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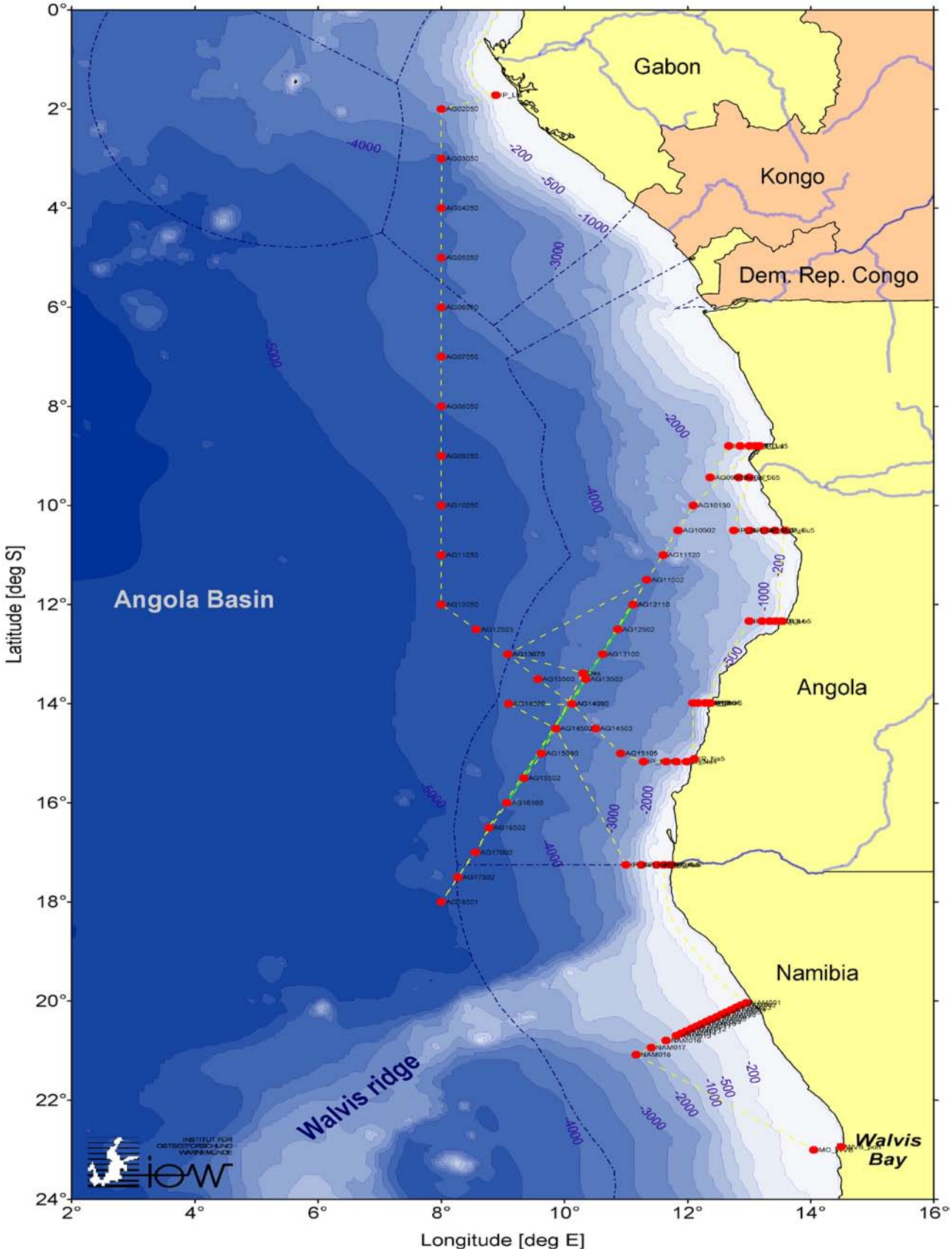
Short Cruise Report
RV Maria S. Meria Cruise MSM 18/4

Libreville – Walvis Bay
24.07.2011 – 20.08.2011
Chief Scientist: Martin Schmidt
Captain: Friedhelm von Staa


Gabon
Kongo
Dem. Rep. Congo
Angola
Namibia
Angola Basin
Walvis ridge
Walvis Bay
-200
-500
-1000
-2000
-3000
-4000
-5000
Latitude [deg S]
Longitude [deg E]
0°
2°
4°
6°
8°
10°
12°
14°
16°
18°
20°
22°
24°
2°
4°
6°
8°
10°
12°
14°
16°

Objectives

The cruise MSM 18-4 combines hydrographic and chemical measurrments with investigations of the phytoplankton, zooplankton and ichthyoplankton community under the umbrella of research in the oxygen minimum zone in the Angola Gyre as well as in its continuation through the Angola-Benguela frontal zone into the Bengueal upwelling area off Namibia. The aim is to contribute to a quantification of those processes that maintain the characteristic oxygen depletion of South Atlantic Central Water (SACW) in the Angola gyre. This will allow for an evaluation of observed trends in the extent of the oxygen minimum zones. From the physical point of view the focus is on wind driven surface processes that govern the transport of nutrients into the euphotic zone. This comprises upwelling due to the more or less permanent negative wind stress curl as well as entrainment into the surface layer by turbulent mixing.

The cruise covers the area of the oxygen minimum zone and some of the adjacent water masses. The vertical and horizontal extent of the oxygen minimum zone is determined. The area of investigation follows the SACW on its way along the Angolan coast to the northern Benguela upwelling area. The comparison of different phytoplankton communities, their primary production in relation to varying nutrient supply by upwelling and mixing and different optical sea water properties will be the basis for a quantification of the carbon export from the surface layer to deeper ocean layers. The export of organic matter from the surface layer will be determined with a drifting sediment trap. Underway measurements of CO_2 surface concentration in ocean and atmosphere are used to quantify the atmosphere-ocean carbon flux.

A related topic is the investigation of reasons for the relatively high biomass and biodiversity of the deep sea plankton in the Angola Basin in relation to the hydrographic conditions. A hypothesis is that the oxygen minimum zone prevents grazing and mineralisation of detritus. Hence, more detritus may sink into deeper layers. Strategies are studied of different zooplankton groups to adapt physiology and behaviour to the oxygen depleted conditions. In the laboratory, oxygen consumption of various individuals of different species is measured to determine the metabolic activity in dependence on environmental conditions like oxygen concentration and temperature. In the same manner the behaviour of fish larvae and juvenile individual in dependence on the oxygen conditions is studied. Also the egg production rate of several tropical copepod species from the surface waters is measured.

At the transects on the Angolan shelf, distribution and abundance of fish larvae is studied in relation to hydrographic conditions. The data will help to estimate and understand the seasonal migration of larvae from tropical fish species in dependence on the position of the Angoal-Benguela Frontal Zone (ABFZ). To understand the regime shift from sardine dominated to horse makrel dominated communities which is observed in the northern Benguela, the tolerance of fish larvae is studied for oxygen depleted conditions at different environmental temperature. Since the northern Benguela is strongly influenced by SACW from the Angola Gyre a comparitive study is carried out with individuals from different latitudes along the Angolan coast.

The opportunity of the cruise is also used for a taxonomic study of the variability of macrozoobenthos in the different habitats in the Angola current. This study will be continued at the next cruise leg in the northern Benguela.

Narrative

The cruise started 10 a.m. on 24th July 2011 in port Owengo near Libreville. The container and crew exchange could be carried out in time kindly supported by the German embassy and the port captain. In the night, the first station was worked at the shelf off Gabon to check the CTD and to test a new drift net for ichthyoplankton sampling. A couple of fish larvae for physiological experiments were caught to start the incubation experiments.

The cruise is organized as follows:

1. The transit to the area of investigation along a transect at 8°E
2. stations in the center of the Angola Gyre
3. transects at the Angolan shelf
4. a long transect across the wind stress curl minimum
5. a permanent station off-shore in the Angola Gyre
6. a transect off the Kunene river
7. a transect in the northern Benguela

Transect along 8°E

Until 28th July *Maria S. Merian* is heading south at 8°E in transit to the area of investigation off Angola. Trade winds are southerly and weak; the ship runs against a long swell from south-south-west. The sky is mostly cloud covered. Every degree a station is worked with CTD, lowered ADCP, nutrient, oxygen and trace metal sampling, zooplankton sampling with vertical multinet and determination of primary production. Optical properties of surface waters are measured in relation to the content of chlorophyll and yellow substances. This provides information on the embedding of the Angola Gyre in the surrounding water masses. There is always a thin well mixed layer of warm surface water. Its thickness is growing southward from a few meters near the equator to about 40 m at 13°S. The transect touches a tongue of the Congo plume indicated by reduced surface salinity. The fluorescence (chlorophyll) maximum is met below the bottom of the surface mixed layer. Immediately below the chlorophyll maximum oxygen concentration is strongly declining. The oxygen concentration has its minimum at about 300 m depth. The minimum value is decreasing southward and is about 0.45 ml/l.

In the night to July 29th a drifter is released at about 13°S and 9° 4'E. The drifter is equipped with a thermistor chain, a pressure sensor and a sediment trap in about 90 m depth. It observes the daily cycle of the thermocline and delivers its position via an IRIDIUM transponder. The drifter is moving south-east-ward against the wind, it path shows an inertial period of about 51 h. The drifters “holy sock” is in between 10 m and 20 m depth. This seems to be well below the main Ekman drift layer. It could be speculated that the drifter is located at the north-eastern rim of the area where the sea surface height is depressed by the divergence in the Ekman transport due to the wind stress curl. This will be investigated later with help of scatterometer-based wind stress data and a numerical circulation model.

Stations in the Center of the Angola Gyre

A similar station work is carried out in the center of the Angola Gyre. These stations are worked from 28th July to 29th July.

Transects at the Angolan shelf

From July 29th to August 03th five transects are sampled that orient perpendicularly to the Angolan coast between Namiba and Luanda. The sea was calm and the sky overcast. Most time visibility was low. The oxygen minimum zone is found extended to the coast. Remarkably are intrusions in several depths of water bodies with suddenly enhanced oxygen concentration but with almost the same temperature and salinity as in the water body above and below. At the shelf isotherms show the characteristic vertical spreading which is a typical for intense Kelvin- or shelf wave dynamics.

Besides hydrographic and chemical measurements ichthyoplankton is caught with a towed multinet and a Tucker trawl. The low abundance of fish larvae is surprising. Nevertheless enough larvae where caught for physiological experiments.

With a van-Veen-grab and a dredge samples of makro-zoobenthos where taken at 9 stations from 100 m to 50 m depth. The spectrum of species and their abundance varies considerably between the stations. The relation of this variability to environmental parameters like water mass and substrate properties will be investigated later in the laboratory. Obviously, at stations off the big cities Luanda and Lobito anthropogenic influence seems to be the reason for much less species and number of individuals. From several species some individuals are fixed separately for later taxonomic determination from morphological distinctive features but also from genetic characteristics.

29th July 21:00 - 30th July 09:15	Namibe transect	15° 10' S
30th July 18:00 - 31th July 02:00	Santa Marta transect	13° 59' S
31th July 12:34 - 31th July 23:30	Lobito transect	12° 20' S
01th Aug. 11:30 - 01th Aug. 23:30	Sumbe transect	10° 34' S
02th Aug. 18:15 - 92th Aug. 04:00	Luanda transect	08° 48' S

On 3th August *MARIA S. MERIAN* had a rendezvous with the bunker ship *DÜZGIT HARMONY* off Luanda. We could welcome Dr. Antonio da Silva and Filomena Vaz Velho from INIP on board. They also brought medical drugs needed for malaria prophylaxis on the scheduled near shore transects, which had been ordered via the German Embassy in Luanda. The main interest of the guests is to see their colleagues participating in the cruise and to talk about future co-operation especially in ichthyoplankton research.

The transect across the wind stress curl minimum

3th August 20:00, start of the station work on the hydrographic section crossing the wind stress curl minimum. CTD stations are arranged in a distance of about ½ degree. CTD casts are carried out to 1200m depth at night and 1000m depth at day time. At selected stations hauls with the vertical multinet are carried out to 1800m depth. The samples are used for physiological experiments. At day time light measurements are done by means of Satlantic. At each station phytoplankton samples are taken for the species determination and measurement of primary production. At several stations single colonies of *trichodesmium* are found. This is an important finding, because it is still unknown where the ocean gains the nitrogen lost in denitrifying areas. The sampling is supplemented with Secci-depth (daytime) and water color determination. The water color is nearly blue. At most stations zooplankton surface samples are collected with a driftnet for determination of egg production rates. During the first days wind is moderate but is increasing at 6th August and drives a wind sea that combined with some swell makes life and work on board uncomfortable. Unfortunately some members of the scientific crew are seriously sea

sick.

6th August, hump day celebration while steaming slowly to the next station. All sea sick persons recovered and Waldemar prepared a delicious barbecue supplemented with sufficient beer and drinks to find a smooth way to the second side of the hill.

7th August 21:00 Deployment of the towed ADCP and towed CTD (Scanfish). Moderate wind and sea state permit reasonable pitch and role of the catamaran. Unfortunately the concentration of scatterers is very low and the range of the 300 kHz ADCP is limited by the thermocline. The ship velocity is optimized so that the scanfish can go as deep as possible. An undulation between sea surface and 100 m depth could be achieved. The track ended successfully at 10th August. Scanfish and catamaran with ADCP are recovered successfully. A first result is that isotherms and isohalines show a significant doming below the thermocline. At some places the upward arching water is entrained into the mixed surface layer. This process generates horizontal gradients in temperature and salinity, but also in oxygen concentration and fluorescence. The thermocline depth is growing southward from some 10 meters off Luanda to almost 90 m at 18°S. A subsurface maximum of fluorescence exists in the north and is located mostly above the thermocline, but seems to be mixed away near frontal areas. The oxygen depleted water mass extends upward to the thermocline.

11th August 07:30 Recovery of the drifter. The experiment was not a complete success. The rope was broken due to corrosion and the chain of instruments was lost almost completely. The drifter delivered the drift path and daily cycles of SST only.

3 day permanent station

At a permanent 3-day station daily cycles in surface layer dynamics are observed, e.g. vertical mixing with microstructure probe (MSS) and CTD. Diurnal zooplankton migration is measured with the ship borne ADCP. The data are verified with repeated catches with the vertical multinet. In addition primary production and optical sea water properties are determined. Intermittently fish larvae are caught with the Tucker trawl.

Station work was carried out from 11th August to 14th August. Winds are weak or gentle and southerly. There was only little swell. The sky was generally overcast. We observed a high patchiness in zooplankton abundance (salps, rare copepods, pteropods) in surface water. 12th August the clean sea water supply is congested with salps. At other times catches are low. Every second hour a micro structure probe (MSS) is deployed. In-between Satlantic optical measurements and vertical multinet hauls are carried out.

Kunene and Dune Point transect

Two transects perpendicularly to the coast off the Kunene mouth (17° 15'S) and Dune point (20° 1.9'S) cover the poleward current that carries oxygen depleted water into the northern Benguela.

15th August 05:30, start of Kunene transect at the outmost station. Obviously there is much more phytoplankton, mostly diatoms, but Secci depth is still 11 m. Seals, whales and a lot of Albatrosses indicate plenty of food, but the abundance of fish larvae is low. The oxygen minimum is as pronounced as in the open ocean. Benthos samples are taken of the mouth of Kunene. The sediment is anoxic with H_2S smell. Nevertheless it reveals a rich benthos and also some fish. A lot of mussels are found that are suspected to live symbiotic with

denitrifying bacteria.

16th August 15:00 start of the Dune point transects. Stations are worked with CTD, MSS and plankton nets. Remarkably at coastal stations bottom water is well mixed most probably from breaking internal waves. This is investigated in detail with the MSS profiles. The bottom layer is anoxic, but without H_2S smell. In the early morning of 17th August a mooring is laid at station NAM006 to be recovered at the next cruise leg. Station work continues.

Station and Mooring off Walvis Bay

19th August 08:00, recovery of the mooring laid out in February 2011. The mooring is deployed again after maintenance

The cruise ended in the morning 20th August in Walvis Bay.

Acknowledgements

The support of many persons in the preparation of the cruise must be noted and appreciated. This comprises the instrumentation group of the IOW, several colleagues lending instruments, kind help to get a French translation of the cruise notification and help with the large amount of paperwork for visa, container transports, flight and hotel reservation. Special thanks to Klaus Bohn for his patient and professsional clearing of the container and dangerous goods transports, to our colleagues filling our container to the roof in the hot sun of June, to the agent of GETMA for affording our transit to the ship in the port of Libreville. Special thanks to Mrs. Edelgard Schwalcke whose engagement for the shipments to *MARIA S. MERIAN* in the hopelessly congested port of Libreville allowed starting the cruise in time. Special thanks also to the director of the INIP in Luanda, Dr. Antonio da Silva for his kind support to get the permission for work in Angolan waters, to the German embassy in Luanda and Antonio da Silva to obtain missing medical drugs, not at least to „Leitstelle“ and „Briese Schiffahrts GmbH“ and master Friedhelm von Staa for delivering and maintaining a good ship in excellent state with a skilled and cooperative crew, that carried us safely over the ocean waves and gave all needed support with remarkably good seamanship. Finally special thanks to all cruise participants for their excellent round-the-clock work in a lovely and creative atmosphere.

Cruise Participants

Martin Schmidt	Chief scientist	IOW
Dr. Volker Mohrholz	Hydrography	IOW
Toralf Heene	Hydrography	IOW
Annethea Muller	Hydrography	IOW
Sebastian Beier	Hydrography	IOW
Sven Trinkler	Nutrient chemistry	IOW
Ursula Henning	Trace metals	IOW
Anita Flohr	Carbon chemistry	ZMT
Dr. Thomas Ohde	Seawater optics	IOW
Monika Gerth	Seawater optics	IOW
Anja Hansen	Phytoplankton	IOW
Dr. Werner Ekau	Ichthyoplankton	ZMT
Dr. Andreas Kuntzmann	Ichthyoplankton	ZMT
Pia Kegler	Ichthyoplankton	ZMT
Katarina Ruby	Ichthyplankton	INIP
Dr. Hans Verheye	Zooplankton	DEA
Dr. Holger Auel	Zooplankton	MarZoo
Lena Teuber	Zooplankton	MarZoo
Marcelina André	Zooplankton	INIP
Silvana Faria	Benthos	INIP
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List of stations

780	**25.07.11**	**00:03**	**1° 42.91' S 8° 52.93' E**	**72.1**	**CTD, Plankton net, Ring Trawl**
781	25.07.11	07:09	1° 59.95' S 7° 59.98' E	2675.5	CTD, Plankton net, Satlantic, Secchi disc,
782	25.07.11	13:36	2° 59.89' S 8° 00.03' E	3967.2	CTD, drift net, multi net, Plankton net, Satlantic, Secchi disc,
783	25.07.11	22:21	3° 59.99' S 7° 59.94' E	4065.7	CTD, Plankton net,
784	26.07.11	04:28	4° 59.95' S 7° 59.97' E	4091.9	CTD, drift net, multi net, Plankton net, Satlantic, Secchi disc,
785	26.07.11	13:27	5° 59.98' S 7° 59.91' E	4098.5	CTD, drift net, Plankton net, Satlantic, Secchi disc,
786	26.07.11	19:43	6° 59.95' S 7° 59.95' E	4250.7	CTD, drift net, multi net, Plankton net,
787	27.07.11	04:19	7° 59.96' S 8° 00.02' E	4460.0	CTD, drift net, multi net, Satlantic, Secchi disc,
788	27.07.11	13:16	8° 59.93' S 8° 00.02' E	4712.3	CTD, drift net, Plankton net, Satlantic, Secchi disc,
789	27.07.11	19:35	9° 59.95' S 7° 59.99' E	4846.2	CTD, drift net, multi net, Plankton net,
790	28.07.11	04:12	10° 59.98' S 8° 00.00' E	4884.7	CTD, drift net, Plankton net,
791	28.07.11	10:13	11° 59.97' S 8° 00.01' E	4863.5	CTD, drift net, multi net, Plankton net, Satlantic, Secchi disc,
792	28.07.11	17:57	12° 29.98' S 8° 34.05' E	4712.9	CTD, drift net, Plankton net,
793	28.07.11	22:34	12° 59.92' S 9° 04.74' E	4634.5	CTD, Plankton net, Drifter recovered
794	29.07.11	03:52	13° 29.87' S 9° 33.97' E	4222.0	CTD, drift net, Plankton net,
795	29.07.11	08:44	13° 59.96' S 10° 07.36' E	3889.8	CTD, Plankton net, Satlantic, Secchi disc,
796	29.07.11	13:20	14° 29.81' S 10° 30.25' E	3542.3	CTD, drift net, Plankton net, Satlantic, Secchi disc,
797	29.07.11	17:53	14° 59.94' S 10° 54.80' E	3040.7	CTD, drift net, Plankton net,
798	29.07.11	21:03	15° 09.95' S 11° 17.01' E	2548.0	CTD, drift net, multi net, Plankton net,
799	30.07.11	00:51	15° 10.01' S 11° 39.01' E	1745.4	CTD, drift net, multi net, Plankton net,
800	30.07.11	03:43	15° 10.03' S 11° 49.06' E	1114.6	CTD, drift net, multi net, Plankton net, Tucker trawl,
801	30.07.11	06:37	15° 10.01' S	442.5	CTD, drift net, multi net,

			11° 58.99' E		Plankton net, Satlantic, Secchi disc,
802	30.07.11	09:13	15° 5.64' S 12° 6.38' E	67.7	CTD, Dredge, multi net, Plankton net, Satlantic, Secchi disc, Tucker trawl, van Veen grab,
803	30.07.11	17:48	13° 59.01' S 12° 05.05' E	1477.1	CTD, drift net, multi net, Plankton net,
804	30.07.11	19:57	13° 59.01' S 12° 10.00' E	917.9	CTD, drift net, multi net, Plankton net, Tucker trawl,
805	30.07.11	22:03	13° 59.01' S 12° 16.90' E	127.2	CTD, drift net, multi net, Plankton net, Tucker trawl,
806	30.07.11	23:45	13° 58.98' S 12° 19.81' E	104.3	CTD, drift net, multi net, Plankton net, Tucker trawl,
807	31.07.11	01:45	13° 59.05' S 12° 22.07' E	48.4	CTD, Dredge, drift net, multi net, Plankton net, Tucker trawl, van Veen grab,
808	31.07.11	12:44	12° 19.88' S 13° 00.18' E	1321.5	CTD, drift net, multi net, Plankton net, Satlantic, Secchi disc,
809	31.07.11	15:28	12° 20.11' S 13° 12.49' E	908.6	CTD, drift net, multi net, Plankton net, Secchi disc,
810	31.07.11	17:32	12° 20.01' S 13° 20.08' E	525.2	CTD, drift net, multi net, Plankton net, Tucker trawl,
811	31.07.11	19:49	12° 19.98' S 13° 25.93' E	99.4	CTD, Dredge, drift net, multi net, Plankton net, Tucker trawl, van Veen grab,
812	31.07.11	23:32	12° 19.77' S 13° 32.16' E	63.7	CTD, Dredge, drift net, multi net, Tucker trawl, van Veen grab,
813	01.08.11	11:20	10° 29.82' S 13° 34.85' E	25.0	CTD, Dredge, drift net, multi net, Plankton net, Satlantic, Secchi disc, Tucker trawl, van Veen grab,
814	01.08.11	14:25	10° 29.87' S 13° 25.05' E	65.9	CTD, Dredge, drift net, multi net, Plankton net, Satlantic, Secchi disc, Tucker trawl, van Veen grab,
815	01.08.11	18:03	10° 29.99' S 13° 14.92' E	113.5	CTD, drift net, multi net, Plankton net, Tucker trawl,
816	01.08.11	20:48	10° 30.02' S 12° 59.95' E	612.1	CTD, drift net, multi net, Plankton net,
817	01.08.11	23:21	10° 29.96' S 12° 44.98' E	1361.0	CTD, drift net, multi net,
818	02.08.11	06:44	9° 26.11' S 12° 59.97' E	48.3	CTD, Dredge, Satlantic, Secchi disc, Tucker trawl, van Veen grab,
819	02.08.11	09:58	9° 26.04' S 12° 49.95' E	104.7	CTD, Dredge, Satlantic, Secchi disc, Tucker trawl, van Veen grab,

820	02.08.11	14:52	9° 26.10' S 12° 22.12' E	1275.1	CTD, Plankton net,
821	02.08.11	19:06	8° 47.96' S 12° 40.06' E	0.0	CTD, drift net, multi net, Plankton net, Tucker trawl,
822	02.08.11	22:17	8° 47.95' S 12° 51.05' E	446.7	CTD, drift net, multi net, Plankton net,
823	03.08.11	00:22	8° 47.68' S 13° 00.14' E	193.7	CTD, drift net, multi net, Plankton net,
824	03.08.11	02:10	8° 47.89' S 13° 6.13' E	103.1	CTD, drift net, multi net, Tucker trawl,
825	03.08.11	04:01	8° 48.01' S 13° 09.93' E	86.5	CTD, Dredge, drift net, multi net, Tucker trawl, van Veen grab,
826	04.08.11	01:20	9° 59.94' S 12° 05.53' E	1948.5	CTD, drift net, Plankton net,
827	04.08.11	05:12	10° 30.00' S 11° 50.81' E	1887.8	CTD, drift net, multi net, Plankton net, Satlantic, Secchi disc,
828	04.08.11	09:51	10° 59.97' S 11° 36.18' E	2647.9	CTD, drift net, Satlantic, Secchi disc,
829	04.08.11	13:48	11° 29.94' S 11° 20.26' E	3607.8	CTD, Satlantic, Secchi disc,
830	04.08.11	17:43	11° 59.88' S 11° 06.70' E	3533.2	CTD, drift net,
831	04.08.11	21:28	12° 29.95' S 10° 51.92' E	3578.2	CTD, drift net, multi net,
832	05.08.11	01:40	12° 59.91' S 10° 37.13' E	3720.0	CTD, drift net,
833	05.08.11	05:32	13° 29.91' S 10° 20.76' E	3802.4	CTD, drift net,
834	05.08.11	09:09	14° 0.23' S 10° 07.24' E	3843.9	CTD, drift net, multi net, Satlantic, Secchi disc,
835	05.08.11	15:50	13° 59.99' S 9° 05.61' E	4358.7	CTD, drift net, multi net, Plankton net, Secchi disc,
836	06.08.11	00:18	14° 29.99' S 9° 51.51' E	3921.7	CTD, drift net,
837	06.08.11	04:13	14° 59.96' S 9° 37.38' E	4067.6	CTD, drift net, multi net, Plankton net,
838	06.08.11	08:54	15° 30.08' S 9° 20.19' E	4224.3	CTD, drift net, Satlantic, Secchi disc,
839	06.08.11	13:05	16° 00.05' S 9° 03.90' E	4463.5	CTD, Plankton net, Satlantic, Secchi disc,
840	07.08.11	03:52	17° 59.93' S 7° 59.95' E	5025.8	CTD, multi net, Plankton net, Satlantic, Secchi disc,
841	07.08.11	10:40	17° 30.01' S 8° 15.90' E	4858.2	CTD, drift net, Plankton net, Satlantic, Secchi disc,
842	07.08.11	14:45	17° 00.05' S 8° 33.35' E	4752.2	CTD, drift net, multi net, Plankton net,

843	07.08.11	20:46	16° 29.97' S 8° 46.27' E	4564.5	ADCP CTD, drift net, Katamaran Scan-Fish
844	10.08.11	06:26	11° 29.94' S 11° 20.69' E	3612.8	CTD, drift net, Plankton net, Satlantic, Secchi disc,
845	10.08.11	20:51	12° 59.96' S 9° 04.73' E	4550.8	CTD, drift net, multi net, Plankton net,
846	11.08.11	06:44	13° 23.04' S 10° 17.94' E	3851.1	CTD, drift net, Plankton net, Satlantic, Secchi disc, Drifter deployed
847	11.08.11	13:59	14° 28.13' S 9° 51.54' E	3921.5	CTD, drift net, MSS, multi net, Plankton net, Satlantic, Secchi disc, Tucker trawl,
848	15.08.11	04:04	17° 14.96' S 11° 00.00' E	2107.2	CTD, multi net, Plankton net,
849	15.08.11	07:08	17° 15.04' S 11° 15.00' E	592.8	CTD, drift net, multi net, Plankton net, Satlantic, Secchi disc, Tucker trawl,
850	15.08.11	11:09	17° 15.04' S 11° 30.09' E	147.4	CTD, Dredge, drift net, multi net, Satlantic, Secchi disc, Tucker trawl, van Veen grab,
851	15.08.11	14:53	17° 15.00' S 11° 36.96' E	101.7	CTD, Dredge, drift net, multi net, Tucker trawl, van Veen grab,
852	15.08.11	18:16	17° 14.97' S 11° 43.03' E	39.3	CTD, Dredge, drift net, multi net, Tucker trawl, van Veen grab,
853	15.08.11	20:48	17° 14.56' S 11° 43.77' E	25.0	CTD, Dredge, drift net, multi net, Plankton net, Tucker trawl, van Veen grab,
854	16.08.11	14:36	20° 01.88' S 12° 57.16' E	70.0	CTD, drift net, MSS, multi net, Plankton net, Satlantic, Secchi disc,
855	16.08.11	16:44	20° 04.62' S 12° 52.22' E	107.9	CTD, drift net, MSS, multi net, Plankton net,
856	16.08.11	18:45	20° 07.62' S 12° 47.45' E	127.8	CTD, drift net, MSS, multi net,
857	16.08.11	20:41	20° 10.38' S 12° 42.53' E	131.4	CTD, drift net, MSS, multi net,
858	16.08.11	22:29	20° 13.26' S 12° 37.64' E	148.9	CTD, drift net, MSS, multi net,
859	17.08.11	00:31	20° 16.00' S 12° 32.83' E	205.2	CTD, MSS, Mooring layed
860	17.08.11	03:20	20° 19.16' S 12° 27.98' E	264.8	CTD, MSS,
861	17.08.11	05:39	20° 21.93' S 12° 23.18' E	288.3	CTD, MSS, Plankton net, Satlantic, Secchi disc,
862	17.08.11	08:10	20° 24.74' S 12° 18.13' E	305.3	CTD, MSS, Satlantic, Secchi disc,
863	17.08.11	10:21	20° 27.61' S	316.2	CTD, MSS, Satlantic, Secchi

			12° 13.19' E		disc,
864	17.08.11	12:39	20° 30.51' S 12° 08.49' E	384.0	CTD, drift net, MSS, Satlantic, Secchi disc,
865	17.08.11	15:13	20° 33.40' S 12° 03.61' E	0.0	CTD, MSS, Satlantic, Secchi disc,
866	17.08.11	18:14	20° 36.30' S 11° 58.74' E	710.3	CTD, MSS,
867	17.08.11	20:33	20° 39.05' S 11° 53.80' E	875.8	CTD, MSS,
868	17.08.11	22:56	20° 41.89' S 11° 48.93' E	1036.5	CTD, MSS,
869	18.08.11	02:01	20° 47.60' S 11° 39.18' E	1378.8	CTD, MSS,
870	18.08.11	05:33	20° 56.28' S 11° 24.51' E	2127.5	CTD, MSS, Satlantic, Secchi disc,
871	18.08.11	09:29	21° 04.81' S 11° 09.71' E	2515.9	CTD, MSS, Plankton net, Satlantic, Secchi disc,
872	19.08.11	03:55	22° 58.95' S 14° 02.35' E	140.3	CTD, Dredge, multi net, Plankton net, van Veen grab, Mooring maintenance

CTD: conductivity (salinity), temperature, depth, fluorescence, oxygen concentration, water sampling
MSS: Microstructure probe
Satlantic: Spectrometer for optical absorption measurements