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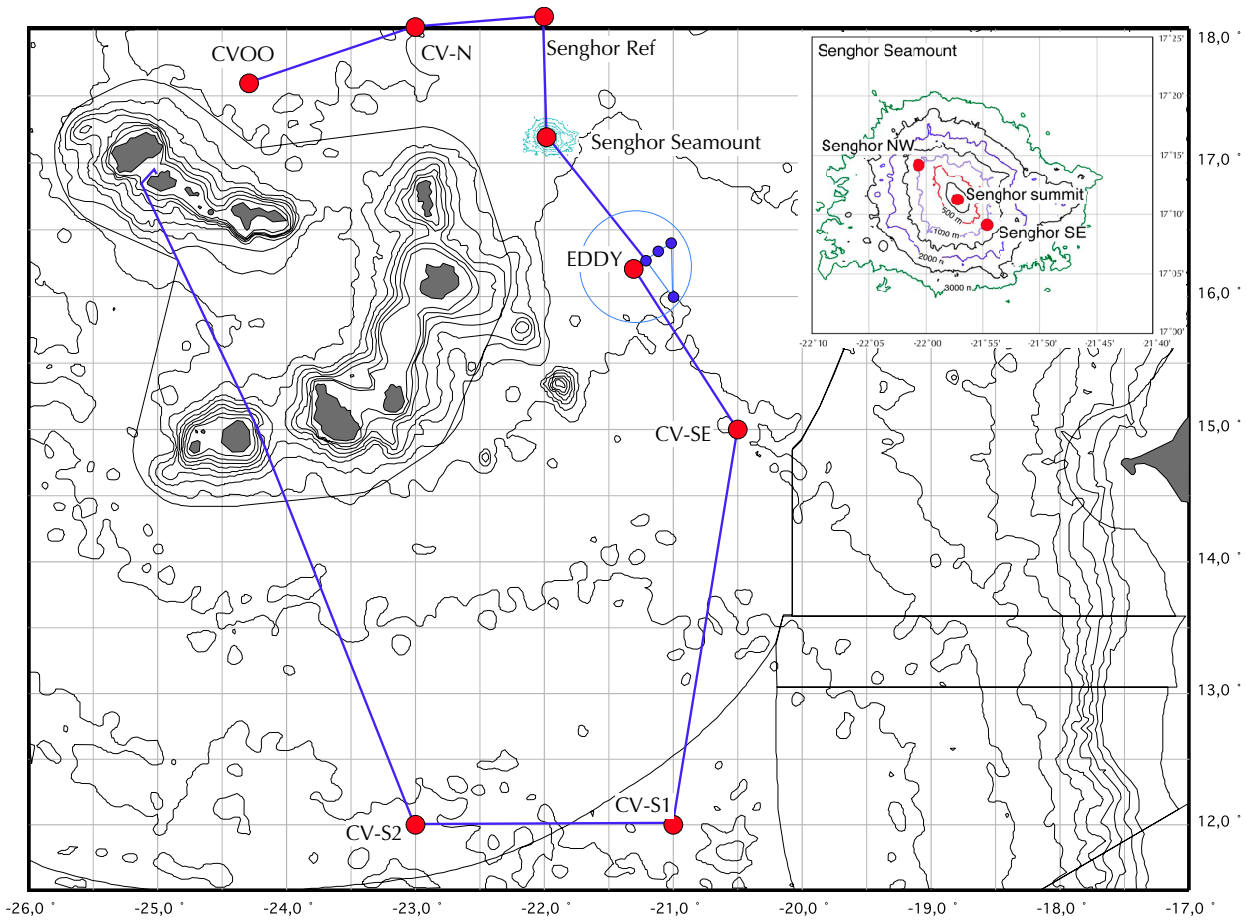
Short Cruise Report
Maria S. Merian MSM 49

Las Palmas de Gran Canaria (Spain) - Mindelo (Cape Verde)
28 November - 21 December 2015

Chief Scientist: Bernd Christiansen
Captain: Björn Maaß



Objectives

The overarching aim of cruise MSM49 was to assess the medium-sized pelagic fauna, such as gelatinous macrozooplankton, mesopelagic fishes, shrimps, krill and squids, and their role within the pelagic community in relation to 1) water mass properties, with special emphasis on oxygen minimum zones (OMZ) of different intensity, and 2) the influence of a shallow seamount reaching into the realm of the fauna which performes extensive diel vertical migrations. The study area in the waters around the Cape Verde islands in the eastern tropical Atlantic (ETA), offers both, OMZs of different intensity and an isolated seamount (Senghor Seamount) with well-known bathymetry and ecology of smaller-sized plankton.

In order to reach the goals, the following main objectives were addressed:

1. Description of water mass properties (oxygen, salinity, temperature, fluorescence, POC)
2. Mapping of the standing stocks, biodiversity, vertical distribution and diel vertical migrations of medium-sized pelagic fauna in the epi- and mesopelagic zones around the Cape Verde Islands within different hydrographic and bathymetric settings (strong OMZ vs. weak OMZ, seamount vs. deep-sea plain, seamount summit vs. slopes)
3. Analysis of the trophic structure of the medium-sized pelagic fauna

While optical methods are superior at surveying fragile gelatinous zooplankton, fast swimming fauna is typically better sampled using nets. Combining advanced optical samplers with modern multiple net systems and traditional trawls made depth-stratified, quantitative sampling possible for a wide taxonomical range of the ecologically important medium-sized pelagic fauna, which has rarely been considered in open-ocean studies so far.

The resulting data will be used to

- identify the influence of OMZs of different intensities on the composition, distribution and diel vertical migration behaviour of small nekton and macrozooplankton
- establish a baseline of faunal patterns in relation to OMZs of different intensity by correlating fauna to the ecological zonation associated with OMZs (mixed layer, picnocline, upper oxygen limited zone, OMZ core, lower oxygen limited zone)
- determine the ecological effect of the physical intrusion of a shallow seamount into the moderate OMZ
- evaluate the influence of shallow topography and its associated hydrodynamic characteristics on the distribution and abundance of small nekton and macrozooplankton
- identify the role of gelatinous plankton and (micro)nekton in the pelagic food web in different hydrographic, hydrodynamic and topographic settings
- determine the role of orange back squid *Sthenoteuthis pteropus* in the pelagic food web of the ETA
- contribute to repeat hydrography and biological measurements (for example, CVOO)

The information gained from this cruise will advance our understanding of the ecology of medium-sized pelagic fauna in the ETA under different forcings, and will help to predict the possible consequences of expanding oxygen minimum zones. In addition, it will complement previous and ongoing studies on the smaller components of the pelagic communities in the area (phytoplankton, micro-, meso- and macrozooplankton), leading to a comprehensive picture of the pelagic ecosystem in the region.

Narrative

MARIA S. MERIAN left the port of Las Palmas on 28 November, 2015, at 09:00. The transit to the study area was used for assembling and testing the instruments and to set up the laboratories. The sampling programme included different nets and optical systems in order to assess a wide variety of pelagic fauna. The PELAGIOS, a newly developed towed video camera system, aimed especially at gelatinous macrozooplankton. The Underwater Vision Profiler (UVP) is an optical recorder for smaller-sized plankton and particles; it was used in combination with the PELAGIOS and the CTD-rosette. The MOCNESS is a multiple net system with a series of nets which can be opened and closed sequentially. Two types were used; the $10m^2$-MOCNESS (MOC-10) has a $10m^2$ net opening and was equipped with five nets of 1.5 mm mesh size targeting micronekton. The $1m^2$-MOCNESS (MOC-1) with a $1m^2$ opening carried three nets of 2 mm mesh size specifically for krill plus six nets of 335 µm for macrozooplankton and larger mesozooplankton. The WP3 is a simple conical net which was used for gently sampling gelatinous organisms, and the Apstein net with a mesh aperture of 55 µm was employed to sample larger phytoplankton. A non-closing Isaac Kidd Midwater Trawl (IKMT) was used for fishing micronekton at some stations. Water samples for different chemical and biological analyses were taken with a 24 bottle CTD-rosette. Squids were fished by hook-and line.

On 30 November we reached the Cape Verdian EEZ and performed a short test station with two shallow CTD hauls before steaming to our first station, CVOO (Cape Verde Ocean Observatory). The general sampling scheme for all stations comprised two CTD-rosette casts, one day and one night haul each with PELAGIOS and MOC-10, two day and two night MOC-1 hauls, two WP3 and one Apstein net hauls. Hook-and line fishing for squids was done during night times when station work allowed. MOCNESS and PELAGIOS were fished down to 1000 m, WP3 and IKMT to 500 m, and the Apstein net to 150 m.

The CVOO is a monitoring site mainly for hydrographic and biogeochemical parameters. We started work there in the morning of 1 December. Winds at CVOO were moderate, the sky was overcast with Saharan dust. Sargassum was abundant on the sea surface, and during the night large pyrosoma colonies were frequently observed. The CTD casts at CVOO showed a shallow OMZ at 100 m, above the permanent OMZ, which points to the influence of a cyclonic eddy. Net samples and PELAGIOS videos indicated that organisms were abundant in the OMZ; large ctenophores seemed to be particularly linked with the low oxygen zone.

Station work at CVOO was finished on 3 December, and we proceeded to station CV-N. Here, only a shortened sampling programme was performed due to time constraints, before we steamed to station Senghor Ref, about 55 nm north of Senghor Seamount. This station, which is not influenced by elevated topography, served as an oceanic reference station for Senghor Seamount and had also been sampled during previous cruises to the seamount on R.V.s METEOR and POSEIDON. The oxygen distribution at Senghor Ref showed the expected profile with the minimum at 400 m. We left this station after finishing the sampling programme on 5 December and arrived at Senghor Seamount on 6 December. The weather had improved meanwhile, with clear sky and gentle breeze.

Senghor Seamount is a nearly conical seamount which rises from 3300 m to a small summit plateau with a minimum depth of 100 m. Our work on this cruise focused on three locations: the northwestern slope above the 1000 m contour, the southwestern slope above the 1000 m contour, and the summit. Above the slopes, our routine sampling programme with full profiles down to

1000 m was employed, whereas the maximum sampling depth above the summit was ca 80 m. Only with the PELAGIOS we were able to sample down to within 1 m above the bottom by mounting an additional, downward looking camera. During the night haul, high abundances of fishes were observed in the near-bottom layer. The work at Senghor was finished on 10 December.

Initially, the next station (CV-E) was planned at 16°N - 020°W. However, we had information that a cyclonic eddy was slowly proceeding westwards close to our supposed cruise track, and we decided to sample this eddy if we were able to locate its core. Using two orthogonal ADCP transects guided by information from satellite data, and a series of CTD casts, we found the core of the eddy at 16°12.4'N - 021°18.4'W and employed the full sampling programme there. As expected, very low oxygen values of <40 µmol l^{-1} were observed in a shallow lens at 100 m. The deep OMZ showed minimum O_2 concentrations of ca. 45 µmol l^{-1} between 200 and 300 m. Organisms were frequently observed in the layers of low oxygen concentrations and were also abundant in net samples of the respective depths. Preliminary observations of the net samples indicate that the eddy featured a species composition which differed markedly from the other stations. For example, an indicator species for coastal upwelling, the copepod *Calanoides carinatus*, showed up regularly in the eddy samples, but not at the other stations.

On 13 December we steamed to our next station, CV-SE, which had initially been planned for 14°N, but was shifted to 15°N now to serve as a reference station for the eddy. After finishing the routine sampling programme here on 15 December in the early afternoon, we proceeded to the two southernmost stations, CV-S1 and CV-S2, at 12°N in the area of the expected most intense OMZ of the Cape Verde region. Lowest O_2 concentrations outside the eddy were in fact observed at station CV-S2 with 41.4 µmol l^{-1} at 400 m. The routine sampling programme was performed at both stations without problems, and on 20 December we left station CV-S2 for the transit to Mindelo.

MARIA S. MERIAN docked in the port of Mindelo on 21 December at 08:30.

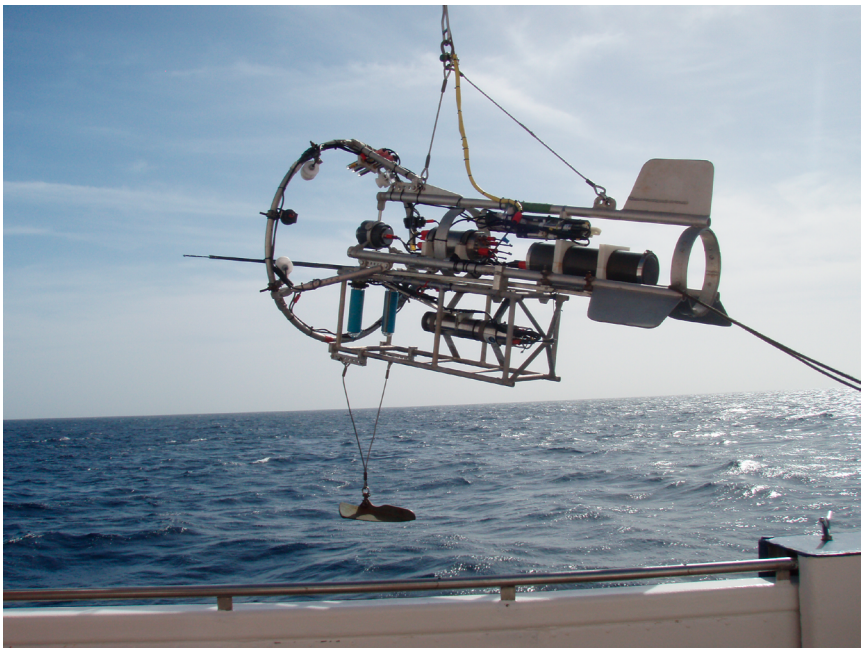


Fig. 1 PELAGIOS with UVP

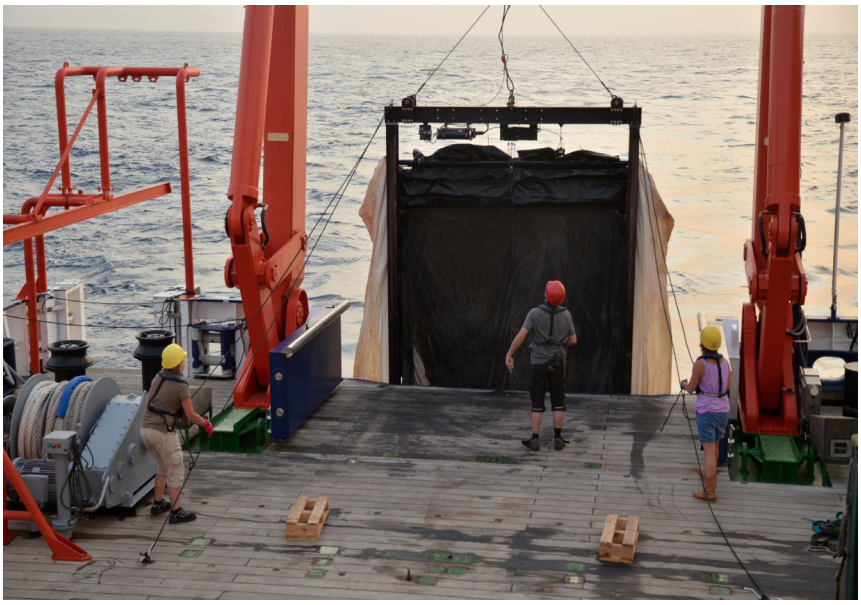


Fig. 2 Deployment of the 10m^2-MOCNESS

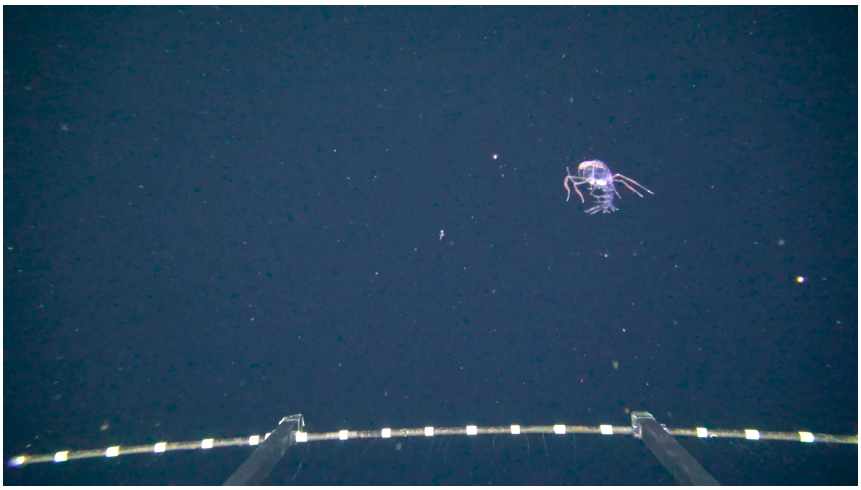


Fig. 3 The amphipod *Cystisoma neptuni* recorded by PELAGIOS

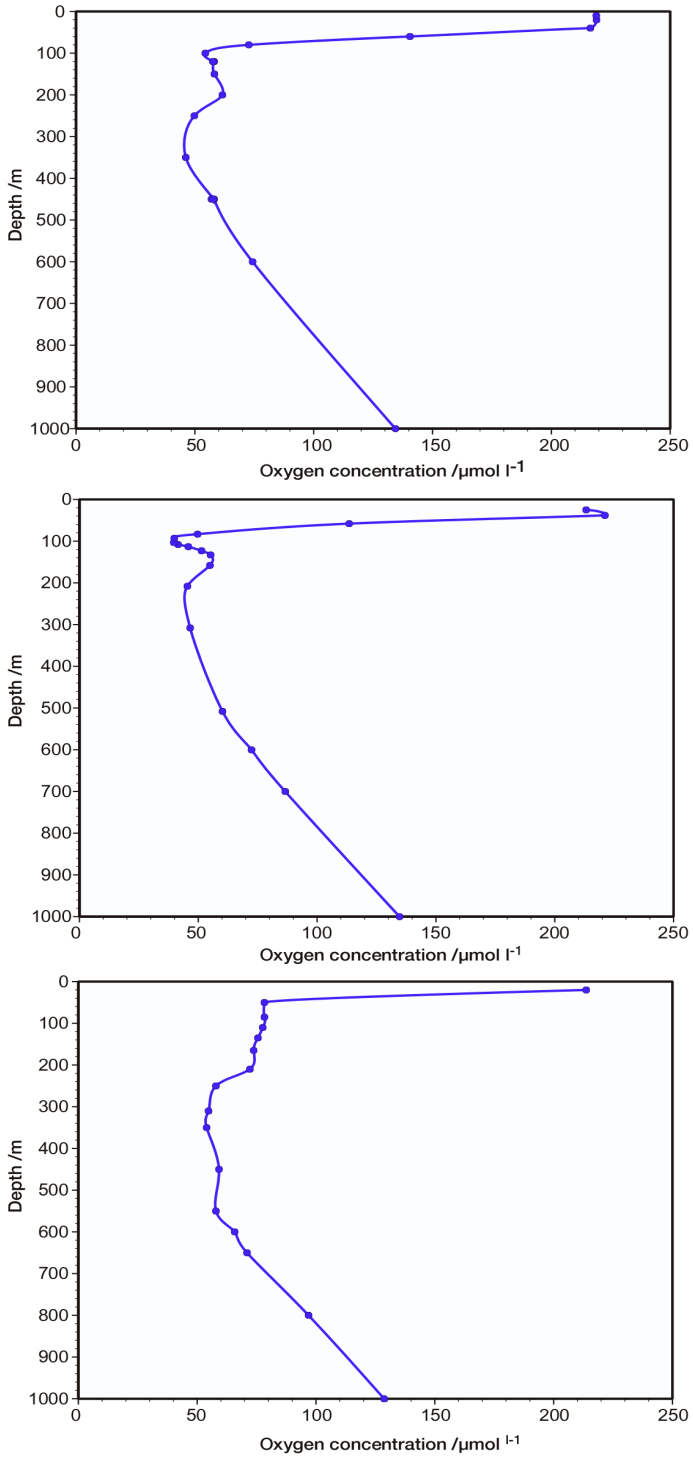


Fig. 4 Oxygen profiles at CVOO (top), EDDY (middle), CV-SE (bottom)

Acknowledgements

We thank Captain Maaß and his crew for their excellent support throughout the cruise. The ship-time and financial support were provided by the Deutsche Forschungsgemeinschaft.

List of participants

Name	Role	Institution
Christiansen, Bernd, Dr.	chief scientist	UHH-IHF
Buchholz, Cornelia, Dr.	krill/MOCNESS	AWI
Buchholz, Friedrich, Prof.	krill/MOCNESS	AWI
Chi, Xupeng	gelatinous zooplankton	GEOMAR
Christiansen, Svenja	zooplankton/UVP, PELAGIOS	GEOMAR
Denda, Anneke, Dr.	zooplankton, micronekton,/ MOCNESS	UHH-IHF
Fabrizius, Eduard	technics	GEOMAR
Hoving, Hendrik J.T., Dr.	macrozooplankton/PELAGIOS	GEOMAR
Janßen, Silke	technics/MOCNESS	UHH-IHF
Kaufmann, Manfred, Prof.	phytoplankton	UMA and CIIMAR
Kronschnabel, Alessandra	zooplankton/MOCNESS	UHH-IHF
Lischka, Alexandra	cephalopods	GEOMAR
Lüskow, Florian	gelatinous zooplankton	GEOMAR
Martin, Bettina, Dr.	zooplankton/MOCNESS	UHH-IHF
Merten, Veronique	cephalopods	GEOMAR
Pinheiro, Neusa	oxygen	UniCV
Silva, Pericles	oxygen	INDP
Springer, Barbara, Dr.	CTD, ADCP	UHH-IHF
Zankl, Solvin	photography	
Zeimet, Timo	zooplankton/MOCNESS	UHH-IHF

Participating institutions

AWI	Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany
CIIMAR	CIIMAR-Madeira, Funchal, Portugal
GEOMAR	Helmholtz-Zentrum für Ozeanforschung Kiel, Germany
INDP	Instituto Nacional de Desenvolvimento das Pescas, Mindelo, Sao Vicente, Republic of Cape Verde
UHH-IHF	Universität Hamburg, Institut für Hydrobiologie und Fischereiwissenschaft, Hamburg, Germany
UMA	Universidade da Madeira, Estação de Biologia Marinha do Funchal, Funchal, Portugal
UniCV	Universidade de Cabo Verde, Mindelo, Sao Vicente, Republic of Cape Verde

Station list

Times and positions refer to beginning of station

Gear abbreviations:

CTD/RO	Seabird CTD with 24 bottle rosette
PGS	PELAGIOS
MOCN	1m²-MOCNESS
MOC-10	10m²-MOCNESS
WP3	WP3 net
IKMT	Isaac Kidd Midwater Trawl
APSN	Apstein net
UVP	Underwater Vision Profiler

Station No	Date	Time (UTC)	Latitude	Longitude	Depth (m)	Gear.
MSM49/583-1	01.12.15	08:24	17° 35.00‘ N	24° 17.04‘ W	3611.5	CTD/RO+UVP
MSM49/583-3	01.12.15	10:04	17° 35.37‘ N	24° 17.11‘ W	3613.2	MOCN
MSM49/583-4	01.12.15	14:14	17° 35.00‘ N	24° 17.01‘ W	3613.9	PGS+UVP
MSM49/583-5	01.12.15	15:56	17° 35.38‘ N	24° 17.33‘ W	3614.1	PGS+UVP
MSM49/583-6	01.12.15	16:53	17° 35.43‘ N	24° 17.38‘ W	3614.1	PGS+UVP
MSM49/583-7	01.12.15	19:15	17° 35.09‘ N	24° 16.92‘ W	3612.2	MOC-10
MSM49/583-8	01.12.15	23:03	17° 35.13‘ N	24° 16.87‘ W	3612.0	MOCN
MSM49/583-9	02.12.15	02:15	17° 39.67‘ N	24° 13.58‘ W	3614.6	PGS+UVP
MSM49/583-10	02.12.15	08:14	17° 37.10‘ N	24° 16.23‘ W	3615.2	MOCN
MSM49/583-11	02.12.15	12:36	17° 35.06‘ N	24° 17.07‘ W	3608.4	PGS+UVP
MSM49/583-12	02.12.15	16:26	17° 35.01‘ N	24° 17.05‘ W	3613.4	CTD/RO
MSM49/583-13	02.12.15	19:16	17° 35.79‘ N	24° 17.34‘ W	3615.5	WP3
MSM49/583-14	02.12.15	21:03	17° 37.26‘ N	24° 17.06‘ W	3617.3	IKMT
MSM49/583-15	02.12.15	23:59	17° 37.06‘ N	24° 17.29‘ W	3619.5	MOCN
MSM49/584-1	03.12.15	09:26	17° 59.98‘ N	23° 00.02‘ W	3504.5	CTD/RO+UVP
MSM49/584-2	03.12.15	10:51	18° 00.01‘ N	22° 59.99‘ W	3504.7	MOCN
MSM49/584-2	03.12.15	12:21	18° 02.26‘ N	22° 57.91‘ W	3496.9	MOCN
MSM49/584-3	03.12.15	14:24	17° 59.99‘ N	23° 00.02‘ W	3504.3	PGS+UVP
MSM49/584-4	03.12.15	19:22	18° 02.86‘ N	23° 04.36‘ W	3542.6	MOC-10
MSM49/585-1	04.12.15	02:34	18° 00.21‘ N	22° 04.31‘ W	3311.1	MOCN
MSM49/585-2	04.12.15	05:47	18° 04.99‘ N	22° 00.02‘ W	3307.4	CTD/RO
MSM49/585-3	04.12.15	08:30	18° 05.04‘ N	21° 59.96‘ W	3306.8	MOCN
MSM49/585-4	04.12.15	12:37	18° 05.01‘ N	22° 00.00‘ W	3306.6	PGS+UVP
MSM49/585-5	04.12.15	18:00	18° 04.97‘ N	22° 00.02‘ W	3307.5	APSN
MSM49/585-6	04.12.15	20:10	18° 05.06‘ N	21° 59.92‘ W	3307.4	IKMT
MSM49/585-7	04.12.15	22:57	18° 05.05‘ N	21° 59.89‘ W	3306.9	MOCN
MSM49/585-8	05.12.15	02:55	18° 04.98‘ N	22° 00.02‘ W	3307.0	PGS+UVP
MSM49/585-9	05.12.15	08:40	18° 04.99‘ N	22° 00.02‘ W	3306.6	CTD/RO+UVP
MSM49/585-10	05.12.15	09:55	18° 05.03‘ N	21° 59.97‘ W	3306.3	MOCN
MSM49/585-11	05.12.15	14:00	18° 05.32‘ N	21° 59.52‘ W	3305.6	MOC-10
MSM49/585-12	05.12.15	17:12	18° 04.99‘ N	22° 00.02‘ W	3306.6	WP3
MSM49/585-13	05.12.15	18:17	18° 05.01‘ N	22° 00.04‘ W	3308.2	APSN
MSM49/585-14	05.12.15	19:12	18° 05.23‘ N	21° 59.72‘ W	3305.8	MOC-10
MSM49/586-1	06.12.15	02:55	17° 14.18‘ N	22° 00.62‘ W	946.1	IKMT
MSM49/586-2	06.12.15	07:02	17° 14.23‘ N	22° 00.72‘ W	1004.2	CTD/RO+UVP
MSM49/586-3	06.12.15	09:00	17° 10.92‘ N	22° 02.54‘ W	1900.0	MOCN
MSM49/586-4	06.12.15	13:23	17° 14.18‘ N	22° 00.66‘ W	987.2	PGS+UVP
MSM49/586-4	06.12.15	13:39	17° 14.19‘ N	22° 00.66‘ W	987.1	PGS+UVP
MSM49/586-5	06.12.15	18:45	17° 14.22‘ N	22° 00.72‘ W	1005.6	APSN
MSM49/586-6	06.12.15	19:45	17° 10.95‘ N	22° 02.52‘ W	1894.6	MOC-10

Station No	Date	Time (UTC)	Latitude	Longitude	Depth (m)	Gear.
MSM49/586-7	06.12.15	23:01	17° 14.22‘ N	22° 00.73‘ W	1007.2	PGS+UVP
MSM49/586-8	07.12.15	07:01	17° 14.22‘ N	22° 00.71‘ W	1004.4	CTD/RO
MSM49/586-9	07.12.15	08:58	17° 10.99‘ N	22° 02.51‘ W	1889.3	MOC-10
MSM49/587-1	07.12.15	12:25	17° 09.91‘ N	21° 57.62‘ W	487.7	MOCN
MSM49/587-2	07.12.15	14:09	17° 10.33‘ N	21° 57.47‘ W	273.4	MOCN
MSM49/587-3	07.12.15	14:54	17° 11.26‘ N	21° 57.27‘ W	108.5	PGS+UVP
MSM49/587-4	07.12.15	16:41	17° 10.33‘ N	21° 57.48‘ W	277.4	IKMT
MSM49/587-5	07.12.15	17:27	17° 11.26‘ N	21° 57.27‘ W	107.9	CTD/RO+UVP
MSM49/587-6	07.12.15	17:56	17° 11.26‘ N	21° 57.27‘ W	109.4	WP3
MSM49/587-7	07.12.15	18:42	17° 11.26‘ N	21° 57.27‘ W	109.3	APSN
MSM49/587-8	07.12.15	19:05	17° 11.27‘ N	21° 57.27‘ W	109.9	CTD/RO+UVP
MSM49/587-9	07.12.15	22:17	17° 10.36‘ N	21° 57.46‘ W	255.2	MOCN
MSM49/587-10	07.12.15	23:15	17° 11.26‘ N	21° 57.27‘ W	218.4	PGS+UVP
MSM49/588-1	08.12.15	01:28	17° 10.94‘ N	22° 02.53‘ W	1894.7	MOCN
MSM49/588-2	08.12.15	05:29	17° 14.22‘ N	22° 00.72‘ W	1004.8	WP3
MSM49/588-2	08.12.15	06:22	17° 14.22‘ N	22° 00.72‘ W	1005.3	WP3
MSM49/588-3	08.12.15	07:59	17° 10.88‘ N	22° 02.56‘ W	1905.0	MOCN
MSM49/590-1	08.12.15	17:40	17° 11.26‘ N	21° 57.29‘ W	109.1	PGS
MSM49/591-1	08.12.15	20:15	17° 10.89‘ N	22° 02.56‘ W	1890.0	MOCN
MSM49/592-1	09.12.15	00:15	17° 11.26‘ N	21° 57.29‘ W	108.5	PGS
MSM49/593-1	09.12.15	02:01	17° 10.44‘ N	21° 57.68‘ W	305.5	MOCN
MSM49/593-2	09.12.15	03:03	17° 10.79‘ N	21° 57.36‘ W	117.5	IKMT
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MSM49/595-3	09.12.15	09:36	17° 04.57‘ N	21° 54.45‘ W	2643.0	MOC-10
MSM49/595-4	09.12.15	13:02	17° 09.16‘ N	21° 54.68‘ W	976.3	PGS+UVP
MSM49/595-5	09.12.15	19:09	17° 07.40‘ N	21° 54.81‘ W	1699.6	MOC-10
MSM49/595-6	09.12.15	23:00	17° 05.00‘ N	21° 55.73‘ W	2631.6	MOCN
MSM49/595-7	10.12.15	02:40	17° 09.72‘ N	21° 55.31‘ W	542.7	PGS+UVP
MSM49/595-8	10.12.15	03:15	17° 09.72‘ N	21° 55.31‘ W	540.1	PGS+UVP
MSM49/595-9	10.12.15	07:58	17° 05.08‘ N	21° 55.69‘ W	2648	MOCN
MSM49/595-10	10.12.15	11:40	17° 09.12‘ N	21° 54.74‘ W	932.5	APSN
MSM49/595-11	10.12.15	12:46	17° 05.03‘ N	21° 55.72‘ W	2654.8	MOCN
MSM49/595-12	10.12.15	16:26	17° 09.69‘ N	21° 52.45‘ W	1728.3	PGS+UVP
MSM49/595-13	10.12.15	17:31	17° 09.51‘ N	21° 53.10‘ W	1676.1	PGS+UVP
MSM49/595-14	10.12.15	18:45	17° 09.13‘ N	21° 54.69‘ W	959.8	CTD/RO+UVP
MSM49/595-15	10.12.15	20:46	17° 04.56‘ N	21° 56.97‘ W	2763	MOCN
MSM49/596-1	11.12.15	07:24	15° 59.99‘ N	21° 00.01‘ W	3870.2	CTD/RO+UVP
MSM49/597-1	11.12.15	11:56	16° 24.10‘ N	21° 01.13‘ W	3759.6	CTD/RO+UVP
MSM49/598-1	11.12.15	13:24	16° 20.28‘ N	21° 06.92‘ W	3795.0	CTD/RO+UVP
MSM49/599-1	11.12.15	14:52	16° 16.16‘ N	21° 12.60‘ W	3819.5	CTD/RO+UVP
MSM49/600-1	11.12.15	16:19	16° 12.17‘ N	21° 18.51‘ W	3840.2	CTD/RO+UVP
MSM49/601-1	11.12.15	20:19	16° 12.19‘ N	21° 18.51‘ W	3839.8	CTD/RO+UVP
MSM49/601-2	11.12.15	22:13	16° 08.78‘ N	21° 20.54‘ W	3854.1	MOCN
MSM49/601-3	12.12.15	01:46	16° 10.41‘ N	21° 16.36‘ W	3842.9	PGS+UVP
MSM49/601-4	12.12.15	06:57	16° 12.19‘ N	21° 18.52‘ W	3838.8	CTD/RO
MSM49/601-5	12.12.15	08:25	16° 10.48‘ N	21° 19.34‘ W	3846.4	MOC-10
MSM49/601-6	12.12.15	11:13	16° 12.24‘ N	21° 18.52‘ W	3837.9	APSN
MSM49/601-7	12.12.15	12:17	16° 09.93‘ N	21° 20.49‘ W	3848.7	MOCN
MSM49/601-8	12.12.15	15:36	16° 12.19‘ N	21° 18.52‘ W	3837.7	CTD/RO+UVP
MSM49/601-9	12.12.15	16:59	16° 12.20‘ N	21° 18.53‘ W	3838.1	WP3
MSM49/601-9	12.12.15	17:25	16° 12.23‘ N	21° 18.55‘ W	3838.6	WP3
MSM49/601-9	12.12.15	17:51	16° 12.26‘ N	21° 18.60‘ W	3838.1	WP3

Station No	Date	Time (UTC)	Latitude	Longitude	Depth (m)	Gear.
MSM49/601-10	12.12.15	19:30	16° 10.55‘ N	21° 19.50‘ W	3846.6	MOC-10
MSM49/601-11	12.12.15	23:05	16° 08.71‘ N	21° 20.56‘ W	3853.5	MOCN
MSM49/601-12	13.12.15	02:08	16° 12.18‘ N	21° 18.50‘ W	3839.8	CTD/RO+UVP
MSM49/601-13	13.12.15	03:09	16° 12.18‘ N	21° 18.50‘ W	3838.7	WP3
MSM49/601-13	13.12.15	03:44	16° 12.18‘ N	21° 18.50‘ W	3840.4	WP3
MSM49/601-13	13.12.15	04:20	16° 12.18‘ N	21° 18.50‘ W	3839.6	WP3
MSM49/601-14	13.12.15	07:54	16° 08.28‘ N	21° 19.23‘ W	3853.8	MOCN
MSM49/601-15	13.12.15	11:12	16° 13.43‘ N	21° 16.24‘ W	3833.4	PGS+UVP
MSM49/602-1	13.12.15	23:28	15° 01.59‘ N	20° 28.05‘ W	4055.0	PGS+UVP
MSM49/602-2	14.12.15	04:49	14° 59.99‘ N	20° 30.01‘ W	4071.9	WP3
MSM49/602-2	14.12.15	06:21	14° 59.99‘ N	20° 30.01‘ W	4071.0	WP3
MSM49/602-3	14.12.15	08:11	14° 59.99‘ N	20° 30.01‘ W	4072.4	CTD/RO+UVP
MSM49/602-4	14.12.15	09:56	14° 56.52‘ N	20° 32.09‘ W	4088.2	MOCN
MSM49/602-5	14.12.15	13:18	14° 59.08‘ N	20° 27.56‘ W	4062.0	PGS+UVP
MSM49/602-6	14.12.15	19:05	15° 00.18‘ N	20° 29.94‘ W	4071.0	MOC-10
MSM49/602-7	14.12.15	22:13	14° 59.99‘ N	20° 30.01‘ W	4071.4	MOCN
MSM49/602-8	15.12.15	02:06	15° 00.09‘ N	20° 29.97‘ W	4069.2	MOCN
MSM49/602-9	15.12.15	05:45	14° 59.99‘ N	20° 30.01‘ W	4070.4	CTD/RO+UVP
MSM49/602-10	15.12.15	07:56	15° 00.05‘ N	20° 29.99‘ W	4068.3	MOCN
MSM49/602-11	15.12.15	11:46	15° 00.11‘ N	20° 29.96‘ W	4073.3	MOC-10
MSM49/602-12	15.12.15	14:11	15° 04.27‘ N	20° 27.95‘ W	4050.4	APSN
MSM49/603-1	16.12.15	07:43	11° 59.99‘ N	21° 00.01‘ W	4924.4	CTD/RO+UVP
MSM49/603-2	16.12.15	09:13	12° 00.10‘ N	20° 59.96‘ W	4926.1	MOC-10
MSM49/603-4	16.12.15	12:02	12° 01.21‘ N	20° 57.24‘ W	4918.2	PGS+UVP
MSM49/603-5	16.12.15	19:03	12° 00.19‘ N	20° 59.94‘ W	4920.0	MOC-10
MSM49/603-6	16.12.15	22:04	12° 00.09‘ N	20° 59.98‘ W	4922.6	MOCN
MSM49/603-7	17.12.15	01:34	12° 00.08‘ N	20° 59.96‘ W	4920.4	MOCN
MSM49/603-8	17.12.15	04:51	11° 59.99‘ N	21° 00.01‘ W	4921.5	WP3
MSM49/603-8	17.12.15	06:22	11° 59.99‘ N	21° 00.01‘ W	4924.0	WP3
MSM49/603-9	17.12.15	08:07	11° 59.99‘ N	21° 00.01‘ W	4922.6	APSN
MSM49/603-10	17.12.15	08:34	11° 59.99‘ N	21° 00.01‘ W	4920.2	CTD/RO+UVP
MSM49/603-11	17.12.15	09:34	12° 00.06‘ N	20° 59.97‘ W	4921.9	MOCN
MSM49/603-12	17.12.15	13:29	12° 00.05‘ N	20° 59.94‘ W	4922.1	MOCN
MSM49/603-13	17.12.15	16:54	11° 59.99‘ N	21° 00.01‘ W	4921.7	WP3
MSM49/603-14	17.12.15	19:56	12° 00.85‘ N	20° 57.61‘ W	4917.6	PGS+UVP
MSM49/604-1	18.12.15	10:49	11° 58.62‘ N	23° 01.44‘ W	5059.6	MOCN
MSM49/604-2	18.12.15	14:14	11° 58.65‘ N	23° 01.39‘ W	5057.6	MOCN
MSM49/604-3	18.12.15	19:02	11° 58.69‘ N	23° 01.35‘ W	5056.8	MOC-10
MSM49/604-4	18.12.15	22:13	11° 58.62‘ N	23° 01.42‘ W	5057.6	MOCN
MSM49/604-5	19.12.15	01:55	11° 58.61‘ N	23° 01.42‘ W	5059.2	MOCN
MSM49/604-6	19.12.15	05:23	11° 59.99‘ N	23° 00.01‘ W	5053.1	CTD/RO+UVP
MSM49/604-7	19.12.15	07:16	11° 59.99‘ N	23° 00.01‘ W	5052.1	APSN
MSM49/604-8	19.12.15	08:07	11° 58.57‘ N	23° 01.24‘ W	5056.7	MOC-10
MSM49/604-9	19.12.15	11:05	12° 00.85‘ N	22° 57.63‘ W	5045.3	PGS+UVP
MSM49/604-10	19.12.15	17:24	11° 59.99‘ N	23° 00.01‘ W	5052.4	CTD/RO
MSM49/604-11	19.12.15	18:33	11° 59.99‘ N	23° 00.01‘ W	5054.2	WP3
MSM49/604-12	19.12.15	21:01	12° 00.85‘ N	22° 57.63‘ W	5044.9	PGS+UVP