

BCLME Project EV/Angola/03/01

***Compilation of Inventory and Acquisition of
Oceanographic Environmental Data in the Angolan Sector
of the Benguela Current Large Marine Ecosystem:
Phase 1 (Inventory)***

A project contracted to:

The Instituto de Investigação Marinha (IIM), Angola

By:

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On behalf of:

The Benguela Current Large Marine Ecosystem Programme (BCLME)

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Submitted by Principal Investigator:

Quilanda Fidel



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Project Title:

Compilation of Inventory and Acquisition of Oceanographic Environmental Data in the Angolan Sector of the Benguela Current Large Marine Ecosystem: Phase 1 (Inventory)

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Table of Contents

List of Tables.....	i
List of Figures.....	i
List of Acronyms.....	ii
List of Symbols.....	ii
Executive Summary.....	iii
1. Introduction	1
2. A comprehensive annotated inventory	1
2.1 Records from SADC / WDC	2
2.2 Records from IIM	3
2.3 Records from oil and mining companies	3
3. Assessment of the quality of the data sets	4
4. A “once-off” budget and timetable for the acquisition by SADC of the “additional” data sets	4
5. An annual budget and timetable for the medium/long term management of data and support by SADC	5
6. Summary and conclusions	6
7. Recommendations	7
8. Capacity Building	8
8.1 Training in the handling some <i>excel</i> and <i>word</i> tools	8
8.2 Converting files of the different formats into “.xls” format in <i>excel</i>	8
8.3 Preparing files with data in <i>excel</i> and <i>word</i>	8
8.4 Training to perform TS diagrams in <i>excel</i> and <i>Hydrolog</i> software	8
8.5 Tools from the Internet (search)	8
9. Acknowledgements	9
10. References	10

Appendix containing Figures and Tables
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List of Tables

Table 1	List of organizations/individuals visited
Table 1.1	Oceanographic/meteorological data (-holding institutions and individuals) inventory from coastal stations
Table 1.1a	Data collected by coastal climatological stations
Table 1.1b	Data collected by coastal meteorological stations
Table 1.1c	Data collected at coastal tidal gauges.
Table 2a	Inventory of national oceanographic / meteorological surveys off Angola
Table 2b	Inventory of foreign oceanographic measurements off Angola
Table 3	Parameter limits
Table 4	Acceptable values for various temperature parameters
Table 5a	Temperature ranges for the Atlantic Ocean as a function of depth
Table 5b	Salinity ranges for the Atlantic Ocean as a function of depth
Table 5c	Oxygen ranges for the Atlantic Ocean as a function of depth

List of Figures

Figure 1:	“EV ANGOLA/03/01” project data sheet form (1)
Figure 2:	“EV ANGOLA/03/01” project data sheet form (2)
Figure 3:	Geographic definition of data collection areas

List of Acronyms

ADCP	Acoustic Doppler Current Profiler
BCLME	Benguela Current Large Marine Ecosystem
CD	Compact Disk
CTD	Conductivity Temperature Depth probe
EEZ	Exclusive Economic Zone
IIM	Institute of Marine Research
IOC	Intergovernmental Oceanographic Commission
MBT	Mechanical Bathythermograph
MEBPA	Bio-oceanographic Fishery Studies of Angola
NODC	National Oceanographic Data Center
OSD	Oceanographic Station Data
RV	Research Vessel
SADCO	Southern African Data Centre for Oceanography
TS	Temperature Salinity
WDC	World Data Center
WMO	World Meteorological Organization
WOD01	World Ocean Data 2001
WODSelect	World Ocean Data online retrieval program
XBT	Expendable Bathythermograph

List of Symbols

E	=	longitude east
S	=	latitude south

Executive Summary

Oceanographic data collection in Angola dates back to the pre-independence times, when observational programs were run by the Portuguese Navy and government institutions (e.g. MEBPA, Lobito). During the cold war years, large quantities of oceanographic data were collected by foreign vessels. In addition, it is known that substantial oceanographic data sets have been collected by companies in the petroleum and mining industries. A major worldwide problem is that data collected during research and industry-based surveys are not always lodged in oceanographic data centres until many years later – often never – with the consequence that data is either lost or is not available for comparative purposes and for the establishment of baselines.

The main objective of this project was to locate and compile an inventory of all available historic oceanographic environmental data collected in the Angolan sector of the BCLME (*i.e.* within the general area of Angola's EEZ) prior to 2003. An exhaustive search has been undertaken for oceanographic data collected in the general area of Angola's EEZ. This search included the present data holdings of *inter alia* SADCO and the WDC. Unfortunately no information was made available by the companies involved in oil exploration.

From the organizations/institutions visited (Table 1) it has been noted that the following data exist in discrete, profile or time series format:

- Ocean temperature (collected via various means)
- Salinity
- Dissolved oxygen
- Currents
- Wind speed and direction (from oceanographic surveys and coastal stations)
- Nutrients
- Chlorophyll (shipboard collections)
- Waves
- Tidal data
- Plankton

As a consequence of the devastating war that Angola experienced for many decades, many archives containing the oceanographic and meteorological historical data have been destroyed / lost. Unfortunately these data will not be able to be rescued. This project is welcome in order to rescue the existing (or “surviving”) data mostly on paper sheet and not maintained in perfect conditions.

It is strongly recommended that the quality control of oceanographic and meteorological data be made a dedicated phase (*i.e.* a sub-project) because of its complexity and the exhaustive work involved.

1. Introduction

A major worldwide problem is that data collected during research and industry-based surveys are not always lodged in dedicated data centers until many years later – often never – with the consequence that data is either lost or is not available for comparative purposes and for the establishment of baselines. In the case of the BCLME it is known that the amount of data collected during the past two to three decades greatly exceeds that of the various data center holdings. This is particularly true in the ocean off Angola where a large quantity of potentially useful baseline data was collected during the cold war years by foreign vessels. In addition it is known that substantial oceanographic data sets have been collected operationally by companies involved in the petroleum and mining industries. As a first step (Phase 1) towards accessing this valuable baseline information, it is necessary to compile a proper inventory of what is available, where it is held, who owns it and what its quality is like, and then to devise an affordable plan to acquire it. Phase 2 will then be its acquisition.

The final date for delivery of this project did not coincide with the due date because of communication problems. Despite these, the EV/ANGOLA/03/01 report is delivered as expected.

2. A comprehensive annotated inventory of all oceanographic environmental data available for the Angola sector of the BCLME. The inventory indicates specifically which of the available data sets are additional to the existing data holdings of SADCO.

An exhaustive search has been undertaken for oceanographic data collected in the general area of Angola's EEZ. This search included the present data holdings of *inter alia* SADCO and the WDC. Unfortunately no information was made available by companies involved in oil exploration. To avoid loss of collected information from the organizations or individuals involved, appropriate data sheets were electronically created (**Figures 1 and 2**) and the information received was filled in and gathered in word or excel spreadsheets.

The organisations visited for this purpose of this project are listed in Table 1. The data (discrete / profiles / time series) existing at the organizations / institutions visited are listed in Tables 1.1, 1.1a, 1.1b ,1.1c , 2a and 2b and cover the following parameters:

- Ocean temperature (collected via various means)
- Salinity
- Dissolved oxygen
- Currents
- Wind speed and direction (in respect of oceanographic surveys and coastal stations)
- Nutrients
- Chlorophyll (shipboard collections)
- Waves
- Tides
- Plankton

The earlier collected data and data collected on the national cruises are all from discrete observations whereas most of the international data (except nutrient data) is from CTD profiles. The fixed station data (Lobito and Namibe) are time series.

2.1 Records from SADCO/WDC

The WODSelect (WOD01) retrieval system has been used for the area off Angola (5°-20°S, 0°-15°E). The following data inventory was found (Robert D. Gelfeld from NODC, pers. comm.):

9915 OSD stations

394 CTD stations

1523 XBT stations

5478 MBT stations

17310 TOTAL stations

Note: the data that SADCO has off the coast of Angola would be largely the same as on the WDC CD (Marten Grundlingh from SADCO, personal communication). This was confirmed after SADCO Namibian and Angolan Data held by SADCO and WOD2001 CD had been checked and explored by Quilanda Fidel and Pedro Tchivalanga, the project leader and one of the project members respectively.

2.2 Records from IIM

Angola's marine environmental database is divided into two components according to age: "Recent" data from the last two decades and "Historical" data from 1960-1975.

Data sets of both temperature and salinity from MEBPA were used in the seventies by researchers (e.g. Berrit and Dias, 1977) to study the oceanographic climate in central Angola (see Figure 3). The temperature and salinity observations were made by the MEBPA (now, IIM) as part of the Fisheries Oceanography program. Marine environmental and oceanographic data were collected periodically from selected hydrographic stations off Angola in the eighties and nineties, by various research vessels (Tables 2a, b).

Post-1985 hydrographic data are maintained within the NAN-SIS CTD management system at IIM (1985-1991: bottle samples; 1994-up to now: CTD measurements).

Angolan surveys: hydrographic data have been obtained along the coast of Angola since 1967 mainly by the Angolan research vessels RV *Goa* and RV *Sardinella* (Table 2a). Temperature and salinity were the parameters mostly observed and most of the data only exist on the original paper sheets. Occasionally foreign research vessels have collected CTD, ADCP and other data (see Table 2b).

Figure 3 shows the geographical areas that are reasonably well-covered and those that are lacking in data collection.

2.3 Records from oil and mining companies

It is known that companies in the oil exploration and exploitation industries have collected substantial oceanographic data sets. In Angola, mining industries do not exploit mineral resources at sea as mining industries do in Namibia and South Africa. Inshore and offshore oil platforms/moorings have been collecting oceanographic and meteorological data mainly since the eighties in northern Angola (5°-9°S) (Figure 3). Unfortunately the project team members did not succeed in gaining oceanographic/meteorological data from these companies.

3. A thorough assessment of the quality of the data sets which are additional to existing SADCO holdings

A fundamental requirement for programmes such as BCLME is to have easy and affordable access to high quality baseline oceanographic data. Oceanographic environmental data are traditionally lodged in dedicated data centers such as the international WDC, or in regional centers such as SADCO.

A shortcoming in the data collection method for this project is that the data quality is assessed and assigned by the project team in consultation with the data 'owners'. The assessment of quality is therefore largely subjective and results cannot easily be compared between organizations. As indicated under Recommendations, section 7 of this report, a follow-up sub-project phase needs to be implemented under which national (Table 2a) and international (Table 2b) ships data is subjected to criteria published in the December 2003 SADCO Newsletter -see Table 3 "Parameter limits" (Anonymous, 2003); Table 4 "Acceptable values for various temperature parameters" and Tables 5a, b and c for ranges of T, S and O acceptable for Atlantic Ocean samples as a function of depth (Boyer and Levitus, 1994).

4. A budget and timetable for the acquisition by SADCO of the "additional" data sets of suitable quality and utility (Once-off cost)

For this task it is suggested that the following steps are followed:

1. Bring together all available additional data sets to add to existing IIM data holdings:
 - Get data from the organizations
 - Put data in order
 - Digitize data

2. Quality control checks
 - Data sources
 - Instrumentation problems
 - Recording errors

Item	Rate	Time required	USD
Project leader	750x1/month	36-month	27000
Consultant	9000x1/month	2-month	18000
(6) Project team members	500x6/month	36-month	108000
Travel + DSA			100000
Hardware + Software			20000
Consumables			10000
Other costs			10000
TOTAL			293000

Note: Data to be delivered to SADCO after quality control checks have been undertaken.

5. An annual budget and timetable for the medium/long term management of data and support by SADCO to the BCLME (Annual costs)

The project team members should improve their knowledge by participating in training courses and workshops on data management. Routines for data acquisition from organizations and data maintenance should be set up.

Item	Rate	Time required	USD
Project leader	750x1/month	12-month	9000
Consultant	9000x1/month	01-month	9000
(6) Project' s team members	500x6/month	12-month	36000
Travel + DSA			100000
Hardware + Software			20000
Consumables			10000
Routine data acquisition			3000
Routine maintenance			3000
Other costs			6000
TOTAL			196000

6. Summary and conclusions

Implementation of this project provided an excellent opportunity to interact with various roleplayers in Angola. The benefit of co-operation and critical concerns in managing data plus the availability of historic oceanographic environmental data collected in Angolan waters was discussed. Issues discussed focused primarily on compilation of inventories and acquisition of Oceanographic Environmental Data and the benefits of the project to the country.

As a consequence of the devastating war that Angola experienced for many decades, many archives containing the oceanographic and meteorological historical data have been destroyed. Unfortunately it is impossible to rescue these data. This project is a welcome intervention to rescue the existing (or “surviving”) data. Most of it is in paper sheet format and is not maintained in perfect conditions.

The project team and IIM representative did not succeed in convincing oil company representatives in Luanda of the need for information required for this project. All attempts to contact targeted oil company staff unfortunately failed.

The inventory (Phase 1 - to identify and locate data and the related information such as surveys/cruises within the Angolan EEZ) has been completed. As a result of the complexity of the data quality control procedures, it is recommended that a sub-project is designed for this specific purpose.

It is important to point out that the lack of a reliable means of communication negatively affected our efficiency. Due to serious communication problems mainly in Namibe, and sometimes at the Benguela lab, the project members were reduced to personal cellphone use to communicate when there was no fax, email or landline available.

7. Recommendations

It is strongly recommended that the quality control of oceanographic and meteorological data is subjected to a dedicated phase (i.e. a sub-project) because of its complexity and the exhaustive work involved.

A major instrumentation problem in the historical oceanographic database occurs in the XBT probe type of data. Estimates of the depth of measurements are dependent on the drop rate formulation. The original manufacturer's drop rate for certain XBT probes was found to contain a systematic error (Hanawa and Yoritaka, 1987; Hallock and Teague, 1992; IOC, 1992a,b; Singer 1990)

Boyer and Levitus (1994) encountered two major problems in quality control procedures on constructing climatological atlases of objectively analyzed fields of oceanic data. The first was the paucity of data in many areas of the ocean. The second was the use of data that do not appear to be representative of the actual parameter fields in an area of the ocean. These data, which were termed "outliers", are non-representative for a variety of reasons that can be categorized in three major groups:

- 1) Problems with instrumentation
- 2) Recording errors
- 3) Sampled oceanographic features, such as eddies and fronts, which are non-representative for the analyzed time and space scales.

Factors such as large temperature inversions and gradients, density inversions and other factors may also adversely affect quality of data. The project members should be trained on quality control procedures and processing of historical physical, biological and chemical oceanographic and meteorological data. Also it is strongly recommended that they work closely with an expert on quality control and processing historical data.

In order to work within the established deadlines in the next phases of the project it is necessary that the project members have access to a reliable means of corresponding locally and internationally via email. Without that vital means of communication, difficulties will continue to be experienced in meeting deadlines and that will reflect badly on the appropriate execution of the established goals of the project.

8. Capacity Building

Senior project members trained colleagues in some useful data handling techniques during the course of this work. Data handling techniques included:

8.1 Training in the use of some *Excel* and *Word* tools:

Handling tools from the main toolbar such as “File”; “Edit”; “View”; “Insert”; “Format”; “Tools”; “Table” that helped to prepare data in a table form in *Excel* and *Word*

8.2 Converting files of the different formats into “.xls” format in *Excel*:

“.txt” and “.cnv” format files were converted into “.xls” *Excel* files to facilitate the task.

Steps:

- Go to *Excel* and activate the file (use the item “all files” instead of “files in Microsoft *Excel*”)
- For the “.cnv” file format: “Delimited” (next); “Space” (next); “Finish” (next). It is necessary to verify the number of each column belonging to the respective parameters. If necessary, eliminate all unnecessary information then save the new file in the *excel* format “.xls”
- For the “.txt” file format: “Delimited (next); “Finish”. It is necessary to verify the parameter of each column. If necessary, eliminate all unnecessary information then save the new file in the *Excel* format as an “.xls” file.

8.3 Preparing files with data in *excel* and *word*

After data has been converted or transformed into “.xls” format, the data are standardized in table form both in *Word* and *Excel*

8.4 Training to perform TS diagrams in *excel*

TS diagrams were used to plot temperature and salinity data for water samples, and hence to identify water masses (Brown *et al*, 1992) within Angola’s EEZ.

8.5 Tools from the Internet (search)

Exhaustive searches and contacts have been conducted through the Internet that partially facilitated the execution of this work. It was possible with the aid of the additional information obtained from the Internet to assess data and extract observed and tested parameters. This work was done for the data from SADCO / WDC.

9. Acknowledgements

The project team members would like to express our sincere appreciation to all interviewees who were willing and gracious to share their time with us so we could have the opportunity to learn about the targeted data and to be able to interact with them.

Special thanks to all project team members, Nkosi Luyeye, Lesley Staegemann, Maria de Lourdes Sardinha, Francisca Delgado, Victoria de Barros and other individuals who made it possible to get this important project funded, completed and written up appropriately.

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Sheet N° _____ / _____; / Date: _____ / _____ / _____; Person in charge (name and signature): _____ / _____ Project EV/ANGOLA/03/01: Compilation of Inventory and Acquisition of Oceanographic Environmental Data in the Angola Sector of the Benguela Current Large Marine Ecosystem: Phase 1 (Inventory) Inventory of all (available) historic oceanographic environmental data collected in Angola's EEZ (prior to 2003) Organization / Individual's name: _____ Parameters: Temperature; Salinity; Dissolved oxygen; Nutrients (silicate; phosphate; nitrate; nitrite, ammonium;...); Tides; Sea level; Chlorophyll; Phytoplankton; . Primary production; HAB; Zooplankton; Temperature via satellite; Waves; Optical measurements; Altimetry via satellite; Other data...;
BACKGROUND:
CURRENT SITUATION:
EXISTING DATA:
DIFFICULTIES:
PROPOSALS:
PERSPECTIVES:

Figure 1: EV/ANGOLA/03/01 project data sheet form 1

Sheet N° _____ / _____; / Data: _____ / _____ / _____; Person in charge (name and signature): _____ / _____

Project EV/ANGOLA/03/01: Compilation of Inventory and Acquisition of Oceanographic Environmental Data in the Angola Sector of the Benguela Current Large Marine Ecosystem: Phase 1 (Inventory)

Inventory of all (available) historic oceanographic environmental data collected in Angola's EEZ (prior to 2003)

Name of Organisation / Individual: _____

Parameters: Temperature; Salinity; Dissolved oxygen; Nutrients (silicate; phosphate; nitrate; nitrite, ammonium); Tides; Sea level; Chlorophyll; Phytoplankton; .
Primary production; HAB; Zooplankton; Temperature via satellite; Waves; Optical measurements; Altimetry via satellite; Other data...;

Parameter: _____	Area / Coordinates	Period/measurement frequency/ Depth (m)	Quality (very good:1; good:2; normal:3; bad:4)	Remarks/Comments
Parameter: _____				
Parameter: _____				

Figure 2: EV/ANGOLA/03/01 project data sheet form 2

Geographical Division of Shelf Areas off Angola in Which Oceanographic Data Have Been Collected

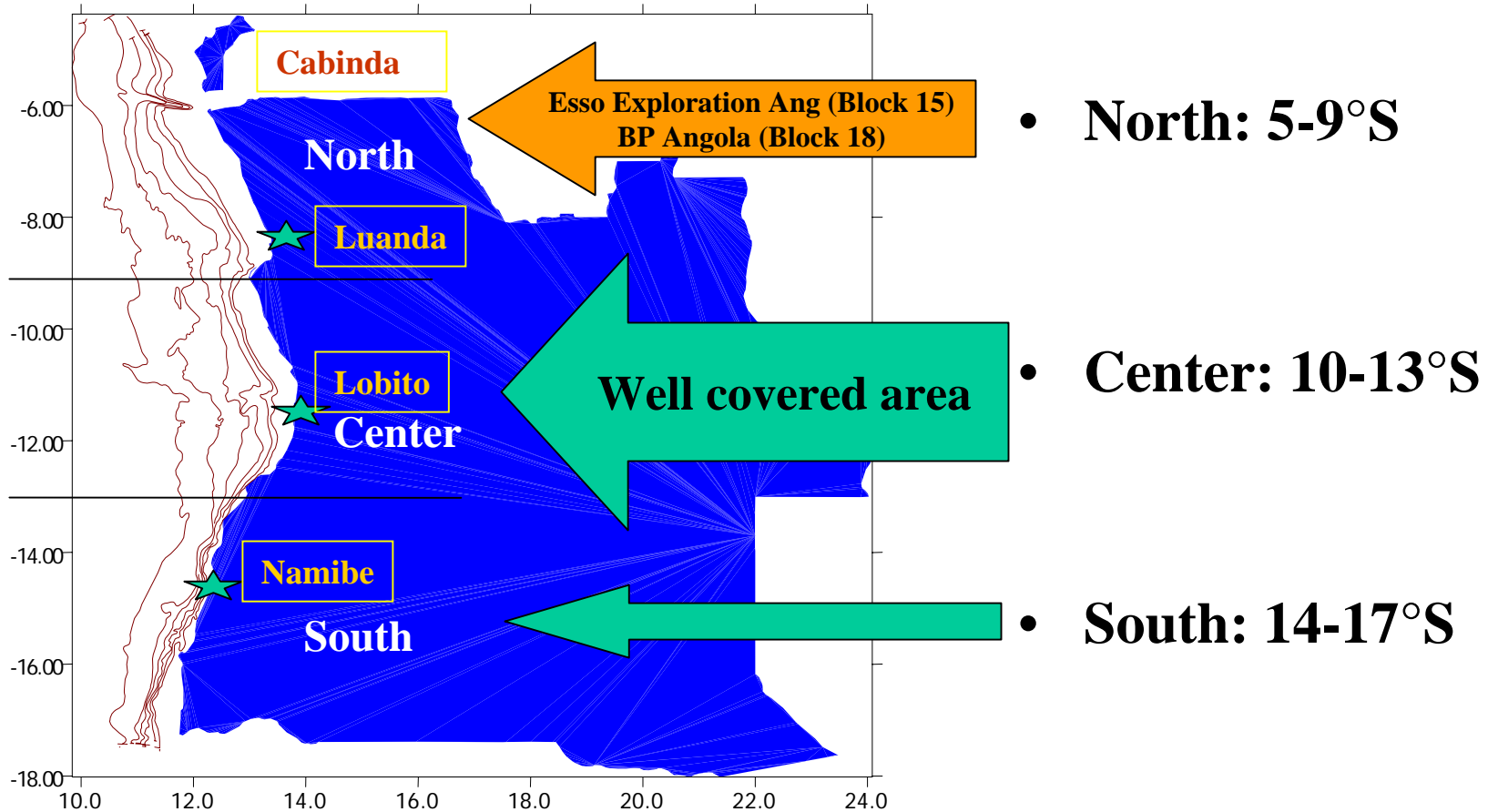


Figure 3: Geographic definition of data collection areas

Table 1: List of organizations/individuals visited

ORGANIZATIONS	INDIVIDUALS
Airport of Benguela	Employees in the technical area
Airport of Lobito	Employees in the technical area
Airport of Namibe "Yuri Gagarine"	Mr. Terça Jesus F. Adriano, Director of the meteorological services of Namibe
Angolan national library	Employee linked to the services of the library
Baia-Farta local fishery board	Employee linked to the services of the fishery section
Benguela municipality administration	Employees
Benguela provincial environmental board	Mr. J dos Santos, Head of provincial department
Benguela provincial fishery board	Eng. J Silva, Head of production department
Port Captain of Lobito	Mr. Henriques Pedro, Captain of the Lobito port
Port Captain of Namibe	Mr. Germano, Captain of the Namibe port
CRIM Lobito (Benguela lab, IIM)	Mr. Enoque Cangajo, Responsible of the oceanography sector
CRIM Namibe (Namibe lab, IIM)	Mr. Q Fidel, Director of lab; P Tchupalanga, Head of the technical sector
Fishery factory Praia Amelia	Mr. Manuel Francisco, Head of production
IIM-Luanda	Mr. F de Almeida, Oceanographer; Mr. D Azevedo, database manager
INAMET Benguela (Weather Bureau)	Employee linked to the services of the weather bureau
INAMET Luanda (Weather Bureau)	Eng. Manga Waku
Institut of agronomy research of Angola	Eng. C Nequetela, Head of technical area
Laboratory of technology and fish processing, Benguela	Head of the lab
Laboratory of technology and fish processing, Tombwa, IIM	Ms. E Mangureira, Head of lab; Mr. F Junior, Head of inspection sector
Lobito municipality administration	Employees
Luanda international airport "4 de Fevereiro"	Eng. Osvaldo, Chief of the meteo division of the airport
Luanda provincial fishery board	Employee of the fishery section
Namibe library	Employees
Namibe provincial fishery board	Employee of the fishery section
Port of Luanda	Mr. Mariano Neto / Area of safety and environment of the port
Port of Namibe	Employee linked to the services of the port
Salt company "sal do sol"	Mr. Chitomba, Head of production
Salt company of Cacucaco	Dombaxi Tana, Director
Tombwa shipyard of naval repairing	Employees in the technical area

Table 1.1: Oceanographic/meteorological data (-holding institutions and individuals) inventory from coastal stations

Organization: Ministry of Fisheries

Nomination	Parameters	Remarks/ Comments
1- Lobito Fixed station		
Location: 12°18'36" S;13°34'38 E Depth (m): 0 - 35 Period: 1968 - 1995 Quality of data: 1 Sampling Period: Daily (except weekends/holidays) Holding: CRIM - Lobito Contact: K. Kilongo/E.Canganjo	Sea water temperature Salinity oxygen nutrients currents Sigma t pH State of the sea State of the sky Air temperature wind (speed, direction) relative humidity	Gaps: 1975 - 1976 Data with some gaps: 1977 - 1995 nutrients: nitrate, nitrite, silicate, phosphate
2- Mocamedes Fixed station (Namibe)		
Location: 15°12'48" S;12°06'40 E Depth (m): 0 - 30 Period: 1972 - 1975 Quality of data: 2 Sampling Period: Daily (except weekends/holidays) Holding: CRIM - Lobito Contact: K. Kilongo/E.Canganjo	Sea water temperature Transparency Salinity currents Sigma t Air temperature wind (speed, direction) State of the sea State of the sky	
3- Ponta da Noronha Fixed station (Namibe)		
Location: 15°12'12" S;12°08'12 E Depth (m): 0 - 30 Period: 1972 - 1975 Quality of data: 2 Sampling Period: Daily (except weekends/holidays) Holding: CRIM - Lobito Contact: K. Kilongo/E.Canganjo	Sea water temperature Transparency Salinity currents Sigma t Air temperature wind (speed, direction) State of the sea State of the sky	

Table 1.1a: Oceanographic / meteorological data (-holding institutions and individuals) inventory from climatological stations
 Organization: Ministry of Transport and Communication

Parameters	Nomination		
	1- Mouth of Cunene River (Namibe)	2- Viana climatological station (Luanda)	3- Palmerinhas climatological station (Luanda)
Wind (sp,dir)	Location: 17°16' S;11°48' E	Location: 08°57' S;13°20' E	Location: 09°04' S;12°58' E
Air Temperature	Altitude (m): 5 m	Altitude (m): 130 m	Altitude (m): 5 m
Precipitation	Period: 1940 - 1985	Period: 1957 - 1985	Period: 1957 - 1985
Cloud	Data quality: 1	Data quality: 1	Data quality: 1
Humidity	Sample Period: daily average	Sample Period: daily average	Sample Period: daily average
Pressure	Holding: INAMET - Benguela	Holding: INAMET - Benguela	Holding: INAMET - Benguela
Evaporation	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo
	4- Quinzau (Zaire)	5- Mussera (Zaire)	6- Cassequel (Benguela)
Wind (sp,dir)	Location: 06°53' S;12°45' E	Location: 07°40' S;13°14' E	Location: 12°40' S;13°32' E
Air Temperature	Altitude (m): 30 m	Altitude (m): 160 m	Altitude (m): 5 m
Precipitation	Period: 1957 - 1985	Period: 1957 - 1985	Period: 1957 - 1985
Cloud	Data quality:	Data quality: 1	Data quality:
Humidity	Sample Period: daily average	Sample Period: daily average	Sample Period: daily average
Pressure	Holding: INAMET - Benguela	Holding: INAMET - Benguela	Holding: INAMET - Benguela
Evaporation	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo
	7- Benguela	8- Baia Farta (Benguela)	8- Lucira (Namibe)
Wind (sp,dir)	Location: 12°35' S;13°23' E	Location: 12°37' S;13°13' E	Location: 13°52' S;12°32' E
Air Temperature	Altitude (m): 5 m	Altitude (m): 5 m	Altitude (m): 5 m
Precipitation	Period: 1957 - 1985	Period: 1957 - 1985	Period: 1957 - 1985
Cloud	Data quality:	Data quality: 1	Data quality: 1
Humidity	Sample Period: daily average	Sample Period: daily average	Sample Period: daily average
Pressure	Holding: INAMET - Benguela	Holding: INAMET - Benguela	Holding: INAMET - Benguela
Evaporation	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo
	9- Santa Marta (Namibe)	10- Tombwa (Namibe)	11- Baia dos Tigres (Namibe)
Wind (sp,dir)	Location: 13°53' S;12°25' E	Location: 15°53' S;12°25' E	Location: 16°36' S;11°43' E
Air Temperature	Altitude (m): 50 m	Altitude (m): 10 m	Altitude (m): 4 m
Precipitation	Period: 1957 - 1985	Period: 1940 - 1985	Period: 1957 - 1985
Cloud	Data quality: 1	Data quality: 1	Data quality: 1
Humidity	Sample Period: daily average	Sample Period: daily average	Sample Period: daily average
Pressure	Holding: INAMET - Benguela	Holding: INAMET - Benguela	Holding: INAMET - Benguela
Evaporation	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo

Table 1.1b: Oceanographic / meteorological data (-holding institutions and individuals) inventory from Meteorological coastal stations
 Organization: Ministry of Transport and Communication

Parameters	Nomination		
	1- Luanda Airport	2- Cabinda's aerodrome (Cabinda)	3- Cabinda's aerodrome (Cabinda)
Wind (sp,dir)	Location: 08°51' S;13°14' E	Location: 05°33' S;12°11' E	Location: 05°33' S;12°08' E
Air Temp	Altitude (m): 74 m	Altitude (m): 20 m	Altitude (m): 10 m
Precipitation	Period: 1940 - 1985	Period: 1940 -1960	Period: 1957 - 1985
Cloud	Data quality: 1	Data quality: 1	Data quality: 1
Humidity	Sample period: daily average	Sample period: daily average	Sample period: daily average
Pressure	Holding: INAMET - Benguela	Holding: INAMET - Benguela	Holding: INAMET - Benguela
Evaporation	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo
	4- Lobito aerodrome (Benguela)	5- Benguela aerodrome (Benguela)	6- Porto Amboim (Kwanza Sul)
Wind (sp,dir)	Location: 12°22' S;13°32' E	Location: 12°35' S;13°25' E	Location: 10°42' S;13°45' E
Air Temp	Altitude (m): 10 m	Altitude (m): 5 m	Altitude (m): 5 m
Precipitation	Period: 1940 - 1960	Period: 1940 - 1960	Period: 1940 - 1960
Cloud	Data quality: 1	Data quality: 1	Data quality: 1
Humidity	Sample period: daily average	Sample period: daily average	Sample period: daily average
Pressure	Holding: INAMET - Benguela	Holding: INAMET - Benguela	Holding: INAMET - Benguela
Evaporation	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo
	7- Namibe's airport (Namibe)	8- Institute of Agronomy Research, Cavaco (Benguela)	
Wind (sp,dir)	Location: 15°12' S;12°09' E	Location: 12°35' 5"S;13°28' E	
Air Temp	Altitude (m): 44 m	Altitude (m): 30 m	
Precipitation	Period: 1940 - 1960	Period: Mar-68	
Cloud	Data quality: 1	Data quality: 1	
Humidity	Sample period: daily average	Sample period: daily average	
Pressure	Holding: INAMET - Benguela	Holding: INAMET - Benguela	
Evaporation	Contact: K. Kilongo/E.Canganjo	Contact: K. Kilongo/E.Canganjo	
	Cabinda	Altitude (m):	sea surface
	Ambrizete	Period:	1957- 1973
Atmospheric Pressure	Luanda	Data quality:	1
	Porto Amboim	Sample period:	Daily
	Lobito	Holding:	INAMET - Benguela
	Namibe	Contact:	K. Kilongo/E.Canganjo
Air Temperature	IIM's Jetty	Period: 1957- 1973	Sample period: Daily
Pressure	(Lobito)	Data quality: 1	Holding and contact: K. Kilongo/E.Canganjo
Solar Radiation	Namibe airport	Period: 1973- 1975	Sample period: Daily average
	Lobito airport	Data quality: 1	Holding and contact: K. Kilongo/E.Canganjo

Table 1.1c: Oceanographic tide gauge data (-holding institutions and individuals) inventory from coastal stations
 Organization: Ministry of Transport and Communication

Parameters	Nomination		
	1- Mouth of Congo River (Zaire)	2- Luanda harbour-jetty (Luanda)	3- Lobito harbour-jetty (Benguela)
Tides	Location: 06°04'9" S;13°32'8" E Range (m): 1. - 10 Period: 1940 - 1960 Data quality 1 Sample period: hourly Holding: INAHMET - Namibe Contact: Tercas de Jesus	Location: 06°04'9" S;13°32'8" E Range (m): 1. - 10 Period: 1940 - 1960 Data quality 1 Sample period: hourly Holding: INAHMET - Namibe Contact: Tercas de Jesus	Location: 06°04'9" S;13°32'8" E Range (m): 1. - 10 Period: 1940 - 1960 Data quality 1 Sample period: hourly Holding: INAHMET - Namibe Contact: Tercas de Jesus
	4- Namibe harbour-jetty (Namibe)		
Tides	Location: 06°04'9" S;13°32'8" E Range (m): 1. - 10 Period: 1940 - 1960 Data quality Sample period: hourly Holding: INAHMET - Namibe Contact: Tercas de Jesus		

Table 2a: Inventory of National oceanographic cruises in the EEZ of Angola

Cruise	Vessel	Description	Dates/Period	Org	Data	Holder	Contact
G670401	GOA	Experiment with the vessel	1 st week of April 1967	ex-MEBPA	T, S	CRIM-Lobito	K.K; E.C
G670801	GOA	Establish oceanographic transect	1 st week August 1967	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G670802	GOA	Monitoring of oceanography	2 nd week August 1967	ex-MEBPA		CRIM-Lobito	K.K; E.C
G670803	GOA	Echo-sounding on continental shelf	3 rd week August 1967	ex-MEBPA	T, S	CRIM-Lobito	K.K; E.C
G680101	GOA	Echo-sounding on continental shelf	1 st week January 1968	ex-MEBPA		CRIM-Lobito	K.K; E.C
G680102	GOA	Establish standard T,S profiles	2 nd week January 1968	ex-MEBPA	T, S	CRIM-Lobito	K.K; E.C
G680201	GOA	Establish standard T, S profiles	1 st week February 1968	ex-MEBPA	T, S	CRIM-Lobito	K.K; E.C
G680402	GOA	Baía-Farta & Luanda transects	2 nd week April 1968	ex-MEBPA	T, S	CRIM-Lobito	K.K; E.C
G680501	GOA	Baía-Farta & Luanda transects	1 st week May 1968	ex-MEBPA	T, S	CRIM-Lobito	K.K; E.C
G680502	GOA	Oceanographic transect off Luanda	2 nd week May 1968	ex-MEBPA	T, S	CRIM-Lobito	K.K; E.C
G680901	GOA	Monitoring surface conditions	1 st week Sep. 1968	ex-MEBPA	T, S	CRIM-Lobito	K.K; E.C
G681001	GOA	Env. & ecological parameters	1 st week October 1968	ex-MEBPA	T, S	CRIM-Lobito	K.K; E.C
G681101	GOA	Bio-oceanographic conditions part I	1 st week Nov. 1968	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G690301	GOA	Bio-oceanographic conditions part II	1 st week March 1969	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G690502	GOA	Oceanographic transect Baia Farta	2 nd week of May 1969	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G690602	GOA	Bio-oceanography up to 60 nm	2 nd week of June 1969	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G690701	GOA	Surveying demersal population	1 st week of July 1969	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G690702	GOA	Monitoring of oceanography	2 nd week of July 1969	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G691101	GOA	Demersal population survey	1 st week Nov. 1969	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G691202	GOA	Env. , fish egg and larvae survey	2 nd week Dec. 1969	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G700101	GOA	Surveying demersal population	1 st week January 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G700501	GOA	Pelagic research cruise	1 st week of May 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G700901	GOA	Oceanographic transect at 12S	1 st week Sep. 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G701002	GOA	Oceanographic transect Baia Farta	2 nd week October 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G701101	GOA	Oceanographic transect at 12S	1 st week Nov. 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G701201	GOA	Oceanographic transect Baia Farta	1 st week Dec. 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G710201	GOA	Oceanographic transect Baia Farta	1 st week February 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G710301	GOA	Oceanographic transect at 12S	1 st week of March 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G710601	GOA	Oceanographic transect Baia Farta	1 st week of June 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G710701	GOA	Oceanographic transect Baia Farta	1 st week of July 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G710703	GOA	Oceanographic transect Baia Farta	3 rd week of July 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G710801	GOA	Oceanographic transect Baia Farta	1 st week August 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G711101	GOA	Oceanographic transect Baia Farta	1 st week Nov. 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G711201	GOA	Oceanographic transect Baia Farta	1 st week Dec. 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G720101	GOA	Oceanographic transect Baia Farta	1 st week January 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G720102	GOA	Experimental traps (crustaceans)	2 nd week January 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C

Table 2a (cont.): Inventory of National oceanographic cruises in the EEZ of Angola

Cruise	Vessel	Description	Dates/Period	Org	Data	Holders	Contact
G720303	GOA	Oceanographic transect off Baia Farta	3 rd week March 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G720401	GOA	Oceanographic transect off Baia Farta	1 st week April 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G720701	GOA	Oceanographic transect off Baia Farta	1 st week July 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G720801	GOA	Study of oceanographic conditions	1 st week August 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G720901	GOA	Oceanographic transect off Baia Farta	1 st week Sep. 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G721001	GOA	Oceanographic transect off Baia Farta	1 st week Oct. 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G721101	GOA	Oceanographic transect off Baia Farta	1 st week Nov. 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G721201	GOA	Oceanographic transect off Baia Farta	1 st week Dec. 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730101	GOA	Oceanographic transect off Baia Farta	1 st week Jan. 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730201	GOA	Oceanographic transect off Baia Farta	1 st week Feb. 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730303	GOA	Study of oceanographic conditions	3 rd week March 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730304	GOA	Study of oceanographic conditions	4 th week March 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730502	GOA	Oceanographic transect off Baia Farta	2 nd week May 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730503	GOA	Fixed station: internal wave t/ series	3 rd week May 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730504	GOA	Study of oceanographic conditions	4 th week May 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730601	GOA	Oceanographic transect off Baia Farta	1 st week June 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730701	GOA	Oceanographic transect off Baia Farta	1 st week of July 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730801	GOA	Oceanographic transect off Baia Farta	1 st week August 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G730802	GOA	Study of oceanographic conditions	2 nd week Aug. 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G731201	GOA	Oceanographic transect off Baia Farta	1 st week Dec. 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G731202	GOA	Oceanographic transect off Baia Farta	2 nd week Dec. 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G740102	GOA	Oceanographic transect off Baia Farta	2 nd week Jan. 1974	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G740502	GOA	Oceanographic transect off Baia Farta	2 nd week May 1974	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G740503	GOA	Oceanographic transect off Baia Farta	3 rd week May 1974	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G740702	GOA	Oceanographic transect off Baia Farta	2 nd week July 1974	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G740801	GOA	Oceanographic transect off Baia Farta	1 st week August 1974	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G741102	GOA	Oceanographic transect off Baia Farta	2 nd week Nov. 1974	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G750101	GOA	Oceanographic transect off Baia Farta	1 st week Jan. 1975	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G750201	GOA	Oceanographic transect off Baia Farta	1 st week Feb. 1975	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G750301	GOA	Oceanographic transect off Baia Farta	1 st week March 1975	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G750401	GOA	Oceanographic transect off Baia Farta	1 st week April 1975	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
G840501	GOA	Oceanographic transect off Baia Farta	1 st week May 1984	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G840902	GOA	Baia Farta and Luanda transects	2 nd week Sep. 1984	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G850201	GOA	Baia Farta and Luanda transects	1 st week Feb. 1985	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G850301	GOA	Hydrographic survey	1 st week March 1985	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G854227	GOA	Acoustic survey Lobito-Luanda	4 th week March 1985	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C

Table 2a (cont.): Inventory of National oceanographic cruises in the EEZ of Angola							
Cruise	Vessel	Description	Dates/Period	Org	Data	 HOLDERS	Contact
G850527	GOA	Acoustic survey Lobito-Luanda	4 th week May 1985	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G850619	GOA	Oceanographic transect Baia Farta	3 rd week June 1985	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G851008	GOA	Hydrographic survey	2 nd week Oct 1985	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G860211	GOA	Hydrographic survey	2 nd week Feb 1986	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G860511	GOA	Hydrographic survey	2 nd week May 1986	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G860626	GOA	Hydro-acoustic	4 th week June 1986	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G860201	GOA	Oceanographic transect Baia Farta	1 st week Feb. 1985	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G860501	GOA	Oceanographic transect Baia Farta	1 st week May 1985	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G860701	GOA	Oceanographic transect Baia Farta	1 st week July 1985	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G860728	GOA	Oceanographic transect Baia Farta	4 th week July 1986	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G861201	GOA	Oceanographic transect Baia Farta	1 st week Dec. 1986	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G870201	GOA	Oceanographic transect Baia Farta	1 st week Feb. 1987	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G870601	GOA	Oceanographic transect Baia Farta	1 st week June 1987	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G880801	GOA	Oceanographic transect Baia Farta	1 st week August 1988	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G881001	GOA	Oceanographic transect Baia Farta	1 st week Oct. 1988	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G8510	GOA	Resources & Environment survey	October 1985	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G8606	GOA	Resources & Environment survey	June 1986	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G8810	GOA	Resources & Environment survey	1-3 rd week Oct. 1988	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
G9110	GOA	Resources & Environment survey	3-4 th week Oct. 1991	IIM	T, S, O ₂	CRIM-Lobito	K.K; E.C
S670901	SARDINELLA	Bio-oceanographic conditions	1 st week Sep. 1967	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S670904	SARDINELLA	Nocturnal plankton, eggs & larvae	4 th week Sep. 1967	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S680201	SARDINELLA	Plankton, eggs and larval collection	1 st week Feb.1968	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S680202	SARDINELLA	Plankton, eggs and larval collection	2 nd week Feb. 1968	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S680203	SARDINELLA	Plankton, eggs and larval collection	3 rd week Feb. 1968	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S680404	SARDINELLA	Plankton, eggs and larval collection	4 th week Feb. 1968	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S680601	SARDINELLA	School capture by means of gill net	1 st week June 1968	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S681101	SARDINELLA	Exploratory fishery for crustaceans	1 st week Nov. 1968	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S690902	SARDINELLA	Oceanographic transect Baia Farta	2 nd week Sep. 1969	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S691001	SARDINELLA	Bio-oceanographic conditions	1 st week Nov. 1969	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S691201	SARDINELLA	Bio-oceanographic conditions	1 st week Dec. 1969	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S700102	SARDINELLA	Bio-oceanographic conditions	2 nd week Jan. 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S700201	SARDINELLA	Oceanographic transect Baia Farta	1 st week Feb. 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S700301	SARDINELLA	Oceanographic transect Baia Farta	1 st week March 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S700401	SARDINELLA	Oceanographic transect Baia Farta	1 st week April 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S700501	SARDINELLA	Oceanographic transect Baia Farta	1 st week May 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S700601	SARDINELLA	Resources & Env. off Baia Farta	1 st week June 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S700701	SARDINELLA	Oceanographic transect Baia Farta	1 st week July 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C

Table 2a (cont.): Inventory of National oceanographic cruises in the EEZ of Angola							
Cruise	Vessel	Description	Dates/Period	Org	Data	Holder	Contact
S700801	SARDINELLA	Oceanographic transect Baia Farta	1 st week August 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S700901	SARDINELLA	Oceanographic transect Baia Farta	1 st week Sep. 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S701001	SARDINELLA	Oceanographic transect Baia Farta	1 st week Oct. 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S701002	SARDINELLA	Oceanographic transect Baia Farta	2 nd week Oct. 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S701201	SARDINELLA	Oceanographic transect Baia Farta	1 st week Dec. 1970	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S710101	SARDINELLA	Oceanographic transect Baia Farta	1 st week Jan. 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S710204	SARDINELLA	Oceanographic transect Baia Farta	4 th week Feb. 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S710901	SARDINELLA	Oceanographic transect Baia Farta	1 st week Sep. 1971	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S720402	SARDINELLA	Oceanographic transect Baia Farta	2 nd week April 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S720501	SARDINELLA	Oceanographic transect Baia Farta	1 st week May 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S720801	SARDINELLA	Oceanographic transect Baia Farta	1 st week August 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S720902	SARDINELLA	Oceanographic transect Baia Farta	2 nd week Aug. 1972	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S730902	SARDINELLA	Oceanographic transect Baia Farta	2 nd week Sep. 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S731001	SARDINELLA	Oceanographic transect Baia Farta	1 st week Oct. 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S731101	SARDINELLA	Oceanographic transect Baia Farta	1 st week Nov. 1973	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S740301	SARDINELLA	Oceanographic transect Baia Farta	1 st week March 1974	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S740901	SARDINELLA	Oceanographic transect Baia Farta	1 st week Sep. 1974	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
S741001	SARDINELLA	Oceanographic transect Baia Farta	1 st week Oct. 1974	ex-MEBPA	T, S, O ₂	CRIM-Lobito	K.K; E.C
NML1200	TICO TICO	Oceanographic transect Namibe	December 4th 2000	BENEFIT	CTD ++	CRIM-Namibe	Q.F; P.T
NML0101	TICO TICO	Oceanographic transect off Namibe	January 24th 2001	BENEFIT	CTD ++	CRIM-Namibe	Q.F; P.T
NML0501	TICO TICO	Oceanographic transect off Namibe	May 31st 2001	BENEFIT	CTD ++	CRIM-Namibe	Q.F; P.T
NML1102	CALAFATE	Oceanographic transect off Namibe	November 7th 2002	BENEFIT	CTD ++	CRIM-Namibe	Q.F; P.T
	P. SERGIO	Oceanographic transect off Namibe	January 23rd 2003	BENEFIT	CTD ++	CRIM-Namibe	Q.F; P.T

Key to contact persons:

K.K – Kumbi Kilongo
E.C - Enoque Canganjo
D.A - Domingos Azevedo
A.F - Alberto Filomena
Q.F – Quilanda Fidel
P.T - Pedro Tchicalanga

Key to samples taken for analysis ashore:

CTD ++ = CTD profile of T, S, O and chl *a*
Discrete bottle samples for O, nutrients, chl *a*
Plankton samples

Table 2b: Inventory of foreign oceanographic surveys/cruises off Angola							
Region of the coast: Angola EEZ zone							
Depth (m): 0 - 1500							
Cruise	Vessel	Description	Dates/Period	Org	Data	Holders	Contact
ANG8505	<i>F. NANSEN</i>	Resources & environment	January 1985-June 1986	Nansen programme	CTD	IIM- Luanda	D.A;/A.F
ANG8504	<i>F. NANSEN</i>	Resources & environment	April 23rd-30th 1989	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG8904	<i>F. NANSEN</i>	Resources & environment	April 30th-29th 1989	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG8902	<i>F. NANSEN</i>	Resources & environment	February 13th-19th 1989	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG8903	<i>F. NANSEN</i>	Resources & environment	March 19th-March 1989	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG8911	<i>F. NANSEN</i>	Resources & environment	November 17th-13th 1989	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG9105	<i>F. NANSEN</i>	Resources & environment	May 04th-June 19th 1991	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG9108	<i>F. NANSEN</i>	Resources & environment	August 06th-Sept 18th 1991	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG9208	<i>F. NANSEN</i>	Resources & environment	August 05th-Sept 22nd 1992	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG9408	<i>F. NANSEN</i>	Resources & environment	August 02nd-17th 1994	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG9409	<i>F. NANSEN</i>	Resources & environment	September 01st-19th 1994	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG9502	<i>F. NANSEN</i>	Resources & environment	Feb 27th-April 02nd 1995	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG9602	<i>F. NANSEN</i>	Resources & environment	Feb 02nd-April 01st 1996	Nansen programme	CTD, ADCP	IIM-Luanda	D.A;/A.F
ANG9608	<i>F. NANSEN</i>	Resources & environment	Aug 19th-Sept 19th 1996	Nansen programme	CTD	IIM-Luanda	D.A;/A.F
ANG9708	<i>F. NANSEN</i>	Resources & environment	August 06th-Sept 03rd 1997	Nansen programme	CTD, ADCP	IIM-Luanda	D.A;/A.F
ANG9704	<i>F. NANSEN</i>	Resources & environment	April 04th-23rd 1997	Nansen programme	CTD, ADCP	IIM-Luanda	D.A;/A.F
ANG9806	<i>F. NANSEN</i>	Resources & environment	July 27th-August 23rd 1998	Nansen programme	CTD, ADCP	IIM-Luanda	D.A;/A.F
ANG1999	<i>F. NANSEN</i>	Resources & environment	1999	Nansen programme	CTD, ADCP	IIM-Luanda	D.A;/A.F
ANG2000	<i>F. NANSEN</i>	Resources & environment	2000	Nansen programme	CTD, ADCP	IIM-Luanda	D.A;/A.F
ANG2001	<i>F. NANSEN</i>	Resources & environment	2001	Nansen programme	CTD, ADCP	IIM-Luanda	D.A;/A.F
ANG2002	<i>F. NANSEN</i>	Resources & environment	2002	Nansen programme	CTD, ADCP	IIM-Luanda	D.A;/A.F
	<i>F. NANSEN</i>	Resources & environment	2003	Nansen programme	CTD, ADCP	IIM-Luanda	D.A;/A.F
	<i>F. NANSEN</i>	Resources & environment	2004	Nansen programme	CTD, ADCP	IIM-Luanda	D.A;/A.F
	"CUBAN"	Resources & environment	October 07th-Nov 07th 1976	Ang-Cuba Cooperatn.	T, S, O ₂	CRIM-Lobito	K.K;/E.K
	"CUBAN"	Resources & environment	Nov 16th-December 10th 1976	Ang-Cuba Cooperatn.	T, S, O ₂	CRIM-Lobito	K.K;/E.K

Table 2b (cont.): Inventory of foreign oceanographic surveys/cruises off Angola

	"CUBAN"	Resources & environment	January 08 th -19th 1977	Ang-Cuba Cooperatn.	T, S, O ₂	CRIM-Lobito	K.K;E.K
	"RUSSIAN"	Resources & environment	May 31st-26th 1974	Ang-Russia Coop.	T, transparency	CRIM-Lobito	K.K;E.K
	"RUSSIAN"	Resources & environment	Nov 08th-December 03rd 1976	Ang-Russia Coop.	T, S, O ₂	CRIM-Lobito	K.K;E.K
	"RUSSIAN"	Resources & environment	May 31st-Sept 10th 1978	Ang-Russia Coop.	T, S, O ₂	CRIM-Lobito	K.K;E.K
	"RUSSIAN"	Resources & environment	October 23rd-Dec 10th 1978	Ang-Russia Coop.	T, S, O ₂	CRIM-Lobito	K.K;E.K
	"RUSSIAN"	Resources & environment	Nov-December 1982	Ang-Russia Coop.	T, S, O ₂	CRIM-Lobito	K.K;E.K
	<i>P KOTZOV</i>	Oceanographic survey off Angola	April 20th-May 13th 1997	BENEFIT	CTD, Nutrients, ADCP,	IIM-Luanda	D.A;A.F
	<i>WELWITCHIA</i>	Oceanographic transect off Namibe	26 Jul 1999	BENEFIT	CTD	CRIM Namibe	Q.F; P.T
	<i>WELWITCHIA</i>	Oceanographic transects off Angola (9-16S)	25 Jul - 3 Aug 1999	BENEFIT	T,S,O ₂ , Nutrients, Plankton,Drifters	CRIM Namibe	Q.F; P.T
	<i>METEOR</i>	Oceanographic transect off Namibe	Aug 26th-September 16th 2000	BENEFIT	CTD, Nutrients, ADCP,	IIM-Luanda	D.A;A.F
	<i>WELWITCHIA</i>	Oceanographic transect off Namibe	March 21st 2001	BENEFIT	CTD, Nutrients, Plankton	CRIM Namibe	Q.F; P.T
	<i>WELWITCHIA</i>	Oceanographic transect off Namibe	August 07th 2001	BENEFIT	CTD, Nutrients, Plankton	CRIM Namibe	Q.F; P.T
A166 leg 2	<i>AFRICANA</i>	Oceanographic transect off Namibe to 48 nm o/s	March 03rd-04th 2002	BENEFIT	CTD, Nutrients, Plankton	CRIM Namibe	Q.F; P.T
A166 legs2&3	<i>AFRICANA</i>	Oceanographic transects off S Angola (14-18S)	25 Feb - 6 Mar 2002	BENEFIT	CTD, Nutrients, Plankton	CRIM Namibe	Q.F; P.T
	<i>A. v. HUMBOLDT</i>	Oceanographic transect off Namibe	13 Feb 2004	BENEFIT	CTD, Nutrients, Plankton	CRIM Namibe	Q.F; P.T

Key to contact persons

K.K - Kumbi Kilongo Q.F. Quilanda Fidel
D.A - Domingos Azevedo P.T. Pedro Tchpalanga
E.K - Enoque Canganjo

Table 3: Parameter limits

(source: SADCO Newsletter Vol 14 No 4-December 2003)

Parameter	WMO limits	SADCO
SST	(-) 2 to 37 deg C	See Table 4
Drybulb	(-) 25 to 40 deg C	See Table 4
Wetbulb	(-) 25 to 40 deg C. < Drybulb	See Table 4
Dewpoint	(-) 25 to 40 deg C. < Wetbulb	See Table 4
Atmospheric pressure	930 to 1050 kPa	Same as WMO
Wind speed	0 to 40 m/s	Same as WMO
Wave height	0 to 17.5m	Same as WMO
Wave period	0 to 20s	Same as WMO

Table 5a: Temperature ranges for the Atlantic Ocean as a function of depth
 (source: Boyer, T., and S. Levitus, 1994); units= $^{\circ}$ C

Depth	North Atlantic		Eq. Atlantic		South Atlantic	
	Low	High	Low	High	Low	High
0	-3	35	5	35	0	32
10	-3	35	5	35	0	32
20	-3	35	5	35	0	32
30	-3	32	5	35	0	32
50	-3	32	5	35	0	32
75	-2	32	5	35	0	32
100	-2	30	5	30	-1.5	32
125	-2	28	5	30	-1.5	30
150	-2	28	5	30	-1.5	30
200	-2	28	5	30	-1.5	30
250	-1.7	28	3	28	-1.5	28
300	-1.7	28	3	28	-1.5	28
400	-1.5	20	3	28	-1.5	28
500	-1.5	20	3	28	-1.5	28
600	-1.5	20	3	20	-1.5	20
700	-1.5	20	3	20	-1.5	20
800	-1.5	20	-0.5	20	-1.5	20
900	-1.5	20	-0.5	20	-1.5	20
1000	-1.5	18	-0.5	18	-1.5	18
1100	-1.5	18	-0.5	18	-1.5	18
1200	-1.5	18	-0.5	18	-1.5	18
1300	-1.5	18	-0.5	18	-1.5	18
1400	-1.5	18	-0.5	18	-1.5	18
1500	-1.5	18	-0.5	18	-1.5	18
1750	-1.5	13	-0.5	13	-1.5	13
2000	-1.5	13	-0.5	13	-1.5	13
2500	-1.5	13	-0.5	13	-1.5	13
3000	-1.5	7	-0.5	7	-1.5	7
3500	-1.5	7	-0.5	7	-1.5	7
4000	-1.5	7	-0.5	7	-1.5	7
4500	-1.5	7	-0.5	7	-1.5	7
5000	-1.5	7	-0.5	7	-1.5	7
5500	-1.5	5	-0.5	3	-1.5	3

Table 5b: Salinity ranges for the Atlantic Ocean as a function of depth
 (source: Boyer, T., and S. Levitus, 1994); units=psu

Depth	North Atlantic		Eq. Atlantic		South Atlantic	
	Low	High	Low	High	Low	High
0	0	40	0	40	0	40
10	27	38.2	20	37.6	28	38.5
20	28.3	38.2	28	37.4	28	38
30	28.5	38.2	31	37.4	30.6	38
50	28.9	38	31.4	37.4	31	38
75	28.9	38	31.8	37.4	31.2	38
100	29.4	38	31.8	37.4	31.4	38
125	29.4	38	31.8	37.4	31.4	37.8
150	29.6	37.2	31.8	37.2	31.4	37.4
200	29.9	37.4	31.8	37	31.4	36.6
250	30.3	37.1	32	37	31.4	36.2
300	30.8	36.8	32.2	36.8	31.6	36
400	30.8	36.6	32.4	36.6	32	35.8
500	31.2	36.6	33.7	36.5	34	35.5
600	32.2	36.6	33.7	36	34.1	35.1
700	33	36.6	33.6	35.8	34.1	35.1
800	33	36.6	33.6	35.6	34.1	35
900	33	36.6	33.6	35.6	34.1	34.9
1000	33	36.6	33.6	35.4	34.2	34.9
1100	33	36.6	33.6	35.4	34.2	34.9
1200	33	36.6	33.6	33.6	34.2	34.9
1300	33	36.6	33.6	33.6	34.3	34.9
1400	33	36.6	33.6	33.6	34.3	35
1500	33	36.6	33.6	33.8	34.4	35
1750	33	36.6	34.6	34.6	34.5	35
2000	33	36	34.7	34.7	34.6	35
2500	34.7	35.5	34.8	34.8	34.6	35
3000	34.8	36.6	34.8	34.8	34.66	35
3500	34.8	35.4	34.7	34.7	34.64	35
4000	34.8	35.4	34.5	34.5	34.62	35
4500	34.8	35.4	34.5	34.5	34.62	35
5000	34.8	35.4	34.5	34.5	34.62	35
5500	34.8	35.4	34.5	34.5	34.62	35

Table 5c: Oxygen ranges for the Atlantic Ocean as a function of depth
 (source: Boyer, T. and S. Levitus, 1994); units=ml/l

Depth	North Atlantic		Eq. Atlantic		South Atlantic	
	Low	High	Low	High	Low	High
0	0.01	12	0.01	12	0.01	12
10	0.01	12	0.01	12	0.01	12
20	0.01	12	0.01	12	0.01	12
30	0.01	12	0.01	12	0.01	12
50	0.01	12	0.01	12	0.01	12
75	0.01	9.5	0.01	9.5	0.01	9.5
100	0.01	9.5	0.01	9.5	0.01	9.5
125	0.01	9.5	0.01	9.5	0.01	9.5
150	0.01	9.5	0.01	9.5	0.01	9.5
200	0.01	9.0	0.01	9.0	0.01	9.0
250	0.01	9.0	0.01	9.0	0.01	9.0
300	0.01	8.5	0.01	8.0	0.01	8.0
400	0.01	8.5	0.01	8.0	0.01	8.0
500	0.01	8.5	0.01	8.0	0.01	8.0
600	0.01	8.5	0.01	7.1	0.01	7.1
700	0.01	8.5	0.01	7.1	0.01	7.1
800	0.01	8.5	0.01	7.1	0.01	7.1
900	0.01	8.5	0.01	7.1	0.01	7.1
1000	0.01	8.5	0.01	7.1	0.01	7.1
1100	0.01	8.5	0.01	7.1	0.01	7.1
1200	0.01	8.5	0.01	7.1	0.01	7.1
1300	0.01	8.5	0.01	7.1	0.01	7.1
1400	0.01	7.1	0.01	7.1	0.01	7.1
1500	0.01	7.1	0.01	7.1	0.01	7.1
1750	0.01	7.1	0.01	7.1	0.01	7.1
2000	0.01	7.1	0.01	7.1	0.01	7.1
2500	0.01	7.1	0.01	7.1	0.01	7.1
3000	0.01	7.1	0.01	7.1	0.01	7.1
3500	0.01	7.1	0.01	7.1	0.01	7.1
4000	0.01	7.1	0.01	7.1	0.01	7.1
4500	0.01	6.9	0.01	6.0	0.01	6.0
5000	0.01	6.9	0.01	6.0	0.01	6.0
5500	0.01	6.9	0.01	6.0	0.01	6.0