Short Cruise Report

Cruise No. MSM19, Leg 1(a-c)

September 22 – October 1, 2011
Walvisbay (Namibia) – Walvisbay (Namibia)
Chief Scientist: Prof. Dr. Martin Visbeck

October 1 – October 11, 2011
Walvisbay (Namibia) – Walvisbay (Namibia)
Chief Scientist: Dr. Werner Ekau

Oktober12 – October 21, 2011
Walvisbay (Namibia) – Walvisbay (Namibia)
Chief Scientist: PD Dr. Matthias Zabel

Captain: Matthias Günther

1.1 Leg MSM19/1a

1.1.1 Objectives

Research cruise MSM19/1 took place in the upwelling region off Namibia. It was divided into three legs with foci on each with a different scientific focus. and was focused on research-based training and capacity building in the field of physical oceanography. The cruise is being carried out within the framework of the German-Namibian bilateral cooperation in Earth-System-Research as envisaged in the bilateral agreement signed in October 2010. The upwelling ecosystem off Namibia is eminently suited for carrying out state of the art marine scientific research with the accompanying structured training and education program. The cruise aims at the education of students and junior faculty from Namibia and other countries in southern Africa as well as from Germany.

Specific research objectives include:

- Water mass distributions along transects between the Cape Basin and the Namibia shelf system
- Horizontal and vertical mixing of water masses through sub-mesoscale processes.
- Circulation systems in the transition region between the near coastal intensive upwelling on the shelf, the jet along the shelf edge and the open ocean above the continental slope.
- Oxygen distribution on the Namibian shelf system
- Phytoplankton community structures and its relation to surface water mass properties.

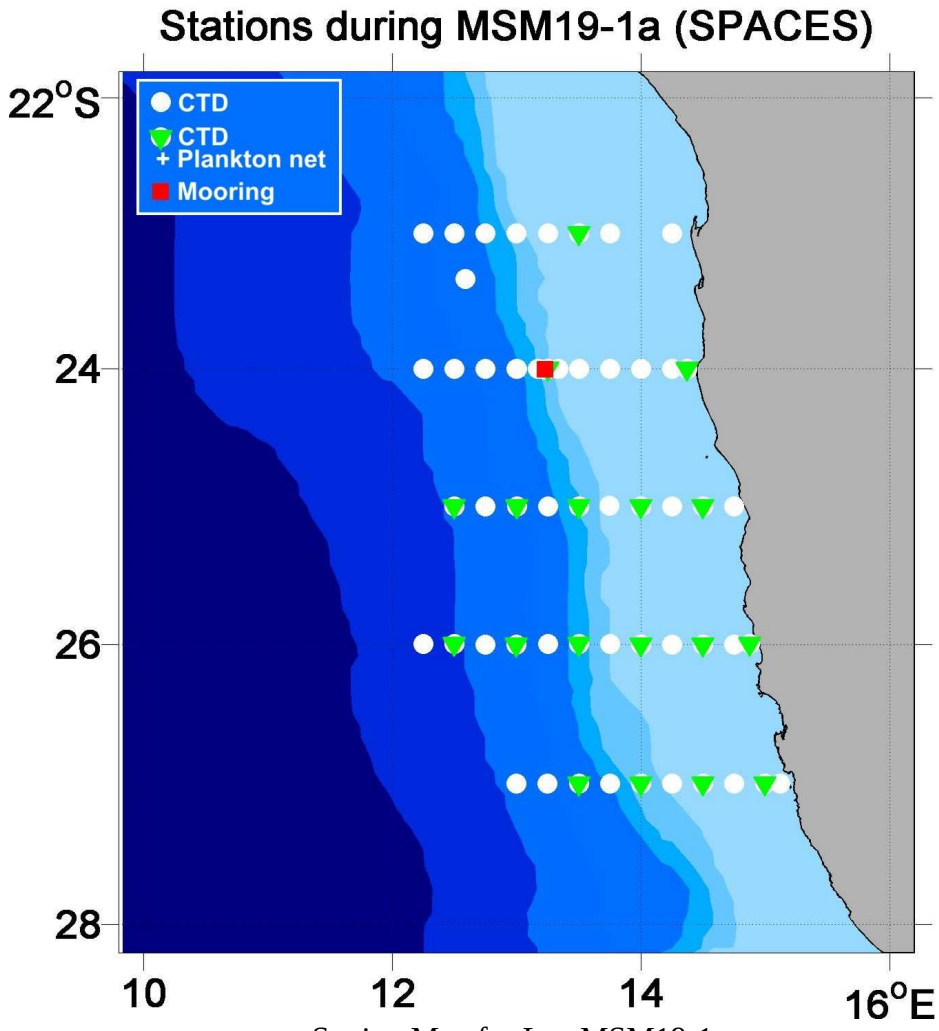
1.1.2 Narrative

September 22, 2011 science party boarded the MERIAN and prepared laboratories. On September 23 left Walvisbay at 9:00 am and began with the first CTD transect along 23°S from 14°E 15’ west until 12°E 15’. After a transect we deployed on September 24 a short ADCP mooring at 24°S 13°E 13’ in 430m deep water. A second CTD transect began eastward until the Namibian coastline and continuing on September 25 towards the west until 12°E 13’. A glider deployment had to be aborted in the afternoon after an unfortunate collision of the glider with the Fast-Rescue boat. CTD sections along 25°S and 26°S continue on September 26 and 27. The southernmost section along 27°S began on September 28. Early in the morning of September 29 we transit back North. Early on September 30 ADCP section from coast along 24°S to the mooring site. Mooring recovered and last few CTDs taken. Final transit along 23°S towards Walvisbay.

1.1.3 Summary

Most the main goals of the cruise were met. We have taken 60 CTD stations and several phytoplankton net hauls along 5 zonal sections crossing the shelf break towards the Namibian coast. A mooring was deployed for 5 days in 400m deep waters. The glider could not be deployed and was unfortunately damaged during the pre launch preparations. The ship’s ADCP and thermosalinograph were used extensively. Every day we had one or more science meeting where either scientific lectures were given, the incoming data discussed, or student projects were presented.

Scientifically we observed the Namibian Shelf system during a strong upwelling phase, could document the signatures of the upwelling in water mass distributions, cross shelf currents and plankton community structures.



Station Map for Leg MSM19-1a

1.2 Leg MSM19/1b

1.2.1 Objectives

During the second part of the training cruise the focus was put on processes in the water column. Besides measuring basic physical (temperature, salinity) and chemical (oxygen, nutrient, alkalinity and pCO_2) water parameters, different size fractions of the plankton were sampled with different gears: Phytoplankton sampling was performed with an Apstein net, different zooplankton groups could be collected with Bongo net, vertical and towed multiple opening closing nets, drift net and Tucker Trawl. Water samples and the catches were processed on board by the students and living organisms analyzed under the microscope. The students were also instructed in fundamentals of Biogeochemistry, Marine Botany and Zoology (Phyto- and Zooplankton, Benthos, Fish) and Fisheries.

Students were split into working groups to investigate the following research objectives:

- CO_2 emission from the Benguela Upwelling System

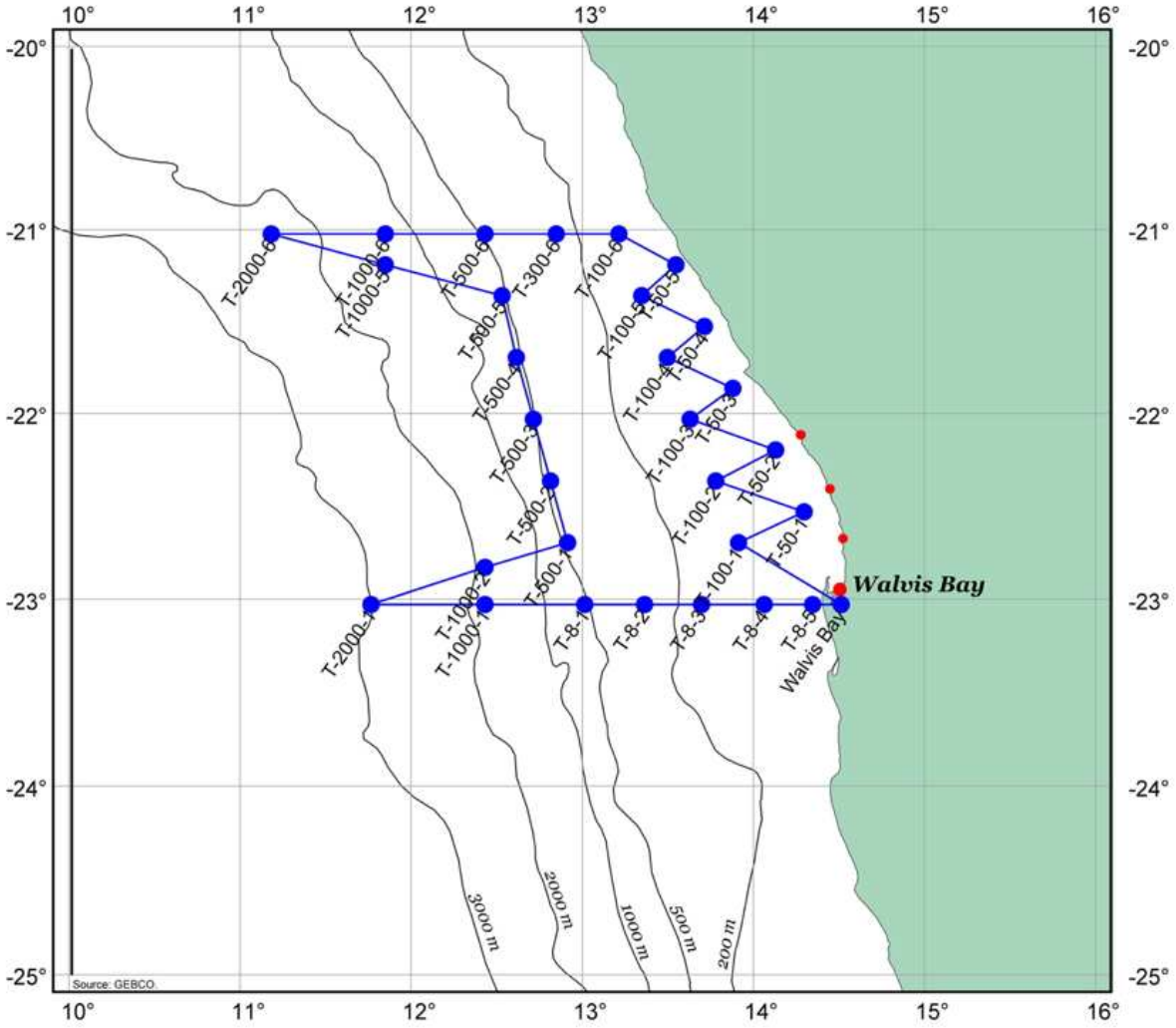
- Nutrient cycle and the relevance of the Benguela Upwelling System for the biological pump.
- Distribution of Microzooplankton in the Northern Benguela Upwelling Region of the Namibian Coast
- An assessment on spatial and vertical trends in meso-zooplankton biovolume on the Upwelling system of Namibia.
- Distribution of main ichthyoplankton in the Benguela Upwelling System
- Frequency of occurrence of seabirds, marine mammals and jellyfish in central Namibian waters.

1.2.2 Narrative

Scientific participants boarded the MARIA S. MERIAN in the morning of October 2nd and immediately started to prepare the laboratories. The first station was reached at 1600 hours at 22°40'S 13°54,5'E deploying CTD, Bongo, Multinet, Apstein net and Tucker Trawl. The ship followed a zick-zack course along the coast up to 21°S sampling phytoplankton, different sizes of zooplankton, and performing an observation program on jellies and sea birds and mammals. The last station of this transect on October 5th formed the first station of a transect at 21°S perpendicular to the coast that reached until 11°10'E and a water depth of about 3000 m to collect deep water and zooplankton samples. The ship then followed the 500 m water depth line until 23°S again to investigate the shelf egde plankton community. On October 8th the ship reached again the outermost station on the transect at 23°S (Walvis Bay line) to repeat a deep station collecting water and zooplankton. MARIA S. MERIAN reached its last nearshore station on October 10th at 0900 hours. The rest of the day was used to clean nets, pack equipment and analyze samples and data to prepare poster presentations to be shown at the BCC-Forum (17.-20.10.2011) and reception on MARIA S. MERIAN on October 21st.

1.1.3 Summary

The goals of the cruise could be achieved. We worked up 29 stations with 31 CTD casts, 33 multi net hauls, 18 Tucker Trawls, 26 Bongo net hauls and 17 Apstein nets. Underway measurements could be performed on pCO_2 distribution. Lectures were hold regularly on different topics and students were supervised to prepare posters. The posters gave a good overview on the preliminary results of the cruise and could be presented at the BCC-Forum in the week after the cruise. Large number of plankton organisms could be sampled for further biochemical analysis in the home labs.



Station Map for Leg MSM19-1b

1.3 Leg MSM19/1c

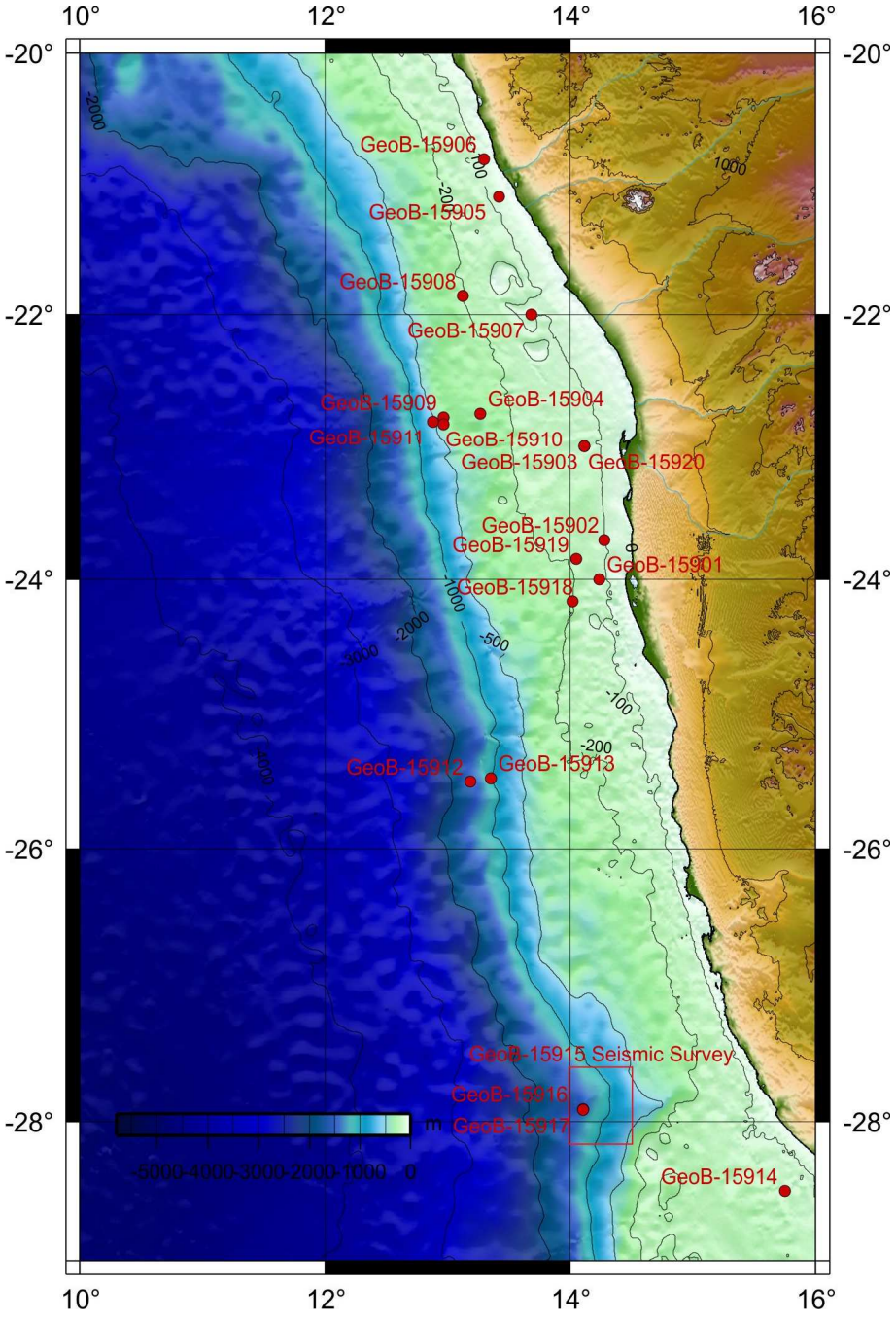
1.3.1 Objectives

Also the third leg of MARIA S. MERIAN cruise 19/1 took place in the upwelling region off Namibia. The research-based training and capacity building now focussed in the fields of biology, microbiology, biogeochemistry, marine geology, and geophysics. Accompanied by lectures on the background of the specific disciplines, the main objective was to offer practical experience to the students and junior faculty. So, the students were made familiar with a great variety of different techniques and methods. Depending on individual interests the students were intimately involved in the scientific investigations. Also the third leg was carried out within the framework of the German-Namibian bilateral cooperation in Earth-System-Research.

Specific research objectives include:

- Distribution of the suspension load and its composition in anoxic and oxygenated waters (aggregate formation, particle degradation, etc.)

- Nutrient cycles in the water column
- Investigation of benthic communities (sulphur bacteria and their distribution, comparison of macrobenthic life in and out of heavily trawled areas, etc.)
- Geochemical signatures in sub-surface sediments (formation and dilution of biogenic and authigenic barite)
- Acoustic surveying of the seafloor (identification and description of internal sediment structures, bathymetric mapping, etc.)



Station Map for Leg MSM19-1b

1.3.2 Narrative

In advance of the third section of cruise leg MSM19/1, an informal introductory seminar took place in the National Marine Information and Research Centre (NatMIRC) in Swakopmund. Besides the exchange of general information on the program of the expedition, all involved disciplines and planned projects of individual students were presented. The scientific group on this very interdisciplinary tour was composed of nine scientists and 13 students from five nations.

The cruise started as scheduled, at 9 pm on October 12. During the first days, the ship operated mainly between 22°S and 24°S. Sampling of surface sediments, water and its suspension load was concentrated along the southern 23rd latitude, where anoxic bottom water conditions could already have been detected during the two previous legs. Additionally, at two shallow water locations at about 21°S sediment cores were taken for reconstructions of paleoclimate conditions in the hinterland of the two rivers Huab and Ugab. After four days, the ship ran to the south. Several long sediment cores could be taken from an organic carbon depot center on upper continental slope at approximately 25,5°S. On October 17th, we arrived at the southernmost station at 28,5°S. Here, the water column was completely oxygenated which therefore allowed the proposed comparison between geochemical extremes. After subsequent, mainly geophysical investigations of a pockmark field, we began the journey back to Walvisbay. On the way, some additional surface sediments samples were taken. The scientific program ended with a last deployment of the CTD rosette sampler in the late evening of Oct. 20th. After disembarkation in the morning of Oct. 21st, the MARIA S. MERIAN cruise 19/1 ended in the evening with the presentation of preliminary results by the student participants during an official reception onboard.

1.3.3 Summary

The ambitious goals of the cruise could fully be achieved. In total, investigations took place at 19 locations with 49 deployments of different devices. Additionally, 86 nm of seismic profiles were driven, accompanied by Parasound and EM120 observations along the whole track. The cooperation between the German and the African students and scientists was outstanding and will be the continued in some cases. The high quality of the sample material which could be gained constitutes the basis for joint, ongoing investigations and further experiments in the home labs.

2 Participants

2.1 Participants of Leg MSM19/1a

Name	Discipline	Institution
Visbeck, Martin	Chief scientist	IFM-GEOMAR
Abel, Raphael	Student	IFM-GEOMAR
Arlindo, Machaieie Helder	Student	SMCS
Jochumsen, Kerstin	Physical Oceanography	ZMAW
Köllner, Manuela	Student	ZMAW
Krahmann, Gerd	Physical Oceanography	IFM-GEOMAR
Lensch, Julius	Student	ZMAW
Malan, Neil	Student	UCT
Müller, Katharina	Student	IFM-GEOMAR
Nkumbwa, Simon	Student	UNamib
Patara, Lavinia	Oceanography (modeling)	IFM-GEOMAR
Paul, Daniel N.	Student	UDS
du Plessis, Kirsten A.	Student	UCT
Schäfer, Kirsten	Biological Oceanography	IFM-GEOMAR
Smart, Sandi	Student	UCT
Tippenhauer, Sandra	Student	IFM-GEOMAR
Tutjavi, Vasana	Student	MFMR
Vollmer, Lukas	Student	ZMAW
Welsch, Andreas	Technician	ZMAW
Yates, Sarah Elizabeth	Student	UCT

2.2 Participants of Leg MSM19/1b

Name	Discipline	Institution
Ekau, Werner	Chief scientist	ZMT
Auel, Holger	Zooplankton	MarZoo
Bröhl, Stefanie	Ichthyoplankton	ZMT
Kovacs, Csilla	Biogeochemistry	ZMT
Pardal de Souza Dias, Francisco M.	Student	EMBS
Rixen, Tim	Biogeochemistry	ZMT
Peterson, Mareike	Hydrography	IOW
Sartoris, Franz Josef	Zooplankton	AWI
Schickenberg, Nina	Student	Uni-HB
Schwinghammer, Katharina	Student	Uni-HB
Steigüber, Claas	Student	Uni-HB
Chiloya, Gabriel Sousa	Student	UNamib

Chiquequela, Jeorgina	Student	ANU
Kaholongo, Indileni Mupewe	Student	UNamib
Mashifane, Thulwaneng	Student	UCT
Mokanya, Erikka	Student	UNamib
Nyandoto, Juvinaries	Student	UNamib
Pattrick, Paula	Student	NMMU
Pillay, Keshnee	Student	DEA
Saima, Kaipa	Student	UNamib
Schneider, Gabi	Scientist	GSN

2.3 Participants of Leg MSM19/1c

Name	**Discipline**	**Institution**
Zabel, Matthias	Chief Scientist	MARUM
Ahrens, Janis	Geochemistry	GeoB
Chikwililwa, Chibola	Biology	IOW
Cloete, Franky	Biology	UNamib
Currie, Bronwen	Biology	NatMIRC
Emvula, Monika	Geology	UNamib
Füssel, Jessika	Biogeochemistry	MPI-MM
Govin, Aline	Geology	MARUM
Hach, Philipp	Biogeochemistry	MPI-MM
Holtappels, Moritz	Biogeochemistry	MPI-MM
Iversen, Morten	Biogeochemistry	MARUM
Julies, Elsabe	Mircrobiology	UNamib
Kasten, Sabine	Geochemistry	AWI
Salman, Verena	Biogeochemistry	MPI-MM
Sam, Martha	Biology	UNamib
Schulz-Vogt, Heide	Microbiology	MPI-MM
Shiindi, Sally	Biology	UNamib
Shikongo, Taimi	Biology	UNamib
Sokoll, Sarah	Biogeochemistry	MARUM / MPI-MM
Tambo, Munyaradzi	Biology	UNamib
Uushona, Taimi	Biology	UNamib

ANU
Agostino Neto University
Luanda, Angola

AWI
Alfred Wegener Inst. for Polar and Marine Research
Am Handelshafen 12
27570 Bremerhaven, Germany

DEA
Department of Environmental Affairs
Cape Town, South Africa

EMBS
Erasmus Mundus Study Programme

GeoB
Dept. of Geoscience
Bremen University
Klagenfurter Str.
28359 Bremen, Germany

GSN
Geological Survey of Namibia
Windhoek, Namibia

IFM-GEOMAR
Leibniz-Institut für Meereswissenschaften
Universität Kiel
Wischhofstr. 1-3
24148 Kiel, Germany

IOW
Leibniz Institute for Baltic Sea Research
Seestraße 15
18119 Rostock-Warnemünde, Germany

MARUM
Center for Marine and Environmental Sci.
Bremen University
Leobener Str.
28359 Bremen, Germany

MarZoo
Marine Zoology (FB2)
University of Bremen (NW2A)
Pbox 33 04 40
28334 Bremen, Germany

MFMR
Ministry of Fisheries and Marine Resources
P.O. Box 912
Swakopmund, Namibia

MPI-MM
Max-Planck-Institut für Marine Mikrobiologie
Celsiusstr. 1
28359 Bremen, Germany

NatMIRC
National Marine Information and Research Center
Strand Street Box 912
Swakopmund, Namibia

NMMU
Nelson Mandela Metropolitan University
Port Elisabeth, South Africa

SANUMARC
Sam Nujoma Marine Aquaculture Research Center
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UNamib
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Windhoek, Namibia

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ZMAW
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Institut für Meereskunde
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ZMT
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Fahrenheitstr. 6
28359 Bremen, Germany

3 Lists of Stations

3.1 List of Stations Leg MSM19/1a

Station Number	Cast Type	CTD #	Date	Time	Latitude	Longitude	Depth	Bottles Closed	Comments
956	CTD	1	23/09/2011	10:18	22 59.98S	14 15.00E	97	17	
957	CTD	2	23/09/2011	13:57	22 59.97S	13 44.97E	149	12	
958	CTD	3	23/09/2011	15:34	22 59.95S	13 30.02E	238	10	Phytoplankton net
959	CTD	4	23/09/2011	17:25	22 59.97S	13 15.01E	368	10	Releasertest and Microcatcalibrationstops
960	CTD	5	23/09/2011	19:42	22 59.95S	12 59.99E	481	12	
961	CTD	6	23/09/2011	22:19	22 59.90S	12.45.00E	990	16	Phytoplankton net
962	CTD	7	24/09/2011	00:53	22 59.98S	12 30.00E		12	
963	CTD	8	24/09/2011	04:31	22 59.99S	12 14.99E		16	Echo-sounder not working
964	MOOR		24/09/2011	15:00	24 00.08S	13 13.66E	432		Mooring deployment
965	CTD	9	24/09/2011	15:25	23 59.99S	13 15.02E	385	10	Phytoplankton net
966	CTD	10	24/09/2011	17:19	23 59.99S	13 30.00E	282	10	
967	CTD	11	24/09/2011	19:00	23 59.97S	13 44.96E	255	10	
968	CTD	12	24/09/2011	20:48	23 59.97S	14 00.01E	214	12	
969	CTD	13	24/09/2011	22:26	24 00.00S	14 15.00E	125	10	
970	CTD	14	24/09/2011	23:23	24 00.00S	14 22.49E	65	8	Phytoplankton net
971	CTD	15	25/09/2011	03:41	24 00:00S	13 30.00E	283	6	
972	CTD	16	25/09/2011	05:22	23 59.99S	13 14.99E	389	12	
973	CTD	17	25/09/2011	07:13	23 59.99S	13 00.00E	1031	14	
974	CTD	18	25/09/2011	09:21	23 59.98S	12 45.00E	1690	10	
975	GL		25/09/2011	12:10	24 00:00S	12 30.26E			Glider launch aborted
976	CTD	19	25/09/2011	13:26	23 59.97S	12 30.00E	2239	10	Phytoplankton net
977	CTD	20	25/09/2011	16:22	23 59.96S	12 14.98E	2597	12	
978	CTD	21	25/09/2011	23:49	24 59.99S	12 29.99E	2792	13	Phytoplankton net
979	CTD	22	26/09/2011	03:00	24 59.97S	12 45.02E	2223	13	
980	CTD	23	26/09/2011	05:49	25 00.00S	13 00.00E	1783	17	Phytoplankton net
981	CTD	24	26/09/2011	08:32	24 59.99S	13 15.00E	2260	14	
982	CTD	25	26/09/2011	10:39	24 59.96S	13 29.97E	730	15	Phytoplankton net
983	CTD	26	26/09/2011	12:36	24 59.90S	13 44.70E	303	14	
984	CTD	27	26/09/2011	14:27	24 59.99S	13 59.99E	178	8	Phytoplankton net
985	CTD	28	26/09/2011	16:13	24 59.99S	14 15.00E	164	10	
986	CTD	29	26/09/2011	17:45	24 59.99S	14 29.99E	112	6	Phytoplankton net
987	CTD	30	26/09/2011	19:21	24 59.99S	14 44.99E	49	2	
988	CTD	31	27/09/2011	01:15	25 59.92S	14 52.47E	69	8	Phytoplankton net
989	CTD	32	27/09/2011	02:15	25 59.98S	14 44.99E	128	8	
990	CTD	33	27/09/2011	03:52	25 59.99S	14 29.99E	189	8	Phytoplankton net
991	CTD	34	27/09/2011	05:38	25 59.98S	14 14.98E	252	8	
992	CTD	35	27/09/2011	07:16	25 59.99S	13 59.98E	339	10	Phytoplankton net
993	CTD	36	27/09/2011	09:01	25 59.96S	13 44.96E	421	11	
994	CTD	37	27/09/2011	10:46	25 59.99S	13 21.99E	830	14	Phytoplankton net
995	CTD	38	27/09/2011	12:43	25 59.96S	13 14.97E	1333	12	
996	CTD	39	27/09/2011	15:02	25 59.99S	12 59.96E	2029	8	Phytoplankton net
997	CTD	40	27/09/2011	17:46	25 59.99S	12 44.99E	2630	8	
998	CTD	41	27/09/2011	20:53	25 59.99S	12 29.99E	3110	10	Phytoplankton net
999	CTD	42	28/09/2011	00:15	25 59.95S	12 15.03E	3527	17	
1000	CTD	43	28/09/2011	09:19	26 59.99S	12 59.99E	2716	0	
1001	CTD	44	28/09/2011	12:33	26 59.98S	13 14.99E	2178	0	
1002	CTD	45	28/09/2011	15:21	26 59.99S	13 29.99E	1535	0	Phytoplankton net
1003	CTD	46	28/09/2011	17:45	26 59.99S	13 44.99E	940	0	
1004	CTD	47	28/09/2011	19:49	26 59.98S	13 59.99E	438	0	phytoplankton net
1005	CTD	48	28/09/2011	21:40	26 59.98S	14 14.99E	378	0	
1006	CTD	49	28/09/2011	23:29	26 59.74S	14 29.48E	321	0	Phytoplankton net
1007	CTD	50	29/09/2011	01:09	26 59.99S	14 44.98E	230	0	
1008	CTD	51	29/09/2011	02:09	26 59.98S	14 59.98E	143	0	Phytoplankton net
1009	CTD	52	29/09/2011	03:44	26 59.97S	15 70.28E	101	0	
1010	CTD	53	30/09/2011	00:59	23 59.90S	13 45.02E	250	0	
1011	CTD	54	30/09/2011	02:51	23 59.99S	13 30.00E	279	0	
1012	CTD	55	30/09/2011	04:14	23 59.99S	13 20.00E	307	0	
1013	CTD	56	30/09/2011	05:42	23 59.98S	13 29.98E	279	0	
1014	MOOR		30/09/2011	07:47	24 00.08S	13 13.66E	432		Mooring recovery
1015	CTD	57	30/09/2011	07:53	24 00.03S	13 13.63E	428	0	
1016	CTD	58	30/09/2011	08:58	23 59.98S	13 09.99E	506	0	
1017	CTD	59	30/09/2011	12:34	23 59.98S	12 59.99E	1100	0	
1018	CTD	60	30/09/2011	16:44	23 20.26S	12 35.22E	1504	0	

3.2 List of Stations Leg MSM19/1b

Station Number	Cast Type	Cast #	Date	Time	Latitude	Longitude	Depth
1019	CTD/RO	1	02/10/2011	14:28	22°39,96' S	13°54, 43' E	129
1019	BONGO	1	02/10/2011	14:48	22°39,96' S	13°54,4 3' E	130
1019	MN	1	02/10/2011	15:23	22°40,45' S	13°54,55' E	130
1019	TT	1	02/10/2011	16:39	22°41,06' S	13°54,69' E	130
1020	CTD/RO	2	02/10/2011	19:28	22°29,97' S	14°17, 02' E	68
1020	TT	2	02/10/2011	19:44	22°30,01' S	14°17,02' E	66
1021	CTD/RO	3	02/10/2011	23:06	22°20,00' S	13°46, 00' E	128
1021	TT	3	02/10/2011	23:20	22°20,03' S	13°46,00' E	129
1021	MN	2	02/10/2011	23:56	22°20,68' S	13°46,16' E	128
1021	MN	3	03/10/2011	0:23	22°21,53' S	13°46,45' E	128
1021	BONGO	2	03/10/2011	0:54	22°22,15' S	13°46,66 ' E	128
1022	CTD/RO	4	03/10/2011	7:16	22°10,00' S	14°7,00 ' E	60
1022	TT	4	03/10/2011	7:28	22°10,03' S	14°7,00' E	59
1022	TT	5	03/10/2011	7:50	22°10,21' S	14°7,01' E	61
1023	CTD/RO	5	03/10/2011	11:09	22°0,00' S	13°37,5 0' E	120
1023	BONGO	3	03/10/2011	11:32	22°0,00' S	13°37,50 ' E	119
1023	MN	4	03/10/2011	11:55	22°0,45' S	13°37,60' E	119
1023	MN	5	03/10/2011	12:21	22°1,31' S	13°37,77' E	118
1023	TT	6	03/10/2011	12:55	22°1,71' S	13°37,87' E	124
1023	TT	7	03/10/2011	13:20	22°1,92' S	13°37,87' E	122
1023	CTD/RO	6	03/10/2011	13:54	22°2,06' S	13°37,8 8' E	123
1024	CTD/RO	7	03/10/2011	16:58	21°50,00' S	13°52, 00' E	64
1024	TT	8	03/10/2011	17:14	21°50,03' S	13°52,01' E	65
1025	CTD/RO	8	04/10/2011	4:14	21°40,00' S	13°29,0 0' E	122
1025	BONGO	4	04/10/2011	4:33	21°40,00' S	13°29,00 ' E	122
1025	MN	6	04/10/2011	4:57	21°40,38' S	13°29,19' E	124
1025	MN	7	04/10/2011	5:25	21°41,24' S	13°29,59' E	124
1025	TT	9	04/10/2011	6:06	21°41,78' S	13°29,86' E	123
1025	TT	10	04/10/2011	6:40	21°42,02' S	13°29,95' E	123
1026	CTD/RO	9	04/10/2011	8:48	21°30,00' S	13°41,9 9' E	71
1026	TT	11	04/10/2011	9:03	21°30,05' S	13°42,00' E	70
1027	CTD/RO	10	04/10/2011	12:10	21°20,00' S	13°20 ,50' E	115
1027	BONGO	5	04/10/2011	12:31	21°20,00' S	13°20,5 0' E	114
1027	MN	8	04/10/2011	12:49	21°20,30' S	13°20,57' E	118
1027	MN	9	04/10/2011	13:14	21°21,09' S	13°20,81' E	117
1027	TT	12	04/10/2011	13:57	21°21,51' S	13°20,92' E	113
1028	CTD/RO	11	04/10/2011	15:55	21°9,99' S	13°31, 99' E	72
1028	TT	13	04/10/2011	16:12	21°10,04' S	13°32,00' E	40
1029	CTD/RO	12	05/10/2011	4:19	21°0,00' S	13°12,0 0' E	118
1029	BONGO	6	05/10/2011	4:36	21°0,00' S	13°12,00' E	118
1029	MN	10	05/10/2011	4:59	21°0,38' S	13°12,05' E	121
1029	MN	11	05/10/2011	5:26	21°1,16' S	13°12,14' E	124
1029	TT	14	05/10/2011	6:09	21°1,63' S	13°12,22' E	126
1030	CTD/RO	13	05/10/2011	8:47	21°0,00' S	12°50,0 0' E	296
1030	BONGO	7	05/10/2011	9:18	21°0,00' S	12°50,00' E	298
1030	BONGO	8	05/10/2011	9:45	21°0,00' S	12°50,00' E	297
1030	MN	12	05/10/2011	10:25	21°0,64' S	12°50,04' E	296
1031	CTD/RO	14	05/10/2011	13:51	21°0,00' S	12°25, 00' E	507
1031	BONGO	9	05/10/2011	14:22	21°0,00' S	12°25,00 ' E	507
1031	BONGO	10	05/10/2011	15:03	21°0,00' S	12°25,0 0' E	507
1031	MN	13	05/10/2011	15:43	21°0,58' S	12°25,07' E	509
1031	MN	14	05/10/2011	16:26	21°2,00' S	12°25,28' E	520
1032	CTD/RO	15	05/10/2011	20:45	21°0,00' S	11°50, 00' E	1.205
1032	MN	15	05/10/2011	21:38	21°0,54' S	11°49,99' E	1.211
1032	MN	16	05/10/2011	22:54	21°2,88' S	11°50,08' E	1.235
1033	CTD/RO	16	06/10/2011	4:30	21°0,00' S	11°10,0 0' E	2.410
1033	MN	17	06/10/2011	5:27	21°0,69' S	11°9,96' E	2.428
1033	MN	18	06/10/2011	6:59	21°3,25' S	11°9,60' E	2.487
1034	CTD/RO	17	06/10/2011	12:08	21°10,00' S	11°50 ,00' E	1.321
1034	MN	19	06/10/2011	13:06	21°9,46' S	11°50,03' E	1.311
1034	MN	20	06/10/2011	14:36	21°9,80' S	11°50,24' E	1.317
1035	CTD/RO	18	07/10/2011	4:21	21°20,00' S	12°31, 00' E	510
1035	BONGO	11	07/10/2011	5:12	21°20,00' S	12°31,0 4' E	510
1035	BONGO	12	07/10/2011	5:41	21°20,01' S	12°31,1 1' E	508
1035	MN	21	07/10/2011	6:15	21°19,27' S	12°31,17' E	501
1036	CTD/RO	19	07/10/2011	9:19	21°40,01' S	12°36, 01' E	544
1036	BONGO	13	07/10/2011	9:47	21°40,00' S	12°36,0 1' E	545
1036	BONGO	14	07/10/2011	10:21	21°39,99' S	12°36, 10' E	546
1036	MN	22	07/10/2011	11:04	21°40,47' S	12°36,33' E	547
1037	CTD/RO	20	07/10/2011	13:55	22°0,00' S	12°42, 00' E	442
1037	BONGO	15	07/10/2011	14:20	22°0,00' S	12°42,0 0' E	441

Station Number	Cast Type	Cast #	Date	Time	Latitude	Longitude	Depth
1037	BONGO	16	07/10/2011	14:57	22°0,00' S	12°42,0 0' E	440
1037	MN	23	07/10/2011	15:51	22°0,64' S	12°42,24' E	436
1037	MN	24	07/10/2011	16:36	22°2,13' S	12°42,42' E	438
1038	CTD/RO	21	07/10/2011	18:57	22°20,00' S	12°48 ,00' E	415
1038	BONGO	17	07/10/2011	19:26	22°20,00' S	12°48, 01' E	413
1038	BONGO	18	07/10/2011	19:56	22°19,99' S	12°48, 05' E	413
1038	MN	25	07/10/2011	20:33	22°20,46' S	12°48,21' E	412
1039	CTD/RO	22	07/10/2011	23:06	22°40,00' S	12°54 ,00' E	352
1039	BONGO	19	07/10/2011	23:35	22°40,00' S	12°54, 00' E	352
1039	BONGO	20	08/10/2011	0:02	22°40,00' S	12°54,0 0' E	351
1039	MN	26	08/10/2011	0:49	22°40,58' S	12°54,19' E	353
1040	CTD/RO	23	08/10/2011	4:48	22°48,00' S	12°25, 00' E	1.896
1041	CTD/RO	24	08/10/2011	9:55	23°0,00' S	11°45,0 0' E	2.976
1041	MN	27	08/10/2011	12:05	23°1,91' S	11°44,76' E	2.975
1042	CTD/RO	25	09/10/2011	4:51	23°0,04' S	12°25,0 5' E	1.838
1042	MN	28	09/10/2011	6:24	23°1,44' S	12°24,33' E	1.865
1043	CTD/RO	26	09/10/2011	11:14	23°0,00' S	13°0,0 0' E	991
1043	CTD/RO	27	09/10/2011	12:12	23°0,00' S	13°0,0 0' E	495
1043	BONGO	21	09/10/2011	12:45	23°0,00' S	13°0,00 ' E	495
1043	BONGO	22	09/10/2011	13:20	23°0,00' S	13°0,00 ' E	495
1043	MN	29	09/10/2011	14:05	23°0,51' S	12°59,93' E	505
1043	BONGO	23	09/10/2011	14:42	23°1,39' S	12°59,8 1' E	521
1044	CTD/RO	28	09/10/2011	18:07	23°0,00' S	13°21, 00' E	339
1044	BONGO	24	09/10/2011	18:33	23°0,00' S	13°21,0 2' E	341
1044	BONGO	25	09/10/2011	19:12	23°0,00' S	13°21,0 4' E	341
1044	MN	30	09/10/2011	19:50	23°0,72' S	13°21,05' E	342
1044	TT	15	09/10/2011	21:03	23°1,64' S	13°21,07' E	341
1045	CTD/RO	29	09/10/2011	23:23	23°0,00' S	13°41, 00' E	150
1045	BONGO	26	09/10/2011	23:43	23°0,00' S	13°41,0 0' E	151
1045	MN	31	10/10/2011	0:06	23°0,50' S	13°41,10' E	149
1045	TT	16	10/10/2011	1:11	23°1,14' S	13°41,28' E	153
1046	CTD/RO	30	10/10/2011	4:06	23°1,22' S	14°2,99 ' E	134
1046	MN	32	10/10/2011	4:26	23°1,52' S	14°2,94' E	135
1046	TT	17	10/10/2011	4:57	23°2,24' S	14°2,81' E	137
1047	CTD/RO	31	10/10/2011	7:10	23°0,00' S	14°20,0 0' E	64
1047	MN	33	10/10/2011	7:27	23°0,20' S	14°20,01' E	64
1047	TT	18	10/10/2011	7:47	23°0,77' S	14°20,02' E	63

3.3 List of Stations Leg MSM19/1c

Ship's Station No.	**GeoB No.**	**Date** (2011) dd.mm	**Time** (UTC)	**Lat** [S]	**Long** [E]	**Water Depth** [m]	**Gear**
MSM19/1048-2	15901-1	12.10	15:06	24°00,00'	14°14,17'	124	CTD-ROS
MSM19/1048-3	15901-2		16:25			124	MC
MSM19/1049-1	15902-1	12.10	18:49	23°42,40'	14°16,67'	121	MC
MSM19/1049-2	15902-2		19:17			120	MC
MSM19/1049-3	15902-3		20:04			120	MC
MSM19/1049-4	15902-4		20:16			121	MC
MSM19/1050-1	15903-1	13.10	03:58	23°00,00'	14°07,00'	134	CTD-ROS
MSM19/1050-2-4	15903-2		07:47			128	BWS
MSM19/1050-5	15903-3		10:02			141	MC
MSM19/1050-6	15903-4		10:16			128	MC
MSM19/1050-7	15903-5		10:33			127	MC
MSM19/1050-8	15903-6		10:53			129	MC
MSM19/1050-9	15903-7		11:12			130	MC
MSM19/1050-10	15903-8		11:34			131	MC
MSM19/1050-11	15903-9		12:01			137	MC
MSM19/1050-12	15903-10		12:47			131	MC
MSM19/1051-1	15904-1	13.10	17:53	22°45,00'	13°16,00'	312	CTD-ROS
MSM19/1051-2	15904-2		18:16			311	GC(6)
MSM19/1051-3	15904-3		19:35			311	MC

Ship's Station No.	**GeoB No.**	**Date** (2011) dd.mm	**Time** (UTC)	**Lat** [S]	**Long** [E]	**Water Depth** [m]	**Gear**
MSM19/1052-2	15905-2		07:32			84	MC
MSM19/1052-3	15905-3		07:51			84	MC
MSM19/1052-4	15905-4		08:30			84	GC(6)
MSM19/1052-5	15905-5		09:25			85	GC(12)
MSM19/1053-1	15906-1		11:31			84	CTD-ROS
MSM19/1053-2	15906-2	14.10	11:58	20°48,79'	13°17,75'	86	GC(12)
MSM19/1053-3	15906-3		12:59			85	MC
MSM19/1054-1	15907-1	14.10	19:57	21°59,90'	13°40,92'	118	CTD-ROS
MSM19/1054-2	15907-2		20:48			117	BWS
MSM19/1055-1	15908-1	15.10	04:49	22°51,49'	13°07,59'	289	CTD-ROS
MSM19/1055-2	15908-2		05:39			289	MC
MSM19/1056-1	15909-1	15.10	08:14	22°46,75'	12°58,10 '	783	CTD-ROS
MSM19/1057-1	15910-1	15.10	10:43	22°49,70'	12°58,13 '	374	CTD-ROS
MSM19/1058-1	15911-1	15.10	12:13	22°48,71'	12°52,82 '	550	CTD-ROS
MSM19/1059-1	15912-1		03:42			1500	CTD-ROS
MSM19/1059-2	15912-2	16.10	05:10	25°30,40'	13°11,00'	1497	GC(12)
MSM19/1059-3	15912-3		06:59			1497	GC(12)
MSM19/1060-1	15913-1		09:06			1039	CTD-ROS
MSM19/1060-2	15913-2	16.10	10:03	25°28,90'	13°21,10'	1035	GC(12)
MSM19/1060-3	15913-3		11:47			1039	GC(12)
MSM19/1061-1	15914-1		07:02			131	CTD-ROS
MSM19/1061-2	15914-2	17.10	07:51	28°30,00'	15°45,00'	130	BWS
MSM19/1061-3	15914-3		08:40			131	MC
MSM19/1061-4	15914-4		08:57			131	MC
Bathymetric survey							
MSM19/1062-1	*(Start)*	18:10	11:28	27°53,28'	14°07,69'	1427	Seismic
	(End)	19.10	15:14	27°57,00'	14°01,47'	1453	
MSM19/1063-1	15915-1	19.10	16:34	27°54,53'	14°06,13 '	1439	GC(12)
MSM19/1064-1	15916-1	19.10	19:01	27°54,83'	14°06,33 '	1598	CTD-ROS
MSM19/1065-1	15917-1	20.10	13:32	24°10,05'	14°01,11 '	199	MC
MSM19/1066-1	15918-1	20.10	15:33	24°10,05'	14°01,11 '	184	MC
MSC19/1067-1	15919-1	20.10		23°00,00'	14°07,00'		CTD -ROS

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