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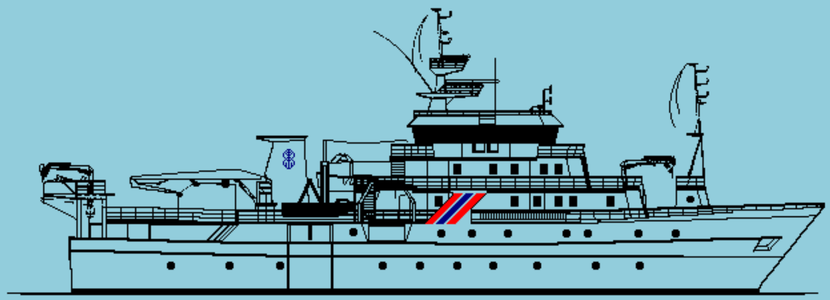
EAF - N/2012/7



Environmental monitoring Ghana 2012
Chemical and biological analysis

GHANA
04 November - 23 November 2012

Institute of Marine Research
Bergen, Norway

Environmental Protection Agency
Ghana

Fisheries Department
Ghana

Univerisity of Ghana
Ghana

Univerisity of Cape Coast
Ghana

University of LODZ
Polen

Argus Remote System A/S
Bergen, Norway

Bergen 2016

HAVFORSKNINGSINSTITUTTET
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Abstract: The objective of this survey was to repeat sampling on the 9 transects previously sampled during the Marine Environmental Baseline Studies (2009 – 2011) and in this way start the marine environmental monitoring. Compared to the findings from the baseline study we see some changes in chemical composition and in biodiversity on the two shallow stations in the Takoradi / Sekondi area.

Samples were collected along the transects going from the lower end of the beach to about 1000m water depth. The monitoring consisted of benthic soft bottom macro fauna analyses, sediment grain size analysis and chemical analyses of hydrocarbons and heavy metals related to oil industry activities. PCB and pesticides were not analyzed due to the lack of findings in the baseline phase.

The results of the metal analysis showed values within the lower part of what is defined as good conditions compared to available European and Norwegian standards. The leveles found represents no risk of ecological effects according to these standards and are mostly well below what is regarded as background levels. The parameters related to hydrocabons also show low values. Most of the parameters show an increase with depth most likely related to the finer grain size in the sediments associated with increasing water depth and the general pattern of sedimentation.

The biological samples support these findings.

Based on the biological and chemical analysis, the investigated areas were generally in good environmental condition with regards to the observed parameters. Some variation from year to year may be observed on the different stations on all the parameters, mostly due to diverse habitat structure on the sampling sites. **The stations close to the Mahogany oil field at the end of transect 2 that was sampled in 2010 in relation to a spill of drill cuttings, showed high levels of Barium when resampled in 2012. The shallow water stations near Secondi had elevated values on many parameters compared to 2010 and to the rest of the shallow water stations for both coverages. We recommend that the development of these areas are monitored closely in future investigations.**

A large cold water coral reef was discovered approximately 0,1 degrees East of transect 1 at around 400 meters' depth. The structure was detected by Multibeam Echo-sounder in 2009 and it was further investigated by use of the Video Assisted Multi Sampler (VAMS) in 2012. The main reef building organism is *Lophelia*, which is the same coral species that we find in Norwegian waters. The reef off Ghana is one of the world's largest cold water coral reefs; 1400 meters long 250 meters wide and 70 meters high. The banana shaped reef was oriented perpendicular to the main current, the convex side facing the current, there was no sign of human impact. The great height of the reef is probably a result of undisturbed growth for more than 20 000 years. The reef was located near the large oilfields off the west coast of Ghana and it is important to monitor the environmental conditions of this reef structure to make sure that it can continue its long and sound growth.

Keywords: Marine environmental monitoring, Benthic biodiversity, THC, PAH, NPD, heavy metals, PCB, offshore monitoring, Coral reef	

Responsible for:	Date:	Signature:
Professional evaluations and interpretations:		
Project:	2012407	

Accreditation:

The following activities were performed accredited:
Geological analyses by: Molab A/S Glomfjord
Chemical analyses by: Molab A/S Mo in Rana and Porsgrunn. IMR Bergen
Organic chemical analysis IMR, Chemistry Department

Sampling for analyses of: benthos, geology and chemical compounds by Ghanaian personnel under the supervision of IMR and University of Lodz.

Other activities:
Sorting of sediment by: IMR and University of Lodz
Identification of marine fauna by: University of Lodz

SUPPLIERS
Research vessel: Dr Fridtjof Nansen
Chemical analyses by: Molab (metals),
Organic chemical analysis IMR, Chemistry Department
Sorting and species identification, benthic samples: University of Lodz, Poland.

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/programs 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.

Participants on the cruise

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SAM ADU-KUMI	(EPA Ghana)
ISAAC DEBRAH	(EPA Ghana)
HAKIM SEIDU	(EPA Ghana)
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Supervised by:

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Jan Frode Wilhelmsen	(IMR)
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Jan Bryn	(Argus R-S A/S)
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We would like to thank the officers and the crew on board *Dr Fridtjof Nansen*.

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INTRODUCTION

The coastal zone of Ghana stretches from the borders with the Republic of Togo in the east to the Republic of Cote d'Ivoire in the West and covers a total distance of 565 km. The coastal stretch may be divided into three geomorphologic zones with various characteristics as below:

The West Coast covers 95 km and is made up of fine sand, gentle beaches and coastal lagoons
The Central Coast covers 321 km, and is made up of embayed coast of rocky headlands, rocky shores, littoral sand barriers and coastal lagoons The East Coast is 149 km long and has sandy beaches with the deltaic estuary of Volta River situated half way in between.

Ghana's coastal zones cover about 6.5 % of the country's land area, but inhabits about 25 % of the nations population. The current use of the coastal areas in Ghana are fishing; human settlements; tourism; industrial development; mining; sand winning, oil and gas exploration and exploitations. Marine fishing contributes about 4 % to the country's GDP. The living standards of people in the fishing communities in these areas are significantly lower than in the urban centres. Average welfare levels among food farmers in rural coastal areas, estimated by the Ghana Poverty Reduction Strategy, are 12 % below that of large urban centres such as Accra. Lack of healthcare, poverty and environmental degradation contribute to a vicious circle that inhibits human development in the coastal zone.

Consequently, the emerging oil industry poses a challenge to Ghana's coastal population, the majority being fishermen. The effects of the oil industry on other industrial and economic interests are also of concern to Ghana. These groups are concerned about the possible negative impacts of the petroleum activity in several areas, such as:

- Operational discharges from oil production and transportation.
- Accidental discharges from well operations production and transport.
- Discharges of untreated wastes from oil tankers and other vessels.
- Loss of marine biodiversity due to drilling activity and pollution.
- Reduced fish stocks.
- Limited access to fishing grounds.
- Limitations to settlements and recreational use of the coast line.
- Fear of health problems relating to pollution.
- Limitations to the emerging tourist industry.

The co-existence of the fishing communities and the oil industries among others is necessary for a sustainable utilisation of marine resources, and protection of the marine environment. An effective Coastal Zone Management must therefore be based on a clear understanding of the complexities in relation to the natural resources of the coastal areas, and the coastal population that subsists on these resources.

An important factor in safeguarding and balancing the relation between different commercial users, the coastal inhabitants and the protection of the marine environment, is the development of legislations, political instruments, establishment of governmental institutions, NGOs and private institutions. These initiatives are being spearheaded by the Environment Protection Agency (EPA). Previous Ghanaian legislations that have been passed in the area of integrated coastal zone management and sustainable development includes the following:

- Towns Ordinance, 1892
- Beaches Obstruction Ordinance, 1897 (Cap 240)
- Rivers Ordinance, 1903 (Cap 226)
- Wild Animals Preservation Act, Act 43, 1961
- Volta River Development Act, 1961
- Oil in Navigable Waters Act, Act 235, 1964
- Ghana National petroleum corporation law (1983)
- Fisheries (Amended) Regulations, 1977 and 1984
- Fisheries Law, PNDC 256, 1991
- The Environmental Protection Act (1994)
- Environmental Assessment regulations (1999)
- Fisheries Act 625, 2002
- Guidelines on Environmental Assessment and Management (2011)

The legislation for marine environmental protection, sustainable use, and conservation of marine living resources is contained in *the Biodiversity Strategy and Action Plan* and the Coastal Wetlands Strategy of Ghana. For the purposes of the newfound oil industry and the possible pollution that could result from an oil spill incident, various laws have been developed including the Petroleum Revenue Management (Amendment) Act, 2015 (Act 893).

The problems with pollution and transport of pollutants are complex and transboundary. Petroleum activities are not only limited to the Ghanaian territory but also to the neighbours in the West and East. It is therefore a shared problem between countries in the Guinea Current Large Marine Ecosystems (GCLME).

A detailed overview of the marine resources and the environmental state of the ecosystem is necessary for the management of the marine resources in a way that will benefit Ghana.

The Baseline surveys conducted on the Ghanaian continental shelf has been aimed at providing useful data on the existing marine environment, fish stocks, benthic fauna, oceanography and levels of pollution as a basis for the marine monitoring. A multisectorial approach for the baseline surveys and the monitoring survey in 2012, resampling the Baseline transects were facilitated by The Environmental Protection Agency (EPA), the Ministry of Environment Science Technology and Innovation (MESTI), Ministry of Energy (Petroleum), Ministry of Fisheries and Aquaculture, University of Cape Coast and University of Ghana, Legon.

Based on the above and in line with the EPA’s mandate to co-manage, protect and enhance the country’s environment, an offshore environmental management plan comprising both baseline surveys prior to oil and gas production and monitoring of the industrial activity and natural changes were developed. An initial marine environmental baseline survey was carried out in the western part in 2009 prior to oil and gas production, in the area around the Jubilee field.

The second and third part of the baseline study conducted in 2010 and 2011 covered the central and eastern part of the coast respectively prior to industrial activities related to oil and gas (except for the small scale Saltpond production site in the Central area). The 2011 survey completed the baseline coverage of the coastline with regards to chosen parameters related to oil exploration and production.

This survey, the fourth of the environmental surveys, done by the team in 2012 is therefore serving as a monitoring survey for all the three previous surveys. It aims at comparing the values obtained with the previous ones to find out whether changes have occurred since the previous surveys. The survey took place between October 17th and November 22nd which differs from the previous surveys that was conducted in April and early May. The shoreline samples were done first.
The survey went ahead as planned with only minor technical problems thanks to dedicated participants from all stakeholders.

In 2012 therefore, starting on the monitoring phase, the whole Ghanaian coast with the initial nine transects and stations were resampled using the R/V Dr Fridtjof Nansen. The newly developed VAMS (Video Assisted Multi Sampler) was in operative use for the first time. Based on experience from the Baseline studies (2009-2011) some improvements to the macro fauna sampling using finer sieves and refrigerated seawater to wash the fauna samples were applied.

The new equipment –VAMS - proved to be efficient when working in deep waters and provided visual documentation of the habitats to supply the biological data from the sediment samples. The work was completed on 1/3 of the time due to new efficient equipment, saving ship time and money. The new VAMS also allowed the team to investigate the banana shaped structure that proved to be one of the world’s largest deep water coral reefs (1400 meters long, 250-meter-wide and 70 meter high; detected by Multibeam echo sounder on the 2009 survey.

2. MATERIALS AND METHODS

2.1 Survey area

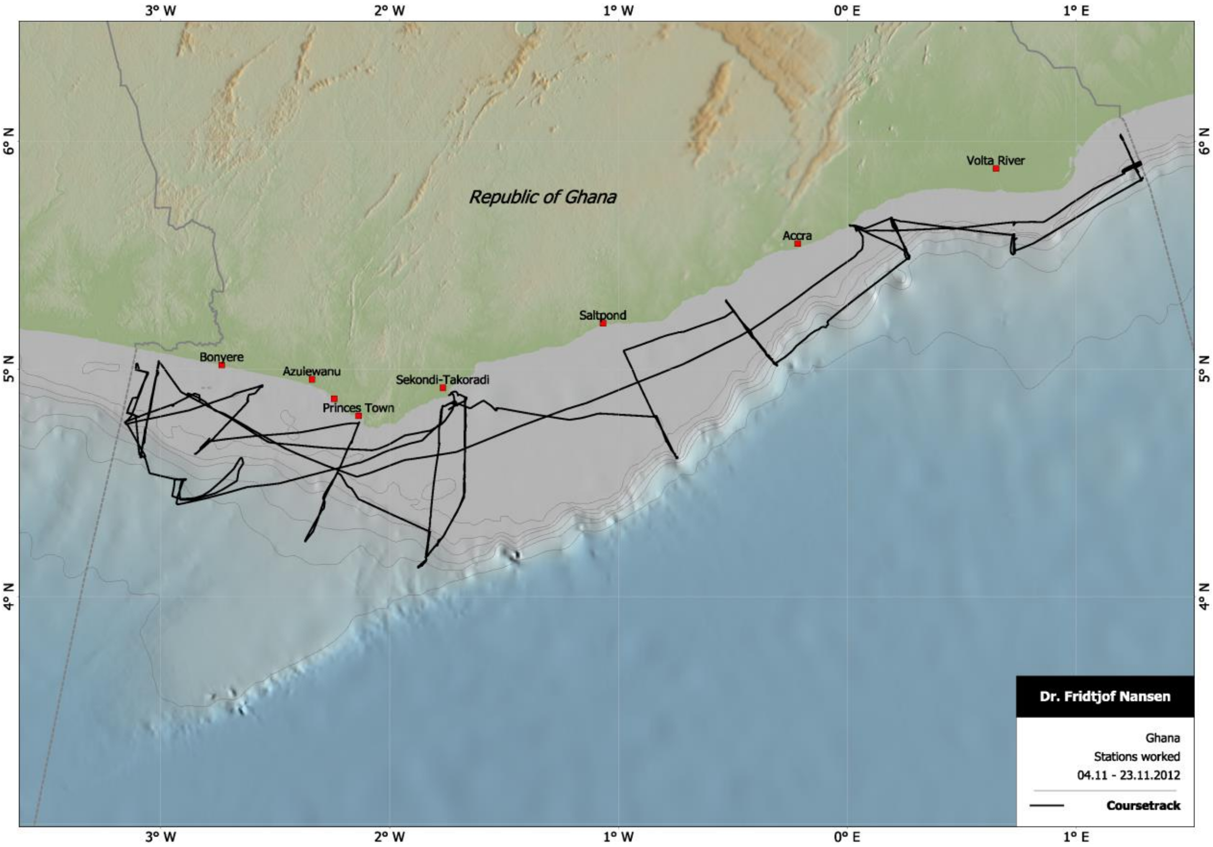
Nine transects along the Ghanaian coastline, distributed between New Town near the border to The Ivory Coast and Denu near the Togo border were resampled. The sampling covered an area with water depths ranging from the beach/littoral zone out to 1000-1500 meters' depth. The sailing tracks are shown in (Map 2.1) and the station map is illustrated in (Map 2.2).

2.2 Sampling design

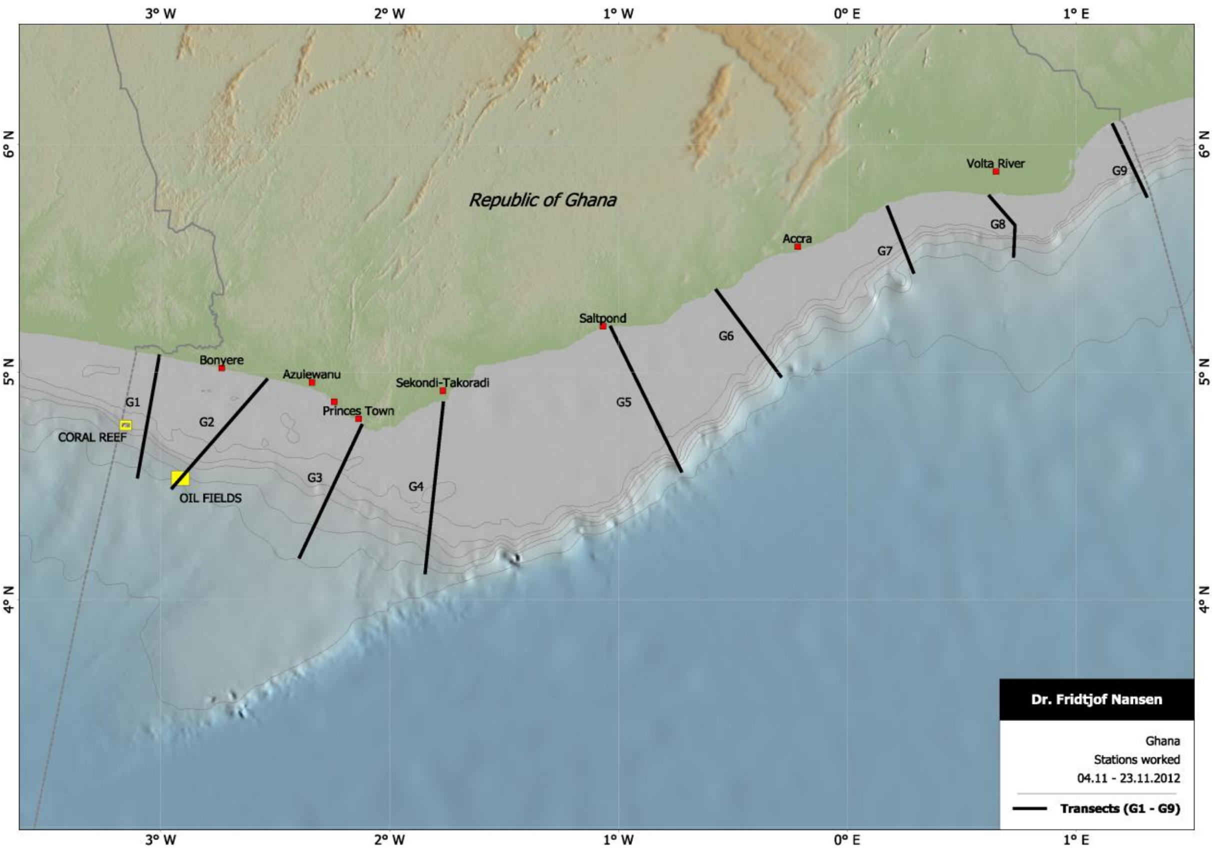
The goal of the survey was to monitor the environmental status of the coastal areas and the seafloor in Ghanaian waters based on the OSPAR guidelines for environmental monitoring of offshore oil and gas industry and compare it with the baseline data gathered during 2009-2011 surveys. To achieve this, 77 grab stations on the 9 transects from the 2009-2011 surveys were resampled. Experiences from the three previous surveys were implemented leading to refined procedures for sample treatment. The new Video Assisted Multi Sampler (VAMS) was used for collection of samples on the deep stations. The VAMS produced high resolution pictures and video of the bottom habitats and benthic macro fauna. The visual information added value to the samples and made it possible to obtain samples from areas that were difficult to sample with the traditional Van Veen grab. The sampling sites were spread out on the nine transects at eight predefined depths as in the previous surveys (at approximately 0m (shoreline/littoral zone) 5m, 25 m, 50 m, 100 m, 250 m, 500 m and 1000/1200 m depth, plus some additional stations near the Mahogany oil field.) The previously sampled stations at the Jubilee field were not possible to assess due to safety restrictions around the construction and production area.

Composite samples were collected at the shore (0m) within the tidal zone and at 5m depth using a handheld 0.025m^2 Van Veen grab, using four grabs for each sample to get a comparable sampling area to the deeper stations sampled from Nansen. The 5m depth sites were sampled using canoes hired from local fishermen.

The sediment sampling was executed in accordance with the OSPAR guidelines for sediment monitoring in offshore oil production areas with some adjustment to mesh size. O,5 mm mesh from 0- 100 meters and 0,3mm from 250 meters' and deeper. Some duplicate chemical, biological and grain size samples were collected for laboratory training purposes to benefit the local scientists and for comparison of analytical results.



Map 2.1: Course track at the coast of Ghana 2012



Map 2.2. Transects G1 – G9, the coral reef and the oil fields (Jubilee and Mahogany).

2.2.1 Hydrographical and meteorological sampling

CTD profiles were deployed at selected sediment sampling stations. 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 metres above the sea floor. The CTD data was post processed in the Quick cast database and displayed with the software package Ocean Data Viewer 4. The SBE 21 Seacat thermosalinograph was running continuously during the survey, collecting data for salinity and relative temperature at 5 m depth every 10 seconds. An attached in-line Turner Design SCUFA Fluorometer was used to supplement these data with the underway measurements of Chlorophyll-a levels [RFU].
Meteorological data including wind direction and speed, air temperature and sea surface temperature (SST) were automatically logged into the system using a WIMDA meteorological station and averaged by every nautical mile distance sailed.
ADCP/LADCP

2.2.2 Sediment sampling and sample treatment

The positioning of *Dr Fridtjof Nansen* was conducted by the officers on the bridge assisted by the Differential Global Positioning System (DGPS).

The sediment samples were collected by Ghanaian scientists under the supervision of experienced Norwegian and Polish scientists that instructed and assisted in the sampling process including washing, preservation, packing, labelling and storage of samples for both chemical and biological analysis, including all the required documentation in the sampling journal. The sampling was performed in accordance to the Norwegian guidelines;” Aktivitetsforskriften”, OSPAR guidelines, the Draft “Requirements for Environmental Monitoring of the Petroleum Activities on the Ghanaian Continental Shelf” and International Standards (ISO 5667-19 and ISO 16665).

Sampling equipment.
The sediment samples were collected using the Video Assisted Multi Sampler (VAMS) and three different Van Veen grabs, two single chamber grabs and one with double chamber. The grabs had adjustable weights to ensure sufficient sediment penetration and an opening of 0.1 m² for biological samples. The sampling equipment was operated by the ship’s crew. Information on each grab is listed in the appendix page 8.

The VAMS

The Video Assisted Multi Sampler (VAMS) was developed to improve the sampling technique in terms of visual inspections, reliability, speed, accuracy and the ability to carry an array of relevant sensors. The VAMS consist of a sampling platform with 5 hydraulically operated grabs, a current meter, a CTD and a sonar. An ROV with a 30meter umbilical cable is integrated in the sampling platform. The ROV is equipped with a HD camera for documentation, guidance and visual inspection of the sampling. The rig can operate down to 2500 meters’ depth and collect 9 parallel sediment samples in one dive thanks to 4 double chamber grabs.

The ROV was used to monitor the sampling process and to provide documentation of the invertebrate macro fauna and demersal fish at the sampling sites. This part of the fauna is usually not caught using the grabs, some pelagic fish and plankton samples were also recorded.

10-11 grab samples were collected at each grab station along all nine transects (there were a few exceptions to this). Five samples were used for biological analysis, three for chemical analysis and one for grain size were sent to Norway for analysis. The remaining samples were stored in Ghana for training purposes.

Once the sampling equipment was landed and secured on board, the surface water was drained and the sample volume was measured. The sample was then validated in terms of volume, undisturbed sediment surface and leakage. The drained water was sieved to obtain fauna from the drainage water. The sample for species determination was sieved through a 5 mm sieve and a 0,5 mm mesh sieve placed in a water bath for samples from 25 to 100meters and a 5mm and 0,3 mm mesh sieve for samples from 250 meters and deeper. In muddy samples the top layer was scoped off and washed separately in cold sea water to provide an ideal temperature for washing the deep water samples, the mesh size was 0,3 mm. After sieving, the material retained in the sieves were carefully transferred to containers and fixed as soon as possible in either pre-buffered[1] 4%[2] formaldehyde solution (diluted with sea water) and buffered with additional Borax, or (70) 96% ethanol. Samples preserved in ethanol can be used for genetic analysis (bar coding). (70 % ethanol was used on Sipuncula and Priapulida. The sieves were washed carefully between each sample to avoid contamination. The containers were filled to a maximum of 2/3 sediment filling to ensure adequate formaldehyde/ethanol concentration for fixation/conservation. The samples preserved in ethanol, had the ethanol changed within a 24-hour period to ensure good quality for DNA analysis.

The samples were labelled with the station notation, date, depth, sample number and number of containers, the container was then placed in a transparent plastic bag with the label inside facing out for easy identification, an additional label were placed in the inner cap of the container or inside the container and stored in boxes labelled with the contents. A sample inventory was also made.

The biological samples were sorted and the retrieved animals subjected to species determination in cooperation with the University of Lodz in Poland.

Samples for chemical analysis were collected with a special spatel from the upper 1 centimetre of the sediment surface. The samples were bagged in Rilsan bags and labelled with station notation, date, water depth and sample number. They were stored in the ships fridge before shipment on dry ice to Norway for analysis.

Samples for sediment composition and organic matter were collected from the upper 5 centimetres of the sediment labelled and frozen.

The chemical samples for analysis of heavy metals and grain size were transported to Molab

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[1] Borax was added to the formaldehyde solution to raise the buffer capacity.
This was done to prevent shifts in pH during sample storeage and thereby the dissolution of calcified structures or other tissues. Approximately, 1 ss (soup spoon) were added for each liter of 4 % formaldehyde.

[2] To ensure a final concentration of 4 % Formaldehyde, a 8 % Formaldehyde solution is often used while working on samples with high contents of water to make up for water added in the sample itself.

Environmental Laboratory AS for analysis.
The hydrocarbons were analysed at the IMR.

All relevant information about the sampling process and the samples were recorded in the sampling journal located in the appendix page: 8

Deviations:

Station G8/5 meter was not sampled since most of the village and all the boats had moved due to excessive erosion problems. Benthic material adapted to the temperatures in deep sea habitats, are more subjected to decay in surface temperature, than the ones living in shallow and thereby warmer habitats closer to the surface temperature. In 2012 an upgrade was made to address this problem by installing a small RSW plant on board the Nansen providing 5-10^{o}C seawater to wash the samples. The deep water samples (>250m) was processed using a mesh size of 300µm, square openings.

2.2.3 Colour, grain size and Total Organic Matter (TOM)

The colour of the sediments were determined using a revised Munsell® Soil Colour Chart System year 2000 (Gretag Macbeth, New Windsor, NY, USA). 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.

The particle size was analysed in the laboratory by dissolving the sediment in water and then sieving it through a 0,063 mm sieve. Particles larger than 0,063 mm, was then dry sieved trough Endecott sieves. The sieves had square holes with mesh sizes found in table 2.2. The analysis was performed at Molab with sieves ranging from 2mm to 63µm. There was no budget for analysis of the finer fractions.

The median diameter and sorting (Table 2.1) were calculated with the formulas below (Buchanan (1984) and Folk & Ward (1957)), and the program GradiStat version 4.01 (Blott & Pye 2001).

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

Median particle diameter: **Md $\Phi = \Phi 50$.**

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

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

Table 2.1: The mesh sizes of the sieves used for grain size analysis.

Size of the sieve	Phi class	Description

(mm)	Φ	
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

TOM

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

2.2.4 Chemical Analysis

Oil Hydrocarbons Analysis

Principle
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 (extracted) from the solid phase column with pentane followed by dichloromethane. The extract was reduced using a heating jacket and analysed using Gas Chromatography with Flame Ionisation 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 excess water. The amount of dry matter in the centrifuged sample was determined by the differential weight of 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 equipped with glass cups and cellulose thimbles at 150°C. 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 its 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 analysed 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 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 re-dissolved in 1 mL of dichloromethane and analysed by GC/FID (THC) and GC/MS-SIM (PAH, NPD).

Quantification of components

THC

Twenty-five years back in time oil-based drilling mud was extensively used in the North SEA and THC was one of the main parameters to monitor. Discharge of oil based mud was prohibited in Norwegian waters in 1992 and we have since the adopted a zero emission vision discharge vision with strict demands for reporting. The decision to take out the requirement to analyse THC from the environmental monitoring guidelines for the North Sea area in 2007 was based on the development towards the use of more environmental friendly chemicals. From our experience oil based mud are still in use in West Africa and it is interesting to know whether we will see changes in this parameter in the future.

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. A chromatogram illustrates the presence of specific compounds within the samples (Figure 2.1) while the analytical conditions of the GC/FID system are presented in Table 2.2.

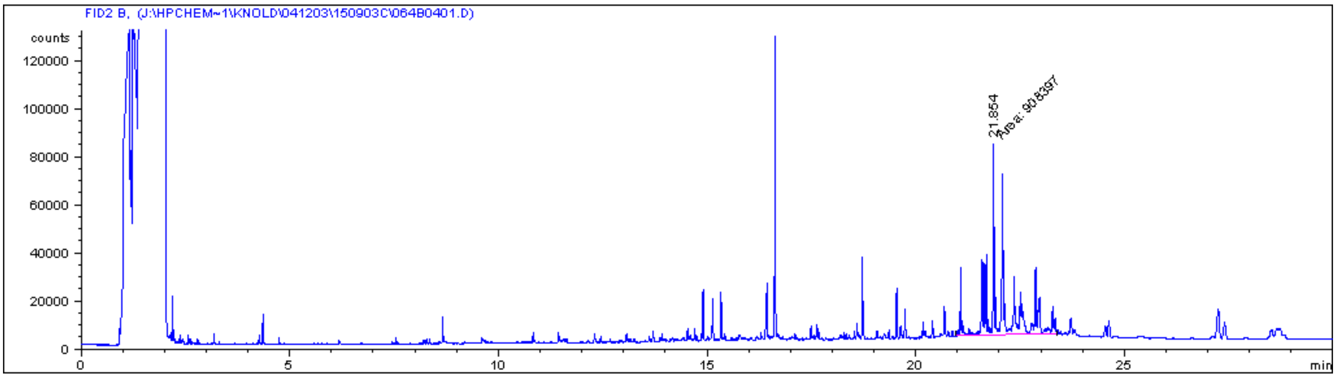


Figure 2.1: Chromatogram showing the subtracted phytosterol fraction of sediment sample.

Table 2.2: GC/FID conditions

GC system	Hewlett-Packard 5890 Series II Gas Chromatograph with split/splitless injector, Flame Ionisation 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 analytical conditions of the GC/MS system are shown in Table 2.3.

Table 2.3: 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 (Table 2.4). 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 2.4 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 2.4: Analysed 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		

Metal Analysis

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

Procedure
The sediment samples were dried at 105°C or 40°C for samples containing mercury. The sample was sieved through a 0.5 mm sieve and the fraction <0.5 mm was digested with nitric acid in accordance with NS4770.

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

Metal analysis by ICP-AES
The metals, except mercury, were analysed by a Varian Vista-PRO ICP-AES method. The analytical conditions are found in Table 2.5.

Table 2.5: 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 analysed using the mercury analyser instrument, Cetac M6000-A. 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 used as a reference.

2.2.5 Biological Analyses

Prior to sorting and species identification, each sample was washed through a 0,3 mm sieve to remove formalin. Specimens were then sorted out under a dissecting microscope, split into taxonomic groups and fixed on small tubes containing ethanol. The specimens were then identified and enumerated before being 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 included:

- Total number of species
- Total number of specimens standardised to 0.5 m^2 of sea floor
- The ten most abundant species at each site (species name, number of specimens and percent of total number of specimens)
- 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”

All data was analysed using the data program PRIMER, from Plymouth Marine Laboratory in England.

Univariate analyses:
The mathematical bases for the diversity indices are outlined by (Shannon & Weaver 1949)

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

The species-area curve is produced by the program Estimates from The University of Connecticut. (For more information about the method see Colwell & al 2004).

Log-normal curve
An indication of the environmental condition is gained by using geometrical classes. Geometrical classes are the relations between the species and the number of individuals. For example, species which are represented by one individual, 2-3 individuals, 4-7 individuals among others are defined as geometrical class I, class II, and class III respectively. Geometrical classes are plotted against number of species for each station. Good environmental conditions are indicated by the presence of 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. For further information, see Gray & Mirza (1979) and Pearson & al. 1983.

Multivariate analyses
Multivariate analyses were done 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 done using the program PRIMER from Plymouth Marine Laboratory in England.

Cluster analysis

The cluster analysis is a hierarchical agglomerative clustering of stations with the most similar species composition grouped together first at a high similarity level and then grouping the other stations at lower and lower similarity levels together, until all stations are grouped in a single cluster. The comparisons of the fauna at each station 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.

Ordination procedure (MDS)

The non-metric multidimensional scaling (MDS) groups the stations with the most similar fauna. This analysis presents the results such that the distance between the stations on the plot reflects 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 done using the PRIMER program.

2.2.6 Linking biota to multivariate environmental patterns

The correlation between biological patterns and environmental variables (all combinations of the environmental variables: pelite; TOM; Cu; Ba; Zn; Cd; Cr; Pb and THC) was studies in the computer program Canoco (Braak and Smilauer 1997). Chemical variables were log(x+1) transformed prior to analysis. The statistical significance of each environmental variable was determined by using Monte Carlo Permutation Tests.

2.2.7 Seabed mapping with multibeam echo sounder

Fig. 2.2: R/V Dr. Fridtjof Nansen on survey in Ghanaian waters

BATHYMETRIC MAPING USING MULTIBEAM ECHO SOUNDER

The detailed bathymetric maps produced by the multibeam eccosounder from all R/V Dr Fridtjof Nansen Surveys in Ghana cover an area of approximately 5000 km^2 between the border of the Ivory Coast and 20 nautical miles eastward, depth from 100 m to 1500 m. During the survey, local scientists were trained in the sampling methodology and equipment operation. The information will be used to improve the bathymetric maps for Ghanaian waters.

The survey was executed using the Kongsberg Maritime EM710 multibeam echo sounder with positioning and motion data from Seapath 200. The positioning system used was Fugro SeaStar. Seabed Information System (SIS) software was used for online logging and echo sounder control. Post-processing of data was performed using Neptune, which was also used for the calibration of the EM710.

Seabed Information System (SIS)
SIS is used for the online operation of Kongsberg Maritime multibeam echo sounder systems. The application was used by the operator to control all settings and logging during the survey.

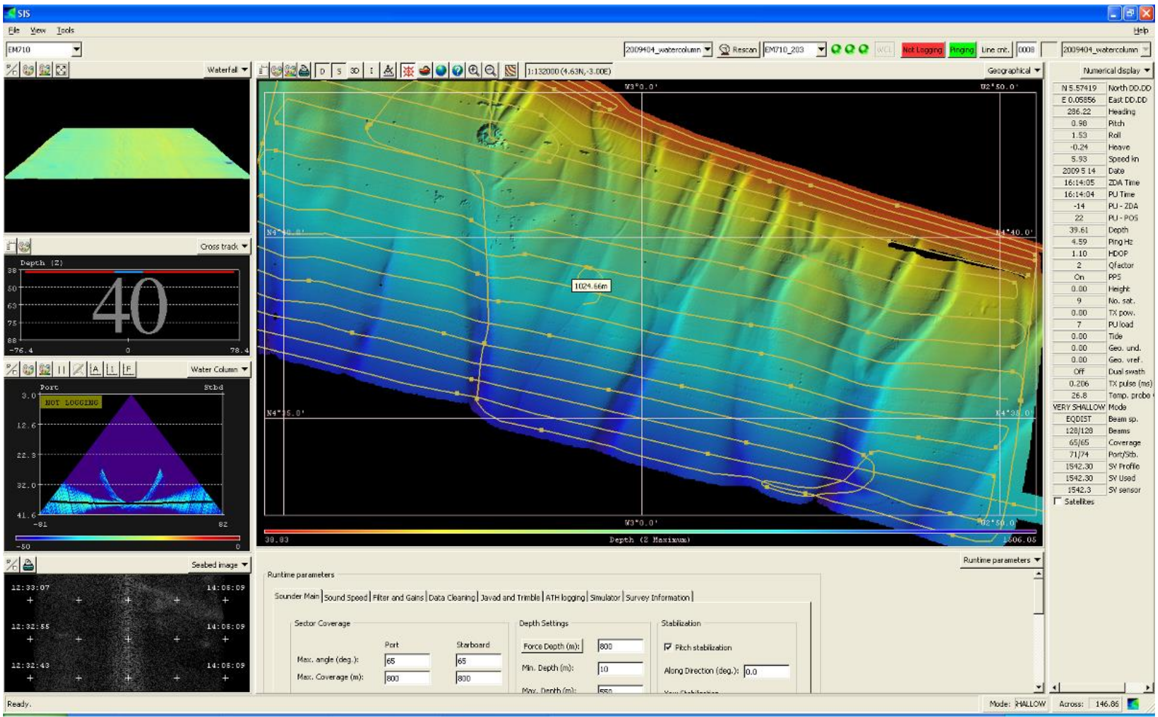


Figure 2.3.2: Screenshot from the Multibeam EM 710 during bathymetric mapping

NEPTUNE – Post Processing

Prepared raw data from SIS were processed using Neptune post-processing software. All depths were corrected for tidal influence using post-processed GPS data and reduced to mean sea level.

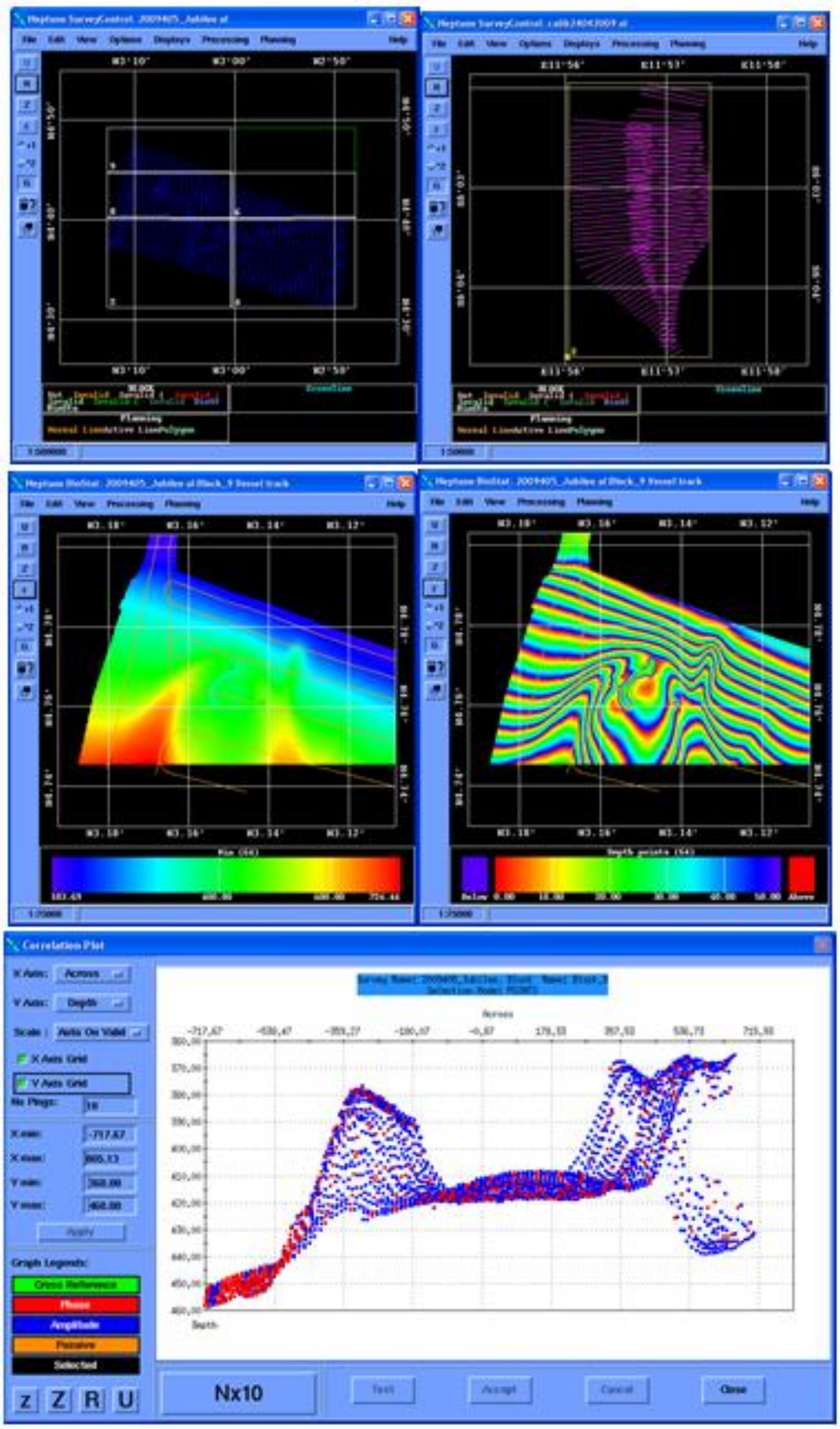


Figure 2.3.3: Screenshots from Neptune Post-processing software

After tide correction, spurious soundings were removed/flagged invalid using the BinStat module. Cleaned accepted data were exported to ASCII files as formatted as latitude, longitude and depth. In addition, mean depths were exported for each processing cell (30x30m).
The surveyed area is 780km2 containing approx. 14 million soundings ranging from 104m to 1474m.
Fledermaus – Visualization.
Exported ASCII data were imported into Fledermaus visualization and DTM software.

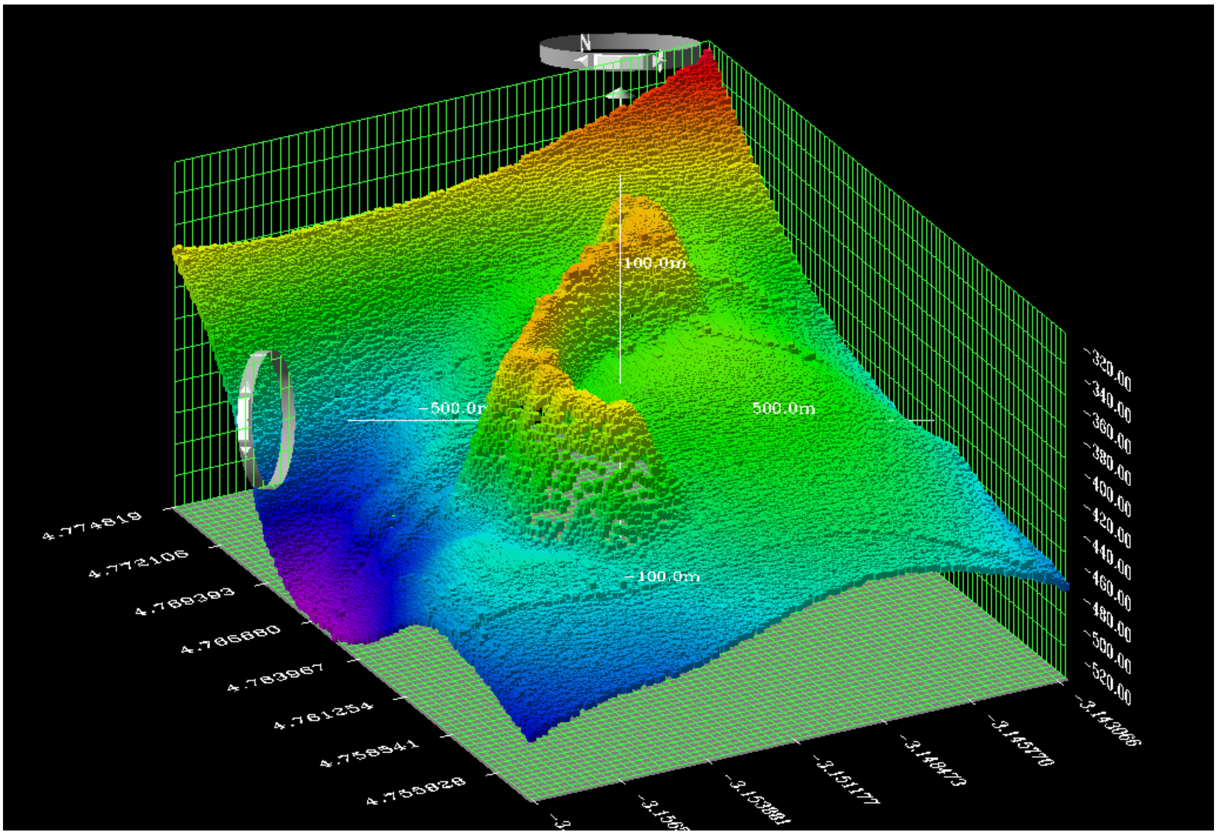


Figure 2.3.4: The first visualisation of the newly detected structure on the seafloor off Ghana that was verified as one of the world's largest deep-water coral reefs. The visualisation is produced with the Fledermaus program.

2.2.7 Quality Control

Chemical analysis was performed in accordance with the criteria of Norwegian Accreditation at the IMR accredited chemistry laboratory for hydrocarbon analysis the metal and grain size analysis was performed by the accredited lab at Molab A/S. Biological samples were sorted and identified partly by IMR and partly by personnel from University of Lodz in Poland
Biological and geological samples were also subject to quality control according to CDCFs internal routines. Any deviations from the sampling procedures were noted in the sampling journal.

2.2.8 Storage of samples

The biological samples were stored at the IMR in Bergen prior to analysis and shipment to the University of Lodz in Poland.

3. OCEANOGRAPHIC CONDITIONS

3.1 Surface temperature and salinity

The annual cycle in Ghanaian waters is characterized by four distinct seasons: minor upwelling, December-March; stratified conditions thermocline formation, April-June; major upwelling, July-September and the second thermocline formation period; October-November (Wiafe et al. 2008). Throughout the entire period of this survey, the stratified conditions characteristic to the boreal autumn thermocline formation dominated the distributions of all surveyed oceanographic variables.

Figure 3.1.1 and 3.1.2 depict the distributions of temperature and salinity at the depth of 5 m, derived from the continuously recorded data along the survey track. Both figures exhibit relatively small differences in the temperature and salinity in cross-shelf direction, which is typical for the stratified seasonal conditions in the absence of coastal upwelling. In contrast, in the along-shore direction there is a clear trend of a 1°C cooling and 0.2 PSU salinity increase between the western eastern ends of the Ghanaian shelf.

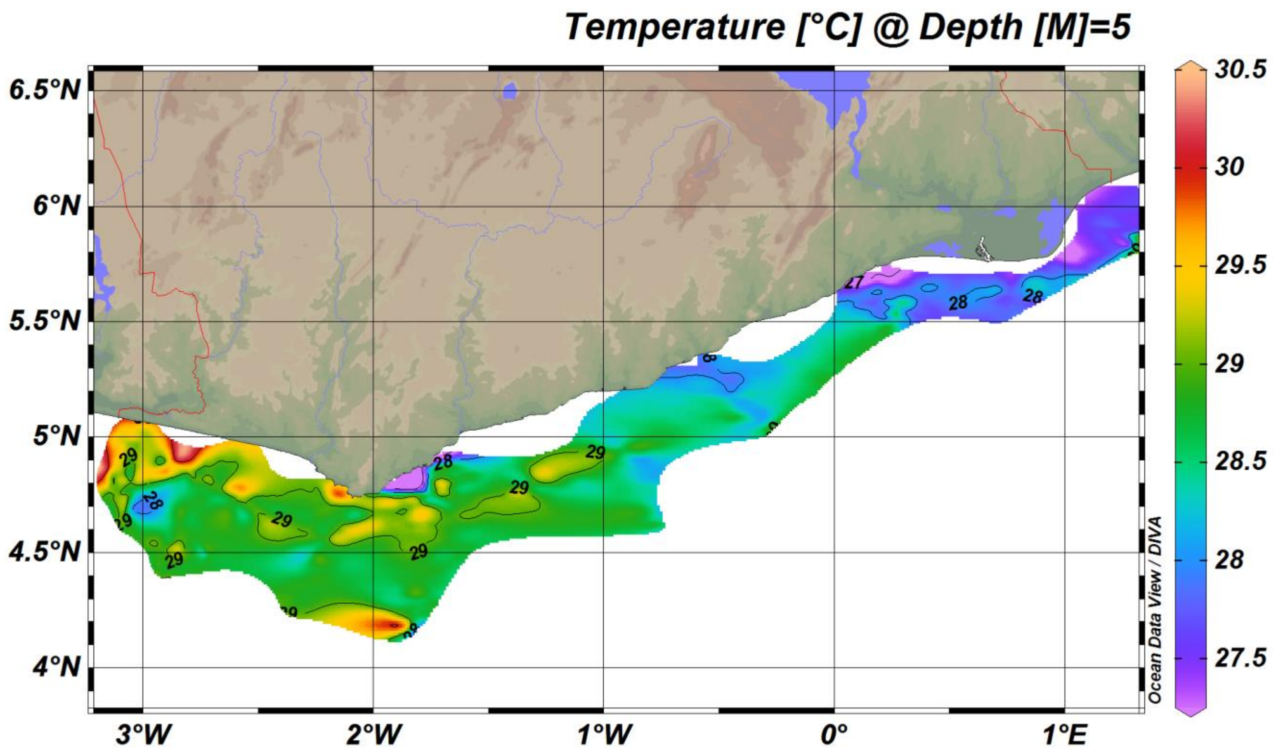


Fig. 3.1.1: Temperature from termosalinograph at 5-meter depth.

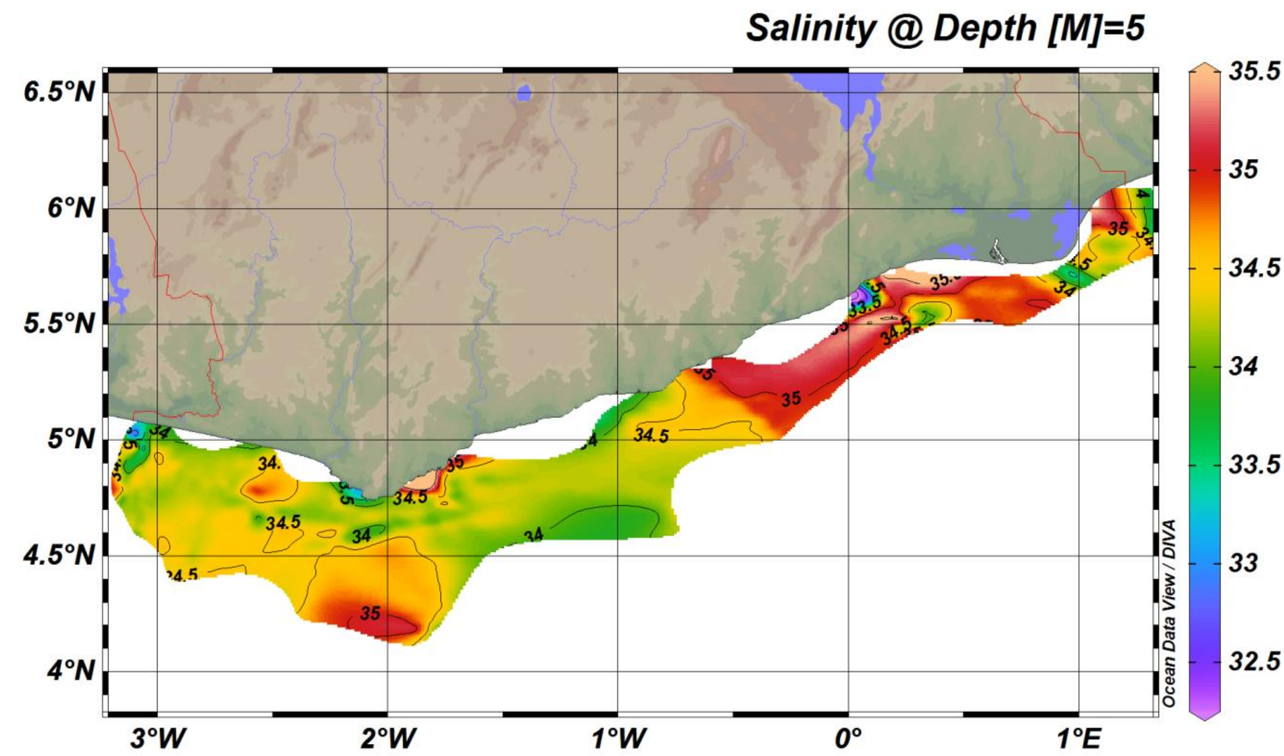


Fig. 3.1.2: Salinity from termosalinograph at 5-meter depth.

3.2 Vertical sections

The vertical distributions of temperature, salinity, dissolved oxygen and fluorescence along the sections occupied during the survey are shown in Figure 3.2.1-3.2.9. (For the location of these sections on the map of the survey area the reader is referred to Figure 2.2). The distributions manifest presence of the same vertical water mass structure on all sections across the Ghanaian shelf. In the top mixed layer, down to 60 m depth, Tropical Surface Water (TSW) dominates all distributions. At the sea surface, its temperature has the range of 28-30°C and salinity has the range 34.2-34.6 psu, depending on the location of a section with the sea surface being distinctly warmer and less saline to the west of the Cape of Three Points, compared to the region located to the east of Tema. The alongshore spatial pattern observed in near-surface regions along the sections is thus consistent to the sea surface distributions (see Figure 3.1.1 – 3.1.2).

The vertical structure of the TSW layer, which extends down to 60 m, is characterized by a gradual drop in temperature and increase in salinity. Dissolved oxygen is uniform within this layer, ~4.5 ml l^{-1}, exhibiting saturation levels close to 100% (not shown). The same the vertical structure in the oxygen distribution characterizes all sections in Figure 3.2.1-3.2.9.

The lower boundary TSW layer is terminated with the sharp thermocline located in the depth range 55-80 m where temperature drops from 25° to 18°C. In the same depth range, salinity reaches the maximum of 35.75-35.8 PSU. The combination of the strong temperature stratification and the salinity maximum leads to sharp density gradient (pycnocline) and high stability of the water column.

The pycnoline marks the separation between the top layer of TSW and underlying it South Atlantic Central Water (SACW). SACW is characterized by the linear decrease of temperature and salinity with depth, by a drop in dissolved oxygen concentration < 2.5 ml l^{-1} and high nutrient content (the latter not measured during this survey). A distinct feature in the oxygen distributions is the presence of the Oxygen Minimum Zone (OMZ) located in the depth range of 250-320m, where dissolved oxygen concentration reaches the minimum of ~1.2 ml l^{-1}.

Fluorescence distributions along all sections (Figure 3.2.1-3.2.9) exhibit an enhanced primary productivity region within the so-called Deep Chlorophyll Maximum (DCM). It is found in the depth range 60-80 m, thus coincident with the location of the main thermocline. The pattern of concentration of the primary productivity within the DCM is a typical seasonal condition observed in the Ghanaian shelf from the past Nansen surveys. All these surveys were carried during the first annual season of stratified conditions (April-June). Within the DCM, the relative chlorophyll concentrations observed during those surveys, as well as during this survey, have always been in the range 0.1-02 µg l^{-1}. While there are no data to compare these values to the upwelling season on the Ghanaian shelf, the observations made with the same vessel during upwelling on the Angolan shelf (which is characterized by the similar annual cycle of oceanographic conditions), suggests that the chlorophyll values during the stratified seasons are about one fifth of those characterizing the upwelling season.

The stratified conditions during the stratified seasons are generally thought to be unfavourable for biological productivity over the shelf. However, the primary productivity near the seabed may be still enhanced, due to the near-bottom turbulence causing a mixing of nutrient-rich SACW to the euphotic layer. The fluorescence distributions presented in Figures 3.2.1-3.2.9 suggest that the bottom turbulence related primary productivity enhancement is omnipresent over the Ghanaian in particular in the bottom depth range between 30 and 50m, as this depth range is well above the depth the oceanic DCM and thermocline depth while the strong stratified conditions are unfavourable to upwelling. On the other hand, the presence of the geographically fixed regions where the primary productivity is enhanced near the sea bottom suggests points to the bottom turbulence as physical driver contributing a zonation of benthic habitats over the inner Ghanaian shelf during the stratified seasons (April-June, October-November).

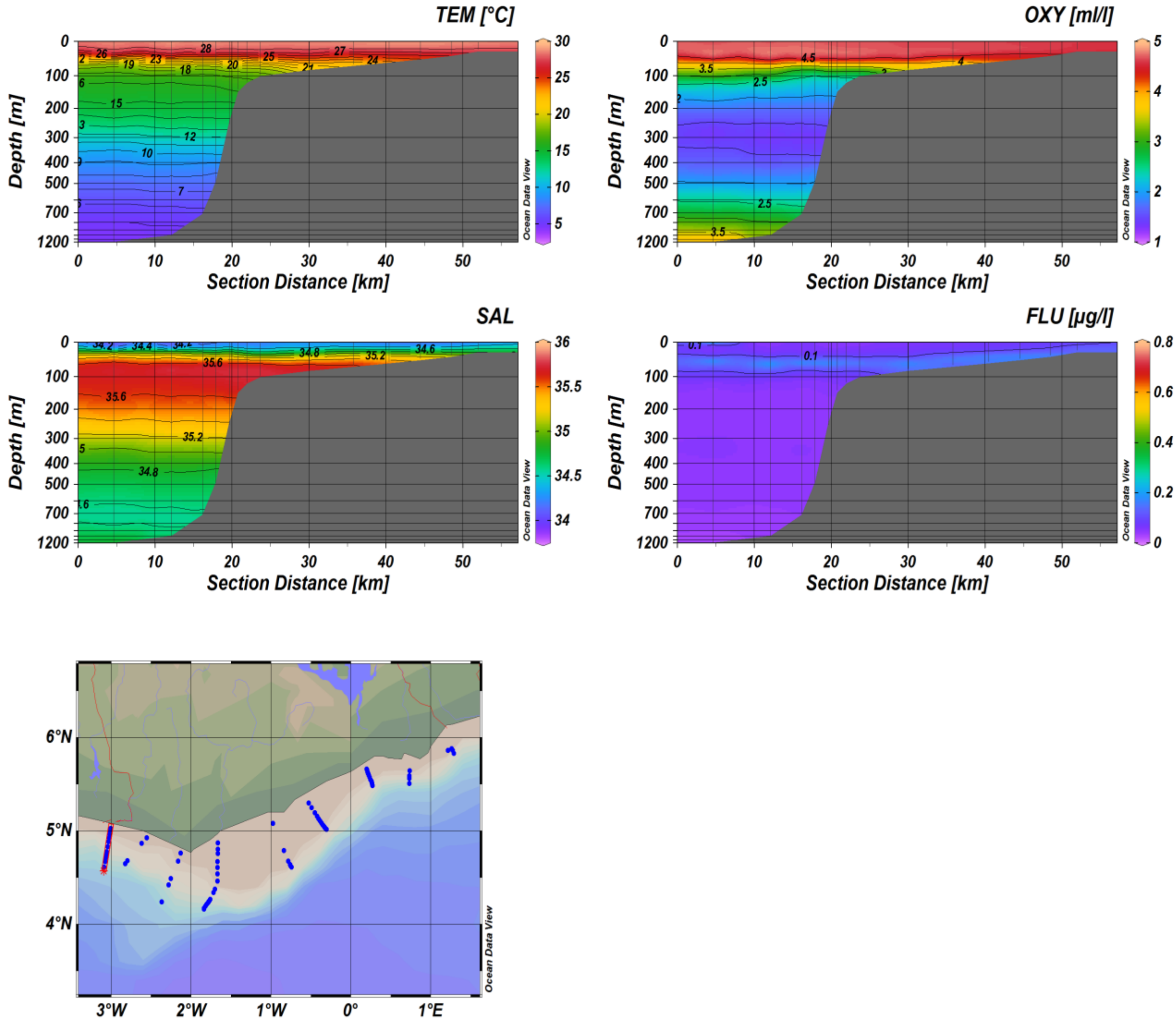


Figure 3.2.1: CTD Sections showing distributions of temperature, salinity, oxygen and fluorescence as a measure of chlorophyll A along transect G1.

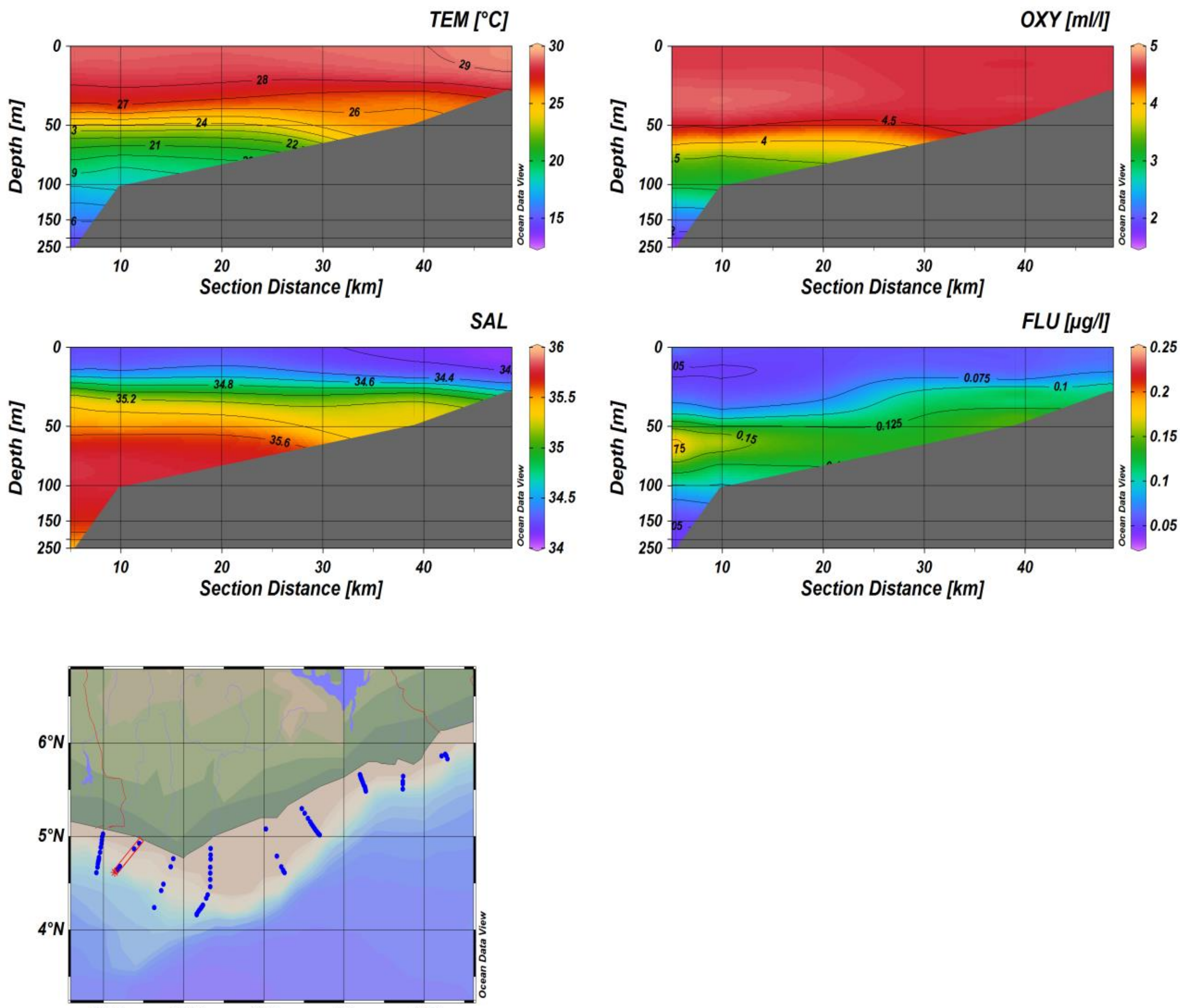


Figure 3.2.2: CTD Sections showing distributions of temperature, salinity, oxygen and fluorescence as a measure of chlorophyll A along transect G2.

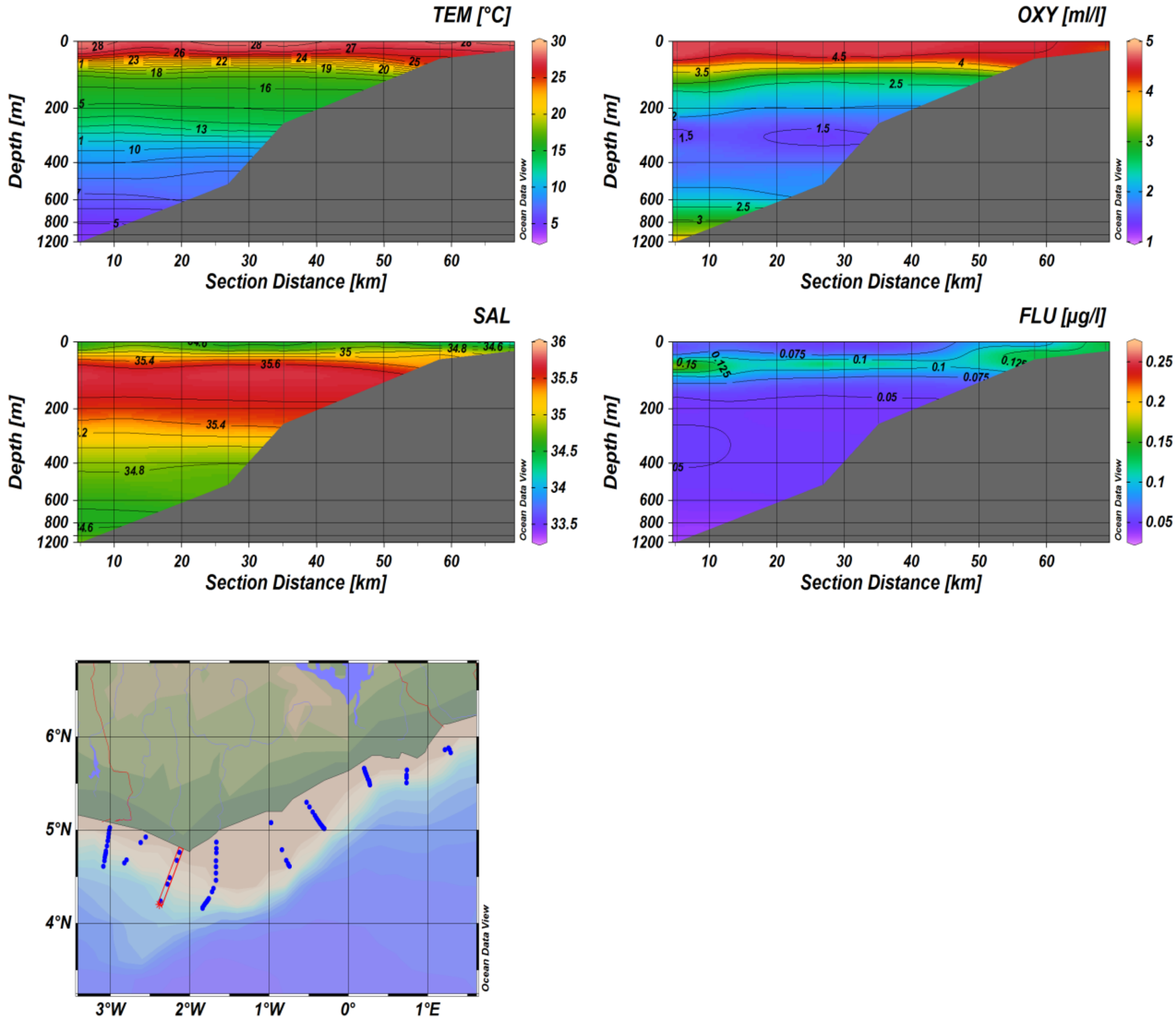


Figure 3.2.3: CTD Sections showing distributions of temperature, salinity, oxygen and fluorescence as a measure of chlorophyll A along transect G3.

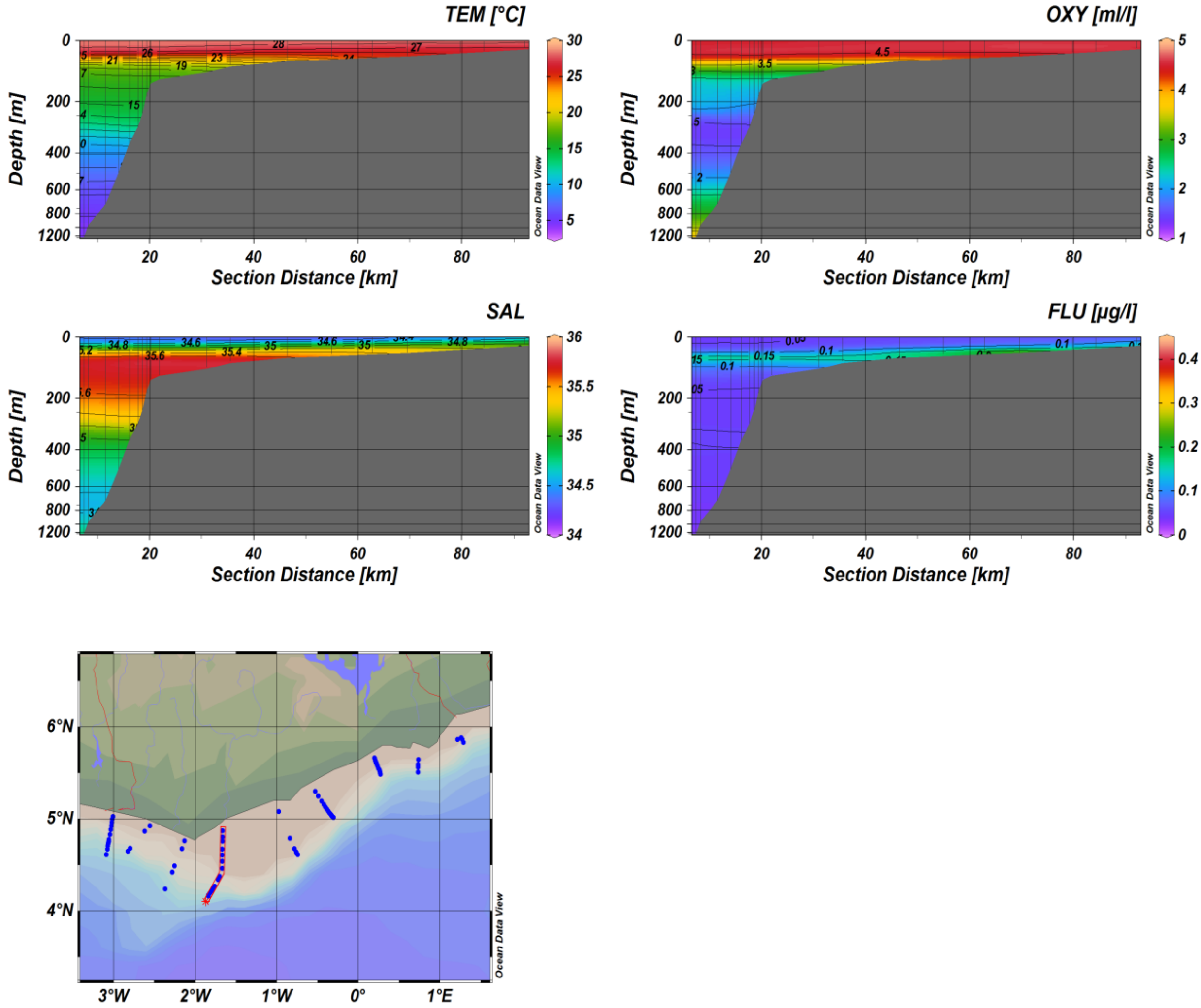


Figure 3.2.4: CTD Sections showing distributions of temperature, salinity, oxygen and fluorescence as a measure of chlorophyll A along transect G4.

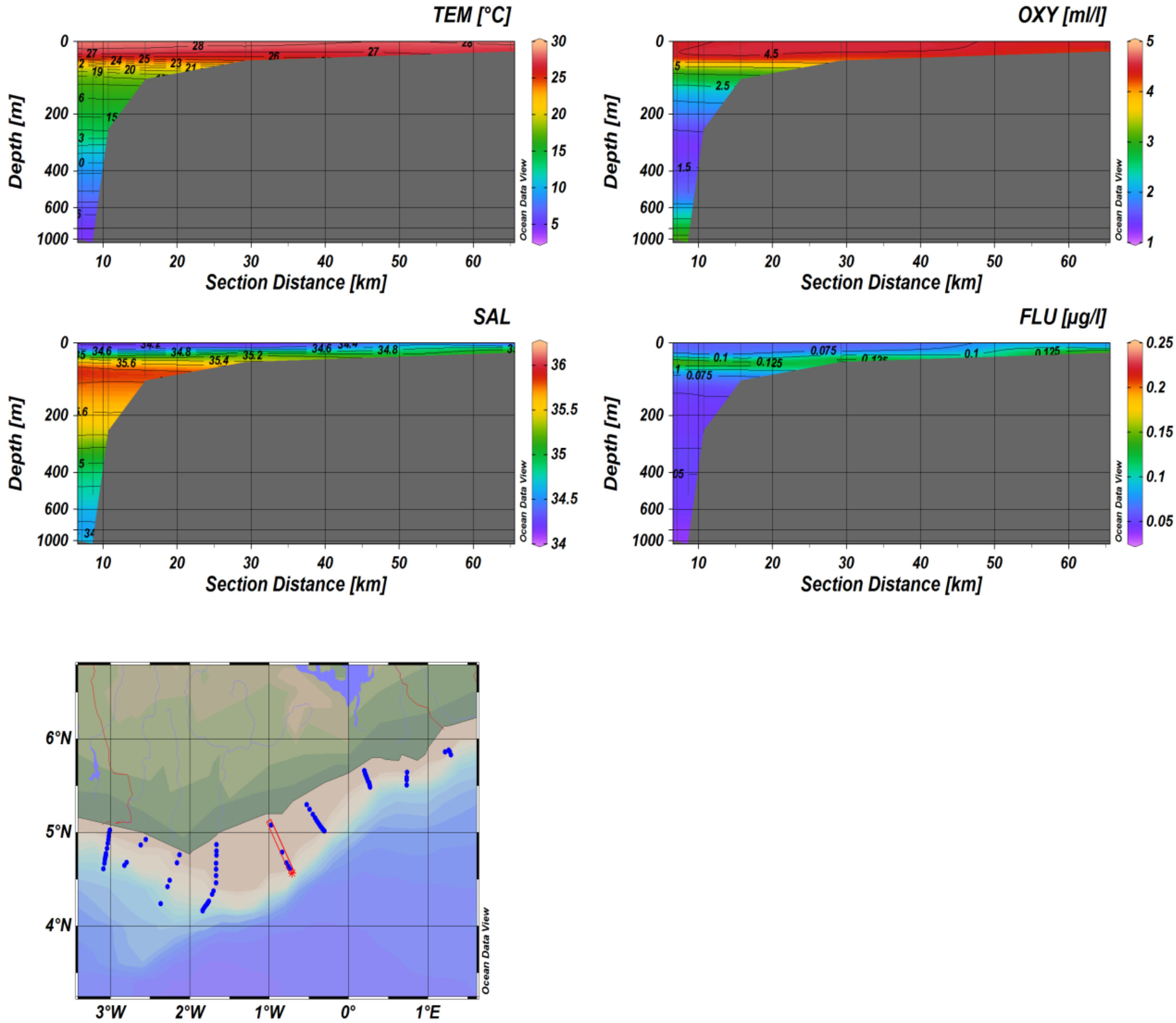


Figure 3.2.5: CTD Sections showing distributions of temperature, salinity, oxygen and fluorescence as a measure of chlorophyll A along transect G5.

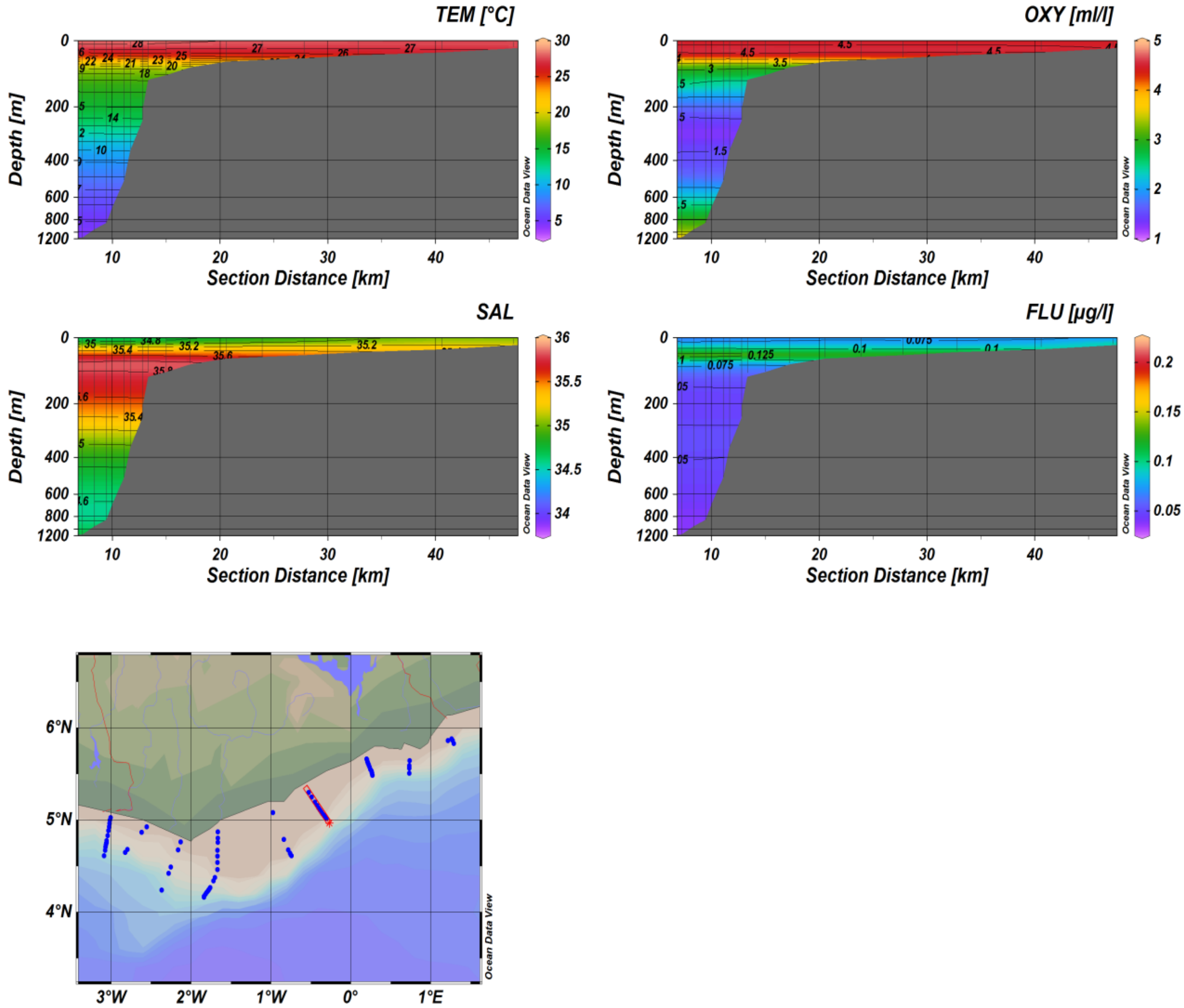


Figure 3.2.6: CTD Sections showing distributions of temperature, salinity, oxygen and fluorescence as a measure of chlorophyll A along transect G6.

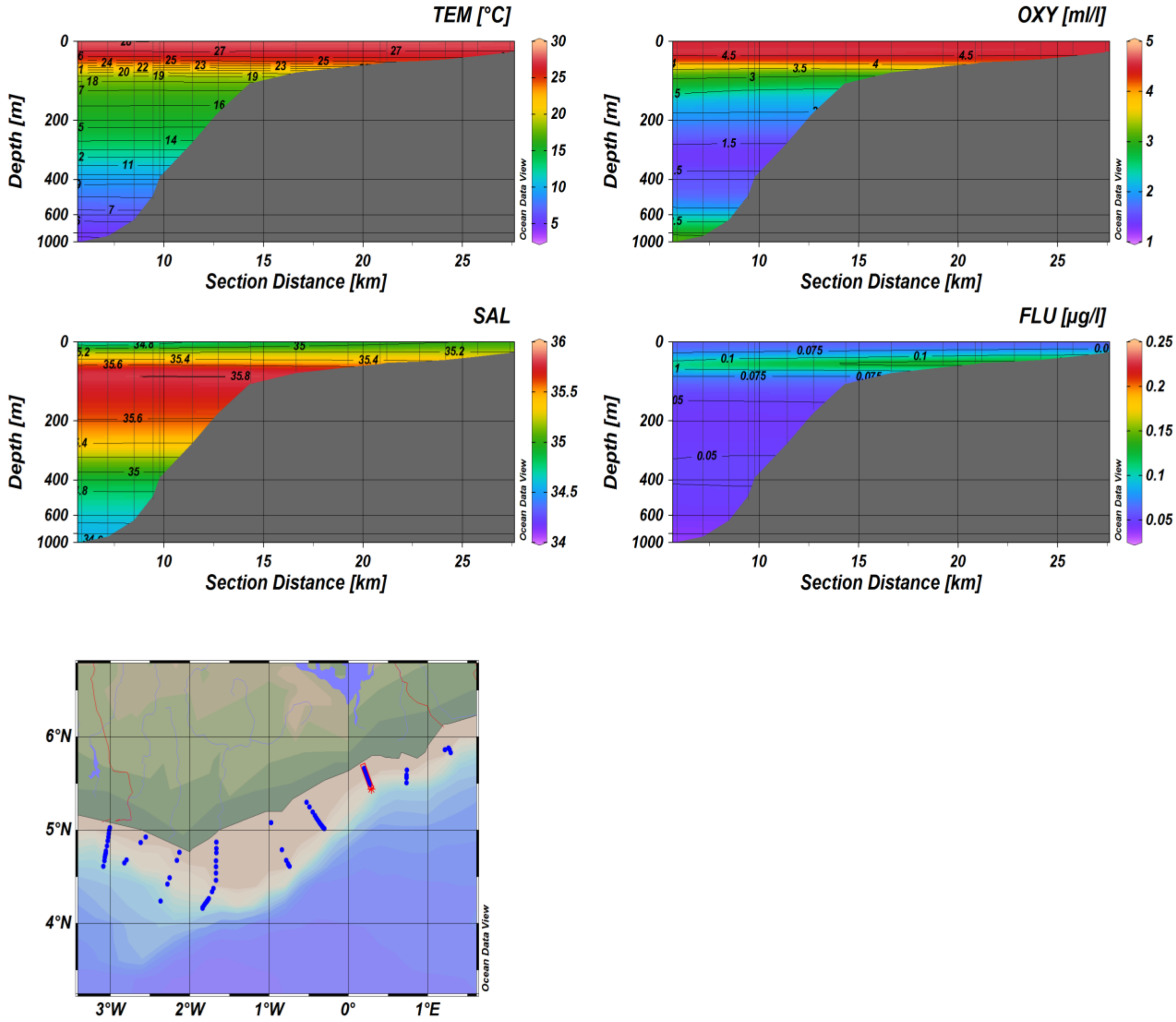


Figure 3.2.7: CTD Sections showing distributions of temperature, salinity, oxygen and fluorescence as a measure of chlorophyll A along transect G7.

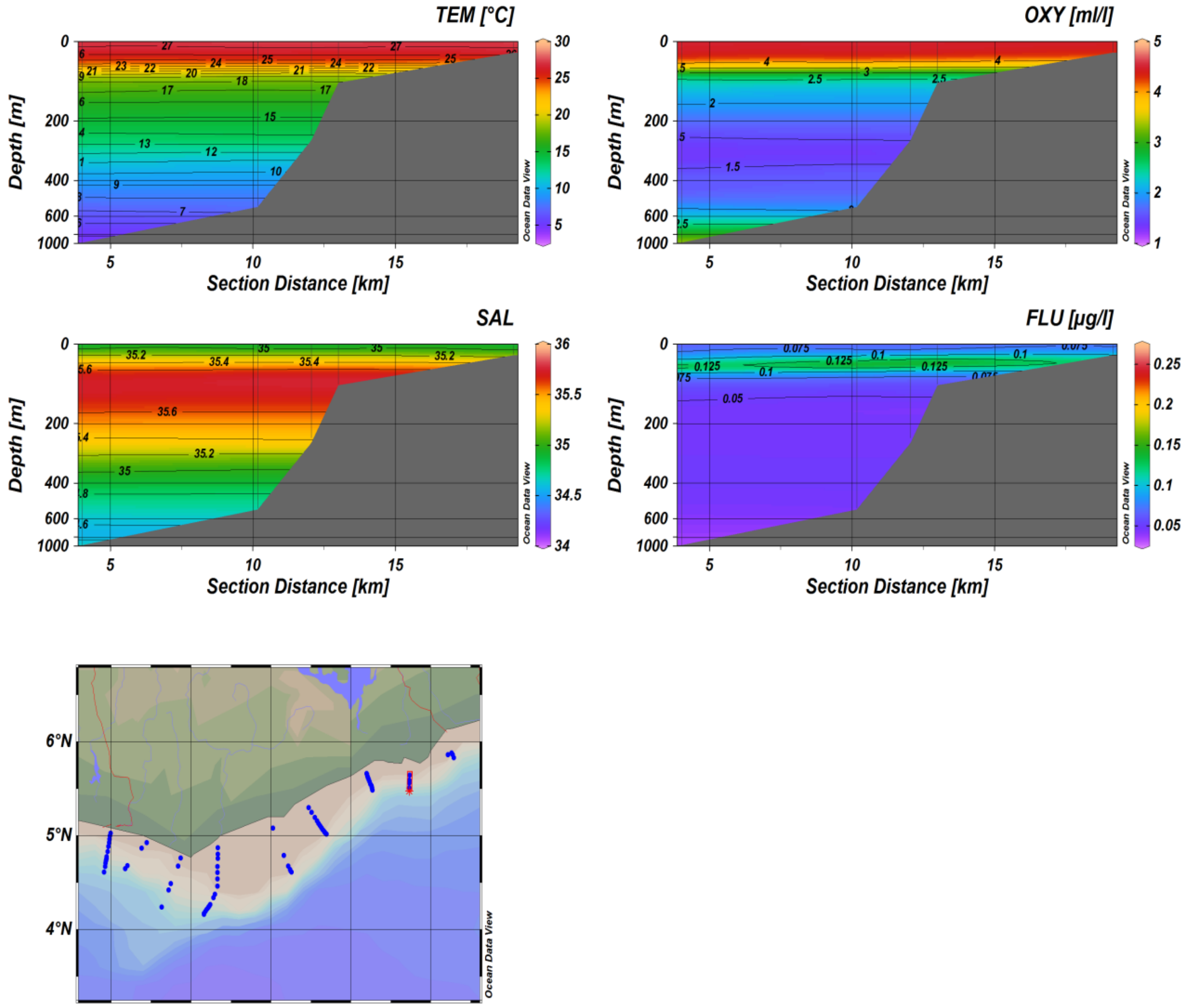


Figure 3.2.8: CTD Sections showing distributions of temperature, salinity, oxygen and fluorescence as a measure of chlorophyll A along transect G8.

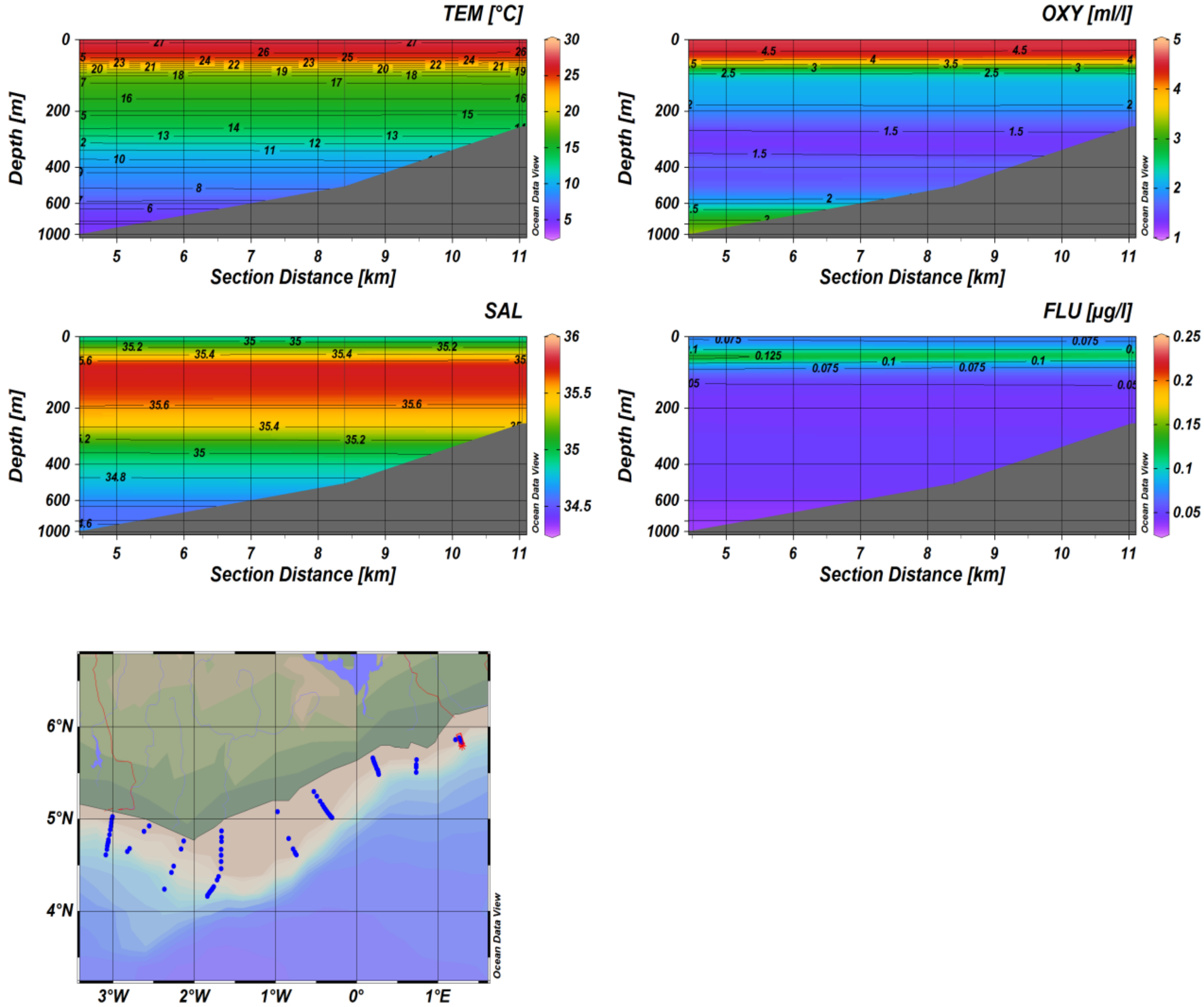


Figure 3.2.9: CTD Sections showing distributions of temperature, salinity, oxygen and fluorescence as a measure of chlorophyll A along transect G9.

DATA DELIVERABLE

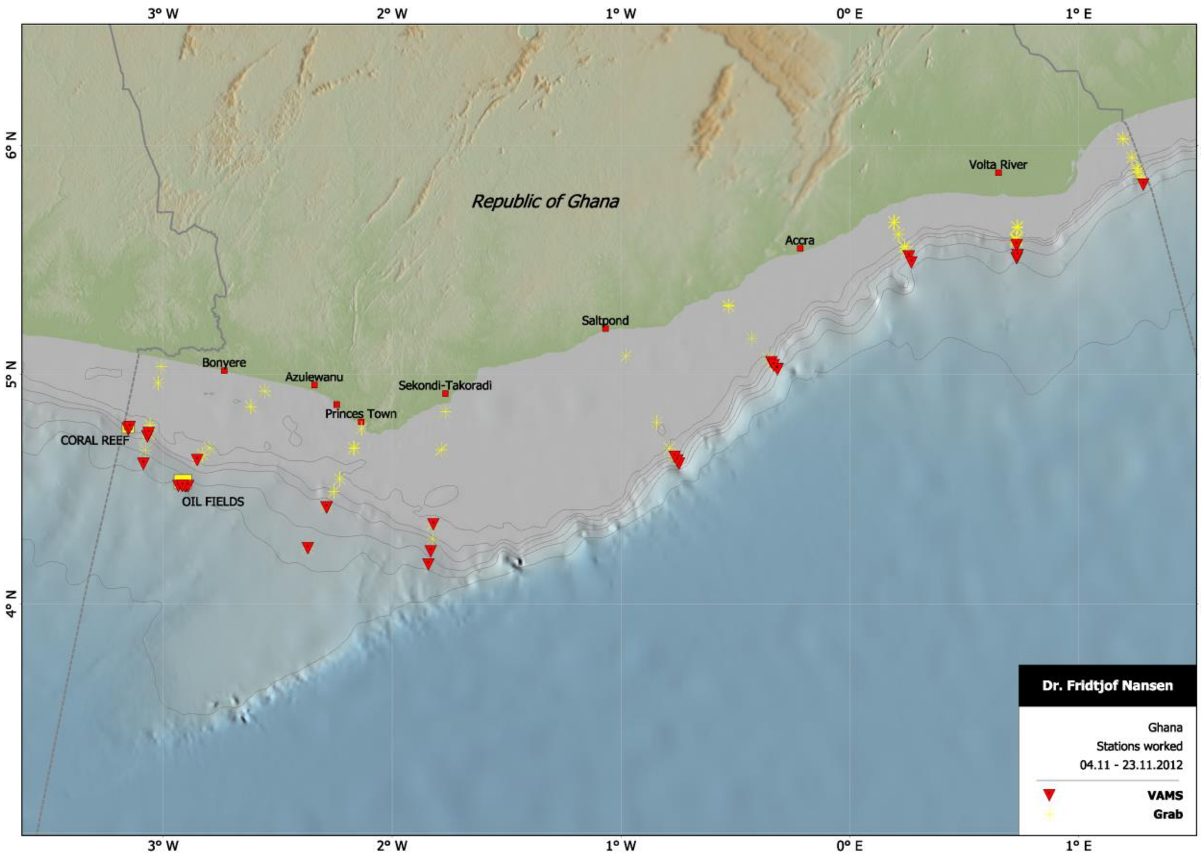
Exported data were stored on portable hard drives.

4. SEABED MAPPING

Raw data from the multibeam echo sounder was collected from all the transects covered during the survey period. The data has been passed on along with the rest of the raw data for processing. These data are currently used to produce bathymetric maps for the area.

5. BENTHIC SAMPLING.

The sampling stations are shown in map 5.1 and a brief description of the samples are listed in table 5.1 The deeper parts of the 9 transects were sampled with the new VAMS. Judging from the grain size distribution it seems the sampling quality is approximately the same in terms of grain size.



Map 5.1.: Shows all sampling stations. The stations sampled with the Video Assisted Multi Sampler (VAMS) are showed by inverted triangles.

Table 5.1: Sampling stations and sediment composition.

Station	DATE (DMY)	LON	LAT	DEEP	Diary	REMARK	*	Sediment Description from journal	Vol.
G1/0	17/10/12	-3.1044	5.0952	0		Hg	2	Fine sand. Light greyish brown	
G1/5	17/10/12	-3.1017	5.0851	5		Hg	4	Fine sand. Light greyish brown	
G1/25	17/11/12	-3.0092	5.0328	27	196-202	Duo	3	Sandy mud. Very dark greenish grey	
G1/50	17/11/12	-3.0227	4.9642	50	203-208	Duo	4	Sandy mud. Very dark greenish grey	
G1/100	17/11/12	-3.0578	4.7795	101	209-214	Duo	4	Very dark greenish grey	
G1/250	17/11/12	-3.0647	4.7440	241	215-217	Duo/VG	3	Sandy clay with mud. Dark greenish grey	
Coral reef 1	17/11/12	-3.1530	4.7613	386	219	VG			
Coral reef 2	23/11/12	-3.1541	4.7641	376	312	VG			
Coral reef 3	23/11/12	-3.1469	4.7706	375	313	VG			
G1/500	16/11/12	-3.0698	4.7286	501	192, 193, 195	VG	5	Clay. 3/10 GY Very dark greenish Grey (Gley 1)	
G1/1200	16/11/12	-3.0852	4.6116	1201	190, 191	VG	5	Muddy clay. Very dark greenish grey	
G2/0	18/10/12	-2.3257	4.9226	0		Hg	3	Fine sand less than 1mm grain size. Light brownish grey.	
G2/5	18/10/12	-2.3261	4.9183	5		Hg	4	Fine sand. Light grey.	
G2/25	18/11/12	-2.5759	4.9280	27	220-226	Duo	5	Sandy clay and mud, s. 3 sandy. Dark greenish grey, s. 3 reddish black.	
G2/50	18/11/12	-2.6188	4.8543	51	227-232	Duo	4		
G2/100	18/11/12	-2.7988	4.6799	103	242-247	Duo	4		
G2/250	18/11/12	-2.8273	4.6503	255	236-241	Duo	2	Sand. Dark greenish grey.	
G2/500	18/11/12	-2.8530	4.6283	508	233-235	VG	5	Muddy clay. Very dark grey	
G2/1361	21/11/12	-2.9002	4.5136	1361	304, 305	VG	5	Clay. Greenish black	
MA 2-1/1361	22/11/12	-2.9050	4.5135	1366	307	VG	5		
G2 1598	21/11/12	-2.9344	4.5136	1600	306	VG	5	Clay	
G2 1400	22/11/12	-2.9164	4.5134	1424	308	VG		Mud. Very dark greenish grey Chart: gley 1	
MA 2-3/1376	22/11/12	-2.8907	4.5133	1377	309, 310	VG		Mud. Very dark greenish grey Chart: gley 1	
MA 2-3/1414	22/11/12	-2.9160	4.5145	1414	311	VG			
G3/0	18/10/12	-2.0908	4.7454	0		Hg	3	Fine sand. light greyish brown.	
G3/5	18/10/12	-2.0942	4.7426	5		Hg	3	Fine sand. Light brown	
G3/25	19/11/12	-2.1327	4.7647	28	248-253	Duo	5	Fine sandy mud. Dark greenish grey.	
G3/50	19/11/12	-2.1645	4.6812	52	254-259	Duo	5	Fine sandy mud. Dark greenish grey.	
G3/100	20/11/12	-2.2289	4.5472	100	272-277	Duo	4	Fine sandy mud. Very dark greenish grey.	
G3/250	19/11/12	-2.2540	4.4903	252	266-271	Duo	4		
G3/500	19/11/12	-2.2817	4.4216	509	260, 261, 265	VG/Duo	5	Very fine sandy mud. Very dark greenish grey.	
G3/1200	19/11/12	-2.3691	4.2421	1197	262-264	VG	5	Very fine sandy mud. Very dark greenish grey.	

Table 5.1: Sampling stations and sediment composition.

Station	DATE (DMY)	LON	LAT	DEEP	Diary	REMARK	*	Sediment Description from journal	Vol
G4/0	19/10/12	-1.7058	4.9512	0		Hg	3	Fine sand. Light greyish brown	
G4/5	19/10/12	-1.7045	4.9506	5		Hg	5	Clay and sand. Dark grey	
G4/25	21/11/12	-1.7667	4.8386	25	299-303	SA	5	Sandy mud. Very dark greenish grey	
G4/50	20/11/12	-1.7838	4.6814	52	293-298	Duo	5		
G4/100	20/11/12	-1.8196	4.3510	108	287-292	Duo	4		
G4/250	20/11/12	-1.8222	4.2815	250	278-283	Duo	4		
G4/500	20/11/12	-1.8338	4.2329	497	284	VG	4	Fine Sandy mud. Very dark greenish grey	
G4/1000	20/11/12	-1.8398	4.1718	993	285-286	VG	5	Fine Sandy mud. Very dark greenish grey	
G5/0	20/10/12	-1.0345	5.2004	0		Hg	2	Sand. Light greyish brown	
G5/5	20/10/12	-1.0340	5.1994	5		Hg	1	Sand and a little silt. Black.	
G5/25	13/11/12	-0.9774	5.0816	27	163-168	Duo	3	Coarse sand broken shells. 5/10 Y Greenish grey (gley 1)	
G5/50	14/11/12	-0.8359	4.7942	52	169, 186-189	Duo	4	Coarse sand and shell fragments. 4/10Y Dark greenish grey (gley 1)	
G5/100	14/11/12	-0.7868	4.6788	101	180-185	Duo	4	Broken shells medium coarse sand. 4/10 Y, dark greenish grey (gley 1)	
G5/250	13/11/12	-0.7655	4.6408	252	173-179	Duo	5	Fine Sand. 4/10 Y, Dark greenish grey, Gley 1.	
G5/500	13/11/12	-0.7557	4.6252	507	172	VG	5	Clay. 4/10 Y, dark greenish grey (gley 1)	
G5/1000	13/11/12	-0.7456	4.6126	1040	170-171	VG	5	Clay. 4/5 GY, dark greenish grey	
G6/0	21/10/12	-0.5879	5.3583	0		Hg	2	Sand. 2,5 Y, 6/2, Light brownish grey	
G6/5	21/10/12	-0.5888	5.3443	6		Hg	4	Fine compact sand. 10Y 5GY 3/2, very dark greyish olive.	
G6/25	12/11/12	-0.5214	5.3048	24	137-144	Duo	5	Sand, shell sand. 4/10Y dark greenish grey (Gley 1)	
G6/50	12/11/12	-0.4254	5.1522	52	145-149	Duo	4	Fine sand, shell sand. 4/5 GY Dark greenish grey, Gley 1	
G6/100	12/11/12	-0.3589	5.0691	102	150-155	Duo	3	Fine sand. 4/10 Y Dark greenish grey (gley 1)	
G6/250	12/11/12	-0.3428	5.0530	247	158, 160-162	VG/Duo	3	Fine sand. 4/10 Y Dark greenish grey (gley 1)	
G6/500	12/11/12	-0.3397	5.0297	499	157, 159	VG	5	Clay and fine sand. 4/10 Y dark greenish grey	
G6/1000	11/11/12	-0.3177	5.0230	994	136, 156	VG	5	Clay. 4/10 BG Dark greenish grey (gley 2)	

Sediment description

Gravel	0
Coarse sand	1
Medium sand	2
Fine sand	3
Very fine sand	4
Silt and clay	5
Clay	6

Table 5.1: Sampling stations and sediment composition.

Station	DATE (DMY)	LON	LAT	DEEP	Diary	REMARK	*	Sediment Description from journal	Vol
G7/0	22/10/12	0.1658	5.7339	0		Hg	2	Sand and shellsand. 10 YR 8/2 Very pale brown.	
G7/5	22/10/12	0.1849	5.7412	5		Hg	4	Fine sand. 10Y 5GY 3/2 Very dark greyish olive.	
G7/25	8/11/12	0.1964	5.6607	25	92-94, 115-123	LA	1	Sand and corals.	
G7/50	8/11/12	0.2170	5.6097	52	95-104	LA	4	Shells clay and coarse sand. 4/10 Y dark greenish grey.	
G7/100	8/11/12	0.2411	5.5570	102	105-114	LA	5	Clay, sand and shells. 4/10 Y	
G7/250	10/11/12	0.2497	5.5350	251	127-133	Duo	5	Clay. 2,5 Y 2/4 Dark greyish brown.	
G7/500	10/11/12	0.2583	5.5145	504	124, 125	VG	5	Clay. 4/10 Y Dark greenish grey.	
G7/1000	11/11/12	0.2706	5.4868	972	134, 135	VG	5	Muddy clay. 4/10 G Dark greenish grey (gley 2)	
G8/0	25/10/12	0.6180	5.7763	0		Hg	3	Coarse sand, light brown.	
G8/5	25/10/12	0.6186	5.7711	5		Hg	2		
G8/25	4/11/12	0.7339	5.6435	27	1-11	SA	5	Clay, sea shells, sand and gravel. 4/10 Y Dark greenish grey	
G8/50	7/11/12	0.7276	5.5926	49	56-66	SA	5	Clay and fine sand. 4/5 GY. Dark greenish grey.	
G8/100	7/11/12	0.7276	5.5891	100	67-70, 85-91	Duo	5	Clay.	
G8/250	7/11/12	0.7294	5.5794	247	71-80	Duo	5	Clay. 4/10 GY Dark greenish grey	
G8/500	7/11/12	0.7320	5.5638	509	83-84	VG	5	Clay. 4/10 GY Dark greenish grey.	
G8/1000	7/11/12	0.7277	5.5208	999	55, 81-82	VG	5	Clay. 4/10 GY, Dark greenish grey.	
G9/0	24/10/12	1.1524	6.0922	0		Hg	1	Sand, coarser than 1mm. Middle brown.	
G9/5	24/10/12	1.1566	6.0917	5		Hg	1	Fine sand. 5Y 3/2 Dark olive grey	
G9/25	5/11/12	1.1980	6.0220	26	23-32	SA	3	Sand. 5/5 GY Greenish grey.	
G9/50	6/11/12	1.2359	5.9439	52	33-42	SA	5	Fine sand and shells. 4/5 GY Dark greenish grey.	
G9/100	6/11/12	1.2552	5.8969	103	43-52	LA	5	Clay and sand. 4/10 Y Dark greenish grey.	
G9/250	5/11/12	1.2616	5.8833	251	12-20	Duo	5	Clay. 4/10 Y Dark greenish grey.	
G9/500	5/11/12	1.2719	5.8608	510	21-22	VG	5	Clay. 4/10 Y Dark greenish grey.	
G9/1000	6/11/12	1.2844	5.8294	998	53-54	VG	5	Clay. 4/10 Y Dark greenish grey.	

5.1 Sediment composition

The deposit of sediments occurs where the water currents are no longer strong enough to carry the suspended materials according Stokes law.
Organic compounds are usually added to the sediments bound to organic particles and will primarily be allocated where there is much fine-grained material such as clay and silt. Coarser sediments like sand etc. usually contain less organic material and are therefore inferior for analysis of organic contaminants. Sediment samples are therefore mainly collected from locations with soft bottom consisting of a large proportion of fine grained sediments (<0.063 mm grain size, i.e., silt and clay). With exception of the 5 and the 250 m, the general pattern in the survey area was gradually finer sediments with depth as illustrated in Fig. 5.1.1 and fig. 5.1.3- 5.1.11. (in the triangle plots the black dots represent one station.)

Table 5.1.2 gives total organic matter, the grain size distribution and the computer interpretations of the sediment median diameter at the sampling stations along the nine transects G1-9.
The analysis from 2012 indicates a finer sediment between 5 and 100 meters than in 2009-11 when averaged along the depth strata (fig 5.1.1).
The differences however are within the range of the standard deviation and the number of samples limited to 9 pr. depth.
The differentiation between the finer fractions of the material is computerized because the budgets did not allow for more than sieving of the samples. Because of this the material does not provide full resolution to discriminate between the fine graded samples in the deeper end of the sampling area. The median diameters for these samples are therefore probably a bit underestimated table 5.1.2.

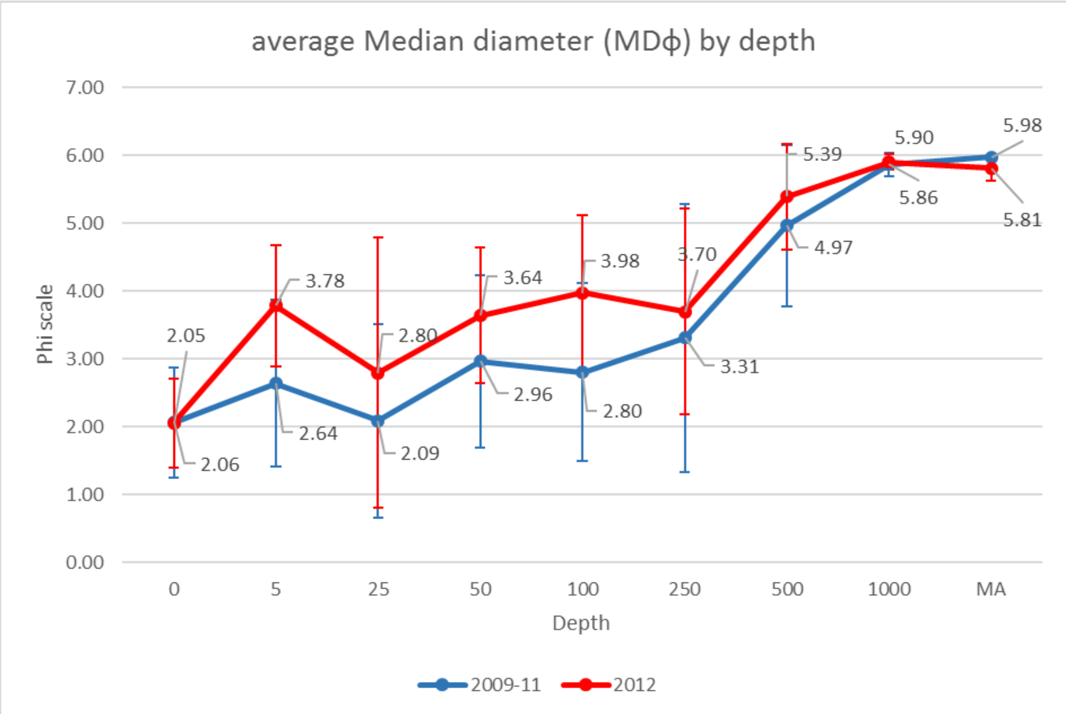


Figure 5.1.1: Average values of median diameter of the sediment particle size along the depth strata in 2009-11 and 2012

The shoreline consisted of sand and shell sand varying from relatively coarse sand in G1 to finer sand in G 2-4, coarser again in G5-7, a little finer in G8 and coarser sand in G9 Denu. The total organic matter (TOM) varied between 1% and 3%, with the lowest values in G9 and G1. Less than 10% of the sediment consisted of silt and clay. The finest sediments were found in Takoradi then Kikam and Three Points. The median diameter ranged from 0,91-2,94 with an average of 2,05 which is consistent with medium grind sand.
The 5 meter was made up of compact sediment consisting of very fine sand probably grinded from the beach. The finest sediments were found at G4/5 in Takoradi consisting of 84 % silt and clay and then old Nigo with almost 33% silt and clay. G8 was not sampled due to movement of the settlement related to erosion and sample G9 was lost due to rough conditions. The TOM values were like the 0m except for G4 with 7.17 %. The median diameter ranged from 2,77-5,63 with an average of 3,78 which is consistent with very fine sand. The sediment grain size on station G4/5 had changed significantly between 2010 and 2012 and the median diameter went from 3,2 to 5,6 while the total organic matter increased from 0,7 to 7,17 %. This may be a result of changed pattern of currents due to structural changes in the nearby area or an effect of seasonal variations or a combination. A

nearby drill cutting deposit may also have contributed to the change in sedimentation. The G7/5 (Old Nigo) is located near the river outlet and may be influenced by this.
At 25 meter we found coarser sediments to the east and finer sediments to the west, consisting of lots of shell sand in some of the locations. We had fine sand in G1 to very fine sand in G4, G6 was mainly silt and clay and the rest were consisting of relatively coarser sand. The three eastern transects (G7-9) had between 20 and 30% gravel. The TOM values varied from 7-8% in G2-G4 and between 3 and 6% in G6-G8, G1, G5 and G9 was between 1 and 2%. The median diameter ranged from 0,46-5,54 with an average of 2,80 which is consistent with medium to fine sand.
At 50 meter the sediment the median diameter ranged from 2,3 (G5) - 5,65(G3) with an average of 3,64 consistent with fine to very fine sand. The TOM values were between 4.5 and 6 % on all stations except G3 (9%) and G6 with less than 1%.
At 100 m the average median diameter ranged from 2,68 (G6)-5,95 (G8) with an average of 3.98, it ranged from very fine sand in G1-G5, fine sand in G6 and silt and clay in G7-G9. The finest sediments were found in the eastern part. TOM levels were between 5 and 11% with the highest levels to the east.
At 250 meter the median diameter ranged from 1,47 (G2) to 5,98 (G8) with an average of 3,7. The finest sediments were found to the east. TOM levels were between 5,5 and 9,5 %, the highest levels were in the eastern transects.
From 500 m and deeper the samples were dominated by silt and clay, the exception was G4 with a median diameter of 3,44 consisting of about 42 % silt and clay and the about 58 % fine sand. The average MD was 5,39 and the range 3,44- 5,98. TOM levels ranged from 5,5% in G6 to about 12% in G3 and G7.
From 1000 m and on the sediments were more homogenous in terms of grain size, the average MD was 5,87 and the range between 5,60-5,99. Clay and silt dominated the samples with 83,5-99,5 % of the weight. TOM varied from 9,8% (G6) to around 18% (G7).

The interpretations were made from the plots and the table with sediment descriptions generated in Gradistat, listed in table 5.1.2 as described in chapter 2.2.4 in materials and methods and displayed in figure 5.1.4-16.
The overall TOM values were approximately the same in 2009-11 as in the monitoring in 2012. Changes were seen on some stations for example the G4/5.

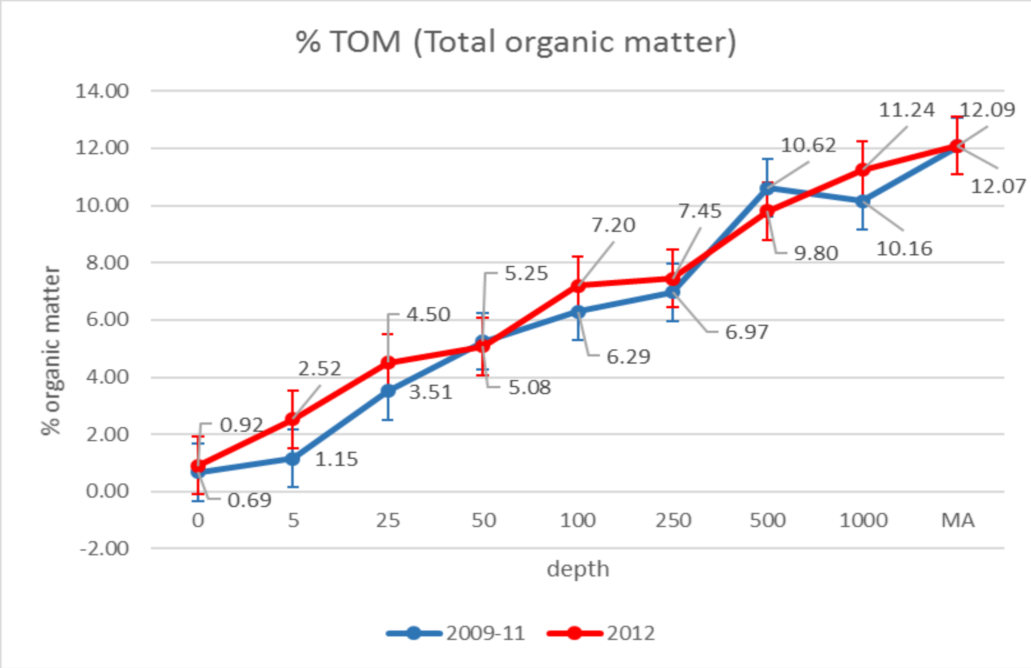


Figure 5.1.2: Average values of total organic matter (TOM) along the depth strata in 2009-11 and 2012

Table 5.1.1 Phi scale to explain the MD Φ distribution.

Mesh size of the sieve (mm)	Phi class Φ	Rough description	Description
16	-4	Gravel	Coarse gravel
>16-8	-3		Medium gravel
>8-4	-2		Fine gravel
>4-2	-1		Very fine gravel
>2-1	0	Sand	Very coarse sand
>1-0,5	1		Coarse sand
>0,5-0,25	2		Medium sand
>0,25-0,0125	3		Fine sand
>0,0126-0,063	4		Very fine sand
>0.062-0.031	5	Silt	Very coarse silt
>0,030-0.016	6		Coarse silt
>0.015-0.008	7		Medium silt
>0.007-0.004	8		Fine silt
>0.003-0.002	9		Very fine silt
>0.002		Clay	Clay

Table 5.1.2: Total organic matter and sediment grain size at sites along the nine transects Ghana East G1-9. The sizes of mud particles or pelite are < 0.063 mm.

	TOM	Median diameter		grain size distribution %			St.dev.	Skewness	Kurtosis
Station	%	MD Φ	Classification	Silt and clay	Sand	Gravel	SDΦ	SkΦ	KΦ
G1/0	0.48	1.66	Medium sand	0.01	99.99	0.00	0.66	-0.01	1.17
G1/5	0.90	3.15	Very Fine sand	0.05	99.95	0.00	0.47	0.06	0.77
G1/25	1.90	2.76	Fine sand	5.90	94.03	0.08	0.79	0.05	1.50
G1/50	4.65	3.61	Very Fine sand	34.82	65.11	0.07	2.09	0.17	1.01
G1/100	7.11	3.47	Very Fine sand	42.29	56.15	1.56	2.44	0.12	0.87
G1/250	7.59	2.27	Fine sand	24.66	74.95	0.39	2.06	0.49	1.16
G1/500	10.09	5.63	Silt og Clay	84.49	15.51	0.00	1.48	-0.02	0.77
G1/1200	15.47	5.99	Silt og Clay	99.43	0.57	0.00	1.23	0.00	0.74
G2/0	1.43	2.75	Fine sand	4.62	95.38	0.00	0.53	0.21	1.73
G2/5	1.25	3.69	Very Fine sand	0.01	99.99	0.00	0.28	-0.31	1.30
G2/25	8.43	4.20	Silt og Clay	52.59	45.77	1.63	2.34	-0.01	0.86
G2/50	4.32	3.19	Very Fine sand	34.47	52.88	12.65	3.10	-0.11	0.85
G2/100	6.12	3.71	Very Fine sand	40.01	58.61	1.37	2.04	0.22	0.94
G2/250	6.36	1.47	Medium sand	21.00	76.79	2.21	2.44	0.41	1.04
G2/500	9.07	5.42	Silt og Clay	77.42	22.09	0.49	1.77	-0.11	0.92
G2 1361	14.57	5.97	Silt og Clay	98.55	1.45	0.00	1.24	0.00	0.74
G2 1598	14.09	5.93	Silt og Clay	96.53	3.14	0.33	1.27	0.00	0.74
MA 2-1 /1361	14.60	5.63	Silt og Clay	84.52	15.12	0.36	1.71	-0.14	1.03
G2/1418			missing sample						
MA 2-3 /1376	13.60	5.60	Silt og Clay	83.49	16.51	0.00	1.78	-0.17	1.05
MA 2-3 /1414	13.52	5.93	Silt og Clay	96.40	3.60	0.00	1.27	0.00	0.74
G3/0	2.43	2.57	Fine sand	8.52	91.48	0.00	0.85	0.21	2.44
G3/5	2.74	2.77	Fine sand	2.52	97.48	0.00	0.47	-0.05	1.23
G3/25	8.28	5.03	Silt og Clay	67.40	32.29	0.31	2.00	-0.09	0.75
G3/50	9.13	5.65	Silt og Clay	85.04	14.44	0.52	1.63	-0.11	0.95
G3/100	6.42	3.54	Very fine sand	44.98	50.75	4.26	2.89	-0.05	0.70
G3/250	7.78	3.79	Very fine sand	47.24	52.53	0.23	2.27	0.13	0.80
G3/500	12.21	5.57	Silt og Clay	82.23	17.77	0.00	1.64	-0.10	0.87
G3/1200	14.01	5.95	Silt og Clay	97.37	2.63	0.00	1.26	0.00	0.74

Table 5.1.2: Total organic matter and sediment grain size at sites along the nine transects Ghana East G1-9. The sizes of mud particles or pelite are < 0.063 mm.

	TOM	Median diameter		grain size distribution %			St.dev.	Skewness	Kurtosis
Station	%	MD Φ	Classification	Silt and clay	Sand	Gravel	SDΦ	SkΦ	KΦ
G4/0	1.84	2.94	Fine sand	1.06	98.94	0.00	0.49	-0.10	1.13
G4/5	7.17	5.63	Silt og Clay	84.24	15.51	0.25	1.58	-0.08	0.89
G4/25	7.05	4.15	Silt og Clay	51.95	47.26	0.79	2.01	0.17	0.86
G4/50	6.09	4.48	Silt og Clay	56.89	43.11	0.00	2.06	0.05	0.76
G4/100	6.28	3.07	Very fine sand	38.91	58.91	2.19	2.65	0.12	0.81
G4/250	6.38	3.70	Very fine sand	44.78	54.79	0.43	2.12	0.23	0.81
G4/500	6.65	3.44	Very fine sand	42.19	57.81	0.00	2.10	0.31	0.76
G4/1000	10.04	5.71	Silt og Clay	87.43	12.57	0.00	1.53	-0.09	0.89
G5/0	0.45	1.94	Medium sand	4.39	95.61	0.00	0.57	0.24	1.42
G5/5	2.17	3.76	Very fine sand	17.34	82.66	0.00	0.79	0.48	4.40
G5/25	0.89	0.83	Coarse sand	3.68	91.15	5.17	1.23	0.18	1.20
G5/50	4.28	2.31	Fine sand	19.75	72.45	7.80	2.45	0.08	1.14
G5/100	5.09	3.16	Very fine sand	42.97	55.44	1.59	2.30	0.30	0.85
G5/250	6.10	3.38	Very fine sand	40.37	58.34	1.30	2.26	0.22	0.86
G5/500	9.20	5.13	Silt og Clay	69.66	30.34	0.00	2.20	-0.20	0.81
G5/1000	11.51	5.87	Silt og Clay	94.10	5.80	0.10	1.37	-0.05	0.83
G6/0	0.40	1.96	Medium sand	4.55	95.23	0.22	0.74	-0.02	1.41
G6/5	1.58	3.67	Very fine sand	6.96	90.42	2.62	0.91	-0.36	4.18
G6/25	2.75	5.54	Silt og Clay	81.25	18.75	0.00	1.63	-0.08	0.86
G6/52	0.86	3.25	Very fine sand	38.16	57.22	4.63	2.54	0.11	0.98
G6/102	5.59	2.68	Fine sand	29.52	68.82	1.66	2.35	0.27	1.04
G6/250	5.36	2.53	Fine sand	18.48	79.21	2.31	2.14	0.09	1.32
G6/500	8.26	5.68	Silt og Clay	86.07	13.93	0.00	1.59	-0.10	0.93
G6/1000	9.77	5.78	Silt og Clay	89.90	10.10	0.00	1.52	-0.10	0.93

Table 5.1.2: Total organic matter and sediment grain size at sites along the nine transects Ghana East G1-9. The sizes of mud particles or pelite are < 0.063 mm.

	TOM	Median diameter		grain size distribution %			St.dev.	Skewness	Kurtosis
Station	%	MD Φ	Classification	Silt and clay	Sand	Gravel	SDΦ	SkΦ	KΦ
G7/0	0.27	1.48	Medium sand	0,00	100,00	0.00	0.55	-0.05	1.21
G7/5	1.87	3.81	Very fine sand	32.90	67.10	0.00	1.47	0.50	1.42
G7/25	4.10	0.73	Coarse sand	4.33	75.17	20.50	1.82	-0.01	0.92
G7/50	4.82	3.65	Very fine sand	43.34	55.41	1.25	2.38	0.10	0.83
G7/100	7.12	4.78	Silt og Clay	62.13	36.82	1.04	2.67	-0.26	0.66
G7/250	9.38	5.75	Silt og Clay	88.79	10.86	0.35	1.66	-0.16	1.07
G7/500	11.96	5.97	Silt og Clay	98.51	1.49	0.00	1.24	0.00	0.74
G7/1000	17.58	5.99	Silt og Clay	99.51	0.49	0.00	1.23	0.00	0.74
G8/0	0.66	2.29	Fine sand	6.33	93.67	0.00	0.76	0.30	2.18
G8/5									
G8/25	5.80	1.47	Medium sand	27.08	42.73	30.20	3.68	0.04	0.76
G8/50	5.46	4.00	Silt og Clay	49.99	47.72	2.28	2.36	0.04	0.81
G8/100	10.28	5.95	Silt og Clay	97.33	2.67	0.00	1.26	0.00	0.74
G8/250	9.47	5.96	Silt og Clay	97.85	2.15	0.00	1.25	0.00	0.74
G8/500	9.16	5.98	Silt og Clay	98.90	1.10	0.00	1.24	0.00	0.74
G8/1000	10.26	5.99	Silt og Clay	99.49	0.51	0.00	1.23	0.00	0.74
G9/0	0.27	0.91	Coarse sand	4.82	95.03	0.15	0.78	0.18	1.38
G9/5			missing sample						
G9/25	1.27	0.46	Coarse sand	1.12	70.54	28.33	1.75	-0.16	0.73
G9/50	6.08	2.62	Fine sand	41.54	55.33	3.13	2.87	0.19	0.69
G9/100	10.80	5.44	Silt og Clay	78.27	20.59	1.14	2.15	-0.27	1.12
G9/250	8.64	4.43	Silt og Clay	55.99	43.77	0.24	2.13	0.03	0.70
G9/500	11.60	5.71	Silt og Clay	87.43	12.57	0.00	1.62	-0.13	1.00
G9/1000	10.67	5.96	Silt og Clay	98.11	1.89	0.00	1.25	0.00	0.74

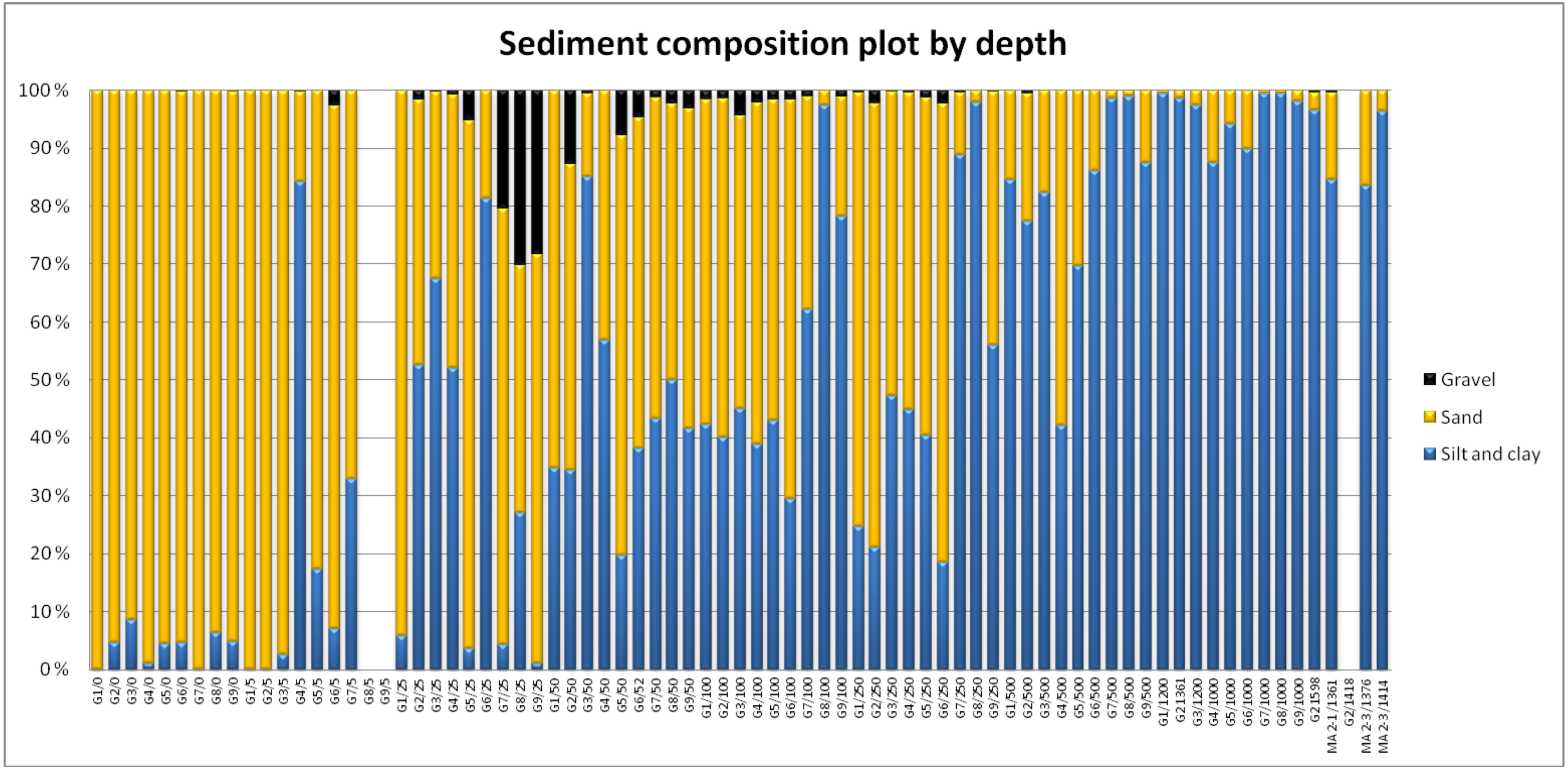


Figure 5.1.3: Content of gravel, sand, silt and clay along the depth strata of G 1-9.

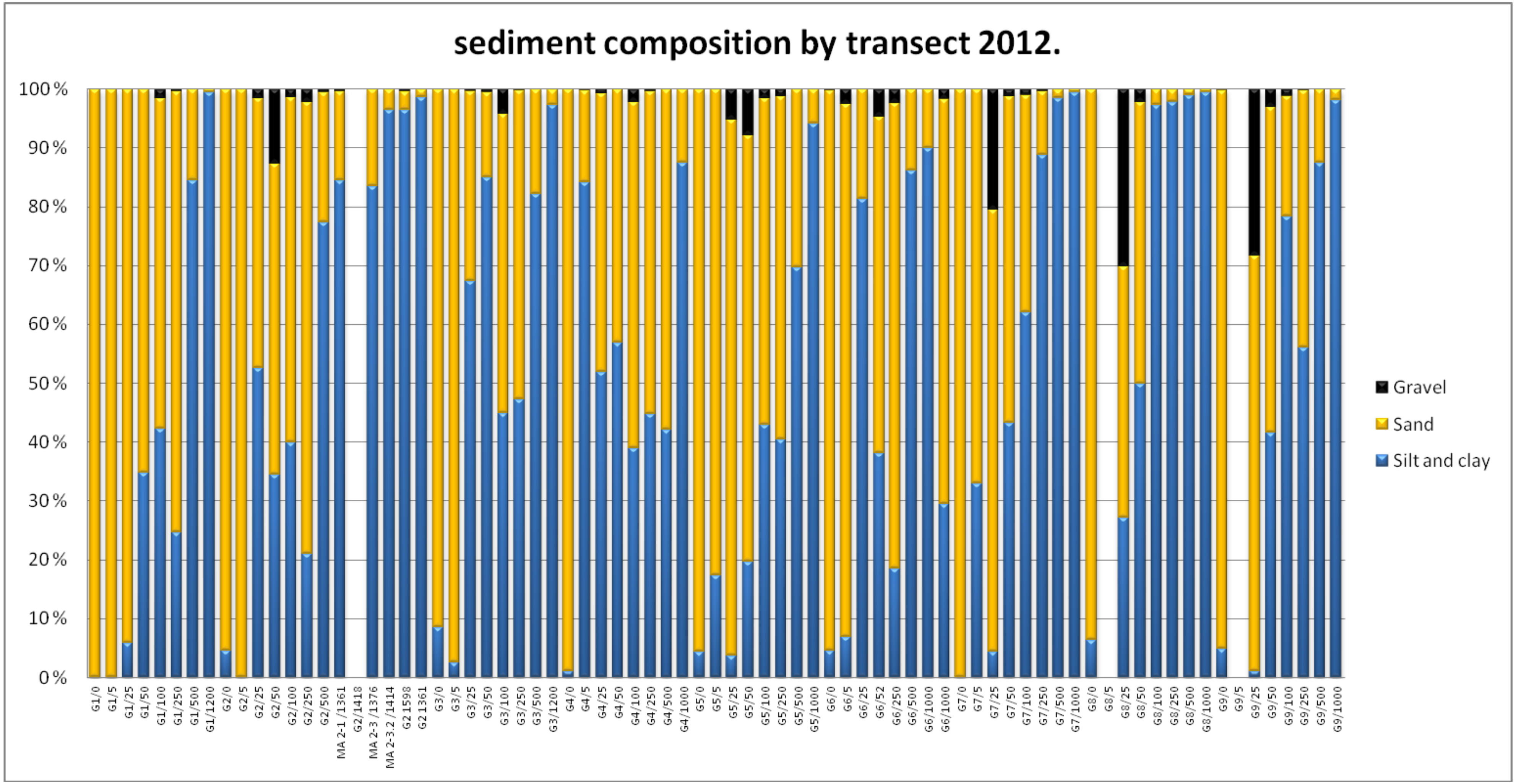


Figure 5.1.4: Content of gravel, sand, silt and clay along the nine transects of G 1-9 (west towards east).

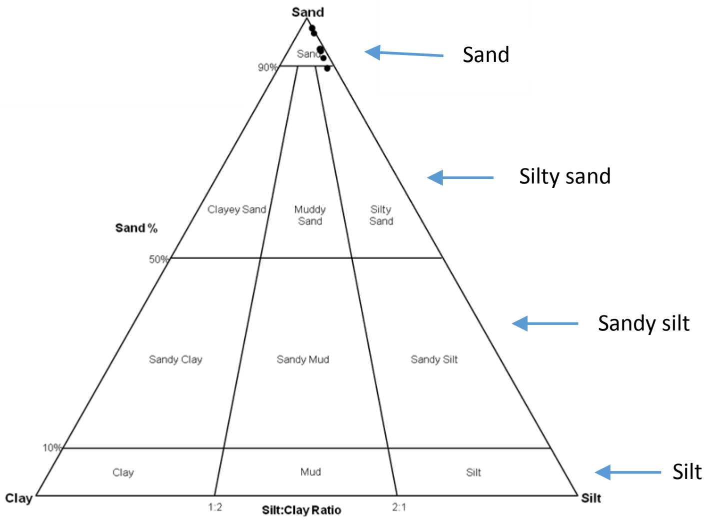


Figure 5.1.5: 0 meter stations, sand, silt and clay diagrams.

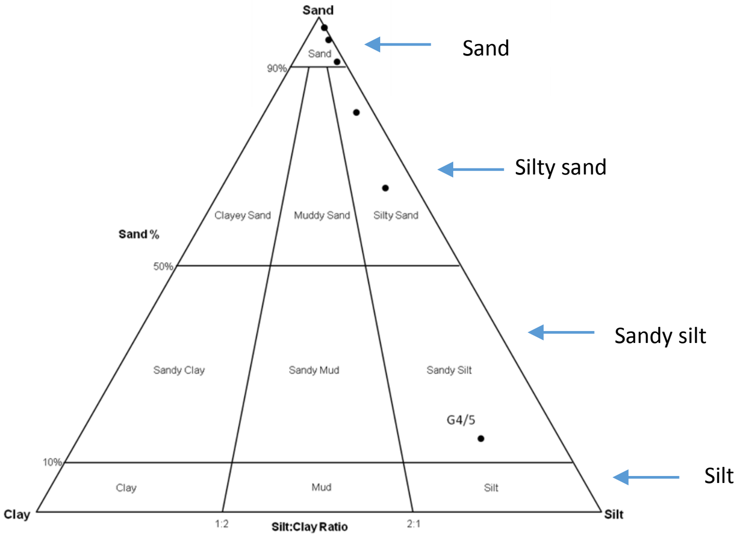


Figure 5.1.6: 5 meter stations, sand, silt and clay diagrams.

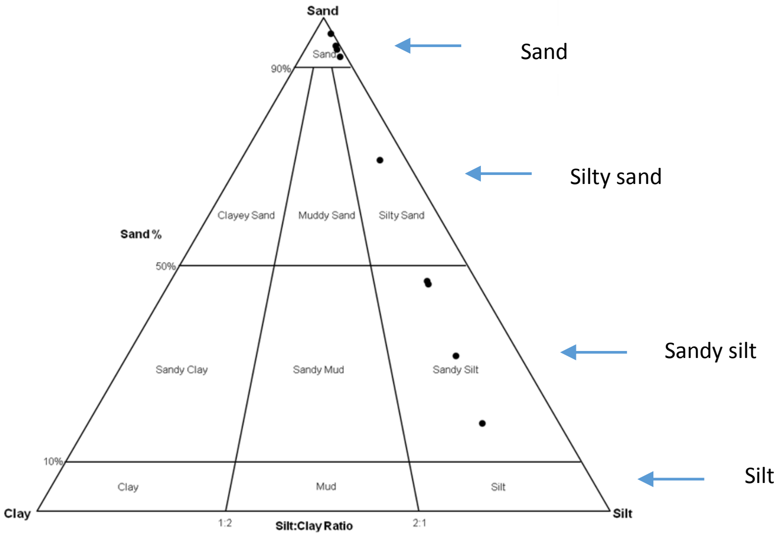


Figure 5.1.7: 25 meter stations, sand, silt and clay diagrams.

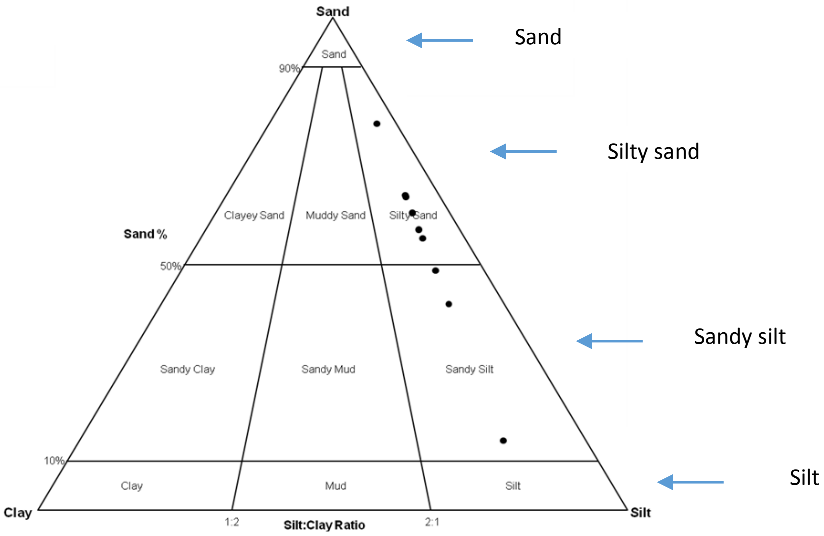


Figure 5.1.8: 50 meter stations, sand, silt and clay diagrams.

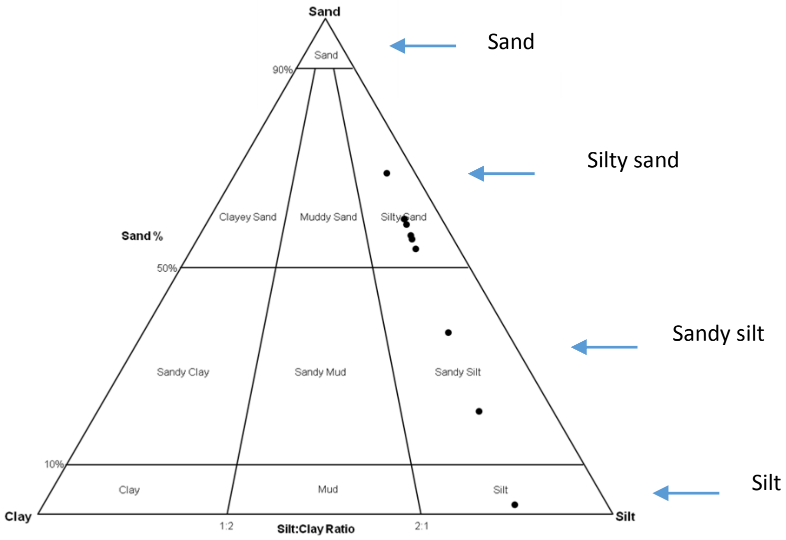


Figure 5.1.9: 100 meter stations, sand, silt and clay diagrams.

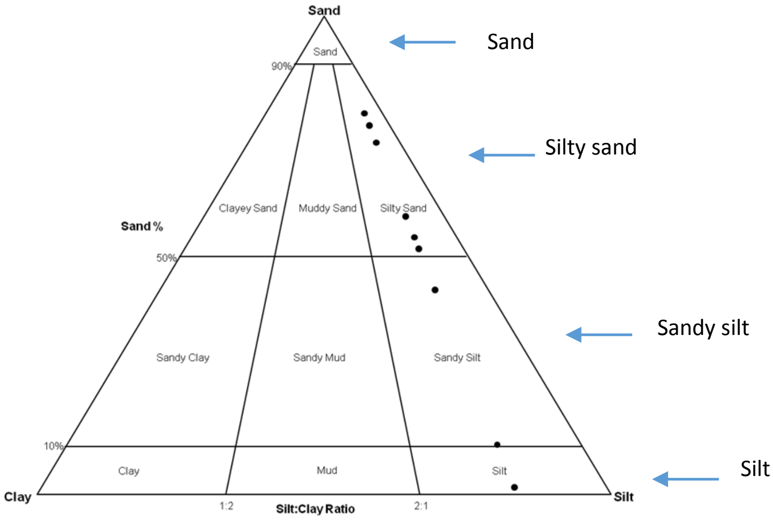


Figure 5.1.10: 250 meter stations, sand, silt and clay diagrams.

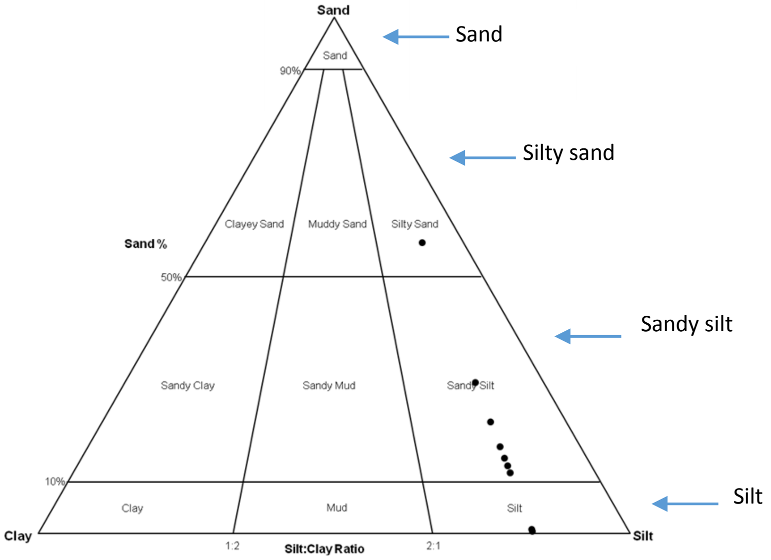


Figure 5.1.11: 500 meter stations, sand, silt and clay diagrams.

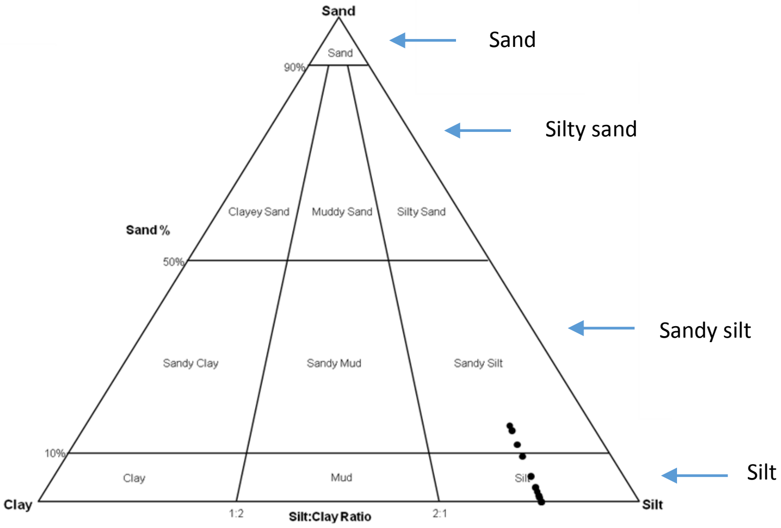


Figure 5.1.12: 1000 meter stations, sand, silt and clay diagrams.

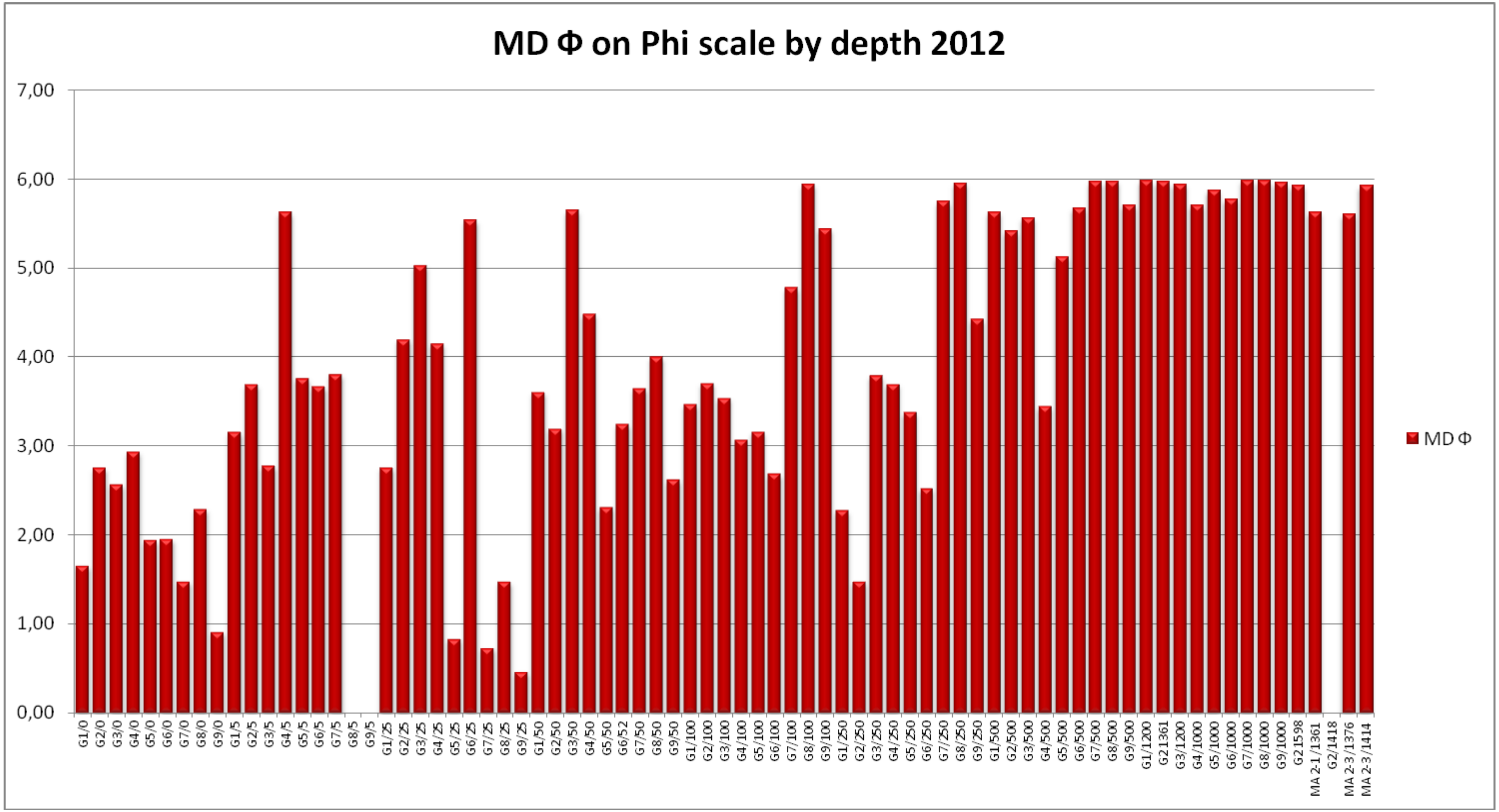


Figure 5.1.13: Median diameter (MDΦ) along the depth strata of G 1-9.

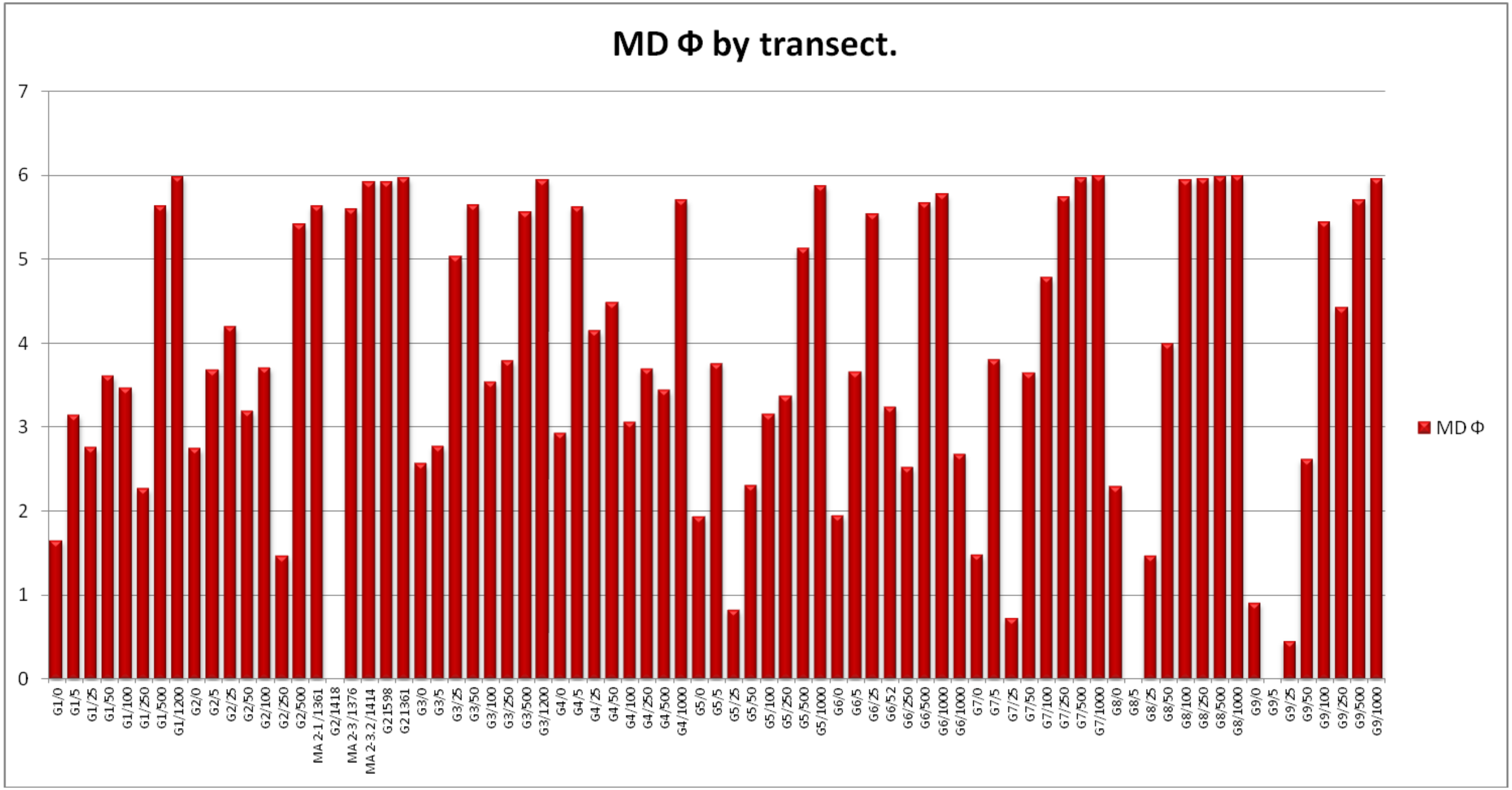


Figure 5.1.14: Median diameter (MDΦ) along the nine transects of G 1-9.

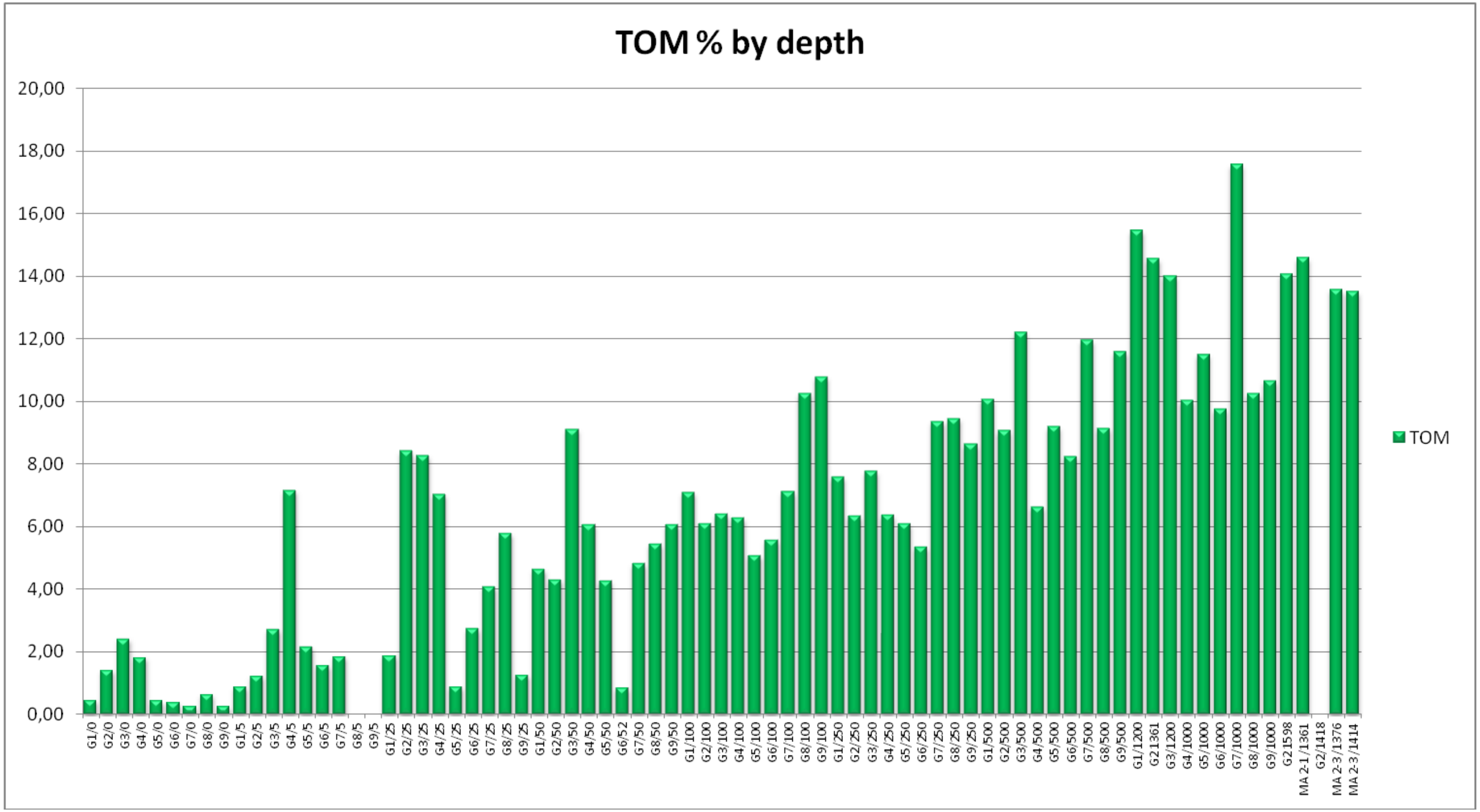


Figure 5.1.15: Content of total organic matter (TOM) along the depth strata of G 1-9.

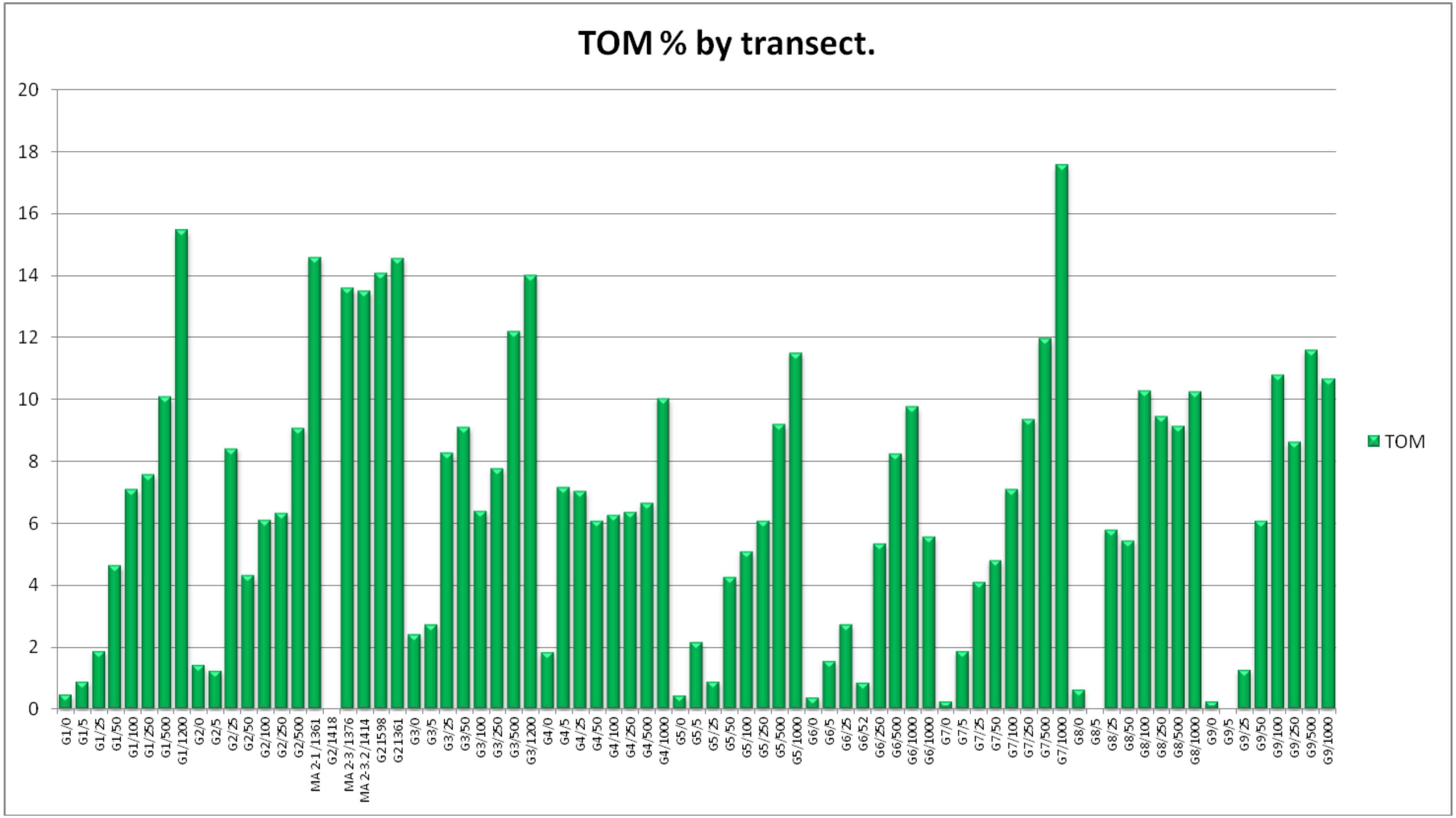
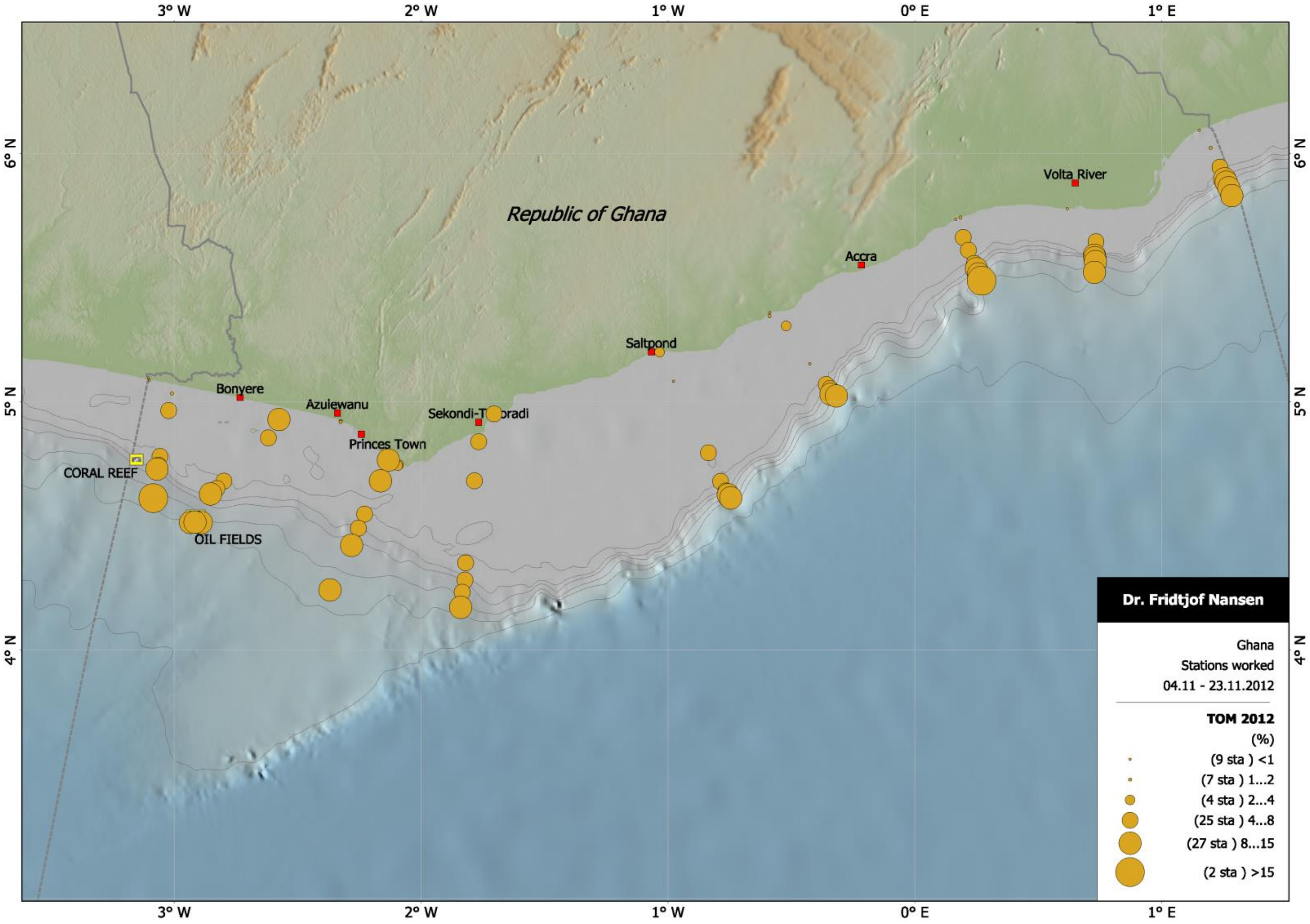


Figure 5.1.16: Content of total organic matter (TOM) along the nine transects of G 1-9.



Map 5.1.1: Content of total organic matter (TOM) along the nine transects of G 1-9.

5.2 Chemical analysis

77 stations each consisting of 3 replicates were sampled for chemical analysis. The sampling was conducted according to the OSPAR guidelines for monitoring of offshore oil activities and analyzed in accredited laboratories. The sampled parameters were metals (Ba, As, Pb, Cu, Cr, Hg, Ni, Zn and Cd), THC, PAH's and NPD's.

Since our search for local standards on pollutants and metals in marine sediments came up short, the data set was compared to OSPAR and Klif (Norwegian Pollution Authority) standards for coastal waters. The background levels for the natural occurring substances however, might differ considerably from one area to another depending on geological conditions, the listed background levels should therefore be regarded as guidance levels rather than strict limits (NGU Rapport 2011.035 TA-2683/2011 p: 6). The comparison to these standards might therefore not be relevant for the natural occurring substances.:

The results of the analysis were compared to the Background concentrations found in the OSPAR guidelines and KLIF's (The Directorate of Climate and Pollution, Norway) TA 2229-2007, Classification of metals and organic poisons in water and sediments. These two standards are developed for use in the North West Atlantic region and are based on measurements mainly on the continental shelf. The measurements vere taken in what is regarded as, prestine areas, and from sedment layers thought to be formed prior to industrialisation.

The gradually finer sediments coming with the depth gradient gives an increased surface to mass ratio, the increased ratio makes room for a higher affinity to the analysed components. This explains a rise in the concentration with depth for many of the components as the sediments tends to become finer with depth. (NGU Rapport 2011.035 TA-2683/2011).
The Ospar background concentrations (Bc) are marked with a light blue line when measurments are approaching this limit, the KLIF classes are also marked where it is relevant concerning the levels of contaminents. (The KLIF classification system is based on risk assesment regarding ecological effects and the relevant values are listed in table 5.2.4) Table 5.2.1 gives an overview of the methods, measurement uncertainty (MU) and the level of quantification from the two different labs used during 2009 - 2012. (Eurofins 2009-11 and Molab 2012) For comparison of the data sets.

Table 5.2.1: Methods, measurement uncertainty (MU) and the level of quantification from Eurofins (2009-11) and Molab (2012)

			Eurofins			Molab		
Parameter		Unit	MU	Method	LOQ:	MU		LOQ
Arsenic	(As)	mg/kg	20%	EN ISO 11885	0.5	10%	ICP-OES	1
Lead	(Pb)	mg/kg	20%	EN ISO 11885	0.3	10-15%	ICP-OES	1
Copper	(Cu)	mg/kg	20%	EN ISO 11885	0.05	10%	ICP-OES	0,2
Chromium	(Cr)	mg/kg	30%	EN ISO 11885	0.05	10-15%	ICP-OES	0,2
Mercury	(Hg)	mg/kg	20%	NS 4768	0.001	20-35%	NS-EN 1483	0,01
Nickel	(Ni)	mg/kg	20%	EN ISO 11885	0.2			
Zinc	(Zn)	mg/kg	20%	EN ISO 11885	0.05	10-15%	ICP-OES	0,1
Barium	(Ba)	mg/kg	20%	EN ISO 11885	0.05	10%	ICP-OES	1
Cadmium	(Cd)	mg/kg	40%	EN SO 17294-2	0.01	10%		0,03
THC		mg/kg	40%	Annon KG. 58	1			
PAH		µg/kg	40%		0.01			
NPD		µg/kg	40%	Annon KG. 58	0.01			

5.2.1 Metals

In general, the content of the targeted metals seen in the samples increase with deeper waters and finer sediments as described above. The most likely explanation for this is that the reduced particle size gives a higher surface ratio and therefore higher affinity to the targeted metals as well as other chemical compounds.

All the samples from the 2012 survey showed low values for the targeted parameters, except for some measurements of Arsenic and one for Nickel.

The measured values were mostly within background levels. Some measurements fell into category II good conditions according to the SFT standard (SFT TA 2229-2007) with concentrations well below levels that are assumed to represents a risk of ecological effects. See table 5.2.2 for the OSPAR background concentrations and table 5.2.2, 5.2.3 and 5.2.4 for the (TA 2229) Klif classifications for the basis of the enterpetations. Only 7 stations showed walues above this level and only for two parameters, Arsenic on six stations and Nickel on one station.
Table 5.2.1 and 5.2.4 summarises the results of metal analysis. The complete data set including replicates is given in the Appendix table. The sediment samples were analysed for the following heavy metals: arsenic (As), cadmium (Cd), copper (Cu), barium (Ba), mercury (Hg), chromium (Cr), lead (Pb), Nickel (Ni) and zinc (Zn) (figure. 5.2.1-5.2.18).

Table 5.2.2: Overview over results of the metal analysis compared to background concentrations (Bc).

Parameter	Arsenic (As)		Barium (Ba)		Lead (Pb)		Copper (Cu)		Chromium (Cr)		Mercury (Hg)		Nickel (Ni)		Zink (Zn)		Cadmium (Cd)	
	Bc	Bac	Bc	Bac	Bc	Bac	Bc	Bac	Bc	Bac	Bc	Bac	Bc	Bac	Bc	Bac	Bc	Bac
KLIF	<20		-	-	<30		<35		<70		<0,15		<30		<150		<0,25	
OSPAR	<15	<25	-	-	<25	<38	<20	<27	<60	<81	<0,05	<0,07	<30	<36	<90	<122	<0,2	<0,31
Highest measurement	**185.78**		**3013.9**		**23.98**		**25.72**		**94.63**		**0,06**		**46.17**		**102.03**		**0,399**	
stations above ospar bc	24				0/0		11		23		1		16		2		21	

Table 5.2.3: Klif classification system

I Background	II Good	III Moderate	IV Bad	V Extremely bad
Background levels	No toxic effects	Chronical effects from long term exposure	acute toxic effects from short term exposure	extensive acute toxic effects

Table 5.2.4; Classification of state from content of metals and organic substances in sediments (KLIF)

	I	II	III	IV	V
	Background	Good	Moderate	Bad	Extremely bad
As (Arsenic)	<20	20-52	52-76	76-580	>580
Pb (Lead)	<30	30-83	83-100	100-720	>720
Cd (Cadmium)	<0.25	0.25-2.6	2.6-15	15-140	>140
Cu (Copper)	<35	35-51	51-55	55-220	>220
Cr (Chrome)	<70	70-560	560-5900	5900-59000	>59000
Hg (Mercury)	<0.15	0.15-0.63	0.63-0.86	0.86-1.6	>1.6
Ni (Nickel)	<30	30-46	46-120	120-840	>840
Zn (Zink)	<150	150-360	360-590	590-4500	>4500
Ba (Barium)					
Naphthalene	<2	2-290	290-1000	1000-2000	>2000
Acenaftylen	<1.6	1.6-33	33-85	85-850	>850
Acenaften	<4.8	2.4-160	160-360	360-3600	>3600
Fluoren	<6.8	6.8-260	260-510	510-5100	>5100
Fenantren	<6.8	6.8-500	500-1200	1200-2300	>2300
Antracen	<1.2	1.2-31	31-100	100-1000	>1000
Fluoranten	<8	8-170	170-1300	1300-2600	>2600
Pyrene	<5.2	5.2-280	280-2800	2800-5600	>5600
Benzo(a)anthracene	<3.6	3.6-60	60-90	90-900	>900
Krysen	<4.4	4.4-280	280-280	280-560	>560
Benzo(b)fluoranten	<46	46-240	240-490	490-4900	>4900
Benzo(k)fluoranten		<210	210-480	480-4800	>4800
Benzo(a)pyrene	<6	6-240	420-830	830-4200	>4200
Indeno(1,2,3-cd)pyrene	<20	20-47	47-70	70-700	>700
Dibenzo(a,h)anthracene	<12	12-590	590-1200	1200-12000	>12000
Benzo(ghi)perylene	<18	18-21	21-31	31-310	>310
PAH 16	<300	300-2000	2000-6000	6000-20000	>20000
THC		<50			

Barium

The averaged Barium content showed a strong correlation with depth and to some degree grain size. Most of the values seemed to be within a normal range.

The highest Barium values were found at 5 stations on the Mahogany Field, these specific stations were sampled for the first time in 2010 in relation to an unintentional discharge of drill cuttings and oil based drilling fluids. The values found at the time (Av: 182,66 mg/kg)showed no significant increase when compared to the 2009 values (av: 163.48 mg/kg) found at the same depth in that area. The average value from the 2012 material however peaked at 1039 mg/kg on these stations. This peak showed no correlation with grain size composition or the depth gradient, measurement uncertainties cannot account for this either. It is therefore difficult to explain this increase with other sources than industrial activities. The highest values were found 750 and 250 meters west of the discharge point at stations MA2-1/1361 and MA2-5/1361 showing average values of 3014 and 1193 mg/kg. The same stations were measured to 193 mg/kg each in 2010.

The Jubilee oil field is located in the deep end of transect 2. Elevated values of barium were found in the neighboring G1 and G3 transects at 500 (G3) and 1200 meters' depth. There were also relatively high values at 0 and 5 meters on transect G4 in Secondi. The G4 0 and 5 meters are located at Ngyiresia Beach 1 in Sekondi (4th exit from W. Ofori Atta rd. to the west when going northwards from the fisheries port). The average values were 3,5mg/kg and 5,8 in 2010 while the 2012 values gave 39,3 and 137,7 respectively on G4/0 and G4/5. For the rest of the 2012 measurements 0 meter averaged on 4,5 mg/kg while the 5 meter averaged on 7,5 mg/kg Fig. 5.2.1 and Map 5.2.1

Arsenic

The Arsenic values showed elevated values in 24 stations compared to Ospar bc. Nineten of these falls into class II good conditions, three samples falls into class III moderate conditions (G2/25, G3/25 and G1/250) and the last three falls into class IV bad conditions (G4/25, G8/25 and G8/50) as listed in the Norwegian standard 2229/2007.

Arsenic is often associated with sulphites. Arsenic and Cadmium are associated with the type of rock called shales. An estimate of the background levels for these parameters is therefore dependent on knowledge of geological conditions in this specific geological area including runoffs and possible anthropogenic sources. Arsenic has also been associated with deposits of shellfish scales, as mentioned in chapter 5.1. The highest average concentrations were found at 25 and 50 meters, the Arsenic values showed a decrease with depth, opposite to the other parameters. The lowest values were found at the deepest stations at Mahogany. Arsenic occurred in a different pattern than the rest of the parameters.

There is to our knowledge no obvious antropogenic sources to explain the elevated values in the 25 and 50 meter samples, this and the low values from Mahogany points to a natual source rather than an antropogenic one. The lower values was found in transect 5 and 6 while higher values was found in the east, the top values were found at 25 and 50 meters depth on transect 8. The elevated levels are therefore believed to originate from either geological formations or deposits of shellfish scales. Fig. 5.2.2 and Map 5.2.2.

Lead

All values but one measurement were lower than the Ospar Bc. The highest value was found at G4/25 (23.98mg/kg) compared to the rest of the transects elevated values were found on 0 and 5 meters at G4/0, 5 Takoradi. There was a tendency of higher values on the eastern transects at 100m and 500m compared to the east. Fig. 5.2.3 and Map 5.2.3.

Copper

11 stations had values above background concentrations. Mostly on the deep Mahogany stations but also the surrounding deep stations at G1 and 3. There is also a tendency towards slightly elevated concentrations in the three easternmost transects.

The shallow parts of G4, 0 and 5 meters showed relatively high and increasing values compared to the findings in 2010. Fig. 5.2.4 and Map 5.2.4.

Chromium
23 stations showed values slightly above European background concentrations, mostly in the deeper parts of the area to the east and west. Fig. 5.2.5 and Map 5.2.5.

Mercury
All stations showed average values below the upper limit for background levels, except one. station G2/5 gave an average of 0.06 mg/kg. With the exception of this single sample only two single measurements reached the upper limit of what is regarded as background levels (Ospar 2005-06, North Atlantic). The runner up was G4/5 with values slightly under the 0,05 limit and an average of 0.047 mg/kg. this is however considerably higher than the other 5 meter stations. Fig. 5.2.6 and Map 5.2.6.

Nickel
For Nickel there was 16 stations with average values above background concentration (ospar BC), mostly in the deeper part of the survey area. The concentration gets higher with depth. Also here there seems to be a tendency of higher values to the east from 50-250 meters' depth.
The 5 m has a peak at the secondi transect on G4/5. Fig. 5.2.7 and Map 5.2.7.

Zinc
For Zinc there were only 2 stations above background concentration, G9/50 and G1/250. The concentration gets higher with depth for this parameter too. The 0 and 5 m has peaks on transect 4 Secondi (G4/5). Fig. 5.2.8 and Map 5.2.8.

Cadmium
For Cadmium there were 21 stations above background concentration, mostly in the deep end of the survey area. The concentration gets higher with depth but falls off at the Mahogany field. The 0 and 5 m has peaks on transect 3 and 4 (G4/5). Fig. 5.2.9 and Map 5.2.9.

Only two of the stations on the transects were located close to any city centre, known sources of sewage or runoffs from densely populated areas and Industrial activity, that was the G4/0 and 5m.

Picture 5.2.1 Sampling location in Sekondi G4/5

Table 5.2.4: Average concentrations and standard deviations from three parallel samples (mg/kg dry weight) of metal at eight depths of transects G1-G5. Samples were collected in October / November 2012. The values above background concentrations (Bc) are in bold and the highest mean value for each parameter is marked red, values below level of quantification are marked green and given a value of half the detection limit, * = contains values less than LOQ.

Parameter Station	As Av.	As St.dev.	Ba Av.	Ba St.dev.	Cd Av.	Cd St.dev.	Cr Av.	Cr St.dev.	Cu Av.	Cu Stdev.
G1/0	**24.95**	4.77	3.33	0.69	0.015	0.00	20.44	3.99	0.32	0.03
G1/5	**15.30**	1.68	2.82	0.09	0.015	0.00	15.43	2.60	0.32	0.04
G1/25	**16.14**	2.52	11.55	11.36	0.020*	0.009	29.41	11.21	1.50	0.91
G1/50	12.45	1.45	32.58	7.53	0.034	0.003	45.25	0.08	3.26	0.20
G1/100	7.55	0.88	51.03	8.65	0.117	0.007	35.89	0.42	5.48	0.26
G1/250	**66.91**	6.34	51.46	3.42	0.143	0.016	**89.21**	7.17	4.74	1.26
G1/500	6.92	0.29	71.33	11.88	0.163	0.038	50.01	0.71	9.60	1.20
G1/1200	7.56	0.76	301.44	104.21	**0.215**	0.046	**63.69**	0.98	**20.39**	3.70
G2/0	**33.91**	1.99	3.51	0.04	0.020*	0.009	20.98	1.84	1.87	0.05
G2/5	**25.47**	0.60	3.51	0.17	0.015	0.00	24.38	0.27	0.80	0.05
G2/25	**68.39**	16.81	5.04	1.06	0.071	0.054	51.12	11.86	1.10	0.27
G2/50	14.63	1.57	11.50	1.75	0.049	0.007	50.08	2.02	3.12	0.40
G2/100	6.93	0.58	21.66	2.11	0.116	0.003	31.42	1.48	4.36	0.40
G2/250	**29.55**	2.38	24.18	2.46	0.144	0.013	58.69	0.87	4.81	0.75
G2/500	8.82	0.83	185.62	73.54	0.197	0.027	**61.64**	1.74	8.32	0.82
G2 1361 (MA 2-5)	5.80	0.39	1193.17	406.77	**0.244**	0.01	**70.38**	0.96	**24.32**	0.37
G2 1598 (MA 2-4)	6.51	1.85	557.38	241.95	0.208	0.055	**71.80**	2.29	**25.72**	0.89
MA 2-1 /1361	7.32	2.47	**3013.93**	676.04	0.205	0.044	**73.57**	3.53	**24.04**	1.39
G2/1418 (MA 2-2)	5.85	0.23	394.37	28.16	0.203	0.037	**69.50**	1.37	**24.02**	0.54
MA 2-3 /1376	6.13	0.40	631.64	242.69	0.217	0.014	**70.56**	0.75	**24.16**	0.37
MA 2-3 /1414	5.64	0.29	443.94	49.86	0.235	0.014	**71.24**	0.17	**24.47**	0.18
G3/0	**34.94**	0.74	5.57	0.10	0.050	0.00	39.60	5.08	1.38	0.15
G3/5	**33.47**	1.33	6.52	0.10	0.062	0.00	44.68	2.34	1.72	0.16
G3/25	**66.87**	8.51	20.20	1.91	0.072	0.01	**68.09**	0.44	5.44	0.73
G3/50	10.92	0.98	30.60	1.50	0.055	0.00	51.94	0.16	7.27	0.41
G3/100	7.40	0.59	27.19	2.07	0.124	0.01	37.72	1.06	5.39	0.33
G3/250	**20.84**	0.52	21.95	1.61	0.148	0.01	**75.53**	1.67	5.59	0.06
G3/500	7.64	0.38	133.01	61.75	**0.296**	0.01	**71.80**	1.23	13.42	0.60
G3/1200	6.78	0.28	363.33	2.70	**0.229**	0.019	**64.00**	1.16	**22.61**	0.40
G4/0	13.38	0.18	39.26	4.01	0.043	0.004	17.64	0.61	3.79	0.22
G4/5	**16.04**	1.46	137.71	4.37	0.065	0.002	35.54	0.20	14.13	0.53
G4/25	**106.84**	7.56	16.76	0.73	0.047	0.001	**90.88**	6.52	4.41	0.25
G4/50	**15.77**	0.52	15.69	0.66	0.073	0.01	**62.94**	2.27	3.72	0.41
G4/100	4.65	0.50	19.28	1.84	0.134	0.001	31.06	1.36	5.03	0.37
G4/250	12.72	0.47	15.60	2.58	0.126	0.003	**64.85**	1.74	4.48	0.27
G4/500	**17.77**	2.74	27.52	4.92	0.110	0.022	**94.63**	6.30	4.47	0.75
G4/1000	7.77	0.24	184.89	15.92	0.173	0.017	59.32	0.94	12.50	0.53
G5/0	5.07	0.25	1.98	0.09	0.015	0.00	4.10	0.12	0.10	0.00
G5/5	14.22	1.53	7.16	0.73	0.015	0.00	27.25	8.11	1.17	0.10
G5/25	4.64	1.08	3.50	1.18	0.015	0.00	15.14	3.30	0.46	0.05
G5/50	6.76	0.22	11.39	0.63	0.172	0.019	27.76	0.95	2.41	0.18
G5/100	5.62	0.40	14.69	1.03	0.112	0.003	36.11	0.32	4.09	0.27
G5/250	11.26	1.26	15.03	0.61	**0.204**	0.07	55.58	0.01	4.41	0.44
G5/500	10.23	0.80	73.62	3.89	0.185	0.01	**67.85**	1.98	10.02	0.35
G5/1000	5.90	0.73	219.62	9.04	**0.276**	0.076	57.78	1.81	17.55	0.78

Table 5.2.4: continued.

Parameter Station	Ni Av.	Ni St.dev.	Pb Av.	Pb St.dev.	Zn Av.	Zn St.dev.	Hg Av.	Hg St.dev.
G1/0	2.86	0.52	2.49	0.48	10.62	2.24	0.005	0.000
G1/5	2.54	0.41	1.68	0.21	9.62	1.67	0.005	0.000
G1/25	7.04	3.45	3.96	0.54	24.27	10.48	0.005	0.000
G1/50	12.84	0.12	4.86	0.15	39.57	0.73	0.060	0.000
G1/100	13.60	0.50	3.11	0.05	38.36	3.33	0.005	0.000
G1/250	18.97	1.30	9.14	0.46	**102.03**	9.17	0.005	0.000
G1/500	20.61	0.46	3.37	0.33	65.11	19.00	0.012	0.001
G1/1200	**35.67**	4.31	5.15	0.96	73.62	3.14	0.013	0.003
G2/0	5.18	0.35	2.77	0.13	26.33	1.88	0.013	0.001
G2/5	4.81	0.05	2.26	0.04	31.37	0.36	0.027	0.005
G2/25	7.71	1.22	4.89	0.68	32.50	3.13	0.005	0.000
G2/50	12.34	0.67	5.15	0.19	42.72	1.47	0.012	0.000
G2/100	10.97	0.86	2.54	0.16	30.67	1.82	0.012	0.001
G2/250	14.95	0.69	4.11	0.32	70.80	11.12	0.011	0.000
G2/500	22.41	1.79	2.82	0.09	53.90	1.69	0.015	0.001
G2 1361	**43.81**	0.52	4.42	0.32	78.94	0.55	0.043	0.009
G2 1598	**46.17**	0.54	4.69	0.91	81.43	2.05	0.037	0.002
MA 2-1 /1361	**43.59**	1.39	5.75	0.39	80.20	1.95	0.037	0.002
G2/1418	**43.57**	0.76	4.06	0.29	78.13	1.69	0.035	0.000
MA 2-3 /1376	**43.51**	0.44	4.51	0.27	79.19	0.86	0.035	0.001
MA 2-3 /1414	**44.39**	0.00	3.99	0.08	79.42	0.36	0.043	0.010
G3/0	8.98	1.16	2.56	0.06	5.88	0.64	0.005	0.000
G3/5	9.43	0.60	2.76	0.16	8.65	4.89	0.005	0.000
G3/25	22.03	1.08	11.85	1.29	62.87	13.20	0.030	0.004
G3/50	17.13	0.21	5.04	0.06	40.58	1.14	0.021	0.001
G3/100	14.85	0.74	2.77	0.05	50.54	16.09	0.013	0.001
G3/250	20.18	0.12	4.14	0.09	74.18	1.72	0.013	0.001
G3/500	**32.40**	1.02	2.45	0.16	63.99	0.93	0.017	0.002
G3/1200	**43.21**	0.57	4.89	0.02	76.67	1.44	0.040	0.000
G4/0	5.82	0.07	9.20	0.35	52.75	1.23	0.005	0.000
G4/5	13.72	0.09	18.61	0.72	83.40	0.68	0.047	0.001
G4/25	23.05	1.19	**23.98**	1.56	84.17	4.57	0.013	0.001
G4/50	15.05	0.57	5.18	0.09	45.21	1.86	0.005	0.000
G4/100	12.81	0.76	2.47	0.11	34.13	1.19	0.005	0.000
G4/250	17.10	0.40	3.62	0.14	85.53	1.97	0.005	0.000
G4/500	15.96	0.80	3.58	0.34	57.99	0.82	0.010	0.000
G4/1000	26.60	0.47	3.92	0.41	60.05	0.07	0.022	0.003
G5/0	1.10	0.01	1.86	0.14	7.00	1.29	0.005	0.000
G5/5	6.09	1.33	5.79	0.38	37.25	10.04	0.005	0.000
G5/25	2.38	0.53	1.42	0.33	8.07	2.51	0.005	0.000
G5/50	7.89	0.43	2.75	0.04	30.65	13.17	0.040	0.000
G5/100	12.67	0.43	2.49	0.13	35.34	0.28	0.005	0.000
G5/250	14.51	0.14	3.69	0.11	66.09	1.25	0.005	0.000
G5/500	25.09	0.60	4.29	0.08	62.62	1.60	0.017	0.000
G5/1000	**34.65**	1.56	4.49	0.13	64.60	1.94	0.023	0.001

Table 5.2.4: continued.

Parameter Station	As Av.	As St.dev.	Ba Av.	Ba St.dev.	Cd Av.	Cd St.dev.	Cr Av.	Cr St.dev.	Cu Av.	Cu St.dev.
G6/0	8.72	0.72	2.82	0.75	0.015	0.00	8.40	0.92	0.92	0.03
G6/5	10.40	0.49	7.24	1.10	0.015	0.00	31.72	1.22	1.56	0.18
G6/25	**17.71**	10.29	7.93	0.29	0.099	0.056	24.43	5.22	1.55	0.19
G6/52	**15.69**	3.15	16.57	0.55	0.147	0.01	38.51	0.60	3.69	0.47
G6/102	6.56	1.15	17.96	1.32	0.123	0.003	37.34	0.71	5.07	0.64
G6/250	6.93	0.60	17.59	0.88	0.148	0.003	42.60	0.59	5.08	0.51
G6/500	5.79	1.48	69.50	4.51	**0.215**	0.046	46.43	0.30	12.06	0.07
G6/1000	7.28	0.51	160.50	15.49	**0.207**	0.009	54.20	1.59	14.76	0.93
G7/0	3.11	0.07	12.01	6.63	0.015	0.00	5.34	0.65	1.13	0.35
G7/5	7.33	0.36	20.91	3.78	0.023*	0.014	20.80	0.91	2.11	0.11
G7/25	8.77	0.99	12.01	1.13	0.066	0.003	12.16	1.31	2.18	0.23
G7/50	12.96	0.53	19.43	0.76	0.075	0.011	42.38	3.75	5.37	0.18
G7/100	**34.83**	18.98	23.95	2.25	0.109	0.002	52.82	5.61	8.01	0.29
G7/250	7.97	1.52	36.03	2.04	0.143	0.016	56.26	2.12	12.71	0.92
G7/500	8.31	0.45	80.18	0.61	**0.266**	0.008	**62.93**	0.88	18.53	0.26
G7/1000	9.52	1.52	159.06	2.43	**0.260**	0.004	**64.25**	0.56	22.10	2.17
G8/0	1.33	0.16	5.68	4.09	0.015	0.00	3.65	0.15	1.13	0.20
G8/25	**109.49**	44.70	23.13	3.94	0.052	0.008	43.15	2.75	10.50	1.83
G8/50	**185.78**	22.69	19.78	1.98	0.077	0.001	52.75	1.43	9.52	0.56
G8/100	**15.40**	1.22	46.48	4.01	0.074	0.014	59.89	1.80	17.70	2.00
G8/250	13.48	3.13	42.62	1.02	0.118	0.008	53.91	1.39	14.56	0.56
G8/500	**18.82**	3.10	62.54	2.18	**0.209**	0.016	56.97	0.50	15.17	0.16
G8/1000	**21.59**	2.95	100.94	5.84	**0.216**	0.006	57.84	1.02	17.27	0.45
G9/0	2.14	0.23	1.37	0.03	0.015	0.00	10.40	1.51	1.31	0.23
G9/5	9.20	0.14	4.19	0.16	0.015	0.00	14.21	0.60	1.35	0.31
G9/25	4.70	0.84	3.35	0.57	0.034	0.002	14.99	0.43	1.37	0.13
G9/50	7.53	1.19	31.64	2.01	**0.399**	0.036	48.59	2.51	9.66	0.82
G9/100	10.34	1.63	39.28	7.88	**0.312**	0.084	52.47	9.19	11.40	2.05
G9/250	**23.43**	1.77	31.83	3.43	0.176	0.034	**78.06**	2.44	11.07	0.92
G9/500	10.81	0.45	86.55	2.51	**0.318**	0.017	**68.05**	0.51	20.10	0.26
G9/1000	13.68	6.63	132.98	3.60	**0.279**	0.009	**64.32**	0.53	20.17	0.72

Table 5.2.4: continued.

Parameter	Ni Av.	Ni Stdev.	Pb Av.	Pb Stdev.	Zn Av.	Zn Stdev.	Hg Av.	Hg Stdev.
G6/0	2.02	0.23	2.71	0.32	10.26	1.24	0.005	0.00
G6/5	6.03	0.18	5.75	0.32	33.55	0.48	0.005	0.00
G6/25	4.27	1.06	3.74	0.53	14.85	7.47	0.005	0.00
G6/52	10.81	0.48	4.38	0.27	29.23	0.51	0.005	0.00
G6/102	14.48	0.44	3.08	0.14	37.92	0.79	0.005	0.00
G6/250	13.28	0.41	2.82	0.12	47.18	1.17	0.005	0.00
G6/500	25.36	0.36	3.36	0.53	47.91	0.19	0.01	0.00
G6/1000	28.72	1.92	4.57	0.47	61.03	5.24	0.02	0.00
G7/0	1.37	0.50	2.53	0.24	4.85	0.41	0.005	0.00
G7/5	4.74	0.07	4.69	0.56	35.32	0.37	0.005	0.00
G7/25	4.11	0.52	3.29	0.16	11.79	1.05	0.005	0.00
G7/50	14.79	0.81	4.80	0.03	45.20	6.17	0.	0.003
G7/100	21.04	1.64	8.91	3.03	50.05	3.38	0.01	0.00
G7/250	26.07	1.07	5.13	0.05	53.59	2.06	0.01	0.00
G7/500	**35.68**	0.42	6.40	0.26	60.25	0.69	0.02	0.00
G7/1000	**39.07**	0.60	7.60	0.38	66.94	0.34	0.02	0.00
G8/0	0.47	0.07	2.36	0.42	2.38	0.88	0.005	0.00
G8/25	22.85	2.36	12.66	1.82	71.44	17.60	0.005	0.00
G8/50	29.46	1.01	19.84	1.81	99.54	7.56	0.005	0.00
G8/100	**30.33**	2.27	8.16	0.49	54.45	1.90	0.02	0.00
G8/250	26.67	0.99	7.96	0.09	48.83	1.11	0.017	0.001
G8/500	28.83	0.44	8.92	0.11	52.90	0.85	0.02	0.00
G8/1000	**32.15**	0.76	9.24	0.25	57.52	1.21	0.02	0.00
G9/0	2.31	0.38	0.67*	0.30	6.06	6.16	0.005	0.00
G9/5	3.63	0.02	2.66	0.36	11.76	0.27	0.005	0.00
G9/25	2.96	0.12	1.45	0.06	6.22	0.62	0.005	0.00
G9/50	22.43	1.23	4.36	0.22	47.48	2.78	0.005	0.00
G9/100	26.63	4.93	5.49	0.67	54.20	10.49	0.01	0.00
G9/250	25.97	1.38	6.82	0.18	71.47	5.16	0.01	0.00
G9/500	**38.77**	0.16	7.56	0.39	74.52	13.66	0.023	0.002
G9/1000	**38.32**	0.51	8.52	0.74	67.81	0.64	0.026	0.001

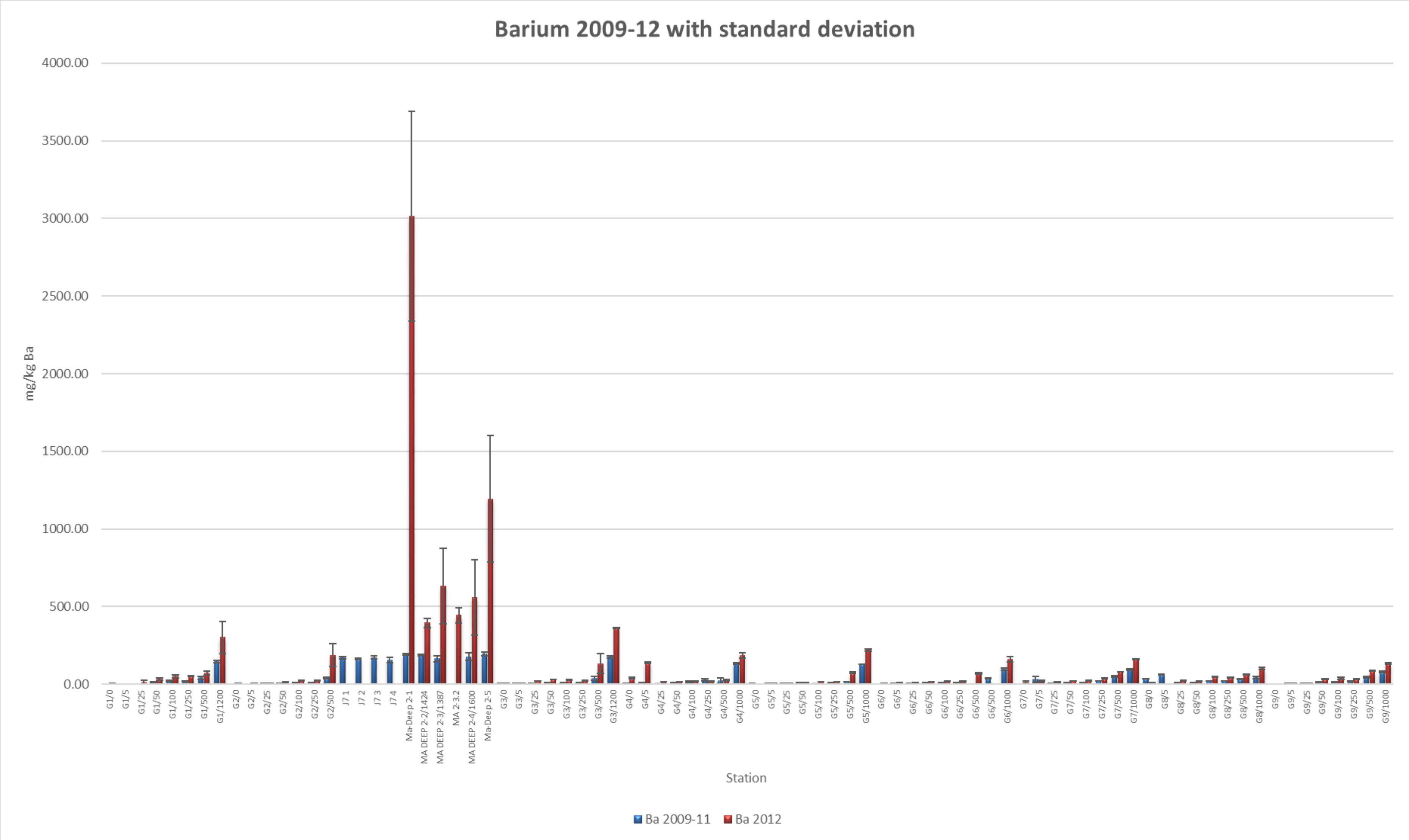


Figure 5.2.1.a: Distribution of Barium (average and stdev) along trasects G1-G9.

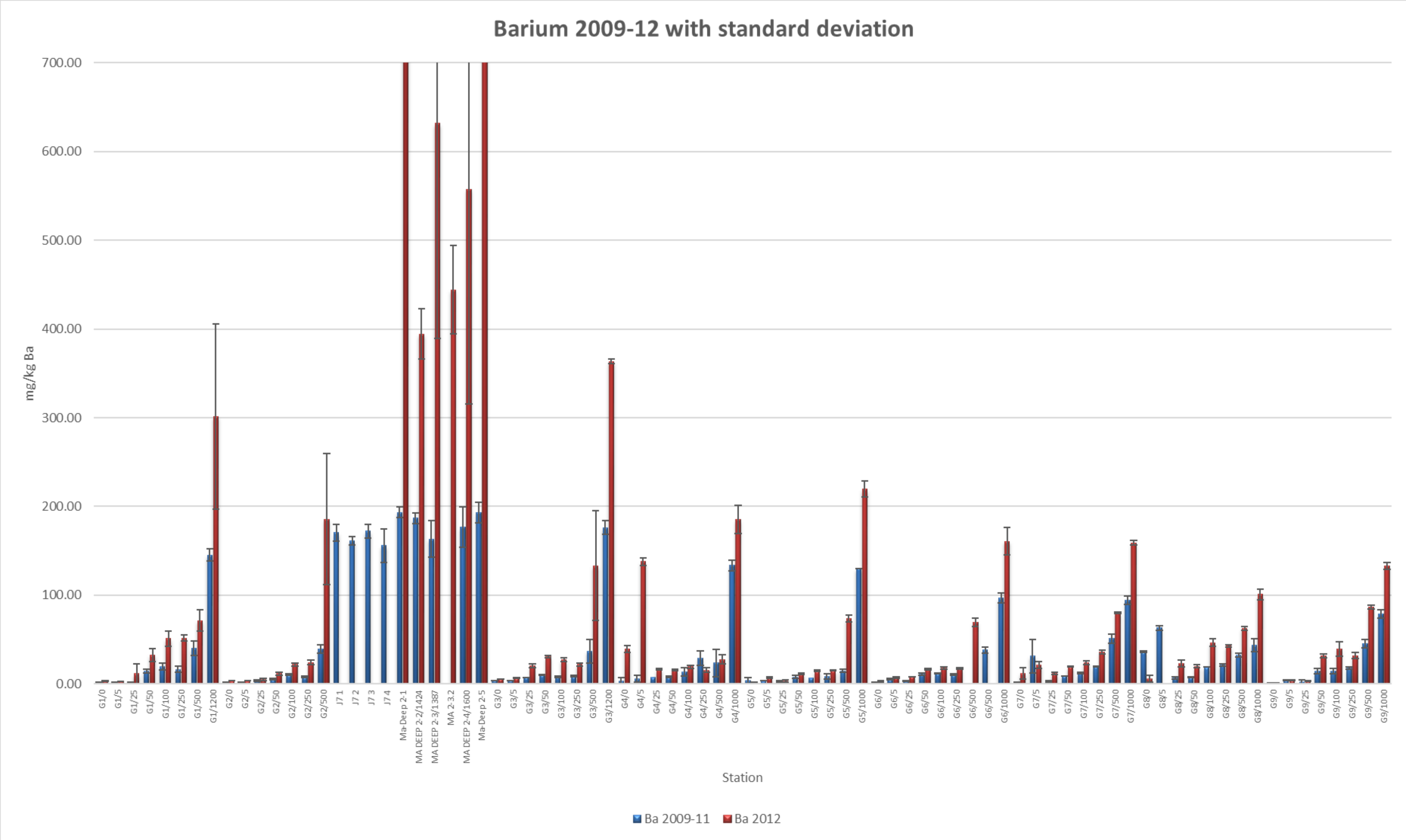
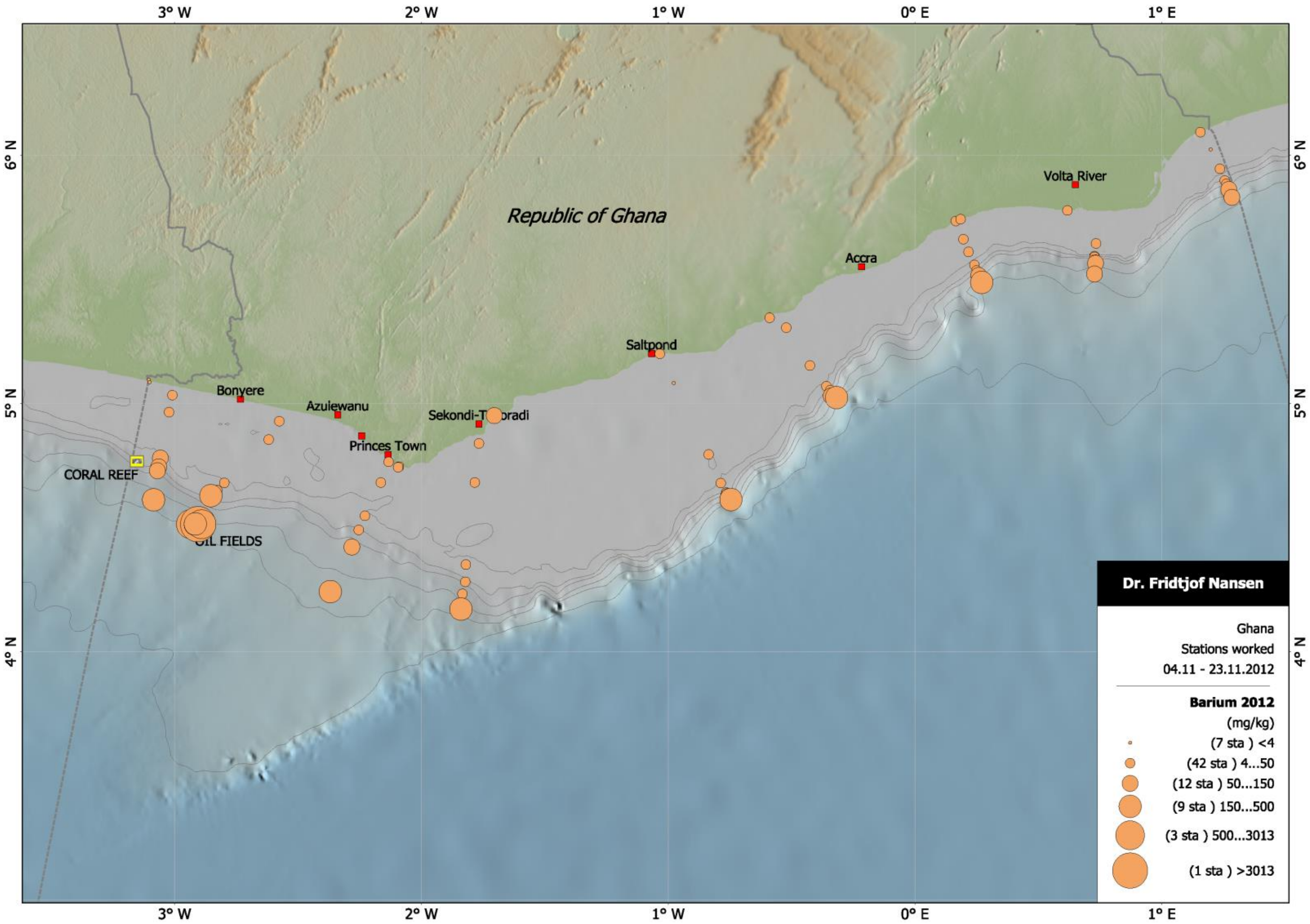


Figure 5.2.1.b: Distribution of Barium (average and stdev) along trasects G1-G9. (scaled to 700 on the y axis)



Map 5.2.1: Distribution of Barium (average) along trasects G1-G9.

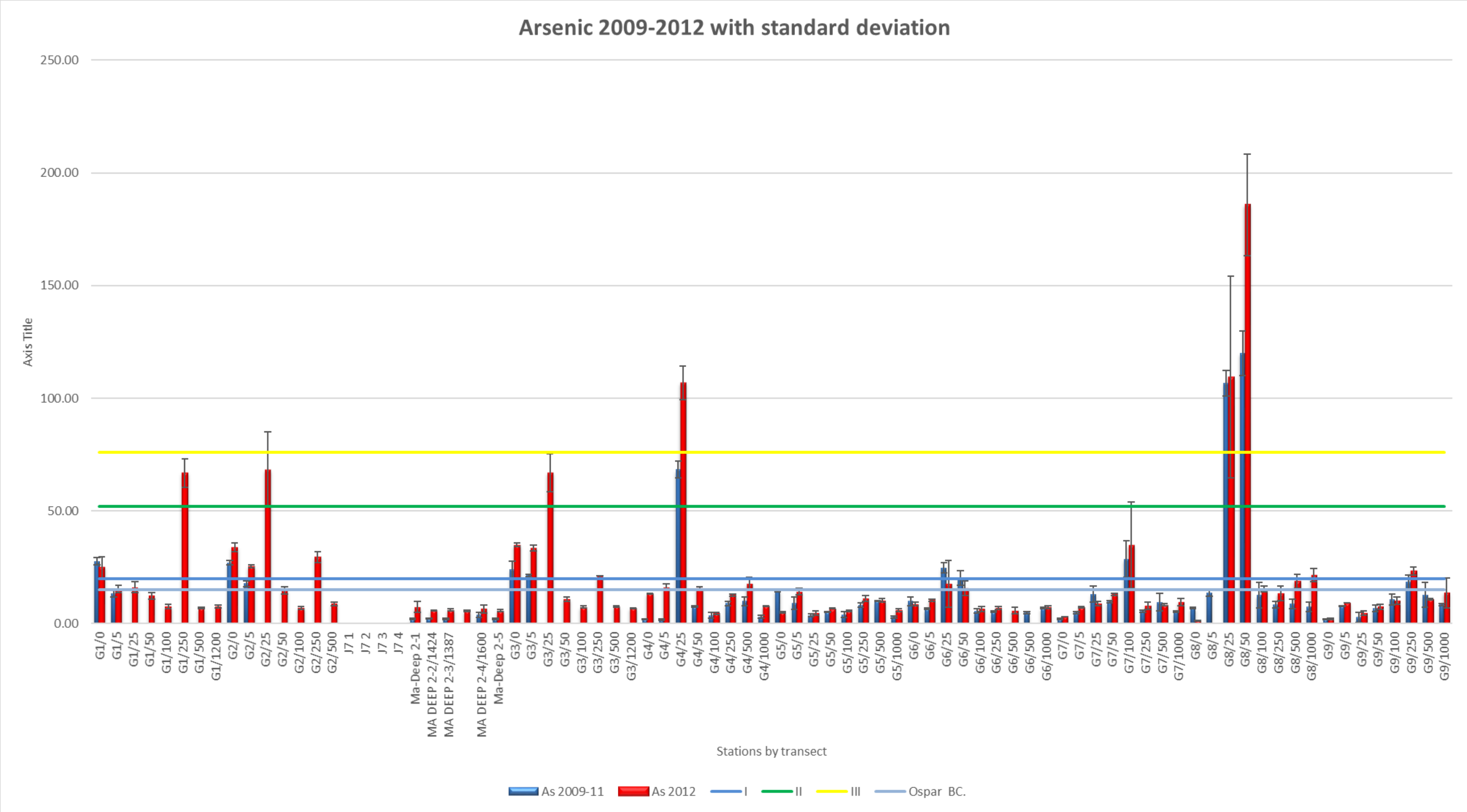
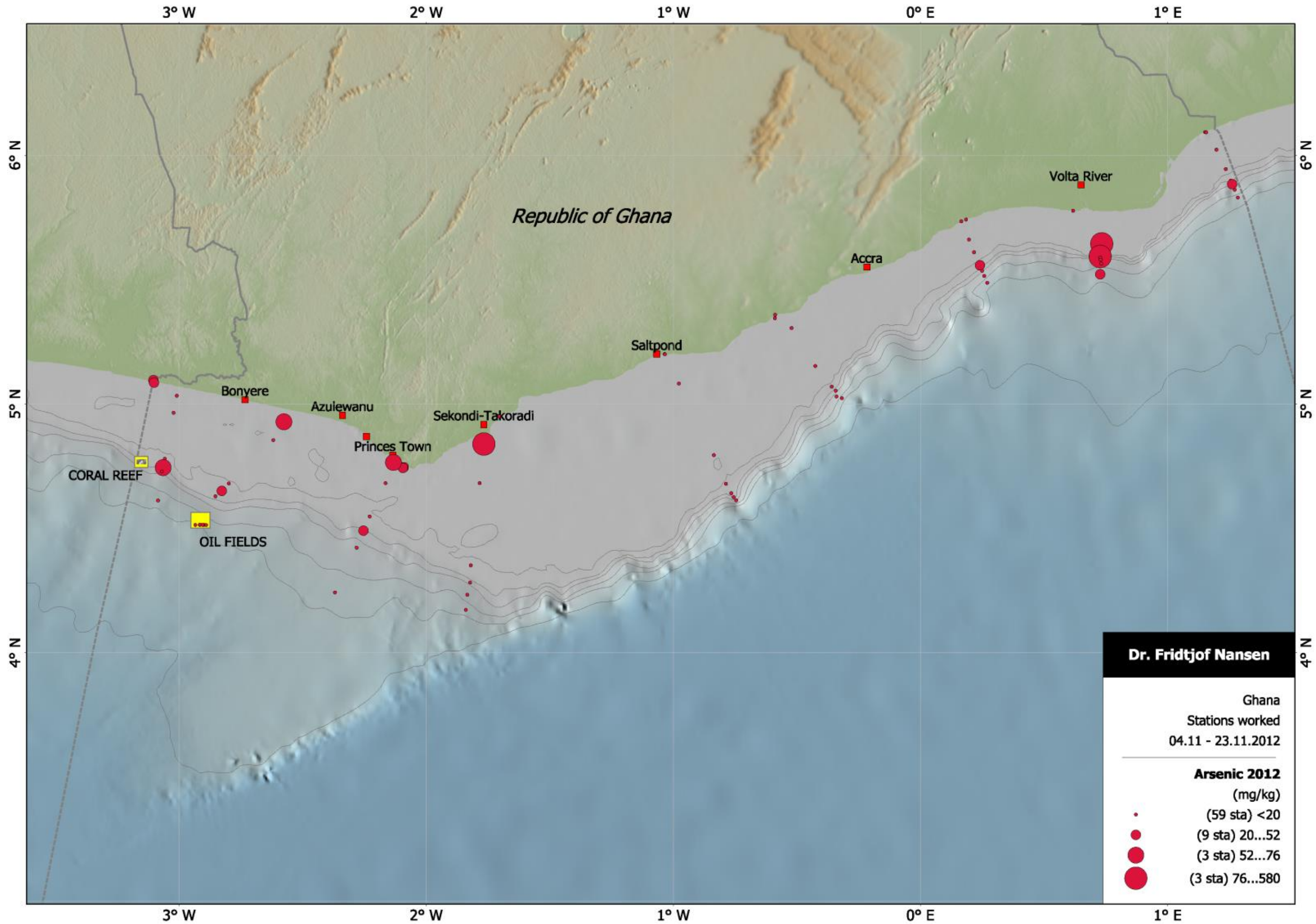


Figure 5.2.2: Distribution of Arsenic (average and stdev) along trasects G1-G9. The light blue line marks the upper limit of the bacground concentration set by Ospar, the rest of the lines refer to the klif manual from Table 5.2.3.



Map. 5.2.2. Distribution of Arsenic (average) along trasects G1-G9.

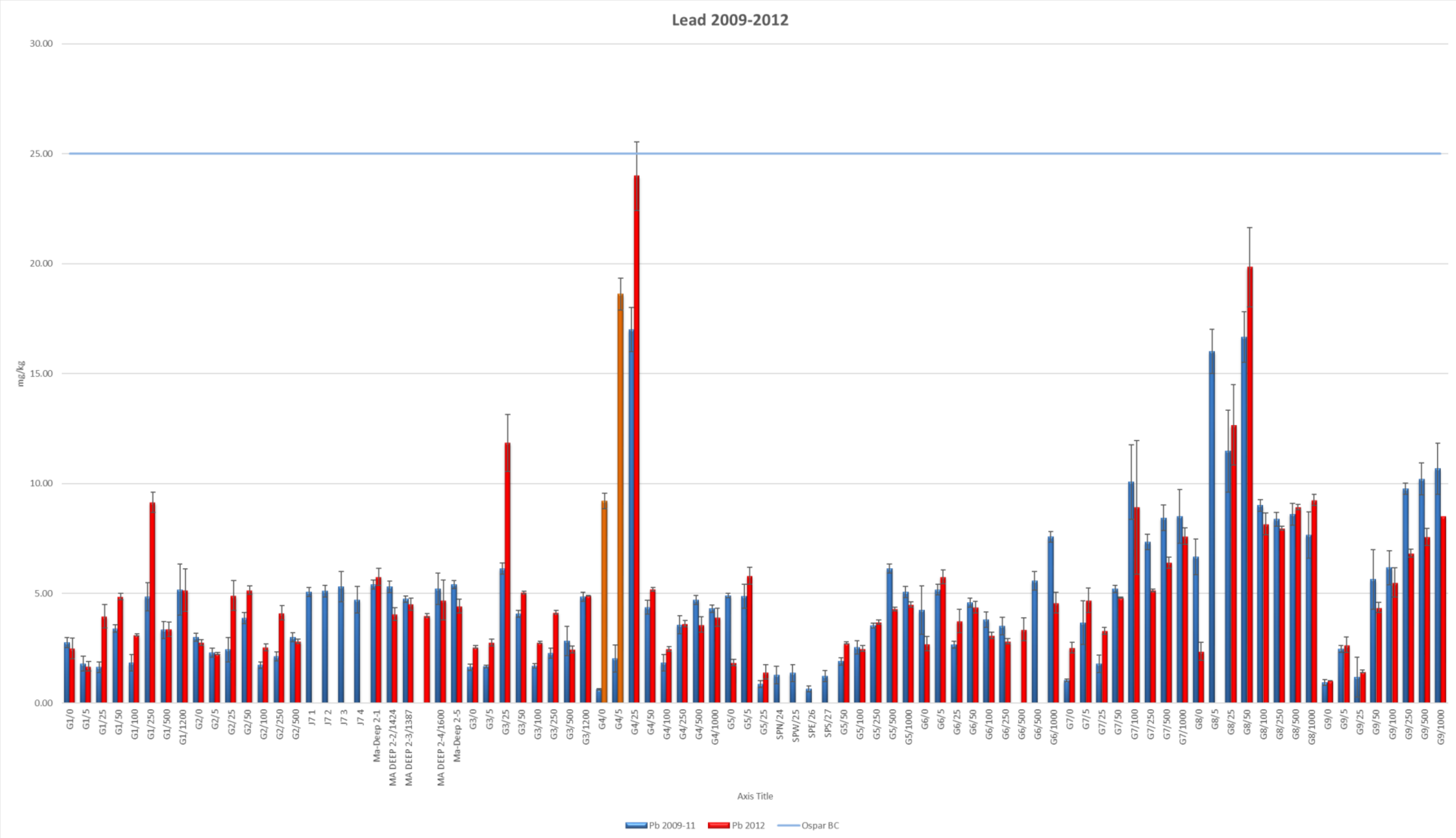
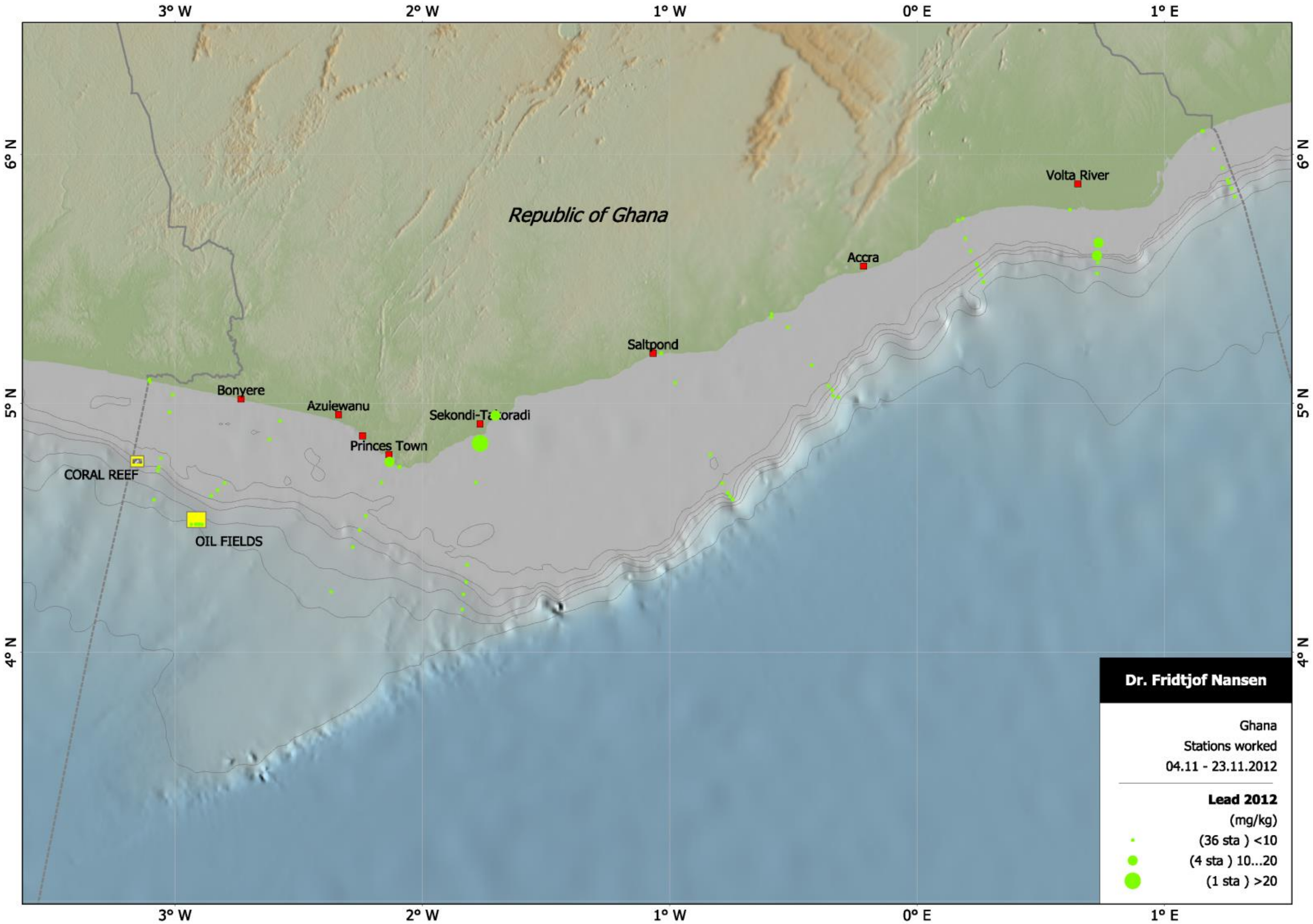


Figure 5.2.3: Distribution of Lead (average and stdev) along the trasects G1-G9. The light blue line marks the upper limit of the bacground concentration set by Ospar.



Map. 5.2.3: Distribution of Lead (average) along trasects G1-G9.

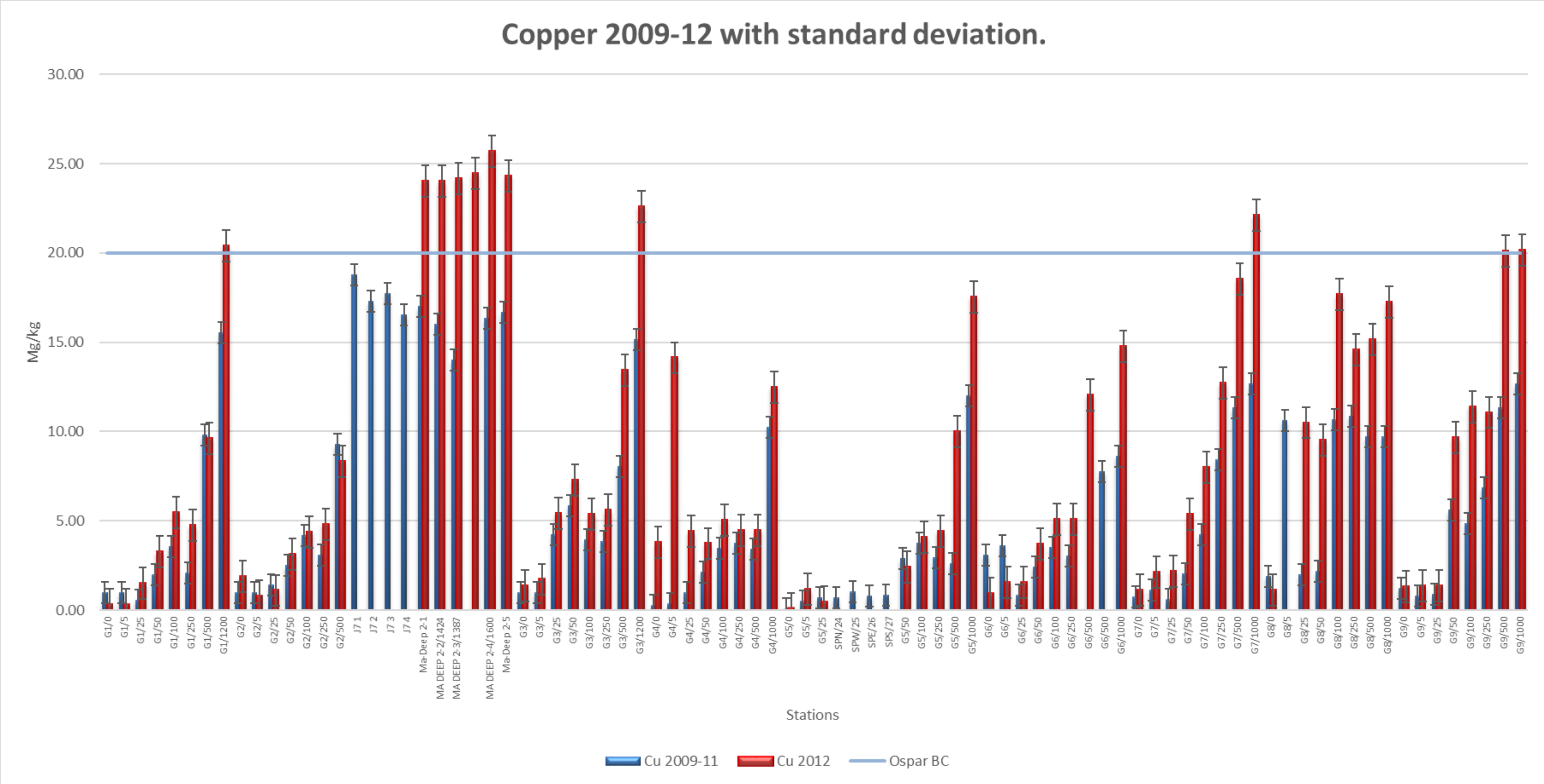
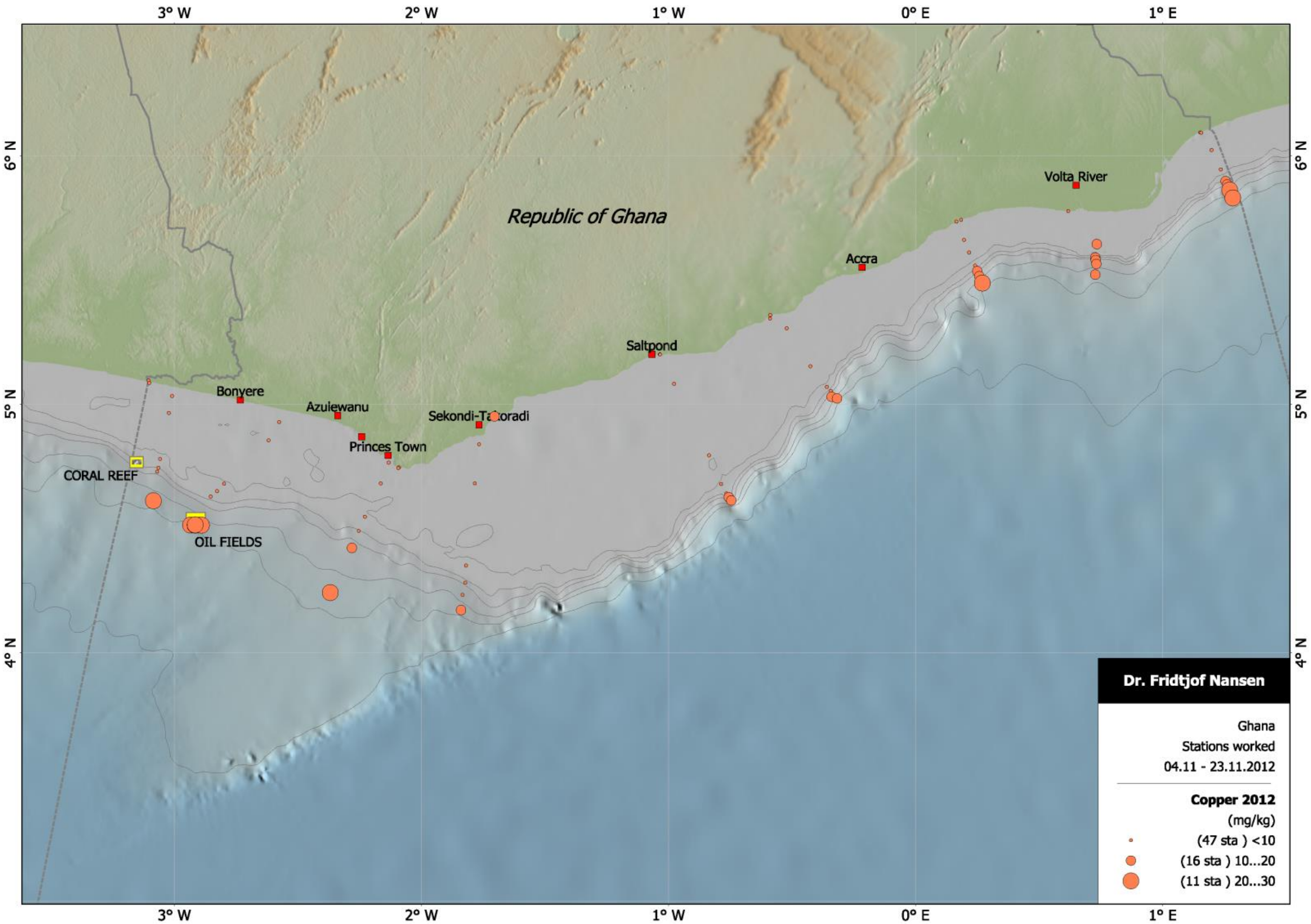


Figure 5.2.4: Distribution of Copper (average and stdev) along the trasects G1-G9. The light blue line marks the upper limit of the bacground concentration set by Ospar.



Map. 5.2.4: Distribution of Copper (average) along trasects G1-G9.

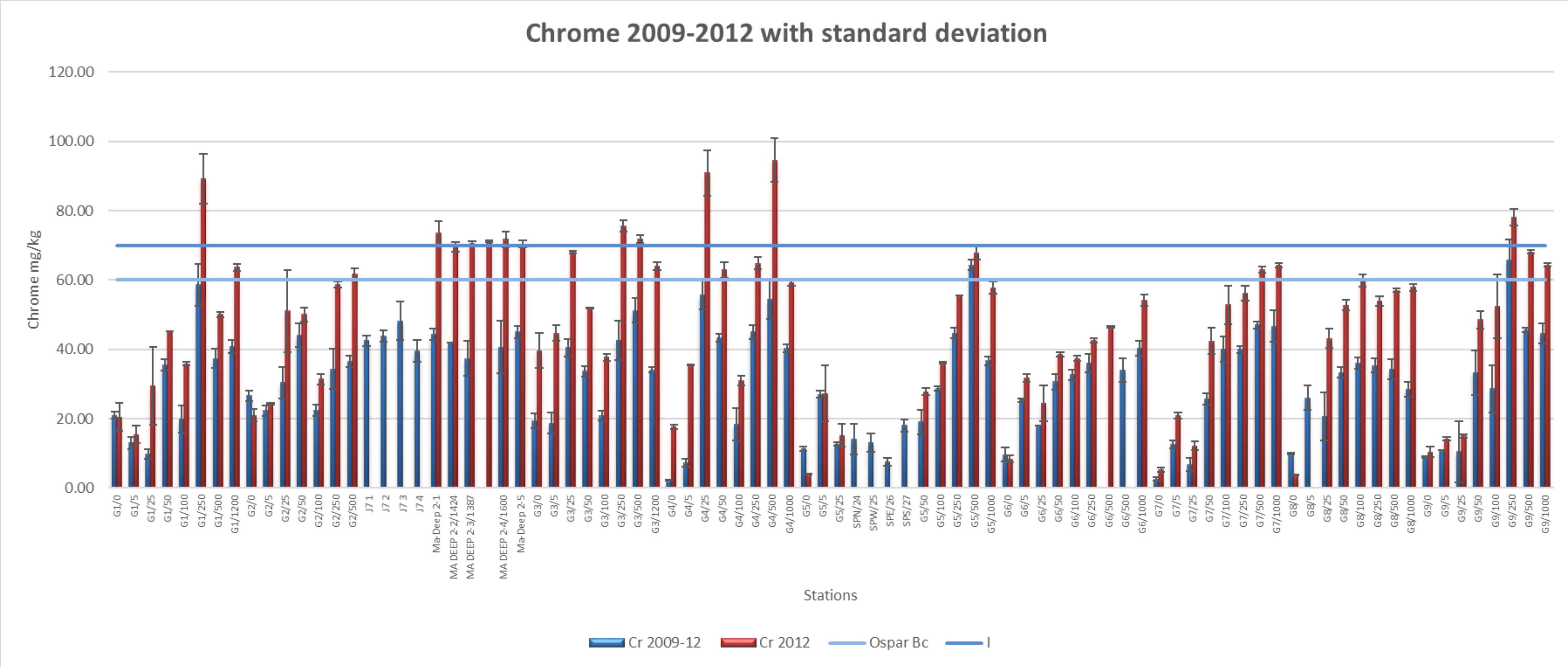
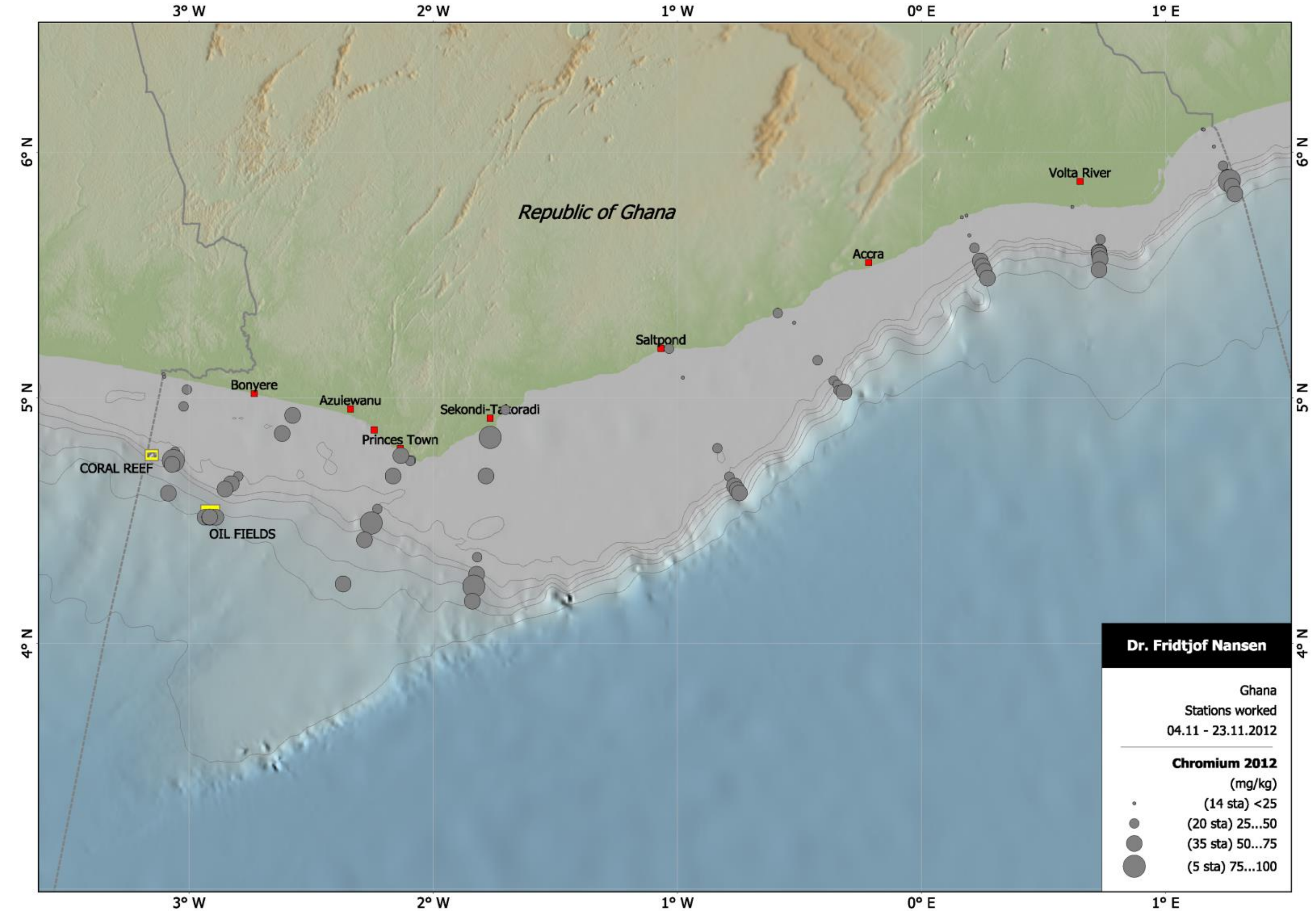


Figure: 5.2.5: Distribution of Chromium (average and stdev) along trasects G1-G9. The light blue line marks the upper limit of the bacground concentration set by Ospar while the darker blue indicates the background levels set by Klif for Norwegian coastal waters.



Map. 5.2.5: Distribution of Chromium (average) along trasects G1-G9.

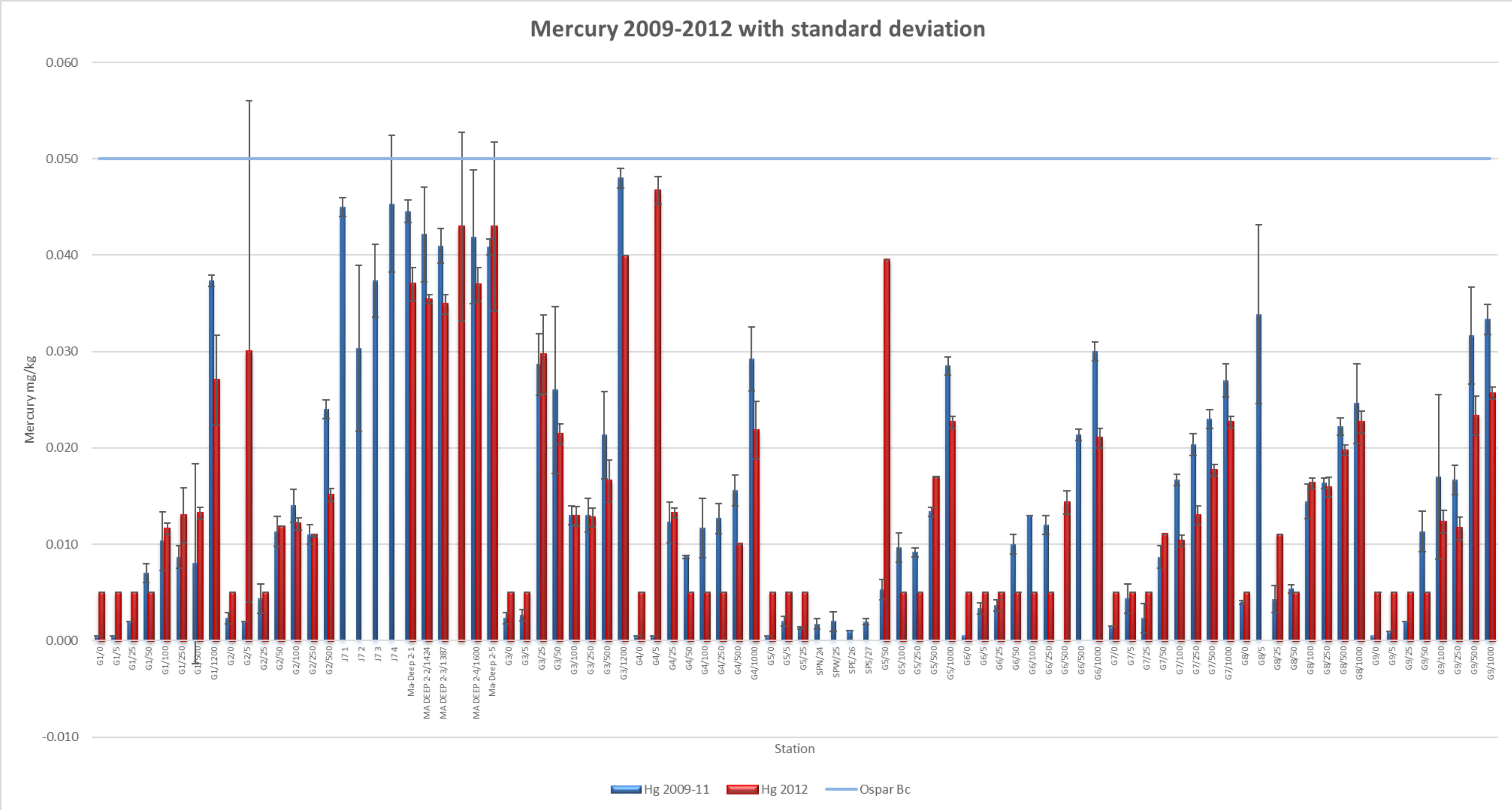
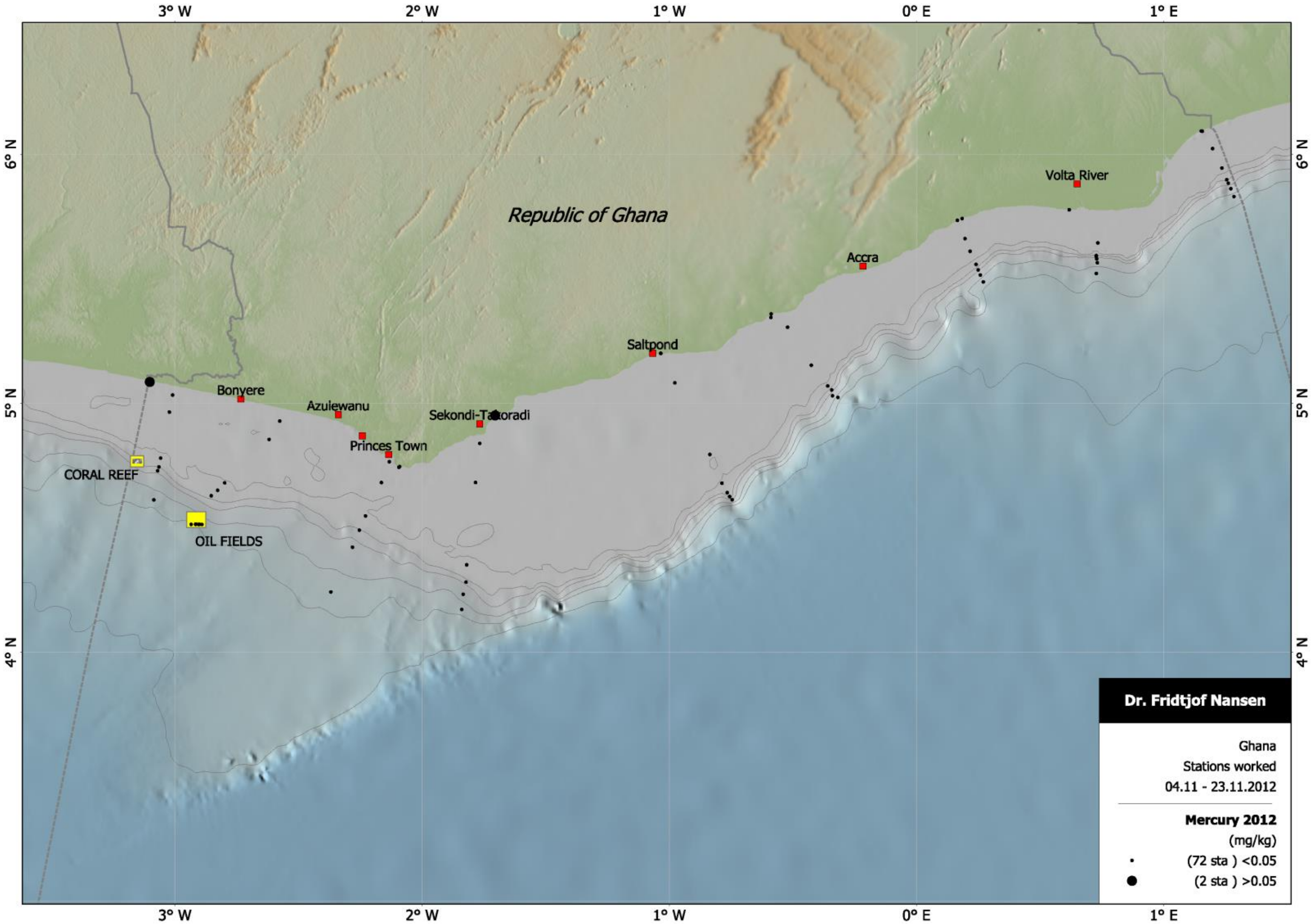


Figure 5.2.6: Distribution of Mercury (average and stdev) along the depth strata at trasects G1-G9. The green line marks the upper limit of the bacground concentration set by Ospar.



Map. 5.2.6: Distribution of Mercury (average) along trasects G1-G9.

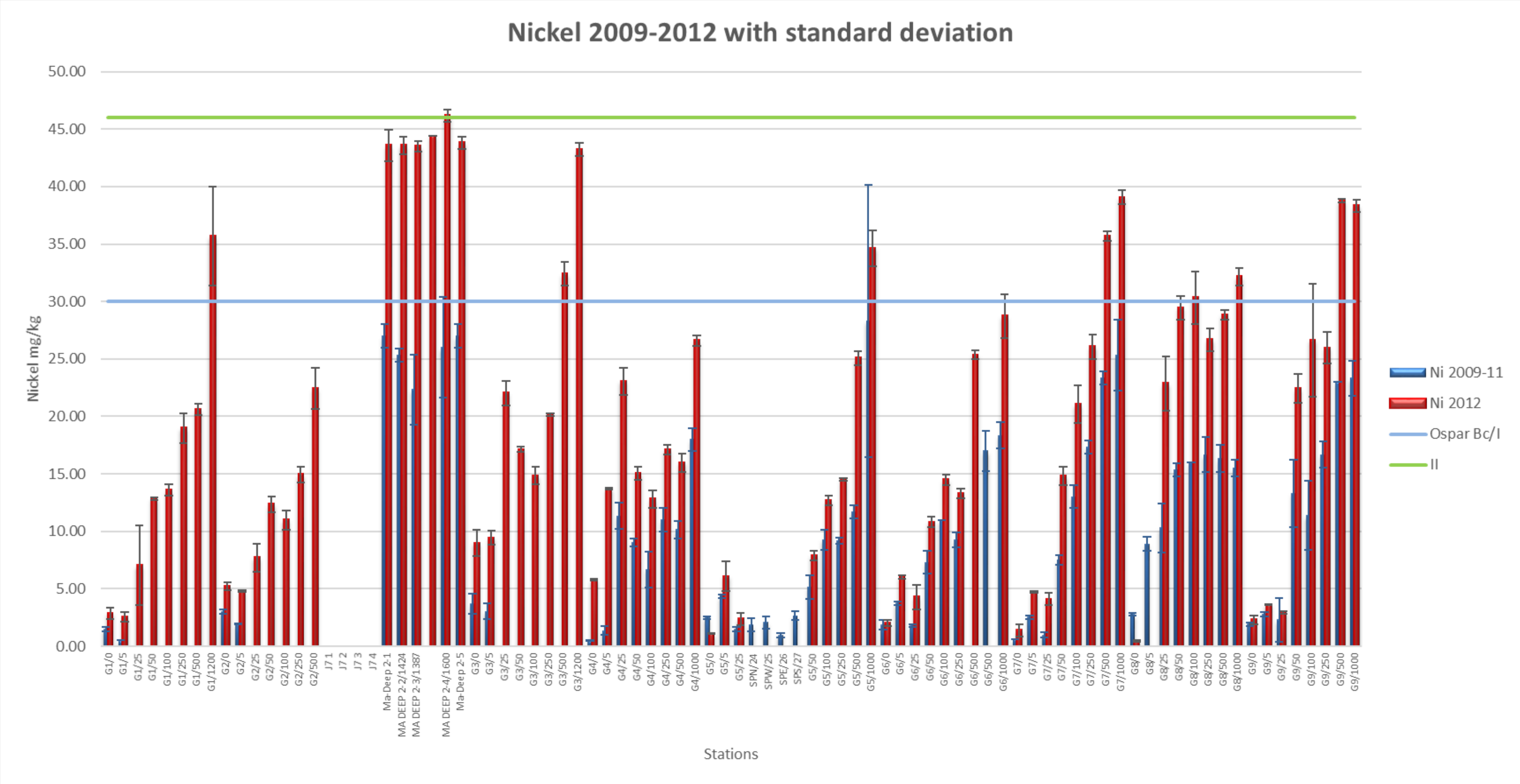
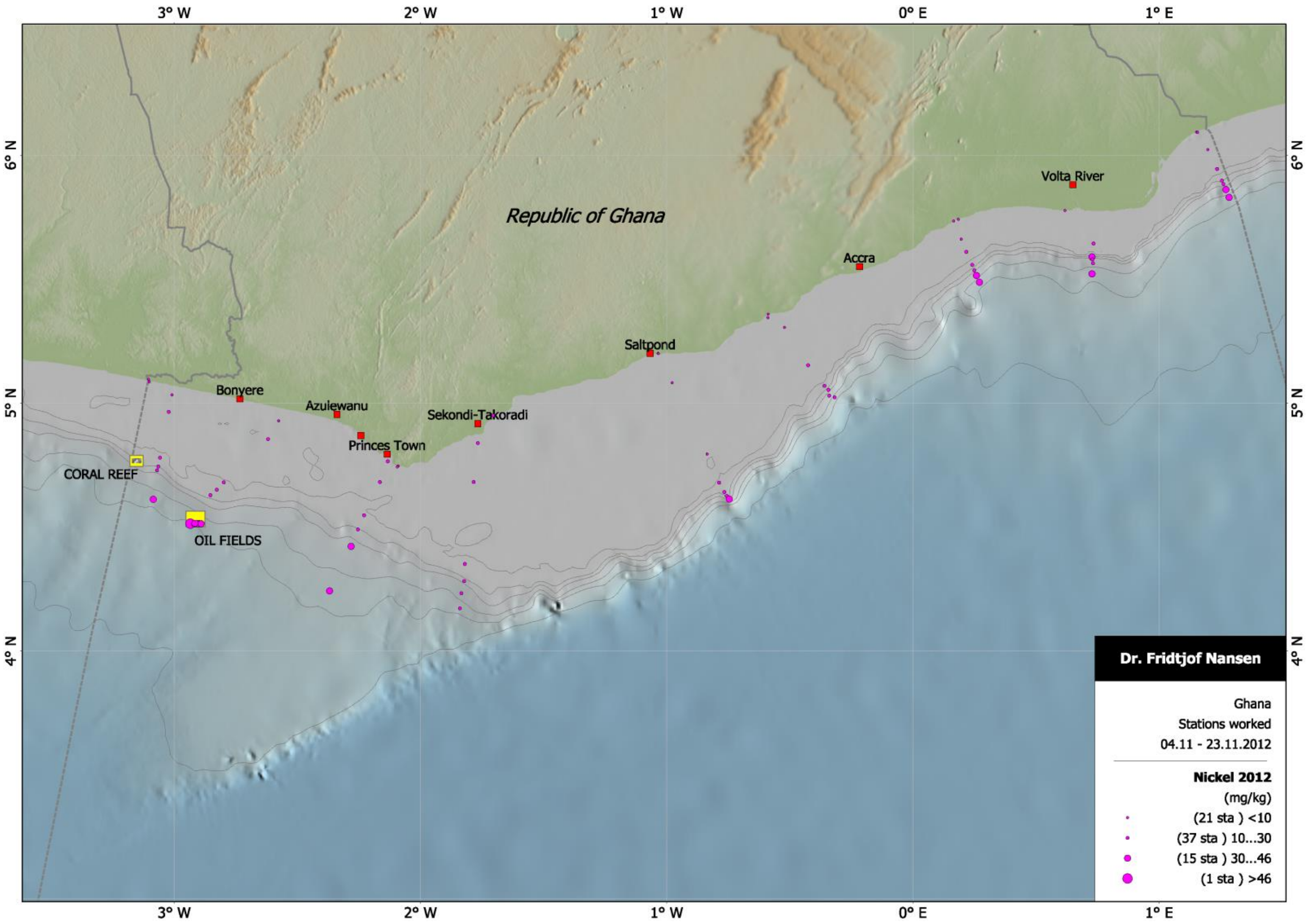


Figure 5.2.7: Distribution of Nickel (average and stdev) along trasects G1-G9. The light blue line marks the upper limit of the bacground concentration set by Ospar and Norwegian authorities for comparison the green line represent the upper limit of the classification good conditions set by KLIF.



Map. 5.2.7: Distribution of Nickel (average) along trasects G1-G9.

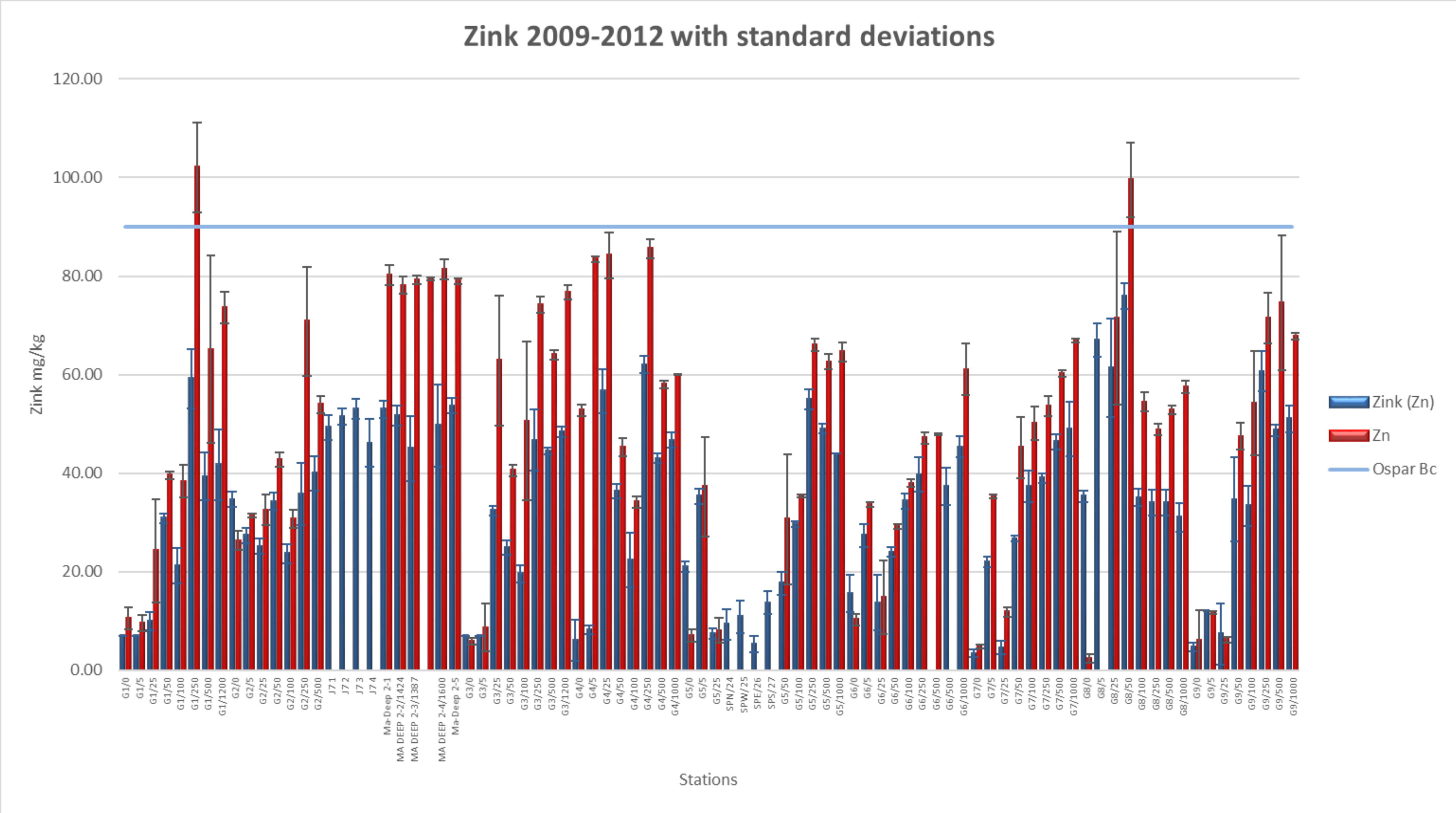
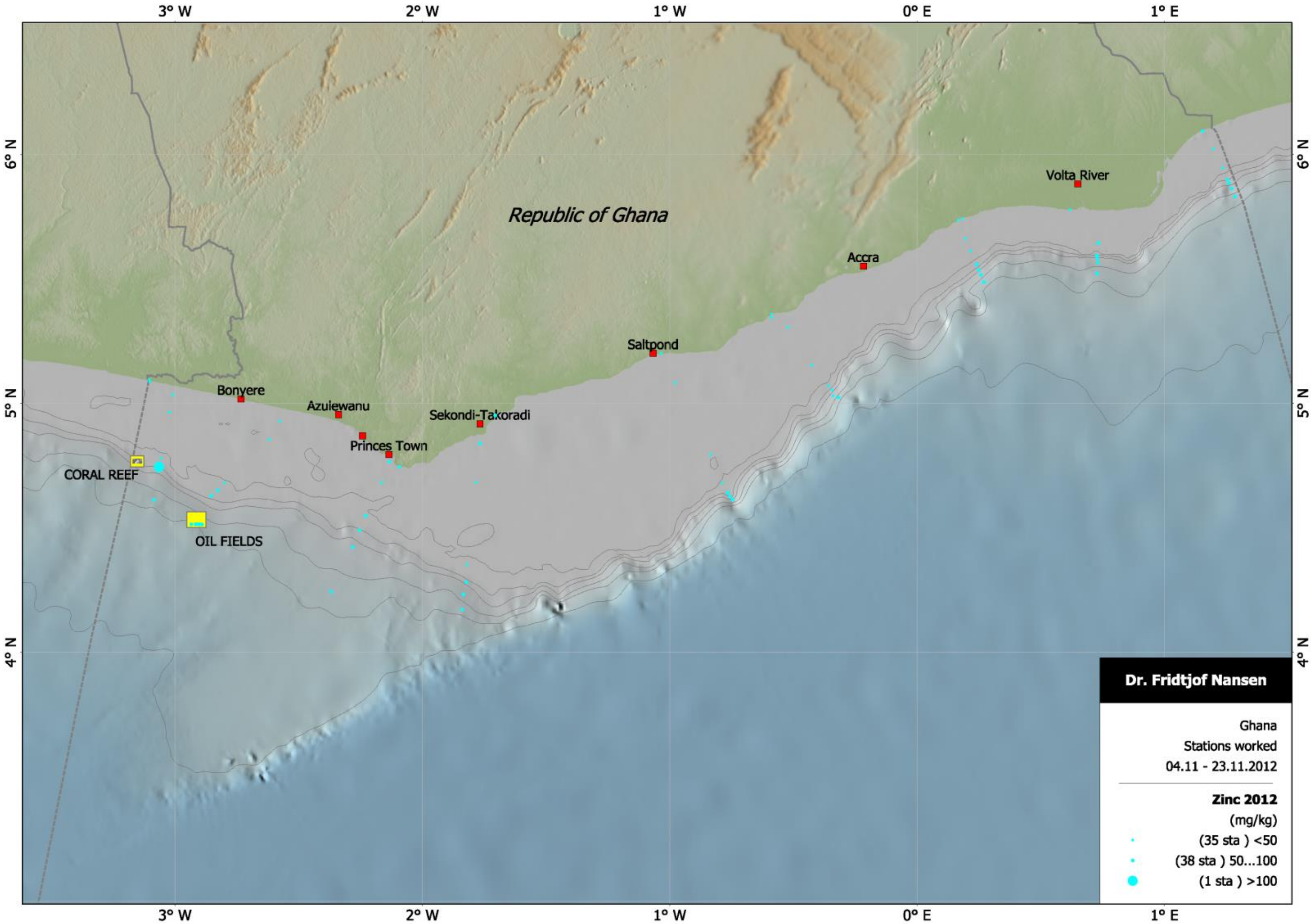


Figure 5.2.8: Distribution of Zink (average and stdev) along trasects G1-G9. The light blue line marks the upper limit of the bacground concentration set by Ospar.



Map 5.2.8: Distribution of Zink (average) along trasects G1-G9.

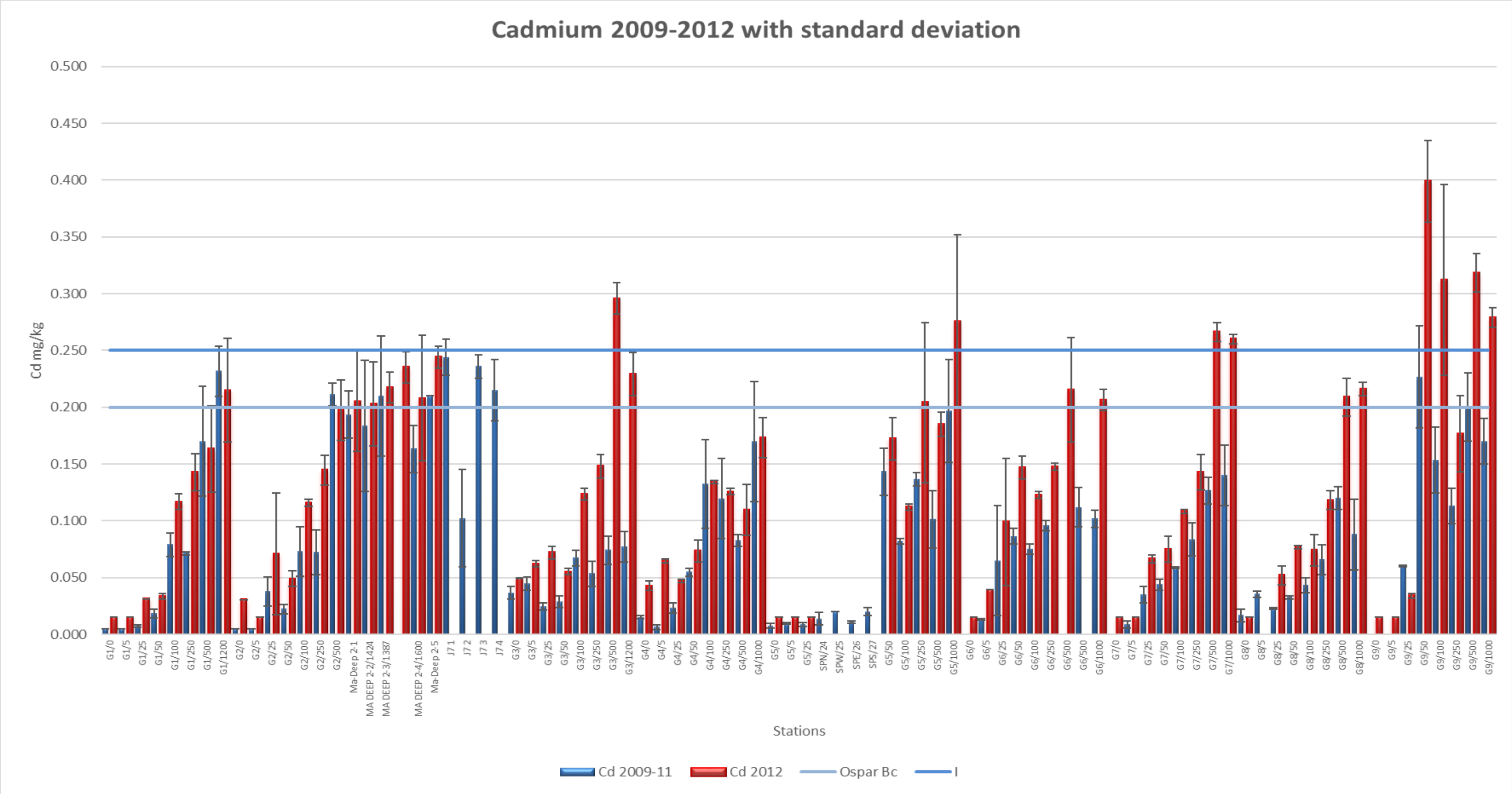
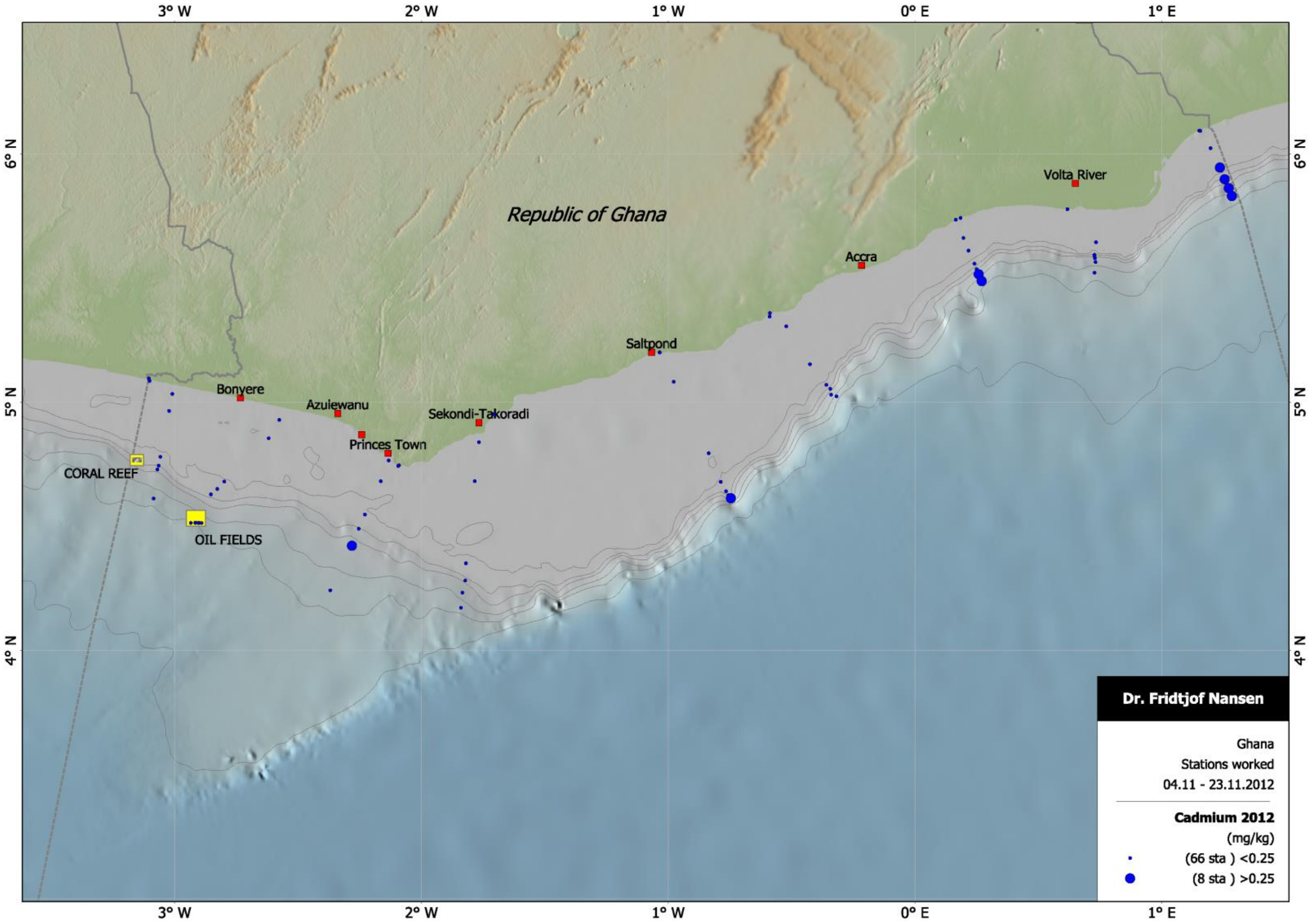


Figure 5.2.9: Distribution of Cadmium (average and stdev) along trasects G1-G9. The light blue line marks the upper limit of the bacground concentration set by Ospar the blue line marks the bacground concentration set by norwegian authorities for comparison.



Map. 5.2.9: Distribution of Cadmium (average) along trasects G1-G

5.2.2 Hydrocarbons

THC

The total hydrocarbon content, THC, gives an overall picture of the total hydrocarbon content in the studied area. It includes PAHs, mono aromatic hydrocarbons, alkanes and cycloalkanes. Elevated THC levels can point to oil spills in the area or natural occurrences of oil or coal. There are no established state classes for THC in sediment samples, but a limit of 50 mg / kg dry weight is often used as a threshold level for possible effects on benthic marine organisms (eg OSPAR 2009). The average THC value for the whole set was 8.2 mg/kg while the median was 6.1 mg/kg. There was a slow and steady increase from 0 to 250 meters and only one station showed values above the threshold limit of 50 mg/kg, st. G9/500 with an average of 59.2 mg/kg (30.4, 117 and 30.3 mg/kg). Station G4/5 also showed high levels of THC with an average of 42.7 mg/kg (42,0, 48,5 and 37,6 mg/kg) which is much higher than the rest of the 5 meter stations. Both G4/0 and 5 meter showed a large increase in THC levels compared to the 2010 data as well as data from the other transects at the same depths. The G4 0 and 5 meters are located at Ngyiresia Beach 1 in Sekondi (4^{th} exit from W. Ofori Atta rd. to the west when going northwards from the fisheries port).The fishing community on this beach has several smoke houses for conservation of fish. Possible sources for the THC content could originate from either the harbour or the fisheries beach. Other industrial activities in the area is the Takoradi power plant in Aboadze. Station MA 2-1 is also worth mentioning with a steady average of 22.5 mg/kg. Table 5.2.5: summarises the results of the hydrocarbon analysis. (Fig. 5.2.10a and b). The complete data set including replicates is presented in the Appendix.

Table 5.2.5: Average concentrations and standard deviations of THC (C12-35), PAH16, NPD's and PCB (mg/kg dw) at 77 stations with different depths along the transects G1-9.

Station	depth	THC ppm µg/g		PAH sum ng/g (µg/kg)		Sum NPD ng/g (µg/kg)	
		Av.	Stdev.	Av.	Stdev.	Av.	Stdev.
G1/0	0	1.0	0.2	13.0	0.8	9.3	1.1
G2/0	0	0.5	0.2	4.4	0.1	7.5	2.4
G3/0	0	1.9	0.4	4.3	0.0	6.4	4.8
G4/0	0	7.2	1.1	394.9	40.1	105.1	7.7
G5/0	0	0.3	0.0	13.3	11.3	2.8	1.0
G6/0	0	0.5	0.2	4.3	0.2	2.3	0.0
G7/0	0	1.4	0.5	4.3	0.0	2.3	0.0
G8/0	0	0.3	0.0	5.2	1.7	3.3	1.8
G9/0	0	0.4	0.2	4.3	0.0	2.3	0.0
G1/5	5	0.4	0.2	4.3	0.0	2.6	0.6
G2/5	5	0.5	0.3	4.3	0.0	2.9	0.9
G3/5	5	2.1	0.5	4.3	0.0	2.3	0.0
G4/5	5	42.7	5.5	1474.0	358.1	578.3	70.0
G5/5	5	1.3	0.5	57.1	26.2	9.2	2.9
G6/5	5	1.8	0.5	25.7	14.1	2.3	0.0
G7/5	5	6.4	1.4	8.2	2.5	9.0	1.6
G8/5							
G9/5	5	0.3	0.0	4.4	0.2	2.3	0.0
G1/25	25	1.1	0.1	7.9	5.2	7.2	4.9
G2/25	25	2.6	3.1	4.6	0.3	4.9	3.2
G3/25	25	10.3	0.8	34.3	9.1	38.5	6.8
G4/25	25	6.8	1.0	67.0	14.3	35.1	8.5
G5/25	26	1.6	0.3	5.3	1.8	4.1	0.5
G6/25	23	5.0	1.5	24.2	11.0	14.7	3.7
G7/25	25	9.6	0.1	11.9	1.6	13.6	2.0
G8/25	25	8.7	4.8	204.0	277.9	64.1	48.3
G9/25	25	1.6	0.8	6.9	4.4	9.3	6.9
G1/50	50	4.8	0.6	8.5	0.4	18.0	1.5
G2/50	50	4.6	0.8	18.7	13.6	20.9	4.1
G3/50	50	11.7	3.1	56.7	8.2	68.0	6.7
G4/50	52	6.2	0.9	11.8	1.5	26.9	3.6
G5/50	50	3.1	1.1	6.69	1.98	12.5	5.2
G6/50	51	4.5	0.4	13.2	2.2	14.6	1.5
G7/50	51	6.9	0.9	18.8	1.1	22.2	0.9
G8/50	50	6.0	1.3	27.9	8.6	23.5	8.6
G9/50	52	8.3	3.5	1117.1	1891.9	229.6	352.5

Table 5.2.5 continued: Average concentrations and standard deviations of THC (C12-35), PAH16, NPD's and PCB (mg/kg dw) at 77 stations with different depths along the transects G1-9.

Station	depth	THC ppm µg/g Av.	Stdev.	PAH sum ng/g (µg/kg) Av.	Stdev.	Sum NPD ng/g (µg/kg) Av.	Stdev.
G1/100	100	6.0	0.8	20.5	2.3	12.3	17.1
G3/100	100	6.6	0.3	12.7	1.1	25.6	2.0
G4/100	100	4.5	0.5	10.4	0.3	18.3	1.5
G5/100	100	4.0	0.8	9.9	1.3	16.7	2.6
G7/100	101	8.6	0.2	23.8	2.8	28.0	4.0
G2/100	103	5.1	2.4	13.6	3.0	24.9	3.4
G6/100	103	4.9	0.1	12.6	1.2	17.0	2.7
G8/100	104	10.4	2.5	66.88	13.41	52.7	8.1
G9/100	104	9.2	1.4	42.0	3.3	34.2	2.1
G1/250	250	4.8	0.5	10.2	0.9	16.8	1.1
G2/250	250	3.7	0.3	9.0	0.2	17.5	3.4
G3/250	254	6.4	0.2	18.7	10.2	24.1	2.4
G4/250	250	4.3	0.2	8.4	0.3	14.4	1.1
G5/250	250	5.5	0.9	9.4	0.4	20.3	4.8
G6/250	250	4.5	1.0	9.8	2.2	21.2	4.4
G7/250	248	11.7	0.4	35.8	4.0	41.6	3.2
G8/250	250	14.5	1.8	72.7	4.2	69.6	4.8
G9/250	249	8.3	1.7	36.0	4.0	34.3	6.0
G1/500	492	10.2	0.7	25.1	1.6	36.9	4.7
G2/500	503	8.4	3.5	27.2	10.8	27.5	4.1
G3/500	508	11.5	2.3	30.7	3.0	35.8	7.4
G4/500	500	3.5	0.6	12.0	3.8	13.4	5.0
G5/500	500	7.3	2.4	22.1	3.0	24.3	4.0
G6/500	505	12.9	0.5	34.7	3.2	44.1	3.1
G7/500	504	21.3	1.5	109.9	16.3	75.6	1.5
G8/500	508	22.2	2.1	91.6	6.8	87.1	5.8
G9/500	500	59.2	50.0	77.3	4.7	94.5	24.6
G1/1200	1218	13.7	0.7	46.8	0.2	42.4	1.9
G2/1400	1361	9.1	2.1	41.9	7.4	30.7	6.3
G2 1418	1418	12.6	0.3	42.9	4.0	36.6	3.5
G2/1600	1598	8.8	0.6	45.9	2.4	30.7	3.4
MA2-1	1361	22.5	0.6	54.9	0.4	79.2	14.2
MA2-3	1376	14.9	0.7	52.4	2.4	52.4	4.9
MA2-3	1414	14.0	4.2	41.7	0.7	38.5	2.9
G3/1200	1204	9.6	2.5	40.4	0.8	30.6	3.7
G4/1000	1000	5.1	1.7	26.9	1.2	20.7	3.2
G5/1000	1045	11.9	3.6	42.7	4.9	42.0	7.0
G6/1000	975	11.2	1.5	39.5	3.5	40.9	7.2
G7/1000	973	19.4	1.5	66.1	3.2	54.3	2.2
G8/1000	979	18.9	2.6	86.7	1.4	67.1	4.5
G9/1000	1019	14.8	2.5	71.2	8.2	53.6	3.7

PAH's and NPD's

There are both natural and anthropogenic sources for PAH's and NPD's (naphtalenes, phenathrenes and dibenzothiophenes) in marine sediments.
Their composition together with knowledge of possible sources, currents and the bathymetry will give clues to the origin. Table 5.2.6 is an overview of possible sources in the marine environment.

Table 5.2.6: Sources for PAH and NDP's in marine sediments.

PAH origin	**Petrogenic**	**Pyrogenic**	**biogenic**
Sources	Fossil substances	Products of incomplete combustion	Biological processes
Example of natural source	Natural occurrence of example. coal, oil.	Forest fires, volcanic	Biological processes
Example of anthropogenic source	Oil spills from boats or oil platform	Coal- and wood-burning, automotive and ship exhaust.	
Types of PAH			Some heavy PAH.
Examples of representative PAH	Naphthalene, phenanthrene, alkylnaphthalenes, alkylfenantrener	Phenanthrene, fluoranthene, pyrene, benzo [a] pyrene, benzo [ghi] perylene	Perylene
Indicators*	NPD	PAH16	Perylene
PAH ratios **	(Sum AlkylNAF) / NAF> 1	FEN / ANT <10	

* NPD - summed levels of naphthalene, phenanthrene, dibenzothiophene and their alkylated homologues. PAH16 - summed levels of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo [a] anthracene, chrysene, benzo [b] fluoranthene, benzo [k] fluoranthene, benzo [a] pyrene, indeno [1, 2,3-cd] pyrene, dibenz [a, h] anthracene, benzo [ghi] perylene.

** NAF: Naphthalene, FEN: phenanthrene, ANT: Anthracene. 6

Most stations show low levels of PAH 16, only 3 stations show an average above the BC.
This is the G4/0 and 5, and the G9/50 there is also one measurement at G8/25.
Both the smoke houses on the beach or the port could be sources for the increase at stations G4/0 and G4/5. There is a tendency towards higher values to the east. This may be associated with outlets and transport from large cities or washings from the Volta estuary at Adah Foah. (Fig 5.2.11a and b)

For NPD's we see the same pattern and elevated values at G4/0 and 5 metres.

High values of THC, PAH and NPD in the sediment samples is observed at G4/0 and 5 m are located outside Secondi at the beach with the smoke houses east of to the Fishing Harbour. The findings correspond with the increased heavy metal levels observed in sediment samples from the same area (Chapter 5.2.1)

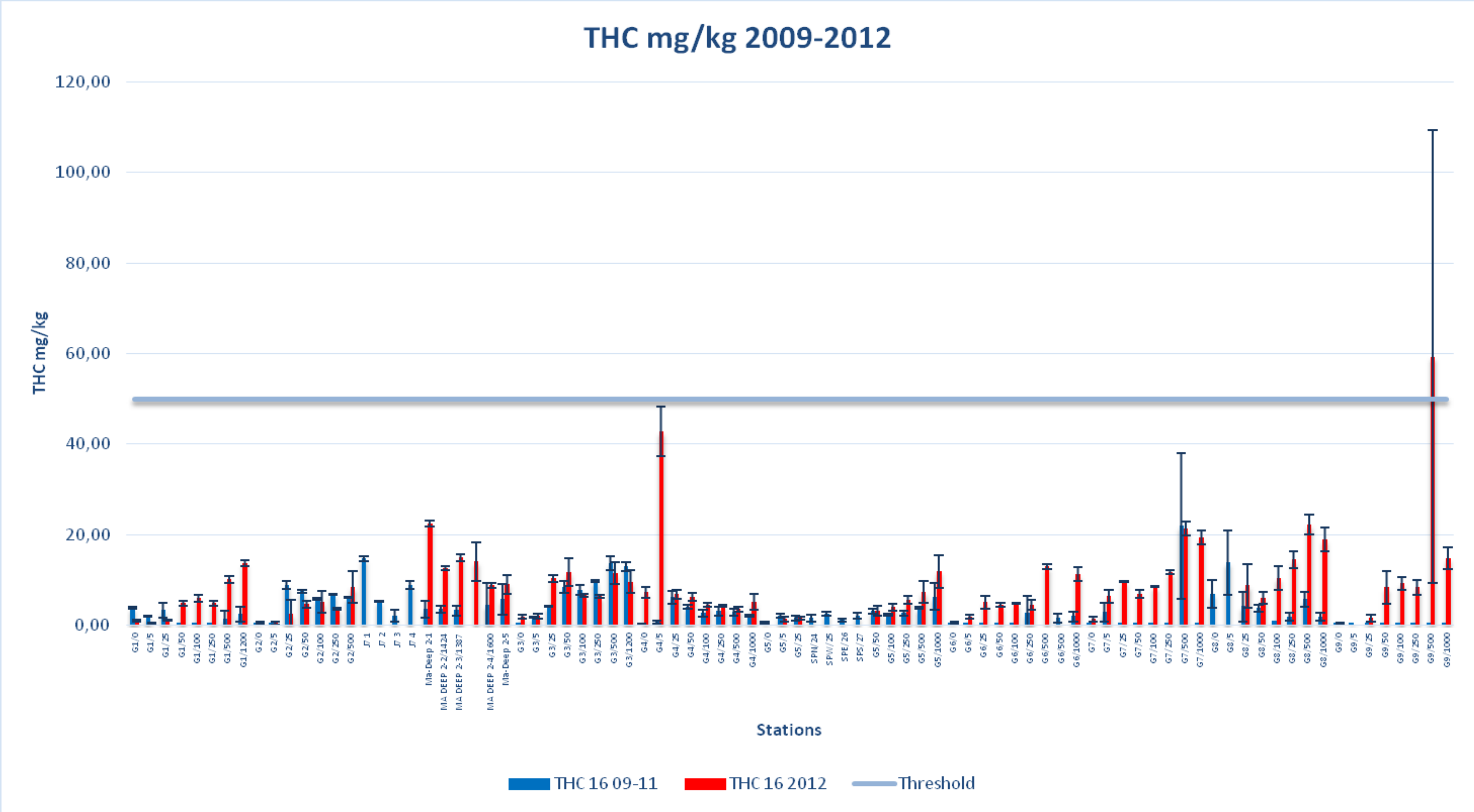


Figure 5.2.10a:. Distribution of THC (C12-35) (average and standard deviation) along the depth strata on G1 to G9. Data lower than the detection limit are presented as half the detection limit, the light blue line represents the threshold value at wich there are risk of environmental effects.

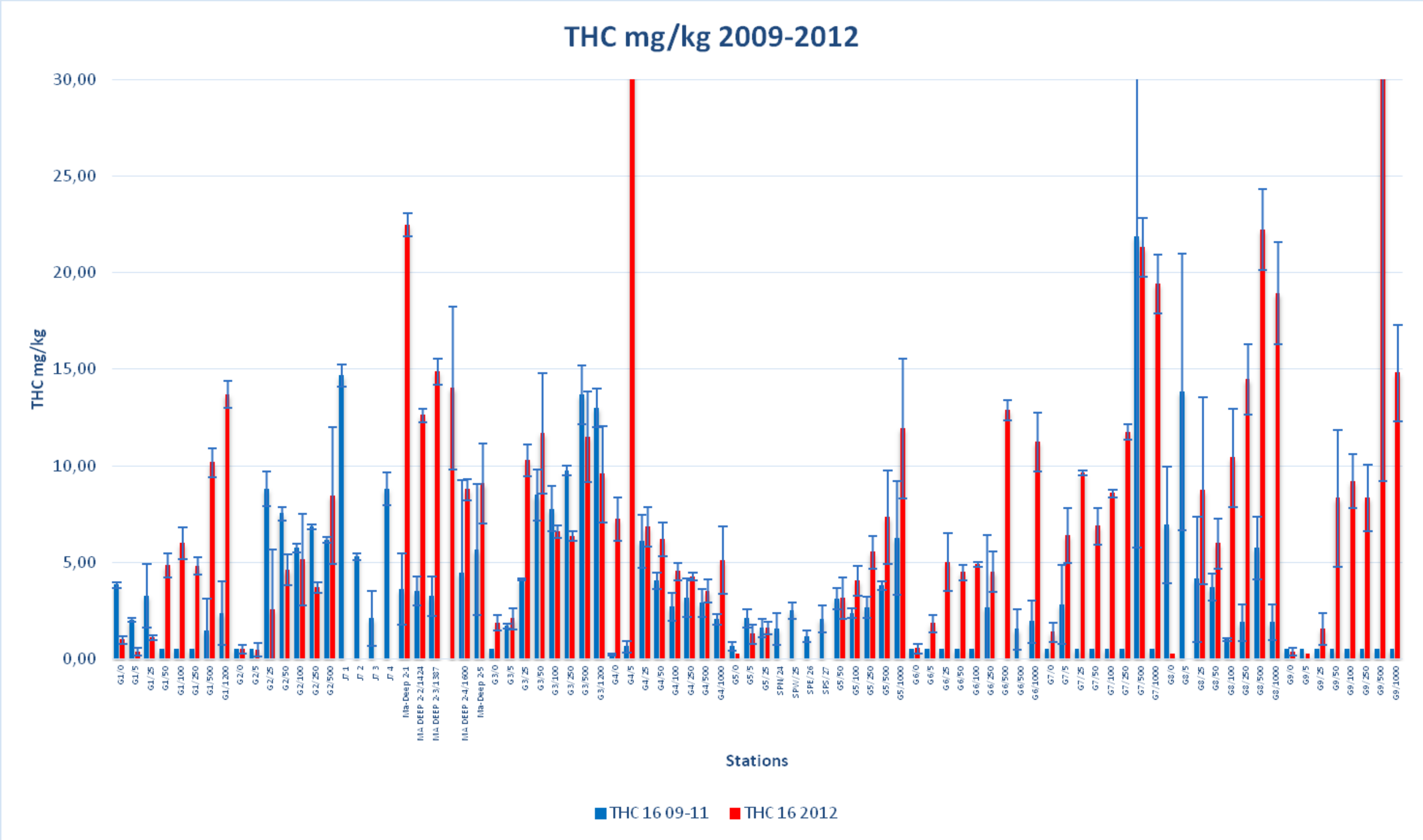
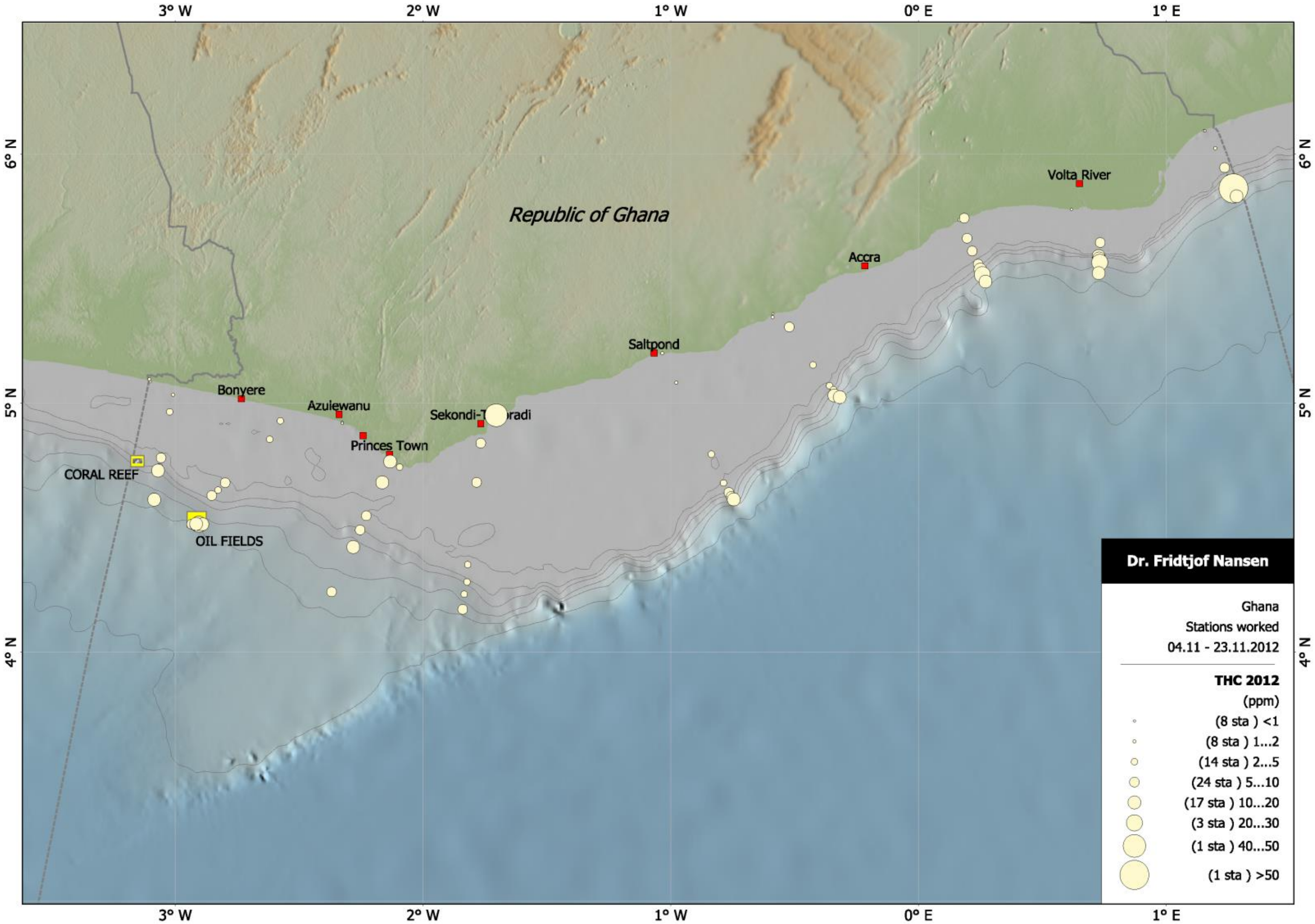


Figure 5.2.10b:. Distribution of THC (C12-35) (average and standard deviation) along the transects G1 to G9. Data lower than the detection limit are presented as half the detection limit. The scale is limited to 30 mg/kg.



Map 5.2.10: Distribution of THC (C12-C35). The circles shows the relative abundance.

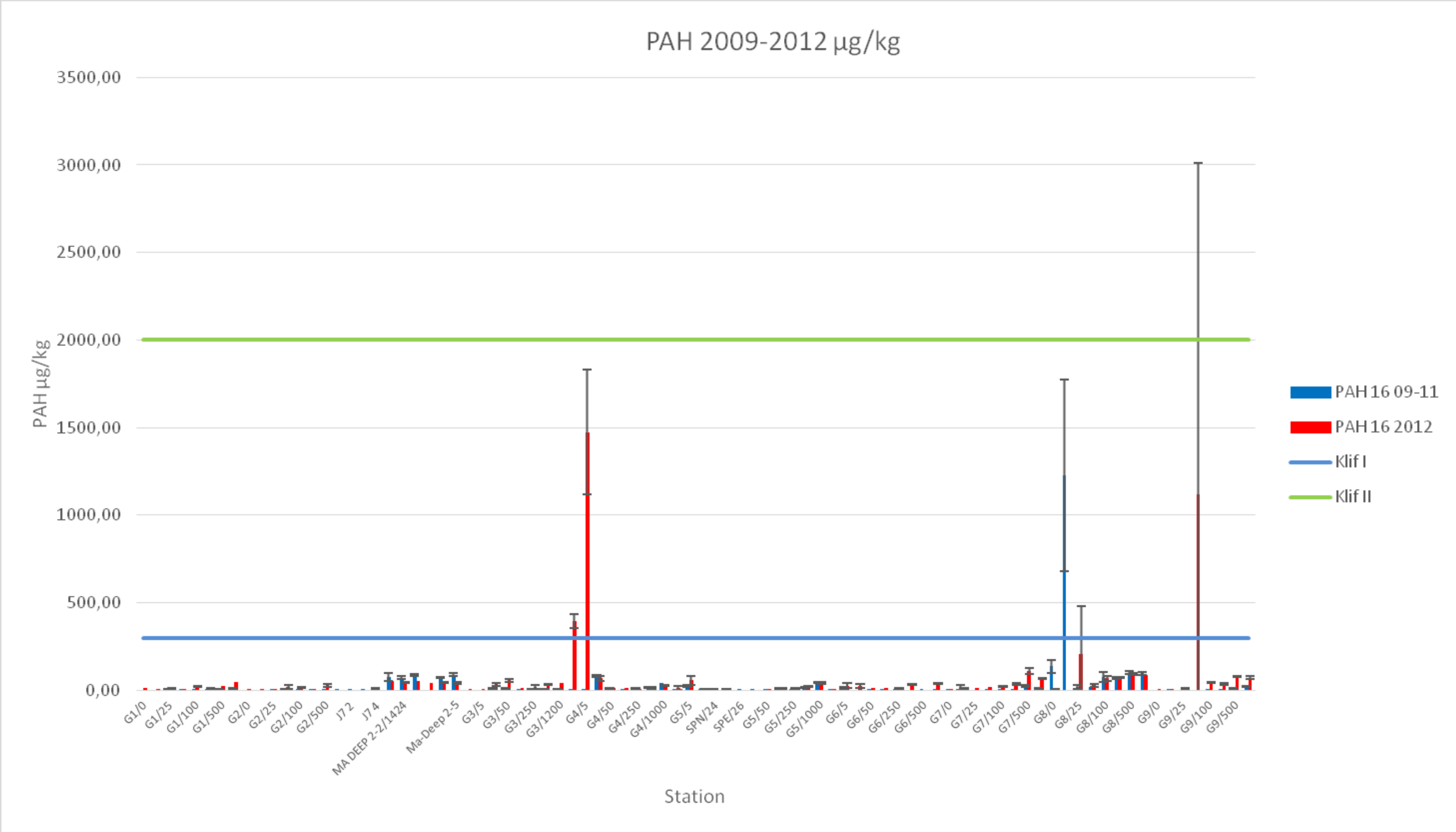


Figure 5.2.11a:. Distribution of the PAH 16 EPA (average and standard deviation) along transects G1 to G9. Data lower than the detection limit are presented as half the detection limit.

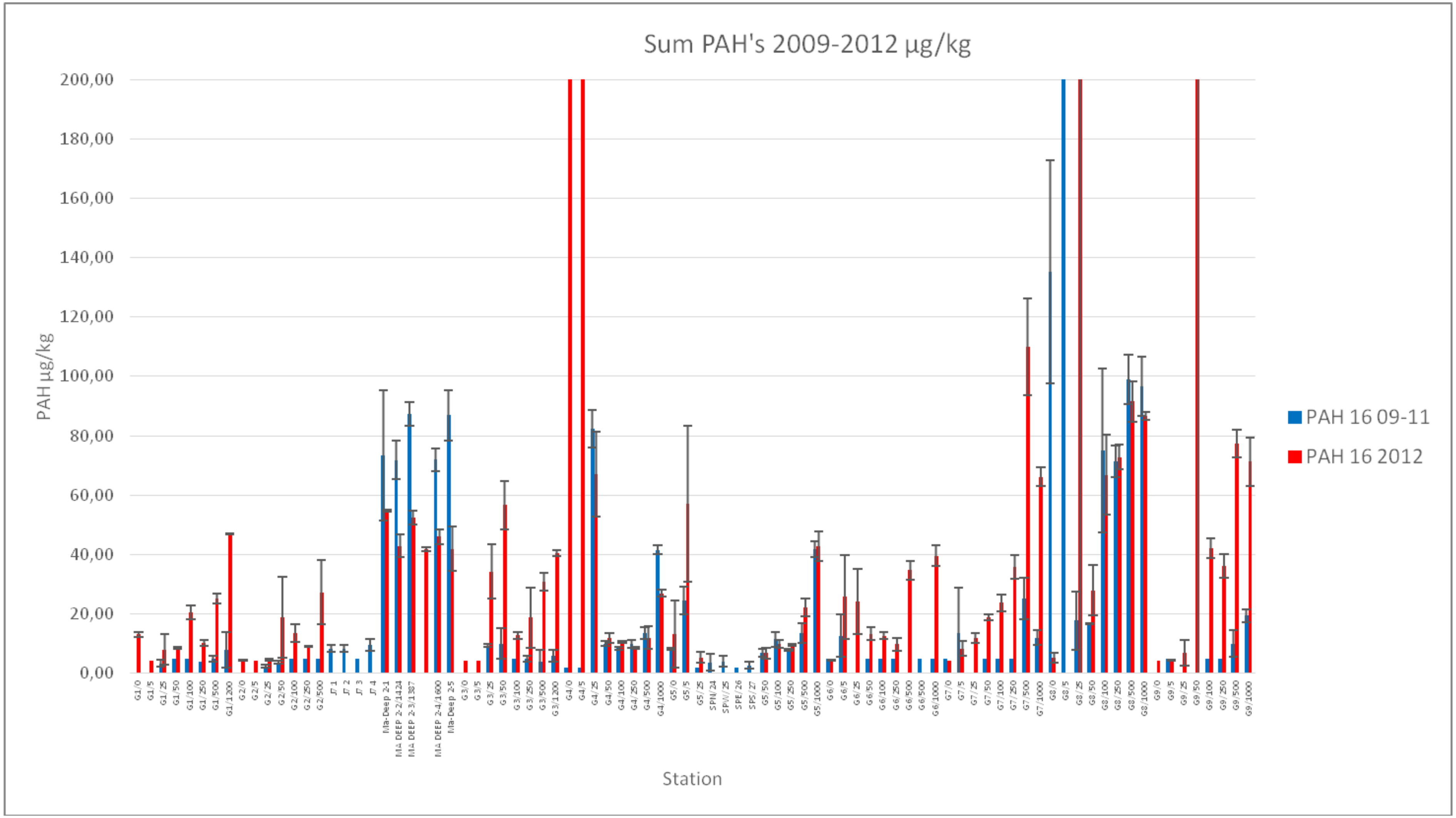


Figure 5.2.11b:. Distribution of the PAH 16 EPA (average and standard deviation) along transects G1 to G9. Data lower than the detection limit are presented as half the detection limit. Scaled to 200 µg/kg.

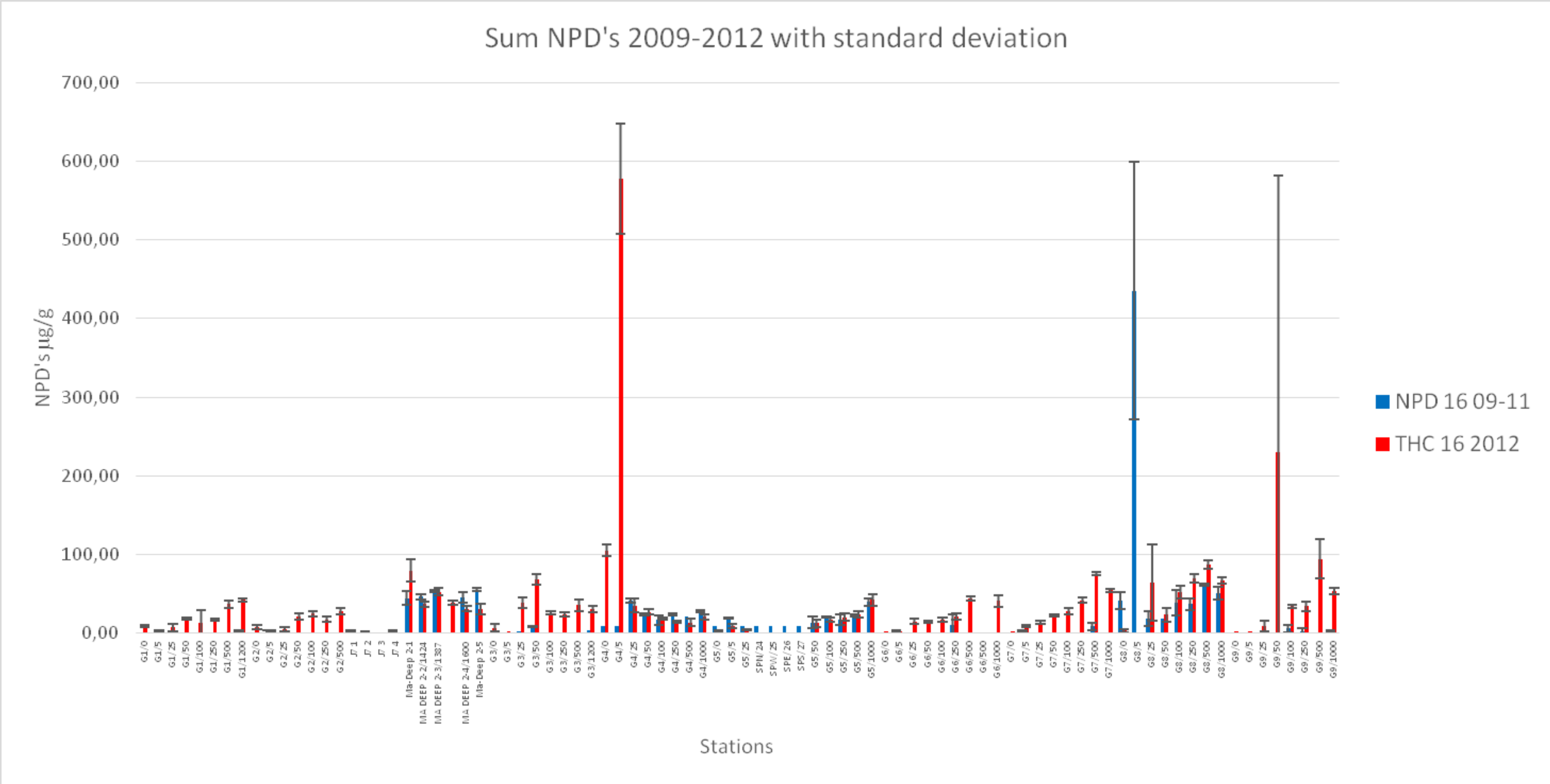


Figure 5.2.12a:. Distribution of NPD's (sum Naphtalene C1, C2, C3, Phenanthren C1, C2, C3 and Dibenzothiophene C1, C2, C3) (average and standard deviation) along transects G1 to G9. Data lower than the detection limit are presented as half the detection limit.

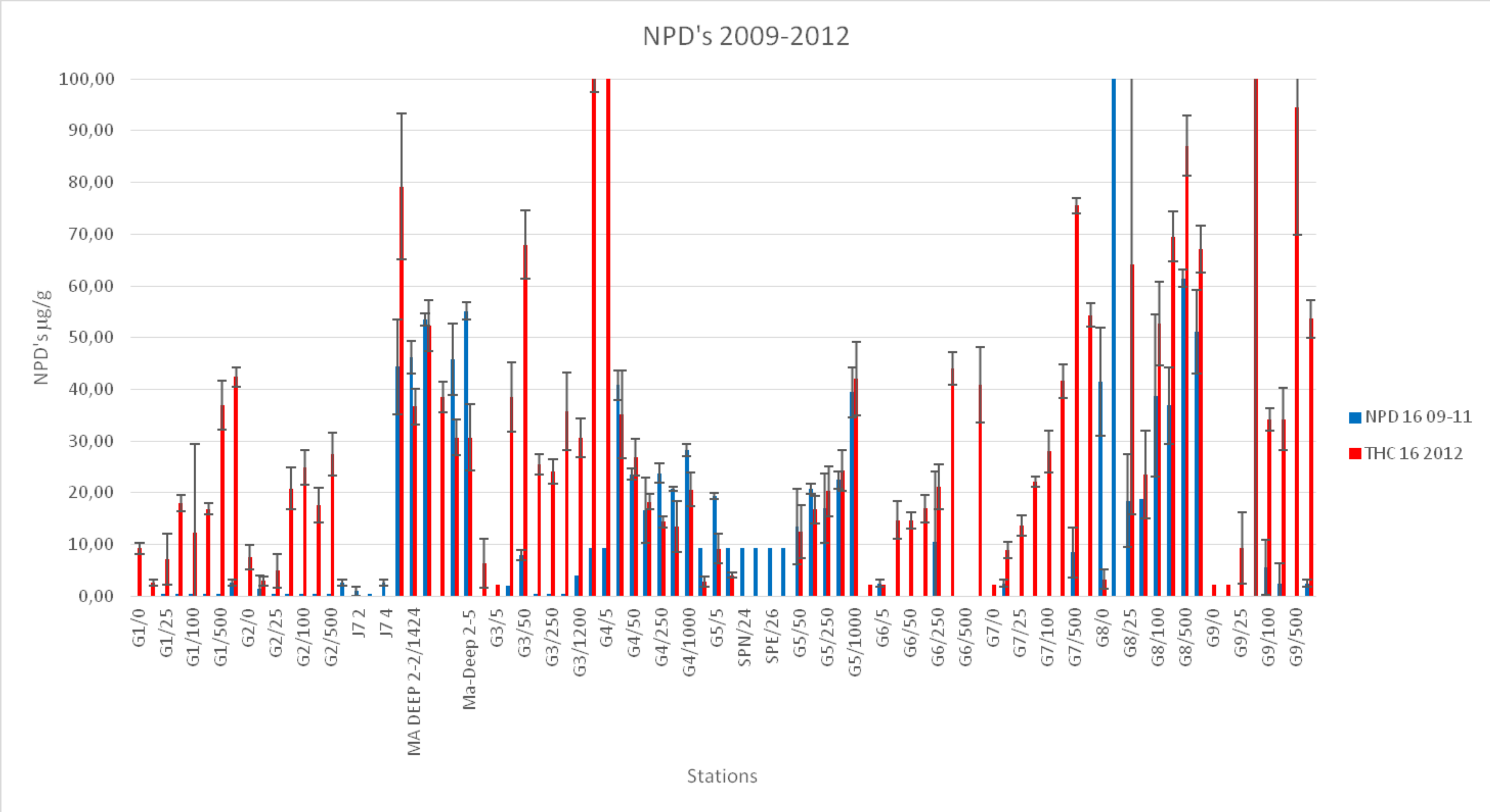


Figure 5.2.12b:. Distribution of NPD's (sum Naphtalene C1, C2, C3, Phenanthrene C1, C2, C3 and Dibenzothiophene C1, C2, C3) (average and standard deviation) along the transects G1 to G9. Data lower than the detection limit are presented as half the detection limit. Scaled to 100 µg/kg.

5.3 Biology

Fauna from the deep water stations.

Macroinvertebrate fauna along the Ghanaian Coast

MATERIAL AND STUDY AREA

The 2012 survey consisted of all the nine transects along the Ghanaian Coast starting from Newtown in the West to Denu in the East. Eight stations were sampled along each transect stretching from the beach to about 1000m water depth and 5 stations at the Mahogany field (deepest station 1600 meters).

A total of 328 benthic samples were collected using Van Veen grabs [0,1m2] together with the VAMS (Video Assisted Monitoring System). The depth range was 0-1600 m and the sampling was done in October and November 2012. Due to limited budgets 228 samples were reported. The material was identified to the lowest possible taxonomic level (mostly families and morphospecies) except of damaged or juvenile individuals.

There are several natural gradients defining the stations going from the beach and shallow waters to the deepest stations at 1000 meters' depth. The beach and the 5m stations are largely characterized by the influence of the heavy wave activity creating a grinding effect. This effect seemed to increase towards the eastern part of the coast line where there are major erosion problems. The oxygen minimum zone, between approximately 200 and 500 meters was also very distinct during the survey period. Each station for biology consisted of 5 replicates except for the 5 m samples; these were limited to 3 replicates for practical reasons. Three samples from each sampling location were analysed.

The complete species list is available in the Appendix.

Sorting procedure of benthic samples
Samples from 25-1600 m was washed on a 0.3 mm sieve, the samples from 0 and 5 meters was sieved trough a 1mm sieve. The sorting of animals was done under the stereo microscope. Even the empty tubes of Polychaeta's and empty shells of mollusks were sorted out to avoid mistakes. Only living specimens were identified and counted. All animals were fixed in 80% ethanol.

Results
Abundance and diversity
23 667 individuals of benthic invertebrates were found in 228 Van Veen grab samples collected in the Ghanaian waters of the Gulf of Guinea at the depth range of 0 – 1600 m. Fauna was dominated by Polychaeta (48% of all specimens), followed by Amphipods (11%) and Bivalves (9 %) (Fig. 5.3.1). No macro fauna was found in seven samples: G1/0m sp 5 22/10/2012, GW1/0m sp 8, G2/0m sp 7, G3/0m sp 5, G3/0m sp 7, G2/5 sp 4 and G9/500m sp 6. 417 taxa were identified in the analyzed material. The most diverse groups were: Cumacea (85 species), Polychaeta (51 families and 8 species), Gastropoda (44 families), Decapoda (39 families), Ophiuroidea (37 species), Isopoda (26 families), Bivalves (25 families), Amphipods (22 families) and Tanaidacea (22 families).

Taxonomic richness expressed as the number of taxa per sample (S) was calculated for each sample. Shannon Index ($H' = - \Sigma p_i \ln p_i$) was also calculated for each sample. Mean values of density (N) and both diversity indices were calculated for each of the studied depth zones (Fig. 5.3.2-4). Mean values of richness, diversity and density in the whole studied material were high (Mean S = 22,1, Mean Shannon Index = 2,2, Mean density = 87,6 ind./0,0,1m^2).

The lowest mean values of taxonomic richness were found in the 0 and 5m zone. The highest mean richness values were observed in the 25 and 50 m zone with 38,7 and 40,2 taxa per sample respectively. In the 100-1600m depth range a clear decrease of richness was observed starting from 29,8 at 100m and ending with 18,7 and 1000-1600m area (Fig. 5.3.2). Nevertheless, it is worth mentioning that richness and diversity was high at all depth ranges except of the shallowest zones (0 and 5m). Similar pattern was observed for diversity values (Fig. 5.3.3). Distribution of abundance along the depth gradient differs from the richness and diversity values. The highest abundance was found at 25 m (207,2 ind./0.2m^2). In the 50-1600m depth range strong decrease in abundance was observed (Fig. 5.3.4).

This pattern was also reflected in the maximum values of richness and density recorded in a single sample at each depth zone (Table 2). The highest richness and density value was recorded in the 25m zone (90 taxa per sample and 1096 individuals per sample) (table 5.3.1. The lowest maximum richness values were found in the shallowest area at 0m depth (12 taxa per sample), while the lowest maximal density was recorded in the 1000-1600m depth range (186 individuals per sample) and in 0m zone (188 individuals per sample). It is worth mentioning that even in the 5 m depth were the mean richness value was relatively low (Fig. 5.3.2) maximal recorded value was still high (37 taxa per sample). The Shannon diversity, evenness, Es (100), number of taxa and individuals are given in table 5.3.2 and 5.3.3 and fig. 5.3.13 to 5.3.21.

The plots for each depth strata are given in the appendix together with the ten most abundant species for each station.

Table 5.3.1. Maximum richness and density value recorded for a single sample in each depth zone studied.

Depth zone	Maximum S value in single sample	Maximum density value in single sample
0m	12	188
5m	37	691
25m	90	1096
50	68	364
100m	51	181
250m	37	204
500m	41	278
1000-1300m	44	186

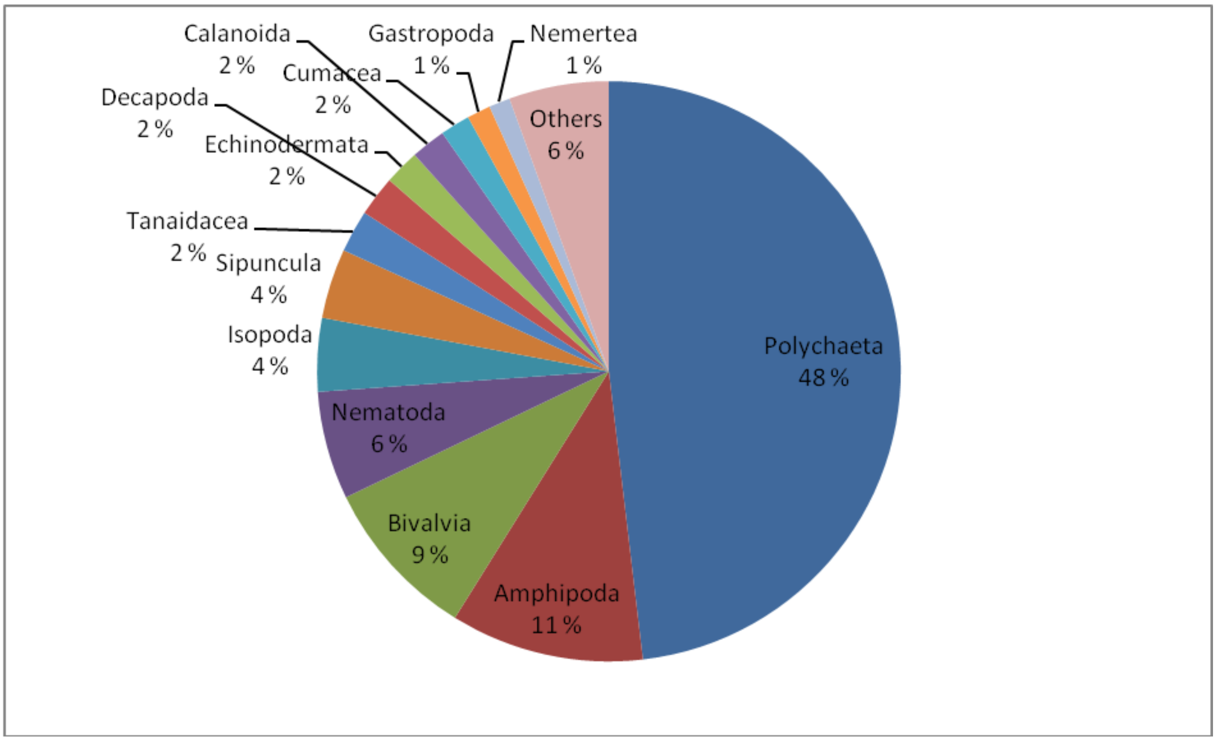


Figure 5.3.1. Dominance structure (percentage of the individuals of a particular taxonomic group in a total number of individuals) of macroinvertebrate fauna in the studied material.

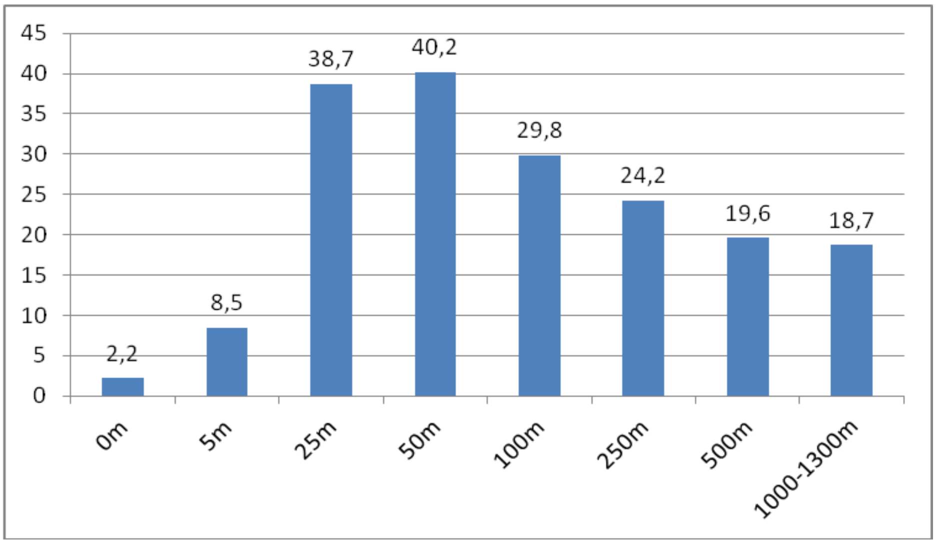


Figure 5.3.2. Mean value of taxonomic richness (S - number of taxa per sample) at each studied depth zone.

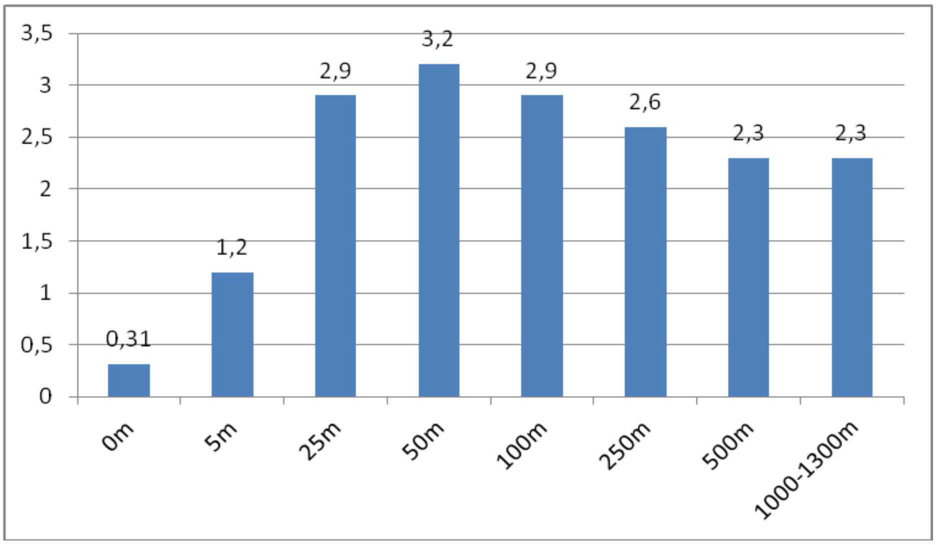


Figure 5.3.3. Mean value of diversity (H - Shannon Index (Log e base)) at each studied depth zone.

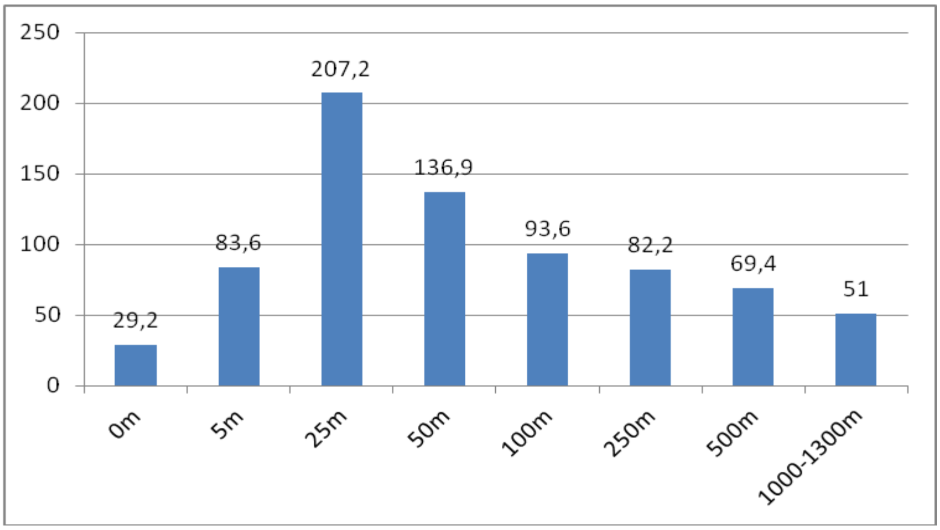


Figure 5.3.4. Mean value of density [ind./0.1m²] at each studied depth zone.

Composition of fauna along the depth gradient.

Differences in dominance structure and composition of fauna were also observed along depth gradient (Fig. 5.3.5-12). Polychaeta dominated in all depth zones except of the shallowest area, which was dominated by Isopoda (86%) and Amphipods (27%). The 5m depth zone was strongly dominated by Polychaeta (71% of the fauna). It is also worth mentioning that this area was dominated by only three groups of macro fauna. Besides Polychaeta only Amphipods (27%) and Bivalves (14%) were among the most numerous taxa. Polychaeta and Amphipods dominated in the 25 and 50m depth zones followed by Bivalves and Nematodes (Fig. 5.3.7-8). Dominance structure was similar in the 100m depth zone, however in this depth Amphipods (7%) and Sipuncula (5%) were also among main dominants (Fig. 9). 250 and 500m depth zones were dominated by Polychaeta (55% and 41% respectively, although Bivalves, Sipuncula and Nematodes were also abundant in this zone (Fig. 5.3.10 and 11). Polychaeta (44%) and Nematodes (10%) dominated in the deepest zone, followed by Isopoda (8%) and Tanaidacea (7%) (Fig. 5.3.12).

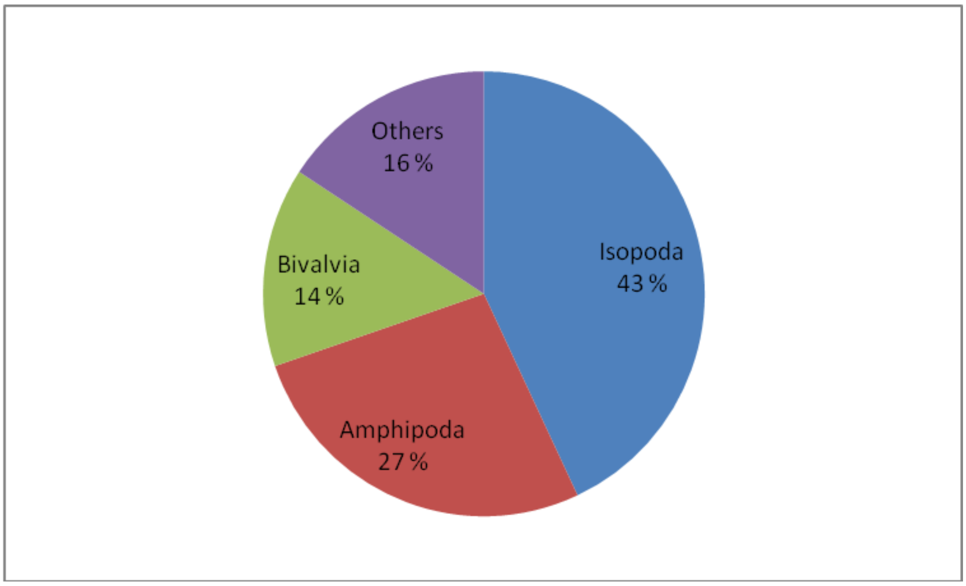


Figure 5.3.5. Dominance structure (percentage of the individuals of a particular taxonomic group in a total number of individuals) of macroinvertebrate fauna in the 0m zone.

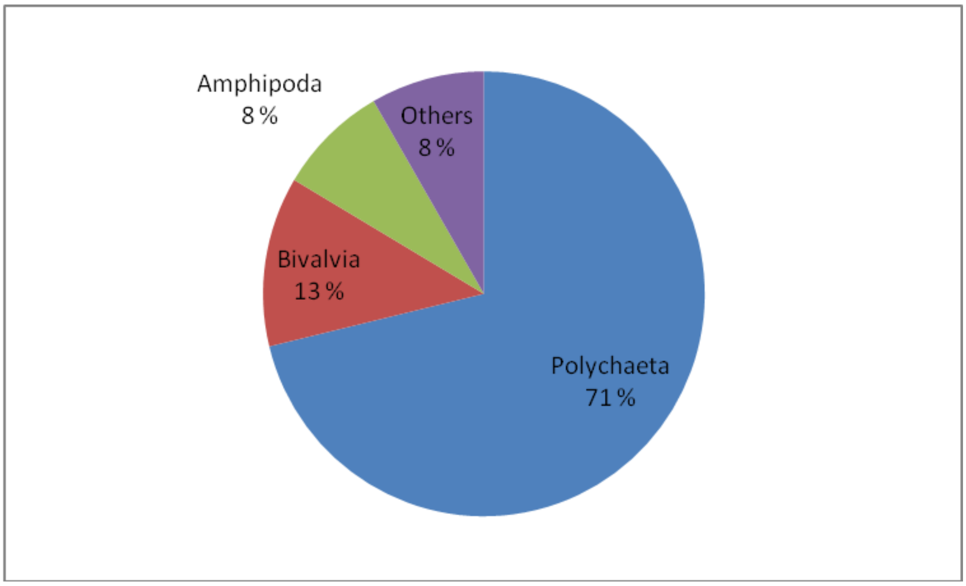


Figure 5.3.6. Dominance structure (percentage of the individuals of a particular taxonomic group in a total number of individuals) of macroinvertebrate fauna in the 5m zone.

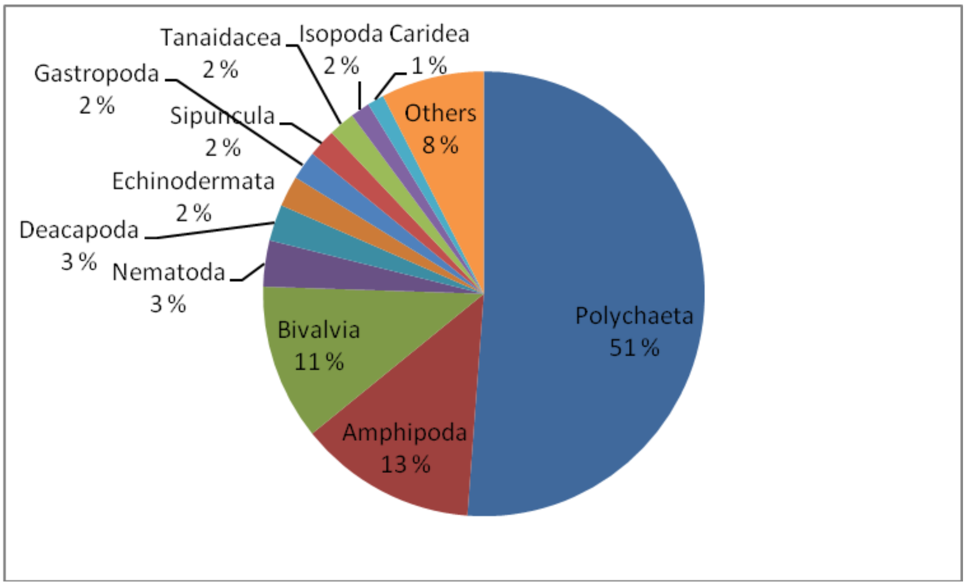


Figure 5.3.7. Dominance structure (percentage of the individuals of a particular taxonomic group in a total number of individuals) of macroinvertebrate fauna in the 25m zone.

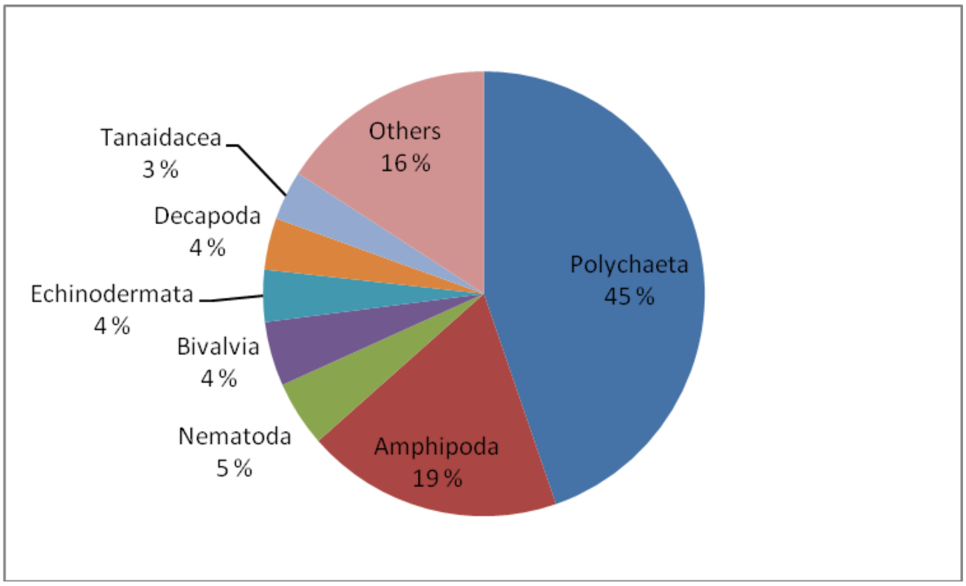


Figure 5.3.8. Dominance structure (percentage of the individuals of a particular taxonomic group in a total number of individuals) of macroinvertebrate fauna in the 50m zone.

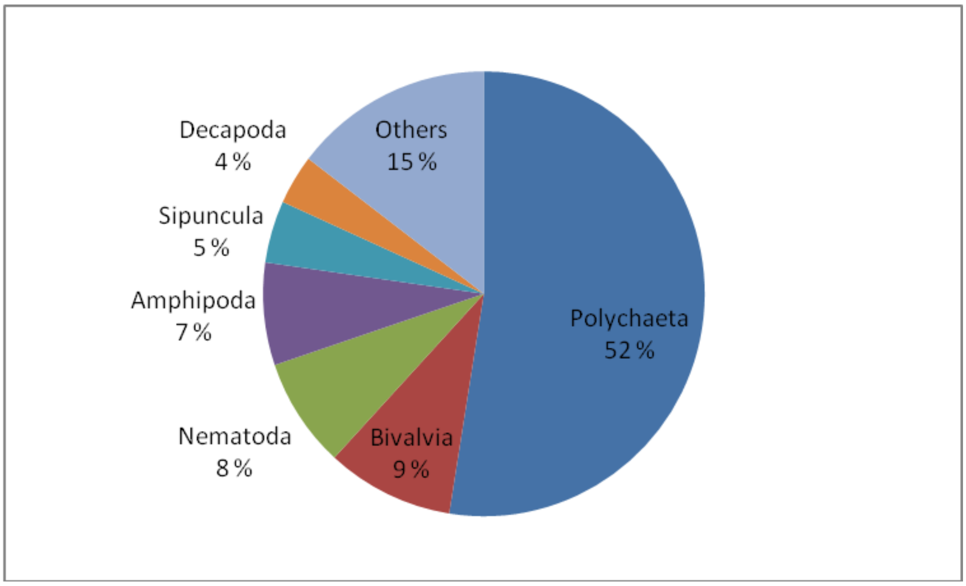


Figure 5.3.9. Dominance structure (percentage of the individuals of a particular taxonomic group in a total number of individuals) of macroinvertebrate fauna in the 100m zone.

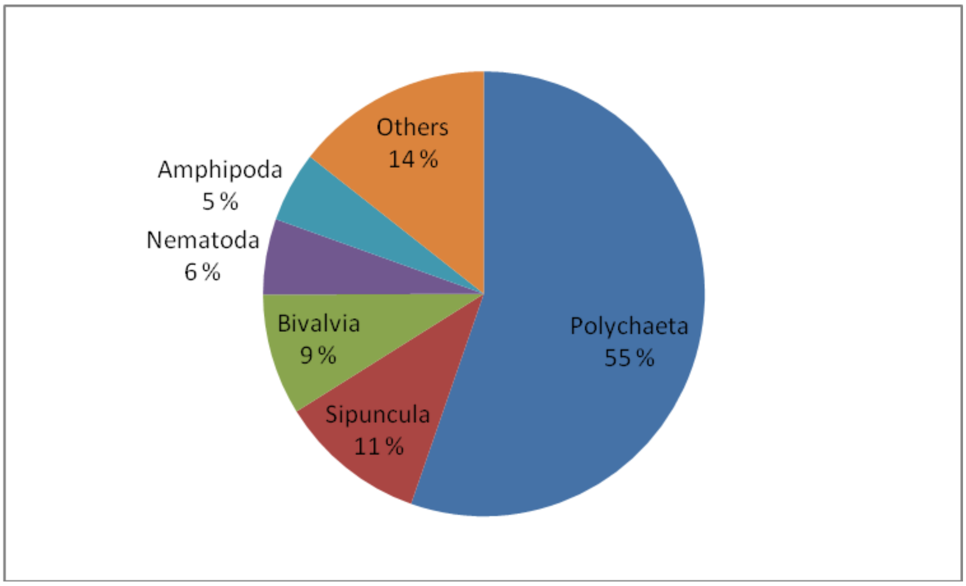


Figure 5.3.10. Dominance structure (percentage of the individuals of a particular taxonomic group in a total number of individuals) of macroinvertebrate fauna in the 250m zone.

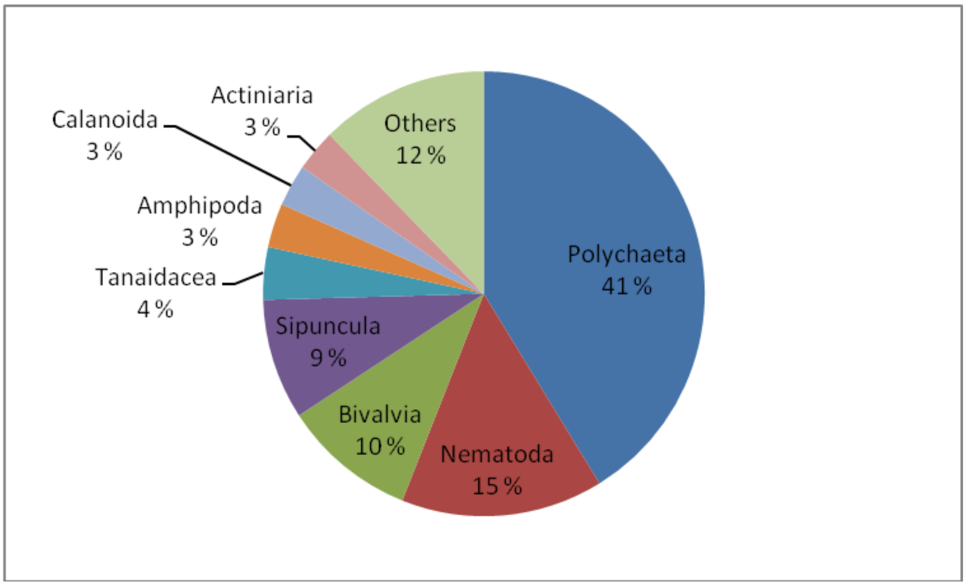


Figure 5.3.11. Dominance structure (percentage of the individuals of a particular taxonomic group in a total number of individuals) of macroinvertebrate fauna in the 500m zone.

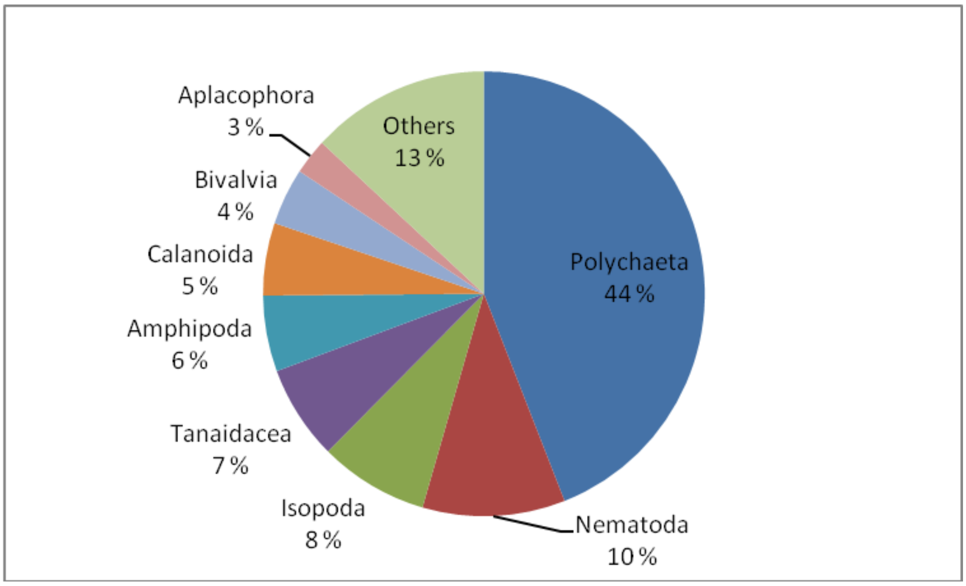


Figure 5.3.12. Dominance structure (percentage of the individuals of a particular taxonomic group in a total number of individuals) of macroinvertebrate fauna in the 1000-1300m zone.

Table 5.3.2 Number of individuals, species, diversity (H'), evenness (J) and max. diversity (H'max) for each station along the transects of the Ghanaian coast. 1mm mesh for 0 and 5m stations.

Station	Species S	Specimens N	Richness d	Evenness J'	ES(100)	Shannon H'(loge)	Shannon H'(log2)
G 1/0	20	134	3.88	0.79	18	2.36	3.40
G2/0	3	7	1.03	0.87	3	0.96	1.38
G3/0	7	152	1.19	0.65	6	1.27	1.83
G4/0	12	318	1.91	0.16	5	0.40	0.58
G5/0	5	170	0.78	0.22	4	0.35	0.50
G6/0	1	109	0.00		1	0.00	0.00
G7/0	2	91	0.22	0.09	2	0.06	0.09
G8/0	4	6	1.67	0.90	4	1.24	1.79
G9/0	2	14	0.38	0.37	2	0.26	0.37
G1/5	6	21	1.64	0.69	6	1.23	1.78
G2/5							
G3/5	10	23	2.87	0.88	10	2.02	2.91
G4/5	46	1785	6.01	0.53	19	2.05	2.95
G5/5	14	20	4.34	0.95	14	2.51	3.62
G6/5	18	78	3.90	0.87	18	2.51	3.62
G7/5	16	58	3.69	0.72	16	2.00	2.89
G8/5							
G9/5	7	8	2.89	0.98	7	1.91	2.75

Table 5.3.2 continued. Number of individuals, species, diversity (H'), evenness (J) and max. diversity (H'max) for each station along the transects of the Ghanaian coast. 0,3mm mesh for 25 -100m stations.

Station	Species S	Specimens N	Richness d	Evenness J'	ES(100)	Shannon H'(loge)	Shannon H'(log2)
G1/25	70	373	11.65	0.88	41.14	3.73	5.39
G2/25	56	401	9.18	0.81	32.83	3.24	4.68
G3/25	58	615	8.88	0.67	27.08	2.74	3.95
G4/25	54	271	9.46	0.87	36.06	3.46	5.00
G5/25	64	407	10.48	0.85	38.49	3.55	5.12
G6/25	96	1150	13.48	0.80	40.33	3.66	5.29
G7/25	116	1789	15.36	0.77	40.07	3.66	5.28
G8/25	74	661	11.24	0.81	35.93	3.50	5.04
G9/25	71	667	10.76	0.69	28.01	2.94	4.24
G1/50	96	563	15.00	0.86	46.03	3.92	5.66
G2/50	97	617	14.94	0.79	43.63	3.63	5.23
G3/50	49	264	8.61	0.83	32.94	3.25	4.68
G4/50	85	457	13.71	0.84	42.82	3.74	5.39
G5/50	89	663	13.55	0.86	43.14	3.88	5.59
G6/50	98	998	14.05	0.82	41.24	3.78	5.45
G7/50	65	180	12.32	0.92	49.10	3.85	5.55
G8/50	66	338	11.16	0.88	40.99	3.67	5.30
G9/50	34	87	7.39	0.89	34.00	3.15	4.54
G1/100	50	208	9.18	0.86	36.18	3.36	4.84
G2/100	69	410	11.30	0.86	39.85	3.65	5.27
G3/100	62	291	10.75	0.88	39.98	3.65	5.27
G4/100	50	339	8.41	0.83	31.59	3.25	4.68
G5/100	66	387	10.91	0.84	37.15	3.51	5.06
G6/100	52	313	8.88	0.83	32.45	3.28	4.74
G7/100	61	345	10.27	0.79	35.01	3.24	4.68
G8/100	33	149	6.39	0.81	26.57	2.82	4.07
G9/100	65	440	10.51	0.77	34.07	3.21	4.64

Table 5.3.2 continued. Number of individuals, species, diversity (H'), evenness (J) and max. diversity (H'max) for each station along the transects of the Ghanaian coast. 0,3mm mesh for 250 - 1600m stations.

Station	Species S	Specimens N	Richness d	Evenness J'	ES(100)	Shannon H'(loge)	Shannon H'(log2)
G1/250	43	346	7.18	0.79	27.64	2.96	4.28
G2/250	61	329	10.35	0.85	37.87	3.50	5.05
G3/250	48	224	8.68	0.87	34.32	3.36	4.85
G4/250	55	206	10.14	0.90	40.54	3.59	5.18
G5/250	37	282	6.38	0.72	24.32	2.60	3.75
G6/250	51	235	9.16	0.85	36.19	3.34	4.81
G7/250	55	488	8.72	0.73	27.64	2.94	4.24
G8/250	49	336	8.25	0.76	28.75	2.98	4.29
G9/250	31	108	6.41	0.84	29.99	2.90	4.18
G1/500	54	425	8.76	0.78	28.81	3.12	4.50
G2/500	46	283	7.97	0.88	32.55	3.36	4.84
G3/500	41	272	7.14	0.72	26.06	2.68	3.87
G4/500	36	509	5.62	0.57	17.59	2.04	2.95
G5/500	53	329	8.97	0.80	32.22	3.17	4.57
G6/500	56	215	10.24	0.83	37.67	3.36	4.84
G7/500	35	77	7.83	0.82	35.00	2.93	4.23
G8/500	60	333	10.16	0.77	35.12	3.16	4.56
G9/500	26	52	6.33	0.92	26.00	3.00	4.33
G1/1200	54	319	9.19	0.84	33.49	3.35	4.84
MA 2-1	30	84	6.55	0.92	30.00	3.13	4.52
MA 2-2	12	19	3.74	0.96	12.00	2.38	3.43
MA 2-3	65	280	11.36	0.92	45.32	3.84	5.53
MA 2-4	4	7	1.54	0.92	4.00	1.28	1.84
MA 2-5	41	319	6.94	0.78	26.81	2.91	4.20
G3/1200	50	250	8.87	0.82	32.93	3.20	4.62
G4/1000	48	188	8.98	0.88	36.40	3.42	4.93
G5/1000	39	103	8.20	0.86	38.44	3.17	4.57
G6/1000	54	372	8.95	0.75	28.24	2.98	4.30
G7/1000	34	78	7.57	0.90	34.00	3.16	4.56
G8/1000	42	205	7.70	0.85	31.68	3.19	4.60
G9/1000	14	17	4.59	0.98	14.00	2.59	3.73

Evaluation of the species composition.

The budget for the 2012 survey restricted the biological analysis to three replicates compared to 5 from the previous years. The material was mostly determined to family level. More replicates and effort to taxonomy would have given a better resolution. The current resolution makes it difficult to see finer shifts in the fauna induced by different variables such as oxygen, temperature and lighter anthropogenic disturbances.

Taking the above into account the overall results from the species composition suggests that the benthic communities in the investigated area are in good condition. There are however two places that stands out from the rest of the material: The Takoradi beach and the Mahogany field.

Judging from the geometric classes plots three stations separates from the rest;

The G4/5 (Fig 5.3.24) stretches to class X with 950 of the polychaete family Oweniidae. These are tube dwelling filter feeders and are regarded as a tolerant family in terms of organic enrichment. The numbers of specimens are much higher here than the rest of the 5 meter stations and the high number of polychaete from one family could indicate a source of organic enrichment in this area. The diversity is still high so the location has not exceeded its carrying capacity. The same station also stands out in the chemical analysis with increasing values in most of the measured parameters.

The other two stations are MA 2-2 and 2-4 at the Mahogany field. These stations had few taxa and individuals, but as it turned out these two only consisted of one sample each making it speculative to draw any conclusions from it.

The dendrogram fig. 5.3.38 shows that the samples group together mainly along the depth strata it also singles out the two stations at the Mahogany field, most likely because of the lack of data.

Plots for number of taxa, number of individuals, and diversity plots are given below.

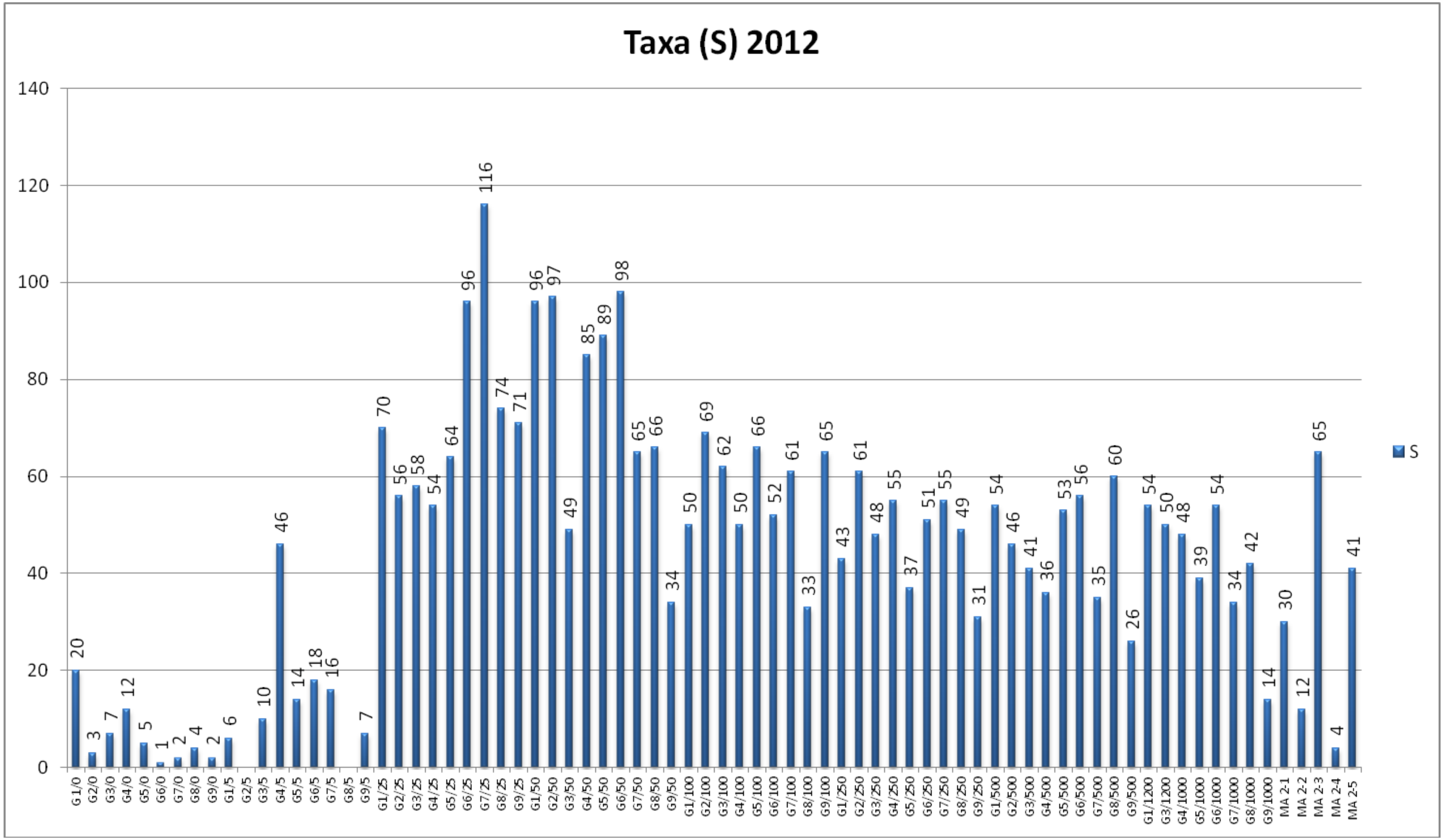


Figure 5.3.13: number of taxa on each station, representing 0.3m² sampled area by depth.

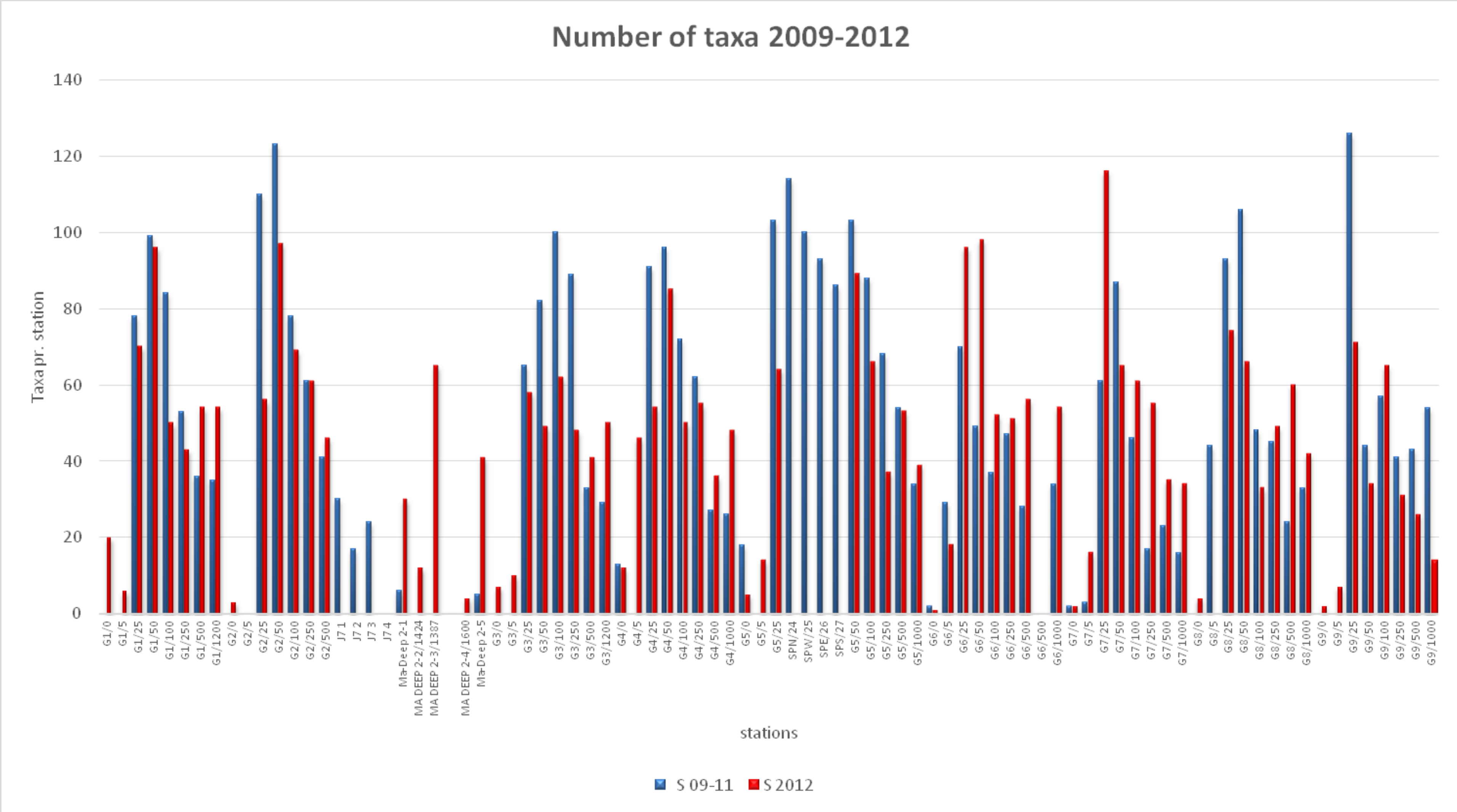


Figure 5.3.14: Number of taxa on each station 2009-2012, representing 0.3m² sampled area by depth.

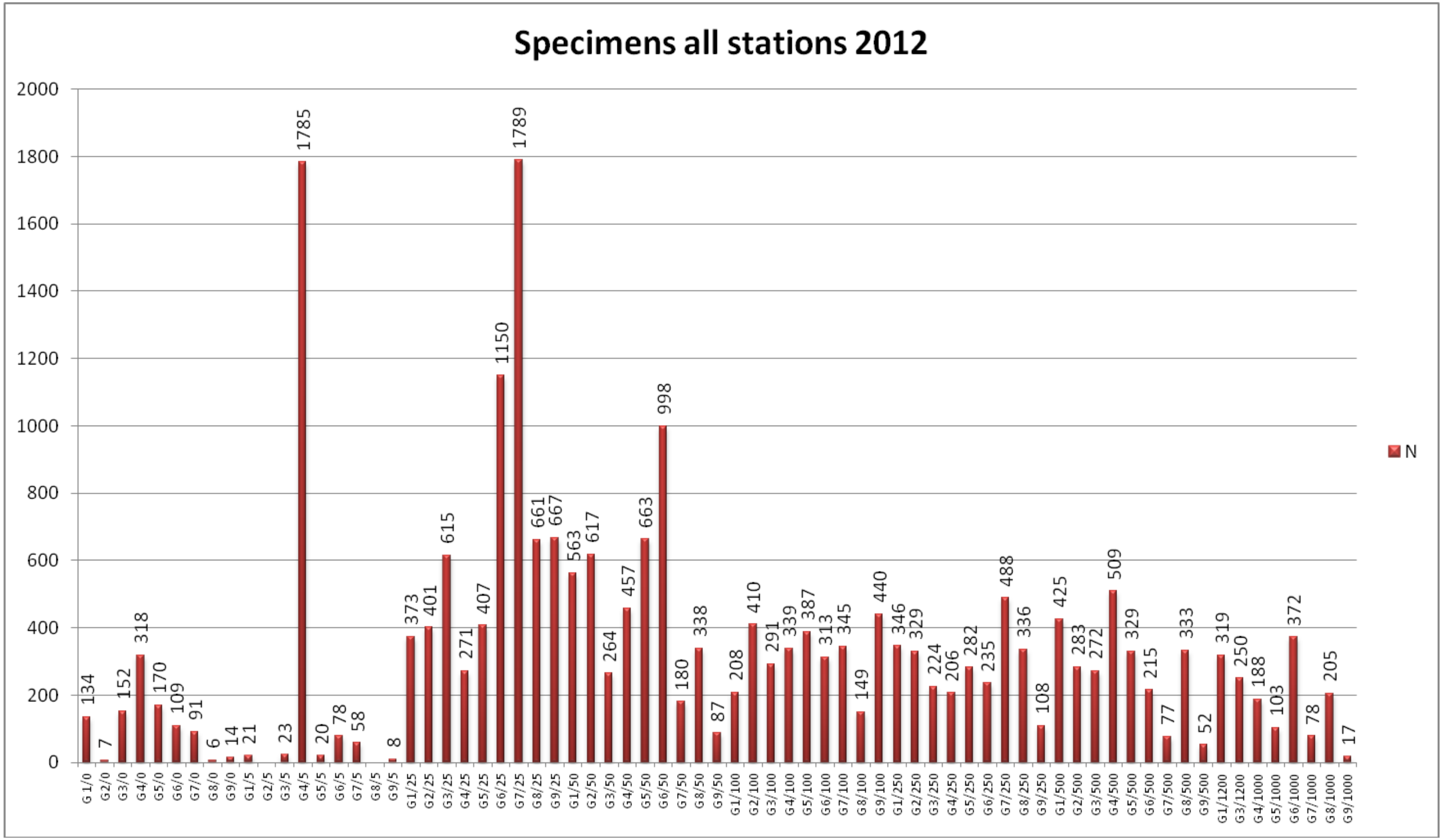


Figure 5.3.15: number of specimens on each station 2012, representing 0.3m² sampled area by depth.

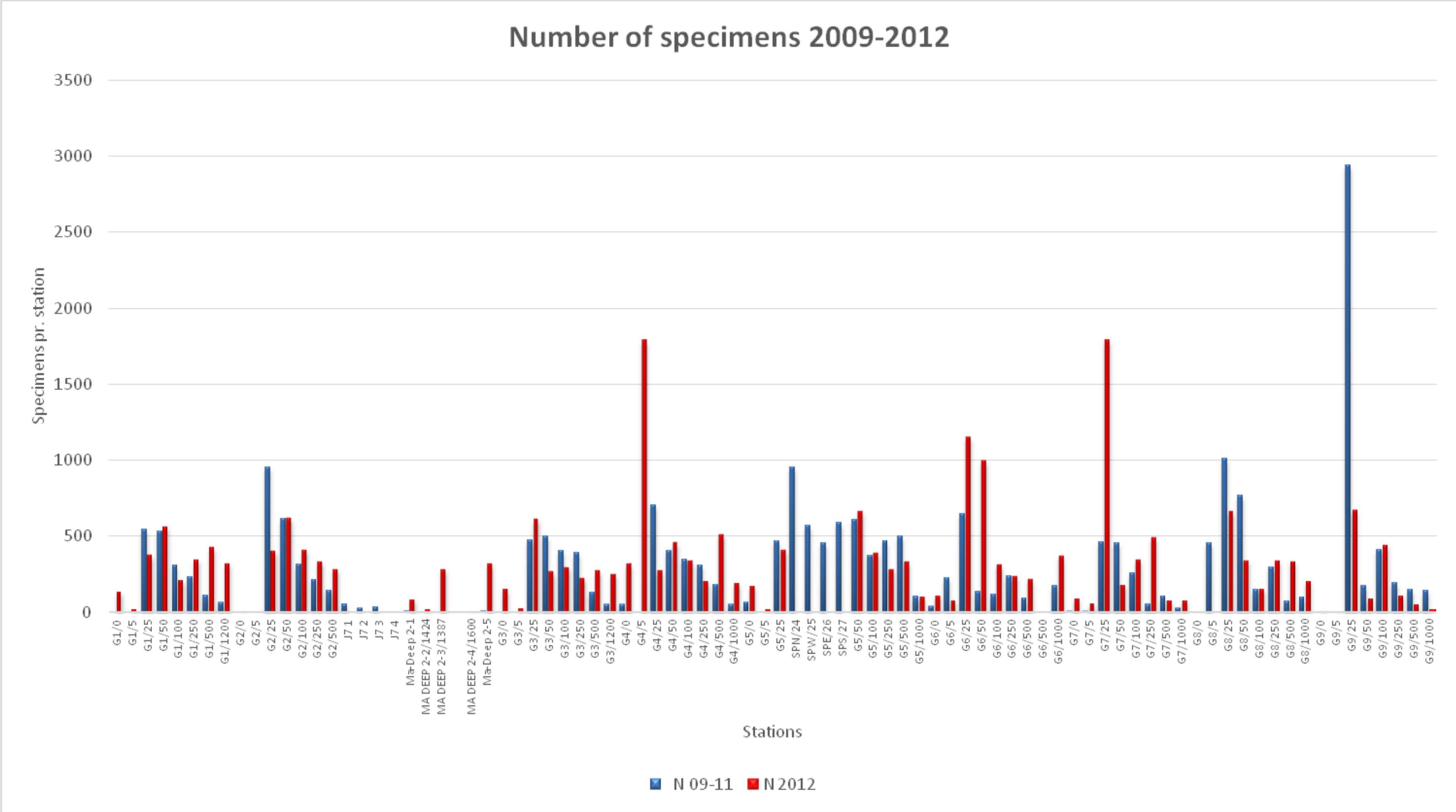


Figure 5.3.16: Number of specimens on each station 2009 -2012, representing 0.3m² sampled area by depth

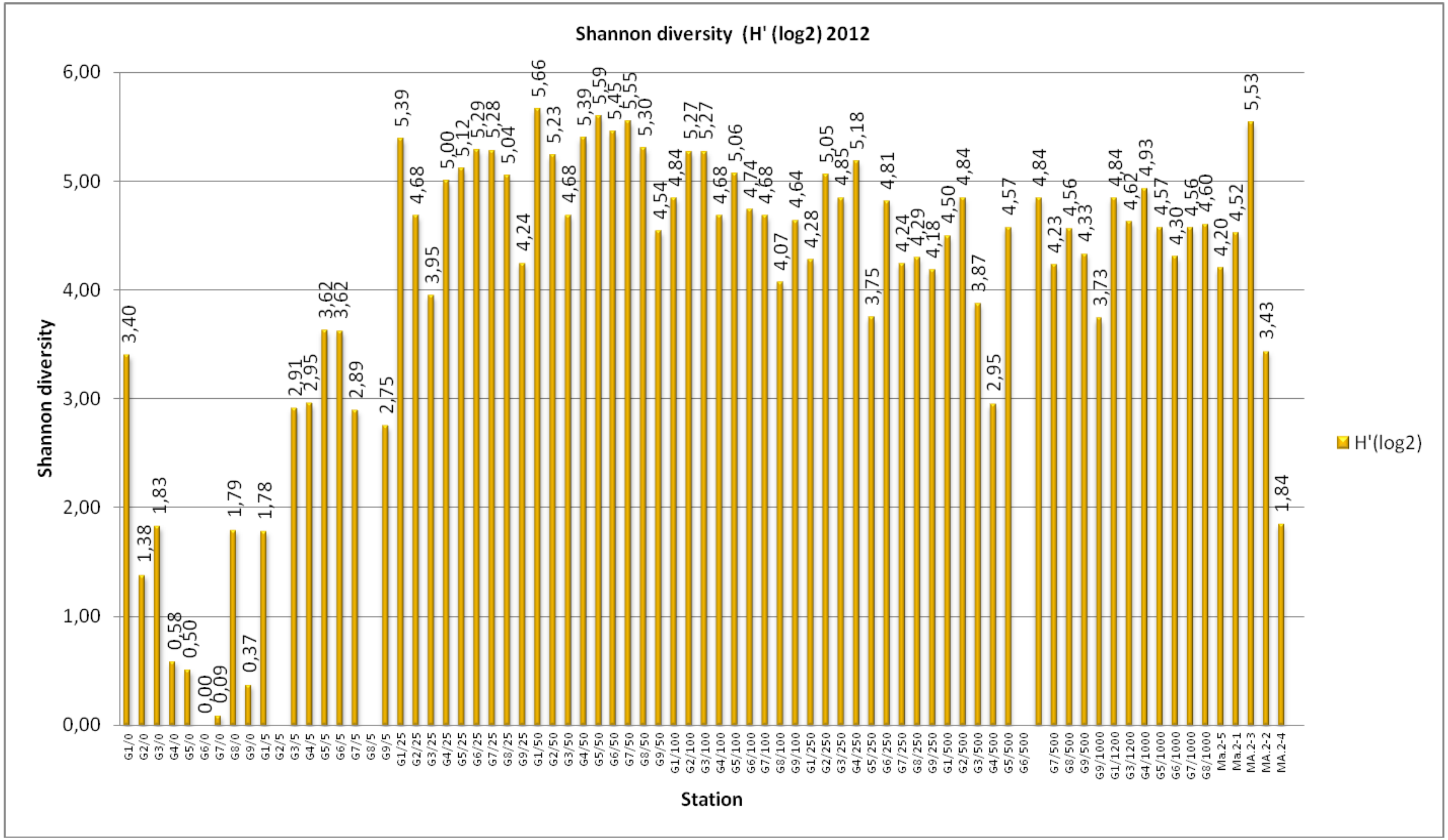


Figure 5.3.17: Shannon diversity for each station, representing 0.3m^2 sampled area by depth.

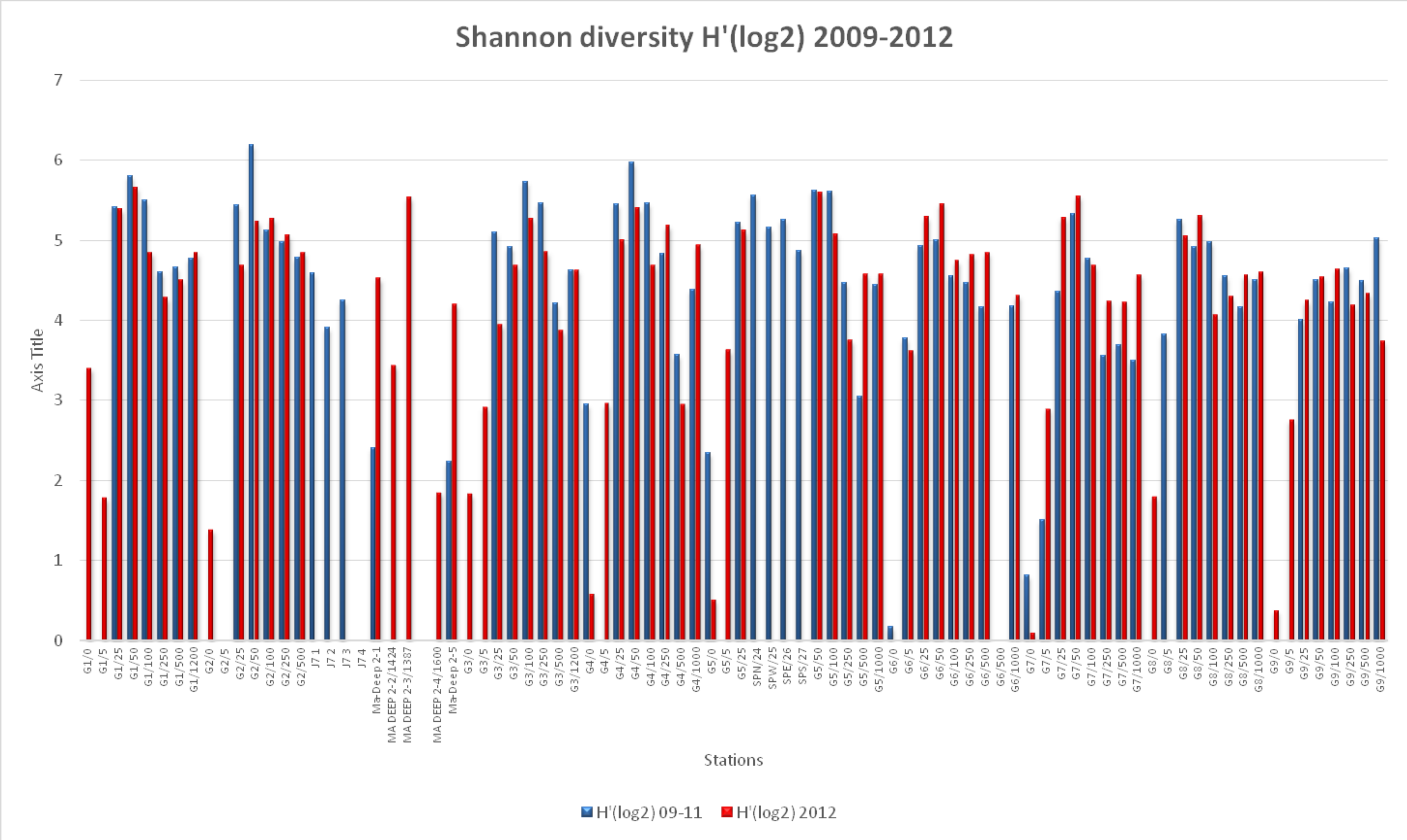


Figure 5.3.18: Shannon diversity for each station 2009-2012, representing 0.3m² sampled area by depth

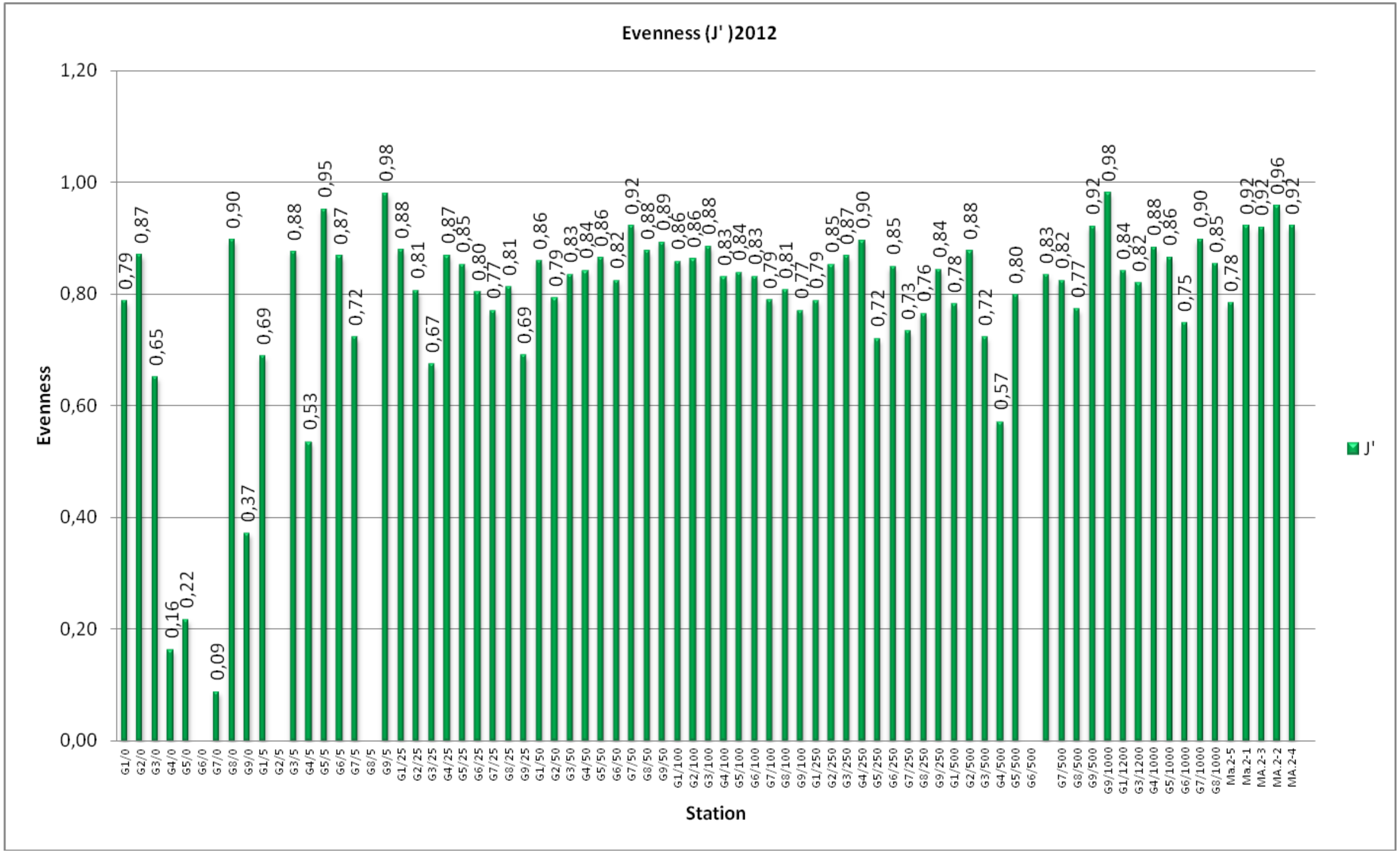


Figure 5.3.19: Evenness for each station, representing 0.3m^2 sampled area by depth.

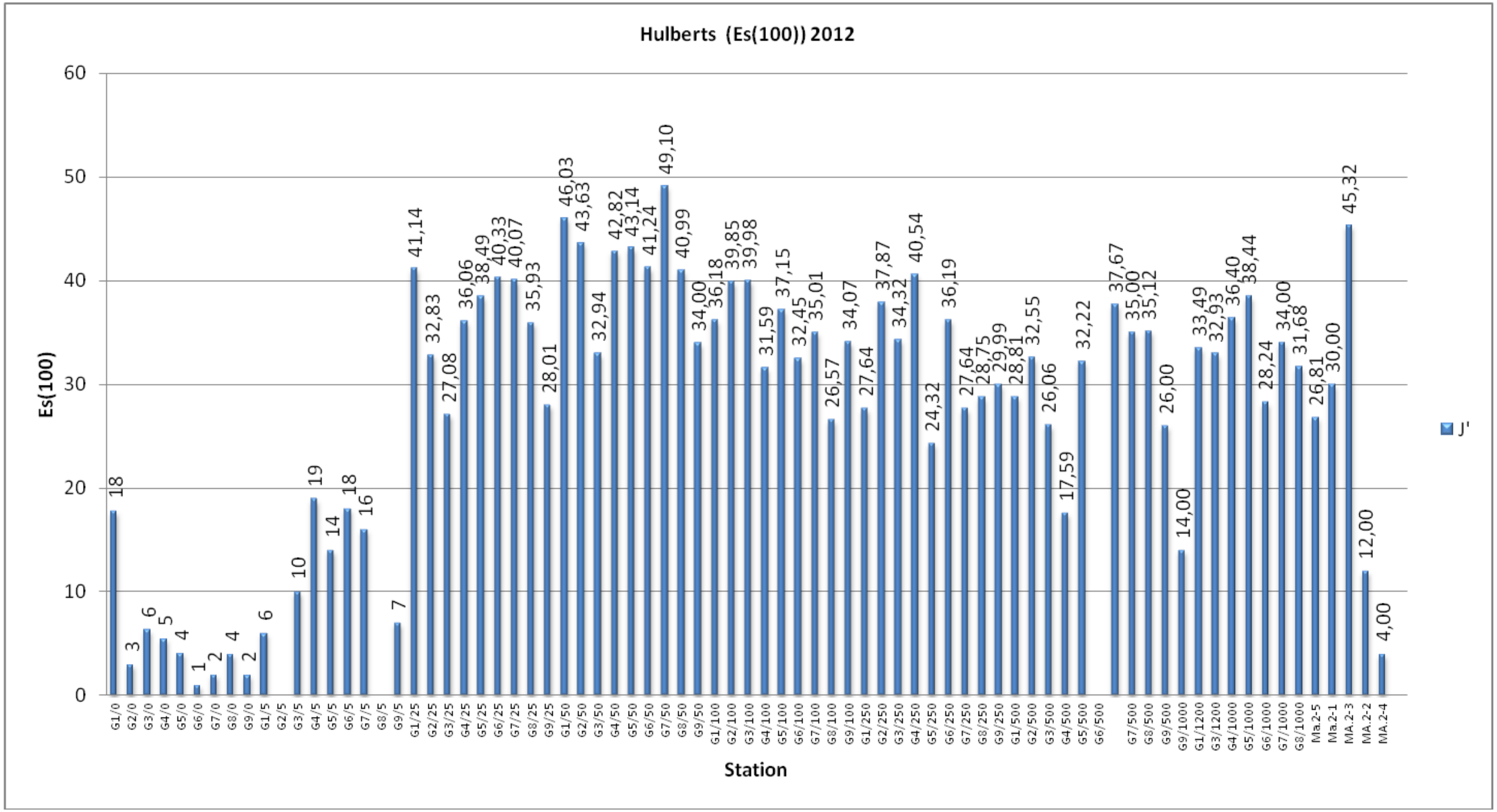


Figure 5.3.20: Es (100) for each station, representing 0.3m² sampled area by depth.

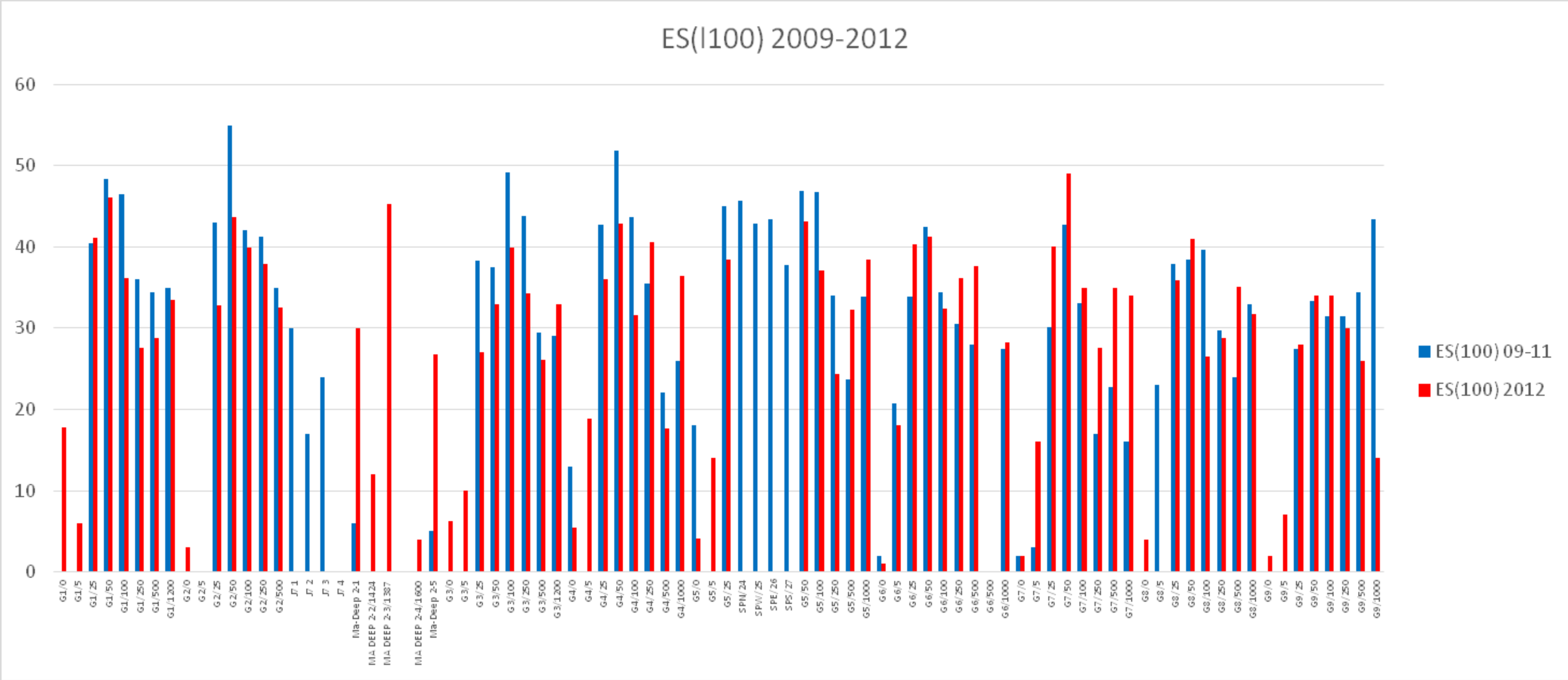


Figure 5.3.21: Es (100) for each station 2009-2012, representing 0.3m² sampled area by depth.

Table 5.3.3: Distribution of taxa in geometric groups for stations along the transect GE1 2011.

Geometric classes 0 and 5 m		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
I (1)	I	9	1	2	9	2	0	1	3	1	3	6	11	10	6	8	6
II (2-3)	II	4	1	0	1	1	0	0	1	0	2	2	7	3	5	5	1
III (4-7)	III	2	1	1	0	0	0	0		0	0	2	6	1	3	2	
IV (8-15)	IV	2		2	1	1	0	0		1	1		6		4	0	
V (16-31)	V	3		0	0	0	0	0					8			1	
VI (32-63)	VI			1	0	0	0	0					4				
VII (64-127)	VII			1	0	0	1	1					2				
VIII (128-255)	VIII				0	1							1				
IX (256-511)	IX				1								0				
X (512-1023)	X												1				
XI (1024-2047)	XI																

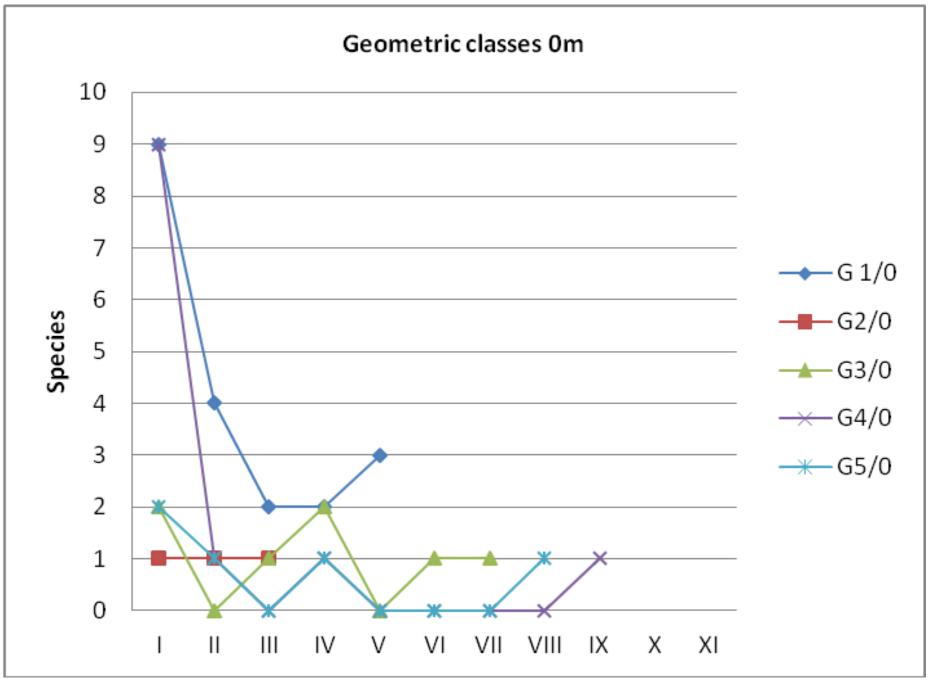


Figure 5.3.22: Number of taxa in geometrical classes along depths of 0 meters (litoral zone).

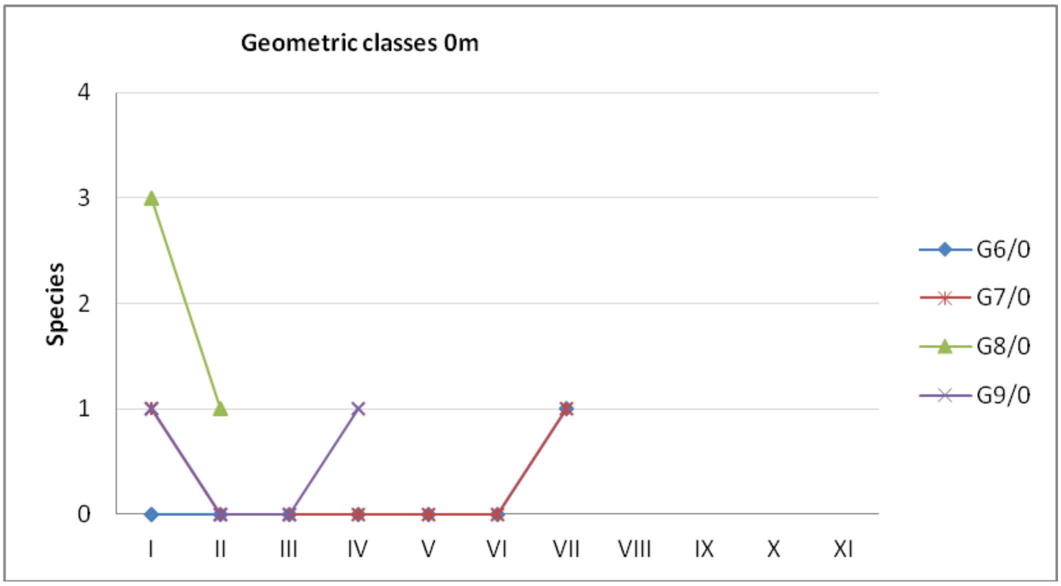


Figure 5.3.23: Number of taxa in geometrical classes along depths of 0 meters (litoral zone).

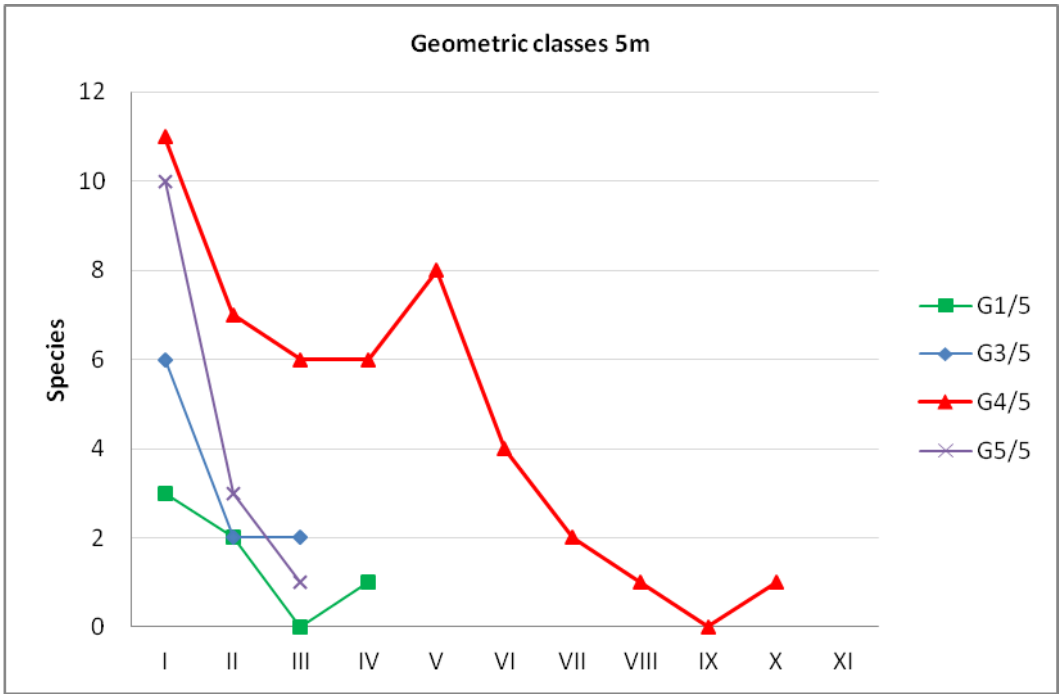


Figure 5.3.24: Number of taxa in geometrical classes along depths of 5 meters.

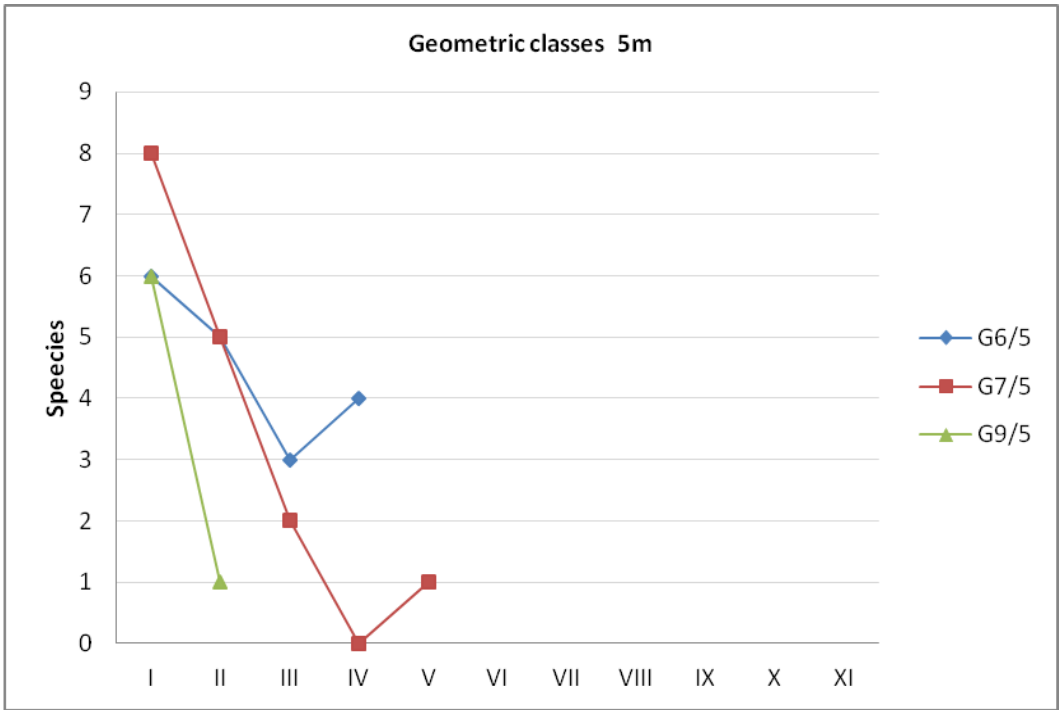


Figure 5.3.25: Number of taxa in geometrical classes along depths of 5 meters.

Table 5.3.4: Number of taxa in geometrical classes along depths from shorline to 25 meters.

Geometrical classes 25-100 m		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100	G7/100	G8/100	G9/100
I (1)	I	28	18	17	21	19	23	26	24	28	31	29	17	30	32	27	27	21	14	21	17	24	17	24	18	24	19	22
II (2-3)	II	10	13	16	12	12	15	24	17	20	27	26	13	23	9	24	21	19	16	12	24	13	12	17	15	16	2	21
III (4-7)	III	15	13	11	10	18	23	2	11	10	16	24	7	19	23	13	13	13	3	9	11	12	6	8	8	11	5	7
IV (8-15)	IV	12	5	7	7	9	16	2	9	5	14	11	7	7	9	15	4	8	0	6	11	10	10	12	3	5	5	9
V (16-31)	V	5	4	4	3	4	12	13	9	2	6	6	3	5	14	11		5	1	1	5	3	4	3	7	3	1	4
VI (32-63)	VI		2	1	1	2	3	7	3	4	2	0	2	1	2	6				1	1		1	2	1	1	1	0
VII (64-127)	VII		1	1			3	5	1	1		0				2										1		2
VIII (128-255)	VIII			1			1			1		1																
IX (256-511)	IX							1																				
X (512-1023)	X																											
XI (1024-2047)	XI																											

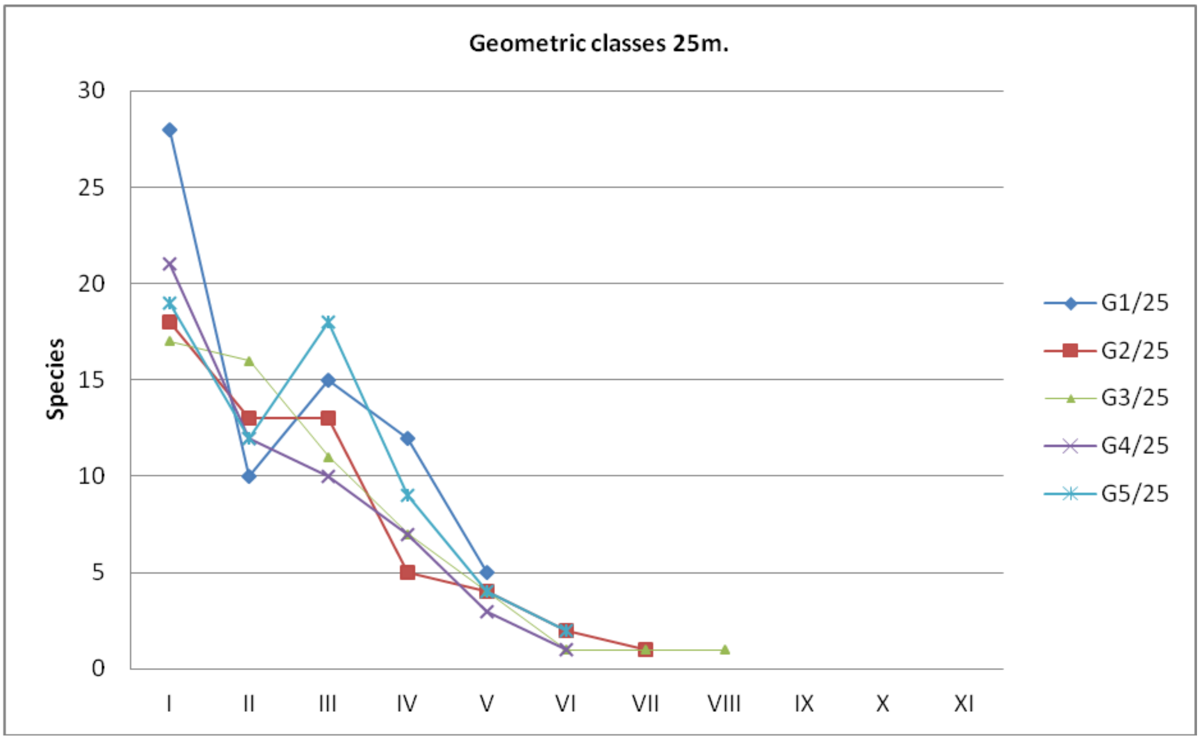


Figure 5.3.26: Number of taxa in geometrical classes along depths of 25 meters.

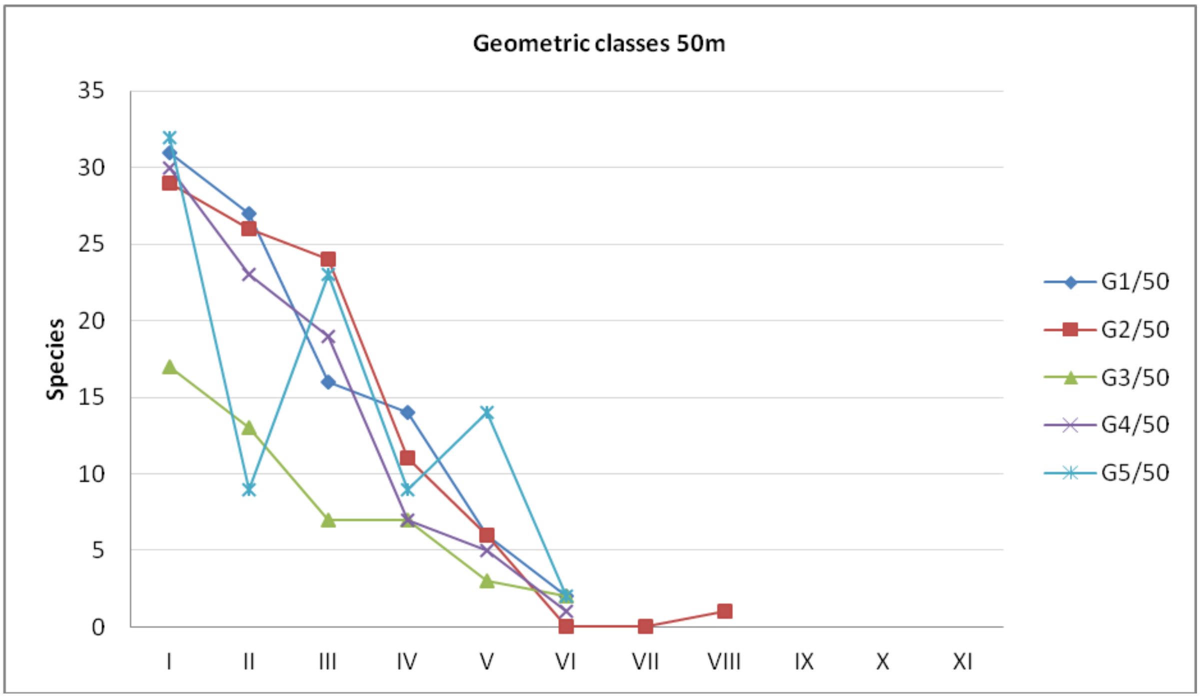


Figure 5.3.27: Number of taxa in geometrical classes along depths of 50 meters.

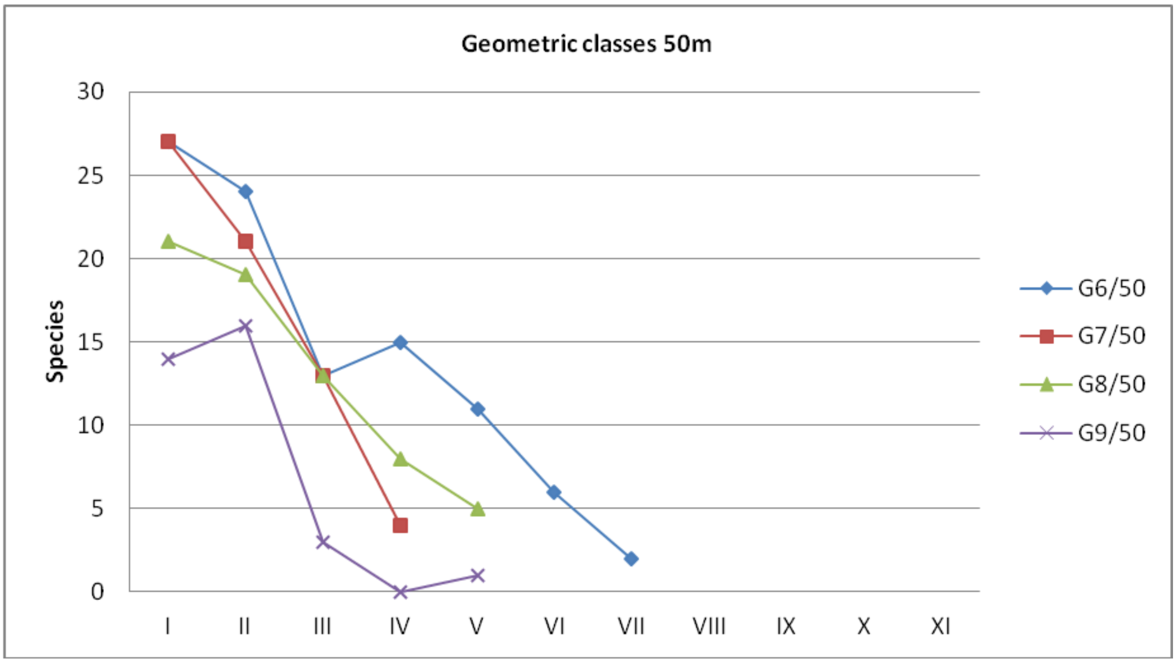


Figure 5.3.28: Number of taxa in geometrical classes along depths of 50 meters.

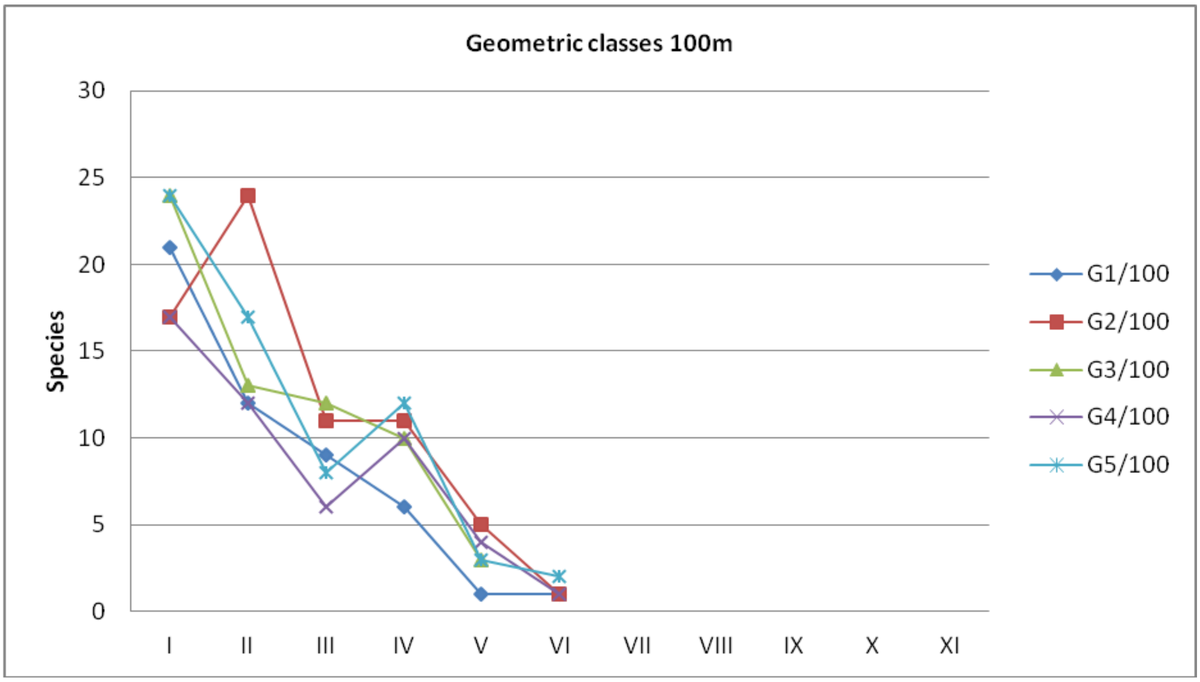


Figure 5.3.29: Number of taxa in geometrical classes along depths of 100 meters.

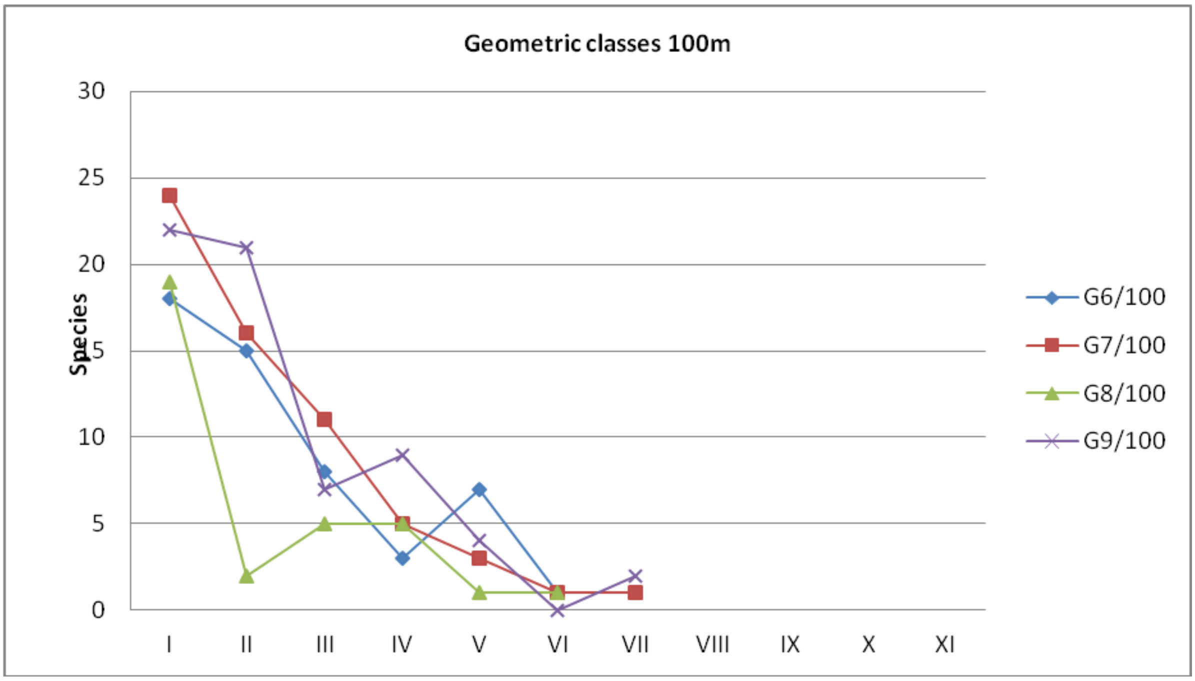


Figure 5.3.30: Number of taxa in geometrical classes along depths of 100 meters.

Table 5.3.5: Number of taxa in geometrical classes along depths from 250 to 1000/1200 meters.

Geometrical classes 25-1600m		G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
I (1)	I	12	20	20	19	13	15	22	20	13	24	15	15	14	22	26	25	22	16
II (2-3)	II	13	16	9	19	9	20	11	11	9	9	8	15	7	8	15	6	17	6
III (4-7)	III	6	12	9	8	6	9	8	8	6	7	8	4	9	13	8	3	11	4
IV (8-15)	IV	7	9	8	7	4	4	7	5	2	6	12	4	3	5	4	0	7	
V (16-31)	V	3	3	2	2	4	3	3	2	1	6	3	1	0	4	2	1	2	
VI (32-63)	VI	1	1			0		2	2		1		1	0	0	1		0	
VII (64-127)	VII	1				1		2	1		1		1	2	1			1	
VIII (128-255)	VIII													1					
IX (256-511)	IX																		
X (512-1023)	X																		
XI (1024-2047)	XI																		

Geometrical classes 25-1600m		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
I (1)	I	18	13	7	13	2	15	22	21	19	25	21	15	11
II (2-3)	II	16	8	5	26	2	6	9	9	15	12	7	12	3
III (4-7)	III	8	8		14		8	11	10	3	6	4	8	
IV (8-15)	IV	6	1		12		7	4	7	0	3	2	4	
V (16-31)	V	5					4	3	1	2	5		3	
VI (32-63)	VI	1					0	1			2			
VII (64-127)	VII						1				1			
VIII (128-255)	VIII													
IX (256-511)	IX													
X (512-1023)	X													
XI (1024-2047)	XI													

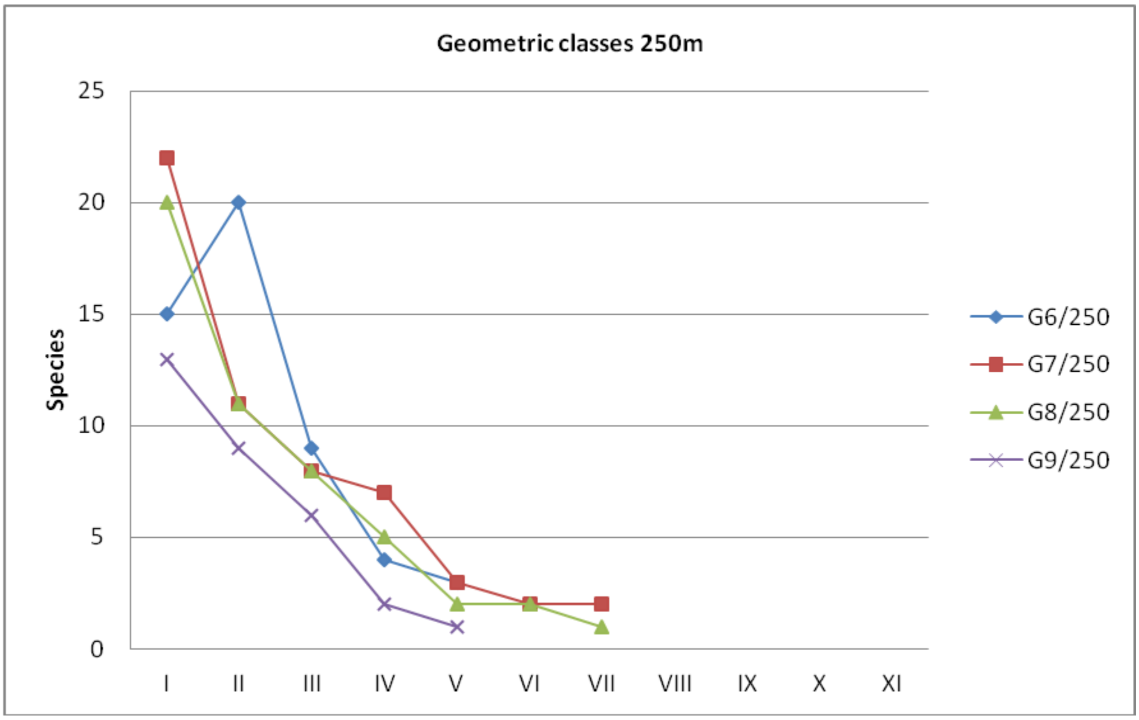


Figure 5.3.31: Number of taxa in geometrical classes along depths of 250meters.

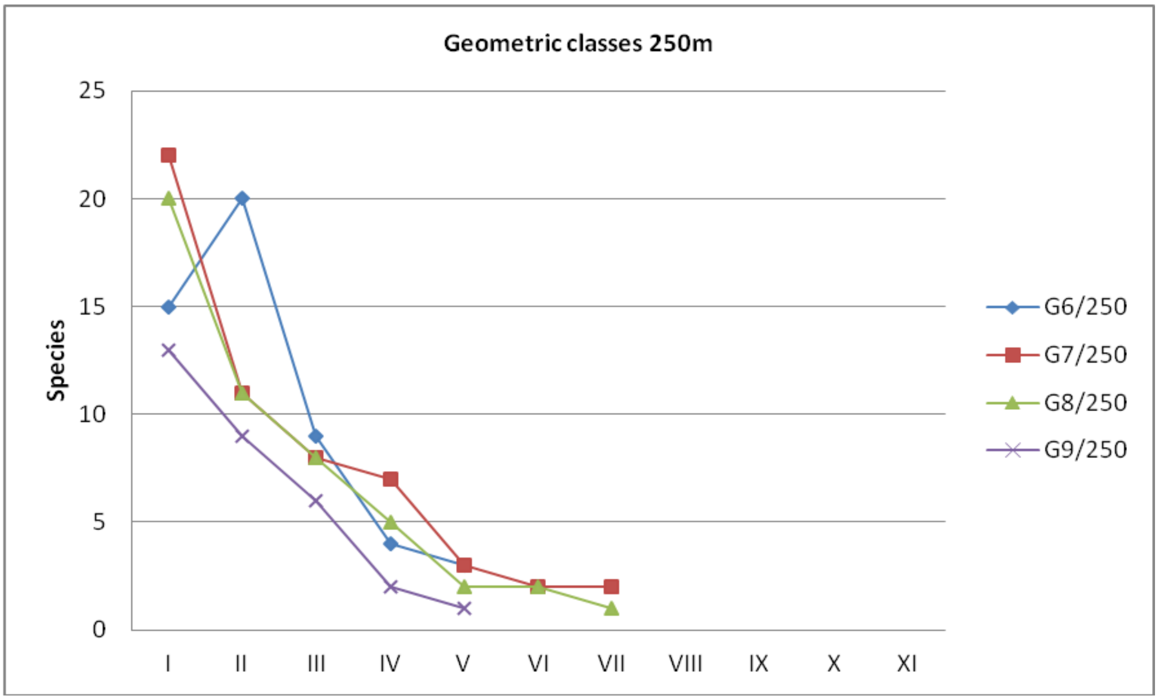


Figure 5.3.32: Number of taxa in geometrical classes along depths of 250 meters.

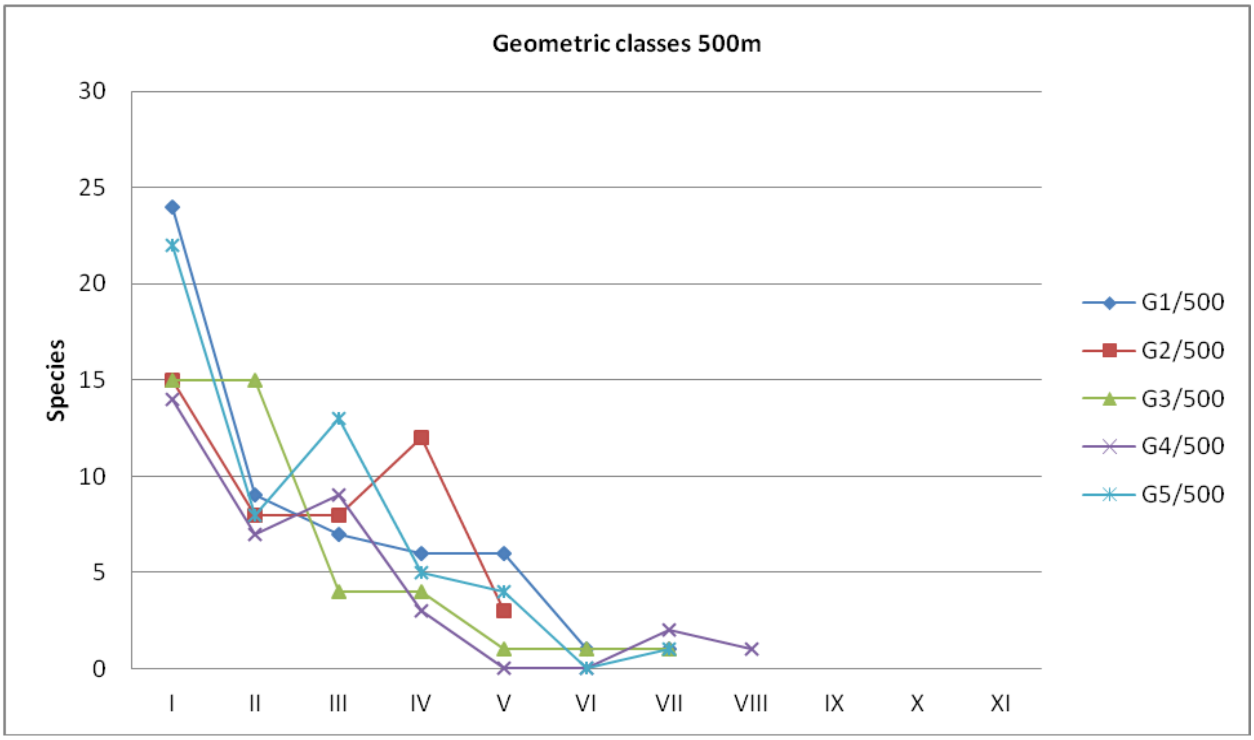


Figure 5.3.33: Number of taxa in geometrical classes along depths of 500 meters.

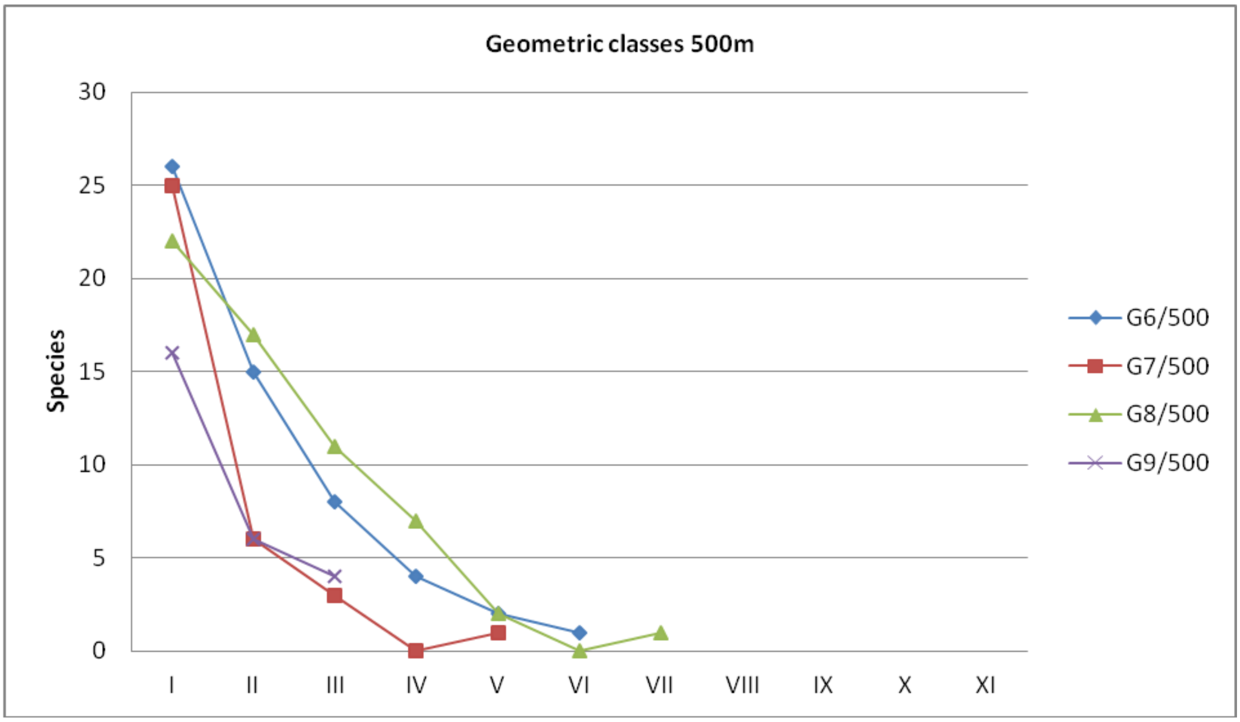


Figure 5.3.34: Number of taxa in geometrical classes along depths of 500 meters.

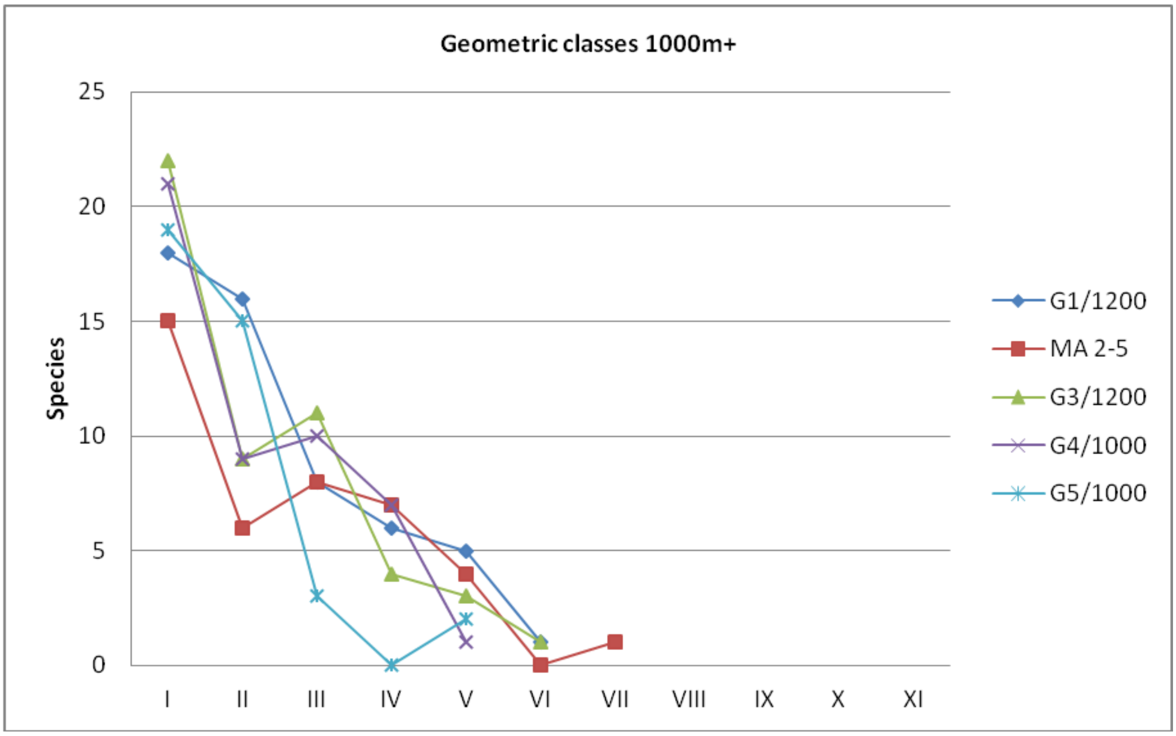


Figure 5.3.35: Number of taxa in geometrical classes along depths of 1000 meters

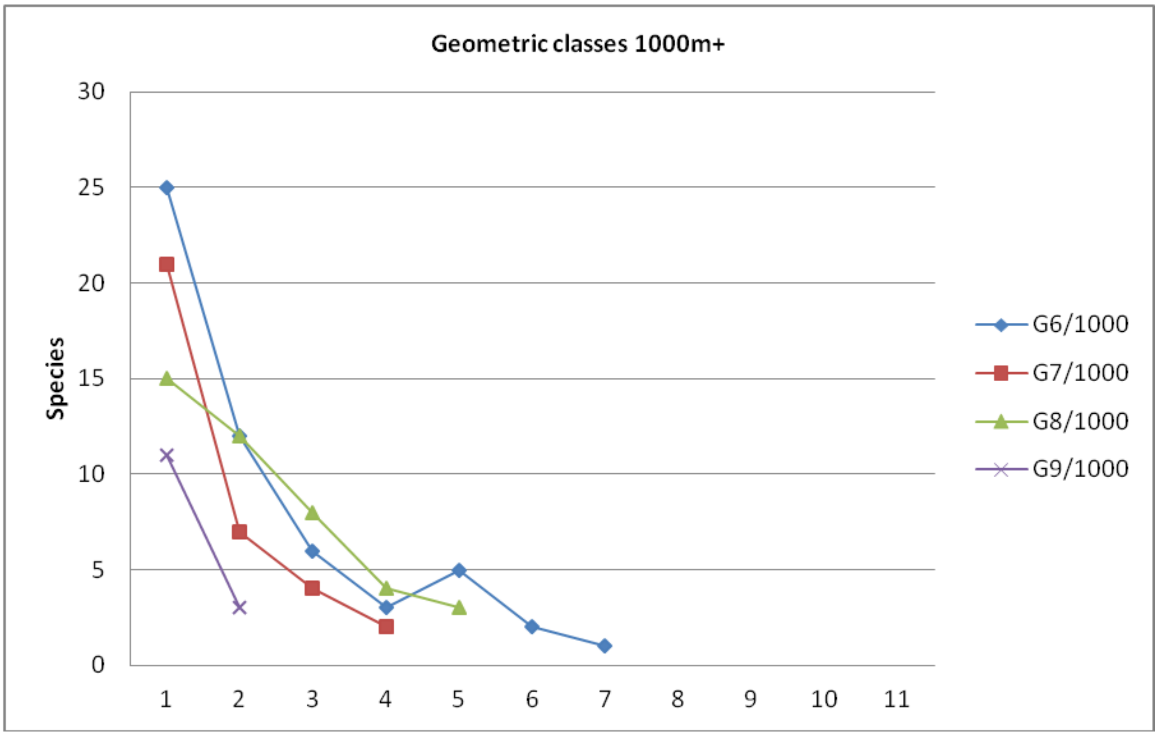


Figure 5.3.36: Number of taxa in geometrical classes along depths of 1000 meters

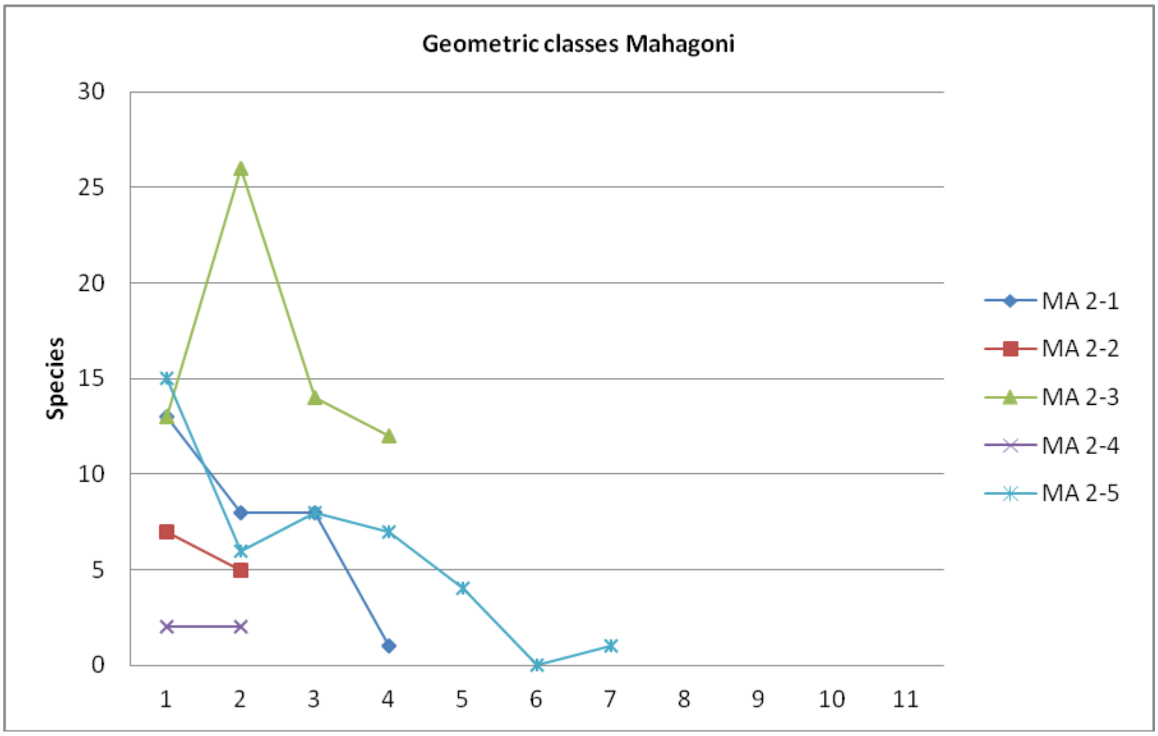


Figure. 5.3.37: Number of taxa in geometrical classes at Mahogani Field at 1200- 1600 meters

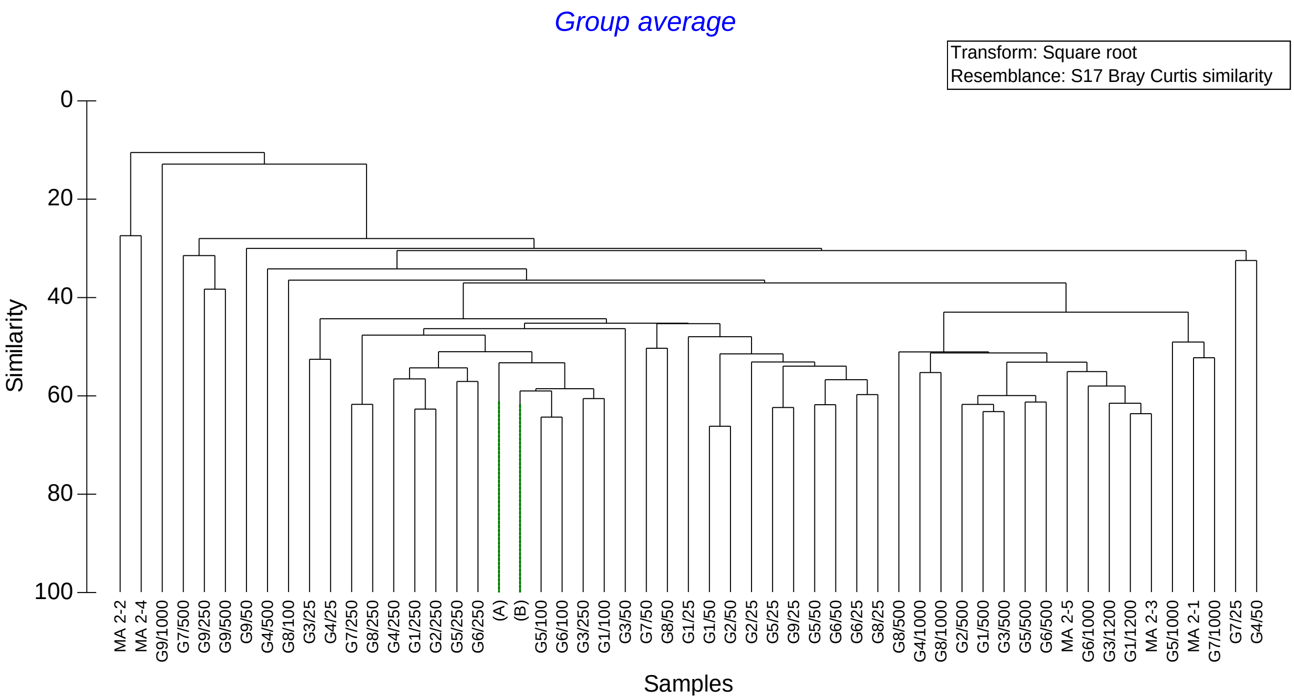


Fig. 5.3.38: Dendrograms showing the similarity between fauna from sampling stations along the 9 transects of Ghana. The dataset was root transformed.

6. SUMMARY

The sampling in 2012 consisted of all nine transects with 8 stations on each ranging from 0 m (shoreline) to around 1000 m depth (1600 on transect 2). In addition, some stations around the Mahogany field were re-sampled using the VAMS. (The Mahogany location was sampled in 2010 after a spill of used drilling mud. The stations at the jubilee field that was sampled in 2009 was not assessable due to restrictions to our operations in the safety zone. The investigation included sediment sampling for analysis of grain size, chemical content and benthic fauna as in the previous surveys. The sampling was executed according to the OSPAR guidelines for sediment monitoring in offshore oil production areas. The sediment sampling was carried out by a scientific crew from Ghana under the supervision of experienced people from Institute of Marine Research (IMR) in Norway and from University of Lodz in Poland.
There were made some adjustments to the sampling protocol concerning the samples for biodiversity. These samples were sieved at 0,3 mm using refrigerated sea water. This adjustment was done to adapt to the conditions in the deeper parts of the sampling area, from 250 m depth and deeper in terms of water temperature and a generally lower access to food resources giving generally smaller specimens.

CTD profiles were deployed along the three sediment sampling transects. The determined parameters included temperature, conductivity, dissolved oxygen and fluorescence. The investigation also included use of multiband echo sounder for seabed mapping. ADCP was used for currents measurements. The multibeam survey covered parts of all nine transects.

During the survey, local scientists were trained in the sampling methodology and equipment operation, including the newly developed VAMS (Video Assisted Multi Sampler).

PCB-levels were not detected in the collected samples in the first surveys (2009-2011) and have therefore not been analysed in the material from 2012. Only low values were found for PAH NPD's and THC from 2009-11. In 2012 we found higher values at G9 500 meters and on G4 0 and 5 meters at Ngyiresia Beach 1 in Sekondi (4th exit from W. Ofori Atta rd. to the west when going northwards from the fisheries port). The analysis of metals still shows generally low values associated with background levels with no risk of biological impact. Most of the metals showed increasing concentrations with depth and reduced grain size.

The benthic infauna shows no obvious signs of disturbance by human activity except for the stations at the deep end of transect 2 at the Mahogany field and at G4 0 and 5m (Sekondi, Ngyiresia Beach)
In 2011 GE3/25 showed signs of what we suspected to be a source of organic enrichment, this was however not seen in the 2012 samples.

Altogether, the result suggests a benthic environment of good condition. The increase in Barium mentioned above however calls for a closer and perhaps more frequent monitoring of the eastern part of the coast. The survey data is the start of an important environmental monitoring as a follow up from the environmental baseline studies and the first contribution to the monitoring phase.

Along transect 1 at approximately 400 meters' depth a large cold water coral reef was discovered by Multibeam echo sounder in 2009. The reef was investigated by use of the Video Assisted Multi Sampler (VAMS). The main reef building organism is Lophelia, the same species as we find in Norwegian waters. This reef in Ghana is one of the world's largest cold water coral reefs 4000 meters long 250 meters wide and 70 meters high. The banana shaped reef was oriented perpendicular to the main current, the convex side facing the current and there was no sign of human impact. The great height of the reef is probably a result of undisturbed growth for more than 20 000 years. The reef is located near the large oilfields off the west coast of Ghana and it is important monitor the environmental conditions to make sure that it can continue its sound growth.

7. REFERENCES

Henriksen K.S. Investigation of crustaceans from shelf areas in the Gulf of Guinea, with special emphasis on Brachyura. Thesis University of Bergen.

Anon 2009. Requirements for Environmental Monitoring of the Petroleum Activities on the Ghanaian Continental Shelf. Second Draft December 2009.

Blott SJ, Pye K. 2001. Gradistat: a grain size distribution and statistics package for the analysis of unconsolidated sediments. *Earth Surface Processes and Landforms* 26, 1237-1248.

Bray JR, Curtis JT. 1957. An ordination of the upland forest communities of Southern Wisconsin. - *Ecological Monographs* 27:325-349.

Buchanan JB. 1984. Sediment analysis. Pp. 41-65 in: N.A. Holme & A.D. McIntyre (eds). *Methods for the study of marine benthos*. Blackwell Scientific Publications, Oxford.

ter Braak C.F., Smilauer P. 1997. Canoco for Windows 4.5. Biometrics – Plant Research International, Wageningen, Netherlands.

Field, JG., KR. Clarke, & R.M. Warwick 1982. A practical strategy for analysing multispecies distribution patterns. - *Marine Ecology Progress Series* 8:37-52.

Folk RL, Ward WC. 1957. Brazos river bar: A study in the significance of grain size parameters. *Journal of sedimentary petrology* 27: 3-26.

Gray JS, Mirza FB. 1979. A possible method for the detection of pollution-induced disturbance on marine benthic communities. - *Marine Pollution Bulletin* 10:142-146.

OSPAR 2006. OSPAR convention for the protection of the marine environment of the north-east atlantic. Harmonised reporting format to compile environmental monitoring data and information related to offshore oil and gas activities. Reference number 2006-07.

Longhurst A. R 1964 The costal oceanography of western Nigeria. Bull IFAN 26(A)2 337-402

Pearson TH, Gray JS, Johannessen PJ. 1983. Objective selection of sensitive species indicative of pollution-induced change in benthic communities. 2. Data analyses. - *Marine Ecology Progress Series* 12:237-255.

Petroleumstilsynet (Ptil), Statens forurensningstilsyn (SFT), Sosial- og helsedirektoratet (SHdir), 2006. Forskrift om utføring av aktiviteter i petroleumsvirksomheten (Aktivitetsforskriften). Vedlegg 1: Krav til miljøovervåking av petroleumsvirksomheten på norsk kontinentalsokkel 2: Sediment overvåkning.

Pielou EC. 1966. The measurement of species diversity in different types of biological collections. - *Journal of Theoretical Biology* 13:131-144.

Shannon CE, Weaver W. 1949. *The mathematical theory of communication.* - University of Illinois Press, Urbana. 117 s.

Renaud PE, Jensen T, Wassbotten I, Mannvik HP, Botnen H. 2008. Offshore sediment monitoring on the Norwegian shelf. A regional approach 1996-2006. Akvaplan-niva report no 3487-003. 95 s.

Guidelines for environmental assessment and management. EPA Ghana 2011.

8. LIST OF ABBREVIATIONS

Ba	Barium
Bc	Background concentrations according to Ospar for the North Atlantic
Cd	Cadmium
CDCF	Centre for development cooperation in fisheries.
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
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
UCC	University of Cape Coast
Zn	Zinc

APPENDIX I

Benthos stations list.

Station	DATE (DMY)	LON	LAT	DEEP	Diary	REMARK	*	Sediment Description	vol
G1/0	17/10/12	-3.1044	5.0952	0		Hg	2	Fine sand. Light greyish brown	
G1/5	17/10/12	-3.1017	5.0851	5		Hg	4	Fine sand. Light greyish brown	
G1/25	17/11/12	-3.0092	5.0328	27	196-202	Duo	3	Sandy mud. Very dark greenish grey	
G1/50	17/11/12	-3.0227	4.9642	50	203-208	Duo	4	Sandy mud. Very dark greenish grey	
G1/100	17/11/12	-3.0578	4.7795	101	209-214	Duo	4	Very dark greenish grey	
G1/250	17/11/12	-3.0647	4.7440	241	215-217	Duo/VG	3	Sandy clay with mud. Dark greenish grey	
Banana reef 1	17/11/12	-3.1530	4.7613	386	219	VG			
Banana reef 2	23/11/12	-3.1541	4.7641	376	312	VG			
Banana reef 3	23/11/12	-3.1469	4.7706	375	313	VG			
G1/500	16/11/12	-3.0698	4.7286	501	192, 193, 195	VG	5	Clay. 3/10 GY Very dark greenish Grey (Gley 1)	
G1/1200	16/11/12	-3.0852	4.6116	1201	190, 191	VG	5	Muddy clay. Very dark greenish grey	
G2/0	18/10/12	-2.3257	4.9226	0		Hg	3	Fine sand less than 1mm grain size. Light brownish grey.	
G2/5	18/10/12	-2.3261	4.9183	5		Hg	4	Fine sand. Light grey.	
G2/25	18/11/12	-2.5759	4.9280	27	220-226	Duo	5	Sandy clay and mud, s. 3 sandy. Dark greenish grey, s. 3 reddish black.	
G2/50	18/11/12	-2.6188	4.8543	51	227-232	Duo	4		
G2/100	18/11/12	-2.7988	4.6799	103	242-247	Duo	4		
G2/250	18/11/12	-2.8273	4.6503	255	236-241	Duo	2	Sand. Dark greenish grey.	
G2/500	18/11/12	-2.8530	4.6283	508	233-235	VG	5	Muddy clay. Very dark grey	
G2/1361	21/11/12	-2.9002	4.5136	1361	304, 305	VG	5	Clay. Greenish black	
MA 2-1/1361	22/11/12	-2.9050	4.5135	1366	307	VG	5		
G2 1598	21/11/12	-2.9344	4.5136	1600	306	VG	5	Clay	
G2 1400	22/11/12	-2.9164	4.5134	1424	308	VG		Mud. Very dark greenish grey Chart: gley 1	
MA 2-3/1376	22/11/12	-2.8907	4.5133	1377	309, 310	VG		Mud. Very dark greenish grey Chart: gley 1	
MA 2-3/1414	22/11/12	-2.9160	4.5145	1414	311	VG			
G3/0	18/10/12	-2.0908	4.7454	0		Hg	3	Fine sand. light greyish brown.	
G3/5	18/10/12	-2.0942	4.7426	5		Hg	3	Fine sand. Light brown	
G3/25	19/11/12	-2.1327	4.7647	28	248-253	Duo	5	Fine sandy mud. Dark greenish grey.	
G3/50	19/11/12	-2.1645	4.6812	52	254-259	Duo	5	Fine sandy mud. Dark greenish grey.	
G3/100	20/11/12	-2.2289	4.5472	100	272-277	Duo	4	Fine sandy mud. Very dark greenish grey.	
G3/250	19/11/12	-2.2540	4.4903	252	266-271	Duo	4		
G3/500	19/11/12	-2.2817	4.4216	509	260, 261, 265	VG/Duo	5	Very fine sandy mud. Very dark greenish grey.	
G3/1200	19/11/12	-2.3691	4.2421	1197	262-264	VG	5	Very fine sandy mud. Very dark greenish grey.	

Benthos stations Ghana west.

Station	DATE (DMY)	LON	LAT	DEEP	Diary	REMARK	*	Sediment Description	Vol
G4/0	19/10/12	-1.7058	4.9512	0		Hg	3	Fine sand. Light greyish brown	
G4/5	19/10/12	-1.7045	4.9506	5		Hg	5	Clay and sand. Dark grey	
G4/25	21/11/12	-1.7667	4.8386	25	299-303	SA	5	Sandy mud. Very dark greenish grey	
G4/50	20/11/12	-1.7838	4.6814	52	293-298	Duo	5		
G4/100	20/11/12	-1.8196	4.3510	108	287-292	Duo	4		
G4/250	20/11/12	-1.8222	4.2815	250	278-283	Duo	4		
G4/500	20/11/12	-1.8338	4.2329	497	284	VG	4	Fine Sandy mud. Very dark greenish grey	
G4/1000	20/11/12	-1.8398	4.1718	993	285-286	VG	5	Fine Sandy mud. Very dark greenish grey	
G5/0	20/10/12	-1.0345	5.2004	0		Hg	2	Sand. Light greyish brown	
G5/5	20/10/12	-1.0340	5.1994	5		Hg	1	Sand and a little silt. Black.	
G5/25	13/11/12	-0.9774	5.0816	27	163-168	Duo	3	Coarse sand broken shells. 5/10 Y Greenish grey (gley 1)	
G5/50	14/11/12	-0.8359	4.7942	52	169, 186-189	Duo	4	Coarse sand and shell fragments. 4/10Y Dark greenish grey (gley 1)	
G5/100	14/11/12	-0.7868	4.6788	101	180-185	Duo	4	Broken shells medium coarse sand. 4/10 Y, dark greenish grey (gley 1)	
G5/250	13/11/12	-0.7655	4.6408	252	173-179	Duo	5	Fine Sand. 4/10 Y, Dark greenish grey, Gley 1.	
G5/500	13/11/12	-0.7557	4.6252	507	172	VG	5	Clay. 4/10 Y, dark greenish grey (gley 1)	
G5/1000	13/11/12	-0.7456	4.6126	1040	170-171	VG	5	Clay. 4/5 GY, dark greenish grey	
G6/0	21/10/12	-0.5879	5.3583	0		Hg	2	Sand. 2,5 Y, 6/2, Light brownish grey	
G6/5	21/10/12	-0.5888	5.3443	6		Hg	4	Fine compact sand. 10Y 5GY 3/2, very dark greyish olive.	
G6/25	12/11/12	-0.5214	5.3048	24	137-144	Duo	5	Sand, shell sand. 4/10Y dark greenish grey (Gley 1)	
G6/50	12/11/12	-0.4254	5.1522	52	145-149	Duo	4	Fine sand, shell sand. 4/5 GY Dark greenish grey, Gley 1	
G6/100	12/11/12	-0.3589	5.0691	102	150-155	Duo	3	Fine sand. 4/10 Y Dark greenish grey (gley 1)	
G6/250	12/11/12	-0.3428	5.0530	247	158, 160-162	VG/Duo	3	Fine sand. 4/10 Y Dark greenish grey (gley 1)	
G6/500	12/11/12	-0.3397	5.0297	499	157, 159	VG	5	Clay and fine sand. 4/10 Y dark greenish grey	
G6/1000	11/11/12	-0.3177	5.0230	994	136, 156	VG	5	Clay. 4/10 BG Dark greenish grey (gley 2)	

Benthos stations Ghana Central.

Gravel	0
Coarse sand	1
Medium sand	2
Fine sand	3
Very fine sand	4
Silt and clay	5
Clay	6

Station	DATE (DMY)	LON	LAT	DEEP	Diary	REMARK	*	Sediment Description	Vol
G7/0	22/10/12	0.1658	5.7339	0		Hg	2	Sand and shellsand. 10 YR 8/2 Very pale brown.	
G7/5	22/10/12	0.1849	5.7412	5		Hg	4	Fine sand. 10Y 5GY 3/2 Very dark greyish olive.	
G7/25	8/11/12	0.1964	5.6607	25	92-94, 115-123	LA	1	Sand and corals.	
G7/50	8/11/12	0.2170	5.6097	52	95-104	LA	4	Shells clay and coarse sand. 4/10 Y dark greenish grey.	
G7/100	8/11/12	0.2411	5.5570	102	105-114	LA	5	Clay, sand and shells. 4/10 Y	
G7/250	10/11/12	0.2497	5.5350	251	127-133	Duo	5	Clay. 2,5 Y 2/4 Dark greyish brown.	
G7/500	10/11/12	0.2583	5.5145	504	124, 125	VG	5	Clay. 4/10 Y Dark greenish grey.	
G7/1000	11/11/12	0.2706	5.4868	972	134, 135	VG	5	Muddy clay. 4/10 G Dark greenish grey (gley 2)	
G8/0	25/10/12	0.6180	5.7763	0		Hg	3	Coarse sand, light brown.	
G8/5	25/10/12	0.6186	5.7711	5		Hg	2		
G8/25	4/11/12	0.7339	5.6435	27	1-11	SA	5	Clay, sea shells, sand and gravel. 4/10 Y Dark greenish grey	
G8/50	7/11/12	0.7276	5.5926	49	56-66	SA	5	Clay and fine sand. 4/5 GY Dark greenish grey.	
G8/100	7/11/12	0.7276	5.5891	100	67-70, 85-91	Duo	5	Clay.	
G8/250	7/11/12	0.7294	5.5794	247	71-80	Duo	5	Clay. 4/10 GY Dark greenish grey	
G8/500	7/11/12	0.7320	5.5638	509	83-84	VG	5	Clay. 4/10 GY Dark greenish grey.	
G8/1000	7/11/12	0.7277	5.5208	999	55, 81-82	VG	5	Clay. 4/10 GY, Dark greenish grey.	
G9/0	24/10/12	1.1524	6.0922	0		Hg	1	Sand, coarser than 1mm. Middle brown.	
G9/5	24/10/12	1.1566	6.0917	5		Hg	1	Fine sand. 5Y 3/2 Dark olive grey	
G9/25	5/11/12	1.1980	6.0220	26	23-32	SA	3	Sand. 5/5 GY Greenish grey.	
G9/50	6/11/12	1.2359	5.9439	52	33-42	SA	5	Fine sand and shells. 4/5 GY Dark greenish grey.	
G9/100	6/11/12	1.2552	5.8969	103	43-52	LA	5	Clay and sand. 4/10 Y Dark greenish grey.	
G9/250	5/11/12	1.2616	5.8833	251	12-20	Duo	5	Clay. 4/10 Y Dark greenish grey.	
G9/500	5/11/12	1.2719	5.8608	510	21-22	VG	5	Clay. 4/10 Y Dark greenish grey.	
G9/1000	6/11/12	1.2844	5.8294	998	53-54	VG	5	Clay. 4/10 Y Dark greenish grey.	

Benthos stations Ghana East.

Trawl stations list.

DATE	TIME	LON	LAT	DEP	STA	EVENT	REMARK
14/11/12	9:49:56	-1.7268	4.8305	31	BT1	S	
14/11/12	10:20:25	-1.7035	4.8446	30	BT1	E	
14/11/12	11:12:43	-1.7541	4.8385	26	BT2	S	
14/11/12	11:41:07	-1.7275	4.8522	27	BT2	E	
23/11/12	0:45:08	-3.1109	4.7945	111	BT3	S	
23/11/12	1:20:11	-3.1401	4.8056	110	BT3	E	
23/11/12	3:38:02	-3.0933	4.9926	49	BT4	S	
23/11/12	4:09:13	-3.0671	4.9859	49	BT4	E	
17/11/12	17:00:00	-3.0872	4.6143	1199	PL1	P	multinet
21/11/12	22:26:00	-2.9444	4.4394	1824	PL2	P	multinet

CTD stations list.

STA	DATE	TIME	LON	LAT	DEP	Transect
HD1430	4/11/12	16:38:20	0.7317	5.6426	27	G8
HD1430	4/11/12	16:55:43	0.7321	5.6425	27	G8
HD1430	4/11/12	23:03:08	0.7331	5.6430	27	G8
HD1431	5/11/12	2:46:52	1.2122	5.8606	224	G8
HD1432	5/11/12	7:22:21	1.2606	5.8836	248	G9
HD1433	5/11/12	18:50:57	1.2705	5.8612	493	G9
HD1434	6/11/12	12:54:40	1.2839	5.8287	1006	G9
HD1435	6/11/12	21:14:53	0.7276	5.5071	979	G8
HD1436	7/11/12	1:45:02	0.7285	5.5890	100	G8
HD1437	7/11/12	3:49:33	0.7285	5.5798	255	G8
HD1438	7/11/12	14:59:12	0.7296	5.5633	538	G8
HD1439	8/11/12	2:43:28	0.1932	5.6642	25	G7
HD1440	8/11/12	4:01:46	0.2135	5.6117	51	G7
HD1441	8/11/12	6:05:50	0.2399	5.5557	103	G7
HD1442	10/11/12	16:12:46	0.2589	5.5158	476	G7
HD1443	11/11/12	0:32:49	0.1930	5.6650	27	G7
HD1444	11/11/12	0:46:08	0.1994	5.6520	36	G7
HD1445	11/11/12	1:01:33	0.2058	5.6366	44	G7
HD1446	11/11/12	1:38:13	0.2092	5.6241	48	G7
HD1447	11/11/12	1:52:36	0.2167	5.6092	54	G7
HD1448	11/11/12	2:07:42	0.2227	5.5954	62	G7

STA	DATE	TIME	LON	LAT	DEP	Transect
HD1449	11/11/12	2:22:24	0.2312	5.5769	76	G7
HD1450	11/11/12	2:40:11	0.2404	5.5565	101	G7
HD1451	11/11/12	2:54:39	0.2468	5.5433	179	G7
HD1452	11/11/12	3:15:30	0.2527	5.5345	267	G7
HD1453	11/11/12	3:35:28	0.2595	5.5207	390	G7
HD1454	11/11/12	3:57:24	0.2619	5.5074	646	G7
HD1455	11/11/12	4:28:50	0.2656	5.4971	857	G7
HD1456	11/11/12	5:02:22	0.2699	5.4868	993	G7
HD1457	11/11/12	23:18:18	-0.5288	5.3014	23	G6
HD1458	12/11/12	2:33:52	-0.4271	5.1587	52	G6
HD1459	12/11/12	4:39:10	-0.3562	5.0693	102	G6
HD1460	12/11/12	7:13:04	-0.3242	5.0299	845	G6
HD1461	12/11/12	10:20:12	-0.3146	5.0236	949	G6
HD1462	12/11/12	11:00:25	-0.3086	5.0161	1161	G6
HD1463	12/11/12	11:50:22	-0.3277	5.0357	680	G6
HD1464	12/11/12	13:48:49	-0.3318	5.0400	496	G6
HD1465	12/11/12	14:17:33	-0.3357	5.0449	358	G6
HD1466	12/11/12	14:42:32	-0.3428	5.0532	249	G6
HD1467	12/11/12	16:35:53	-0.3434	5.0543	214	G6
HD1468	12/11/12	16:49:38	-0.3476	5.0580	116	G6
HD1469	12/11/12	22:57:03	-0.3685	5.0851	79	G6
HD1470	12/11/12	23:18:02	-0.3880	5.1096	62	G6
HD1471	12/11/12	23:36:32	-0.4058	5.1339	57	G6
HD1472	13/11/12	0:16:22	-0.4533	5.1944	43	G6
HD1473	13/11/12	0:50:08	-0.4928	5.2497	35	G6
HD1474	13/11/12	4:16:19	-0.9772	5.0797	27	G5
HD1475	13/11/12	7:39:04	-0.8426	4.7902	51	G5
HD1476	13/11/12	13:47:57	-0.7457	4.6117	1026	G5
HD1477	13/11/12	17:11:04	-0.7532	4.6244	522	G5
HD1478	13/11/12	20:09:02	-0.7646	4.6408	247	G5
HD1479	14/11/12	0:11:39	-0.7866	4.6791	101	G5
HD1480	14/11/12	14:26:46	-1.6690	4.8734	29	G4
HD1481	14/11/12	15:00:16	-1.6684	4.8065	37	G4
HD1482	14/11/12	15:25:53	-1.6684	4.7616	41	G4
HD1483	14/11/12	16:05:37	-1.6698	4.6734	51	G4
HD1484	14/11/12	16:33:42	-1.6713	4.6121	55	G4
HD1485	14/11/12	17:08:25	-1.6723	4.5396	61	G4
HD1486	14/11/12	17:43:38	-1.6710	4.4642	66	G4
HD1487	14/11/12	18:25:02	-1.7034	4.3766	83	G4
HD1488	14/11/12	18:49:36	-1.7230	4.3408	102	G4
HD1489	14/11/12	19:30:13	-1.7631	4.2671	125	G4
HD1490	14/11/12	19:45:07	-1.7712	4.2559	138	G4
HD1491	14/11/12	19:57:53	-1.7764	4.2501	176	G4

STA	DATE	TIME	LON	LAT	DEP	Transect
HD1492	14/11/12	20:11:10	-1.7808	4.2444	244	G4
HD1493	14/11/12	20:26:19	-1.7854	4.2383	292	G4
HD1494	14/11/12	20:46:44	-1.7951	4.2280	358	G4
HD1495	14/11/12	21:14:01	-1.8078	4.2122	499	G4
HD1496	14/11/12	21:42:58	-1.8228	4.1944	707	G4
HD1497	14/11/12	22:18:22	-1.8407	4.1739	956	G4
HD1498	14/11/12	22:55:19	-1.8391	4.1621	1252	G4
HD1499	16/11/12	5:01:25	-3.0092	5.0288	30	G1
HD1500	16/11/12	5:21:39	-3.0153	4.9982	43	G1
HD1501	16/11/12	5:47:18	-3.0211	4.9631	53	G1
HD1502	16/11/12	6:06:57	-3.0285	4.9270	62	G1
HD1503	16/11/12	6:28:23	-3.0361	4.8875	72	G1
HD1504	16/11/12	6:55:02	-3.0469	4.8336	84	G1
HD1505	16/11/12	7:22:46	-3.0564	4.7781	103	G1
HD1506	16/11/12	7:49:25	-3.0608	4.7608	122	G1
HD1507	16/11/12	12:02:49	-3.0891	4.6122	1210	G1
HD1508	16/11/12	16:36:18	-3.0684	4.7303	491	G1
HD1509	16/11/12	17:12:33	-3.0715	4.7110	712	G1
HD1510	16/11/12	20:27:46	-3.0764	4.6751	995	G1
HD1511	16/11/12	23:15:20	-3.0640	4.7438	247	G1
HD1512	16/11/12	23:36:27	-3.0629	4.7496	149	G1
HD1513	18/11/12	1:02:44	-2.5563	4.9273	27	G2
HD1514	18/11/12	5:07:36	-2.6191	4.8685	49	G2
HD1515	18/11/12	14:37:16	-2.8274	4.6506	251	G2
HD1516	18/11/12	18:27:13	-2.7968	4.6804	102	G2
HD1517	19/11/12	1:33:53	-2.1330	4.7639	28	G3
HD1518	19/11/12	4:49:43	-2.1646	4.6781	51	G3
HD1519	19/11/12	8:38:08	-2.2854	4.4218	506	G3
HD1520	19/11/12	14:15:22	-2.3678	4.2421	1192	G3
HD1521	19/11/12	23:12:32	-2.2541	4.4894	251	G3
HD1522	19/11/12	23:58:07	-2.2280	4.5450	100	G2
HD1523	20/11/12	5:41:42	-1.8211	4.2826	239	G4
HD1524	20/11/12	10:08:57	-1.8306	4.2290	495	G4
HD1525	20/11/12	14:12:36	-1.8412	4.1716	986	G4
HD1526	20/11/12	17:34:22	-1.8213	4.3472	107	G4
HD1527	20/11/12	21:42:17	-1.7847	4.6728	52	G4
HD1528	21/11/12	0:08:41	-1.7655	4.8383	25	G4
HD1529	21/11/12	20:30:11	-2.9336	4.5130	1592	G2

SAMPLING JOURNAL **Sign. in:** **Page nr: 1 of 18 Land**

Vessel: None	**Area:** Ghana W 2012 Newtown (Ivory C. border)	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: GW/0 (Old)	Date:	Position		Depth (m) 0 m
		Longitude E/W E/W	Latitude N/S N/S	
G1/0 (Newtown)	17/10-2012	-3.1044	5.0952	**Positioning control:**

Weather: Overcast	**Wind:** light breeze	**Wave height (m):**
Time Start: 11:00	**Time Finish:** 14:35	**Duration:** 3 hr 35 min
Sample equipment used (name, bite area, weight): 0,025m² Van Veen Grab and 1mm sieve (round holes)		

Type of bottom sediment: Beach, Fine sand.			
Colour: Light greyish brown	Odour: none		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.: Some plastic rubbish on the beach, drift from sea.	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1		Off the beach							Hg		N
2		1		1		1				1		Off the beach					1		Hg		N
3		1		1		1				1		Off the beach							Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks:	Grab nr.	Extra weights
4	Full	1			Hg	
5	Full	1			Hg	
6	Full	1			Hg	
7	Full	1			Hg	
8	Full	1			Hg	

Sign. out:

Vessel:	**Area:** Ghana W 2012 Newtown (Iv.C border)	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) 5- 6 m
		Longitude E/W	Latitude N/S	
G1/5	17.10-2012	-3.1017	5.0851	**Positioning control:**

Weather: Sunny	**Wind: Breeze**	**Wave height (m):**
Time Start:	**Time Finish: 14:35**	**Duration: 3 hr 35 min Both stations**
Sample equipment used (name, bite area, weight): 0,025m² Van Veen Grab and 1mm sieve (round holes)		

Type of bottom sediment: Fine sand			
Colour: Light greyish brown	Odour: None		
Observation of animals: Sand dollars, polychaeta and bivalves.	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1									Hg		N
2		1		1		1				1							1		Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks:	Grab nr.	Extra weights
4	Full	1		30-40 m off breaking point.	Hg	
5	Full	1			Hg	
6	Full	1			Hg	

Sign. out:

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off Newtown	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) 27m
		Longitude E/W	Latitude N/S	
G1/25	17/11-2012	-3,0092	5,0328	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 01.40	**Time Finish: 05.40**	**Duration: 4 hr**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen Grab and 0,5mm sieve (round holes)		

Type of bottom sediment: Sandy mud			
Colour: Very dark greenish grey	Odour:		
Observation of animals:	No. rejected samples: 1		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	13	1	1	1	1	1	1			1	1								D	2	N
2	12	1		1		1				1									D	2	N
3	13	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5mm	Remarks: GR 196-202	Grab nr.	Extra weights
4	13		10		Duo	2
5	12		7		Duo	2
6	13		9		Duo	2
7	12,5		4		Duo	2
8	13		15		Duo	2
9	13		8			

Sign. out:

Institute of Marine Research

SAMPLING JOURNAL **Sign. in:** **Page nr: 35 of 63 sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off Newtown	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) 53 m
		Longitude E/W	Latitude N/S	
G1/50	17/11-2012	-3.0227	4.9642	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 06.04	**Time Finish: 08.30**	**Duration: 2 hr 26 min.**
Sample equipment used (name, bite area, weight): 0,1m² Van Veen Grab and 0,5mm sieve (round holes)		

Type of bottom sediment: Sandy mud			
Colour: Very dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	9	1	1	1	1	1	1			1	1								D	2	N
2	12	1	1	1	1	1	1			1	1						1		D	2	N
3	13,2	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5 mm	Remarks: GR 203-208	Grab nr.	Extra weights
4	9		4		Duo	2
5	12		4		Duo	2
6	13,2		5		Duo	2
7	11		6		Duo	2
8	10,5		4		Duo	2
9	13,5		6		Duo	2

Sign. out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 36 of 63 sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012 Off Newtown	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth (m) 102 m
		Longitude E/W	Latitude N/S	
G1/100	17/11-2012	-3,0578	4,7795	Positioning control:

Weather: Sunny	Wind:	Wave height (m):
Time Start: 09.20	Time Finish: 11:10	Duration: 1 hr 50 min
Sample equipment used (name, bite area, weight): 0,1m² Van Veen Grab and 0,5 mm sieve (round holes)		

Type of bottom sediment:			
Colour: Very dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	11,5	1	1	1	1	1	1			1	1								D	2	N
2	11,5	1		1		1				1							1		D	2	N
3	9,5	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks: GR 209-214 (1missing from bridge log)	Grab nr.	Extra weights
4	11,5		7		Duo	2
5	11,5		6		Duo	2
6	9,5		9		Duo	2
7	10,5		6		Duo	2
8	9,5		8		Duo	2
9	10,5		??		Duo	2

Sign. out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 37 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012 Off Newtown	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth (m) 241 m
		Longitude E/W	Latitude N/S	
G1/250	17/11-2012	-3,0647	4,7440	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 11.29	Time Finish: 18:00	Duration: 6 hr 31 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on Vams 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Sandy clay with mud			
Colour: Dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH		foraminifera		Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	12	1	1	1	1	1	1	1		1	1								D		N
2	9,5	1		1		1		1		1							1		D		N
3	15	1		1		1				1									D		N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR 215-218	Grab nr.	Extra weights
4	12	10	1		Duo	
5	13	10	1		Duo	
6	9,5	10	1		Duo	
7	6	14	1		2 VG	
8	15	5	1		3 VG	
9	13,5	8	1		1 VG	

Sign. out:

SAMPLING JOURNAL **Sign. in:** **L.A** **Page nr: 33 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off Newtown	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) 503 m
		Longitude E/W	Latitude N/S	
G1/500	16/11-2012	-3,0698	4,7286	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 15:20	**Time Finish: 22:45**	**Duration: 7 hr 25 min**
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen duo and Grabs on Vams Sampler 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay?			
Colour: Gley 1, 3/10 GY, very dark greenish grey	Odour: None		
Observation of animals: Crustacea	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	12	1	1	1	1	1	1			1	1								3		N
2	11,5	1		1		1				1							1	1	1		N
3	2,5	1		1		1				1									3		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 192,193,195	Grabnr.	Extra weights
4		3	1		2	
5		2	1		3	
6		?	?		1	
7		4	1		2	
8		8	1		3	
9		2	1		1	

Sign. out: **Eben**

SAMPLING JOURNAL **Sign. in:** **Page nr: 32 of 63 sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth (m) 1218 m
		Longitude E/W	Latitude N/S	
G1/ 1200	16/11-2012	-3,0852	4,6116	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 10.00	Time Finish: 14.20	Duration: 4 hr 20 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on Vams 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Muddy clay			
Colour: Very dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	13	1	1	1	1	1				1	1								3		N
2	3	1		1		1				1									3		N
3	9,5	1		1		1				1									1		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 190,191	Grabnr.	Extra weights
4	4	2	1		2	
5	13	3	1		3	
6	11,5	2	1		1	
7	4	2	1		2	
8	3	2	1		3	
9	9,5	2	1		1	

Sign. out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 3 of 18 land**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Kikam	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: Old: GP/shore GW2/0	Date:	Position		Depth (m) 0 m
		Longitude E/W	Latitude N/S	
G2/0	18/10-2012	-2.3257	4.9226	Positioning control: Garmin Gps

Weather: Sunny	Wind: Breeze, Windy	Wave height (m):
Time Start: 10:15	Time Finish: 12:28	Duration: 3 hr 13 min
Sample equipment used (name, bite area, weight): 0,025m² Van Veen Grab and 1mm sieve (round holes)		

Type of bottom sediment: Fine sand, less than 1mm grain size			
Colour: Light brownish grey	Odour: none		
Observation of animals: Amphipods	No. rejected samples:		
Observation of oil, waste etc.: Cleaned, beach being cleaned by public servants.	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1		Off the beach							Hg		N
2		1		1		1				1		Off the beach					1		Hg		N
3		1		1		1				1		Off the beach							Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks:	Grabnr.	Extra weights
4	Full	1			Hg	
5	Full	1			Hg	
6	Full	1			Hg	
7	Full	1			Hg	
8	Full	1			Hg	

Sign. out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 4 of 18 land**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off kikam	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: Old: GP/5 GW2/0	Date:	Position Longitude E/W	 Latitude N/S	Depth (m) 5 m
G2/5	18/10-2012	-2.3261	4.9183	**Positioning control: Garmin Gps**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 09:15	**Time Finish: 12:28**	**Duration: 3 hr 13 min**
Sample equipment used (name, bite area, weight): 0,025m^2 Van Veen Grab and 1mm sieve (round holes)		

Type of bottom sediment: Fine sand			
Colour: Light grey	Odour: none		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.: none	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor 0-2	2-4	4-6	granulometry geo. Sek.	Nor	Gh	G. nr	Ex. w	Br. Surf
1		1		1		1				1									Hg		N
2		1		1		1				1							1		Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks:	Grabnr.	Extra weights
4				Grab malfunctioned boat without motor rowing		
5				No biological samples.		
6						
7						
8						

Sign. out:

SAMPLING JOURNAL **Sign. in:** **Lawrence** **Page nr: 39 of 63 sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012 Off Kikam	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: GP/ 1 (25) (Old)	Date:	Position		Depth (m) 27 m
		Longitude E/W	Latitude N/S	
G2/25	18/11-2012	-2,5759	4,9280	Positioning control:

Weather: cool	Wind: breezy	Wave height (m):
Time Start: 01:02	Time Finish: 04:20	Duration: 3 hr 18 min
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen Grab and 0,5mm sieve (round holes)		

Type of bottom sediment: Sandy clay and mud, sample 3 sandy			
Colour: Dark greenish grey, sample 3 reddish black	Odour: none		
Observation of animals: Tanaids	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	10,5/12,5	1	1	1	1	1	1			1	1								D	2	N
2	10/10	1	1	1	1	1	1			1	1						1	1	D	2	N
3	12,5	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR: 220-226	Grabnr.	Extra weights
4	10,5	15			Duo	2
5	12,5	4			Duo	2
6	10	15			Duo	2
7	12,5	10			Duo	2
8	10	16			Duo	2
9	11,5	17			Duo	2
10				Foraminifera ??		

Sign. out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 40 of 63 sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012 Off Kikam	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: GP/2 (50) (old)	Date:	Position		Depth (m) 51 m
		Longitude E/W	Latitude N/S	
G2/50	18/11-2012	-2,6188	4,8543	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 05:45	Time Finish: 07:30	Duration: 1:45
Sample equipment used (name, bite area, weight): 0,1m^2 Van Veen Grab and 0,5 mm sieve (round holes)		

Type of bottom sediment:			
Colour:	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	12	1	1	1	1	1	1		1	1									D	2	N
2	9,5	1	1	1	1	1	1		1	1									D	2	N
3	8,5	1		1		1			1	1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 227-232	Grabnr.	Extra weights
4	12	6			Duo	2
5	9,5	6			Duo	2
6	8,5	5			Duo	2
7	9	5			Duo	2
8	7,5	5			Duo	2
9	9,5	5			Duo	2

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SAMPLING JOURNAL **Sign. in:** **Eben** **Page nr: 43 of 63 sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: GP3 (/103) (Old)	Date:	Position		Depth (m) 103 m
		Longitude E/W	Latitude N/S	
G2/100	18/11-2012	-2,7988	4,6799	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 18:35	**Time Finish: 21:30**	**Duration: 2 hr 55 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen Duo Grab and 0,5 mm sieve (round holes)		

Type of bottom sediment:			
Colour:	**Odour:**		
Observation of animals:	**No. rejected samples:**		
Observation of oil, waste etc.: Some plastic rubbish on the beach, drift from sea.	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	10/9,5	1	1	1	1	1	1			1	1								D		N
2	9,5/ 10,5	1	1	1	1	1	1			1	1						1	1	D		N
3	11	1		1		1				1									D		N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR 242-247	Grabnr.	Extra weights
4	10	5			Duo	2
5	9,5	6			Duo	2
6	9,5	6			Duo	2
7	10,5	7			Duo	2
8	11	5			Duo	2
9	10	6			Duo	2

Sign. out: Eben

SAMPLING JOURNAL **Sign. in:** **Lawrence** **Page nr: 42 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off Kikam	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: GP 4 (/250)	Date:	Position		Depth (m) 255 m
		Longitude E/W	Latitude N/S	
G2/250	18/11-2012	-2,8273	4,6503	Positioning control:

Weather: Sunny	**Wind:**	**Wave height (m):**
Time Start: 14:52	**Time Finish:** 18:15	**Duration:** 3 hr 23 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Sand			
Colour: Dark greenish grey	Odour: none		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	12/13	1	1	1	1	1	1			1	1		1	1					1		N
2	12	1		1		1				1							1	1	3		N
3	14,5	1		1		1				1									1		N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR: 236-241	Grabnr.	Extra weights
4	12	10	1		Duo	
5	13	10	1		Duo	
6	12	9	1		Duo	
7	14,5	7	1		Duo	
8	15	8	1		Duo	
9	13	?	?		Duo	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off Kikam	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: GP 5 (/502) (Old)	Date:	Position		Depth (m) 504 m
		Longitude E/W	Latitude N/S	
G2/500	18/11-2012	-2,8530	4,6283	**Positioning control:**

Weather: Sunny	**Wind:**	**Wave height (m):**
Time Start: 10:05	**Time Finish: 14:00**	**Duration: 3 hr 55 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Muddy clay			
Colour: Very dark grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	10,5/8,5	1	1	1	1	1	1			1	1								1/3		N
2	8	1		1		1				1							1	1	1		N
3	6	1		1		1				1									3		N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR: 233-235 Video grab. (nr. 2 middle)	Grabnr.	Extra weights
4	5,5	4	1	Two dives 10:07 and 12:09 + grab or eq. fail ?	2	
5	10,5	3	1		1	
6	8,5	2	1		3	
7	8	3	1		2	
8	8	3	1		1	
9	6	3	1		3	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off Kikam	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: MA 2-5/1361 (old)	Date:	Position: Longitude E/W	Position: Latitude N/S	Depth (m) 1361 m
G2/1361	18/11-2012	-2,9002	4,5136	**Positioning control:**

Weather: Sunny	**Wind:**	**Wave height (m):**
Time Start: 14:22	**Time Finish: 18:00**	**Duration: 3 hr 38 min**
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: Greenish black	**Odour: hydrocarbons**		
Observation of animals:	**No. rejected samples:**		
Observation of oil, waste etc.: Oily sample	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	10/8,5	1	1	1	1	1	1			1	1						1	1	1/3		N
2	11,5/13,5	1	1	1	1	1	1			1	1								1/3		N
3		1		1		1				1									?		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 304, 305. 250 m off discharge point of cuttings.	Grabnr.	Extra weights
4	0	1	1		2	
5	10	1	1		1	
6	8,5	1	1		3	
7	5,5	1	1		2	
8	11,5		1		1	
9	13,5	?			3	

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012 Off Kikam	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: Old: MA 2-4/1600	Date:	Position		Depth (m) 1598 m
		Longitude E/W	Latitude N/S	
G2/1528	21/11-2012	-2,9339	4,5134	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 18:14	Time Finish:	Duration:
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay and mud			
Colour:	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor 0-2	2-4	4-6	granulometry geo. Sek.	Nor	Gh	G. nr	Ex. w	Br. Surf
1	0	1		1		1				1							1	1	1		N
2	0																				N
3	0	2		2		2				2									3		N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks:	Grabnr.	Extra weights
4	Full	1	1		1	
5	Full		1		3	
6	full	?	?		2	
7						
8						

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: MA 2-1/1366 (Old)	Date:	Position Longitude E/W	Latitude N/S	Depth (m) 1361 m
MA 2-1/1361	22/11-2012	-2,9050	4,5135	Positioning control:

Weather: sunny	Wind:	Wave height (m):
Time Start: 08:32	Time Finish: 10:30	Duration: 1 hr 58 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment:			
Colour:	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor 0-2	2-4	4-6	granulometry geo. Sek.	Nor	Gh	G. nr	Ex. w	Br. Surf
1	9,5	1		1		1				1									1		N
2	13,5	1		1		1				1							1		3		N
3																					

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR: 307. 750 m off discharge point.	Grabnr.	Extra weights
4	0		1		2	
5	9,5		1		1	
6	13,5		1		3	
7						
8						

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: MA 2-2/1418(Old)	Date:	Position		Depth (m) 1418 m
		Longitude E/W	Latitude N/S	
G2/1400	22/11-2012	-2,9164	4,5134	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 11:53	Time Finish: 14:15	Duration: 2 hr 22 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Mud			
Colour: Very dark greenish grey Chart: gley 1	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.: oily	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	4	1		1		1				1							1		1		N
2	4	1		1		1				1									3		N
3																					N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR: 308	Grabnr.	Extra weights
4	9,5	1	1		2	
5	4	1	1		1	
6	4	1	1		3	
7						
8						

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off kikam	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) 1377 m
		Longitude E/W	Latitude N/S	
MA 2-3/1376	22/11-2012	-2,8907	4,5133	Positioning control:

Weather:	**Wind:**	**Wave height (m):**
Time Start: 13:28	**Time Finish: 18:00**	**Duration: 4 hr 32 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Mud			
Colour: Very dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.: oily	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	3,5	1		1		1				1							1	1	1		N
2	7	1		1		1				1									3		N
3	3	1		1		1				1									2		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 309, 310	Grabn r.	Extra weights
4	3	1	1		2	
5	3,5	1	1		1	
6	7	1	1		3	
7	3	1	1		2	
8	12	1	1		1	
9					3	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off Kikam	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) 1414 m
		Longitude E/W	Latitude N/S	
MA 2-3/1414	22/11-2012	-2,9160	4,5145	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 18:40	**Time Finish: 21:30**	**Duration: 2 hr 50 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment:			
Colour:	**Odour:**		
Observation of animals:	**No. rejected samples:**		
Observation of oil, waste etc.:	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	9	1		1		1				1							1	1	1		N
2	10	1	1	1	1	1	1			1	1								3		N
3																					N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 311	Grabn r.	Extra weights
4	3	1	1		2	
5	9,5	1	1		1	
6	10	1	1		3	
7						
8						

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SAMPLING JOURNAL **Sign. in:** **Page nr: 5 of 18 land**

Vessel: None	**Area:** Ghana W 2012 West of Cape three points	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: Old GE/0 GW3/0	Date:	Position		Depth (m) 0 m Beach
		Longitude E/W	Latitude N/S	
G3/0	18/10-2012	-2.0908	4.7454	**Positioning control:**

Weather: sunny	**Wind:** light breeze	**Wave height (m):**
Time Start: 15:00	**Time Finish:** 18:00	**Duration:** 3 hr
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen hand held grab. and 1 mm sieves (round holes)		

Type of bottom sediment: Fine sand			
Colour: Light greyish brown.	Odour: none		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.: Some plastic waste in the western corner.	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1		Off the beach							Hg		N
2		1		1		1				1							1		Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks: fine sand	Grabnr.	Extra weights
4		1			Hg	
5		1			Hg	
6		1			Hg	
7		1			Hg	
8		1			Hg	

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SAMPLING JOURNAL **Sign. in:** **Page nr: 6 of 18 land**

Vessel: Jesus is Lord	**Area:** Ghana W 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: Old GE/5 GW3/5	Date:	Position		Depth (m) 4 m
		Longitude E/W	Latitude N/S	
G3/5	18/10-2012	-2.0942	4.7426	**Positioning control:**

Weather: sunny	**Wind: light breeze**	**Wave height (m):**
Time Start: 15:00	**Time Finish: 18:00**	**Duration: 3 hr**
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen hand held grab. and 1 mm sieves (round holes)		

Type of bottom sediment: Fine sand			
Colour: Light brown	**Odour: none**		
Observation of animals:	**No. rejected samples:**		
Observation of oil, waste etc.:	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1									Hg	4	N
2		1		1		1				1							1		Hg	4	N
3		1		1		1				1									Hg	4	N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks:	Grabn r.	Extra weights
4		1			HG	4
5		1			HG	4
6		1			HG	4
7						
8						

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SAMPLING JOURNAL **Sign. in:** **Page nr: 44 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off Cape Three Points	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: Old: GE1/25	Date:	Position		Depth (m) 28 m
		Longitude E/W	Latitude N/S	
G3/25	19/11-2012	-2,1327	4,7647	**Positioning control:**

Weather: cool	**Wind:** calm	**Wave height (m):**
Time Start: 01:33	**Time Finish:** 04:45	**Duration:** 3hr 12 min
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen duo and Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Fine sandy mud			
Colour: Dark greenish grey	Odour:		
Observation of animals: Juvenile eel	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	2/3	1	1	1	1	1	1			1	1						1	1	D	2	N
2	6/4	1	1	1	1	1	1			1	1								D	2	N
3	6	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 248-253	Grabn r.	Extra weights
4	2	7			Duo	2
5	3	7			Duo	2
6	6	9			Duo	2
7	4	5			Duo	2
8	4	6			Duo	2
9	8	6			Duo	2

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth (m) 52m
		Longitude E/W	Latitude N/S	
G3/50	19/11-12	-2,1645	4,6812	Positioning control:

Weather: Cool warm night	Wind:	Wave height (m):
Time Start: 04:58	Time Finish: 07:15	Duration: 2hr 17 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Fine sandy mud			
Colour: Dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	6/4	1	1	1	1	1	1			1	1						1	1	D	2	N
2	2/3	1	1	1	1	1	1			1	1								D	2	N
3	3	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 254-259	Grabnr.	Extra weights
4	6	4			Duo	2
5	4	3			Duo	2
6	2	4			Duo	2
7	3	3			Duo	2
8	3	3			Duo	2
9	7	4			Duo	2

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: Old GW3 GW3/100	Date:	Position		Depth (m) 101 m
		Longitude E/W	Latitude N/S	
G3/ 100	20/11-2012	-2,2289	4,5472	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 00:07	Time Finish: 02:50	Duration: 2 hr 43 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Sandy mud			
Colour: Very dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	8,5/9,5	1	1	1	1	1	1			1	1						1	1	D	2	N
2	11	1		1		1				1									D	2	N
3	14	1		1		1				1		From sample 8	1	1					D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR: 272-277	Grabnr.	Extra weights
4	8,5	8			Duo	2
5	9,5	7			Duo	2
6	11	8			Duo	2
7	14	6			Duo	2
8	14	6			Duo	2
9	15	8			Duo	2

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth (m) 252 m
		Longitude E/W	Latitude N/S	
G3/250	19/11-2012	-2,2540	4,4903	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 21:04	Time Finish: 23:30	Duration: 2hr 26 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment:			
Colour:	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	10/9	1	1	1	1	1	1			1	1						1	1	D	2	N
2	9,5/10	1	1	1	1	1	1			1	1								D	2	N
3	13	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR 266-271	Grabnr.	Extra weights
4	10	4	1		Duo	2
5	9	6	1		Duo	2
6	9,5	4	1		Duo	2
7	10	6	1		Duo	2
8	13	4	1		Duo	2
9	9,5	6	1		Duo	2

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012 Off Three Points	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: GE 5	Date:	Position		Depth (m) 509 m
		Longitude E/W	Latitude N/S	
G3/500	19/11-2012	-2,2817	4,4216	Positioning control:

Weather: Sunny	Wind:	Wave height (m):
Time Start: 9:03+20:05	Time Finish: 12:00+22:00	Duration: 4 hr 52 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Very fine sandy mud			
Colour: Very dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	11,5/6,5	1	1	1	1	1	1			1	1						1	1	1/3		N
2	5	1		1		1				1									3		N
3	10	1		1		1				1									1		N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR: 261, 262, 265. (262 miss ?)	Grabnr.	Extra weights
4	6	1	1		2	
5	11,5	2	1		1	
6	6,5	1	1		3	
7	5	2	1		2	
8	11	2	1		3	
9	10	2	1		1	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: Old: GE 6	Date:	Position		Depth (m) 1197 m
		Longitude E/W	Latitude N/S	
G3/1200	19/11-2012	-2,3691	4,2421	**Positioning control:**

Weather: Sunny	**Wind:** Breeze	**Wave height (m):**
Time Start: 13.10	**Time Finish:** 20.00	**Duration:** 6 hr 50 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Very fine sandy mud			
Colour: Very dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor 0-2	2-4	4-6	granulometry geo. Sek.	Nor	Gh	G. nr	Ex. w	Br. Surf
1	12/11	1		1		1				1							1	1	3/1		N/N
2	11,2/0	1		1		1				1									1/3		N/J
3	??	1		1		1				1									??		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 262-264 last one with duo grab	Grabn r.	Extra weights
4	4,5	1	1		2	
5	12	1	1		3	
6	11	1	1		1	
7	6	1	1		2	
8	11,2	1	1	Cylinder on grab 1 broke off, before sampling possible fluid contamination.	1	
9	0	?	?		3	
10	6,5	?	?			

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SAMPLING JOURNAL **Sign. in:** **Page nr: 7 of 18 Land**

Vessel: None	**Area:** Ghana C 2012 Sekondi	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: Old GC1/0	Date:	Position		Depth (m) 0 m
		Longitude E/W	Latitude N/S	
G4/0	19/10-2012	-1.7058	4.9512	**Positioning control:**

Weather: Cloudy	**Wind:** Breeze	**Wave height (m):**
Time Start: 12.00	**Time Finish:** 14:25	**Duration:** 2 hr 25 min
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen 1 mm sieves (round holes)		

Type of bottom sediment: Fine sand			
Colour: Light greyish brown	**Odour:** Sewage and fish		
Observation of animals:	**No. rejected samples:**		
Observation of oil, waste etc.: Lots of waste on the beach. Shiny metal gold looking sand. Plastic fish nets etc.	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1		Off the beach							Hg	4	N
2		1		1		1				1							1		Hg	4	N
3		1		1		1				1									Hg	4	N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks:	Grabnr.	Extra weights
4		1			Hg	4
5		1			Hg	4
6		1			Hg	4
7		1			Hg	4
8		1			Hg	4

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Vessel: ??	Area: Ghana C 2012 Off Secondi	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: Old GC1/5	Date:	Position		Depth (m) 5 m
		Longitude E/W	Latitude N/S	
G4/5	19/10-2012	-1.7045	4.9506	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 12.00	Time Finish: 14.25	Duration: 2hr 25 min
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen hand Grab 1 mm sieves (round holes)		

Type of bottom sediment: Clay and sand			
Colour: Dark grey	Odour: none		
Observation of animals: Lots of polychaeta, hermit crabs	No. rejected samples: 0		
Observation of oil, waste etc.: Debris and old clothes	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1									Hg		N
2		1		1		1				1							1		Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks:	Grabnr.	Extra weights
4		1			Hg	
5		1			Hg	
6		1			Hg	
7						
8						

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C 2012 Off Secondi	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) m
		Longitude E/W	Latitude N/S	
G4/25	21/11-2012	1,7667	4,8386	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 00:20	**Time Finish: 02:55**	**Duration: 2 hr 35 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5 mm sieves (round holes)		

Type of bottom sediment: Sandy mud			
Colour: Dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	4/6,5	1	1	1	1	1	1			1	1						1	1	D		N
2	11/7	1	1	1	1	1	1			1	1								D		N
3	5,5	1		1		1				1									D		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 299-303	Grabn r.	Extra weights
4	4	7			Duo	
5	6,5	6			Duo	
6	11	5			Duo	
7	5,5	7			Duo	
8	7	7			Duo	
9	6,5	6			Duo	

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana C 2012 Off Secondi	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth (m) 52 m
		Longitude E/W	Latitude N/S	
G4/50	20/11-2012	-1,7838	4,6814	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 21:54	Time Finish: 23:10	Duration: 1 hr 16 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment:			
Colour:	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	6/11	1	1	1	1	1	1			1	1						1	1	D	2	N
2	9/9	1	1	1	1	1	1			1	1								D	2	N
3	9,5	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 293-298	Grabnr.	Extra weights
4	6	?			Duo	2
5	11	?			Duo	2
6	9	?			Duo	2
7	9	?			Duo	2
8	9,5	?			Duo	2
9	11	?			Duo	2

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana C 2012 Off Sekondi	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: GC1/100	Date:	Position		Depth (m) 108 m
		Longitude E/W	Latitude N/S	
G4/100	20/11-2012	-1,8196	4,3510	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 17:45	Time Finish: 19:45	Duration: 2 hrs
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab 0,5mm sieves (round holes)		

Type of bottom sediment:			
Colour:	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	12,5/14	1	1	1	1	1	1			1	1						1	1	D	2	N
2	12/12	1	1	1	1	1	1			1	1								D	2	N
3	12,5	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 287-292	Grabnr.	Extra weights
4	12,5	11		Found 13 jars	Duo	2
5	14	12		Found 13 jars	Duo	2
6	12	12			Duo	2
7	12	6			Duo	2
8	12,5	8			Duo	2
9	12,5	?			Duo	2

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C 2012 Off Secondi	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: GC1/250 (Old)	Date:	Position		Depth (m) 250 m
		Longitude E/W	Latitude N/S	
G4/250	20/11-2012	-1,8222	4,2815	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 05:58	**Time Finish: 08:35**	**Duration: 2 hr 37 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab on VAMS, 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment:			
Colour:	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	11/10	1	1	1	1	1	1			1	1						1	1	D		N
2	10/9,5	1	1	1	1	1	1			1	1								D		N
3	6,5	1		1		1				1									D		N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR: 278-283	Grabnr.	Extra weights
4	11	5	1		Duo	
5	10	5	1		Duo	
6	10	6	1		Duo	
7	9,5	5	1		Duo	
8	6,5	12	1		Duo	
9	11	10	1		Duo	

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana C 2012 Off Secondi	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: GC1/500 (Old)	Date:	Position		Depth (m) 500 m
		Longitude E/W	Latitude N/S	
G4/500	20/11-2012	-1,8310	4,2288	Positioning control:

Weather: Sunny	Wind:	Wave height (m):
Time Start: 10:10	Time Finish: 13:30	Duration: 3 hr 20 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Fine sandy mud			
Colour: Very dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	15/15	1	1	1	1	1	1			1	1						1	1	1/3		N
2	14	1		1		1				1									1		N
3	14	1		1		1				1									3		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 284	Grabnr.	Extra weights
4	8	7	1		2	
5	15	8	1		1	
6	15	5	1		3	
7	6,5	4	1		2	
8	14	2	1		1	
9	14	3	1		3	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C 2012 Off Secondi	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) 993 m
		Longitude E/W	Latitude N/S	
G4/1000	20/11-2012	-1,8398	4,1718	**Positioning control:**

Weather: Sunny	**Wind:**	**Wave height (m):**
Time Start: 12:34	**Time Finish: 17:45**	**Duration: 5 hr 11 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Fine sandy mud			
Colour: Very dark greenish grey	**Odour:**		
Observation of animals:	**No. rejected samples:**		
Observation of oil, waste etc.:	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	10/6	1	1	1	1	1	1			1	1						1	1	1/3		N
2	9	1		1		1				1									1		N
3	7	1		1		1				1									3		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 285, 286	Grabnr.	Extra weights
4	5	3	1		2	
5	10	2	1		1	
6	6	3	1		3	
7	4	2	1		2	
8	9	1	1		1	
9	7	2	1		3	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C 2012 Salt Pond	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: GC2/0	Date:	Position		Depth (m) 0 m
		Longitude E/W	Latitude N/S	
G5/0	20/10-2012	-1.0345	5.2004	**Positioning control:**

Weather: sunny	**Wind:**	**Wave height (m):**
Time Start: 09:34	**Time Finish:** 16:00	**Duration:** 6 hr 26 min
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen hand Grab 1 mm sieves (round holes)		

Type of bottom sediment: Sand			
Colour: Light greyish brown	Odour: none		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.: Average	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1							1		Hg		N
2		1		1		1				1									Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks:	Grabnr.	Extra weights
4		1			Hg	
5		1			Hg	
6		1			Hg	
7		1			Hg	
8		1			Hg	

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Vessel:	Area: Ghana C 2012 Off Salt Pond	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth (m) 5 m
		Longitude E/W	Latitude N/S	
G5/5	20/10-12	-1.0340	5.1994	Positioning control:

Weather: sunny	Wind: none	Wave height (m):
Time Start: 09:45	Time Finish: 16:00	Duration: 6 hr 15 min
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen hand Grab 1 mm sieves (round holes)		

Type of bottom sediment: Sand and a little silt.			
Colour: Black	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.: None	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	1,5	1		1		1				1							1		Hg	4	N
2	1,5	1		1		1				1									Hg	4	N
3	1,5	1		1		1				1									Hg	4	N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,5/0,3mm	Remarks:	Grabn r.	Extra weights
4	Ca 8 litre	1			HG	4
5	Ca 8 litre	1			HG	4
6	Ca 8 litre	1			HG	4

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) 27 m
		Longitude E/W	Latitude N/S	
G5/25	13/11-2012	-0.9774	5.0816	**Positioning control:**

Weather:	**Wind:** light breeze	**Wave height (m):**
Time Start: 04:26	**Time Finish: 06:00**	**Duration: 1 hr 34 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Coarse sand and broken shells			
Colour: 5/10 Y, greenish grey (gley 1)	Odour:		
Observation of animals: Bivalves	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	17,5/14,5	1	1	1	1	1	1			1	1						1	1	D	2	N
2	14,5/14	1	1	1	1	1	1			1	1								D	2	N
3	18	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 163-168	Grabnr.	Extra weights
4	17,5	7		Vol. from bottom??	duo	2
5	14,5	14			“	2
6	14,5	11			“	2
7	18	3			“	2
8	14	12			“	2
9	16,5	12			“	2

Sign. out:

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana C 2012	Project code: 11596-44	Survey nr: 2012407

Grab station nr.: GC2/50 (Old)	Date:	Position Longitude E/W	Position Latitude N/S	Depth (m) 52 m
G5/50	13-14/11-2012	-0.8359	4.7942	Positioning control:

Weather:	Wind: Flat /Calm	Wave height (m):
Time Start: 07:52 + 02:30	Time Finish: 03:30	Duration: 1 hr 30 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Coarse sand and shell fragments.			
Colour: 4/10Y , dark greenish grey (gley 1)	Odour:		
Observation of animals: polychaeta	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	13/15	1	1	1	1	1	1			1	1								D		N
2	12/17	1	1	1	1	1	1			1	1	Mixed geo					1	1			N
3	17	1		1		1				1											N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 169, 186-189	Grabn r.	Extra weights
4	13	4			Duo	
5	12	7				
6	15	6				
7	17	6				
8	17	6				
9	14	6				

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) 101 m
		Longitude E/W	Latitude N/S	
G5/100	14/11-2012	-0,7868 W	4,6788 N	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 00:15	**Time Finish: 01:40**	**Duration: 1 hr 25 min**
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: B shells medium coarse sand			
Colour: 4/10 Y, dark greenish grey (gley 1)	Odour:		
Observation of animals: shrimps, polychaete, crabs, opiuroidea.	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	14,5/9	1	1	1	1	1	1			1	1								D	2	N
2	7/13	1	1	1	1	1	1			1	1						1	1	D	2	N
3	14	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 180-185	Grabnr.	Extra weights
4	14,5	4			Duo	2
5	7	5			Duo	2
6	9	4			Duo	2
7	13	4			Duo	2
8	14	5			Duo	2
9	12	4			Duo	2

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C 2012 Off Saltpond	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: GC2/250 (Old)	Date:	Position		Depth (m) 252 m
		Longitude E/W	Latitude N/S	
G5/250	13/11-2012	-0.7655	4.6408	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 21:02	**Time Finish: 23:50**	**Duration: 2 hr 48 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Fine Sand			
Colour: 4/10 Y, dark greenish grey, gley 1.	**Odour:** none		
Observation of animals:	**No. rejected samples:** 0		
Observation of oil, waste etc.:	**Empty:** 1	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor	THC GH	Metals Nor	Metals GH	PCB Nor	PCB GH			Toc Nor	Toc GH	Remarks :	DNA Nor 0-2	DNA Nor 2-4	DNA Nor 4-6	granulometry geo. Sek.	granulometry geo. Nor	granulometry geo. Gh	G. nr	Ex. w	Br. Surf
1	12/12	1	1	1	1	1	1			1	1								D		N
2	13/12	1	1	1	1	1	1			1	1						1	1	D		N
3	13	1		1		1				1									D		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 173-179	Grabnr.	Extra weights
4	12	4	1	VAMS ??	Duo	
5	12	3	1		Duo	
6	12	3	1		Duo	
7	13	2	1		Duo	
8	13	4	1		Duo	
9	14	2	1		Duo	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth (m) 528 m
		Longitude E/W	Latitude N/S	
G5/500	13/10-2012	-0.7557 W	4,6252 N	**Positioning control:**

Weather: sunny/ bright	**Wind: calm**	**Wave height (m):**
Time Start: 15:00	**Time Finish: 20:30**	**Duration: 5 hr 30 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on Serigstad Sampler 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 4/10 Y, dark greenish grey (gley 1)	Odour:		
Observation of animals: Crustacea	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	7,5/11	1	1	1	1	1	1			1	1						1	1	3/3		N
2	8	1		1		1				1									1		N
3	10	1		1		1				1									1		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 172	Grabnr.	Extra weights
4	7,5	3	1		3	
5	8	2	1		1	
6	6	5	1		2	
7	10	3	1		1	
8	11	2	1		3	
9	3	4	1		2	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C 2012 Off Salt Pond	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: GC2/1000 (Old)	Date:	Position		Depth (m) 1040 m
		Longitude E/W	Latitude N/S	
G5/1000	13/11-2012	-0,7456 W	4,6126	**Positioning control:**

Weather: sunny	**Wind: Flat / Calm**	**Wave height (m):**
Time Start: 09:31	**Time Finish: 14:46**	**Duration: 5 hr 15 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 4/5 GY, dark greenish grey	Odour:		
Observation of animals: Crustacea	No. rejected samples:		
Observation of oil, waste etc.: Oil on surface of grab 2	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	7/5	1	1	1	1	1	1			1	1						1	1	1/3		N
2	2/5	1	1	1	1	1	1			1	1	Two last samples							3/1		N
3	5	1		1		1				1		From same grab							1		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 170, 171	Grabnr.	Extra weights
4	Full	1	1		2	
5	7	2	1		1	
6	5	3	1		3	
7	Full	1	1		2	
8	2,5	2	1		3	
9	5	3	1		1	

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SAMPLING JOURNAL **Sign. in:** **Page nr: 11 of 18 Land**

Vessel: None	**Area:** Ghana 2012 Ghana central Winneba	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: GC3/0 (old)	Date:	Position		Depth: 0 m
		Longitude E/W	Latitude N/S	
G6/0	21/10-12	-0.5879	5.3583	**Positioning control:**

Weather: sunny	**Wind: light breeze**	**Wave height (m):**
Time Start: 10:00	**Time Finish: 14:50**	**Duration: 4 hr 50 min**
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen Grab and 1 mm sieves (round holes)		

Type of bottom sediment: Sand			
Colour: 2,5 Y 6/2. Light brownish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.: Litter and old fish nets	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1									Hg		N
2		1		1		1				1							1		Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,3mm	Remarks:	Grabn r.	Extra weights
4		1			Hg	
5		1			Hg	
6		1			Hg	
7		1			Hg	
8		1			Hg	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C. 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: GC3/5	Date:	Position		Depth: 5 m
		Longitude E/W	Latitude N/S	
G6/5	21/10-2012	-0.5888	5.3443	**Positioning control:**

Weather: sunny	**Wind: Breeze**	**Wave height (m):**
Time Start: 12:30	**Time Finish: 14:50**	**Duration: 2 hr 20 min**
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen Grab and 1mm sieves (round holes)		

Type of bottom sediment: Fine compact sand			
Colour: 10Y 5GY 3/2, very dark greyish olive	Odour: None		
Observation of animals: Nemertini	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1									Hg		N
2		1		1		1				1							1		Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,3mm	Remarks:	Grabn r.	Extra weights
4		1				
5		1				
6		1				

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C 2012 Off Winneba	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 24 m
		Longitude E/W	Latitude N/S	
G6/25	11-12/11-2012	-0.5214	5.3048	Positioning control:

Weather:	**Wind:**	**Wave height (m):**
Time Start: 23:25	**Time Finish: 01:30**	**Duration: 2 hr 05 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Sand, shell sand			
Colour: 4/10Y, dark greenish grey (Gley 1)	Odour:		
Observation of animals: tanaids polychaetae.	No. rejected samples: 2		
Observation of oil, waste etc.:	Empty:2	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	9/11	1	1	1	1	1	1			1	1								D		N
2	8/12	1	1	1	1	1	1			1	1						1	1	D		N
3	12	1		1		1				1									D		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: Gr: 137-144	Grabn r.	Extra weights
4	9	3			Duo	
5	11	3			Duo	
6	8	9			Duo	
7	14	4			Duo	
8	12	11			Duo	
9	14	5			Duo	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C. 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 52 m
		Longitude E/W	Latitude N/S	
G6/50	12/11-2012	-0.4254	5.1522	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 02:42	**Time Finish: 04:00**	**Duration: 1 hr 18 min**
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Fine sand, shell sand			
Colour: 4/5 GY, dark greenish grey, gley 1	**Odour:**		
Observation of animals: polychaeta	**No. rejected samples:**		
Observation of oil, waste etc.:	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	8,5/14,5	1	1	1	1	1	1			1	1								D	2	N
2	8	1		1		1				1							1	1	D	2	N
3	16,5	1		1		1				1									D	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR: 145-149	Grabnr.	Extra weights
4	8,5	6			Duo	2
5	14,5	5			Duo	2
6	8	6			Duo	2
7	16,5	6			Duo	2
8	16	5			Duo	2
9	16	5			Duo	2

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C. 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 102 m
		Longitude E/W	Latitude N/S	
G6/100	12/11-2012	-0.3589	5.0691	Positioning control:

Weather: warm	**Wind:** Calm	**Wave height (m):**
Time Start: 04:30	**Time Finish:** 07:30	**Duration:** 3 hr
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Fine sand			
Colour: 4/10 Y, dark greenish grey (gley 1)	Odour:		
Observation of animals: polychaeta	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	12/10,4	1		1		1				1									D		N
2	13/14	1		1		1				1							1	1			N
3	10,4	1		1		1				1											N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 150-155	Grabn r.	Extra weights
4	12	7			Duo	
5	10,5	8				
6	13	7				
7	10,4	6				
8	14	6				
9	12	8				

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C. 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 247 m
		Longitude E/W	Latitude N/S	
G6/250	12/11-2012	-0.3428	5.0530	**Positioning control:**

Weather: Cloudy	**Wind:** Fresh breeze	**Wave height (m):**
Time Start: 15:30	**Time Finish:** 22:45	**Duration:** 7 hr 15 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Duo Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Fine sand			
Colour: 4/10 Y, dark greenish grey (gley 1)	**Odour:**		
Observation of animals:	**No. rejected samples:**		
Observation of oil, waste etc.:	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	13/6,5	1	1	1	1	1	1			1	1						1	1	1/3		N
2	11/10	1	1	1	1	1	1			1	1								D		N
3	11	1		1		1				1									D		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 158, 160-162	Grabnr.	Extra weights
4	13	6	1		1	
5	6,5	8	1		3	
6	7	9	1		2	
7	11	3	1		Duo	
8	10	6	1		Duo	
9	11	8	1		Duo	

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana C. 2012	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 499 m
		Longitude E/W	Latitude N/S	
G6/500	12/11-2012	-0.3397	5.0297	**Positioning control:**

Weather: Partly cloudy dull warm	**Wind:** Calm- Strong breeze	**Wave height (m):**
Time Start: 12:30	**Time Finish:** 20:30	**Duration:** 8 hr 00 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay and fine sand.			
Colour: 4/10 Y , dark greenish grey	Odour:		
Observation of animals: Polychaetae, fish, shrimp and Sipuncula.	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	5/6	1	1	1	1	1	1			1	1						1	1	3/ 1		N
2	5	1		1		1				1									1		N
3	6	1		1		1				1									3		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 157, 159	Grabn r.	Extra weights
4	5	1	1		3	
5	6	2	1		1	
6	Full	2	1		2	
7	Full	3	1		2	
8	5	3	1		1	
9	6	2	1		3	

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana C. 2012	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 1013 and 975 m
		Longitude E/W	Latitude N/S	
G6/1000	11-12/11-2012	-0.3177	5.023	Positioning control:

Weather:	Wind: Calm	Wave height (m):
Time Start: 19:30 08:25	Time Finish: 21:30 10:25	Duration: 4 hr
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 4/10 BG, dark greenish grey (gley 2)	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	8/11	1	1	1	1	1	1			1	1						1	1			N
2	11	1		1		1				1											N
3	8	1		1		1				1											N

Sample nr	Vol. (cm)	No bottles bio. 0,5mm	bottles bio. 0,3mm	Remarks: GR: 136 and 156	Grabnr.	Extra weights
4	8	2	1		1	
5	11	1	1		3	
6	4	2	1		2	
7	11	2	1		1	
8	8	2	1		3	
9	full	2	1		2	

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SAMPLING JOURNAL **Sign. in:** **Page nr: 13 of 18 Land**

Vessel: None	**Area:** Ghana E 2012 Old Nigo	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: Old GE2/0 GE-1/0	Date:	Position		Depth: 0 m
		Longitude E/W	Latitude N/S	
G7/0	22/10-2012	0.1839	5.7439	**Positioning control:**

Weather: sunny	**Wind:** Breeze	**Wave height (m):**
Time Start:	**Time Finish:**	**Duration:**
Sample equipment used (name, bite area, weight): 0,025 m² Van Veen Grab and 1 mm sieves (round holes)		

Type of bottom sediment: Sand and shellsand			
Colour: 10 YR 8/2, very pale brown	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1							1		Hg		N
2		1		1		1				1									Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 0,5/1mm	bottles bio. 0,3mm	Remarks: moved from New Nigo in 2011 to the beach in Old Ningo (2012) because of the boats.	Grabnr.	Extra weights
4		1			HG	
5		1			HG	
6		1			HG	
7		1			HG	
8		1			HG	

Sign out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 14 of 18 Land**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Old Nigo	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 5 m
		Longitude E/W	Latitude N/S	
G7/5	22/10-2012	0.1849	5.7412	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start:	**Time Finish:**	**Duration:**
Sample equipment used (name, bite area, weight): 0,025 m² Van Veen Grab and 1 mm sieves (round holes)		

Type of bottom sediment: Fine sand			
Colour: 10Y 5GY 3/2, very dark greyish olive	Odour: none		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.: none	Empty:1	Stone:	Open:3

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1							1		Hg		N
2		1		1		1				1									Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,3mm	Remarks:	Grabn r.	Extra weights
4		1			Hg	
5		1			Hg	
6		1			Hg	

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SAMPLING JOURNAL **Sign. in:** **Page nr: 14 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Old Nigo	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	**Date:**	**Position**		**Depth:** 25 m
		Longitude E/W	**Latitude N/S**	
G7/25	08/11-2012	0.1964	5.6607	**Positioning control:**

Weather:	**Wind:** Calm	**Wave height (m):**
Time Start: 02:46 10:11	**Time Finish:** 03:30 11:00	**Duration:** 1 hr 33 min
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Sand and corals			
Colour:	**Odour:**		
Observation of animals: Corals, shrimps and crabs	**No. rejected samples:** 2		
Observation of oil, waste etc.:	**Empty:** 1	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	17	1	1	1	1	1	1			1	1	Corals					1	1	L		N
2	20	1		1		1				1		Corals							L		N
3	18	1		1		1				1		Corals							L		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 92-94 and 115-123	Grabnr.	Extra weights
4	Full	5		Corals	Long	
5	Full	3		Corals	Long	
6	15	7		Corals	Long	
7	17	2		Corals	Long	
8	17	3		Corals	Long	
9	15	3		Corals	Long	

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SAMPLING JOURNAL **Sign. in:** **Page nr: 15 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana E 2012 Off Old Nigo	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 52 m
		Longitude E/W	Latitude N/S	
G7/50	08/11-2012	0.2170	5.6097	Positioning control:

Weather:	Wind: calm	Wave height (m):
Time Start: 04:00	Time Finish: 05:47	Duration: 1 hr 47 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Shells clay and coarse sand			
Colour: 4/10 Y, dark greenish grey	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	4,5/7	1	1	1	1	1	1			1	1						1	1	LA		N
2	5	1		1		1				1									LA		N
3	5	1		1		1				1									LA		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 95-104	Grabnr.	Extra weights
4	Full	6			LA	
5	8	8			LA	
6	3	10			LA	
7	7	6			LA	
8	5	7			LA	
9	8	7			LA	

Sign out:

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana E 2012 Off Old Nigo	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 102 m
		Longitude E/W	Latitude N/S	
G7/100	8/11-2012	0.2411	5.557	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 06:15	Time Finish: 09: 30	Duration: 3 hr 15 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay, sand and shells			
Colour: 4/10 Y	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1	1	1	1	1	1			1	1						1	1	L		N
2		1		1		1				1									L		N
3		1		1		1				1									L		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 105-114	Grabnr.	Extra weights
4	5	7		Clay	LA	
5	Full	8		Sandy	LA	
6	4,5	6			LA	
7	7	7			LA	
8	5	4			LA	
9	5	6			LA	

Sign out:

SAMPLING JOURNAL **Sign. in:**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Old Nigo	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 251 m
		Longitude E/W	Latitude N/S	
G7/250	10/11-2012	0.2497	5.535	**Positioning control:**

Weather:	**Wind:** Calm	**Wave height (m):**
Time Start: 19:20	**Time Finish: 22:50**	**Duration: 3 hr 30 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 2,5 Y 2/4, dark greyish brown	**Odour:**		
Observation of animals:	**No. rejected samples:**		
Observation of oil, waste etc.:	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	8/7,5	1	1	1	1	1	1			1	1						1	1	D		N
2	12/6	1	1	1		1	1			1	1								D		N
3	12	1		1		1				1									D		N

Sample nr	Vol. (cm)	No bottles bio. 0,5/1mm	bottles bio. 0,3mm	Remarks: GR: 126-133	Grabnr.	Extra weights
4	8	2	1	Forgot the separation wall	Duo	
5	8	3	1		Duo	
6	12	3	1		Duo	
7	7,5	3	1		Duo	
8	6	3	1		Duo	
9	6	2	1		Duo	

Sign out:

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana E 2012 Off Old Nigo	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 504 m
		Longitude E/W	Latitude N/S	
G7/500	10/11-2012	0.2583	5.5145	Positioning control:

Weather: Sunny and warm	Wind: Calm	Wave height (m):
Time Start: 12:26	Time Finish: 17:30	Duration: 5 hr 4 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 4/10 Y, dark greenish grey	Odour:		
Observation of animals: Crustacea, Polychaeta and Sipuncula.	No. rejected samples: 1 (used anyway)		
Observation of oil, waste etc.:	Empty:	Stone:	Open: 1

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	Full/7	1	1	1	1	1	1			1	1	Grab 3 slightly open					1	1	3/ 1		Y/N
2	6,5	1		1		1				1									3		N
3	7	1		1		1				1									1		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks:	Grabn r.	Extra weights
4	7	4	1		1	
5	Full	2	1	Partly open	3	
6	Full	5	1		2	
7	6,5	3	1		3	
8	7	3	1		1	
9	16	1	1		2	

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana E 2012 Off Old Nigo	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 972 m
		Longitude E/W	Latitude N/S	
G7/1000	11/11-2012	0.2692	5.4885	Positioning control:

Weather: Sunny	Wind: Calm	Wave height (m):
Time Start: 08:45	Time Finish: 15:20	Duration: 6 hr 35 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment:			
Colour: 4/10 G, dark greenish grey (gley 2)	Odour:		
Observation of animals: Polychaeta, crustacean, amphipods and tanaidiacea.	No. rejected samples:		
Observation of oil, waste etc.: some plastic on sea bed	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	full	1	1	1	1	1	1			1	1						1	1	3/ 1		J
2	full	1	1	1	1	1	1			1	1								3		J
3	2	1		1		1				1									1		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks:	Grabn r.	Extra weights
4	full	1	1		3	
5	full	1	1		1	
6	full	1	1		2	
7	2	3	1		1	
8	3,5	2	1		3	
9	full	2	1		2	

Sign out:

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana E 2012 Ada Foah	Project code: 11596-44	Survey nr: 2012407

Grab station: Old GC3/0 GE2/0	Date:	Position		Depth: 0 m
		Longitude E/W	Latitude N/S	
G8/0	25/10-2012	0.6180	5.7763	Positioning control:

Weather: Sunny	Wind:	Wave height (m):
Time Start:	Time Finish:	Duration: 1 hr 30 min
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen Grab and 1 mm sieves (round holes)		

Type of bottom sediment: Coarse sand			
Colour: Light brown	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1									Hg		N
2		1		1		1				1									Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR:	Grabn r.	Extra weights
4	F	1		Bottles from counting		
5	F	1				
6	F	1				
7	F	1				
8	F	1				

Sign out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 18 of 18 Land**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Ada Foah	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.: Old GC3/5 GE2/5	Date:	Position		Depth: 5 m
		Longitude E/W	Latitude N/S	
G8/5	25/10-2012	0.6186	5.7711	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start:	**Time Finish:**	**Duration:**
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen Grab and 1 mm sieves (round holes)		

Type of bottom sediment:			
Colour:	**Odour:**		
Observation of animals:	**No. rejected samples:**		
Observation of oil, waste etc.:	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1																			Hg		N
2																			Hg		N
3																			Hg		N

Sample nr	Vol. (cm)	No bottles bio. 0,5/1mm	bottles bio. 0,3mm	Remarks:	Grabnr.	Extra weights
4				Could not find sufficient boat not sampled. Village moved.		
5						
6						
7						
8						

Sign out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 1 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana E 2012 Off Ada Foah	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 27 m
		Longitude E/W	Latitude N/S	
G8/25	4/11-2012	0.7339	5.6435	Positioning control:

Weather: Partly overcast	Wind: Light breeze	Wave height (m):
Time Start: 19:00	Time Finish: 23:20	Duration: 4 hr 20 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay, sea shells, sand and gravel.			
Colour: 4/10 Y, dark greenish grey	Odour:		
Observation of animals: Crustacea, ophiuroidea and polychaeta.	No. rejected samples: 1		
Observation of oil, waste etc.:	Empty: 1	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	4	1	1	1	1	1	1			1	1						1	1	Sh	2+2	N
2	3	1		1		1				1									Sh	2+2	N
3	8	1		1		1				1									Sh	2+2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 1-11	Grabnr.	Extra weights
4	2	10			Short	2+2
5	2	10			Short	2+2
6	Full	10			Short	2+2
7		11			Short	2+2
8		11			Short	2+2
9	13	7			Short	2+2

Sign out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 9 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Ada Foah	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 49 m
		Longitude E/W	Latitude N/S	
G8/50	6/11-2012	0.7276	5.5926	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 10:41	**Time Finish: 01:40**	**Duration: 2 hr 59 min**
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay and fine sand			
Colour: 4/5 GY, dark greenish grey	Odour:		
Observation of animals:	No. rejected samples: 1		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	5	1	1	1	1	1	1			1	1						1	1			N
2	4	1		1		1				1											N
3	6,5	1		1		1				1											N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 56-66	Grabn r.	Extra weights
4	8	7				
5	4	10				
6	6,5	7				
7	4	10				
8	5	12				
9	5	11				

Sign out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 10 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana E 2012 Off Ada Foah	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 100 m
		Longitude E/W	Latitude N/S	
G8/100	7/11-2012	0.7287	5.5890	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 01:53	Time Finish: 03:15	Duration: 1 hr 22 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour:	Odour:		
Observation of animals: Polychaeta, ophiouridea.	No. rejected samples: 6		
Observation of oil, waste etc.:	Empty: 6	Stone:	Open: 1

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	2,5	1		1		1				1							1		Sh		N
2																					N
3																					N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 67-70	Grabn r.	Extra weights
4	Full	2			Short	
5	Full	2		Station abandoned due to steep slope.	Short	
6						
7						
8						

Sign out:

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Ada Foah	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 101 m
		Longitude E/W	Latitude N/S	
G8/100	7/11-2012	0.7267	5.5874	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 20:07	**Time Finish: 22:45**	**Duration: 2 hr 38 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 4/10 GY, dark greenish grey	Odour:		
Observation of animals:	No. rejected samples: 3		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1																			Hg		
2	Full	1		1		1				1									Hg		Y
3	Full	1		1		1				1									Hg		Y

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 85-91	Grabnr.	Extra weights
4						
5						
6	full	3				2
7	full	3				2
8	full	3				2
9	full	3				2

Sign out:

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Vessel: RV Dr. Fritjof Nansen	Area: Ghana E 2012 Off Ada Foah	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 247 m
		Longitude E/W	Latitude N/S	
G8/250	7/11-2012	0.7294	5.5794	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 04:10	Time Finish: 09:10	Duration: 5 hr
Sample equipment used (name, bite area, weight): 0,1 m² LA. Van Veen Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 5/10 Y, greenish grey	Odour:		
Observation of animals: priapulids and ophiuridea	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	6/4,5	1	1	1	1	1	1			1	1						1	1	L		N
2	2	1		1		1				1									L		N
3	Full	1		1		1				1									L		J

Sample nr	Vol. (cm)	No bottles bio. 0,5/1mm	bottles bio. 0,3mm	Remarks: GR: 71-80	Grabnr.	Extra weights
4	Full	1	1	Label date should be 7th not 6th.	LA	2
5	Full	1	1		LA	2
6	Full	2	1	Duo or LA ??	LA	2
7	Full	1	1		LA	2
8	Full	1	1		LA	2
9	6	1	1		LA	2

Sign out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 12 of 59 Sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Ada Foah	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 509 m
		Longitude E/W	Latitude N/S	
G8/500	7/11-2012	0.7320	5.5638	**Positioning control:**

Weather: Sunny	**Wind: Calm**	**Wave height (m):**
Time Start: 15:45	**Time Finish: 21:10**	**Duration: 5 hr 25 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment:			
Colour:	**Odour:**		
Observation of animals:	**No. rejected samples:**		
Observation of oil, waste etc.:	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	Full	1	1	1	1	1	1			1	1						1	1			N
2	Full	1		1		1				1											N
3	11	1		1		1				1											N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 83, 84	Grabnr.	Extra weights
4	Full	2	1		3	
5	Full	2	1		1	
6	Full	2	1		2	
7	Full	1	1		1	
8	11	1	1		3	
9	Full	4	1		2	

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SAMPLING JOURNAL **Sign. in:** **Page nr: 8 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Ada Foah	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 1034 m
		Longitude E/W	Latitude N/S	
G8/1000	6-7/11-2012	0.7277	5.5208	**Positioning control:**

Weather: Sunny	**Wind: Calm**	**Wave height (m):**
Time Start: 20:15 11:55	**Time Finish: 22:00 15:30**	**Duration: 5 hr 20 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on Serigstad Sampler 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 4/10 GY, dark greenish grey	Odour:		
Observation of animals: Ehinoidea	No. rejected samples: 2		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	Full	1		1		1				1							1	1			J
2	2	1		1		1				1											N
3	2	1		1		1				1											N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 55, 81, 82	Grabn r.	Extra weights
4	Full	1	1		3	
5	Full	2	1		1	
6	Full	1	1		2	
7	Full	1	1		2	
8	2	1	1		3	
9	2	1	1		1	

Sign out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 15 of 18 land**

Vessel: none	**Area:** Ghana E 2012 Denu	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 0 m
		Longitude E/W	Latitude N/S	
G9/0	24/10-2012	1.1524	6.0922	**Positioning control:**

Weather: Overcast	**Wind:** Breeze	**Wave height (m):**
Time Start: 10:00	**Time Finish:**	**Duration:**
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen hand grab and 1mm sieves (round holes)		

Type of bottom sediment: Sand, coarser than 1mm.			
Colour: Middle brown	Odour:		
Observation of animals:	No. rejected samples:		
Observation of oil, waste etc.: None. Cleanest beach visited nice.	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1		Off the beach							Hg		N
2		1		1		1				1							1		Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,3mm	Remarks:	Grabnr.	Extra weights
4		2		Coarser than 1mm.	Hg	
5		4			Hg	
6		5			Hg	
7		5			Hg	
8		5			Hg	

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SAMPLING JOURNAL **Sign. in:** **Page nr: 16 of 18 Land**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Denu	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: m
		Longitude E/W	Latitude N/S	
G9/5	24/11-2012	1.1566	6.0917	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 10:00	**Time Finish: 14:00**	**Duration: 4 hr**
Sample equipment used (name, bite area, weight): 0,025 m^2 Van Veen hand grab and 1 mm sieves (round holes)		

Type of bottom sediment: Fine sand			
Colour: 5Y 3/2, dark olive grey	Odour:		
Observation of animals: Mollusca	No. rejected samples:		
Observation of oil, waste etc.: plastic bags in the water otherwise clean.	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1		1		1		1				1									Hg		N
2		1		1		1				1							1		Hg		N
3		1		1		1				1									Hg		N

Sample nr	Vol. (cm)	No bottles bio. 1mm	bottles bio. 0,3mm	Remarks:	Grabn r.	Extra weights
4		1			Hg	
5		1			Hg	
6		1			Hg	
7						
8						

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SAMPLING JOURNAL **Sign. in:** **Page nr: 4 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana E 2012 Off Denu	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 26 m
		Longitude E/W	Latitude N/S	
G9/25	5/11-2012	1.1980	6.0220	Positioning control:

Weather:	Wind: light breeze	Wave height (m):
Time Start: 22:01	Time Finish: 23:45	Duration: 1 hr 44 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen short arm Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Sand			
Colour: 5/5 GY, greenish grey	Odour:		
Observation of animals: Eel, polychaeta	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	13	1	1	1	1	1	1			1	1						1	1	Sh		N
2	14	1		1		1				1									Sh		N
3	14	1		1		1				1									Sh		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 23-32	Grabn r.	Extra weights
4	12	8			Sh	
5	12	7			Sh	
6	12	9			Sh	
7	13	10			Sh	
8	16	6			Sh	
9	15	8		Ghana	Sh	

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SAMPLING JOURNAL **Sign. in:** **Page nr: 5 of 64 Sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Denu	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 52 m
		Longitude E/W	Latitude N/S	
G9/50	6/11-2012	1.2359	5.9439	**Positioning control:**

Weather:	**Wind:** light breeze	**Wave height (m):**
Time Start: 00:25	**Time Finish:** 02:20	**Duration:** 1 hr 55 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Fine sand and shells			
Colour: 4/5 GY, dark greenish grey	**Odour:**		
Observation of animals: Polychaeta	**No. rejected samples:**		
Observation of oil, waste etc.:	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	7,5	1	1	1	1	1	1			1	1						1	1	Sh	2	N
2	8,5	1		1		1				1									Sh	2	N
3	4,3	1		1		1				1									Sh	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	**Remarks:** GR: 33-42	Grabn r.	Extra weights
4	Full	6			Sh	2
5	Full	5			Sh	2
6	Full	6			Sh	2
7	Full	8			Sh	2
8	Full	7			Sh	2
9	Full	7			Sh	2

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SAMPLING JOURNAL **Sign. in:** **Page nr: 6 of 63**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Denu	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 103 m
		Longitude E/W	Latitude N/S	
G9/100	6/11-2012	1.2552	5.8969	Positioning control:

Weather:	**Wind:**	**Wave height (m):**
Time Start: 02:35	**Time Finish: 05:00**	**Duration: 2 hr 25 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen long armed Grab and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay and sand			
Colour: 4/10 Y, dark greenish grey	Odour: none		
Observation of animals: Ophiuroids and an eel	No. rejected samples: 0		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	4	1	1	1	1	1	1			1	1						1	1	L	2	N
2	Full	1		1		1				1									L	2	J
3	1,5	1		1		1				1									L	2	N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 43-52	Grabn r.	Extra weights
4	Full	6			Long	2
5	Full	6			Long	2
6	Full	5			Long	2
7	Full	4			Long	2
8	Full	4			Long	2
9	Full	7			Long	2

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Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Denu	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 251 m
		Longitude E/W	Latitude N/S	
G9/250	5/11-2012	1.2616	5.8833	Positioning control:

Weather: Sunny	**Wind: Calm**	**Wave height (m):**
Time Start: 09:09	**Time Finish: 13:00**	**Duration: 3 hr 51 min**
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen duo Grab, 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 4/10 Y, dark greenish grey	Odour:		
Observation of animals: Polychaeta	No. rejected samples: 1 overflow		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	4	1	1	1	1	1	1			1	1						1	1	L		N
2	6,5	1		1		1				1											N
3	11	1		1		1				1											N

Sample nr	Vol. (cm)	No bottles bio. 0,5/1mm	bottles bio. 0,3mm	Remarks: Gr: 12-20	Grabnr.	Extra weights
4	5		1	1st bottle from each sample from the upper 5 cm.	LA	
5	5	4	1		LA	
6	4	5	1		LA	
7	4	7	1		LA	
8	5	4	1		LA	
9	4	7	1		LA	

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SAMPLING JOURNAL **Sign. in:** **Page nr: 3 of 63**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Denu	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 501 m
		Longitude E/W	Latitude N/S	
G9/500	5/11-2012	1.2719	5.8608	**Positioning control:**

Weather: Sunny	**Wind:** Light breeze	**Wave height (m):**
Time Start: 14:16	**Time Finish:** 20:00	**Duration:** 5 hr 44 min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 4/10 Y, dark greenish grey	Odour:		
Observation of animals: Polychaetae, Ophiuroida.	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	Full	1	1	1	1	1	1			1	1						1	1	3/ 1		J
2	Full	1		1		1				1									1		J
3	Full	1		1		1				1									3		J

Sample nr	Vol. (cm)	No bottles bio. 0,5/1mm	bottles bio. 0,3mm	Remarks: GR: 21, 22	Grabn r.	Extra weights
4	Full	2	1		3	
5	Full	2	1		1	
6	Full	2	1		2	
7	Full	1	1		2	
8	Full	3	1		1	
		1	1		3	

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SAMPLING JOURNAL **Sign. in:**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana E 2012 Off Denu	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 1006 m
		Longitude E/W	Latitude N/S	
G9/1000	6/11-2012	1.2844	5.8294	**Positioning control:**

Weather: Sunny	**Wind: Calm**	**Wave height (m):**
Time Start: 09:55	**Time Finish: 16:30**	**Duration: 6 hr 35 min**
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Clay			
Colour: 4/10 GY, dark greenish grey	Odour:		
Observation of animals: Polychaetae, crustacean, ophiuroidea.	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1	Full	1	1	1	1	1	1			1	1						1	1	3/ 1		J
2	Full	1		1		1				1									1		J
3	8	1		1		1				1									3		N

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 53, 54	Grab nr.	Extra weights
4	Full	1	1		3	
5	Full	2	1		1	
6	Full	1	1		2	
7	8		1		3	
8	Full	1	1		1	
9	Full	1	1		2	

Sign out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 38 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	**Area:** Ghana W 2012 Off New Town	**Project code:** 11596-44	**Survey nr:** 2012407

Grab station nr.:	Date:	Position		Depth: 386 m
		Longitude E/W	Latitude N/S	
Banana Reef 1	17/11-2012	-3.1530	4. 7613	**Positioning control:**

Weather:	**Wind:**	**Wave height (m):**
Time Start: 18:48	**Time Finish: 22:00**	**Duration: 3 hr 12 min**
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Hard bottom coral reef			
Colour:	**Odour:**		
Observation of animals: Polychaetae, Crustaceans, Bivalves and Corals.	**No. rejected samples:**		
Observation of oil, waste etc.:	**Empty:**	**Stone:**	**Open:**

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1																					
2																					
3																					

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 219 slightly west of transect 1.	Grab nr.	Extra weights
4		?	?			
5		?	?			
6		?	?			
7						
8						
9						

Sign out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 62 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012 Off New Town	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 376 m
		Longitude E/W	Latitude N/S	
Banana Reef 2	23/11-2012	-3.1541	4. 7641	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 08:47	Time Finish: 11:30	Duration: 2 hr 43 min
Sample equipment used (name, bite area, weight): 0,1 m^2 Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Hard bottom coral reef			
Colour:	Odour:		
Observation of animals: Polychaetae, Crustaceans, Bivalves and Corals.	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1																					
2																					
3																					

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 312 slightly west of transect 1.	Grab nr.	Extra weights
4		?	?			
5		?	?			
6		?	?			
7						
8						
9						

Sign out:

SAMPLING JOURNAL **Sign. in:** **Page nr: 63 of 63 Sea**

Vessel: RV Dr. Fritjof Nansen	Area: Ghana W 2012 Off New Town	Project code: 11596-44	Survey nr: 2012407

Grab station nr.:	Date:	Position		Depth: 375 m
		Longitude E/W	Latitude N/S	
Banana Reef 3	23/11-2012	-3.1469	4. 7706	Positioning control:

Weather:	Wind:	Wave height (m):
Time Start: 12:17	Time Finish: 15:00	Duration: 2 hr 43min
Sample equipment used (name, bite area, weight): 0,1 m² Van Veen duo and Grabs on VAMS 0,3mm (square holes) and 0,5mm sieves (round holes)		

Type of bottom sediment: Hard bottom coral reef			
Colour:	Odour:		
Observation of animals: Polychaetae, Crustaceans, Bivalves and Corals.	No. rejected samples:		
Observation of oil, waste etc.:	Empty:	Stone:	Open:

Sample nr.	Volume (cm)	THC Nor / GH		Metals Nor / GH		PCB Nor/ GH				Toc Nor/GH		Remarks :	DNA Nor			granulometry geo.			G. nr	Ex. w	Br. Surf
													0-2	2-4	4-6	Sek.	Nor	Gh			
1																					
2																					
3																					

Sample nr	Vol. (cm)	No bottles bio. 0,5 mm	bottles bio. 0,3mm	Remarks: GR: 313 slightly west of transect 1.	Grab nr.	Extra weights
4		?	?			
5		?	?			
6		?	?			
7						
8						
9						

Sign out:

Chemical parameters.

Ghana 2012 metals.

Parameter	As Av.	As Stdev.	Ba Av.	Ba Stdev.	Cd Av.	Cd Stdev.	Cr Av.	Cr Stdev.	Cu Av.	Cu Stdev.	Ni Av.	Ni Stdev.	Pb Av.	Pb Stdev.	Zn Av.	Zn Stdev.	Hg Av.
G1/0	24.95	4.77	3.33	0.69	0.015	0.00	20.44	3.99	0.32	0.03	2.86	0.52	2.49	0.48	10.62	2.24	0.005
G1/5	15.30	1.68	2.82	0.09	0.015	0.00	15.43	2.60	0.32	0.04	2.54	0.41	1.68	0.21	9.62	1.67	0.005
G1/25	16.14	2.52	11.55	11.36	0.031	0.00	29.41	11.21	1.50	0.91	7.04	3.45	3.96	0.54	24.27	10.48	0.005
G1/50	12.45	1.45	32.58	7.53	0.034	0.00	45.25	0.08	3.26	0.20	12.84	0.12	4.86	0.15	39.57	0.73	0.005
G1/100	7.55	0.88	51.03	8.65	0.117	0.01	35.89	0.42	5.48	0.26	13.60	0.50	3.11	0.05	38.36	3.33	0.012
G1/250	66.91	6.34	51.46	3.42	0.143	0.02	89.21	7.17	4.74	1.26	18.97	1.30	9.14	0.46	102.03	9.17	0.013
G1/500	6.92	0.29	71.33	11.88	0.163	0.04	50.01	0.71	9.60	1.20	20.61	0.46	3.37	0.33	65.11	19.00	0.013
G1/1200	7.56	0.76	301.44	104.21	0.215	0.05	63.69	0.98	20.39	3.70	35.67	4.31	5.15	0.96	73.62	3.14	0.027
G2/0	33.91	1.99	3.51	0.04	0.031	0.00	20.98	1.84	1.87	0.05	5.18	0.35	2.77	0.13	26.33	1.88	0.005
G2/5	25.47	0.60	3.51	0.17	0.015	0.00	24.38	0.27	0.80	0.05	4.81	0.05	2.26	0.04	31.37	0.36	0.060
G2/25	68.39	16.81	5.04	1.06	0.071	0.05	51.12	11.86	1.10	0.27	7.71	1.22	4.89	0.68	32.50	3.13	0.005
G2/50	14.63	1.57	11.50	1.75	0.049	0.01	50.08	2.02	3.12	0.40	12.34	0.67	5.15	0.19	42.72	1.47	0.012
G2/100	6.93	0.58	21.66	2.11	0.116	0.00	31.42	1.48	4.36	0.40	10.97	0.86	2.54	0.16	30.67	1.82	0.012
G2/250	29.55	2.38	24.18	2.46	0.144	0.01	58.69	0.87	4.81	0.75	14.95	0.69	4.11	0.32	70.80	11.12	0.011
G2/500	8.82	0.83	185.62	73.54	0.197	0.03	61.64	1.74	8.32	0.82	22.41	1.79	2.82	0.09	53.90	1.69	0.015
G2 1361	5.80	0.39	1193.17	406.77	0.244	0.01	70.38	0.96	24.32	0.37	43.81	0.52	4.42	0.32	78.94	0.55	0.043
G2 1598	6.51	1.85	557.38	241.95	0.208	0.06	71.80	2.29	25.72	0.89	46.17	0.54	4.69	0.91	81.43	2.05	0.037
MA 2-1 /1361	7.32	2.47	3013.93	676.04	0.205	0.04	73.57	3.53	24.04	1.39	43.59	1.39	5.75	0.39	80.20	1.95	0.037
G2/1418	5.85	0.23	394.37	28.16	0.203	0.04	69.50	1.37	24.02	0.54	43.57	0.76	4.06	0.29	78.13	1.69	0.035
MA 2-3 /1376	6.13	0.40	631.64	242.69	0.217	0.01	70.56	0.75	24.16	0.37	43.51	0.44	4.51	0.27	79.19	0.86	0.035
MA 2-3 /1414	5.64	0.29	443.94	49.86	0.235	0.01	71.24	0.17	24.47	0.18	44.39	0.00	3.99	0.08	79.42	0.36	0.043
G3/0	34.94	0.74	5.57	0.10	0.050	0.00	39.60	5.08	1.38	0.15	8.98	1.16	2.56	0.06	5.88	0.64	0.005
G3/5	33.47	1.33	6.52	0.10	0.062	0.00	44.68	2.34	1.72	0.16	9.43	0.60	2.76	0.16	8.65	4.89	0.005
G3/25	66.87	8.51	20.20	1.91	0.072	0.01	68.09	0.44	5.44	0.73	22.03	1.08	11.85	1.29	62.87	13.20	0.030
G3/50	10.92	0.98	30.60	1.50	0.055	0.00	51.94	0.16	7.27	0.41	17.13	0.21	5.04	0.06	40.58	1.14	0.021
G3/100	7.40	0.59	27.19	2.07	0.124	0.01	37.72	1.06	5.39	0.33	14.85	0.74	2.77	0.05	50.54	16.09	0.013
G3/250	20.84	0.52	21.95	1.61	0.148	0.01	75.53	1.67	5.59	0.06	20.18	0.12	4.14	0.09	74.18	1.72	0.013
G3/500	7.64	0.38	133.01	61.75	0.296	0.01	71.80	1.23	13.42	0.60	32.40	1.02	2.45	0.16	63.99	0.93	0.017
G3/1200	6.78	0.28	363.33	2.70	0.229	0.02	64.00	1.16	22.61	0.40	43.21	0.57	4.89	0.02	76.67	1.44	0.040

Metals Ghana West. (Average and standard deviation)

Parameter	As Av.	As Stdev.	Ba Av.	Ba Stdev.	Cd Av.	Cd Stdev.	Cr Av.	Cr Stdev.	Cu Av.	Cu Stdev.	Ni Av.	Ni Stdev.	Pb Av.	Pb Stdev.	Zn Av.	Zn Stdev.	Hg Av.
G4/0	13.38	0.18	39.26	4.01	0.043	0.00	17.64	0.61	3.79	0.22	5.82	0.07	9.20	0.35	52.75	1.23	0.005
G4/5	16.04	1.46	137.71	4.37	0.065	0.00	35.54	0.20	14.13	0.53	13.72	0.09	18.61	0.72	83.40	0.68	0.047
G4/25	106.84	7.56	16.76	0.73	0.047	0.00	90.88	6.52	4.41	0.25	23.05	1.19	23.98	1.56	84.17	4.57	0.013
G4/50	15.77	0.52	15.69	0.66	0.073	0.01	62.94	2.27	3.72	0.41	15.05	0.57	5.18	0.09	45.21	1.86	0.005
G4/100	4.65	0.50	19.28	1.84	0.134	0.00	31.06	1.36	5.03	0.37	12.81	0.76	2.47	0.11	34.13	1.19	0.005
G4/250	12.72	0.47	15.60	2.58	0.126	0.00	64.85	1.74	4.48	0.27	17.10	0.40	3.62	0.14	85.53	1.97	0.005
G4/500	17.77	2.74	27.52	4.92	0.110	0.02	94.63	6.30	4.47	0.75	15.96	0.80	3.58	0.34	57.99	0.82	0.010
G4/1000	7.77	0.24	184.89	15.92	0.173	0.02	59.32	0.94	12.50	0.53	26.60	0.47	3.92	0.41	60.05	0.07	0.022
G5/0	5.07	0.25	1.98	0.09	0.015	0.00	4.10	0.12	0.10	0.00	1.10	0.01	1.86	0.14	7.00	1.29	0.005
G5/5	14.22	1.53	7.16	0.73	0.015	0.00	27.25	8.11	1.17	0.10	6.09	1.33	5.79	0.38	37.25	10.04	0.005
G5/25	4.64	1.08	3.50	1.18	0.015	0.00	15.14	3.30	0.46	0.05	2.38	0.53	1.42	0.33	8.07	2.51	0.005
G5/50	6.76	0.22	11.39	0.63	0.172	0.02	27.76	0.95	2.41	0.18	7.89	0.43	2.75	0.04	30.65	13.17	0.040
G5/100	5.62	0.40	14.69	1.03	0.112	0.00	36.11	0.32	4.09	0.27	12.67	0.43	2.49	0.13	35.34	0.28	0.005
G5/250	11.26	1.26	15.03	0.61	0.204	0.07	55.58	0.01	4.41	0.44	14.51	0.14	3.69	0.11	66.09	1.25	0.005
G5/500	10.23	0.80	73.62	3.89	0.185	0.01	67.85	1.98	10.02	0.35	25.09	0.60	4.29	0.08	62.62	1.60	0.017
G5/1000	5.90	0.73	219.62	9.04	0.276	0.08	57.78	1.81	17.55	0.78	34.65	1.56	4.49	0.13	64.60	1.94	0.023
G6/0	8.72	0.72	2.82	0.75	0.015	0.00	8.40	0.92	0.92	0.03	2.02	0.23	2.71	0.32	10.26	1.24	0.005
G6/5	10.40	0.49	7.24	1.10	0.039	0.00	31.72	1.22	1.56	0.18	6.03	0.18	5.75	0.32	33.55	0.48	0.005
G6/25	17.71	10.29	7.93	0.29	0.099	0.06	24.43	5.22	1.55	0.19	4.27	1.06	3.74	0.53	14.85	7.47	0.005
G6/52	15.69	3.15	16.57	0.55	0.147	0.01	38.51	0.60	3.69	0.47	10.81	0.48	4.38	0.27	29.23	0.51	0.005
G6/102	6.56	1.15	17.96	1.32	0.123	0.00	37.34	0.71	5.07	0.64	14.48	0.44	3.08	0.14	37.92	0.79	0.005
G6/250	6.93	0.60	17.59	0.88	0.148	0.00	42.60	0.59	5.08	0.51	13.28	0.41	2.82	0.12	47.18	1.17	0.005
G6/500	5.79	1.48	69.50	4.51	0.215	0.05	46.43	0.30	12.06	0.07	25.36	0.36	3.36	0.53	47.91	0.19	0.014
G6/1000	7.28	0.51	160.50	15.49	0.207	0.01	54.20	1.59	14.76	0.93	28.72	1.92	4.57	0.47	61.03	5.24	0.021

Metals Ghana Central. (Average and standard deviation)

Parameter	As Av.	As Stdev.	Ba Av.	Ba Stdev.	Cd Av.	Cd Stdev.	Cr Av.	Cr Stdev.	Cu Av.	Cu Stdev.	Ni Av.	Ni Stdev.	Pb Av.	Pb Stdev.	Zn Av.	Zn Stdev.	Hg Av.
G7/0	3.11	0.07	12.01	6.63	0.015	0.00	5.34	0.65	1.13	0.35	1.37	0.50	2.53	0.24	4.85	0.41	0.005
G7/5	7.33	0.36	20.91	3.78	0.015	0.00	20.80	0.91	2.11	0.11	4.74	0.07	4.69	0.56	35.32	0.37	0.005
G7/25	8.77	0.99	12.01	1.13	0.066	0.00	12.16	1.31	2.18	0.23	4.11	0.52	3.29	0.16	11.79	1.05	0.005
G7/50	12.96	0.53	19.43	0.76	0.075	0.01	42.38	3.75	5.37	0.18	14.79	0.81	4.80	0.03	45.20	6.17	0.011
G7/100	34.83	18.98	23.95	2.25	0.109	0.00	52.82	5.61	8.01	0.29	21.04	1.64	8.91	3.03	50.05	3.38	0.010
G7/250	7.97	1.52	36.03	2.04	0.143	0.02	56.26	2.12	12.71	0.92	26.07	1.07	5.13	0.05	53.59	2.06	0.013
G7/500	8.31	0.45	80.18	0.61	0.266	0.01	62.93	0.88	18.53	0.26	35.68	0.42	6.40	0.26	60.25	0.69	0.018
G7/1000	9.52	1.52	159.06	2.43	0.260	0.00	64.25	0.56	22.10	2.17	39.07	0.60	7.60	0.38	66.94	0.34	0.023
G8/0	1.33	0.16	5.68	4.09	0.015	0.00	3.65	0.15	1.13	0.20	0.47	0.07	2.36	0.42	2.38	0.88	0.005
G8/25	109.49	44.70	23.13	3.94	0.052	0.01	43.15	2.75	10.50	1.83	22.85	2.36	12.66	1.82	71.44	17.60	0.011
G8/50	185.78	22.69	19.78	1.98	0.077	0.00	52.75	1.43	9.52	0.56	29.46	1.01	19.84	1.81	99.54	7.56	0.005
G8/100	15.40	1.22	46.48	4.01	0.074	0.01	59.89	1.80	17.70	2.00	30.33	2.27	8.16	0.49	54.45	1.90	0.016
G8/250	13.48	3.13	42.62	1.02	0.118	0.01	53.91	1.39	14.56	0.56	26.67	0.99	7.96	0.09	48.83	1.11	0.016
G8/500	18.82	3.10	62.54	2.18	0.209	0.02	56.97	0.50	15.17	0.16	28.83	0.44	8.92	0.11	52.90	0.85	0.020
G8/1000	21.59	2.95	100.94	5.84	0.216	0.01	57.84	1.02	17.27	0.45	32.15	0.76	9.24	0.25	57.52	1.21	0.023
G9/0	2.14	0.23	1.37	0.03	0.015	0.00	10.40	1.51	1.31	0.23	2.31	0.38	1.02	#DIV/0!	6.06	6.16	0.005
G9/5	9.20	0.14	4.19	0.16	0.015	0.00	14.21	0.60	1.35	0.31	3.63	0.02	2.66	0.36	11.76	0.27	0.005
G9/25	4.70	0.84	3.35	0.57	0.034	0.00	14.99	0.43	1.37	0.13	2.96	0.12	1.45	0.06	6.22	0.62	0.005
G9/50	7.53	1.19	31.64	2.01	0.399	0.04	48.59	2.51	9.66	0.82	22.43	1.23	4.36	0.22	47.48	2.78	0.005
G9/100	10.34	1.63	39.28	7.88	0.312	0.08	52.47	9.19	11.40	2.05	26.63	4.93	5.49	0.67	54.20	10.49	0.012
G9/250	23.43	1.77	31.83	3.43	0.176	0.03	78.06	2.44	11.07	0.92	25.97	1.38	6.82	0.18	71.47	5.16	0.012
G9/500	10.81	0.45	86.55	2.51	0.318	0.02	68.05	0.51	20.10	0.26	38.77	0.16	7.56	0.39	74.52	13.66	0.023
G9/1000	13.68	6.63	132.98	3.60	0.279	0.01	64.32	0.53	20.17	0.72	38.32	0.51	8.52		67.81	0.64	0.026

Metals Ghana East. (Average and standard deviation)

Station	Old notation	Sample	As mg/kg LOD 1 mg/kg	Ba mg/kg LOD 1 mg/kg	Cd mg/kg LOD 0.03 mg/kg	Cr mg/kg LOD 0.2 mg/kg	Cu mg/kg LOD 0.2 mg/kg	Ni mg/kg LOD 0.3 mg/kg	Pb mg/kg LOD 1 mg/kg	Zn mg/kg LOD 0.1 mg/kg	Hg mg/kg LOD 0.01 mg/kg
G1/0	GW/0	1	29.4	4.03	<0.03	23.9	0.35	3.34	2.99	12.6	<0.01
	New Town	2	25.5	3.31	<0.03	21.3	0.30	2.94	2.46	11.1	<0.01
		3	19.9	2.65	<0.03	16.1	0.31	2.30	2.03	8.19	<0.01
G1/5	GW/5	1	14.0	2.93	<0.03	14.7	0.34	2.51	1.60	9.87	<0.01
	New Town	2	17.2	2.80	<0.03	18.3	0.34	2.96	1.92	11.2	<0.01
		3	14.6	2.74	<0.03	13.3	0.27	2.15	1.53	8	<0.01
G1/0	GW/0	1	36.0	3.53	<0.03	22.9	1.82	5.55	2.88	27.8	<0.01
	New Town	2	33.7	3.54	0.03	20.8	1.86	5.15	2.80	26.9	<0.01
		3	32.0	3.46	<0.03	19.2	1.93	4.86	2.63	24.2	<0.01
G1/5	GW/5	1	24.9	3.64	<0.03	24.1	0.80	4.75	2.30	31.0	<0.01
	New Town	2	26.1	3.58	<0.03	24.6	0.84	4.84	2.24	31.7	<0.01
		3	25.3	3.32	<0.03	24.4	0.75	4.83	2.25	31.4	0.060
G1/25	GW 1	1	17.5	5.42	<0.03	23.1	1.03	5.10	3.81	18.4	<0.01
		2	17.7	4.58	<0.03	22.8	0.93	4.99	3.51	18.1	<0.01
		3	13.2	24.7	0.03	42.4	2.56	11.0	4.56	36.4	<0.01
G1/50	GW 2	1	13.5	27.3	0.03	45.3	3.12	12.9	4.96	40.1	<0.01
		2	11.4	37.9	0.04	45.2	3.40	12.8	4.75	39.1	<0.01
G1/100	GW 3	1	6.68	44.1	0.11	35.4	5.35	13.1	3.05	42.1	0.011
		2	8.44	48.3	0.12	36.3	5.32	13.7	3.15	37.1	0.012
		3	7.54	60.7	0.12	35.9	5.78	14.0	3.14	35.8	0.012
G1/250	GW 4	1	64.5	54.2	0.14	81.0	5.90	18.5	8.61	106	0.011
		2	74.1	52.5	0.16	94.4	4.93	20.4	9.31	108	<0.01
		3	62.1	47.6	0.13	92.1	3.40	18.0	9.48	91.5	0.015
G1/500	G1/492	1	6.61	81.3	0.21	49.4	10.9	20.4	3.62	87.1	0.013
	GW 5	2	7.20	58.2	0.14	49.8	8.65	20.3	3.00	54.2	0.013
		3	6.94	74.5	0.14	50.8	9.20	21.1	3.50	54.0	0.014
G1/1200	GW 6	1	7.18	365	0.20	64.6	22.6	38.1	5.46	75.8	0.030
		2	8.44	358	0.18	63.9	22.5	38.2	5.92	75.1	0.030
		3	7.05	181	0.27	62.6	16.1	30.7	4.07	70.0	0.022

Metals transect 1. (Raw data)

Station	Old notation	Sample	As mg/kg LOD 1 mg/kg	Ba mg/kg LOD 1 mg/kg	Cd mg/kg LOD 0.03 mg/kg	Cr mg/kg LOD 0.2 mg/kg	Cu mg/kg LOD 0.2 mg/kg	Ni mg/kg LOD 0.3 mg/kg	Pb mg/kg LOD 1 mg/kg	Zn mg/kg LOD 0.1 mg/kg	Hg mg/kg LOD 0.01 mg/kg
G2/25	GP 1	1	50.7	6.11	0.13	37.7	1.39	6.32	4.16	36.0	<0.01
		2	70.4	5.01	0.05	55.5	1.05	8.18	5.03	31.4	<0.01
		3	84.1	3.99	0.03	60.1	0.85	8.62	5.49	30.1	<0.01
G2/50	GP2	1	14.0	10.1	0.04	48.2	2.81	11.6	4.95	41.1	<0.01
		2	13.5	13.5	0.06	49.8	3.56	12.8	5.16	43.0	0.012
		3	16.4	10.9	0.05	52.2	2.98	12.7	5.34	44.0	<0.01
G2/100	GP3	1	7.36	19.9	0.11	31.1	4.18	10.8	2.55	30.2	0.012
		2	7.16	24.0	0.12	33.0	4.82	11.9	2.69	32.7	0.012
		3	6.28	21.1	0.12	30.1	4.09	10.2	2.38	29.1	0.013
G2/250	GP4	1	32.3	24.3	0.15	59.6	5.67	15.5	4.47	83.6	0.011
		2	28.1	26.6	0.15	57.8	4.54	15.2	4.02	63.5	0.011
		3	28.3	21.6	0.13	58.7	4.24	14.2	3.84	65.2	<0.01
G2/500	GP5	1	9.04	259	0.19	60.0	7.68	20.9	2.81	52.0	0.015
		2	7.90	112	0.23	63.4	9.24	24.4	2.73	55.4	0.016
		3	9.52	185	0.18	61.5	8.03	21.9	2.91	54.3	0.015
G2 1361	MA 2-5/1361	1	6.20	1662	0.23	69.3	23.9	43.4	4.79	78.3	0.051
		2	5.76	942	0.25	71.1	24.6	44.4	4.26	79.4	0.043
		3	5.43	975	0.25	70.7	24.4	43.7	4.20	79.1	0.034
G2 1598	MA 2-4	1	8.52	831	0.15	69.4	24.8	45.5	5.67	79.3	0.036
		2	4.89	373	0.26	74.0	26.6	46.5	3.89	83.4	0.039
		3	6.11	467	0.21	72.0	25.8	46.4	4.50	81.5	0.036
MA 2-1 /1361	MA 2-1 /1366	1	5.57	3492	0.24	71.1	25.0	44.6	5.47	81.6	0.036
		2	9.06	2536	0.17	76.1	23.1	42.6	6.03	78.8	0.038
G2/1418	MA 2-2 /1418	1	6.01	374	0.18	68.5	23.6	43.0	3.86	76.9	0.036
		2	5.69	414	0.23	70.5	24.4	44.1	4.27	79.3	0.035
MA 2-3 /1376		1	5.75	377	0.21	71.4	24.6	44.0	4.39	80.2	0.036
		2	6.09	657	0.23	70.0	24.1	43.4	4.32	78.5	0.035
		3	6.55	861	0.21	70.2	23.9	43.1	4.82	78.9	0.034
MA 2-3 /1414		1	5.43	409	0.24	71.1	24.6	44.4	4.05	79.7	0.036
		2	5.85	479	0.23	71.4	24.3	44.4	3.94	79.2	0.050

Metals transect 2. (Raw data)

Station	Old notation	Sample	As mg/kg LOD 1 mg/kg	Ba mg/kg LOD 1 mg/kg	Cd mg/kg LOD 0.03 mg/kg	Cr mg/kg LOD 0.2 mg/kg	Cu mg/kg LOD 0.2 mg/kg	Ni mg/kg LOD 0.3 mg/kg	Pb mg/kg LOD 1 mg/kg	Zn mg/kg LOD 0.1 mg/kg	Hg mg/kg LOD 0.01 mg/kg
G3/0	GW3/0	1	35.8	5.69	0.05	45.2	1.55	10.3	2.60	5.33	<0.01
	Cape Three Points	2	34.4	5.49	0.05	35.4	1.25	8.30	2.50	6.59	<0.01
		3	34.6	5.54	0.05	38.2	1.35	8.33	2.58	5.72	<0.01
G3/5	GW3/5	1	34.3	6.64	0.06	44.0	1.56	9.69	2.71	5.56	<0.01
	Cape Three Points	2	31.9	6.45	0.06	42.8	1.71	8.74	2.94	14.3	<0.01
		3	34.1	6.47	0.06	47.3	1.89	9.86	2.64	6.11	<0.01
G3/25	GE 1	1	58.9	21.1	0.07	68.4	5.91	21.6	10.4	51.6	0.031
		2	75.9	18.0	0.08	67.6	4.60	23.3	13.0	59.7	0.025
		3	65.8	21.5	0.07	68.3	5.80	21.3	12.2	77.4	0.033
G3/50	GE2	1	12.1	28.9	0.05	52.1	6.80	16.9	4.99	39.5	0.021
		2	10.2	31.5	0.06	51.9	7.53	17.2	5.10	40.4	0.021
		3	10.5	31.4	0.06	51.9	7.47	17.3	5.02	41.8	0.023
G3/100	GE3	1	6.75	29.4	0.12	38.9	5.76	15.7	2.81	34.6	0.014
		2	7.54	25.2	0.13	37.0	5.20	14.3	2.71	66.7	0.012
		3	7.91	27.0	0.12	37.2	5.20	14.6	2.81	50.3	0.013
G3/250	GE4	1	20.5	22.6	0.14	75.2	5.64	20.2	4.04	73.7	0.014
		2	21.4	23.2	0.16	74.1	5.62	20.1	4.20	72.8	0.012
		3	20.6	20.1	0.14	77.4	5.52	20.3	4.18	76.1	0.013
G3/500	GE5	1	7.76	204	0.28	72.3	12.7	31.2	2.61	63.4	0.016
		2	7.94	97.7	0.31	72.7	13.8	33.0	2.42	65.1	0.019
		3	7.21	97.0	0.30	70.4	13.7	33.0	2.30	63.5	0.015
G3/1200	GE6	1	6.98	361	0.22	63.2	22.3	42.8	4.91	75.7	0.040
		2	6.59	365	0.24	64.8	22.9	43.6	4.88	77.7	0.040

Metals transect 3. (Raw data)

Station	Old notation	Sample	As mg/kg LOD 1 mg/kg	Ba mg/kg LOD 1 mg/kg	Cd mg/kg LOD 0.03 mg/kg	Cr mg/kg LOD 0.2 mg/kg	Cu mg/kg LOD 0.2 mg/kg	Ni mg/kg LOD 0.3 mg/kg	Pb mg/kg LOD 1 mg/kg	Zn mg/kg LOD 0.1 mg/kg	Hg mg/kg LOD 0.01 mg/kg
G4/0	GC1/0	1	13.6	34.7	0.04	18.3	3.98	5.80	9.61	51.8	<0.01
	Tacoradi/ Secondi	2	13.2	42.3	0.05	17.2	3.83	5.90	9.01	52.3	<0.01
		3	13.4	40.8	0.04	17.5	3.54	5.76	8.99	54.1	<0.01
G4/5	GC1/5	1	15.1	143	0.06	35.4	14.5	13.8	18.6	83.3	0.046
	Tacoradi/ Secondi	2	15.3	135	0.07	35.5	14.4	13.7	19.3	84.1	0.048
		3	17.7	135	0.07	35.8	13.5	13.6	17.9	82.8	0.045
G4/25	GC1/25	1	98.3	17.6	0.05	83.6	4.36	21.7	22.3	79.1	0.013
		2	113	16.6	0.05	96.3	4.19	23.7	25.4	87.9	0.013
		3	110	16.2	0.05	92.7	4.67	23.8	24.3	85.5	0.014
G4/50	GC1/50 G4/52	1	15.2	15.7	0.07	60.9	3.41	15.0	5.08	44.3	<0.01
		2	15.8	16.3	0.08	65.4	4.18	15.6	5.26	47.4	<0.01
		3	16.3	15.0	0.07	62.6	3.57	14.5	5.21	44.0	<0.01
G4/100	GC1/100	1	4.32	19.8	0.13	31.6	5.33	13.2	2.57	33.7	<0.01
		2	4.40	17.2	0.13	29.5	4.62	11.9	2.35	33.2	<0.01
		3	5.22	20.8	0.14	32.0	5.14	13.3	2.49	35.5	<0.01
G4/250	GC1/250	1	13.0	16.1	0.12	66.4	4.59	17.4	3.65	86.0	<0.01
		2	12.2	17.9	0.13	63.0	4.68	17.3	3.47	83.4	<0.01
		3	13.0	12.8	0.12	65.2	4.17	16.6	3.74	87.2	<0.01
G4/500	GC1/500	1	15.7	31.6	0.13	91.0	5.10	16.8	3.40	57.6	<0.01
		2	20.9	22.1	0.09	101.9	3.64	15.2	3.98	58.9	<0.01
		3	16.8	28.8	0.10	91.0	4.66	15.9	3.37	57.4	0.010
G4/1000	GC1/1000	1	7.50	170	0.18	58.8	12.6	26.6	3.53	60.1	0.019
		2	7.96	202	0.19	58.8	13.0	27.1	4.35	60.1	0.025
		3	7.84	182	0.15	60.4	11.9	26.2	3.87	60.0	0.022

Metals transect 4. (Raw data)

Station	Old notation	Sample	As mg/kg LOD 1 mg/kg	Ba mg/kg LOD 1 mg/kg	Cd mg/kg LOD 0.03 mg/kg	Cr mg/kg LOD 0.2 mg/kg	Cu mg/kg LOD 0.2 mg/kg	Ni mg/kg LOD 0.3 mg/kg	Pb mg/kg LOD 1 mg/kg	Zn mg/kg LOD 0.1 mg/kg	Hg mg/kg LOD 0.01 mg/kg
G5/0	GC2/0	1	4.79	1.93	<0.03	4.23	<0.2	1.08	1.69	6.03	<0.01
	Salt Pond	2	5.13	1.92	<0.03	4.01	<0.2	1.11	1.92	6.49	<0.01
		3	5.28	2.08	<0.03	4.06	<0.2	1.10	1.95	8.47	<0.01
G5/5	GC2/5	1	13.8	6.93	<0.03	32.1	1.20	6.91	6.11	43.3	<0.01
	Salt Pond	2	12.9	6.57	<0.03	31.8	1.24	6.80	5.90	42.8	<0.01
		3	15.9	7.98	<0.03	17.9	1.06	4.56	5.37	25.7	<0.01
G5/25	GC2/25	1	5.87	4.04	<0.03	17.6	0.49	2.73	1.59	9.77	<0.01
		2	3.80	2.14	<0.03	11.4	0.39	1.77	1.04	5.18	<0.01
		3	4.26	4.31	<0.03	16.5	0.48	2.63	1.64	9.26	<0.01
G5/50	GC2/50	1	6.55	11.0	0.16	27.1	2.51	7.69	2.71	23.9	0.040
		2	6.98	12.1	0.16	28.8	2.52	8.39	2.79	45.8	<0.01
		3	6.77	11.0	0.19	27.4	2.20	7.61	2.75	22.2	<0.01
G5/100	GC2/100	1	5.33	14.0	0.12	36.4	3.85	12.3	2.59	35.5	<0.01
		2	5.46	15.9	0.11	36.1	4.39	13.1	2.34	35.5	<0.01
		3	6.08	14.2	0.11	35.8	4.03	12.5	2.54	35.0	<0.01
G5/250	GC2/250	1	10.7	15.4	0.16	55.6	4.24	14.6	3.63	66.6	<0.01
		2	10.4	14.3	0.17	55.6	4.08	14.4	3.63	67.0	<0.01
		3	12.7	15.4	0.29	55.6	4.92	14.5	3.81	64.7	<0.01
G5/500	GC2/500	1	10.9	77.1	0.18	68.1	10.2	25.7	4.32	63.2	0.017
		2	10.5	69.4	0.18	69.7	9.61	24.5	4.34	63.8	0.017
		3	9.34	74.3	0.20	65.8	10.2	25.1	4.20	60.8	0.017
G5/1000	GC2/1000	1	5.09	215	0.28	56.9	17.2	33.9	4.34	63.6	0.023
		2	6.11	230	0.35	59.9	18.4	36.4	4.56	66.8	0.023
		3	6.49	214	0.20	56.6	17.0	33.6	4.57	63.4	0.022

Metals transect 5. (Raw data)

Station	Old notation	Sample	As mg/kg LOD 1 mg/kg	Ba mg/kg LOD 1 mg/kg	Cd mg/kg LOD 0.03 mg/kg	Cr mg/kg LOD 0.2 mg/kg	Cu mg/kg LOD 0.2 mg/kg	Ni mg/kg LOD 0.3 mg/kg	Pb mg/kg LOD 1 mg/kg	Zn mg/kg LOD 0.1 mg/kg	Hg mg/kg LOD 0.01 mg/kg
G6/0	GC3/0	1	8.44	3.68	<0.03	8.02	0.90	1.96	2.55	9.58	<0.01
	Winneba	2	8.19	2.28	<0.03	7.73	0.91	1.82	2.50	9.50	<0.01
		3	9.54	2.50	<0.03	9.44	0.95	2.27	3.08	11.7	<0.01
G6/5	GC3/5	1	10.0	6.84	0.04	31.7	1.53	6.07	5.56	33.0	<0.01
	Winneba	2	11.0	6.40	<0.03	30.5	1.40	5.83	5.56	33.6	<0.01
		3	10.2	8.49	<0.03	32.9	1.74	6.18	6.12	34.0	<0.01
G6/25	GE1/25	1	5.94	8.13	0.04	29.7	1.74	5.47	3.27	23.4	<0.01
		2	24.9	8.08	0.15	24.4	1.36	3.88	4.31	11.3	<0.01
		3	22.3	7.60	0.11	19.2	1.56	3.46	3.64	9.77	<0.01
G6/52	GE1/50	1	13.3	17.1	0.14	38.2	3.80	11.1	4.14	29.3	<0.01
		2	19.3	16.0	0.16	38.2	3.17	10.3	4.66	28.7	<0.01
		3	14.5	16.7	0.15	39.2	4.09	11.1	4.34	29.7	<0.01
G6/102	GE1/100	1	5.88	17.8	0.13	36.5	4.63	14.2	2.99	37.1	<0.01
		2	7.89	16.7	0.12	37.6	4.79	14.2	3.24	38.7	<0.01
		3	5.92	19.3	0.12	37.9	5.81	15.0	3.01	37.9	<0.01
G6/250	GE1/250	1	7.53	17.3	0.15	43.3	4.55	13.3	2.95	48.5	<0.01
		2	6.32	16.9	0.15	42.2	5.14	12.9	2.72	46.7	<0.01
		3	6.93	18.6	0.15	42.3	5.56	13.7	2.78	46.3	<0.01
G6/500	GC1/500	1	5.11	65.3	0.23	46.1	12.0	25.0	2.81	47.7	0.013
		2	4.76	68.9	0.26	46.6	12.1	25.3	3.40	48.1	0.015
		3	7.48	74.3	0.16	46.6	12.0	25.7	3.87	47.9	0.015
G6/1000	GC1/1000	1	7.82	172	0.22	55.4	15.4	30.3	4.95	66.7	0.021
		2	6.80	143	0.20	52.4	13.7	26.6	4.04	56.5	0.020
		3	7.23	167	0.20	54.8	15.2	29.3	4.73	59.9	0.022

Metals transect 6. (Raw data)

Station	Old notation	Sample	As mg/kg LOD 1 mg/kg	Ba mg/kg LOD 1 mg/kg	Cd mg/kg LOD 0.03 mg/kg	Cr mg/kg LOD 0.2 mg/kg	Cu mg/kg LOD 0.2 mg/kg	Ni mg/kg LOD 0.3 mg/kg	Pb mg/kg LOD 1 mg/kg	Zn mg/kg LOD 0.1 mg/kg	Hg mg/kg LOD 0.01 mg/kg
G7/0	GE1/0	1	3.05	4.62	<0.03	6.02	1.52	1.94	2.80	5.28	<0.01
	Old Ningo	2	3.10	17.5	<0.03	5.26	0.96	1.17	2.44	4.80	<0.01
		3	3.20	14.0	<0.03	4.73	0.90	1.00	2.35	4.46	<0.01
G7/5	GE1/5	1	7.62	17.5	<0.03	20.5	2.09	4.66	4.42	35.7	<0.01
	Old Ningo	2	7.45	20.2	<0.03	20.0	2.23	4.78	4.31	35.1	<0.01
		3	6.92	25.0	<0.03	21.8	2.01	4.79	5.33	35.1	<0.01
G7/25	GE2/25	1	9.76	11.2	0.07	11.9	1.99	3.88	3.32	11.9	<0.01
		2	7.77	11.6	0.06	11.0	2.10	3.74	3.12	10.7	<0.01
		3	8.78	13.3	0.07	13.6	2.44	4.71	3.44	12.8	<0.01
G7/50	GE2/50	1	13.6	18.6	0.09	38.1	5.54	13.9	4.81	40.1	<0.01
		2	12.7	20.0	0.07	45.1	5.19	15.3	4.82	52.1	<0.01
		3	12.6	19.7	0.07	44.0	5.37	15.2	4.77	43.4	0.011
G7/100	GE2/100	1	24.7	24.1	0.11	49.7	7.93	19.8	7.40	49.2	0.010
		2	23.1	26.1	0.11	49.4	8.34	20.4	6.94	47.2	0.011
		3	56.7	21.6	0.11	59.3	7.78	22.9	12.4	53.8	0.010
G7/250	GE2/250	1	8.61	38.0	0.13	56.2	13.6	27.2	5.07	52.3	0.013
		2	9.06	33.9	0.16	58.4	11.7	25.1	5.16	56.0	0.012
		3	6.23	36.2	0.15	54.2	12.8	25.9	5.17	52.5	0.014
G7/500	GE2/500	1	8.11	79.9	0.27	62.1	18.4	35.2	6.37	60.7	0.017
		2	7.99	80.9	0.27	63.9	18.8	36.0	6.67	60.6	0.018
		3	8.83	79.8	0.26	62.8	18.4	35.9	6.15	59.5	0.018
G7/1000	GE2/1000	1	8.18	161	0.26	64.7	20.7	39.4	7.54	66.9	0.023
		2	9.19	156	0.26	64.4	21.0	39.4	7.25	66.6	0.022
		3	11.2	159	0.26	63.6	24.6	38.4	8.01	67.3	0.023

Metals transect 7. (Raw data)

Station	Old notation	Sample	As mg/kg LOD 1 mg/kg	Ba mg/kg LOD 1 mg/kg	Cd mg/kg LOD 0.03 mg/kg	Cr mg/kg LOD 0.2 mg/kg	Cu mg/kg LOD 0.2 mg/kg	Ni mg/kg LOD 0.3 mg/kg	Pb mg/kg LOD 1 mg/kg	Zn mg/kg LOD 0.1 mg/kg	Hg mg/kg LOD 0.01 mg/kg
G8/0	GE2/0	1	1.31	10.2	<0.03	3.60	1.09	0.43	2.53	1.75	<0.01
	Adah Foah	2	1.18	2.27	<0.03	3.54	1.34	0.43	1.88	2.01	<0.01
		3	1.49	4.55	<0.03	3.83	0.95	0.54	2.67	3.39	<0.01
G8/25	GC3/25	1	140	21.1	0.06	46.1	11.4	25.5	14.3	86.2	<0.01
		2	131	20.6	0.05	40.6	8.39	21.8	13.0	76.2	<0.01
		3	58.1	27.7	0.04	42.8	11.7	21.2	10.7	52.0	0.011
G8/50	GC3/50	1	165	22.1	0.08	51.5	10.2	28.7	18.1	91.4	<0.01
		2	210	18.5	0.08	54.3	9.13	30.6	21.7	106.3	<0.01
		3	182	18.8	0.08	52.4	9.26	29.1	19.7	100.9	<0.01
G8/100	GC3/100	1	15.0	51.1	0.06	62.0	20.0	32.9	7.60	56.6	0.017
		2	14.4	44.8	0.08	59.0	16.6	29.1	8.33	53.6	0.016
		3	16.8	43.6	0.08	58.7	16.5	28.9	8.53	53.1	0.016
G8/250	GC3/250	1	10.3	43.5	0.13	55.0	15.2	27.7	7.91	49.8	0.017
		2	16.5	41.5	0.11	52.3	14.2	25.7	7.91	47.6	0.015
		3	13.6	42.8	0.12	54.4	14.3	26.7	8.06	49.1	0.016
G8/500	GC3/500	1	15.5	60.5	0.23	56.5	15.1	28.4	8.81	52.1	0.020
		2	21.7	64.8	0.21	57.5	15.1	29.3	9.04	53.8	0.019
		3	19.3	62.4	0.19	56.9	15.4	28.8	8.92	52.9	0.020
G8/1000	GC3/1000	1	20.1	108	0.22	59.0	17.7	33.0	9.18	58.9	0.024
		2	19.7	97.8	0.21	57.6	17.3	31.9	9.03	57.0	0.022
		3	25.0	97.3	0.22	57.0	16.8	31.5	9.52	56.7	0.022

Metals transect 8. (Raw data)

Station	Old notation	Sample	As mg/kg LOD 1 mg/kg	Ba mg/kg LOD 1 mg/kg	Cd mg/kg LOD 0.03 mg/kg	Cr mg/kg LOD 0.2 mg/kg	Cu mg/kg LOD 0.2 mg/kg	Ni mg/kg LOD 0.3 mg/kg	Pb mg/kg LOD 1 mg/kg	Zn mg/kg LOD 0.1 mg/kg	Hg mg/kg LOD 0.01 mg/kg
G9/0	GE3/0	1	2.12	1.37	<0.03	11.8	1.33	2.33	<1	3.20	<0.01
	Denu	2	2.38	1.35	<0.03	10.6	1.52	2.67	1.02	13.1	<0.01
		3	1.92	1.40	<0.03	8.8	1.07	1.92	<1	1.84	<0.01
G9/5	GE3/5	1	9.24	4.16	<0.03	14.2	1.08	3.65	2.55	11.6	<0.01
	Denu	2	9.32	4.05	<0.03	13.6	1.69	3.61	2.37	11.6	<0.01
		3	9.05	4.36	<0.03	14.8	1.27	3.65	3.06	12.1	<0.01
G9/25	GE3/25	1	3.77	4.01	0.04	14.6	1.42	3.09	1.45	6.93	<0.01
		2	4.92	3.08	0.03	15.0	1.46	2.86	1.38	5.93	<0.01
		3	5.42	2.96	0.03	15.4	1.22	2.92	1.51	5.79	<0.01
G9/50	GE3/50	1	8.15	33.9	0.44	51.5	10.3	23.8	4.62	50.6	<0.01
		2	8.29	30.0	0.36	47.0	8.73	21.5	4.22	45.3	<0.01
		3	6.16	31.1	0.40	47.3	9.93	21.9	4.23	46.5	<0.01
G9/100	GE3/100	1	12.2	46.9	0.40	60.8	13.2	31.0	6.17	64.1	0.013
		2	9.37	39.7	0.31	54.0	11.8	27.5	5.46	55.2	0.013
		3	9.42	31.2	0.23	42.6	9.20	21.3	4.84	43.2	0.011
G9/250	GE3/250	1	23.2	34.9	0.21	76.7	11.8	27.1	6.92	68.8	0.013
		2	21.8	32.5	0.18	76.6	11.4	26.3	6.61	68.2	0.011
		3	25.3	28.1	0.14	80.9	10.0	24.4	6.93	77.4	0.011
G9/500	GE3/500	1	11.3	89.2	0.33	68.6	20.3	38.9	7.94	90.3	0.024
		2	10.8	84.3	0.30	67.6	20.2	38.9	7.15	66.6	0.021
		3	10.4	86.1	0.32	67.9	19.8	38.6	7.60	66.7	0.025
G9/1000	GE3/1000	1	11.8	132	0.28	64.6	20.5	38.5	8.36	68.5	0.026
		2	21.1	137	0.29	63.7	19.4	37.7	9.32	67.6	0.025
		3	8.22	130	0.27	64.6	20.7	38.7	7.87	67.3	0.026

Metals transect 9. (Raw data)

Ghana 2012 THC, PAH's, NDP's				PAH		PAH		PAH		PAH		PAH		PAH		PAH		PAH	
Station	Depth	THC ppm		Naftalen		Acenaftylen		Acenaften		Fluoren		Dibenzotiofen		Fenantren		Antracen		Fluoranten	
		Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.
G1/0	0	1.0	0.2	7.9	0.6	0.3	0.0	0.3	0.0	0.3	0.2	0.3	0.0	1.3	0.1	0.3	0.0	0.3	0.0
G1/5	5	0.4	0.2	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G1/25	25	1.1	0.1	3.4	4.5	0.3	0.0	0.3	0.0	0.4	0.2	0.3	0.0	0.8	0.8	0.3	0.0	0.2	0.1
G1/50	50	4.8	0.6	1.0	0.3	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.9	0.1	0.3	0.0	0.9	0.1
G1/100	100	6.0	0.8	8.5	0.9	0.3	0.0	0.3	0.0	0.7	0.1	0.3	0.0	2.4	0.4	0.6	0.1	1.5	0.2
G1/250	250	4.8	0.5	1.3	0.2	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.3	0.2	0.3	0.2	1.1	0.1
G1/500	492	10.2	0.7	5.1	0.3	0.6	0.1	0.3	0.0	0.4	0.2	0.3	0.0	3.2	0.3	1.2	0.1	2.8	0.2
G1/1200	1218	13.7	0.7	11.7	0.2	1.0	0.1	0.3	0.0	0.7	0.1	0.3	0.0	6.2	0.1	1.4	0.2	5.4	0.0
G2/0	0	0.5	0.2	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.4	0.1
G2/5	5	0.5	0.3	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G2/25	25	2.6	3.1	0.6	0.3	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G2/50	50	4.6	0.8	1.4	0.3	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	2.3	1.2	0.6	0.4	2.5	2.3
G2/100	103	5.1	2.4	2.3	0.5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	2.1	0.6	0.7	0.1	1.5	0.4
G2/250	250	3.7	0.3	1.6	0.1	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.2	0.1	0.3	0.0	0.8	0.0
G2/500	503	8.4	3.5	4.9	0.8	0.5	0.2	0.3	0.0	0.5	0.2	0.3	0.0	3.0	0.8	1.0	0.3	3.1	1.3
G2/1400	1361	9.1	2.1	11.4	1.9	0.8	0.2	0.3	0.0	0.8	0.1	0.3	0.0	5.9	0.7	1.2	0.3	4.3	0.8
G2 1418	1418	12.6	0.3	11.7	0.1	0.9	0.0	0.3	0.0	0.7	0.0	0.3	0.0	4.8	0.2	0.9	0.0	4.5	0.4
G2/1600	1598	8.8	0.6	12.5	0.5	0.9	0.0	0.3	0.0	0.7	0.0	0.3	0.0	5.8	0.3	1.4	0.1	5.4	0.5
MA2-1 1361	1361	22.5	0.6	12.8	0.4	1.0	0.0	0.3	0.0	1.3	0.1	0.9	0.1	8.9	0.2	1.5	0.3	5.5	0.1
MA2-3 1376	1376	14.9	0.7	12.9	0.9	1.0	0.2	0.3	0.0	0.9	0.1	0.5	0.1	6.6	0.2	1.3	0.1	5.5	0.2
MA2-3 1414	1414	14.0	4.2	11.8	0.7	1.0	0.0	0.3	0.0	0.8	0.1	0.3	0.1	5.3	0.4	1.0	0.1	4.5	0.1
G3/0	0	1.9	0.4	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G3/5	5	2.1	0.5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G3/25	25	10.3	0.8	2.9	0.9	0.3	0.0	0.3	0.0	0.3	0.2	0.3	0.2	2.8	0.7	1.2	0.3	4.5	1.1
G3/50	50	11.7	3.1	4.3	0.7	0.7	0.1	0.3	0.0	0.6	0.1	0.6	0.1	4.4	0.6	1.8	0.4	7.9	1.1
G3/100	100	6.6	0.3	2.1	0.1	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.3	0.2	0.4	0.2	1.5	0.1
G3/250	254	6.4	0.2	2.4	0.2	0.3	0.1	0.3	0.0	0.3	0.0	0.3	0.0	2.1	1.1	0.7	0.6	2.3	1.8
G3/500	508	11.5	2.3	8.3	1.1	0.7	0.1	0.3	0.0	0.5	0.2	0.3	0.0	3.5	0.4	1.3	0.2	3.3	0.3
G3/1200	1204	9.6	2.5	11.7	0.0	0.9	0.0	0.3	0.0	0.6	0.0	0.3	0.0	4.7	0.1	1.1	0.0	4.2	0.1
G4/0	0	7.2	1.1	3.7	0.9	1.0	0.1	1.0	0.4	1.0	0.2	0.9	0.1	16.1	2.0	5.7	0.8	50.2	9.2
G4/5	5	42.7	5.5	32.7	4.2	4.3	1.0	4.1	1.1	5.0	1.1	3.8	0.6	64.7	15.9	22.0	6.0	215.1	56.9
G4/25	25	6.8	1.0	2.6	0.5	0.3	0.2	0.3	0.0	0.3	0.0	0.3	0.0	3.9	0.5	1.3	0.3	9.0	1.9
G4/50	52	6.2	0.9	1.3	0.2	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.8	0.2	0.3	0.0	1.4	0.2
G4/100	100	4.5	0.5	2.0	0.1	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.1	0.1	0.3	0.0	1.1	0.1
G4/250	250	4.3	0.2	1.3	0.1	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.9	0.1	0.3	0.0	0.7	0.0
G4/500	500	3.5	0.6	2.4	1.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.9	0.7	0.5	0.3	1.0	0.3
G4/1000	1000	5.1	1.7	6.7	0.8	0.6	0.1	0.3	0.0	0.3	0.0	0.3	0.0	3.5	0.4	0.8	0.0	2.6	0.2

Station	Depth	THC ppm		PAH Naftalen		PAH Acenaftylen		PAH Acenaften		PAH Fluoren		PAH Dibenzotiofen		PAH Fenantren		PAH Antracen		PAH Fluoranten	
		Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.
G5/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.4	0.2	0.3	0.0	1.1	1.3
G5/5	5	1.3	0.5	0.5	0.2	0.4	0.3	0.3	0.0	0.3	0.0	0.3	0.0	1.8	0.5	0.6	0.3	7.6	3.8
G5/25	26	1.6	0.3	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.4	0.2	0.3	0.0	0.5	0.4
G5/50	50	3.1	1.1	0.7	0.2	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.6	0.2	0.3	0.0	0.7	0.2
G5/100	100	4.0	0.8	1.6	0.2	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.9	0.2	0.3	0.0	1.1	0.1
G5/250	250	5.5	0.9	1.4	0.1	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.9	0.1	0.3	0.0	0.9	0.0
G5/500	500	7.3	2.4	5.0	0.3	0.3	0.2	0.3	0.0	0.3	0.0	0.3	0.0	2.4	0.3	0.7	0.4	2.4	0.3
G5/1000	1045	11.9	3.6	9.9	0.4	1.0	0.1	0.3	0.0	0.6	0.1	0.3	0.0	4.9	0.8	1.4	0.2	4.6	0.4
G6/0	0	0.5	0.2	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G6/5	5	1.8	0.5	0.4	0.3	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.7	1.2	0.3	0.0	3.6	2.4
G6/25	23	5.0	1.5	1.0	0.5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.4	0.6	0.4	0.3	3.2	1.6
G6/50	51	4.5	0.4	1.0	0.1	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.8	0.2	0.3	0.0	1.5	0.3
G6/100	103	4.9	0.1	1.6	0.6	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.3	0.3	0.3	0.0	1.3	0.1
G6/250	250	4.5	1.0	0.5	0.5	0.3	0.0	0.3	0.0	0.4	0.1	0.3	0.0	1.6	0.3	0.3	0.0	1.0	0.2
G6/500	505	12.9	0.5	6.6	0.2	0.8	0.0	0.3	0.0	0.6	0.1	0.3	0.0	3.7	0.2	1.3	0.1	3.9	0.4
G6/1000	975	11.2	1.5	8.3	1.3	0.9	0.1	0.3	0.0	0.7	0.1	0.3	0.0	4.6	0.6	1.3	0.1	4.6	0.3
G7/0	0	1.4	0.5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G7/5	5	6.4	1.4	0.3	0.2	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.4	0.2	0.3	0.0	0.8	0.3
G7/25	25	9.6	0.1	0.3	0.0	0.4	0.2	0.3	0.0	0.3	0.0	0.3	0.0	0.5	0.2	0.3	0.0	1.3	0.2
G7/50	51	6.9	0.9	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.1	0.2	0.5	0.0	2.1	0.2
G7/100	101	8.6	0.2	0.7	0.7	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	2.1	0.7	0.7	0.1	2.6	0.3
G7/250	248	11.7	0.4	3.7	1.1	0.8	0.1	0.3	0.0	0.5	0.2	0.3	0.0	2.7	0.3	1.2	0.2	4.1	0.6
G7/500	504	21.3	1.5	9.0	0.3	1.4	0.1	0.3	0.0	1.2	0.0	0.4	0.2	6.4	0.1	2.9	0.3	14.9	2.2
G7/1000	973	19.4	1.5	10.6	0.4	1.3	0.1	0.3	0.0	1.0	0.0	0.3	0.0	5.9	0.2	2.1	0.0	7.7	0.5
G8/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.1
	5																		
G8/25	25	8.7	4.8	15.6	18.8	1.4	1.2	6.5	10.8	6.5	9.8	1.9	2.9	40.6	63.5	3.2	2.7	31.2	46.0
G8/50	50	6.0	1.3	3.3	1.0	0.6	0.3	0.3	0.0	0.5	0.3	0.3	0.0	2.5	0.9	1.1	0.4	2.6	0.9
G8/100	104	10.4	2.5	7.5	1.1	1.5	0.2	0.5	0.2	1.4	0.2	0.3	0.0	6.1	0.6	2.8	0.2	7.4	0.6
G8/250	250	14.5	1.8	7.1	0.8	1.4	0.2	0.6	0.0	1.4	0.1	0.3	0.1	5.8	0.3	2.6	0.2	7.8	0.2
G8/500	508	22.2	2.1	9.3	0.6	1.8	0.3	0.7	0.1	1.6	0.2	0.5	0.2	7.2	0.8	2.9	0.2	9.2	0.6
G8/1000	979	18.9	2.6	10.4	1.0	1.7	0.2	0.4	0.2	1.4	0.1	0.5	0.0	7.4	0.2	2.3	0.2	9.6	0.3
G9/0	0	0.4	0.2	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G9/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G9/25	25	1.6	0.8	0.3	0.0	0.3	0.0	0.3	0.0	0.4	0.3	0.4	0.3	0.5	0.3	0.4	0.3	0.5	0.3
G9/50	52	8.3	3.5	17.7	26.4	2.8	4.2	64.4	111.2	66.8	115.2	19.0	32.5	258.9	445.0	42.7	72.9	164.9	281.4
G9/100	104	9.2	1.4	4.6	0.5	0.7	0.0	0.3	0.0	0.3	0.1	0.3	0.0	2.9	0.1	1.0	0.1	4.3	0.4
G9/250	249	8.3	1.7	4.2	0.2	0.8	0.1	0.3	0.0	0.5	0.2	0.3	0.0	2.9	0.7	1.0	0.1	3.6	0.3
G9/500	500	59.2	50.0	9.3	0.8	1.7	0.1	0.3	0.1	1.4	0.1	0.6	0.1	6.3	0.6	2.2	0.1	8.4	0.4
G9/1000	1019	14.8	2.5	10.8	0.4	1.7	0.1	0.3	0.0	1.1	0.0	0.3	0.0	6.7	0.9	1.9	0.0	7.8	0.9

		PAH		PAH		PAH		PAH		PAH		PAH		PAH	
Station	Depth	Pyren		Benz[a]antracen		Krysen		Benzo[b]fluoranten		Benzo[k]fluoranten		Benzo[a]pyren		Indeno[1,2,3-cd]pyren	
		Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.
G1/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G1/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G1/25	25	0.3	0.0	0.3	0.0	0.2	0.1	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G1/50	50	0.9	0.1	0.3	0.0	0.5	0.0	0.7	0.0	0.3	0.0	0.3	0.0	0.6	0.0
G1/100	100	1.5	0.2	0.5	0.2	0.9	0.2	0.9	0.2	0.3	0.0	0.5	0.2	0.8	0.1
G1/250	250	1.4	0.1	0.3	0.0	0.7	0.0	0.7	0.1	0.3	0.0	0.3	0.2	0.7	0.0
G1/500	492	3.0	0.2	0.9	0.1	1.5	0.1	1.5	0.1	0.6	0.0	0.8	0.1	1.4	0.1
G1/1200	1218	4.9	0.6	1.6	0.0	3.3	0.0	3.3	0.1	1.2	0.1	1.2	0.1	2.3	0.1
G2/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G2/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G2/25	25	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G2/50	50	2.3	2.0	1.4	1.7	1.3	1.2	1.5	1.1	0.4	0.3	1.2	1.2	1.4	1.2
G2/100	103	1.5	0.3	0.5	0.2	0.8	0.2	0.9	0.2	0.3	0.0	0.4	0.3	0.7	0.2
G2/250	250	1.0	0.0	0.3	0.0	0.6	0.0	0.7	0.0	0.3	0.0	0.3	0.0	0.5	0.0
G2/500	503	3.5	1.4	1.2	0.8	1.7	0.9	2.0	1.2	0.8	0.6	1.4	1.1	1.5	0.8
G2/1400	1361	4.9	1.0	1.4	0.3	2.6	0.4	2.9	0.9	0.5	0.3	0.8	0.1	2.3	0.5
G2 1418	1418	5.2	0.2	1.6	0.2	2.7	0.5	3.5	0.6	0.7	0.2	0.9	0.5	2.7	0.8
G2/1600	1598	6.1	0.2	1.3	0.1	2.9	0.4	3.1	0.3	1.0	0.1	0.9	0.2	1.9	0.2
MA2-1 1361	1361	5.7	0.8	2.0	0.0	3.9	0.6	3.9	0.3	0.8	0.1	1.2	0.2	3.0	0.3
MA2-3 1376	1376	6.1	0.8	2.2	0.5	3.7	0.4	4.0	0.1	0.7	0.0	1.4	0.6	3.1	0.3
MA2-3 1414	1414	5.1	0.2	1.4	0.1	2.7	0.4	3.0	0.1	0.5	0.0	0.6	0.2	2.3	0.3
G3/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G3/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G3/25	25	4.3	1.1	2.2	0.6	2.4	0.7	2.9	0.7	1.5	0.4	2.7	0.9	2.4	0.7
G3/50	50	7.4	1.0	3.7	0.5	4.0	0.6	4.9	0.8	2.4	0.3	4.6	0.6	3.9	0.7
G3/100	100	1.4	0.1	0.6	0.0	0.9	0.1	0.9	0.1	0.3	0.0	0.3	0.1	1.0	0.1
G3/250	254	2.7	1.9	1.1	0.9	1.4	1.0	1.2	0.5	0.4	0.3	0.8	0.8	1.3	0.5
G3/500	508	4.2	0.4	1.1	0.1	1.8	0.1	1.7	0.1	0.3	0.0	0.6	0.0	1.7	0.0
G3/1200	1204	5.3	0.0	1.2	0.1	2.7	0.1	2.9	0.2	0.7	0.0	0.8	0.1	2.0	0.1
G4/0	0	51.5	10.1	41.8	9.3	36.0	7.7	49.2	8.5	17.6	3.4	46.8	5.8	34.5	7.4
G4/5	5	225.9	58.5	159.6	42.1	131.3	30.5	145.0	39.8	46.7	11.7	144.1	35.3	126.3	29.9
G4/25	25	9.2	2.0	6.3	2.0	5.7	1.6	7.1	1.1	2.3	0.4	6.3	1.6	5.9	1.2
G4/50	52	1.3	0.2	0.7	0.1	0.8	0.1	1.1	0.1	0.3	0.0	0.7	0.1	1.2	0.1
G4/100	100	1.1	0.1	0.3	0.0	0.9	0.1	0.8	0.2	0.3	0.0	0.3	0.0	0.7	0.1
G4/250	250	1.0	0.0	0.3	0.0	0.6	0.1	0.6	0.1	0.3	0.0	0.3	0.0	0.7	0.1
G4/500	500	1.6	0.6	0.3	0.0	0.7	0.1	0.8	0.3	0.3	0.0	0.3	0.0	0.6	0.3
G4/1000	1000	3.1	0.5	0.9	0.0	1.9	0.1	2.2	0.4	0.4	0.3	0.8	0.3	1.5	0.2

		PAH		PAH		PAH		PAH		PAH		PAH		PAH	
Station	Depth	Pyren		Benz[a]antracen		Krysen		Benzo[b]fluoranten		Benzo[k]fluoranten		Benzo[a]pyren		Indeno[1,2,3-cd]pyren	
		Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.	Av.	Stdev.
G5/0	0	1.2	1.4	0.7	0.7	0.9	1.1	2.5	2.8	1.0	1.1	1.4	1.3	1.3	0.8
G5/5	5	7.7	3.8	5.5	1.9	5.2	2.3	6.8	3.7	2.9	1.4	5.9	2.5	5.5	3.3
G5/25	26	0.4	0.3	0.4	0.2	0.3	0.0	0.4	0.3	0.3	0.0	0.4	0.2	0.3	0.2
G5/50	50	0.5	0.2	0.3	0.0	0.4	0.1	0.5	0.5	0.3	0.0	0.4	0.2	0.6	0.2
G5/100	100	1.1	0.1	0.4	0.2	0.8	0.1	0.8	0.1	0.3	0.0	0.3	0.0	0.8	0.1
G5/250	250	1.1	0.1	0.3	0.0	0.6	0.0	0.7	0.0	0.3	0.0	0.3	0.1	0.8	0.1
G5/500	500	2.5	0.4	0.9	0.2	1.5	0.2	1.5	0.2	0.3	0.2	0.8	0.1	1.6	0.3
G5/1000	1045	4.4	0.4	1.6	0.2	2.8	0.4	3.4	0.8	1.2	0.4	1.4	0.4	2.9	0.7
G6/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.2	0.3	0.0	0.3	0.0	0.3	0.0
G6/5	5	3.5	2.3	2.5	1.4	2.4	1.5	2.7	1.4	1.0	0.6	2.6	1.4	2.2	1.1
G6/25	23	3.0	1.6	2.2	1.1	2.0	0.9	2.6	1.2	1.0	0.6	2.2	1.1	2.2	1.0
G6/50	51	1.3	0.2	0.9	0.2	0.9	0.2	1.4	0.2	0.3	0.2	0.9	0.3	1.5	0.3
G6/100	103	1.4	0.2	0.7	0.1	0.8	0.0	1.1	0.1	0.3	0.0	0.7	0.0	1.1	0.1
G6/250	250	1.2	0.2	0.4	0.2	0.4	0.3	0.8	0.6	0.3	0.0	0.4	0.3	1.0	0.2
G6/500	505	4.1	0.3	1.6	0.3	2.2	0.4	2.5	0.4	0.7	0.1	1.3	0.3	2.5	0.5
G6/1000	975	4.3	0.2	1.7	0.1	2.6	0.2	2.9	0.1	0.9	0.0	1.3	0.1	2.7	0.2
G7/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G7/5	5	0.8	0.3	0.7	0.2	0.5	0.4	0.8	0.3	0.3	0.0	0.6	0.4	0.9	0.2
G7/25	25	1.1	0.2	0.8	0.1	0.9	0.1	1.4	0.2	0.5	0.2	1.0	0.1	1.4	0.1
G7/50	51	2.1	0.2	1.5	0.1	1.5	0.2	2.3	0.1	0.8	0.1	1.5	0.1	2.2	0.2
G7/100	101	2.9	0.3	1.7	0.2	1.8	0.3	2.7	0.2	0.9	0.1	1.7	0.2	2.7	0.3
G7/250	248	5.2	0.7	2.3	0.2	2.2	0.2	3.6	0.5	1.0	0.1	2.1	0.3	3.0	0.3
G7/500	504	13.3	1.9	8.9	2.1	7.0	1.6	11.0	1.8	3.6	0.7	9.4	2.7	10.1	2.1
G7/1000	973	7.1	0.3	4.0	0.5	4.7	0.3	6.1	0.4	1.7	0.2	3.3	0.5	5.4	0.5
G8/0	0	0.3	0.0	0.4	0.2	0.4	0.2	0.3	0.0	0.3	0.0	0.5	0.4	0.5	0.4
	5														
G8/25	25	25.8	37.5	13.6	17.5	14.5	20.3	12.9	14.4	5.0	6.2	8.9	10.0	8.5	8.7
G8/50	50	2.6	0.8	1.9	0.5	1.4	0.5	3.2	1.0	1.0	0.3	1.9	0.5	2.4	0.7
G8/100	104	7.5	0.6	4.4	1.6	3.3	1.4	7.6	1.9	2.1	0.2	4.0	1.0	6.0	0.8
G8/250	250	7.5	0.5	5.8	0.7	4.9	0.7	7.5	0.4	2.0	0.1	5.0	0.3	6.6	0.5
G8/500	508	8.4	0.5	6.9	0.1	5.8	0.2	11.1	1.2	2.4	0.2	7.0	0.6	8.7	0.7
G8/1000	979	8.5	0.3	6.0	0.7	5.5	0.5	9.7	0.2	2.2	0.1	5.9	0.3	8.0	0.3
G9/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G9/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.4	0.2
G9/25	25	0.4	0.3	0.5	0.4	0.4	0.2	0.3	0.0	0.3	0.0	0.5	0.4	0.8	0.9
G9/50	52	122.7	208.7	84.0	142.6	59.3	100.0	63.1	103.3	17.1	28.0	54.0	90.3	43.1	70.3
G9/100	104	4.8	0.4	2.9	0.5	2.5	0.5	5.0	0.1	1.3	0.1	2.9	0.2	4.5	0.5
G9/250	249	5.6	1.0	2.1	0.2	2.1	0.4	3.8	1.0	0.9	0.2	2.1	0.5	3.1	0.4
G9/500	500	9.7	1.3	5.0	0.2	5.0	0.4	8.1	1.2	1.7	0.3	4.7	0.8	6.8	1.2
G9/1000	1019	7.1	0.4	4.1	0.9	4.0	0.7	8.0	1.2	1.7	0.3	4.0	0.7	6.5	1.0

Station	Depth	Dibenz[a,h]antracen Av.	Dibenz[a,h]antracen Stdev.	Benzo[ghi]perylen Av.	Benzo[ghi]perylen Stdev.	C1-naftalener Av.	C1-naftalener Stdev.	C2-naftalener Av.	C2-naftalener Stdev.	C3-naftalener Av.	C3-naftalener Stdev.	C1-fenantrener Av.	C1-fenantrener Stdev.	C2-fenantrener Av.	C2-fenantrener Stdev.
G1/0	0	0.3	0.0	0.3	0.0	1.7	0.1	2.7	0.1	2.5	0.2	0.4	0.2	0.4	0.2
G1/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.4	0.2	0.5	0.3	0.3	0.0	0.2	0.1
G1/25	25	0.3	0.0	0.3	0.0	1.0	1.0	2.1	1.8	2.0	1.6	0.4	0.3	0.3	0.0
G1/50	50	0.3	0.0	0.6	0.0	0.8	0.1	6.7	0.9	3.2	0.5	1.2	0.1	1.4	0.0
G1/100	100	0.3	0.0	0.7	0.2	3.0	0.3	11.1	0.6	7.0	0.1	2.1	0.2	2.2	0.1
G1/250	250	0.3	0.0	0.6	0.1	1.1	0.1	5.8	0.4	2.9	0.2	1.3	0.1	1.3	0.1
G1/500	492	0.3	0.0	1.2	0.1	2.7	0.2	13.7	2.5	6.7	1.3	3.1	0.3	2.9	0.2
G1/1200	1218	0.3	0.0	1.7	0.1	4.6	0.2	11.7	2.2	7.7	0.9	4.3	0.0	3.9	0.1
G2/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G2/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.2	0.3	0.2	0.3	0.0	0.3	0.2
G2/25	25	0.3	0.0	0.3	0.0	0.3	0.0	1.0	0.9	0.9	0.7	0.4	0.3	0.3	0.0
G2/50	50	0.3	0.0	1.2	0.8	0.8	0.1	7.0	1.2	3.7	0.6	1.8	0.6	1.9	0.7
G2/100	103	0.3	0.0	0.7	0.2	0.9	0.2	8.3	3.5	4.3	1.7	2.1	1.2	2.2	1.4
G2/250	250	0.3	0.0	0.3	0.2	0.7	0.1	4.8	0.4	2.8	0.6	1.6	0.7	1.7	0.6
G2/500	503	0.3	0.0	1.4	0.8	2.3	0.4	10.2	3.1	4.3	1.4	2.3	1.2	2.1	0.9
G2/1400	1361	0.4	0.3	1.2	0.2	4.1	1.0	9.5	2.3	4.9	1.1	3.3	0.6	2.7	0.5
G2 1418	1418	0.3	0.0	1.5	0.7	4.4	0.6	11.5	0.1	7.3	0.3	3.3	0.2	2.9	0.4
G2/1600	1598	0.3	0.0	1.3	0.2	4.3	0.5	9.2	0.6	4.7	0.2	3.1	1.1	2.7	0.8
MA2-1 1361	1361	0.3	0.0	1.8	0.1	6.7	0.3	20.6	6.1	20.2	7.1	6.6	0.5	7.6	0.7
MA2-3 1376	1376	0.3	0.0	1.9	0.4	5.7	0.6	14.7	2.7	11.3	3.4	4.7	0.4	4.5	0.1
MA2-3 1414	1414	0.3	0.0	1.0	0.2	5.1	0.0	12.0	0.3	8.2	0.4	3.6	0.5	3.0	0.4
G3/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	1.2	1.6	1.1	1.1
G3/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G3/25	25	0.5	0.2	2.8	0.7	2.1	0.5	14.8	5.9	5.8	1.9	2.6	2.0	3.2	2.6
G3/50	50	0.8	0.1	4.4	0.7	2.7	0.4	24.2	4.8	8.2	2.4	5.5	0.6	6.7	0.7
G3/100	100	0.3	0.0	0.8	0.1	1.3	0.1	10.5	0.8	4.9	0.2	1.6	0.2	0.9	1.2
G3/250	254	0.3	0.0	0.9	0.4	1.4	0.1	8.1	0.2	4.5	0.6	1.8	0.5	1.9	0.3
G3/500	508	0.3	0.0	1.0	0.0	3.6	0.6	15.4	3.9	6.7	2.3	3.0	0.4	1.7	1.3
G3/1200	1204	0.3	0.0	1.0	0.0	4.2	0.0	10.1	1.4	5.5	1.6	2.7	0.1	2.3	0.2
G4/0	0	6.5	1.6	31.3	6.4	2.4	0.4	6.5	1.2	11.6	1.8	18.6	0.7	26.2	2.5
G4/5	5	22.0	4.1	121.4	22.4	22.5	4.8	50.0	7.5	61.2	5.6	81.0	15.8	120.9	14.7
G4/25	25	1.2	0.3	5.0	0.9	1.5	0.1	7.6	1.3	4.6	1.8	4.5	0.8	4.4	3.0
G4/50	52	0.3	0.0	0.9	0.1	0.9	0.2	11.0	1.6	4.6	0.5	1.5	0.2	2.1	0.2
G4/100	100	0.3	0.0	0.4	0.2	1.1	0.1	6.2	1.2	2.5	0.4	1.6	0.2	1.6	0.3
G4/250	250	0.3	0.0	0.3	0.0	0.9	0.0	4.5	0.3	2.9	0.3	0.9	0.1	1.1	0.1
G4/500	500	0.3	0.0	0.4	0.2	1.2	0.4	4.9	2.2	2.2	0.7	1.1	0.4	0.9	0.3
G4/1000	1000	0.3	0.0	0.9	0.1	2.5	0.3	5.3	1.6	3.2	1.0	2.2	0.1	2.0	0.3

Station	Depth	PAH Dibenz[a,h]antracen Av.	Stdev.	PAH Benzo[ghi]perylen Av.	Stdev.	NPD C1-naftalener Av.	Stdev.	NPD C2-naftalener Av.	Stdev.	NPD C3-naftalener Av.	Stdev.	NPD C1-fenantrener Av.	Stdev.	NPD C2-fenantrener Av.	Stdev.
G5/0	0	0.3	0.0	1.0	0.6	0.3	0.0	0.3	0.0	0.3	0.0	0.4	0.3	0.5	0.4
G5/5	5	1.0	0.6	4.7	3.0	0.3	0.0	0.7	0.2	0.8	0.4	1.9	0.5	2.2	0.7
G5/25	26	0.3	0.0	0.3	0.0	0.3	0.0	1.3	0.2	0.8	0.2	0.3	0.0	0.4	0.1
G5/50	50	0.3	0.0	0.4	0.2	0.6	0.0	5.0	2.3	2.2	1.1	0.8	0.3	1.1	0.4
G5/100	100	0.3	0.0	0.5	0.2	1.0	0.1	6.3	1.0	2.7	0.7	1.1	0.2	1.2	0.2
G5/250	250	0.3	0.0	0.6	0.1	0.9	0.1	6.4	0.7	3.6	0.3	1.1	0.1	1.7	0.6
G5/500	500	0.3	0.0	1.1	0.2	2.1	0.4	7.3	1.9	3.5	1.0	2.1	0.2	2.2	0.2
G5/1000	1045	0.3	0.0	1.9	0.4	3.8	0.7	13.5	2.6	6.5	2.0	4.0	0.8	3.8	1.2
G6/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G6/5	5	0.3	0.0	1.6	0.8	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G6/25	23	0.3	0.0	1.8	0.8	0.8	0.3	4.5	1.7	2.5	0.9	1.8	0.7	1.3	0.8
G6/50	51	0.3	0.0	1.1	0.2	0.8	0.1	4.7	0.2	2.6	0.4	1.1	0.1	1.6	0.2
G6/100	103	0.3	0.0	0.9	0.1	1.2	0.4	6.1	1.1	3.3	1.0	1.0	0.1	1.3	0.1
G6/250	250	0.3	0.0	0.7	0.2	1.9	0.7	7.6	2.0	4.9	1.9	1.1	0.1	1.3	0.2
G6/500	505	0.3	0.0	1.8	0.3	3.5	0.3	17.7	1.1	7.3	0.5	3.3	0.1	3.3	0.6
G6/1000	975	0.3	0.0	1.9	0.2	4.2	0.2	13.5	2.5	6.8	1.1	3.4	0.5	3.3	0.6
G7/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G7/5	5	0.3	0.0	0.7	0.2	0.3	0.0	1.3	0.3	1.3	0.3	0.9	0.2	1.6	0.3
G7/25	25	0.3	0.0	1.1	0.1	0.4	0.2	3.2	0.6	2.0	0.2	1.1	0.2	1.8	0.3
G7/50	51	0.3	0.0	1.7	0.1	1.3	0.1	5.9	0.4	3.3	0.1	1.5	0.1	2.5	0.1
G7/100	101	0.3	0.0	2.1	0.2	1.7	0.4	9.0	1.3	4.0	0.4	2.0	0.2	2.7	0.4
G7/250	248	0.3	0.0	2.5	0.2	2.5	0.4	16.8	1.9	7.1	1.3	2.6	0.2	3.3	0.1
G7/500	504	1.9	0.6	8.1	1.6	4.7	0.3	27.0	0.5	11.1	0.3	6.5	0.4	7.7	0.7
G7/1000	973	0.7	0.1	4.1	0.4	5.0	0.3	16.1	1.2	8.3	1.1	4.8	0.3	5.3	0.9
G8/0	0	0.4	0.3	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.7	0.8	0.6	0.6
	5														
G8/25	25	1.5	2.0	6.4	6.2	9.9	12.4	14.0	8.9	7.4	4.3	11.8	13.5	9.0	6.0
G8/50	50	0.3	0.0	2.2	0.6	1.8	0.5	5.5	1.9	2.9	0.9	2.5	1.0	3.8	1.5
G8/100	104	0.6	0.3	4.0	2.5	3.9	0.3	14.6	2.5	6.9	1.1	5.6	0.7	7.3	1.1
G8/250	250	0.8	0.1	5.5	0.2	4.0	0.4	18.6	2.2	10.2	1.0	6.4	0.3	8.8	0.9
G8/500	508	1.3	0.1	6.9	0.6	5.2	0.4	27.0	1.0	11.8	0.5	8.0	0.9	10.6	0.7
G8/1000	979	1.1	0.0	5.9	0.1	5.4	0.4	18.3	2.4	9.3	0.3	6.5	0.1	7.9	0.3
G9/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G9/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G9/25	25	0.5	0.5	0.4	0.3	0.4	0.3	3.7	3.7	1.8	1.2	1.0	0.9	0.8	0.7
G9/50	52	7.5	12.6	29.2	47.4	36.7	61.4	43.9	62.8	26.8	39.1	66.1	110.5	29.5	45.6
G9/100	104	0.6	0.1	3.3	0.2	2.1	0.1	9.6	0.7	4.9	0.5	3.2	0.3	3.9	0.4
G9/250	249	0.4	0.2	2.4	0.3	2.0	0.3	11.1	1.6	5.6	1.3	2.9	0.5	3.7	1.1
G9/500	500	0.9	0.2	5.1	0.5	4.7	0.6	20.7	2.8	11.1	3.1	7.0	0.8	11.0	5.5
G9/1000	1019	0.8	0.2	4.4	0.7	4.8	0.3	15.5	1.0	7.4	0.5	5.5	0.7	6.1	1.1

Station	Depth	NPD C3-fenantrener Av.	NPD C3-fenantrener Stdev.	NPD C1-dibenzotiofener Av.	NPD C1-dibenzotiofener Stdev.	NPD C2-dibenzotiofener Av.	NPD C2-dibenzotiofener Stdev.	NPD C3-dibenzotiofener Av.	NPD C3-dibenzotiofener Stdev.
G1/0	0	**0.3**	**0.0**	**0.3**	**0.0**	**0.4**	**0.3**	**0.7**	**0.3**
G1/5	5	**0.3**	**0.0**	**0.3**	**0.0**	**0.3**	**0.0**	**0.3**	**0.0**
G1/25	25	**0.3**	**0.0**	**0.3**	**0.0**	**0.4**	**0.2**	**0.5**	**0.0**
G1/50	50	**1.4**	**0.1**	**0.3**	**0.0**	**1.1**	**0.1**	**1.8**	**0.1**
G1/100	100	**2.2**	**0.2**	**0.3**	**0.2**	**1.6**	**0.2**	**2.5**	**0.3**
G1/250	250	**1.5**	**0.1**	**0.3**	**0.0**	**1.0**	**0.1**	**1.7**	**0.1**
G1/500	492	**2.9**	**0.4**	**0.3**	**0.0**	**1.7**	**0.4**	**3.0**	**0.8**
G1/1200	1218	**3.3**	**0.2**	**0.4**	**0.3**	**2.3**	**0.3**	**4.1**	**0.6**
G2/0	0	**0.3**	**0.0**	**0.4**	**0.2**	**2.3**	**1.1**	**3.4**	**1.2**
G2/5	5	**0.3**	**0.0**	**0.3**	**0.0**	**0.4**	**0.2**	**0.5**	**0.3**
G2/25	25	**0.4**	**0.3**	**0.3**	**0.0**	**0.5**	**0.4**	**0.9**	**0.7**
G2/50	50	**1.9**	**0.6**	**0.3**	**0.0**	**1.4**	**0.4**	**2.2**	**0.5**
G2/100	103	**2.2**	**1.4**	**0.4**	**0.2**	**1.6**	**1.3**	**2.8**	**1.9**
G2/250	250	**2.0**	**0.3**	**0.3**	**0.0**	**1.2**	**0.4**	**2.4**	**0.5**
G2/500	503	**2.2**	**0.9**	**0.3**	**0.0**	**1.3**	**0.6**	**2.5**	**1.2**
G2/1400	1361	**2.5**	**0.6**	**0.3**	**0.0**	**1.4**	**0.2**	**2.1**	**0.2**
G2 1418	1418	**2.7**	**0.6**	**0.3**	**0.0**	**1.5**	**0.5**	**2.7**	**1.1**
G2/1600	1598	**2.3**	**0.4**	**0.3**	**0.0**	**1.5**	**0.3**	**2.6**	**0.6**
MA2-1 1361	1361	**7.8**	**0.6**	**1.1**	**0.0**	**3.4**	**0.2**	**5.3**	**0.5**
MA2-3 1376	1376	**4.0**	**0.1**	**0.7**	**0.3**	**2.7**	**0.7**	**3.9**	**0.3**
MA2-3 1414	1414	**2.6**	**0.4**	**0.4**	**0.2**	**1.4**	**0.5**	**2.3**	**0.8**
G3/0	0	**1.0**	**1.0**	**0.3**	**0.0**	**0.7**	**0.5**	**1.4**	**0.7**
G3/5	5	**0.3**	**0.0**	**0.3**	**0.0**	**0.3**	**0.0**	**0.3**	**0.0**
G3/25	25	**2.7**	**2.1**	**0.6**	**0.3**	**2.6**	**2.0**	**4.1**	**3.1**
G3/50	50	**6.1**	**0.7**	**1.2**	**0.0**	**5.2**	**0.2**	**8.2**	**0.5**
G3/100	100	**2.2**	**0.1**	**0.3**	**0.0**	**1.3**	**0.1**	**2.4**	**0.2**
G3/250	254	**2.4**	**0.3**	**0.3**	**0.0**	**1.3**	**0.2**	**2.5**	**0.4**
G3/500	508	**2.3**	**0.2**	**0.3**	**0.0**	**1.0**	**0.3**	**1.8**	**0.5**
G3/1200	1204	**2.1**	**0.2**	**0.3**	**0.0**	**1.3**	**0.1**	**2.2**	**0.1**
G4/0	0	**20.2**	**2.1**	**1.8**	**0.1**	**7.5**	**0.6**	**10.3**	**1.0**
G4/5	5	**113.7**	**13.7**	**8.4**	**1.0**	**42.5**	**3.1**	**78.3**	**6.5**
G4/25	25	**4.8**	**0.9**	**0.7**	**0.1**	**2.8**	**0.3**	**4.2**	**0.6**
G4/50	52	**2.4**	**0.3**	**0.3**	**0.0**	**1.5**	**0.2**	**2.6**	**0.5**
G4/100	100	**1.8**	**0.1**	**0.3**	**0.0**	**1.1**	**0.0**	**2.0**	**0.1**
G4/250	250	**1.5**	**0.1**	**0.3**	**0.0**	**0.8**	**0.1**	**1.6**	**0.2**
G4/500	500	**1.1**	**0.4**	**0.3**	**0.0**	**0.7**	**0.2**	**1.2**	**0.5**
G4/1000	1000	**1.8**	**0.1**	**0.3**	**0.0**	**1.2**	**0.1**	**2.2**	**0.4**

Station	Depth	NPD C3-fenantrener Av.	NPD C3-fenantrener Stdev.	NPD C1-dibenzotiofener Av.	NPD C1-dibenzotiofener Stdev.	NPD C2-dibenzotiofener Av.	NPD C2-dibenzotiofener Stdev.	NPD C3-dibenzotiofener Av.	NPD C3-dibenzotiofener Stdev.
G5/0	0	0.4	0.3	0.3	0.0	0.3	0.0	0.3	0.0
G5/5	5	1.8	0.6	0.3	0.0	0.5	0.3	0.8	0.2
G5/25	26	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G5/50	50	1.2	0.3	0.3	0.0	0.5	0.3	1.1	0.2
G5/100	100	1.6	0.2	0.3	0.0	0.9	0.1	1.6	0.1
G5/250	250	2.3	0.9	0.3	0.0	1.4	0.9	2.7	1.7
G5/500	500	2.4	0.3	0.3	0.0	1.7	0.2	2.9	0.2
G5/1000	1045	3.8	1.1	0.4	0.3	2.3	0.9	3.9	1.6
G6/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G6/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G6/25	23	1.8	0.7	0.3	0.0	0.8	0.3	1.1	0.4
G6/50	51	1.6	0.2	0.3	0.0	0.8	0.1	1.3	0.2
G6/100	103	1.6	0.1	0.3	0.0	0.8	0.1	1.5	0.2
G6/250	250	1.6	0.3	0.3	0.0	1.0	0.1	1.6	0.3
G6/500	505	3.6	0.6	0.3	0.0	1.8	0.6	3.3	0.8
G6/1000	975	3.7	0.9	0.4	0.2	1.9	0.5	3.7	0.9
G7/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G7/5	5	1.6	0.3	0.7	0.1	0.5	0.3	0.9	0.2
G7/25	25	2.1	0.3	0.3	0.0	1.0	0.2	1.7	0.2
G7/50	51	2.9	0.2	0.3	0.0	1.6	0.1	2.9	0.3
G7/100	101	3.1	0.3	0.4	0.2	1.9	0.5	3.3	0.6
G7/250	248	3.6	0.0	0.3	0.0	1.9	0.2	3.6	0.3
G7/500	504	7.3	0.2	0.9	0.1	3.5	0.3	6.8	0.8
G7/1000	973	5.7	1.1	0.6	0.1	3.0	0.7	5.4	1.2
G8/0	0	0.4	0.2	0.4	0.2	0.3	0.0	0.3	0.0
	5								
G8/25	25	5.5	2.6	1.1	1.1	2.4	1.3	3.2	1.3
G8/50	50	3.1	1.3	0.3	0.0	1.4	0.5	2.4	0.8
G8/100	104	5.7	1.2	0.7	0.1	2.9	0.6	5.1	1.1
G8/250	250	8.2	0.3	0.9	0.1	4.4	0.3	8.2	0.8
G8/500	508	9.6	1.2	1.2	0.1	5.0	0.5	8.7	0.9
G8/1000	979	7.1	0.5	1.0	0.0	4.4	0.2	7.2	0.6
G9/0	0	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G9/5	5	0.3	0.0	0.3	0.0	0.3	0.0	0.3	0.0
G9/25	25	0.3	0.1	0.7	0.1	0.3	0.0	0.3	0.0
G9/50	52	11.8	15.2	5.3	8.5	5.3	6.3	4.2	3.0
G9/100	104	3.9	0.2	0.5	0.0	2.4	0.1	3.6	0.1
G9/250	249	3.6	0.8	0.4	0.1	1.8	0.6	3.1	0.7
G9/500	500	14.1	10.5	1.4	0.4	8.3	4.0	16.0	9.0
G9/1000	1019	5.1	0.9	0.7	0.2	3.2	0.6	5.3	0.7

Grain size composition, weight distribution.

Weight(g) Diameter(µm)	F	G1/0	G1/5	G1/25	G1/50	G1/100	G1/250	G1/500	G1/1200
2000	-1	0.00	0.00	0.01	0.01	0.13	0.04	0.00	0.00
1000	0	0.07	0.03	0.06	0.28	0.33	0.18	0.00	0.01
500	1	1.56	0.07	0.17	0.52	0.57	0.67	0.01	0.00
355	1.5	3.88	0.09	0.41	0.64	0.39	1.32	0.07	0.01
250	2	4.57	0.11	1.22	1.05	0.60	2.09	0.13	0.00
180	2.5	2.61	0.39	2.31	1.08	0.71	1.40	0.09	0.00
125	3	0.93	4.87	4.73	1.28	0.80	1.05	0.15	0.00
90	3.5	0.13	4.60	3.18	1.41	0.67	0.38	0.25	0.00
63	4	0.11	3.75	0.38	2.65	0.60	0.50	1.19	0.00
<63	8	0.00	0.01	0.78	4.76	3.52	2.50	10.30	3.51
Total		13.86	13.92	13.25	13.68	8.32	10.13	12.19	3.53

Diameter(µm)	F	G2/0	G2/5	G2/25	G2/50	G2/100	G2/250	G2/500	MA 2-1 1361	MA 2-3 1376	MA 2-3.2 1414	MA 2-4 G2/1598	MA 2-5 G2/1361
2000	-1	0.00	0.00	0.20	1.54	0.19	0.20	0.06	0.02	0.00	0.00	0.02	0.00
1000	0	0.03	0.00	0.32	0.94	0.15	1.31	0.04	0.01	0.01	0.04	0.02	0.01
500	1	0.04	0.02	0.40	0.99	0.34	2.00	0.04	0.07	0.10	0.03	0.02	0.00
355	1.5	0.05	0.04	0.63	0.64	0.35	1.08	0.17	0.11	0.06	0.03	0.04	0.01
250	2	0.17	0.04	0.51	0.86	0.73	1.10	0.32	0.12	0.11	0.04	0.05	0.00
180	2.5	2.01	0.11	0.76	0.46	1.23	0.56	0.30	0.15	0.10	0.02	0.02	0.01
125	3	5.72	0.29	1.39	0.41	1.27	0.36	0.43	0.21	0.13	0.01	0.03	0.01
90	3.5	1.16	1.41	0.80	0.64	1.67	0.20	0.40	0.09	0.06	0.03	0.00	0.01
63	4	0.71	7.87	0.79	1.50	2.36	0.35	1.00	0.09	0.07	0.00	0.01	0.03
<63	8	0.48	0.00	6.43	4.20	5.53	1.90	9.46	4.75	3.24	5.36	5.85	5.44
Total		10.37	9.78	12.23	12.18	13.82	9.06	12.22	5.62	3.88	5.56	6.06	5.52

Diameter(µm)	F	G3/0	G3/5	G3/25	G3/50	G3/100	G3/250	G3/500	G3/1200
2000	-1	0.00	0.00	0.03	0.04	0.50	0.02	0.00	0.00
1000	0	0.00	0.01	0.05	0.00	1.13	0.19	0.01	0.00
500	1	0.05	0.07	0.07	0.02	1.61	0.39	0.01	0.02
355	1.5	0.23	0.10	0.12	0.04	0.54	0.37	0.03	0.02
250	2	1.01	0.37	0.38	0.10	0.54	0.70	0.08	0.02
180	2.5	3.15	1.63	0.69	0.30	0.52	0.84	0.15	0.01
125	3	4.12	4.92	0.75	0.43	0.51	0.89	0.36	0.03
90	3.5	0.56	2.28	0.61	0.13	0.46	0.64	0.31	0.01
63	4	0.01	0.12	0.50	0.08	0.64	0.58	0.28	0.07
<63	8	0.85	0.25	6.62	6.48	5.27	4.14	5.69	6.65
Total		9.98	9.75	9.82	7.62	11.72	8.76	6.92	6.83

Diameter(µm)	F	G4/0	G4/5	G4/25	G4/50	G4/100	G4/250	G4/500	G4/1000
2000	-1	0.00	0.03	0.08	0.00	0.18	0.03	0.00	0.00
1000	0	0.00	0.03	0.10	0.07	0.54	0.05	0.00	0.01
500	1	0.05	0.07	0.16	0.28	0.93	0.13	0.12	0.01
355	1.5	0.25	0.10	0.31	0.42	0.55	0.37	0.56	0.02
250	2	0.58	0.14	0.32	0.80	0.64	0.62	0.96	0.07
180	2.5	1.45	0.16	0.46	1.01	0.61	0.50	0.98	0.10
125	3	5.59	0.25	1.01	1.35	0.60	0.76	1.05	0.19
90	3.5	5.55	0.37	0.89	1.06	0.49	0.80	0.74	0.21
63	4	0.81	0.73	1.53	1.40	0.49	0.60	0.59	0.20
<63	8	0.15	10.05	5.25	8.43	3.20	3.13	3.65	5.63
Total		14.43	11.93	10.11	14.82	8.23	6.99	8.65	6.44

Diameter(μm)	F	G5/0	G5/5	G5/25	G5/50	G5/100	G5/250	G5/500	G5/1000
2000	-1	0.00	0.00	0.96	0.82	0.17	0.11	0.00	0.01
1000	0	0.00	0.01	2.18	0.82	0.25	0.15	0.05	0.00
500	1	0.09	0.01	7.41	1.30	0.49	0.41	0.18	0.05
355	1.5	1.18	0.01	2.51	0.81	0.40	0.41	0.46	0.05
250	2	4.91	0.17	2.02	0.94	0.89	0.80	0.46	0.10
180	2.5	3.61	0.18	1.47	0.91	1.62	0.78	0.40	0.10
125	3	0.76	0.52	0.90	0.88	1.37	0.98	0.39	0.11
90	3.5	0.11	1.44	0.22	0.81	0.49	0.80	0.30	0.07
63	4	0.06	11.65	0.20	1.15	0.42	0.62	0.30	0.09
<63	8	0.49	2.93	0.68	2.08	4.60	3.43	5.83	9.24
Total		11.21	16.92	18.55	10.52	10.70	8.49	8.37	9.82

Diameter(μm)	F	G6/0	G6/5	G6/25	G6/52	G6/102	G6/250	G6/500	G6/1000
2000	-1	0.03	0.37	0.00	0.33	0.19	0.27	0.00	0.00
1000	0	0.04	0.28	0.03	0.28	0.52	0.91	0.01	0.01
500	1	1.01	0.14	0.06	0.36	1.06	1.19	0.04	0.03
355	1.5	2.00	0.06	0.08	0.36	0.78	0.88	0.08	0.05
250	2	4.09	0.11	0.17	0.62	1.26	1.25	0.16	0.12
180	2.5	4.19	0.19	0.24	0.76	1.46	1.27	0.20	0.17
125	3	1.34	0.39	0.35	0.62	1.24	1.40	0.31	0.21
90	3.5	0.27	2.51	0.45	0.48	0.82	1.22	0.29	0.16
63	4	0.03	9.09	0.96	0.60	0.74	1.14	0.30	0.22
<63	8	0.62	0.98	10.14	2.72	3.38	2.16	8.59	8.64
Total		13.62	14.12	12.48	7.13	11.45	11.69	9.98	9.61

Diameter(μm)	F	G7/0	G7/5	G7/25	G7/50	G7/100	G7/250	G7/500	G7/1000
2000	-1	0.00		2.40	0.16	0.12	0.02	0.00	0.00
1000	0	0.08		1.77	0.27	0.36	0.05	0.01	0.00
500	1	2.65		2.31	1.01	1.48	0.09	0.03	0.00
355	1.5	6.56		1.23	0.70	0.69	0.07	0.02	0.00
250	2	6.25		1.27	0.92	0.58	0.07	0.01	0.00
180	2.5	2.04		1.01	1.13	0.35	0.08	0.01	0.00
125	3	0.39		0.66	1.21	0.31	0.05	0.01	0.00
90	3.5	0.05		0.30	0.66	0.24	0.08	0.02	0.02
63	4	0.01		0.25	1.22	0.22	0.13	0.01	0.02
<63	8	0.00		0.51	5.57	7.14	5.07	7.95	8.07
Total		18.03		11.71	12.85	11.49	5.71	8.07	8.11

Diameter(μm)	F	G8/0	G8/5	G8/25	G8/50	G8/100	G8/250	G8/500	G8/1000
2000	-1	0.00	0.00	3.64	0.29	0.00	0.00	0.00	0.00
1000	0	0.05	0.04	1.15	0.23	0.03	0.01	0.00	0.00
500	1	0.05	0.05	0.88	0.41	0.04	0.01	0.00	0.00
355	1.5	0.29	0.09	0.38	0.73	0.06	0.01	0.00	0.00
250	2	2.05	0.23	0.51	0.87	0.06	0.02	0.01	0.00
180	2.5	4.65	0.50	0.61	1.07	0.02	0.01	0.01	0.00
125	3	2.36	1.05	0.91	1.88	0.07	0.01	0.01	0.00
90	3.5	0.21	1.74	0.39	0.62	0.03	0.02	0.02	0.01
63	4	0.01	7.34	0.32	0.25	0.01	0.02	0.02	0.02
<63	8	0.65	5.41	3.26	6.35	11.69	5.01	6.30	5.82
Total		10.32	16.45	12.05	12.70	12.01	5.12	6.37	5.85

Diameter(μm)	F	G9/0	G9/5	G9/25	G9/50	G9/100	G9/250	G9/500	G9/1000
2000	-1	0.02		4.33	0.28	0.05	0.02	0.00	0.00
1000	0	0.48		2.33	1.08	0.07	0.04	0.01	0.01
500	1	6.93		2.14	1.42	0.13	0.09	0.04	0.01
355	1.5	4.06		1.64	0.68	0.09	0.31	0.04	0.01
250	2	1.28		2.36	0.55	0.12	0.70	0.13	0.02
180	2.5	0.13		1.46	0.38	0.12	0.82	0.18	0.02
125	3	0.02		0.56	0.35	0.18	0.88	0.20	0.01
90	3.5	0.02		0.25	0.29	0.11	0.40	0.08	0.00
63	4	0.01		0.04	0.20	0.08	0.42	0.04	0.02
<63	8	0.66		0.17	3.72	3.42	4.68	5.01	5.18
Total		13.61		15.28	8.95	4.37	8.36	5.73	5.28

Top ten abundant species on each station.

Number, number of species, % of total and cumulative %.

G 1/0				
Class	family /species	N	%	% acc.
Echinodermata	*Ophiophragmus sp.1*	28	22	22
Crustacea	Cumacea gen. sp. 9	23	18	41
Mollusca	Donacidae	22	18	58
Crustacea	Urothoidae	15	12	70
Echinodermata	Rotulidae	9	7	78
Vermes	Nemertea	6	5	82
Crustacea	Cirolanidae	4	3	86
Annelida	Orbiniidae	3	2	88
Crustacea	Ampeliscidae	2	2	90
Crustacea	Corophioidea	2	2	91
Crustacea	Decapoda n. det.	2	2	93
Annelida	Magelonidae	1	1	94
Annelida	Opheliidae	1	1	94
Annelida	Polynoidae	1	1	95
Crustacea	Oedicerotidae	1	1	96
Crustacea	Cumacea gen. sp. 7	1	1	97
Crustacea	Ogyrididae	1	1	98
Echinodermata	*Amphiura incana*	1	1	98
Mollusca	Skeneidae	1	1	99
Sipuncula	Nematoda	1	1	100
	total	125		
	species	20		

G2/0				
Class	family /species	N	%	% acc.
Crustacea	Cirolanidae	4	57	57
Crustacea	Ogyrididae	2	29	86
Mollusca	Donacidae	1	14	100
	total	7		
	species	3		

G3/0				
Class	family /species	N	%	% acc.
Crustacea	Cirolanidae	80	53	53
Crustacea	Cirripedia	42	28	80
Annelida	Spionidae	12	8	88
Crustacea	Mysida	10	7	95
Annelida	Cirratulidae	6	4	99
Annelida	Flabelligeridae	1	1	99
Crustacea	Amphipoda	1	1	100
	total	152		
	species	7		

G4/0				
Class	family /species	N	%	% acc.
Crustacea	Dogielinotidae	294	92	92
Mollusca	Donacidae	12	4	96
Crustacea	Sphaeromatidae	3	1	97
Crustacea	Cirolanidae	1	0.3	97
Annelida	Flabelligeridae	1	0.3	98
Annelida	Maldanidae	1	0.3	98
Annelida	Pectinaridae	1	0.3	98
Annelida	Sabellidae	1	0.3	99
Crustacea	Phoxocephalidae	1	0.3	99
Crustacea	Brachyura	1	0.3	99
Mollusca	Epitoniidae	1	0.3	100
Mollusca	Trochidae	1	0.3	100
	total	318		
	species	12		

G5/0				
Class	family /species	N	%	% acc.
Crustacea	Cirolanidae	157	92	92
Annelida	Cirratulidae	8	5	97
Annelida	Polychaeta	3	2	99
Mollusca	Donacidae	1	1	99
Crustacea	Metapseudidae	1	1	100
	total	170		
	species	5		

G6/0				
Class	family /species	N	%	% acc.
Crustacea	Cirolanidae	109	100	100
	total	109		
	species	1		

G7/0				
Class	family /species	N	%	% acc.
Crustacea	Cirolanidae	90	99	99
Vermes	Nemertea	1	1	100
	total	91		
	species	2		

G8/0				
Class	family /species	N	%	% acc.
Mollusca	Donacidae	3	50	50
Crustacea	Cirolanidae	1	17	67
Annelida	Flabelligeridae	1	17	83
Annelida	Phyllodocidae	1	17	100
	total	6		
	species	4		

G9/0				
Class	family /species	N	%	% acc.
Crustacea	Cirolanidae	13	93	93
Echinodermata	*Amphiura sp.*	1	7	100
	total	14		
	species	2		

G1/5				
Class	family /species	N	%	% acc.
Mollusca	Donacidae	13	62	62
Vermes	Nemertea	3	14	76
Mollusca	Bivalvia	2	10	86
Crustacea	Cumacea	1	5	90
Mollusca	Tellinidae	1	5	95
Nemertea	Gastropoda	1	5	100
	total	21	17	
	species	6	5	

G3/5				
Class	family /species	N	%	% acc.
Crustacea	Cirripedia	7	30	30
Crustacea	Phoxocephalidae	4	17	48
Crustacea	Mysida	3	13	61
Annelida	Glyceridae	3	13	74
Vermes	Nemertea	1	4	78
Crustacea	Dogielinotidae	1	4	83
Crustacea	Brachyura	1	4	87
Crustacea	Matutidae	1	4	91
Crustacea	Isopoda	1	4	96
Mollusca	Hydrozoa	1	4	100
	total	23		
	species	10		

G4/5				
Class	family /species	N	%	% acc.
Annelida	Oweniidae	950	53	53
Annelida	Ampharetidae	181	119	172
Crustacea	Ampeliscidae	100	66	238
Mollusca	Cardiidae	75	49	287
Mollusca	Pharidae	63	41	329
Annelida	Onuphidae	58	38	367
Crustacea	Dogielinotidae	34	22	389
Annelida	Paraonidae	33	22	411
Mollusca	Donacidae	30	20	431
Annelida	Lumbrineridae	27	18	449
	total	1785		
	species	46		

G5/5				
Class	family /species	N	%	% acc.
Annelida	Cossuridae	4	20	20
Annelida	Paraonidae	2	1	21
Annelida	Lumbrineridae	2	1	21
Crustacea	Urothoidae	2	1	22
Mollusca	Donacidae	1	0	22
Annelida	Cirratulidae	1	0	23
Mollusca	Veneridae	1	0	23
Mollusca	Mactridae	1	0	23
Annelida	Orbiniidae	1	0	23
Annelida	Polynoidae	1	0	24
Annelida	Magelonidae	1	0	24
Crustacea	Anomura	1	0	24
Crustacea	Cirolanidae	1	0	25
Echinodermata	Rotulidae	1	0	25
	total	20		
	species	14		

G6/5				
Class	family /species	N	%	% acc.
Annelida	Orbiniidae	13	17	17
Annelida	Ampharetidae	13	8	24
Annelida	Lumbrineridae	9	5	30
Annelida	Cirratulidae	9	5	35
Vermes	Nemertea	7	4	39
Crustacea	Cirolanidae	5	3	42
Echinodermata	*Ophiophragmus sp.1*	4	2	44
Annelida	Polynoidae	3	2	46
Echinodermata	*Amphiura incana*	3	2	48
Annelida	Paraonidae	2	1	49
Echinodermata	Rotulidae	2	1	50
Annelida	Onuphidae	2	1	51
	total	78		
	species	18		

G7/5				
Class	family /species	N	%	% acc.
Crustacea	Harpacticoida	27	47	47
Crustacea	Oedicerotidae	6	6	52
Crustacea	Anthuridae	6	6	58
Vermes	Nemertea	3	3	60
Annelida	Lumbrineridae	2	2	62
Annelida	Onuphidae	2	2	64
Crustacea	Ampeliscidae	2	2	66
Crustacea	Cumacea gen. sp. 42	2	2	68
Echinodermata	*Amphiura incana*	1	1	69
Annelida	Magelonidae	1	1	69
Annelida	Oweniidae	1	1	70
Annelida	Spionidae	1	1	71
Annelida	Flabelligeridae	1	1	72
Arachnida	Pycnogonida	1	1	73
Crustacea	Liljeborgiidae	1	1	74
Crustacea	Arcturidae	1	1	75
	total	58		
	species	16		

G9/5				
Class	family /species	N	%	% acc.
Mollusca	Donacidae	2	25	25
Crustacea	Ampeliscidae	1	1	26
Echinodermata	Rotulidae	1	1	27
Crustacea	Anomura	1	1	28
Mollusca	Cardiidae	1	1	29
Crustacea	Phoxocephalidae	1	1	30
Crustacea	Lysianassidae	1	1	32
	total	8		
	species	7		

G1/25				
Class	family/species	N	%	% acc.
Bivalvia	Nuculanidae	27	7	7
Bivalvia	Veneridae	24	6	14
Polychaeta	Paraonidae	23	6	20
Caridea	Caridea	18	5	25
Decapoda	Caridea	16	4	29
Polychaeta	Spionidae	15	4	33
Amphipoda	Phoxocephalidae	15	4	37
Nemertea	Nemertea	15	4	41
Polychaeta	Cirratulidae	13	3	45
Calanoida	Calanoida	13	3	48
	Total	373	100	
	Taxon	70		

G2/25				
Class	family/species	N	%	% acc.
Bivalvia	Tellinidae	76	19	19
Amphipoda	Ampeliscidae	35	9	28
Polychaeta	Spionidae	34	8	36
Polychaeta	Paraonidae	27	7	43
Polychaeta	Lumbrineridae	21	5	48
Bivalvia	Veneridae	19	5	53
Amphipoda	Synopiidae	18	4	57
Polychaeta	Ampharetidae	15	4	61
Polychaeta	Cirratulidae	11	3	64
Calanoida	Calanoida	11	3	67
	Total	401	100	
	Taxon	56		

G3/25				
Class	family/species	N	%	% acc.
Bivalvia	Donacidae	208	34	34
Polychaeta	Paraonidae	95	15	49
Polychaeta	Orbiniidae	34	6	55
Polychaeta	Polynoidae	28	5	59
Sipuncula	Sipuncula	26	4	64
Nematoda	Nematoda	25	4	68
Polychaeta	Nereidae	18	3	71
Polychaeta	Cirratulidae	14	2	73
Polychaeta	Spionidae	13	2	75
Nemertea	Nemertea	11	2	77
Polychaeta	Glyceridae	11	2	79
	Total	615	100	
	Taxon	58		

G4/25				
Class	family/species	N	%	% acc.
Echiura	Echiura	33	12	12
Polychaeta	Orbiniidae	19	7	19
Polychaeta	Onuphidae	19	7	26
Bivalvia	Corbulidae	16	6	32
Polychaeta	Paraonidae	12	4	37
Polychaeta	Polychaeta	11	4	41
Bivalvia	Donacidae	10	4	44
Nematoda	Nematoda	10	4	48
Amphipoda	Corophioidea	10	4	52
Polychaeta	Polynoidae	9	3	55
	Total	271	100	
	Taxon	54		

G5/25				
Class	family/species	N	%	% acc.
Polychaeta	Paraonidae	55	14	14
Nematoda	Nematoda	40	10	23
Polychaeta	Spionidae	25	6	29
Polychaeta	Cirratulidae	19	5	34
Bivalvia	Veneridae	19	5	39
Polychaeta	Pilargidae	16	4	43
Polychaeta	Syllidae	14	3	46
Polychaeta	Glyceridae	13	3	49
Amphipoda	Melitidae	11	3	52
Caridea	Caridea	10	2	55
Polychaeta	Pisionidae	10	2	57
	Total	407	100	
	Taxon	64		

G6/25				
Class	family/species	N	%	% acc.
Polychaeta	Spionidae	183	16	16
Polychaeta	Maldanidae	95	8	24
Amphipoda	Ampeliscidae	79	7	31
Polychaeta	Paraonidae	65	6	37
Polychaeta	Lumbrineridae	47	4	41
Gastropoda	Gastropoda	38	3	44
Polychaeta	Syllidae	35	3	47
Polychaeta	Glyceridae	31	3	50
Amphipoda	Corophioidea	29	3	52
Polychaeta	Polychaeta	28	2	55
	Total	1150	100	
	Taxon	96		

G7/25				
Class	family/species	N	%	% acc.
Polychaeta	Syllidae	333	19	19
Polychaeta	Polynoidae	116	6	25
Polychaeta	Phyllodocidae	110	6	31
Polychaeta	Dorvilleidae	100	6	37
Amphipoda	Melitidae	83	5	41
Amphipoda	Corophioidea	66	4	45
Tanaidacea	Apseudidae	62	3	49
Polychaeta	Spionidae	56	3	52
Ophiuroidea	Ophiactis luetkeni	54	3	55
Polychaeta	Eunicidae	36	2	57
	Total	##	100	
	Taxon	116		

G8/25				
Class	family/species	N	%	% acc.
Polychaeta	Spionidae	100	15	15
Polychaeta	Lumbrineridae	51	8	23
Amphipoda	Corophioidea	42	6	29
Amphipoda	Synopiidae	37	6	35
Polychaeta	Ampharetidae	31	5	39
Polychaeta	Paraonidae	27	4	44
Polychaeta	Eunicidae	26	4	48
Amphipoda	Ampeliscidae	25	4	51
Polychaeta	Cirratulidae	25	4	55
Polychaeta	Glyceridae	21	3	58
	Total	661	100	
	Taxon	74		

G9/25				
Class	family/species	N	%	% acc.
Polychaeta	Eunicidae	173	26	26
Nematoda	Nematoda	78	12	38
Polychaeta	Cirratulidae	63	9	47
Polychaeta	Paraonidae	57	9	56
Bivalvia	Veneridae	41	6	62
Polychaeta	Spionidae	37	6	67
Polychaeta	Lumbrineridae	17	3	70
Polychaeta	Polychaeta	17	3	72
Polychaeta	Glyceridae	15	2	75
Polychaeta	Syllidae	15	2	77
	Total	667	100	
	Taxon	71		

G1/50				
Class	family/species	N	%	% acc.
Amphipoda	Ampeliscidae	62	11	11
Polychaeta	Spionidae	34	6	17
Polychaeta	Paraonidae	28	5	22
Caridea	Caridea	23	4	26
Nematoda	Nematoda	21	4	30
Sipuncula	Sipuncula	21	4	34
Polychaeta	Cirratulidae	18	3	37
Polychaeta	Nephtyidae	17	3	40
Ostracoda	Ostracoda	15	3	42
Amphipoda	Phoxocephalidae	14	2	45
	Total	563	100	
	Taxon	96		

G2/50				
Class	family/species	N	%	% acc.
Amphipoda	Ampeliscidae	154	25	25
Amphipoda	Corophioidea	30	5	30
Polychaeta	Nephtyidae	24	4	34
Polychaeta	Paraonidae	18	3	37
Nematoda	Nematoda	18	3	40
Ophiuroidea	Amphioplus aurensis	18	3	42
Amphipoda	Phoxocephalidae	17	3	45
Polychaeta	Spionidae	15	2	48
Caridea	Caridea	15	2	50
Calanoida	Calanoida	15	2	53
Polychaeta	Ampharetidae	15	2	55
	Total	617	100	
	Taxon	97		

G3/50				
Class	family/species	N	%	% acc.
Polychaeta	Pilargidae	37	14	14
Polychaeta	Nephtyidae	34	13	27
Polychaeta	Lumbrineridae	19	7	34
Polychaeta	Cirratulidae	19	7	41
Nematoda	Nematoda	16	6	47
Polychaeta	Ampharetidae	10	4	51
Amphipoda	Ampeliscidae	9	3	55
Polychaeta	Paraonidae	9	3	58
Polychaeta	Spionidae	9	3	61
Polychaeta	Sternaspidae	8	3	64
Polychaeta	Maldanidae	8	3	67
Tanaidacea	Apseudidae	8	3	70
	Total	264	100	
	Taxon	49		

G4/50				
Class	family/species	N	%	% acc.
Amphipoda	Ampeliscidae	60	13	13
Tanaidacea	Apseudidae	27	6	19
Polychaeta	Amphinomidae	27	6	25
Nematoda	Nematoda	25	5	30
Polychaeta	Sternaspidae	25	5	36
Polychaeta	Nereidae	22	5	41
Sipuncula	Sipuncula	15	3	44
Calanoida	Calanoida	15	3	47
Polychaeta	Pilargidae	14	3	50
Amphipoda	Corophioidea	13	3	53
Tanaidacea	Kalliapseudidae	13	3	56
	Total	457	100	
	Taxon	85		

G5/50				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	44	7	7
Polychaeta	Eunicidae	40	6	13
Polychaeta	Spionidae	28	4	17
Polychaeta	Cirratulidae	27	4	21
Polychaeta	Nephtyidae	26	4	25
Polychaeta	Maldanidae	26	4	29
Amphipoda	Ampeliscidae	24	4	32
Amphipoda	Corophioidea	24	4	36
Polychaeta	Phyllodocidae	24	4	40
Polychaeta	Paraonidae	23	3	43
	Total	663	100	
	Taxon	89		

G6/50				
Class	family/species	N	%	% acc.
Polychaeta	Syllidae	107	11	11
Nematoda	Nematoda	77	8	18
Polychaeta	Nephtyidae	56	6	24
Amphipoda	Ampeliscidae	53	5	29
Polychaeta	Eunicidae	50	5	34
Polychaeta	Phyllodocidae	37	4	38
Amphipoda	Urothoidae	34	3	41
Polychaeta	Lumbrineridae	32	3	45
Polychaeta	Spionidae	31	3	48
Polychaeta	Ampharetidae	27	3	51
	Total	998	100	
	Taxon	98		

G7/50				
Class	family/species	N	%	% acc.
Amphipoda	Ampeliscidae	12	7	7
Polychaeta	Onuphidae	12	7	13
Polychaeta	Maldanidae	11	6	19
Polychaeta	Nephtyidae	9	5	24
Bivalvia	Veneridae	7	4	28
Polychaeta	Spionidae	6	3	32
Caridea	Caridea	6	3	35
Polychaeta	Cirratulidae	5	3	38
Amphipoda	Corophioidea	5	3	41
Holothuroidea	Synaptidae	5	3	43
	Total	180	100	
	Taxon	65		

G8/50				
Class	family/species	N	%	% acc.
Polychaeta	Eunicidae	28	8	8
Bivalvia	Veneridae	27	8	16
Polychaeta	Onuphidae	22	7	23
Amphipoda	Ampeliscidae	19	6	28
Polychaeta	Lumbrineridae	19	6	34
Polychaeta	Terebellidae	15	4	38
Nematoda	Nematoda	13	4	42
Polychaeta	Spionidae	11	3	46
Caridea	Caridea	11	3	49
Nemertea	Nemertea	11	3	52
	Total	338	100	
	Taxon	66		

G9/50				
Class	family/species	N	%	% acc.
Polychaeta	Eunicidae	18	21	21
Nemertea	Nemertea	7	8	29
Polychaeta	Opheliidae	5	6	34
Decapoda	Alpheidae	4	5	39
Amphipoda	Ampeliscidae	3	3	43
Polychaeta	Lumbrineridae	3	3	46
Polychaeta	Spionidae	3	3	49
Caridea	Caridea	3	3	53
Polychaeta	Cirratulidae	3	3	56
Polychaeta	Nephtyidae	3	3	60
Polychaeta	Flabelligeridae	3	3	63
	Total	87	100	
	Taxon	34		

G1/100				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	34	16	16
Sipuncula	Sipuncula	19	9	25
Polychaeta	Spionidae	12	6	31
Polychaeta	Eunicidae	10	5	36
Amphipoda	Ampeliscidae	9	4	40
Polychaeta	Phyllodocidae	9	4	45
Polychaeta	Glyceridae	8	4	49
Amphipoda	Corophioidea	8	4	52
Polychaeta	Lumbrineridae	7	3	56
Polychaeta	Ampharetidae	7	3	59
Polychaeta	Paraonidae	7	3	63
	Total	##		
	Taxon	50		

G2/100				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	42	10	10
Sipuncula	Sipuncula	29	7	17
Polychaeta	Lumbrineridae	27	7	24
Amphipoda	Ampeliscidae	25	6	30
Polychaeta	Spionidae	22	5	35
Calanoida	Calanoida	17	4	40
Polychaeta	Ampharetidae	14	3	43
Polychaeta	Paraonidae	14	3	46
Bivalvia	Veneridae	13	3	50
Polychaeta	Polychaeta	12	3	52
	Total	410		
	Taxon	69		

G3/100				
Class	family/species	N	%	% acc.
Polychaeta	Spionidae	23	8	8
Polychaeta	Phyllodocidae	23	8	16
Amphipoda	Ampeliscidae	16	5	21
Polychaeta	Cirratulidae	14	5	26
Polychaeta	Ampharetidae	13	4	31
Nematoda	Nematoda	12	4	35
Polychaeta	Paraonidae	12	4	39
Polychaeta	Lumbrineridae	10	3	42
Polychaeta	Glyceridae	10	3	46
Polychaeta	Eunicidae	10	3	49
	Total	291		
	Taxon	62		

G4/100				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	60	18	18
Polychaeta	Paraonidae	27	8	26
Amphipoda	Ampeliscidae	23	7	32
Sipuncula	Sipuncula	20	6	38
Polychaeta	Eunicidae	18	5	44
Polychaeta	Cirratulidae	15	4	48
Polychaeta	Phyllodocidae	14	4	52
Calanoida	Calanoida	13	4	56
Polychaeta	Syllidae	13	4	60
Polychaeta	Spionidae	11	3	63
	Total	339		
	Taxon	50		

G5/100				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	46	12	12
Polychaeta	Spionidae	45	12	24
Sipuncula	Sipuncula	20	5	29
Polychaeta	Phyllodocidae	18	5	33
Polychaeta	Nephtyidae	16	4	37
Polychaeta	Paraonidae	15	4	41
Amphipoda	Ampeliscidae	15	4	45
Polychaeta	Capitellidae	15	4	49
Polychaeta	Onuphidae	15	4	53
Polychaeta	Ampharetidae	13	3	56
	Total	387		
	Taxon	66		

G6/100				
Class	family/species	N	%	% acc.
Polychaeta	Spionidae	34	11	11
Polychaeta	Onuphidae	31	10	21
Polychaeta	Paraonidae	26	8	29
Polychaeta	Eunicidae	26	8	37
Nematoda	Nematoda	19	6	43
Polychaeta	Ampharetidae	18	6	49
Sipuncula	Sipuncula	17	5	55
Polychaeta	Cirratulidae	16	5	60
Polychaeta	Phyllodocidae	15	5	65
Polychaeta	Lumbrineridae	10	3	68
	Total	313		
	Taxon	52		

G7/100				
Class	family/species	N	%	% acc.
Bivalvia	Nuculanidae	80	23	23
Polychaeta	Onuphidae	35	10	33
Polychaeta	Spionidae	23	7	40
Polychaeta	Eunicidae	17	5	45
Sipuncula	Sipuncula	16	5	50
Polychaeta	Cirratulidae	14	4	54
Brachyura	Brachyura	12	3	57
Polychaeta	Paraonidae	8	2	59
Polychaeta	Nephtyidae	8	2	62
Decapoda	Pilumnidae	8	2	64
	Total	345		
	Taxon	61		

G8/100				
Class	family/species	N	%	% acc.
Polychaeta	Cirratulidae	32	21	21
Polychaeta	Polynoidae	18	12	34
Polychaeta	Paraonidae	12	8	42
Polychaeta	Polychaeta	11	7	49
Polychaeta	Spionidae	10	7	56
Nemertea	Nemertea	10	7	62
Scaphopoda	Scaphopoda	9	6	68
Polychaeta	Nephtyidae	7	5	73
Polychaeta	Lumbrineridae	4	3	76
Polychaeta	Syllidae	4	3	79
Nematoda	Nematoda	4	3	81
Polychaeta	Cossuridae	4	3	84
	Total	149		
	Taxon	33		

G9/100				
Class	family/species	N	%	% acc.
Bivalvia	Nuculanidae	95	22	22
Polychaeta	Onuphidae	69	16	37
Polychaeta	Spionidae	18	4	41
Polychaeta	Nephtyidae	18	4	45
Amphipoda	Ampeliscidae	17	4	49
Polychaeta	Lumbrineridae	16	4	53
Sipuncula	Sipuncula	15	3	56
Nematoda	Nematoda	14	3	60
Bivalvia	Veneridae	12	3	62
Polychaeta	Paraonidae	11	3	65
Polychaeta	Ampharetidae	11	3	67
	Total	440		
	Taxon	65		

G1/250				
Class	family/species	N	%	% acc.
Bivalvia	Nuculanidae	75	22	22
Sipuncula	Sipuncula	39	11	33
Bivalvia	Veneridae	31	9	42
Polychaeta	Spionidae	27	8	50
Polychaeta	Paraonidae	25	7	57
Amphipoda	Ampeliscidae	13	4	61
Polychaeta	Ampharetidae	13	4	64
Polychaeta	Cirratulidae	11	3	68
Bivalvia	Cardiidae	9	3	70
Polychaeta	Capitellidae	8	2	73
Brachyura	Brachyura	8	2	75
Decapoda	Leucosiidae	8	2	77
	Total	346		
	Taxon	43		

G2/250				
Class	family/species	N	%	% acc.
Sipuncula	Sipuncula	52	16	16
Polychaeta	Spionidae	19	6	22
Polychaeta	Capitellidae	18	5	27
Polychaeta	Ampharetidae	16	5	32
Bivalvia	Nuculanidae	14	4	36
Polychaeta	Paraonidae	14	4	40
Polychaeta	Onuphidae	14	4	45
Nematoda	Nematoda	14	4	49
Bivalvia	Veneridae	12	4	53
Amphipoda	Caprellidae	12	4	56
	Total	329		
	Taxon	61		

G3/250				
Class	family/species	N	%	% acc.
Polychaeta	Paraonidae	27	12	12
Polychaeta	Ampharetidae	16	7	19
Polychaeta	Capitellidae	15	7	26
Polychaeta	Phyllodocidae	15	7	33
Polychaeta	Onuphidae	14	6	39
Nematoda	Nematoda	12	5	44
Polychaeta	Cirratulidae	12	5	50
Sipuncula	Sipuncula	10	4	54
Polychaeta	Spionidae	8	4	58
Amphipoda	Melitidae	8	4	61
	Total	224		
	Taxon	48		

G4/250				
Class	family/species	N	%	% acc.
Polychaeta	Paraonidae	16	8	8
Polychaeta	Spionidae	16	8	16
Nematoda	Nematoda	13	6	22
Polychaeta	Magelonidae	12	6	28
Sipuncula	Sipuncula	11	5	33
Polychaeta	Phyllodocidae	10	5	38
Amphipoda	Ampeliscidae	9	4	42
Calanoida	Calanoida	9	4	47
Polychaeta	Polychaeta	8	4	50
Polychaeta	Ampharetidae	6	3	53
Polychaeta	Cossuridae	6	3	56
	Total	206		
	Taxon	55		

G5/250				
Class	family/species	N	%	% acc.
Sipuncula	Sipuncula	99	35	35
Polychaeta	Cirratulidae	26	9	44
Polychaeta	Paraonidae	23	8	52
Polychaeta	Spionidae	19	7	59
Polychaeta	Glyceridae	17	6	65
Polychaeta	Ampharetidae	11	4	69
Polychaeta	Capitellidae	10	4	73
Polychaeta	Polychaeta	9	3	76
Polychaeta	Magelonidae	8	3	79
Polychaeta	Cossuridae	6	2	81
	Total	282		
	Taxon	37		

G6/250				
Class	family/species	N	%	% acc.
Polychaeta	Spionidae	31	13	13
Amphipoda	Ampeliscidae	28	12	25
Sipuncula	Sipuncula	23	10	35
Polychaeta	Capitellidae	14	6	41
Polychaeta	Paraonidae	12	5	46
Polychaeta	Ampharetidae	11	5	51
Cumacea	Cumacea	9	4	54
Polychaeta	Cirratulidae	7	3	57
Polychaeta	Polychaeta	5	2	60
Calanoida	Calanoida	5	2	62
Polychaeta	Lumbrineridae	5	2	64
Amphipoda	Oedicerotidae	5	2	66
Bivalvia	Nuculanidae	5	2	68
Polychaeta	Polynoidae	5	2	70
	Total	235		
	Taxon	51		

G7/250				
Class	family/species	N	%	% acc.
Polychaeta	Paraonidae	100	20	20
Nematoda	Nematoda	83	17	38
Polychaeta	Spionidae	51	10	48
Polychaeta	Ampharetidae	36	7	55
Sipuncula	Sipuncula	23	5	60
Polychaeta	Nereidae	18	4	64
Polychaeta	Onuphidae	17	3	67
Polychaeta	Polychaeta	12	2	70
Polychaeta	Lumbrineridae	12	2	72
Polychaeta	Pilargidae	12	2	75
	Total	488		
	Taxon	55		

G8/250				
Class	family/species	N	%	% acc.
Polychaeta	Spionidae	73	22	22
Polychaeta	Cirratulidae	45	13	35
Polychaeta	Paraonidae	38	11	46
Polychaeta	Pilargidae	19	6	52
Polychaeta	Nereidae	17	5	57
Polychaeta	Ampharetidae	12	4	61
Polychaeta	Maldanidae	12	4	64
Polychaeta	Onuphidae	10	3	67
Polychaeta	Polychaeta	10	3	70
Polychaeta	Polynoidae	8	2	73
	Total	336		
	Taxon	49		

G9/250				
Class	family/species	N	%	% acc.
Bivalvia	Nuculanidae	24	22	22
Polychaeta	Ampharetidae	11	10	32
Sipuncula	Sipuncula	11	10	43
Polychaeta	Paraonidae	6	6	48
Polychaeta	Nereidae	6	6	54
Bivalvia	Semelidae	6	6	59
Polychaeta	Magelonidae	5	5	64
Polychaeta	Maldanidae	4	4	68
Ophiuroidea	Ophiophragmus acutispina	4	4	71
Polychaeta	Cirratulidae	2	2	73
Polychaeta	Pilargidae	2	2	75
Polychaeta	Oweniidae	2	2	77
Polychaeta	Glyceridae	2	2	79
Bivalvia	Veneridae	2	2	81
Polychaeta	Nephtyidae	2	2	82
Polychaeta	Eunicidae	2	2	84
Bivalvia	Donacidae	2	2	86
Gastropoda	Eulimidae	2	2	88
	Total	108		
	Taxon	31		

G1/500				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	76	18	18
Polychaeta	Pilargidae	49	12	29
Polychaeta	Paraonidae	29	7	36
Bivalvia	Nuculanidae	27	6	43
Polychaeta	Spionidae	27	6	49
Sipuncula	Sipuncula	23	5	54
Calanoida	Calanoida	23	5	60
Polychaeta	Maldanidae	17	4	64
Polychaeta	Opheliidae	15	4	67
Polychaeta	Cirratulidae	14	3	71
	Total	425		
	Taxon	54		

G2/500				
Class	family/species	N	%	% acc.
Sipuncula	Sipuncula	31	11	11
Harpacticoida	Harpacticoida	25	9	20
Nematoda	Nematoda	19	7	27
Polychaeta	Spionidae	14	5	31
Polychaeta	Maldanidae	14	5	36
Polychaeta	Paraonidae	12	4	41
Bivalvia	Nuculanidae	12	4	45
Bivalvia	Kelliellidae	12	4	49
Tanaidacea	Typhlotanaidae	11	4	53
Isopoda	Desmosomatidae	11	4	57
Tanaidacea	Pseudotanaidae	11	4	61
	Total	283		
	Taxon	46		

G3/500				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	78	29	29
Sipuncula	Sipuncula	45	17	45
Polychaeta	Spionidae	27	10	55
Polychaeta	Paraonidae	15	6	61
Polychaeta	Maldanidae	14	5	66
Polychaeta	Pilargidae	14	5	71
Isopoda	Desmosomatidae	8	3	74
Polychaeta	Magelonidae	6	2	76
Polychaeta	Syllidae	5	2	78
Aplacophora	Aplacophora	4	1	79
Bivalvia	Semelidae	4	1	81
	Total	272		
	Taxon	41		

G4/500				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	181	36	36
Polychaeta	Spionidae	126	25	60
Actiniaria	Actiniaria	91	18	78
Polychaeta	Maldanidae	12	2	81
Polychaeta	Paraonidae	9	2	82
Decapoda	Sergestidae	8	2	84
Polychaeta	Magelonidae	7	1	85
Polychaeta	Glyceridae	7	1	87
Polychaeta	Onuphidae	6	1	88
Polychaeta	Polychaeta	6	1	89
Bivalvia	Kelliellidae	6	1	90
	Total	509		
	Taxon	36		

G5/500				
Class	family/species	N	%	% acc.
Sipuncula	Sipuncula	73	22	22
Calanoida	Calanoida	27	8	30
Polychaeta	Paraonidae	26	8	38
Nematoda	Nematoda	21	6	45
Polychaeta	Magelonidae	19	6	50
Polychaeta	Pilargidae	12	4	54
Polychaeta	Polynoidae	12	4	58
Polychaeta	Spionidae	9	3	60
Polychaeta	Polychaeta	9	3	63
Polychaeta	Cirratulidae	9	3	66
	Total	329		
	Taxon	53		

G6/500				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	33	15	15
Sipuncula	Sipuncula	23	11	26
Polychaeta	Paraonidae	18	8	34
Polychaeta	Magelonidae	14	7	41
Polychaeta	Polychaeta	12	6	47
Polychaeta	Pilargidae	11	5	52
Polychaeta	Spionidae	8	4	55
Calanoida	Calanoida	5	2	58
Polychaeta	Cirratulidae	5	2	60
Polychaeta	Maldanidae	5	2	62
Isopoda	Desmosomatidae	5	2	65
Tanaidacea	Agathotanaidae	5	2	67
Bivalvia	Nuculanidae	5	2	69
	Total	215		
	Taxon	56		

G7/500				
Class	family/species	N	%	% acc.
Polychaeta	Maldanidae	23	30	30
Bivalvia	Nuculanidae	7	9	39
Sipuncula	Sipuncula	4	5	44
Polychaeta	Polychaeta	4	5	49
Bivalvia	Nuculidae	3	4	53
Isopoda	Gnathidae	3	4	57
Isopoda	Desmosomatidae	2	3	60
Polychaeta	Lumbrineridae	2	3	62
Isopoda	Cirolanidae	2	3	65
Ophiuroidea	Amphiura chiajei	2	3	68
	Total	77		
	Taxon	35		

G8/500				
Class	family/species	N	%	% acc.
Bivalvia	Nuculanidae	98	29	29
Polychaeta	Maldanidae	19	6	35
Bivalvia	Kelliellidae	17	5	40
Polychaeta	Cirratulidae	15	5	45
Polychaeta	Paraonidae	14	4	49
Amphipoda	Phoxocephalidae	13	4	53
Polychaeta	Spionidae	11	3	56
Bivalvia	Veneridae	11	3	59
Calanoida	Calanoida	10	3	62
Cumacea	Cumacea gen. sp. 61	8	2	65
	Total	333		
	Taxon	60		

G9/500				
Class	family/species	N	%	% acc.
Polychaeta	Pilargidae	7	13	13
Polychaeta	Maldanidae	6	12	25
Polychaeta	Lumbrineridae	4	8	33
Vermes	Vermes	4	8	40
Polychaeta	Cirratulidae	3	6	46
Polychaeta	Nephtyidae	3	6	52
Polychaeta	Magelonidae	3	6	58
Polychaeta	Paraonidae	2	4	62
Amphipoda	Amphipoda indet.	2	4	65
Ophiuroidea	Amphiura chiajei Forbes, 1843	2	4	69
	Total	52		
	Taxon	26		

G1/1200				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	37	12	12
Isopoda	Desmosomatidae	30	9	21
Polychaeta	Paraonidae	25	8	29
Amphipoda	Phoxocephalidae	20	6	35
Calanoida	Calanoida	19	6	41
Polychaeta	Opheliidae	16	5	46
Harpacticoida	Harpacticoida	15	5	51
Polychaeta	Cirratulidae	13	4	55
Polychaeta	Nephtyidae	13	4	59
Bivalvia	Kelliellidae	12	4	63
Aplacophora	Aplacophora	12	4	66
	Total	319		
	Taxon	54		

MA 2-1				
Class	family/species	N	%	% acc.
Polychaeta	Paraonidae	8	10	10
Polychaeta	Nephtyidae	7	8	18
Bivalvia	Nuculanidae	6	7	25
Polychaeta	Polychaeta	6	7	32
Nemertea	Nemertea	6	7	39
Polychaeta	Cirratulidae	5	6	45
Polychaeta	Pilargidae	5	6	51
Sipuncula	Sipuncula	5	6	57
Amphipoda	Phoxocephalidae	4	5	62
Polychaeta	Opheliidae	3	4	65
Polychaeta	Fauveliopsidae	3	4	69
Polychaeta	Flabelligeridae	3	4	73
	Total	84		
	Taxon	30		

MA 2-2				
Class	family/species	N	%	% acc.
Polychaeta	Paraonidae	3	16	16
Bivalvia	Nuculidae	3	16	32
Polychaeta	Polychaeta	2	11	42
Aplacophora	Aplacophora	2	11	53
Bivalvia	Bivalvia	2	11	63
Polychaeta	Nephtyidae	1	5	68
Amphipoda	Phoxocephalidae	1	5	74
Nematoda	Nematoda	1	5	79
Calanoida	Calanoida	1	5	84
Amphipoda	Amphipoda indet.	1	5	89
Isopoda	Expanthuridae	1	5	95
Echinoidea	Echinoidea	1	5	100
	Total	19		
	Taxon	12		

MA 2-3				
Class	family/species	N	%	% acc.
Polychaeta	Paraonidae	15	5	5
Polychaeta	Cirratulidae	15	5	11
Polychaeta	Polychaeta	14	5	16
Nematoda	Nematoda	14	5	21
Calanoida	Calanoida	12	4	25
Sipuncula	Sipuncula	12	4	29
Isopoda	Desmosomatidae	12	4	34
Harpacticoida	Harpacticoida	12	4	38
Polychaeta	Fauveliopsidae	9	3	41
Polychaeta	Polynoidae	9	3	44
	Total	280		
	Taxon	65		

MA 2-4				
Class	family/species	N	%	% acc.
Polychaeta	Paraonidae	3	43	43
Sipuncula	Sipuncula	2	29	71
Calanoida	Calanoida	1	14	86
Cumacea	Cumacea	1	14	100
	Total	7		
	Taxon	4		

MA 2-5				
Class	family/species	N	%	% acc.
Polychaeta	Cirratulidae	85	27	27
Calanoida	Calanoida	25	8	34
Cyclopoida	Cyclopoida	22	7	41
Harpacticoida	Harpacticoida	21	7	48
Polychaeta	Polynoidae	16	5	53
Nematoda	Nematoda	14	4	57
Ostracoda	Ostracoda	14	4	62
Aplacophora	Aplacophora	13	4	66
Polychaeta	Pilargidae	13	4	70
Polychaeta	Paraonidae	10	3	73
	Total	319		
	Taxon	41		

G3/1200				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	42	17	17
Calanoida	Calanoida	25	10	27
Polychaeta	Fauveliopsidae	23	9	36
Polychaeta	Paraonidae	20	8	44
Isopoda	Desmosomatidae	15	6	50
Polychaeta	Opheliidae	11	4	54
Sipuncula	Sipuncula	11	4	59
Polychaeta	Spionidae	8	3	62
Ostracoda	Ostracoda	6	2	64
Amphipoda	Phoxocephalidae	6	2	67
Isopoda	Macrostylidae	6	2	69
	Total	250		
	Taxon	50		

G4/1000				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	22	12	12
Calanoida	Calanoida	14	7	19
Tanaidacea	Apseudidae	12	6	26
Polychaeta	Spionidae	11	6	31
Polychaeta	Paraonidae	10	5	37
Amphipoda	Phoxocephalidae	9	5	41
Tanaidacea	Typhlotanaidae	9	5	46
Tanaidacea	Akanthophoreidae	8	4	51
Tanaidacea	Agathotanaidae	7	4	54
Isopoda	Desmosomatidae	6	3	57
Polychaeta	Maldanidae	6	3	61
	Total	188		
	Taxon	48		

G5/1000				
Class	family/species	N	%	% acc.
Polychaeta	Paraonidae	17	17	17
Polychaeta	Cirratulidae	17	17	33
Polychaeta	Polychaeta	6	6	39
Polychaeta	Capitellidae	5	5	44
Nematoda	Nematoda	4	4	48
Polychaeta	Spionidae	3	3	50
Isopoda	Desmosomatidae	3	3	53
Polychaeta	Fauveliopsidae	3	3	56
Polychaeta	Pilargidae	3	3	59
Isopoda	Gnathidae	3	3	62
	Total	103		
	Taxon	39		

G6/1000				
Class	family/species	N	%	% acc.
Nematoda	Nematoda	72	19	19
Polychaeta	Cirratulidae	54	15	34
Polychaeta	Paraonidae	42	11	45
Polychaeta	Maldanidae	22	6	51
Polychaeta	Spionidae	21	6	57
Polychaeta	Polychaeta	18	5	62
Isopoda	Desmosomatidae	18	5	66
Calanoida	Calanoida	16	4	71
Harpacticoida	Harpacticoida	12	3	74
Amphipoda	Phoxocephalidae	9	2	76
			0	76
	Total	372		
	Taxon	54		

G7/1000				
Class	family/species	N	%	% acc.
Polychaeta	Cirratulidae	10	13	13
Polychaeta	Spionidae	8	10	23
Polychaeta	Pilargidae	7	9	32
Polychaeta	Opheliidae	6	8	40
Polychaeta	Maldanidae	5	6	46
Tanaidacea	Typhlotanaidae	4	5	51
Polychaeta	Paraonidae	3	4	55
Isopoda	Desmosomatidae	3	4	59
Tanaidacea	Anarthruridae	3	4	63
Amphipoda	Phoxocephalidae	2	3	65
Nemertea	Nemertea	2	3	68
Polychaeta	Syllidae	2	3	71
Cumacea	Cumacea gen. sp. 71	2	3	73
	Total	78		
	Taxon	34		

G8/1000				
Class	family/species	N	%	% acc.
Polychaeta	Spionidae	25	12	12
Polychaeta	Cirratulidae	23	11	23
Nematoda	Nematoda	21	10	34
Aplacophora	Aplacophora	15	7	41
Polychaeta	Paraonidae	13	6	47
Polychaeta	Polychaeta	10	5	52
Tanaidacea	Agathotanaidae	9	4	57
Polychaeta	Pilargidae	7	3	60
Polychaeta	Maldanidae	7	3	63
Tanaidacea	Colletteidae	7	3	67
			0	67
	Total	205		
	Taxon	42		

G9/1000				
Class	family/species	N	%	% acc.
Polychaeta	Capitellidae	2	12	12
Polychaeta	Lumbrineridae	2	12	24
Cumacea	Cumacea gen. sp. 71	2	12	35
Polychaeta	Spionidae	1	6	41
Polychaeta	Paraonidae	1	6	47
Polychaeta	Polychaeta	1	6	53
Polychaeta	Opheliidae	1	6	59
Amphipoda	Corophioidea	1	6	65
Polychaeta	Onuphidae	1	6	71
Tanaidacea	Tanaellidae	1	6	76
Astacidea	Astacidea	1	6	82
Decapoda	Galatheidae	1	6	88
Echinoidea	Schizasteridae	1	6	94
	Amphiura senegalensis	1	6	100
	Total	17		
	Taxon	14		

Species list benthos 0m and 5m depth

		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
Annelida	Annelida																
Hirudinea	Hirudinea																
Polychaeta	Acoetidae																
Polychaeta	Acrocirridae																
Polychaeta	Ampharetidae												181		13		
Polychaeta	Amphinomidae																
Polychaeta	Aphroditidae																
Polychaeta	Arenicolidae																
Polychaeta	Capitellidae												17		1		
Polychaeta	Chrysopetalidae																
Polychaeta	Cirratulidae			6		8							20	1	9		
Polychaeta	Cossuridae												3	4			
Polychaeta	Dorvilleidae																
Polychaeta	Drilomorpha																
Polychaeta	Eunicidae																
Polychaeta	Euphrosinidae																
Polychaeta	Fauveliopsidae																
Polychaeta	Flabelligeridae			1	1				1				4			1	
Polychaeta	Glyceridae											3	3				
Polychaeta	Goniadidae																
Polychaeta	Hesionidae																
Polychaeta	Lacydonidae																
Polychaeta	Lumbrineridae												27	2	9	2	
Polychaeta	Magelonidae	1											1	1	1	1	
Polychaeta	Maldanidae				1								18				
Polychaeta	Nephtyidae												2				
Polychaeta	Nereidae																
Polychaeta	Oenonidae												5				
Polychaeta	Onuphidae												58		2	2	
Polychaeta	Opheliidae	1															
Polychaeta	Orbiniidae	3											8	1	13		
Polychaeta	Oweniidae												950			1	
Polychaeta	Paralacydonidae																
Polychaeta	Paraonidae												33	2	2		
Polychaeta	Pectinaridae				1												
Polychaeta	Pholoidae																
Polychaeta	Phyllodocidae								1								
Polychaeta	Pilargidae																
Polychaeta	Poecilochaetidae																
Polychaeta	Polynoidae	1											2	1	3		
Polychaeta	Sabellidae				1								5				
Polychaeta	Sabellaridae																
Polychaeta	Scalibregmatidae																
Polychaeta	Serpulidae																
Polychaeta	Sphaerodoridae																
Polychaeta	Spionidae			12									8			1	
Polychaeta	Sternaspidae																

		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
Polychaeta	Syllidae												2				
Polychaeta	Terebellidae																
Polychaeta	Terebellomorpha																
Polychaeta	Trichobranchidae																
Polychaeta	Trochochetidae																
Polychaeta	Polychaeta gen. sp. 1																
Polychaeta	Polychaeta gen. sp. 2																
Polychaeta	Polychaeta gen. sp. 3																
Polychaeta	Polychaeta gen. sp. 4																
Polychaeta	Polychaeta gen. sp. 5																
Polychaeta	Polychaeta gen. sp. 6																
Polychaeta	Polychaeta gen. sp. 7																
Polychaeta	Polychaeta gen. sp. 8																
Polychaeta	Polychaeta					3							4		1		
Pycnogonida	Arhropoda																
	Pycnogonida												1			1	
Acari	Acari																
Amphipoda	Ampeliscidae	2											100			2	1
Amphipoda	Amphilochidae																
Amphipoda	Atylidae																
Amphipoda	Caprellidae												4				
Amphipoda	Cyproideidae																
Amphipoda	Dexaminidae																
Amphipoda	Dogielinotidae				294							1	34				
Amphipoda	Epimeriidae																
Amphipoda	Eusiridae																
Amphipoda	Iphimediidae																
Amphipoda	Leucothoidae																
Amphipoda	Liljeborgiidae												1			1	
Amphipoda	Lysianassidae																1
Amphipoda	Melitidae																
Amphipoda	Melphidippidae																
Amphipoda	Oedicerotidae	1											1		1	6	
Amphipoda	Stenothoidae																
Amphipoda	Synopiidae																
Amphipoda	Phoxocephalidae				1							4					1
Amphipoda	Urothoidae	15												2	1		
Amphipoda	Corophioidea	2											2				
Amphipoda	Hyperiidea																
Amphipoda	Amphipoda			1													
Anomura	Anomura												1	1			1
Astacidea	Astacidea																
Brachyura	Brachyura				1							1	3				
Calanoida	Calanoida																
Caridea	Caridea																
Cirripedia	Cirripedia			42								7					
Copepoda	Copepoda																
Cumacea	Cumacea gen. sp. 1																

		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
Cumacea	Cumacea gen. sp. 2																
Cumacea	Cumacea gen. sp. 3																
Cumacea	Cumacea gen. sp. 4																
Cumacea	Cumacea gen. sp. 5																
Cumacea	Cumacea gen. sp. 6																
Cumacea	Cumacea gen. sp. 7	1															
Cumacea	Cumacea gen. sp. 8																
Cumacea	Cumacea gen. sp. 9	23															
Cumacea	Cumacea gen. sp. 10																
Cumacea	Cumacea gen. sp. 11																
Cumacea	Cumacea gen. sp. 12																
Cumacea	Cumacea gen. sp. 13																
Cumacea	Cumacea gen. sp. 14																
Cumacea	Cumacea gen. sp. 15																
Cumacea	Cumacea gen. sp. 16																
Cumacea	Cumacea gen. sp. 17																
Cumacea	Cumacea gen. sp. 18																
Cumacea	Cumacea gen. sp. 19																
Cumacea	Cumacea gen. sp. 20																
Cumacea	Cumacea gen. sp. 21																
Cumacea	Cumacea gen. sp. 22																
Cumacea	Cumacea gen. sp. 23																
Cumacea	Cumacea gen. sp. 24																
Cumacea	Cumacea gen. sp. 25																
Cumacea	Cumacea gen. sp. 26																
Cumacea	Cumacea gen. sp. 27																
Cumacea	Cumacea gen. sp. 28																
Cumacea	Cumacea gen. sp. 29																
Cumacea	Cumacea gen. sp. 30																
Cumacea	Cumacea gen. sp. 31																
Cumacea	Cumacea gen. sp. 32																
Cumacea	Cumacea gen. sp. 33																
Cumacea	Cumacea gen. sp. 34																
Cumacea	Cumacea gen. sp. 35																
Cumacea	Cumacea gen. sp. 36																
Cumacea	Cumacea gen. sp. 37																
Cumacea	Cumacea gen. sp. 38																
Cumacea	Cumacea gen. sp. 39																
Cumacea	Cumacea gen. sp. 40																
Cumacea	Cumacea gen. sp. 41																
Cumacea	Cumacea gen. sp. 42															2	
Cumacea	Cumacea gen. sp. 43																
Cumacea	Cumacea gen. sp. 44																
Cumacea	Cumacea gen. sp. 45																
Cumacea	Cumacea gen. sp. 46																
Cumacea	Cumacea gen. sp. 47																
Cumacea	Cumacea gen. sp. 48																
Cumacea	Cumacea gen. sp. 49																

		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
Cumacea	Cumacea gen. sp. 50																
Cumacea	Cumacea gen. sp. 51																
Cumacea	Cumacea gen. sp. 52																
Cumacea	Cumacea gen. sp. 53																
Cumacea	Cumacea gen. sp. 54																
Cumacea	Cumacea gen. sp. 55																
Cumacea	Cumacea gen. sp. 56																
Cumacea	Cumacea gen. sp. 57																
Cumacea	Cumacea gen. sp. 58																
Cumacea	Cumacea gen. sp. 59																
Cumacea	Cumacea gen. sp. 60																
Cumacea	Cumacea gen. sp. 61																
Cumacea	Cumacea gen. sp. 62																
Cumacea	Cumacea gen. sp. 63																
Cumacea	Cumacea gen. sp. 64																
Cumacea	Cumacea gen. sp. 65																
Cumacea	Cumacea gen. sp. 66																
Cumacea	Cumacea gen. sp. 67																
Cumacea	Cumacea gen. sp. 68																
Cumacea	Cumacea gen. sp. 69																
Cumacea	Cumacea gen. sp. 70																
Cumacea	Cumacea gen. sp. 71																
Cumacea	Cumacea gen. sp. 72																
Cumacea	Cumacea gen. sp. 73																
Cumacea	Cumacea gen. sp. 74																
Cumacea	Cumacea gen. sp. 75																
Cumacea	Cumacea gen. sp. 76																
Cumacea	Cumacea gen. sp. 77																
Cumacea	Cumacea gen. sp. 78																
Cumacea	Cumacea gen. sp. 79																
Cumacea	Cumacea gen. sp. 80																
Cumacea	Cumacea gen. sp. 81																
Cumacea	Cumacea gen. sp. 82																
Cumacea	Cumacea gen. sp. 83																
Cumacea	Cumacea gen. sp. 84																
Cumacea	Cumacea gen. sp. 85																
Cumacea	Cumacea										1						
Cyclopoida	Cyclopoida																
Decapoda	Alpheidae																
Decapoda	Atelecyclidae																
Decapoda	Axiidae																
Decapoda	Calappidae																
Decapoda	Callianssidae																
Decapoda	Caridea																
Decapoda	Crangonidea																
Decapoda	Cyclodrippidae																
Decapoda	Dendrobranchiata																
Decapoda	Diogenidae																

		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
Decapoda	Galatheidae																
Decapoda	Goneplacidae																
Decapoda	Grapsidae																
Decapoda	Paguroidea																
Decapoda	Hexapodidae																
Decapoda	Homolodromiidae																
Decapoda	Latreilliidae																
Decapoda	Leucosiidae																
Decapoda	Luciferidae																
Decapoda	Majidae																
Decapoda	Matutidae											1					
Decapoda	Mysidacea																
Decapoda	Ocypodidae																
Decapoda	Ogyrididae	1	2														
Decapoda	Paguridae																
Decapoda	Palaemonoidea																
Decapoda	Parthenopidae																
Decapoda	Pasiphaeidae																
Decapoda	Pilumnidae																
Decapoda	Porcellanidae																
Decapoda	Portunidae																
Decapoda	Processidae																
Decapoda	Raninidae																
Decapoda	Sergestidae																
Decapoda	Solenoceridae																
Decapoda	Strahlaxiidae																
Decapoda	Thalassinidea																
Decapoda	Upogebiidae																
Decapoda	Xanthidae																
Decapoda	Decapoda n. det.	2															
Euphasiacea	Euphausiacea																
Harpacticoida	Harpacticoida															27	
Isopoda	Aegidae																
Isopoda	Antheluridae																
Isopoda	Anthuridae												22			6	
Isopoda	Arcturidae															1	
Isopoda	Bopyridae																
Isopoda	Cirolanidae	4	4	80	1	157	109	90	1	13				1	5		
Isopoda	Desmosomatidae																
Isopoda	Expanthuridae																
Isopoda	Gnathidae																
Isopoda	Haplooniscidae																
Isopoda	Holidoteidae																
Isopoda	Idoteidae																
Isopoda	Ischnomesidae																
Isopoda	Janiridae																
Isopoda	Joeropsididae																
Isopoda	Leptanthuridae																

		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
Isopoda	Macrostylidae																
Isopoda	Munnidae																
Isopoda	Munnopsidae																
Isopoda	Nannoniscidae																
Isopoda	Paramunnidae																
Isopoda	Paranthuridae																
Isopoda	Pleurogonidae																
Isopoda	Rectarcturidae																
Isopoda	Sphaeromatidae				3												
Isopoda	Thambametidae																
Isopoda	Isopoda											1					
Mysida	Mysida			10								3					
Nebalicea	Nebaliacea																
Ostracoda	Ostracoda												1				
Stomatopoda	Stomatopoda																
Tanaidacea	Agathotanaidae																
Tanaidacea	Akanthophoreidae																
Tanaidacea	Anarthruridae																
Tanaidacea	Apseudidae																
Tanaidacea	Colletteidae																
Tanaidacea	Heterotanaididae																
Tanaidacea	Insociabilitanais																
Tanaidacea	Kalliapseudidae																
Tanaidacea	Leptochelidae																
Tanaidacea	Leptognathiidae																
Tanaidacea	Metapseudidae					1											
Tanaidacea	Tanaidacea gen. nov																
Tanaidacea	Nototanaidae																
Tanaidacea	Parafilitanais																
Tanaidacea	Paranarthrurella																
Tanaidacea	Parapseudidae																
Tanaidacea	Paratanaidae																
Tanaidacea	Pseudotanaidae																
Tanaidacea	Tanaellidae																
Tanaidacea	Tanaissuidae																
Tanaidacea	Tanaopsidae																
Tanaidacea	Typhlotanaidae																
Tanaidacea	Tanaidacea																
Tanaidacea	Tanaidacea (males)																
Crustacea	Crustacea																
Bryozoa	Bryozoa																
Brachiopoda	Brachiopoda																
Asteroidea	Echinodermata Asteroidea																
Echinodermata	Echinodermata Echinoidea																
Echinoidea	Cidaridae																
Echinoidea	Echinometridae																

		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
Echinoidea	Fibulariidae																
Echinoidea	Parechinidae																
Echinoidea	Rotulidae	9												1	2		1
Echinoidea	Schizasteridae																
Echinoidea	Spatangidae																
Holothuroidea	Cucumariidae																
Holothuroidea	Sclerodactylidae																
Holothuroidea	Synaptidae																
Ophiuroidea	Ophiuroidea																
Ophiuroidea	*Amphilepis ingolfiana Mortensen, 1933*																
Ophiuroidea	*Amphilimna olivacea (Lyman, 1869)*																
Ophiuroidea	*Amphioplus (Amphioplus) aciculatus Mortensen, 1936*																
Ophiuroidea	*Amphioplus archeri A.M. Clark, 1955*																
Ophiuroidea	*Amphioplus aurensis A.M. Clark, 1955*																
Ophiuroidea	*Amphioplus congensis (Studer, 1882)*																
Ophiuroidea	*Amphioplus occidentalis Koehler, 1914*												16				
Ophiuroidea	*Amphioplus sp. juv.*																
Ophiuroidea	*Amphipholis bananensis Koehler, 1911*																
Ophiuroidea	*Amphipholis nudipora Koehler, 1914*												21				
Ophiuroidea	*Amphipholis squamata (Delle Chiaje, 1828)*																
Ophiuroidea	*Amphiura atlantica Ljungman, 1867*																
Ophiuroidea	*Amphiura atlantidea Madsen, 1970*																
Ophiuroidea	*Amphiura chiajei Forbes, 1843*																
Ophiuroidea	*Amphiura filiformis (O.F.Műller, 1776)*																
Ophiuroidea	*Amphiura incana Lyman, 1879*	1													3	1	
Ophiuroidea	*Amphiura senegalensis Madsen, 1970*																
Ophiuroidea	*Amphiura sp.*									1							
Ophiuroidea	*Amphiura ungulata Madsen, 1970*																
Ophiuroidea	*Ophionephthys lowelli A.M.Clark, 1974*																
Ophiuroidea	*Ophiophragmus acutispina (Koehler, 1914)*																
Ophiuroidea	*Ophiophragmus sp.1*	28													4		
Ophiuroidea	*Ophiostigma abnorme (Lyman, 1878)*																
Ophiuroidea	*Ophiactis lymani Ljungman, 1872*																
Ophiuroidea	*Ophiactis luetkeni Marktanner-Turneretscher, 1887*																
Ophiuroidea	*Ophiactis savignyi (Műller, Troschel, 1842)*																

		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
Ophiuroidea	*Ophiactis sp.*																
Ophiuroidea	*Ophiocoma pumila Lutken 1859*																
Ophiuroidea	*Ophiopsila guineensis Koehler, 1914*																
Ophiuroidea	*Ophioderma longicauda (Bruzelius, 1805)*																
Ophiuroidea	*Ophiolepis paucispina (Say, 1825)*																
Ophiuroidea	*Ophiopteron atlanticum Koehler, 1914*																
Ophiuroidea	*Ophiothrix congensis Koehler, 1911*																
Ophiuroidea	*Ophiothrix nociva Koehler, 1907*																
Ophiuroidea	*Ophiohtrix sp.*																
Ophiuroidea	*Ophiura (Dictenophiura) carnea skoogi (Koehler, 1923)*																
Ophiuroidea	*Ophiura grubei Heller, 1863*																
Echiura	Echiura																
	Cnidaria																
Actiniaria	Actiniaria																
Hydrozoa	Hydrozoa											1					
Octocorallia	Octocorallia																
	Mollusca																
Aplacophora	Aplacophora																
Bivalvia	Arcidae												15				
Bivalvia	Astratidae																
Bivalvia	Cardiidae												75				1
Bivalvia	Carditidae																
Bivalvia	Crassatellidae																
Bivalvia	Corbulidae												1				
Bivalvia	Cuspidarridae																
Bivalvia	Donacidae	22	1		12	1			3		13		30	1	1		2
Bivalvia	Dreissenidae																
Bivalvia	Kelliellidae																
Bivalvia	Lucinidae																
Bivalvia	Limidae																
Bivalvia	Mactridae												9	1			
Bivalvia	Myidae												1				
Bivalvia	Mytilidae																
Bivalvia	Nuculanidae												1				
Bivalvia	Nuculidae												11				
Bivalvia	Pectinidae																
Bivalvia	Pharidae												63				
Bivalvia	Semelidae												1				
Bivalvia	Solemyidae																
Bivalvia	Spondylidae																
Bivalvia	Tellinidae										1						

		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
Bivalvia	Thraciidae																
Bivalvia	Veneridae												12	1			
Bivalvia	Bivalvia										2						
Cephalopoda	Cephalopoda																
Gastropoda	Acmaeidae																
Gastropoda	Anabathridae																
Gastropoda	Aporrhaidae																
Gastropoda	Architectonidae																
Gastropoda	Buccinidae																
Gastropoda	Caecidae																
Gastropoda	Calypraeidae																
Gastropoda	Cancellaridae																
Gastropoda	Cassidae																
Gastropoda	Cerithidae																
Gastropoda	Cerithiopsidae																
Gastropoda	Columbellidae																
Gastropoda	Coralliophilidae																
Gastropoda	Cypraeidae																
Gastropoda	Cystiscidae																
Gastropoda	Eulimidae																
Gastropoda	Epitoniidae				1												
Gastropoda	Haloceratidae																
Gastropoda	Holocerathidae																
Gastropoda	Marginellidae																
Gastropoda	Mitridae																
Gastropoda	Muricidae																
Gastropoda	Nassariidae												1				
Gastropoda	Naticidae																
Gastropoda	Nudibranchia																
Gastropoda	Olividae																
Gastropoda	Patellacea																
Gastropoda	Patellidae																
Gastropoda	Phasianellidae																
Gastropoda	Pickworthiidae																
Gastropoda	Pyramidellidae																
Gastropoda	Ringiculidae																
Gastropoda	Rissoidae																
Gastropoda	Rissoinidae																
Gastropoda	Skeneidae	1															
Gastropoda	Terebridae																
Gastropoda	Triphoridae																
Gastropoda	Trochidae				1												
Gastropoda	Turbinidae																
Gastropoda	Turridae																
Gastropoda	Turritellidae																
Gastropoda	Vanikoridae																
Gastropoda	Volvatellidae																
Gastropoda	Ophistobranchia																

		G 1/0	G2/0	G3/0	G4/0	G5/0	G6/0	G7/0	G8/0	G9/0	G1/5	G3/5	G4/5	G5/5	G6/5	G7/5	G9/5
Gastropoda	Gastropoda										1						
Polyplacophora	Polyplacophora																
Scaphopoda	Scaphopoda																
Nematoda	Nematoda	1															
Nemertea	Nemertea	6						1			3	1	7		7	3	
Turbellaria	Turbelaria																
Porifera	Porifera																
Sipuncula	Sipuncula																
Vermes	Vermes																

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100			G4/100	G5/100	G6/100
Annelida	Annelida																1								1
Hirudinea	Hirudinea									1															
Polychaeta	Acoetidae																2								
Polychaeta	Acrocirridae							11																	
Polychaeta	Ampharetidae	1	15	9	5		12	6	31	4	11	15	10		19	27	3	1	2	7	14	13	8	13	18
Polychaeta	Amphinomidae							2						27		2			2		2	1	1	1	3
Polychaeta	Aphroditidae							1							2										
Polychaeta	Arenicolidae																								
Polychaeta	Capitellidae		3	5	1	4	19	3	3	4	8		2		14	8	3	3		4	7	5	4	15	4
Polychaeta	Chrysopetalidae					1	1	8		1				4		7				1	1	2	1		3
Polychaeta	Cirratulidae	13	11	14	1	19	13	9	25	63	18	1	19		27	25	5	8	3	3	10	14	15	11	16
Polychaeta	Cossuridae	4		2			3		2	2	1	1	3	4	1	1	2		1		2	1	1		
Polychaeta	Dorvilleidae		1		1	2	5	100	18	2				7							1		1		
Polychaeta	Drilomorpha																								
Polychaeta	Eunicidae	1	4	1	1	7	26	36	26	173		2			40	50	4	28	18	10	6	10	18	9	26
Polychaeta	Euphrosinidae	1					1	8	1	1				1	6	1							1		
Polychaeta	Fauveliopsidae																								
Polychaeta	Flabelligeridae	1						23	13		3	3	1		1	2	1	1	3	1		1		5	
Polychaeta	Glyceridae	4	6	11	7	13	31	2	21	15	3	9			20	13	2	3	2	8	8	10	10	7	3
Polychaeta	Goniadidae													4											
Polychaeta	Hesionidae			1																					
Polychaeta	Lacydonidae																								2
Polychaeta	Lumbrineridae	8	21	5	1	5	47	10	51	17	7	5	19		15	32	2	19	3	7	27	10	3	8	10
Polychaeta	Magelonidae	6	5	5	2	8			5		3	1		1	4	5		3		3	7				
Polychaeta	Maldanidae			2	7	2	95	3	16	2	6	2	8	5	26	25	11	2	2	3	9	5	7	9	5
Polychaeta	Nephtyidae	3	3	10	3	5	8	8	14		17	24	34	5	26	56	9	5	3		2	9		16	6
Polychaeta	Nereidae		2	18	4		4	6			2	2	1	22	4	2		3			1				
Polychaeta	Oenonidae	1												1		1		1							
Polychaeta	Onuphidae	4	3	4	19	6	16	1	14	1	13	8	2		16	6	12	22	2	1		1		15	31

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Polychaeta	Opheliidae	1	5			3	5	19	1	3		2		7	6	3	1	1	5		1	1	5	1	1
Polychaeta	Orbiniidae	9	5	34	19	4	9		6	4	6	7			8	3	1							1	
Polychaeta	Oweniidae	1		2			4		1	1	1		1	3	2		2	6		1	1			2	
Polychaeta	Paralacydonidae													1			3								
Polychaeta	Paraonidae	23	27	95	12	55	65	6	27	57	28	18	9	2	23	15	3	3		7	14	12	27	15	26
Polychaeta	Pectinaridae		1						4					5		1				1			1		
Polychaeta	Pholoidae													1											
Polychaeta	Phyllodocidae		1				3	110	1	4	11	3			24	37	2	9	2	9	5	23	14	18	15
Polychaeta	Pilargidae			4		16	8	2	2	5	4	1	37	14		3	1		1	2	2		1	1	
Polychaeta	Pisionidae					10	9			1				2											
Polychaeta	Poecilochaetidae											1			1									3	
Polychaeta	Polynoidae	2	2	28	9	2	9	116	3		2	4			4	1	2	3	2	2	1	1	3	6	5
Polychaeta	Sabellidae		1				25	15	1	6	2	2			4	24	1	3		1	2	2	2	2	
Polychaeta	Sabellaridae	1						1				1		3											
Polychaeta	Scalibregmatidae																							2	2
Polychaeta	Serpulidae							1									2								
Polychaeta	Sphaerodoridae							1							1								2		
Polychaeta	Spionidae	15	34	13	7	25	183	56	100	37	34	15	9		28	31	6	11	3	12	22	23	11	45	34
Polychaeta	Sternaspidae			1			4				6	7	8	25		2		3							
Polychaeta	Syllidae	1	1	5		14	35	333	10	15	1	5	1		17	107	4			1	7	6	13	9	2
Polychaeta	Terebellidae	1		2	1	1	7	6	8	3	1	3	6	1	4	23	1	15		1	2	2	1	1	4
Polychaeta	Terebellomorpha							2						2											
Polychaeta	Trichobranchidae						1				1		4			3	1	2						3	1
Polychaeta	Trochochetidae													4											
Polychaeta	Polychaeta gen. sp. 1													2								1			
Polychaeta	Polychaeta gen. sp. 2																					2			
Polychaeta	Polychaeta gen. sp. 3																								

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Polychaeta	Polychaeta gen. sp. 4							1																	
Polychaeta	Polychaeta gen. sp. 5																								
Polychaeta	Polychaeta gen. sp. 6											1													
Polychaeta	Polychaeta gen. sp. 7																								
Polychaeta	Polychaeta gen. sp. 8																								
Polychaeta	Polychaeta	5	6	3	11	8	28	33	16	17	7	4	3		9	16	1	5		1	12	2	6	12	4
Pycnogonida	Arhropoda																								
	Pycnogonida							6	2							1									
Acari	Acari							1																	1
Amphipoda	Ampeliscidae	11	35	8	7	2	79	32	25	9	62	154	9	60	24	53	12	19	3	9	25	16	23	15	8
Amphipoda	Amphilochidae					4		2	1	1					17	1									
Amphipoda	Atylidae																								
Amphipoda	Caprellidae					1	7	27		2	2			1	1	8							4		
Amphipoda	Cyproideidae							1																	
Amphipoda	Dexaminidae							9																	
Amphipoda	Dogielinotidae																								
Amphipoda	Epimeriidae							1																	
Amphipoda	Eusiridae																							1	
Amphipoda	Iphimediidae																								
Amphipoda	Leucothoidae					2	1	5		1	2	5		3		1					2			1	
Amphipoda	Liljeborgiidae		3			7	6	18	2		1	3			1										
Amphipoda	Lysianassidae	3	1					6			9	7		1	4	7		1			2	3	2	5	
Amphipoda	Melitidae		2			11	16	83	9	14	13	5		2	7	2	1	2				1			
Amphipoda	Melphidippidae													1											
Amphipoda	Oedicerotidae	4	1	1		1	2	1	3	2	3	9	1	3	4	3				1	10	7	2		1
Amphipoda	Stenothoidae										1	1		1											
Amphipoda	Synopiidae		18				8		37	2	1	2			16										
Amphipoda	Phoxocephalidae	15	2			4	10				14	17		11	2	5	1				2	1			1

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Amphipoda	Urothoidae	7				2	8			3					1	34									
Amphipoda	Corophioidea	7	3		10	9	29	66	42	8	9	30	3	13	24	16	5	6	1	8	6	3	9	1	3
Amphipoda	Hyperiidea						3					1						1							
Amphipoda	Amphipoda indet.	3	2	1	1	6	10	22	3	5	1	6	1	2	2	4				2				1	3
Anomura	Anomura	2	8	5	3	3	4	20		3	11	11	2	8	5	8	4	1	1	4	2	7	3	1	1
Astacidea	Astacidea			1	2		5	4	3	1	2	4		4				4			1			4	1
Brachyura	Brachyura	5	2		2		2	18	3	1	5	6		1	5	4	1	4		1	3	2	3	2	2
Calanoida	Calanoida	13	11	3	1	5	7	7	3	1	12	15	4	15	7	17		3		6	17	9	13	4	6
Caridea	Caridea	18	8	4		10	14	14	7	4	23	15	2	2	8	8	6	11	3	5	1	4		3	1
Cirripedia	Cirripedia							32														3			
Copepoda	Copepoda																								
Cumacea	Cumacea gen. sp. 1				1		3							4											
Cumacea	Cumacea gen. sp. 2						3						1			1									
Cumacea	Cumacea gen. sp. 3																								
Cumacea	Cumacea gen. sp. 4																								
Cumacea	Cumacea gen. sp. 5								2			1			4	11		1	1		2				
Cumacea	Cumacea gen. sp. 6															2									
Cumacea	Cumacea gen. sp. 7		1							1	2														
Cumacea	Cumacea gen. sp. 8	7													1	2									
Cumacea	Cumacea gen. sp. 9															1									
Cumacea	Cumacea gen. sp. 10						4			2				2	1										
Cumacea	Cumacea gen. sp. 11									1		6													
Cumacea	Cumacea gen. sp. 12					1	1																		
Cumacea	Cumacea gen. sp. 13	1					1		1					1			1								
Cumacea	Cumacea gen. sp. 14						3							1											
Cumacea	Cumacea gen. sp. 15								6			2													
Cumacea	Cumacea gen. sp. 16															1									
Cumacea	Cumacea gen. sp. 17										1														

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Cumacea	Cumacea gen. sp. 18					1																			
Cumacea	Cumacea gen. sp. 19										1														
Cumacea	Cumacea gen. sp. 20											1													
Cumacea	Cumacea gen. sp. 21																								
Cumacea	Cumacea gen. sp. 22						5			1	2	3	1	5		4									
Cumacea	Cumacea gen. sp. 23																								
Cumacea	Cumacea gen. sp. 24																								
Cumacea	Cumacea gen. sp. 25						1																		
Cumacea	Cumacea gen. sp. 26													1											
Cumacea	Cumacea gen. sp. 27																								
Cumacea	Cumacea gen. sp. 28										1					3									
Cumacea	Cumacea gen. sp. 29											1													
Cumacea	Cumacea gen. sp. 30										1														
Cumacea	Cumacea gen. sp. 31	1				1											1								
Cumacea	Cumacea gen. sp. 32	3				1					1			4						2					
Cumacea	Cumacea gen. sp. 33												1							3	2		1		
Cumacea	Cumacea gen. sp. 34			2												1									
Cumacea	Cumacea gen. sp. 35																			1	2	5	1	1	
Cumacea	Cumacea gen. sp. 36																						1		
Cumacea	Cumacea gen. sp. 37																								
Cumacea	Cumacea gen. sp. 38																								
Cumacea	Cumacea gen. sp. 39																								
Cumacea	Cumacea gen. sp. 40						2			2															
Cumacea	Cumacea gen. sp. 41													1											
Cumacea	Cumacea gen. sp. 42																								
Cumacea	Cumacea gen. sp. 43																					1		1	
Cumacea	Cumacea gen. sp. 44																						1	2	
Cumacea	Cumacea gen. sp. 45																								

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Cumacea	Cumacea gen. sp. 46																								
Cumacea	Cumacea gen. sp. 47																								
Cumacea	Cumacea gen. sp. 48																								
Cumacea	Cumacea gen. sp. 49														1										
Cumacea	Cumacea gen. sp. 50																								
Cumacea	Cumacea gen. sp. 51																								
Cumacea	Cumacea gen. sp. 52																								
Cumacea	Cumacea gen. sp. 53																								
Cumacea	Cumacea gen. sp. 54																								
Cumacea	Cumacea gen. sp. 55																								
Cumacea	Cumacea gen. sp. 56																								
Cumacea	Cumacea gen. sp. 57																								
Cumacea	Cumacea gen. sp. 58																								
Cumacea	Cumacea gen. sp. 59																								
Cumacea	Cumacea gen. sp. 60																								
Cumacea	Cumacea gen. sp. 61																								
Cumacea	Cumacea gen. sp. 62																								
Cumacea	Cumacea gen. sp. 63																								
Cumacea	Cumacea gen. sp. 64																								
Cumacea	Cumacea gen. sp. 65																								
Cumacea	Cumacea gen. sp. 66																								
Cumacea	Cumacea gen. sp. 67																								
Cumacea	Cumacea gen. sp. 68																								
Cumacea	Cumacea gen. sp. 69																								
Cumacea	Cumacea gen. sp. 70																								
Cumacea	Cumacea gen. sp. 71																								
Cumacea	Cumacea gen. sp. 72																								
Cumacea	Cumacea gen. sp. 73																								
Cumacea	Cumacea gen. sp. 74																								
Cumacea	Cumacea gen. sp. 75																								
Cumacea	Cumacea gen. sp. 76																								
Cumacea	Cumacea gen. sp. 77																								
Cumacea	Cumacea gen. sp. 78																								

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Cumacea	Cumacea gen. sp. 79																								
Cumacea	Cumacea gen. sp. 80																								
Cumacea	Cumacea gen. sp. 81																								
Cumacea	Cumacea gen. sp. 82																								
Cumacea	Cumacea gen. sp. 83																								
Cumacea	Cumacea gen. sp. 84																								
Cumacea	Cumacea gen. sp. 85																								
Cumacea	Cumacea	1	1			1	3				2	2		1		2	1								
Cyclopoida	Cyclopoida	1				2									1	10					8				
Decapoda	Alpheidae			2			1	8	1										4	2		4		3	2
Decapoda	Atelecyclidae														1										
Decapoda	Axiidae																								
Decapoda	Calappidae	1																							
Decapoda	Callianssidae				3			1	3			4		3				4							
Decapoda	Caridea	16				1	4	1		2	9										2	4			
Decapoda	Crangonidea																								
Decapoda	Cyclodrippidae																								
Decapoda	Dendrobranchiata										1									1	1		3		
Decapoda	Diogenidae		5		3	2					9	1		3	4			1							
Decapoda	Galatheidae					1	5	17		3	3						1			1					
Decapoda	Goneplacidae										1														
Decapoda	Grapsidae																			1					1
Decapoda	Paguroidea		1	1	1		1	1		1		5		3	2	1	1				1	7	2	1	
Decapoda	Hexapodidae																								
Decapoda	Homolodromiidae																								
Decapoda	Latreilliidae																								
Decapoda	Leucosiidae				1						1	2			1						3	1	2		
Decapoda	Luciferidae		4			1	2		1						4				1						
Decapoda	Majidae							2						1				1			4	1	1		
Decapoda	Matutidae																								
Decapoda	Mysidacea																								
Decapoda	Ocypodidae																								
Decapoda	Ogyrididae				2																				
Decapoda	Paguridae												2						1		1		2		1
Decapoda	Palaemonoidea											5													
Decapoda	Parthenopidae										1				1	3					1			2	
Decapoda	Pasiphaeidae	2																							

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Decapoda	Pilumnidae				1		1	3	3						2	1				1					
Decapoda	Porcellanidae							4				1						1							
Decapoda	Portunidae	2	1																						
Decapoda	Processidae											1													
Decapoda	Raninidae										1														
Decapoda	Sergestidae																								
Decapoda	Solenoceridae																								
Decapoda	Strahlaxiidae								1																
Decapoda	Thalassinidea			1								1												1	1
Decapoda	Upogebiidae						4	2				2		3							2			9	
Decapoda	Xanthidae						1	2		1		2													
Decapoda	Decapoda n. det.	2	7	2	3	7	7	10	5		13	8	2	2	15	7	4	10		5	6			1	2
Euphasiacea	Euphausiacea																								
Harpacticoida	Harpacticoida					3	4	6		2	2	5		2	3	13					1			4	
Isopoda	Aegidae																								
Isopoda	Antheluridae																								
Isopoda	Anthuridae	1	1	3	2	4	9	9			2	2		6	8	18					2	2			2
Isopoda	Arcturidae	1					5		3		1	1							1		2				
Isopoda	Bopyridae																								
Isopoda	Cirolanidae						9							1		1	4	4				6			1
Isopoda	Desmosomatidae							10																	
Isopoda	Expanthuridae																								
Isopoda	Gnathidae						1	12							2									2	
Isopoda	Haplooniscidae																								
Isopoda	Holidoteidae					1			4	1						1									
Isopoda	Idoteidae																								
Isopoda	Ischnomesidae																								
Isopoda	Janiridae							2																	
Isopoda	Joeropsididae	1						9																	
Isopoda	Leptanthuridae																								
Isopoda	Macrostylidae																								
Isopoda	Munnidae						1	7																	
Isopoda	Munnopsidae																							1	
Isopoda	Nannoniscidae																								
Isopoda	Paramunnidae																								
Isopoda	Paranthuridae							1																	
Isopoda	Pleurogonidae																								

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Isopoda	Rectarcturidae													1											
Isopoda	Sphaeromatidae																								
Isopoda	Thambametidae																								
Isopoda	Isopoda							2				1										1			
Mysida	Mysida	5				1			1	1												1			
Nebalicea	Nebaliacea						1																		
Ostracoda	Ostracoda		3	2	1	5	5	3	1	1	15	13		1		2					2		10	2	3
Stomatopoda	Stomatopoda	1			1																			2	
Tanaidacea	Agathotanaidae																								
Tanaidacea	Akanthophoreidae																					1		1	
Tanaidacea	Anarthruridae																								
Tanaidacea	Apseudidae		3		1		1	62					8	27	15							1			
Tanaidacea	Colletteidae																								
Tanaidacea	Heterotanaididae							6			3	4		3	4	11		1							
Tanaidacea	Insociabilitanais																							1	
Tanaidacea	Kalliapseudidae					2						1		13	15	1	1								
Tanaidacea	Leptochelidae							23	1								1					1			
Tanaidacea	Leptognathiidae																					1			
Tanaidacea	Metapseudidae							26								14			1	4		1	1		2
Tanaidacea	Tanaidacea gen. nov																								
Tanaidacea	Nototanaidae																								
Tanaidacea	Parafilitanais																								
Tanaidacea	Paranarthrurella																								
Tanaidacea	Parapseudidae							2							1	3			1						
Tanaidacea	Paratanaidae																			1					
Tanaidacea	Pseudotanaidae							2								3					7			1	
Tanaidacea	Tanaellidae																								
Tanaidacea	Tanaissuidae											2		1		2					4			1	
Tanaidacea	Tanaopsidae																								
Tanaidacea	Typhlotanaidae							1			5	2						1			2				
Tanaidacea	Tanaidacea											2						1							
Tanaidacea	Tanaidacea (males)						1	1													1				
Crustacea	Crustacea			1						2															
Bryozoa	Bryozoa							8																	
Brachiopoda	Brachiopoda	2												1	2		1	1							
	Echinodermata																								

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Asteroidea	Asteroidea																								
Echinodermata	Echinodermata							3			2			4				1							
Echinoidea	Echinoidea														1										
Echinoidea	Cidaridae							3																	
Echinoidea	Echinometridae							2																	
Echinoidea	Fibulariidae						1																		
Echinoidea	Parechinidae										6	4			1		1								
Echinoidea	Rotulidae																								
Echinoidea	Schizasteridae																								
Echinoidea	Spatangidae														1										
Holothuroidea	Cucumariidae																								
Holothuroidea	Sclerodactylidae									1	3			1											
Holothuroidea	Synaptidae															2	5							3	1
Ophiuroidea	Ophiuroidea						1	1			1					1				1		2			
Ophiuroidea	*Amphilepis ingolfiana Mortensen, 1933*																								
Ophiuroidea	*Amphilimna olivacea (Lyman, 1869)*										1	4													
Ophiuroidea	*Amphioplus (Amphioplus) aciculatus Mortensen, 1936*					1				1	3	2					2								
Ophiuroidea	*Amphioplus archeri A.M. Clark, 1955*																								
Ophiuroidea	*Amphioplus aurensis A.M. Clark, 1955*									1	2	18		1	4		4								
Ophiuroidea	*Amphioplus congensis (Studer, 1882)*			2	8				4			1						6							
Ophiuroidea	*Amphioplus occidentalis Koehler, 1914*																								
Ophiuroidea	*Amphioplus sp. juv.*										4	2	1												
Ophiuroidea	*Amphipholis bananensis Koehler, 1911*											1													
Ophiuroidea	*Amphipholis nudipora Koehler, 1914*			1	6		2		1		6	9		2	1		2	2		2		1			
Ophiuroidea	*Amphipholis squamata (Delle Chiaje, 1828)*										1														

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Ophiuroidea	*Amphiura atlantica Ljungman, 1867*						2																		1
Ophiuroidea	*Amphiura atlantidea Madsen, 1970*																								1
Ophiuroidea	*Amphiura chiajei Forbes, 1843*																								
Ophiuroidea	*Amphiura filiformis (O.F.Műller, 1776)*																								
Ophiuroidea	*Amphiura incana Lyman, 1879*																								
Ophiuroidea	*Amphiura senegalensis Madsen, 1970*																								
Ophiuroidea	*Amphiura sp.*																								
Ophiuroidea	*Amphiura ungulata Madsen, 1970*	1	1																						
Ophiuroidea	*Ophionephthys lowelli A.M.Clark, 1974*		1									3			1										
Ophiuroidea	*Ophiophragmus acutispina (Koehler, 1914)*		1		1		3		1	1	6	3					2								
Ophiuroidea	*Ophiophragmus sp.1*																								
Ophiuroidea	*Ophiostigma abnorme (Lyman, 1878)*							4																	
Ophiuroidea	*Ophiactis lymani Ljungman, 1872*										2				1										
Ophiuroidea	*Ophiactis luetkeni Marktanner-Turneretscher, 1887*							54															1		
Ophiuroidea	*Ophiactis savignyi (Műller, Troschel, 1842)*							1																	
Ophiuroidea	*Ophiactis sp.*																								
Ophiuroidea	*Ophiocoma pumila Lutken 1859*																								
Ophiuroidea	*Ophiopsila guineensis Koehler, 1914*									1						1									
Ophiuroidea	*Ophioderma longicauda (Bruzelius, 1805)*																								

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Ophiuroidea	*Ophiolepis paucispina (Say, 1825)*							1																	
Ophiuroidea	*Ophiopteron atlanticum Koehler, 1914*																								
Ophiuroidea	*Ophiothrix congensis Koehler, 1911*							26																	
Ophiuroidea	*Ophiothrix nociva Koehler, 1907*										1														
Ophiuroidea	*Ophiohtrix sp.*																								
Ophiuroidea	*Ophiura (Dictenophiura) carnea skoogi (Koehler, 1923)*														1									1	
Ophiuroidea	*Ophiura grubei Heller, 1863*										6	4				9									
Echiura	Echiura				33												1								4
	Cnidaria																								
Actiniaria	Actiniaria			3			1							1	1	3			1			3			
Hydrozoa	Hydrozoa							1	1																
Octocorallia	Octocorallia	1							1									1							
	Mollusca																								
Aplacophora	Aplacophora										1														
Bivalvia	Arcidae	1		1	1				1							1									
Bivalvia	Astratidae																								
Bivalvia	Cardiidae	8								1			1		1	5	4	2							1
Bivalvia	Carditidae							7	1		1							1			1				
Bivalvia	Crassatellidae															1			1						
Bivalvia	Corbulidae			7	16		1		3	1		1					2	5	1			1			
Bivalvia	Cuspidarridae																							1	1
Bivalvia	Donacidae	6	1	208	10	6	20	1	1	7	1		4	7	5	2	2				2			1	
Bivalvia	Dreissenidae							1																	
Bivalvia	Kelliellidae																								
Bivalvia	Lucinidae						14		4			1						4							
Bivalvia	Limidae																								
Bivalvia	Mactridae				7								2												
Bivalvia	Myidae				2																				
Bivalvia	Mytilidae			1		1		4				1				11									
Bivalvia	Nuculanidae	27	1		2	1		5	1		2			1	1	2	3	6		1	10	3	9		

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Bivalvia	Nuculidae	9	5	2	1	6	2		4	1	3			1	1			2		1					
Bivalvia	Pectinidae					8		3								1					1			2	
Bivalvia	Pharidae			2			6	2	1			1	1	2	7	1	1								
Bivalvia	Semelidae		4	1								2				8	2						1		
Bivalvia	Solemyidae											1													
Bivalvia	Spondylidae																								
Bivalvia	Tellinidae		76	4	7				2					2	5			1		2					
Bivalvia	Thraciidae												1												
Bivalvia	Veneridae	24	19			19	16	2	15	41	4	6	5	7		20	7	27	2	1	13	1	7	4	
Bivalvia	Bivalvia						10																		
Cephalopoda	Cephalopoda																								
Gastropoda	Acmaeidae						1	15																	
Gastropoda	Anabathridae																							1	
Gastropoda	Aporrhaidae	1																							
Gastropoda	Architectonidae	1									1	1													
Gastropoda	Buccinidae					1										3									
Gastropoda	Caecidae																								
Gastropoda	Calypraeidae				1																				
Gastropoda	Cancellaridae											1													
Gastropoda	Cassidae																				6				
Gastropoda	Cerithidae										1														
Gastropoda	Cerithiopsidae																								
Gastropoda	Columbellidae														1			1							
Gastropoda	Coralliophilidae																								
Gastropoda	Cypraeidae												1												
Gastropoda	Cystiscidae	1									2	2	2	2											
Gastropoda	Eulimidae																1	2							
Gastropoda	Epitoniidae															1									
Gastropoda	Haloceratidae									2											2				
Gastropoda	Holocerathidae										1			1											
Gastropoda	Marginellidae												2	1	1	4									
Gastropoda	Mitridae															1									
Gastropoda	Muricidae																								
Gastropoda	Nassariidae	6		1					1		2		1		1						1	1			
Gastropoda	Naticidae	4													1	4		3							
Gastropoda	Nudibranchia																								
Gastropoda	Olividae																								

		G1/25	G2/25	G3/25	G4/25	G5/25	G6/25	G7/25	G8/25	G9/25	G1/50	G2/50	G3/50	G4/50	G5/50	G6/50	G7/50	G8/50	G9/50	G1/100	G2/100	G3/100	G4/100	G5/100	G6/100
Gastropoda	Patellacea																								
Gastropoda	Patellidae							2																	
Gastropoda	Phasianellidae			1																					
Gastropoda	Pickworthiidae	1																							
Gastropoda	Pyramidellidae	4						4			4	1	1												
Gastropoda	Ringiculidae			1												1									
Gastropoda	Rissoidae							22		3															
Gastropoda	Rissoinidae																								
Gastropoda	Skeneidae	1											1												
Gastropoda	Terebridae			1													2								
Gastropoda	Triphoridae							1																	
Gastropoda	Trochidae							11		3															
Gastropoda	Turbinidae							2			1				1										
Gastropoda	Turridae				1											1	1								
Gastropoda	Turritellidae							1										1							
Gastropoda	Vanikoridae																								
Gastropoda	Volvatellidae						1																		
Gastropoda	Ophistobranchia		1					1	1								1								
Gastropoda	Gastropoda	1			1		38							6	1			5	2			1			
Polyplacophora	Polyplacophora							4		1															
Scaphopoda	Scaphopoda																2								
Nematoda	Nematoda	9		25	10	40	20	9	9	78	21	18	16	25	44	77		13		34	42	12	60	46	19
Nemertea	Nemertea	15	6	11		4	7	4	9	4	6	4	4	5	6	9	1	11	7	3	8	6	1	2	3
Turbellaria	Turbelaria			2			1																		
Porifera	Porifera					1		1																	
Sipuncula	Sipuncula	10	5	26	7	7	5	20	7	3	21	7	5	15	7	6		3		19	29	9	20	20	17
Vermes	Vermes			4			22	14			2		2	1				3	1		2			2	

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500
Annelida	Annelida																		
Hirudinea	Hirudinea																		
Polychaeta	Acoetidae																		
Polychaeta	Acrocirridae																		
Polychaeta	Ampharetidae	4		11	13	16	16	6	11	11	36	12	11	1		2	3	7	
Polychaeta	Amphinomidae			2	1	1			1										
Polychaeta	Aphroditidae	3		1															
Polychaeta	Arenicolidae																		
Polychaeta	Capitellidae			3	8	18	15	5	10	14	7	3	1	2	8	2	2	1	2
Polychaeta	Chrysopetalidae			2	1	3													
Polychaeta	Cirratulidae	14	32	10	11	9	12	5	26	7	9	45	2	14	3		1	9	5
Polychaeta	Cossuridae		4		2	5		6	6	2	2	6		5		1	5	1	1
Polychaeta	Dorvilleidae	1							2		1								
Polychaeta	Drilomorpha																		1
Polychaeta	Eunicidae	17		2	3	2	4	1		2			2				1	1	
Polychaeta	Euphrosinidae	1				1												1	
Polychaeta	Fauveliopsidae													7	1			6	
Polychaeta	Flabelligeridae	1																	
Polychaeta	Glyceridae	3	1	2	4	11	5	4	17	3	1	2	2	5	3	3	7	5	2
Polychaeta	Goniadidae																		
Polychaeta	Hesionidae																		
Polychaeta	Lacydonidae																		
Polychaeta	Lumbrineridae	4	4	16	2	5	4	1	4	5	12	2		1	3	3			
Polychaeta	Magelonidae				3	3	4	12	8	1	1	1	5	12	6	6	7	19	14
Polychaeta	Maldanidae	7		3		3	5		1	3	9	12	4	17	14	14	12	7	5
Polychaeta	Nephtyidae	8	7	18	5	3		3	1	1	1		2	1		3		3	1
Polychaeta	Nereidae	3		1						1	18	17	6						
Polychaeta	Oenonidae			1			1		1			1							
Polychaeta	Onuphidae	35	3	69	3	14	14	1	3	3	17	10	1	2	1	2	6	1	1

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Annelida	Annelida																					
Hirudinea	Hirudinea																					
Polychaeta	Acoetidae																					
Polychaeta	Acrocirridae																					
Polychaeta	Ampharetidae	4		11	13	16	16	6	11	11	36	12	11	1		2	3	7			2	
Polychaeta	Amphinomidae			2	1	1			1													
Polychaeta	Aphroditidae	3		1																		
Polychaeta	Arenicolidae																					
Polychaeta	Capitellidae			3	8	18	15	5	10	14	7	3	1	2	8	2	2	1	2	1	2	
Polychaeta	Chrysopetalidae			2	1	3																
Polychaeta	Cirratulidae	14	32	10	11	9	12	5	26	7	9	45	2	14	3		1	9	5		15	3
Polychaeta	Cossuridae		4		2	5		6	6	2	2	6		5		1	5	1	1		3	
Polychaeta	Dorvilleidae	1							2		1											
Polychaeta	Drilomorpha																		1			
Polychaeta	Eunicidae	17		2	3	2	4	1		2			2				1	1				
Polychaeta	Euphrosinidae	1				1												1			2	
Polychaeta	Fauveliopsidae													7	1			6				
Polychaeta	Flabelligeridae	1																				
Polychaeta	Glyceridae	3	1	2	4	11	5	4	17	3	1	2	2	5	3	3	7	5	2		4	1
Polychaeta	Goniadidae																					
Polychaeta	Hesionidae																					
Polychaeta	Lacydonidae																					
Polychaeta	Lumbrineridae	4	4	16	2	5	4	1	4	5	12	2		1	3	3				2	6	4
Polychaeta	Magelonidae				3	3	4	12	8	1	1	1	5	12	6	6	7	19	14	1	1	3
Polychaeta	Maldanidae	7		3		3	5		1	3	9	12	4	17	14	14	12	7	5	23	19	6
Polychaeta	Nephtyidae	8	7	18	5	3		3	1	1	1		2	1		3		3	1		3	3
Polychaeta	Nereidae	3		1						1	18	17	6								3	
Polychaeta	Oenonidae			1			1		1			1										
Polychaeta	Onuphidae	35	3	69	3	14	14	1	3	3	17	10	1	2	1	2	6	1	1	1		

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Polychaeta	Opheliidae			1	1	1	2			3				15	6	3		2	2		2	
Polychaeta	Orbiniidae				1					1				1				1	1			1
Polychaeta	Oweniidae	1		1		3	3				4	4	2	3	1	1	4		2	1		
Polychaeta	Paralacydonidae																					
Polychaeta	Paraonidae	8	12	11	25	14	27	16	23	12	100	38	6	29	12	15	9	26	18		14	2
Polychaeta	Pectinaridae																					
Polychaeta	Pholoidae																					1
Polychaeta	Phyllodocidae	5			1	4	15	10		2	2	1		1								
Polychaeta	Pilargidae				6	4	5	4			12	19	2	49	3	14	3	12	11	1	5	7
Polychaeta	Pisionidae																					
Polychaeta	Poecilochaetidae			1								1									1	
Polychaeta	Polynoidae	2	18	7	1	1		1		5	10	8	1	1	5		1	12	1		2	1
Polychaeta	Sabellidae			1		4	3		2			1								1	1	
Polychaeta	Sabellaridae																					
Polychaeta	Scalibregmatidae										1											
Polychaeta	Serpulidae																					
Polychaeta	Sphaerodoridae																					
Polychaeta	Spionidae	23	10	18	27	19	8	16	19	31	51	73	1	27	14	27	126	9	8	1	11	1
Polychaeta	Sternaspidae		1								1	2									1	
Polychaeta	Syllidae	3	4	7	2		6	2			6	1		2	4	5		7	2			
Polychaeta	Terebellidae	2	1	2			1			2		2										
Polychaeta	Terebellomorpha									1												1
Polychaeta	Trichobranchidae					2						2			1	1		1				
Polychaeta	Trochochetidae										1	3										1
Polychaeta	Polychaeta gen. sp. 1														1							
Polychaeta	Polychaeta gen. sp. 2																					
Polychaeta	Polychaeta gen. sp. 3																					

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Polychaeta	Polychaeta gen. sp. 4																					
Polychaeta	Polychaeta gen. sp. 5																					
Polychaeta	Polychaeta gen. sp. 6																					
Polychaeta	Polychaeta gen. sp. 7																					
Polychaeta	Polychaeta gen. sp. 8																					
Polychaeta	Polychaeta	3	11	3	3	2	3	8	9	5	12	10	1	10	7	1	6	9	12	4	5	1
Pycnogonida	Arhropoda																					
	Pycnogonida																1					
Acari	Acari							1														
Amphipoda	Ampeliscidae	6	2	17	13	8	6	9	4	28	3	7	1	1		2		5			1	1
Amphipoda	Amphilochidae																					
Amphipoda	Atylidae					2																
Amphipoda	Caprellidae					12		2														
Amphipoda	Cyproideidae																					
Amphipoda	Dexaminidae																					
Amphipoda	Dogielinotidae																					
Amphipoda	Epimeriidae																					
Amphipoda	Eusiridae			2																		
Amphipoda	Iphimediidae																					
Amphipoda	Leucothoidae				1							1										
Amphipoda	Liljeborgiidae													1								
Amphipoda	Lysianassidae	2		8			1		1												1	
Amphipoda	Melitidae						8	5						8	5	1				1		
Amphipoda	Melphidippidae																					
Amphipoda	Oedicerotidae	1		1	3	1		5	2	5				1	5	2			1		1	
Amphipoda	Stenothoidae																					
Amphipoda	Synopiidae																					
Amphipoda	Phoxocephalidae			3			1			1		1		4	2	3				1	13	

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Amphipoda	Urothoidae																					
Amphipoda	Corophioidea	3		8	1	5	5	1						1			1				1	
Amphipoda	Hyperiidea		1															1				
Amphipoda	Amphipoda indet.	1	1			1	1	1				1	1	1	1		1		2	1	4	2
Anomura	Anomura						1			2					1			1				
Astacidea	Astacidea			1				2									1					
Brachyura	Brachyura	12		2	8	7	1	1	1		2	1		1				1	1	1		
Calanoida	Calanoida	1	1	5	7	4	1	9	4	5	9	7	1	23	8	3	1	27	5		10	
Caridea	Caridea	7	1	1	1	2			1	2	4	4					5		4		1	
Cirripedia	Cirripedia	1																				
Copepoda	Copepoda																		1			
Cumacea	Cumacea gen. sp. 1																					
Cumacea	Cumacea gen. sp. 2																					
Cumacea	Cumacea gen. sp. 3			2																		
Cumacea	Cumacea gen. sp. 4																					
Cumacea	Cumacea gen. sp. 5																					
Cumacea	Cumacea gen. sp. 6																					
Cumacea	Cumacea gen. sp. 7																					
Cumacea	Cumacea gen. sp. 8																					
Cumacea	Cumacea gen. sp. 9																					
Cumacea	Cumacea gen. sp. 10																					
Cumacea	Cumacea gen. sp. 11					1																
Cumacea	Cumacea gen. sp. 12																					
Cumacea	Cumacea gen. sp. 13																					
Cumacea	Cumacea gen. sp. 14							2														
Cumacea	Cumacea gen. sp. 15																					
Cumacea	Cumacea gen. sp. 16																					
Cumacea	Cumacea gen. sp. 17																					

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Cumacea	Cumacea gen. sp. 18																					
Cumacea	Cumacea gen. sp. 19																					
Cumacea	Cumacea gen. sp. 20																					
Cumacea	Cumacea gen. sp. 21																					
Cumacea	Cumacea gen. sp. 22																					
Cumacea	Cumacea gen. sp. 23			1																		
Cumacea	Cumacea gen. sp. 24																					
Cumacea	Cumacea gen. sp. 25																					
Cumacea	Cumacea gen. sp. 26																					
Cumacea	Cumacea gen. sp. 27	1		1	3																	
Cumacea	Cumacea gen. sp. 28																					
Cumacea	Cumacea gen. sp. 29																					
Cumacea	Cumacea gen. sp. 30																					
Cumacea	Cumacea gen. sp. 31																					
Cumacea	Cumacea gen. sp. 32																					
Cumacea	Cumacea gen. sp. 33					2	1	2	2	3												
Cumacea	Cumacea gen. sp. 34				2				4										1			
Cumacea	Cumacea gen. sp. 35	4		4																		
Cumacea	Cumacea gen. sp. 36										2			1		1						1
Cumacea	Cumacea gen. sp. 37																					
Cumacea	Cumacea gen. sp. 38																					
Cumacea	Cumacea gen. sp. 39																					
Cumacea	Cumacea gen. sp. 40																					
Cumacea	Cumacea gen. sp. 41																					
Cumacea	Cumacea gen. sp. 42																					
Cumacea	Cumacea gen. sp. 43																					
Cumacea	Cumacea gen. sp. 44						2				2											
Cumacea	Cumacea gen. sp. 45					1		3	2													

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250
Cumacea	Cumacea gen. sp. 46							1					
Cumacea	Cumacea gen. sp. 47				2			1		1			
Cumacea	Cumacea gen. sp. 48									1			
Cumacea	Cumacea gen. sp. 49												
Cumacea	Cumacea gen. sp. 50					2	1						
Cumacea	Cumacea gen. sp. 51						1	1					
Cumacea	Cumacea gen. sp. 52							1					
Cumacea	Cumacea gen. sp. 53												
Cumacea	Cumacea gen. sp. 54												
Cumacea	Cumacea gen. sp. 55												
Cumacea	Cumacea gen. sp. 56												
Cumacea	Cumacea gen. sp. 57												
Cumacea	Cumacea gen. sp. 58												
Cumacea	Cumacea gen. sp. 59								1				
Cumacea	Cumacea gen. sp. 60												
Cumacea	Cumacea gen. sp. 61												
Cumacea	Cumacea gen. sp. 62												
Cumacea	Cumacea gen. sp. 63												
Cumacea	Cumacea gen. sp. 64												
Cumacea	Cumacea gen. sp. 65												
Cumacea	Cumacea gen. sp. 66												
Cumacea	Cumacea gen. sp. 67												
Cumacea	Cumacea gen. sp. 68												
Cumacea	Cumacea gen. sp. 69												
Cumacea	Cumacea gen. sp. 70												
Cumacea	Cumacea gen. sp. 71												
Cumacea	Cumacea gen. sp. 72												
Cumacea	Cumacea gen. sp. 73												
Cumacea	Cumacea gen. sp. 74												
Cumacea	Cumacea gen. sp. 75												
Cumacea	Cumacea gen. sp. 76												
Cumacea	Cumacea gen. sp. 77												
Cumacea	Cumacea gen. sp. 78												

		G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Cumacea	Cumacea gen. sp. 46									
Cumacea	Cumacea gen. sp. 47									
Cumacea	Cumacea gen. sp. 48									
Cumacea	Cumacea gen. sp. 49									
Cumacea	Cumacea gen. sp. 50									
Cumacea	Cumacea gen. sp. 51									
Cumacea	Cumacea gen. sp. 52									
Cumacea	Cumacea gen. sp. 53								3	
Cumacea	Cumacea gen. sp. 54									
Cumacea	Cumacea gen. sp. 55									
Cumacea	Cumacea gen. sp. 56	5	1			1				
Cumacea	Cumacea gen. sp. 57		1							
Cumacea	Cumacea gen. sp. 58			1				1		
Cumacea	Cumacea gen. sp. 59									
Cumacea	Cumacea gen. sp. 60									
Cumacea	Cumacea gen. sp. 61	2					2		8	
Cumacea	Cumacea gen. sp. 62									
Cumacea	Cumacea gen. sp. 63					4	1			
Cumacea	Cumacea gen. sp. 64									
Cumacea	Cumacea gen. sp. 65									
Cumacea	Cumacea gen. sp. 66									
Cumacea	Cumacea gen. sp. 67									
Cumacea	Cumacea gen. sp. 68									
Cumacea	Cumacea gen. sp. 69									
Cumacea	Cumacea gen. sp. 70									
Cumacea	Cumacea gen. sp. 71									
Cumacea	Cumacea gen. sp. 72									
Cumacea	Cumacea gen. sp. 73									
Cumacea	Cumacea gen. sp. 74									
Cumacea	Cumacea gen. sp. 75									
Cumacea	Cumacea gen. sp. 76									
Cumacea	Cumacea gen. sp. 77									
Cumacea	Cumacea gen. sp. 78									

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Cumacea	Cumacea gen. sp. 79																					
Cumacea	Cumacea gen. sp. 80																					
Cumacea	Cumacea gen. sp. 81															1	2					
Cumacea	Cumacea gen. sp. 82																					
Cumacea	Cumacea gen. sp. 83																					
Cumacea	Cumacea gen. sp. 84																			1		
Cumacea	Cumacea gen. sp. 85																					
Cumacea	Cumacea				1	1			3	9	1			1						1		
Cyclopoida	Cyclopoida	1				2				3	1	2					3		1			
Decapoda	Alpheidae	7										1										
Decapoda	Atelecyclidae																					
Decapoda	Axiidae																					
Decapoda	Calappidae																					
Decapoda	Callianssidae							3									2					
Decapoda	Caridea		1	1					1		2	1										
Decapoda	Crangonidea									2									2			
Decapoda	Cyclodrippidae																	1				
Decapoda	Dendrobranchiata											2							2			
Decapoda	Diogenidae																					
Decapoda	Galatheidae													2								
Decapoda	Goneplacidae								1										1			
Decapoda	Grapsidae																					
Decapoda	Paguroidea									2					1	1		1				
Decapoda	Hexapodidae																					
Decapoda	Homolodromiidae																					
Decapoda	Latreilliidae																					
Decapoda	Leucosiidae	5			8	5		1											1			
Decapoda	Luciferidae																					
Decapoda	Majidae	2		1							1											
Decapoda	Matutidae																					
Decapoda	Mysidacea																					
Decapoda	Ocypodidae																					
Decapoda	Ogyrididae																					
Decapoda	Paguridae																					
Decapoda	Palaemonoidea																					
Decapoda	Parthenopidae																					
Decapoda	Pasiphaeidae																					

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Decapoda	Pilumnidae	8	1	2							1	1										
Decapoda	Porcellanidae																					
Decapoda	Portunidae																					
Decapoda	Processidae				1	1																
Decapoda	Raninidae																					
Decapoda	Sergestidae		1														8					
Decapoda	Solenoceridae																					
Decapoda	Strahlaxiidae																					
Decapoda	Thalassinidea			1							3											
Decapoda	Upogebiidae	1																				
Decapoda	Xanthidae																					
Decapoda	Decapoda n. det.			1			2	1			1											
Euphasiacea	Euphausiacea									2												
Harpacticoida	Harpacticoida							1						12	25	2	1	6	4		3	
Isopoda	Aegidae																					
Isopoda	Antheluridae																					
Isopoda	Anthuridae	1		6													1			1		
Isopoda	Arcturidae			3																		
Isopoda	Bopyridae																					
Isopoda	Cirolanidae																			2	1	
Isopoda	Desmosomatidae													1	11	8		3	5	2	3	
Isopoda	Expanthuridae																					1
Isopoda	Gnathidae			2						4			1							3	1	
Isopoda	Haplooniscidae																					
Isopoda	Holidoteidae																					
Isopoda	Idoteidae																					
Isopoda	Ischnomesidae																					
Isopoda	Janiridae																					
Isopoda	Joeropsididae																					
Isopoda	Leptanthuridae																					
Isopoda	Macrostylidae																				1	
Isopoda	Munnidae																					
Isopoda	Munnopsidae														1			6	1		1	
Isopoda	Nannoniscidae																					
Isopoda	Paramunnidae																					
Isopoda	Paranthuridae																					
Isopoda	Pleurogonidae																					

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Isopoda	Rectarcturidae																					
Isopoda	Sphaeromatidae																					
Isopoda	Thambametidae																					
Isopoda	Isopoda		1				2										1		1			
Mysida	Mysida																	1				
Nebalicea	Nebaliacea																					
Ostracoda	Ostracoda	2			6		1	2	2	1	2			1	1						2	1
Stomatopoda	Stomatopoda																					
Tanaidacea	Agathotanaidae														8	1		2	5		2	
Tanaidacea	Akanthophoreidae											1		1		2	5	4			1	
Tanaidacea	Anarthruridae										1				2	1			1			
Tanaidacea	Apseudidae																			1	2	
Tanaidacea	Colletteidae													3	1	1			1	1	4	
Tanaidacea	Heterotanaididae																					
Tanaidacea	Insociabilitanais										1										1	
Tanaidacea	Kalliapseudidae																					
Tanaidacea	Leptochelidae						1	2														
Tanaidacea	Leptognathiidae														2						1	
Tanaidacea	Metapseudidae			1																		
Tanaidacea	Tanaidacea gen. nov																					
Tanaidacea	Nototanaidae																					
Tanaidacea	Parafilitanais																		1			
Tanaidacea	Paranarthrurella																					
Tanaidacea	Parapseudidae																					
Tanaidacea	Paratanaidae																					
Tanaidacea	Pseudotanaidae					3					1				11	2	1	3	2	1	7	
Tanaidacea	Tanaellidae										1									1		
Tanaidacea	Tanaissuidae																					
Tanaidacea	Tanaopsidae																					
Tanaidacea	Typhlotanaidae					7	1	2			1			1	11				1		2	
Tanaidacea	Tanaidacea																		2	1		
Tanaidacea	Tanaidacea (males)										1										1	
Crustacea	Crustacea		1																			
Bryozoa	Bryozoa																					
Brachiopoda	Brachiopoda																					
	Echinodermata																					

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Asteroidea	Asteroidea																					
Echinodermata	Echinodermata																					
Echinoidea	Echinoidea																					
Echinoidea	Cidaridae																					
Echinoidea	Echinometridae																					
Echinoidea	Fibulariidae																					
Echinoidea	Parechinidae																					
Echinoidea	Rotulidae																					
Echinoidea	Schizasteridae																					
Echinoidea	Spatangidae																					
Holothuroidea	Cucumariidae																					
Holothuroidea	Sclerodactylidae	2																				
Holothuroidea	Synaptidae																				1	
Ophiuroidea	Ophiuroidea	1					1			1			1					1			1	
Ophiuroidea	*Amphilepis ingolfiana Mortensen, 1933*											1	1									
Ophiuroidea	*Amphilimna olivacea (Lyman, 1869)*																					
Ophiuroidea	*Amphioplus (Amphioplus) aciculatus Mortensen, 1936*																					
Ophiuroidea	*Amphioplus archeri A.M. Clark, 1955*																					
Ophiuroidea	*Amphioplus aurensis A.M. Clark, 1955*																					
Ophiuroidea	*Amphioplus congensis (Studer, 1882)*																					
Ophiuroidea	*Amphioplus occidentalis Koehler, 1914*																					
Ophiuroidea	*Amphioplus sp. juv.*																					
Ophiuroidea	*Amphipholis bananensis Koehler, 1911*																					
Ophiuroidea	*Amphipholis nudipora Koehler, 1914*	1																				
Ophiuroidea	*Amphipholis squamata (Delle Chiaje, 1828)*																					

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Ophiuroidea	*Amphiura atlantica Ljungman, 1867*				7	1		2														
Ophiuroidea	*Amphiura atlantidea Madsen, 1970*										4	1	1								6	
Ophiuroidea	*Amphiura chiajei Forbes, 1843*																			2		2
Ophiuroidea	*Amphiura filiformis (O.F.Műller, 1776)*		1			1																
Ophiuroidea	*Amphiura incana Lyman, 1879*																					
Ophiuroidea	*Amphiura senegalensis Madsen, 1970*																					
Ophiuroidea	*Amphiura sp.*	1																				
Ophiuroidea	*Amphiura ungulata Madsen, 1970*																					
Ophiuroidea	*Ophionephthys lowelli A.M.Clark, 1974*																					
Ophiuroidea	*Ophiophragmus acutispina (Koehler, 1914)*	1	1					1			6		4									
Ophiuroidea	*Ophiophragmus sp.1*																					
Ophiuroidea	*Ophiostigma abnorme (Lyman, 1878)*																					
Ophiuroidea	*Ophiactis lymani Ljungman, 1872*																					
Ophiuroidea	*Ophiactis luetkeni Marktanner-Turneretscher, 1887*																					
Ophiuroidea	*Ophiactis savignyi (Műller, Troschel, 1842)*																					
Ophiuroidea	*Ophiactis sp.*																			1		
Ophiuroidea	*Ophiocoma pumila Lutken 1859*									1												
Ophiuroidea	*Ophiopsila guineensis Koehler, 1914*																					
Ophiuroidea	*Ophioderma longicauda (Bruzelius, 1805)*																					

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Ophiuroidea	*Ophiolepis paucispina (Say, 1825)*																					
Ophiuroidea	*Ophiopteron atlanticum Koehler, 1914*																					
Ophiuroidea	*Ophiothrix congensis Koehler, 1911*					1																
Ophiuroidea	*Ophiothrix nociva Koehler, 1907*																					
Ophiuroidea	*Ophiohtrix sp.*																					
Ophiuroidea	*Ophiura (Dictenophiura) carnea skoogi (Koehler, 1923)*																					
Ophiuroidea	*Ophiura grubei Heller, 1863*							2														
Echiura	Echiura																1		3	1		
	Cnidaria																					
Actiniaria	Actiniaria	7	1	2						2			1				91					
Hydrozoa	Hydrozoa														1							
Octocorallia	Octocorallia																					
	Mollusca																					
Aplacophora	Aplacophora						1				1	7		7	10	4		5	1		5	
Bivalvia	Arcidae				2	4		2														
Bivalvia	Astratidae								1													
Bivalvia	Cardiidae	1		1	9			2														
Bivalvia	Carditidae	1				2																
Bivalvia	Crassatellidae																					
Bivalvia	Corbulidae			8		1																
Bivalvia	Cuspidarridae	1				1		3														
Bivalvia	Donacidae			5			1						2									
Bivalvia	Dreissenidae																					
Bivalvia	Kelliellidae	3						2				6		3	12		6	2	2	1	17	
Bivalvia	Lucinidae					1																
Bivalvia	Limidae					1					1											
Bivalvia	Mactridae					1																
Bivalvia	Myidae																					
Bivalvia	Mytilidae			1				1									1					
Bivalvia	Nuculanidae	80	1	95	75	14	1	2	1	5			24	27	12	3		1	5	7	98	1

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Bivalvia	Nuculidae	1		3							2	3		2				1	1	3	5	1
Bivalvia	Pectinidae																					
Bivalvia	Pharidae																					
Bivalvia	Semelidae	3		2	2	2	1			2		2	6	1	1	4		1	3			
Bivalvia	Solemyidae																					
Bivalvia	Spondylidae																					
Bivalvia	Tellinidae	1			1																	
Bivalvia	Thraciidae																					
Bivalvia	Veneridae	1		12	31	12	3	3	1	2	5		2	1				1			11	
Bivalvia	Bivalvia											1			2		2	1			1	
Cephalopoda	Cephalopoda																					
Gastropoda	Acmaeidae																					
Gastropoda	Anabathridae										1											
Gastropoda	Aporrhaidae																					
Gastropoda	Architectonidae																					
Gastropoda	Buccinidae																					
Gastropoda	Caecidae																					1
Gastropoda	Calypraeidae																					
Gastropoda	Cancellaridae																					
Gastropoda	Cassidae																					
Gastropoda	Cerithidae	1				1															4	
Gastropoda	Cerithiopsidae																					
Gastropoda	Columbellidae													1								
Gastropoda	Coralliophilidae									1												
Gastropoda	Cypraeidae																					
Gastropoda	Cystiscidae						1															
Gastropoda	Eulimidae			2									2					1				
Gastropoda	Epitoniidae																					
Gastropoda	Haloceratidae			1																		
Gastropoda	Holocerathidae																					
Gastropoda	Marginellidae																					
Gastropoda	Mitridae																					
Gastropoda	Muricidae																					
Gastropoda	Nassariidae														4						1	
Gastropoda	Naticidae		1																			
Gastropoda	Nudibranchia																					
Gastropoda	Olividae																					

		G7/100	G8/100	G9/100	G1/250	G2/250	G3/250	G4/250	G5/250	G6/250	G7/250	G8/250	G9/250	G1/500	G2/500	G3/500	G4/500	G5/500	G6/500	G7/500	G8/500	G9/500
Gastropoda	Patellacea																					
Gastropoda	Patellidae																					
Gastropoda	Phasianellidae																					
Gastropoda	Pickworthiidae																					
Gastropoda	Pyramidellidae			1				1		2						1		2		1		
Gastropoda	Ringiculidae									1						1						
Gastropoda	Rissoidae																		1			
Gastropoda	Rissoinidae																					
Gastropoda	Skeneidae																					
Gastropoda	Terebridae																		1			
Gastropoda	Triphoridae																					
Gastropoda	Trochidae																	2				
Gastropoda	Turbinidae									1												
Gastropoda	Turridae													1								1
Gastropoda	Turritellidae																					
Gastropoda	Vanikoridae																					
Gastropoda	Volvatellidae																					
Gastropoda	Ophistobranchia										1											
Gastropoda	Gastropoda		1	1						1		1		1				1	1			
Polyplacophora	Polyplacophora																					
Scaphopoda	Scaphopoda	2	9	4																		
Nematoda	Nematoda	2	4	14		14	12	13	4	3	83	1		76	19	78	181	21	33	1	1	
Nemertea	Nemertea	4	10	3		1	3	1	3	4	4	6		5				4	2		2	
Turbellaria	Turbelaria																					
Porifera	Porifera																					
Sipuncula	Sipuncula	16		15	39	52	10	11	99	23	23	1	11	23	31	45		73	23	4	2	
Vermes	Vermes	1	1	3		4					3			1		1		5	1			4

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000

Annelida	Annelida													
Hirudinea	Hirudinea													
Polychaeta	Acoetidae													
Polychaeta	Acrocirridae													
Polychaeta	Ampharetidae	1			1								1	
Polychaeta	Amphinomidae						2					1		
Polychaeta	Aphroditidae													
Polychaeta	Arenicolidae													
Polychaeta	Capitellidae	2			1		2	2		5	2		2	2
Polychaeta	Chrysopetalidae													
Polychaeta	Cirratulidae	13	5		15		85	5	2	17	54	10	23	
Polychaeta	Cossuridae	1	1		4		1	1		1	2			
Polychaeta	Dorvilleidae	2					2							
Polychaeta	Drilomorpha													
Polychaeta	Eunicidae													
Polychaeta	Euphrosinidae										1			
Polychaeta	Fauveliopsidae	6	3		9		4	23	1	3	1	1		
Polychaeta	Flabelligeridae		3		2		3			1		1	1	
Polychaeta	Glyceridae	7	1		5		8	4	5	2	1	1	3	
Polychaeta	Goniadidae				1									
Polychaeta	Hesionidae													
Polychaeta	Lacydonidae													
Polychaeta	Lumbrineridae	1	1		4		6	1	1		4		1	2
Polychaeta	Magelonidae												2	
Polychaeta	Maldanidae	2	2		5			2	6	2	22	5	7	
Polychaeta	Nephtyidae	13	7	1	5		4	1	1	1	3	1	3	
Polychaeta	Nereidae										1		3	
Polychaeta	Oenonidae													
Polychaeta	Onuphidae	1							1	1				1

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Polychaeta	Opheliidae	16	3		6		6	11	1			6	1	1
Polychaeta	Orbiniidae										1			
Polychaeta	Oweniidae	2			4					1			2	
Polychaeta	Paralacydonidae													
Polychaeta	Paraonidae	25	8	3	15	3	10	20	10	17	42	3	13	1
Polychaeta	Pectinaridae													
Polychaeta	Pholoidae													
Polychaeta	Phyllodocidae									1				
Polychaeta	Pilargidae	2	5		4		13		1	3	5	7	7	
Polychaeta	Pisionidae													
Polychaeta	Poecilochaetidae													
Polychaeta	Polynoidae	1			9		16	1			1			
Polychaeta	Sabellidae	1			2						1			
Polychaeta	Sabellaridae													
Polychaeta	Scalibregmatidae													
Polychaeta	Serpulidae				1									
Polychaeta	Sphaerodoridae	1									1			
Polychaeta	Spionidae	7			8		8	8	11	3	21	8	25	1
Polychaeta	Sternaspidae				3									
Polychaeta	Syllidae		2		3		3	2	4		5	2		
Polychaeta	Terebellidae				3		1							
Polychaeta	Terebellomorpha													
Polychaeta	Trichobranchidae	1			1								1	
Polychaeta	Trochochetidae													
Polychaeta	Polychaeta gen. sp. 1													
Polychaeta	Polychaeta gen. sp. 2													
Polychaeta	Polychaeta gen. sp. 3													

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Polychaeta	Polychaeta gen. sp. 4													
Polychaeta	Polychaeta gen. sp. 5													
Polychaeta	Polychaeta gen. sp. 6													
Polychaeta	Polychaeta gen. sp. 7							1						
Polychaeta	Polychaeta gen. sp. 8													
Polychaeta	Polychaeta	5	6	2	14		6	4	5	6	18	1	10	1
Pycnogonida	Arhropoda													
	Pycnogonida													
Acari	Acari													
Amphipoda	Ampeliscidae	5						5	1		5			
Amphipoda	Amphilochidae													
Amphipoda	Atylidae													
Amphipoda	Caprellidae													
Amphipoda	Cyproideidae													
Amphipoda	Dexaminidae													
Amphipoda	Dogielinotidae													
Amphipoda	Epimeriidae													
Amphipoda	Eusiridae													
Amphipoda	Iphimediidae				2									
Amphipoda	Leucothoidae													
Amphipoda	Liljeborgiidae													
Amphipoda	Lysianassidae							1			1		1	
Amphipoda	Melitidae						1			1				
Amphipoda	Melphidippidae													
Amphipoda	Oedicerotidae				3			1			2			
Amphipoda	Stenothoidae													
Amphipoda	Synopiidae										1			
Amphipoda	Phoxocephalidae	20	4	1	3		1	6	9	2	9	2	1	

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Amphipoda	Urothoidae				2									
Amphipoda	Corophioidea		1				1		1	1	1			1
Amphipoda	Hyperiidea													
Amphipoda	Amphipoda indet.	5		1	3			3	2	2	2		1	
Anomura	Anomura													
Astacidea	Astacidea													1
Brachyura	Brachyura													
Calanoida	Calanoida	19		1	12	1	25	25	14	1	16			
Caridea	Caridea							1	2					
Cirripedia	Cirripedia						1						1	
Copepoda	Copepoda		1		1									
Cumacea	Cumacea gen. sp. 1													
Cumacea	Cumacea gen. sp. 2													
Cumacea	Cumacea gen. sp. 3													
Cumacea	Cumacea gen. sp. 4													
Cumacea	Cumacea gen. sp. 5													
Cumacea	Cumacea gen. sp. 6													
Cumacea	Cumacea gen. sp. 7													
Cumacea	Cumacea gen. sp. 8													
Cumacea	Cumacea gen. sp. 9													
Cumacea	Cumacea gen. sp. 10													
Cumacea	Cumacea gen. sp. 11													
Cumacea	Cumacea gen. sp. 12													
Cumacea	Cumacea gen. sp. 13													
Cumacea	Cumacea gen. sp. 14													
Cumacea	Cumacea gen. sp. 15													
Cumacea	Cumacea gen. sp. 16													
Cumacea	Cumacea gen. sp. 17													

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Cumacea	Cumacea gen. sp. 18													
Cumacea	Cumacea gen. sp. 19													
Cumacea	Cumacea gen. sp. 20													
Cumacea	Cumacea gen. sp. 21													
Cumacea	Cumacea gen. sp. 22													
Cumacea	Cumacea gen. sp. 23													
Cumacea	Cumacea gen. sp. 24													
Cumacea	Cumacea gen. sp. 25													
Cumacea	Cumacea gen. sp. 26													
Cumacea	Cumacea gen. sp. 27													
Cumacea	Cumacea gen. sp. 28													
Cumacea	Cumacea gen. sp. 29													
Cumacea	Cumacea gen. sp. 30													
Cumacea	Cumacea gen. sp. 31													
Cumacea	Cumacea gen. sp. 32													
Cumacea	Cumacea gen. sp. 33													
Cumacea	Cumacea gen. sp. 34													
Cumacea	Cumacea gen. sp. 35													
Cumacea	Cumacea gen. sp. 36													
Cumacea	Cumacea gen. sp. 37													
Cumacea	Cumacea gen. sp. 38													
Cumacea	Cumacea gen. sp. 39													
Cumacea	Cumacea gen. sp. 40													
Cumacea	Cumacea gen. sp. 41													
Cumacea	Cumacea gen. sp. 42													
Cumacea	Cumacea gen. sp. 43													
Cumacea	Cumacea gen. sp. 44													
Cumacea	Cumacea gen. sp. 45													

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Cumacea	Cumacea gen. sp. 46													
Cumacea	Cumacea gen. sp. 47													
Cumacea	Cumacea gen. sp. 48													
Cumacea	Cumacea gen. sp. 49										1			
Cumacea	Cumacea gen. sp. 50													
Cumacea	Cumacea gen. sp. 51													
Cumacea	Cumacea gen. sp. 52													
Cumacea	Cumacea gen. sp. 53													
Cumacea	Cumacea gen. sp. 54													
Cumacea	Cumacea gen. sp. 55													
Cumacea	Cumacea gen. sp. 56													
Cumacea	Cumacea gen. sp. 57													
Cumacea	Cumacea gen. sp. 58										1			
Cumacea	Cumacea gen. sp. 59													
Cumacea	Cumacea gen. sp. 60													
Cumacea	Cumacea gen. sp. 61													
Cumacea	Cumacea gen. sp. 62													
Cumacea	Cumacea gen. sp. 63	2						1						
Cumacea	Cumacea gen. sp. 64													
Cumacea	Cumacea gen. sp. 65								1					
Cumacea	Cumacea gen. sp. 66	1							1					
Cumacea	Cumacea gen. sp. 67													
Cumacea	Cumacea gen. sp. 68	1			2						2			
Cumacea	Cumacea gen. sp. 69													
Cumacea	Cumacea gen. sp. 70	3	1		6						1			
Cumacea	Cumacea gen. sp. 71				2				1			2		2
Cumacea	Cumacea gen. sp. 72										1			
Cumacea	Cumacea gen. sp. 73											1		
Cumacea	Cumacea gen. sp. 74											1		
Cumacea	Cumacea gen. sp. 75											1		
Cumacea	Cumacea gen. sp. 76								2					
Cumacea	Cumacea gen. sp. 77	2												
Cumacea	Cumacea gen. sp. 78													

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Cumacea	Cumacea gen. sp. 79				2									
Cumacea	Cumacea gen. sp. 80				1									
Cumacea	Cumacea gen. sp. 81													
Cumacea	Cumacea gen. sp. 82							1						
Cumacea	Cumacea gen. sp. 83							2						
Cumacea	Cumacea gen. sp. 84													
Cumacea	Cumacea gen. sp. 85													
Cumacea	Cumacea	1				1	1					1		
Cyclopoida	Cyclopoida						22				1			
Decapoda	Alpheidae													
Decapoda	Atelecyclidae													
Decapoda	Axiidae													
Decapoda	Calappidae													
Decapoda	Callianssidae													
Decapoda	Caridea							1						
Decapoda	Crangonidea													
Decapoda	Cyclodrippidae													
Decapoda	Dendrobranchiata													
Decapoda	Diogenidae													
Decapoda	Galatheidae													1
Decapoda	Goneplacidae													
Decapoda	Grapsidae													
Decapoda	Paguroidea													
Decapoda	Hexapodidae													
Decapoda	Homolodromiidae													
Decapoda	Latreilliidae													
Decapoda	Leucosiidae													
Decapoda	Luciferidae													
Decapoda	Majidae													
Decapoda	Matutidae													
Decapoda	Mysidacea													
Decapoda	Ocypodidae													
Decapoda	Ogyrididae													
Decapoda	Paguridae													
Decapoda	Palaemonoidea													
Decapoda	Parthenopidae													
Decapoda	Pasiphaeidae													

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Decapoda	Pilumnidae													
Decapoda	Porcellanidae													
Decapoda	Portunidae													
Decapoda	Processidae													
Decapoda	Raninidae													
Decapoda	Sergestidae													
Decapoda	Solenoceridae													
Decapoda	Strahlaxiidae													
Decapoda	Thalassinidea													
Decapoda	Upogebiidae													
Decapoda	Xanthidae													
Decapoda	Decapoda n. det.										1			
Euphasiacea	Euphausiacea													
Harpacticoida	Harpacticoida	15			12		21	1	1		12	1		
Isopoda	Aegidae													
Isopoda	Antheluridae				1									
Isopoda	Anthuridae	3										1	2	
Isopoda	Arcturidae													
Isopoda	Bopyridae													
Isopoda	Cirolanidae							1						
Isopoda	Desmosomatidae	30	1		12		1	15	6	3	18	3		
Isopoda	Expanthuridae			1										
Isopoda	Gnathidae				2					3				
Isopoda	Haplooniscidae							1						
Isopoda	Holidoteidae													
Isopoda	Idoteidae													
Isopoda	Ischnomesidae										3			
Isopoda	Janiridae													
Isopoda	Joeropsididae													
Isopoda	Leptanthuridae				2		1		1		1			
Isopoda	Macrostylidae	8			2			6	5					
Isopoda	Munnidae													
Isopoda	Munnopsidae	2			2		1						1	
Isopoda	Nannoniscidae							1		2	1			
Isopoda	Paramunnidae	1							1					
Isopoda	Paranthuridae	1	1		1		1	1			1			
Isopoda	Pleurogonidae													

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Isopoda	Rectarcturidae													
Isopoda	Sphaeromatidae													
Isopoda	Thambametidae				1				2					
Isopoda	Isopoda				1		1	2			2		4	
Mysida	Mysida									1				
Nebalicea	Nebaliacea													
Ostracoda	Ostracoda	3	1		3		14	6				1		
Stomatopoda	Stomatopoda													
Tanaidacea	Agathotanaidae	2			2			3	7	1		1	9	
Tanaidacea	Akanthophoreidae	1			1			4	8		1		5	
Tanaidacea	Anarthruridae	2			4			1	4	2		3	6	
Tanaidacea	Apseudidae								12	1			1	
Tanaidacea	Colletteidae				3			1	4	1	4		7	
Tanaidacea	Heterotanaididae													
Tanaidacea	Insociabilitanais													
Tanaidacea	Kalliapseudidae													
Tanaidacea	Leptochelidae													
Tanaidacea	Leptognathiidae				4			4	3			1		
Tanaidacea	Metapseudidae													
Tanaidacea	Tanaidacea gen. nov									2				
Tanaidacea	Nototanaidae													
Tanaidacea	Parafilitanais													
Tanaidacea	Paranarthrurella									1				
Tanaidacea	Parapseudidae													
Tanaidacea	Paratanaidae													
Tanaidacea	Pseudotanaidae		1		4				4	1	2	1	4	
Tanaidacea	Tanaellidae				2									1
Tanaidacea	Tanaissuidae													
Tanaidacea	Tanaopsidae								1					
Tanaidacea	Typhlotanaidae				1			3	9		1	4		
Tanaidacea	Tanaidacea		1		2						3	1		
Tanaidacea	Tanaidacea (males)	2							1	1			1	
Crustacea	Crustacea	1											1	
Bryozoa	Bryozoa													
Brachiopoda	Brachiopoda													
	Echinodermata													

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Asteroidea	Asteroidea	1	2		2									
Echinodermata	Echinodermata				2									
Echinoidea	Echinoidea			1				1						
Echinoidea	Cidaridae													
Echinoidea	Echinometridae													
Echinoidea	Fibulariidae													
Echinoidea	Parechinidae													
Echinoidea	Rotulidae													
Echinoidea	Schizasteridae													1
Echinoidea	Spatangidae													
Holothuroidea	Cucumariidae													
Holothuroidea	Sclerodactylidae													
Holothuroidea	Synaptidae													
Ophiuroidea	Ophiuroidea							1						
Ophiuroidea	*Amphilepis ingolfiana Mortensen, 1933*													
Ophiuroidea	*Amphilimna olivacea (Lyman, 1869)*													
Ophiuroidea	*Amphioplus (Amphioplus) aciculatus Mortensen, 1936*													
Ophiuroidea	*Amphioplus archeri A.M. Clark, 1955*													
Ophiuroidea	*Amphioplus aurensis A.M. Clark, 1955*													
Ophiuroidea	*Amphioplus congensis (Studer, 1882)*													
Ophiuroidea	*Amphioplus occidentalis Koehler, 1914*													
Ophiuroidea	*Amphioplus sp. juv.*													
Ophiuroidea	*Amphipholis bananensis Koehler, 1911*													
Ophiuroidea	*Amphipholis nudipora Koehler, 1914*													
Ophiuroidea	*Amphipholis squamata (Delle Chiaje, 1828)*													

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Ophiuroidea	*Amphiura atlantica Ljungman, 1867*													
Ophiuroidea	*Amphiura atlantidea Madsen, 1970*													
Ophiuroidea	*Amphiura chiajei Forbes, 1843*													
Ophiuroidea	*Amphiura filiformis (O.F.Műller, 1776)*													
Ophiuroidea	*Amphiura incana Lyman, 1879*													
Ophiuroidea	*Amphiura senegalensis Madsen, 1970*												1	
Ophiuroidea	*Amphiura sp.*													
Ophiuroidea	*Amphiura ungulata Madsen, 1970*													
Ophiuroidea	*Ophionephthys lowelli A.M.Clark, 1974*													
Ophiuroidea	*Ophiophragmus acutispina (Koehler, 1914)*													
Ophiuroidea	*Ophiophragmus sp.1*													
Ophiuroidea	*Ophiostigma abnorme (Lyman, 1878)*													
Ophiuroidea	*Ophiactis lymani Ljungman, 1872*													
Ophiuroidea	*Ophiactis luetkeni Marktanner-Turneretscher, 1887*													
Ophiuroidea	*Ophiactis savignyi (Műller, Troschel, 1842)*													
Ophiuroidea	*Ophiactis sp.*						1							
Ophiuroidea	*Ophiocoma pumila Lutken 1859*													
Ophiuroidea	*Ophiopsila guineensis Koehler, 1914*													
Ophiuroidea	*Ophioderma longicauda (Bruzelius, 1805)*													

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Ophiuroidea	*Ophiolepis paucispina (Say, 1825)*													
Ophiuroidea	*Ophiopteron atlanticum Koehler, 1914*													
Ophiuroidea	*Ophiothrix congensis Koehler, 1911*													
Ophiuroidea	*Ophiothrix nociva Koehler, 1907*													
Ophiuroidea	*Ophiohtrix sp.*													
Ophiuroidea	*Ophiura (Dictenophiura) carnea skoogi (Koehler, 1923)*		2											
Ophiuroidea	*Ophiura grubei Heller, 1863*													
Echiura	Echiura													
	Cnidaria													
Actiniaria	Actiniaria													
Hydrozoa	Hydrozoa													
Octocorallia	Octocorallia													
	Mollusca													
Aplacophora	Aplacophora	12	1	2	8		13	4		1	3	1	15	
Bivalvia	Arcidae													
Bivalvia	Astratidae													
Bivalvia	Cardiidae													
Bivalvia	Carditidae													
Bivalvia	Crassatellidae													
Bivalvia	Corbulidae													
Bivalvia	Cuspidarridae													
Bivalvia	Donacidae													
Bivalvia	Dreissenidae													
Bivalvia	Kelliellidae	12	2		2		6	1		2	4			
Bivalvia	Lucinidae													
Bivalvia	Limidae													
Bivalvia	Mactridae													
Bivalvia	Myidae													
Bivalvia	Mytilidae								1					
Bivalvia	Nuculanidae	7	6		5		1	4	1	2	2	1	3	

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Bivalvia	Nuculidae	2		3	6		1		3				2	
Bivalvia	Pectinidae													
Bivalvia	Pharidae													
Bivalvia	Semelidae		1										1	
Bivalvia	Solemyidae													
Bivalvia	Spondylidae													
Bivalvia	Tellinidae													
Bivalvia	Thraciidae													
Bivalvia	Veneridae											1		
Bivalvia	Bivalvia			2			2							
Cephalopoda	Cephalopoda													
Gastropoda	Acmaeidae													
Gastropoda	Anabathridae													
Gastropoda	Aporrhaidae													
Gastropoda	Architectonidae													
Gastropoda	Buccinidae													
Gastropoda	Caecidae													
Gastropoda	Calypraeidae													
Gastropoda	Cancellaridae													
Gastropoda	Cassidae													
Gastropoda	Cerithidae													
Gastropoda	Cerithiopsidae													
Gastropoda	Columbellidae													
Gastropoda	Coralliophilidae													
Gastropoda	Cypraeidae													
Gastropoda	Cystiscidae													
Gastropoda	Eulimidae													
Gastropoda	Epitoniidae													
Gastropoda	Haloceratidae													
Gastropoda	Holocerathidae													
Gastropoda	Marginellidae													
Gastropoda	Mitridae													
Gastropoda	Muricidae													
Gastropoda	Nassariidae													
Gastropoda	Naticidae													
Gastropoda	Nudibranchia													
Gastropoda	Olividae													

		G1/1200	MA 2-1	MA 2-2	MA 2-3	MA 2-4	MA 2-5	G3/1200	G4/1000	G5/1000	G6/1000	G7/1000	G8/1000	G9/1000
Gastropoda	Patellacea													
Gastropoda	Patellidae													
Gastropoda	Phasianellidae													
Gastropoda	Pickworthiidae													
Gastropoda	Pyramidellidae	1							1				1	
Gastropoda	Ringiculidae													
Gastropoda	Rissoidae													
Gastropoda	Rissoinidae													
Gastropoda	Skeneidae													
Gastropoda	Terebridae													
Gastropoda	Triphoridae													
Gastropoda	Trochidae													
Gastropoda	Turbinidae	1									1			
Gastropoda	Turridae								1	1				
Gastropoda	Turritellidae													
Gastropoda	Vanikoridae													
Gastropoda	Volvatellidae													
Gastropoda	Ophistobranchia													
Gastropoda	Gastropoda									2			2	
Polyplacophora	Polyplacophora													
Scaphopoda	Scaphopoda													
Nematoda	Nematoda	37		1	14		14	42	22	4	72	1	21	
Nemertea	Nemertea	4	6		3		4	2	3	1	8	2	3	
Turbellaria	Turbelaria													
Porifera	Porifera													
Sipuncula	Sipuncula	2	5		12	2	5	11	3		1		4	
Vermes	Vermes						1		1		1		3	

Record of fishing stations

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R/V Dr. Fridtjof Nansen         SURVEY:2012407         STATION:    1
DATE  :14/11/12          GEAR TYPE: BT NO:  1  POSITION:Lat     N 4°49.83
         start     stop     duration                     Lon     W 1°43.61
TIME  :09:49:56 10:20:25  30.5 (min)          Purpose    : 1
LOG   : 7223.55  7225.16   1.6                Region     : 2600
FDEPTH:       31        30                    Gear cond.: 0
BDEPTH:       31        30                    Validity   : 0
Towing dir:   0°      Wire out    : 125  m    Speed      : 3.2 kn
Sorted    :   0       Total catch: 176.90     Catch/hour: 348.23
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SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Lepidochelys olivacea	51.18	2	14.70	
Trichiurus lepturus	46.46	480	13.34	
Drepane africana	32.38	49	9.30	
Boops boops	26.38	1102	7.57	
Pseudotolithus typus	24.02	18	6.90	
Chloroscombrus chrysurus, juvenile	23.94	4220	6.87	
Sphyraena guachancho	18.66	220	5.36	
Ilisha africana	15.51	1110	4.45	
Selene dorsalis, juvenile	14.96	1496	4.30	
Galeoides decadactylus	12.99	71	3.73	
Pomadasys jubelini	11.97	22	3.44	
Pteroscion peli	9.69	512	2.78	
Parapenaeopsis atlantica	6.30	7	1.81	
Penaeus notialis	6.10	112	1.75	
Sepia officinalis, juvenile	5.51	28	1.58	
Scomberomorus tritor	5.12	4	1.47	
Pomadasys incisus	4.33	142	1.24	
Cynoponticus ferox	3.56	4	1.02	
GRAPSIDAE	3.23	1614	0.93	
Panulirus regius	2.89	12	0.83	
Pseudotolithus typus, juvenile	2.68	47	0.77	
Stromateus fiatola	2.68	4	0.77	
Lagocephalus laevigatus	2.44	39	0.70	
Selene dorsalis	2.11	4	0.60	
Callinectes sp.	1.89	189	0.54	
Sepia officinalis	1.59	4	0.46	
Sardinella maderensis	1.10	55	0.32	
Cynoglossus canariensis	1.04	6	0.30	
Raja miraletus	1.02	2	0.29	
Dasyatis margarita	1.02	2	0.29	
Elops lacerta	0.79	2	0.23	
Pagellus bellottii	0.79	181	0.23	
Calappa rubroguttata	0.71	47	0.20	
Pisodonophis semicinctus	0.59	2	0.17	
Portunus validus	0.55	16	0.16	
Grammoplites gruveli	0.47	39	0.14	
Octopus vulgaris	0.47	8	0.14	
Maja sp.	0.24	31	0.07	
Pentanemus quinquarius	0.16	8	0.05	
Sphoeroides marmoratus	0.16	8	0.05	
Scyllarides herklotsii	0.16	47	0.05	
Dactylopterus volitans	0.16	8	0.05	
Perulibatrachus rossignoli	0.08	8	0.02	
Antennarius occidentalis	0.08	8	0.02	
Dicologoglossa hexophthalma	0.08	8	0.02	
Total	348.23		100.00	

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R/V Dr. Fridtjof Nansen        SURVEY:2012407        STATION:     2
DATE   :14/11/12            GEAR TYPE: BT NO:  1  POSITION:Lat    N 4°50.31
         start     stop     duration                         Lon    W 1°45.25
TIME   :11:12:43 11:41:07  28.4 (min)          Purpose    : 1
LOG    : 7230.92  7232.70   1.8                Region     : 2600
FDEPTH:       26        27                     Gear cond.: 0
BDEPTH:       26        27                     Validity   : 0
Towing dir:    0°     Wire out    : 120  m     Speed      : 3.8 kn
Sorted     :   0      Total catch: 242.33     Catch/hour: 511.96
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SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trichiurus lepturus	118.82	2755	23.21	
Cynoponticus ferox	67.92	32	13.27	
Lepidochelys olivacea	63.38	2	12.38	
Pteroscion peli	36.00	1893	7.03	
Chloroscombrus chrysurus	31.44	6287	6.14	
Boops boops	30.42	777	5.94	
Pseudotolithus typus	28.54	19	5.58	
Callinectes sp.	21.46	1200	4.19	
Dasyatis margarita	14.79	11	2.89	
Selene dorsalis, juvenile	13.69	1132	2.67	
Ilisha africana	12.85	913	2.51	
Sepia officinalis, juvenile	9.13	642	1.78	
Pomadasys jubelini	8.07	8	1.58	
Sphyraena guachancho	6.93	51	1.35	
Lagocephalus laevigatus	5.58	68	1.09	
Sepia officinalis	4.77	6	0.93	
Parapenaeopsis atlantica	4.73	946	0.92	
Galeoides decadactylus	4.73	17	0.92	
Sardinella maderensis	4.39	287	0.86	
Pseudotolithus typus	3.04	51	0.59	0
Portunus validus	3.04	169	0.59	
Selene dorsalis	2.87	8	0.56	
Pentanemus quinquarius	2.70	135	0.53	
Ethmalosa fimbriata	2.54	17	0.50	
Pisodonophis semicinctus	1.96	8	0.38	
Maja sp.	1.69	118	0.33	
Penaeus notialis	1.35	17	0.26	
Perulibatrachus rossignoli	1.18	51	0.23	
GRAPSIDAE	1.01	592	0.20	
Panulirus regius	0.74	4	0.14	
Pomadasys incisus	0.68	17	0.13	
Calappa rubroguttata	0.34	17	0.07	
Penaeus kerathurus	0.34	2	0.07	
Trachurus trecae	0.34	287	0.07	
Pythonichthys microphthalmus	0.19	2	0.04	
Antennarius occidentalis	0.17	17	0.03	
Alectis alexandrina	0.17	17	0.03	
Scyllarides herklotsii	0.17	17	0.03	
Total	512.18		100.04	

```
R/V Dr. Fridtjof Nansen        SURVEY:2012407          STATION:     3
DATE   :23/11/12            GEAR TYPE: BT NO:  1  POSITION:Lat    N 4°47.67
         start     stop     duration                        Lon    W 3°6.66
TIME   :00:45:08 01:20:11  35.0 (min)           Purpose    : 1
LOG    : 8014.04  8015.91   1.9                 Region     : 2600
FDEPTH:      111       110                      Gear cond.: 0
BDEPTH:      111       110                      Validity   : 0
Towing dir:    0°      Wire out    : 260  m     Speed      : 3.2 kn
Sorted     :   0       Total catch: 221.93      Catch/hour: 379.91
```

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Chelidonichthys gabonensis	78.06	685	20.55	
Pteroscion peli	62.58	671	16.47	
Citharus linguatula	40.54	1616	10.67	
Pagellus bellottii	34.78	589	9.16	
Brotula barbata	34.24	55	9.01	
Parapandalus narval	30.40	15201	8.00	
Dentex angolensis	15.89	178	4.18	
Illex coindetii	10.27	110	2.70	
MYCTOPHIDAE	9.72	2438	2.56	
Nettastoma sp.	9.72	781	2.56	
Oxynotus centrina	7.96	2	2.10	
Physiculus sp.	6.85	342	1.80	
Lepidotrigla cadmani	6.44	82	1.69	
NOMEIDAE	5.75	151	1.51	
Umbrina canariensis	4.38	14	1.15	
Sepia officinalis	4.11	151	1.08	
Mustelus mustelus	2.47	14	0.65	
Promethichthys prometheus	2.33	55	0.61	
Arnoglossus imperialis	1.92	151	0.50	
Lepidotrigla carolae	1.64	55	0.43	
CONGRIDAE	1.64	14	0.43	
OMMASTREPHIDAE	1.51	493	0.40	
Priacanthus arenatus	1.37	14	0.36	
Saurida brasiliensis	1.37	219	0.36	
Scyllarides herklotsii	1.10	68	0.29	
OPHICHTHIDAE	0.96	14	0.25	
Scorpaena normani	0.96	14	0.25	
Microchirus frechkopi	0.96	27	0.25	
Total	379.91		100.00	

```
R/V Dr. Fridtjof Nansen        SURVEY:2012407        STATION:    4
DATE   :23/11/12          GEAR TYPE: BT NO:  1  POSITION:Lat    N 4°59.56
         start     stop     duration                      Lon    W 3°5.60
TIME   :03:38:02 04:09:13  31.2 (min)          Purpose    : 1
LOG    : 8035.67  8037.29   1.6                Region     : 2600
FDEPTH:      49        49                      Gear cond.: 0
BDEPTH:      49        49                      Validity   : 0
Towing dir:   0°     Wire out    : 140  m      Speed      : 3.1 kn
Sorted    :   0      Total catch: 299.42       Catch/hour: 576.18
```

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Pagellus bellottii	136.11	4403	23.62	
Pagrus caeruleostictus	75.78	191	13.15	
Pseudupeneus prayensis	74.93	1143	13.01	
Dentex macrophthalmus	61.39	2074	10.65	
Dactylopterus volitans	36.62	148	6.36	
Paraconger notialis	35.14	1185	6.10	
Fistularia petimba	26.04	466	4.52	
Apogon sp.	20.74	2434	3.60	
Balistes capriscus	14.61	42	2.53	
Lagocephalus laevigatus	10.80	106	1.87	
Nettastoma sp.	10.37	550	1.80	
Umbrina canariensis	9.95	148	1.73	
Syacium micrurum	9.74	572	1.69	
Dentex gibbosus	8.89	64	1.54	
Rhinobatos rhinobatos	8.18	4	1.42	
Octopus vulgaris	5.39	4	0.94	
Arnoglossus imperialis	4.02	487	0.70	
Squilla mantis	3.81	233	0.66	
Penaeus notialis	3.60	106	0.62	
Serranus accraensis	2.54	64	0.44	
Sardinella aurita	2.54	64	0.44	
Sardinella maderensis	2.33	21	0.40	
Aluterus monoceros	2.17	2	0.38	
Grammoplites gruveli	2.12	85	0.37	
Cynoglossus canariensis	2.12	21	0.37	
Pomadasys rogeri	1.83	2	0.32	
Priacanthus arenatus	1.69	85	0.29	
Trachurus trecae, juvenile	1.48	508	0.26	
Citharus linguatula	0.64	21	0.11	
Scyllarides herklotsii	0.21	21	0.04	
Decapterus punctatus	0.21	21	0.04	
Boops boops	0.21	42	0.04	
Total	576.18		100.00	

(Trawl Stations-Notepad from 2012

First observations of the structure and megafaunal community of a large Lophelia reef on the Ghanian shelf (the Gulf of Guinea)

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Regular article

First observations of the structure and megafaunal community of a large *Lophelia* reef on the Ghanaian shelf (the Gulf of Guinea)

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ABSTRACT

The distribution of cold-water coral reefs is relatively well known in the North-east Atlantic as compared to the Central-east Atlantic, where only a few documentations exist from low latitudes. In 2012 an initial survey was conducted on a reef situated at 400 m depth on the continental shelf off Ghana. The reef corals and fauna were visually documented using a Video Assisted Multi Sampler (VAMS) coupled with an ROV. Here we present the results from three dives on the 1400 m long and 70 m high reef with an ambient temperatures between 9 and 10 °C. The banana shaped reef was oriented perpendicular to the main current, the convex side facing the current and there was no sign of human impact. The great height of the reef is probably a result of undisturbed growth for more than 20,000 years. On the Norwegian continental shelf the largest reefs are around 30 m high and have been aged to ~9000 years. The reef morphology resembles that of Northeast Atlantic *Lophelia* reefs. The main reef building coral was *Lophelia pertusa* with contribution from *Madrepora oculata*, *Solenosmilia variabilis,* and occasional occurrences of *Dendrophyllia* cf. *alternata*. The skeleton of *Aphrocallistes beatrix* (Hexactinellidae) contributed to the reef framework and the reef consisted of 46% coral blocks 22% sediment, 13% coral rubble, 11% sponge skeleton and 8% live corals.

A rich megafauna of 31 taxa was recorded and most frequent was *Acesta excavate* (bivalve), *Aphrocallistes beatrix* (with an associated Zooanthida on 39% of the colonies), squat lobsters, hydroids and bryozoans. Six fish species were recorded of which the Sebastidae *Helicolenus dactylopterus* and *Nettastoma melanurum* were found amongst coral blocks. The reef community showed several similarities with the northern reefs with sponges, *Sebastes* spp., squat lobsters, and *Acesta excavata* being common megafauna associates. In contrast the gorgonian corals that are characteristic of the northern reefs seemed to be lacking and Hexactinellidae rather than Demospongia were common on the reef and contributed to the reef framework. Crabs that are uncommon on northern reefs were frequently encountered.

1. Introduction

In the North-east Atlantic the distribution of cold-water corals is relatively well known compared with the Central-east Atlantic, and only a few documentations exist of cold-water coral from this area (LeGuilloux et al., 2009; Westphal et al., 2012). The coral reef on the Ghanaian continental shelf was discovered during multibeam bathymetric mapping with R/V Dr. Fridtjof Nansen in 2009. The survey was part of an environmental baseline study related to possible future development of offshore petroleum industry. The first survey of the reef was conducted in November 2012 in order to provide information on the reef structure and fauna It was undertaken with RV Dr Fridtjof Nansen using the Video Assisted Multi Sampler (VAMS). The survey was lead by the Institute of Marine Research (Norway) in co-operation with the Environmental Protection Agency of Ghana and the Food and Agriculture Organization of the United Nations (FAO) as part of the Ghanaian marine environmental monitoring (Serigstad et al., 2015).

Cold water coral reefs are recognized as biodiversity hotspots, providing a wide range of habitats for invertebrates and fish (Costello et al., 2005; Husebø et al., 2002; Jensen and Frederiksen,

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1992; Mortensen and Fosså, 2006). These reefs are complex habitats constituted by coral colonies up to ca. 2 m high and fragments of dead skeleton with variable size and age (Mortensen et al., 1995; Mortensen and Fosså, 2006 Wilson, 1979). Habitats within the reefs can be defined at different spatial scales (Jonsson et al., 2004; Mortensen et al., 1995). At a broad scale a reef typically consists of three vertical zones, or reef habitats: (1) "The live coral-zone" (LC) typically occurs near the summit of the reef and consists of mainly living scleractinian colonies separated by areas with dead broken skeletons. (2) "The coral block-zone" (CB) is found between the top and the foot of the reef. The bottom here is characterised by large fragments of dead corals, and a high diversity of megafauna (Mortensen et al., 1995). (3) "The coral rubble-zone" (CR), has small skeletal fragments mixed with sediments flanking the foot of the reef. The horizontal extent of this zone varies from only a few metres to several tens of metres. The cold water coral reefs are also highly vulnerable to bottom fisheries (Fosså et al., 2002; Koslow et al., 2001), and protection areas have been established at various locations in the North Atlantic (Breeze and Fenton, 2007). In Norway, 18 coral reef areas have been protected pursuant to the Marine Resources Act (Norwegian Government, 2016) and one area to the Norwegian Nature Conservation Act (Norwegian Government, 2013).

Here we present the structure of the reef and the megafauna associated with the different reef habitats based on the video records from the ROV that is part of the VAMS. The results are compared with observations from *Lophelia* reefs on the Norwegian shelf that holds the largest number of reefs known in the North Atlantic (Buhl-Mortensen et al., 2015) and the few existing observations made by LeGuilloux et al. (2009) and Westphal et al. (2012) from coldwater coral remnants off Atlantic Africa.

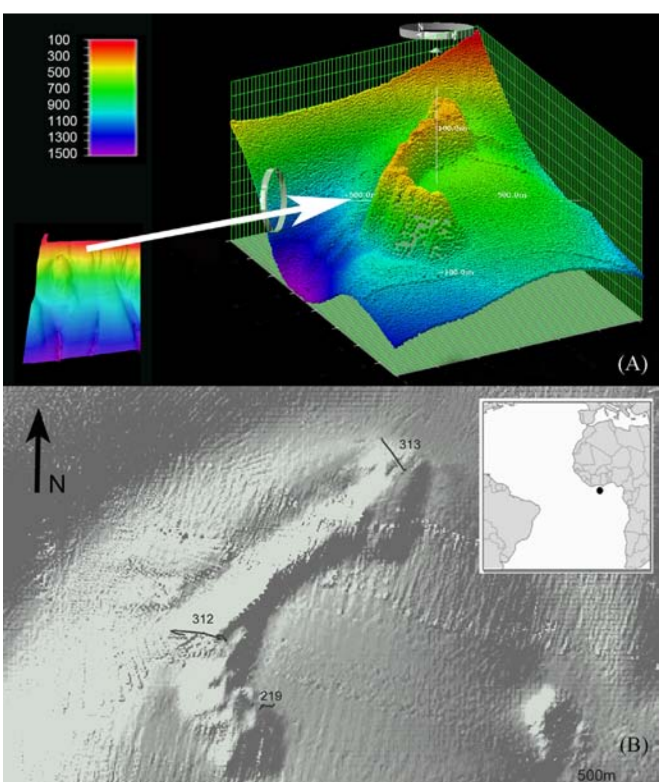

Fig. 1. The position of the 70 m high and 1400 m long *Lophelia* reef. A. The reef is curved and is located at 400 m depth on the continental slope off Ghana (colours indicates depth in metres). B. Position of the three video stations with the VAMS tracks indicated with dark lines. Inserted map shows the general location off Ghana.

2. Material and method

2.1. Description of the area

The elongated, banana-shaped reef is situated at the upper continental slope at around 400 m depth just off the narrow continental slope off Ghana at 4° 46 N and 3°09 W. The coral reef oriented perpendicular to the west coast of Ghana and occurs within the depth range dominated by South Atlantic Central Water (SACW) – the source water mass that feeds the West African upwelling. SACW is rich in nutrients, exhibits the pronounced oxygen minimum zone (OMZ) and the linear temperature–salinity relationship. During the survey, the measured temperature range in the vicinity of the coral reef was of 8.5–9 °C and the salinity range was 34.8–34.85 psu. The multibeam bathymetric mapping conducted in 2009 indicates that the reef is 70 m high, 1400 m long and around 250 m wide at the base (Fig. 1).

2.2. Sampling

Three sites on the reef were inspected using an ROV that is part of the VAMS developed by the Institute of Marine Research (IMR) in co-operation with Argus-Remote System A/S (www.argus-rs.no). It consists of: 9 sediment samplers; CTD with mounted sensors (salinity, temperature, oxygen and fluorescence); sonar; ADCP current metre; altimeter; and an ROV (with high resolution video camera) (Fig. 2). The three video inspections together covered 900 m in length (1 h and 50 min), at depths from 373 m at the summit to 442 at the base of the reef (Fig. 1). The speed of the ROV varied, with an average of 0.25 knot. Of the recorded videos, three hours represented inspection of the seafloor at a close distance allowing for analysis of substratum and megafauna (Table 1). The near bottom video record from station 312 was short due to strong currents that made it hard to keep the vessel in position.

2.3. Video analysis

Video analysis was conducted in the lab after the cruise and records were split into 76 video sequences of approximately

Fig. 2. The VAMS is an integrated sampling unit consisting of 9 parallel sediment samplers as well as a set of sensors to monitor the surrounding ocean to a depth of 2500 m. An ROV with high resolution video and still camera is attached to the sampling unit with a 50 m umbilical. The equipment is designed to collect samples for benthic biodiversity, chemical analyses and video observations.

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Table 1
Details of VAMS transects on the Ghanaian reef. Mean percent cover of substrate was based on the analysed video sequences.

Localities	219	312	313
Date	17/11/2015	23/11/2015	23/11/2015
Location on reef	SE Flank	Central Summit	N Flank
Start position	04°45.681′ N 03°09.181′ W	04°45.846′ N 03°09.246′ W	04°46.237′ N 03°08.816′ W
Stop position	04°45.850′ N 03°09.253′ W	04°46.231′ N 03°08.819′ W	04°46.361′ N 03°08.379′ W
Transect length (m)	277	349	275
Depth range (m)	385–423	374–442	373–402
Length of video record analysed (hh:mm:ss)	1:35:09	0:35:42	1:04:19
No. video subsamples	42	9	26
Soft sediment %	22	19	30
Coral ruble %	17	8	9
Coral block %	45	50	41
Live coral %	4	11	13
Glass sponge skeleton %	12	12	7
Total # observed megafauna taxa %	28	18	18

3 minutes. For each sequence the percentage coverage of six substrate types: soft bottom (SB), coral rubble (CR), coral blocks (CB), living corals (LC), and glass sponge skeletons (GS) was estimated and number of megafauna taxa was counted.

2.4. Reef structure and fauna analysis

The percentage cover of different substratum was compared with depth, and the relationship between occurrence of taxa and substratum was investigated using linear correlation analysis. In order to compare sequences with respect to substrate, each video sequence (76 videosequences, on average 2 min (ca. 60 m) each) was designated to a "habitat" class, where the most dominant (in terms of surface coverage) bottom substrate provided the name to the habitat class. Five different main habitats were defined: Soft bottom habitat (SBH), Coral rubble habitat (CRH), Coral block habitat (CBH), Live coral habitat (LCH), and mixed bottom habitat (MBH). MBH was used for sequences where no substrates dominate, but occurred mixed and patchy. These habitats were defined by the substrate that was dominating in terms of percentage coverage, except for LC, where a coverage $>20\%$ was used as a threshold to enable comparison between live parts of the reef and dead parts. Similar definitions of reef habitats based on dominant substrate type has been previously been used in several studies (Jonsson et al., 2004; Mortensen et al., 1995; Mortensen and Fosså, 2006; Purser et al., 2013). To compare fauna composition with the contribution of dead glass sponge to the reef framework, coverage of sponge skeleton was described as high ($>15\%$ cover) or low ($<15\%$ cover) for sequences within each habitat class. The percentage occurrence of a symbiont (probably commensalistic) Zoanthida on the hexactinellidae *Aphrocallistes beatrix* was calculated.

3. Results

3.1. The reef morphology

The reef has a curved shaped, reminiscent of a banana. The reef is ~1400 m long, when measured along a straight line from end to end, but the total linear distance of the reef is longer (1800 m). The height of the reef, measured from the foot (the location at the seabed where the curvature changes rapidly from almost level to a steep inclination) is around 70 m. The main framework building corals at the reef were *Lophelia pertusa* and *Madrepora oculata*, with contributions from *Solenosmilia variabilis* and occasionally *Dendrophyllia* cf. *alternata*.

The reef was dominated by coral blocks and soft sediment with a mean percentage cover on the three stations of 40–51% and 19–30%, respectively. The skeleton of the Hexactinellidae *Aphrocallistes beatrix* and live coral contributed 7–12% and 4–13%, respectively, to the reef substratum (Table 1). A comparison of the cover of different substrates with depth using linear regression analysis showed that coverage of coral blocks, live coral and *A. beatrix* skeleton decreased with depth while coral rubble and soft sediment increased (Table 2). Thus moving from the base to the summit of the reef the cover of coral blocks, glass sponge skeleton and live corals increased.

Table 3 presents an overview of number of sequences representing different habitats, with and without high contribution

Table 2
Linear correlation between depth and percentage cover of five substratum categories on the African reef. Pearson correlationcoefficient $r>0.32$ is significant at $p<0.01$.

	Depth
Soft sediment	0.59
Coral rubble	0.70
Coral block	–0.73
Live coral	–0.60
Glass spong skeleton	–0.35

Table 3
No. of video sequences (N) within the five main habitats, and split into sequences with high ($>15\%$) and low ($<15\%$) coverage of glass sponge skeleton. Percentage of each substrate is provided as mean values for the sequences within the different habitat types.

Habitat	*N*	Soft sediments	Percentage cover of substrates			
			Coral rubble	Coral blocks	Live coral	Glass sponge skeleton
CBH						
All CB sequences	43	15.2	5.7	59.6	7.2	12.5
$>15\%$ sponge	21	10.3	3.1	58.8	8.6	20.0
$<15\%$ sponge	22	20.0	8.2	60.5	5.8	5.4
CRH						
All CR sequences	7	23.6	57.4	10.3	0.0	7.3
$>15\%$ sponge	2	20.0	40.0	20.0	0.0	15.0
$<15\%$ sponge	5	25.0	64.4	6.4	0.0	4.2
LCH						
All LC sequences	10	4.6	3.0	55.5	23.0	13.9
$>15\%$ sponge	4	5.0	2.5	47.5	23.8	21.3
$<15\%$ sponge	6	4.3	3.3	60.8	22.5	9.0
MBH ($<15\%$ sponge)	6	38.3	38.3	13.3	1.7	5.0
SBH						
All SB sequences	13	53.0	15.0	20.0	2.2	8.8
$>15\%$ sponge	3	40.0	11.7	18.3	0.7	26.0
$<15\%$ sponge	10	56.9	16.0	20.5	2.6	3.6

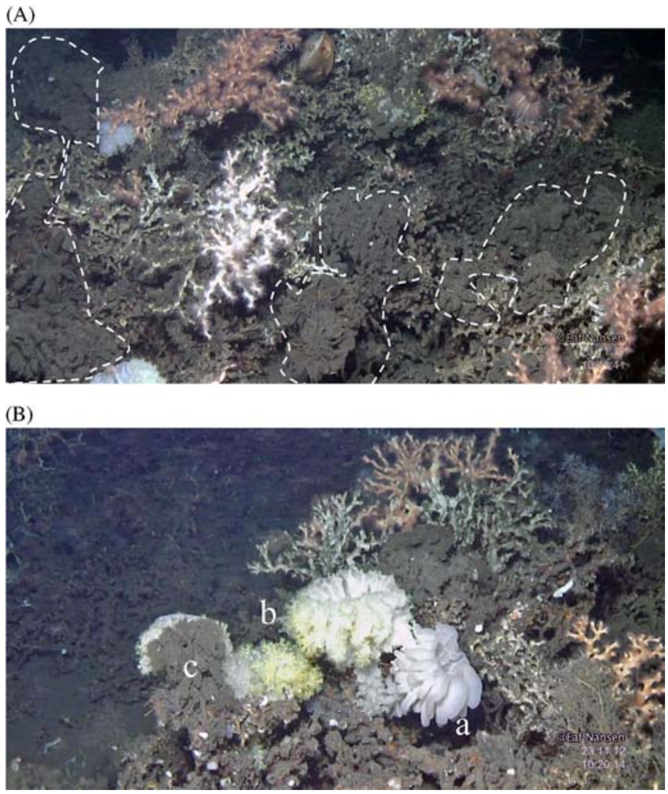

Fig. 3. The main framework building corals on the reef are *L. pertusa* and *M. oculata* but the Hexactinellidae *Aphrocallistes beatrix* also contributes substantially to the reef structure. The two photos from the video transect conducted at station 312 show A: Orange and white colonies of *L. pertusa* and areas covered with the skeleton of dead *A. beatrix* indicated with white dashed line. In the background the echinoid *Gracilechinus* cf. *elegans* and the clam *Acesta excavata* is sitting amongst *Lophelia* branches. B: a group of colonies of the sponge *A. beatrix* that are in different life stages, (a) a full-grown uninfected specimen, (b) two sponges with their associated Anthozoa (yellow), and (c) the skeleton of a dead specimen.

of glass sponge skeleton. A photo from transect 312 (Fig. 3) shows how the skeleton of *Aphrocallistes beatrix* modify the reef structure. Locally, the percentage coverage of the skeleton spicules was up to 40% in the coral block habitat (CBH) (at 387 m, st 219). On average, *A. beatrix* contributed most (13.9%) to the reef structure within the live coral habitat (LCH) (Table 3), and in the upper depth range of the reef (Fig. 4). The lowest taxa richness was found for coral rubble habitat (CRH) and soft bottom habitat (SBH) with low coverage of glass sponges. CBH sequences had the highest number of observed individuals and colonies per video sequence (Fig. 5). LCH and CRH had fewer individuals and colonies than CBH and soft bottom habitat (SBH). The abundance was higher for sequences with great coverage of glass sponge skeleton (GS) for all habitats except CBH. Within the CBH, live glass sponges was more abundant than their skeleton. The greatest difference was found between CB and CR with low cover of glass sponge skeleton. The highest number of taxa was observed for LCH, CBH, and MBH (Fig. 5).

3.2. Associated fauna

In total 31 taxa were recorded from the three stations (Table 5). Linear correlation showed that the richest associated fauna is connected to the coral block substrate (Table 4). Average number of taxa and colonies of *A. beatrix* shows a positive relation to cover of coral blocks (Fig. 6).

Six fish species was observed on the reef, most common were the *Helicolenus dactylopterus, Malacocephalus occidentalis* and the *Nettastoma melanurum* The fishes were often found hiding among blocks of dead coral. Fig. 7A–F shows the different fish taxa in their reef habitat. The number of fish individuals was highest for sequences classified as MBH and SBH with low cover of GS (Fig. 5). Fishes were more frequent on sequences in habitats dominated by scleractinian skeletons with high cover of glass sponges than in those with low cover.

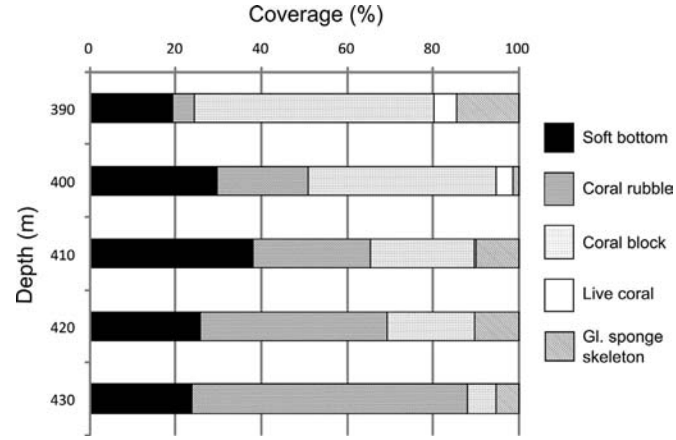

Fig. 4. Relative composition of bottom substrates (Soft bottom=SBH, Coral rubble=CRH, Coral block=CBH, Live coral=LCH, Gl. sponge skeleton=GSH) within 10-m depth intervals from the summit to lower parts of the reef.

The reef hosted rich invertebrate megafauna with a total 24 taxa. Frequently recorded taxa included: ophiuroids, hydroids, the glass sponge *Aphrocallistes* with associated Zoantidae, the bivalve *Acesta excavata*, Bugulidae (Bryozoa) and the squat lobster *Eumunida bella*.

Of the observed individuals of *Aphrocallistes* sp. (hexactinellidae), 39% were carrying the symbiont Zoanthidae, and on 4% of these a small squat lobster was observed (Fig. 8).

4. Discussion

4.1. Reef morphology

The records of reef building cold water corals off Atlantic Africa are few (LeGuilloux et al., 2009; Westphal et al., 2012). These former records documents remnants of reefs and are focusing on geological processes. Thus our observation appear to be the first description of a living and continuous reef that has been growing undisturbed for thousands of years in this region. There were no sign of human impact on the reef and the hypoxic conditions in other parts of the highly productive Ghanaian shelf are remote.

The straight-line distance of the reef is 1400 m, and the height around 70 m. The height of the reef is not likely equivalent to the thickness of the coral skeleton matrix. Cold water coral reefs commonly occur atop local mound-shaped hard-ground elevations, and over time they often form a "cap" over the original structure.

Off Norway this thickness is indicated to be around 8 m (Mortensen et al., 2001). The relationship between height and area of reefs is linear for smaller round reefs while larger reef, often consisting of coalesced neighbouring reefs are more elongate in shape (Mortensen et al., 2001), much like the banana shape observed in this study. This reef is probably coalesced from several smaller round reefs. Given that the width of the reef (ca. 250 m) is indicative of the size of an original un-merged reef, a linear relation between height and area would correspond to its actual height of 70 m (Fig. 9). Many of the reefs off Norway have been aged using adiocarbon and Uranium/Thorium techniques

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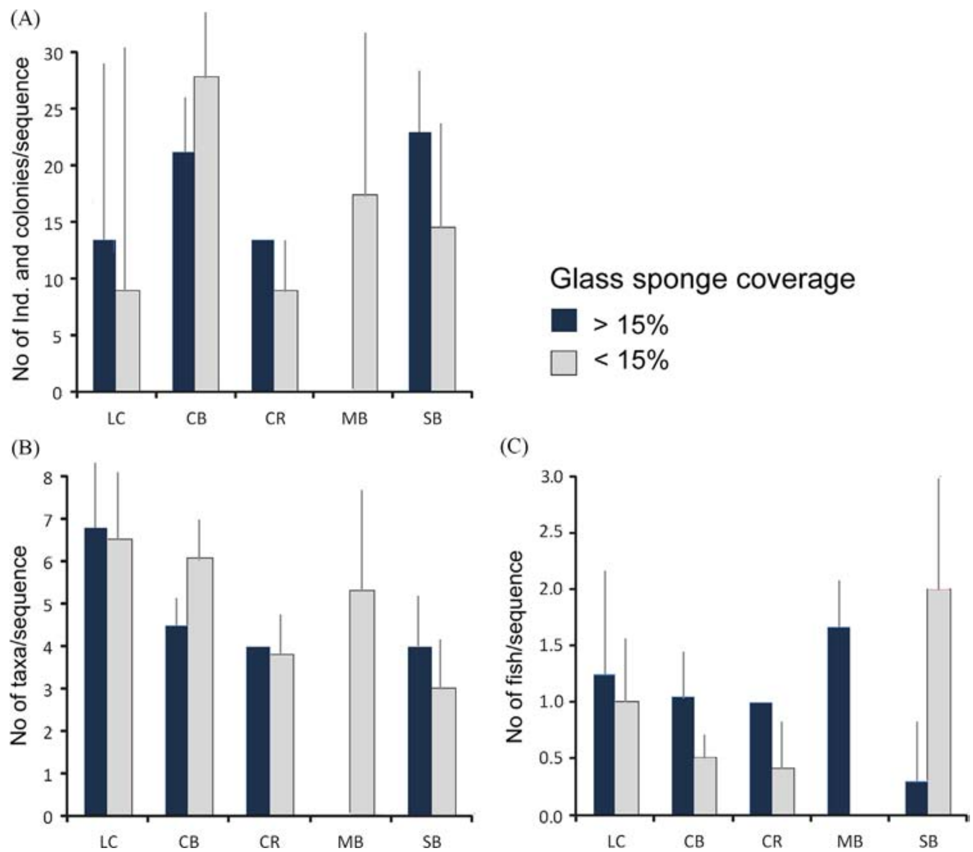

Fig. 5. Number of individuals and colonies (A), taxa per video sequence (B), and fish individuals (C) per video sequence with high (> 15%) and low (< 15%) coverage of glass sponge skeleton. The vertical lines indicate 95% confidence limits. See Table 1 for sample size details.

Table 4
Correlation between cover of five substrate categories and recorded number of megafauna taxa and *Aphrocallistes beatrix* (Hexactinellidae) on 76 video sequences from three stations on the African reef. Correlation coefficient (r) is provided and significant correlation ($p < 0.01$) is indicated in bold numbers.

% cover	*Taxa*	*A. beatrix*
Soft sediment	−**0.44**	−**0.32**
Coral rubble	−0.18	−**0.35**
Coral blocks	**0.39**	**0.49**
Live coral	**0.33**	0.27
Sponge skeleton	0.02	−0.04

(Mikkelsen et al., 1982; Mortensen, 2000; Rokoengen and Østmo, 1985), and a maximum age of around 9000 yr BP for those reefs has been estimated. Mortensen (2000) estimated growth of vertical reef thickness to be around 1.2 mm per year. The total annual vertical extension of a 30 m high and 9000 year old Norwegian reef is 3.3 mm year. If we assume a growth rate of 3.3 mm year-1 and the reef height is approximately 70 m, then the estimated age of the Ghanaian reef is 21,200 year BP. On the Norwegian shelf ambient temperatures are 4–12 °C, which is comparable to the 8.5–9 °C as measured at the African reef site, thus the surrounding temperature is likely not the reason for the size difference. Furthermore, both areas are highly productive upwelling settings and the reefs have good food supply. The Norwegian continental shelf was colonised by marine fauna after the last ice age ~10,000 years BP and reefs started to develop around ~9000 years ago. The great height of the African reef could be a result of undisturbed growth for at least 20,000 years. However, there is also a possibility that the reef growth was interrupted at some stage during the Holocene transgression or the Holocene itself. Ayers and Pilkey (1981)

Table 5
Taxa associated with the coralson the three locations inspected on the African reef. Numbers are individuals recorded at each station. Two taxa associated with *Aphrocallistes beatrix* were indicated as “on *Aphroc.*”.

Group	Station	**219**	**313**	**312**	**Total**
Echinodermata	Ophiuroidea A	475	60	105	**640**
Porifera	*Aphrocallistes beatrix*	206	57	194	**457**
Hydrozoa	Hydroid unid.	144	190	60	**394**
Anthozoa	zoanthid on *Aphroc.*	65	17	90	**172**
Crustacea	Squatlobster small	65	2	6	**73**
Bivalivia	*Acesta escavata*	18	11	36	**65**
Teleostei	*Helicolenus dactylopterus*	9	5	14	**28**
Bryozoa	cf. *Bugula*	23		2	**25**
Teleostei	*Malacocephalus occidentalis*	10	3	8	**21**
Teleostei	*Nettastoma melanurum*	6	2	13	**21**
Crustacea	*Eumunida bella*	9	2	6	**17**
Crustacea	Caprellidae	5	10		**15**
Crustacea	Natantia	14			**14**
Mollusca	Bivalvia indet.	13			**13**
Crustcea	*Bathynectes piperitus*	8			**8**
Crustcea	Squatlopster on *Aphroc.*	1	2	4	**7**
Echinodermata	*Gracilechinus* cf. *elegans*		3	3	**6**
Anthozoa	Actiniaria small	3	1	1	**5**
Teleostei	*Dibranchus sp.*	4			**4**
Echinodermata	Ophiuroidea B	2		1	**3**
Echinodermata	*Ceramaster* sp.	2		1	**3**
Crustacea	Paguridae	2			**2**
Bryozoa	Bryozoa	1		1	**2**
Brachiopoda	Indet.	2			**2**
Scleractinia	Solitary coral		1		**1**
Crustacea	*Paramola* cf. *cuvieri*			1	**1**
Crustacea	*Chaceon* cf. *maritae*		1		**1**
Porifera	Demospongia indet.		1		**1**
Teleostei	Lophiidae	1			**1**
Teleostei	Unid. Ophidiiformes		1		**1**
Mollusca	Nudibrachia	1			**1**

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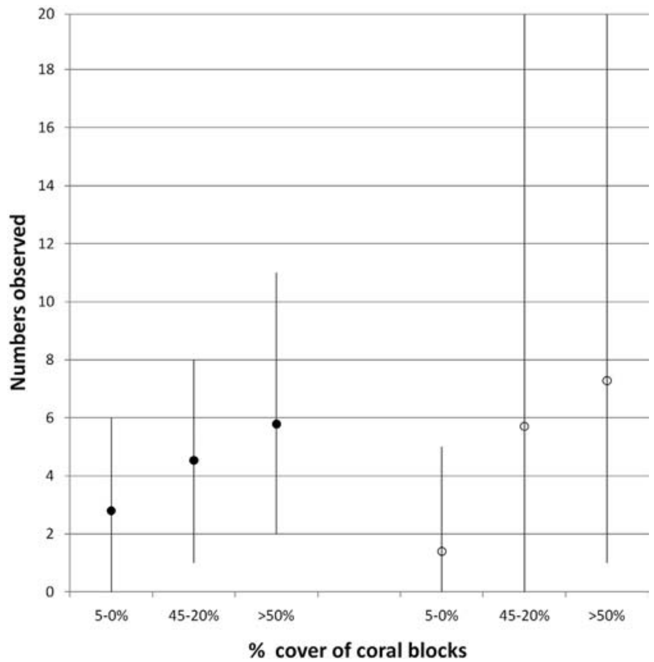

Fig. 6. Average number of taxa (black dots) and colonies of *Aphrocallistes beatrix* (white dots) in relation to percentage cover of coral blocks. Vertical lines shows range.

have dated some coral samples during of the Florida–Hatteras slope and inner Blake Plateau, in the Western Atlantic. Their dead coral samples ranged in age from 5000 to 44,000 years old. The much younger age of Norwegian reefs reflects the strong glacial influence (Mortensen, 2000). Verification of the reef age will require aging of skeleton sampled by coring to the base of the reef. Cores have been collected from reef remnants in other areas off Africa but results on age has to our knowledge not been published yet (Westphal et al., 2012).

The reef is probably an old reef and has large areas with dead coral framework. A mixture of dead and live coral framework is a common feature on cold water coral reefs, and the area occupied by dead coral is typically around 7 times greater than the living corals (Mortensen et al., 1995). The zonation patterns and reef morphology resembles that of *Lophelia* reefs studied off Norway and the shape of the reef suggests a main growth against the currents providing the food particles.

The Ghanaian reef is made with contributions from several framework building corals (*Lophelia pertusa*, *Madrepora oculata*, *Solenosmilia variabilis*, and *Dendrophyllia* cf. *alternata*) as in many regions of the world (Cairns, 1979; Stetson et al., 1962), however here the skeleton of the glass sponge *Aphrocallistes beatrix* contributes to the reef framework. To our knowledge this is the first indication that glass sponges can contribute to the construction of cold water coral reefs. Reefs composed entirely by glass sponges are found in Southeast Alaska and British Columbia (Stone et al., 2013). These are built up by the two glass sponges *Aphrocallistes vastus* and *Heterchone calyx* forming ridges up to 7 km long and 21 m high (Conway et al., 2005). The reefs are constructed by sponge spicules and sediment trapped in the tidal driven currents. Zoanthids (Family Parazoanthidae) have been found covering dead sponge surface at the lower parts of some of these reefs. *Aphrocallistes* sp. has been observed on cold water coral reefs in the western Atlantic off Florida (Reed et al., 2006), but does not contribute to the framework structure as reported in our study.

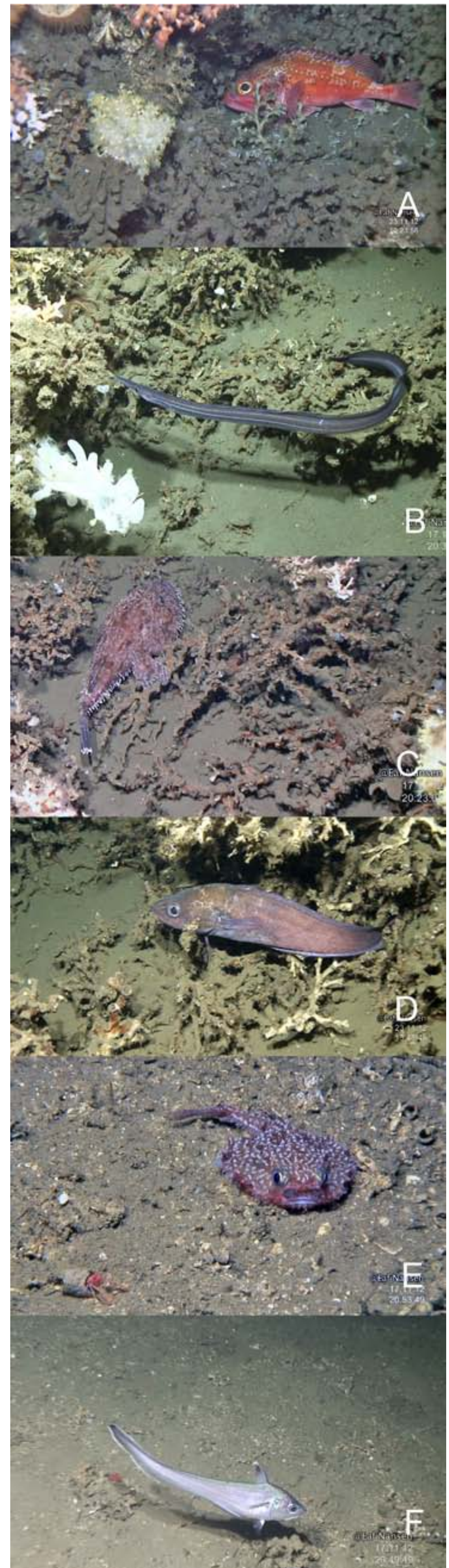

Fig. 7. Several fish species were found on the reef and appear to thrive amongst the coral blocks. *Helicolenus dactylopterus* (Sebastidae) (A), *Nettastoma melanurum* (B) and *Malacocephalus occidentalis* (F) were amongst the most common. Other less frequent fish where unidentified Lophiidae (C), *Dibranchus* sp. (E), and an unidentified Moridae (D).

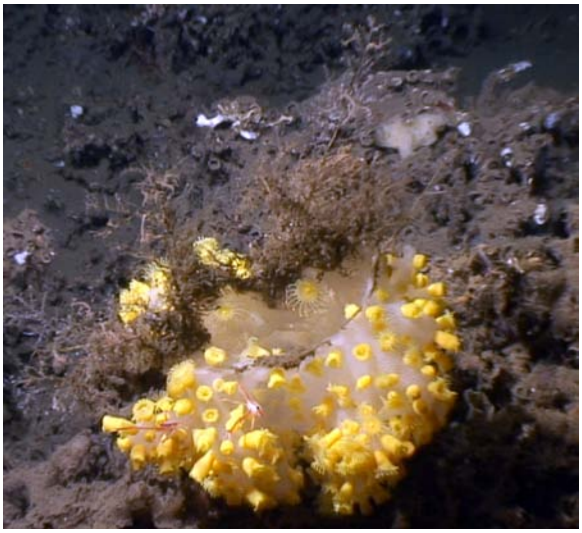

Fig. 8. The Hexactinellidae *Aphrocallistes beatrix* with associated yellow Zoanthidae and two squat lobsters. Of the observed 457 individuals, 39% were infested with the Zoanthidae. The hydroid colonies in the background are populated with Caprellidae amphipods.

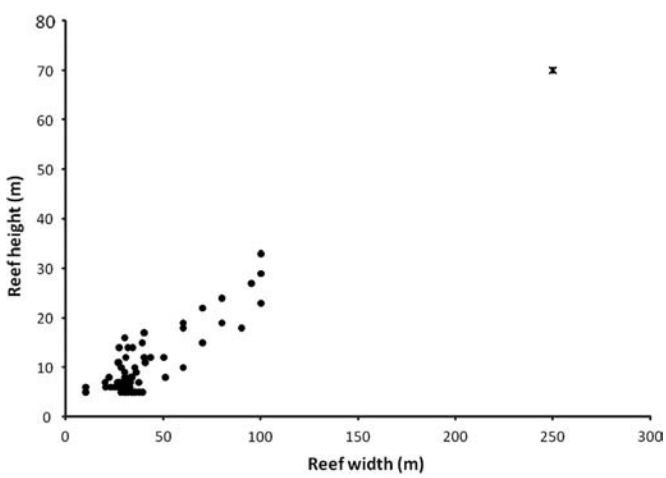

Fig. 9. The relationship between reef height and width. Data from Mortensen et al. (2001) except for the studied reef that is indicated with an asterix.

4.2. Reef associates

As observed on Nordic reefs the richest associated fauna is connected to blocks of dead skeleton (Jensen and Frederiksen, 1992; Jonsson et al., 2004; Mortensen et al., 1995; Mortensen and Fosså, 2006). An example of this habitat is provided in Fig. 10 showing the associated crab *Bathynectes piperitus*. The fauna showed many similarities to the reef community of north Atlantic reefs where Demospongia, *Sebastes* spp., squat lobsters (Fig. 11), and *Acesta excavata* are common (Table 6 and Fig. 12). In contrast the gorgonian corals that contributes substantially to the structure and biodiversity of the northern reefs seemed to be lacking while a hexactinellidae sponge species were important for the reef structure (Fig. 12) and crabs were common.

We are familiar with only two former reports on reef-forming coldwater corals off Atlantic Africa studying remnants of reef and focusing on geological processes (LeGuilloux et al., 2009; Westphal et al., 2012). The reef of our study has many fish species in common with these. Several of the invertebrate species we recorded were also reported by Westphal et al. (2012). However, they reported gorgonian corals from soft sediments that are absent from our records. Another striking difference is that the Hexactinellidae *Aphrocallistes beatrix,* which is extremely common in our study, was not reported from the two former studies on coral sites off the Atlantic Africa. This species has frequently been observed on cold water coral reefs off Florida's east coast on the other side of the Atlantic (e.g. NOAA, 2016; Thomas and Watling, 2012). In the present study a symbiotic yellow zoanthid occurred on 39% of the sponge colonies. A similar looking zoanthid has been observed on *A. beatrix* also in the Gulf of Mexico by Hebbeln et al. (2014),

Fig. 10. The richest associated fauna is connected blocks of dead corals. Here, the crab *Bathynectes piperitus* is surrounded by coral skeleton and skeleton of the Hexactinellidae *A. Beatrix.* Between the branches of dead corals are large numbers of a red coloured Ophiouridea.

Fig. 11. As on other cold water coral reefs squat lobsters are a common part of the associated community. Here, the squat lobster *Eumunida bella* sit on live *Lophelia* of the studied reef.

Table 6
Comparison of reef building corals and associated fauna between the African reef and Norwegian reefs in general.

African reef	Norwegian reef
Main reef building corals	
Lophelia, Madrepora, Solenosmilia	*Lophelia*
Shared associated megafauna	
Sebastidae	Sebastidae
Squat lobsters	Squat lobsters
Shrimps	Shrimps
Hydroids	Hydroids
Ophiuroidea	Ophiuroidea
Acesta	*Acesta*
Dominating megafauna not in common	
Glass sponges	Gorgonian corals
Brachyura	Demosponges
Bugulidae	Anemones

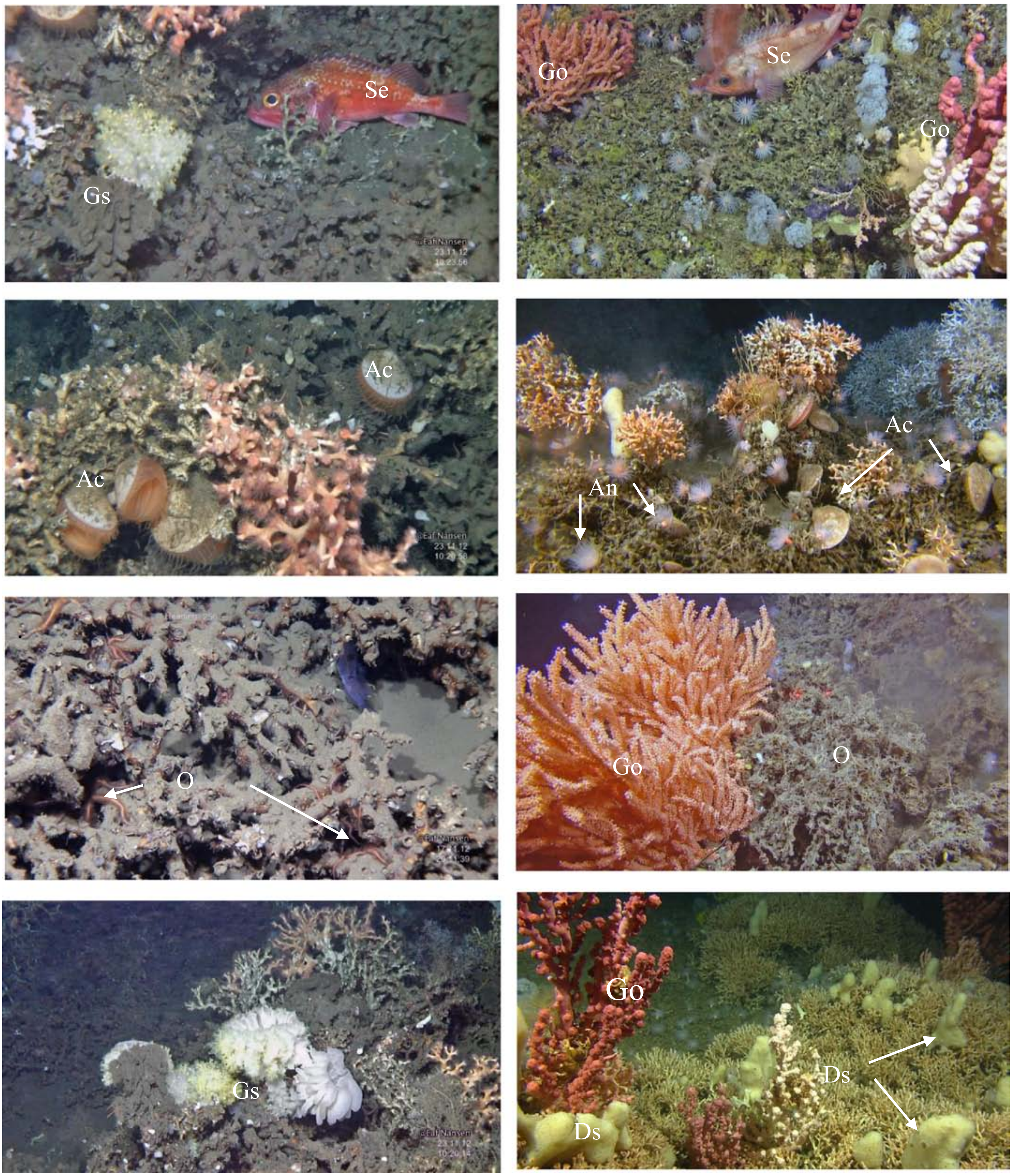

Fig. 12. The *Lophelia* reefs off Africa (photos left side) shares several of its inhabitants with reefs off Norway (photos right side) e.g.: Sebastidae (Se), *Acesta* (Ac) and Ophiuroidea (O) are often found amongst dead coral blocks. In contrast a glass sponge (Gs) dominates on the African reef and contributes to the reef frame work while Norwegian reefs are mainly populated by Demospongia (Ds) that are not important for the reef framework. Furthermore, gorgonians (Go) and anemones (An) that are common on Norwegian reefs appear not to be an important part of the African reef community.

however they did not provide information on its frequency of occurrence. The importance of *A. beatrix* as a dominant part of the reef fauna and as contributor to the reef framework is a characteristic of the African reef shared with reefs off the Central west Atlantic in contrast to the previously studied reef remnants to the north off Africa. The large scale circulation patterns of the

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central Atlantic may explain this similarity in community composition across the Central Atlantic. Our results represents a limited first investigation of a very large reef and more studies are needed to provide further insight to age and morphology of the reef and to better cover its associated fauna.

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References

Ayers, M.W., Pilkey, O.H., 1981. Piston cores and surficial sediment investigations of the Florida-Hatteras slope and inner Blake Plateau. In: Popenoe, P. (Ed.), Environmental geologic studies on the southeastern Atlantic outer continental shelf, pp. 5-1–5-89, USGS Open File Rept 81-582-A.

Breeze, H., Fenton, D.G., 2007. Designing management measures to protect cold-water corals off Nova Scotia, Canada. In: George, R.Y., Cairns, S.D. (Eds.), Conservation and Adaptive Management of Seamount and Deep-sea Coral Ecosystems. Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, pp. 123–133.

Buhl-Mortensen, L., Olafsdottir, S.H., Buhl-Mortensen, P., Burgos, J.M., Ragnarsson, S. A., 2015. Distribution of nine cold-water coral species (Scleractinia and Gorgonacea) in the cold temperate North Atlantic in light of bathymetry and hydrography. Hydrobiologia 759, 39–61.

Cairns, S.D., 1979. The deep-water Scleractinia of the Caribbean Sea and adjacent waters. Studies on the Fauna of Curarao and other Caribbean islands, vol. 56, pp. 1–341.

Conway, K.W., Vaughn Barrie, J., Krautter, M., 2005. Geomorphology of unique reefs on the western Canadian shelf: sponge reefs mapped by multibeam bathymetry. Geo-Mar. Lett. 25, 205–213. http://dx.doi.org/10.1007/s00367-004-0204-z.

Costello, M.J., McCrea, M., Freiwald, A., Lundalv, T., Jonsson, L., Bett, B.J., van Weering, T.C.E., de Hass, H., Roberts, M.J., Allen, D., 2005. Role of cold-water *Lophelia pertusa* coral reefs as fish habitat in the NE Atlantic. In: Freiwald, A., Roberts, J.M. (Eds.), Cold-water Corals and Ecosystems. Springer, Berlin, Germany, pp. 771–805.

Fosså, J.H., Mortensen, P.B., Furevik, D.M., 2002. The cold-water coral *Lophelia pertusa* in Norwegian waters: distribution and fishery impacts. Hydrobiologia 471, 1–12.

Hebbeln, D., Wienberg, C., Wintersteller, P., Freiwald, A., Becker, M., Beuck, L., Dullo, C., Eberli, G.P., Glogowski, S., Matos, L., Forster, N., Reyes-Bonilla, H., Taviani, M., the MSM 20-4 shipboard scientific party, 2014. Environmental forcing of the Campeche cold-water coral province, southern Gulf of Mexico. Biogeosciences 11, 1799–1815.

Husebø, A., Nøttestad, L., Fosså, J.H., Furevik, D., Jørgensen, S., 2002. Distribution and abundance of fish in deep-sea coral habitats. Hydrobiologia 471, 91–99.

Jensen, A., Frederiksen, R., 1992. The fauna associated with the bank-forming cold-water coral *Lophelia pertusa* (Scleractinaria) on the Faroe Shelf. Sarsia 77, 53–69.

Jonsson, L.G., Nilsson, P.G., Floruta, F., Lundälv, T., 2004. Distributional patterns of macro- and megafauna associated with a reef of the cold-water coral *Lophelia pertusa* on the Swedish west coast. Mar. Ecol. Prog. Ser. 284, 163–171.

LeGuilloux, E., Olu, K., Bourillet, J.F., Savoye, B., Iglésias, S.P., Sibuet, M., 2009. First observations of deep-sea coral reefs along the Angola margin. Deep-Sea Res. II 56, 2394–2403.

Koslow, J.A., Gowlett-Holmes, K., Lowry, J.K., O'Hara, T., Poore, G.C.B., Williams, A., 2001. Seamount benthic macrofauna off southern Tasmania: community structure and impacts of trawling. Mar. Ecol. Prog. Ser. 213, 111–125.

Mikkelsen, N., Erlenkauser, H., Killingsley, J.S., Berger, W.H., 1982. Norwegian corals: radiocarbon and stable isotopes in *Lophelia pertusa*. Boreas. 5, 163–171.

Mortensen, P.B., Hovland, M., Brattegard, T., Farestveit, R., 1995. Deep water bioherms of the scleractinian coral *Lophelia pertusa* (L.) at 64°N on the Norwegian shelf: structure and associated megafauna. Sarsia 80, 145–158.

Mortensen, P.B., 2000. *Lophelia pertusa* (Scleractinia) in Norwegian waters. Department of Fisheries and Marine Biology, University of Bergen, Norway.

Mortensen, P.B., Hovland, M.T., Fosså, J.H., Furevik, D.M., 2001. Distribution, abundance and size of *Lophelia pertusa* coral reefs in mid-Norway in relation to seabed characteristics. J. Mar. Biol. Assoc. UK 81, 581–597.

Mortensen, P.B., Fosså, J.H., 2006. Species diversity and spatial distribution of invertebrates on Lophelia reefs in Norway. In: Proceedings of the 10th International Coral Reef Symposium. Okinawa, Japan, pp. 1849–1868.

NOAA., 2016. Florida's Deep-water Oases: Exploration and Characterization of Deep Reef Ecosystems NA07OAR4600290 (2007–2011). 〈http://cnso.nova.edu/messing/strait-of-florida/deep-reefs.html〉 [accessed 04.01.16].

Norwegian Government, 2013. Forskrift om vern av Tauterryggen marine verneområde, Frosta og Leksvik kommuner, Nord-Trøndelag. 〈https://lovdata.no/dokument/MV/forskrift/2013-06-21-693〉.

Norwegian Government, 2016. Forskrift om beskyttelse av korallrev mot ødeleggelser som følge av fiskeriaktivitet. 〈https://lovdata.no/dokument/SF/forskrift/2016-01-08-8〉.

Purser, A., Orejas, C., Gori, A., Tong, R., Unnithan, V., Thomsen, L., 2013. Local variation in the distribution of benthic megafauna species associated with cold-water coral reefs on the Norwegian margin. Cont. Shelf Res. 54, 37–51.

Reed, J.K., Weaver, D.C., Pomponi, S.A., 2006. Habitat and Fauna of Deep-Water *Lophelia pertusa* Coral Reefs off the Southeastern U.S.: Blake Plateau, Straits of Florida, and Gulf of Mexico. Bull. Mar. Sci. 78, 343–375.

Rokoengen, K., Østmo, S.R., 1985. Shallow geology off Fedje western Norway. IKU report. 24.1459/01/85.

Serigstad, B., Ensrud, T.M., Olsen, M., Ostrowski, M., Adu-Kumi, S., Akoto, L., Aggrey-Fynn, J., Blazewicz-Paszkowycz, M., Jozwiak, P., Pabis, K. and Siciński, J., 2015. Environmental monitoring Ghana 2012, chemical and biological analysis. NORAD – FAO PROJECT GCP/003/NOR SURVEY REPORT R/V Dr. FRIDTJOF NANSEN EAF – N/2012/7. 163pp.

Stetson, T.R., Squires, D.F., Pratt, R.M., 1962. Coral Banks Occurring in Deep Water on the Blake Plateau. Am. Mus. Novitiates 2114, 1–39.

Stone, R.P., Conway, K.W., Csepp, D.J., Barrie, J.V., 2013. The Boundary Reefs: Glass Sponge (Porifera: Hexactinellida) reefs on the international border between Canada and the United States. U.S. Dep. Commer., NOAA Tech. Memo, p. 31.

Thomas, J.D., Watling, L., 2012. A New Genus and Species of Didymocheliid Amphipod from Hexactinellid Sponges (Crustacea: Amphipoda: Didymocheliidae) from the Western Atlantic Ocean Bulletin of the Peabody Museum of Natural History. 53(1), pp. 309–323.

Westphal, H., Beuck, L., Braun, S., Freiwald, A., Hanebuth, T., Hetzinger, S., Klicpera, A., Kudrass, H., Lantzsch, H., Lundälv, T., Vicens, G.M., Preto, N., Reumont, J., Schilling, S., Taviani, M., Wienberg, C., 2012. Phaeton – Paleoceanographic and paleo-climatic record on the Mauritanian Shelf. RV Maria S. Merian Cruise MSM16/3, Bremerhaven – Mindelo, 13.10. – 20.11.2010. 53 pp.