INSTITUT FÜR OSTSEEFORSCHUNG WARNEMÜNDE
an der Universität Rostock BALTIC SEA RESEARCH INSTITUTE

Cruise Report

of

Cruise M48/3
with

R/V Meteor

from

26 August to 16 September 2000

by
Dr. H. U. Lass

1 Cruise information

1.1 Summary information

R/V Meteor M48/3, Callsign DBBH

IOW Cruise Number: 130002

Chief Scientist: Hans Ulrich Lass

Institute for Baltic Sea Research Warnemünde (IOW)

Seestr.15

D 18119 Rostock - Warnemünde

Germany

Tel: ++49 (0)381 5197 130

Fax: ++49 (0)381 5197 440

Email: lass@io-warnemuende.de

Ship: R/V Meteor, length: 97.50 m width: 16.5 m , draft: 5.61 m,
displacement: 4280 tons

Port of calls: Namibe / Angola 28 to 29 August 2000

Cruise Dates: 26 August from Walvis Bay to 16 September 2000 Walvis Bay

1.2 Survey Chronology

Activity	Date
Boarding in Walvis Bay	24. 08.00
Unloading container, installing and testing equipment	
Calibration of LADCP	25.08.00
Embarking equipment for oceanographic station in Namibe	
Departure Walvis Bay	26.08.00
Sailing to Namibe, test station, release ARGOS surface drifter in Benguela current	
Arriving Namibe, disembarking equipment, reception on board of R/V Meteor	28.08.00
Departure of Namibe, sailing along the shelf towards northern section, releasing second ARGOS drifter in the Angola current	29.08.00
Starting station work on northern section N01	31.08.00
Releasing third ARGOS drifter, end of station work on northern section N01	01.09.00
Start station work on section N02	02.09.00
End Station work on section N02	04.09.00
Begin station work on section N03	05.09.00
End Station work on section N03	07.09.00
Begin Station work on section N04	08.09.00
End station work on section N04	09.09.00
Begin Station work on section N06	10.09.00
End station work on section N06	11.09.00
Begin Station work on section N07	12.09.00
End station work on section N07	14.09.00
Station work on Section N08 cancelled due to stormy weather	14. – 15. 00
Arrival in Walvis Bay	16.09.00

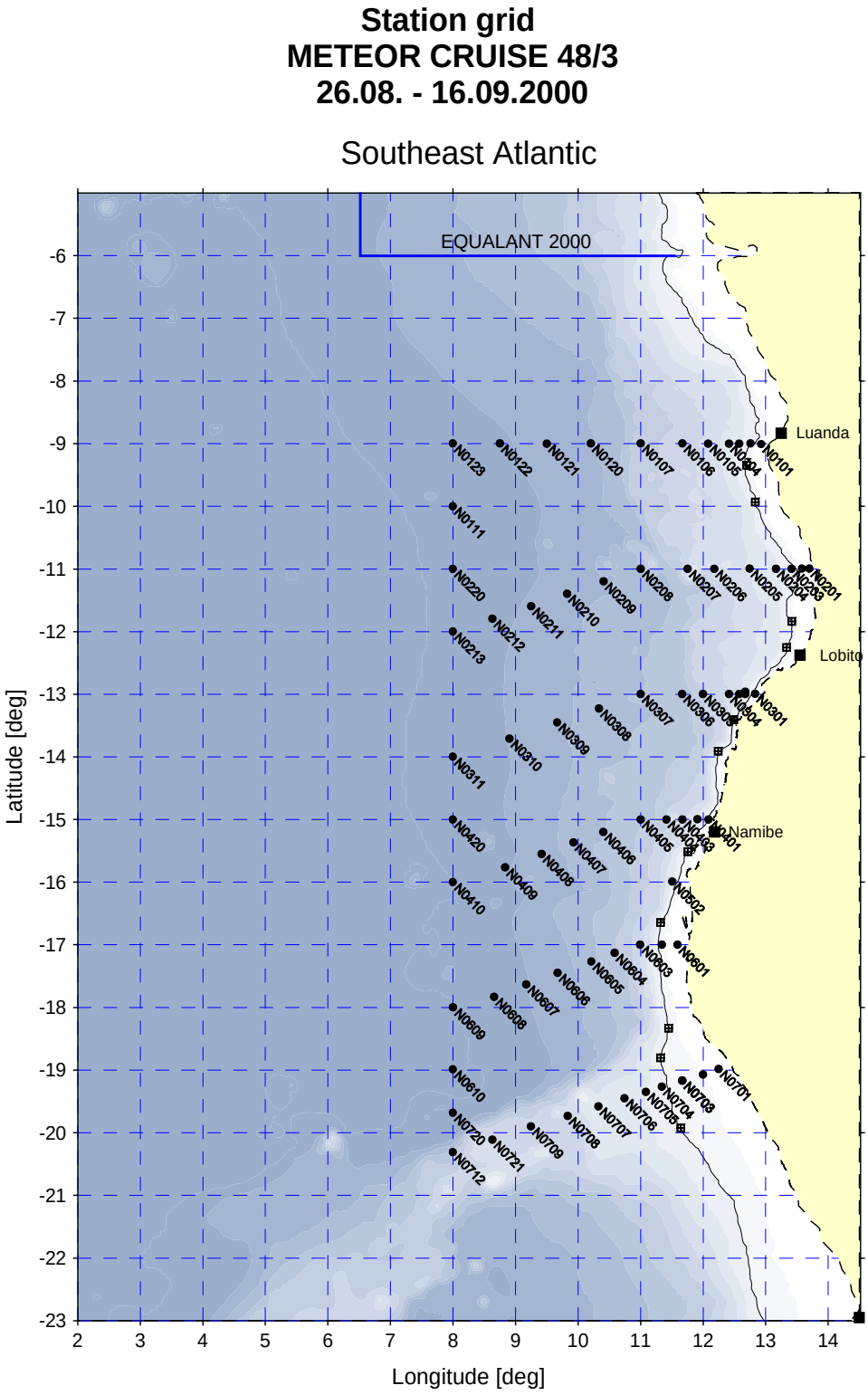

Figure 1. Locations of the CTD and water sample stations taken on M48/3

1.3 Cruise Summary

Number of stations

A total of 73 stations were occupied using a CTD SBE 911+ with IOW two oxygen sensors, 2 channel Haardt fluorometer, Datasonics PSA-900 altimeter together with a HydroBios 12 bottle Kranzwasserschöpfer rosette equipped with 5 - litre free flow water sample bottles of HydroBios. Attached to the CTD frame was LADCP consisting of coupled upward and downward looking Workhorse ADCP in a 3000dbar pressure case. The locations of the stations are shown in Figure 1. The station list is given in Appendix 2.1.

Water Sampling

843 water samples taken on all CTD stations shown in Figure 1 were analysed for oxygen, phosphate, nitrate, nitrite, ammonia, and silicate. The sampling depths in meter were surface, 20, 40, 50, 60, 80, 100, 200, 400, 600, 800, 1000, 1200 or bottom.

Moreover, on 53 stations, shown in Figure 2, 91 water samples have been filtered for phytoplankton analysis and in 314 samples the potential and in 216 samples simulated primary productivity has been estimated, respectively. Chlorophyll-a has been estimated on 54 stations in 799 samples.

Also, at selected stations and depths salinity of water samples was measured by Autosal for intercomparison with the CTD.

At selected stations 132 water samples have been taken from the mixed layer and different depths below for the determination of the Hg, Cd, Pb, Cu, and Mn in the laboratory at shore.

Net sampling

At selected stations listed in Annex 2.2 25 net hauls with a plankton net were made in the surface mixed layer. During day time on this stations depth profiles of light intensity were measured.

17 zooplankton hauls were carried out with the Multi Net and the WP2 net on stations shon in Figure 3. The station list of the Multi net hauls is given in Appendix 2.3.

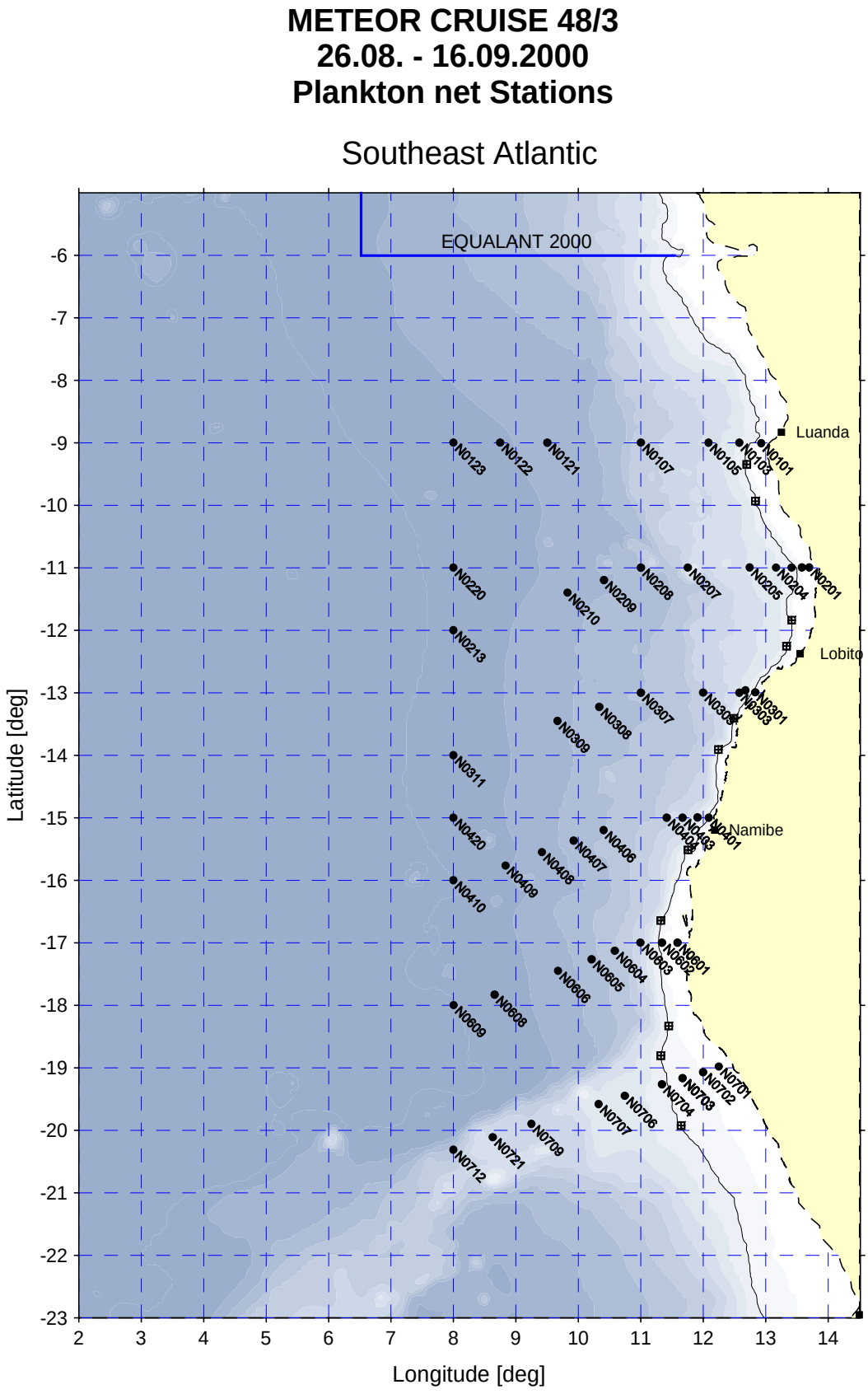

Figure 2. Locations of the plankton sampling stations taken on M48/3

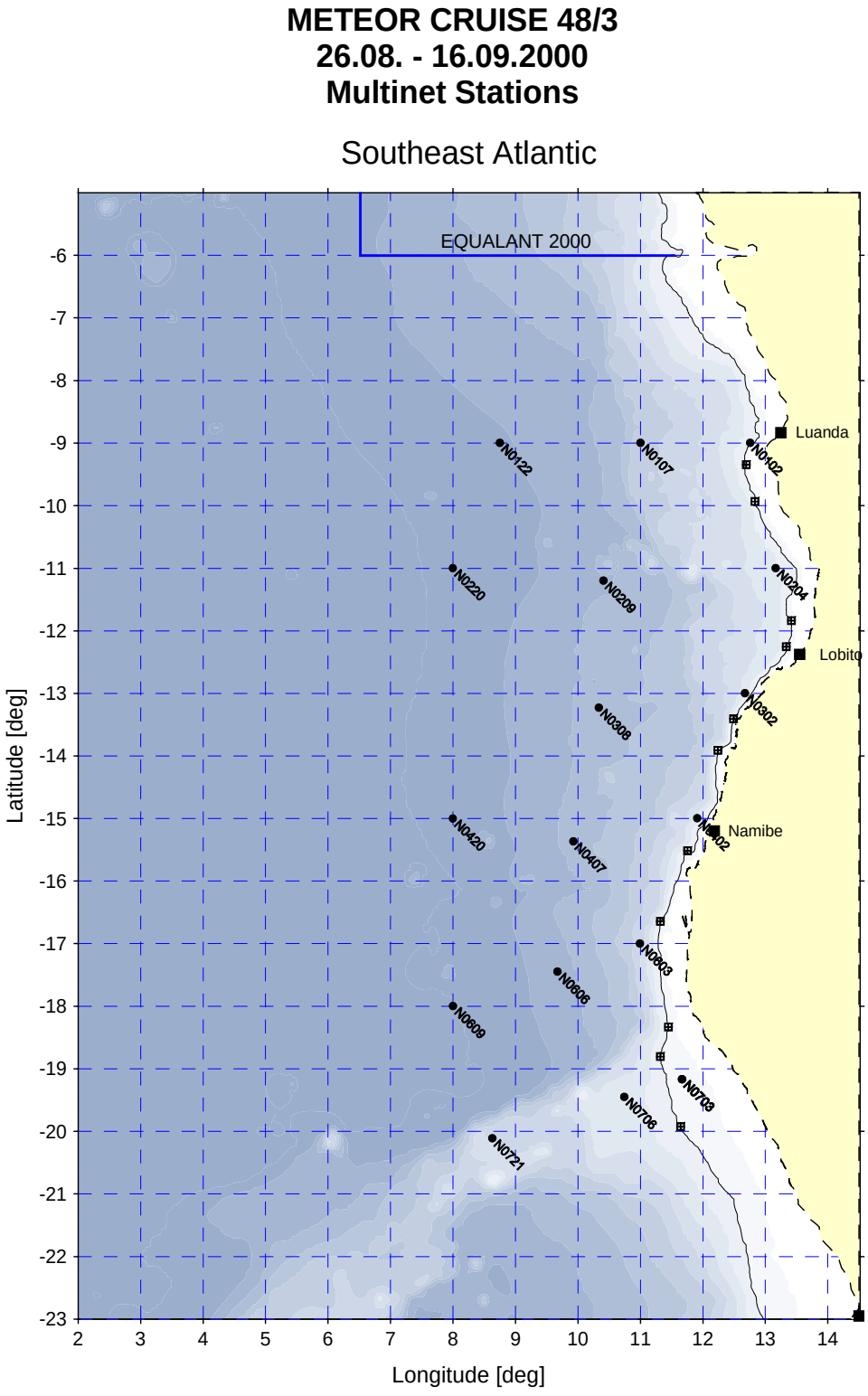

Figure 3. Locations of the Multi net stations taken on M48/3

Underway measurements

A total of 20 days meteorological, thermosalinograph, phosphate and vessel mounted ADCP measurements along the track of the ship have been collected on the cruise.

Drifter

Three ARGOS surface drifter of WOCE-type have been deployed. One at the shelf break in the Benguela current area, one at the shelf break in the Angola current area and one offshore in the assumed area of the South Equatorial Countercurrent.

1.4 List of principal investigators

The principle investigators responsible for the major parameters measured on the cruise are listed in TABLE 1. The responsibility for all tasks undertaken on the cruise will be found in TABLE 2.

TABLE 1: ***Principle Investigators***

Parameter/Instrument	Sampling Group	Principal Investigator
CTDO / Rosette	IOW	M. Schmidt
LADCP	IOW	V. Mohrholz
ADCP	IOW	H. U. Lass
Salinity / Temperature	IOW	M. Schmidt
O2, NH4, NO3, NO2, PO4, SiO4,	IOW	G. Nausch
Chlorophyll-a, Phytoplankton, Primary Productivity	IOW	N. Wasmund
Zooplankton, Species composition, Abundance, Metabolic Activity	IOW	L. Postel

1.5 Scientific programme and methods

The objectives of the investigations during cruise M48/3 are to study the integration of the Angola and Benguela current into the circulation system of the South East Atlantic consisting of the subtropical gyre and the equatorial current system with emphasis on the coupling of the different branches of the current system by the Angola gyre and their response to the wind field. The upwelling in the Benguela drives an intensive flux of matter distributed over a wide area by the circulation which is modified by biochemical processes in the ocean.

The aims of the oceanographic field measurements are:

- to understand the location and the structure of the south-eastern Angola gyre and their variability in response to the large scale wind field as well as to study the role of the Angola gyre in coupling of the equatorial currents and the Angola current.

- to estimate the location of the Angola-Benguela front in relation to the mass transport of the Angola current and the intensity of the meridional wind component along the shelf of South West Africa.

- to estimate the exchange of mass and dissolved and particulate matter between the area of the Angola and the Benguela current.

- to study the structure of the current off the shelf at the core depth of the Antarctic Intermediate Water (AAIW) and to understand the integration of this current into the basin wide circulation.

- to reveale how much cadmium is being transported by the Congo river plume into the area of investigation and how large the cadmium flow is from the sediments into the water column.

Station work started with a CTD cast employing a SBE 911+ CTD and a HydroBios rosette mounted within a plastic covered stainless steel frame. The package was weighted by a lead weight in order to avoid looping during lowering. Subsidiary

instrumentation consisted in two oxygen sensors, a 2 channel fluorometer, an altimeter with a 200 m range for bottom finding, and a LADCP consisting of a coupled upward and downward looking 300 kHz Workhorse ADCP. The wire was a 11 mm single conductor steel cable of the W2 winch. After 5 minutes adjustment of the CTD in a depth of 10 m it was lowered with 0.5 m/s in the upper 150 m and 1 m/s below this depth. The cast went down from the surface to 1200 dbar or near the bottom . Bottles were closed automatically on the downward cast, except for the surface bottle, which was closed by hand at the end of the cast. During the CTD cast the ship was held on position with the bow into wind direction.

After the cast the rosette was placed on the deck without shelter and secured. The oxygen sensor was covered by a protective cap. Subsequently, water samples were drawn from the water bottles for oxygen, nutrient, salinity, phytoplankton analysis, and trace metal analysis. The rosette remained on deck between stations.

The multinet was operated with winch W3 via the aft deck crane on starboard side of the vessel. The multinet, consisting of 5 nets with 200µm meshsize, was lowered while towing with 1.5 kn in different depth levels between the sea surface and a maximum depth of 400 meter. A ME CTD was attached to the multinet in order to measure the actual depth. During ascending of the multinet 5 nets were opened and closed over different depth ranges, which were chosen according to the actual stratification. After towing both nets were rinsed with seawater while hanging over the side, placed on the main deck where the flow meters were read the cod-ends cleaned and the samples transferred to the lab.

Additionally measurements throughout the cruise consisted of temperature and salinity measurements performed continuously in the surface layer by the thermosalinograph of the research vessel. Simultaneously, phosphate concentration of water from the surface layer was measured continuously by an autoanalyser. The current profile in the upper 500 m of the ocean was measured by the vessel mounted 75 kHz ADCP manufactured by RDI. In support to the ADCP measurement heading of the ship was measured by ADU II manufactured by Ashtech Inc. and a fiber optical gyro manufactured by C. Plath GmbH and provided information superior to that of the ship's gyro..

Bottom finding was mainly performed by the Hydro-Sweep and Parasound echo sounders manufactured by Atlas GmbH and meteorological data were continuously measured by the ship's weather station.

Large scale properties of the circulation were detected by the launch of three WOCE type surface drifter. One was released in the coastal branch of the Benguela, one in the branch of the SECC, and one in the Angola current.

A description of the methods of measurement, calibration and analysis of the data and samples received from the different sources will be found in the extended cruise report.

1.6 Preliminary results

The preliminary results reported here are based on the drifter data received until 14 September 2000, the CTD measurements and chemical measurements. This observations were processed on board already and the accuracy of pressure, temperature and salinity were sufficient for the following conclusions.

Structure of currents observed in the work area

The Angola current was well developed and could be detected by both the drifter and the LADCP observations. The Benguela coastal current was weak and variable. The drifter released in this current first moved towards the west and returned later to its initial position.

No well developed SECC could be observed with the measurements at hand. The drifter released within the expected area of the SECC moved slowly toward NW.

Nevertheless, strong currents could be observed within the observational area, but it remains an goal of the forthcoming investigations to detect whether they are parts of eddies or other forms of transient motion.

Water masses and stratification

The surface layer was characterised by cold and nutrient enriched Benguela upwelling water in the South and warm, saline and nutrient depleted Angola current water in the North. Both were separated by the Angola- Benguela front located at about 15°S. The Angola current water was separated from the coast by cold and nutrient enriched upwelling water extending from the front until Luanda.

Below the surface mixed layer SACW was found north of the front which extended seaward beyond the observational area. This water was characterised by oxygen depletion in a depth range between 100 m and 600 m. This water mass was mixed together with Eastern SACW south of 18°S resulting in a ventilation of the thermocline water and a narrowing of the oxygen depleted water mass toward the coast. The oxygen minimum in the thermocline water south of the front moved upward. This could be due to the large production of phytoplankton in the upwelling area and the following decomposition of the sinking organic particles in the layers below the surface mixed layer.

1.7 Major problems encountered on the cruise

Strong winds of up to 8 Bft. on 14 to 15 September 2000 prevented the work on the stations of the southernmost section.

1.8 Other Observations of note

No other observations of note have been made during the cruise.

1.9 List of cruise participants

The members of the scientific party are listed in TABLE 2, along with their responsibilities

TABLE 2: Cruise participants and their responsibilities during the cruise.

Name	Group	Responsibility	Affiliation
H. U. Lass	Chief Scient.	Underway measurements	IOW
M. Schmidt	Hydrography	CTD, LADCP	IOW
V. Mohrholz	Hydrography	CTD, LADCP, ADCP	IOW
St. Weinreben	Hydrography	CTD, LADCP, Salinity	IOW
D. Rüß	Hydrography	CTD, LADCP, Drifter	IOW
R. Kay	Zooplankton	Multinet operation, Mech. Engineer	IOW
G. Nausch	Chemistry	Oxygen, Nutrients, Autoanalyser	IOW
B. Wachs	Chemistry	Nutrients, Oxygen	IOW
N. Wasmund	Phytoplankton	Chlorophylla, Phytoplankton analysis	IOW
K. Kunert	Phytoplankton	Primary Production	IOW
L. Postel	Zooplankton	Metabolic rates	IOW
A. Postel	Zooplankton	Sample Treatment	IOW
Chr. Pohl	Trace metal	Trace metal samples	IOW
I. Kauvee	Chemistry	Nutrients, Oxygen	NMIRC
B. Dundee	Chemistry	Nutrients, Oxygen	NMIRC

A. Iita	Hydrography	CTD & LADCP Operation	NMIRC
D. Mouton	Hydrography	CTD & LADCP Operation	NMIRC
A. da Silva	Zooplankton	Multinet sampling, Data Analysis	IIP
E. Vasco	Chemistry	Nutrients, Oxygen	IIP
A. Chicunga	Zooplankton	Sample Treatment	IIP
G. Kahl	DWD	Weather analysis & prediction	DWD
W. Ochsenhirt	DWD	Weather observation	DWD
T. Truscheit	DWD	Weather observations	DWD

2 Appendix

2.1 CTD-Casts

Cast	Serie	Stationname	Time	Date	Latitude	Longitude
387	1	N0703	10:10	27.08.00	19° 09.9847' S	011° 40.4718' E
387	2	N0703	11:29	27.08.00	19° 10.5967' S	011° 40.9325' E
387	3	N0703	11:34	27.08.00	19° 10.6138' S	011° 40.9050' E
387	4	N0703	11:41	27.08.00	19° 10.6620' S	011° 40.8328' E
389	1	N0101	19:54	30.08.00	09° 00.1835' S	012° 55.6072' E
390	1	N0102	21:34	30.08.00	09° 00.0563' S	012° 45.0740' E
391	1	N0103	1:22	31.08.00	09° 00.0700' S	012° 34.7676' E
391	2	N0103	2:30	31.08.00	09° 00.0460' S	012° 34.8673' E
392	1	N0104	4:04	31.08.00	09° 00.0013' S	012° 24.8910' E
393	1	N0105	6:53	31.08.00	09° 00.0356' S	012° 05.0552' E
393	2	N0105	7:54	31.08.00	09° 00.0460' S	012° 05.0930' E
394	1	N0106	10:44	31.08.00	09° 00.0150' S	011° 40.2931' E
395	1	N0107	15:37	31.08.00	09° 00.0081' S	011° 00.2021' E
396	1	N0120	22:35	31.08.00	08° 59.9909' S	010° 12.3727' E
396	2	N0120	23:48	31.08.00	08° 59.9841' S	010° 12.3590' E
397	1	N0121	4:07	01.09.00	09° 00.0047' S	009° 30.2569' E
398	1	N0122	9:15	01.09.00	09° 00.0253' S	008° 45.0196' E
399	1	N0123	18:11	01.09.00	09° 00.0150' S	007° 59.9541' E
400	1	N0111	1:07	02.09.00	10° 00.0037' S	007° 59.9301' E
400	2	N0111	2:20	02.09.00	09° 59.9934' S	008° 00.0435' E
400	3	N0111	2:23	02.09.00	10° 00.0003' S	008° 00.0470' E
401	1	N0220	8:38	02.09.00	10° 59.9477' S	008° 00.0160' E
402	1	N0213	17:09	02.09.00	11° 59.9742' S	008° 00.0366' E

403	1	N0212	21:27	02.09.00	11° 47.8527' S	008° 37.9309' E
403	2	N0212	21:43	02.09.00	11° 47.9799' S	008° 38.2335' E
403	3	N0212	22:56	02.09.00	11° 47.9593' S	008° 38.4878' E
403	4	N0212	23:00	02.09.00	11° 47.9421' S	008° 38.5016' E
404	1	N0211	2:51	03.09.00	11° 36.0062' S	009° 15.1205' E
405	1	N0210	6:58	03.09.00	11° 23.9432' S	009° 49.6045' E
405	2	N0210	7:12	03.09.00	11° 24.0016' S	009° 50.0239' E
405	3	N0210	7:59	03.09.00	11° 24.0050' S	009° 50.1511' E
406	1	N0209	11:28	03.09.00	11° 12.0314' S	010° 24.6833' E
407	1	N0208	17:33	03.09.00	10° 59.9889' S	011° 00.2880' E
407	2	N0208	18:21	03.09.00	11° 00.0027' S	011° 00.3396' E
408	1	N0207	22:35	03.09.00	10° 59.9855' S	011° 45.3294' E
408	2	N0207	23:40	03.09.00	11° 00.0164' S	011° 45.3466' E
408	3	N0207	23:54	03.09.00	11° 00.0130' S	011° 45.3638' E
409	1	N0206	2:24	04.09.00	11° 00.1093' S	012° 10.6896' E
409	2	N0206	3:47	04.09.00	11° 00.1368' S	012° 10.8856' E
410	1	N0205	7:54	04.09.00	10° 59.7758' S	012° 44.6477' E
410	2	N0205	8:09	04.09.00	11° 00.0268' S	012° 44.9468' E
410	3	N0205	8:58	04.09.00	11° 00.1299' S	012° 45.0774' E
411	1	N0204	11:45	04.09.00	10° 59.9511' S	013° 09.9942' E
412	1	N0203	16:38	04.09.00	10° 59.9614' S	013° 25.0584' E
413	1	N0202	18:03	04.09.00	10° 59.7517' S	013° 34.9282' E
413	2	N0202	18:17	04.09.00	10° 59.9580' S	013° 35.1138' E
413	3	N0202	18:28	04.09.00	10° 59.9855' S	013° 35.2170' E
414	1	N0201	19:10	04.09.00	10° 59.8446' S	013° 41.9206' E
414	2	N0201	19:22	04.09.00	10° 59.9752' S	013° 42.3365' E
414	3	N0201	19:33	04.09.00	10° 59.9752' S	013° 42.3468' E
415	1	N0301	8:05	05.09.00	12° 59.6878' S	012° 49.9350' E
415	2	N0301	8:16	05.09.00	13° 00.0144' S	012° 49.7287' E
415	3	N0301	8:30	05.09.00	13° 00.0385' S	012° 49.6359' E

416	1	N0302	9:23	05.09.00	12° 59.9388' S	012° 40.4536' E
416	2	N0302	9:35	05.09.00	13° 00.0351' S	012° 40.1202' E
416	3	N0302	10:21	05.09.00	13° 00.1829' S	012° 39.9758' E
417	1	N0303	12:56	05.09.00	13° 00.0557' S	012° 34.7229' E
418	1	N0304	14:51	05.09.00	13° 00.0454' S	012° 24.8532' E
419	1	N0305	17:56	05.09.00	12° 59.9285' S	012° 00.0223' E
419	2	N0305	18:05	05.09.00	13° 00.0110' S	011° 59.9192' E
419	3	N0305	18:55	05.09.00	13° 00.0522' S	011° 59.8539' E
420	1	N0306	20:50	05.09.00	12° 59.8391' S	011° 39.8840' E
420	2	N0306	21:03	05.09.00	12° 59.9835' S	011° 39.7980' E
421	1	N0307	1:40	06.09.00	12° 59.9869' S	011° 00.1368' E
421	2	N0307	3:05	06.09.00	12° 59.9766' S	011° 00.1436' E
421	3	N0307	3:20	06.09.00	13° 00.2482' S	010° 59.4320' E
422	1	N0308	7:11	06.09.00	13° 13.7964' S	010° 20.1523' E
422	2	N0308	7:23	06.09.00	13° 14.0095' S	010° 19.7948' E
422	3	N0308	8:13	06.09.00	13° 14.0851' S	010° 19.9289' E
423	1	N0309	14:54	06.09.00	13° 27.0351' S	009° 40.1095' E
424	1	N0310	20:13	06.09.00	13° 42.7353' S	008° 54.2568' E
424	2	N0310	20:25	06.09.00	13° 42.9691' S	008° 54.0505' E
424	3	N0310	21:13	06.09.00	13° 43.1203' S	008° 54.2602' E
425	1	N0311	2:31	07.09.00	13° 59.9756' S	007° 59.9576' E
426	1	N0420	9:57	07.09.00	15° 00.0055' S	007° 59.9370' E
427	1	N0410	22:07	07.09.00	16° 00.0355' S	007° 59.9610' E
427	2	N0410	23:20	07.09.00	15° 59.9702' S	008° 00.1020' E
428	1	N0409	4:24	08.09.00	15° 45.9751' S	008° 50.1212' E
429	1	N0408	8:33	08.09.00	15° 33.0389' S	009° 25.0624' E
429	2	N0408	8:45	08.09.00	15° 33.0182' S	009° 25.5678' E
429	3	N0408	9:34	08.09.00	15° 33.0285' S	009° 25.7912' E
430	1	N0407	12:34	08.09.00	15° 22.0415' S	009° 55.6859' E
431	1	N0406	18:34	08.09.00	15° 11.9930' S	010° 24.2914' E

431	2	N0406	18:46	08.09.00	15° 11.9998' S	010° 24.7348' E
431	3	N0406	19:34	08.09.00	15° 12.0308' S	010° 24.9102' E
432	1	N0405	22:58	08.09.00	14° 59.9918' S	011° 00.1540' E
433	1	N0404	2:20	09.09.00	15° 00.0159' S	011° 24.9882' E
434	1	N0403	4:49	09.09.00	15° 00.0262' S	011° 40.1693' E
435	1	N0402	7:03	09.09.00	14° 59.8577' S	011° 54.7041' E
435	2	N0402	7:18	09.09.00	15° 00.0399' S	011° 54.9413' E
435	3	N0402	8:08	09.09.00	14° 59.8543' S	011° 54.5013' E
436	1	N0401	11:31	09.09.00	15° 00.0777' S	012° 05.3680' E
437	1	N0502	18:16	09.09.00	15° 59.6573' S	011° 30.4371' E
437	2	N0502	18:28	09.09.00	16° 00.1008' S	011° 30.2033' E
437	3	N0502	19:17	09.09.00	16° 00.3346' S	011° 30.2789' E
438	1	N0601	1:14	10.09.00	17° 00.0242' S	011° 35.3943' E
438	2	N0601	1:45	10.09.00	17° 00.0379' S	011° 35.4527' E
439	1	N0602	3:31	10.09.00	17° 00.0173' S	011° 20.5020' E
440	1	N0603	5:51	10.09.00	16° 59.9898' S	010° 59.7930' E
441	1	N0604	10:56	10.09.00	17° 07.8072' S	010° 35.1993' E
442	1	N0605	14:05	10.09.00	17° 16.0475' S	010° 12.8299' E
443	1	N0606	18:06	10.09.00	17° 26.9692' S	009° 40.4807' E
444	1	N0607	23:59	10.09.00	17° 37.9425' S	009° 10.4830' E
445	1	N0608	4:07	11.09.00	17° 50.0021' S	008° 39.7151' E
446	1	N0609	8:55	11.09.00	17° 59.9441' S	008° 00.1810' E
446	2	N0609	9:06	11.09.00	18° 00.1332' S	008° 00.1157' E
447	1	N0610	18:41	11.09.00	18° 59.4893' S	007° 59.9438' E
447	2	N0610	18:54	11.09.00	18° 59.9500' S	007° 59.9954' E
447	3	N0610	19:43	11.09.00	18° 59.9362' S	008° 00.2326' E
448	1	N0720	0:36	12.09.00	19° 40.9588' S	007° 59.9713' E
448	2	N0720	1:49	12.09.00	19° 40.9588' S	007° 59.9473' E
449	1	N0712	6:04	12.09.00	20° 18.7672' S	007° 59.9507' E
449	2	N0712	6:15	12.09.00	20° 18.9700' S	008° 00.0057' E

449	3	N0712	7:04	12.09.00	20° 19.0456' S	008° 00.1192' E
450	1	N0721	11:00	12.09.00	20° 06.7144' S	008° 37.9034' E
451	1	N0709	19:22	12.09.00	19° 53.9810' S	009° 14.9623' E
452	1	N0708	0:02	13.09.00	19° 44.0184' S	009° 50.1339' E
452	2	N0708	1:11	13.09.00	19° 43.9909' S	009° 50.1374' E
453	1	N0707	4:23	13.09.00	19° 34.9737' S	010° 19.5232' E
454	1	N0706	7:45	13.09.00	19° 27.0050' S	010° 44.7975' E
455	1	N0705	12:35	13.09.00	19° 20.9855' S	011° 05.3174' E
456	1	N0704	14:54	13.09.00	19° 16.0077' S	011° 20.3920' E
457	1	N0703	17:25	13.09.00	19° 09.9950' S	011° 40.2243' E
458	1	N0702	21:43	13.09.00	19° 04.2850' S	012° 00.0326' E
459	1	N0701	23:41	13.09.00	18° 58.9736' S	012° 14.9318' E

2.2 Plankton net tows

Stationnumber	Stationname	Time	Date	Latitude	Longitude
387	N0703	9:53	27.08.00	19° 10.0707' S	011° 40.0628' E
388	N0302	22:12	29.08.00	12° 57.7593' S	012° 40.4880' E
389	N0101	19:35	30.08.00	09° 00.5135' S	012° 55.7172' E
391	N0103	1:14	31.08.00	09° 00.0322' S	012° 34.7711' E
393	N0105	6:45	31.08.00	09° 00.0219' S	012° 05.0552' E
395	N0107	15:31	31.08.00	09° 00.0047' S	011° 00.1815' E
397	N0121	4:01	01.09.00	09° 00.0081' S	009° 30.2466' E
398	N0122	9:05	01.09.00	08° 59.9084' S	008° 45.0230' E
399	N0123	18:05	01.09.00	08° 59.9772' S	007° 59.9610' E
401	N0220	8:29	02.09.00	10° 59.9408' S	008° 00.0091' E
402	N0213	17:05	02.09.00	11° 59.9811' S	008° 00.0332' E

405	N0210	6:58	03.09.00	11° 23.9500' S	009° 49.5770' E
406	N0209	11:23	03.09.00	11° 12.0107' S	010° 24.7108' E
407	N0208	17:31	03.09.00	10° 59.9821' S	011° 00.2777' E
408	N0207	22:31	03.09.00	10° 59.9752' S	011° 45.3225' E
410	N0205	7:54	04.09.00	10° 59.7792' S	012° 44.6339' E
411	N0204	11:40	04.09.00	10° 59.9649' S	013° 10.0114' E
412	N0203	16:28	04.09.00	10° 59.8892' S	013° 24.9931' E
413	N0202	18:03	04.09.00	10° 59.7517' S	013° 34.9144' E
414	N0201	19:09	04.09.00	10° 59.8446' S	013° 41.8518' E
415	N0301	8:04	05.09.00	12° 59.6569' S	012° 49.9418' E
417	N0303	12:51	05.09.00	13° 00.0316' S	012° 34.7470' E
419	N0305	17:56	05.09.00	12° 59.9182' S	012° 00.0361' E
421	N0307	1:34	06.09.00	12° 59.9629' S	011° 00.1436' E
422	N0308	7:11	06.09.00	13° 13.7895' S	010° 20.1730' E
423	N0309	14:51	06.09.00	13° 27.0214' S	009° 40.0510' E
425	N0311	2:27	07.09.00	13° 59.9859' S	007° 59.9507' E
426	N0420	9:52	07.09.00	15° 00.0055' S	007° 59.9507' E
427	N0410	22:01	07.09.00	16° 00.0355' S	007° 59.9473' E
428	N0409	4:20	08.09.00	15° 45.9854' S	008° 50.1177' E
429	N0408	8:33	08.09.00	15° 33.0423' S	009° 25.0521' E
430	N0407	12:29	08.09.00	15° 22.0106' S	009° 55.6653' E
431	N0406	18:34	08.09.00	15° 11.9998' S	010° 24.2673' E
433	N0404	2:20	09.09.00	15° 00.0159' S	011° 24.9882' E
434	N0403	4:44	09.09.00	15° 00.0021' S	011° 40.1934' E
435	N0402	7:02	09.09.00	14° 59.8577' S	011° 54.6560' E
436	N0401	11:23	09.09.00	15° 00.0193' S	012° 05.3921' E
438	N0601	1:09	10.09.00	17° 00.0207' S	011° 35.3805' E
439	N0602	3:28	10.09.00	17° 00.0207' S	011° 20.4642' E
440	N0603	5:47	10.09.00	16° 59.9760' S	010° 59.7861' E
441	N0604	10:51	10.09.00	17° 07.8141' S	010° 35.2165' E

442	N0605	14:01	10.09.00	17° 16.0269' S	010° 12.8265' E
443	N0606	18:00	10.09.00	17° 26.9864' S	009° 40.4807' E
445	N0608	4:03	11.09.00	17° 50.0090' S	008° 39.6979' E
446	N0609	8:55	11.09.00	17° 59.9406' S	008° 00.1913' E
449	N0712	6:04	12.09.00	20° 18.7569' S	007° 59.9507' E
450	N0721	10:55	12.09.00	20° 06.7179' S	008° 37.8862' E
451	N0709	19:15	12.09.00	19° 53.9707' S	009° 14.9383' E
453	N0707	4:18	13.09.00	19° 34.9668' S	010° 19.5163' E
454	N0706	7:40	13.09.00	19° 26.9810' S	010° 44.7700' E
456	N0704	14:50	13.09.00	19° 15.9974' S	011° 20.3954' E
457	N0703	17:25	13.09.00	19° 09.9950' S	011° 40.2243' E
458	N0702	21:38	13.09.00	19° 04.2781' S	012° 00.0051' E
459	N0701	23:36	13.09.00	18° 58.9908' S	012° 14.9765' E

2.3 Multi net tows

STATNUMBER	Cast	Serie	DATE	TIME	STATNAME	Latitude	Longitude
389	0	0	30.08.00	07:44:39		12° 51.4786' S	12° 47.3841' E
390	1	0	30.08.00	22:11:43	N0102	10° 59.3524' S	12° 44.9880' E
390	1	1	30.08.00	22:11:45	N0102	10° 59.3490' S	12° 44.9880' E
390	1	2	30.08.00	23:42:10	N0102	10° 56.9907' S	12° 44.5480' E
395	2	0	31.08.00	16:40:08	N0107	10° 59.8853' S	11° 00.1574' E
395	2	1	31.08.00	16:40:14	N0107	10° 59.8853' S	11° 00.1540' E
395	2	2	31.08.00	17:54:32	N0107	10° 58.6340' S	10° 58.8442' E
398	3	0	01.09.00	10:29:22	N0122	10° 59.4349' S	8° 44.6036' E
398	3	1	01.09.00	10:29:24	N0122	10° 59.4349' S	8° 44.6036' E
398	3	2	01.09.00	13:33:00	N0122	10° 58.7405' S	8° 39.9145' E
401	4	0	02.09.00	09:52:00	N0220	12° 59.5607' S	8° 00.2429' E

401	4	1	02.09.00	09:52:03	N0220	12° 59.5573' S	8° 00.2429' E
401	4	2	02.09.00	10:50:11	N0220	12° 58.2234' S	8° 00.3014' E
406	5	0	03.09.00	12:21:22	N0209	12° 47.7624' S	10° 24.7039' E
406	5	1	03.09.00	12:21:25	N0209	12° 47.7624' S	10° 24.7039' E
406	5	2	03.09.00	13:44:39	N0209	12° 45.9369' S	10° 24.8999' E
411	6	0	04.09.00	12:40:18	N0204	12° 59.9904' S	13° 09.9976' E
411	6	1	04.09.00	12:40:18	N0204	12° 59.9904' S	13° 09.9976' E
411	6	2	04.09.00	13:51:39	N0204	12° 58.9075' S	13° 10.1489' E
416	7	0	05.09.00	10:27:17	N0302	14° 59.7759' S	12° 39.9414' E
416	7	1	05.09.00	10:27:17	N0302	14° 59.7759' S	12° 39.9414' E
416	7	2	05.09.00	11:45:55	N0302	14° 58.1326' S	12° 38.6798' E
422	8	0	06.09.00	09:59:28	N0308	14° 44.1582' S	10° 19.2345' E
422	8	1	06.09.00	09:59:32	N0308	14° 44.1547' S	10° 19.2345' E
422	8	2	06.09.00	10:28:48	N0308	14° 43.7285' S	10° 19.0798' E
426	9	0	07.09.00	10:51:57	N0420	16° 59.8844' S	8° 00.0366' E
426	9	1	07.09.00	10:51:59	N0420	16° 59.8810' S	8° 00.0366' E
426	9	2	07.09.00	14:34:19	N0420	16° 56.4364' S	8° 00.5454' E
430	10	0	08.09.00	13:27:43	N0407	16° 37.6560' S	9° 55.7650' E
430	10	1	08.09.00	13:27:43	N0407	16° 37.6560' S	9° 55.7650' E
430	10	2	08.09.00	15:25:32	N0407	16° 34.5723' S	9° 55.6928' E
435	11	0	09.09.00	08:14:08	N0402	15° 00.1217' S	11° 54.5666' E
435	11	1	09.09.00	08:14:44	N0402	15° 00.1251' S	11° 54.5804' E
435	11	2	09.09.00	09:54:52	N0402	15° 00.7267' S	11° 56.0964' E
440	12	0	10.09.00	06:46:31	N0603	18° 59.7455' S	10° 59.7449' E
440	12	1	10.09.00	06:46:32	N0603	18° 59.7421' S	10° 59.7449' E
440	12	2	10.09.00	08:24:00	N0603	18° 58.0026' S	10° 58.6173' E
443	13	0	10.09.00	18:59:50	N0606	18° 32.9792' S	9° 40.7317' E
443	13	1	10.09.00	18:59:57	N0606	18° 32.9758' S	9° 40.7317' E
443	13	2	10.09.00	20:33:53	N0606	18° 31.7038' S	9° 41.8558' E
446	14	0	11.09.00	09:57:39	N0609	19° 59.5437' S	8° 00.3254' E

446	14	1	11.09.00	09:58:20	N0609	19° 59.5299' S	8° 00.3357' E
446	14	2	11.09.00	12:00:10	N0609	19° 57.0307' S	8° 01.8140' E
450	15	0	12.09.00	11:53:56	N0721	21° 53.2409' S	8° 37.9791' E
450	15	1	12.09.00	11:53:58	N0721	21° 53.2409' S	8° 37.9825' E
450	15	2	12.09.00	14:28:26	N0721	21° 50.9307' S	8° 38.6975' E
454	16	0	13.09.00	08:38:15	N0706	20° 32.9056' S	10° 45.1894' E
454	16	1	13.09.00	08:38:22	N0706	20° 32.9022' S	10° 45.1929' E
454	16	2	13.09.00	10:20:34	N0706	20° 31.4996' S	10° 47.6509' E
457	17	0	13.09.00	17:54:26	N0703	20° 49.8537' S	11° 40.4615' E
457	17	1	13.09.00	17:54:31	N0703	20° 49.8537' S	11° 40.4650' E
457	17	2	13.09.00	19:30:51	N0703	20° 48.7192' S	11° 43.0502' E