SSE 8	MN	RL max. 100 m
MSM17/241-13	T8-1a	06.02.2011	06:23	23° 0.15' S	11° 45.36' E	3031.9	SSE 7	MOC-D	Speed 2 Kn
MSM17/241-13	T8-1a	06.02.2011	07:27	23° 1.82' S	11° 46.39' E	2984.0	S 8	MOC-D	RL max. 1613 m
MSM17/242	**T8-1b**								
MSM17/242-1	T8-1b	06.02.2011	12:07	23° 0.00' S	12° 29.96' E	1644.7	S 8	CTD/RO	RL max 115m
MSM17/242-2	T8-1b	06.02.2011	12:09	23° 0.00' S	12° 29.95' E	1648.4	S 7	SD	
MSM17/242-3	T8-1b	06.02.2011	12:13	23° 0.01' S	12° 29.93' E	1648.6	S 7	PLA	

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/242-1	T8-1b	06.02.2011	12:17	23° 0.02' S	12° 29.92' E	1650.3	S 7	CTD/RO	
MSM17/242-4	T8-1b	06.02.2011	12:20	23° 0.02' S	12° 29.93' E	1656.7	S 8	PAR-IOW	
MSM17/242-5	T8-1b	06.02.2011	12:33	23° 0.00' S	12° 30.00' E	1649.8	S 9	MSS	
MSM17/242-6	T8-1b	06.02.2011	13:40	23° 0.46' S	12° 29.99' E	1649.3	S 10	MN	vertically operated
MSM17/242-6	T8-1b	06.02.2011	14:18	23° 0.46' S	12° 29.99' E	1810.5	S 10	MN	RL max.991m
MSM17/242-7	T8-1b	06.02.2011	15:00	23° 0.46' S	12° 29.99' E	1796.8	S 11	MN	vertically operated
MSM17/242-7	T8-1b	06.02.2011	15:07	23° 0.46' S	12° 29.99' E	1654.7	S 11	MN	RL max. 197m
MSM17/242-8	T8-1b	06.02.2011	15:25	23° 0.59' S	12° 29.96' E	1535.5	S 12	MOC-D	Speed 2Kn
MSM17/242-8	T8-1b	06.02.2011	16:28	23° 2.49' S	12° 29.93' E	1592.4	S 11	MOC-D	RL max. 1647 m
MSM17/242-9	T8-1b	06.02.2011	17:34	23° 4.41' S	12° 30.08' E	1651.4	S 11	APSN	
MSM17/242-10	T8-1b	06.02.2011	19:27	23° 0.00' S	12° 30.00' E	1648.9	SSE 9	CTD/RO	RL max. 1625 m
MSM17/242-11	T8-1b	06.02.2011	20:41	23° 0.00' S	12° 30.00' E	0.0	SSE 8	MUC	RL max 1636 m
MSM17/242-12	T8-1b	06.02.2011	22:34	23° 2.41' S	12° 30.71' E	1613.4	SSE 8	MOC-D	RL max 1768m
MSM17/243	**T8-1c**								
MSM17/243-1	T8-1c	07.02.2011	01:15	23° 0.06' S	12° 48.01' E	0.0	S 9	MOC-D	Speed 2kn
MSM17/243-1	T8-1c	07.02.2011	02:09	23° 1.84' S	12° 48.30' E	920.5	SSE 8	MOC-D	RL max.1299m
MSM17/243-2	T8-1c	07.02.2011	03:56	22° 59.98' S	12° 48.00' E	911.6	S 7	CTD/RO	RL max. 898m
MSM17/243-3	T8-1c	07.02.2011	04:18	22° 59.98' S	12° 48.01' E	911.0	S 7	PLA	
MSM17/243-4	T8-1c	07.02.2011	04:25	22° 59.98' S	12° 48.00' E	910.0	S 6	APSN	
MSM17/243-5	T8-1c	07.02.2011	04:38	23° 0.01' S	12° 48.01' E	1046.8	S 6	MSS	
MSM17/243-6	T8-1c	07.02.2011	05:41	23° 0.58' S	12° 48.05' E	913.6	S 7	MN	Speed 2Kn
MSM17/243-6	T8-1c	07.02.2011	05:51	23° 0.89' S	12° 48.11' E	925.0	S 6	MN	RL max. 273m
MSM17/243-7	T8-1c	07.02.2011	06:28	23° 1.85' S	12° 48.32' E	920.7	S 7	MOCN	Speed 2 Kn
MSM17/243-7	T8-1c	07.02.2011	06:52	23° 2.68' S	12° 48.51' E	0.0	S 6	MOCN	RL max. 669 m
MSM17/243-8	T8-1c	07.02.2011	07:43	23° 4.30' S	12° 48.91' E	925.2	S 6	MN	vertically operated
MSM17/243-8	T8-1c	07.02.2011	08:13	23° 4.30' S	12° 48.92' E	921.2	S 7	MN	RL max. 843 m
MSM17/243-9	T8-1c	07.02.2011	08:48	23° 4.30' S	12° 48.92' E	917.9	S 7	MN	vertically operated
MSM17/243-9	T8-1c	07.02.2011	08:56	23° 4.30' S	12° 48.92' E	925.6	S 6	MN	RL max. 198 m
MSM17/243-10	T8-1c	07.02.2011	10:04	23° 0.00' S	12° 48.00' E	911.1	S 7	MUC	RL max 906m
MSM17/243-11	T8-1c	07.02.2011	10:25	23° 0.00' S	12° 48.00' E	870.9	S 6	SD	
MSM17/243-12	T8-1c	07.02.2011	11:30	23° 1.98' S	12° 48.11' E	929.9	S 8	MOC-D	RL max 1284m
MSM17/244-1	MSS-01	07.02.2011	13:10	22° 59.94' S	12° 55.06' E	657.8	S 8	MSS	Speed 0.5kn
MSM17/245-1	MSS-02	07.02.2011	14:46	22° 59.95' S	13° 0.00' E	0.0	S 9	MSS	Speed 0.5Kn
MSM17/246	**T8-1d**								
MSM17/246-1	T8-1d	07.02.2011	16:40	22° 59.96' S	13° 2.97' E	413.1	S 11	CTD/RO	RL max. 399m
MSM17/246-2	T8-1d	07.02.2011	16:53	22° 59.95' S	13° 3.00' E	411.3	S 11	SD	
MSM17/246-3	T8-1d	07.02.2011	16:56	22° 59.95' S	13° 3.00' E	413.9	S 10	APSN	
MSM17/246-4	T8-1d	07.02.2011	16:58	22° 59.95' S	13° 3.00' E	411.4	S 10	PLA	
MSM17/246-5	T8-1d	07.02.2011	17:11	22° 59.97' S	13° 3.00' E	411.8	S 10	MSS	Speed 0.5Kn
MSM17/246-6	T8-1d	07.02.2011	18:08	23° 0.49' S	13° 3.04' E	417.1	S 11	MN	Speed 2 Kn
MSM17/246-6	T8-1d	07.02.2011	18:26	23° 1.06' S	13° 3.15' E	423.3	S 11	MN	RL max. 293 m
MSM17/246-7	T8-1d	07.02.2011	19:39	23° 0.00' S	13° 3.00' E	411.8	S 11	MUC	RL max. 416 m
MSM17/246-8	T8-1d	07.02.2011	19:57	23° 0.12' S	13° 3.02' E	411.4	S 11	MOCN	Speed 2 Kn
MSM17/246-8	T8-1d	07.02.2011	20:19	23° 0.77' S	13° 3.28' E	415.5	S 11	MOCN	RL max. 592 m
MSM17/246-9	T8-1d	07.02.2011	21:17	23° 2.61' S	13° 3.95' E	421.4	S 10	MOCN	Speed 2 Kn
MSM17/246-9	T8-1d	07.02.2011	21:23	23° 2.80' S	13° 4.02' E	425.1	S 10	MOCN	RL max. 141 m
MSM17/246-10	T8-1d	08.02.2011	01:40	23° 1.79' S	13° 3.35' E	425.3	SSW 8	EM120	Attempted to ping
MSM17/246-10	T8-1d	08.02.2011	02:16	22° 59.97' S	13° 3.31' E	0.0	S 9	EM120	Cancelled Mooring did not respond
MSM17/247-1	MSS-03	08.02.2011	02:41	22° 59.95' S	13° 4.99' E	0.0	S 6	MSS	
MSM17/248-1	MSS-04	08.02.2011	04:05	22° 59.95' S	13° 9.99' E	0.0	S 7	MSS	
MSM17/249-1	MSS-05	08.02.2011	05:31	22° 59.98' S	13° 14.99' E	0.0	SSE 10	MSS	
MSM17/250	**T8-1**								
MSM17/250-1	T8-1	08.02.2011	07:17	22° 59.97' S	13° 20.04' E	353.3	SSE 8	CTD/RO	RL max. 347 m
MSM17/250-2	T8-1	08.02.2011	07:32	22° 59.95' S	13° 20.08' E	354.5	SSE 8	PLA	
MSM17/250-3	T8-1	08.02.2011	07:36	22° 59.95' S	13° 20.08' E	354.2	SSE 8	SD	
MSM17/250-4	T8-1	08.02.2011	07:47	22° 59.95' S	13° 20.08' E	355.1	SSE 8	APSN	
MSM17/250-5	T8-1	08.02.2011	08:08	22° 59.95' S	13° 20.08' E	354.6	SSE 8	CTD/RO	RL max. 30 m
MSM17/250-6	T8-1	08.02.2011	08:19	22° 59.97' S	13° 20.09' E	354.5	SSE 8	MSS	Speed 0.5 Kn
MSM17/250-7	T8-1	08.02.2011	09:27	23° 0.71' S	13° 20.32' E	350.2	S 7	MOC-D	Speed 2 Kn
MSM17/250-7	T8-1	08.02.2011	09:51	23° 1.46' S	13° 20.37' E	350.8	SSE 7	MOC-D	RL max. 467 m
MSM17/250-8	T8-1	08.02.2011	10:20	23° 2.39' S	13° 20.46' E	350.4	S 7	MN	Speed 2 kn
MSM17/250-8	T8-1	08.02.2011	10:40	23° 3.00' S	13° 20.68' E	349.6	S 7	MN	RL max 325m
MSM17/250-9	T8-1	08.02.2011	11:14	23° 4.08' S	13° 21.05' E	351.1	S 7	MOCN	Speed 2 kn
MSM17/250-9	T8-1	08.02.2011	11:34	23° 4.71' S	13° 21.29' E	347.3	S 8	MOCN	RL max 489m
MSM17/250-10	T8-1	08.02.2011	12:17	23° 5.96' S	13° 21.76' E	337.9	S 9	MOCN	Speed 2kn
MSM17/250-10	T8-1	08.02.2011	12:36	23° 6.53' S	13° 21.98' E	338.0	S 9	MOCN	RL max 478m
MSM17/250-11	T8-1	08.02.2011	13:08	23° 7.11' S	13° 22.19' E	335.9	S 10	MN	Vertikal

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/250-11	T8-1	08.02.2011	13:15	23° 7.11' S	13° 22.19' E	337.0	S 10	MN	RL max 200m
MSM17/250-12	T8-1	08.02.2011	13:31	23° 7.11' S	13° 22.19' E	336.6	S 10	MN	Vertikal
MSM17/250-12	T8-1	08.02.2011	13:42	23° 7.11' S	13° 22.19' E	335.9	S 11	MN	RL max 299m
MSM17/250-13	T8-1	08.02.2011	14:52	22° 59.98' S	13° 20.01' E	354.5	S 10	MUC	RL max. 357m
MSM17/251-1	MSS-06	08.02.2011	16:12	23° 0.23' S	13° 25.03' E	308.3	S 11	MSS	technical problems
MSM17/252-1	MSS-07	08.02.2011	17:07	22° 59.97' S	13° 29.96' E	243.4	S 9	MSS	
MSM17/253-1	MSS-08	08.02.2011	18:12	23° 0.60' S	13° 30.66' E	232.5	SSE 11	MSS	Speed 0.5 Kn
MSM17/254	**T8-3**								
MSM17/254-1	T8-3	08.02.2011	20:15	22° 59.95' S	13° 40.05' E	154.9	S 14	CTD/RO	RL max. 145 m
MSM17/254-2	T8-3	08.02.2011	20:31	22° 59.95' S	13° 40.03' E	155.4	S 14	PLA	
MSM17/254-3	T8-3	08.02.2011	20:32	22° 59.95' S	13° 40.03' E	154.7	S 12	APSN	
MSM17/254-4	T8-3	08.02.2011	20:46	22° 59.96' S	13° 40.03' E	154.3	S 12	MSS	
MSM17/254-5	T8-3	08.02.2011	21:29	23° 0.47' S	13° 40.17' E	155.2	SSE 11	MOC-D	Speed 2 Kn
MSM17/254-5	T8-3	08.02.2011	21:50	23° 1.11' S	13° 40.44' E	155.3	S 11	MOC-D	RL max. 259 m
MSM17/254-6	T8-3	08.02.2011	22:05	23° 1.55' S	13° 40.65' E	156.7	S 11	MN	Speed 2 kn
MSM17/254-6	T8-3	08.02.2011	22:18	23° 1.93' S	13° 40.77' E	156.8	S 11	MN	RL max 187m
MSM17/254-7	T8-3	08.02.2011	22:45	23° 2.45' S	13° 40.93' E	156.5	SSE 11	MN	vertical
MSM17/254-7	T8-3	08.02.2011	22:49	23° 2.45' S	13° 40.93' E	158.9	S 11	MN	RL max 99m
MSM17/254-8	T8-3	08.02.2011	23:04	23° 2.68' S	13° 40.99' E	158.6	S 11	MOCN	Speed 2 kn
MSM17/254-8	T8-3	08.02.2011	23:17	23° 3.07' S	13° 41.11' E	157.0	S 11	MOCN	RL max 200m
MSM17/254-9	T8-3	09.02.2011	00:11	23° 0.00' S	13° 40.00' E	155.7	S 10	MUC	RL max 156m
MSM17/254-10	T8-3	09.02.2011	00:52	23° 0.00' S	13° 40.00' E	154.1	S 12	MUC	RL max 160m
MSM17/254-11	T8-3	09.02.2011	01:25	23° 0.00' S	13° 40.00' E	155.4	S 12	MUC	RL max 158m
MSM17/255-1	MSS-09	09.02.2011	02:22	22° 59.96' S	13° 44.96' E	150.9	S 11	MSS	
MSM17/256-1	MSS10	09.02.2011	04:12	23° 0.26' S	13° 50.05' E	148.3	SSE 9	MSS	
MSM17/257-1	MSS-11	09.02.2011	04:56	22° 59.96' S	13° 54.99' E	150.6	SSE 9	MSS	
MSM17/258	**T8-4a**								
MSM17/258-1	T8-4a	09.02.2011	06:12	23° 0.00' S	13° 57.96' E	146.7	S 6	CTD/RO	RL max. 133 m
MSM17/258-2	T8-4a	09.02.2011	06:29	22° 59.90' S	13° 57.92' E	146.3	S 5	MOORST	Hydrophon in water
MSM17/258-2	T8-4a	09.02.2011	07:13	23° 0.38' S	13° 58.07' E	144.3	SSW 6	MOORST	Workhorse on deck
MSM17/259-1	MSS12	09.02.2011	07:45	23° 0.01' S	14° 0.00' E	141.0	SSW 6	MSS	Speed 0.5 Kn
MSM17/260	**T8-4**								
MSM17/260-1	T8-4	09.02.2011	09:11	22° 59.99' S	14° 2.99' E	139.1	SSW 7	CTD/RO	RL max. 125 m
MSM17/260-2	T8-4	09.02.2011	09:22	22° 59.99' S	14° 3.00' E	136.4	SW 7	SD	
MSM17/260-3	T8-4	09.02.2011	09:24	22° 59.99' S	14° 3.00' E	135.3	SW 7	PLA	
MSM17/260-4	T8-4	09.02.2011	09:34	23° 0.13' S	14° 3.01' E	136.1	SSW 7	MN	Speed 2 Kn
MSM17/260-4	T8-4	09.02.2011	09:43	23° 0.37' S	14° 3.05' E	136.6	SSW 6	MN	RL max. 155 m
MSM17/260-5	T8-4	09.02.2011	10:10	23° 0.97' S	14° 3.06' E	137.7	S 6	MN	Vertical
MSM17/260-5	T8-4	09.02.2011	10:15	23° 0.97' S	14° 3.06' E	136.9	S 6	MN	RL max 100m
MSM17/260-6	T8-4	09.02.2011	10:38	23° 1.43' S	14° 3.06' E	136.8	SSW 5	MOCN	RL max 85m
MSM17/261-1	MSS-13	09.02.2011	11:27	22° 59.88' S	14° 5.16' E	137.9	SSW 6	MSS	Speed 0.5kn
MSM17/262-1	MSS-14	09.02.2011	12:29	23° 0.00' S	14° 9.96' E	122.2	SSW 7	MSS	Speed 0.5kn
MSM17/263-1	MSS-15	09.02.2011	13:42	22° 59.98' S	14° 15.00' E	105.8	SSW 7	MSS	Speed 0.5kn
MSM17/264	**T8-5**								
MSM17/264-1	T8-5	09.02.2011	14:55	22° 59.98' S	14° 20.01' E	66.4	SSW 9	CTD/RO	RL max. 58m
MSM17/264-2	T8-5	09.02.2011	15:02	22° 59.98' S	14° 20.02' E	66.4	SSW 9	PLA	
MSM17/264-3	T8-5	09.02.2011	15:04	22° 59.98' S	14° 20.02' E	65.9	SSW 9	APSN	
MSM17/264-4	T8-5	09.02.2011	15:09	22° 59.98' S	14° 20.02' E	67.6	SSW 8	SD	
MSM17/264-5	T8-5	09.02.2011	15:12	22° 59.98' S	14° 20.02' E	67.3	SSW 8	MN	vertically operated
MSM17/264-5	T8-5	09.02.2011	15:14	22° 59.98' S	14° 20.02' E	66.8	SSW 8	MN	RL max. 49m
MSM17/264-6	T8-5	09.02.2011	15:28	22° 59.98' S	14° 20.02' E	65.7	S 7	MUC	RL max. 68m
MSM17/264-7	T8-5	09.02.2011	15:39	23° 0.04' S	14° 19.99' E	66.4	SSW 8	MN	Speed 2Kn
MSM17/264-7	T8-5	09.02.2011	15:42	23° 0.14' S	14° 19.96' E	67.8	SSW 7	MN	RL max. 61m
MSM17/264-8	T8-5	09.02.2011	16:17	23° 0.65' S	14° 19.79' E	67.5	SSW 6	MSS	
MSM17/265-1	MSS-16	09.02.2011	16:59	23° 0.06' S	14° 22.96' E	40.2	SSW 5	MSS	
MSM17/266	**Drifter**								
MSM17/266-1	Drifter	10.02.2011	17:54	22° 42.25' S	13° 28.34' E	240.5	S 10	TD	Spotted
MSM17/266-1	Drifter	10.02.2011	19:05	22° 41.37' S	13° 28.75' E	233.9	S 9	TD	Melo and Spiere on deck
MSM17/266-1	Drifter	10.02.2011	19:10	22° 41.29' S	13° 28.86' E	231.0	S 11	TD	2 Seacats. Holey sock and Driftbag on deck
MSM17/266-1	Drifter	10.02.2011	19:16	22° 41.20' S	13° 29.01' E	230.6	S 11	TD	sediment trap on deck
MSM17/266-2	Drifter	10.02.2011	20:14	22° 42.12' S	13° 27.62' E	247.7	S 9	CTD/RO	RL max. 240 m
MSM17/266-3	Drifter	10.02.2011	20:39	22° 42.12' S	13° 27.65' E	247.4	S 7	PLA	

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	**GENUS**		**[UTC]**	**Lat**	**Lon**	**[m]**	**[m/s]**	**Abbreviation**	
MSM17/266-4	Drifter	10.02.2011	20:40	22° 42.12' S	13° 27.65' E	247.2	S 7	D-NET	
MSM17/266-5	Drifter	10.02.2011	20:55	22° 42.15' S	13° 27.66' E	250.3	S 7	MSS	Speed 0.5 Kn
MSM17/266-6	Drifter	10.02.2011	21:46	22° 42.59' S	13° 27.71' E	248.0	S 9	MN	Speed 2 Kn
MSM17/266-6	Drifter	10.02.2011	21:57	22° 42.95' S	13° 27.75' E	248.8	S 10	MN	RL max 272m
MSM17/266-7	Drifter	10.02.2011	22:32	22° 44.06' S	13° 27.91' E	250.1	S 8	MOCN	Speed 2 kn
MSM17/266-7	Drifter	10.02.2011	22:56	22° 44.84' S	13° 28.04' E	250.3	S 8	MOCN	RL max 368m
MSM17/266-8	Drifter	10.02.2011	23:52	22° 45.90' S	13° 28.08' E	255.7	SSE 8	MUC	RL max 257m
MSM17/267	**WKT-1**								
MSM17/267-1	WKT-1	11.02.2011	04:02	22° 0.01' S	13° 9.99' E	211.1	S 8	CTD/RO	RL max. 201m
MSM17/267-2	WKT-2	11.02.2011	04:25	22° 0.01' S	13° 10.00' E	211.5	SSE 7	D-NET	
MSM17/267-3	WKT-3	11.02.2011	04:40	22° 0.05' S	13° 10.02' E	211.3	SSE 9	MN	Speed 2Kn
MSM17/267-3	WKT-4	11.02.2011	04:51	22° 0.35' S	13° 10.22' E	211.1	SSE 8	MN	RL max. 262m
MSM17/267-4	WKT-5	11.02.2011	05:35	22° 1.16' S	13° 10.78' E	211.3	SSE 9	MUC	RL max.210m
MSM17/268	**T-7-5**								
MSM17/268-1	T7-5	11.02.2011	11:04	21° 0.59' S	13° 29.78' E	0.0	S 6	CTD/RO	RL max 12m
MSM17/268-2	T7-5	11.02.2011	11:11	21° 0.60' S	13° 29.77' E	0.0	S 6	APSN	
MSM17/268-3	T7-5	11.02.2011	11:20	21° 0.60' S	13° 29.78' E	0.0	S 6	D-NET	
MSM17/268-4	T7-5	11.02.2011	11:31	21° 0.60' S	13° 29.78' E	0.0	SSE 6	MSS	Speed 0.5kn
MSM17/268-5	T7-5	11.02.2011	11:51	21° 0.80' S	13° 29.66' E	20.4	SSE 6	MN	Speed 2kn
MSM17/268-5	T7-5	11.02.2011	11:52	21° 0.82' S	13° 29.64' E	0.0	SSE 6	MN	RL max 15m
MSM17/268-6	T7-5	11.02.2011	12:14	21° 1.35' S	13° 29.31' E	0.0	SSE 7	TT	Speed 2kn
MSM17/268-6	T7-5	11.02.2011	12:16	21° 1.42' S	13° 29.27' E	0.0	SSE 6	TT	RL max 10m
MSM17/268-7	T7-5	11.02.2011	12:35	21° 1.90' S	13° 29.97' E	0.0	SSE 6	TT	Speed 2kn
MSM17/268-7	T7-5	11.02.2011	12:39	21° 2.02' S	13° 28.91' E	31.5	SSE 6	TT	RL max 10m
MSM17/268-8	T7-5	11.02.2011	13:15	21° 1.75' S	13° 29.18' E	27.4	SSE 7	MUC	RL max 31m
MSM17/268-9	T7-5	11.02.2011	13:30	21° 1.75' S	13° 29.18' E	29.4	S 7	MUC	RL max 33m
MSM17/268-10	T7-5	11.02.2011	13:47	21° 1.75' S	13° 29.18' E	26.7	S 7	MUC	RL max 32m
MSM17/269	**T-7-4**								
MSM17/269-1	T7-4	11.02.2011	14:55	20° 59.98' S	13° 20.00' E	95.2	SSE 8	CTD/RO	RL max. 86m
MSM17/269-2	T7-4	11.02.2011	15:09	20° 59.98' S	13° 20.00' E	97.4	S 9	APSN	
MSM17/269-3	T7-4	11.02.2011	15:15	20° 59.98' S	13° 20.00' E	98.7	SSE 8	D-NET	
MSM17/269-4	T7-4	11.02.2011	15:24	20° 59.98' S	13° 20.00' E	96.9	S 8	MN	vertically operated
MSM17/269-4	T7-4	11.02.2011	15:29	20° 59.98' S	13° 20.00' E	97.7	SSE 7	MN	RL max. 79m
MSM17/269-5	T7-4	11.02.2011	15:44	20° 59.98' S	13° 20.00' E	95.4	S 7	MUC	RL max. 97m
MSM17/269-6	T7-4	11.02.2011	16:12	20° 59.98' S	13° 20.00' E	95.2	SSE 8	MUC	RL max. 94 m
MSM17/269-7	T7-4	11.02.2011	16:22	21° 0.01' S	13° 20.01' E	95.1	SSE 9	MSS	Speed 0.5 Kn
MSM17/269-8	T7-4	11.02.2011	16:48	21° 0.28' S	13° 20.08' E	95.5	SSE 8	MN	Speed 2Kn
MSM17/269-8	T7-4	11.02.2011	16:52	21° 0.40' S	13° 20.11' E	95.8	SSE 9	MN	RL max. 105m
MSM17/269-9	T7-4	11.02.2011	17:07	21° 0.85' S	13° 20.28' E	96.0	SSE 9	TT	Speed 2Kn
MSM17/269-9	T7-4	11.02.2011	17:14	21° 1.06' S	13° 20.36' E	96.8	SSE 8	TT	RL max. 40m
MSM17/270	**T-7-3**								
MSM17/270-1	T7-3	11.02.2011	18:43	20° 59.95' S	13° 10.03' E	125.8	S 7	CTD/RO	RL max. 118 m
MSM17/270-2	T7-3	11.02.2011	18:58	20° 59.95' S	13° 10.04' E	126.2	SSE 7	APSN	
MSM17/270-3	T7-3	11.02.2011	19:07	20° 59.94' S	13° 10.06' E	125.4	SSE 7	D-NET	
MSM17/270-4	T7-3	11.02.2011	19:20	20° 59.93' S	13° 10.05' E	125.5	SSE 7	MUC	RL max. 128 m
MSM17/270-5	T7-3	11.02.2011	19:30	20° 59.94' S	13° 10.06' E	125.5	SE 6	MSS	Speed 0.5 Kn
MSM17/270-6	T7-3	11.02.2011	20:35	21° 0.44' S	13° 10.40' E	125.8	SSE 4	MN	Speed 2 Kn
MSM17/270-6	T7-3	11.02.2011	20:40	21° 0.56' S	13° 10.51' E	124.9	SSE 4	MN	RL max. 157 m
MSM17/270-7	T7-3	11.02.2011	21:08	21° 1.18' S	13° 11.13' E	124.5	SSE 3	TT	Speed 2 Kn
MSM17/270-7	T7-3	11.02.2011	21:11	21° 1.27' S	13° 11.19' E	126.6	SSE 2	TT	RL max. 50 m
MSM17/270-8	T7-3	11.02.2011	21:24	21° 1.66' S	13° 11.45' E	130.4	SSE 3	TT	Speed 2 Kn
MSM17/270-8	T7-3	11.02.2011	21:29	21° 1.81' S	13° 11.55' E	127.3	S 3	TT	RL max. 50 m
MSM17/271	**T-7-2**								
MSM17/271-1	T7-2	11.02.2011	23:54	20° 59.99' S	12° 50.03' E	300.2	S 3	CTD/RO	RL max 292m
MSM17/271-2	T7-2	12.02.2011	00:08	20° 59.96' S	12° 50.06' E	301.6	S 3	APSN	
MSM17/271-3	T7-2	12.02.2011	00:14	20° 59.96' S	12° 50.06' E	299.2	S 3	D-NET	
MSM17/271-4	T7-2	12.02.2011	00:27	20° 59.96' S	12° 50.06' E	299.7	S 2	MN	vertically operated
MSM17/271-4	T7-2	12.02.2011	00:37	20° 59.96' S	12° 50.06' E	300.0	S 3	MN	RL max. 286 m
MSM17/271-5	T7-2	12.02.2011	01:00	20° 59.99' S	12° 50.01' E	302.0	SSE 3	MUC	RL max 303m
MSM17/271-6	T7-2	12.02.2011	01:13	21° 0.01' S	12° 50.02' E	300.0	SSE 4	MSS	Speed 0.5kn
MSM17/271-7	T7-2	12.02.2011	02:07	21° 0.46' S	12° 50.10' E	302.4	SSE 4	MN	Speed 2Kn
MSM17/271-7	T7-2	12.02.2011	02:20	21° 0.87' S	12° 50.21' E	301.7	SSE 3	MN	RL max. 273m
MSM17/271-8	T7-2	12.02.2011	02:52	21° 1.94' S	12° 50.50' E	301.9	S 4	MN	Speed 2Kn
MSM17/271-8	T7-2	12.02.2011	02:57	21° 2.11' S	12° 50.55' E	307.0	S 4	MN	RL max. 136m
MSM17/271-9	T7-2	12.02.2011	03:24	21° 2.89' S	12° 50.87' E	0.0	SSE 4	MOCN	Speed 2Kn
MSM17/271-9	T7-2	12.02.2011	03:43	21° 3.41' S	12° 51.29' E	299.8	S 5	MOCN	RL max. 411m
MSM17/271-10	T7-2	12.02.2011	04:32	21° 4.73' S	12° 52.32' E	296.0	S 6	MOCN	Speed 2Kn
MSM17/271-10	T7-2	12.02.2011	04:40	21° 4.94' S	12° 52.49' E	294.8	S 6	MOCN	RL max. 175m

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/272	**T-7-1**								
MSM17/272-1	T7-1	12.02.2011	07:20	21° 0.05' S	12° 29.99' E	434.3	SSE 7	CTD/RO	RL max. 424 m
MSM17/272-2	T7-1	12.02.2011	07:34	21° 0.05' S	12° 29.98' E	434.0	SE 7	APSN	
MSM17/272-3	T7-1	12.02.2011	08:01	21° 0.05' S	12° 29.99' E	435.2	SE 6	CTD/RO	RL max. 60 m
MSM17/272-4	T7-1	12.02.2011	08:11	21° 0.05' S	12° 30.02' E	432.3	SE 6	MSS	Speed 0.5 Kn
MSM17/272-5	T7-1	12.02.2011	09:11	21° 0.40' S	12° 30.33' E	431.6	SE 6	MN	vertically operated
MSM17/272-5	T7-1	12.02.2011	09:25	21° 0.40' S	12° 30.33' E	430.2	SE 6	MN	RL max. 397 m
MSM17/272-6	T7-1	12.02.2011	09:48	21° 0.40' S	12° 30.33' E	431.0	SSE 6	MN	vertically operated
MSM17/272-6	T7-1	12.02.2011	09:53	21° 0.40' S	12° 30.33' E	432.6	SSE 6	MN	RL max. 97 m
MSM17/272-7	T7-1	12.02.2011	10:30	21° 0.00' S	12° 30.00' E	431.9	SSE 6	MUC	RL max 434m
MSM17/272-8	T7-1	12.02.2011	10:46	21° 0.11' S	12° 30.04' E	432.9	SSE 7	MOCN	Speed 2kn
MSM17/272-8	T7-1	12.02.2011	11:11	21° 0.85' S	12° 30.44' E	434.2	SSE 7	MOCN	RL max 631m
MSM17/272									
MSM17/273-1		12.02.2011	14:08	20° 46.12' S	12° 20.64' E	405.1	SSE 10	ROV	Teststation
MSM17/273-1		12.02.2011	14:13	20° 46.12' S	12° 20.64' E	401.7	SSE 10	ROV	Crane operation corrected
MSM17/273-1		12.02.2011	14:35	20° 46.08' S	12° 20.80' E	405.8	SSE 8	ROV	RL max. 85m
MSM17/274	**T-6-1**								
MSM17/274-1	T6-1	12.02.2011	19:42	19° 59.93' S	11° 49.99' E	412.2	SSE 11	CTD/RO	RL max. 402 m
MSM17/274-2	T6-1	12.02.2011	19:58	19° 59.90' S	11° 50.04' E	412.2	SSE 12	D-NET	
MSM17/274-3	T6-1	12.02.2011	20:11	19° 59.92' S	11° 50.04' E	409.9	SSE 12	MSS	Speed 0.5 Kn
MSM17/274-4	T6-1	12.02.2011	21:08	20° 0.33' S	11° 50.21' E	410.9	SSE 11	MN	vertically operated
MSM17/274-4	T6-1	12.02.2011	21:22	20° 0.33' S	11° 50.21' E	411.8	SSE 11	MN	RL max. 383 m
MSM17/274-5	T6-1	12.02.2011	21:43	20° 0.33' S	11° 50.21' E	410.4	SSE 11	MN	vertically operated
MSM17/274-5	T6-1	12.02.2011	21:48	20° 0.33' S	11° 50.21' E	411.0	SSE 11	MN	RL max. 92 m
MSM17/274-6	T6-1	12.02.2011	22:25	20° 0.00' S	11° 50.00' E	413.5	SE 9	MUC	RL max 415m
MSM17/274-7	T6-1	12.02.2011	22:44	20° 0.14' S	11° 50.15' E	411.1	SE 9	MOCN	Speed 2kn
MSM17/274-7	T6-1	12.02.2011	23:07	20° 0.64' S	11° 50.76' E	406.2	SE 8	MOCN	RL max 623m
MSM17/275	**T-6-2**								
MSM17/275-1	T6-2	13.02.2011	01:44	20° 0.00' S	12° 9.96' E	278.8	SE 6	CTD/RO	RL max 270m
MSM17/275-2	T6-2	13.02.2011	01:52	19° 59.98' S	12° 9.93' E	278.6	SE 6	D-NET	
MSM17/275-3	T6-2	13.02.2011	02:03	19° 59.99' S	12° 9.96' E	279.2	SSE 7	MSS	Speed 0.5Kn
MSM17/275-4	T6-2	13.02.2011	03:01	20° 0.32' S	12° 10.24' E	280.1	SE 6	MN	vertically operated
MSM17/275-4	T6-2	13.02.2011	03:11	20° 0.32' S	12° 10.24' E	278.5	SSE 8	MN	RL max. 199m
MSM17/275-5	T6-2	13.02.2011	03:48	20° 0.00' S	12° 10.01' E	278.6	SSE 7	MUC	RL max. 280m
MSM17/275-6	T6-2	13.02.2011	04:10	20° 0.26' S	12° 10.31' E	278.0	SSE 8	MN	Speed 2Kn
MSM17/275-6	T6-2	13.02.2011	04:20	20° 0.45' S	12° 10.57' E	278.9	SSE 7	MN	RL max. 259m
MSM17/275-7	T6-2	13.02.2011	05:03	20° 1.25' S	12° 11.75' E	270.9	SSE 7	TT	RL max. 60m
MSM17/276	**T-6-3**								
MSM17/276-1	T6-3	13.02.2011	07:06	19° 59.98' S	12° 29.97' E	155.6	SSE 7	CTD/RO	RL max. 147 m
MSM17/276-2	T6-3	13.02.2011	07:17	19° 59.97' S	12° 30.00' E	149.7	SSE 7	D-NET	
MSM17/276-3	T6-3	13.02.2011	07:30	20° 0.00' S	12° 30.04' E	155.1	SSE 7	MSS	Speed 0.5 Kn
MSM17/276-4	T6-3	13.02.2011	08:09	20° 0.25' S	12° 30.16' E	156.2	SSE 7	MN	vertically operated
MSM17/276-4	T6-3	13.02.2011	08:14	20° 0.25' S	12° 30.16' E	155.3	SSE 8	MN	RL max. 138 m
MSM17/276-5	T6-3	13.02.2011	08:41	20° 0.00' S	12° 30.00' E	157.9	SSE 8	MUC	RL max. 159 m
MSM17/276-6	T6-3	13.02.2011	08:55	20° 0.09' S	12° 30.05' E	154.7	SSE 8	MN	Speed 2 Kn
MSM17/276-6	T6-3	13.02.2011	09:01	20° 0.24' S	12° 30.18' E	155.7	SSE 8	MN	RL max. 181 m
MSM17/276-7	T6-3	13.02.2011	09:25	20° 0.91' S	12° 30.70' E	156.3	SSE 8	TT	Speed 2 Kn
MSM17/276-7	T6-3	13.02.2011	09:30	20° 1.06' S	12° 30.81' E	154.1	SSE 7	TT	RL max. 30 m
MSM17/276-8	T6-3	13.02.2011	09:38	20° 1.31' S	12° 30.98' E	154.2	SSE 7	TT	Speed 2 Kn
MSM17/276-8	T6-3	13.02.2011	09:41	20° 1.39' S	12° 31.04' E	156.1	SSE 7	TT	RL max. 30 m
MSM17/277	**T-6-4**								
MSM17/277-1	T6-4	13.02.2011	11:43	19° 59.99' S	12° 50.01' E	109.6	S 8	CTD/RO	RL max 95m
MSM17/277-2	T6-4	13.02.2011	11:52	19° 59.99' S	12° 50.00' E	104.0	S 9	D-NET	
MSM17/277-3	T6-4	13.02.2011	12:03	19° 59.96' S	12° 49.96' E	104.2	S 9	MSS	Speed 0.5kn
MSM17/277-4	T6-4	13.02.2011	12:51	20° 0.00' S	12° 50.00' E	104.2	S 10	MUC	RL max 104m
MSM17/277-5	T6-4	13.02.2011	13:00	20° 0.09' S	12° 50.00' E	105.5	S 8	MN	Speed 2kn
MSM17/277-5	T6-4	13.02.2011	13:04	20° 0.21' S	12° 50.01' E	104.5	S 10	MN	RL max 100m
MSM17/277-6	T6-4	13.02.2011	13:24	20° 0.88' S	12° 50.15' E	109.7	S 10	TT	Speed 2kn
MSM17/277-6	T6-4	13.02.2011	13:29	20° 1.04' S	12° 50.18' E	114.7	S 9	TT	RL max 30m
MSM17/277-7	T6-4	13.02.2011	13:36	20° 1.28' S	12° 50.22' E	110.0	S 9	TT	Speed 2kn
MSM17/277-7	T6-4	13.02.2011	13:39	20° 1.37' S	12° 50.24' E	108.8	S 9	TT	RL max. 30m
MSM17/277-8	T6-4	13.02.2011	13:48	20° 1.67' S	12° 50.29' E	110.2	S 8	TT	RL max 30m
MSM17/277-9	T6-4	13.02.2011	14:20	20° 1.98' S	12° 50.42' E	110.2	S 10	ROV	DummyTransponder in water
MSM17/277-9	T6-4	13.02.2011	14:49	20° 1.92' S	12° 50.54' E	108.3	S 10	ROV	101m
MSM17/278	**T-6-5**								
MSM17/278-1	T6-5	13.02.2011	16:51	20° 0.00' S	13° 0.00' E	0.0	SSE 6	CTD/RO	RL max. 26m
MSM17/278-2	T6-5	13.02.2011	16:59	20° 0.00' S	13° 0.00' E	34.7	SSE 6	D-NET	

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/278-3	T6-5	13.02.2011	17:11	20° 0.00' S	13° 0.00' E	34.4	SSE 6	MSS	Speed 0.5Kn
MSM17/278-4	T6-5	13.02.2011	17:35	20° 0.00' S	13° 0.00' E	0.0	SE 7	MUC	RL max. 35m
MSM17/278-5	T6-5	13.02.2011	17:41	20° 0.00' S	13° 0.00' E	0.0	SSE 7	MN	Speed 2 kn
MSM17/278-5	T6-5	13.02.2011	17:47	20° 0.13' S	13° 0.02' E	34.9	SSE 7	MN	RL max. 30 m
MSM17/278-6	T6-5	13.02.2011	18:02	20° 0.59' S	13° 0.14' E	35.1	S 7	TT	Speed 2 Kn
MSM17/278-6	T6-5	13.02.2011	18:04	20° 0.66' S	13° 0.15' E	35.4	SSE 7	TT	RL max. 20 m
MSM17/279	**T-5-5**								
MSM17/279-1	T5-5	14.02.2011	00:11	18° 59.97' S	12° 27.00' E	38.4	SE 5	CTD/RO	RL max 30m
MSM17/279-2	T5-5	14.02.2011	00:15	18° 59.98' S	12° 27.01' E	39.2	SE 5	D-NET	
MSM17/279-3	T5-5	14.02.2011	00:22	18° 59.96' S	12° 27.00' E	38.7	SSE 6	APSN	
MSM17/279-4	T5-5	14.02.2011	00:31	18° 59.98' S	12° 27.01' E	75.1	SE 6	MSS	Speed 0.5kn
MSM17/279-5	T5-5	14.02.2011	00:51	19° 0.08' S	12° 27.05' E	75.2	SE 6	MUC	RL max 40m
MSM17/279-6	T5-5	14.02.2011	01:01	19° 0.08' S	12° 27.05' E	39.6	SE 5	MUC	RL max 38m
MSM17/279-7	T5-5	14.02.2011	01:11	19° 0.19' S	12° 27.08' E	39.3	SE 5	MN	Speed 2kn
MSM17/279-7	T5-5	14.02.2011	01:12	19° 0.22' S	12° 27.10' E	0.0	SSE 5	MN	RL max 30m
MSM17/280-1	T5-4	14.02.2011	01:47	18° 59.95' S	12° 24.96' E	62.9	SE 5	MSS	Speed 0.5kn
MSM17/281-1	T5-3	14.02.2011	03:11	19° 0.08' S	12° 20.14' E	97.5	ESE 4	CTD/RO	RL max. 91 m
MSM17/282	**T-5-4**								
MSM17/282-1	T5-4	14.02.2011	04:34	18° 59.97' S	12° 15.00' E	113.5	ESE 5	CTD/RO	RL max. 104m
MSM17/282-2	T5-4	14.02.2011	04:39	18° 59.97' S	12° 15.00' E	113.1	ESE 5	D-NET	
MSM17/282-3	T5-4	14.02.2011	04:44	18° 59.97' S	12° 15.00' E	114.7	ESE 4	APSN	
MSM17/282-4	T5-4	14.02.2011	04:54	18° 59.98' S	12° 15.02' E	112.8	ESE 5	MSS	
MSM17/282-5	T5-4	14.02.2011	05:26	19° 0.12' S	12° 15.21' E	112.5	SE 4	MN	vertically operated
MSM17/282-5	T5-4	14.02.2011	05:29	19° 0.12' S	12° 15.21' E	112.4	SE 4	MN	RL max. 99m
MSM17/282-6	T5-4	14.02.2011	05:44	19° 0.19' S	12° 15.32' E	112.6	ESE 4	MN	Speed 2 Kn
MSM17/282-6	T5-4	14.02.2011	05:49	19° 0.27' S	12° 15.47' E	0.0	SE 4	MN	RL max. 124m
MSM17/282-7	T5-4	14.02.2011	06:13	19° 0.63' S	12° 16.22' E	111.3	SE 4	TT	Speed 2 Kn
MSM17/282-7	T5-4	14.02.2011	06:16	19° 0.67' S	12° 16.31' E	111.1	SE 4	TT	RL max. 40 m
MSM17/282-8	T5-4	14.02.2011	06:24	19° 0.79' S	12° 16.55' E	111.3	SE 4	TT	Speed 2 Kn
MSM17/282-8	T5-4	14.02.2011	06:26	19° 0.82' S	12° 16.61' E	111.6	SE 4	TT	RL max. 30 m
MSM17/282-9	T5-4	14.02.2011	07:10	18° 59.91' S	12° 15.05' E	112.4	SE 4	ROV	DummyTransponder in water
MSM17/282-9	T5-4	14.02.2011	07:26	18° 59.87' S	12° 15.12' E	113.8	ESE 3	ROV	Dummy at 95 m
MSM17/282-9	T5-4	14.02.2011	07:32	18° 59.90' S	12° 15.11' E	113.5	ESE 3	ROV	110 m
MSM17/283-1	MSS-19	14.02.2011	10:10	19° 0.02' S	12° 10.04' E	130.6	SE 1	MSS	Speed 0.5kn
MSM17/285	**T-5-3**								
MSM17/285-1	T5-3	14.02.2011	12:53	19° 0.00' S	11° 59.95' E	210.9	S 5	CTD/RO	RL max 202m
MSM17/285-2	T5-3	14.02.2011	13:01	19° 0.00' S	11° 59.96' E	210.5	S 5	D-NET	
MSM17/285-3	T5-3	14.02.2011	13:09	18° 59.97' S	11° 59.94' E	211.2	S 5	APSN	
MSM17/285-4	T5-3	14.02.2011	13:29	18° 59.98' S	12° 0.03' E	210.4	SSW 6	CTD/RO	RL max 50m
MSM17/285-5	T5-3	14.02.2011	13:42	18° 59.98' S	12° 0.06' E	209.6	S 5	MN	Vertical
MSM17/285-5	T5-3	14.02.2011	13:48	18° 59.98' S	12° 0.06' E	210.2	S 5	MN	RL max 174m
MSM17/285-6	T5-3	14.02.2011	14:07	18° 59.98' S	12° 0.06' E	209.4	S 4	MN	Vertical
MSM17/285-6	T5-3	14.02.2011	14:09	18° 59.98' S	12° 0.06' E	209.3	S 4	MN	RL max. 65m
MSM17/285-7	T5-3	14.02.2011	14:23	19° 0.14' S	12° 0.10' E	209.7	SSW 3	MOC-D	Speed 2 Kn
MSM17/285-7	T5-3	14.02.2011	14:41	19° 0.73' S	12° 0.14' E	214.0	SSE 2	MOC-D	RL max. 240m
MSM17/285-8	T5-3	14.02.2011	15:08	19° 1.29' S	12° 0.18' E	214.8	SSE 4	MSS	Speed 0.5 Kn
MSM17/285-9	T5-3	15.02.2011	03:06	19° 0.10' S	12° 0.02' E	210.8	SSW 6	MOC-D	Speed 2 Kn
MSM17/285-9	T5-3	15.02.2011	03:22	19° 0.61' S	12° 0.11' E	213.3	SSE 5	MOC-D	RL max. 237m
MSM17/285-10	T5-3	15.02.2011	03:42	19° 1.20' S	12° 0.21' E	215.0	S 4	MSS	
MSM17/285-11	T5-3	15.02.2011	04:37	19° 1.71' S	12° 0.31' E	215.7	SW 5	MN	Speed 2 Kn
MSM17/285-11	T5-3	15.02.2011	04:48	19° 2.06' S	12° 0.40' E	217.1	SW 4	MN	RL max. 250m
MSM17/285-12	T5-3	15.02.2011	05:22	19° 3.00' S	12° 0.71' E	217.7	SW 1	TT	RL max. 50m
MSM17/285-13	T5-3	15.02.2011	05:38	19° 3.42' S	12° 1.00' E	223.9	SW 2	TT	RL max. 50m
MSM17/285-14	T5-3	15.02.2011	05:50	19° 3.71' S	12° 1.21' E	217.1	SW 1	TT	RL max. 50m
MSM17/285-15	T5-3	15.02.2011	07:05	18° 59.95' S	12° 0.05' E	209.1	SW 2	ROV	DummyTransponder in water
MSM17/285-15	T5-3	15.02.2011	07:25	18° 59.95' S	12° 0.15' E	209.4	SSW 2	ROV	205 m
MSM17/285-16	T5-3	15.02.2011	10:32	19° 0.29' S	12° 0.61' E	209.1	ESE 6	MOCN	Speed 2kn
MSM17/285-16	T5-3	15.02.2011	10:46	19° 0.66' S	12° 0.88' E	208.7	SE 5	MOCN	RL max 271m
MSM17/286-1	MSS-21	15.02.2011	12:07	19° 0.00' S	11° 55.00' E	248.7	S 4	MSS	Speed 0.5 kn
MSM17/287-1	MSS-22	15.02.2011	13:42	19° 0.01' S	11° 50.00' E	275.3	SSE 5	MSS	Speed 0.5 kn
MSM17/288-1	MSS-23	15.02.2011	15:12	18° 59.99' S	11° 44.98' E	302.4	SE 4	MSS	Speed 0.5 Kn
MSM17/289-1	MSS-24	15.02.2011	16:44	18° 59.97' S	11° 39.99' E	303.8	SSE 5	MSS	Speed 0.5 Kn
MSM17/290-1	MSS-25	15.02.2011	18:14	18° 59.97' S	11° 34.95' E	279.1	SE 3	MSS	Speed 0.5 Kn
MSM17/291-1	MSS-26	15.02.2011	19:42	18° 59.99' S	11° 29.99' E	299.9	SSE 3	MSS	Speed 2 Kn

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/292	**T-5-2**								
MSM17/292-1	T5-2	15.02.2011	21:32	18° 59.98' S	11° 26.02' E	417.6	SSE 3	CTD/RO	RL max. 411 m
MSM17/292-2	T5-2	15.02.2011	21:45	18° 59.95' S	11° 26.06' E	417.4	SSE 3	D-NET	
MSM17/292-3	T5-2	15.02.2011	21:53	18° 59.94' S	11° 26.07' E	416.5	SE 3	APSN	
MSM17/292-4	T5-2	15.02.2011	22:10	18° 59.93' S	11° 26.07' E	417.9	S 4	CTD/RO	RL max 60m
MSM17/292-5	T5-2	15.02.2011	22:16	18° 59.93' S	11° 26.08' E	418.6	SSE 4	MSS	Speed 0.5 Kn
MSM17/292-6	T5-2	15.02.2011	23:30	19° 0.50' S	11° 26.23' E	414.1	S 5	MN	Vertical
MSM17/292-6	T5-2	15.02.2011	23:42	19° 0.50' S	11° 26.22' E	414.7	SSE 7	MN	RL max 372m
MSM17/292-7	T5-2	16.02.2011	00:05	19° 0.51' S	11° 26.23' E	416.7	SSE 7	MN	Vertikal
MSM17/292-7	T5-2	16.02.2011	00:09	19° 0.50' S	11° 26.23' E	413.4	S 6	MN	RL max 98m
MSM17/292-8	T5-2	16.02.2011	00:37	19° 0.00' S	11° 26.00' E	418.5	SSE 7	MUC	RL max 425m
MSM17/292-9	T5-2	16.02.2011	01:00	19° 0.11' S	11° 26.02' E	422.0	SSE 8	MOC-D	Speed 2kn
MSM17/292-9	T5-2	16.02.2011	01:34	19° 1.15' S	11° 26.47' E	407.5	SSE 7	MOC-D	RL max 685m
MSM17/292-10	T5-2	16.02.2011	02:20	19° 2.14' S	11° 27.05' E	393.4	SSE 6	MN	Speed 2 Kn
MSM17/292-10	T5-2	16.02.2011	02:31	19° 2.44' S	11° 27.28' E	389.6	SSE 7	MN	RL max. 298m
MSM17/292-11	T5-2	16.02.2011	03:02	19° 3.22' S	11° 27.88' E	373.4	S 5	MOCN	Speed 2 Kn
MSM17/292-11	T5-2	16.02.2011	03:28	19° 3.89' S	11° 28.26' E	363.8	SSE 6	MOCN	RL max. 505m
MSM17/293-1	MSS-27	16.02.2011	05:20	18° 59.99' S	11° 20.00' E	602.5	SE 4	MSS	Speed 0.5 kn
MSM17/294-1	MSS-28	16.02.2011	07:24	19° 0.00' S	11° 10.02' E	928.0	SSE 5	MSS	Speed 0.5 Kn
MSM17/295	**T-5-1**								
MSM17/295-1	T5-1	16.02.2011	09:56	18° 59.99' S	11° 0.05' E	0.0	SSE 4	CTD/RO	RL max. 1286 m
MSM17/295-2	T5-1	16.02.2011	10:24	18° 59.99' S	11° 0.05' E	1300.4	SSE 3	D-NET	
MSM17/295-3	T5-1	16.02.2011	10:33	18° 59.99' S	11° 0.05' E	1306.5	SSE 3	APSN	
MSM17/295-4	T5-1	16.02.2011	10:51	18° 59.99' S	11° 0.05' E	1309.2	SSE 4	CTD/RO	RL max 60m
MSM17/295-5	T5-1	16.02.2011	11:02	19° 0.00' S	11° 0.03' E	1306.9	S 4	MSS	Speed 0.5kn
MSM17/295-6	T5-1	16.02.2011	12:10	19° 0.71' S	11° 0.17' E	1288.6	SSW 5	MOC-D	Speed 2kn
MSM17/295-6	T5-1	16.02.2011	13:22	19° 3.07' S	11° 0.64' E	1251.3	S 5	MOC-D	RL max 1902m
MSM17/295-7	T5-1	16.02.2011	14:34	19° 5.35' S	11° 1.24' E	1199.5	S 6	MN	vertically operated
MSM17/295-7	T5-1	16.02.2011	15:11	19° 5.35' S	11° 1.24' E	1195.7	SSW 5	MN	RL max. 991m
MSM17/295-8	T5-1	16.02.2011	16:03	19° 5.35' S	11° 1.24' E	1199.1	S 6	MN	RL max. 197 m
MSM17/295-9	T5-1	16.02.2011	17:23	19° 0.00' S	11° 0.00' E	1304.3	SSE 4	MUC	RL amx. 1280m
MSM17/295-10	T5-1	16.02.2011	17:54	19° 0.09' S	11° 0.01' E	1299.5	S 6	MN	Speed 2 Kn
MSM17/295-10	T5-1	16.02.2011	18:03	19° 0.39' S	11° 0.06' E	1295.6	S 6	MN	RL max. 260 m
MSM17/295-11	T5-1	16.02.2011	18:43	19° 1.71' S	11° 0.27' E	1428.6	S 5	MOCN	Speed 2 Kn
MSM17/295-11	T5-1	16.02.2011	19:05	19° 2.44' S	11° 0.39' E	1263.3	SSE 5	MOCN	RL max. 643 m
MSM17/295-12	T5-1	16.02.2011	19:56	19° 4.08' S	11° 0.74' E	1231.5	SSE 6	MOC-D	Speed 2 Kn
MSM17/295-12	T5-1	16.02.2011	21:05	19° 6.09' S	11° 1.90' E	1172.1	SSE 7	MOC-D	RL max. 1752 m
MSM17/296-1	MSS-29	16.02.2011	23:39	18° 59.99' S	10° 49.99' E	1419.5	SSE 6	MSS	Speed 0.5kn
MSM17/297-1	MSS-30	17.02.2011	01:56	18° 59.98' S	10° 40.01' E	1698.6	SE 7	MSS	Speed 0.5kn
MSM17/298	**T-5-1a**								
MSM17/298-1	T5-1a	17.02.2011	04:41	19° 0.00' S	10° 30.00' E	2077.2	S 5	CTD/RO	RL amx. 2057m
MSM17/298-2	T5-1a	17.02.2011	05:25	19° 0.00' S	10° 30.00' E	2084.8	S 6	D-NET	
MSM17/298-3	T5-1a	17.02.2011	05:36	19° 0.00' S	10° 30.00' E	2103.1	SSW 6	APSN	
MSM17/298-4	T5-1a	17.02.2011	05:56	19° 0.00' S	10° 30.00' E	2079.7	S 7	CTD/RO	RL max. 60 m
MSM17/298-5	T5-1a	17.02.2011	06:06	19° 0.01' S	10° 30.00' E	2062.9	S 6	MSS	Speed 0.5 Kn
MSM17/298-6	T5-1a	17.02.2011	07:09	19° 0.51' S	10° 29.93' E	2062.8	S 9	MN	vertically operated
MSM17/298-6	T5-1a	17.02.2011	07:49	19° 0.51' S	10° 29.93' E	2019.0	SSE 9	MN	RL max. 990 m
MSM17/298-7	T5-1a	17.02.2011	08:37	19° 0.51' S	10° 29.93' E	2059.6	SSE 9	MN	vertically operated
MSM17/298-7	T5-1a	17.02.2011	08:46	19° 0.51' S	10° 29.93' E	2046.5	SSE 9	MN	RL max. 196 m
MSM17/298-8	T5-1a	17.02.2011	11:20	19° 0.06' S	10° 30.02' E	2055.9	SE 6	MOC-D	Speed 2kn
MSM17/298-8	T5-1a	17.02.2011	12:29	19° 2.20' S	10° 30.87' E	1923.3	SE 9	MOC-D	RL max 1836m
MSM17/298-9	T5-1a	17.02.2011	15:07	19° 0.00' S	10° 30.00' E	2081.5	S 8	MUC	RL max. 2069m
MSM17/298-10	T5-1a	17.02.2011	16:41	19° 0.00' S	10° 30.00' E	2076.0	SSE 10	MUC	RL max. 2074m
MSM17/298-11	T5-1a	17.02.2011	17:25	19° 0.03' S	10° 30.01' E	2107.3	SSE 10	MSS	Speed 0.5 Kn
MSM17/298-12	T5-1a	17.02.2011	18:08	19° 0.44' S	10° 30.13' E	2050.0	SSE 9	MOC-D	Speed 2 Kn
MSM17/298-12	T5-1a	17.02.2011	19:22	19° 2.70' S	10° 30.85' E	1905.3	SSE 10	MOC-D	RL max. 1616 m
MSM17/298-13	T5-1a	17.02.2011	20:28	19° 4.45' S	10° 31.80' E	1795.4	SSE 12	MSS	Speed 0.5 Kn
MSM17/298-14	T5-1a	17.02.2011	21:36	19° 4.97' S	10° 32.06' E	1767.4	SSE 11	MSS	Speed 0.5 Kn
MSM17/299	**WKT-2a**								
MSM17/299-1	WKT-2a	18.02.2011	03:52	18° 29.99' S	11° 24.98' E	444.9	SSE 9	CTD/RO	RL max. 435m
MSM17/299-2	WKT-2a	18.02.2011	04:08	18° 30.00' S	11° 25.00' E	441.6	SE 9	D-NET	
MSM17/299-3	WKT-2a	18.02.2011	04:30	18° 30.04' S	11° 25.02' E	0.0	SE 10	TT	Speed 2 Kn
MSM17/299-3	WKT-2a	18.02.2011	04:34	18° 30.13' S	11° 25.07' E	2184.6	SE 10	TT	RL max. 40m
MSM17/299-4	WKT-2a	18.02.2011	04:45	18° 30.33' S	11° 25.19' E	0.0	SE 9	TT	Speed 2 Kn
MSM17/299-4	WKT-2a	18.02.2011	04:51	18° 30.49' S	11° 25.28' E	2263.4	SE 10	TT	RL max. 50m
MSM17/299-5	WKT-2a	18.02.2011	05:01	18° 30.74' S	11° 25.41' E	1931.3	SE 10	TT	Speed 2 Kn
MSM17/299-5	WKT-2a	18.02.2011	05:03	18° 30.79' S	11° 25.44' E	2220.7	SE 10	TT	RL max. 30m
MSM17/299-6	WKT-2a	18.02.2011	05:51	18° 30.00' S	11° 25.00' E	1951.2	SSE 10	MUC	RL max. 443m

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/299-7	WKT-2a	18.02.2011	06:33	18° 30.00' S	11° 25.00' E	442.1	SE 9	MUC	RL max. 444 m
MSM17/299-8	WKT-2a	18.02.2011	06:48	18° 30.01' S	11° 25.00' E	435.9	SSE 10	MOCN	Speed 2 Kn
MSM17/299-8	WKT-2a	18.02.2011	07:15	18° 30.70' S	11° 25.34' E	418.1	SSE 9	MOCN	RL max. 504 m
MSM17/300-1	**WKT-2**								
MSM17/300-1	WKT-2	18.02.2011	11:30	17° 59.98' S	11° 29.97' E	241.6	SSE 11	CTD/RO	RL max 231m
MSM17/300-2	WKT-2	18.02.2011	11:40	18° 0.00' S	11° 30.00' E	242.3	SSE 10	D-NET	
MSM17/300-3	WKT-2	18.02.2011	11:57	18° 0.00' S	11° 30.00' E	241.2	SSE 10	MUC	RL max 243m
MSM17/300-4	WKT-2	18.02.2011	12:10	18° 0.09' S	11° 30.03' E	242.7	SSE 9	MN	Speed 2kn
MSM17/300-4	WKT-2	18.02.2011	12:20	18° 0.37' S	11° 30.20' E	234.9	SSE 10	MN	RL max 253m
MSM17/300-5	WKT-2	18.02.2011	12:51	18° 1.27' S	11° 30.76' E	241.3	SSE 10	TT	Speed 2kn
MSM17/300-5	WKT-2	18.02.2011	12:56	18° 1.41' S	11° 30.85' E	242.1	SSE 10	TT	RL max 50m
MSM17/300-6	WKT-2	18.02.2011	13:09	18° 1.80' S	11° 31.04' E	242.0	SSE 10	TT	Speed 2kn
MSM17/300-6	WKT-2	18.02.2011	13:16	18° 2.02' S	11° 31.13' E	241.5	S 10	TT	RL max 30m
MSM17/301	**WKT-2b**								
MSM17/301-1	WKT-2b	18.02.2011	14:51	18° 0.76' S	11° 23.92' E	416.2	SSE 10	CTD/RO	RL max. 409m
MSM17/301-2	WKT-2b	18.02.2011	15:14	18° 0.89' S	11° 23.97' E	417.2	SSE 12	MOCN	Speed 2 Kn
MSM17/301-2	WKT-2b	18.02.2011	15:39	18° 1.60' S	11° 24.39' E	426.8	SSE 10	MOCN	RL max. 617m
MSM17/302	**WKT-2c**								
MSM17/302-1	WKT-2c	18.02.2011	19:07	17° 39.71' S	11° 32.10' E	170.5	SSE 12	CTD/RO	RL max. 160 m
MSM17/302-2	WKT-2c	18.02.2011	19:21	17° 39.89' S	11° 32.16' E	168.3	SSE 13	TT	Speed 2 Kn
MSM17/302-2	WKT-2c	18.02.2011	19:24	17° 39.98' S	11° 32.19' E	168.0	SSE 13	TT	RL max. 30 m
MSM17/302-4	WKT-2c	18.02.2011	19:56	17° 40.86' S	11° 32.71' E	165.6	SSE 13	TT	RL max. 90 m
MSM17/303	**WKT-2d**								
MSM17/303-1	WKT-2d	18.02.2011	21:57	17° 33.19' S	11° 20.33' E	439.3	SSE 12	CTD/RO	RL max. 432 m
MSM17/303-2	WKT-2d	18.02.2011	22:13	17° 33.29' S	11° 20.40' E	437.7	SSE 12	MOCN	Speed 2kn
MSM17/303-2	WKT-2d	18.02.2011	22:22	17° 33.57' S	11° 20.51' E	430.2	SSE 13	MOCN	RL max 227m
MSM17/304	**T-1-5**								
MSM17/304-1	T1-5	19.02.2011	01:44	17° 15.00' S	11° 43.00' E	41.2	S 9	CTD/RO	RL max 33m
MSM17/304-2	T1-5	19.02.2011	01:50	17° 15.00' S	11° 43.00' E	40.5	S 10	D-NET	
MSM17/304-3	T1-5	19.02.2011	02:02	17° 15.00' S	11° 43.00' E	0.0	S 9	APSN	
MSM17/304-4	T1-5	19.02.2011	02:13	17° 15.01' S	11° 42.99' E	41.1	S 10	MSS	Speed 0.5 Kn
MSM17/304-5	T1-5	19.02.2011	02:34	17° 15.29' S	11° 42.96' E	18.0	S 10	MN	Speed 2 Kn
MSM17/304-5	T1-5	19.02.2011	02:36	17° 15.36' S	11° 42.95' E	44.0	S 9	MN	RL max. 43m
MSM17/304-6	T1-5	19.02.2011	02:53	17° 15.91' S	11° 42.97' E	43.0	S 9	TT	Speed 2 Kn
MSM17/304-6	T1-5	19.02.2011	02:59	17° 16.10' S	11° 42.99' E	41.9	S 9	TT	RL max. 30m
MSM17/304-7	T1-5	19.02.2011	03:03	17° 16.23' S	11° 43.01' E	0.0	S 9	TT	Speed 2 Kn
MSM17/304-7	T1-5	19.02.2011	03:06	17° 16.33' S	11° 43.02' E	0.0	S 8	TT	RL max. 30m
MSM17/304-8	T1-5	19.02.2011	03:14	17° 16.58' S	11° 43.05' E	0.0	S 9	TT	Speed 2 Kn
MSM17/304-8	T1-5	19.02.2011	03:16	17° 16.64' S	11° 43.06' E	41.2	S 9	TT	RL max. 20m
MSM17/304-9	T1-5	19.02.2011	03:22	17° 16.83' S	11° 43.08' E	42.8	S 9	TT	Speed 2 Kn
MSM17/304-9	T1-5	19.02.2011	03:25	17° 16.92' S	11° 43.09' E	0.0	S 9	TT	RL max. 30m
MSM17/304-10	T1-5	19.02.2011	04:04	17° 15.00' S	11° 43.00' E	0.0	S 8	MUC	RL max. 43m
MSM17/305	**T-1-4**								
MSM17/305-1	T1-4	19.02.2011	05:44	17° 15.00' S	11° 30.00' E	149.9	SSE 11	CTD/RO	RL max. 139m
MSM17/305-2	T1-4	19.02.2011	05:55	17° 15.00' S	11° 30.00' E	149.7	S 10	D-NET	
MSM17/305-3	T1-4	19.02.2011	06:02	17° 15.00' S	11° 29.99' E	149.4	SSE 11	APSN	
MSM17/305-4	T1-4	19.02.2011	06:20	17° 15.00' S	11° 29.99' E	149.5	SSE 11	CTD/RO	RL max. 50 m
MSM17/305-5	T1-4	19.02.2011	06:29	17° 15.02' S	11° 29.99' E	149.0	S 10	MSS	Speed 0.5 Kn
MSM17/305-6	T1-4	19.02.2011	07:22	17° 15.34' S	11° 30.11' E	148.8	S 10	ROV	DummyTransponder in water
MSM17/305-6	T1-4	19.02.2011	07:48	17° 15.28' S	11° 30.34' E	146.7	S 11	ROV	145 m
MSM17/305-7	T1-4	19.02.2011	10:00	17° 15.24' S	11° 30.37' E	146.4	S 10	MN	vertically operated
MSM17/305-7	T1-4	19.02.2011	10:05	17° 15.24' S	11° 30.38' E	147.0	S 10	MN	RL max 128m
MSM17/305-8	T1-4	19.02.2011	10:20	17° 15.24' S	11° 30.39' E	145.1	S 10	MUC	RL max 150m
MSM17/305-9	T1-4	19.02.2011	10:38	17° 15.24' S	11° 30.39' E	147.4	S 11	MUC	RL max 147m
MSM17/305-10	T1-4	19.02.2011	10:46	17° 15.29' S	11° 30.39' E	149.0	S 11	MN	Speed 2kn
MSM17/305-10	T1-4	19.02.2011	10:53	17° 15.52' S	11° 30.41' E	146.9	S 11	MN	RL max 173m
MSM17/305-11	T1-4	19.02.2011	11:19	17° 16.39' S	11° 30.47' E	149.1	S 10	TT	Speed 2kn
MSM17/305-11	T1-4	19.02.2011	11:22	17° 16.49' S	11° 30.47' E	150.2	S 10	TT	RL max 40m
MSM17/305-12	T1-4	19.02.2011	11:33	17° 16.86' S	11° 30.47' E	152.6	S 9	TT	Speed 2kn
MSM17/305-12	T1-4	19.02.2011	11:35	17° 16.93' S	11° 30.48' E	150.8	S 10	TT	RL max 20m
MSM17/305-13	T1-4	19.02.2011	11:41	17° 17.13' S	11° 30.48' E	151.5	S 10	TT	Speed 2kn
MSM17/305-13	T1-4	19.02.2011	11:45	17° 17.26' S	11° 30.48' E	150.4	S 10	TT	RL max 40m
MSM17/305-14	T1-4	19.02.2011	11:53	17° 17.53' S	11° 30.49' E	152.3	S 11	TT	Speed 2kn
MSM17/305-14	T1-4	19.02.2011	11:56	17° 17.63' S	11° 30.49' E	151.6	S 10	TT	RL max 40m
MSM17/305-15	T1-4	19.02.2011	12:12	17° 18.16' S	11° 30.49' E	153.6	S 12	TT	Speed 2kn
MSM17/305-15	T1-4	19.02.2011	12:15	17° 18.26' S	11° 30.49' E	153.8	S 11	TT	RL max 10m
MSM17/305-16	T1-4	19.02.2011	12:24	17° 18.57' S	11° 30.50' E	153.6	S 11	MOC-D	Speed 2kn

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/305-16	T1-4	19.02.2011	12:37	17° 19.00' S	11° 30.50' E	154.9	S 12	MOC-D	RL max 181m
MSM17/305-17	T1-4	19.02.2011	12:59	17° 19.30' S	11° 30.53' E	158.3	S 11	TT	driften
MSM17/305-17	T1-4	19.02.2011	13:00	17° 19.30' S	11° 30.52' E	154.4	S 11	TT	RL max 10m
MSM17/305-18	T1-4	19.02.2011	13:12	17° 19.20' S	11° 30.52' E	157.0	S 11	TT	driften
MSM17/305-18	T1-4	19.02.2011	13:17	17° 19.14' S	11° 30.51' E	156.2	S 11	TT	RL max 10m
MSM17/306	**T-1-4a**								
MSM17/306-1	T1-4a	19.02.2011	15:07	17° 14.88' S	11° 17.34' E	501.1	S 11	ROV	DummyTransponder in water
MSM17/306-1	T1-4a	19.02.2011	15:29	17° 14.74' S	11° 17.38' E	501.5	S 12	ROV	Cancelled. RL max. 200m
MSM17/306-1	T1-4a	19.02.2011	15:42	17° 14.70' S	11° 17.40' E	499.4	S 12	ROV	New attempt to deploy
MSM17/306-1	T1-4a	19.02.2011	15:57	17° 14.76' S	11° 17.41' E	498.8	S 12	ROV	ROV winch stopped due to technical problems Pulled in by hand
MSM17/306-2	T1-4a	19.02.2011	16:51	17° 15.01' S	11° 17.27' E	497.9	S 12	CTD/RO	RL max. 492m
MSM17/306-3	T1-4a	19.02.2011	17:03	17° 15.01' S	11° 17.26' E	497.8	S 12	D-NET	
MSM17/306-4	T1-4a	19.02.2011	17:13	17° 15.01' S	11° 17.26' E	502.0	S 12	APSN	
MSM17/306-5	T1-4a	19.02.2011	17:28	17° 15.01' S	11° 17.25' E	500.2	S 13	CTD/RO	RL max. 60m
MSM17/306-6	T1-4a	19.02.2011	17:37	17° 15.02' S	11° 17.26' E	498.0	SSE 12	MSS	Speed 0.5 Kn
MSM17/306-6	T1-4a	19.02.2011	18:03	17° 15.22' S	11° 17.33' E	488.2	SSE 14	MSS	technical problems
MSM17/306-7	T1-4a	19.02.2011	18:37	17° 15.59' S	11° 17.47' E	479.7	S 14	MN	Speed 2 Kn
MSM17/306-7	T1-4a	19.02.2011	18:46	17° 15.89' S	11° 17.58' E	467.8	S 13	MN	RL max. 279 m
MSM17/306-8	T1-4a	19.02.2011	19:15	17° 16.87' S	11° 17.95' E	440.4	S 14	MOCN	Speed 2 Kn
MSM17/306-8	T1-4a	19.02.2011	19:42	17° 17.76' S	11° 18.36' E	418.5	S 14	MOCN	RL max. 693 m
MSM17/306-9	T1-4a	19.02.2011	20:32	17° 19.09' S	11° 19.11' E	0.0	S 13	MN	vertically operated
MSM17/306-9	T1-4a	19.02.2011	20:47	17° 19.09' S	11° 19.11' E	0.0	SSE 13	MN	RL max. 409 m
MSM17/306-10	T1-4a	19.02.2011	21:12	17° 19.09' S	11° 19.11' E	390.2	S 12	MN	vertically operated
MSM17/306-10	T1-4a	19.02.2011	21:17	17° 19.09' S	11° 19.11' E	389.8	S 13	MN	RL max. 98 m
MSM17/306-11	T1-4a	19.02.2011	22:26	17° 15.00' S	11° 17.30' E	497.2	S 14	MUC	RL max 499m
MSM17/306-12	T1-4a	19.02.2011	22:42	17° 15.03' S	11° 17.31' E	496.9	SSE 14	MSS	Speed 0.5kn
MSM17/306-13	T1-4a	19.02.2011	23:42	17° 15.30' S	11° 17.42' E	484.9	SSE 13	MOC-D	Speed 2kn
MSM17/306-13	T1-4a	20.02.2011	00:11	17° 16.22' S	11° 17.69' E	458.5	SSE 13	MOC-D	RL max 660m
MSM17/307	**T-1-3a**								
MSM17/307-1	T1-3a	20.02.2011	01:37	17° 15.04' S	11° 10.96' E	932.3	S 11	MOCN	Speed 2kn
MSM17/307-1	T1-3a	20.02.2011	01:57	17° 15.60' S	11° 11.12' E	0.0	SSE 13	MOCN	RL max 503m
MSM17/307-2	T1-3a	20.02.2011	02:43	17° 16.87' S	11° 11.91' E	896.3	S 13	MOC-D	Speed 2 Kn
MSM17/307-2	T1-3a	20.02.2011	03:35	17° 18.37' S	11° 12.80' E	773.9	SSE 12	MOC-D	RL max. 1228m
MSM17/307-3	T1-3a	20.02.2011	05:39	17° 14.99' S	11° 10.98' E	917.2	SSE 10	CTD/RO	RL max. 920m
MSM17/307-4	T1-3a	20.02.2011	06:03	17° 14.99' S	11° 10.98' E	918.1	SSE 10	D-NET	
MSM17/307-5	T1-3a	20.02.2011	06:12	17° 14.99' S	11° 10.98' E	918.1	SSE 10	APSN	
MSM17/307-6	T1-3a	20.02.2011	06:25	17° 15.00' S	11° 10.96' E	921.5	SSE 10	MSS	Speed 0.5 Kn
MSM17/307-7	T1-3a	20.02.2011	07:39	17° 15.59' S	11° 11.29' E	890.0	SSE 10	MN	Speed 2 Kn
MSM17/307-7	T1-3a	20.02.2011	07:49	17° 15.89' S	11° 11.45' E	861.5	SSE 10	MN	RL max. 302 m
MSM17/307-8	T1-3a	20.02.2011	08:17	17° 16.51' S	11° 11.79' E	820.5	SSE 11	MN	vertically operated
MSM17/307-8	T1-3a	20.02.2011	08:44	17° 16.51' S	11° 11.79' E	820.2	SSE 10	MN	RL max. 795 m
MSM17/307-9	T1-3a	20.02.2011	09:25	17° 16.51' S	11° 11.79' E	823.3	SSE 10	MN	Vertically operated
MSM17/307-9	T1-3a	20.02.2011	09:32	17° 16.51' S	11° 11.79' E	823.9	S 11	MN	RL max. 198 m
MSM17/307-10	T1-3a	20.02.2011	10:37	17° 15.00' S	11° 11.00' E	915.6	SSE 10	MUC	RL max 924m
MSM17/307-11	T1-3a	20.02.2011	11:00	17° 15.11' S	11° 10.99' E	955.0	S 8	MOC-D	Speed 2kn
MSM17/307-11	T1-3a	20.02.2011	11:57	17° 16.83' S	11° 11.69' E	0.0	S 9	MOC-D	RL max 1239m
MSM17/308	**T-1-3**								
MSM17/308-1	T1-3	20.02.2011	14:53	17° 15.00' S	10° 59.89' E	2001.6	S 10	CTD/RO	RL max. 2125m
MSM17/308-2	T1-3	20.02.2011	15:36	17° 15.00' S	10° 59.89' E	0.0	S 9	D-NET	
MSM17/308-3	T1-3	20.02.2011	15:41	17° 15.00' S	10° 59.89' E	2043.2	S 9	APSN	
MSM17/308-4	T1-3	20.02.2011	16:04	17° 15.01' S	10° 59.87' E	2007.6	S 9	CTD/RO	RL max. 110 m
MSM17/308-5	T1-3	20.02.2011	16:15	17° 15.05' S	10° 59.89' E	2010.4	S 9	MSS	Speed 0.5 Kn
MSM17/308-6	T1-3	20.02.2011	17:30	17° 15.55' S	11° 0.18' E	2015.5	S 8	MN	vertically operated
MSM17/308-6	T1-3	20.02.2011	18:05	17° 15.55' S	11° 0.18' E	2001.6	S 10	MN	RL max. 992 m
MSM17/308-7	T1-3	20.02.2011	18:50	17° 15.55' S	11° 0.18' E	2002.7	S 10	MN	vertically operated
MSM17/308-7	T1-3	20.02.2011	18:56	17° 15.55' S	11° 0.18' E	1997.6	S 10	MN	RL max. 198 m
MSM17/308-8	T1-3	20.02.2011	20:31	17° 15.00' S	11° 0.00' E	2111.9	SSE 10	MUC	RL max. 2109 m
MSM17/308-9	T1-3	20.02.2011	21:22	17° 15.22' S	11° 0.23' E	3378.7	SSE 10	MOCN	Speed 2 Kn
MSM17/308-9	T1-3	20.02.2011	21:46	17° 15.78' S	11° 0.83' E	3385.6	SSE 10	MOCN	RL max. 770 m
MSM17/309	**T-1-2**								
MSM17/309-1	T1-2	21.02.2011	00:02	17° 15.42' S	10° 47.10' E	0.0	SSE 10	MOC-D	Speed 2kn
MSM17/309-1	T1-2	21.02.2011	00:07	17° 15.56' S	10° 47.18' E	3202.2	SSE 10	MOC-D	Communication failure. Cancelled - back on board
MSM17/309-2	T1-2	21.02.2011	00:23	17° 15.71' S	10° 47.17' E	3166.0	SSE 10	MOC-D	Speed 2kn
MSM17/309-2	T1-2	21.02.2011	01:40	17° 17.40' S	10° 49.16' E	3363.4	SSE 11	MOC-D	RL max 1985m

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/309-3	T1-2	21.02.2011	04:43	17° 15.00' S	10° 46.98' E	3003.2	SSE 11	CTD/RO	RL max. 2937m
MSM17/309-4	T1-2	21.02.2011	05:37	17° 15.00' S	10° 46.98' E	0.0	SSE 10	D-NET	
MSM17/309-5	T1-2	21.02.2011	05:50	17° 15.00' S	10° 46.98' E	2740.5	SSE 12	APSN	
MSM17/309-6	T1-2	21.02.2011	06:08	17° 14.99' S	10° 46.99' E	3112.4	S 12	CTD/RO	RL max. 60 m
MSM17/309-7	T1-2	21.02.2011	06:19	17° 15.01' S	10° 47.01' E	0.0	SSE 11	MSS	Speed 0.5 Kn
MSM17/309-8	T1-2	21.02.2011	07:32	17° 15.46' S	10° 47.36' E	3041.6	SSE 10	MN	vertically operated
MSM17/309-8	T1-2	21.02.2011	08:09	17° 15.46' S	10° 47.36' E	3022.5	SSE 11	MN	RL max. 989 m
MSM17/309-9	T1-2	21.02.2011	08:57	17° 15.46' S	10° 47.36' E	2995.8	SSE 8	MN	vertically operated
MSM17/309-9	T1-2	21.02.2011	09:04	17° 15.46' S	10° 47.36' E	2901.2	SSE 9	MN	RL max. 198 m
MSM17/309-10	T1-2	21.02.2011	10:39	17° 15.00' S	10° 47.00' E	2901.7	SSE 10	MUC	RL max 2948m
MSM17/309-11	T1-2	21.02.2011	11:44	17° 15.07' S	10° 47.03' E	0.0	SSE 11	MOC-D	Speed 2kn
MSM17/309-11	T1-2	21.02.2011	12:56	17° 16.77' S	10° 48.42' E	0.0	S 10	MOC-D	RL max 1792m
MSM17/310	**T-1-1**								
MSM17/310-1	T1-1	21.02.2011	16:12	17° 15.04' S	10° 29.96' E	3264.3	S 9	MSS	Speed 0.5 Kn
MSM17/310-2	T1-1	21.02.2011	17:23	17° 15.52' S	10° 30.28' E	3253.4	SSE 10	D-NET	
MSM17/310-3	T1-1	21.02.2011	17:36	17° 15.59' S	10° 30.33' E	3258.9	S 10	MOC-D	Speed 2 Kn
MSM17/310-3	T1-1	21.02.2011	20:50	17° 20.76' S	10° 33.83' E	3224.7	SE 9	MOC-D	RL max. 5672 m
MSM17/310-4	T1-1	22.02.2011	02:43	17° 15.00' S	10° 30.00' E	3269.1	SSE 9	CTD/RO	RL max. 2974m
MSM17/310-5	T1-1	22.02.2011	04:04	17° 15.00' S	10° 30.00' E	3269.5	SSE 9	CTD/RO	RL max. 80m
MSM17/310-6	T1-1	22.02.2011	05:12	17° 15.00' S	10° 30.00' E	3262.4	SSE 7	MUC	RL max. 3266m
MSM17/310-7	T1-1	22.02.2011	06:19	17° 15.13' S	10° 30.07' E	3266.4	SSE 9	MOC-D	Speed 2 Kn
MSM17/310-7	T1-1	22.02.2011	09:52	17° 21.56' S	10° 33.17' E	3250.3	SE 7	MOC-D	RL max. 5739 m
MSM17/310-8	T1-1	22.02.2011	14:47	17° 15.00' S	10° 29.97' E	3268.2	S 6	MN	vertically operated
MSM17/310-8	T1-1	22.02.2011	15:22	17° 15.00' S	10° 29.97' E	3274.0	SSW 7	MN	RL max. 991m
MSM17/310-9	T1-1	22.02.2011	16:06	17° 15.00' S	10° 29.97' E	3256.9	SSW 8	MN	vertically operated
MSM17/310-9	T1-1	22.02.2011	16:14	17° 15.00' S	10° 29.97' E	3266.0	S 8	MN	RL max. 198m
MSM17/310-10	T1-1	22.02.2011	16:32	17° 15.00' S	10° 29.97' E	3255.6	S 9	MN	vertically operated
MSM17/310-10	T1-1	22.02.2011	17:07	17° 15.00' S	10° 29.97' E	3260.1	S 8	MN	RL max. 988m
MSM17/311	**T-1-4**								
MSM17/311-1	T1-4	22.02.2011	22:02	17° 15.00' S	11° 11.00' E	915.8	SSE 11	MUC	RL max 928m
MSM17/311-2	T1-4	22.02.2011	22:48	17° 14.97' S	11° 10.97' E	918.2	SSE 11	MUC	RL max 928m
MSM17/311-3	T1-4	22.02.2011	23:38	17° 15.61' S	11° 11.55' E	856.8	SSE 11	MOCN	RL max 635m
MSM17/312-1	MSS-31	23.02.2011	01:40	17° 15.13' S	11° 24.03' E	243.2	S 10	MSS	Speed 0.5kn
MSM17/313	**T-1-4**								
MSM17/313-1	T1-4	23.02.2011	03:34	17° 15.00' S	11° 30.00' E	150.8	S 11	D-NET	
MSM17/313-2	T1-4	23.02.2011	03:56	17° 15.00' S	11° 30.00' E	149.3	S 11	RT	Operated as driftnet
MSM17/313-2	T1-4	23.02.2011	03:58	17° 15.00' S	11° 30.00' E	150.2	S 10	RT	RL max. 13m
MSM17/313-3	T1-4	23.02.2011	04:10	17° 15.00' S	11° 30.00' E	151.4	S 11	RT	Operated as driftnet
MSM17/313-3	T1-4	23.02.2011	04:13	17° 15.00' S	11° 30.00' E	150.4	S 11	RT	RL max. 10m
MSM17/313-4	T1-4	23.02.2011	04:17	17° 15.00' S	11° 30.00' E	149.6	S 11	RT	Operated as driftnet
MSM17/313-4	T1-4	23.02.2011	04:18	17° 15.00' S	11° 30.00' E	150.8	S 12	RT	RL max. 10m
MSM17/313-5	T1-4	23.02.2011	04:25	17° 15.00' S	11° 30.00' E	148.5	S 11	RT	Operated as driftnet
MSM17/313-5	T1-4	23.02.2011	04:28	17° 15.00' S	11° 30.01' E	151.7	S 10	RT	RL max. 10m
MSM17/313-6	T1-4	23.02.2011	04:43	17° 15.00' S	11° 30.01' E	151.2	SSE 10	RT	Operated as driftnet
MSM17/313-6	T1-4	23.02.2011	04:44	17° 15.00' S	11° 30.01' E	148.8	SSE 11	RT	RL max. 10m
MSM17/313-7	T1-4	23.02.2011	04:50	17° 15.00' S	11° 30.01' E	151.8	SSE 10	RT	Operated as driftnet
MSM17/313-7	T1-4	23.02.2011	04:51	17° 15.00' S	11° 30.01' E	148.8	SSE 9	RT	RL max. 10m
MSM17/313-8	T1-4	23.02.2011	04:58	17° 15.00' S	11° 30.01' E	148.2	S 9	RT	Operated as driftnet
MSM17/313-8	T1-4	23.02.2011	05:01	17° 15.00' S	11° 30.01' E	149.9	S 11	RT	RL max. 10m
MSM17/313-9	T1-4	23.02.2011	05:21	17° 15.00' S	11° 30.01' E	150.6	S 10	RT	Operated as driftnet
MSM17/313-9	T1-4	23.02.2011	05:22	17° 15.00' S	11° 30.01' E	148.9	S 9	RT	RL max. 10m
MSM17/313-10	T1-4	23.02.2011	05:29	17° 15.00' S	11° 30.01' E	151.6	S 9	RT	Operated as driftnet
MSM17/313-10	T1-4	23.02.2011	05:32	17° 15.00' S	11° 30.01' E	150.0	S 9	RT	RL max. 25m
MSM17/313-11	T1-4	23.02.2011	05:40	17° 15.00' S	11° 30.01' E	150.7	S 10	RT	Operated as driftnet
MSM17/313-11	T1-4	23.02.2011	05:41	17° 15.00' S	11° 30.01' E	149.2	S 9	RT	RL max. 15m
MSM17/313-12	T1-4	23.02.2011	05:46	17° 15.00' S	11° 30.01' E	150.9	S 9	RT	Operated as driftnet
MSM17/313-12	T1-4	23.02.2011	05:52	17° 15.00' S	11° 30.01' E	150.0	S 9	RT	RL max. 15m
MSM17/313-13	T1-4	23.02.2011	05:55	17° 15.00' S	11° 30.01' E	149.9	S 9	RT	Operated as driftnet
MSM17/313-13	T1-4	23.02.2011	05:58	17° 15.00' S	11° 30.01' E	150.0	S 9	RT	RL max. 15m
MSM17/314	**T-1-4a**								
MSM17/314-1	T1-4a	23.02.2011	07:24	17° 14.93' S	11° 17.29' E	501.2	SSE 9	ROV	DummyTransponder in water
MSM17/314-1	T1-4a	23.02.2011	08:19	17° 15.04' S	11° 17.35' E	492.7	SSE 9	ROV	Dummy at 480 m
MSM17/314-1	T1-4a	23.02.2011	08:20	17° 15.05' S	11° 17.34' E	494.1	SSE 8	ROV	495 m
MSM17/314-2	T1-4a	23.02.2011	10:50	17° 15.12' S	11° 17.35' E	491.3	S 7	MOCN	Speed 2kn
MSM17/314-2	T1-4a	23.02.2011	11:21	17° 16.02' S	11° 17.77' E	458.3	S 7	MOCN	RL max 716m
MSM17/314-3	T1-4a	23.02.2011	12:21	17° 17.64' S	11° 18.59' E	411.6	S 8	RT	Operated as driftnet
MSM17/314-3	T1-4a	23.02.2011	12:24	17° 17.65' S	11° 18.59' E	412.8	S 8	RT	RL max 15m

Station#		Date	Time	Position	Position	Depth	Wind	Gear	Comment
Merian	GENUS		[UTC]	Lat	Lon	[m]	[m/s]	Abbreviation	
MSM17/315	**T-1-3a**								
MSM17/315-1	T1-3a	23.02.2011	13:34	17° 14.98' S	11° 12.14' E	806.6	S 9	ROV	DummyTransponder in water
MSM17/315-1	T1-3a	23.02.2011	14:46	17° 15.08' S	11° 12.45' E	780.0	S 9	ROV	Dummy at 765m
MSM17/315-1	T1-3a	23.02.2011	14:48	17° 15.08' S	11° 12.46' E	779.1	S 9	ROV	780m
MSM17/315-2	T1-3a	23.02.2011	17:23	17° 15.02' S	11° 12.74' E	755.2	SSE 11	RT	Operated as driftnet
MSM17/315-2	T1-3a	23.02.2011	17:25	17° 15.02' S	11° 12.74' E	755.2	SSE 11	RT	RL max. 15m
MSM17/315-3	T1-3a	23.02.2011	17:30	17° 15.02' S	11° 12.74' E	753.8	SSE 11	RT	Operated as driftnet
MSM17/315-3	T1-3a	23.02.2011	17:34	17° 15.02' S	11° 12.74' E	755.2	SSE 12	RT	RL max. 20m
MSM17/315-4	T1-3a	23.02.2011	17:40	17° 15.02' S	11° 12.74' E	754.6	SSE 11	RT	Operated as driftnet
MSM17/315-4	T1-3a	23.02.2011	17:43	17° 15.02' S	11° 12.74' E	755.2	SSE 10	RT	RL max. 15m
MSM17/315-5	T1-3a	23.02.2011	18:20	17° 15.10' S	11° 11.04' E	931.5	SSE 11	MOCN	Speed 2 Kn
MSM17/315-5	T1-3a	23.02.2011	18:38	17° 15.62' S	11° 11.34' E	879.3	SSE 12	MOCN	RL max. 465 m
MSM17/316	**T-1-1a**								
MSM17/316-1	T1-1a	24.02.2011	02:21	17° 15.00' S	10° 0.00' E	4135.6	SSE 8	CTD/RO	RL max. 3000m
MSM17/316-2	T1-1a	24.02.2011	03:25	17° 15.00' S	10° 0.00' E	3362.3	SSE 8	MN	vertically operated
MSM17/316-2	T1-1a	24.02.2011	04:01	17° 15.00' S	10° 0.00' E	3967.3	S 7	MN	RL max. 990m
MSM17/316-3	T1-1a	24.02.2011	06:25	17° 15.00' S	10° 0.00' E	0.0	SSE 7	MUC	RL max. 3931 m
MSM17/317	**Tr-1_Ang**								
MSM17/317-1	Tr-1_Ang	25.02.2011	21:08	9° 59.98' S	7° 59.96' E	4844.1	SSE 4	CTD/RO	RL max. 3000 m
MSM17/317-2	Tr-1_Ang	25.02.2011	22:05	9° 59.98' S	7° 59.96' E	4842.6	S 4	D-NET	
MSM17/317-3	Tr-1_Ang	25.02.2011	22:19	9° 59.97' S	7° 59.97' E	4855.1	S 4	MN	vertically operated
MSM17/317-3	Tr-1_Ang	25.02.2011	22:50	9° 59.97' S	7° 59.99' E	4847.4	S 4	MN	RL max 989m
MSM17/317-4	Tr-1_Ang	25.02.2011	23:54	10° 0.00' S	8° 0.00' E	4848.3	SSE 5	MOC-D	Speed 2kn
MSM17/317-4	Tr-1_Ang	26.02.2011	01:01	10° 2.04' S	8° 0.90' E	4829.7	SSE 5	MOC-D	RL max 1850m
MSM17/317-5	Tr-1_Ang	26.02.2011	02:13	10° 4.17' S	8° 1.68' E	4823.9	S 4	MN	vertically operated
MSM17/317-5	Tr-1_Ang	26.02.2011	02:18	10° 4.17' S	8° 1.68' E	4826.5	S 5	MN	RL max. 100m
MSM17/317-6	Tr-1_Ang	26.02.2011	02:37	10° 4.20' S	8° 1.70' E	4823.0	S 4	MOCN	Speed 2 Kn
MSM17/317-6	Tr-1_Ang	26.02.2011	03:14	10° 5.30' S	8° 2.27' E	4837.3	S 4	MOCN	RL max. 877m
MSM17/317-7	Tr-1_Ang	26.02.2011	04:28	10° 7.00' S	8° 3.19' E	4825.5	SSW 4	CTD/RO	RL max. 300m
MSM17/317-8	Tr-1_Ang	26.02.2011	04:39	10° 7.00' S	8° 3.19' E	4826.3	SSW 4	MN	vertically operated
MSM17/317-8	Tr-1_Ang	26.02.2011	05:14	10° 7.00' S	8° 3.19' E	4824.2	S 4	MN	RL max. 991m
MSM17/317-9	Tr-1_Ang	26.02.2011	06:01	10° 7.00' S	8° 3.19' E	4823.3	SSE 4	MN	vertically operated
MSM17/317-9	Tr-1_Ang	26.02.2011	06:09	10° 7.00' S	8° 3.19' E	4824.9	S 3	MN	RL max. 197 m
MSM17/317-10	Tr-1_Ang	26.02.2011	07:57	10° 7.00' S	8° 3.19' E	4826.0	S 5	MUC	RL max. 4837 m
MSM17/317-11	Tr-1_Ang	26.02.2011	09:27	10° 6.99' S	8° 3.17' E	4829.0	SSE 4	MSS	
MSM17/317-12	Tr-1_Ang	26.02.2011	10:40	10° 6.43' S	8° 3.03' E	4826.7	SSE 4	MN	vertical
MSM17/317-12	Tr-1_Ang	26.02.2011	11:16	10° 6.42' S	8° 3.01' E	4830.4	SE 3	MN	RL max 992m
MSM17/317-13	Tr-1_Ang	26.02.2011	12:11	10° 6.42' S	8° 3.00' E	4825.5	SSE 3	MN	vertical
MSM17/317-13	Tr-1_Ang	26.02.2011	12:18	10° 6.43' S	8° 2.98' E	4827.6	SE 3	MN	RL max 200m
MSM17/317-14	Tr-1_Ang	26.02.2011	13:56	10° 6.44' S	8° 2.97' E	4825.9	SSE 3	MUC	RL max. 4845m
MSM17/318	**Tr-2_EqS**								
MSM17/318-1	Tr-2_EqS	28.02.2011	19:41	4° 8.98' S	1° 23.30' W	4794.6	NNW 5	MOCN	Speed 2 Kn
MSM17/318-1	Tr-2_EqS	28.02.2011	20:17	4° 8.21' S	1° 24.22' W	4732.7	N 5	MOCN	RL max. 905 m
MSM17/318-2	Tr-2_EqS	28.02.2011	21:15	4° 6.98' S	1° 25.56' W	4570.3	WNW 2	D-NET	
MSM17/318-3	Tr-2_EqS	28.02.2011	22:27	4° 6.99' S	1° 25.59' W	4550.3	SSW 1	CTD/RO	RL max 3000m
MSM17/318-4	Tr-2_EqS	28.02.2011	23:56	4° 6.99' S	1° 25.59' W	4556.9	S 1	MN	vertical
MSM17/318-4	Tr-2_EqS	01.03.2011	00:30	4° 6.99' S	1° 25.59' W	4558.6	S 2	MN	RL max 990m
MSM17/319	**Tr-1_EqN**								
MSM17/319-1	Tr-2_EqN	04.03.2011	01:25	3° 47.01' N	13° 58.01' W	4762.9	SSW 4	D-NET	
MSM17/319-2	Tr-2_EqN	04.03.2011	02:34	3° 47.00' N	13° 58.00' W	4767.8	W 3	CTD/RO	RL max 3000m
MSM17/319-3	Tr-2_EqN	04.03.2011	03:40	3° 47.00' N	13° 58.00' W	4767.9	WNW 2	MN	vertical
MSM17/319-3	Tr-2_EqN	04.03.2011	04:12	3° 47.00' N	13° 58.00' W	4772.3	WNW 2	MN	RL max 991m

8 Data and Sample Storage and Availability

All data and samples collected during cruise MSM 17/3 refer to the GENUS program. In a first stage the GENUS project stores all data of the cruise on an ftp-server at the Leibniz-Institute for Baltic Research in Warnemünde. The server can be accessed through ftp://ftp.io-warnemuende.de. The scientist in charge and to contact for access is Dr. Anja Eggert (anja.eggert@io-warnemuende.de). During the first stage most data are only available to the user groups of the GENUS program and to affiliated project partners and still need to be processed or validated.

However, one central task of the GENUS program is the binding agreement to share the collected data with the scientific community. Therefore, GENUS has already established a legal cooperation with the Pangaea Database (www.pangaea.de) at WDC Mare. This means that all data collected during this cruise as well as for all other GENUS cruises will be transferred and finally stored in the Pangaea Database by the end of the GENUS project in early 2012 and then accessible according to the release requirements of the respective working groups.

All biological and biogeochemical samples collected during this cruise were sent under frozen conditions (-80°C or -20°C) to the respective home laboratories in Germany (IOW, IHF, ZMT, MarZoo, AWI). The majority of the samples will be used for measurements and experiments within the GENUS program. The remaining samples are submitted to the German archives according to the agreement with the *Deutsche Zentrum für Marine Biodiversitätsforschung* (DZMB).

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