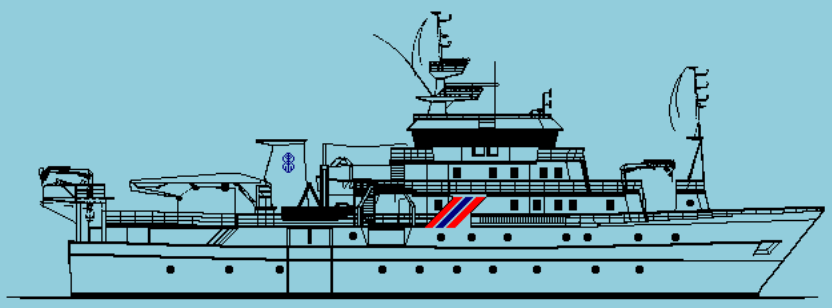

MARINE ENVIRONMENTAL SURVEY OF BOTTOM SEDIMENTS IN CABINDA AND SOYO PROVINCE, ANGOLA

Cruise report No 4/2009

April 2009

Institute of Marine Research – IMR
Norway

Uni Research AS, SAM-Marin
Norway

Instituto Investigação Marinha (INIP)
Angola

Ministry of Petroleum (MinPet)
Angola

Ministry of Urbanisimo e Ambiente (MinAmb)
Angola

Agostinho Neto University
Angola

Ministry of Transportation (MinTrans) (SAME)
Angola

Chevron
Angola

Sonangol
Angola

Bergen June 2010

THE EAF-NANSEN PROJECT

FAO started the implementation of the project “Strengthening the Knowledge Base for and Implementing an Ecosystem Approach to Marine Fisheries in Developing Countries (EAF-Nansen GCP/INT/003/NOR)” in December 2006 with funding from the Norwegian Agency for Development Cooperation (Norad). The EAF-Nansen project is a follow-up to earlier projects/programmes in a partnership involving FAO, Norad and the Institute of Marine Research (IMR), Bergen, Norway on assessment and management of marine fishery resources in developing countries. The project works in partnership with governments and also GEF-supported Large Marine Ecosystem (LME) projects and other projects that have the potential to contribute to some components of the EAF-Nansen project.

The EAF-Nansen project offers an opportunity to coastal countries in sub-Saharan Africa, working in partnership with the project, to receive technical support from FAO for the development of national and regional frameworks for the implementation of Ecosystem Approach to Fisheries management and to acquire additional knowledge on their marine ecosystems for their use in planning and monitoring. The project contributes to building the capacity of national fisheries management administrations in ecological risk assessment methods to identify critical management issues and in the preparation, operationalization and tracking the progress of implementation of fisheries management plans consistent with the ecosystem approach to fisheries.

LE PROJET EAF-NANSEN

La FAO a initié la mise en oeuvre du projet "Renforcement de la base des connaissances pour mettre en œuvre une approche écosystémique des pêcheries marines dans les pays en développement (EAF-Nansen GCP/INT/003/NOR)" en décembre 2006. Le projet est financé par de l'Agence norvégienne de coopération pour le développement (Norad). Le projet EAF-Nansen fait suite aux précédents projets/ programmes dans le cadre du partenariat entre la FAO, Norad et l'Institut de recherche marine (IMR) de Bergen en Norvège, sur l'évaluation et l’aménagement des ressources halieutiques dans les pays en développement. Le projet est mis en oeuvre en partenariat avec les gouvernements et en collaboration avec les projets grands écosystèmes marins (GEM) soutenus par le Fonds pour l’Environnement Mondial (FEM) et d'autres projets régionaux qui ont le potentiel de contribuer à certains éléments du projet EAF-Nansen.

Le projet EAF-Nansen offre l’opportunité aux pays côtiers de l'Afrique subsaharienne partenaires de recevoir un appui technique de la FAO pour le développement de cadres nationaux et régionaux visant une approche écosystémique de l’aménagement des pêches et la possibilité d'acquérir des connaissances complémentaires sur leurs écosystèmes marins. Ces éléments seront utilisés pour la planification et le suivi des pêcheries et de leurs écosystèmes. Le projet contribue à renforcer les capacités des administrations nationales responsables de l’aménagement des pêches en introduisant des méthodes d'évaluation des risques écologiques pour identifier les questions d’aménagement d’importance majeure ainsi que la préparation, la mise en œuvre et le suivi des progrès de la mise en œuvre de plans d’aménagement des ressources marines conformes à l'approche écosystémique des pêches.

MARINE ENVIRONMENTAL SURVEY OF BOTTOM SEDIMENTS IN CABINDA AND SOYO PROVINCE, ANGOLA

Survey of the bottom fauna and selected physical and chemical compounds in April 2009

Institute of Marine Research (IMR)
Norway

UNI RESEARCH AS, SAM-marine
Norway

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Angola

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Ministry of Urbanisimo e Ambiente (MinAmb)
Angola

Agostinho Neto University
Angola

Ministry of Transportation (MinTrans) (SAME)
Angola

Chevron
Angola

Sonangol
Angola

Participations at the cruise

Sediment sampling at *Dr. Fridtfjof Nansen*
Lia Neto Sausa, Silvana Faria, Hélia Dinah Guise da Piedade, Irene Bernando Mosambique
Paulo Andrè De Sausa Coelho, Domingos Pedro, Florencio Estevao Andrè (INIP),
Supervised by Gisle Vassenden (UNI RESEARCH AS) and Bjørn Serigstad (IMR)

Seabed mapping with multibeam
Alexey Andrew (Elcom/Marimeter) and Atle Lagestrand (Statens Kartverk Sjø)
Helder Rufino da CONCEIÇÃO (SAME) and Salustiano Francisco Pinto FERREIRA (Ministry of Transp)

From IMR
Bjørn Serigstad (cruise leader**)**
Magne Olsen
Tore Mørk
Jarle Kristiansen

From Chevron:
Gary Wolinski
Stuart Gowing (Servtech)
David Ndo Akam (Sonamet surveyor)
Neil Whitehead

We would like to thank the officers and the crew onboard *Dr. Fridtjof Nansen*.

ANALYSIS AND REPORTING

Sorting of biological samples
Lomba (LB): UNI RESEARCH AS, Norway
Cabinda diverse: UNI RESEARCH AS, Norway
Palanca (PAL): INIP, Angola

Identification of biological samples
UNI RESEARCH AS

Organic chemical analyses
Personnel at Eurofins Environmental laboratory AS

Metal analyses
Personnel at Eurofins Environmental laboratory AS

TOM and Grain size analyses
Helge Grønning (UNI RESEARCH AS)

Computer analyses
Gisle Vassenden (UNI RESEARCH AS)

Reporting
Bjørn Serigstad (IMR), Gisle Vassenden (Uni Research AS), Marek Ostrowski, (IMR), Magne Olsen (IMR), Atle Lagestrand (Norwegian Mapping Authority, Hydrographic Service), Per-Otto Johansen (Uni Research AS) og Kristin Hatlen (Uni Research AS).

Table of content

1. INTRODUCTION

The co-existence of the fisheries, sea transport and oil sectors is a worldwide challenge related to sustainable utilization of marine living resources in particular, and conservation and protection of the marine environment in general.

An important factor in safeguarding this co-existence between different commercial users of the marine environment has been the development of legislation and policy instruments and the establishment of governmental institutions, NGOs and private institutions.

The new monitoring plan for Angola, called "Environmental Monitoring of the Petroleum Activities on the Angolan Continental Shelf" has been the basis for this survey in Cabinda and Soyo.

The coast of Cabinda from S 5º00 to S 6º00 consists mainly of sandy beaches, lined with sand dunes. The area is part of the marine ecosystem called GCLME (Guinea Current Large Marine Ecosystem). Cabinda is strongly influenced by the fresh water discharge from the Congo River which has the second largest water flow in the world behind the Amazon. Most of the water from Congo River flows northward affecting the horizontal and vertical gradient of temperature and salinity in the Cabinda area. In addition pollutants from big cities along the river, agriculture and runoff from land may give effects on marine life.

The coast of Soyo from S 6º00 to S 7º00 is part of the marine ecosystem called BCLME (Bengulea Current Large Marine Ecosystem). Soyo is located south of Congo River.

For more than 50 years, oil exploration and production have taken place in Cabinda. The petroleum industry is operating both on land and offshore. There is a concern that this petroleum activity may have negative impact on the marine recourses resulting in reduced recruitment to fishstocks or loss of marine biodiversity. In addition there is a concern among other users of the sea, especially among the artisanal fishermen and other people living along the coast making their income from the sea. Besides the possible impact on the marine ecosystem these people also fear health problems for themselves and coming generation. Another concern in addition to possible pollution is the access to fishing grounds and beaches where they traditionally have made their work and living. A reduced water quality and increased industrial activity will probably also be negative for the tourism industry.

With all these possible impacts on the ecosystem with possible impact on different users of the sea it is important to make as good documentation as possible of the environmental conditions in an area. This makes it possible take action if the conditions show to be severely influenced by some specific activities. To be able to have a good environmental monitoring, an environmental monitoring plan covering the areas of concern must be in place. When time series is established it is possible to see if the situation is stable or if pollution is increasing. Lomba was investigated 3 years ago (2006), and the result from the 2009 survey can tell us if there have been any changes in the benthic community and concentration of hydrocarbon and heavy metal in the sediment.

The bottom fauna samples collected at the Palanca field in Soyo will be processed at INIP in Angola in cooperation with IMR and presented in a separate report.

History of petroleum industry in Angola
The Petroleum was first discovered in Angola in the 18th century, but the first attempts of industrial exploration started in the early 19th century but it was no commercial success in the beginning.

The first commercial oil well was discovered in the Cabinda province in 1954. It was located in shallow waters in the Basin of Low Congo. The Cabinda Gulf Oil Company (CABGOC) was established and started exploration in 1966.

From 1974 to 1995 the Angolan oil industry was in a structuring phase. SONANGOL (National Society of Fuels of Angola) was founded in June of 1976. SONANGOL was responsible for the concessions of the exploration rights and hydrocarbon production.

The Angolan continental shelf was divided in Blocks by SONANGOL. In 1979 14 blocks (Block 0 – 13) in shallow waters from 0 to 200m depth were defined. In 1990 17 new blocks (Block 14 – 30) in deep water from 200m to 1500m (14 to 30) where defined. The ultra-deep areas were divided in 4 Blocks.

Today the Angolan shelf is divided in 35 Blocks of which 17 are awarded, 7 are abandoned and 11 are still free.

COOPERATION IN ANGOLA
For Implementation of the National Environmental Monitoring Plan for Angola multisectorial cooperation has been established among the Ministry of Fisheries (National Institute of Fishery Research), Ministry of the Urbanism and Environment, Ministry of Petroleum, Ministry of Geology and Mines and the Agostinho Neto University.

The problems with pollution and transport of pollutants are complex and a Tran boundary. Petroleum activities are not limited to the Angolan territory; it also takes place north of Angola in Congo and Gabon. In this way it is a shared problem with counties in the large marine ecosystems; GCLME and BCLME. Angola is a link between the two current systems.

The monitoring survey will hopefully enhanced the understanding of the nature and extend the knowledge of how the offshore oil activities can affect the marine ecosystem. This first survey will hopefully contribute with valuable information especially on the benthic communities and levels of contamination by hydrocarbons and heavy metals in the sediments. The Angolan Multisectoral Group of Experts has divided activities in two phases:

1) **The first phase** is to Elaboration the Angolan Environmental legislation for Monitoring of offshore oil activities. The Ministry of the Urbanism and Environment coordinates this activity with assistance from the Ministry of Petroleum and Ministry of the Fisheries.
2) **The second phase** is the Monitoring Strategies which is coordinated by the Ministry of Fisheries (National Institute of Fisheries Research).

2 METHODS

2.1 Sampling cruise – planning and operations

March 12 – 19, 2009 meeting with: MinPet, MinPescas, MinAmb, INIP, Chevron, Sonangol and Norwegian Embassy in Angola for planning of the field activities.

The plan was to involve Sonangol and Chevron in the Environmental monitoring activities, in addition to other petroleum operators on the Angolan Continental shelf. The monitoring in 2009 was in cooperation with Chevron and Sonangol.

MinPet took the lead in the planning on the Angolan side.

Maps were provided by MinPet from Chevron and Sonangol.

The MOU for the Cooperation between MinPescas/MinPet/MinAmband FAO was signed by the director of INIP.

A preliminary cruise plan was presented, but the specific sampling area was not elaborated in detail. This was not possible since there was no information about activities in the different areas and no information about accessibility.

April 13. 2008. Meeting with MinPet and INIP for planning of the cruise and the sampling sites.

April 14. The vessel *Dr Fridtjof Nansen* left Luanda April 14, at 14:27. The vessel sailed northward during the night.

April 15-18. Anchored in Pointe Noire. Change of crew.

April 18-19. Anchored in Cabinda. Inspection of the vessel was done on April 19. The ISPS inspector left the ship to go back to the base to write a report.

April 20. *Dr Fridtjof Nansen* was security cleared. But only the conventional grab and crane winch was allowed to use. The focus winch was not security cleared. The first sampling started at 14:25 at Takula Kilo jacket. Sediment sampling continued to 18:00. During the night seabed mapping was conducted with a multibeam echo sounder.

April 24. Last sample was collected in Cabinda.

April 25. Arrived Palanca early morning. Waiting for the surveyor to present maps with pipelines and for permission to take the samples. Started with seabed mapping during the night.

April 26. Surveyor from Fugro came onboard in the morning with maps. Sampling sites were chosen along three different transects within safe distance from pipelines and cables. The sampling started at 16:36, and continued during the night outside the security zone.

April 27. In the morning we entered the security zone. The sites close to the platform were not taken for security reasons. Last sample was collected 15:20. Steaming to Soyo. Seabed mapping in Congo River canyon during the night.

April 28. Anchored in Soyo. The Angolan scientists left the vessel in the morning.

The scientists that have been on previous environmental cruises and on training in Norway are working as professionals on board performing the work in an excellent way.

The weather conditions were good during the whole cruise and there were no incidents hurting or damaging crew members, sample equipment, samples or the vessel.

2.2 Survey area and sampling design

Lomba was investigated 3 years ago, and the same set of sites is investigated in this survey. It is therefore possible to detect any changes in the benthic community and concentration of hydrocarbon and heavy metal in the sediment.

In addition to Lomba, the investigation included one 300m and one 1000m site west of Takula Kilo jacket and Takula Oscar jacket and north-west of Wamba-Bravo jacket.
Oil spills are previously observed west of Takula Oscar and are the reason for sampling in Takula area. Oil spills have also been observed in Malongo North area, and to sites north of GS-D were investigated. On request from Chevron, to sites were investigated north-west of a newly installed jacket called Mafumeira Centro.

In Soyo, the Palanca oilfield was investigated. Sites along four different transects were sampled according to the monitoring plan.

In addition to sediment sampling, there was an on-the-job training of Angolan scientists in seabed mapping with multibeam.

Figure 2.1 shows the sediment sampling sites near the investigated oilfields. Table 2.1 – 2.5 gives information of the position of sites.

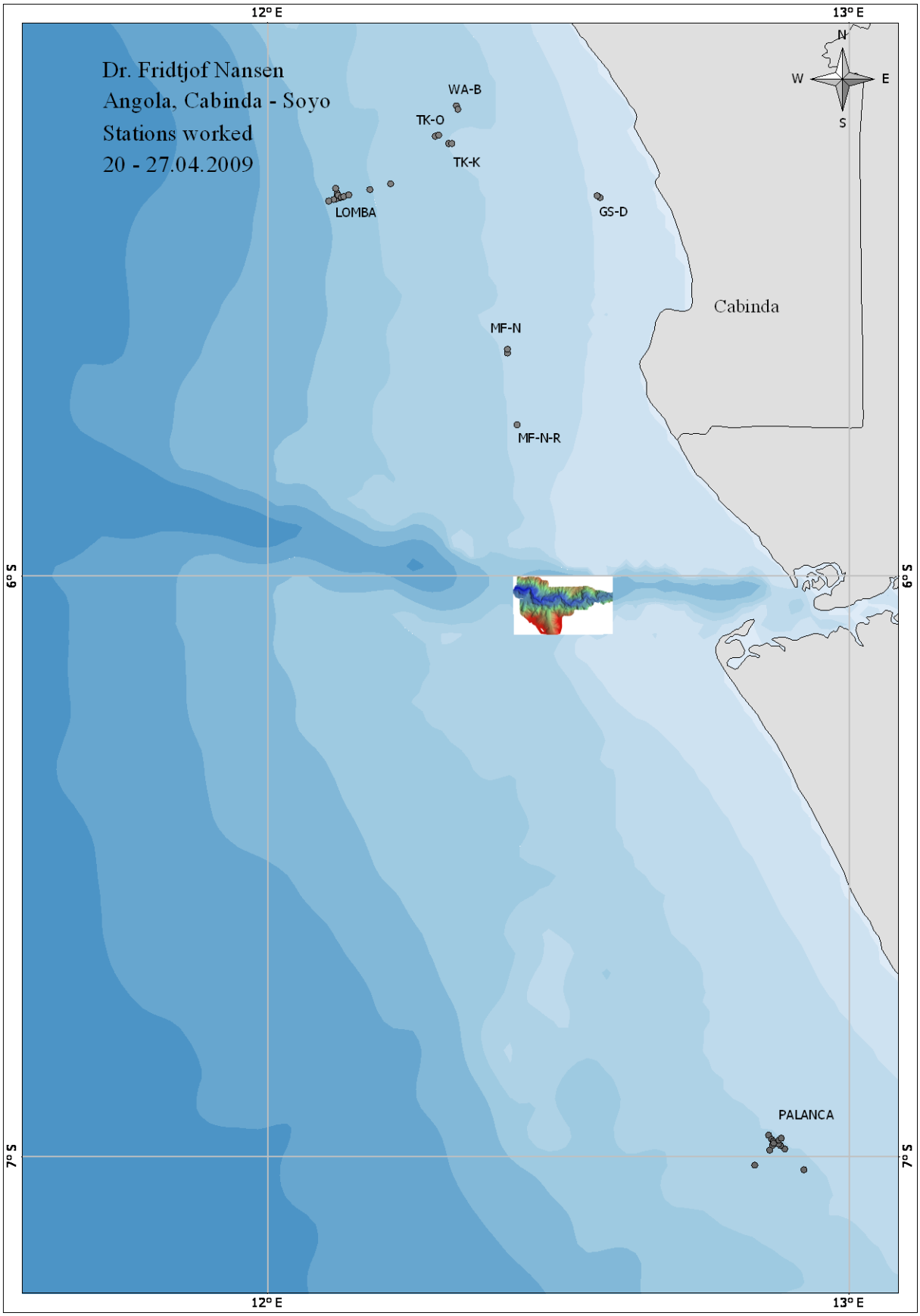


Figure 2.1. Map showing all the investigated sites. Position of the seabed mapping in Congo River canyon is included.

Table 2.1. Information of the CTD sites.

Site nr.	Date	Time UTC	Latitude	Longitude	Depth (m)	Comment
461	20.04.2009	13:25:15	5°48,671` S	11°15,314` E	67	Same position as TK-K-2
462	20.04.2009	19:52:52	5°42,433` S	11°19,892` E	99	
463	21.04.2009	05:39:02	5°49,435` S	11°11,412` E	65	
464	21.04.2009	12:48:20	5°37,265` S	11°20,726` E	132	Same position as LB1
465	21.04.2009	19:52:32	5°40,493` S	11°19,396` E	109	
466	22.04.2009	00:10:17	5°46,814` S	11°25,418` E	72	
467	22.04.2009	19:32:00	5°40,493` S	11°19,435` E	109	
468	23.04.2009	18:08:59	5°55,684` S	11°44,214` E	48	Same position as MF-N-R
469	23.04.2009	21:06:21	5°47,532` S	11°24,931` E	67	
470	24.04.2009	07:14:38	5°03,978` S	12°20,693` E	21	Same position as GS-D-2
471	24.04.2009	20:43:52	6°57,065` S	11°01,859` E	862	
473	26.04.2009	16:55:28	6°58,160` S	12°22,005` E	51	Same position as PAL3
474	26.04.2009	21:52:55	7°00,869` S	12°20,282` E	72	Same position as PAL8

Table 2.2. Information of the bottom fauna sampling sites at Lomba. Positions in WGS84 datum. Site LB4 change position closer to the platform, and have a new site number compared to the 2006 survey.

Site nr.	Date	Time UTC	Latitude	Longitude	Depth (m)	Sediment description	Volume (l)	Sediment layer Chemistry	Comments
Lomba									
LB1	21.04.2009	12:55:36	5°20,735` S	11°37,294` E	132	Mud	21	0-1, 1-3, 3-6 cm	Oil in the sediment
LB2	22.04.2009	10:27:43	5°20,656` S	11°37,278` E	132	Mud	18-21	0-1, 1-3, 3-6 cm	
LB3	21.04.2009	17:23:43	5°20,417` S	11°37,185` E	131	Mud	21	0-1 cm	
LB4a	22.04.2009	17:27:17	5°19,946` S	11°37,024` E	132	Mud, soft	21	0-1 cm	
LB5	21.04.2009	14:57:34	5°20,884` S	11°37,517` E	130	Mud	21	0-1 cm	
LB6	22.04.2009	12:32:45	5°20,856` S	11°37,609` E	129	Mud	21	0-1 cm	
LB7	22.04.2009	14:06:13	5°20,783` S	11°37,885` E	127	Mud	21	0-1 cm	
LB8	22.04.2009	15:43:02	5°20,640` S	11°38,410` E	123	Mud	21	0-1 cm	
LB9	23.04.2009	09:40:31	5°20,056` S	11°40,575` E	110	Mud	21	0-1 cm	
LB10	23.04.2009	11:15:10	5°19,479` S	11°42,722` E	98	Mud, soft	21	0-1 cm	
LB15	22.04.2009	06:06:06	5°20,932` S	11°37,160` E	132	Mud, soft	21	0-1 cm	
LB16	22.04.2009	08:25:32	5°21,002` S	11°37,106` E	133	Mud	21	0-1 cm	
LB17	23.04.2009	06:05:56	5°21,108` S	11°36,854` E	135	Mud and sand	21	0-1 cm	
LB18	23.04.2009	08:17:43	5°21,259` S	11°36,330` E	147	Mud	21	0-1 cm	

Table 2.3. Information of the other bottom fauna sampling sites in Cabinda. Positions in WGS84 datum.

Site nr.	Date	Time UTC	Latitude	Longitude	Depth (m)	Sediment description	Volume (l)	Sediment layer Chemistry	Comments
Mafumeira North									
MF-N-1	23.04.2009	14:59:16	5°36,941` S	11°54,758` E	50	Mud	21	0-1 cm	
MF-N-2	23.04.2009	16:15:35	5°36,581` S	11°54,756` E	49	Mud	13-21	0-1 cm	
MF-N-R	23.04.2009	18:21:20	5°44,362` S	11°55,749` E	48	Mud	18-21	0-1 cm	
Takula-Kilo jacket									
TK-K-1	20.04.2009	15:48:19	5°15,288` S	11°49,018` E	65	Mud	21	0-1 cm	
TK-K-2	20.04.2009	13:39:15	5°15,290` S	11°48,702` E	67	Mud	21	0-1 cm	
Takula-Oscar jacket									
TK-O-1	21.04.2009	09:58:35	5°14,421` S	11°47,660` E	73	Mud	21	0-1 cm	
TK-O-2	20.04.2009	17:37:00	5°14,554` S	11°47,296` E	74	Mud	21	0-1 cm	Oil in the sediment
Wamba-Bravo jacket									
WA-B-1	21.04.2009	08:48:38	5°11,768` S	11°49,633` E	65	Mud	21	0-1 cm	Oil in the sediment
WA-B-2	21.04.2009	05:45:52	5°11,428` S	11°49,499` E	65	Mud	21	0-1 cm	
Malongo North									
GS-D-1	24.04.2009	05:43:05	5°20,902` S	12°04,323` E	21	Mud	17-21	0-1 cm	
GS-D-2	24.04.2009	07:20:12	5°20,695` S	12°03,982` E	21	Mud and broken shells	18-21	0-1 cm	

Table 2.4. Information of the bottom fauna sampling sites in Soyo. Positions in WGS84 datum.

Site nr.	Date	Time UTC	Latitude	Longitude	Depth (m)	Sediment description	Volume (l)	Sediment layer Chemistry	Comments
Palanca									
PAL2	27.04.2009	09:03:55	6°58,414` S	12°22,173` E	49			0-1, 1-3, 3-6 cm	
PAL3	26.04.2009	17:11:43	6°58,199` S	12°22,006` E	50	Sand	0,5-13	0-1 cm	
PAL4	26.04.2009	15:40:24	6°57,781` S	12°21,693` E	53	Sand	12-16	0-1 cm	
PAL5	27.04.2009	10:33:48	6°58,605` S	12°22,189` E	51			0-1 cm	
PAL6	26.04.2009	18:46:57	6°58,845` S	12°22,069` E	49	Sand and stones	0,5-7	0-1 cm	
PAL7	26.04.2009	20:13:23	6°59,320` S	12°21,794` E	53	Sand	0,5-9	0-1 cm	
PAL8	26.04.2009	22:01:04	7°00,858` S	12°20,263` E	72	Sand	12-21	0-1 cm	
PAL10	27.04.2009	07:12:16	6°58,689` S	12°22,730` E	48			0-1 cm	
PAL11	27.04.2009	05:16:08	6°58,863` S	12°22,907` E	48			0-1 cm	
PAL12	27.04.2009	01:30:24	6°59,207` S	12°23,334` E	47	Sand and stones	13-15	0-1 cm	
PAL13	26.04.2009	23:53:56	7°01,343` S	12°25,339` E	52	Hard sediment	9-18	0-1 cm	
PAL14	27.04.2009	12:04:25	6°58,301` S	12°22,759` E	46			0-1 cm	
PAL15	27.04.2009	13:11:49	6°58,094` S	12°22,997` E	43			0-1 cm	

2.3 Sampling and sample treatment

All the sampling was done by the crew from Instituto Nacional de Investigação Pesqueira (INIP) under supervision by Gisle Vassenden (UNI RESEARCH AS/SAM-Marine) and Bjørn Serigstad (Institute of Marine Research). Section of applied environmental research (SAM-Marine) is accredited by Norsk Akkreditering for sampling, sorting and taxonomic identification under accreditation number Test 057. The sampling was undertaken in accordance with the Norwegian guideline ”Aktivitetsforskriften”, OSPAR monitoring plan, the Requirements for Environmental Monitoring of the Petroleum Activities on the Angolan Continental Shelf and international standards (ISO 5667-19 and ISO 16665).

Positioning of *Dr. Fridtjof Nansen* was done by Differential Global Positioning System (DGPS). The positions were approved by the surveyor from ServTech (Cabinda) and Fugro (Soyo).

2.3.1 Temperature, salinity and oxygen

CTD sites were taken on selected sites in the different fields. A Seabird 911 CTD plus was used to obtain vertical profiles of temperature, salinity and oxygen. Real time plotting and logging was done using the Seabird Seasave software installed on a PC. The profiles were taken down to a few meters above the bottom. The new oxygen sensor has shown to be very stable, and no calibration was conducted during the survey.

The SBE 21 Seacat thermosalinograph was running routinely during the survey, obtaining samples of sea surface salinity and relative temperature and fluorescence (5 m depth) every 10 seconds. An attached in-line Turner Design SCUFA Fluorometer continuously measured Chlorophyll A levels [RFU] at 5 m below the sea surface while underway during the entire cruise.

Meteorological observations including wind direction and speed, air temperature and sea surface temperature (SST) were automatically logged using a WIMDA meteorological site and averaged by every nautical mile distance sailed (Appendix table 1).

2.3.2 Sediment sampling

Sampling took place at two different types of sampling sites, ordinary field sites and reference sites. Ordinary field sites were the most numerous. At each site, 8 grab samples were taken. Five were used for biological analysis and 3 for chemical analysis (metals and oil hydrocarbons). Sediment that was used for chemical analysis was taken from the upper 0-1 cm of the sample. From field sites downstream and closest to the installation, additional sectioned samples were taken for chemical analysis from 1-3 and 3-6 cm depth of the sediment.

The field sampling sites were spread out along two transects at a predefined distance from the installation. One transects extended upstream and downstream from the centre of the installation, and the other extended to the right and left at a right angel to the first transect at the centre of the installation. At Lomba, previously investigated sites from 2006 were repeated Because of pipelines and electrical cables at the seafloor, and for security reason, some sites were not sampled or they were moved.

Sediment samples were taken by a van Veen grab with adjustable weight and an opening of 0.1 m². The total volume of the grab was 21 liters. Due to soft sediments, the sediment was stuck to the lids of almost every grab samples in Cabinda. A lighter (0.1 m²) van Veen grab would have been a better grab for the sediment at Cabinda, but was not available on board the ship.

On deck the volume of each sample was measured. Sediment was described, and color was recorded, as well as anomalous odor and conspicuous taxonomic groups. Samples for biological analysis were sieved through sieves with 5 mm and 1 mm round holes. Material retained in the sieves was placed in 500-1000 ml plastic containers where formalin and borax was added. Each sample was marked and stored on board in transport containers. Samples for chemical analysis were taken through the hatches on top of the grab from the upper 0-1 cm of the sediment sample inside the grab.

Sectioned sediment samples were taken at designated sites. These samples were taken by a corer which was pressed into the sediment inside the grab from the topside. The sediment in the corer was sectioned into 3 subsamples respectively from the 0-1, 1-3 and 3-6 cm layers.

To avoid contamination, a special designed metal spatel was used when taking the sediment for hydrocarbon and grain size analyses, but a plastic spoon was used when taken the sediment for metal analyses. The spoons were washed with seawater between each sample. Each sample was put into Rilsan plastic bags which were marked and immediately frozen to prevent evaporation of labile compounds. The samples were kept frozen until further analysis in the onshore laboratory. Samples for TOM and grain size analyses were taken from the upper 0-5 cm of the sediment and put in separate plastic bag, marked and frozen immediately.

At the end of the survey the samples for chemical analyses in Angola were transported to a freezer at INIP. The samples for analyses in Norway were stored onboard in the freezer, and were shipped to Norway from Ghana. The biological samples from Palanca were transported to INIP, but the samples from Cabinda were shipped to Norway from Namibia.

Deviations

Only samples where the grab was completely closed, and with open space between the sediment surface and the lid should be accepted. In this way only complete and undisturbed sediment samples would be collected for further processing. This was not achieved due to too very soft sediment in Cabinda area.

In Soyo, there was some deviation from the acceptance criteria that there should be at least 3 liter sediment of sand in the grab. In the Palanca area there is heterogeneous bottom condition with stones and hard substrate in addition to the sandy sediment. If the grab was completely closed, some small samples were accepted.

2.3.3 Seabed mapping with multibeam echo sounder

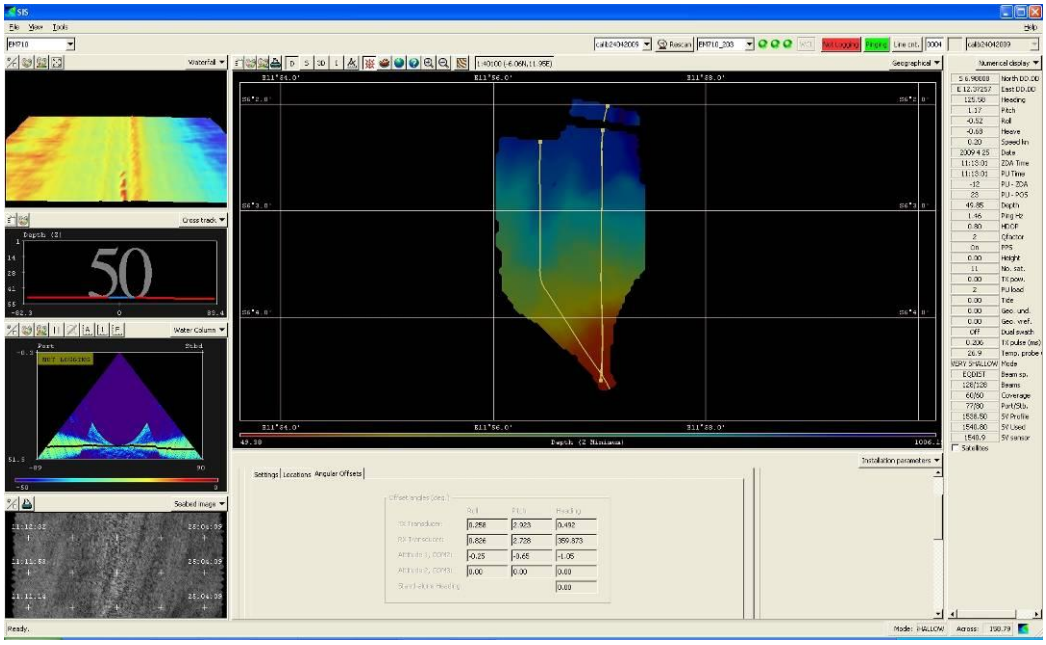
By Atle Lagestrand (Norwegian Hydrographic Office)

During the IMR-Cruise 2009404 outside Angola, two Angolan scientists participated to gain experience using the hardware and software that were used. The two scientists were Helder Rufino da CONCEIÇÃO (SAME) and Salustiano Francisco Pinto FERREIRA (Ministry of Transp).

The survey was executed using the Kongsberg Maritime EM710 multibeam echo sounder with position- and attitude data from Seapath 200.
SIS (Seabed Information System) software was used for online logging and echo sounder control.
Post-processing was performed using Neptune. The latter was also used for calibration of the EM710.

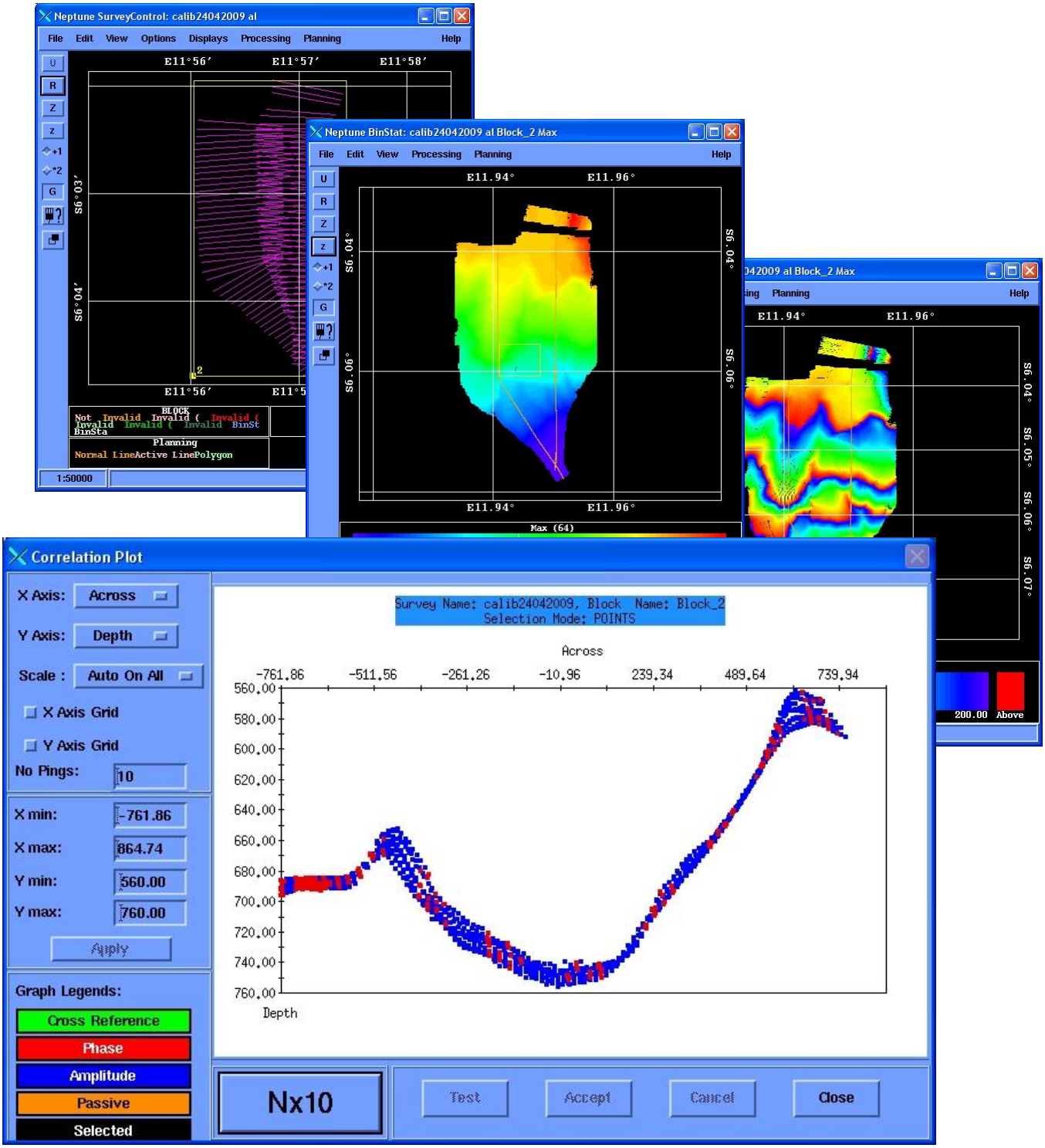
SIS – Seabed Information System

This is used for the online operation of Kongsberg Maritime multibeam echo sounder systems. The operator controls all settings and logging from within this application during the survey.



NEPTUNE – Post Processing

Prepared raw data from SIS are processed using Neptune. Tide corrections are applied and spurious soundings are removed/flagged invalid using the BinStat module.



Screenshots from Neptune Post-processing software

2.3.4 Color, grain size and TOM

Color
The color of the sediment was determined according to Munsell® Soil Color Chart System year 2000 revised (GretagMacbeth, New Windsor, NY, USA) when the sample arrived on deck. A mixture consisting of sediment from the upper 0-5 cm of three separate grab samples was used for the grain size analysis at each sampling site.

Grain size
The particle size was analyzed in the laboratory by dissolving the sediment in water and then sieved through a 0,063 mm sieve. The particle bigger than 0,063 mm, was dry sieved on Endecott sieves. The sieves had square holes with opening 16mm (ϕ=-4), 8mm (ϕ=-3), 4mm (ϕ=-2), 2mm (ϕ=-1), 1mm (ϕ=0), 0,5mm (ϕ=1), 0,250mm (ϕ=2), 0,125mm (ϕ=3) and 0,063mm (ϕ=4) (Buchanan 1984). The analysis was performed at SAM.

The median diameter and sorting (Table 2.5) was calculated with the formula in Buchanan (1984) and Folk & Ward (1957), and the program GradiStat version 4.01 (Blott & Pye 2001).

Particle diameter: x = Φ-value ($\Phi=-\log_2 x$)

Median particle diameter: Md Φ = Φ50.

Mean diameter $M_z = \frac{\Phi(16) + \Phi(50) + \Phi(84)}{3}$

Sorting: SD $\Phi = \frac{\Phi(84) - \Phi(16)}{4} + \frac{\Phi(95) - \Phi(5)}{6,6}$

Table 2.5. The mesh size of the sieves used for grain size analysis.

Size of the sieve (mm)	Phi class Φ	Description
16	-4	Gravel
16-8	-3	Gravel
8-4	-2	Gravel
4-2	-1	Gravel
2-1	0	Sand
1-0,5	1	Sand
0,5-0,25	2	Sand
0,25-0,0125	3	Sand
0,0125-0,063	4	Sand
< 0,063		Pelite

Total Organic matter (TOM)
The amount of organic material (TOM) was determined as weight loss in a 2-3 gram dried sample (105° C for about 20 hours) after combustion at 480° C for 2 hour.

2.3.5 Chemical compound analyses

2.3.5.1 The principles of the oil hydrocarbons analysis

The petroleum hydrocarbon content was determined by GC/FID analysis of the extracts obtained as outlined in Intergovernmental Oceanographic Commission, Manuals & Guides no 11, UNESCO 1982.

The petroleum hydrocarbons were isolated from the sediment sample by saponification with methanolic potassium hydroxide for two hours, followed by extraction with pentane. The pentane phase is reduced using a Rotavapor, and is subsequently purified by solid phase extraction. The petroleum hydrocarbon components were eluted from the solid phase column with pentane followed by dichloromethane. The extract was reduced using a heating jacket and analyzed by Gas Chromatography with Flame Ionization Detection (GC/FID). The analyses of PAHs and Decalines were performed by Gas Chromatography with Mass Selective Detection operating in the Single Ion Monitoring mode (GC/MS SIM).

Procedure

The sediment sample was homogenized by stirring and subsequently centrifuged at 2300 rpm for 5 minutes to remove additional water. The amount of dry matter in the centrifuged sample was determined by weighing a small part (about 10 g) of the sample before and after drying at 105°C for 16 hours.

Soxtec extraction

The saponification was carried out using a Soxtec System at 150°C, equipped with glass cups and cellulose thimbles. In order to reduce the background level of hydrocarbons in the blank samples, the empty cellulose thimbles were boiled for 1 hour in methanol prior to use.

About 20 g of the sample was placed in the cellulose thimble and boiled for 1 hour (in the "boiling position") in 50 mL of a solution of potassium hydroxide in methanol (30 g/L). Before boiling, 1,0 mL of a mixture of internal standards is added to the extraction cups. The thimble was lifted to the "rinsing position" for 1 hour while the refluxing methanol extracted hydrocarbons from the sample. For every 20 samples, reference samples of HDF 200 (base oil in drilling fluid; for THC, olefins and decalines) and HS-4B (Harbour Marine Sediment Reference Material; for PAH and NPD) are extracted, purified and analyzed according to this method for monitoring the accuracy of the method.

Pentane extraction

The methanol extract was collected in a Duran bottle. After cooling, 25 mL of pentane was added and the bottle was shaken for 10 minutes. The pentane phase was separated from the methanol phase and collected in a conical flask. Another 25 mL of pentane was added to the methanol, shaken, separated and added to the first pentane phase. The pentane was reduced to 1 mL using a Rotavapor with a water bath at 30°C.

Solid phase clean up

The final clean up was carried out using 200 mg florisil solid phase columns. The columns were conditioned prior to use. The sample was then added to the column, which was eluted with 2x2 mL pentane and 2 mL dichloromethane. The elute was reduced to dryness using a heating jacket at 40°C. The residue was redissolved in 1 mL of dichloromethane and analyzed by GC/FID (THC) and GC/MS-SIM (PAH, NPD).

The quantification of the components

- THC

The content of THC was quantified in the nC_{12}-nC_{35} boiling point range by using external and internal standards. The external standard was a solution of n-alkanes in dichloromethane (5 mg/L of each component, Restek # 57257). This external standard was also used to establish the retention time window. The internal standards (bromobenzene, *o*-terphenyl and squalane; all 5 mg/L) were added to the sample before boiling as well as to the external standard. The average THC value from blank samples was subtracted before the final quantification of the THC content of the sample. The conditions of the GC/FID system are shown in Table 2.6.

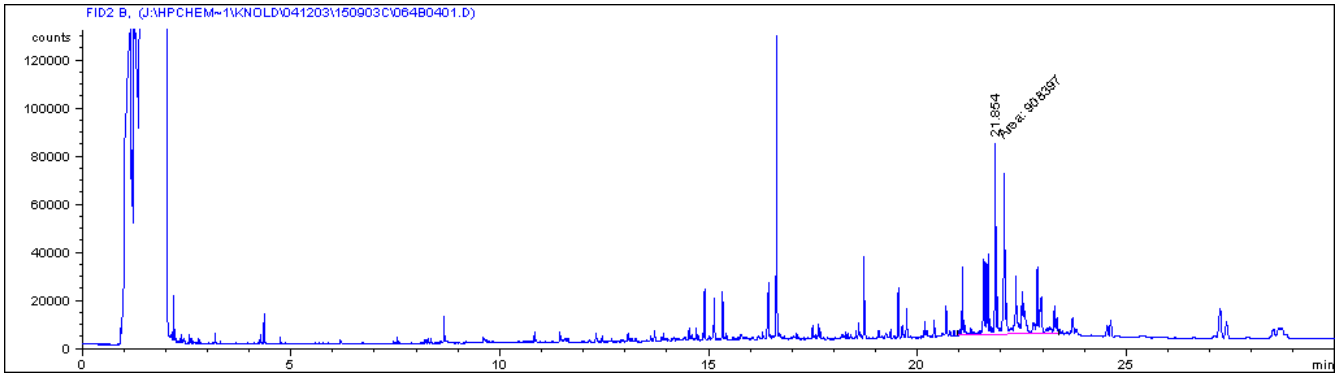


Figure 2.2. Chromatogram showing the subtracted phytosterol fraction of sediment sample.

Table 2.6. GC/FID conditions

GC system	Hewlett-Packard 5890 Series II Gas Chromatograph with split/splitless injector, Flame Ionization Detector
Column	Agilent DB-5, length: 25 m, ID: 0,2 mm, film: 0,33 µm
Injector temperature	290°C
Detector temperature	300°C
Temperature program	35°C (3 min) - 15°C/min - 315°C (9,5 min)
Carrier gas	H_2, 1,4 mL/min
Injection	1 µL, splitless

- PAH and NPD

The PAHs/NPDs analysis was performed by GC/MS operating in the SIM (single ion monitoring) mode. The conditions of the GC/MS system are shown in Table 2.7.

Table 2.7. GC/MS conditions

GC system	Agilent Technologies 6890N Network GC System
MS	Agilent 5973 Network Mass Selective Detector
Column	Agilent DB-5ms, length: 30 m, ID: 0,25 mm, film: 0,25 μm
Injector temperature	300°C
Temperature program	60°C (2 min) - 12°C/min - 300°C (8 min)
Carrier gas	He, 1,0 mL/min
Injection	1 μL, splitless, purge flow: 40 mL/min in 1 min

The amounts of PAHs and NPDs were quantified using internal deuterium marked standards and calibration curves made from 3 levels of standards containing the 16 EPA PAHs and selected NPDs. The internal standards were added to the sample before boiling as well as to the external standard. The 16 standard EPA PAHs were obtained in PAH cocktail ampoules from Ehrensdorfer (20952500 PAH Mix 25) and Chemservice (PP-HC6JM). A NPD cocktail containing 1 compound representing each of the NPD clusters was obtained from Chiron (NPD Cocktail 3, S-4046). The NPD compounds in the cocktail were: Dibenzothiophene, 4-methyldibenzothiophene, 2,8-dimethyldibenzothiophene, 2,4,7-trimethyldibenzothiophene, naphthalene, 2-methylnaphthalene, 2,3-dimethylnaphthalene, 2,3,6-trimethylnaphtalene, phenanthrene, 2-methylphenanthrene, 1,6-dimethylphenanthrene and 1,2,8-trimethylphenanthrene. Table 2.3.3 shows target ion, qualifier ion, and the corresponding internal standard for each PAH compound and NPD cluster. Before the final quantification was carried out, the corresponding average concentration of blank samples was subtracted.

Table 2.8. Analyzed PAH compounds and NPD clusters

Compound / cluster	Target ion m/z	Qualifier ion m/z	Corresponding internal standard
Naphthalene	128	102	Naphthalene-d8
C1-naphthalene	142	141	Naphthalene-d8
C2-naphthalene	156	141	Acenaphthylene-d10
Acenaphthylene	152	151	Acenaphthylene-d10
Acenaphthene	153	154	Acenaphthylene-d10
C3-naphthalene	170	155	Acenaphthylene-d10
Flourene	166	165	Acenaphthylene-d10
Dibenzothiophene	139	168	Acenaphthylene-d10
Phenanthrene	178	176	Phenanthrene-d10
Anthracene	178	176	Phenanthrene-d10
C1-dibenzothiophene	198	-	Phenanthrene-d10
C1-phenanthrene	192	191	Phenanthrene-d10
C2-dibenzothiophene	212	-	Phenanthrene-d10
C2-phenanthrene	206	191	Phenanthrene-d10
Fluoranthene	202	101	Fluoranthene-d10
C3-dibenzothiophene	226	-	Fluoranthene-d10
Pyrene	202	101	Pyrene-d10
C3-phenanthrene/antracene	220	-	Pyrene-d10
Benzanthracene	228	114	Pyrene-d10
Chrysene/triphenylene	228	114	Pyrene-d10
Benz[bjk]fluoranthenes	252	250	Benz[a]pyrene-d12
Benz[a]pyrene	252	250	Benz[a]pyrene-d12
Indeno(1,2,3-cd)pyrene	276	274	Benz[a]pyrene-d12
Dibenzo[a,h]anthracene	278	-	Benz[a]pyrene-d12
Benzo(ghi)perylene	276	274	Benzo(ghi)perylene-d12
Internal standards			
Naphthalene-d8	136		
Acenaphthylene-d10	160		
Phenanthrene-d10	188		
Fluoranthene-d10	212		
Pyrene-d10	212		
Benz[a]pyrene-d12	264		
Benzo(ghi)perylene-d12	288		

2.3.5.2 The principle of metal analysis

The metal content is determined by Inductively Coupled Plasma – Atomic Emission Spectrometry (ICP-AES) except mercury which determined by Cold Vapor Atomic Emission Spectrometry (CVAAS) after drying, sieving and digestion.

Procedure
The sediment samples were dried at 105°C or 40°C for samples for mercury determination. The sample was sieved through a 0.5 mm sieve. The fraction <0.5 mm was digested with nitric acid according to NS4770.

Digestion by nitric acid
Digestion was performed in a autoclave. About 1 g of sample was weighed in to a sterile PP test tube with 4 mL of nitric acid. The samples were then autoclaveted in 120 °C in 30 min. After digestion, the samples were filtered and diluted to 50 mL.

Metal analysis by ICP-AES
The metals, except mercury, were analyzed by a Varian Vista-PRO ICP-AES. The analytical conditions are found in Table 2.9.

Table 2.9 ICP-AES analytical conditions

Element	Wavelength	Power (kW)	Background correction
Ba	233.527	1.35	Fitted
Cd	228.802	1.35	One point, left
Cr	267.716	1.35	Fitted
Cu	324.754	1.35	Fitted
Pb	220.353	1.35	Fitted
Zn	213.857	1.35	Fitted

Mercury analysis by CVAAS

Mercury was analyzed by a Cetac M6000-A mercury analyzer. The mercury in the solution was reduced by $SnCl_2$ to its elementary form Hg^0. Elementary mercury is volatile and was separated from the solution in a gas liquid separator by an argon carrier gas. The absorption at 254 nm was measured to determine the concentration of mercury.

Reference materials

CRM015-050 metals on sediment and CRM031-040 metals on soil (Resource Technology Corporation) were use as a reference.

2.3.6 Limits of significant contamination (LSC)

LSC values were calculated from the replicates at the reference sites by using a one-tailed student t-test at 95 % significant level according to the formula given in the Norwegian guideline "Aktivitetsforskriften" and Requirements for Environmental Monitoring of the Petroleum Activities on the Angolan Continental Shelf.

A limit of significant contamination (LSC) was calculated with the formula:

$$LSC > \bar{R}_{\bullet\bullet} + t_{\alpha(\nu)} \cdot s \cdot \sqrt{1 + \frac{1}{N_r}}$$

$\bar{R}_{\bullet\bullet}$ = the average of mean values for the reference sites.

$t_{\alpha(\nu)}$ = critical value from the t-distribution, using a unilateral t-test with a level of Significance of α (=0.05)

and ν = N_r-1 degrees of freedom.

s = Standard deviation for the spread between the site average.

N_r = Number of reference sites

The standard deviation s is calculated as $s = \sqrt{\frac{\sum_{i=1}^{N_r} (\bar{R}_{i\bullet} - \bar{R}_{\bullet\bullet})^2}{N_r - 1}}$

where $\bar{R}_{i\bullet}$ = the mean values of the parallels at reference Site no. *i.*

For a further explanation concerning the formula, see memorandum O 99218 from NIVA.

2.3.7 Biological analyses

Prior to sorting and species identification, each sample was sieved and washed once more to remove formalin. Specimens were then sorted out under dissecting microscope, and each taxonomic group placed in a small bottle with ethanol. The specimens were then identified, and enumerated and returned to the fixation fluid.

A complete species list is presented in the appendix. Only the bottom fauna (benthos) was used for further analyses which used:

- Total number of species
- Total number of specimens standardized to 0.5 m² of sea floor
- The ten most abundant species at each site (species name, number of specimens and % of total number of specimens)
- Cumulative species / area graph, for reference sites only (5 samples)
- Species diversity as "Shannon Wiener index" on a $\log_2$ base (Shannon & Weaver 1963)
- Evenness as Pielous's "J" (Pielou 1966)
- Cluster analysis based on "Bray-Curtis dissimilarity index" (Bray & Curtis 1957), followed by "group average sorting" on 4th root transformed data
- Ordination by "multidimensional scaling"

The analysis is done by the computer program PRIMER from Plymouth Marine Laboratory in England.

- Univariate analyses:
The mathematical bases for the diversity indices are outlined as follows:

Diversity H', the Shannon-Wiener function (Shannon & Weaver 1949)

$$H' = -\sum_{i=1}^{s} p_i \log_2 p_i ,$$

where: $p_i = n_i/N$

s = total number of species

n_i = number of individuals of species i

N = total number of individuals

Species diversity (H`) above 4 is considered high, between 3 and 4 is moderate, diversity between 2 and 3 is low and below 2 is very low.

Pielou's measure of evenness, J (Pielou, 1966)

$$J = \frac{H'}{H' \max}$$

where $H' \max = (\log_2 s)$

Evenness, an estimate of how the individuals are distributed among the species, varies between 0 and 1, with a value close to 0 if all individuals belong to one or a couple of species. Evenness has the value 1 if all individuals are equally distributed between the species.

The species-area curve is produced by the program EstimateS from University of Connecticut. More about the method see Colwell & al 2004.

- Log-normal curve
An indication of the environmental condition may be gained by using geometric classes. For example, species which are represented by one individual in geometric class I, species which are represented by 2 to 3 individuals are in geometric class II, species which are represented by 4 to 7 individuals are in geometric class III and so on. Geometric classes are plotted against number of species for each Site. Good environmental conditions are indicated when there are many species with few individuals and few species with many individuals. Impoverished environmental conditions are indicated by the presence of only a few species with very many individuals. Further information, see Gray & Mirza (1979) and Pearson & al. 1983.

- Multivariate analyses
Multivariate analyses were undertaken to compare the actual species composition at the sites. Two different types of multivariate analyses where executed, a classification (cluster analysis) and an ordination (non-metric multidimensional scaling). The species abundance data were double square root transformed prior to analysis to reduce the effect of the most abundant species and to include more of the rare species. The calculation was performed by the program PRIMER from Plymouth Marine Laboratory in England.

• **Cluster analysis**

The cluster analysis is a hierarchical agglomerative clustering of Sites with the most similar species composition grouped together first at a high similarity level and then grouping the other Sites at lower and lower similarity levels together, until all Sites are grouped in a single cluster. The comparisons of the fauna at each Site were based on Bray-Curtis similarity index (BRAY & CURTIS 1957), while the linking of the groups is based on group average sorting of the similarity indices. The final result is presented as a dendrogram.

Bray-Curtis similarity measure: $S_{jk} = 100\left\{1 - \frac{\sum_{i=1}^{p} |y_{ij} - y_{ik}|}{\sum_{i=1}^{p} (y_{ij} + y_{ik})}\right\}$

where:
S_{jk} = similarity between two sample, j and k
Y_{ij} = number of species i in sample j
Y_{ik} = number of species i in sample k

• **Ordination procedure (MDS)**

The non-metric multidimensional scaling (MDS) again groups the Sites with the most similar fauna. This analysis presents the results such that the distance between the Sites on the plot should reflect the similarity in fauna. Thus the MDS can be used to support the cluster analysis results. More importantly the MDS reveals any existing continuum or gradient in the sampled fauna. The MDS analysis is based on the same similarity matrix as the cluster analysis and the calculation was performed by the PRIMER program.

The goodness of fit are expressed as

$$\text{Stress} = \sum_j \sum_k (d_{jk} - \hat{d}_{jk})^2 / \sum_j \sum_k d_{jk}^2$$

where: $\hat{d}_{jk}$ = the distance predicted from the fitted regression line corresponding to dissimilarity d_{jk}

$d_{jk} = 100\left\{\frac{\sum_{i=1}^{p} |y_{ij} - y_{ik}|}{\sum_{i=1}^{p} (y_{ij} + y_{ik})}\right\}$ and distance (d).

2.3.8 Linking biota to multivariate environmental patterns

A BIO-ENV procedure is used for matching biotic to environmental patterns (all combinations of the environmental variables pelite, sand, median Φ, TOM, Cu, Ba, Zn, Cd, Cr, Pb and THC). A weighted Spearman rank correlation was used in the analysis. Chemical variable were log(x+1) transformed prior to analysis. The calculation was performed by the program PRIMER from Plymouth Marine Laboratory in England.

2.3.9 Estimation of influenced area

The estimated area of contaminated sediments and disturbed fauna is based on the calculation of an asymmetric ellipse. The distance to contaminated/disturbed sites was used in the calculation of influenced sites. The radius varies from field to field and between transects within a field.

2.3.10 Quality control

Only samples where the grab was completely closed, and with open space between the sediment surface and the lid should be accepted. In this way only complete and undisturbed sediment samples would be collected for further processing. This was not achieved due to too heavy grab.

Eurofins Analyse Ltd. is an accredited chemistry laboratory and performed the chemical analysis in accordance with the criteria of Norwegian Accreditation under accreditation-number Test043. UNI Research, SAM-marin is accreditated by Norwegian Accreditation for sampling and taxonomical analyses, professional assessment and interpretations under accreditation-number Test157. Biological samples from Lomba and Cabinda were sorted and species identified in accordance with the criteria of the Norwegian Accreditation. Analyses of geological samples were not performed accreditated. The Palanca samples sorted by INIP are done none accredited.

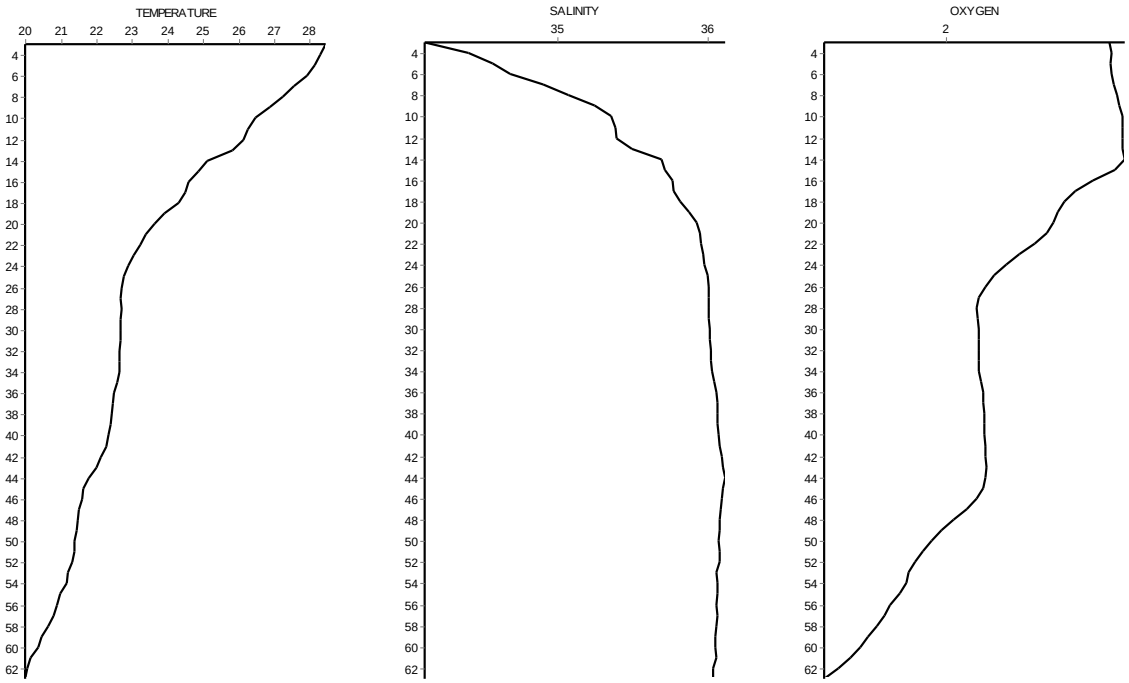
Biological and geological samples were also subject to quality control according to Uni Research AS`s internal routines. Any deviations from the sampling procedures were noted in the sampling journal.

2.3.11 Storage of samples

Biological samples are stored at the Zoological Museum in Bergen, but selected specimens of high quality are included in the reference collection kept at UNI Research AS in Bergen.

3. OCEANOGRAPHIC CONDITIONS

Sta 461 (TK-K-2)



Sta 464 (LB1)

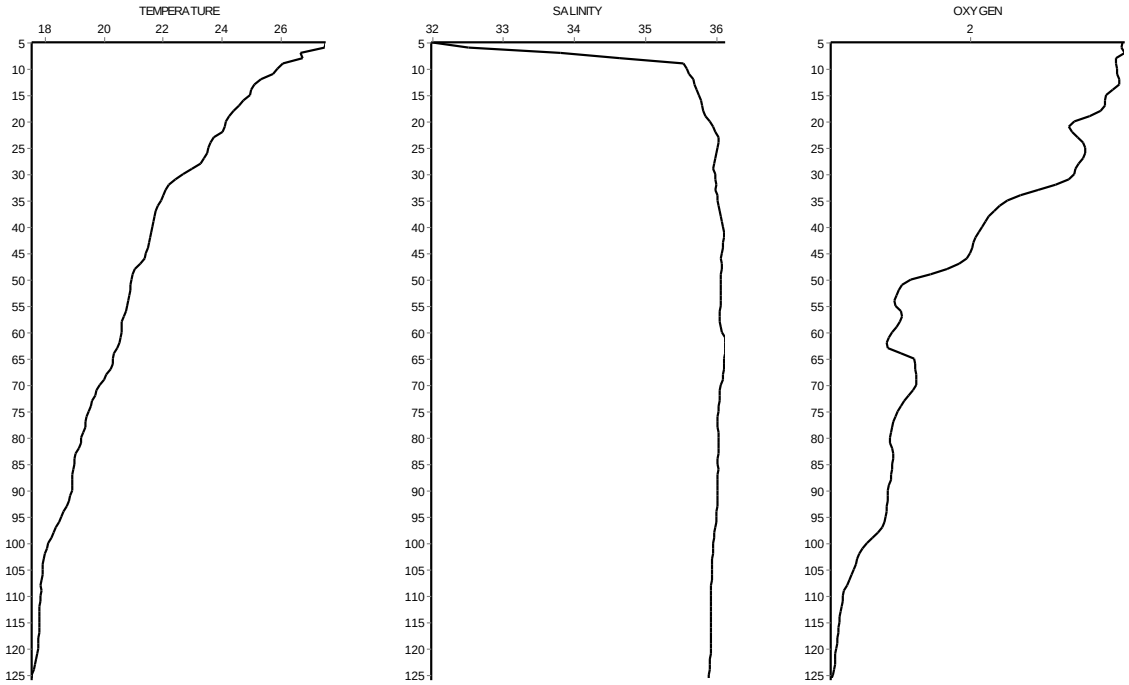
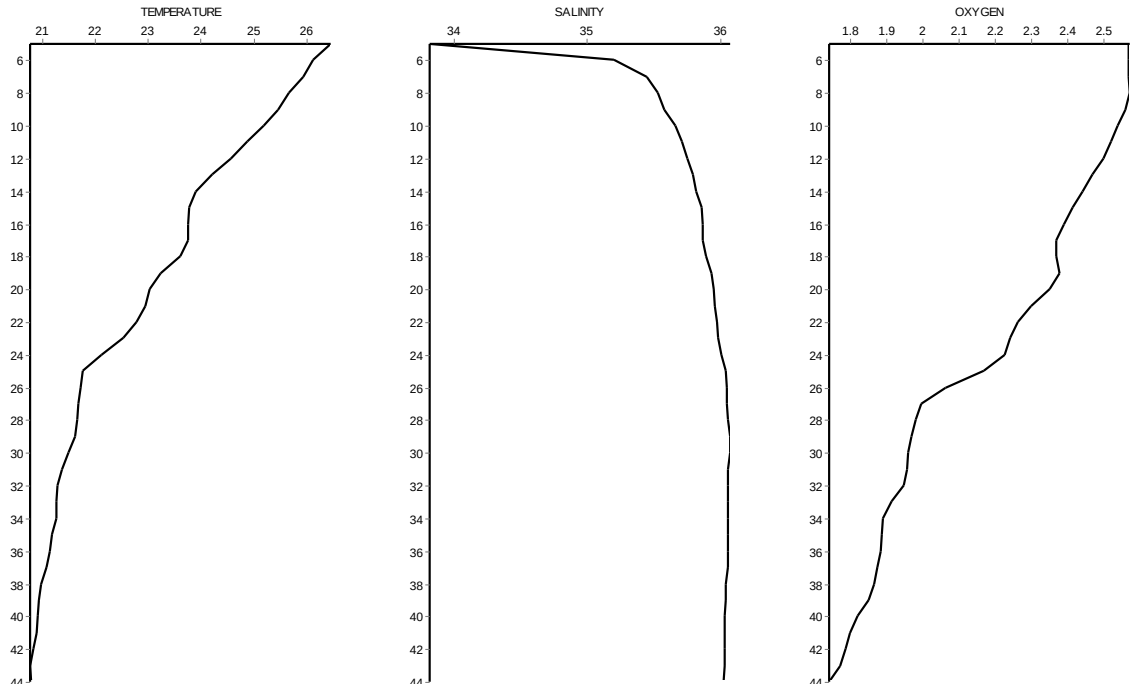


Figure 3.1. Vertical sections of temperature (°C), salinity (‰) and oxygen (ml/l) at some sampling sites.

Sta 468 (MF-N-R)



Sta 470 (GS-D)

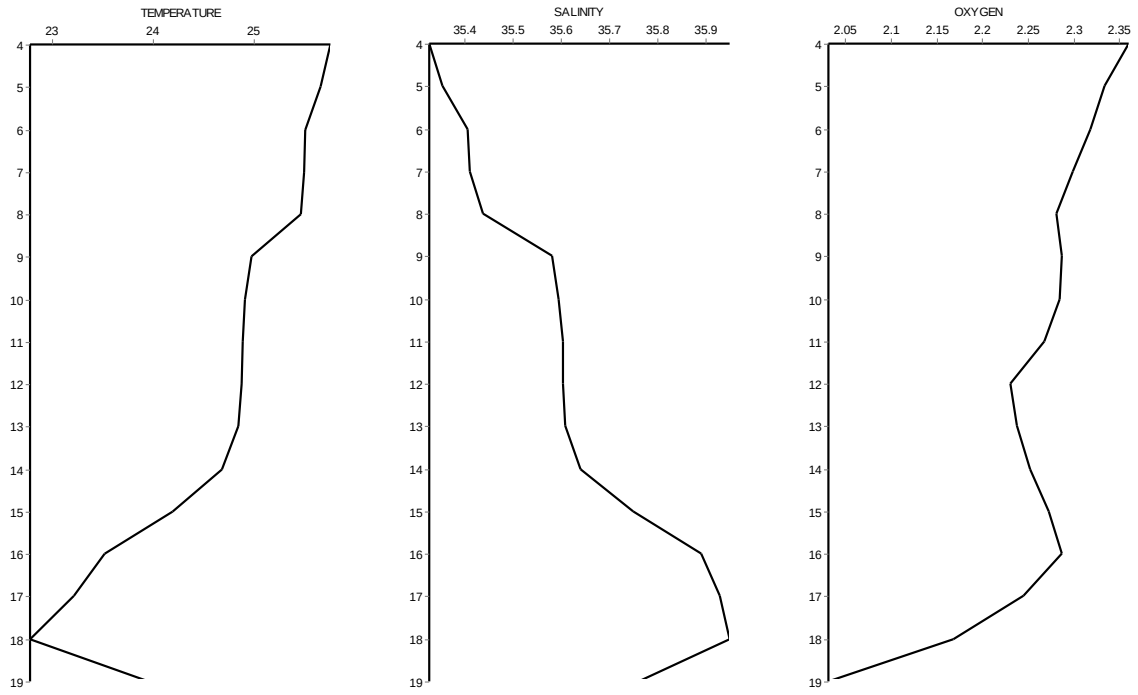
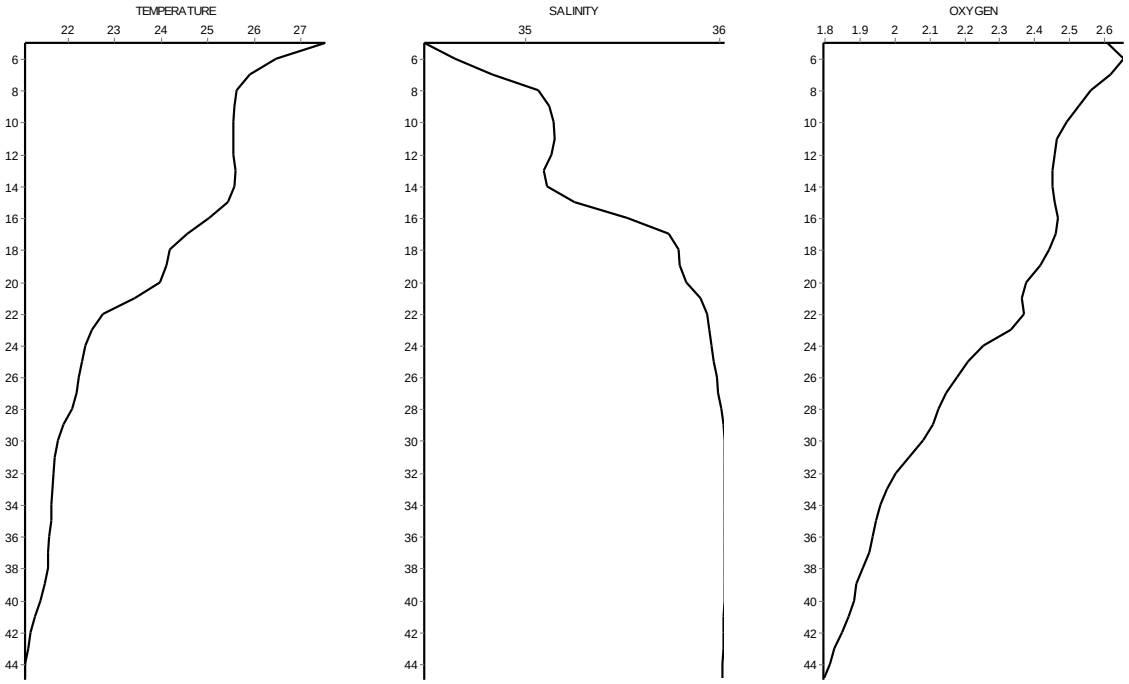


Figure 3.1 continue. Vertical sections of temperature (°C), salinity (‰) and oxygen (ml/l) at some sampling sites.

Sta 473 (PAL3)



Sta 474 (PAL-8)

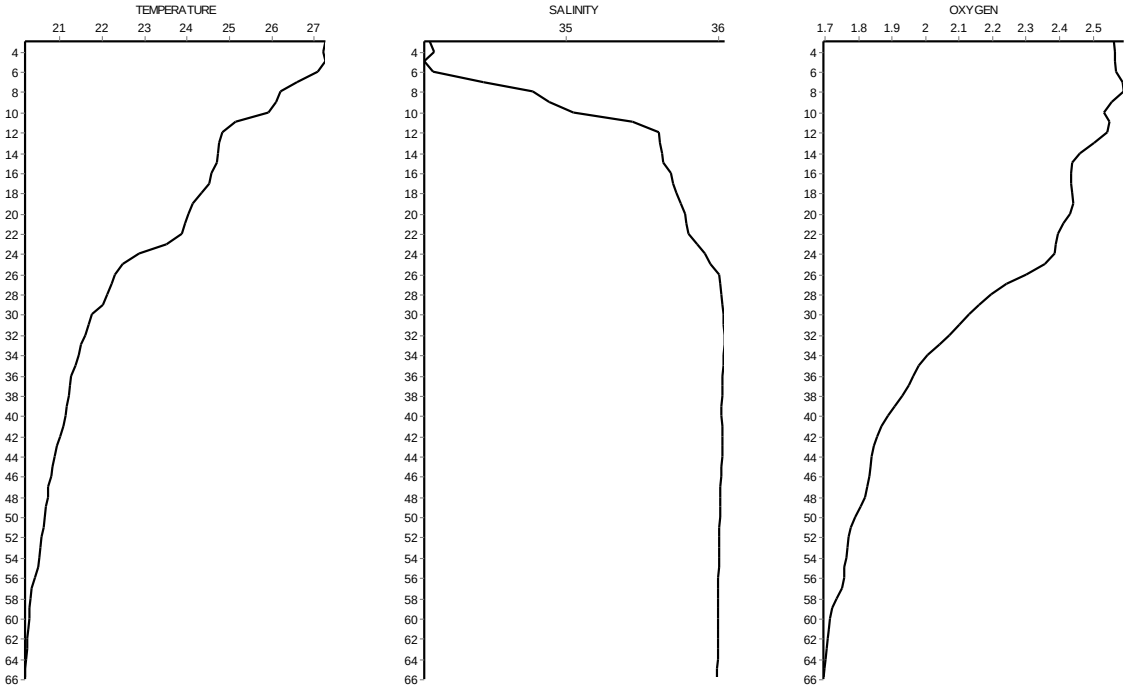


Figure 3.1 continue. Vertical sections of temperature (°C), salinity (‰) and oxygen (ml/l) at some sampling sites.

4. SEABED MAPPING

Seabed mapping was performed in two areas, one in a relative flat area in Cabinda and one in the Congo river canyon. A map of the canyon is presented in Figure 4.1. Red color are approximately 50-100 m depth, dark blue are around 1000 m depth.

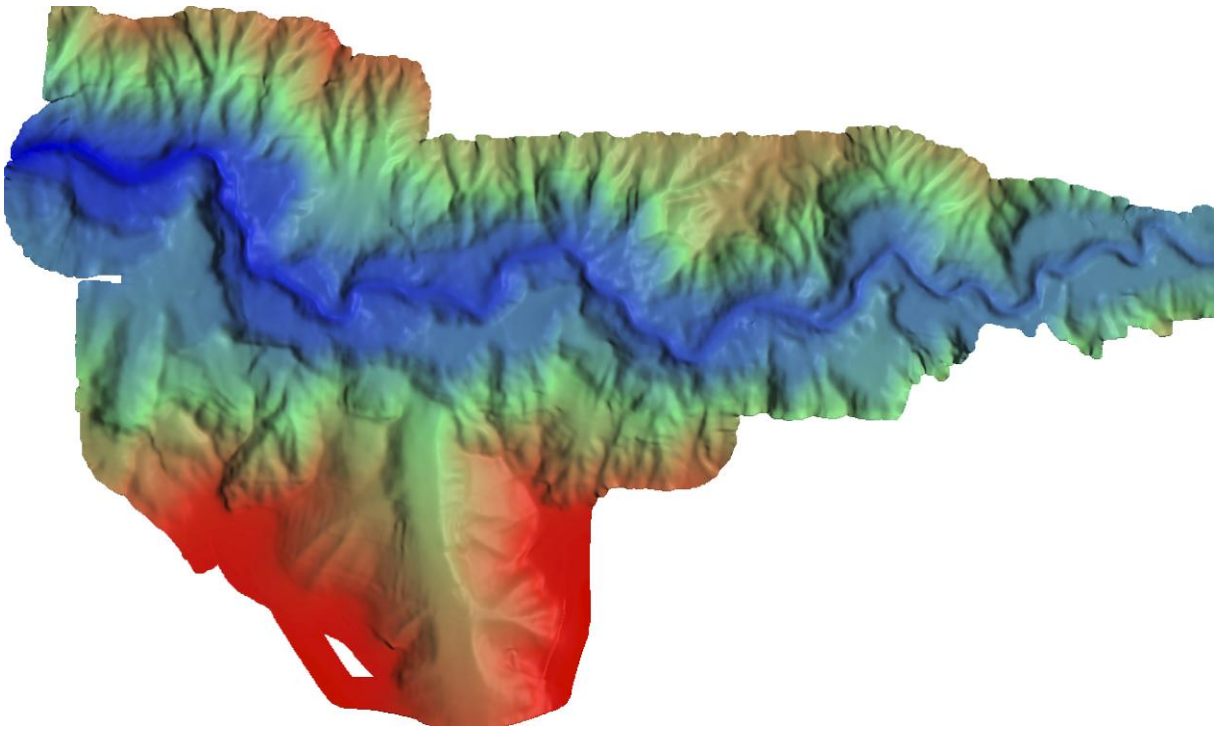


Figure 4.1. Seabed map of a part of the Congo River canyon.

5. ENVIRONMENTAL CONDITION – LOMBA

5.1. Introduction

The Lomba field is situated in block 0. The platform was installed in 1998 and is located 64 km off the coast. Recent discharges at Lomba are not reported.

Lomba was investigated last time in 2006, and the plan was to repeat the sampling performed in 2006. There was a deviation in planned and real sampling at Lomba. For security reason the sampling south (upstream) from the platform was not performed. The site LB4 was replaced by LB 4a to avoid crossing the border to Congo. Sampling sites are shown in Figure 5.1.

Table 5.1. Recent well drilling and discharges from operations and accidents at Lomba.

No. of wells drilled Barite Cuttings Water-based drilling mud Cementing chemicals Completion chemicals Accidental discharges Etc	Not reported

Picture 5.1. The Lomba platform.

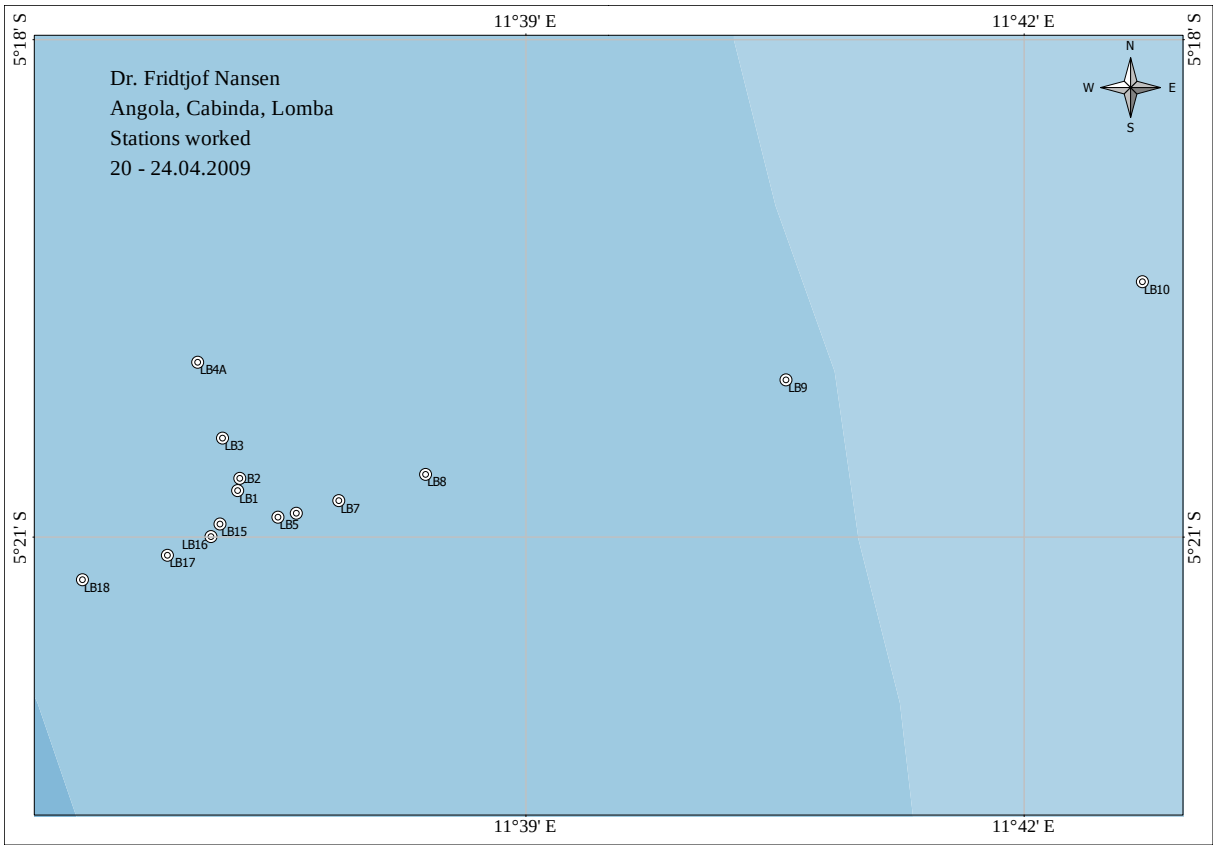


Figure 5.1. Map showing the internal distribution of sampling sites (circles) at Lomba in 2009. Positioning of Lomba according to WGS 84 (see Table 2.2). Site LB9 and LB10 are reference sites.

5.2. Results and discussion

5.2.1 Sediments characteristics

Total organic matter (TOM), and the amount (%) of gravel, sand, pelite and median (Φ) in the sediment are presented in Table 5.2 and Figure 5.2. Additional information on grain size parameters is presented in the Appendix, and information on color and odor can be found in the sampling journal in the Appendix.

The bottom in the investigated area at Lomba was dominated by very fine grained sediment. The median (Φ) values ranged from 5.2 to 8.4, the amount of pelite varied from 58 to 93 % and the sand content varied from 7 to 42 %. The reference sites LB10 had the highest amount of pelite.

The content of total organic matter (TOM) varied from 8.7 to 12.4 %.

Table 5.2. Total organic matter and sediment grain size at all sites at Lomba. Pelite is particles < 0,063 mm, sand from 0,063 to 2 mm.

	TOM %	Pelite %	Sand %	Gravel %	Median (Φ)
LB 1	10.52	69.4	30.6	0.01	7.2
LB 2	11.15	66.0	34.0	0.00	6.2
LB 3	12.38	90.6	9.3	0.13	8.4
LB 4a	11.58	71.8	28.2	0.00	7.5
LB 5	11.94	75.6	24.4	0.00	8.1
LB 6	11.79	81.7	18.3	0.04	8.3
LB 7	12.09	75.1	24.9	0.00	7.6
LB 8	12.42	81.6	18.4	0.01	7.4
LB 9	10.37	71.3	28.6	0.14	7.6
LB 10	11.89	92.8	7.2	0.00	8.4
LB 15	10.16	70.8	29.2	0.00	6.9
LB 16	11.28	77.2	22.8	0.02	7.8
LB 17	9.22	57.7	42.3	0.01	5.2
LB 18	8.65	66.7	33.3	0.00	6.9

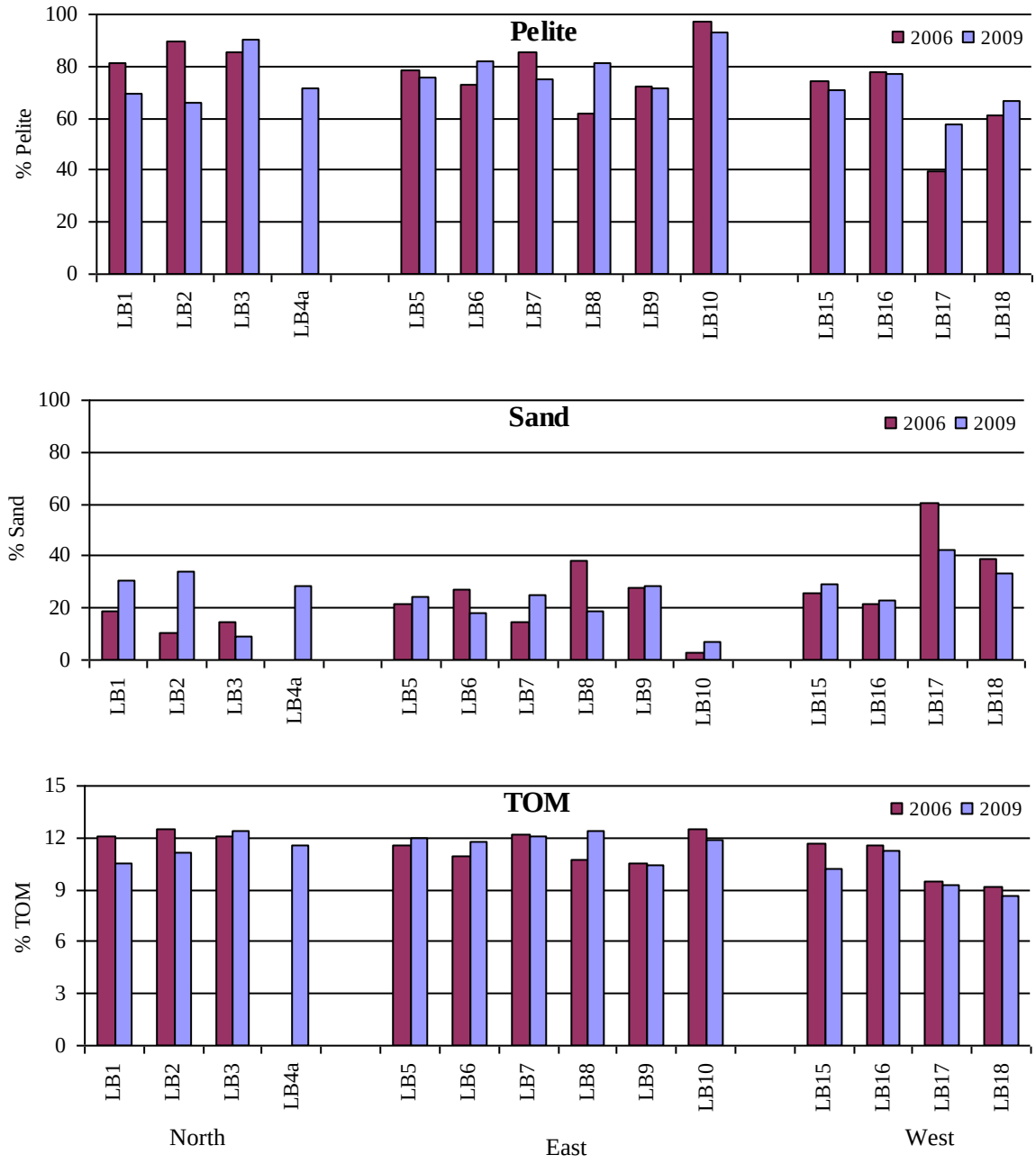


Figure 5.2. Sediment characteristics at Lomba. The sampling sites are organized by transects.

5.2.2 Chemical compounds

5.2.2.1 LSC

The results of the LSC (limits of significant contamination) calculations of hydrocarbons and metals are presented in Table 5.3.

Table 5.3. Limits of Significant Contamination (LSC) for the Lomba field based on data from LB9 and LB10 in 2006 and 2009. All values in mg/kg dry sediment.

		THC	NPD's	PAH_{16}	Ba	Pb	Cd	Cu	Cr	Hg	Zn
$LSC_{LB9,LB10}$	2009	10.5	0.02	0.01	623	19	0.082	15	58	0.069	88
$LSC_{LB9,LB10}$	2006 and 2009	28.5	0.06	0.05	409	38	0.086	28	115	0.069	164

5.2.2.2 Hydrocarbons

Summarized results of the hydrocarbon analyses, along with the content of selected hydrocarbon compounds in the different layers in the sediment (0-1, 1-3 and 3-6 cm) are given in Table 5.4 and Table 5.5. The complete data set including replicates is given in the Appendix.

Highest concentration of THC was found at LB1, 350 m north-west and downstream from the platform. Some black spots observed in the sediment at this site support the high level of THC in the sediment. Concentration above the $LSC_{06\text{-}09}$ occurred also at LB3 and LB5. LB 3 is located 1000 m north-west of the platform and LB 5 is 300 m of the platform along the north-east transect. The concentrations were at the same level as in 2006, except at site LB2 and LB15 which show a reduction.

Higher concentration of PAH and NPD was found at LB1 compared to the other sites. The concentrations were lower than analyzed in 2006.

THC content above LSC was found in the vertical samples of the sediments at LB1. The 0-1 and 1-3 cm layer of LB1 contained THC above $LSC_{06\text{-}09}$. Highest concentrations of THC, NPD and PAH were detected in the top layers, which indicate recent supply of hydrocarbon.

Table 5.4 Average concentration and standard deviation of hydrocarbons (mg/kg dw) at Lomba. Values above LSC_{06-09} are dark shaded.

Site	THC		PAH(16)		NPD	
2009	average	stdev.	average	stdev.	average	stdev.
LB1	**139**	79	**0.013**	0.003	**0.031**	0.004
LB2	**24**	2	**0.003**	0.001	**0.013**	0.001
LB3	**29**	0.6	**0.003**	0.001	**0.007**	0.001
LB4a	**13**	0	**0.002**	-	**0.004**	0.001
LB5	**31**	2	**0.006**	0.001	**0.009**	0.003
LB6	**15**	1	**0.004**	0.001	**0.006**	0.001
LB7	**14**	2	**0.004**	0.001	**0.007**	0.002
LB8	**16**	0.6	**0.004**	0.001	**0.007**	0.001
LB9	**7**	0.3	**0.005**	0.000	**0.005**	0.001
LB10	**9**	1	**0.003**	0.000	**0.012**	0.001
LB15	**20**	3	**0.006**	0.001	**0.016**	0.002
LB16	**8**	0.3	**0.005**	0.001	**0.007**	0.001
LB17	**16**	2	**0.002**	0.000	**0.006**	0.001
LB18	**15**	1	**0.003**	0.001	**0.005**	0.001

Table 5.5. The content of total hydrocarbons in vertical sections of sediment from 2 sampling sites at Lomba. All values in mg/kg dry sediment. Values above LSC_{06-09} are dark shaded.

Site	Layer (cm)	THC	NPD	PAH16
LB 1	0-1	230	0,031	0,011
	1-3	31	0,008	0,008
	3-6	13	< 0.001	0,003
LB 2	0-1	23	0,012	0,003
	1-3	24	0,009	0,005
	3-6	18	0,008	0,005

Picture 5.2. In the sediment from LB1 oil was observed.

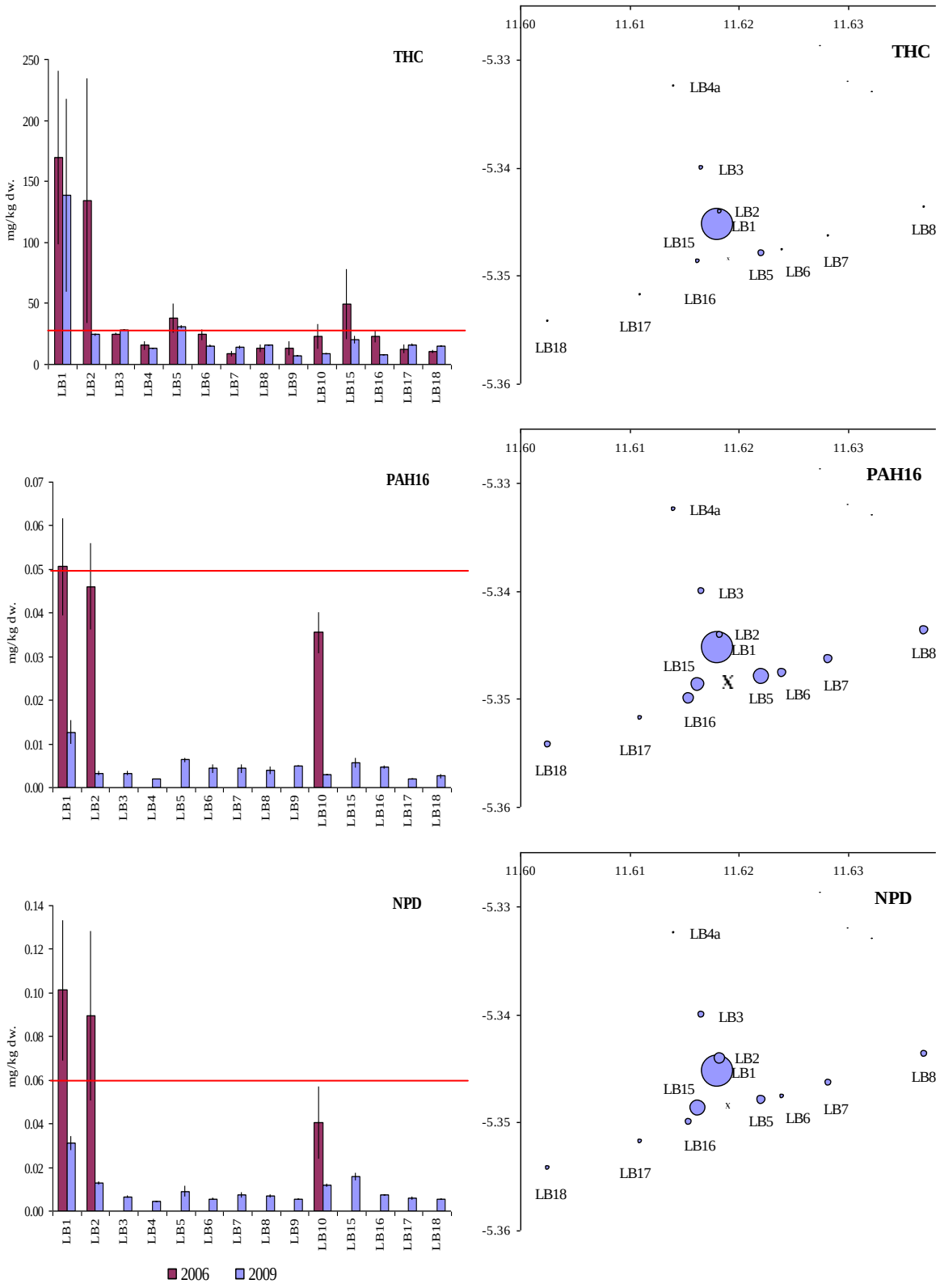


Figure 5.3. Result of the hydrocarbon analysis from Lomba sites in 2009 and 2006. The size of the circle to the right reflect the concentration of hydrocarbons in 2009, at sites within the closest proximity to the centre. Red line is $LSC_{06\text{-}09.}$

5.2.2.3 Metals

Table 5.6 summarizes the results of the metal analyses at Lomba. Concentrations of selected metals in the different layers (0-1, 1-3 and 3-6 cm) of sediment are given in Table 5.7, whereas the complete data set including replicates is given in the Appendix.

Barium was found in a range from 59 ± 7 mg/kg at LB9 to 1226 ± 908 mg/kg at LB1. Sediments from site LB1, LB2, LB5, LB6, LB15 and LB16 had barium content above $LSC_{06\text{-}09}$. The barium content shows a gradient with decreasing content of barium with increasing distance from the platform at all transects. The site LB1, LB5 and LB15 which are closest to the platform had the highest concentration. Variation among the parallels indicates patchy distribution of barium.

All the other metals were lower than the $LSC_{06\text{-}09}$ value, and had even distribution among the sites.

Vertical sediment samples (0-1, 1-3 and 3-6 cm) from LB1 and LB2 had barium content above $LSC_{06\text{-}09}$ from 0-6 cm depth interval. LB2 had lead, copper, chromium and zinc above $LSC_{06\text{-}09}$ at 1-6 cm and mercury at 1-3 cm depth interval.

Table 5.6 Average concentration and standard deviation of metal (mg/kg dw) at Lomba in 2009. Values above LSC_{06-09} are dark shaded

Site	Ba		Pb		Cd		Cu	
	average	stdev.	average	stdev.	average	stdev.	average	stdev.
LB1	**1226**	908	**12.7**	1.0	**0.048**	0.003	**10.4**	1.8
LB2	**498**	305	**14.0**	1.2	**0.049**	0.007	**8.5**	2.9
LB3	**191**	81	**11.6**	1.1	**0.050**	0.003	**11.2**	1.0
LB4	**130**	21	**11.1**	0.6	**0.050**	0.005	**9.3**	0.3
LB5	**1450**	202	**14.8**	0.9	**0.066**	0.018	**12.6**	0.9
LB6	**503**	124	**13.3**	0.3	**0.069**	0.011	**11.2**	1.2
LB7	**126**	47	**14.8**	1.7	**0.075**	0.008	**9.0**	3.0
LB8	**122**	83	**16.7**	1.7	**0.062**	0.005	**10.6**	2.4
LB9	**59**	7	**16.0**	1.3	**0.068**	0.011	**11.3**	1.6
LB10	**226**	318	**14.0**	2.0	**0.061**	0.004	**10.9**	2.0
LB15	**665**	197	**13.3**	0.5	**0.063**	0.003	**9.5**	2.4
LB16	**553**	180	**13.2**	1.6	**0.049**	0.008	**12.0**	0.9
LB17	**167**	56	**18.2**	2.0	**0.041**	0.008	**6.1**	2.6
LB18	**118**	16	**18.0**	1.0	**0.058**	0.003	**6.2**	0.4

Site	Cr		Hg		Zn	
	average	stdev.	average	stdev.	average	stdev.
LB1	**41.7**	1.5	**0.066**	0.017	**68.0**	6.5
LB2	**49.7**	3.5	**0.050**	0.009	**86.5**	15.1
LB3	**41.7**	1.8	**0.054**	0.003	**60.4**	2.8
LB4	**43.3**	2.4	**0.049**	0.001	**67.8**	6.9
LB5	**43.1**	0.1	**0.057**	0.002	**68.7**	4.1
LB6	**43.1**	3.8	**0.054**	0.005	**64.6**	12.2
LB7	**49.6**	5.8	**0.051**	0.010	**76.4**	15.2
LB8	**50.2**	5.0	**0.054**	0.009	**72.6**	12.5
LB9	**48.8**	4.1	**0.058**	0.006	**65.4**	13.3
LB10	**48.1**	5.3	**0.055**	0.007	**64.4**	10.2
LB15	**50.2**	1.9	**0.050**	0.011	**73.3**	8.5
LB16	**47.4**	7.1	**0.059**	0.004	**61.0**	13.2
LB17	**60.5**	8.3	**0.038**	0.007	**86.3**	10.9
LB18	**53.7**	2.4	**0.040**	0.003	**84.7**	4.3

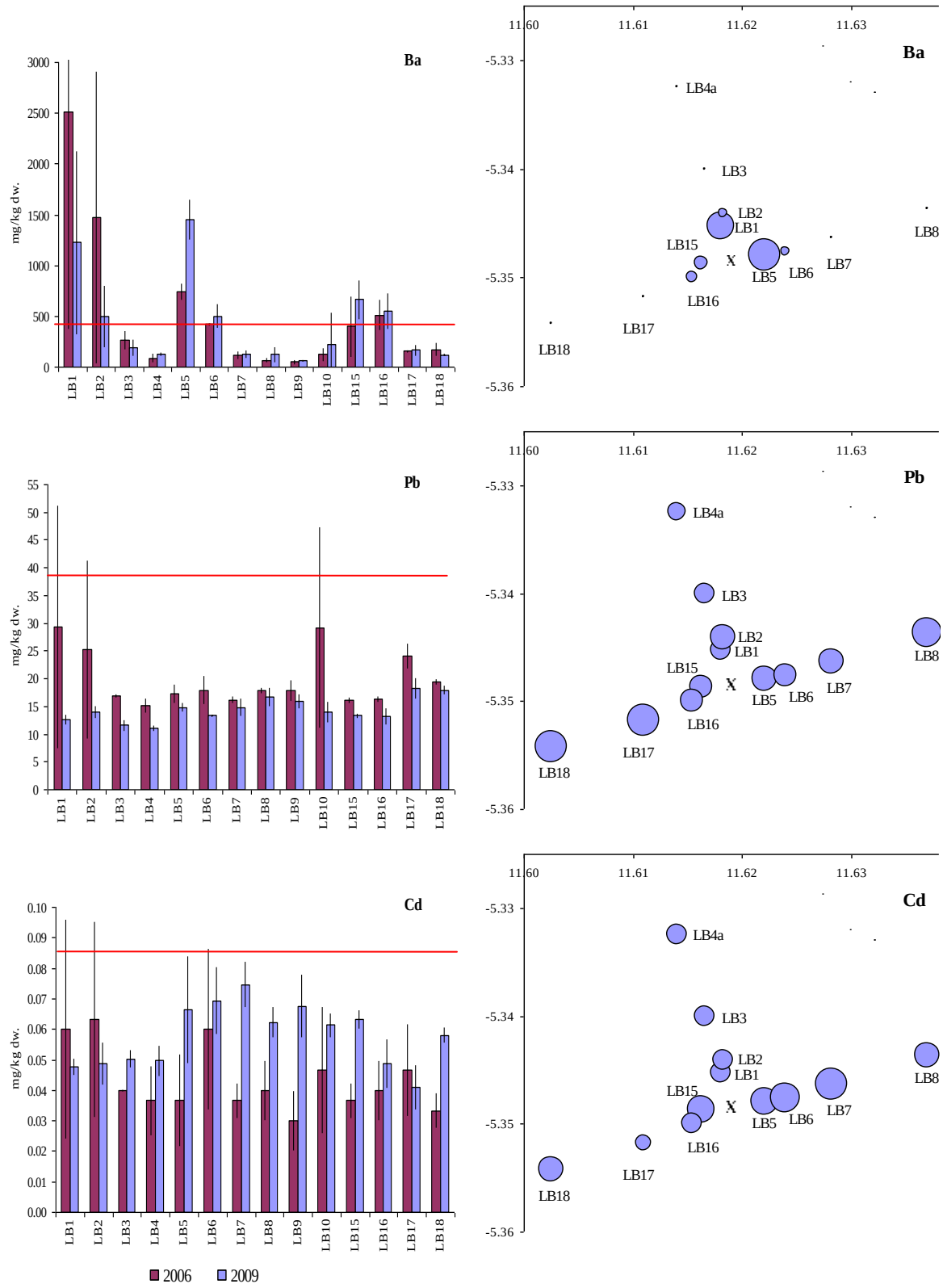


Figure 5.4. Result of the metal analysis from Lomba sites in 2009 and 2006. The size of the circle to the right reflect the concentration of metals in 2009, at sites within the closest proximity to the centre. Red line is $LSC_{06\text{-}09}$.

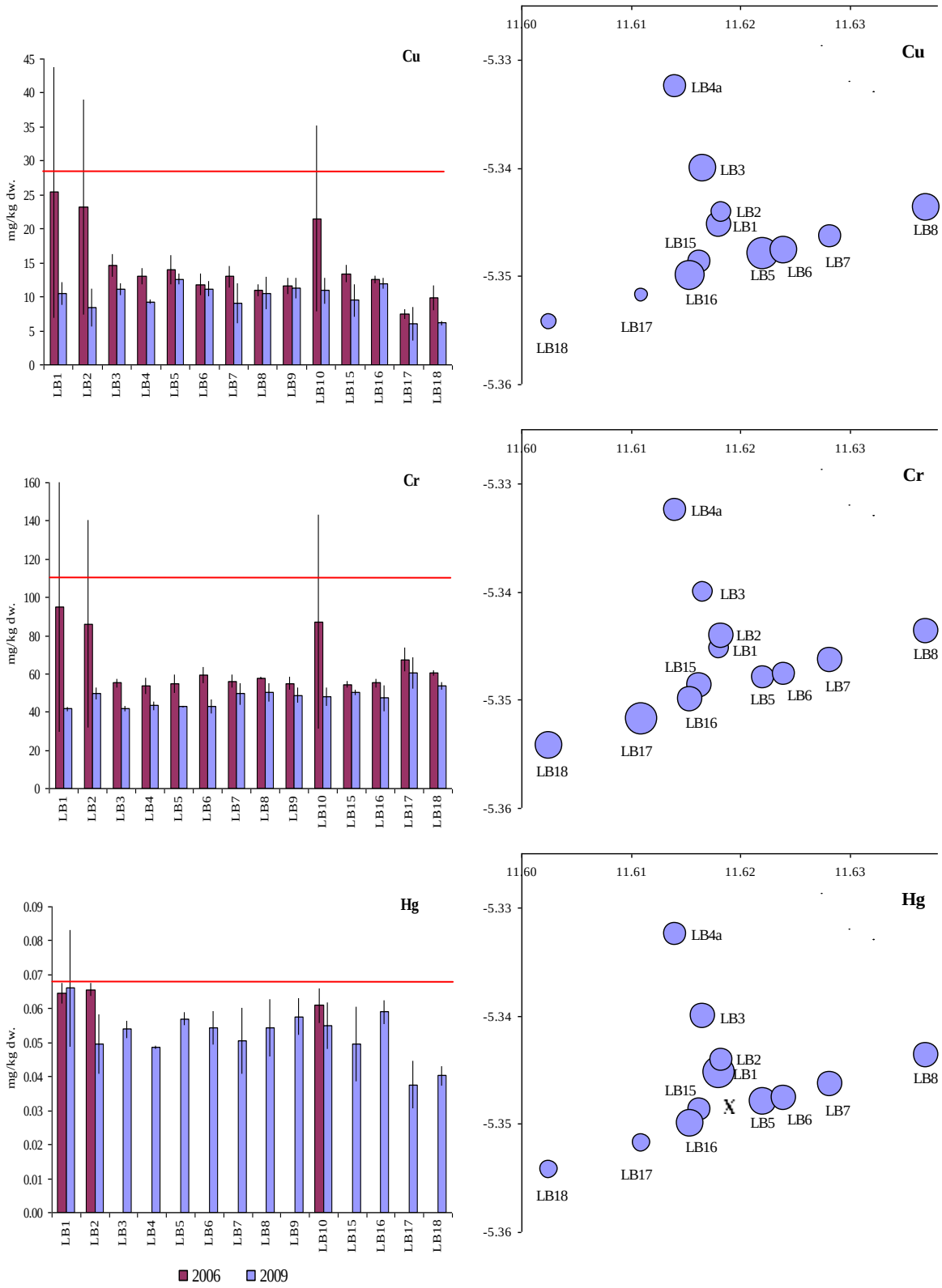


Figure 5.4 continue. Result of the metal analysis from Lomba sites in 2009 and 2006. The size of the circle to the right reflect the concentration of metals in 2009, at sites within the closest proximity to the centre. Red line is $LSC_{06\text{-}09}$.

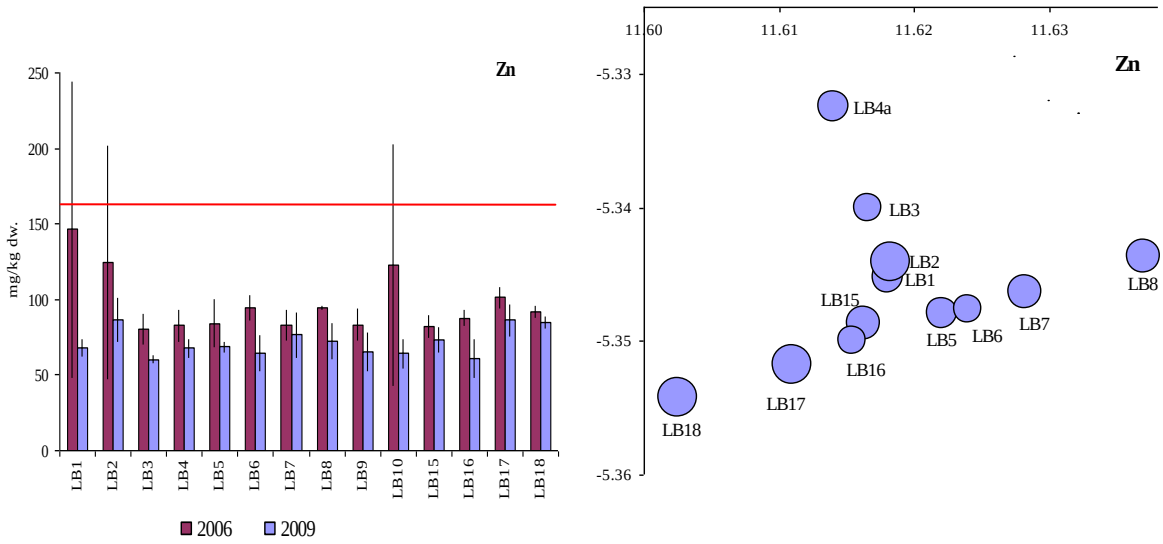


Figure 5.4 continue. Result of the metal analysis from Lomba sites in 2009 and 2006. The size of the circle to the right reflect the concentration of metals in 2009, at sites within the closest proximity to the centre. Red line is $LSC_{06\text{-}09}$.

Table 5.7. The content of metals in vertical sections of sediment from 2 sampling sites at Lomba. All values in mg/kg dry sediment. Values above $LSC_{06\text{-}09}$ are dark shaded.

Site	Layer	Ba	Pb	Cd	Cu	Cr	Hg	Zn
LB1	0-1 cm	199	11,5	0,046	9,0	42,8	0,054	71,1
	1-3 cm	159	12,2	0,052	9,7	48,7	0,054	79,6
	3-6 cm	1240	14,6	0,053	11,5	47,1	0,072	78,1
LB2	0-1 cm	224	15,1	0,042	6,7	53,5	0,044	98,9
	1-3 cm	321	13,4	0,059	7,1	46,8	0,044	81,7
	3-6 cm	678	15,1	0,056	6,2	50,6	0,040	97,3

5.2.3 Bottom fauna

A summary of number of individuals and taxa within the main taxonomic groups is presented in Table 5.8. A complete species list is available in Appendix. At the Lomba field, Annelida were the most abundant group, both regarding number of individuals (61 %) and number of species (45 %). Mollusks were also numerous, with 23 % of all individuals and 36 % of all taxa.

The distribution of individuals and taxa, diversity and evenness is presented in Table 5.9 and Figure 5.5. LB9 contained the largest number of individuals (78), while the lowest number was found at LB3 (31). LB3 was also the site with the lowest number of taxa (14), while LB7 contained the highest number (33). The greatest diversity was found at LB7 and LB9 (4.59), while the lowest diversity was found at LB1 (3.49). Figure 5.6. presents the horizontal distribution of individuals and species.

Generally, the number of individuals had increased since the sampling in 2006, while the number of species was more or less at the same level (Figure 5.5). The exception was an increase in number of species at LB2 and LB9 and a decrease at LB3. There were only minor changes of diversity between the two years.

Distribution of taxa in geometrical classes is presented in Figure 5.7. At most sites, the graph began higher in 2006 than 2009, indicating a decrease in number of species with few individuals. Apart from this, the curves are similar between the sites and indicate good environmental conditions.

The ten most abundant species/groups for each site are presented in Table 5.10. Polychaets were most frequently presented among the top ten species or groups, but other taxa were also represented. No species were numerous enough to dominate a site.

Results of the multivariate analyses are given in dendrogram and MDS plots (Figure 5.8 and 5.9.). In 2009, all sampling sites were linked together with 35.2 % similarity. No clear pattern was detected, indicating even and good conditions. When comparing results from 2006 with 2009, the two sampling years clearly divide, and have merely 9.3 % similarity. The comparison also reveals a greater similarity within the field in 2009 compared to 2006. Results from the MDS analysis support the findings in the dendrogram.

The correlation between distribution of bottom fauna and the chemical and geological data was tested with a RDA-analysis, in the program Canoco. A pre-treatment indicated a linear distribution of the data and a RDA analysis with Monte Carlo forward selection was therefore utilized. The results indicated that concentration of barium had the greatest impact on the composition of bottom fauna (p=0,03) (Figure 5.10).

Allthough concentrations of barium affected the distribution of bottom fauna, no clear patterns of disturbance were detected at the Lomba field.

Table 5.8. Distribution of individuals and taxa within the main taxonomic groups at the Lomba field.

Large taxonomic groups	Number of individuals	%	Number of taxa	%
Annelida	380	61	44	45
Arthropoda	86	14	9	9
Mollusca	144	23	36	37
Echinodermata	5	1	3	3
Various groups	9	1	6	6
Total	624	100	98	100

Table 5.9. Number of individuals, taxa and selected community indices for each site at the Lomba field. Maximum and minimum values are presented in bold numbers.

Site	Number of individuals	Number of taxa	Diversity H'	Evenness J
LB1	36	17	**3.49**	**0.85**
LB2	36	19	3.91	0.92
LB3	**31**	**14**	3.55	0.93
LB4	38	22	4.20	0.94
LB5	43	20	3.77	0.87
LB6	33	19	4.04	**0.95**
LB7	66	**33**	**4.59**	0.91
LB8	39	20	3.99	0.92
LB9	**78**	32	**4.59**	0.92
LB10	50	23	4.21	0.93
LB15	38	22	3.98	0.89
LB16	61	29	4.53	0.93
LB17	75	27	4.03	**0.85**
Average	48	23	4.07	0.91
Min	31	14	3.49	0.85
Max	78	33	4.59	0.95

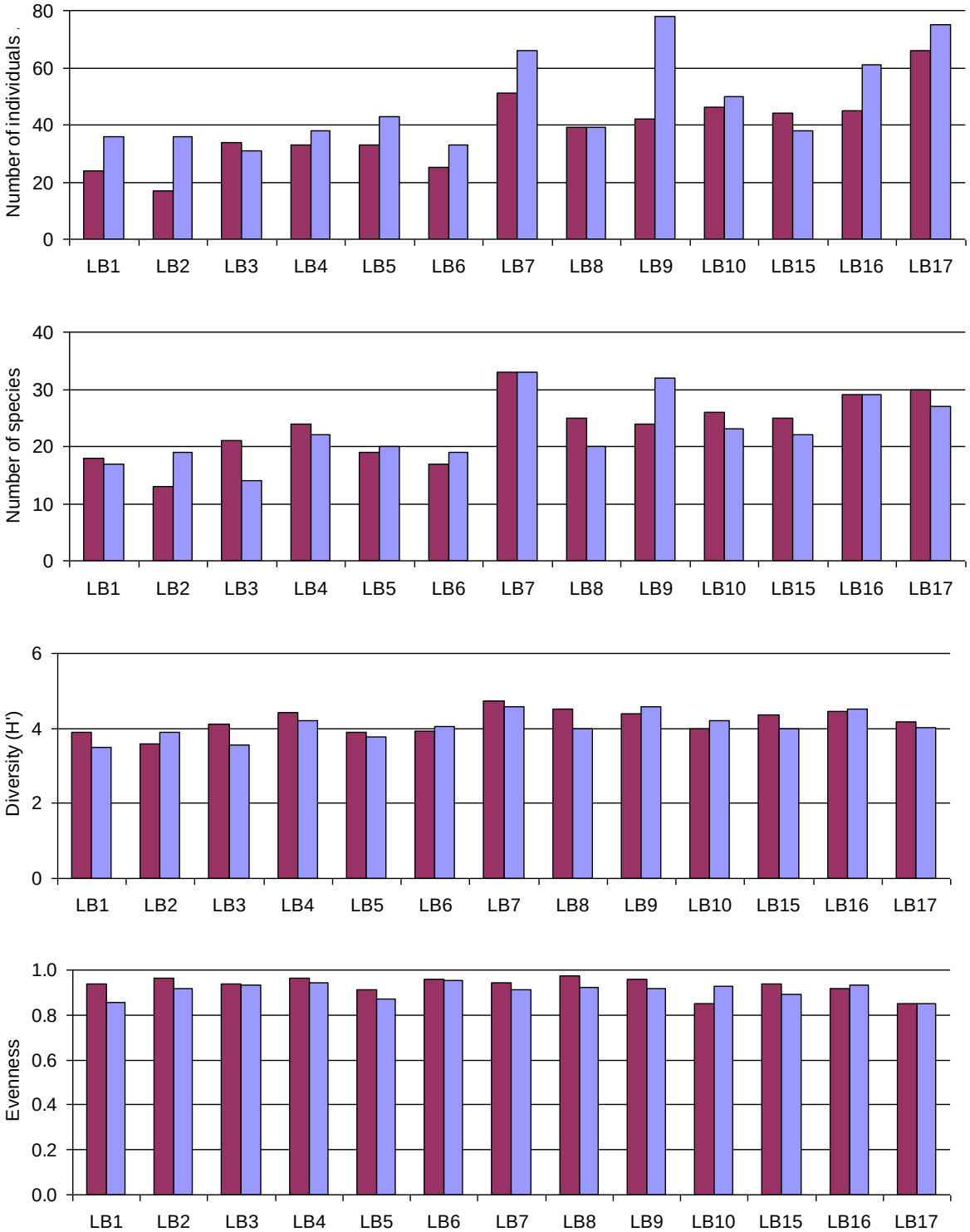


Figure 5.5 Number of individuals and species, diversity and evenness are presented as bars for each site.

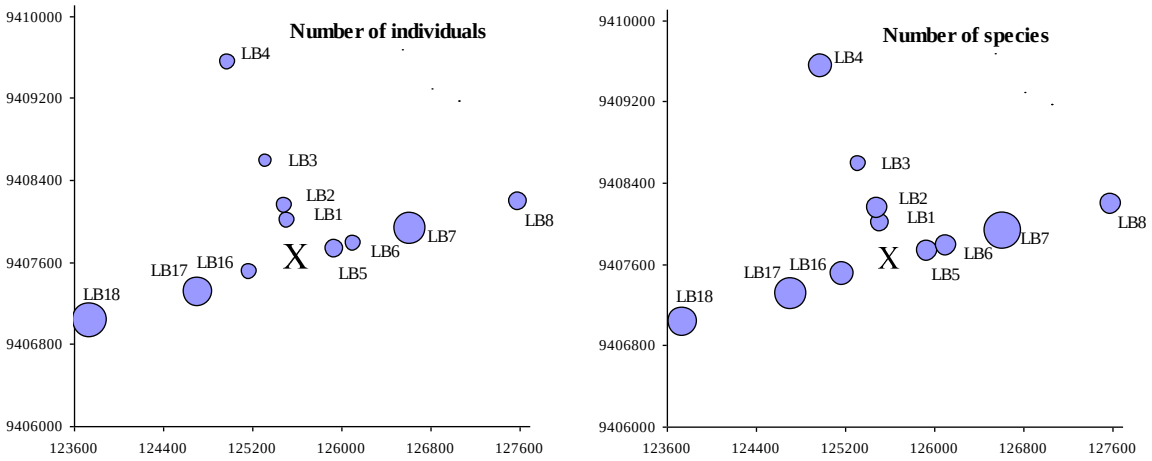


Figure 5.6 In addition the horizontal distribution of individuals and species, at sites within the closest proximity to the platform, are presented. The size of the circle reflects the number of individuals and species.

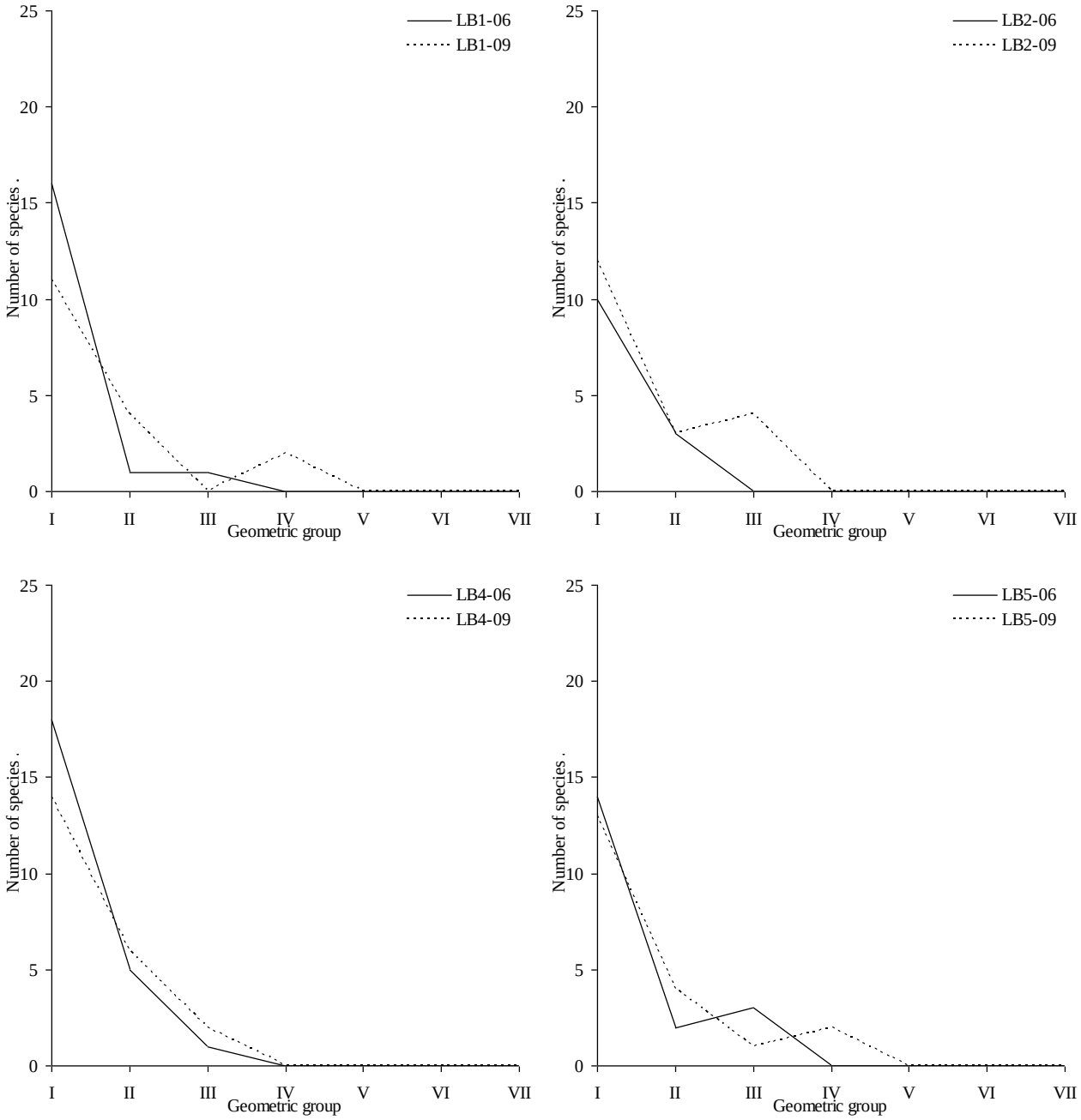


Figure 5.7. Distribution of taxa in geometrical classes for the sites at Lomba.

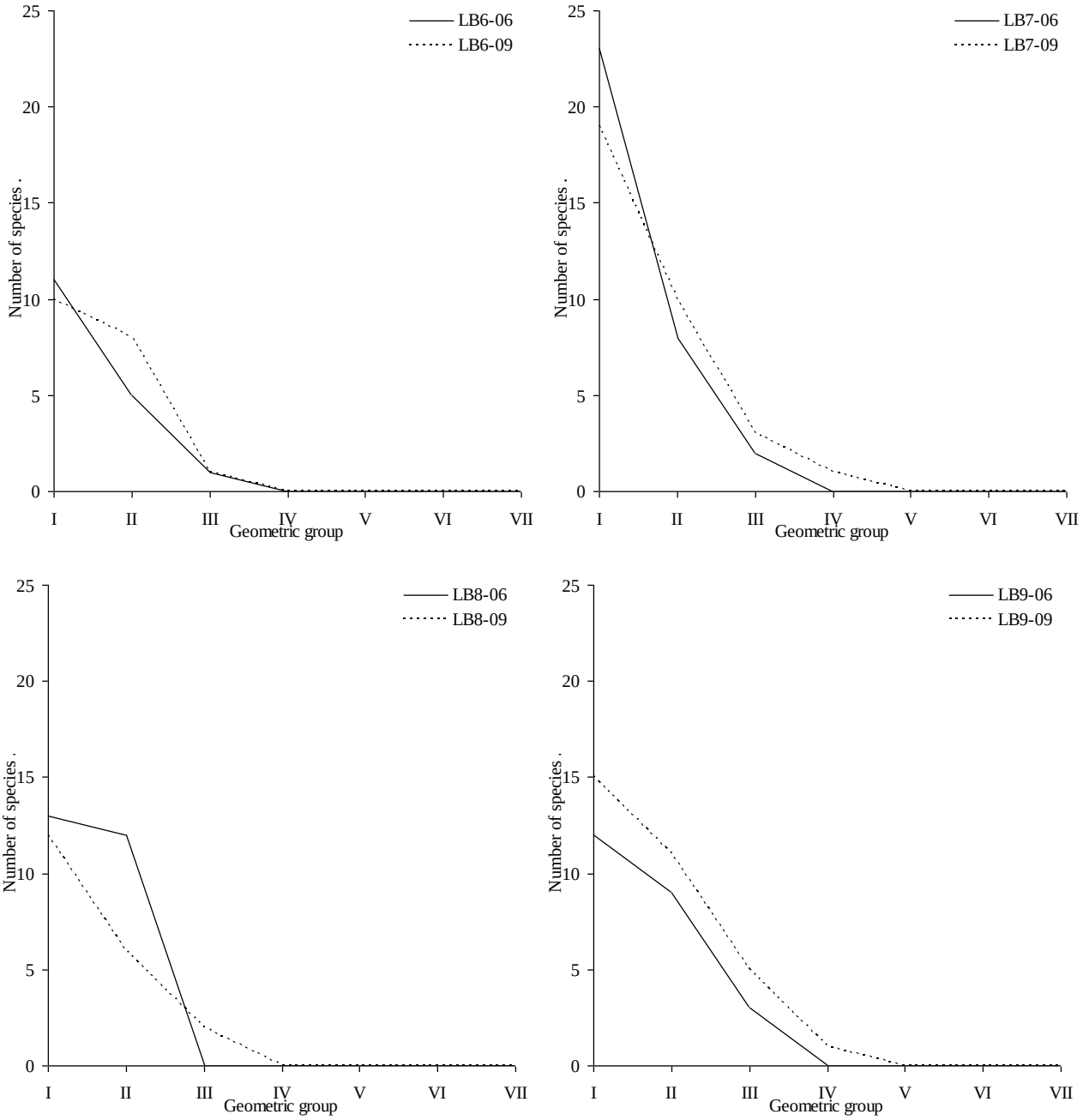


Figure 5.7. continued Distribution of taxa in geometrical classes for the sites at Lomba.

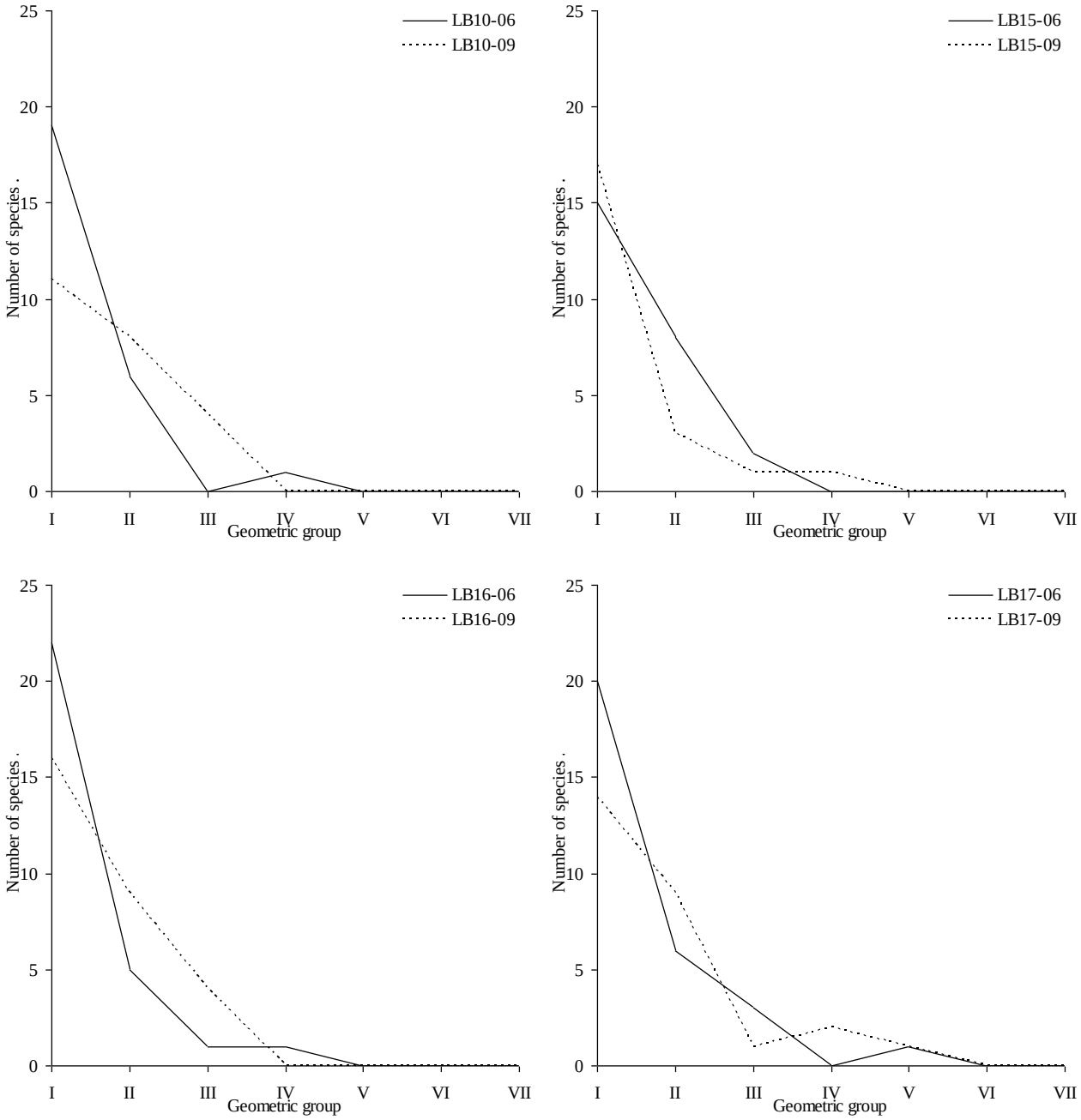


Figure 5.7. continued Distribution of taxa in geometrical classes for the sites at Lomba.

Table 5.10. Number of most numerous individuals and groups sampled at Lomba. Species with only one individual are not presented.

LB1	Number of individuals	%	Cumulative %
Buccinacea indet 1	9	25.0	25.0
Leanira hystricis	8	22.2	47.2
Nephtys sp.	2	5.6	52.8
Lumbrineridae indet.	2	5.6	58.3
Buccinacea indet 2	2	5.6	63.9
Lucinidae indet 1	2	5.6	69.4

LB2	Number of individuals	%	Cumulative %
Leanira hystricis	6	16.7	16.7
Lumbrineridae indet.	4	11.1	27.8
Prionospio sp.	4	11.1	38.9
Decapoda juv indet (larve)	4	11.1	50.0
Polynoidae indet.	2	5.6	55.6
Myrtea spinifera	2	5.6	61.1
Amphiuridae indet.	2	5.6	66.7

LB3	Number of individuals	%	Cumulative %
Leanira hystricis	5	16.1	16.1
Buccinacea indet 1	4	12.9	29.0
Ampharete sp.	4	12.9	41.9
Nephtys sp.	4	12.9	54.8
Lumbrineridae indet.	2	6.5	61.3
Prionospio sp.	2	6.5	67.7
Spiochaetopterus sp.	2	6.5	74.2
Owenia sp	2	6.5	80.6

LB4	Number of individuals	%	Cumulative %
Caridea indet.	5	13.2	13.2
Thyasira sp.1	4	10.5	23.7
Leanira hystricis	3	7.9	31.6
Lumbrineridae indet.	3	7.9	39.5
Prionospio sp.	3	7.9	47.4
Nephtys sp.	2	5.3	52.6
Decapoda juv indet (larve)	2	5.3	57.9
Sternaspis scutata	2	5.3	63.2

LB5	Number of individuals	%	Cumulative %
Buccinacea indet 1	9	20.9	20.9
Leanira hystricis	8	18.6	39.5
Pilargiidae indet. 2	4	9.3	48.8
Cadulus sp. 1	3	7.0	55.8
Decapoda juv indet (larve)	2	4.7	60.5
Myrtea spinifera	2	4.7	65.1
Lophogaster sp	2	4.7	69.8

LB6	Number of individuals	%	Cumulative %
Leanira hystricis	5	15.2	15.2
Buccinacea indet 1	3	9.1	24.2
Ampharete sp.	3	9.1	33.3
Spiochaetopterus sp.	2	6.1	39.4
Polynoidae indet.	2	6.1	45.5
Caridea indet.	2	6.1	51.5
Thyasira sp.1	2	6.1	57.6
Eunicidae indet.	2	6.1	63.6
Cossura sp	2	6.1	69.7

LB7	Number of individuals	%	Cumulative %
Nephtys sp.	11	16.7	16.7
Prionospio sp.	6	9.1	25.8
Leanira hystricis	5	7.6	33.3
Caridea indet. 3	4	6.1	39.4
Pherusa sp.	3	4.5	43.9
Polynoidae indet.	2	3.0	47.0
Decapoda juv indet (larve)	2	3.0	50.0
Amphinomidae indet.	2	3.0	53.0
Lumbrineridae indet.	2	3.0	56.1
Cirratulidae indet.	2	3.0	59.1
Lophogaster sp	2	3.0	62.1
Thyasira sp.	2	3.0	65.2
Heterospionidae indet	2	3.0	68.2
Cylichna sp. I	2	3.0	71.2

LB8	Number of individuals	%	Cumulative %
Leanira hystricis	7	17.9	17.9
Heterospionidae indet	4	10.3	28.2
Nephtys sp.	3	7.7	35.9
Prionospio sp.	3	7.7	43.6
Lophogaster sp	3	7.7	51.3
Caridea indet.	3	7.7	59.0
Polynoidae indet.	2	5.1	64.1
Naticidae indet. 2	2	5.1	69.2

Table 5.10 continued. Number of most numerous individuals and groups sampled at Lomba. Species with only one individual are not presented.

LB9	Number of individuals	%	Cumulative %
Nephtys sp.	10	12.8	12.8
Caridea indet.	7	9.0	21.8
Apseudidae indet	6	7.7	29.5
Leanira hystricis	5	6.4	35.9
Ampharete sp.	5	6.4	42.3
Lophogaster sp	4	5.1	47.4
Prionospio sp.	3	3.8	51.3
Polynoidae indet.	3	3.8	55.1
Buccinacea indet 1	3	3.8	59.0
Pilargiidae indet. 2	3	3.8	62.8

LB10	Number of individuals	%	Cumulative %
Polynoidae indet.	6	12.0	12.0
Leanira hystricis	5	10.0	22.0
Prionospio sp.	5	10.0	32.0
Brachyura indet. 1	5	10.0	42.0
Apseudidae indet	3	6.0	48.0
Lophogaster sp	3	6.0	54.0
Nephtys sp.	2	4.0	58.0
Caridea indet.	2	4.0	62.0
Ampharete sp.	2	4.0	66.0
Terebellides stroemi	2	4.0	70.0
Ampharetidae indet.	2	4.0	74.0
Dentalium sp.	2	4.0	78.0

LB15	Number of individuals	%	Cumulative %
Buccinacea indet 1	9	23.7	23.7
Ampharete sp.	4	10.5	34.2
Lumbrineridae indet.	3	7.9	42.1
Heterospionidae indet	3	7.9	50.0
Thyasira sp.	2	5.3	55.3

LB16	Number of individuals	%	Cumulative %
Prionospio sp.	7	11.5	11.5
Ampharete sp.	5	8.2	19.7
Lumbrineridae indet.	5	8.2	27.9
Buccinacea indet 1	4	6.6	34.4
Leanira hystricis	3	4.9	39.3
Nephtys sp.	3	4.9	44.3
Thyasira sp.1	3	4.9	49.2
Paralacydonia paradoxa	3	4.9	54.1
Ampharetidae indet 3	3	4.9	59.0
Amphinomidae indet. 1	3	4.9	63.9

LB17	Number of individuals	%	Cumulative %
Prionospio sp.	17	22.7	22.7
Lumbrineridae indet.	10	13.3	36.0
Buccinacea indet 1	8	10.7	46.7
Nephtys sp.	5	6.7	53.3
Ampharete sp.	3	4.0	57.3
Terebellides stroemi	3	4.0	61.3
Aphelochaeta sp.	3	4.0	65.3
Thyasira sp.1	2	2.7	68.0
Lucinidae indet 1	2	2.7	70.7
Caridea indet. 3	2	2.7	73.3
Lophogaster sp	2	2.7	76.0
Cossura sp	2	2.7	78.7
Pista sp.	2	2.7	81.3

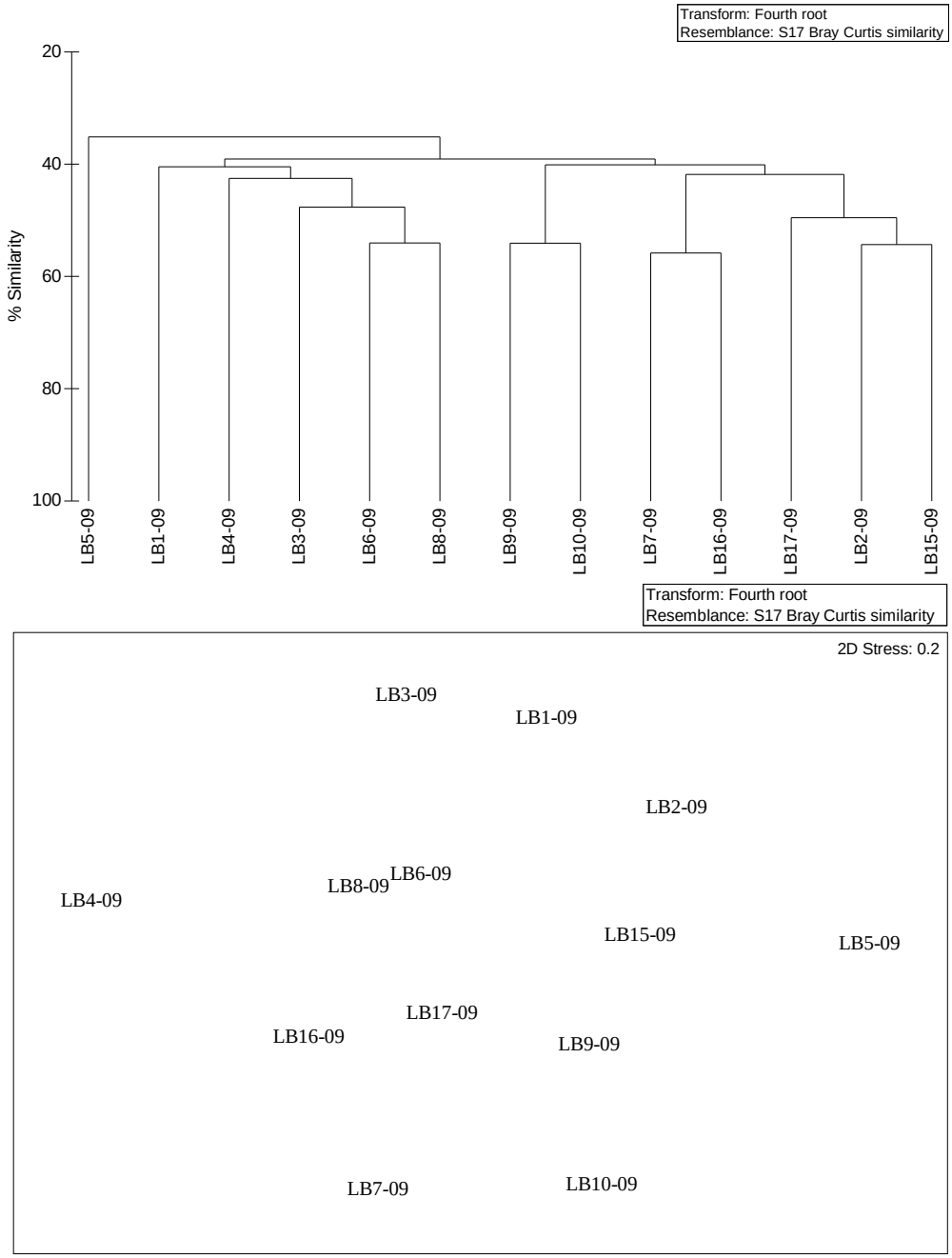


Figure 5.8. Dendrogram and MDS showing the similarity between fauna from sampling sites at Lomba in 2009.

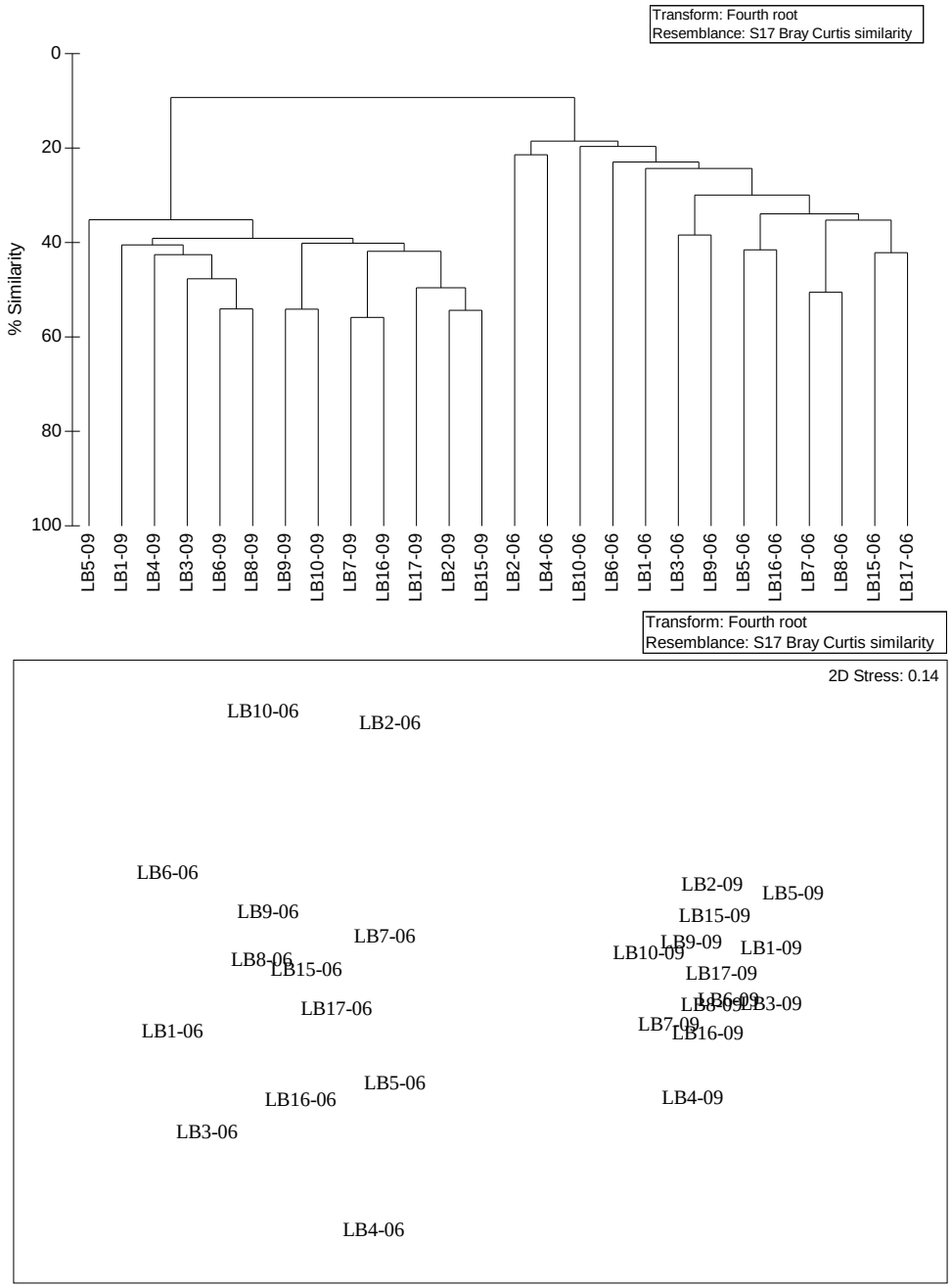
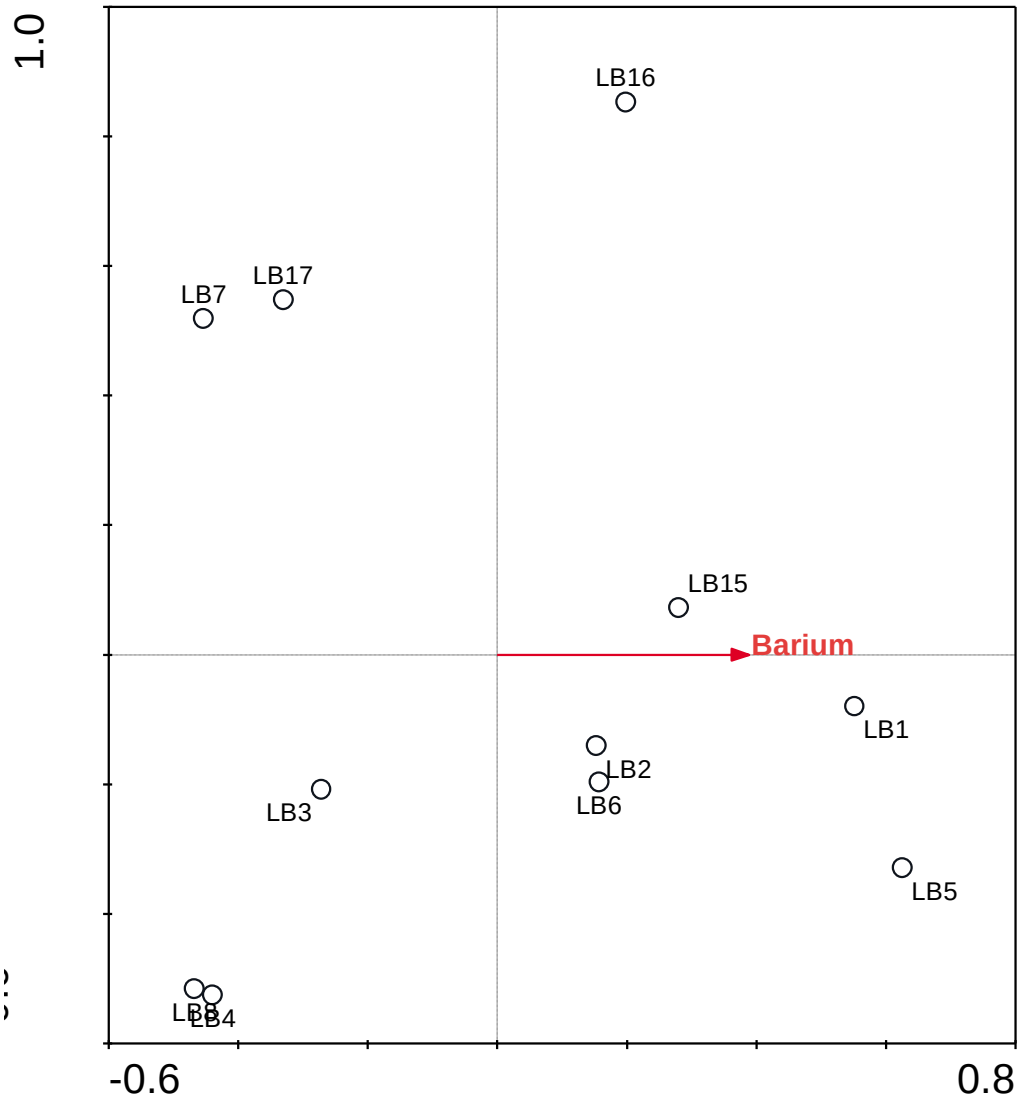


Figure 5.9. Dendrogram and MDS comparing fauna from sampling sites at Lomba in 2009 and 2006.



Figur 5.10. Results from the RDA-analysis of the biological and the environmental factors at Lomba, conducted in Canoco. Barium was the factor with the greatest effect on the distribution of the bottom fauna. The first axis explains 15,1 % while the second axis explains 18,7 % of the variation within the bottom fauna.

5.2.4 Estimation of influenced area

The extension of contamination along sampling transects and the minimum area of contaminated sediments for THC, barium and other metals as well as for faunal disturbance are given in Figure 5.11. and Table 5.11. A minimum area of 0.24 km^2 was contaminated by THC and 0.39 km^2 contaminated by barium around the platform at Lomba. No fauna disturbance was detected.

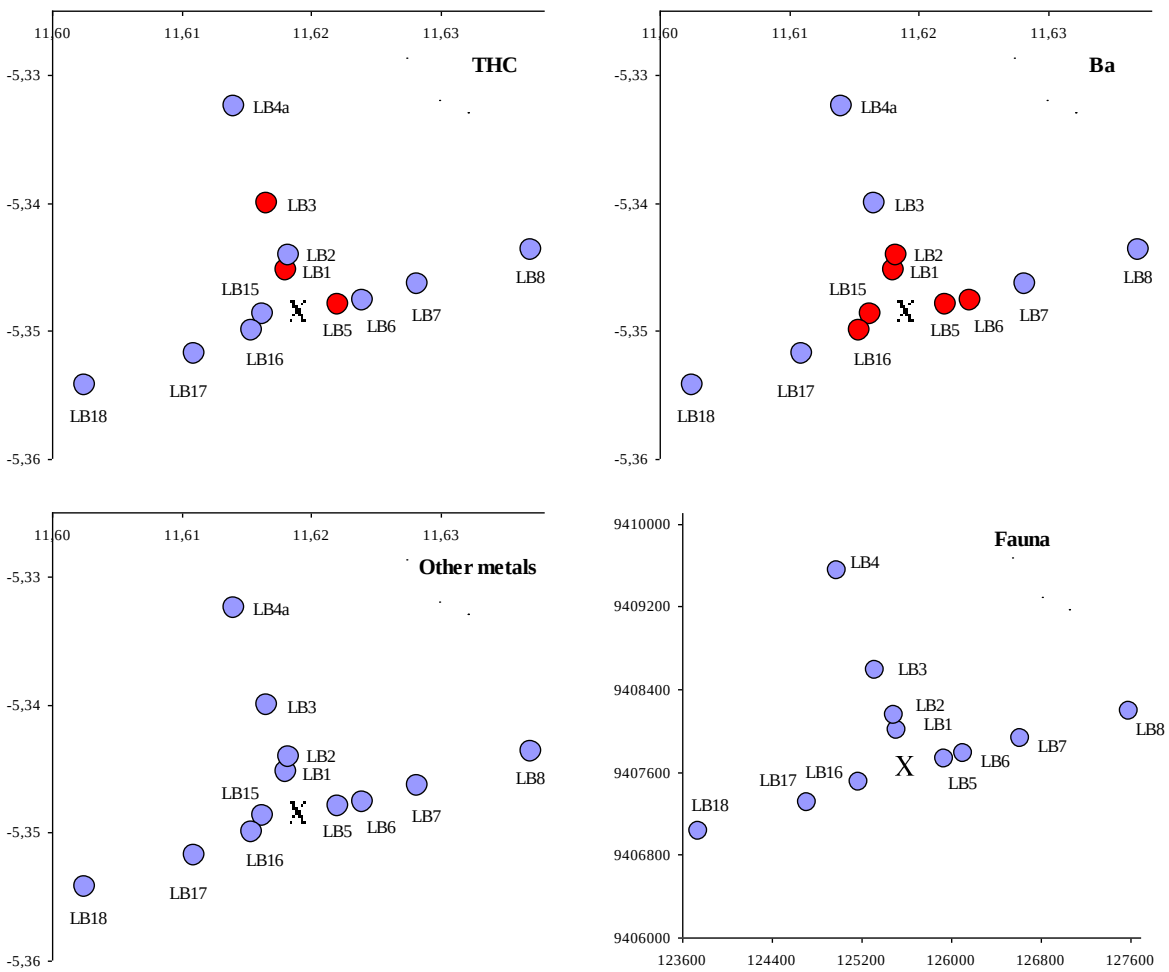


Figure 5.11. Faunal disturbance and chemical contamination of the sediments at Lomba are marked with red circles. Uncontaminated sites and sites with no faunal disturbance are marked with blue circles. Sites far from the field centre (X) are not presented and were below LSC of all parameters.

Table 5.11. Estimated distance of contamination and faunal disturbance from the installation, and estimated area of contamination and faunal disturbance around the field centre.

Lomba	NW m	NE m	SW m	km² 2006	km² 2009
THC	1000	300	0	0.20	0.24
Ba	500	500	500	1.57	0.39
Other metals	0	0	0	0.00	0.00
Fauna	0	0	0	0.06	0.00

5.3 Summary and conclusions

Fourteen sites were investigated at Lomba. The samples were taken with increasing distance from the platform. The sites are the same as sampled in 2006. The sediment was mostly fine grained (pelite) with even distribution of TOM. Some oil spots were detected in the sediment from LB1, which is 350 m north-west of the platform. This supports the findings that LB1 had very high amounts of THC and higher concentrations of PAH and NPD in the sediment. Two other sites had concentrations of THC above LSC. This indicates a minimum area of THC contamination of 0.24 km^2. The concentration of barium was high at LB1. All sites out to 500m from the platform had barium concentrations above the LSC value. The minimum area of Ba contamination was 0.39 km^2 which is a smaller area than in 2006. No other metal contamination was detected. In defiance of high levels of THC, PAH, NPD and barium, no disturbance of bottom fauna was detected.

6. ENVIRONMENTAL CONDITIONS – CABINDA

6.1. Introduction

On request from Chevron, selected platforms in Cabinda block 0 were investigated. Sampling was undertaken at two sites in distance 300 and 500 m from each platform. Sampling sites are shown in Figure 5.1.

Table 6.1. Recent well drilling and discharges from operations and accidents at the platforms.

No of wells drilled Barite Cuttings Water-based drilling mud Cementing chemicals Completion chemicals Accidental discharges Etc	Not reported

Picture 6.1. The jackets and platforms at Takula Oscar (a) (similar to Takula Kilo and Wamba Bravo), GS-D (b) and Mafumeira North (c).

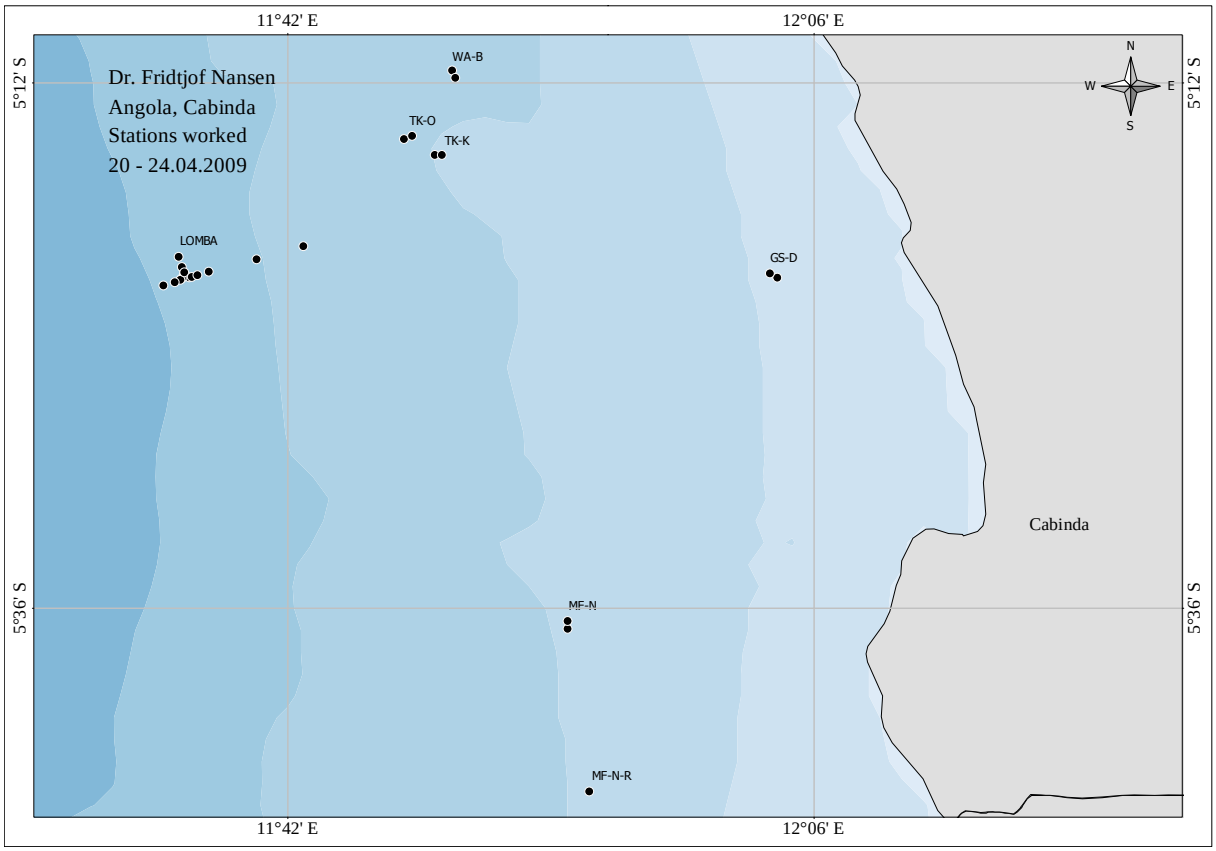


Figure 6.1. Map showing the investigated sites in Cabinda (Block 0). Positioning according to WGS 84 (see Table 2.3).

6.2. Results and discussion

6.2.1 Sediments characteristics

Total organic matter (TOM), and the amount (%) of gravel, sand, pelite and median (Φ) in the sediment are presented in Table 6.2 and Figure 6.2. Additional information on grain size parameters is presented in the Appendix, and information on color and odor can be found in the sampling journal in the Appendix.

The bottom in the investigated area in Cabinda was dominated by very fine grained sediment. The amount of pelite varied from 56 to 99 % and the sand content varied from 1.5 to 44 %.

The content of total organic matter (TOM) varied from 4.4 to 12.7 %.

Table 6.2. Total organic matter and sediment grain size at Cabinda sites in 2009. Pelite is particles < 0,063 mm, sand from 0,063 to 2 mm.

Site	TOM %	Pelite %	Sand %	Gravel %	Median (Φ)
MF-N-1	8,95	58,5	41,5	0,02	4,6
MF-N-2	10,59	58,0	41,9	0,11	4,6
MF-N-R	12,67	92,5	7,5	0,01	5,8
TK-K-1	9,62	60,7	39,2	0,13	4,7
TK-K-2	10,62	74,4	25,3	0,27	5,3
TK-O-1	12,11	96,6	3,3	0,06	5,9
TK-O-2	12,16	97,8	2,2	0,03	6,0
WA-B-1	11,7	98,5	1,5	0,09	6,0
WA-B-2	12,04	98,4	1,5	0,14	6,0
GS-D-1	4,39	55,5	44,3	0,18	4,4
GS-D-2	4,61	57,7	42,3	0,09	4,5

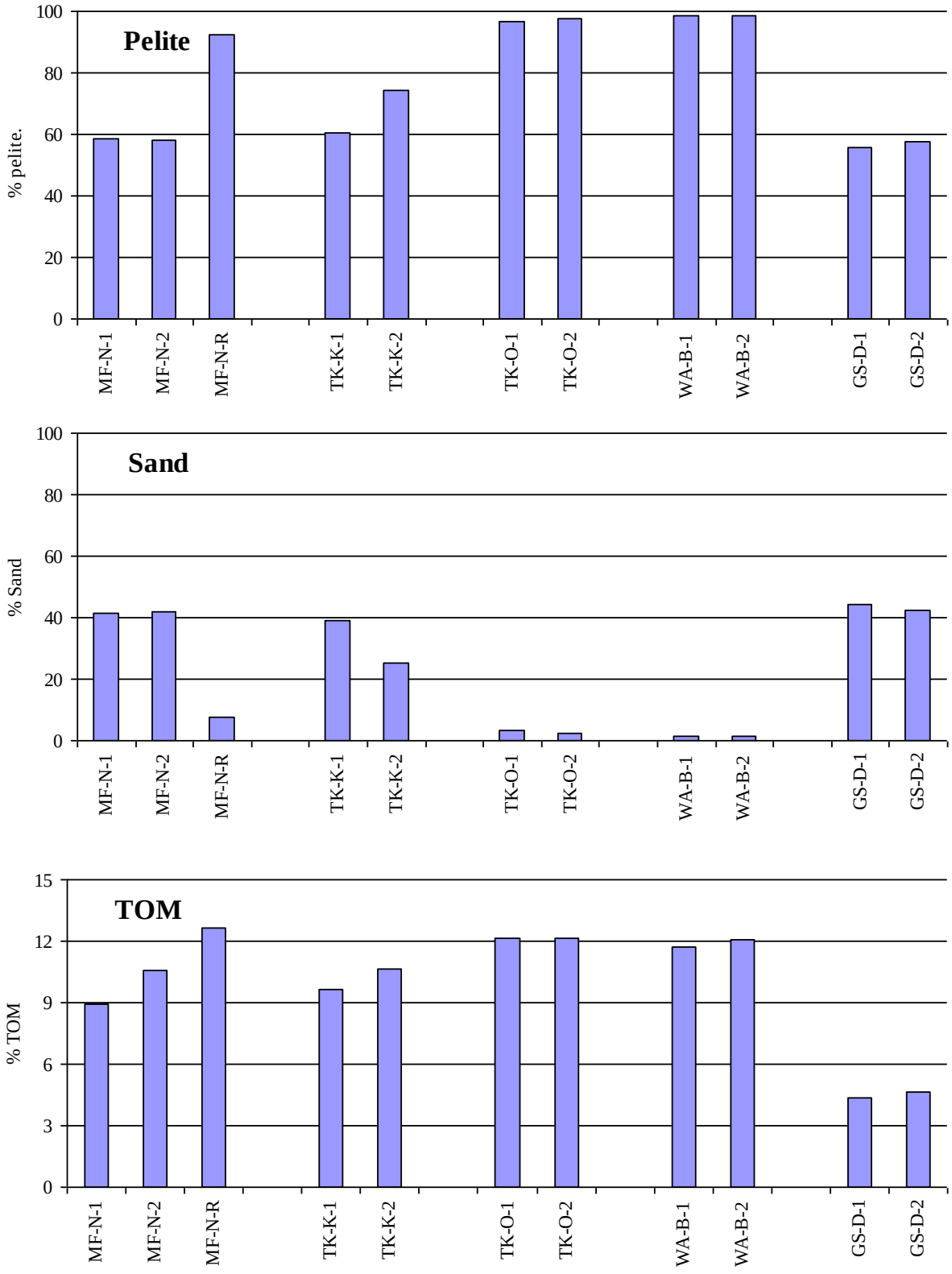


Figure 6.2. Sediment characteristics at Cabinda sites.

6.2.2 Chemical compounds

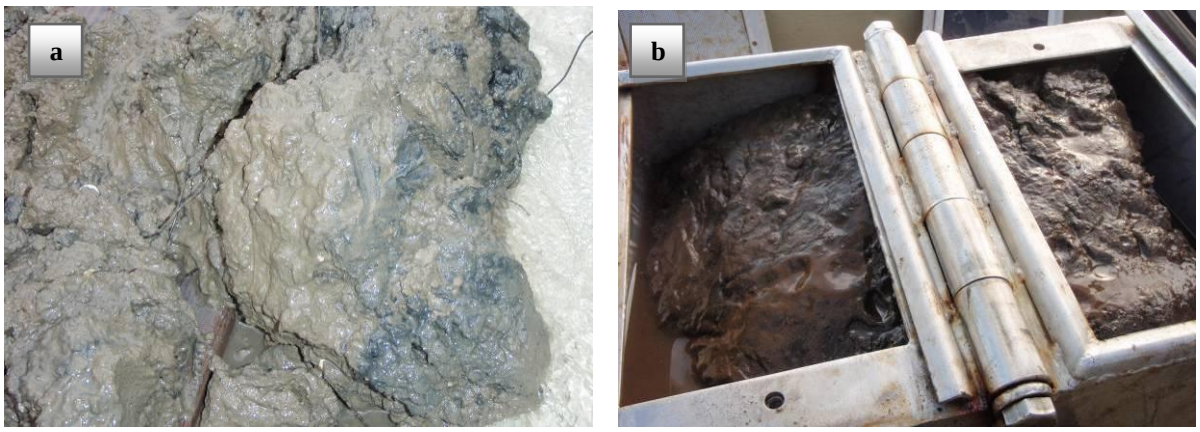
6.2.2.1 Hydrocarbons

Summarized results of the hydrocarbon analyses are given in Table 6.3 and Figure 6.3. The complete data set including replicates is given in the Appendix.

Highest concentration of THC, PAH and NPD was found at site WA-B-1, 300 m north and downstream from the platform. Some black spots observed in the sediment at this site support the high level of hydrocarbons in the sediment. Also MF-N-1 close to the Mafumeira North platform had elevated concentration of THC and NPD. All other sites had low concentration of hydrocarbons.

Table 6.3 Average concentration and standard deviation of hydrocarbons (mg/kg dw) at Cabinda sites.

Site	**THC**		**PAH(16)**		**NPD**	
	average	stdev.	average	stdev.	average	stdev.
MF-N-1	**130**	87	**0.110**	0.105	**<0.01**	-
MF-N-2	**14**	0.6	**0.009**	0.000	**0.002**	-
MF-N-R	**17**	1.5	**0.009**	0.001	**<0.01**	-
TK-K-1	**30**	4.5	**0.028**	0.002	**0.011**	0.001
TK-K-2	**24**	2.6	**0.026**	0.002	**0.006**	0.000
TK-O-1	**37**	0.6	**0.029**	0.001	**0.008**	0.002
TK-O-2	**23**	2.1	**0.021**	0.001	**0.014**	0.002
WA-B-1	**300**	10	**0.186**	0.003	**0.107**	0.005
WA-B-2	**42**	2.3	**0.042**	0.001	**0.005**	0.001
GS-D-1	**14**	0.6	**0.005**	0.001	**0.003**	0.000
GS-D-2	**8**	0.1	**0.009**	0.001	**<0.01**	-



Picture 6.2. Sediment from a) WA-B-1, b) MF-N-1. Oil in sediment was observed close to Wamba North.

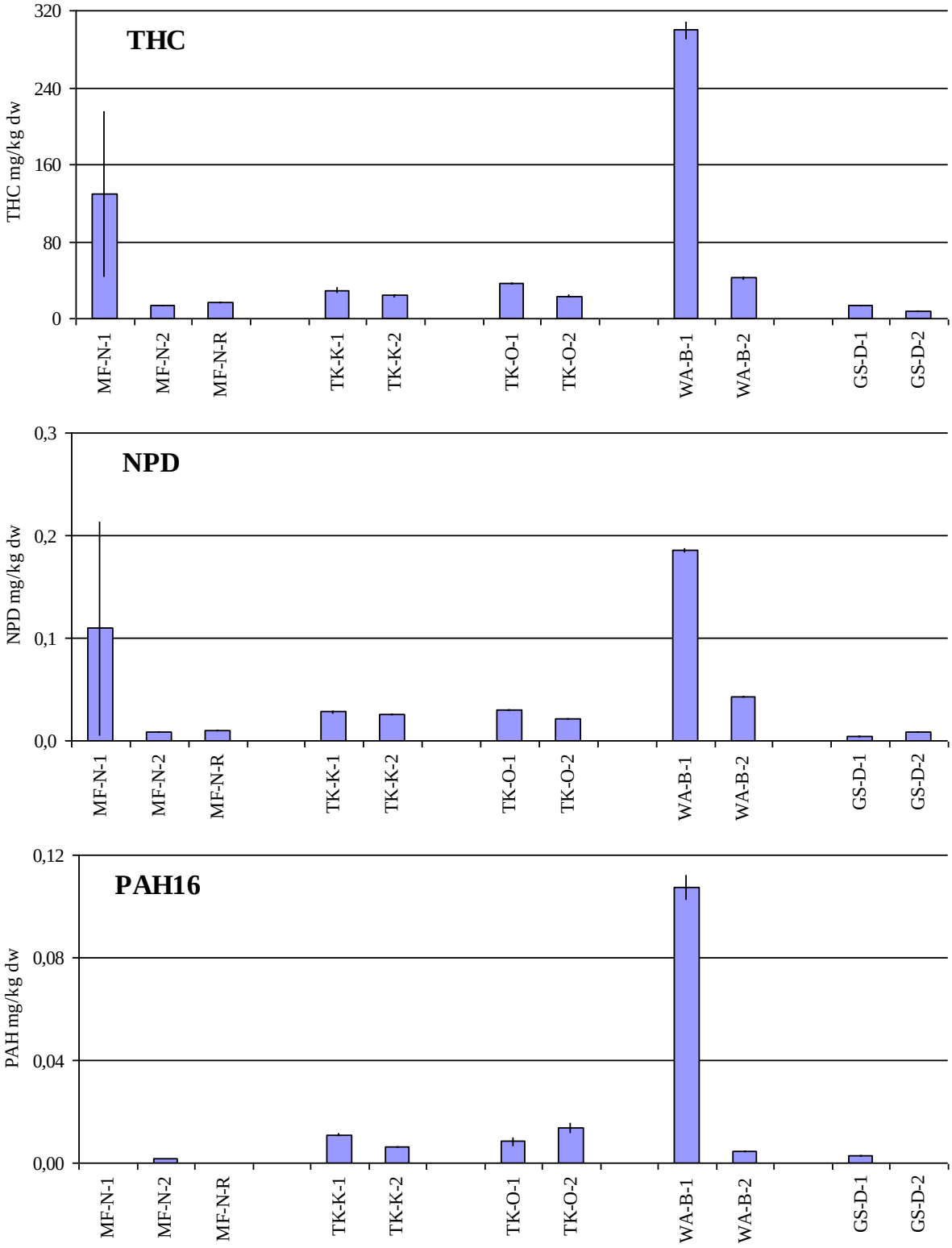


Figure 6.3. Result of the hydrocarbon analysis from Cabinda sites in 2009.

6.2.2.2 Metals

Table 6.4 and Figure 6.4 summarize the results of the metal analyses at Cabinda sites. The complete data set including replicates is given in the Appendix.

Barium was found in a range from 77 ± 7 mg/kg at MF-N-R to 736 ± 289 mg/kg at WA-B-1. The concentrations were generally low, except at WA-B-1. Variation among the parallels indicates patchy distribution of barium.

The concentrations of other metals were generally low. GS-D sites had generally lowest concentrations, and Wa-B-1 and TK-O-2 generally the highest concentrations. This corresponds to the grain size distribution.

Table 6.4 Average concentration and standard deviation of metal (mg/kg dw) in Cabinda in 2009.

Site	**Ba**		**Pb**		**Cd**		**Cu**	
	average	stdev.	average	stdev.	average	stdev	average	stdev
MF-N-1	**242**	128	**16.8**	2.4	**0.060**	0.008	**5.5**	1.2
MF-N-2	**90**	20	**18.9**	0.5	**0.057**	0.003	**5.5**	0.6
MF-N-R	**77**	7	**19.1**	0.6	**0.058**	0.002	**8.6**	0.2
TK-K-1	**168**	13	**17.0**	0.6	**0.057**	0.005	**8.1**	0.9
TK-K-2	**135**	98	**15.8**	2.2	**0.057**	0.018	**9.5**	1.9
TK-O-1	**429**	25	**17.2**	0.6	**0.067**	0.006	**11.4**	0.8
TK-O-2	**345**	268	**17.5**	2.8	**0.098**	0.082	**12.5**	3.3
WA-B-1	**736**	289	**19.2**	0.8	**0.148**	0.056	**13.0**	0.3
WA-B-2	**306**	74	**18.1**	0.2	**0.045**	0.004	**11.3**	0.5
GS-D-1	**105**	5	**7.9**	0.2	**0.068**	0.021	**2.9**	0.2
GS-D-2	**81**	8	**9.0**	0.1	**0.081**	0.006	**3.9**	0.4

Site	**Cr**		**Hg**		**Zn**	
	average	stdev.	average	stdev.	average	stdev.
MF-N-1	**40.3**	1.1	**0.041**	0.012	**90.8**	11.9
MF-N-2	**40.8**	0.7	**0.046**	0.005	**90.6**	1.8
MF-N-R	**41.9**	0.8	**0.073**	0.001	**71.6**	3.1
TK-K-1	**43.0**	0.8	**0.048**	0.005	**73.5**	4.2
TK-K-2	**40.9**	2.3	**0.048**	0.008	**64.9**	8.1
TK-O-1	**39.9**	0.7	**0.055**	0.004	**57.4**	1.1
TK-O-2	**39.8**	4.3	**0.058**	0.010	**56.5**	9.0
WA-B-1	**38.9**	3.3	**0.067**	0.006	**59.0**	6.2
WA-B-2	**38.7**	0.8	**0.052**	0.001	**55.3**	0.9
GS-D-1	**22.7**	0.6	**0.016**	0.001	**44.1**	0.2
GS-D-2	**24.8**	0.5	**0.022**	0.001	**46.0**	0.8

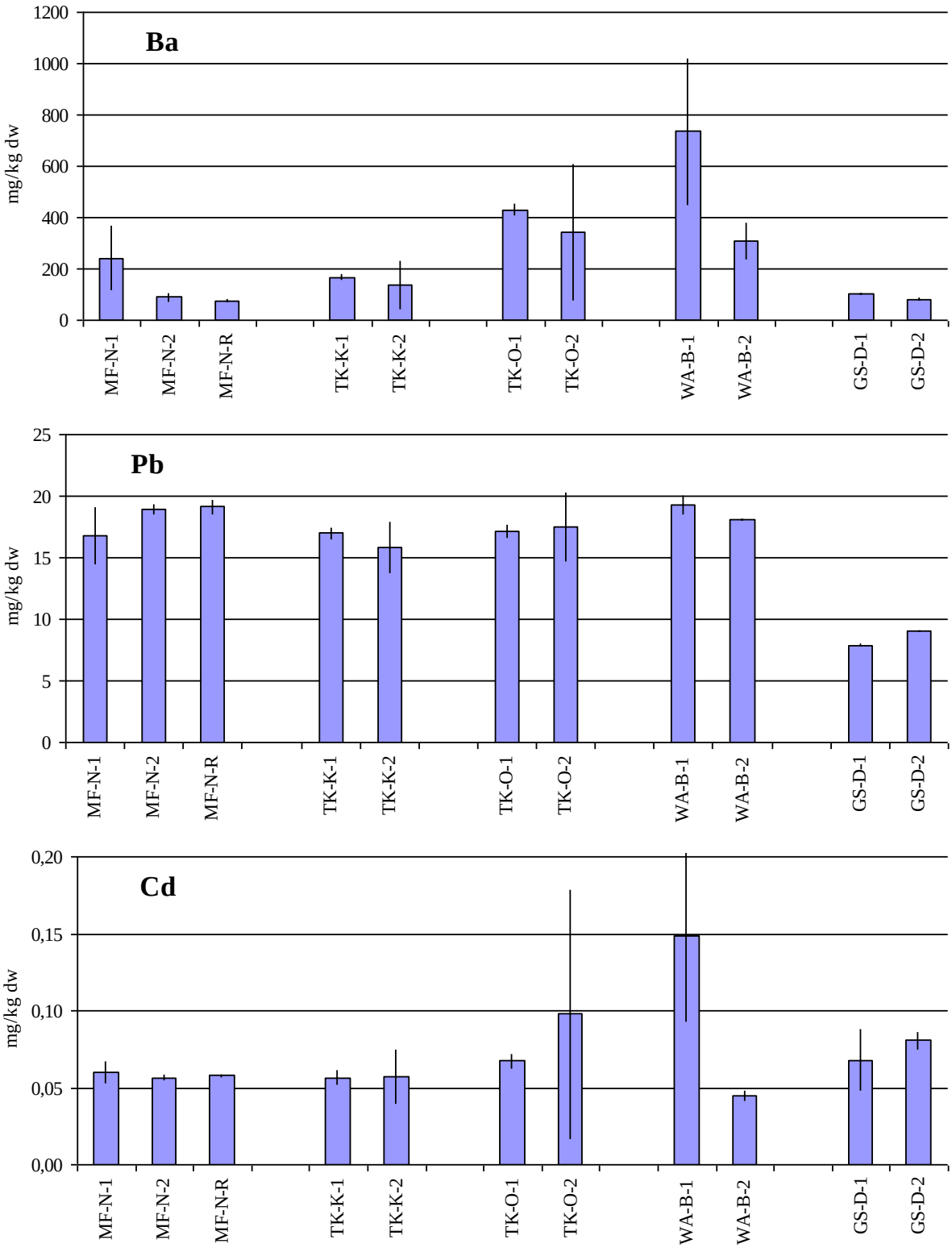


Figure 6.4. Result of the metal analysis from Cabinda sites in 2009.

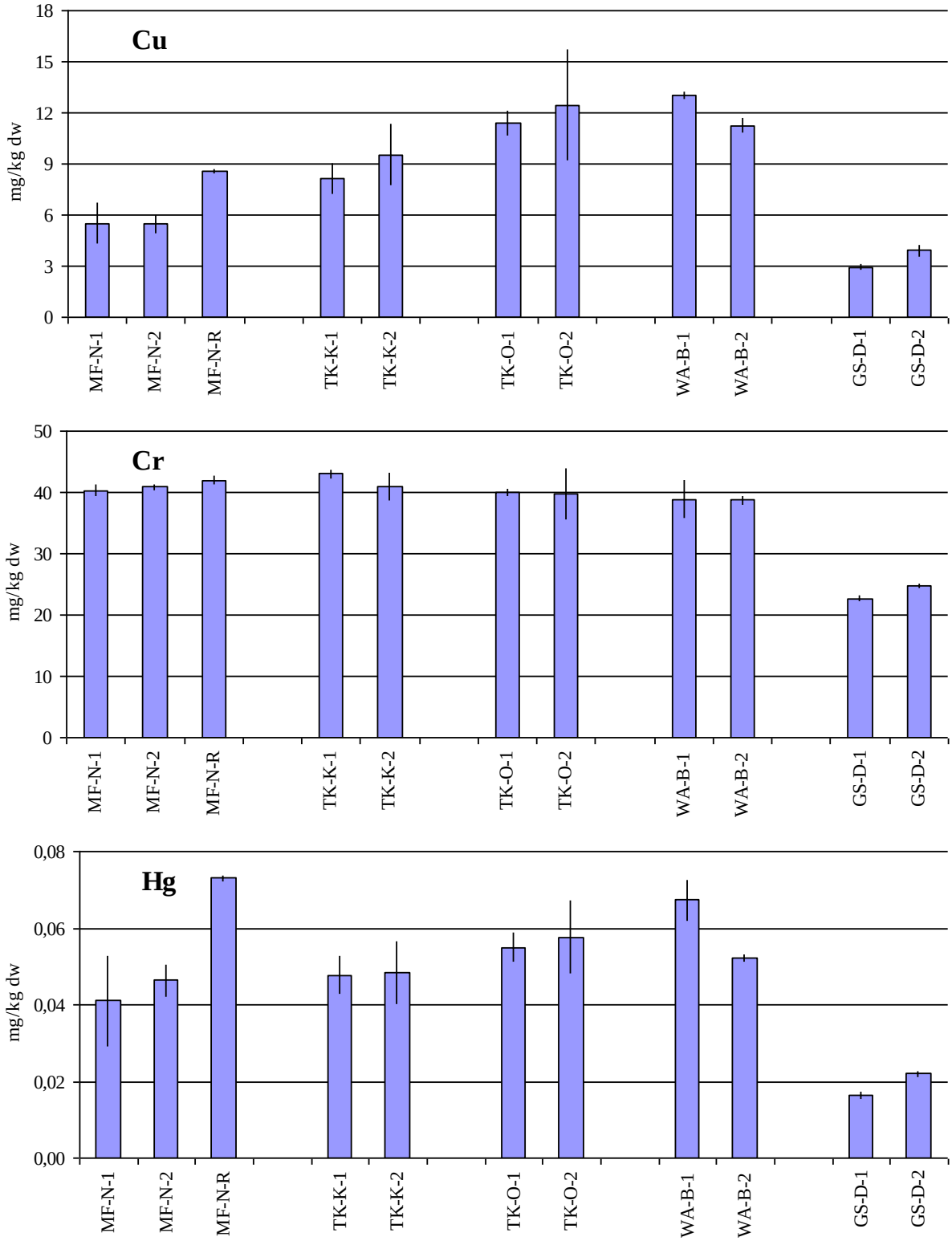


Figure 6.4 continue. Result of the metal analysis from Cabinda sites in 2009.

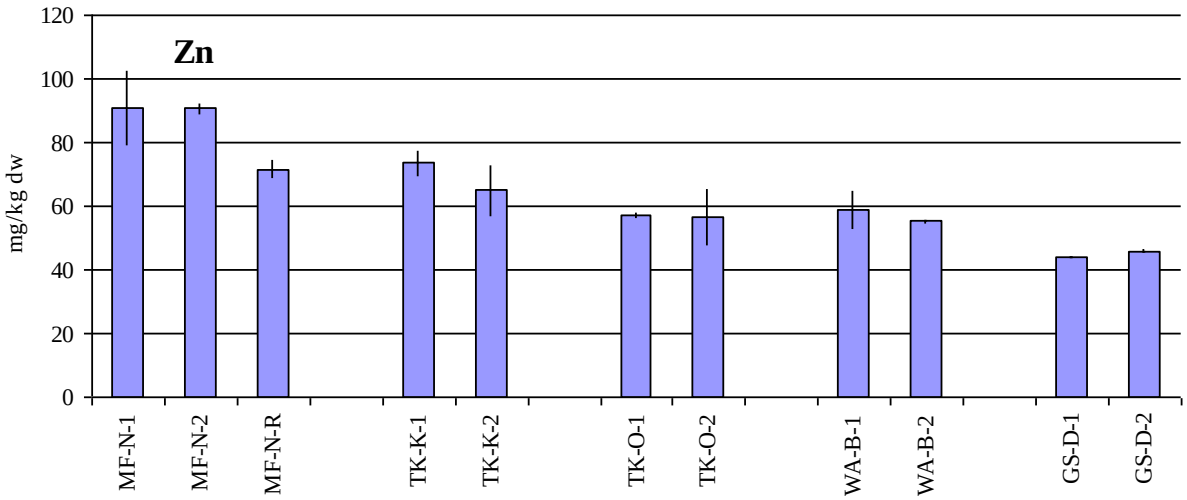


Figure 6.4 continue. Results of the metal analysis from Cabinda sites in 2009.

6.2.3 Bottom fauna

A summary of number of individuals and taxa within the main taxonomic groups is presented in Table 6.5. A complete species list is available in Appendix. At the Cabinda field, as a whole, Annelida were the most abundant group, both regarding number of individuals (60 %) and number of species (43 %).

The distribution of individuals and taxa, diversity and evenness are presented in Table 6.6 and Figures 6.5-6.6. The two shallowest sites, GS-D-1 and 2, contained the largest number of individuals (404 and 362) and the largest number of taxa (76 and 67). This is also reflected in high diversity scores (5.21 and 5.19). At the deepest sites, TK-O-1 and TK-O-2, the lowest number of individuals (58 and 41) and the lowest number of taxa (24 and 17) were found. The lowest diversity was found at MN-F-R (3.85).

Distribution of taxa in geometrical classes is presented in Figure 6.7. The graph of TK-O-2 indicates a low number of species with few individuals. This may be related to findings of oil in the sediment. Apart from this, the curves are even and quite similar all over Cabinda, indicating good environmental conditions.

The ten most abundant species/groups for each site are presented in Table 6.7. Although polychaets were more frequent, most of the other large taxonomic groups were present among the ten most abundant species or groups at all sites. No species or group dominated any of the sites investigated.

Results of the multivariate analyses are given in dendrogram and MDS plots (Figure 6.8). All sampling sites of Cabinda were linked with a similarity of 28 %. The two shallowest sites, GS-D-1 and 2, were most different from the rest of the area, parting at 31 % similarity. At 35 % similarity follows TK-O-2, where oil was detected in the sediment. Results from the MDS analysis support the findings in the dendrogram.

The correlation between distribution of bottom fauna and the chemical and geological data was tested with a RDA-analysis, in the program Canoco. A pre-treatment indicated a linear distribution of the data and a RDA analysis with Monte Carlo forward selection was therefore utilized. The results indicated that concentration of lead and copper had the greatest impact on the composition of bottom fauna ($p=0.004$ and $p=0.02$, respectively) (Figure 6.9).

Allthough concentrations of lead and copper affected the distribution of bottom fauna, no clear patterns of disturbance were detected at the Cabinda field.

Table 6.5. Distribution of individuals and taxa within the main taxonomic groups, at the Cabinda field. The same distributions within each part of the field are also presented.

Cabinda total Large taxonomic groups	Number of individuals	%	Number of taxa	%
Annelida	1093	60.0	73	42.7
Arthropoda	97	5.3	18	10.5
Mollusca	265	14.6	59	34.5
Echinodermata	78	4.3	8	4.7
Various groups	288	15.8	13	7.6
Total	1821	100.0	171	100.0

WA-B Large taxonomic groups	Number of individuals	%	Number of taxa	%
Annelida	174	66.9	28	51.9
Arthropoda	26	10.0	8	14.8
Mollusca	50	19.2	13	24.1
Echinodermata	3	1.2	2	3.7
Various groups	7	2.7	3	5.6
Total	260	100.0	54	100.0

GS-D Large taxonomic groups	Number of individuals	%	Number of taxa	%
Annelida	433	56.5	51	55.4
Arthropoda	17	2.2	7	7.6
Mollusca	116	15.1	25	27.2
Echinodermata	19	2.5	2	2.2
Various groups	181	23.6	7	7.6
Total	766	100.0	92	100.0

MF-N Large taxonomic groups	Number of individuals	%	Number of taxa	%
Annelida	171	50.0	39	54.9
Arthropoda	17	5.0	7	9.9
Mollusca	31	9.1	13	18.3
Echinodermata	42	12.3	6	8.5
Various groups	81	23.7	6	8.5
Total	342	100.0	71	100.0

Table 6.5 continued. Distribution of individuals and taxa within the main taxonomic groups, at the Cabinda field. The same distributions within each part of the field are also presented.

TK Large taxonomic groups	Number of individuals	%	Number of taxa	%
Annelida	315	69.5	39	48.8
Arthropoda	37	8.2	10	12.5
Mollusca	68	15.0	23	28.8
Echinodermata	14	3.1	2	2.5
Various groups	19	4.2	6	7.5
Total	453	100.0	80	100.0

Table 6.6. Number of individuals, taxa and selected community indices for each site at the Cabinda field. Maximum and minimum values are presented in bold numbers.

Site	**Number of individuals**	**Number of taxa**	**Diversity H'**	**Evenness J**
WA-B-1	151	41	4.42	0.82
WA-B-2	109	35	4.25	0.83
GS-D-1	**404**	**76**	**5.21**	0.83
GS-D-2	362	67	5.19	0.86
MNF R	123	30	3.85	**0.78**
MF-N 1	114	36	4.47	0.86
MF-N 2	105	44	4.90	0.90
TK-K-1	205	52	4.83	0.85
TK-K-2	149	50	4.98	0.88
TK-O-1	58	24	4.19	**0.91**
TK-O-2	**41**	**17**	**3.69**	0.90
Average	166	43	4.54	0.86
Min	41	17	3.69	0.78
Max	404	76	5.21	0.91

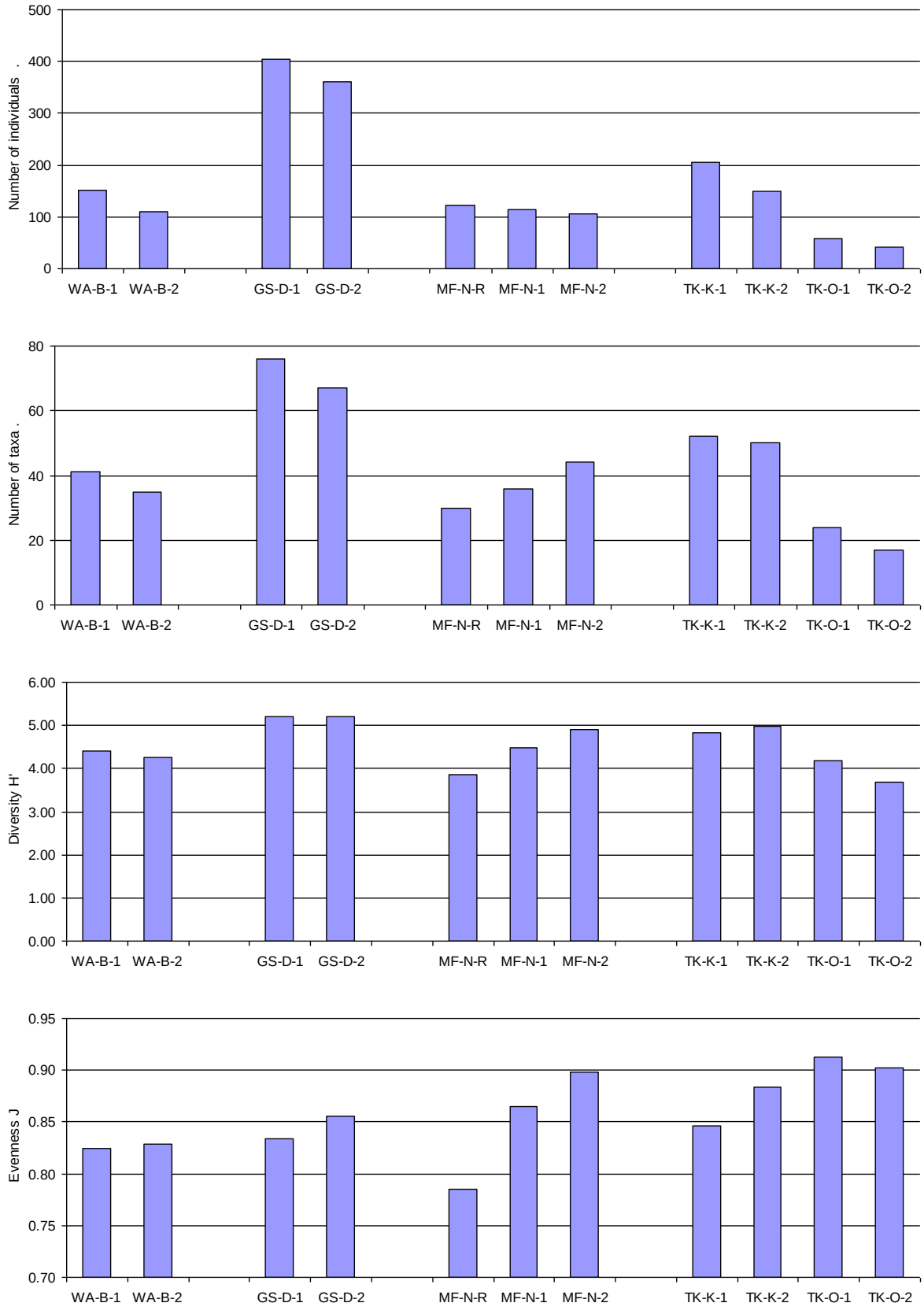


Figure 6.5 Number of individuals and species, diversity and evenness are presented as bars for each site.

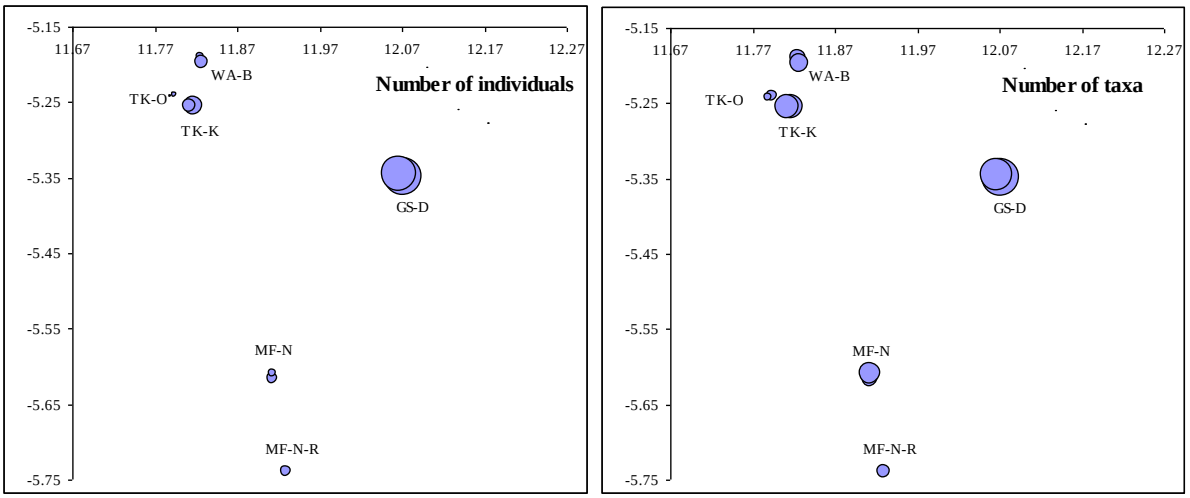


Figure 6.6. The horizontal distribution of individuals and species are presented. The size of the circle reflects the number of individuals and species.

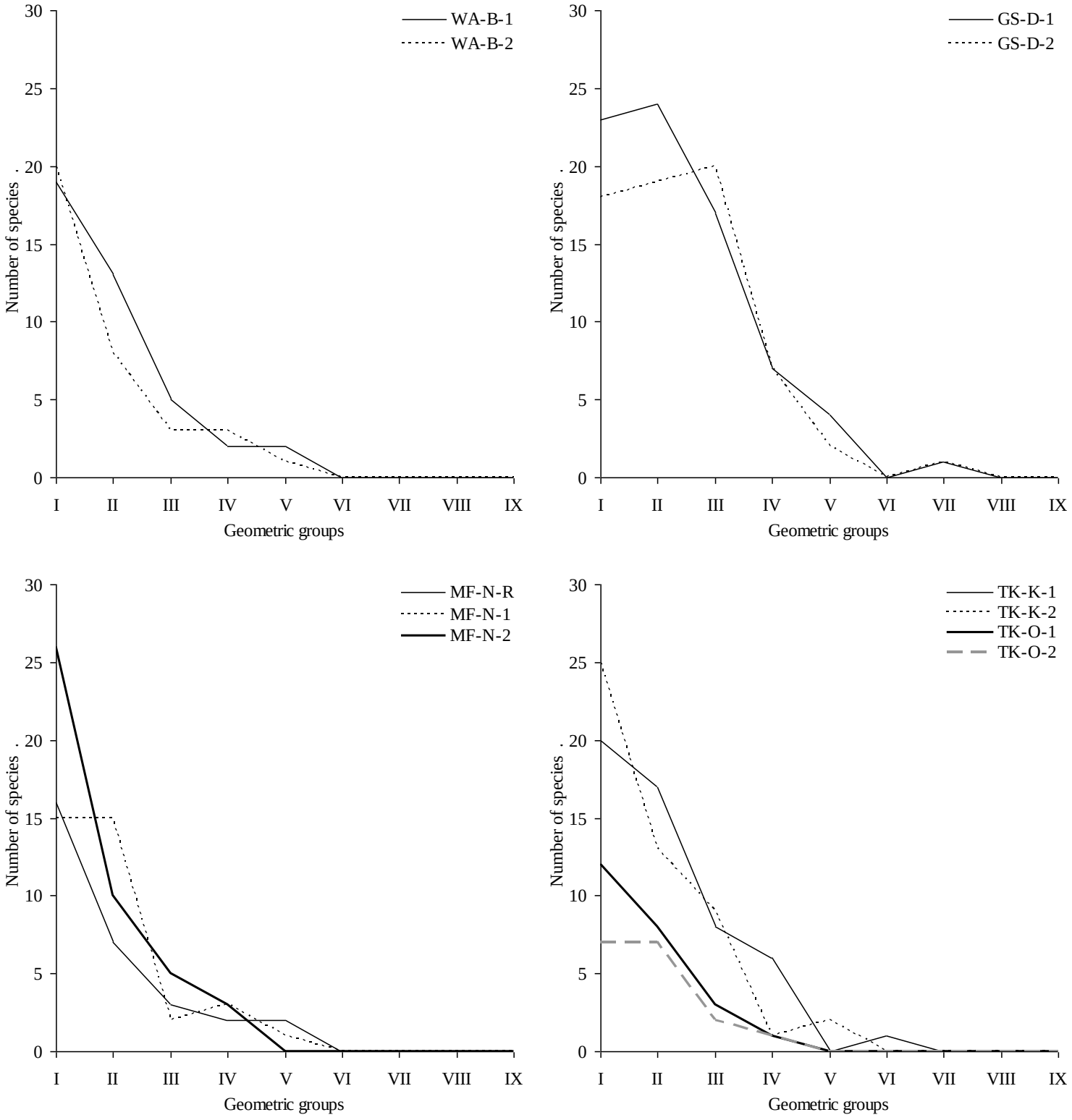


Figure 6.7. Distribution of taxa in geometrical classes at the sites of Cabinda.

Table 6.7. Number of most numerous individuals and groups sampled at Cabinda.

WA-B-1	Number of individuals	%	Cum. %
Diopatra sp	30	19.9	19.9
Veneridae indet 3	20	13.2	33.1
Spiochaetopterus sp.	12	7.9	41.1
Nephtys sp.	11	7.3	48.3
Prionospio sp.	7	4.6	53.0
Notomastus sp.	6	4.0	57.0
Apseudidae indet	6	4.0	60.9
Caridea indet. 4	6	4.0	64.9
Heterospionidae indet	4	2.6	67.5
Pilargiidae indet. 2	3	2.0	69.5
Nereidae indet.	3	2.0	71.5
Lumbrineridae indet.	3	2.0	73.5
Aphelochaeta sp.	3	2.0	75.5

WA-B-2	Number of individuals	%	Cum. %
Diopatra sp	23	21.1	21.1
Veneridae indet 3	13	11.9	33.0
Spiochaetopterus sp.	10	9.2	42.2
Lumbrineridae indet.	9	8.3	50.5
Nephtys sp.	6	5.5	56.0
Prionospio sp.	6	5.5	61.5
Ampharete sp.	4	3.7	65.1
Apseudidae indet	3	2.8	67.9
Aspidosiphon sp	3	2.8	70.6
Notomastus sp.	2	1.8	72.5
Actiniaria indet.	2	1.8	74.3
Cirratulidae indet.	2	1.8	76.1
Nucula sp 2	2	1.8	78.0
Glycera sp.	2	1.8	79.8
Amphiura sp.	2	1.8	81.7

GS-D-1	Number of individuals	%	Cum. %
Onchnesoma sp	80	19.8	19.8
Ampharetidae indet 3	23	5.7	25.5
Aspidosiphon sp	19	4.7	30.2
Diopatra sp	18	4.5	34.7
Abra sp 1	18	4.5	39.1
Notomastus sp.	14	3.5	42.6
Glycera sp.	13	3.2	45.8
Scoloplos sp	11	2.7	48.5
Heterospionidae indet	10	2.5	51.0
Maldanidae indet	9	2.2	53.2

GS-D-2	Number of individuals	%	Cum. %
Onchnesoma sp	64	17.7	17.7
Ampharetidae indet 3	22	6.1	23.8
Diopatra sp	18	5.0	28.7
Abra sp 1	14	3.9	32.6
Scoloplos sp	13	3.6	36.2
Nephtys sp.	13	3.6	39.8
Aspidosiphon sp	12	3.3	43.1
Notomastus sp.	12	3.3	46.4
Ampharetidae indet 4	11	3.0	49.4
Amphiura sp.	11	3.0	52.5

MF-N-R	Number of individuals	%	Cum. %
Aspidosiphon sp	27	22.0	22.0
Onchnesoma sp	24	19.5	41.5
Synaptidae indet.	12	9.8	51.2
Nephtys sp.	9	7.3	58.5
Lucinoma sp 1	7	5.7	64.2
Amphiuridae indet.	7	5.7	69.9
Lumbrineridae indet.	5	4.1	74.0
Notomastus sp.	3	2.4	76.4
Euphrosinidae indet	3	2.4	78.9
Heterospionidae indet	2	1.6	80.5
Phylo sp	2	1.6	82.1
Orbinia sp.	2	1.6	83.7
Pennatulacea indet.	2	1.6	85.4
Orbiniidae indet. 1	2	1.6	87.0

MF-N-1	Number of individuals	%	Cum. %
Aspidosiphon sp	17	14.9	14.9
Amphiuridae indet.	15	13.2	28.1
Heterospionidae indet	11	9.6	37.7
Nephtys sp.	10	8.8	46.5
Phylo cf. capensis	6	5.3	51.8
Magelona sp.	4	3.5	55.3
Orbiniidae indet. 1	3	2.6	57.9
Sternaspis scutata	3	2.6	60.5
Nereidae indet. 1	3	2.6	63.2
Arca sp. 1	3	2.6	65.8
Apseudidae indet	3	2.6	68.4
Pholoe sp	3	2.6	71.1

Table 6.7. continued Number of most numerous individuals and groups sampled at Cabinda.

MF-N-2	Number of individuals	%	Cum. %
Heterospionidae indet	13	12.4	12.4
Nephtys sp.	9	8.6	21.0
Magelona sp.	8	7.6	28.6
Orbiniidae indet. 1	6	5.7	34.3
Apseudidae indet	6	5.7	40.0
Lucinoma sp 1	5	4.8	44.8
Aspidosiphon sp	4	3.8	48.6
Capitellidae indet.	4	3.8	52.4
Lumbrineridae indet.	3	2.9	55.2
Notomastus sp.	3	2.9	58.1
Maldanidae indet	3	2.9	61.0
Ampharetidae indet.	3	2.9	63.8

TK-K-1	Number of individuals	%	Cum. %
Diopatra sp	42	20.5	20.5
Veneridae indet 3	14	6.8	27.3
Nephtys sp.	13	6.3	33.7
Lumbrineridae indet.	9	4.4	38.0
Prionospio sp.	9	4.4	42.4
Cirratulidae indet.	9	4.4	46.8
Heterospionidae indet	8	3.9	50.7
Sternaspis scutata	7	3.4	54.1
Sabellides sp	6	2.9	57.1
Caridea indet. 3	6	2.9	60.0

TK-K-2	Number of individuals	%	Cum. %
Nephtys sp.	18	12.1	12.1
Diopatra sp	16	10.7	22.8
Veneridae indet 3	12	8.1	30.9
Cirratulidae indet.	7	4.7	35.6
Sabellides sp	6	4.0	39.6
Prionospio sp.	5	3.4	43.0
Heterospionidae indet	5	3.4	46.3
Pholoe sp	5	3.4	49.7
Amphiura sp.	5	3.4	53.0
Marphysa sp I	4	2.7	55.7
Dentalium sp. 3	4	2.7	58.4
Caridea indet. 4	4	2.7	61.1

TK-O-1	Number of individuals	%	Cum. %
Nephtys sp.	9	15.5	15.5
Veneridae indet 3	6	10.3	25.9
Diopatra sp	5	8.6	34.5
Lumbrineridae indet.	5	8.6	43.1
Amphiura sp.	3	5.2	48.3
Caridea indet. 4	3	5.2	53.4
Spiochaetopterus sp.	3	5.2	58.6
Polynoidae indet.	3	5.2	63.8
Pilargiidae indet. 2	3	5.2	69.0
Prionospio sp.	2	3.4	72.4
Sternaspis scutata	2	3.4	75.9
Apseudidae indet	2	3.4	79.3

TK-O-2	Number of individuals	%	Cum. %
Nephtys sp.	9	22.0	22.0
Diopatra sp	5	12.2	34.1
Lumbrineridae indet.	5	12.2	46.3
Notomastus sp.	3	7.3	53.7
Amphiura sp.	2	4.9	58.5
Polynoidae indet.	2	4.9	63.4
Pilargiidae indet. 2	2	4.9	68.3
Sabellides sp	2	4.9	73.2
Calanoida indet	2	4.9	78.0
Aricidea sp.	2	4.9	82.9

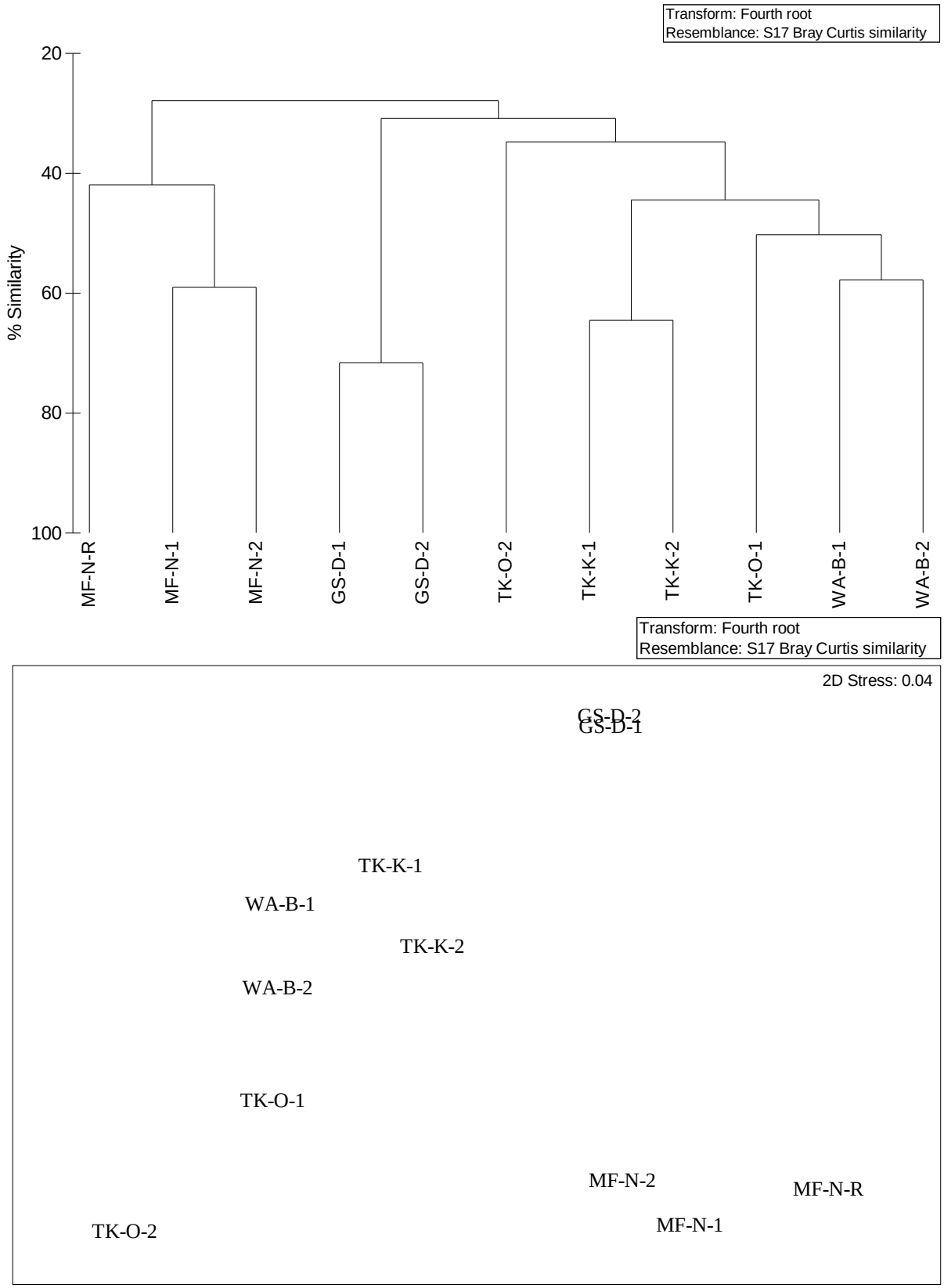
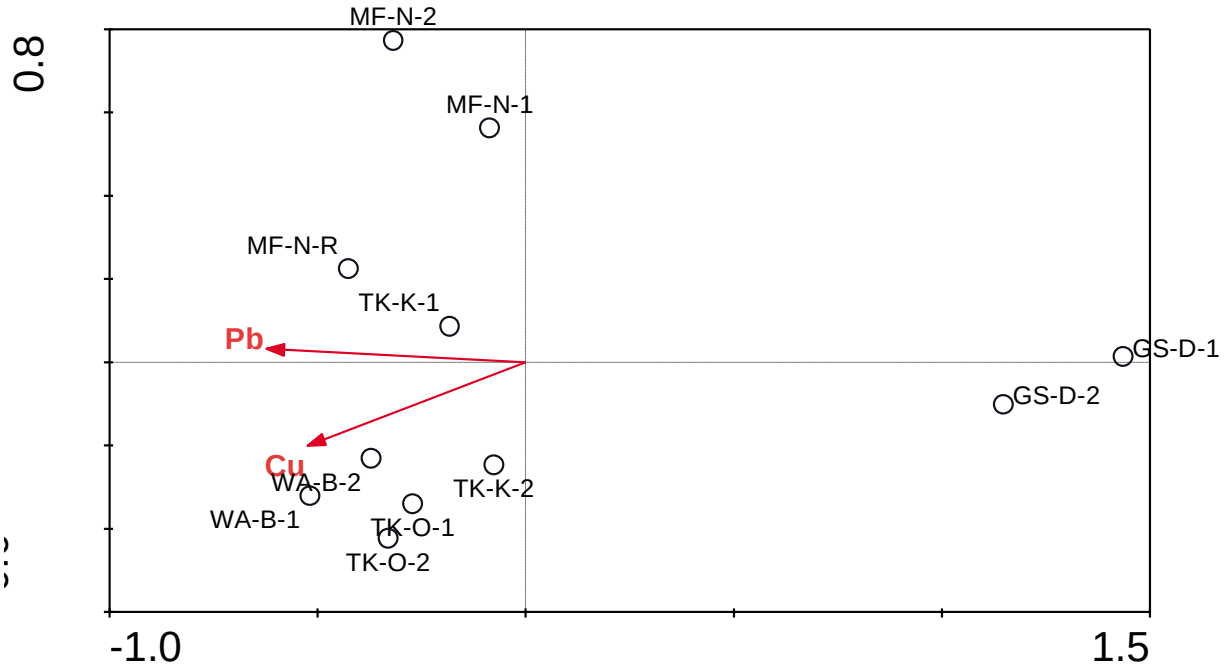


Figure 6.8. Dendrogram and MDS showing the similarity between fauna from sampling sites at Cabinda in 2009.



Figur 6.9. Results from the RDA-analysis of the biological and the environmental factors at Cabinda, conducted in Canoco. Lead (Pb) and copper (Cu) were the factors with the greatest effect on the distribution of the bottom fauna. The first axis explains 39,1 % while the second axis explains 13,6 % of the variation within the bottom fauna.

6.3 Summary and conclusions

Two sites close to five selected platforms were investigated in Cabinda. Samples were collected 300 and 500 m from the platforms. The sediment was mostly fine grained (pelite) with generally low content of TOM. Some oil spots were detected in the sediment from WA-B-1, 300 m to the north of the platform. This supports the findings that WA-B-1 had high amounts of hydrocarbons in the sediment. MF-N-1 had also elevated concentration of hydrocarbons. WA-B-1 was also the site with the highest concentration of heavy metals. GS-D-sites had a lower content of pelite and TOM, and generally the lowest concentration of hydrocarbons and metals. The highest number of individuals and taxa were found at the shallowest sites, while the lowest numbers were discovered at the deepest sites. Lead and copper were found to have an impact on the bottom fauna distribution at Cabinda, however no other results indicate fauna disturbance.

7. ENVIRONMENTAL CONDITION – PALANCA

7.1. Introduction

In Soyo the seabed around Palanca was investigated. Sampling was done according to the OSPAR guideline, with increasing distance from the platform along four different transects. Sampling sites are presented in Figure 5.1.

Table 7.1. Recent well drilling and discharges from operations, and accidents at the platforms.

No of wells drilled Barite Cuttings Water-based drilling mud Cementing chemicals Completion chemicals Accidental discharges Etc	Not reported

Picture 7.1. The Palanca platform.

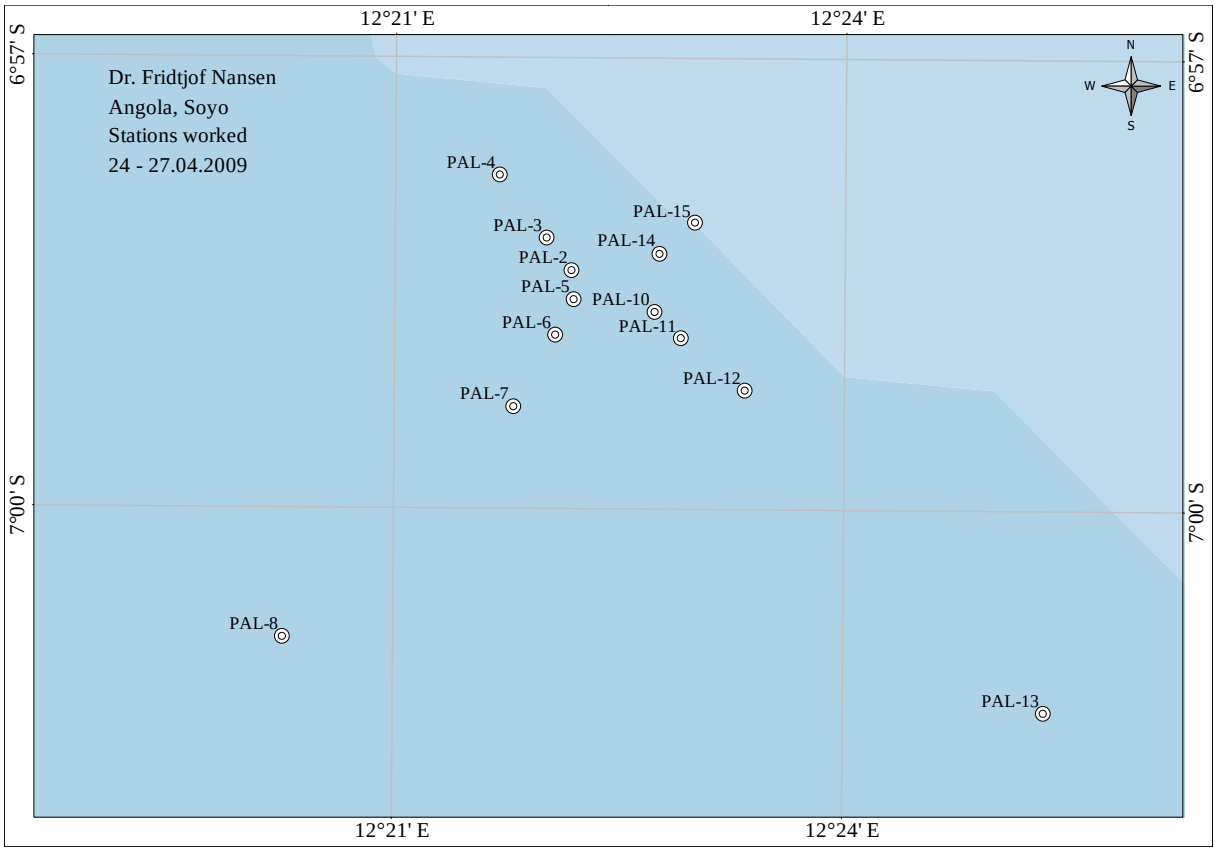


Figure 7.1. Map showing the investigated sites in detail at the Palanca field in Soyo (Block 3). Positioning according to WGS 84 (see Table 2.4).

7.2. Results and discussion

7.2.1 Sediments characteristics

Total organic matter (TOM), and the amount (%) of gravel, sand, pelite and median (Φ) in the sediment are presented in Table 7.2 and Figure 7.2. Additional information on grain size parameters is presented in the Appendix, and information on color and odor can be found in the sampling journal in the Appendix.

The bottom in the investigated area in Palanca Field was dominated by sandy sediment. The amount of sand varied from 68 % to 97 %, and pelite varied from 0.7 to 19 %.

The content of total organic matter (TOM) varied from 2.1 to 4.2 %.

Table 7.2. Total organic matter and sediment grain size at Palanca sites in 2009. Pelite is particles < 0,063 mm, sand from 0,063 to 2 mm.

Site	TOM %	Pelite %	Sand %	Gravel %	Median (Φ)
PAL2	3,13	6,6	93,2	0,2	1,84
PAL3	2,11	1,2	90,3	8,5	0,69
PAL4	2,13	8,0	89,6	2,4	1,74
PAL5	3,77	1,2	97,0	1,8	0,62
PAL6	4,24	4,7	70,0	25,3	0,85
PAL7	3,93	10,7	68,2	21,1	2,00
PAL8	2,73	15,9	80,7	3,4	1,67
PAL10	2,88	3,7	79,2	17,0	0,93
PAL11	2,88	2,3	71,0	26,6	1,18
PAL12	2,79	1,9	62,3	35,8	-0,35
PAL13	3,94	19,0	69,7	11,3	2,71
PAL14	2,96	0,7	95,1	4,2	0,73
PAL15	2,39	0,9	88,7	10,4	1,74

Picture 7.2. The sandy sediment at Palanca. This is PAL 2.

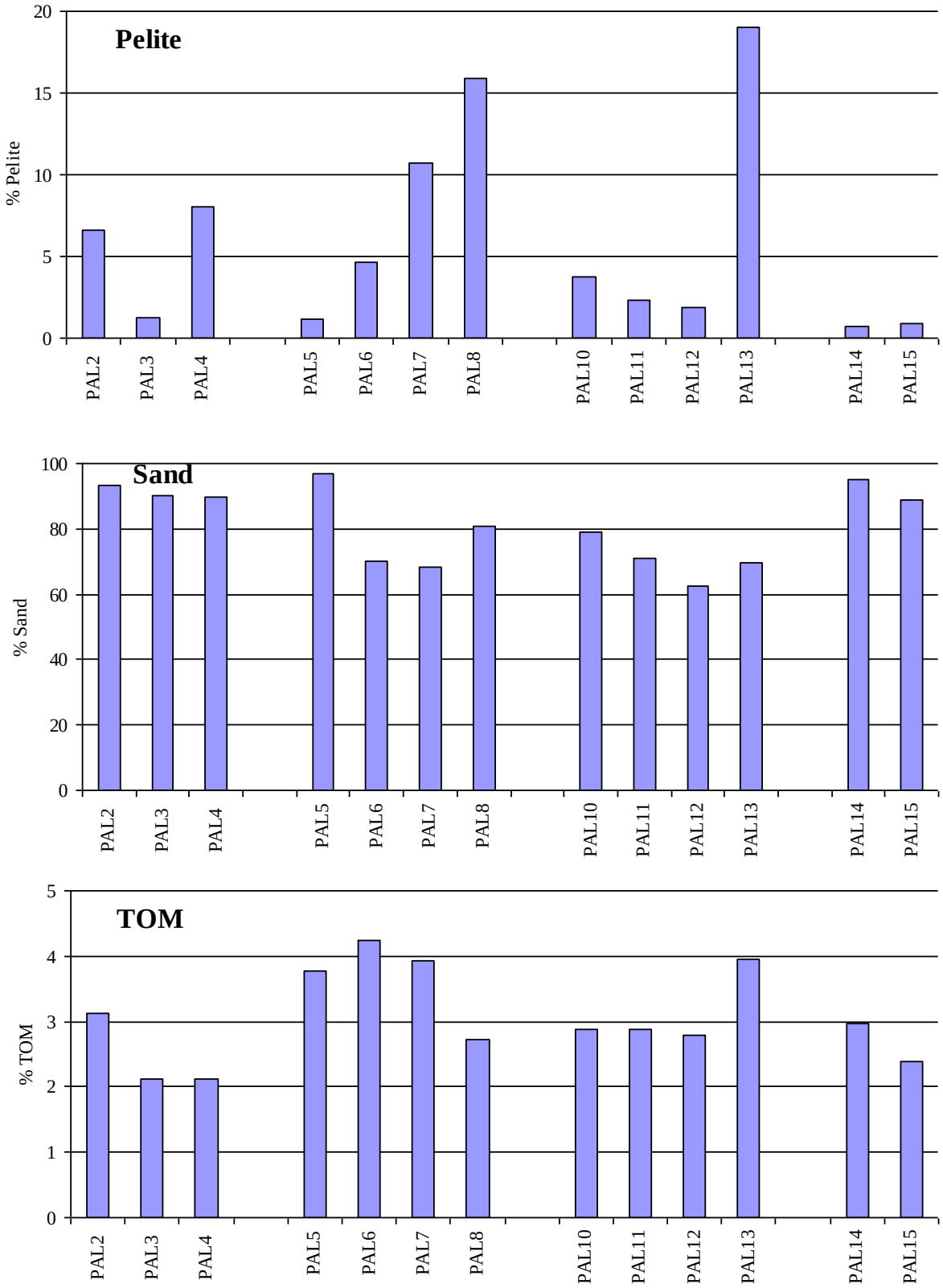


Figure 7.2. The sediment characteristics at Palanca sites.

7.2.2 Chemical compounds

7.2.2.1 Hydrocarbons

Summarized results of the hydrocarbon analyses are given in Table 7.3 and Figure 7.3. The complete data set including replicates is given in the Appendix.

The concentration of hydrocarbons (THC, PAH and NPD) was low in the investigated area. Highest concentrations of THC were found at site PAL 2, PAL 10 and PAL 12. PAL 2 is situated 300 m north-east of the platform, and PAL 10 and 12 are 300 and 1000 m south-west of the platform. These transects are parallel to the current direction.

PAH and NPD was also highest close to the platform at PAL 10.

Table 7.3. Average concentration and standard deviation of hydrocarbon (mg/kg dw) at Palanca.

	THC		NPD		PAH(16)	
Site	average	stdev.	average	stdev.	average	stdev.
PAL2	**13**	1	**0.001**	0.001	**0.010**	0.003
PAL3	**3.8**	0.6	**0.002**	0.001	**0.003**	0.001
PAL4	**6.3**	0.4	**< 0.001**	-	**0.009**	0.001
PAL5	**6.2**	0.8	**< 0.001**	-	**<0.01**	-
PAL6	**5.0**	0.2	**< 0.001**	-	**<0.01**	-
PAL7	**5.9**	0.3	**0.004**	0.000	**<0.01**	-
PAL8	**2.7**	0.1	**0.003**	0.001	**0.003**	0.001
PAL10	**12**	1	**0.009**	0.002	**0.014**	0.001
PAL11	**11**	1	**< 0.001**	-	**<0.01**	-
PAL12	**13**	1	**< 0.001**	-	**0.006**	0.001
PAL13	**11**	1	**< 0.001**	-	**<0.01**	-
PAL14	**8.1**	0.6	**< 0.001**	-	**<0.01**	-
PAL15	**2.6**	0.5	**< 0.001**	-	**<0.01**	-

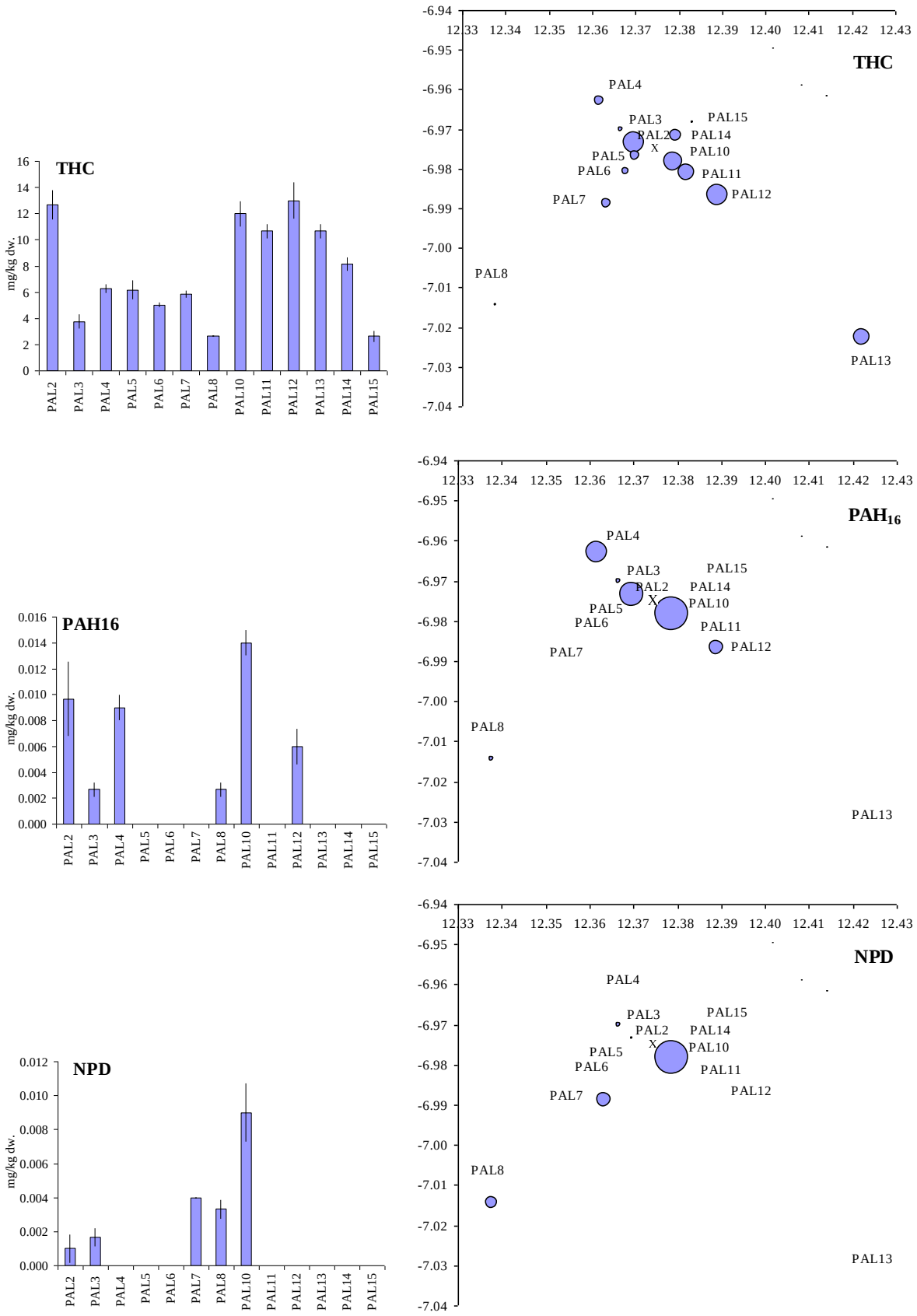


Figure 7.3. Result of the hydrocarbon analysis from Palanca sites in Soyo. The size of the circle to the right reflect the concentration of hydrocarbons.

7.2.2.2 Metals

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Table 7.4 and Figure 7.4 summarize the results of the metal analyses at Palanca sites. The complete data set including replicates is given in the Appendix.

The concentrations of heavy metal were generally low at all sites. Barium was found in a range from 12 ± 4 mg/kg at PAL 3 to 76 ± 37 mg/kg at PAL 7. The concentration of barium, copper and mercury correspond to the particle size, PAL 7, 8 and 13 had the highest content of pelite and also the highest concentration of these metals.

Table 7.4 Average concentration and standard deviation of metal (mg/kg dw) at Palanca.

	Ba		Pb		Cd		Cu	
Site	average	stdev.	average	stdev.	average	stdev.	average	stdev.
PAL2	**46.1**	13.2	**5.3**	0.2	**0.173**	0.013	**2.3**	0.6
PAL3	**11.7**	3.7	**6.8**	0.3	**0.092**	0.016	**0.8**	0.1
PAL4	**12.6**	3.3	**9.7**	2.2	**0.173**	0.033	**1.1**	0.2
PAL5	**12.8**	1.5	**11.8**	1.7	**0.155**	0.009	**1.1**	0.3
PAL6	**40.9**	3.3	**6.4**	1.2	**0.144**	0.012	**2.1**	0.4
PAL7	**75.5**	36.5	**4.0**	0.3	**0.172**	0.005	**3.9**	1.1
PAL8	**62.2**	14.0	**3.2**	0.2	**0.105**	0.015	**3.1**	0.5
PAL10	**56.0**	28.2	**5.3**	0.3	**0.110**	0.024	**3.0**	0.1
PAL11	**48.7**	29.9	**4.4**	0.2	**0.133**	0.016	**2.2**	0.5
PAL12	**17.2**	1.3	**4.9**	1.1	**0.079**	0.008	**1.2**	0.6
PAL13	**66.7**	48.2	**5.1**	1.0	**0.118**	0.023	**3.5**	0.8
PAL14	**34.4**	33.0	**6.2**	1.6	**0.098**	0.053	**1.5**	0.9
PAL15	**20.0**	7.7	**3.1**	1.0	**0.142**	0.024	**2.0**	0.1

	Cr		Hg		Zn	
Site	average	stdev.	average	stdev.	average	stdev.
PAL2	**24.9**	0.4	**0.006**	0.000	**30.7**	0.6
PAL3	**17.9**	1.0	**0.004**	0.001	**18.6**	1.4
PAL4	**22.1**	4.4	**0.005**	0.001	**22.9**	4.2
PAL5	**25.1**	0.8	**0.007**	0.001	**31.2**	0.6
PAL6	**26.0**	1.6	**0.008**	0.001	**32.4**	2.0
PAL7	**17.9**	0.9	**0.013**	0.005	**25.2**	1.0
PAL8	**18.9**	0.7	**0.012**	0.002	**31.5**	1.5
PAL10	**25.3**	1.8	**0.007**	0.002	**27.4**	3.4
PAL11	**24.8**	2.5	**0.006**	0.001	**27.2**	1.8
PAL12	**16.0**	1.4	**0.006**	0.001	**18.8**	2.8
PAL13	**25.0**	3.2	**0.011**	0.005	**38.2**	1.7
PAL14	**25.0**	3.8	**0.007**	0.004	**42.4**	9.1
PAL15	**19.8**	7.2	**0.005**	0.002	**20.9**	7.2

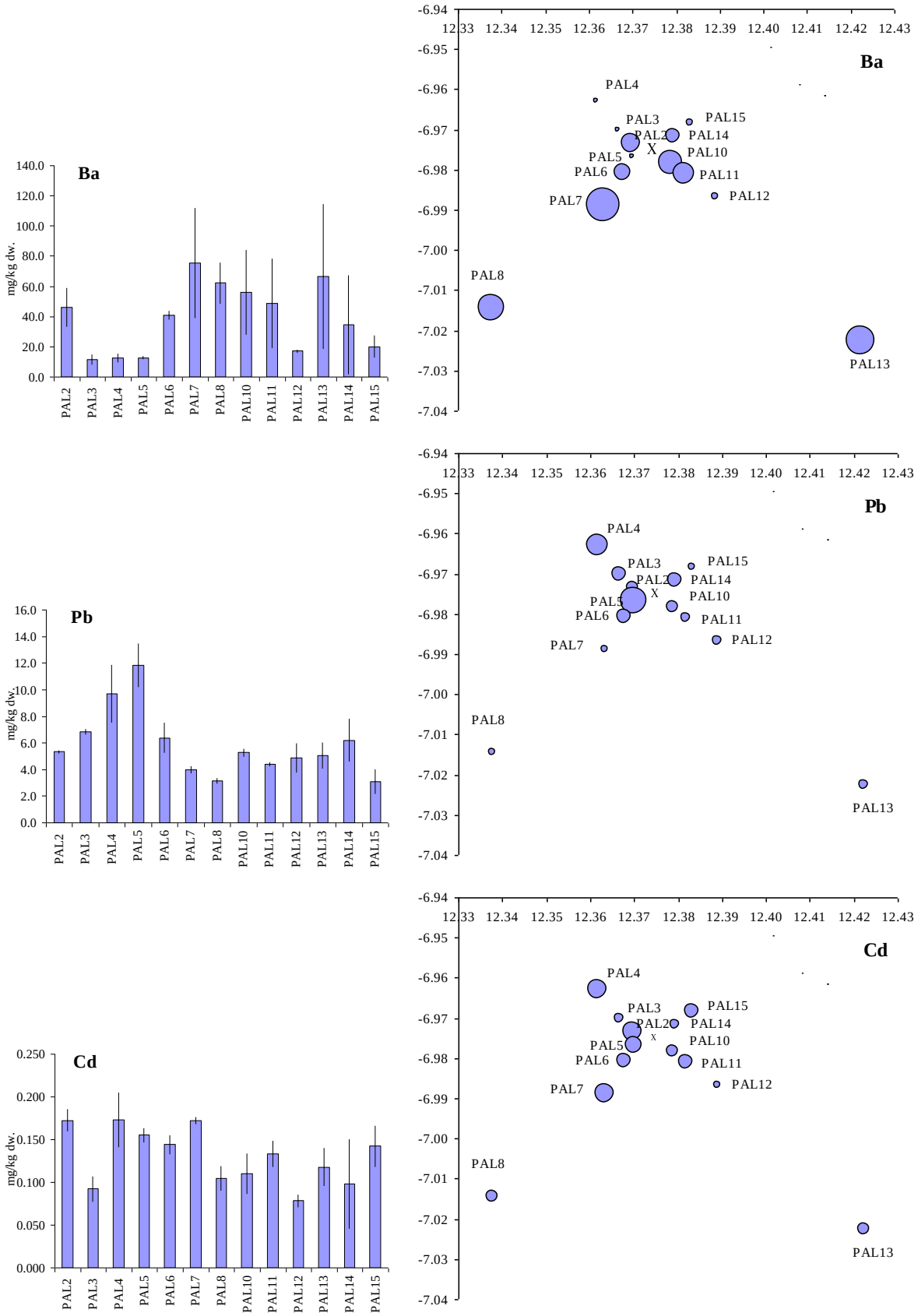

Figure 7.4. Result of the metal analysis from Palanca sites in Soyo. The size of the circle to the right reflect the concentration of hydrocarbons.

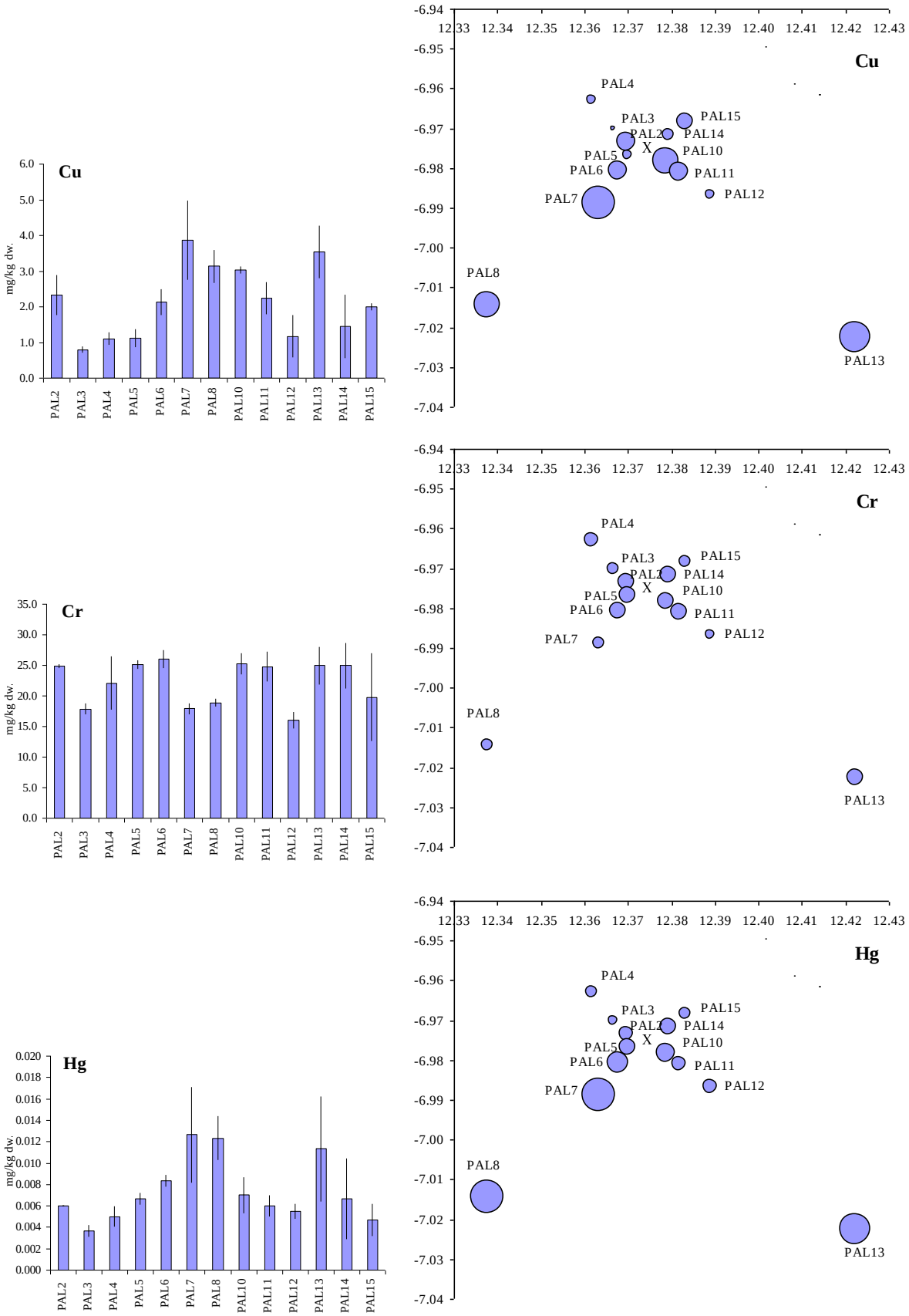

Figure 6.5 continue. Result of the metal analysis from Palanca sites in Soyo. The size of the circle to the right reflect the concentration of hydrocarbons.

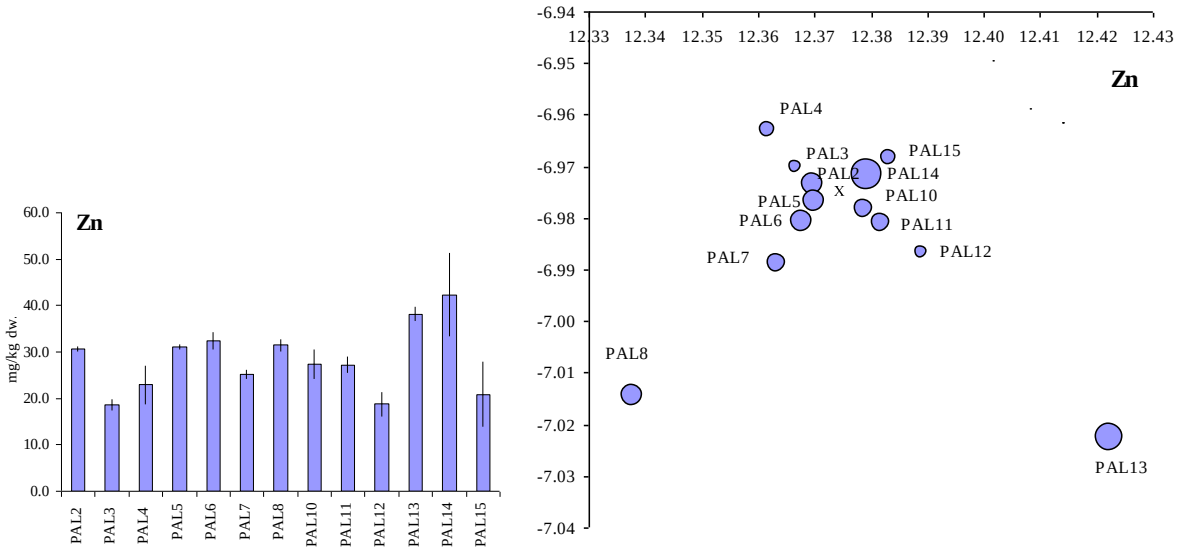

Figure 6.5 continue. Result of the metal analysis from Palanca sites in Soyo. The size of the circle to the right reflects the concentration of hydrocarbons.

7.2.3 Bottom fauna

In possess at INIP Angola in cooperation with IMR.

7.3 Summary and conclusions

13 sites along four different transects around Palanca were investigated. The samples were collected 300, 500, 1000, 2000 and 4000 m from the platform. The sediment was mostly sandy with low content of TOM. The concentration of hydrocarbons and metals were generally low in the sediment.

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9 LIST OF ABBREVIATIONS

Ba	Barium
Cd	Cadmium
Cu	Copper
CTD	Conductivity, Temperature and Density
DGPS	Differential Global Positioning System
ES_{100}	Expected number of species in a 100 specimens sample
Fe	Iron
GC/FID	Gas chromatography with flame ionization detector
GC/MS	Gas chromatography with mass selective detector
GPS	Global Positioning System
H'	Shannon-Wiener diversity
Hg	Mercury
IMR	Institute of Marine Research
J	Pielou's measure of evenness
LSC	Lower significant contamination
MDS	Multidimensional scaling
NPD	Naphthalene, Phenathrene/Anthracene, Dibenzothiophene and their C_1-C_3 homologues
NS	Norwegian Standard
PAH	Polycyclic Aromatic Hydrocarbons, including NPDs and 3-6 ring aromatics
Pb	Lead
SAM	Section of applied environmental research
THC	Total Hydrocarbon Content
TOM	Total Organic Material
UNI	University Science of Bergen
RESEAR CH	
Zn	Zinc

10. APPENDIX

Appendix Table 1. Selected data from the meterological observations.

dat	time	Lon	Lat	Depth	Water Temp	Air temp	Truewind speed	Truewind dir	Rel humidity	Air Pressure
20.04.2009	00:00:58	12.12639500	-5.533446667	13	26.7	27.3	2.80	153.49	97	1010.0
20.04.2009	04:00:00	12.12615000	-5.533666667	13	26.4	26.5	7.37	87.74	100	1010.4
20.04.2009	08:00:00	12.12618500	-5.533700000	13	26.4	27.1	7.25	155.67	91	1011.8
20.04.2009	12:00:00	11.87722167	-5.419175000	51	27.3	27.2	14.02	152.19	80	1009.5
20.04.2009	16:00:00	11.81757500	-5.255123333	64	27.8	27.6	15.33	194.95	78	1007.5
20.04.2009	20:00:59	11.70702667	-5.332410000	99	27.6	27.9	10.95	185.65	82	1010.9
21.04.2009	00:00:59	11.75519167	-5.411605000	80	27.2	27.9	12.20	165.26	86	1009.9
21.04.2009	04:00:59	11.72749833	-5.347455000	90	27.0	27.9	10.80	165.62	84	1009.8
21.04.2009	08:00:00	11.82718333	-5.196135000	65	26.9	27.3	11.06	135.53	86	1011.4
21.04.2009	12:00:00	11.68734833	-5.308133333	106	27.1	27.8	4.43	165.88	82	1008.3
21.04.2009	16:00:01	11.62557000	-5.348093333	129	27.5	29.2	11.64	215.79	77	1005.7
21.04.2009	20:00:01	11.67523667	-5.321810000	110	27.1	28.2	10.39	196.10	83	1008.5
22.04.2009	00:00:00	11.76847333	-5.412806667	74	27.4	28.3	7.18	147.02	84	1007.6
22.04.2009	04:00:00	11.78337333	-5.418416667	70	27.0	27.9	9.14	196.88	85	1006.8
22.04.2009	08:00:00	11.61921000	-5.348770000	132	27.3	29.0	7.69	189.04	78	1009.1
22.04.2009	12:00:59	11.62089667	-5.344188333	132	27.3	29.3	4.18	157.28	77	1006.9
22.04.2009	16:00:01	11.63994500	-5.343391667	123	27.4	29.2	11.73	199.36	77	1004.4
22.04.2009	20:00:00	11.67820167	-5.320676667	108	27.7	28.7	10.34	176.69	82	1008.1
23.04.2009	00:00:00	11.69895667	-5.328805000	103	26.9	27.8	12.05	140.46	98	1007.5
23.04.2009	04:00:01	11.74548500	-5.365521667	81	26.2	25.6	10.32	116.44	80	1006.4
23.04.2009	08:00:59	11.61194333	-5.354685000	138	26.1	26.6	1.59	104.03	78	1008.7
23.04.2009	12:00:00	11.71172500	-5.324288333	98	26.2	27.8	9.03	163.20	71	1006.9
23.04.2009	16:00:00	11.91264500	-5.615671667	50	26.0	27.9	11.81	193.17	80	1004.7
23.04.2009	20:00:01	11.87074333	-5.601456667	57	26.2	27.9	9.97	189.27	84	1007.0
24.04.2009	00:00:00	11.76731333	-5.379333333	73	26.2	27.1	3.08	247.74	100	1007.3
24.04.2009	04:00:00	11.92238167	-5.421658333	44	26.2	26.1	5.37	61.26	100	1006.7
24.04.2009	08:00:59	12.06627667	-5.344996667	21	25.6	26.4	4.65	63.11	100	1009.1
24.04.2009	12:00:00	12.12951333	-5.515323333	13	25.6	27.9	13.69	189.95	81	1006.9
24.04.2009	16:00:00	12.12948167	-5.515306667	14	25.0	28.1	11.94	217.03	82	1005.2
24.04.2009	20:00:59	11.95217333	-5.921906667	50	26.6	28.2	12.00	183.67	86	1008.2
25.04.2009	00:00:00	12.01609167	-6.249815000	62	27.1	26.4	18.46	165.4	97	1008.0
25.04.2009	04:00:59	12.24533333	-6.776066667	56	27.1	27.1	6.90	67.20	85	1007.8
25.04.2009	08:00:00	12.37906000	-6.979273333	47	27.0	27.1	6.14	137.77	81	1009.8
25.04.2009	12:00:00	12.38377667	-6.988148333	49	27.1	28.9	10.40	163.71	71	1008.0
25.04.2009	16:00:59	12.38447667	-6.989520000	50	27.1	27.7	13.69	202.19	82	1005.3
25.04.2009	20:00:01	12.16420667	-7.166756667	155	27.4	28.6	10.22	217.97	79	1008.5
26.04.2009	00:00:00	12.17744833	-7.172461667	151	27.2	28.0	5.54	185.46	82	1009.3
26.04.2009	04:00:00	12.25492667	-7.102530000	108	26.8	28.0	11.95	223.7	80	1007.4
26.04.2009	08:00:00	12.37709667	-6.988981667	48	26.3	27.0	7.18	78.22	100	1011.0
26.04.2009	12:00:00	12.37602500	-7.016975000	57	26.3	29.4	4.06	54.20	74	1009.6
26.04.2009	16:00:00	12.36145667	-6.962881667	52	25.6	28.7	14.27	230.54	77	1006.5
26.04.2009	20:00:59	12.36632000	-6.984581667	50	27.2	28.2	5.86	227.64	80	1010.0
27.04.2009	00:00:00	12.42293333	-7.022531667	51	26.5	28.0	6.63	202.68	82	1010.4
27.04.2009	04:00:02	12.41986333	-7.009056667	50	26.8	27.5	6.98	178.19	83	1008.4
27.04.2009	08:00:00	12.37873000	-6.978445000	48	27.0	27.1	8.31	73.55	99	1011.5
27.04.2009	12:00:59	12.37983667	-6.968916667	44	27.6	30.0	8.15	183.68	73	1009.0
27.04.2009	16:00:00	12.23739833	-6.746925000	61	28.0	28.5	14.93	222.91	78	1007.3

Appendix table 2 Sediment caracteristics at all Lomba sites, 2009.

Site	Mean(Φ)	Mean	Sorting	Sorting	Skewness	Skewness	Kurtosis	Kurtosis	Median(Φ)
LB 1	6,354	Medium Silt	3,221	Very Poorly Sorted	-0,467	Very Coarse Skewed	0,440	Very Platykurtic	7,216
LB 2	6,336	Medium Silt	3,102	Very Poorly Sorted	-0,102	Coarse Skewed	0,436	Very Platykurtic	6,163
LB 3	7,746	Fine Silt	1,977	Poorly Sorted	-0,718	Very Coarse Skewed	0,503	Very Platykurtic	8,450
LB 4a	6,488	Medium Silt	3,184	Very Poorly Sorted	-0,520	Very Coarse Skewed	0,456	Very Platykurtic	7,460
LB 5	6,687	Medium Silt	3,058	Very Poorly Sorted	-0,697	Very Coarse Skewed	0,529	Very Platykurtic	8,059
LB 6	7,038	Fine Silt	2,736	Very Poorly Sorted	-0,753	Very Coarse Skewed	0,601	Very Platykurtic	8,296
LB 7	6,762	Medium Silt	2,807	Very Poorly Sorted	-0,519	Very Coarse Skewed	0,454	Very Platykurtic	7,597
LB 8	6,964	Medium Silt	2,622	Very Poorly Sorted	-0,396	Very Coarse Skewed	0,540	Very Platykurtic	7,368
LB 9	6,686	Medium Silt	2,985	Very Poorly Sorted	-0,531	Very Coarse Skewed	0,441	Very Platykurtic	7,581
LB 10	7,794	Fine Silt	1,892	Poorly Sorted	-0,708	Very Coarse Skewed	0,537	Very Platykurtic	8,441
LB 15	6,569	Medium Silt	2,888	Very Poorly Sorted	-0,302	Very Coarse Skewed	0,422	Very Platykurtic	6,916
LB 16	6,921	Medium Silt	2,709	Very Poorly Sorted	-0,572	Very Coarse Skewed	0,480	Very Platykurtic	7,825
LB 17	5,966	Coarse Silt	2,966	Very Poorly Sorted	0,204	Fine Skewed	0,436	Very Platykurtic	5,156
LB 18	6,500	Medium Silt	2,750	Very Poorly Sorted	-0,324	Very Coarse Skewed	0,388	Very Platykurtic	6,911

Site	% V FINE GRAVEL:	% V COARSE SAND:	% COARSE SAND:	% MEDIUM SAND:	% FINE SAND:	% V FINE SAND:	% V COARSE SILT:	% COARSE SILT:	% MEDIUM SILT:	% FINE SILT:	% V FINE SILT:	% CLAY:
LB 1	0,01 %	0,02 %	3,9%	15,5%	8,0%	3,2%	5,4%	8,4%	3,8%	8,3%	10,9%	32,5%
LB 2	0,00 %	0,01 %	0,09 %	8,0%	20,0%	5,9%	6,3%	9,3%	2,6%	5,9%	10,0%	31,9%
LB 3	0,13 %	0,01 %	0,02 %	0,24 %	4,6%	4,4%	5,3%	12,1%	4,9%	10,9%	16,5%	41,0%
LB 4a	0,00 %	0,01 %	3,2%	14,0%	7,7%	3,4%	3,8%	11,1%	3,2%	8,1%	11,0%	34,6%
LB 5	0,00 %	0,02 %	3,6%	11,4%	6,4%	2,9%	2,2%	10,4%	3,9%	8,5%	12,1%	38,6%
LB 6	0,04 %	0,03 %	2,2%	8,0%	5,5%	2,6%	3,7%	10,3%	4,2%	9,3%	14,2%	40,0%
LB 7	0,00 %	0,02 %	0,11 %	4,4%	15,8%	4,6%	3,8%	12,7%	4,0%	7,8%	9,7%	37,1%
LB 8	0,01 %	0,04 %	0,12 %	3,0%	10,6%	4,7%	7,1%	16,4%	4,5%	9,7%	10,7%	33,1%
LB 9	0,14 %	0,01 %	0,9%	9,0%	13,2%	5,5%	6,6%	3,2%	6,9%	7,9%	9,9%	36,8%
LB 10	0,00 %	0,02 %	0,05 %	0,55 %	3,7%	2,9%	6,5%	8,1%	10,9%	11,0%	14,2%	42,0%
LB 15	0,00 %	0,02 %	0,05 %	3,5%	19,9%	5,7%	6,3%	8,1%	7,0%	7,9%	8,8%	32,7%
LB 16	0,02 %	0,02 %	0,05 %	1,6%	14,5%	6,6%	3,8%	9,1%	6,3%	9,8%	11,5%	36,7%
LB 17	0,01 %	0,05 %	0,30 %	1,7%	28,8%	11,4%	6,7%	6,9%	5,9%	5,3%	6,7%	26,2%
LB 18	0,00 %	0,02 %	0,02 %	0,43 %	21,4%	11,4%	4,4%	6,6%	6,4%	8,7%	8,6%	32,1%

Appendix table 3 Sediment caracteristics at Cabinda sites, 2009.

	Mean((ϕ))	Mean	Sorting	Sorting	Skewness	Skewness	Kurtosis	Kurtosis	Median((ϕ))
MF-N-1	4,850	Very Coarse Silt	Poorly Sorted	1,770	0,181	Fine Skewed	0,755	Platykurtic	4,582
MF-N-2	4,651	Very Coarse Silt	Very Poorly Sorted	2,004	0,052	Symmetrical	0,752	Platykurtic	4,553
MF-N-R	5,838	Coarse Silt	Poorly Sorted	1,374	-0,038	Symmetrical	0,799	Platykurtic	5,838
TK-K-1	4,723	Very Coarse Silt	Very Poorly Sorted	2,035	-0,009	Symmetrical	0,777	Platykurtic	4,704
TK-K-2	5,082	Coarse Silt	Very Poorly Sorted	2,014	-0,184	Coarse Skewed	0,923	Mesokurtic	5,312
TK-O-1	5,930	Coarse Silt	Poorly Sorted	1,268	0,000	Symmetrical	0,738	Platykurtic	5,930
TK-O-2	5,954	Coarse Silt	Poorly Sorted	1,253	0,000	Symmetrical	0,738	Platykurtic	5,954
WA-B-1	5,969	Coarse Silt	Poorly Sorted	1,245	0,000	Symmetrical	0,738	Platykurtic	5,969
WA-B-2	5,968	Coarse Silt	Poorly Sorted	1,245	0,000	Symmetrical	0,738	Platykurtic	5,968
GS-D-1	4,764	Very Coarse Silt	Poorly Sorted	1,816	0,213	Fine Skewed	0,822	Platykurtic	4,395
GS-D-2	4,864	Very Coarse Silt	Poorly Sorted	1,753	0,209	Fine Skewed	0,791	Platykurtic	4,531

Site	% FINE GRAVEL:	% V FINE GRAVEL:	% V COARSE SAND:	% COARSE SAND:	% MEDIUM SAND:	% FINE SAND:	% V FINE SAND:	% MUD:
MF-N-1	0,00 %	0,02 %	0,03 %	0,09 %	0,52 %	13,7%	27,2%	58,5%
MF-N-2	0,03 %	0,08 %	0,07 %	0,34 %	6,6%	17,6%	17,3%	58,0%
MF-N-R	0,00 %	0,01 %	0,03 %	0,06 %	0,19 %	1,7%	5,5%	92,5%
TK-K-1	0,00 %	0,13 %	0,21 %	0,69 %	7,3%	14,7%	16,3%	60,7%
TK-K-2	0,00 %	0,27 %	0,23 %	0,94 %	5,8%	11,0%	7,3%	74,4%
TK-O-1	0,00 %	0,06 %	0,02 %	0,06 %	0,23 %	1,4%	1,6%	96,6%
TK-O-2	0,00 %	0,03 %	0,01 %	0,07 %	0,18 %	0,80 %	1,1%	97,8%
WA-B-1	0,04 %	0,05 %	0,02 %	0,04 %	0,14 %	0,40 %	0,86 %	98,5%
WA-B-2	0,00 %	0,14 %	0,10 %	0,08 %	0,17 %	0,42 %	0,69 %	98,4%
GS-D-1	0,05 %	0,13 %	0,19 %	0,67 %	4,3%	9,1%	30,0%	55,5%
GS-D-2	0,03 %	0,06 %	0,12 %	0,48 %	2,7%	7,2%	31,8%	57,7%

Appendix table 4 Sediment caracteristics at all Palanca sites, 2009.

Site	Mean((ϕ))	Mean	Sorting	Sorting	Skewness	Skewness	Kurtosis	Kurtosis	Median((ϕ))
Pal2	1,922	Medium Sand	1,131	Poorly Sorted	0,249	Fine Skewed	1,501	Very Leptokurtic	1,842
Pal3	0,648	Coarse Sand	1,210	Poorly Sorted	-0,076	Symmetrical	1,207	Leptokurtic	0,694
Pal4	1,853	Medium Sand	1,643	Poorly Sorted	0,187	Fine Skewed	1,262	Leptokurtic	1,742
Pal5	0,689	Coarse Sand	1,016	Poorly Sorted	0,134	Fine Skewed	1,165	Leptokurtic	0,622
Pal6	0,412	Coarse Sand	2,290	Very Poorly Sorted	-0,201	Coarse Skewed	0,902	Mesokurtic	0,850
Pal7	1,328	Medium Sand	2,585	Very Poorly Sorted	-0,199	Coarse Skewed	1,003	Mesokurtic	2,001
Pal8	2,001	Fine Sand	2,039	Very Poorly Sorted	0,318	Very Fine Skewed	1,575	Very Leptokurtic	1,665
Pal10	0,786	Coarse Sand	1,957	Poorly Sorted	-0,131	Coarse Skewed	1,249	Leptokurtic	0,928
Pal11	0,409	Coarse Sand	2,314	Very Poorly Sorted	-0,345	Very Coarse Skewed	0,739	Platykurtic	1,181
Pal12	-0,190	Very Coarse Sand	1,628	Poorly Sorted	0,156	Fine Skewed	0,923	Mesokurtic	-0,351
Pal13	2,530	Fine Sand	2,740	Very Poorly Sorted	-0,171	Coarse Skewed	2,035	Very Leptokurtic	2,710
Pal14	0,751	Coarse Sand	1,018	Poorly Sorted	0,033	Symmetrical	1,083	Mesokurtic	0,730
Pal15	1,448	Medium Sand	1,415	Poorly Sorted	-0,410	Very Coarse Skewed	1,412	Leptokurtic	1,739

Site	Medium gravel	Fine gravel	V. fine gravel	V. coarse sand	Coarse sand	Medium sand	Fine sand	V. fine sand	% Pelite:
Pal2	0,00 %	0,00 %	0,24 %	0,90 %	10,5%	45,5%	32,3%	3,8%	6,6%
Pal3	0,44 %	2,3%	5,7%	15,5%	37,5%	29,4%	6,7%	1,2%	1,2%
Pal4	0,00 %	0,29 %	2,1%	4,8%	20,3%	30,3%	21,1%	13,1%	8,0%
Pal5	0,00 %	0,14 %	1,7%	19,0%	46,9%	23,2%	6,2%	1,6%	1,2%
Pal6	11,2%	6,3%	7,7%	11,9%	15,0%	19,3%	19,7%	4,1%	4,7%
Pal7	8,9%	4,2%	8,0%	6,7%	9,2%	12,9%	25,1%	14,2%	10,7%
Pal8	0,38 %	1,2%	1,8%	6,0%	18,7%	33,0%	17,9%	5,2%	15,9%
Pal10	4,6%	6,0%	6,4%	10,1%	24,7%	23,4%	14,9%	6,2%	3,7%
Pal11	14,5%	4,5%	7,7%	9,1%	10,7%	19,8%	25,3%	6,2%	2,3%
Pal12	1,0%	9,0%	25,8%	21,9%	18,7%	13,8%	6,6%	1,3%	1,9%
Pal13	5,4%	2,1%	3,8%	3,7%	4,1%	10,9%	28,2%	22,8%	19,0%
Pal14	0,00 %	0,26 %	4,0%	15,1%	42,0%	30,4%	6,2%	1,3%	0,7%
Pal15	3,3%	1,1%	6,0%	5,9%	8,1%	34,6%	37,7%	2,4%	0,9%

Appendix Table 5. Concentration of metals and total hydrocarbon (mg/kg dw) and dry weight % at Lomba in April 2009.

Site	Sample nr	Sediment depth	Barium Ba	Lead Pb	Cadmium Cd	Copper Cu	Chromium Cr	Mercury Hg	Zinc Zn	THC C12-35	Dry weight
LB1	1	0-1 cm	199	11.5	0.046	9	42.8	0.054	71.1	230	54.2
LB1	2	0-1 cm	1560	13.4	0.046	12.4	40	0.086	60.6	96	49.7
LB1	3	0-1 cm	1920	13.1	0.051	9.9	42.3	0.058	72.4	90	55.9
LB1	1	1-3 cm	159	12.2	0.052	9.7	48.7	0.054	79.6	31	56.4
LB1	1	3-6 cm	1240	14.6	0.053	11.5	47.1	0.072	78.1	13	55.9
LB2	1	0-1 cm	224	15.1	0.042	6.7	53.5	0.044	98.9	23	57.6
LB2	2	0-1 cm	827	14.1	0.056	6.9	48.9	0.045	91	24	57.7
LB2	3	0-1 cm	444	12.7	0.048	11.8	46.7	0.06	69.7	26	51.9
LB2	1	1-3 cm	321	13.4	0.059	7.1	46.8	0.044	81.7	24	57.2
LB2	1	3-6 cm	678	15.1	0.056	6.2	50.6	0.04	97.3	18	57.1
LB3	1	0-1 cm	284	12.8	0.052	12.1	43.8	0.056	63.6	29	49.5
LB3	2	0-1 cm	153	11.3	0.047	11.2	41	0.055	58.2	29	49.9
LB3	3	0-1 cm	135	10.6	0.052	10.2	40.4	0.051	59.4	28	50.6
LB4	1	0-1 cm	117	10.7	0.054	9.5	43.1	0.049	66.4	13	55.9
LB4	2	0-1 cm	155	10.8	0.044	9.5	41	0.049	61.7	13	55.7
LB4	3	0-1 cm	119	11.7	0.051	8.9	45.7	0.048	75.2	13	54.7
LB5	1	0-1 cm	1530	14.4	0.061	11.7	43	0.055	73.3	32	52.6
LB5	2	0-1 cm	1220	14.2	0.052	13.5	43.1	0.057	67.2	29	49.4
LB5	3	0-1 cm	1600	15.9	0.086	12.7	43.1	0.059	65.6	32	42.7
LB6	1	0-1 cm	443	13.3	0.082	9.8	47.4	0.049	78.6	14	56.8
LB6	2	0-1 cm	646	13.6	0.065	11.6	41.5	0.059	59.1	16	47.1
LB6	3	0-1 cm	421	13.1	0.061	12.1	40.3	0.055	56.1	16	48.5
LB7	1	0-1 cm	178	14	0.083	12.2	45.8	0.062	65.1	16	53.4
LB7	2	0-1 cm	113	13.7	0.068	8.7	46.7	0.046	70.5	14	57.1
LB7	3	0-1 cm	87.6	16.8	0.073	6.2	56.2	0.044	93.7	13	62.5
LB8	1	0-1 cm	217	14.8	0.057	12.9	44.6	0.062	59.8	16	47.4
LB8	2	0-1 cm	65.2	18.1	0.067	8.1	54.3	0.045	84.7	16	49.6
LB8	3	0-1 cm	84.6	17.3	0.063	10.7	51.8	0.056	73.2	15	49.6
LB9	1	0-1 cm	60.1	17.1	0.078	9.7	53.3	0.052	80.7	7.1	56.1
LB9	2	0-1 cm	51.5	14.5	0.057	11.4	45.2	0.058	57	7.6	52.6
LB9	3	0-1 cm	65.7	16.3	0.068	12.8	48	0.063	58.5	7.4	55.4
LB10	1	0-1 cm	39.6	12.9	0.057	9.8	42.2	0.05	53.2	7.5	53.4
LB10	2	0-1 cm	46.1	16.3	0.065	13.2	52.2	0.063	66.9	9.7	51.3
LB10	3	0-1 cm	593	12.9	0.062	9.7	50	0.052	73.1	9.3	52.9
LB15	1	0-1 cm	830	12.9	0.061	9.8	49.2	0.051	70.3	22	56.1
LB15	2	0-1 cm	447	13.3	0.062	6.9	52.4	0.038	82.9	16	58.1
LB15	3	0-1 cm	718	13.8	0.067	11.7	49.1	0.06	66.6	22	55.7
LB16	1	0-1 cm	679	14.8	0.058	11.5	54.7	0.063	75.4	8.2	56.3
LB16	2	0-1 cm	346	11.6	0.043	11.5	40.6	0.058	49.5	8.7	52.7
LB16	3	0-1 cm	633	13.2	0.045	13	46.8	0.056	58.1	8.1	51.7
LB17	1	0-1 cm	115	20.1	0.049	3.5	69.5	0.031	97.3	15	67.8
LB17	2	0-1 cm	227	16.2	0.034	8.6	59	0.045	75.6	16	59.6
LB17	3	0-1 cm	159	18.3	0.04	6.1	53.1	0.037	86	18	61.8
LB18	1	0-1 cm	123	17.1	0.055	6.6	51.5	0.043	80.1	16	61.7
LB18	2	0-1 cm	131	19	0.06	6	56.2	0.041	88.6	15	60.1
LB18	3	0-1 cm	99.3	17.8	0.059	5.9	53.5	0.037	85.5	14	62.9

Appendix Table 6. Concentration of PAH (mg/kg dw) at Lomba in April 2009.

Site	Sample nr	Sediment depth	Acen-aphthene	Acen-aphthylene	Anthracene	Benzo (g,h,i) perylene	Benzo(a) anthracene	Benzo(a) pyrene,	Benzo(b,k) fluoranthene	Chrysene	Dibenzo (a,h) anthracene	Fluor-anthene	Fluorene	Indeno (1,2,3-cd) pyrene	Nafthalene	Phen-anthrene	Pyrene	PAH(16)
LB1	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.008	0.011
LB1	2	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.011	0.016
LB1	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.008	0.011
LB1	1	1-3 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.008	0.008
LB1	1	3-6 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB2	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB2	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB2	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.004
LB2	1	1-3 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB2	1	3-6 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB3	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB3	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.004
LB3	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB4	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002
LB4	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
LB4	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
LB5	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.006
LB5	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.006
LB5	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.007	0.007
LB6	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB6	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB6	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB7	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB7	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB7	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB8	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB8	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.004
LB8	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB9	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB9	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB9	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB10	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB10	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB10	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB15	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB15	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.007	0.007
LB15	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB16	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB16	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
LB16	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.004
LB17	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002
LB17	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002
LB17	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002
LB18	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
LB18	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002
LB18	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003

Appendix Table 7. Concentration of NPD (mg/kg dw) at Lomba in April 2009.

Site	Sample nr	Sediment depth	Dibenzo-thiophen	Dibenzo-thiophen C1	Dibenzo-thiophen C2	Dibenzo-thiophen C3	Nafthalene	Naftalen C1	Naftalen C2	Naftalen C3	Phenanthrene	Phenantren C1	Phenantren C2	Phenantren C3	NPD
LB1	1	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	0.002	0.002	< 0.001	0.007	0.007	0.011	0.031
LB1	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	< 0.001	0.006	0.007	0.011	0.028
LB1	3	0-1 cm	< 0.001	< 0.001	< 0.001	0.008	< 0.001	< 0.001	0.002	0.002	< 0.001	0.007	0.006	0.01	0.035
LB1	1	1-3 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.002	0.003	0.008
LB1	1	3-6 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
LB2	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.004	0.006	0.012
LB2	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	0.006	0.013
LB2	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	0.007	0.014
LB2	1	1-3 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.003	0.004	0.009
LB2	1	3-6 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.002	0.003	0.008
LB3	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	0.007
LB3	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	0.007
LB3	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003	0.006
LB4	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.003	0.005
LB4	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	0.004
LB4	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	0.004
LB5	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.006	0.012
LB5	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	0.007
LB5	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.004	0.008
LB6	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.003	0.005
LB6	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003	0.006
LB6	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.004	0.006
LB7	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.005	0.009
LB7	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003	0.006
LB7	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	0.007
LB8	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	0.007
LB8	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.005	0.008
LB8	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003	0.006
LB9	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.003	0.005
LB9	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003	0.006
LB9	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.003	0.005
LB10	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.004	0.005	0.011
LB10	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.005	0.006	0.013
LB10	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.004	0.006	0.012
LB15	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.006	0.007	0.018
LB15	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.005	0.006	0.014
LB15	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.006	0.007	0.016
LB16	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	0.007
LB16	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.004	0.008
LB16	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	0.007
LB17	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.003	0.005
LB17	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.004	0.006
LB17	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.004	0.007
LB18	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.003	0.005
LB18	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003	0.006
LB18	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.003	0.005

Appendix Table 8. Concentration of metals and total hydrocarbon (mg/kg dw) and dry weight % in Cabinda in April 2009.

Site	Sample nr	Sediment depth	Barium Ba	Lead Pb	Cadmium Cd	Copper Cu	Chromium Cr	Mercury Hg	Zinc Zn	THC C12-35	Dry weight
MF-N-1	1	0-1 cm	102	14.2	0.060	4.1	41.4	0.027	104	180	62.3
MF-N-1	2	0-1 cm	271	18.9	0.052	5.9	40.4	0.048	87.8	180	55.1
MF-N-1	3	0-1 cm	354	17.2	0.067	6.5	39.2	0.048	80.7	29	60.3
MF-N-2	1	0-1 cm	103	18.8	0.059	4.9	40.5	0.042	92.6	14	63.6
MF-N-2	2	0-1 cm	99.6	18.5	0.057	5.5	40.4	0.046	89.1	14	63.5
MF-N-2	3	0-1 cm	67.6	19.4	0.054	6.1	41.6	0.051	90.2	15	63.5
MF-N-R	1	0-1 cm	84.7	19.5	0.059	8.4	42.5	0.074	74.3	19	43.4
MF-N-R	2	0-1 cm	71.3	19.5	0.058	8.7	42.3	0.072	72.3	17	49.1
MF-N-R	3	0-1 cm	74.2	18.4	0.056	8.7	41.0	0.073	68.2	16	51.1
TK-K-1	1	0-1 cm	155	16.5	0.052	7.4	42.8	0.042	75.3	30	57.2
TK-K-1	2	0-1 cm	167	16.8	0.056	7.8	43.9	0.049	76.5	25	58.5
TK-K-1	3	0-1 cm	181	17.6	0.062	9.2	42.3	0.052	68.7	34	54.3
TK-K-2	1	0-1 cm	248	17.8	0.078	10.8	42.1	0.055	64.8	26	46.9
TK-K-2	2	0-1 cm	72.3	13.5	0.051	7.4	42.4	0.039	73.0	21	46.7
TK-K-2	3	0-1 cm	85.2	16.1	0.043	10.4	38.3	0.051	56.8	25	52
TK-O-1	1	0-1 cm	458	16.6	0.067	10.6	39.3	0.051	57.9	36	49.9
TK-O-1	2	0-1 cm	419	17.8	0.073	12.1	40.7	0.059	58.1	37	48.7
TK-O-1	3	0-1 cm	411	17.1	0.062	11.5	39.7	0.055	56.1	37	48.7
TK-O-2	1	0-1 cm	205	16.2	0.049	10.4	37.6	0.052	54.0	21	49.4
TK-O-2	2	0-1 cm	175	15.6	0.052	10.7	37.0	0.052	49.0	25	50.4
TK-O-2	3	0-1 cm	654	20.8	0.192	16.3	44.8	0.069	66.5	24	48.4
WA-B-1	1	0-1 cm	420	18.3	0.189	12.8	36.9	0.07	53.7	290	49.7
WA-B-1	2	0-1 cm	987	19.5	0.085	13.3	42.7	0.061	65.8	300	48.3
WA-B-1	3	0-1 cm	800	19.9	0.171	13.0	37.1	0.071	57.4	310	48.4
WA-B-2	1	0-1 cm	291	17.9	0.041	10.9	38.4	0.051	55.3	41	50.5
WA-B-2	2	0-1 cm	387	18.2	0.045	11.8	38.1	0.053	54.4	45	47.5
WA-B-2	3	0-1 cm	241	18.2	0.049	11.1	39.6	0.053	56.1	41	48.2
GS-D-1	1	0-1 cm	110	7.7	0.047	2.7	22.1	0.015	44.2	14	73.5
GS-D-1	2	0-1 cm	104	7.9	0.069	3.0	22.7	0.017	43.9	14	73.8
GS-D-1	3	0-1 cm	101	8.1	0.088	3.1	23.3	0.017	44.2	13	72.6
GS-D-2	1	0-1 cm	85.7	8.9	0.087	4.2	24.8	0.022	45.8	8.0	72.4
GS-D-2	2	0-1 cm	85.6	9.0	0.080	3.5	24.4	0.021	46.9	8.1	72.7
GS-D-2	3	0-1 cm	72.4	9.1	0.075	4.1	25.3	0.023	45.3	8.1	71.6

Appendix Table 9. Concentration of PAH (mg/kg dw) at Cabinda sites in April 2009.

Site	Sample nr	Sediment depth	Acen-aphthene	Acen-aphthylene	Anthracene	Benzo (g,h,i) perylene	Benzo(a) anthracene	Benzo(a) pyrene,	Benzo(b,k) fluoranthene	Chrysene	Dibenzo (a,h) anthracene	Fluor-anthene	Fluorene	Indeno (1,2,3-cd) pyrene	Nafthalene	Phen-anthrene	Pyrene	PAH(16)
MF-N-1	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
MF-N-1	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
MF-N-1	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
MF-N-2	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
MF-N-2	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
MF-N-2	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002
MF-N-R	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
MF-N-R	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
MF-N-R	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
TK-K-1	1	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.012
TK-K-1	2	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.010
TK-K-1	3	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.011
TK-K-2	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.006
TK-K-2	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.006
TK-K-2	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.006
TK-O-1	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.006
TK-O-1	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.01	0.010
TK-O-1	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.009	0.009
TK-O-2	1	0-1 cm	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.011
TK-O-2	2	0-1 cm	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	0.009	0.015
TK-O-2	3	0-1 cm	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	0.009	0.015
WA-B-1	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003	< 0.001	0.008	< 0.001	< 0.001	< 0.001	0.003	0.085	0.102
WA-B-1	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003	< 0.001	0.008	< 0.001	< 0.001	< 0.001	0.003	0.09	0.108
WA-B-1	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.003	< 0.001	0.009	< 0.001	< 0.001	< 0.001	0.004	0.092	0.112
WA-B-2	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
WA-B-2	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.005
WA-B-2	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.004
GS-D-1	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
GS-D-1	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
GS-D-1	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003
GS-D-2	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
GS-D-2	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01
GS-D-2	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	<0.01

Appendix Table 10. Concentration of NPD (mg/kg dw) at Cabinda sites in April 2009.

Site	Sample nr	Sediment depth	Dibenzo-thiophen	Dibenzo-thiophen C1	Dibenzo-thiophen C2	Dibenzo-thiophen C3	Nafthalene	Naftalen C1	Naftalen C2	Naftalen C3	Phenanthrene	Phenantren C1	Phenantren C2	Phenantren C3	NPD
MF-N-1	1	0-1 cm	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.007	0.027	0.16	< 0.001	0.006	0.009	0.01	0.221
MF-N-1	2	0-1 cm	< 0.001	0.003	0.002	< 0.001	< 0.001	0.011	0.024	0.02	< 0.001	0.006	0.014	0.015	0.095
MF-N-1	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.004	0.007	0.013
MF-N-2	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.005	0.009
MF-N-2	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.005	0.009
MF-N-2	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.005	0.009
MF-N-R	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.006	0.010
MF-N-R	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.005	0.009
MF-N-R	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.005	0.009
TK-K-1	1	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.007	0.008	0.013	0.030
TK-K-1	2	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.008	0.012	0.028
TK-K-1	3	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.007	0.011	0.026
TK-K-2	1	0-1 cm	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.008	0.01	0.026
TK-K-2	2	0-1 cm	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.007	0.01	0.024
TK-K-2	3	0-1 cm	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.008	0.011	0.027
TK-O-1	1	0-1 cm	< 0.001	< 0.001	0.004	0.004	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.008	0.007	0.029
TK-O-1	2	0-1 cm	< 0.001	< 0.001	0.005	0.004	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.007	0.007	0.006	0.029
TK-O-1	3	0-1 cm	< 0.001	< 0.001	0.005	0.004	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.007	0.008	0.006	0.030
TK-O-2	1	0-1 cm	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.006	0.007	0.020
TK-O-2	2	0-1 cm	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.007	0.008	0.022
TK-O-2	3	0-1 cm	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.006	0.008	0.021
WA-B-1	1	0-1 cm	< 0.001	0.011	0.03	0.024	< 0.001	0.002	0.005	0.006	0.003	0.047	0.032	0.023	0.183
WA-B-1	2	0-1 cm	< 0.001	0.011	0.034	0.021	< 0.001	0.003	0.006	0.006	0.003	0.044	0.035	0.024	0.187
WA-B-1	3	0-1 cm	< 0.001	0.011	0.035	0.022	< 0.001	0.003	0.005	0.007	0.004	0.046	0.03	0.025	0.188
WA-B-2	1	0-1 cm	< 0.001	< 0.001	0.003	0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.012	0.015	0.041
WA-B-2	2	0-1 cm	< 0.001	< 0.001	0.003	0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.007	0.012	0.016	0.043
WA-B-2	3	0-1 cm	< 0.001	< 0.001	0.003	0.005	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.007	0.012	0.016	0.043
GS-D-1	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003	0.006
GS-D-1	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	0.004
GS-D-1	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.002	0.005
GS-D-2	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.004	0.009
GS-D-2	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.004	0.004	0.008
GS-D-2	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	0.004	0.009

Appendix Table 11. Concentration of metals and total hydrocarbon (mg/kg dw) and dry weight % at Palanca in April 2009.

Site	Sample nr	Sediment depth	Barium Ba	Lead Pb	Cadmium Cd	Copper Cu	Chromium Cr	Mercury Hg	Zinc Zn	THC C12-35	Dry weight
PAL2	1	0-1 cm	60.2	5.3	0.167	3	24.6	0.006	30.4	14	62.2
PAL2	2	0-1 cm	44.1	5.5	0.163	2	25.3	0.006	31.4	12	71.4
PAL2	3	0-1 cm	34.1	5.2	0.188	2	24.7	0.006	30.3	12	66.3
PAL2	1	1-3 cm	49.8	4.9	0.126	2.1	21.4	0.005	26.4	9.7	66.3
PAL2	1	3-6 cm	26.1	5.1	0.115	1.8	20.2	0.004	17.3	6.2	68.2
PAL3	1	0-1 cm	7.6	7.1	0.11	0.69	17.7	0.003	19.6	3.1	83.5
PAL3	2	0-1 cm	12.7	6.6	0.086	0.89	18.9	0.004	19.2	4	75.8
PAL3	3	0-1 cm	14.8	6.8	0.081	0.8	17	0.004	17	4.2	75.5
PAL4	1	0-1 cm	16	9.2	0.142	0.92	17	0.004	18.4	6.6	68.3
PAL4	2	0-1 cm	9.5	7.8	0.207	1.1	24.1	0.006	23.6	6.3	76.5
PAL4	3	0-1 cm	12.3	12.1	0.171	1.3	25.1	0.005	26.8	5.9	76.1
PAL5	1	0-1 cm	14.2	10.1	0.153	1.4	24.4	0.007	30.7	6.6	66.7
PAL5	2	0-1 cm	12.9	12	0.165	1.1	25.1	0.007	31.9	6.6	60.9
PAL5	3	0-1 cm	11.3	13.4	0.148	0.87	25.9	0.006	30.9	5.3	76.1
PAL6	1	0-1 cm	37.4	7.7	0.144	1.7	27.4	0.008	33.7	5.1	73.2
PAL6	2	0-1 cm	43.9	5.8	0.133	2.3	24.3	0.008	30.1	4.8	75.7
PAL6	3	0-1 cm	41.3	5.6	0.156	2.4	26.4	0.009	33.3	5.2	70.6
PAL7	1	0-1 cm	95.6	4.3	0.177	4.7	18.1	0.017	26.1	5.6	70.8
PAL7	2	0-1 cm	33.4	3.9	0.171	2.6	18.7	0.008	25.4	6.2	69.2
PAL7	3	0-1 cm	97.6	3.7	0.168	4.3	16.9	0.013	24.1	5.8	71.1
PAL8	1	0-1 cm	65	3.3	0.118	3.5	19.6	0.014	32.1	2.7	77.2
PAL8	2	0-1 cm	47	2.9	0.089	2.6	18.9	0.01	32.5	2.7	76.4
PAL8	3	0-1 cm	74.5	3.3	0.107	3.3	18.2	0.013	29.8	2.6	74.2
PAL10	1	0-1 cm	43.4	5	0.09	3.1	26.7	0.006	30.7	13	71.1
PAL10	2	0-1 cm	88.3	5.6	0.104	3.1	25.8	0.009	24	11	74.7
PAL10	3	0-1 cm	36.2	5.2	0.137	2.9	23.3	0.006	27.4	12	70.6
PAL11	1	0-1 cm	77.8	4.4	0.129	2.5	22.3	0.007	28.7	11	70.6
PAL11	2	0-1 cm	18.1	4.6	0.12	1.7	27.3	0.005	27.8	10	71.5
PAL11	3	0-1 cm	50.2	4.2	0.151	2.5	24.7	0.006	25.2	11	70.4
PAL12	1	0-1 cm	18.1	4.1	0.084	1.6	15	0.005	16.8	14	66.2
PAL12	2	0-1 cm	16.3	5.7	0.073	0.75	17	0.006	20.7	12	74.3
PAL13	1	0-1 cm	33.8	6.2	0.092	3.1	28.3	0.009	39.7	11	70.4
PAL13	2	0-1 cm	122	4.7	0.132	4.4	22	0.017	38.6	11	72.1
PAL13	3	0-1 cm	44.4	4.3	0.13	3.1	24.6	0.008	36.3	10	71.6
PAL14	1	0-1 cm	72	4.4	0.159	2.5	24.8	0.011	42.9	8.1	70.3
PAL14	2	0-1 cm	21.1	6.6	0.066	0.97	21.3	0.005	33	8.7	57.2
PAL14	3	0-1 cm	10.1	7.6	0.069	0.91	28.8	0.004	51.2	7.6	72
PAL15	1	0-1 cm	28.1	3.6	0.147	2.1	20.5	0.006	21.9	2.2	66.7
PAL15	2	0-1 cm	12.8	2	0.116	2	12.2	0.003	13.3	3.1	60.4
PAL15	3	0-1 cm	19.2	3.7	0.164	1.9	26.6	0.005	27.5	2.6	64.5

Appendix Table 12. Concentration of PAH (mg/kg dw) at Palanca in April 2009.

Site	Sample nr	Sediment depth	Acen-aphthene	Acen-aphthylene	Anthracene	Benzo (g,h,i) perylene	Benzo(a) anthracene	Benzo(a) pyrene,	Benzo(b,k) fluoranthene	Chrysene	Dibenzo (a,h) anthracene	Fluor-anthene	Fluorene	Indeno (1,2,3-cd) pyrene	Nafthalene	Phen-anthrene	Pyrene	**PAH(16)**
PAL2	1	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	0.002	< 0.001	< 0.001	0.004	< 0.001	< 0.001	< 0.001	0.002	0.003	**0.013**
PAL2	2	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	0.005	**0.008**
PAL2	3	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	0.005	**0.008**
PAL2	1	1-3 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	**0.003**
PAL2	1	3-6 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	**0.003**
PAL3	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	**0.003**
PAL3	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	**0.003**
PAL3	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	**0.002**
PAL4	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	< 0.001	0.005	**0.008**
PAL4	2	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	0.006	**0.010**
PAL4	3	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	0.006	**0.009**
PAL5	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL5	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL5	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL6	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL6	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL6	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL7	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL7	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL7	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL8	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	**0.003**
PAL8	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	**0.003**
PAL8	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	**0.002**
PAL10	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	0.002	0.002	< 0.001	0.004	< 0.001	< 0.001	< 0.001	0.002	0.003	**0.014**
PAL10	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	0.002	0.002	< 0.001	0.003	< 0.001	< 0.001	< 0.001	0.002	0.003	**0.013**
PAL10	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	0.002	0.002	< 0.001	0.004	< 0.001	< 0.001	< 0.001	0.003	0.003	**0.015**
PAL11	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL11	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL11	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL12	1	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.005	**0.007**
PAL12	2	0-1 cm	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	**0.005**
PAL13	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL13	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL13	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL14	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL14	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL14	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL15	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL15	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**
PAL15	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	**<0.01**

Appendix Table 13. Concentration of NPD (mg/kg dw) at Palanca in April 2009.

Site	Sample nr	Sediment depth	Dibenzo-thiophen	Dibenzo-thiophen C1	Dibenzo-thiophen C2	Dibenzo-thiophen C3	Nafthalene	Naftalen C1	Naftalen C2	Naftalen C3	Phenanthrene	Phenantren C1	Phenantren C2	Phenantren C3	NPD
PAL2	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001	0.002
PAL2	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL2	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL2	1	1-3 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL2	1	3-6 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL3	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	0.001
PAL3	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	0.002
PAL3	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	0.002
PAL4	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL4	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL4	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL5	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL5	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL5	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL6	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL6	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL6	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL7	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	0.004
PAL7	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	0.004
PAL7	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	0.004
PAL8	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.001	0.003
PAL8	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	0.002	0.003
PAL8	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	0.004
PAL10	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	0.002	0.002	0.008
PAL10	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.002	0.002	0.002	0.008
PAL10	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.003	0.003	0.003	0.002	0.011
PAL11	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL11	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL11	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL12	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL12	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL13	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL13	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL13	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL14	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL14	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL14	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL15	1	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL15	2	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PAL15	3	0-1 cm	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Appendix Table 14. Conversion of sediment sample depth to volume (litre).

Sediment depth (cm)	Distance from the lid to the sediment surface (cm)	Volume (litre)
21.0	0	20.8
20.0	1	19.5
19.0	2	18.3
18.0	3	17.0
17.0	4	15.8
16.0	5	14.5
15.0	6	13.3
14.0	7	12.1
13.0	8	11.0
12.0	9	9.8
11.0	10	8.7
10.0	11	7.6
9.0	12	6.5
8.0	13	5.5
7.0	14	4.6
6.0	15	3.6
5.0	16	2.8
4.0	17	2.0
3.0	18	1.3
2.0	19	0.7
1.0	20	0.3

Appendix Table 15. Geometric groups of the Lomba area.

Geometric groups	LB1-09	LB2-09	LB3-09	LB4-09	LB5-09	LB6-09	LB7-09	LB8-09	LB9-09	LB10-09	LB15-09	LB16-09	LB17-09
I	11	12	6	14	13	10	19	12	15	11	17	16	14
II	4	3	4	6	4	8	10	6	11	8	3	9	9
III	0	4	4	2	1	1	3	2	5	4	1	4	1
IV	2	0	0	0	2	0	1	0	1	0	1	0	2
V	0	0	0	0	0	0	0	0	0	0	0	0	1
VI	0	0	0	0	0	0	0	0	0	0	0	0	0
VII	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix Table 16. Geometric groups of the Cabinda area.

Geometric groups	WA-B-1	WA-B-2	GS-D-1	GS-D-2	MF-N-R	MF-N-1	MF-N-2	TK-K-1	TK-K-2	TK-O-1	TK-O-2
I	19	20	23	18	16	15	26	20	25	12	7
II	13	8	24	19	7	15	10	17	13	8	7
III	5	3	17	20	3	2	5	8	9	3	2
IV	2	3	7	7	2	3	3	6	1	1	1
V	2	1	4	2	2	1	0	0	2	0	0
VI	0	0	0	0	0	0	0	1	0	0	0
VII	0	0	1	1	0	0	0	0	0	0	0
VIII	0	0	0	0	0	0	0	0	0	0	0
IX	0	0	0	0	0	0	0	0	0	0	0

Appendix Table 17. Species list, Lomba and Cabinda.

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BENTHOS SPECIES LIST

Employer: Institute of Marine Research (IMR)
Project nr.: 803241
Sampling location: Angola
Date of sampling: 20-27.04.2009
Responsible for sampling: Uni Research, SAM
The species are identified by: Per Johannesen

Method: The material is collected in accordance to the accreditation by Norsk Akkreditering for sampling and taxonomical analysis with accreditation number Test 157. The survey follows the Norsk Standard NS 9423 and intern standard regulations.

Information about marking in the species list:
For each station, the number of grab sample is given and in which one the species were found.

/ in the table means a partition between adults and juveniles (example: 4/2 means 4 adults and 2 juveniles).

cf. before genus means that the genus and species are uncertain.

cf. between genus and species means that the genus is certain, but the species is unsure.

***** in the first column means describes species or groups being left out from analyses.

Other information:
The table starts on the next page and continuous over 23 pages.

The species list shall not be copied incomplete without a written approval from SAM.

Signatur: P-O. Johannesen
Signaturberettiget

Lomba	LB1					LB2					LB3					LB4					LB5					LB6					LB7				
	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
* HYDROZOA indet																+																			
* ANTHOZOA indet																											1				1				
* NEMERTINI indet.	1		1			1		1		1	1		1	2							1						1						1		
* NEMATODA indet.											1	1																							
ANNELIDA																																			
POLYCHAETA																																			
Polychaeta indet.																						1							+						
Amphinomidae indet.				1																				1				1				1	1		
Amphinomidae indet. 1																																			
Amphinomidae indet. 2																	1																		
Amphinomidae indet. 3							1																												
Polynoidae indet.			1			1	1																1				2				2				
Panthalis oerstedi																																			
Leanira hystricis	2	4	1		1	1	1	4			2	1	1		1				1/1	0/1	1	1	3	2	1	2				3	1	1	1	1	1
Sthenelais sp																																			
Paralacydonia paradoxa																															1				
Pilargiidae indet. I																																			
Pilargiidae indet. 2				1																		2	1	1											
Nephtys sp.				1	1						1	1	1		1		2											1			2	1	3	5	
Glycera sp.																																			
Goniadidae indet.																									1								1		
Eunicidae indet.																											0/2								
Marphysa sp																															1				
Onuphis sp																	1																		
Lumbrineridae indet.			1		1		2	1		1	1		1			2		1									1				1		1	
Drilonereis sp.																																			
Orbinia sp 3																																			
Heterospionidae indet																																	2		
Prionospio sp.		1						1	1	2	1			1			2	1						1						1	1	1		4	
Spiochaetopterus sp.													1		1									1				1		1					
Maldanidae indet																																			
Aricidea sp.											1																	1							
Paraonidae indet.																							1					1							

	Lomba	LB1					LB2					LB3					LB4					LB5					LB6					LB7				
		4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
	Cirratulidae indet.																												1					1	1		
	Aphelochaeta sp.								1												1																
	Cossura sp																										1		1							
	Pherusa sp.																															3				
	Capitella capitata																																			
	Notomastus sp.																																			
	Myriochele sp.																																			
	Owenia sp													2																				1			
	Sternaspis scutata																	2					1									1				
	Ampharetidae indet.																																			
	Ampharetidae indet 3																																		1	
	Ampharete sp.				1				1			1	2		1													1	1		1	1				
	Pista sp.																																			
	Lanice sp																																			
	Terebellidae indet 1														1																					
	Terebellidae indet 2															1																		1		
	Terebellides stroemi																	1													1				
*	HIRUDINEA indet.																																			
	ECHIURA indet.																																			
	Echiuridae indet.																															1				
	SIPUNCULA indet.																															1				
	Sipuncula indet 1											1						1																		
	Onchnesoma sp																																	1		
	ARTHROPODA																																			
	CRUSTACEA																																			
*	Crustacea indet.																																			
*	Copepoda indet.																																			
*	*Euchaeta sp*	1									1				1												2		1		1					
*	Ostracoda indet.													1																						
*	Mysidae indet.																														1					
	Lophogaster sp																					1				1						1	1			
*	Cumacea indet.																																		1	
*	Diastylis sp.							1						1												1										

	Lomba	LB1					LB2					LB3					LB4					LB5					LB6					LB7				
		4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
	Apseudidae indet								1																											
*	Anthuridae indet.																												1							
*	Gnathia sp.																																			
*	*Natatolana sp*				1							6																								
*	Amphipoda indet.																					1														
*	Caprellidae indet.					1									1																				1		
*	Ampeliscidae indet.				1																															
*	Gammaridea indet.							1	2							1		2		1												1		1	1	
*	Euphausiacea indet.	2														1																				
	Decapoda juv indet (larve)						0/1		0/2		0/1						0/1	0/1					0/1		0/1					0/1				0/1	0/1
	Caridea indet. 2							1																										1		
	Caridea indet. 3																															4				
	Caridea indet.																	5									1		1							
	Brachyura indet.				1															0/1																
	Brachyura indet. 1																	1														1				
	Brachyura larve	0/1																																		
*	Crangonidae indet.													4					1				1	1	1		1									
*	*Calocaris sp I*																																			
*	*Upogebia sp.*																															1				
*	*Thalasinoidae indet.*																																			
*	*Thalasinoidae indet.4*																																			
*	*Paguridae indet.*								1	1	1	1						1			1			1		4	1		1					1		
	INSECTA																																			
	Chironomidae indet larve							1																												
	Sikade indet						1																													
*	PYCNOGONIDA																																			
	MOLLUSCA																																			
	Caudofoveata indet.										1														1											
	Naticidae indet. 1																																			
	Naticidae indet. 2				1																															
	Naticidae indet. 6																																			
	Naticidae indet. 7				1																															

Lomba	LB1					LB2					LB3					LB4					LB5					LB6					LB7				
	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
Natica cf. Canariensis																								1											
Teretia sp 1																				1															
Conidae indet 1	1																																		
Metula sp. 1 ?																																			
Buccinacea indet 1	1		1	6	1					0/1		1		2	1					0/1	3	0/1	0/3	0/2		1			0/2			1			
Buccinacea indet 2	0/1	1																																	
Raphitoma cf. Linearis																					1														
Marginella marimba															1							1													
Gibbberula sp. juv																															0/1				
Cylichna sp. I																															0/1	1			
Roxania utriculus																				1															
Bivalvia indet.																				0/1															
Nucula cf. sulcata																	1																		
Nucula sp 1																																			
Nucula sp 2			1																																
Nucula sp 3																																			
Lucinidae indet 1?		1	1				1													1															
Myrtea spinifera						0/1		0/1													0/1		0/1												
Mendicula cf. Ferruginosa																																			
Thyasira sp.						0/1																										1	1		
Thyasira sp.1																2		2										2						1	
Erycinacea indet																					0/1														
Erycinacea sp 2																																			
Erycinacea sp 3																																			
Corbuliidae indet I																													1						
Thracia pubescens																	1																		
Cuspidaria sp. 1																																			
Dentalium sp.																																			
Dentalium sp. 2																															1				
Dentalium occidentale																															1				
Cadulus sp. 1						1									1						0/1	1	1												
* BRYOZOA																																			
* Bryozoa grenet																																			

	Lomba	LB1					LB2					LB3					LB4					LB5					LB6					LB7				
		4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
	ECHINODERMATA																																			
*	Ophiuroidea indet.									+												+						+	+							
	Amphiuridae indet.								2																											
	Cucumariidae indet																																			
	Cucumariidae indet 1																																	1		
*	POGONOPHORA																																			
*	CHAETOGNATHA																																			
*	Chaetognatha indet.																																			
	ASCIDIACEA																																			
	CHORDATA																																			
*	PISCES																																			
*	Pisces indet.													1																						
*	Pisces indet. 1																																			
*	Fiske egg.	1																						1												
*	VARIA	+			+													+		+				+												

	Lomba	LB8					LB9					LB10					LB15					LB16					LB-17				
		4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
*	HYDROZOA indet																														
*	ANTHOZOA indet	1								1																					
*	NEMERTINI indet.		1		1								2		1						+		1								
*	NEMATODA indet.																														
	ANNELIDA																														
	POLYCHAETA																														
	Polychaeta indet.										+																				
	Amphinomidae indet.							1			1												1								
	Amphinomidae indet. 1																						2			1					
	Amphinomidae indet. 2																														
	Amphinomidae indet. 3																														
	Polynoidae indet.	1		1							3		6				1					1	1						1		
	Panthalis oerstedi								1																						
	Leanira hystricis	1/1	3		1	1		1	2	2		3			1/1				1			0/1			1	0/1				0/1	
	Sthenelais sp												1																		

Lomba	LB8					LB9					LB10					LB15					LB16					LB-17				
	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
Paralacydonia paradoxa																									3					
Pilargiidae indet. I																									1					
Pilargiidae indet. 2									3			1						1												
Nephtys sp.	1		2			6			2	2		2					1					2	1					1		4
Glycera sp.									1			1																		
Goniadidae indet.																	1													
Eunicidae indet.																														
Marphysa sp																							1							
Onuphis sp	1																													
Lumbrineridae indet.			1			1		1			1						2		1			2	1		2	2	3	3		2
Drilonereis sp.														1																
Orbinia sp 3																														1
Heterospionidae indet		1	1	2		1			1							2	1						1							
Prionospio sp.	1	1	1			1			1	1		1	4					1				7				4	5	2	2	4
Spiochaetopterus sp.	+																								1			1		
Maldanidae indet																	1											1		
Aricidea sp.							1	1										1												
Paraonidae indet.						1																								
Cirratulidae indet.																					1	1								
Aphelochaeta sp.																										1	1			1
Cossura sp			1																										1	1
Pherusa sp.																														
Capitella capitata																					2									
Notomastus sp.							1								1			1												
Myriochele sp.										1																				
Owenia sp																														
Sternaspis scutata									2					1																
Ampharetidae indet.													1	1					1											
Ampharetidae indet 3																						2		1						
Ampharete sp.	1					1	1	1	2				2			2	1		1			2		1	2	1	1	1		
Pista sp.																												1		1
Lanice sp										1																				
Terebellidae indet 1			1																											

	Lomba	LB8					LB9					LB10					LB15					LB16					LB-17				
		4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
	Terebellidae indet 2																														
	Terebellides stroemi	1						1		1			2															1	1		1
*	HIRUDINEA indet.																														
	ECHIURA indet.																														
	Echiuridae indet.																														
	SIPUNCULA indet.																														
	Sipuncula indet 1					1																									
	Onchnesoma sp																										1				
	ARTHROPODA																														
	CRUSTACEA																														
*	Crustacea indet.																												1		
*	Copepoda indet.									1																2					
*	*Euchaeta sp*		1																	1											
*	Ostracoda indet.																														
*	Mysidae indet.																														
	Lophogaster sp		2	1			2			2				1		2			1											1/1	
*	Cumacea indet.										2																				
*	Diastylis sp.																														
	Apseudidae indet			1				1		4	1	1			2							+									
*	Anthuridae indet.										1																				
*	Gnathia sp.													2																	
*	*Natatolana sp*																														5
*	Amphipoda indet.																														
*	Caprellidae indet.																														
*	Ampeliscidae indet.																														
*	Gammaridea indet.	1								2						1		1								1		1			1
*	Euphausiacea indet.																														
	Decapoda juv indet (larve)		0/1																							0/1			0/1		
	Caridea indet. 2																1														
	Caridea indet. 3							1					1													1	1		1		
	Caridea indet.	2		1				4		3				2																	
	Brachyura indet.																														

	Lomba	LB8					LB9					LB10					LB15					LB16					LB-17				
		4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
	Brachyura indet. 1			1									5													1					
	Brachyura larve											0/1																			
*	Crangonidae indet.							1			1											1									
*	*Calocaris sp I*												2																		
*	*Upogebia sp.*																														
*	*Thalasinoidae indet.*																														1
*	*Thalasinoidae indet.4*												1/1																		
*	*Paguridae indet.*																	1					2					1			
	INSECTA																														
	Chironomidae indet larve																														
	Sikade indet																														
*	PYCNOGONIDA																														
	MOLLUSCA																														
	Caudofoveata indet.																	1				+									
	Naticidae indet. 1					1																									
	Naticidae indet. 2				1	1					1																				
	Naticidae indet. 6														0/1															1	
	Naticidae indet. 7																								1						
	Natica cf. Canariensis																														
	Teretia sp 1																														
	Conidae indet 1																														
	Metula sp. 1 ?							1																							
	Buccinacea indet 1			0/1			2	1									0/2	2	0/1	3	1		1/1	1/1				0/1	0/4	1/1	1
	Buccinacea indet 2																														
	Raphitoma cf. Linearis																														
	Marginella marimba																									1					
	Gibbberula sp. juv						0/1			0/1														0/1			0/1				
	Cylichna sp. I																														
	Roxania utriculus																														
	Bivalvia indet.																														
	Nucula cf. sulcata																														
	Nucula sp 1											1																			
	Nucula sp 2																														

Lomba	LB8					LB9					LB10					LB15					LB16					LB-17				
	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
Nucula sp 3																						1								
Lucinidae indet 1?																			1					0/1					0/1	0/1
Myrtea spinifera										1							0/1								0/1	0/1				
Mendicula cf. Ferruginosa																													1	
Thyasira sp.									1							0/1	1													1
Thyasira sp.1																						1	1		1	0/1	0/1			
Erycinacea indet																														
Erycinacea sp 2								1																						
Erycinacea sp 3																									1					
Corbuliidae indet I																														
Thracia pubescens																														
Cuspidaria sp. 1						1																								
Dentalium sp.													2				1													
Dentalium sp. 2																														1
Dentalium occidentale																														
Cadulus sp. 1								1										1												1
* BRYOZOA																														
* Bryozoa grenet																		+												
ECHINODERMATA																														
* Ophiuroidea indet.										+																				
Amphiuridae indet.							1																							
Cucumariidae indet																					1									
Cucumariidae indet 1																														
* POGONOPHORA																														
* CHAETOGNATHA																														
* Chaetognatha indet.														1																
ASCIDIACEA																														
CHORDATA																														
* PISCES																														
* Pisces indet.																														
* Pisces indet. 1						1	1		2		4	4			1				1											
* Fiske egg.																	1													
* VARIA											+							+				+	+		+		+			

	Cabinda	WA-B-1					WA-B-2					GS-D-1					GS-D-2					MFN R				
		4	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**
*	**ANTHOZOA indet**							1												1						
	Virgularia sp.																1									
	Pennatulacea indet.																						1	1		
	Actiniaria indet.					1			1	1			1													
	Edwardsia sp.																									
*	**NEMERTINI indet.**	1	+	2	1	2	1	2	3	1		2	1	1		1		1		1		1				2
	ANNELIDA POLYCHAETA																									
	Polychaeta indet.									1			3					1								
	Amphinomidae indet.											1	3	1				1								
	Euphrosinidae indet																								2	1
	Polynoidae indet.					1				1		1		2												
	Pholoe sp																									
	Panthalis oerstedi										1															
	Sthenelais sp												1	1			2	1	1							
	Phyllodoce sp.			1																				1		
	Gyptis sp.			1																						
	Pilargiidae indet.																									
	Pilargiidae indet. I														1											
	Pilargiidae indet. 2	2				1							1	1	2	2		1	1							
	Pilargiidae indet. 3											3			2		1	1	2	1						
	Pilargiidae indet.4												1													
	Syllidae indet.										1															
	Nereidae indet.	2		1			1						1	2		1	1	1		1						
	Nereidae indet. 1																						1			
	Nereidae indet. 2																									
	Nephtys sp.	2	4		2	3	3		1	1	1	3	3		1		2	3	6		2	2	5		1	1
	Glycera sp.						1				1	1	2	1	5	4	1	2		1						1
	Goniadidae indet.												1	3		1		2	1							

Cabinda	WA-B-1					WA-B-2					GS-D-1					GS-D-2					MFN R				
	4	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**
Oenonidae indet													2		1		1								
Diopatra sp	0/3	6/5	1/6	4/1	1/3	0/4	2/5	1/2	1/6	0/2	3/2	1/2	3	3/1	1/2	2/2	2/1	4/1	1/1	3/1					
Marphysa sp									1																
Marphysa sp I																									
Lumbrineridae indet.	1	1			1	1	2	3	2	1			1	1		1	1	1	2		1	1	1	1	1
Drilonereis sp.																									
Orbiniidae indet. 1																					2				
Orbinia sp.		1								1												1			1
Phylo cf. capensis																									
Phylo sp													1										2		
Scoloplos sp											2	1	1		7	4	3	3	2	1					
Heterospionidae indet		1	+	2	1				1		2	4			4	1	1	4		1			1	1	
Spionidae indet.																									
Malacoceros sp.												1													
Polydora sp.											1														
Prionospio sp.	1	2	2	2		1	2		2	1				1		2			2	1			1		
Scolelepis sp.																									
Spiophanes sp.		1					1				1								2						
Trochochaeta sp.		1																							
Chaetopterus sp.															0/1						1				
Spiochaetopterus sp.	1		7	1	3		2/1	3	1	3	0/2					0/2									
Magelona sp.											1	1	1	2				1							
Maldanidae indet											1	3	1		4	1			2	2					1
Aricidea sp.											2	1			2	2	1		1	1					
Paraonidae indet.	2					1										1	3								
Paranoidae indet. VII											2	1	3												
Cirratulidae indet.		1					1			1	3	1				1		1	1				1		
Aphelochaeta sp.			1	1	1						1						1		1						
Dodecaceria sp.																									

Cabinda	WA-B-1					WA-B-2					GS-D-1					GS-D-2					MFN R				
	4	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**
Cossura sp												1			1				1	1					1
Flabelligeridae indet.				2								3								1					
Pherusa sp.			2																						
Capitellidae indet.																									
Notomastus sp.	3	1	1		1	1	1				2	2	3	2	5	1	1	3	4	3		2			1
Myriochele sp.											1	3	1		1	1	1	1	3	1					
Owenia sp											1	0/4	0/2	0/1		0/1	2/1	0/1							
Sternaspis scutata												3				2	1	2	2					1	
Pectinaria sp.																									
Ampharetidae indet.											2	3	1												
Ampharetidae indet 3											7	10	1	3	2	5	9	2	2	4					
Ampharetidae indet 4											2	2	1	2		1	8			2					
Ampharetidae indet 5											1	2													
Ampharete sp.	1					1		1	2		1				1	4			1	1					
Sabellides sp			1						1			1			1					1					
Amphicteis sp.												1		1											
Isolda sp. ?											3	3	1		1	1		2	1	2					
Lanice sp													2				2		1						
Streblosoma sp.															1		1								
Polycirrus sp.											1														
Trichobranchus sp.																		1							
Terebellides sp.	2											2		1	1	1		1	1	1					
Hydroides sp																	1								
ECHIURA indet.																1									
Ochetostoma sp													1				1			1					
SIPUNCULA indet.																						1			
Sipuncula sp																					1				
Aspidosiphon sp							2			1		11	4	1	3	1	6	1	3	1	6	2	6	6	7
Onchnesoma sp											18	14	14	14	20	12	14	12	10	16	9	5	1	6	3
ARTHROPODA																									

	Cabinda	WA-B-1					WA-B-2					GS-D-1					GS-D-2					MFN R				
		4	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**
	CRUSTACEA																									
*	Crustacea indet.		1																1							2
	Stomatopoda indet.																									
*	Copepoda indet.																					1				
	Calanoida indet																									
*	*Euchaeta sp*						1																	1		
*	**Ostracoda indet.**												1													
	Cypridinidae indet.																	2								
*	**Mysidacea indet.**																									
*	Mysidae indet.																									
*	Bodotridae indet.												1	2	1		1			1	1					
	Bodotridae indet. 1																									
	Eocuma sp			1																						
*	Iphinoe sp									1								1								
*	Diastylis sp.									1																
	Apseudidae indet		3		3		3																			
*	Anthuridae indet.																									
	Arcturidae indet													1	1				1	1						
*	**Amphipoda indet.**	1		2	2	3	4	1	3	3	2	10	10	9	6	8	14	10	7	14	19					
*	Caprellidae indet.		1																							
*	Gammaridea indet.																					1				
*	**Euphausiacea indet.**																									
*	**Decapoda indet.**																									
	Decapoda juv indet (larve)																			0/1						
	Caridea indet. 2			2						1			1	2												
	Caridea indet. 3		2																							
	Caridea indet. 4		5		1					1																
	Caridea indet. 5				1																					
	Caridea indet. 6											2														
	Caridea indet.										1															

	Cabinda	WA-B-1					WA-B-2					GS-D-1					GS-D-2					MFN R				
		4	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**
	Brachyura indet.																									
	Brachyura indet. 2																									
	Brachyura indet 3		1			1									1			1		1							
	Alpheus sp																		2							
*	Crangonidae indet.		0/1				1																			
*	*Thalasinoidae indet.*					1				1		5	3	15	10	8	8	4	3	10	4					
*	*Thalasinoidae indet.5*																									
*	*Paguridae indet.*												2		1					1						
	MOLLUSCA																									
	Caudofoveata indet.						1																			
	Gastropoda indet			2									1													
	Nassarius tritoniformis												2/1				1	1								
	Naticidae 1																									
	Naticidae indet.																					0/1				
	Naticidae indet. 1																									
	Naticidae indet. 6								1																	
	Vitrinella sp.												2													
	Risopsis sp.																									
	Aporrhais senegalensis																									
	Mangelia sp.																			1						
	Mangelia sp. 3																									
	Drilia rosasea																									
	Eulima sp 1																									
	Conidae indet 2																									
	Buccinacea indet 1			1																						
	Bullia sp.												1			1		4	1/1	1						
	Philine sp 2																									
	Cylichna cylindracea								1																	
	Bivalvia indet.												1													
	Nucula sp 1												1		0/1	0/1	0/1									0/1
	Nucula sp 2				0/1			0/1			0/1															

Cabinda	WA-B-1					WA-B-2					GS-D-1					GS-D-2					MFN R				
	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
Mytilidae indet.												0/1													
Mytilidae indet. 1																			1						
Arca sp. 1											3/1	2	1			1				3/1					
Lucinidae indet 1																									1
Lucinoma sp 1																									
Lucinoma sp 1																						0/3		0/1	0/3
Myrtea spinifera																									
Thyasira sp.																									
Thyasira sp.2				1																					
Diplodonta sp.																0/2	0/1								
Diplodonta sp. 1												0/4		1	0/1										
Aloidis cf. striatissima												1	1			1/1	2/1		1	1					
Erycinacea sp 2																									
Montacuta sp.1															2										
Cuna sp.																									
Cardiacea indet 1														1			1								
Phaxas pellucidus											1					0/4				1					
Tellinacea indet 1											1														
Tellinidae indet 1											1														
Tellinidae indet 2														1				1		2					
Tellinidae indet 3																	1	1/1	0/2	2					
Tellinidae indet 4																	1								
Tellinidae indet 5																									
Tellina sp. 1																		1		0/1					
Abra sp 1												7/8	0/1	0/1	0/1	3/5	5/1								
Veneridae indet 1																			0/2						
Veneridae indet 3	1/1	1	2/3	2/2	5/3	2/1	2/2		2/1	2/1															
Veneridae indet 4																									
Corbuliidae indet 1																									

	Cabinda	WA-B-1					WA-B-2					GS-D-1					GS-D-2					MFN R				
		4	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**
	Pholadacea indet. 1												1													
	Cuspidaria cuspidata					1																				
	Cuspidaria costellata						0/1																			
	Cuspidaria cf. costellata																									
	Dentalium sp. 2		0/2																							
	Dentalium sp. 3				1			1																		
	Dentalium sp. 4				1																					
	Cadulus sp. 1																							1		
	ECHINODERMATA																									
*	Ophiuroidea indet.	+	+	+		+					+					+									+	
	Amphiuridae indet.																					3	4	+		
	Amphiura sp.								1	1		1	1	2	1		1	3/1	3	1/1	1					
	Holothuroidea indet.																									
	Cucumariidae indet			1									1	1				1								
	Cucumariidae indet 6																					1				
	Cucumariidae indet 7																									
	Synaptidae indet.																					3			2	7
	Synaptidae indet. 1																									
	ENTEROPNEUSTA indet.										1															
*	**CHAETOGNATHA**																									
*	Chaetognatha indet.																									
	Pterobranchia indet.												+	+	+		+									
	ASCIDIACEA																									
	Ascidiacea indet.																									
	CHORDATA																									
*	**PISCES**																									
*	Pisces indet. 1																									
*	**VARIA**				+		+			+		+	+		+						+					

	Cabinda	MFN 1					MFN 2					TK-K-1					TK-K-2					TK-O-1					TK-O-2				
		4	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**
*	**ANTHOZOA indet**						1	1																							
	Virgularia sp.																														
	Pennatulacea indet.																														
	Actiniaria indet.											1		1	1		2		1												
	Edwardsia sp.			1																											
*	**NEMERTINI indet.**	1			1	1	1	2	1	4		1	1		2			1	1	2	1	+	1				1	3		1	2
	ANNELIDA POLYCHAETA																														
	Polychaeta indet.																						1								
	Amphinomidae indet.																														
	Euphrosinidae indet																														
	Polynoidae indet.					1				1		1	1		1				1				3					1	1		
	Pholoe sp	1	1	1						1			1								5										
	Panthalis oerstedi						1							1																	
	Sthenelais sp																														
	Phyllodoce sp.							1				1		1																	
	Gyptis sp.																								1						
	Pilargiidae indet.		+																1												
	Pilargiidae indet. I																														
	Pilargiidae indet. 2																		1				1			2		1	1		
	Pilargiidae indet. 3											3				1			1					+							
	Pilargiidae indet.4	1				1																									
	Syllidae indet.														1																
	Nereidae indet.							1						1	1			1							1						
	Nereidae indet. 1		2			1					1																				
	Nereidae indet. 2					1					1																				
	Nephtys sp.	2		1	3	4	1		1	2	5	3	4	4	2		3	3	3	4	5	1	3	2	2	1			1	5	3
	Glycera sp.																														
	Goniadidae indet.	1				1				1																					

Cabinda	MFN 1					MFN 2					TK-K-1					TK-K-2					TK-O-1					TK-O-2				
	4	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**
Oenonidae indet												2		2				2		1										
Diopatra sp		1					1		1		0/15	0/13	1/3	0/10		2/4	1/2	0/3		0/4		0/1	1	1	2	0/3		1		0/1
Marphysa sp																														
Marphysa sp I											1		1	1			1	0/1	1	0/1										
Lumbrineridae indet.		1			1	1			2		2	2	1	4				1	1	1		1	2	1	1		2	1		2
Drilonereis sp.						1																								
Orbiniidae indet. 1	1		1		1		1	3	1	1																				
Orbinia sp.													2																	
Phylo cf. capensis	1	1	1	1	2	1		1																						
Phylo sp																														
Scoloplos sp																														
Heterospionidae indet	2	2	1	3	3	6		3		4	2	1	3	2			3	1	1			+								
Spionidae indet.																		1												
Malacoceros sp.																														
Polydora sp.																														
Prionospio sp.			2						1		4	2	1	2		2		1	1	1	1				1					
Scolelepis sp.						1																								
Spiophanes sp.																	1													
Trochochaeta sp.							1																							
Chaetopterus sp.																														
Spiochaetopterus sp.											2		1	1				1		1	+	1	1		1					
Magelona sp.		1	2	1			2	4	1	1										1										
Maldanidae indet			1		1	1			2							1	1	1												
Aricidea sp.											1																			2
Paraonidae indet.																														
Paranoidae indet. VII																														
Cirratulidae indet.											4	2	2	1			1	3	3			+								
Aphelochaeta sp.																														
Dodecaceria sp.										1																				

Cabinda	MFN 1					MFN 2					TK-K-1					TK-K-2					TK-O-1					TK-O-2				
	4	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**	**4**	**5**	**6**	**7**	**8**
Cossura sp																														
Flabelligeridae indet.																												+		
Pherusa sp.						1						1																		
Capitellidae indet.						2	1		1									2												
Notomastus sp.	1				1				3			2	1				1	1	1				1				1	1	1	
Myriochele sp.												1		1				1	1											
Owenia sp					1	1																								
Sternaspis scutata		2		1					1		3	1	2	1			1	1		1		1	1							
Pectinaria sp.							1					1								1								1		
Ampharetidae indet.							1	1		1	1	1	1																	
Ampharetidae indet 3																														
Ampharetidae indet 4																														
Ampharetidae indet 5																														
Ampharete sp.												1		1			1					1								
Sabellides sp						1					2	1	1	2		3	3									2				
Amphicteis sp.																	1			1/1					1					
Isolda sp. ?																														
Lanice sp										1																				
Streblosoma sp.													1																	
Polycirrus sp.																														
Trichobranchus sp.																														
Terebellides sp.																														
Hydroides sp													1				1													
ECHIURA indet.												2																		
Ochetostoma sp																														
SIPUNCULA indet.	1		1				1	1																	1					
Sipuncula sp																														
Aspidosiphon sp	3		1	10	3	2		2																						
Onchnesoma sp											3	1	1					1	1											
ARTHROPODA																														

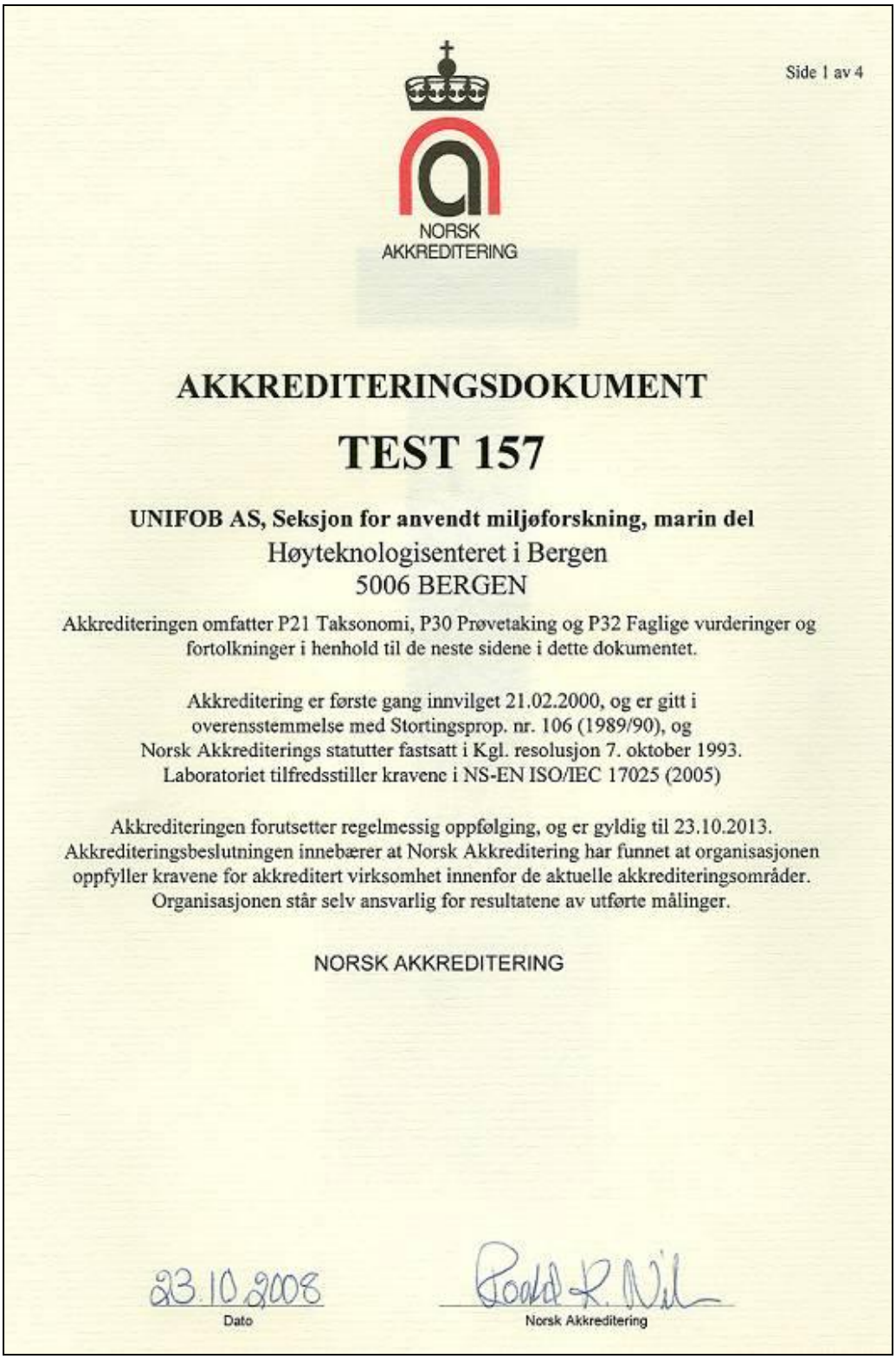
	Cabinda	MFN 1					MFN 2					TK-K-1					TK-K-2					TK-O-1					TK-O-2				
		4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
	CRUSTACEA																														
*	Crustacea indet.																											1			
	Stomatopoda indet.									1																					
*	Copepoda indet.		1																												
	Calanoida indet												1		1		1		1								1				1
*	*Euchaeta sp*	1																													
*	**Ostracoda indet.**																														
	Cypridinidae indet.																														
*	**Mysidacea indet.**																1														
*	Mysidae indet.																								1						
*	Bodotridae indet.																														
	Bodotridae indet. 1														3																
	Eocuma sp											2	1							1									1		
*	Iphinoe sp																														
*	Diastylis sp.																														
	Apseudidae indet		2		1		6																		1	1			1		
*	Anthuridae indet.	3	1	2	2	4	1		1	2	1		2	1	1			1	1		2										
	Arcturidae indet																														
*	**Amphipoda indet.**											4	4	1	1					1		1			3					1
*	Caprellidae indet.		1										2	1																	
*	Gammaridea indet.	1						3	3	2	3																				
*	**Euphausiacea indet.**																													1	
*	**Decapoda indet.**																			0/1											
	Decapoda juv indet (larve)										0/1																				
	Caridea indet. 2			2									1																		
	Caridea indet. 3			1								1	4		1																
	Caridea indet. 4						1										2		1	1		1	1			1					
	Caridea indet. 5												1																		
	Caridea indet. 6																														
	Caridea indet.																														
	Brachyura indet.			2									2	1	1																

	Cabinda	MFN 1					MFN 2					TK-K-1					TK-K-2					TK-O-1					TK-O-2				
		4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
	Brachyura indet. 2																		1												
	Brachyura indet 3																														
	Alpheus sp																														
*	Crangonidae indet.		1														0/2			1			1/1	0/1					1/1		
*	*Thalasinoidae indet.*						1				1										3										
*	*Thalasinoidae indet.5*		2			1																									
*	*Paguridae indet.*				3		1			1		2			1														1		
	MOLLUSCA																														
	Caudofoveata indet.											1														1					
	Gastropoda indet																														
	Nassarius tritoniformis																														
	Naticidae 1										0/1																				
	Naticidae indet.																														
	Naticidae indet. 1														1						1										
	Naticidae indet. 6																			0/1											
	Vitrinella sp.																														
	Risopsis sp.																												1		
	Aporrhais senegalensis																		1												
	Mangelia sp.																														
	Mangelia sp. 3											1																			
	Drilia rosasea																		1												
	Eulima sp 1																				1										
	Conidae indet 2														1																
	Buccinacea indet 1																														
	Bullia sp.																														
	Philine sp 2											1					1														
	Cylichna cylindracea																														
	Bivalvia indet.																														
	Nucula sp 1					0/1	0/1	1												0/1						0/1					
	Nucula sp 2																														
	Mytilidae indet.																														

Cabinda	MFN 1					MFN 2					TK-K-1					TK-K-2					TK-O-1					TK-O-2				
	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
Mytilidae indet. 1																														
Arca sp. 1		0/2			0/1																									
Lucinidae indet 1																		0/1												
Lucinoma sp 1			1						2	3																				
Lucinoma sp 1																														
Myrtea spinifera																								0/1						
Thyasira sp.				0/1																										
Thyasira sp.2																										1				
Diplodonta sp.		0/1																												
Diplodonta sp. 1																														
Aloidis cf. striatissima																														
Erycinacea sp 2													0/1																	
Montacuta sp.1																														
Cuna sp.									1																					
Cardiacea indet 1																														
Phaxas pellucidus																														
Tellinacea indet 1																												1		
Tellinidae indet 1																														
Tellinidae indet 2																														
Tellinidae indet 3																														
Tellinidae indet 4									1																					
Tellinidae indet 5		1																												
Tellina sp. 1																														
Abra sp 1																														
Veneridae indet 1																														
Veneridae indet 3											0/2	2/3	2/4	1		1	1/3	1/3	0/3		0/1	2/1		0/2						
Veneridae indet 4													1					1												
Corbuliidae indet 1											0/1		0/1							0/1										
Pholadacea indet. 1																														

	Cabinda	MFN 1					MFN 2					TK-K-1					TK-K-2					TK-O-1					TK-O-2				
		4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8	4	5	6	7	8
	Cuspidaria cuspidata																														
	Cuspidaria costellata																													1	
	Cuspidaria cf. costellata																								0/1						
	Dentalium sp. 2																														
	Dentalium sp. 3												0/1	0/1					0/2		0/2				0/1						
	Dentalium sp. 4																														
	Cadulus sp. 1	1									1				1						1										
	ECHINODERMATA																														
*	Ophiuroidea indet.								1			+	+	+	+									+							
	Amphiuridae indet.	5	4	2	2	2	1				1																				
	Amphiura sp.																		2	1	2		3					1	1		
	Holothuroidea indet.				1																										
	Cucumariidae indet												0/1		1			1			1										
	Cucumariidae indet 6																														
	Cucumariidae indet 7			1																											
	Synaptidae indet.								2																						
	Synaptidae indet. 1			1																											
	ENTEROPNEUSTA indet.														1																
*	**CHAETOGNATHA**																														
*	Chaetognatha indet.																													+	
	Pterobranchia indet.																														
	ASCIDIACEA																														
	Ascidiacea indet.													1					1												
	CHORDATA																														
*	**PISCES**																														
*	Pisces indet. 1												1		1																
*	**VARIA**				+	+	+					+		+	+		+	+	+	+	+		+				+				

Appendix Table 18. Frontpage of accreditation documents from UNI Research-SAM-marin and Eurofins as.



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NORSK
AKKREDITERING

AKKREDITERINGSDOKUMENT

TEST 157

UNIFOB AS, Seksjon for anvendt miljøforskning, marin del
Høyteknologisenteret i Bergen
5006 BERGEN

Akkrediteringen omfatter P21 Taksonomi, P30 Prøvetaking og P32 Faglige vurderinger og fortolkninger i henhold til de neste sidene i dette dokumentet.

Akkreditering er første gang innvilget 21.02.2000, og er gitt i overensstemmelse med Stortingsprop. nr. 106 (1989/90), og Norsk Akkrediterings statutter fastsatt i Kgl. resolusjon 7. oktober 1993. Laboratoriet tilfredsstiller kravene i NS-EN ISO/IEC 17025 (2005)

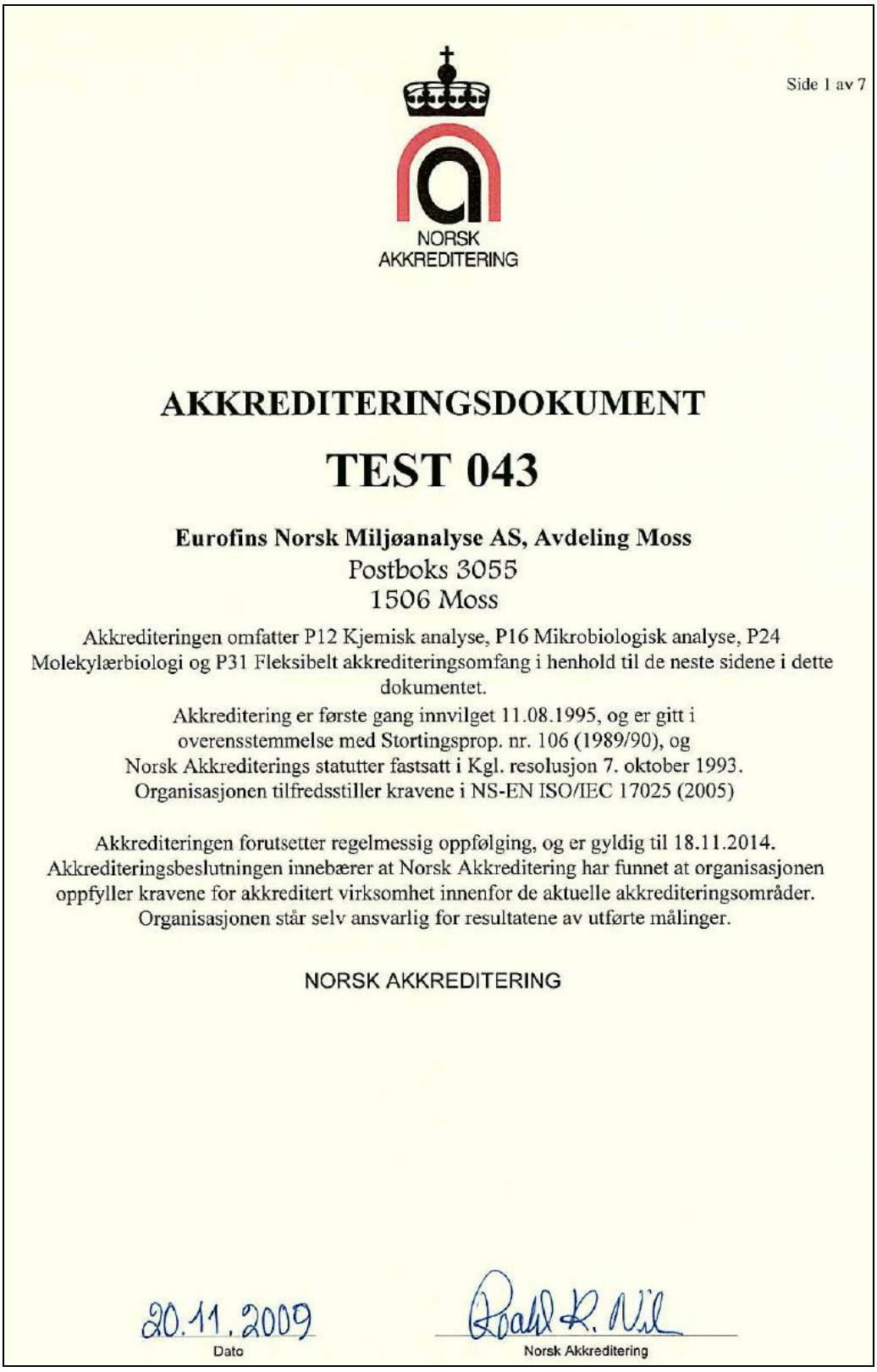
Akkrediteringen forutsetter regelmessig oppfølging, og er gyldig til 23.10.2013. Akkrediteringsbeslutningen innebærer at Norsk Akkreditering har funnet at organisasjonen oppfyller kravene for akkreditert virksomhet innenfor de aktuelle akkrediteringsområder. Organisasjonen står selv ansvarlig for resultatene av utførte målinger.

NORSK AKKREDITERING

23.10.2008
Dato

Norsk Akkreditering

Accreditation document UNIFOB AS. The name of UNIFOB AS was changed to Uni Research AS in November 2009. Chapter 2.3.10 in this report describes which activities and analyses were accredited in accordance with this certificate.



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NORSK
AKKREDITERING

AKKREDITERINGSDOKUMENT

TEST 043

Eurofins Norsk Miljøanalyse AS, Avdeling Moss
Postboks 3055
1506 Moss

Akkrediteringen omfatter P12 Kjemisk analyse, P16 Mikrobiologisk analyse, P24 Molekylærbiologi og P31 Fleksibelt akkrediteringsomfang i henhold til de neste sidene i dette dokumentet.

Akkreditering er første gang innvilget 11.08.1995, og er gitt i overensstemmelse med Stortingsprop. nr. 106 (1989/90), og Norsk Akkrediterings statutter fastsatt i Kgl. resolusjon 7. oktober 1993. Organisasjonen tilfredsstiller kravene i NS-EN ISO/IEC 17025 (2005)

Akkrediteringen forutsetter regelmessig oppfølging, og er gyldig til 18.11.2014. Akkrediteringsbeslutningen innebærer at Norsk Akkreditering har funnet at organisasjonen oppfyller kravene for akkreditert virksomhet innenfor de aktuelle akkrediteringsområder. Organisasjonen står selv ansvarlig for resultatene av utførte målinger.

NORSK AKKREDITERING

20.11.2009
Dato

Norsk Akkreditering

Accreditation document Eurofins Norsk Miljøanalyse AS. Chapter 2.3.10 in this report describes which activities and analyses were accredited in accordance with this certificate.

Appendix Table 19. Sample journal. Starts at the next page and contains 38 sheets.

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
TK-K-2	20.04.09			67m

Weather:	Wind:	Wave hight (m):
Time Start: 15:00	Time Finish:	Duration:
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? short		

Type of bottom sediment: Silt and Clay, Mud	
Color: 2.5Y4/2 Dark grayish brown	Odor:
Observation of animals: Polychaeta, Mollusca, Anthozoa	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	2	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
TK-K-1	20.04.09			65m

Weather:	Wind:	Wave hight (m):
Time Start: 16:40	Time Finish: 18:00	Duration: 1:20
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud	
Color: 2.5Y4/2 Dark grayish brown	Odor:
Observation of animals: Polychaeta, Mollusca	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	-	-	Had no permition to take the last Site, had to stop 18:00

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
TK-O-2	20.04.09			74m

Weather:	Wind:	Wave hight (m):
Time Start: 18:42	Time Finish: 19:42	Duration: 1:00
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud	
Color: Gley2 2.5/1 Greenish black	Odor:
Observation of animals: Polychaeta, Ophiuroidea	
Observation of oil, waste etc: oil in the sediment	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	oil in the sediment
2	Full = 21 litre	1	1	1	1		oil in the sediment
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
WA-B-2	21.04.09			65m

Weather:	Wind:	Wave hight (m):
Time Start: 06:00	Time Finish: 08:45	Duration: 2:45
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? short		

Type of bottom sediment: Mud	
Color: Gley 2 4/1 Dark greenish gray	Odor:
Observation of animals: Polychaeta, Echinoderamta, Crustacea	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
WA-B-1	21.04.09			65m

Weather:	Wind:	Wave hight (m):
Time Start: 08:55	Time Finish: 10:10	Duration: 1:15
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? short		

Type of bottom sediment: Mud	
Color: 5 Y3/2 Dark olive gray	Odor:
Observation of animals: Polychaeta, Nemertini, Crustacea (Crab)	
Observation of oil, waste etc: Oil in the sediment	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	Oil
2	Full = 21 litre	1	1	1	1		Oil
3	Full = 21 litre	1	1	1	1		Oil

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
TK-O-1	21.04.09			73m

Weather:	Wind:	Wave hight (m):
Time Start: 11:00	Time Finish: 12:25	Duration: 1:25
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? short		

Type of bottom sediment: Mud	
Color: 2.5 Y 3/2 Very dark grayish brown	Odor:
Observation of animals: Polychaeta, Echinoderamta, Crustacea	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB1	21.04.09			132m

Weather:	Wind:	Wave hight (m):
Time Start: 13:55	Time Finish: 15:55	Duration: 2:00
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? short		

Type of bottom sediment: Mud	
Color: 2.5 Y4/2 Dark grayish brown	Odor:
Observation of animals: Polychaeta,	
Observation of oil, waste etc: Oil in the sediment	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	3	1	1	3	1	Corer 0-1, 1-3, 3-6 cm Norway
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB5	21.04.09			130m

Weather:	Wind:	Wave hight (m):
Time Start: 16:10	Time Finish: 17:45	Duration: 1:35
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? short		

Type of bottom sediment: Mud	
Color: 2.5 Y4/2 Dark grayish brown	Odor:
Observation of animals: Polychaeta, Mollusca	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB3	21.04.09			131m

Weather:	Wind:	Wave hight (m):
Time Start: 18:30	Time Finish:	Duration:
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? short		

Type of bottom sediment: Mud	
Color: 10 YR 3/1 Very dark gray	Odor:
Observation of animals: Polychaeta	
Observation of oil, waste etc:	No rejected samples: 3

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB15	22.04.09			132m

Weather:	Wind:	Wave hight (m):
Time Start: 07:05	Time Finish: 09:10	Duration: 2:05
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Soft, mud	
Color: 10 YR 3/1 Very dark gray	Odor:
Observation of animals: Polychaeta, Mollusca	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	3cm= 17 litre	1	
5	5cm = 15litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB16	22.04.09			133m

Weather:	Wind:	Wave hight (m):
Time Start: 09:30	Time Finish: 11:00	Duration: 1:30
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment:Mud	
Color: 10 YR 3/2 Very dark grayish brown	Odor:
Observation of animals: Polychaeta,	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB2	22.04.09			132m

Weather: sun	Wind:	Wave hight (m):
Time Start: 11:25	Time Finish: 13:30	Duration: 2:05
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment:Mud	
Color: 2.5 Y 3/2 Very dark grayish brown	Odor:
Observation of animals: Polychaeta, Crustacea (Crabs, shrimps) Echinodermata	
Observation of oil, waste etc:	No rejected samples: 1

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	3	1	1	3	1	Corer, 0-1, 1-3, 3-6 cm Norway
2	Full = 21 litre	1	1	1	1		
3	2cm = 18 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB6	22.04.09			129m

Weather:	Wind:	Wave hight (m):
Time Start: 13:40	Time Finish: 14:58	Duration: 1:18
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment:Mud	
Color: 2.5 Y 3/2 Very dark grayish brown	Odor:
Observation of animals: Polychaeta, Nemertini	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	2 cm=18 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB7	22.04.09			127m

Weather: Sun	Wind:	Wave hight (m):
Time Start: 15:10	Time Finish:	Duration:
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment:Mud	
Color: 2.5 Y 3/2 Very dark grayish brown	Odor:
Observation of animals: Polychaeta, Crustacea (Crabs, shrimps), Echinodermata	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB8	22.04.09			123m

Weather: Sun	Wind:	Wave hight (m):
Time Start: 16:40	Time Finish:	Duration:
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment:Mud	
Color: 2.5 Y 3/3 Very dark olive brown	Odor:
Observation of animals: Polychaeta	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	2 cm=18 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB4a*	22.04.09			132m

Weather:	Wind:	Wave hight (m):
Time Start: 18:30	Time Finish: 20:00	Duration: 1:30
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment:Soft, mud	
Color: 10 YR 3/1 Very dark gray	Odor:
Observation of animals: Polychaeta	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	
The site was moved approximately 200 m closer to the platform. This result in a new Site nr LB4a			

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB17	23.04.09			135m

Weather:	Wind:	Wave hight (m):
Time Start: 07:10	Time Finish: 09:00	Duration: 1:50
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud and sand	
Color: 5 Y 3/2 Dark olive gray	Odor:
Observation of animals: Polychaeta	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	3cm = 17 litre	1	1	1	1	1	
2	2cm = 18 litre	1	1	1	1		
3	5cm = 15 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB18	23.04.09			147m

Weather:	Wind:	Wave hight (m):
Time Start: 09:25	Time Finish: 09:58	Duration: 0:33
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud	
Color: 5 Y 3/2 Dark olive gray	Odor:
Observation of animals:	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	3cm = 17 litre	1	1	1	1	1	
2	6cm = 13 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4			No biological samples was taken.
5			
6			
7			
8			

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB9	23.04.09			110m

Weather:	Wind:	Wave hight (m):
Time Start: 10:40	Time Finish:	Duration:
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud	
Color: 5 Y 3/2 Dark olive gray	Odor:
Observation of animals: Polychaeta, Echinoderamta, Mollusca	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	1cm = 20 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
LB10	23.04.09			98m

Weather:	Wind:	Wave hight (m):
Time Start: 12:20	Time Finish: 13:20	Duration: 1:00
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud, soft	
Color: 10 YR 3/2 Very dark grayish brown	Odor:
Observation of animals: Polychaeta, Crabs, Mollusca	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
MF-N-1	23.04.09			50m

Weather: Sunshine	Wind:	Wave hight (m):
Time Start: 16:00	Time Finish: 17:00	Duration: 1:00
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud	
Color: 10 YR 3/2 Very dark grayish brown	Odor:
Observation of animals: Polychaeta, Echinodermata, Mollusca, Crustacea	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	Full = 21 litre	1	1	1	1		
3	Full = 21 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
MF-N-2	23.04.09			49m

Weather: Sunshine	Wind:	Wave hight (m):
Time Start: 17:20	Time Finish: 18:15	Duration: 0:55
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud	
Color: 10 YR 3/2 Very dark grayish brown	Odor:
Observation of animals:	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	5 cm= 15 litre	1	1	1	1		
3	6cm = 13 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
MF-N-R	23.04.09			48m

Weather:	Wind:	Wave hight (m):
Time Start: 19:25	Time Finish: 20:05	Duration: 0:40
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud	
Color: 10 YR 3/2 Very dark grayish brown	Odor:
Observation of animals: Polychaeta	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	Full = 21 litre	1	1	1	1	1	
2	2 cm= 18 litre	1	1	1	1		
3	2cm = 18 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
GS-D-1	24.04.09			21m

Weather:	Wind:	Wave hight (m):
Time Start: 06:40	Time Finish:	Duration:
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud	
Color: 2.5 Y 3/2 Very dark grayish brown	Odor:
Observation of animals: Polychaeta	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	3cm = 17 litre	1	1	1	1	1	
2	3 cm= 17 litre	1	1	1	1		
3	3cm = 17 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
GS-D-2	24.04.09			21m

Weather:	Wind:	Wave hight (m):
Time Start: 08:25	Time Finish: 09:25	Duration: 1:00
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms?? Short		

Type of bottom sediment: Mud and broken shells	
Color: 10 YR 3/2 Very dark grayish brown	Odor:
Observation of animals: Polychaeta, Crustacea, Ophiuroidea	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g			Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Chevron	Norway		
1	2cm = 18 litre	1	1	1	1	1	
2	2 cm= 18 litre	1	1	1	1		
3	1cm = 20 litre	1	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	Full = 21 litre	1	
5	Full = 21 litre	1	
6	Full = 21 litre	1	
7	Full = 21 litre	1	
8	Full = 21 litre	3	A lot of broken shells

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL4	26.04.09			53m

Weather: sun	Wind:	Wave hight (m):
Time Start: 16:36	Time Finish: 17:50	Duration: 1:14
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand	
Color: 2,5 Y 4/2 dark grayish brown	Odor:
Observation of animals: Polychaeta, Crustacea, Ophiuroidea	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	5cm = 15 litre	1	1	1	1	
2	6 cm= 13 litre	1	1	1		
3	6cm = 13 litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	6cm = 13 litre	7	
5	4,5cm=16litre	5	
6	6,5cm=13litre	1	
7	7cm = 12litre	7	
8	7,5cm=12litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL3	26.04.09			50m

Weather: sun	Wind:	Wave hight (m):
Time Start: 18:10	Time Finish: 19:30	Duration: 1:20
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand	
Color: 2,5 Y 4/3 olive brown	Odor:
Observation of animals:	
Observation of oil, waste etc:	No rejected samples: 3

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	18,5cm=1litre	1	1	1	1	
2	9,5cm=9 litre	1	1	1		
3	6cm = 13 litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	9cm = 10 litre	7	
5	15cm=4litre	7	
6	17cm=2litre	2	
7	20cm =0,5 l	1	
8	16cm=3litre	5	

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL6	26.04.09			49m

Weather:	Wind:	Wave hight (m):
Time Start: 19:50	Time Finish: 20:55	Duration: 1:05
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand and stones	
Color: 2,5 Y 4/3 olive brown	Odor:
Observation of animals: Echinodermata, Polychaeta, Crustacea	
Observation of oil, waste etc:	No rejected samples: 3

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	18cm=1litre	1	1	1	1	
2	18cm=1 litre	1	1	1		
3	20cm=0,5litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	12cm = 7 litre	4	
5	15cm=4litre	9	
6	12cm=7litre	5	
7	18cm =1 litre	5	
8	14cm=5litre	6	

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL7	26.04.09			53m

Weather:	Wind:	Wave hight (m):
Time Start: 21:15	Time Finish: 22:30	Duration: 1:15
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand	
Color: 2,5 Y 4/2 dark grayish brown	Odor:
Observation of animals: Echinodermata, Polychaeta, Sipuncula	
Observation of oil, waste etc:	No rejected samples: 5

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	16cm=3litre	1	1	1	1	
2	17cm=2litre	1	1	1		
3	20cm=0,5litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	10cm=9 litre	2	
5	14,5cm=4litre	3	
6	17cm=2litre	2	
7	11,5cm=7litre	4	
8	20cm=0,5litre	4	

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL8	26.04.09			72m

Weather:	Wind:	Wave hight (m):
Time Start: 23:02	Time Finish: 00:00	Duration: 0:58
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand	
Color: 2,5 Y 4/2 dark grayish brown	Odor:
Observation of animals: Echinodermata, Polychaeta	
Observation of oil, waste etc:	No rejected samples: 5

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	2,5cm=18litre	1	1	1	1	
2	7cm=12litre	1	1	1		
3	3cm=17litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	21 litre	5	
5	21 litre	4	
6	21 litre	6	
7	21 litre	3	
8	21 litre	2	

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL13	27.04.09			52m

Weather:	Wind:	Wave hight (m):
Time Start: 00:55	Time Finish: 01:55	Duration: 1:00
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Hard sediment	
Color: 5 Y 3/2 dark olive gray	Odor:
Observation of animals: Echinodermata, Mollusca, Crustacea	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	7,5cm=12litre	1	1	1	1	
2	9cm=10litre	1	1	1		
3	5,5cm=14litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	10cm=9litre	2	
5	5cm=15litre	3	
6	6cm=13litre	3	
7	2,5cm=18litre	1	
8	3,5cm=16litre	3	

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL12	27.04.09			47m

Weather:	Wind:	Wave hight (m):
Time Start: 02:45	Time Finish: 03:56	Duration: 1:11
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand and stones	
Color:	Odor:
Observation of animals: Echinodermata, Mollusca, Crustacea	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	7,5cm=12litre	1	1	1	1	
2	9cm=10litre	1	1	1		
3						Leave the Site.

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4			Leave the Site. Too many rejected samples
5			
6			
7			
8			

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL11	27.04.09			48m

Weather:	Wind:	Wave hight (m):
Time Start: 06:25	Time Finish: 07:35	Duration: 1:10
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand	
Color: 10YR 4/2 Dark grayish brown	Odor:
Observation of animals: Echinodermata, Crustacea	
Observation of oil, waste etc:	No rejected samples: 4

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	12 cm=7 litre	1	1	1	1	
2	15cm=4litre	1	1	1		
3	8,5cm=11litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	19cm=1 litre	1	
5	6cm=13litre	13	
6	12cm=7litre	3	
7	17cm=2litre	1	
8	15cm=4litre	2	

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL10	27.04.09			48m

Weather:	Wind:	Wave hight (m):
Time Start: 08:14	Time Finish: 09:35	Duration: 1:21
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand	
Color: 10YR 4/2 Dark grayish brown	Odor:
Observation of animals: Echinodermata, Crustacea	
Observation of oil, waste etc:	No rejected samples: 9

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	17 cm=2 litre	1	1	1	1	
2	12cm=7litre	1	1	1		
3	17cm=2litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	10cm=9 litre	10	
5	11,5cm=7litre	5	
6	17cm=2litre	2	
7			Left the Site. Difficult to take samples
8			

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL2	27.04.09			49m

Weather:	Wind:	Wave hight (m):
Time Start: 10:05	Time Finish: 11:30	Duration: 1:25
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand	
Color: 10YR 4/2 Dark grayish brown	Odor:
Observation of animals: Echinodermata, Polychaeta	
Observation of oil, waste etc:	No rejected samples: 3

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	5 cm=15 litre	3	1	3	1	0-1, 1-3 and 3-6 cm corer
2	6cm=13litre	1	1	1		
3	11cm=8litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	6cm=13 litre	2	
5	8cm=11litre	2	
6	12cm=7litre	2	
7	11cm=8litre	2	
8	4cm=16litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL5	27.04.09			51m

Weather:	Wind:	Wave hight (m):
Time Start: 11:35	Time Finish: 13:00	Duration: 1:25
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand	
Color: 10YR 4/2 Dark grayish brown	Odor:
Observation of animals: Echinodermata, Crustacea	
Observation of oil, waste etc:	No rejected samples:

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	5 cm=15 litre	1	1	1	1	
2	5cm=15litre	1	1	1		
3	3,5cm=16litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	5,5cm=14litre	13	
5	2,5cm=18litre	6	
6	1,5cm=19litre	9	
7	3,5cm=16litre	1	
8	4cm=16litre	1	

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL14	27.04.09			47m

Weather:	Wind:	Wave hight (m):
Time Start: 13:10	Time Finish: 14:00	Duration: 0:50
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand	
Color: 10YR 4/2 Dark grayish brown	Odor:
Observation of animals: Crustacea	
Observation of oil, waste etc:	No rejected samples: 1

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	4 cm=16 litre	1	1	1	1	
2	2cm=18litre	1	1	1		
3	16cm=3litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	4cm=16litre	6	
5	10cm=9litre	4	
6	6cm=13litre	6	
7	10cm=9litre	5	
8	6cm=13litre	4	

Vessel: R/V Dr. Fridtjof Nansen	Area: Soyo, Angola	Project code:	Survey nr: 2009404

Grab Site nr.	Date	Position		Depth (m)
		Latitude	Longitude	
PAL15	27.04.09			43m

Weather:	Wind:	Wave hight (m):
Time Start: 14:15	Time Finish: 15:20	Duration: 1:05
Sample equipment used (name, bite area, weight): 0,1 m2 van-veen. Long og short arms? Long arms (heavy grab)		

Type of bottom sediment: Sand	
Color: 10YR 4/2 Dark grayish brown	Odor:
Observation of animals:	
Observation of oil, waste etc:	No rejected samples: 1

Sample nr	Volume (cm from lid to sediment)	Hydrocarbons 300 g		Heavy metal 100 g	Grain size TOM 300 g	Remarks:
		Norway	Angola	Norway		
1	17 cm=2 litre	1	1	1	1	
2	4cm=16litre	1	1	1		
3	10cm=9litre	1	1	1		

Sample nr	Volume (cm)	No containers bottom fauna	Remarks:
4	12cm=7litre	2	
5	10cm=9litre	3	
6	8,5cm=11litre	4	
7	15cm=4litre	1	
8	16cm=3litre	1	