TotalEnergies E&P Namibia

Environmental Baseline Survey: Block 2912

Environmental Baseline and Habitat Assessment Survey Report

Dates of Survey:

30.09.2022 – 14.10.2022

Main Survey Contractor:

Benthic Solutions Limited

Unit A Greengates Way

Hoveton

Norfolk

United Kingdom

Report Prepared By:

Creocean

128 avenue de Fès

34080 Montpellier

France

Client:

TotalEnergies E&P Namibia

55 Ausspannplatz

Rehobother Rd

Windhoek

Namibia

Document Ref.	Revision	Date	Author	Review	Approved
CREO_2912_EBS_Report_V1_230228	00	28/02/2023	STH	CRE	EDU
CREO_2912_EBS_Report_V2_231222	01	22/12/2023	STH	CRE	EDU

COMPANY: TOTALENERGIES EP NAMIBIA

Address	55 Ausspannplatz, Rehobother Rd, Windhoek
Contact	Saviour UFOT Cell Phone: +264 811433881 saviour.ufot@totalenergies.com

CONTRACTOR: CREOCEAN

ADDRESS	Les Belvédères - Bâtiment B | 128 avenue de Fès | 34080 Montpellier | France
CONTACT	Romain LE GALL | Phone: +33 4 99 23 31 31 | Email: legall@creocean.fr

PROJECT: ENVIRONMENTAL BASELINE SURVEY – NAMIBIA – BLOCK 2912

TYPE OF DOCUMENT	OUR REFERENCE		WORK ORDER N°
STUDY REPORT	RE_2912_EBS_Report		220834
DOCUMENT ID	CREO_2912_EBS_Report_V2_231222		

Summary

TotalEnergies EP Namibia (TEEPNA) contracted Benthic Solutions Limited (BSL) for the provision of an Environmental Baseline Study (EBS) within Block 2912 located off the southwest coast of Namibia. This survey was part of a wider regional campaign, located in blocks operated by Total Energies Namibia (Blocks 2913B and 2912) and South Africa (TEEPSA, Block DWOB, 567 and 11B/12B).

The oceanographic campaign was carried out aboard the supply vessel Bourbon Evolution 807 between the 30th of September 2022 and the 14th October 2022. The area across Block 2912 is in the abyssal plain up to 400km offshore Namibia. The water depth in the survey area ranged from approximately 2,900m to over 3,700m below sea level.

The main objectives for surveying within Block 2912 were to:

- Acquire baseline data of sediment and water column physico-chemical characteristics.
- Identify and assess any existing pollutants within the sediment and the water column, in particular, those related to oil and gas activities.
- Identify sensitive habitats or species susceptible to disturbance from drilling-related activities.
- Establish an understanding of the natural variation in environmental conditions against which the environmental impact of future oil and gas operations can be assessed.

This study will serve as a baseline for any changes generated by TotalEnergies operations in this Block.

Key words: Offshore drilling, EBS, Block 2912, Namibia, TotalEnergies

Main Survey Contractor: Benthic Solutions Limited (BSL)

Report Prepared By: Creocean

Report Document Reference: CREO_2912_EBS_Report_V2_231221

Survey Area: Namibia: Block 2912

Survey Type: Environmental Baseline and Habitat Assessment Survey Report

Survey Period: 30.09.2022-24.10.2022

Survey Vessel: PSV Bourbon Evolution 807

Survey Equipment: 1 x 0.5m^2 Box Core, 1 x 0.25m^2 Box Core, 1 x DVV Grabs, 2 x Wilson Auto-siever, 3 x Pressure Cameras, 2 x Live Feed Cameras, 2 x CTD Multiprofilers, 6 x 10L Niskin Bottles, 1 x eDNA Pump, 1 x Bongo Plankton Net System (Phytoplankton and Zooplankton), 1 x Chl-α pump, 1 x NORM meter, 2x PAM systems (Vanishing Point), 1 x Launch and Recovery System (LARS), 1 x RAPP Winch, 1 x MARE Winch, 1 x ORE Winch

Table of contents

List of figures

List of tables

Glossary

AAIW: Antarctic Intermediate Water

AFAH: Aerobic Flora Adapted to Hydrocarbons

Anchor: Anchor Environmental Consultants (Pty) Ltd.

ANOSIM: Analysis of Similarity

ANOVA: Analysis of Variance

ANZECC: Australian and New Zealand Environment and Conservation Council

ARMCANZ: Agriculture and Resource Management Council of Australia and New Zealand

BSL: Benthic Solutions Limited

CCC: Criterion continuous concentration (synonymous with "chronic")

CCME: Canadian Council of Ministers of the Environment

CFU: Colony Forming Unit

CMC: Criterion maximum concentration (synonymous with "acute")

EBS: Environmental Baseline Study

eDNA: Environmental Deoxyribonucleic Acid

EGASPIN: Environmental Guidelines and Standards for the Petroleum Industry In Nigeria

EQS: Environmental Quality Standards

ERL: Effect Range Low

ESACW: Eastern South Atlantic Central Water

GIS: Geographic Information System

HI: Hydrocarbon Index

LoD: Limit of detection

LoQ: Limit of Quantification

LPL: Laboratoire des Pyrénées et des Landes

MDS: Multi-dimensional Scaling

MLA: Mining License Area

%m/m: % mass/mass

NPP: (in French) Numéro le Plus Probable

NADW: North Atlantic Deep Waters

NOAA: National Oceanic and Atmospheric Administration

NPD: naphthalenes, phenanthrenes and dibenzothiophenes

NORM: Naturally occurring Radioactive Material

PAH: Polycyclic Aromatic Hydrocarbons

PWL: Proposed Well Location

PRIMER: Plymouth Routines In Multivariate Ecological Research

ROV: Remotely Operated Video

SACs: Special Areas of Conservation

SASSW: South Atlantic and Subtropical Surface Waters

SD: Standard Deviation

SIMPER: Similarity Percentage Analysis

SQGs: Sediment quality guidelines

TAF: Total Aerobic Flora

TEEPNA: TotalEnergies EP Namibia

TEEPSA: TotalEnergies E&P South Africa

TEL: Threshold Effect Level

THC: Total Hydrocarbon Concentrations

TOC: Total Organic Carbon

TOM: Total Organic Matter

TPH: Total Petroleum Hydrocarbon

TRL: Toxicity Reference Level

TSS: Total Suspended Solids

UVP: Underwater video profiler

WAS: Wilson Autosiever

WFD: Water framework Directive

WoRMS: World Register of Marine Species

Executive summary

TotalEnergies E&P Namibia (TEEPNA) contracted Benthic Solutions Limited (BSL) for the provision of an Environmental Baseline Study (EBS) including Block 2912 located off the southwest coast of Namibia. This survey was part of a wider regional campaign, located in blocks operated by TotalEnergies Namibia (Blocks 2913B and 2912) and South Africa (TEEPSA, Block DWOB, 5/6/7 and 11B/12B). Benthic Solutions Limited subcontracted Creocean, who in turn appointed Anchor Environmental Consultants (Pty) Ltd for local support and expertise, to assist with sample collection, analyses, and reporting.

Survey operations within Block 2912 were carried out aboard the supply vessel *Bourbon Evolution 807* between the 30th of September 2022 and the 14th October 2022.

The following table summarizes the sampling operations and observation in the field during the oceanographic campaign:

EBS sampling strategy in Block 2912

Sampler	Purpose of Analysis	Number of Stations	Number of Samples Per Station
Box corer	Sediment – Benthic macrofauna	31	1 replicate sample
	Sediment – Microbiology		1 set (with spares)
	Sediment – eDNA		2 replicates
	Sediment – Physico-chemistry		1 set (with spares)
10L Niskin Bottle	Water- Chemistry, chlorophyll-*a* and eDNA	4	3 samples (surface layer, middle layer and the bottom layer), 2 replicates of eDNA
Multiprobe	Water – physical characteristics including salinity (conductivity), temperature, depth (pressure), redox, pH, turbidity and dissolved oxygen saturation	4	1 profile per water station (digital)
Plankton Net	Water – Zooplankton (200µm)	4	1 horizontal tow per water station *
	Water – Phytoplankton (50µm)	4	1 horizontal tow per water station *
HD Underwater Camera Transect	Video – Habitat and Potential Sensitivities	8	1km transect per camera transect station

** Samples were all performed but were lost during their transport to the laboratory.*

The area across Block 2912 is in the deep abyssal plain up to 400km offshore Namibia. The depth ranges from approximately 2,900m to over 3,700m below sea level. The floor is composed of a deep flat, homogeneous and soft silty mud seabed, with no expected particular and natural hard relief or seabed structure.

Sediment

All sediment samples were from the abyssal plain and comprised soft pale mud over consolidated clay. Sediment were all characterized as fine to very fine silts according to the Wentworth classification, the mean size particle is 0.01 mm and the phi range from 6.02 to 7.33 for a mean value of 6.81. The fine fraction (> 63 µm) varies between 74% (S27) and 97% (S08, S39), which makes it quite homogeneous throughout the whole area.

Normalised values of redox potential, made at 1cm and 10cm in the sediment, appeared very high at all stations (above 300 mV), suggesting an oxic zone throughout the first 10cm of sediment. However, considering the high-water depth and the muddy nature of the sediments, these values appear unusually high. Redox measurements rather correspond to a very oxygenated sandy shallow substrate. In deep reduced seabed, microbial-mediated redox processes have been known to decrease the redox potential to a level as low as −300mV (Søndergaard, 2009). Then, these results can also be due to a consistent malfunction of the probe or relate to the high clay content of the sediment causing higher readings.

All stations had Alpha and Beta NORM measurements which differed by <3 CPS from their respective sample background levels indicating no contamination.

Total Organic Matter was low (average of 3.6% m/m) and very stable among Block 2912 stations, Total Organic Carbon values were a little more heterogeneous but stayed low, below 0.75% m/m. Total Nitrogen and Phosphorous were also stable and low (respectively below 0.07% and 287 mg/kg). Consequently, in spite of the high clay fraction of the sediment, the synthetic Alzieu index resulted to a low organic enrichment close to oligotrophic conditions.

The sediment was characterized by the absence or a low contamination level:

- Trace metals were recorded below existing reference values or laboratory detection limits.
- Concentrations of Total Hydrocarbon Content (THC) ranged from 827 µg/kg (S35) up to 1,861 µg/kg (S32), which was far below target values defined by OSPAR 2009 and EGASPIN 2002.
- Polycyclic Aromatic Hydrocarbons (PAH) analyses were below the detection limits for all sediment samples (<1µg/kg of dry weight).
- Total n-alkanes parameter ranged from 111 µg/kg (S33) up to 188 µg/kg (S11) and contributed on average around 10% to the total hydrocarbons. The Carbon Preference Index (close or higher than 2) and chromatograms (with a quasi-absence of molecules having less than 20 carbon atoms) suggest a significant biogenic origin of hydrocarbons.
- BTEX analytes were below detection limits in all samples.

In spite of the low concentrations of organic and nutrient contents as well as metals, hydrocarbon and BTEX contaminants, spatial distribution of the results shows higher values in the eastern part of the Block 2912 surveyed area (for TOM, P, THC and alkanes) which suggest a slight decreasing sediment quality eastward, with no obvious link with bathymetry (no correlation and very few variations of depth between stations).

Benthic fauna

Taxa were identified, counted and weighed, with both a physical and photographic reference collection. In total, 836 specimens from 117 different taxa were recorded from the 31 stations sampled, comprising six phyla, 11 classes, 22 orders and 58 families. The infaunal community was dominated by the phylum Annelida (segmented worms), Arthropoda (crustaceans) and Mollusca. The most abundant taxa recorded were two polychaetes (*Spiophanes* sp. A and *Spiophanes* sp. B) and the bivalve *Microgloma mirmidina*. These species also played a role in the significant structuring of the macrofauna communities dominating respectively the western (*Microgloma mirmidina*) and eastern (*Spiophanes* sp.) portion of the block. Only 16 taxa could be identified to species level, likely attributed to the taxonomic impediment and low reference for so deep environment. At present, none of these are considered endemic or invasive.

The benthic community was characterized by a global biological poverty:

- The number of taxa was low in all the stations (never exceeding 24 species).
- Abundance was also quite low in all the stations (never exceeding 50 individuals).
- Biomass was also low, never exceeding 1g/station except on stations 34 and 35 due to the capture in the box core of one big individual of Polychaete (*Abarenicola affinis Africana*) and ophiurids (*Ophiomyxidae* sp.).
- Stations 1 and 14 were particularly impoverished and close to azoic conditions since only 3 and 6 individuals were sampled.
- Since abundance was never high, no great unbalance was observed between the different species density, even though the Shannon-Wiener diversity index remained globally low (below 3).

This global biological poverty is consistent with the low organic and nutrient content of the sediments.

Despite a low inter-station variability, values of all community descriptors differed according to general longitudinal position within Block 2912, with the number of taxa, species richness, Shannon–Wiener diversity and evenness greater in the western portion of the block, while abundance and biomass was greater in the eastern portion of the block. This gradient is consistent with the one observed on the sediment characteristics and the slight better quality of the seabed in the western part of the block.

Because of the very low variations of depth between stations, no obvious link was observed between the westward increase of the community descriptors and bathymetry.

The Michaelis-Menton species accumulation curve showed that overall the sampling effort was found to be sufficient to accurately document the benthic macrofauna diversity.

Water

Water column profiles were quite similar between the four sampled stations, with a continuous decrease of parameters between the surface and 700m or 1200m depth and then a more or less stable values (except for turbidity which was stable throughout the water column):

- Temperatures vary between a maximum of 16°C at surface and 2°C near sea bottom.
- Salinity ranges roughly between 35.5 PSU at the surface to 34-35 between 500m depth and the bottom.
- Oxygen concentration was close to 100% saturation in the first 100m below sea surface and decreased to a minimum of around 36% oxygen saturation at the lower depths.
- pH values decreased from 8.2 to 7.9.
- Turbidity values were always low (between 0.17 FTU for S04 and 0.24 FTU for S40) indicating clear waters.

Water samples were performed at 4 stations at three different depths: below surface, mid-depth and near sea bottom depth from water samples collected using a Niskin bottle.

TSS concentrations were below 10 mg/L except at station S04, where TSS appeared high compared to coastal water concentrations reported by Aminot and Kérouel (2004). **TOC** values were relatively consistent among the different samples, ranging from 26,1 to 31,3 mg/L.

All the measurements of the **nitrogen Kjeldahl and the nitrite** parameters were below the detection limit of the laboratory. **Nitrates** concentrations were detected (between 0.1 mg/L and 4.2 mg/L) but always low. **Orthophosphates** ranged from 0.02 mg/L near the surface to 0.217 mg/L in deeper waters, indicating a pattern of a richer deep layer (mid-depth and near bottom) with orthophosphates close to zero at the surface layer. It is consistent with previous results showing stratification of the water column.

A total of 21 heavy metals were analyzed in seawater. Those results are compared with the reference values defined by Background levels, and the NOAA reports of 2008 Most of the metal concentrations were below laboratory limit of detection of the laboratory, either below or close to the different threshold values, with few exceptions:

- **Cadmium and chromium** both showed one value above the environmental quality standard for coastal and transitional waters (S04 at mid depth for cadmium and S01 at surface for chromium). There were also above the background levels.
- **Zinc** measured concentrations were relatively high in half of the samples (S01 subsurface, S04 subsurface, S04 near bottom, S23 subsurface and mid depth and S40 subsurface samples), with values higher than background levels. Nevertheless, they remained below NOAA's different thresholds established for this parameter.
- **Vanadium was above** but very close to **the background level** (acute) at stations S01 (mid depth sample) and S04 (surface and bottom samples), not exhibiting significant contamination.

Concentrations of total hydrocarbon were low among the 12 samples: below the LoD of 27.4 µm/L. Concentrations of Polycyclic Aromatic Hydrocarbons were also low, between 1.44 ng/L and 213.43 ng/L (represented less than 0.03% of the hydrocarbons).

Due to an error of manipulation by the laboratory during the analysis, the samples were contaminated, and result of **Alkanes** were then lost for this parameter.

All the **BTEX** analyses were below the LoD threshold (3.0 µg/L for Toluene and 1.5 µg/L for the three other BTEX).

The number of **Aerobic Flora Adapted to Hydrocarbons** (AFAH) remain generally low (<10 units/ml), except for station S04 at mid depth where the value reached 43 units /ml. **Low ratios between aerobic flora adapted to hydrocarbons and total aerobic flora (TAF) do not suggest any contamination of the water by hydrocarbons.** At station S04 at 100m depth, where the ratio is high (52%). However,

this result is both due to a particularly low value of TAF and a maximum value of AFAH. Then it is difficult to conclude between a hydrocarbon contamination of water and a natural water impoverished in bacterial community.

Results on **pigment concentrations** showed indication of very low phytoplankton biomasses (less than 0.35 µg/L Chl a) and contrast between the mid-depth and sub-surface sampling points. Conversely, the percentages of pheophytin a (degradation product of Chlorophyll a) were higher in the "mid-water" or “bottom” water samples with particularly high values (up to 100%).

Plankton

Plankton was collected during the 2022 Block 2912 campaign as planned in the scope of the study, but unfortunately the samples were lost during their transport to the laboratory at the marine station of Villefranche-sur-Mer (France). Due to the loss of the plankton and in replacement of the missing data, in order to provide an understanding of the planktonic community that could have been expected in Block 2912, a bibliographic study was performed using data from the contiguous Block 2913 and underwater video profiler (UVP) profiles conducted in 2015 within the same general area.

The horizontal nets deployed at the 2 Block 2913B stations were particularly insightful for characterizing the phytoplankton community, since the camera of the UVP camera is not adapted for organisms <64 µm which constitute the major part of phytoplankton.

From the analysis of the different phytoplankton communities collected with nets or observed using a UVP, we can assess that the phytoplankton in the area of Blocks 2912 and 2913B were quite similar. Diatoms were the most abundant groups in agreement with previous studies that also reported that diatoms dominated generally Namibian waters (Barlow et al. 2006). This study also reported the presence of dinoflagellates, in concordance with the phytoplankton sampled at the 2 Block 2913B, as well as small flagellates that could correspond to the silicoflagellates . Cyanobacteria of the genus *Trichodesmium* are not always found in Namibian waters especially near the coast (Wasmund et al. 2015). However, studies have found *Trichodesmium* to be more abundant beyond the shelf break (Nagel et al. 2013) with abundances corresponding to what was found at the offshore stations investigated with the UVP.

The distribution of the crustacean and gelatinous zooplankton taxa throughout the water column indicates that this zooplankton community may play a major role in different food webs from the surface to the bottom of the water column. This also suggests the importance of plankton in the bathypelagic food webs as well as potential interactions with benthic organisms depending on the depth of the water column.

Epibenthic fauna

Typical invertebrate fauna associated with deep-sea soft sediments were observed throughout the video transects and occasionally in video footage captured during box coring. Sediments showed extensive bioturbation, which was evidenced by a self-contained pressure activated camera system attached to the box corer.

Faunal communities observed at all stations included the slime star (probably *Hymenaster* sp.) and burrowing anemone (Actiniaria). Records of the sea pen *Umbellula* sp., and hermit crabs (Paraguridae), which occupy white gastropods or are covered in zoanthids (Epizoanthus spp.) or anemones were observed throughout the Block. The latter represents a symbiotic relationship, with the zoanthid or anemone replacing the original shell, and providing protection from predators (Ates, 2003).

Echinoderms were abundant, comprising Holothurians (including *Benthodytes lingua* and the sea pig, family Elpidiidae), urchins, and white ophiuroids (brittle stars).

Other observations include benthopelagic shrimps, acorn worms (Enteropneusta, likely *Tergivelum cinnabarinum*), Polychaeta, a white isopod and Mollusca. The latter comprised Gastropods, a swimming bivalve, and a Cephalopod (possible dumbo octopus, *Grimpoteuthis* sp).

Xenophyophores (foraminifera) were often large and easily visible. These were regularly collected in box core samples.

Chordata included *Bathypterois* sp. (tripod fish), *Ipnops* sp. (grideye fish), a single indistinct Chondrichthyan (skate or ray), and rattails (Macrouridae).

Besides the taxa listed above, discarded "houses" of the giant larvacean *Bathochordaeus* spp. were regularly observed. Discarded larvacean houses were frequently observed in Block 2912 and are most likely the source of the abundant mucus masses, ranging from fresh transparent to older brownish coloration, seen in all transects.

Habitat classification and sensitivity

According to the depth and the sediment characteristics and nature (pure mud), only one habitat corresponding to the **EUNIS habitat classification** (2019) was identified: “ME62 Atlantic upper bathyal mud” (corresponding to the 2012 EUNIS type “A6.5 deep sea mud”) applicable for 2500 to 3200m water depth.

According to the **JNCC UK classification**, the habitat belongs to the “Atlantic upper or abyssal mud” respectively corresponding to 2100 – 3100 m or 3100 – 4100 m depth and can be described as “deep-sea mud sediments with a diverse infaunal community dominated by polychaetes

The area was quite homogeneous with soft, muddy bottom. No particular hard bottom or relief was identified. Overall, the benthic habitat supported low biological population levels and no species with a particular heritage or protection status was detected. **Thus, no potentially environmentally sensitive habitats were documented during this survey**.

1. Introduction

1.1. Project information and overview

TotalEnergies EP Namibia (TEEPNA) contracted Benthic Solutions Limited (BSL) for the provision of a regional Environmental Baseline Study (EBS) within Block 2912 located off the southwest coast of Namibia. This survey was part of a wider regional campaign, located in blocks operated by TotalEnergies Namibia (Blocks 2913B and 2912) and South Africa (TEEPSA, Block DWOB, 5/6/7 and 11B/12B).

The EBS aims to identify and chart sensitive zones as well as any pre-existing pollution.

Survey operations within Block 2912 were carried out aboard the supply vessel *Bourbon Evolution 807* between the 30th of September 2022 and the 14th October 2022. Environmental operations were conducted across the survey area to gather information on the physico-chemical and biological environment prior to drilling activities. The area across Block 2912 is in the deep abyssal plain up to 400km offshore Namibia. The water depth in the survey area ranged from approximately 2,900m to over 3,700m below sea level.

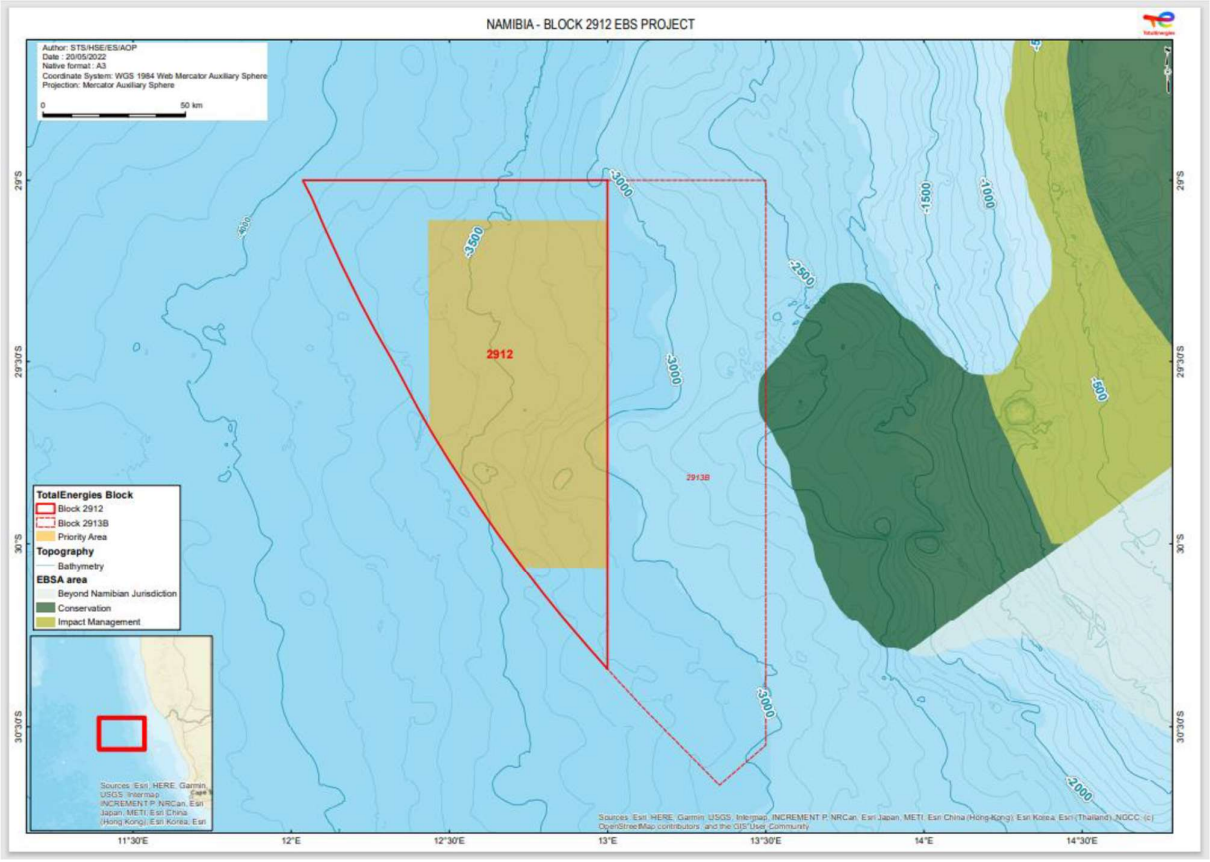


Figure 1. Location of the survey area - Block 2912

1.2. Scope of work

This survey included characterization of the seabed and water column physico-chemistry and biology to provide an understanding of the conditions prior to commencing further drilling activities.

The main objectives for surveying within Block 2912 were to:

- Acquire baseline data of sediment and water column physico-chemical characteristics.
- Identify and assess any existing pollutants within the sediment and the water column, in particular those related to oil and gas activities.
- Identify sensitive habitats or species susceptible to disturbance from drilling-related activities.
- Establish an understanding of the natural variation in environmental conditions against which the environmental impact of future oil and gas operations can be assessed.

This document is an Environmental Baseline Study (EBS) report, which describes the initial state of the environment in the area prior to the start of any operations on the Block 2912 and will serve as a reference for the identification any changes generated by these operations.

1.3. Reporting structure

This report is organized into the following sections:

0. Executive Summary - an overview of the information yielded EBS, including analytical results used to evaluate and report on environmental conditions.

1. Introduction - the framework of the project and the EBS report objectives, as well as existing information and reference levels.

2. Field survey program and analytical methods – these include:

- Geodesic parameters,
- The sampling design, an inventory of sediment and water data samples collected in the field,
- The sample analysis by laboratory, procedures, and data treatment.

3. Results and discussion - results and interpretation of general, abiotic, and biotic data collected during the EBS field campaign, as follows:

- Bathymetric and seabed features
- Sediment compartment results including summary data and interpretation of:
  - Physical and chemical characteristics of surface sediment samples.
  - Characteristics of soft bottom benthic macrofauna
- Water compartment results including summary data and interpretation of:
  - The water column profiles, and discrete water samples collected at each of 3 depths,
  - Water quality
  - Plankton in terms of total abundance, diversity, and abundances of key species,
- Environmental habitats results including:
  - Epibenthic infauna based on seafloor videos,
  - Habitat classifications and sensitive species and areas.

The results and interpretation are presented by environmental compartment.

The following table list the reports provided by BSL (BSL, 2023) and Creocean, relating to the operations within blocks B2912 and B2913b conducted offshore Namibia:

Table 1. Multiblock Survey Reporting Structure – Namibia

Report Volume	Report title	Citation
Field Report	Environmental Baseline Survey: Block 2912: Field report	BSL, 2022a
Marine Mammals Report	Environmental Baseline Survey: Block 2912: regional. Marine Mammal Observation Monitoring report	BSL, 2022b
Environmental Report	Environmental Baseine Survey: Block 2912: Final Environmental Baseline and Habitat Assessment Survey	This report

1.4. Background and existing information and background reference levels

1.4.1. Background Information Relating to Offshore Namibia

1.4.1.1. Background Information Relating to Offshore Namibia

Before sampling commenced within Block 2912, a bibliographic study of the regional area was produced by BSL for the Venus-1X PWL area in nearby Block 2913B (BSL, 2018), in conjunction with the 'Marine Spatial Planning' report published by the Ministry of Fisheries and Marine Resources (MFMR) (2021). The documents included an in-depth overview of the current literature for the offshore Namibia region, characterizing the environment and identifying areas of specific concern and sensitivity in the regional area. A summary of findings for Block 2912 is provided below.

1.4.1.1.1. Ecologically or Biologically Significant Marine Areas

The Convention on Biological Diversity (CBD) aims to address the conservation of open ocean and deep-sea ecosystems using the concept of Ecologically or Biologically Significant Marine Areas (EBSAs). The parties to the CBD, in 2008, approved to adopt the scientific criteria for identifying EBSAs and the identification of EBSAs allows for management and conservation to be prioritized within areas that are key for the long-term conservation of ecosystems (CBD, 2008). Although, the criteria for defining EBSAs are broad with differing levels of importance and EBSAs do not necessarily imply that a management response is required, they provide useful information for further marine protection measures (Clark et al., 2014).

Namibia has six internally recognized EBSAs that were designated to submarine ridges, continental margin, canyons, escarpments, and seamounts (Table 2; Nelson Mandela University, 2022). These features in conjunction with cold deep-water upwelling cells support the life histories of key species through increased productivity in these areas.

Table 2. Namibian EBSAs

EBSA	Distance from the center of Block 2912	Description
Orange Cone	375km northeast	The coastal area includes ten threatened ecosystem types: two Critically Endangered, four Endangered and four Vulnerable types. The marine environment experiences slow and weak wind speeds, making it potentially favorable for the reproduction of pelagic species

EBSA	Distance from the center of Block 2912	Description
Walvis Ridge Namibia	1000km north	The Walvis Ridge Namibia EBSA encompasses a series of seamounts, which provide increased habitat heterogeneity that could potentially support a relatively high biological diversity.
Orange Seamount and Canyon Complex	150km east	The EBSA comprises a range of threatened and endangered shelf and shelf edge habitats that are in relatively natural/pristine condition.
Namibian Islands	400km northeast	The Lüderitz upwelling cell surrounding the Namibian Islands drives productive waters that provide important foraging and breeding habitats for threatened seabirds and marine mammals.
Namibe	1,600km north	The presence of shelf-incising canyons and seamounts in the EBSA footprint area contributes to elevated productivity that provides foraging habitats for a range of species.
Namin Flyway	800km northeast	The sheltered bays and shallow waters lead to increased water temperatures and hence higher productivity. A weak upwelling cell is present off Walvis Bay which further contributes to the productivity of the EBSA.
Cape Fria	1,200km north	The continental shelf within the EBSA narrows and produces an upwelling cell that enhances local productivity and provides foraging grounds for a range of species

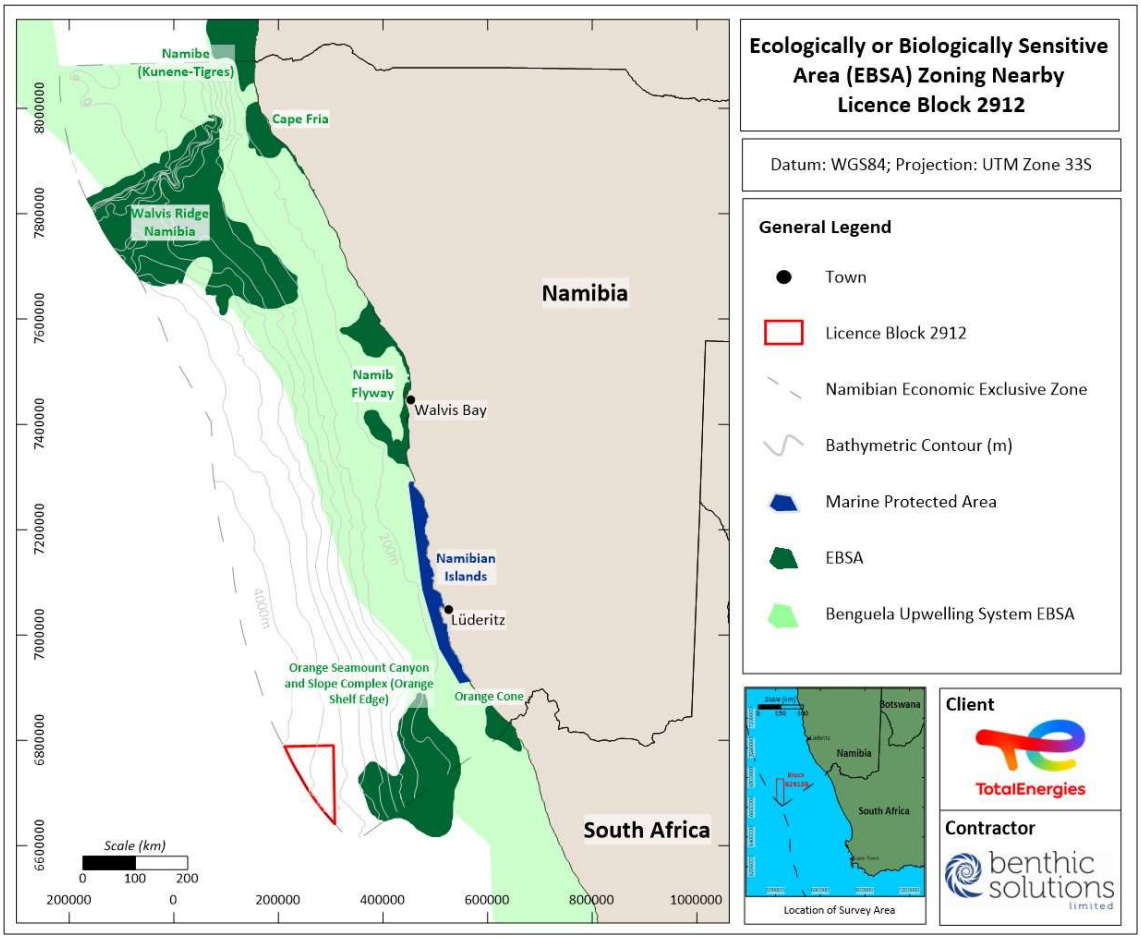


Figure 2. Ecological and biological sensitive and marine protected areas in proximity of Block 2912

1.4.1.1.2. Large Marine Ecosystems

Block 2912 is situated offshore the Benguela coastal upwelling system, which is one of the most biologically productive regions of the world ocean and subsequently has been established as a Large Marine Ecosystem (LME) that is jointly managed by the states of Angola, Namibia and South Africa (Emeis et al., 2004). The Benguela Current Large Marine Ecosystem (BCLME) is one of the world's four major Eastern Boundary Upwelling Systems (EBUS) and is located in the SE Atlantic east of the 0° meridian, between 14°S and 37°S. Wind-driven coastal upwelling of nutrients fuels high productivity and the northern Benguela upwelling is typically driven by equatorward, south-easterly winds, while south Benguela upwelling is more discrete and pulsed. In addition to commercial fisheries the BCLME also provides ecosystem goods and services from offshore oil and gas production, coastal and marine diamond mining, coastal tourism, shipping, and marine aquaculture estimated to be worth between US$ 54.3 billion and US$ 269 billion (Finke et al., 2020).

1.4.1.1.3. Geography and Geological Features

The **continental shelf off southern Namibia is variable in width and is characterised by well-defined shelf breaks, a shallow outer shelf and an aerofoil-shaped submarine 'Recent River Delta' on the inner shelf, along with shallow canyons, escarpments, eroded plateaus and sedimentary basins** (BSL, 2018). Other topographical features of interest in the region, but outside of the Block include Orange Bank, an area that shallows to 160m, Child's Bank situated approximately 150km offshore and the Tripp Seamount situated 300km offshore (SLR Environmental Consulting, 2020).

The **surface geology of the inner shelf is underlain by Precambrian bedrock, while the middle and outer continental shelf areas are composed of Cretaceous and Tertiary sediments** The continental slope, seaward of the shelf break, has a smooth seafloor, underlain by calcareous deposition, which was primarily deposited by historic Orange River discharge Erosion of the continental shelf has resulted in a **generally thin unconsolidated sediment layer of approximately 1m thick**. Sediments become finer seaward towards deeper water, changing from sand dominated to clay dominated sediments, with muddy sand and sandy mud expected within the deep waters of Block 2912 (SLR Environmental Consulting, 2020).

1.4.1.1.4. Focus on Namibian Islands Marine Protected Area (MPA)

The Namibian Islands Marine Protected Area (MPA) is Africa's second largest proclaimed MPA and the only designated MPA in Namibian waters. Situated along the southwestern coast of Namibia, the MPA covers a surface area of 10,000km2 and is located 400km northeast of Block 2912. Since its proclamation, no formal management plan has been implemented, placing the MPA and its ecosystems at risk (Blue Marine Foundation, 2023).

1.4.1.1.5. Wind, Waves and Tides

Namibia is subject to predominantly **southerly, south-westerly and south-easterly winds**. Winds are one of the main physical drivers of the nearshore Benguela region and generate consistent south-westerly swells, which contribute to the northward-flowing longshore currents. As a consequence, physical processes are characterised by the average seasonal wind patterns. The prevailing winds in the Benguela region are controlled by the South Atlantic subtropical anticyclone (a high-pressure area), which undergoes seasonal variation (RPS, 2020). The strongest winds occur during summer from southeast to southwest and are strongly dominated by south-southeasterlies, while the winter winds are south to south-easterly, but are dominated by north-westerlies. The combination of the southerly and south-easterly winds drives the upwelling of nutrient-rich bottom waters and results in high biological production (SLR Environmental Consulting, 2020). The total wave climate in deeper waters will most often be dominated by long period swell waves. Strong winds and large waves are possible throughout the year, but most severe in the winter months (RPS, 2020).

A majority of the west coast of southern Africa is classified as exposed and is influenced by predominantly **wind driven south-westerly swells**. The wave climate of offshore Namibia shows seasonal variation, with winter periods (from June to August) showing maximum wave heights that exceed 10m, while the wave heights in summer are typically 2m (RPS, 2020; SLR Environmental Consulting, 2020).

The tidal regime of Namibia is **semi-diurnal**, with two high tides and two low tides during a tidal day, occurring almost synchronously along the coast. Tides range between 0.6m on the neap tidal cycle and 1.5m on the spring tide (SLR Environmental Consulting, 2020).

1.4.1.1.6. Currents

The south African West Coast is **strongly influenced by the Benguela Current** and current velocities on the continental shelf range between 10 to 30cm/s, with localised flows, associated with eddies, reaching current speeds in excess of 50 cm/s. On the western side of the Benguela Current, the water flow is more transient and is characterised by large eddies that are shed from the Agulhas Current. The flows are predominantly wind-forced, barotropic and fluctuate between poleward and equatorward flow (SLR Environmental Consulting, 2020).

1.4.2. Existing Data Relating to Block 2912

An environmental baseline survey (EBS) was conducted at the Venus 1X well prospect in Block 2913B for TotalEnergies E&P Namibia (TEEPNA). Operations were carried out by Metocean Services International, environmental scope subcontracted to Benthic Solutions Limited (BSL) onboard the MV Oya in October and November 2018, before the drilling operation. This EBS campaign can be considered then as a good reference for comparison with the 2022 campaign, even if Venus 1X area is shallowest than most of the block 2913B survey area.

A total of 8 locations were surveyed using a single box corer deployment at water depth around 2970m, with full water column profiles acquired at a further two sites using a multi-parameter probe, and samples acquired over the central Venus 1X prospect with Niskin bottles and a plankton net. The basis of the prioritized sampling stations was a cruciform template around the Venus 1X prospect out to 500m, with additional sites 1km, 2km and 3km downstream along the surface of the Benguela current.

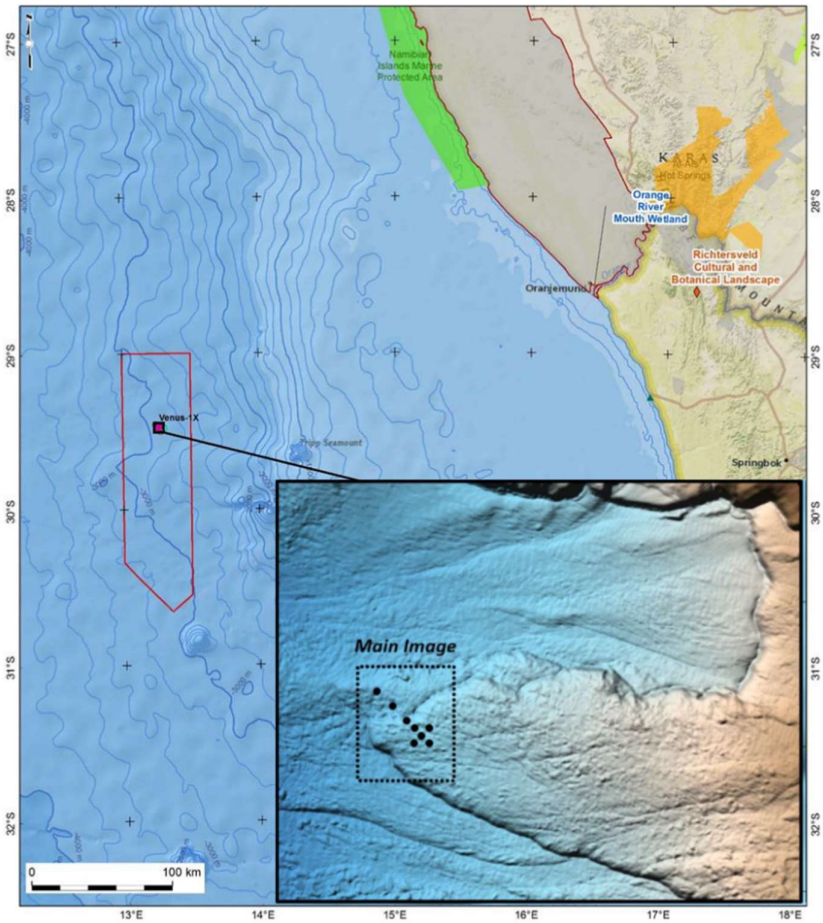


Figure 3. Location of the Venus 1X Survey Area

Sediment

The water depth within the environmental survey area ranged from approximately 2,959m to 2,995m below sea level. The survey data revealed a generally homogenous deep-sea sandy mud habitat. No potentially environmentally sensitive habitats were identified in the area. The seabed samples reflected the dominance of silts throughout, with only subtle variations in the proportion of coarser components (within the sand size-class, probably mostly from relic foraminifera tests) and the finer clay components. Seabed photography showed a very homogeneous habitat type based on a deep-sea sandy mud with very limited bioturbation or evidence of faunal assemblages through Lebensspuren (i.e. tracks, burrows bioturbation features etc.).

Physico-chemical analysis generally showed very low natural levels of most of the chemical parameters analyzed, typical for uncontaminated west-africans sediments. Overall levels indicated no anthropogenic sources either from allochthonous origin (aeolian or riverine inputs) or marine inputs (such as shipping and drilling related activities). Petrogenic hydrocarbon sources also appeared to be absent, suggesting that natural seeps are also absent from the immediate vicinity of the site.

Concentrations of all metals remained at low concentrations throughout with very little change between stations. Only the metals copper, nickel and barium were found to be consistently above the US EPA toxicity reference level (TRL), NOAA Effect Range Low (ERL) or the Canadian Council of Ministers of the Environment (CCME) threshold effect level (TEL). These results, however, relate to a consistent natural sediment level for these metals.

Seawater

The seawater quality profiles and seawater chemistry data from the two stations varied slightly between profiles, although these were generally attributed to sensors errors on individual profile deployments. The temperature and salinity profiles showed the upper ~50m of the water column to be relatively well mixed with temperatures of >17°C and salinity of around >35.5 PSU. A slow but consistent zone of mixing down to a depth of 670 meters with approximate temperature and salinities of 4.8°C and 34.4 PSU, respectively. The dissolved oxygen (DO) profile indicated a slight elevation from phytoplankton activity near the surface (also supported by a slightly elevated turbidity in the same area), with a slow and consistent decrease to an oxygen minimum layer at 1200m before increasingly slightly towards the seabed at 3000m.

Macrofauna community

The macrofauna community was dominated by Annelida and Mollusca, but the was generally impoverished throughout. A total of 105 species were recorded of which annelids accounted for 66 of the species and represented 64.1% of the individuals. Results indicated a relatively high diversity but low abundance, with many taxa represented by only 1 or 2 individuals.

The overall top three species in both numerical abundance and ranking were represented by the polychaete *Spiophanes* sp. followed by the mollusc *Microgloma mirmidina* and then another polychaete tentatively identified as a *Leiocapitellide*.

Epifaunal species, along with identification of conspicuous survey species from seabed imagery, were essentially absent from the survey data. Whilst high productivity upwelling areas are sporadically found along the Namibian coast, these are located in shallower areas where the continental shelf narrows and at a significant distance from the current Venus 1X prospect. The EBS survey revealed that the sediments at these survey depths, are not supported by significant organic enrichment, resulting in a relatively small but diverse macro-invertebrate community.

1.4.3. Reference Levels and Sources

1.4.3.1. Sediment compartment

The following tables present reference values for the sediment compartment:

Table 3. Sediment enrichment reference values (Alzieu, 2003)

Score	Total Organic Carbon (% m/m)	Total Nitrogen (mg/kg m/m)	Total Phosphorous (mg/kg m/m)
0	<0.6	< 600 (or 0.06%)	<500
1	0.6 - 2.3	600 - 1200 (or 0.06 - 0.12%)	500 - 800
2	2.4 - 4.0	1200 - 2400 (or 0.12 - 0.24%)	800 - 1200
3	4.1 - 5.8	2400 - 3600 (or 0.24 - 0.36%)	>1200
4	>5.8	>3600 (or > 0.36%)	

Alzieu score (sum of above score)	Organic Enrichment
0	Nil
1 – 3	Low
4 – 6	medium
>6	High

Table 4. Trace metals with reference values for sediment

Threshold (mg/kg)	French Circular N1 [1]	French Circular N2 [1]	OSPAR (2014) ERL [2]	NOAA (2008) ERM [3]	AZNECC/ ARMCANZ SQGV Guideline value [4]	AZNECC/ ARMCANZ SQGV High value [4]
Antimony (Sb)	-	-	-	-	2	25
Arsenic (As)	25	50	8.2	70	20	70
Cadmium (Cd)	1.2	2.4	1.2	9.6	1.5	10
Chromium (Cr)	90	180	81	370	80	370
Copper (Cu)	45	90	34	270	65	270
Lead (Pb)	100	200	46.7	218	50	220
Mercury (Hg)	0.4	0.8	0.15	0.71	0.15	1
Nickel (Ni)	37	74	20.9	51.6	21	52
Silver (Ag)	-	-	-	-	1	4
Zinc (Zn)	276	552	150	410	200	410

[1] *French circular 9/08/2006 France*

[2] *OSPAR, 2014. Levels and Trends in Marine Contaminants and their Biological Effects. CEMP Assessment Report 2013. Publication number: 631/2014, OSPAR Commission 2014.*

[3] *Buchman, M. F. 2008. NOAA Quick Screening Reference Tables. NOAA OR&R Report 08-1 Seattle WA, Office of Response and Restoration Division, National Atmospheric and Oceanic Administration (2008): 34 pages.*

[4] *Simpson SL, Batley GB and Chariton AA (2013). Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines. CSIRO Land and Water Science Report 08/07. CSIRO Land and Water.*

Table 5. THC reference values for sediment

Threshold (mg/kg)	OSPAR (2009) [1]	EGASPIN (2002) Target Value [2]	EGASPIN (2002) Intervention Value [2]
THC	50	50	5,000

[1] *OSPAR, 2009. Implementation report on Recommendation 2006/5 on a management regime for offshore cutting piles, pp. 24.*

[2] *Department of Petroleum Resources (DPR). 2002. EGASPIN soil/sediment target and intervention values for Mineral oil (or TPH). Environmental guidelines and standards for The Petroleum Industry in Nigeria. 2: 1-415.*

Table 6. PAHs reference values for sediment (Simpson et al., 2013)

Threshold (µg/kg)	AZNECC/ARMCANZ SQGV Guideline value	AZNECC/ARMCANZ SQGV High value
Total PAH	10,000	50,000

Table 7. BTEX reference values for sediment (WFD 2000/60/EC, 2015)

Threshold (mg/kg)	EQS (2013)
Benzene	6
Toluene	6
Ethylbenzene	6
Xylene	6

Table 8. Interpretation of thresholds for sediment

Abbreviations	Explanation
French circular N1 / N2	Concentration < N1: non-toxic sediment. Concentration > N1: sediment requiring ecotoxicological investigations. Concentration > N2: toxic sediment.
OSPAR ERL Effect Range Low	Levels were defined as concentration of metals at which adverse effects were reported in 10% of the data reviewed.
NOAA ERM Effect Range Median	Levels were defined as the concentrations at which 50% of studies reported harmful effects.
AZNECC/ARMCANZ SQGV sediment quality guideline values	Results below their respective SQGV deemed to constitute 'low risk', indicating the contaminant poses little risk of adverse biological effects. Results above the SQGV is acceptable if the concentrations are below the background levels determined from previous surveys in the area that has a similar sediment type. Results above the SQGV but below the SQGV-high threshold and is in line with background conditions for this region, the metal can be considered a contaminant of potential concern (COPCs), where effects on the biological community are possible but considered a 'low risk'.
OSPAR (2009) THC Threshold	Based on benthic amphipod (e.g: *Corophium volutator*) biomarkers for oil pollution. Study indicated that the critical tissue residue (the highest tissue concentration at which no significant mortality was observed) was approximately 900 mg/kg in sediment containing 31-48 mg/kg of cuttings derived hydrocarbons. As such, study deduced a no-effect residue concentration in the region of 50 mg/kg dry weight.
EGASPIN (2002) Target Value	Indicating the soil/sediment quality required for sustainability or expressed in terms of remedial policy, the soil/sediment quality required for the full restoration of the soils/sediments functionality for human, animal and plant life.
EGASPIN (2002) Intervention Value	Indicate the quality for which the functionality of soil and sediments for human, animal and plant life are, or threatened with being seriously impaired. Concentrations in excess of the intervention values correspond to serious contamination.
EQS Environmental Quality Standards	Environmental quality standards concerning the presence in surface of certain substances or groups of substances identified as priority pollutants because of the significant risk they pose to or via the aquatic environment.

1.4.3.2. Water compartment

The following tables give reference values for water compartment:

Table 9. References for seawater profile (pH and dissolved oxygen)

Threshold	pH	Dissolved Oxygen (mg/L)
CCME (Long term concentration) *	[7.0-8.7]	8

** CCME (1999) Dissolved Oxygen reference value provided as 8mg.l-1 as the absence of salinity and temperature prevented conversion to percentage (%) saturation.*

Table 10. Reference for organic and nutrient content in seawater

WFD thresholds * (mg/L)	Dissolved Organic Carbon	Total Nitrogen	Nitrate (NO3)	Nitrite (NO2)	Orthophosphate (PO4)
Very good	≤ 5	≤ 0.70	≤ 10	<0.3	≤ 0.03
Good	<7	]0.70-1.05]	<50		[0.03-0.1]
Medium	<10	]1.05-1.40]	*	> 0.3	[0.10-0.14]
Poor	<15	]1.40-1.68]	*		[0.14-0.38]
Bad	> 15	>1.68	*		> 0.38

** WFD 2000/60/EC (2015): In 2018, new European Standards for water enrichment were introduced (based on the Decree of 27 July 2018). However, these standards are only based on the monitoring of the DIN (Dissolved Inorganic Nitrogen) which is not measured in this study. We decided to measure the previous indicator concentrations (Total Nitrogen, nitrates and orthophosphates) and compare them to the previous Water framework Directive (ruling of 27 July 2015, amending the ruling of January 25, 2010).*

Table 11. Reference for Chlorophyll-a content in seawater

WFD Threshold *	Chl-a (µg/ l)
Very good ecological status	[0-4.4]
Good ecological status	[4.4-10]

** The EU Water Framework Directive (WFD) specifies standards for chlorophyll biomass in European coastal waters (decree of July 27th, 2018).*

Table 12. Reference for metal concentrations in seawater

Threshold (µg/ l)	Background Levels [1]	UK Marine SACs Project. 1999 [2]	EQS Coastal and Transitional Waters [3]	NOAA (2008) CCC [4]	NOAA (2008) CMC [4]
Arsenic (As)	3-4	25	-	36	69
Barium (Ba)	4 -21	-	-	200	1000
Beryllium (Be)	-	100	-	1500	-
Cadmium (Cd)	0.0001-0.11	2.5	0.2	8.8	40
Chromium (Cr)	0.16-0.26	-	-	-	-
Cobalt (Co)	0.012	-	-	-	-
Copper (Cu)	3-10	-	-	3.1	4.8
Iron (Fe)		1000	-	50	300
Lead (Pb)	0.001-0.030	-	1.3	8.1	210
Mercury (Hg)	0.00004-0.03	0.3	-	0.94	1,8
Molybdenum (Mo)	10	23	-	100	-
Nickel (Ni)	0.15-0.70	-	8.6	8.2	74
Selenium (Se)	0.04-0.20	71	-	290	-
Thallium (Th)	-	17	-	-	-
Tin (Ti)	0.0001-0.0023	-	-	-	-
Vanadium (V)	1.5-1.8	100	-	50	-
Zinc (Zn)	1-10		-	81	90

[1] Bruland and Lohan (2003) & Bruland et al. (1991): background levels focused on the Pacific coast but enlarged to the open ocean.

[2] UK Marine SACs Project (1999): Guidelines for managing water quality impacts within UK European marine sites.

[3] WFD 2000/60/EC (2015): In 2018, new European Standards for water enrichment were introduced (based on the Decree of 27 July 2018).

[4] Buchman (2008). CCC is synonymous with "chronic", and CMC is synonymous with "acute".

Table 13. Reference for BTEX concentrations in seawater

Threshold (µg/ l)	EQS Coastal and Transitional Waters [1]	NOAA (2008) CCC [2]	NOAA (2008) CMC [2]
Benzene	8	110	5100
Toluene	-	215	6300
Ethylbenzene	-	25	430
Xylene	-	-	-

[1] WFD 2000/60/EC (2015): In 2018, new European Standards for water enrichment were introduced (based on the Decree of 27 July 2018). However, these standards are only based on the monitoring of the DIN (Dissolved Inorganic Nitrogen) which is not measured in this study. We decided to measure the previous indicator concentrations (Total Nitrogen, nitrates and orthophosphates) and compare them to the previous Water framework Directive (ruling of 27 July 2015, amending the ruling of January 25, 2010).

[2] Buchman (2008). CCC is synonymous with "chronic", and CMC is synonymous with "acute".

Table 14. Interpretation of thresholds

Thresholds	Explanation
EQS (Environmental Quality Standards)	Environmental quality standards concerning the presence in surface of certain substances or groups of substances identified as priority pollutants because of the significant risk they pose to or via the aquatic environment
NOAA CCC (Criterion continuous concentration)	Is an estimate of the highest concentration of a material in the water column to which an aquatic community can be exposed indefinitely without resulting in unacceptable effect. CCC is synonymous with "chronic".
NOAA CMC (Criterion maximum concentration)	Is an estimate of the highest concentration of a material in the water column to which an aquatic community can be exposed briefly without resulting in an unactable effect. CMC is synonymous with "acute".

2. Field Survey Program and Analytical Methods

2.1. Geodetic parameters

The geodetic parameters used and equipment accuracy are provided in the following tables. A USBL positioning calibration was conducted on the 14th of September in 617m of water following completion of mobilization in Walvis Bay, Namibia. Full calibration details were supplied in the dedicated sensor calibration and verification internal report.

Table 15. Geodetic parameters (horizontal datum)

Required Datum	
GPS Datum	World Geodetic System 1984 (WGS84) EPSG Code:32744
Semi-major Axis (a)	6378137.000m
Inverse Flattening (1/f)	298.257223563
Projection Parameters	
Grid Projection	Universal Transverse Mercator
Projection Name	UTM Zone 33 South
Central Meridian & Scale Factor at C.M.	15° East & 0.9996
False Easting & False Northing	500 000m & 10000000m

Table 16. Equipment Accuracy

Surface (Vessel)	System	Specifications
GPS (Primary)	CNAV 3050	Horizontal ± 0.15m
GPS (Secondary)	CNAV 3050	Horizontal ± 0.15m
Gyro	TSS Meridian Surveyor Gyro	Heading ± 0.1° Secant Latitude
MRU	Inertial Labs	Attitude ± 0.01°
USBL Positioning	Sonardyne Ranger II	< ± 0.2% slant range
CTD (Primary)	Valeport MIDAS CTD+	Temp ±0.002°; Conductivity +/-0.01mS/cm; Pressure +/-0.01%; Turbidity +/-2%; DO +/-0.07ml/l; pH +/-0.05; Redox +/-1mV
CTD (Secondary	Valeport MIDAS CTD+	Temp ±0.002°; Conductivity +/-0.01mS/cm; Pressure +/-0.01%; Turbidity +/-2%; DO +/-0.07ml/l; pH +/-0.05; Redox none.

Figure 4. USBL beacon

2.2. Sampling plan

2.2.1. Survey design

The sampling strategy was designed by BSL and Creocean to follow TEEPNA set investigation targets and station selection rationale. The sampling plan consisted of sediment and water column sampling combined with seabed video acquisition in order to provide a greater understanding of the regional seabed habitats.

Block 2912 sampling locations were positioned using a grid pattern across the survey area which distanced stations by approximate distance of 13.3km in the horizontal plane and 8.6km in the vertical plane. This method provided an even distribution of sampling locations throughout the sampling area. Water sampling locations were selected based on area coverage.

Video transects and some sampling locations were located across the Block 2912, after review of available data based on the seismic bathymetry data covering some of Block 2913B and the broadscale low resolution bathymetry across blocks 2912 and 2913. The aim of the sampling plan was to gather information on bathymetric changes, spatial variability, and possible seabed features (geological feature or potential sensitivity), to comprehensively characterize the seabed habitats of the block.

Any sampling locations within the subsea cable 2km both side exclusion zone were moved accordingly (see 6.1 Appendix I - Field Operations and Survey Methods).

The sampling plan have been adapted during the survey due to sea state inducing time constraint and considering the deadline of mission of the 14th of October in Cape Town for a crew change. The operations completed 75% of the initial scope.

The effective EBS sampling plan is shown in the following table.

Table 17. EBS sampling strategy in Block 2912

Sampler	Purpose of Analysis	Number of Stations	Number of Samples Per station
Box corer	Sediment – Benthic macrofauna	31	1 replicate sample
	Sediment – Microbiology		1 set (with spares)
	Sediment – eDNA		2 replicates
	Sediment – Physico-chemistry		1 set (with spares)
10L Niskin Bottle	Water- Chemistry, chlorophyll-*a* and eDNA	4	3 samples (surface layer, middle layer and the bottom layer), 2 replicates of eDNA
Multiprobe	Water – physical characteristics including salinity (conductivity), temperature, depth (pressure), redox, pH, turbidity and dissolved oxygen saturation	4	1 profile per water station (digital)
Plankton Net	Water – Zooplankton (200µm)	4	1 horizontal tow per water station*
	Water – Phytoplankton (50µm)	4	1 horizontal tow per water station*
HD Underwater Camera Transect	Video – Habitat and Potential Sensitivities	8	1km transect per camera transect station

** Samples were all performed but were lost during their transport to the laboratory.*

2.2.2. Water sampling

The identification and location of the 4 water sampling stations are listed in the table below. On these same stations, CTD profiles and plankton samples were also performed.

Table 18. Location of water sampling stations

Sediment Station	Water Sample ID	Easting (m)	Northing (m)	Depth (m)
S01	**S01-B**	257 396	6 769 335	5
	S01-M			1 000
	S01-S			3 519
S04	**S04-B**	298 185	6 769 382	5
	S04-M			1 000
	S04-S			3 160
S23	**S23-B**	284 942	6 726 484	5
	S23-M			1 000
	S23-S			3 406
S40	**S40-B**	298 335	6 680 412	5
	S40-M			1 000
	S40-S			3 214

2.2.3. Sediment and benthic fauna sampling

The identification and location of the 31 sediment sampling stations are listed in the table below.

Table 19. Location of sediment and benthic fauna sampling stations (water depth classification)

Station	Easting (m)	Northing (m)	Depth (m)
S32	298,361	6,708,459	2,992
S35	298,331	6,699,316	2,998
S28	298,311	6,717,737	3,057
S38	298,395	6,689,572	3,145
S31	285,291	6,708,668	3,175
S04	298,185	6,769,382	3,184
S08	298,160	6,760,904	3,208
S40	298,335	6,680,412	3,227
S12	298,252	6,752,507	3,230
S34	283,543	6,697,632	3,232
S16	298,221	6,744,039	3,268
S37	285,559	6,689,844	3,276
S20	298,239	6,735,026	3,301
S24	298,295	6,726,519	3,301
S39	285,637	6,680,652	3,306
S07	284,485	6,760,883	3,308
S03	284,371	6,769,356	3,324
S11	284,587	6,752,388	3,325
S27	285,062	6,717,707	3,338
S15	284,693	6,743,991	3,370
S30	271,210	6,708,798	3,387
S19	284,823	6,734,996	3,394
S23	284,942	6,726,484	3,411
S10	270,821	6,752,299	3,423
S06	270,708	6,760,870	3,435
S33	271,198	6,699,504	3,438
S14	270,872	6,743,972	3,498
S22	270,959	6,726,491	3,528
S01	257,396	6,769,335	3,532
S13	257,613	6,743,965	3,584
S21	257,854	6,726,454	3,624

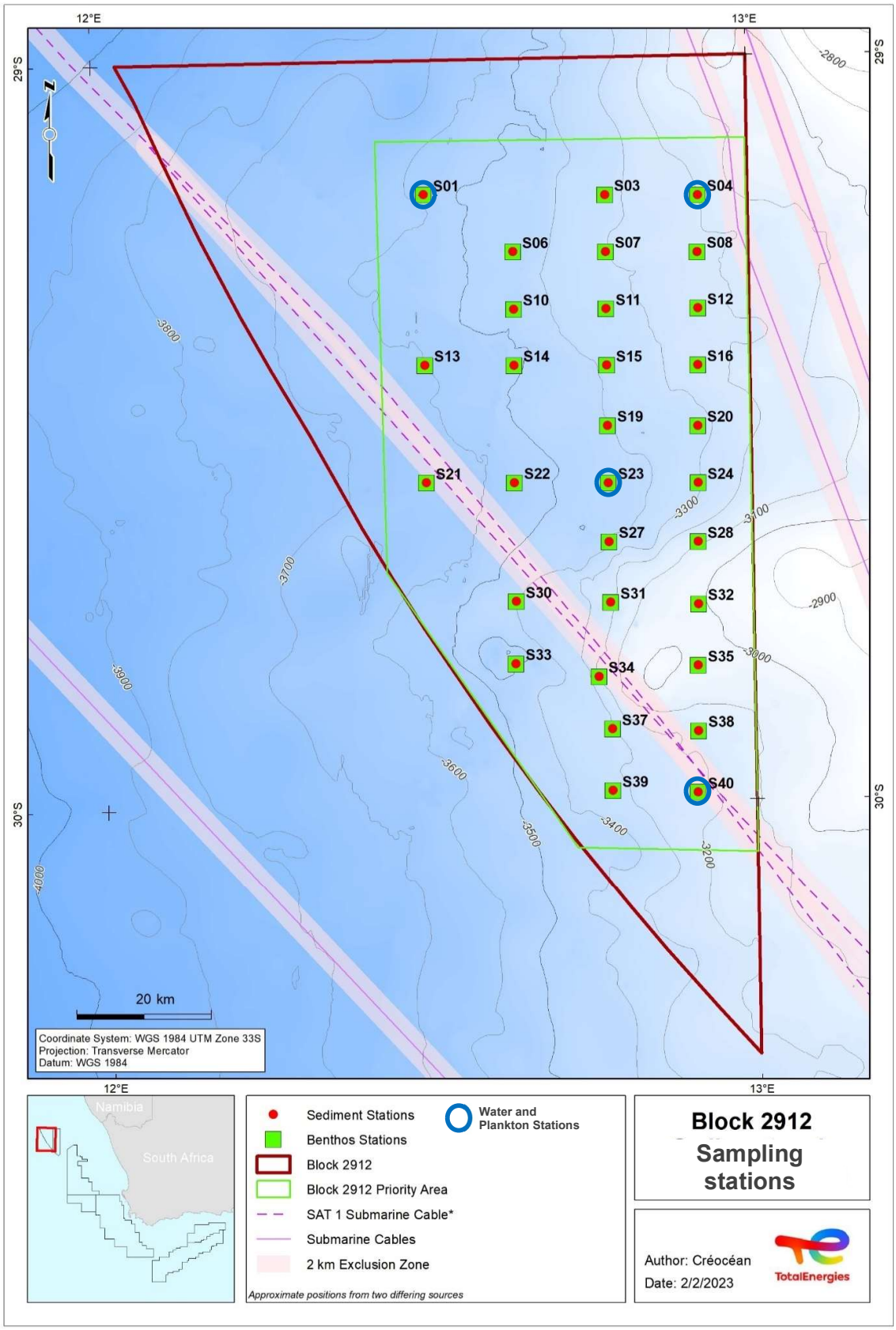


Figure 5. Location of water, plankton, sediment and benthic fauna sampling stations

2.2.4. Underwater video/Camera acquisition

The characteristics of the 8 camera transects (front and side view) are presented in the table below.

Detailed video transect log sheets area given in Appendix (6.20 Appendix XX – Camera Transect Log Sheets).

Table 20. Characteristics of the video transects

Transect	Vertice (m)	Easting (m)	Northing (m)	Depth (m)	Length (m)
CAM01	SoL	300,533	6,770,449	3,152	500
	EoL	300,793	6,770,022	3,151	
CAM04	SoL	298,337	6,760,743	3,210	531
	EoL	298,002	6,761,155	3,211	
CAM05	SoL	280,394	6,754,186	3,346	332
	EoL	280,553	6,753,895	3,262	
CAM07	SoL	270,492	6,744,219	3,503	519
	EoL	270,892	6,743,889	3,500	
CAM08	SoL	284,650	6,726,790	3,410	479
	EoL	285,063	6,726,547	3,407	
CAM09	SoL	294,098	6,721,192	3,309	426
	EoL	294,432	6,720,927	3,295	
CAM12	SoL	298,046	6,708,763	2,894	550
	EoL	298,451	6,708,391	2,985	
CAM14	SoL	291,406	6,699,649	2,943	574
	EoL	291,846	6,699,280	2,942	

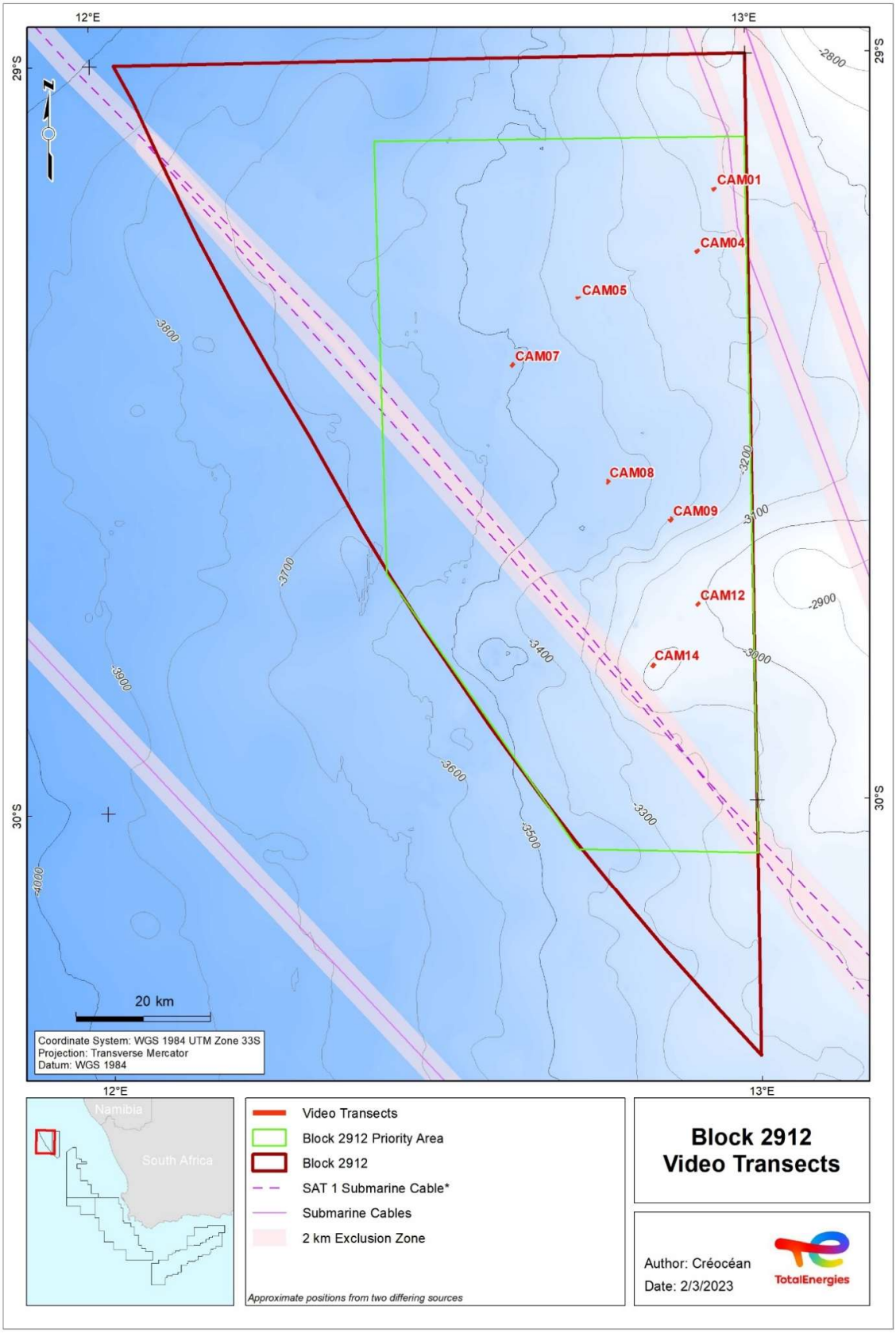


Figure 6. Location of video transects

2.3. Sample analysis

2.3.1. Laboratory analyses

The traceability of the samples was maintained from the field sampling record to the respective Chain of Custody (CoC) forms which accompanied the shipments to the analytical laboratories. Upon receipt of the samples, the respective analytical laboratories signed off the CoC form and emailed a scanned copy of the signed form to Creocean.

Back to port, all samples were packed and sent by plane and dedicated trucks to the analytical laboratories along with a chain of custody form and a proforma invoice.

All samples were received by the laboratories as planned (except plankton samples which were lost during their transport), respecting the cold chain from the time of collection to their arrival at the laboratory.

Table 21. List of laboratories

Matrix	Parameter	Transportation temperature	Laboratory
Seawater	**Suspended matter, organic content, and trace metals, nutrients, total heterotrophic microorganisms, hydrocarbon adapted microorganisms**	+4°C	Laboratoire des Pyrénées et des Landes (LPL) (Lagor, France)
	Hydrocarbons, PAHs, alkanes, and BTEX	-18°C	CEDRE (Brest, France)
	Chlorophyll pigments	-18°C	MARBEC (Montpellier, France)
	Phytoplankton & Zooplankton (identification to species if possible and biomass)	Ambient temperature	PIQv (Villefranche sur Mer, France)
Sediment	**Grain size**	+4°C	BSL (UK)
	Organic content, and trace metals, nutrients,	+4°C	SOCOTEC (UK)
	TPH, PAHs, aliphatic hydrocarbons and BTEX	+4°C	SOCOTEC (UK)
	Microbiology total heterotrophic microorganisms, hydrocarbon adapted microorganisms	+4°C	EUROFINS (UK)
	Benthic macrofauna (identification to species if possible and biomass)	Ambient temperature	ANCHOR (Cape Town, SA)

More details on laboratories, analyses and data treatment are given in Appendix II - Data Presentation. Laboratory and Statistical Analyses.

2.3.2. Video transects treatment

Video transects were carried out along lines of around 500m in length in order to optimize data retrieval across the block. To obtain the best video, transects were conducted at very low speed (below 1 knot).

Additional observations were made at all the sediment stations with the BSL pressure camera system attached to the frame of the box corer (31 sediment sampling stations successfully captured seabed imagery).

A marine biologist recorded all the observations made from the video and entered them into an excel file. Observations included the characteristics of the seabed, evidence of bioturbation, and the identification of the different epibenthic living organisms encountered.

These observations were then synthetised, and a descriptive summary sheet was generated for each transect (see section 3.4.2).

Based on these transect-by-transect observations, a global assessment of the biological richness and diversity could be assessed, as well as the general sea bottom visual characteristics.

3. Environmental Baseline Survey Results and Discussion

3.1. Bathymetry and seabed features

The survey area across Block 2912 is in the deep abyssal plain up to 400km offshore Namibia. The depth ranges from approximately 2,900m to over 3,700m below sea level. The floor is composed of a deep flat (average slope of 2.1%), homogeneous and soft silty mud seabed.

No particular and natural relief or seabed structure are expected in the area. However, it must be noticed that a cable (STA1) is crossing the block.

Other topographical features of interest in the region are banks located far away east or north to the block on the continental shelf. These include the Orange Bank (Shelf or Cone), a shallow (160 - 190 m) zone that reaches maximal widths (180 km) offshore of the Orange River, and Child's Bank (South Africa), situated approximately 150 km offshore at about 31°S. Tripp Seamount is a geological feature situated approximately 300 km offshore at about 29°S, which rises from the seabed at approximately 1,000 m to a depth of 150 m.

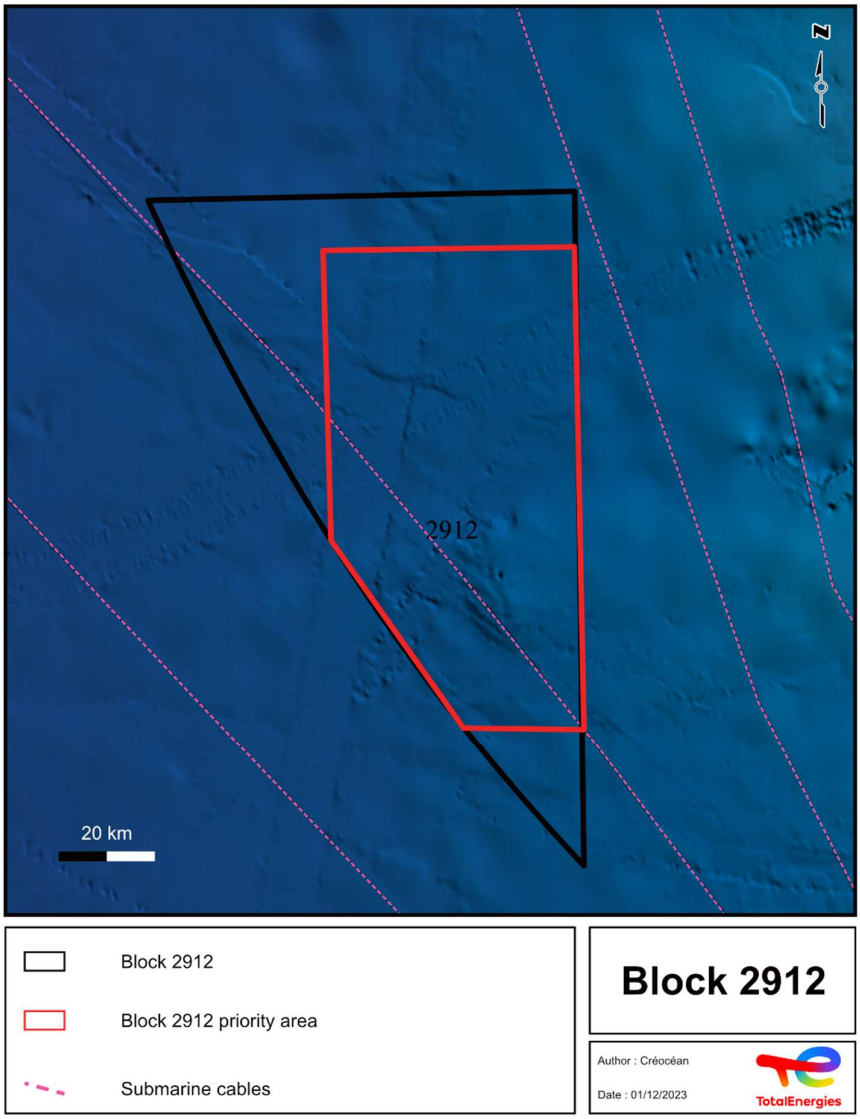


Figure 7. Block 2912 seabed and bathymetry

3.2. Sediment compartment

3.2.1. Sediment physico-chemical characteristics

A total of 31, of the proposed 40, sediment stations were sampled from a depth of 2,992 to 3,624m. All seabed samples were acquired using the Gray O'Hara box corer (0.25m² box core: 50 x 50 x 50 centimeters (cm).

3.2.1.1. Visual observations during field operations

Samples were collected from the abyssal plain and comprised soft pale mud over consolidated clay, with extensive bioturbation.

The table below is an extract from the database of sediment samples taken during the survey with information on the superficial sediment characteristics. Attributes were directly measured in the box core onboard after sampling each station.

The following is an overview of the characteristics of the sediment:

- Sediment was mostly composed of pale mud over consolidated clay while a few stations (S27, S31, S34, S37) show mud mixed with a sand component.
- Sediment color was typically brownish gray and light gray with no odor, no detritus, and no evidence of visible pollution.
- Very few biota were observed on the surface of box cores (brittle stars mainly) with low bioturbation.

Photo plates of the sediment aspect using the drop-down camera are presented in 6.19 Appendix XIX - Seabed Photograph.

Table 22. Extract from the sediment sample database related to superficial sediments.

Station	Depth	Color code	Sediment description/stratification
S01	3,532	10YR 6/2	Pale mud over consolidated clay
S03	3,324	10YR 6/2	Pale mud over consolidated clay
S04	3,184	10YR 6/2	Pale mud over consolidated clay
S06	3,435	10YR 6/2	Pale mud over consolidated clay
S07	3,308	10YR 6/2	Pale mud over consolidated clay
S08	3,208	10YR 6/2	Pale mud over consolidated clay
S10	3,423	10YR 6/2	Pale mud over consolidated clay
S11	3,325	10YR 6/2	Pale mud over consolidated clay
S12	3,230	10YR 6/2	Pale mud over consolidated clay
S13	3,584	10YR 6/2	Pale mud over consolidated clay
S14	3,498	10YR 6/2	Pale mud over consolidated clay
S15	3,370	10YR 6/2	Pale mud over consolidated clay
S16	3,268	10YR 6/2	Pale mud over consolidated clay
S19	3,394	10YR 6/2	Pale mud over consolidated clay
S20	3,301	10YR 6/2	Pale mud over consolidated clay
S21	3,624	2.5Y 7/2	Pale mud over consolidated clay
S22	3,528	2.5Y 7/2	Pale mud over consolidated clay
S23	3,411	10YR 6/2	Pale mud over consolidated clay
S24	3,301	10YR 6/2	Pale mud over consolidated clay
S27	3,338	10YR 6/2	Pale mud with fine sand component over consolidated clay
S28	3,057	10YR 6/2	Pale mud over consolidated clay
S30	3,387	2.5Y 7/2	Pale mud over consolidated clay
S31	3,175	10YR 6/2	Pale mud with fine sand component over consolidated clay
S32	2,992	10YR 6/2	Pale mud over consolidated clay
S33	3,438	2.5Y 7/2	Pale mud over consolidated clay

S34	3,232	10YR 6/2	Pale mud with fine sand component over consolidated clay
S35	2,998	10YR 6/2	Pale mud over consolidated clay
S37	3,276	10YR 6/2	Pale mud with fine sand component over consolidated clay
S38	3,145	10YR 6/2	Pale mud over consolidated clay
S39	3,306	10YR 6/2	Pale mud over consolidated clay
S40	3,227	10YR 6/2	Pale mud over consolidated clay

3.2.1.2. Particle Size Distribution

> *The analysis of the granulometric pattern (grain size distribution for clay, silt and sand, and >2mm refusal for coarse sediment as gravel or pebble) and granulometric index (mean particle size, phi scale, sorting coefficient used to assess the degree of classification of a sediment) enables to highlight the dominance (or not) of a granulometric class, to understand the setup of the sediment (superficial or sediment mass silting, bioclastic or lithoclastic inputs ...). The phi scale allows more emphasis for the finer grain sizes. Phi size values for the sediment class limits range from −5 phi (for a diameter of 32 mm, or very coarse pebble size) down to +10 phi (for a diameter of 1/1,024 mm, or clay size).*
>
> *The particle size distribution enables among others to determine the ability of the sediment:*
>
> *- to host benthic infauna (fluidity and compactness of the sediment),*
>
> *- to accumulate chemical contaminants (trace metals) which are potentially toxic to aquatic fauna and flora.*

Grain size analyses per class are given for each station (sample) in the following Table 23. Raw data are given in 6.4 Appendix IV – Particle Size Distribution.

Sediments are all characterized as fine to very fine silts according to Wentworth classification, the mean size particle ranges from 0.006 to 0.013 mm (mean of 0.01mm) and the phi ranges from 6.02 to 7.33 for a mean value of 6.81. Block 2912 stations are all classified as poorly to very poorly sorted. Fine fraction (< 63µm or 0.063 mm) makes up approximately 89% of the sediment (mean value), sands (63 µm – 2mm) 11% of the sediment (mean value), and gravel less than 0.13% (max value).

The distribution of granulometric classes for each station within Block 2912 is presented in the following Figure 8:

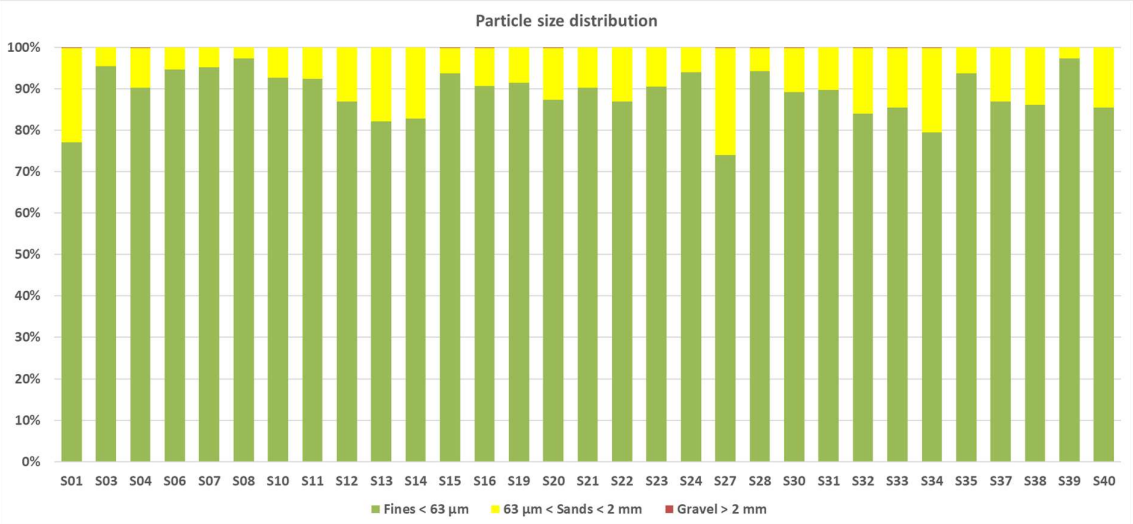


Figure 8. Variations of the different fractions composing the sediments

The fine fraction (> 63µm) varies between 74% (S27) and 97% (S08, S39), for a standard deviation of ±5.79% which makes it quite homogeneous throughout the whole area. The Figure 9 shows the percentage of the fine fraction throughout the Block 2912, the area with the finest fraction is located in the northeast part of the block, with a high percentage of fine fraction located at stations S03 and S06 to S08. Areas with larger fractions are distributed from the northeast part of the block to the southwest among the different stations S01, S13, S14, S27 and S34.

Table 23. Grain size value percentages and classification by survey sediment station

Station	Depth (m)	Mean Particle Size		Wentworth Classification	Sorting	Sorting Classification	Fines < 63 µm	63 µm < Sands < 2 mm	Gravel > 2 mm
		mm	Phi		Coefficient		(%)	(%)	(%)
S01	3,532	0.01	6.23	Fine Silt	2.61	Very Poorly Sorted	77.11	22.86	0.03
S03	3,324	0.01	7.18	V. Fine Silt	1.82	Poorly Sorted	95.53	4.47	0.00
S04	3,184	0.01	6.89	Fine Silt	2.07	Very Poorly Sorted	90.37	9.58	0.05
S06	3,435	0.01	7.20	V. Fine Silt	1.88	Poorly Sorted	94.71	5.29	0.00
S07	3,308	0.01	7.27	V. Fine Silt	1.79	Poorly Sorted	95.22	4.78	0.00
S08	3,208	0.01	7.26	V. Fine Silt	1.67	Poorly Sorted	97.38	2.63	0.00
S10	3,423	0.01	7.10	V. Fine Silt	1.95	Poorly Sorted	92.74	7.26	0.00
S11	3,325	0.01	7.04	V. Fine Silt	1.99	Poorly Sorted	92.39	7.62	0.00
S12	3,230	0.01	6.58	Fine Silt	2.10	Very Poorly Sorted	87.00	13.00	0.00
S13	3,584	0.01	6.55	Fine Silt	2.45	Very Poorly Sorted	82.21	17.79	0.00
S14	3,498	0.01	6.55	Fine Silt	2.41	Very Poorly Sorted	82.83	17.17	0.00
S15	3,370	0.01	7.07	V. Fine Silt	1.85	Poorly Sorted	93.79	6.18	0.04
S16	3,268	0.01	6.79	Fine Silt	1.97	Poorly Sorted	90.71	9.21	0.08
S19	3,394	0.01	6.89	Fine Silt	1.93	Poorly Sorted	91.56	8.44	0.00
S20	3,301	0.01	6.71	Fine Silt	2.14	Very Poorly Sorted	87.39	12.49	0.13
S21	3,624	0.01	6.87	Fine Silt	2.05	Very Poorly Sorted	90.25	9.76	0.00
S22	3,528	0.01	6.68	Fine Silt	2.17	Very Poorly Sorted	86.93	13.08	0.00
S23	3,411	0.01	6.90	Fine Silt	2.04	Very Poorly Sorted	90.52	9.48	0.00
S24	3,301	0.01	7.15	V. Fine Silt	1.89	Poorly Sorted	94.04	5.96	0.00
S27	3,338	0.02	6.02	Fine Silt	2.65	Very Poorly Sorted	74.08	25.87	0.05
S28	3,057	0.01	7.08	V. Fine Silt	1.88	Poorly Sorted	94.27	5.69	0.04
S30	3,387	0.01	6.76	Fine Silt	2.02	Very Poorly Sorted	89.24	10.73	0.04
S31	3,175	0.01	6.81	Fine Silt	2.02	Very Poorly Sorted	89.80	10.20	0.00
S32	2,992	0.01	6.43	Fine Silt	2.23	Very Poorly Sorted	84.05	15.87	0.08
S33	3,438	0.01	6.64	Fine Silt	2.26	Very Poorly Sorted	85.48	14.49	0.04
S34	3,232	0.01	6.24	Fine Silt	2.35	Very Poorly Sorted	79.45	20.46	0.09

Station	Depth (m)	Mean Particle Size		Wentworth Classification	Sorting	Sorting Classification	Fines < 63 µm	63 µm < Sands < 2 mm	Gravel > 2 mm
		mm	Phi		Coefficient		(%)	(%)	(%)
S35	2,998	0.01	7.04	V. Fine Silt	1.85	Poorly Sorted	93.71	6.29	0,00
S37	3,276	0.01	6.70	Fine Silt	2.17	Very Poorly Sorted	86.91	13.09	0,00
S38	3,145	0.01	6.59	Fine Silt	2.18	Very Poorly Sorted	86.11	13.89	0,00
S39	3,306	0.01	7.33	V. Fine Silt	1.63	Poorly Sorted	97.32	2.69	0,00
S40	3,227	0.01	6.64	Fine Silt	2.26	Very Poorly Sorted	85.56	14.44	0,00
Mean		**0.01**	**6.81**	**-**	**2.07**	**-**	**88.99**	**10.99**	**0.02**
SD		**0.00**	**0.33**	**-**	**0.25**	**-**	**5.79**	**5.77**	**0.03**
CV (%)		**24.0**	**4.8**	**-**	**12.0**	**-**	**6.5**	**52.5**	**0.0**
Minimum		**0.01**	**6.02**	**-**	**1.63**	**-**	**74.08**	**2.63**	**0.00**
Maximum		**0.02**	**7.33**	**-**	**2.65**	**-**	**97.38**	**25.87**	**0.13**

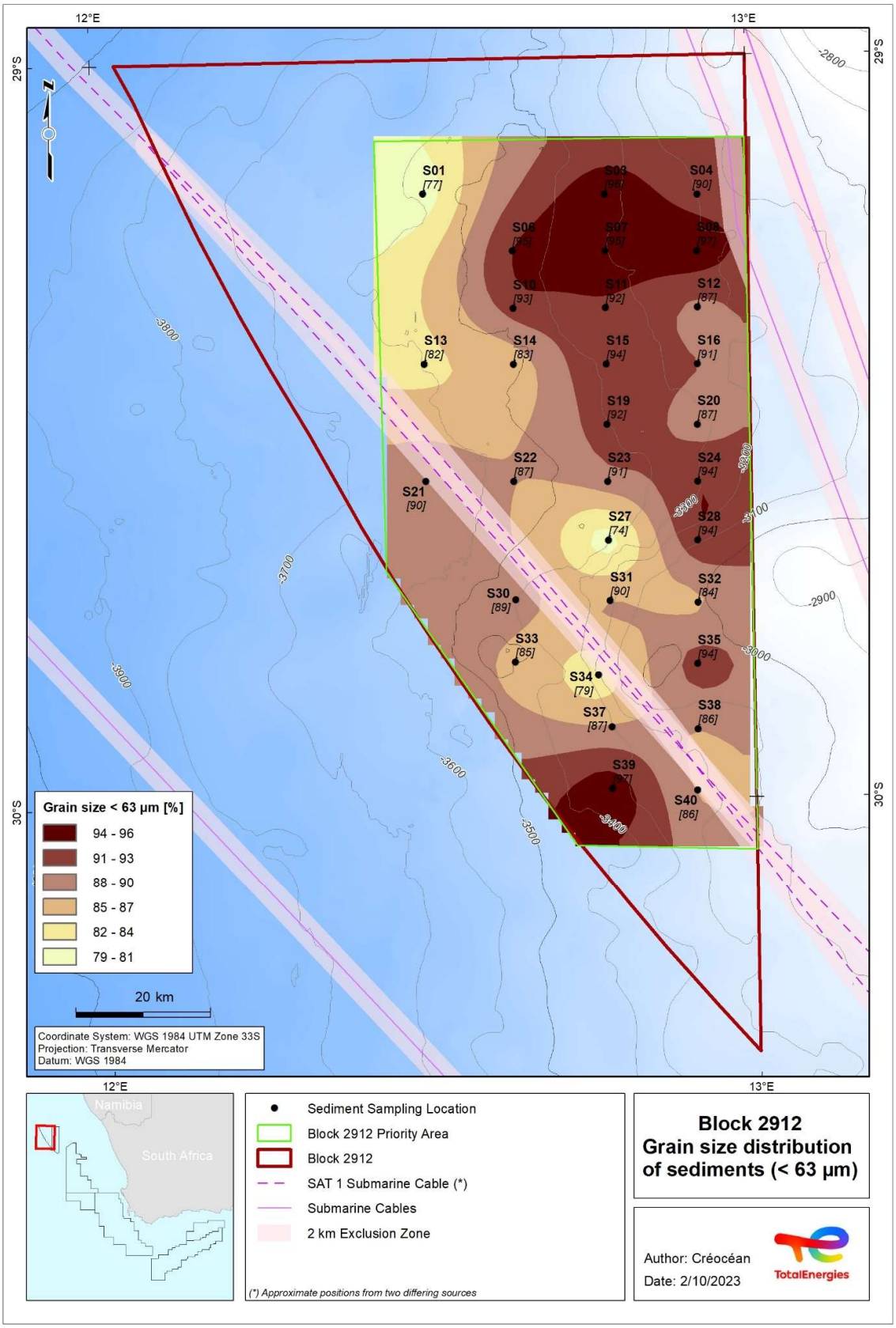
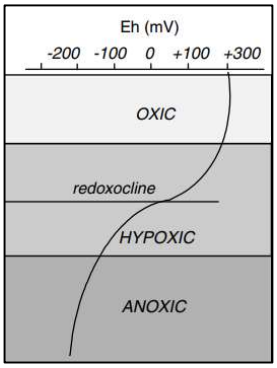


Figure 9. Block 2912 grain size distribution of sediments - Fines (<63 µm)

3.2.1.3. Sediment Reduction-Oxidation (Redox) Potential, pH and Naturally occurring Radioactive Material (NORM)

The Redox potential is a summary variable that reflects the biological activity of the bacteriological compartment in the sediment. It results from a set of physico-chemical and biological processes that originate from the degradation of organic matter. It is an operational method for the analysis of organic enrichment of sediments whether it be either punctual or diffuse.



Oxygen reduction in surface aerobic (oxic) sediments is replaced by nitrate and metal oxide reduction in post-oxic sediments at deeper depths where sulfate reduction predominates. If oxygen supply from the water column is sufficient, a surface oxic layer of sediment of variable thickness will always be present with reduced sediments at deeper depths. The redoxocline, also referred to as the redox potential discontinuity (RPD) reflects the depth of oxygen penetration into surface sediments. It represents the depth where redox potentials (EhNHE) change rapidly from positive to negative values. Surface aerobic sediments may range from a few millimeters up to 10 cm in depth depending on the balance between oxygen penetration and consumption and will generally be deeper in sandy sediments than in more fine-grained organically rich mud deposits. (Hargrave et al., 2008 - see opposite illustrative profile of redox potentials (Eh) in marine sediments in oxic (light grey), suboxic or hypoxic (medium grey), and anoxic (dark grey) sediment zones).

The pH (Hydrogen Potential) is a unitless value that expresses the acidity or basicity of a solution or medium. It is defined by a formula that calculates the concentration of hydrogen ions, with results ranging from 0 (very acidic) to 14 (very basic).

NORM is present in very low concentrations in the Earth's crust and surface. Depending the components in place, NORM can also form due to the precipitation of minerals (e.g. barium, calcium, strontium and radium sulfates), as scale, on the outside of tubulars and/or casing, due to changes in temperature and pressure of fluids injected into hydrocarbon reservoirs during drilling and production.

The Table 24 below summarizes the measurements of redox potential (Eh) pH and NORM measures in sediment samples throughout Block 2912, made at 1cm and 10cm depths in the sediment. The observed redox was then standardized to 10°C and normalized to the standard hydrogen electrode (SHE) by adding 214mV (non-normalized data are given in 6.5 Appendix V – Redox, pH and NORM in Sediment.

The redox potential appears very high at all station, either at a 1 or 10 cm depth for all samples (above 300 mV) reflecting a well oxygenated sediment. This suggests an oxic zone throughout the first 10cm of the sediment, where dominant aerobic metabolism for benthic organisms will occur in a "normal" organic enrichment environment. However, considering the high water depth and the muddy nature of the sediments, as well as the oxygen decrease near the seabed (around 35% of saturation: see section 3.3.1.1), these values appear unusually high. They rather correspond to a very oxygenated sandy shallow substrate. In deep reduced seabed, microbial-mediated redox processes have been known to decrease the redox potential to a level as low as −300mV (Søndergaard, 2009). Then, these results can also be due to a consistent malfunction of the probe or relate to the high clay content of the sediment causing higher readings.

pH is mostly consistent, ranging between 6.7 and 8.8 at 1cm. Two stations, S24 and S33, had low pH values down to 5.2 but these do not appear to be correlated with suboxic conditions.

NORM background levels were established on the vessel by taking a reading before each sample at different locations on the vessel. No γ readings were taken at stations in the survey area due to a probe malfunction. All stations had Alpha and Beta measurements which differed by <3 CPS from their respective sample background levels indicating no contamination.

Table 24. Sediment Redox potential, pH and NORM results

Station	NORM (CPS) *		Normalised Redox (mV) **		pH	
	αβ Background*	αβ	1cm	10cm	1cm	10cm
S01	0.28	0.49	366	335	8.0	7.9
S03	0.28	0.83	418	394	7.5	7.1
S04	0.29	0.66	472	467	7.2	7.0
S06	0.36	0.56	415	390	7.9	7.9
S07	0.26	0.36	450	446	7.5	7.5
S08	0.43	0.46	390	354	7.2	6.8
S10	0.56	0.43	452	422	7.0	7.7
S11	0.24	0.39	484	490	7.9	7.8
S12	0.01	0.29	509	456	7.0	6.3
S13	0.33	0.66	373	352	7.9	7.7
S14	0.39	0.53	444	436	7.5	6.7
S15	0.36	0.43	478	484	7.0	7.0
S16	0.43	0.59	417	394	7.5	7.3
S19	0.16	0.33	404	360	8.0	8.0
S20	0.36	0.56	379	364	7.3	7.5
S21	0.19	0.63	539	498	6.7	6.9
S22	0.26	0.53	351	314	7.5	7.0
S23	0.36	0.19	459	411	7.0	7.2
S24	0.26	0.63	444	411	5.6	6.0
S27	0.28	0.69	362	362	8.8	8.7
S28	0.36	0.46	516	472	7.1	7.1
S30	0.39	0.29	436	409	7.0	7.6
S31	0.28	0.23	440	408	8.1	8.2
S32	0.36	0.26	617	523	6.6	7.9
S33	0.53	0.33	468	460	6.0	5.2
S34	0.31	0.56	555	566	6.9	7.0
S35	0.31	0.63	452	440	8.8	7.8
S37	0.24	0.53	534	538	7.2	8.1
S38	0.33	0.59	393	328	8.0	8.0
S39	1.36	1.46	537	508	7.2	7.3
S40	0.29	0.73	431	392	8.0	8.0

3.2.1.4. Total Organic Matter/Carbon, Moisture Content, Nutrients and Index of Enrichment

Organic matter in sediments originates from terrestrial inputs and/or dead marine animal and plant decomposition. It is usually composed of small size particles, mostly associated with the finest suspended particles, which deposit on the seafloor when aggregation becomes high. The bacterial degradation of this matter consumes oxygen. It can be incomplete when inputs of organic matter are too high compared to the available oxygen. Thus, high levels of organic matter or carbon point out incomplete mineralization.

Nitrogen mainly originates from domestic urban waste and agricultural runoff discharged into watersheds and delivered to the ocean. The different forms of Nitrogen are generally dissolved in seawater. Their distribution is not directly linked with the input sources but rather with the renewal rate of waters. Thus, the highest concentrations found in sediments are mainly recorded in areas of low water circulation, and in deep areas where sedimentation processes are high. Nitrogen measured in sediments is mainly organic and originates for the most part from sedimentation and dead biomass (dead plant and animal material).

Phosphorus also mainly originates from domestic urban waste and agricultural runoff. Unlike Nitrogen, values are generally higher in areas receiving these inputs, due to absorption process on suspended matter and iron hydroxides, as well as the process of phosphate precipitation with calcium. Thus, phosphorus usually occurs in decanted particle forms, forming a building « capital ». The mineralization of deposits is also a source of phosphorus (orthophosphate).

Raw data are given in 6.6 Appendix VI – Organic and Nutrient Content in Sediment.

The South African upwelling system is one of the biggest in the world. It consists of a series of upwelling cells stretching over 2500 km from north to south, from the Angolan margin to Cape Town in South Africa. Sedimentary records from cores taken in the Namibian basin show total organic carbon (TOC) contents of 5-20% at 1000 m and up to 8% at depths greater than 3500 m. Such high concentrations of organic matter in deep oceanic areas are considered exceptional (Pichevin, 2004).

An organic pollution index (OPI) developed by Alzieu (2003) for dredging operations was used here to assess enrichment classes. The OPI is a summary index which sums the scores of TOC, Kjeldahl nitrogen and phosphorus.

Total Organic Matter (TOM) in sediments was **very stable** and low among Block 2912 stations. It ranged from 3.2% m/m (mass of substance, %mass/mass) to 4.1 % m/m, for an average of 3.6% m/m (S.D = ±0.2% m/m) (Figure 10).

Total Organic Carbon (TOC) values were a **little more heterogeneous** throughout Block 2912 but **remained low**. They varied from 0.34 % m/m to 0.75 % m/m for an average value of 0.59 % m/m (SD = ±0.12%). The southernmost stations (S34 to S40) showed less TOC compared to the other stations (Figure 10). TOC levels in the Block 2912 survey area are expected to reflect inputs of both autochthonous and allochthonous material.

Phosphorous as P concentrations were **low** and ranged from 182 mg/kg (S04) to 287 mg/kg (S32) for an average value of 253.5 mg/kg (SD = ±27.8 mg/kg) (Figure 11).

Total nitrogen concentrations were also **very stable and low** throughout Block 2912, most ranging from 0.05 or 0.06 % except for S12 (0.07%) and S21 and S35 (below the 0.05% detection limit) (Figure 11).

Applying the **Alzieu index**, all stations obtained a score between 0 and 2 showing a **low organic enrichment**.

This result means that in spite of the high clay fraction, **organic and nutrient concentrations are globally low explaining oligotrophic conditions.**

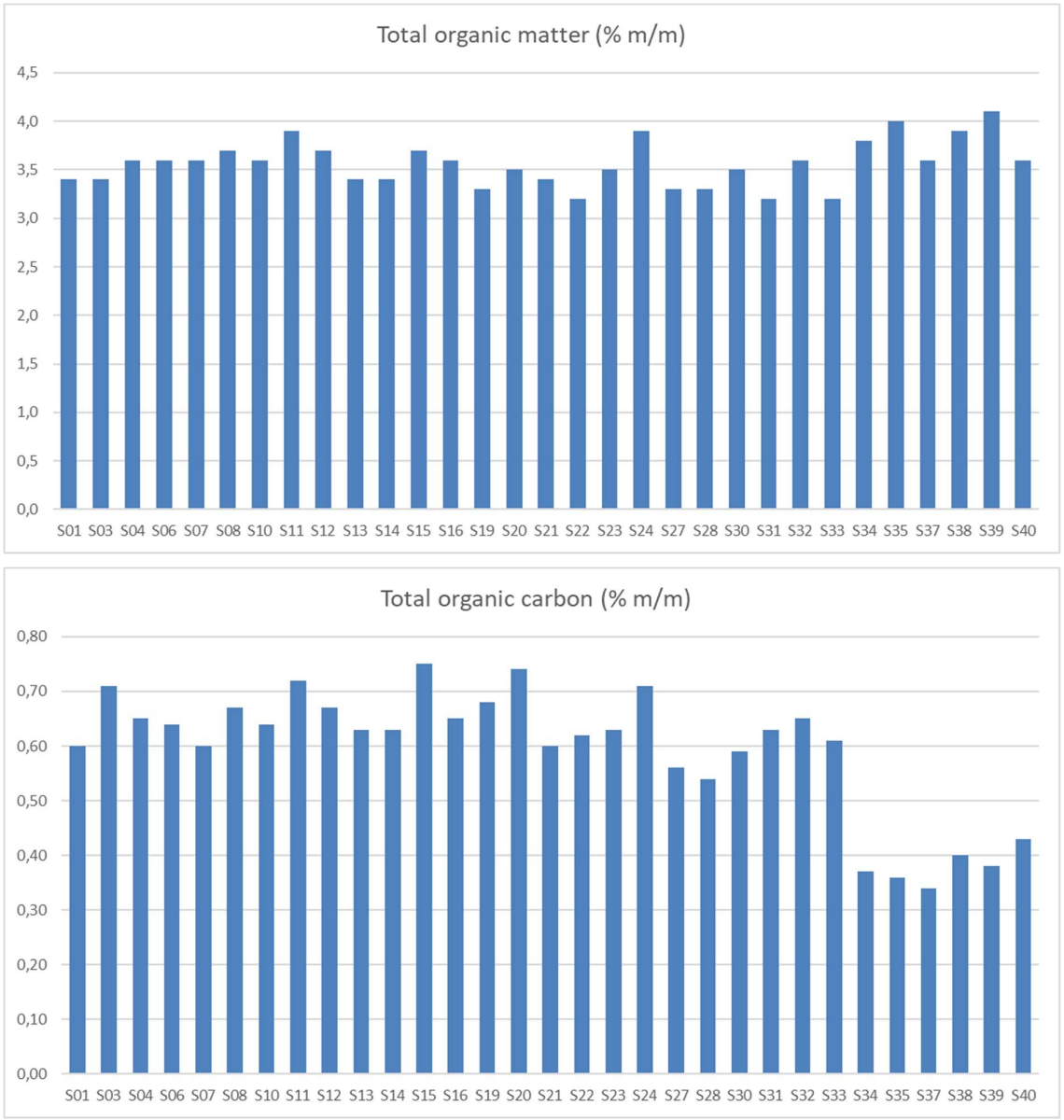


Figure 10. Variations of organic matter and organic carbon between sediment stations

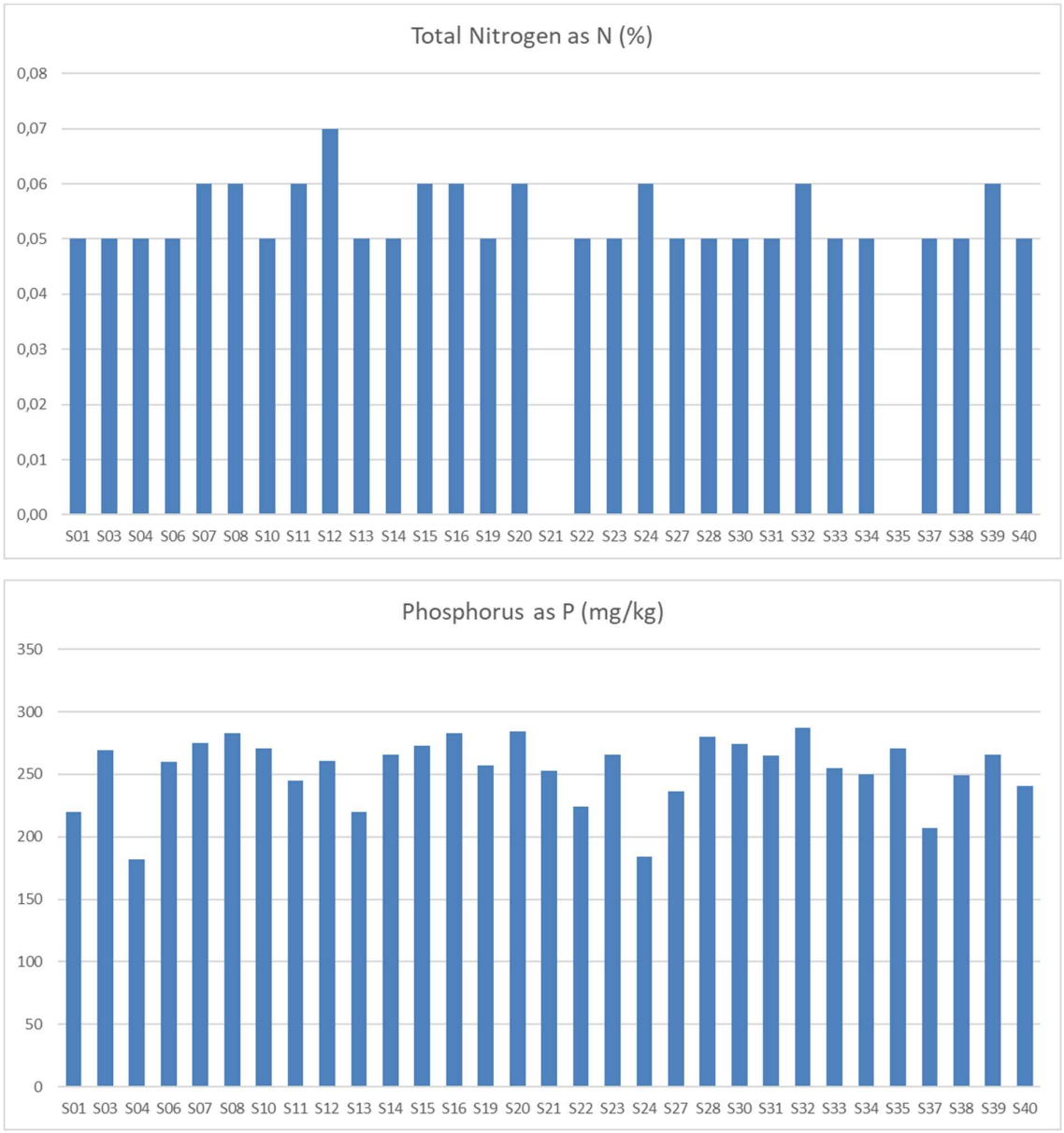


Figure 11. Variations of nutrient contents (Nitrogen and Phosphorus) between sediment stations

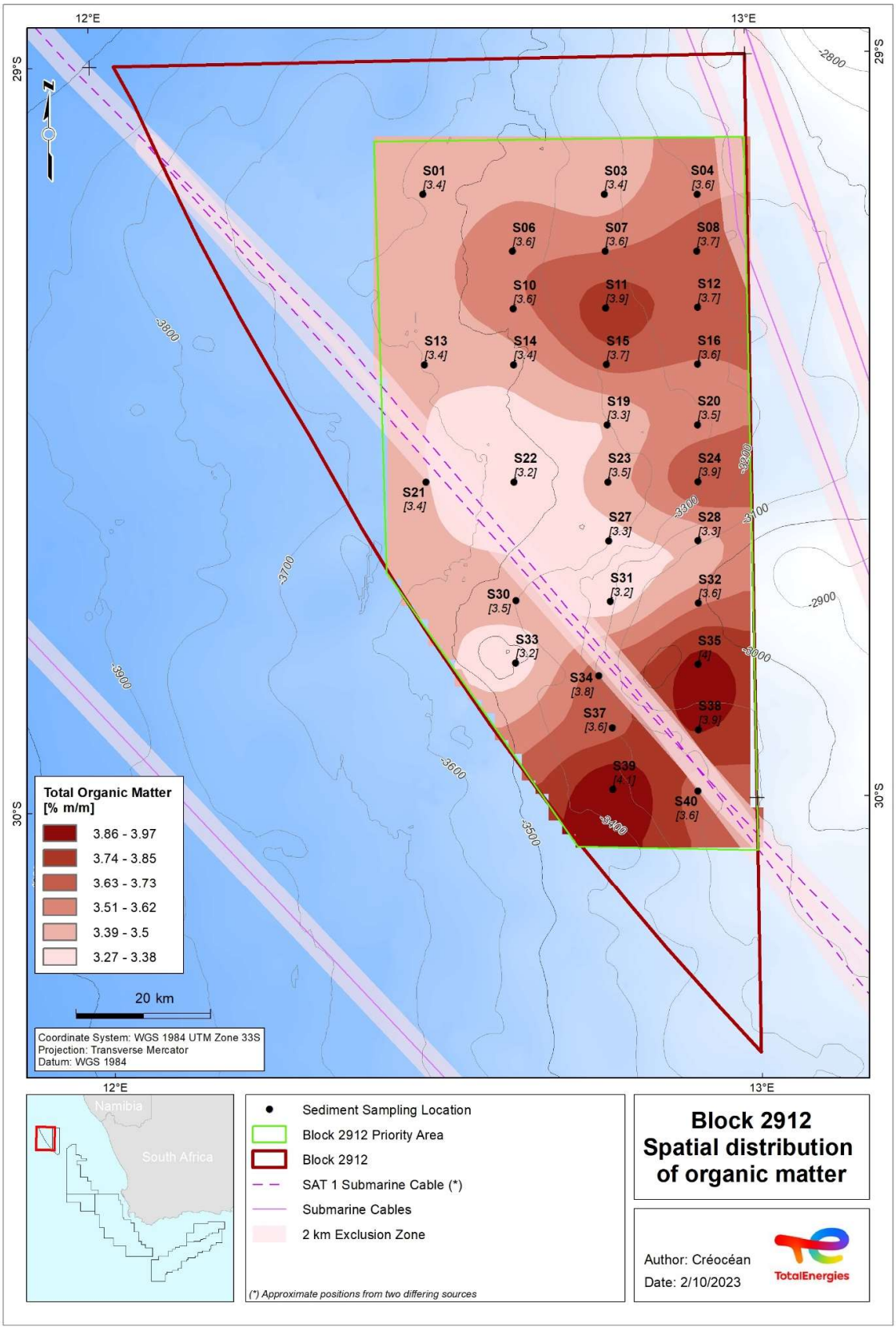


Figure 12. Spatial distribution of Total Organic Matter in sediment

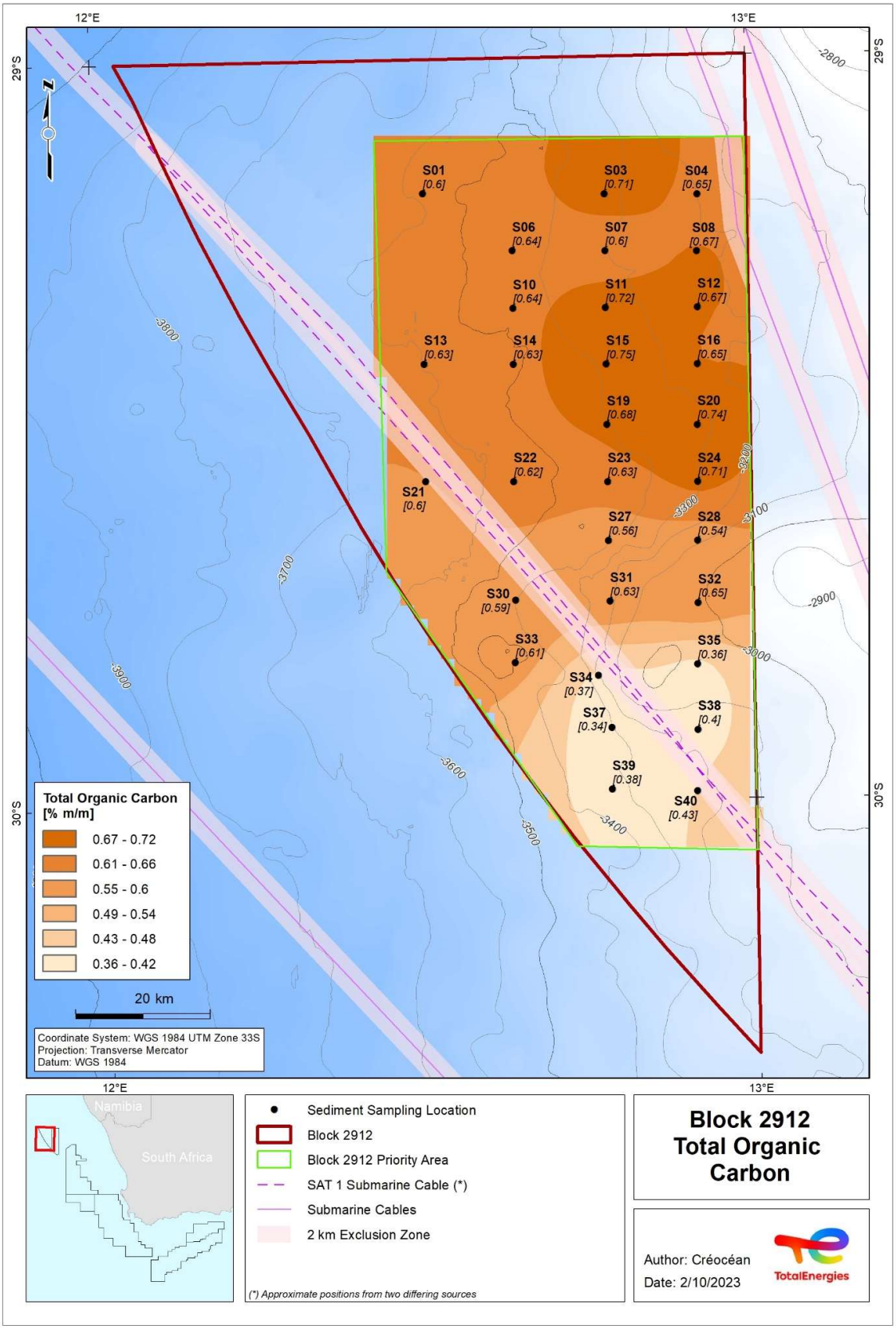


Figure 13. Spatial distribution of Total Organic Carbon in sediment

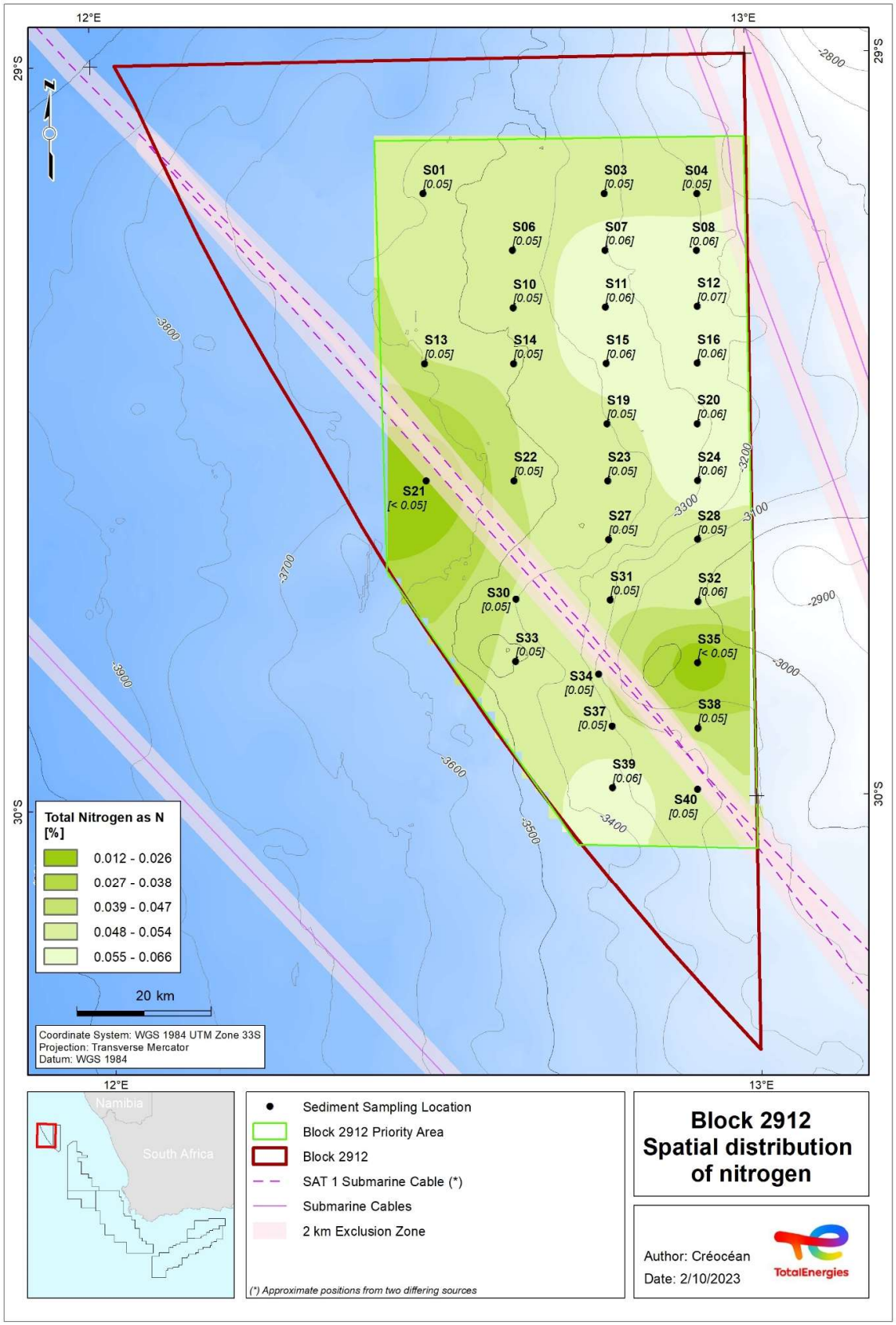


Figure 14. Spatial distribution of Nitrogen in sediment

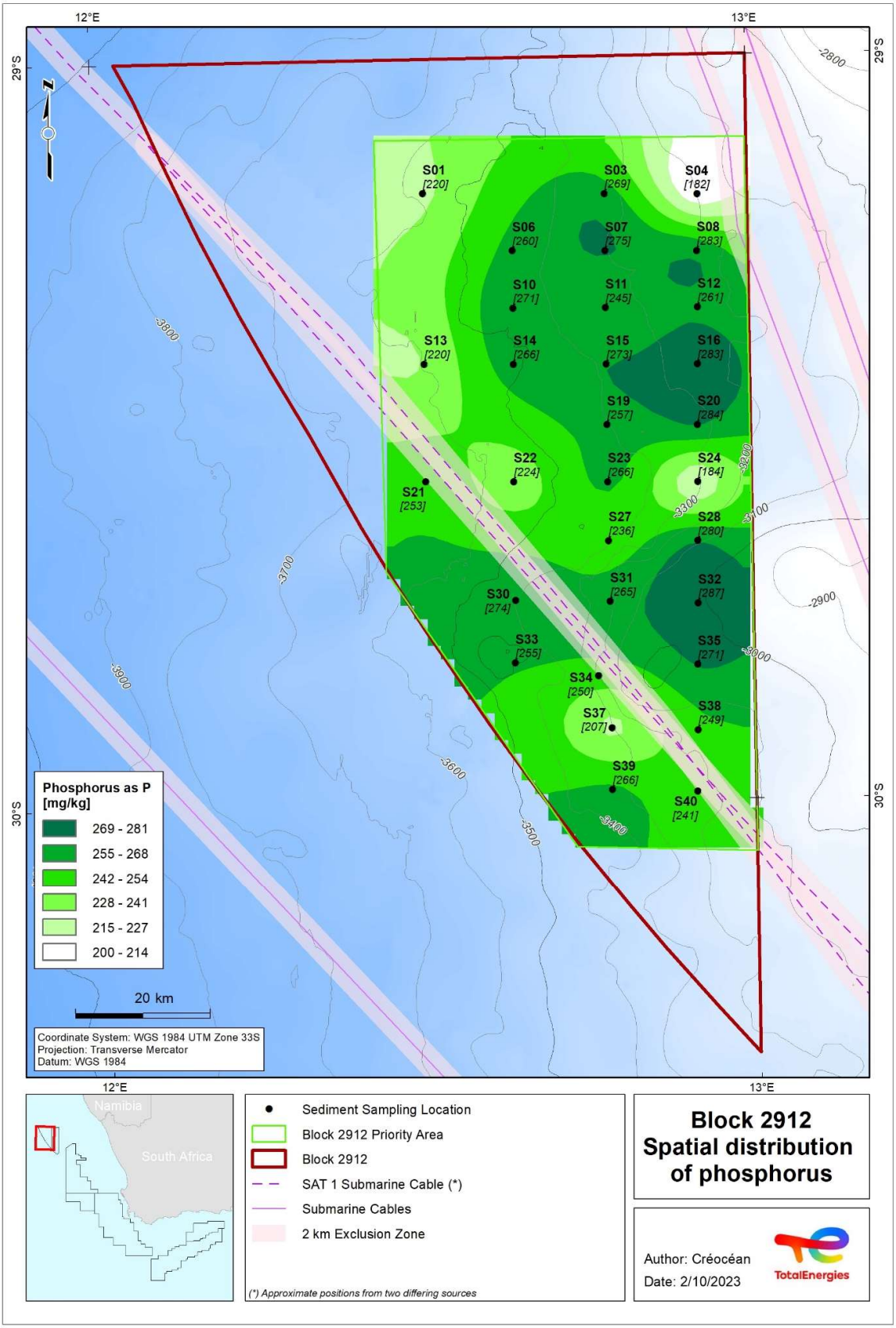


Figure 15. Spatial distribution of Phosphorus in sediment

3.2.1.5. Heavy and Trace Metal Concentrations

> *Aluminum, Iron, and Manganese can occur naturally at high concentrations and are useful indicators of geological sources for other metals and mineral complexes. Metals occur naturally in the marine environment and are widely distributed in both dissolved and sedimentary forms. Some are essential to marine life while others may be toxic to numerous organisms (Paez-Osuna and Ruiz-Fernandez, 1995). Rivers, coastal discharges, and the atmosphere are the principal modes of entry for most metals into the marine environment (Schaule and Patterson, 1983), with anthropogenic inputs occurring primarily as components of industrial and municipal wastes.*
>
> *Other metals are useful to detect pre-existing anthropogenic contaminations. Of particular relevance to the offshore oil and gas industry are metals associated with drilling related discharges. These can contain substantial amounts of barium sulphate (barites) as a weighting agent (NRC, 1983) and barium is frequently used to detect the deposition of drilling fluids around offshore installations (Chow and Snyder, 1980; Gettleson and Laird, 1980; Trocine and Trefry, 1983). The majority of barium is typically insoluble in the form of a non-toxic sulphate (Gerrard et al., 1999); this metal is rarely of toxicological concern to the marine fauna. Solid barites are often discharged during the drilling process and also contain measurable concentrations of heavy metals as impurities, including chromium, copper, lead, vanadium and zinc (NRC, 1983). Other heavy metals, either as impurities or additives are also present in other mud components.*

Results on metal contents per station are shown in the following Table 25 and when available, they are compared with reference values, when existing, presented in Table 4.

Heavy and trace metal concentrations showed limited variation across the survey area, which is unsurprising given the similar depths encountered through the Block.

Trace metals were recorded below the analytical detection limit for the following elements: Antimony, Molybdenum, Selenium and Tin.

For metals with existing reference values, the concentrations for the entire study area were below the reference values.

Most metals associated with drilling related barite discharges (arsenic, chromium, nickel, vanadium, zinc and iron) were low throughout the survey area. More specifically, natural barium concentrations were considered to be low and indicative of a non-industrialised deep-sea habitat, ranging from 292mg.kg-1 at station S24 to 492mg.kg-1 at station S08).

Table 25. Heavy metals in sediment (mg/kg)

Station	Antimony (AR-ICP)	Arsenic (AR-ICP)	Cadmium (AR-ICP)	Chromium (AR-ICP)	Cobalt (AR-ICP)	Copper (AR-ICP)	Lead (AR-ICP)	Manganese (AR-ICP)	Mercury (AR-ICP)	Molybdenum (AR-ICP)	Nickel (AR-ICP)	Selenium (AR-ICP)	Tin (AR-ICP)	Vanadium (AR-ICP)	Zinc (AR-ICP)	Aluminium (AR-ICP)	Barium (AR-ICP)	Barium by fusion/XRF	Beryllium (AR-ICP)	Iron (AR-ICP)	Lithium (AR-ICP)	Titanium (AR-ICP)
S01	<0.1	<0.5	0.13	9.3	2.80	19.1	1.60	200	<0.01	<0.5	10.4	<1.0	<0.5	9.4	15.4	5650	344	500	0.18	3520	11.8	100
S03	<0.1	1.00	0.14	14.6	4.10	26.4	2.40	324	0.02	<0.5	15.8	<1.0	<0.5	13.4	22.4	7300	466	700	0.20	4630	15.3	127
S04	<0.1	<0.5	0.12	8.5	2.30	15.2	1.30	225	<0.01	<0.5	11.6	<1.0	<0.5	8.1	13.9	4510	329	600	<0.10	2960	9.4	88.6
S06	<0.1	0.70	0.23	13.3	3.80	24.5	2.00	281	0.01	<0.5	15.9	<1.0	<0.5	12.6	20.4	6650	423	700	0.19	4160	14.2	115
S07	<0.1	0.50	0.14	12.8	3.60	22.8	1.90	287	0.01	<0.5	14.4	<1.0	<0.5	12.6	18.6	7250	470	700	0.20	4590	15.5	125
S08	<0.1	0.90	0.18	14.4	4.00	24.7	2.20	382	0.02	<0.5	18.5	<1.0	<0.5	13.5	21.7	7370	492	700	<0.10	4750	15.7	128
S10	<0.1	0.90	0.13	13.4	4.00	25.3	2.20	296	0.02	<0.5	13.8	<1.0	<0.5	12.8	20.7	7020	433	600	<0.10	4370	14.8	120
S11	<0.1	0.70	0.14	11.6	3.30	22.0	2.10	256	0.02	<0.5	12.3	<1.0	<0.5	11.7	22.4	5790	414	700	<0.10	3880	12.9	99.8
S12	<0.1	1.10	0.22	14.6	4.00	24.3	2.20	358	0.02	<0.5	17.8	<1.0	<0.5	14.3	22.2	6530	459	700	<0.10	4310	14.3	113
S13	<0.1	<0.5	0.21	11.2	3.40	22.0	1.90	242	<0.01	<0.5	11.7	<1.0	<0.5	11.1	18.4	5700	337	600	0.18	3420	11.6	96.6
S14	<0.1	1.40	0.28	13.7	4.10	25.1	2.20	297	0.02	<0.5	13.1	<1.0	<0.5	13.6	20.4	7180	423	500	0.20	4380	15.0	121
S15	<0.1	1.20	0.27	14.3	4.20	26.1	2.40	315	0.02	<0.5	14.2	<1.0	<0.5	13.8	20.7	6350	438	700	0.20	4210	14.1	104
S16	<0.1	1.10	0.29	15.0	4.20	24.0	2.30	382	0.02	<0.5	18.5	<1.0	<0.5	14.3	22.1	7230	478	700	0.20	4790	15.8	123
S19	<0.1	0.80	0.2	13.0	3.80	22.1	2.10	284	0.02	<0.5	13.3	<1.0	<0.5	12.6	19.6	6640	419	600	<0.10	4130	14.1	110
S20	<0.1	1.00	0.18	14.2	4.00	25.4	2.50	322	0.02	<0.5	16.0	<1.0	<0.5	13.3	28.7	7270	472	700	0.20	4650	15.6	121
S21	<0.1	1.20	0.33	13.0	4.20	24.4	2.20	303	<0.01	<0.5	14.2	<1.0	<0.5	12.5	20.6	6740	380	500	<0.10	4010	13.9	111
S22	<0.1	1.10	0.19	10.5	3.30	19.3	1.80	235	<0.01	<0.5	10.7	<1.0	<0.5	10.1	16.2	5580	332	500	<0.10	3400	11.7	94.6
S23	<0.1	1.10	0.28	13.1	3.90	23.0	2.10	292	0.01	<0.5	13.8	<1.0	<0.5	12.3	19.4	6550	424	600	<0.10	4230	14.1	112
S24	<0.1	0.70	0.19	8.8	2.60	16.8	1.50	203	<0.01	<0.5	9.6	<1.0	<0.5	9.2	16.0	4150	292	600	<0.10	2690	8.7	77.3
S27	<0.1	1.10	0.26	10.6	3.70	23.9	2.00	284	0.01	<0.5	13.4	<1.0	<0.5	11.2	21.9	4680	371	600	0.24	3390	11.5	73
S28	<0.1	1.10	0.29	13.2	4.10	22.8	2.10	376	0.02	<0.5	18.5	<1.0	<0.5	13.0	20.8	6680	440	600	0.32	4480	15.4	115
S30	<0.1	1.20	0.23	13.6	4.20	23.9	2.20	303	0.02	<0.5	13.7	<1.0	<0.5	13.5	20.2	6900	412	500	0.31	4240	14.8	118
S31	<0.1	1.20	0.18	12.1	3.70	20.3	1.80	286	0.01	<0.5	13.1	<1.0	<0.5	12.7	17.2	6610	411	600	0.32	4160	14.4	116
S32	<0.1	1.50	0.30	13.2	4.20	22.7	2.20	383	0.02	<0.5	18.0	<1.0	<0.5	13.6	23.2	5850	471	600	0.32	4270	14.5	98.9
S33	<0.1	1.20	0.26	12.0	3.70	20.6	1.90	303	<0.01	<0.5	14.5	<1.0	<0.5	11.9	18.4	6120	390	600	0.31	3860	13.2	107
S34	<0.1	1.10	0.24	12.3	4.10	21.9	2.00	307	0.01	<0.5	14.6	<1.0	<0.5	13.2	18.3	5950	380	500	0.31	3840	13.7	102
S35	<0.1	0.80	0.45	12.7	4.10	22.7	4.60	387	0.01	<0.5	19.0	<1.0	<0.5	12.7	32.8	6850	415	600	0.31	4340	15.1	120
S37	<0.1	0.70	0.24	9.0	3.20	18.8	1.60	243	<0.01	<0.5	12.1	<1.0	<0.5	9.6	17.3	4190	294	500	0.23	2870	10.2	72.6
S38	<0.1	1.00	0.33	11.8	3.90	22.1	1.90	310	0.01	<0.5	15.5	<1.0	<0.5	12.6	21.1	5380	364	500	0.31	3670	12.6	92.3
S39	<0.1	1.20	0.27	11.3	3.50	21.2	1.80	249	<0.01	<0.5	12.0	<1.0	<0.5	11.9	17.3	6620	389	500	0.31	4030	14.5	113
S40	<0.1	0.90	0.25	9.9	3.10	19.9	1.90	237	<0.01	<0.5	13.2	<1.0	<0.5	10.2	20.6	5370	374	600	0.31	3650	12.6	92.2

3.2.1.6. Hydrocarbons in Sediments

Hydrocarbons enter the marine environment from a variety of sources including biological sources (animal, plant, and bacterial material), petroleum products (downstream transport of water and sediments contaminated by industrial, urban, and sewerage runoff; accidental oil spills from ships and rigs; and vessel traffic), deposition of airborne particles, and natural oil/gas seeps. Most hydrocarbons reach maximum concentrations in rivers, estuarine and coastal environments, as there have a strong tendency to adsorb onto suspended particles that settle before being transported offshore. Ultimately, these hydrocarbons are degraded, are taken up by biota in the water column, or are sequestered in the sediments.

Total petroleum hydrocarbon (TPH) data typically include aliphatic hydrocarbons and linear alkanes (n-alkanes) in the range of C9 to C40. They have both biogenic and petrogenic (petroleum) sources, which are distinguished by the distribution of individual analytes in the analytical chromatogram. Plants synthesize n-alkanes almost exclusively with an odd number of carbon atoms, whereas petrogenic n-alkanes have a more uniform distribution of odd and even number carbons. Owing to their hydrophobic character and affinity for particulate matter, hydrocarbons tend to accumulate in sediments. (Charriau et al., 2009).

Marine sediments throughout the world's open oceans have detectable concentrations of Polycyclic Aromatic Hydrocarbons (PAHs). They derive from both natural and anthropogenic sources. Natural sources include the post-depositional degradation of biogenic precursors (diagenetic source), hydrocarbon seeps, and atmospheric deposition of combustion-related PAH from forest fires (Laflamme 1978; Hunt 1995; Kennish 1997). Anthropogenic sources derive from.the incomplete combustion of organic matter including biomass and fossil fuels (pyrolytic source), and from the spillage of petroleum or refinery products (petrogenic source). Total PAH concentrations from natural sources typically range from low part-per-billion (30−100 ng g-1) to several parts-per-million (1−2 ppm, µg g-1).

n-alkanes can be of petrogenic origin or produced by a variety of terrestrial and aquatic organisms. Plants synthesize n-alkanes almost exclusively with an odd number of carbon atoms, whereas petrogenic n-alkanes have a more uniform distribution of odd and even number carbons. Owing to their hydrophobic character and affinity toward particulate matter, hydrocarbons tend to accumulate in sediments. (Charriau et al., 2009)

Results on the detection of hydrocarbons, n-alkanes, and PAHs in sediments are presented in the synthesis table below.

Table 26. Total hydrocarbons concentrations in sediment

Station	Depth (m)	THC (µg/kg)	Total n-alkanes (µg/kg)	Total PAHs (µg/kg)
S01	3,532	854	119	<34
S03	3,324	1,423	131	<34
S04	3,184	1,210	148	<34
S06	3,435	1,328	119	<34
S07	3,308	1,069	119	<34
S08	3,208	1,097	148	<34
S10	3,423	917	117	<34
S11	3,325	1,510	188	<34
S12	3,230	1,748	126	<34
S13	3,584	1,010	145	<34
S14	3,498	1,124	117	<34
S15	3,370	1,010	127	<34
S16	3,268	1,010	152	<34
S19	3,394	1,655	145	<34
S20	3,301	1,518	175	<34
S21	3,624	1,006	104	<34
S22	3,528	1,307	143	<34
S23	3,411	850	125	<34
S24	3,301	1,176	131	<34
S27	3,338	1,204	157	<34

S28	3,057	1,390	130	<34
S30	3,387	1,073	115	<34
S31	3,175	1,819	134	<34
S32	2,992	1,861	145	<34
S33	3,438	883	111	<34
S34	3,232	1,276	175	<34
S35	2,998	827	131	<34
S37	3,276	1,407	125	<34
S38	3,145	1,464	120	<34
S39	3,306	1,366	127	<34
S40	3,227	1,646	131	<34
Mean		**1,259**	**135**	
SD		**296**	**20**	
Min		**827**	**104**	
Max		**1,861**	**188**	

3.2.1.6.1. Total Hydrocarbon Concentrations

Total Hydrocarbon variations between stations are given in the following figure. Raw data are given in Appendix VII – Total Hydrocarbon and Total Alkane Concentrations in Sediment.

Concentrations of Total Hydrocarbon Content (THC) ranged from 827 µg/kg (S35) up to 1,861 µg/kg (S32), the mean value for this parameter being 1,259 µg/kg. The target value defined by OSPAR 2009 and EGASPIN 2002 for this parameter is 50,000 µg/kg, and therefore the values recorded in Block 2912 are far below these values. These results indicate an homogeneous and not contaminated study area.

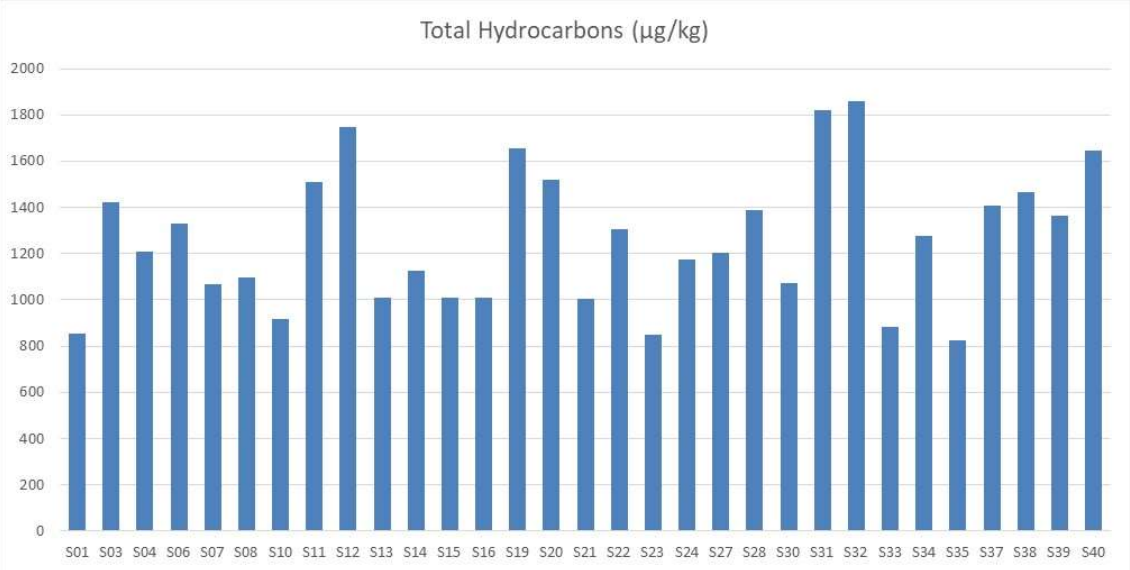


Figure 16. Variations of THC between sediment stations

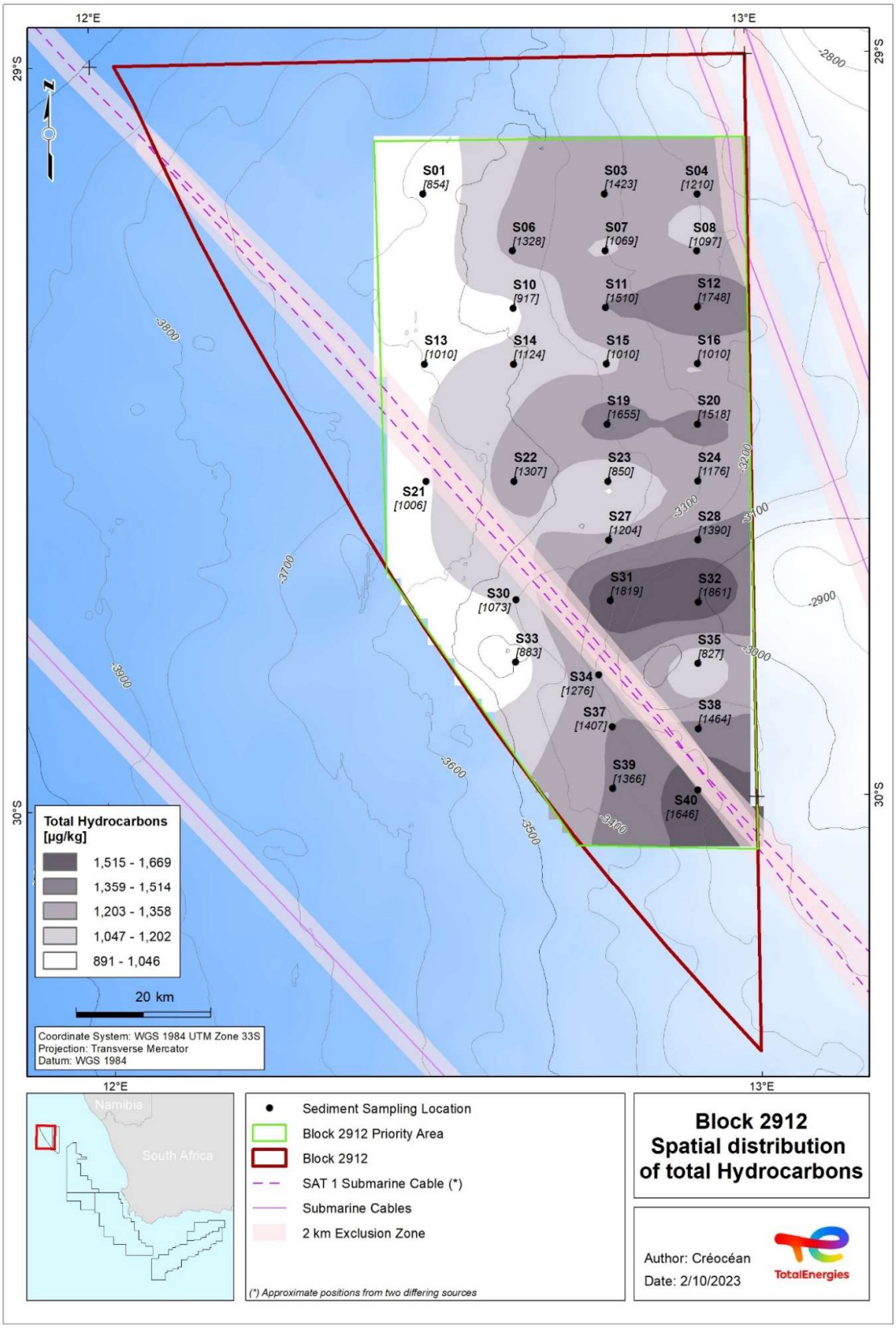


Figure 17. Spatial distribution of total hydrocarbons concentrations in sediment

3.2.1.6.2. Polycyclic Aromatic Hydrocarbons

Raw data of PAH levels are given in 6.8 Appendix VIII – PAH Concentrations in Sediment.

Polycyclic Aromatic Hydrocarbons (PAH) analyses were below the detection limits for all sediment samples (<1µg/kg of dry weight) and, therefore, the same for the lighter and more volatile NPD (naphthalenes, phenanthrenes and dibenzothiophenes) portion.

In the absence of PAH quantification, it is not possible to calculate source indices to discriminate between pyrogenic and petrogenic contributions.

3.2.1.6.3. Total n-alkanes

Raw data of alkane levels are given in 6.9 Appendix IX – Alkane Concentrations in Sediment.

Total n-alkanes were relatively low across much of the Block ranged from 111 µg/kg (S33) up to 188 µg/kg (S11), the mean value was 135 µg/kg.

The following figure displays the spatial variations of total n-alkanes within Block 2912.

Linear alkanes (n-alkanes) were quantified in all the samples, mainly above 20 carbon atoms. They contributed on average around 10% to the total hydrocarbons presented above.

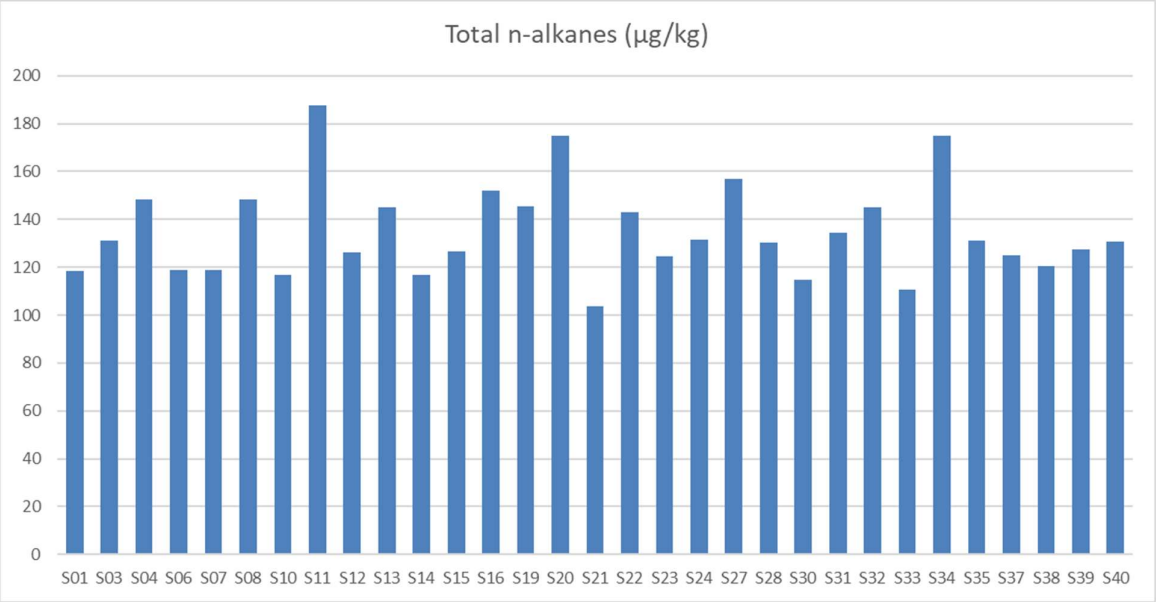


Figure 18. Variations of total alkane contents between sediment stations

The Carbon Preference Index (CPI) is the ratio of the concentrations of odd n-alkanes to even n-alkanes, typically for molecules above nC20 (the method of calculation is not specified with the data). Large CPI values (typically greater than 2) are evidence of a biogenic origin. On the contrary, if the CPI ratios are low, the n-alkanes are petrogenic in nature. The CPI values for all of the samples were close or greater than 2 (average of 3 with a standard deviation of 0.5) pointing to a significant biogenic contribution.

The P/B ratio compares the lighter, more petrogenic aliphatics (nC10-20) with the heavier, and more biogenic aliphatics (nC21-37). Ratios varied from 0.00 to 0.08 (mean 0.01±0.02SD), indicating all stations were influenced by biogenic aliphatic compounds with no indication of hydrocarbon contamination (6.7 Appendix VII – Total Hydrocarbon and Total Alkane Concentrations in Sediment). No Pristane & Phytane was detected, then no Pr/ Ph ratio calculated.

The chromatograms (6.10 Appendix X – Chromatogram), obtained in FID (Flame Ionization Detection) mode, are all similar. They show a quasi-absence of molecules having less than 20 carbon atoms. This and the CPI values point solely to a **biogenic origin**.

3.2.1.7. BTEX - Monocyclic Aromatic Hydrocarbons

> *BTEX (benzene, toluene, ethylbenzene and xylene) are volatile compounds which are found in incomplete combustion emissions, cleaning solvents, and other fuel products. While BTEX compounds evaporate quickly into the atmosphere, they can also occur in sediments and be dissolved in seawater because of accidental spills of oil and petroleum products, industrial effluents, and atmospheric pollution.*

Raw data for BTEX are given in (Appendix XI – BTEX Concentrations in Sediment).

BTEX analytes were below detection limits (<4.0 for the m/p-Xylene and <1.5 µg/Kg for the other component) in all samples.

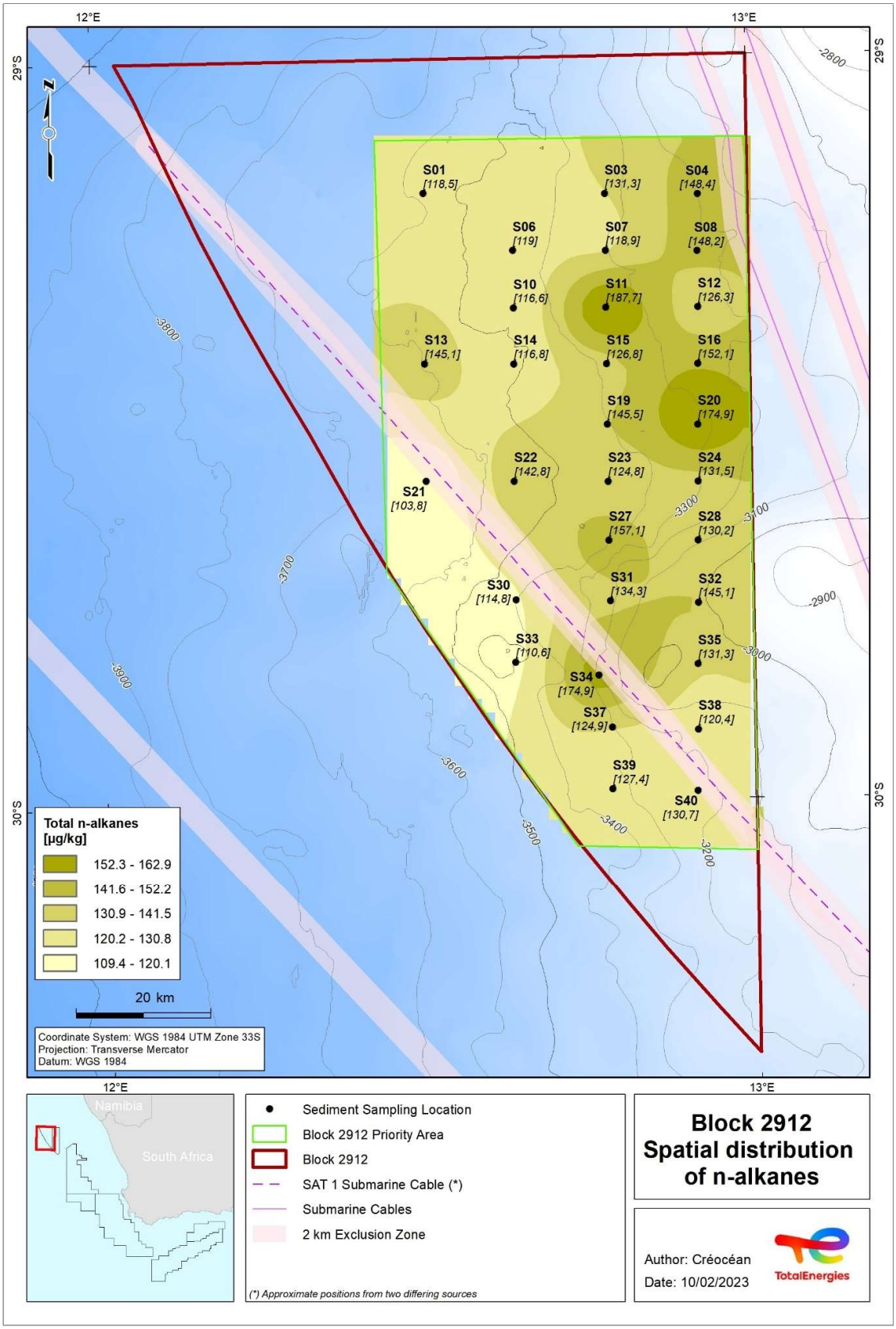


Figure 19. Spatial distribution of n-alkanes in sediment

3.2.2. Sediment Microbiology Analysis

Hydrocarbon-degrading bacteria in the marine environment occur in relatively low abundances, but they become enriched in the presence of hydrocarbons, such as during oil spills. Though some species, mainly those found in anoxic sediments, are capable of anaerobic degradation of hydrocarbons, most marine hydrocarbon-degrading bacteria are strictly aerobic. (Nikolova, and Gutierrez 2022).

Marine heterotrophic Bacteria play an important role in the ocean carbon cycle by utilizing, respiring, and remineralizing organic matter exported from the surface to deep ocean (Kim et al. 2023).

Raw data are given in Appendix (6.12 Appendix XII – Microflora Concentrations in Sediment).

The number of hydrocarbon-degrading bacteria ranged between 600 NPP/g and > 11,000 NPP/g.

The heterotrophic bacteria ranged from 600,000 NPP/g to >11,000,000 NPP/g.

Then the ratios between hydrocarbon-degrading and heterotrophic can be considered as very low (<1%, when it can be calculated: data without approximation sign '>').

These results suggest the absence of sediment contamination with hydrocarbons.

3.2.3. Sediment Biology - Macrofauna Analysis

Benthic macrofauna are the biotic component most frequently monitored to detect changes in the health of the marine environment. This is largely because benthic macrofauna are a fundamental part of the food web and are important as processors of organic particles, as well as these species are short lived and, therefore, their community composition responds rapidly to environmental changes (Warwick 1993). Given that they are also relatively non-mobile (as compared to fish and birds), they tend to be directly affected by pollution on their area. Additionally, they are relatively easy to sample quantitatively, and they exhibit a range of tolerances to environmental stress and pollution (Warwick 1993s Dutertre et al., 2013). Furthermores they are scientifically well-studied, compared with other sediment-dwelling components (e.g. meiofauna and microfauna) and taxonomic keys are available for most groups. In addition, benthic community responses to a number of anthropogenic influences have been well documented.

The use of benthos in aquatic ecological research, and particularly in evaluating marine pollution, is especially effective in assessing long term changes and detecting input from diffuse sources (Gerhard et al. 2002). Because they are largely dependent on local circumstances for their survival and reproduction, contact with effluent or contaminated sediment can cause sensitive species to die and allow opportunistic, pollution tolerant species to proliferate. The community composition of benthic macrofauna is likely to be impacted by increased levels of contaminants such as trace metals and hydrocarbons found in the sediments. Then anthropogenic disturbance to the benthos can result in significant changes to the community composition of benthic macrofauna. Such changes may include reduction in the number of species and/or even complete disappearance of benthic organisms in severely disturbed sediments (Warwick 1993). Pollution is typically reflected by shifts in the abundance of component species, reduction in diversity, or a relative proliferation of pollution tolerant opportunistic species (Pearson & Rosenberg 1978). Furthermore, sediments can also be disturbed by mechanical means (e.g. dredging, construction and drilling activities) are likely to be inhabited by a greater proportion of opportunistic pioneer species.

The structure of the community, in particular richness. Abundance, and diversity of species, is the result of the equilibrium of such important factors as feeding resource inputs, oxygenation conditions and organic component renewal. Good global conditions are illustrated by the high number and diversity of species with high general abundance but no proliferating species. Poorer conditions (excessive nutrient/organic inputs, low oxygenation rate, low organic matter renewal or chemical contamination, etc.) often lead to a decrease in species richness and diversity with proliferation of "tolerant" species to the detriment of others unable to support such degraded environments.

If environmental degradation continues to increase, even "tolerant" species regress and a high mortality rate may occur leading to very low levels of richness. Diversity, and species abundance.

3.2.3.1. Community composition

In total, 836 specimens from 117 different taxa were recorded from the 31 stations sampled in Block 2912 (see Appendix XIII – Benthic Macrofauna Abundance Matrix and Appendix XIV – Benthic Macrofauna Biomass Matrix).

These taxa comprise six phyla, 11 classes, 22 orders and 58 families. The infaunal community was dominated by the phylum Annelida (segmented worms), with 61 taxa (52%) recorded (see Figure 20 and Table 27 below). Arthropoda (crustaceans) and Mollusca were also well represented, with 37 (32%) and 13 (11%) taxa identified respectively. The remaining phyla not as frequently encountered include Echinodermata (sea cucumbers and stars), Nemertea (ribbon worms) and Nematoda (roundworms).

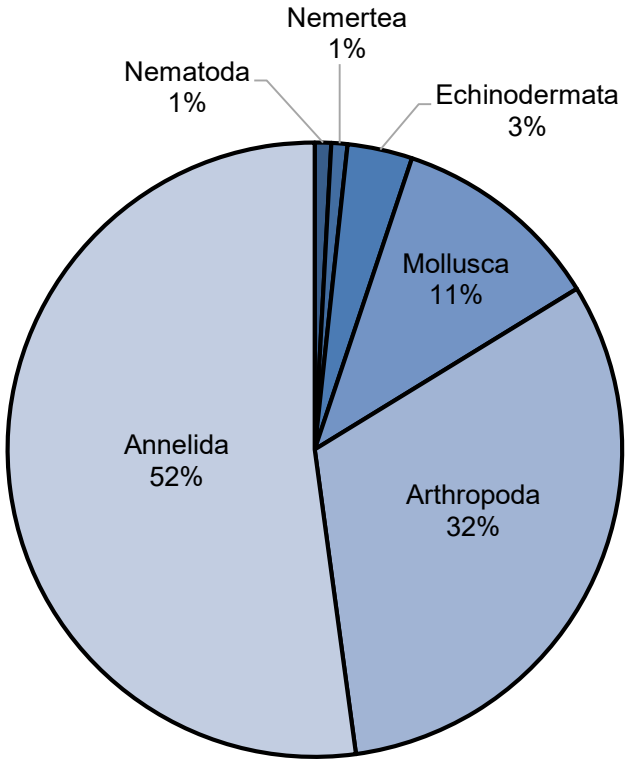


Figure 20. Phyla composition of the marine invertebrate taxa in sediment

Table 27. Marine invertebrate taxa identified from Block 2912 sediment

Phylum	Class	Order	Family	Taxa
Annelida		Sipuncula		Sipuncula sp. A
				Sipuncula sp. B
				Sipuncula sp. C
				Sipuncula sp. D
				Sipuncula sp. E
				Sipuncula sp. F
			Phascolosomatidae	*Phascolosoma* sp.
	Clitellata			Oligochaeta sp.
	Polychaeta			Polychaeta sp.
			Arenicolidae	*Abarenicola affinis africana*
			Capitellidae	Capitellidae sp. A
				Capitellidae sp. B

Phylum	Class	Order	Family	Taxa
				Notomastus sp. A
				Notomastus sp. B
			Magelonidae	*Magelona bizkaiensis*
			Maldanidae	Maldanidae sp.
			Opheliidae	*Armandia* sp.
				Ophelina sp.
				Ophelina cf. *abranchiata*
				Ophelina nematoides (?)
			Orbiniidae	*Orbinia* sp.
			Oweniidae	Oweniidae sp.
			Paraonidae	*Aricidea (Acmira) simplex*
				Levinsenia sp.
				Paraonides sp. (?)
				Paraonidae sp.
			Scalibregmatidae	*Oligobregma* sp.
				Oligobregma tani
				Scalibregmatidae sp.
			Travisiidae	*Travisia* cf. *glandulosa*
		Echiuroidea	Bonelliidae	Bonelliidae sp.
		Eunicida	Lumbrineridae	*Abyssoninoe* sp.
				Lumbrineris sp. A
				Lumbrineris sp. B
				Lumbrineris sp. C
			Onuphidae	*Kinbergonuphis* sp.
				Onuphidae sp. (juv)
				Paradiopatra sp.
		Phyllodocida	Goniadidae	*Goniada* sp.
			Hesionidae	Hesionidae sp.
			Nereididae	Nereididae sp. A
				Nereididae sp. B
			Phyllodocidae	Phyllodocidae sp.
			Polynoidae	*Scalisetosus* sp.
			Sigalionidae	*Leanira quatrefagesi*
		Sabellida	Sabellidae	*Jasmineira* sp.
		Spionida	Spionidae	*Microspio* sp.
				Prionospio sp. (?)
				Spionidae sp.
				Spiophanes sp. A
				Spiophanes sp. B
		Terebellida	Ampharetidae	Ampharetidae sp.
				Lysippe cf. *labiata*
			Cirratulidae	*Chaetozone* sp. A
				Chaetozone sp. B
				Cirratulidae sp.
			Flabelligeridae	*Diplocirrus* sp.
				Pherusa sp.
			Melinnidae	*Melinnopsis* sp.
			Pectinariidae	Pectinariidae sp.
			Terebellidae	Terebellidae sp.
Arthropoda	Copepoda			Copepoda sp.
	Malacostraca	Amphipoda		Amphipoda sp.
			Lysianassidae	Lysianassidae sp. A
				Lysianassidae (?) sp. B
				Lysianassidae sp. C
			Oedicerotidae	Oedicerotidae sp.
			Tryphosidae	*Hippomedon* sp. (?)
			Urothoidae	Urothoidae sp.
		Cumacea	Bodotriidae	Bodotriidae sp. A

Phylum	Class	Order	Family	Taxa
				Bodotriidae sp. B
				Bodotriidae sp. C
			Diastylidae	*Makrokylindrus* cf. *aculeatus*
			Leuconidae	*Leucon* sp.
		Decapoda		Dendrobranchiata sp.
		Isopoda		Asellota sp.
			Arcturidae	Arcturidae sp.
				Neastacilla sp.
			Desmosomatidae	*Desmosoma* sp.
			Gnathiidae	*Bathygnathia* sp.
				Gnathiidae sp.
			Haploniscidae	*Antennuloniscus dimeroceras*
				Chauliodoniscus cf. *princeps*
				Haploniscus sp.
			Ischnomesidae	*Haplomesus* sp.
			Macrostylidae	*Macrostylis* sp. A
				Macrostylis sp. B
			Munnopsidae	Eurycopinae sp.
		Mysida	Mysidae	*Mysis* sp. (larvae)
		Tanaidacea		Tanaidacea sp.
			Agathotanaidae	*Paranarthrura* sp.
			Apseudidae	*Leviapseudes* sp. A
				Leviapseudes sp. B
			Neotanaidae	*Neotanais* sp.
			Pseudotanaidae	Pseudotanaidae sp. (?)
	Ostracoda			Ostracoda sp. A
				Ostracoda sp. B
		Podocopida		Podocopida sp.
Echinodermata	Holothuroidea			Holothuroidea sp. (?)
		Apodida	Synaptidae	Synaptidae sp.
	Ophiuroidea	Ophiacanthida	Ophiomyxidae	Ophiomyxidae sp.
		Ophiurida	Ophiuridae	*Ophiura (Ophiura) trimeni* (?)
Mollusca	Bivalvia			Bivalvia sp. A
				Bivalvia sp. B
			Cuspidariidae	Cuspidariidae sp.
		Arcida	Limopsidae	*Limopsis* sp.
		Limida	Limidae	*Limatula* sp.
		Lucinida	Thyasiridae	*Mendicula* sp. (?)
		Nuculanida	Nuculanidae	*Ledellina* sp.
			Pristiglomidae	*Pristigloma nitens*
			Yoldiidae	*Microgloma mirmidina*
		Nuculida	Nuculidae	*Nucula atacellana*
	Caudofoveata			Caudofoveata sp.
	Gastropoda			Gastropoda sp.
	Solenogastres			Solenogastres sp.
Nematoda				Nematoda sp.
Nemertea				Nemertea sp.

Dominant species in terms of abundance (>1% total abundance) were **mostly annelids polychaetes, which is usual for this kind of very muddy and deep substrate.** The most abundant taxa recorded were two polychaetes (*Spiophanes* sp. and *Spiophanes* sp. B) and the bivalve *Microgloma mirmidina*, while the remainder were represented by less than 50 specimens each. Two other bivalves representing more than 3% of the total abundance were a non-identified species and *Pristigloma nitens.* The other species contributed to less than 3% of the total abundance. We can notice the relative abundance of an arthropod tanaidacea (*Paranarthrura* sp.), a nematoda, and non-identified bivalve which are present in the following list of dominant species. Figure 21 gives some illustrations a several dominant species.

Table 28. Dominant species in terms of individuals abundance (>1% total abundance)

Phylum/Class	Taxa	Mean (ind./station)	Mean (% total abundance)
Annelida polychaeta	*Spiophanes* sp. B	3.29	12.2
Mollusca bivalvia	*Microgloma mirmidina*	3.03	11.2
Annelida polychaeta	*Spiophanes* sp. A	2.16	8.0
Mollusca bivalvia	Bivalvia sp. A	1.58	5.9
Mollusca bivalvia	*Pristigloma nitens*	0.84	3.1
Annelida polychaeta	*Prionospio* sp.?	0.74	2.8
Annelida polychaeta	Ampharetidae sp.	0.65	2.4
Annelida polychaeta	Cirratulidae sp.	0.65	2.4
Annelida polychaeta	*Paraonides* sp.?	0.52	1.9
Annelida polychaeta	Capitellidae sp. A	0.48	1.8
Annelida polychaeta	*Lysippe* cf. *labiata*	0.42	1.6
Annelida polychaeta	*Microspio* sp.	0.42	1.6
Annelida polychaeta	Maldanidae sp.	0.39	1.4
Arthropoda tanaidacea	*Paranarthrura* sp.	0.39	1.4
Annelida polychaeta	*Goniada* sp.	0.35	1.3
Arthropoda isopoda	*Haploniscus* sp.	0.35	1.3
Annelida polychaeta	Kinbergonuphis sp.	0.32	1.2
Annelida polychaeta	*Leanira quatrefagesi*	0.32	1.2
Nematoda	Nematoda sp.	0.32	1.2
Mollusca bivalvia	Bivalvia sp. B	0.29	1.1
Annelida polychaeta	*Jasmineira* sp.	0.29	1.1
Annelida polychaeta	Onuphidae sp. juv	0.29	1.1
Annelida polychaeta	*Paradiopatra* sp.	0.29	1.1
Total Annelida	***16 dominant species***	***Mean 0.72 ind./station***	***Mean 2.7 %***
Total Molusca bivalva	***4 dominant species***	***Mean 1.44 ind./station***	***Mean 5.3 %***
Total Others	***3 dominant species***	***Mean 0.35 ind./station***	***Mean 1.3 %***

Dominant species in terms of biomass (>1% total biomass) were t**axa characterized by large size organisms** (such as echinoderms ophiurids or holothuroids and certain annelids such as the one listed in the following Table 29), or abundant species such as the bivalve *Microgloma mirmidina*. Six species of echinoderms and large annelids contributed each to more than 5% of the total biomass.

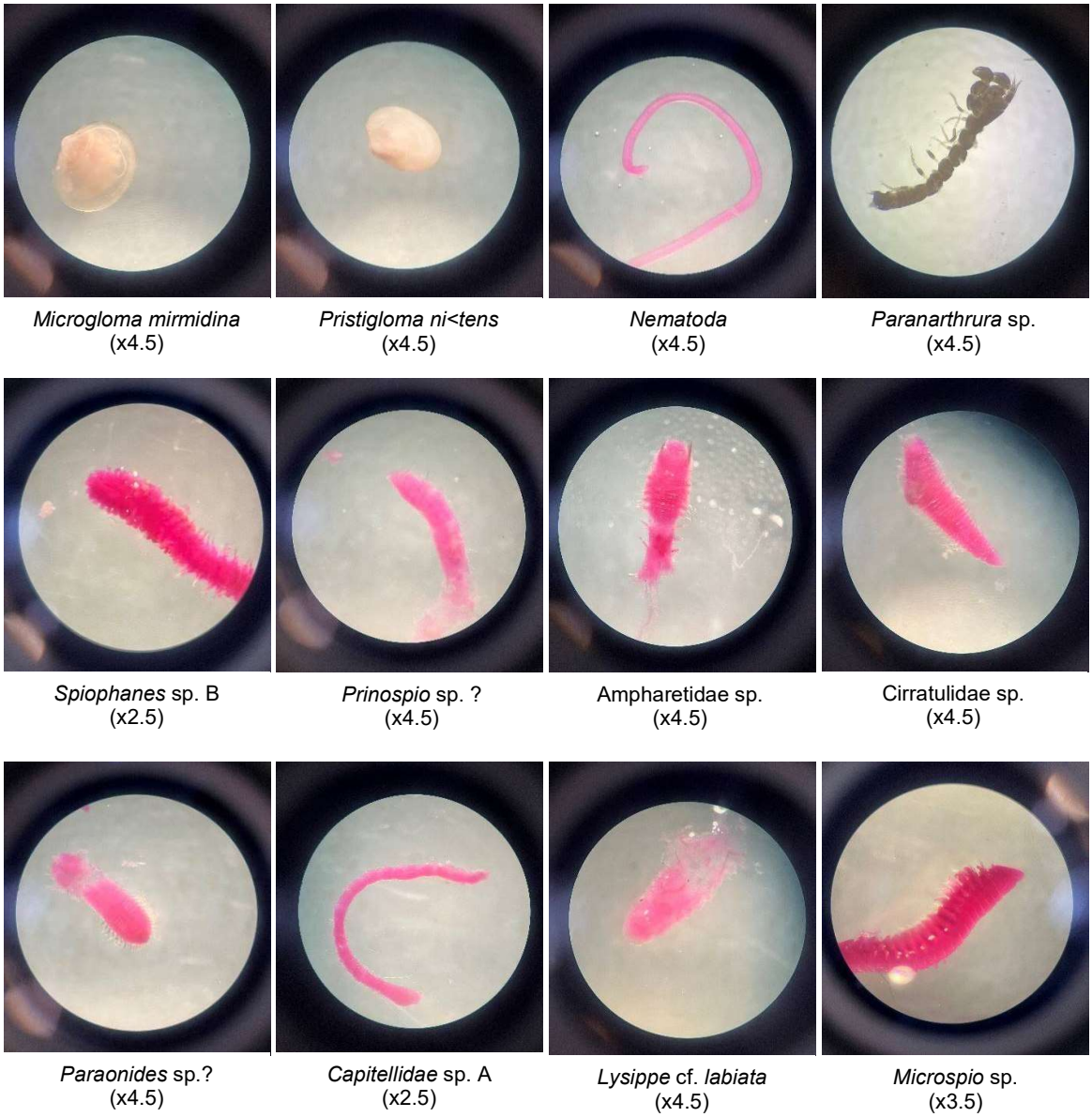
Table 29. Dominant species in terms of taxa biomass (>1% total biomass)

Phylum/Class	Taxa	Mean (g/station)	Mean (% total biomass)
Echinodermata ophiuroidea	Ophiomyxidae sp.	0.07	21.7
Echinodermata ophiuroidea	*Ophiura (Ophiura) trimeni*?	0.05	16.3
Annelida polychaeta	*Abarenicola affinis africana*	0.05	15.1
Annelida sipunculida	*Phascolosoma* sp.	0.03	8.9
Annelida sipunculida	Sipuncula sp. A	0.02	6.0
Echinodermata holothuroidea	Synaptidae sp.	0.02	5.9
Annelida polychaeta	*Spiophanes* sp. B	0.01	3.0

Annelida polychaeta	Scalibregmatidae sp.	0.01	3.0
Annelida sipunculida	Sipuncula sp. E	0.01	1.9
Annelida polychaeta	*Spiophanes* sp. A	0.00	1.6
Mollusca bivalvia	*Microgloma mirmidina*	0.00	1.1
Total Echinodermata	***3 dominant species***	***Mean 0.05 g/station***	***Mean 14.6 %***
Total Annelida	***7 dominant species***	***Mean 0.02 g/station***	***Mean 5.6 %***
Total Mollusca	***1 dominant species***	***Mean 0.00 g/station***	***Mean 1.1 %***

Only 16 taxa from the 117 could be identified to species level. This could be attributed to the taxonomic impediment, which is the global shortage of trained taxonomists, curators and consequently taxonomic knowledge (Costello *et al.* 2010). This is especially true for certain understudied habitats (e.g., the deep sea). Of these 16, one species (*Abarenicola affinis africana*) was previously known from Namibia, while another five have previously been documented in South Africa (*Makrokylindrus (Adiastylis)* cf. *aculeatus* and *Ophiura (Ophiura) trimeni*), the South Atlantic Ocean (*Chauliodoniscus* cf. *princeps*), the Atlantic Ocean (*Antennuloniscus dimeroceras*) and Antarctica (*Ophelina nematoides*). The remaining ten species have not previously been recorded anywhere near Namibia (e.g., *Magelona bizkaiensis* is only known from the North Atlantic) and may reflect the shared abyssal plain habitat that is largely homogenous across the different ocean basins. Alternatively, these species could represent complexes or cryptic species that require further investigation.

At present, **none of the taxa recorded in Block 2912 are considered endemic or invasive**.



Microgloma mirmidina (x4.5) | *Pristigloma ni<tens* (x4.5) | *Nematoda* (x4.5) | *Paranarthrura* sp. (x4.5)

Spiophanes sp. B (x2.5) | *Prinospio* sp. ? (x4.5) | Ampharetidae sp. (x4.5) | Cirratulidae sp. (x4.5)

Paraonides sp.? (x4.5) | *Capitellidae* sp. A (x2.5) | *Lysippe* cf. *labiata* (x4.5) | *Microspio* sp. (x3.5)

Figure 21. Illustration of some dominant benthos species in terms of abundance

3.2.3.2. Community descriptors and spatial variation

3.2.3.2.1. Macrobenthic structure of the community

The **number of taxa was low in all the stations** (never exceeding 24 species), and very low in stations S01 and S14 since only 3 and 6 species were sampled.

Abundance was also quite low in all the stations (never exceeding 50 individuals), and very low on stations S01 and S14 since only 3 and 6 individuals were sampled.

Biomass was also low, never exceeding 1g/station except on stations S34 and S35 due to the capture in the box core of one large Polychaete (*Abarenicola affinis Africana*) and ophiurids (*Ophiomyxidae* sp.).

Since abundance was never high, no great unbalance was observed between the species density, and thus species richness (Margalef) was mostly close or upper to the threshold value of 3. However, due to low values of total taxa and abundance, the Shannon-Wiener **diversity index remained low** (below 3). In contrast, Pielou's evenness was very high, because of the automatic absence of unbalance between species abundances due to the general low levels of the community in taxa and abundance. Pielou's evenness reached even the maximum value of 1 when very few species were sampled by one single specimen (in station S01 and S14).

Table 30. Univariate benthic macrofaunal community descriptors per station sampled in Block 2912

Station	No. of taxa (per 0.1m²)	Abundance (ind./0.1m²)	Biomass (g/0.1m²)	Species Richness (Margalef)	Shannon-Wiener Index	Pielou's Evenness
S01	3	3	0.010	1.82	1.10	1.00
S03	11	17	0.050	3.53	2.28	0.95
S04	9	16	0.040	2.89	1.98	0.90
S06	14	22	0.100	4.21	2.45	0.93
S07	10	34	0.350	2.55	1.76	0.76
S08	14	26	0.040	3.99	2.42	0.92
S10	13	27	0.030	3.64	2.41	0.94
S11	10	18	0.030	3.11	2.19	0.95
S12	12	24	0.530	3.46	2.28	0.92
S13	10	12	0.560	3.62	2.25	0.98
S14	6	6	0.290	2.79	1.79	1.00
S15	18	35	0.080	4.78	2.69	0.93
S16	12	18	0.060	3.81	2.32	0.93
S19	14	22	0.870	4.21	2.50	0.95
S20	15	38	0.060	3.85	2.41	0.89
S21	23	36	0.470	6.14	2.86	0.91
S22	16	24	0.210	4.72	2.60	0.94
S23	15	29	0.070	4.16	2.58	0.95
S24	18	33	0.940	4.86	2.67	0.93
S27	9	23	0.060	2.55	1.73	0.79
S28	10	44	0.060	2.38	1.67	0.72
S30	21	30	0.490	5.88	2.93	0.96
S31	13	34	0.070	3.40	2.24	0.87
S32	13	24	0.050	3.78	2.38	0.93
S33	13	19	0.100	4.08	2.43	0.95
S34	15	39	1.520	3.82	2.27	0.84
S35	12	33	2.170	3.15	2.28	0.92
S37	24	50	0.130	5.88	2.77	0.87
S38	19	31	0.090	5.24	2.71	0.92
S39	11	27	0.040	3.03	2.17	0.90
S40	20	42	0.180	5.08	2.71	0.91
Mean	**13.6**	**27.0**	**0.31**	**3.88**	**2.32**	**0.91**
SD	**4.7**	**10.7**	**0.48**	**1.06**	**0.40**	**0.06**
Minimum	**3.0**	**3.0**	**0.01**	**1.82**	**1.10**	**0.72**
Maximum	**24.0**	**50.0**	**2.17**	**6.14**	**2.93**	**1.00**

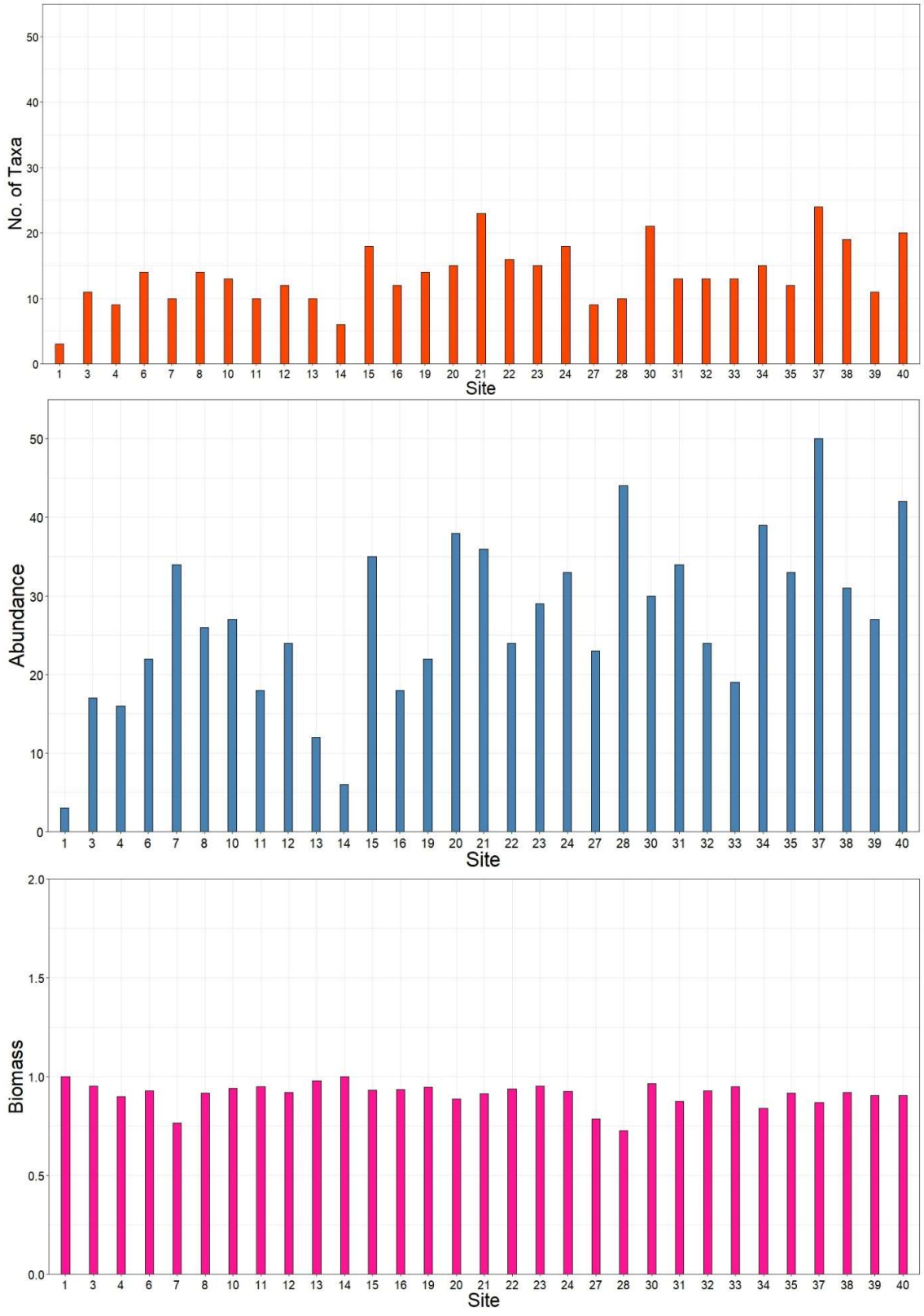


Figure 22. Univariate benthic macrofaunal community descriptors per sediment station (no. of taxa, abundance, biomass)

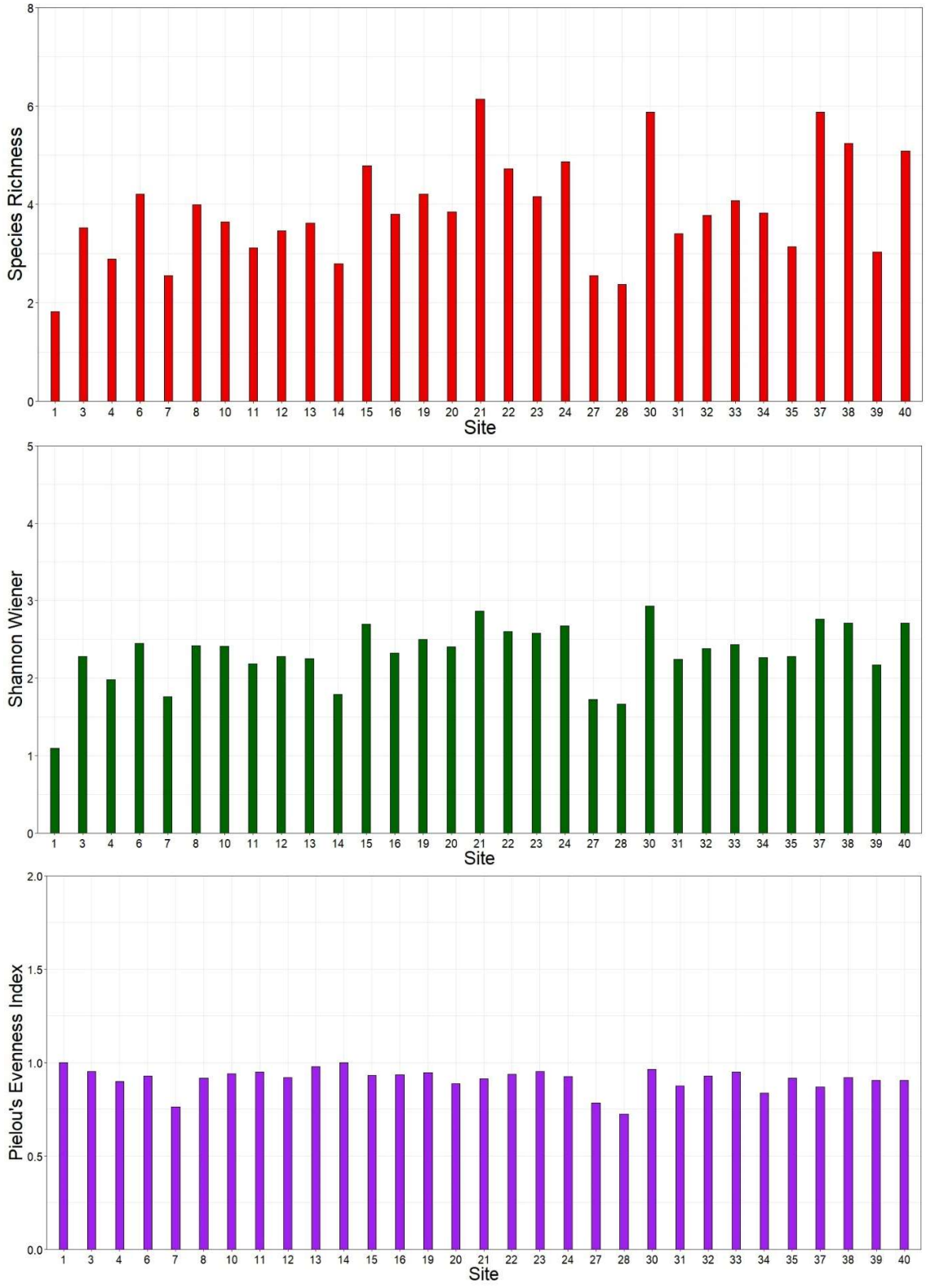


Figure 23. Univariate benthic macrofaunal community descriptors per sediment station (species richness, Shannon Wiener diversity index, Pielou's evenness index)

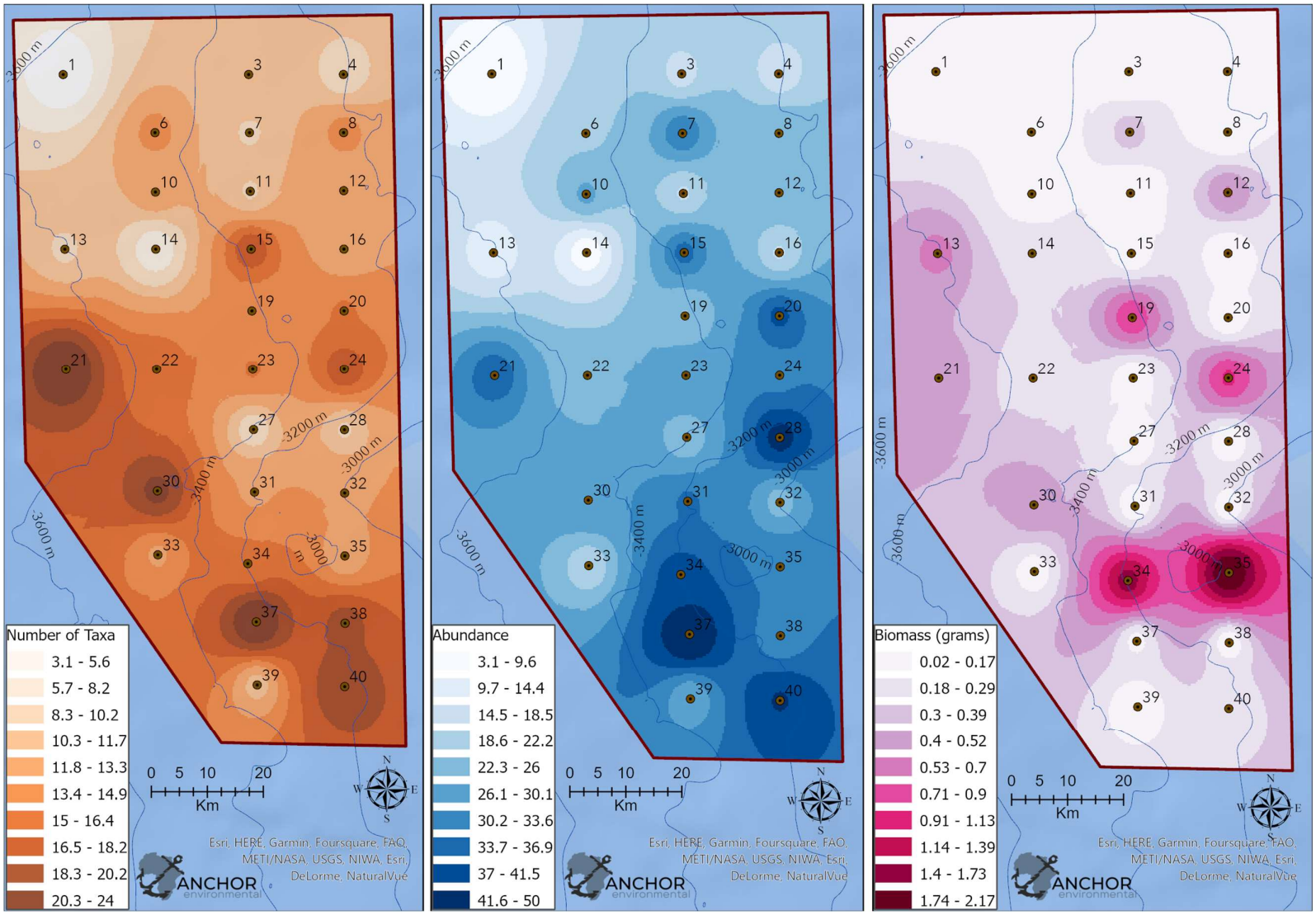


Figure 24. Spatial variation in benthic macrofaunal community descriptors (number of taxa. abundance and biomass)

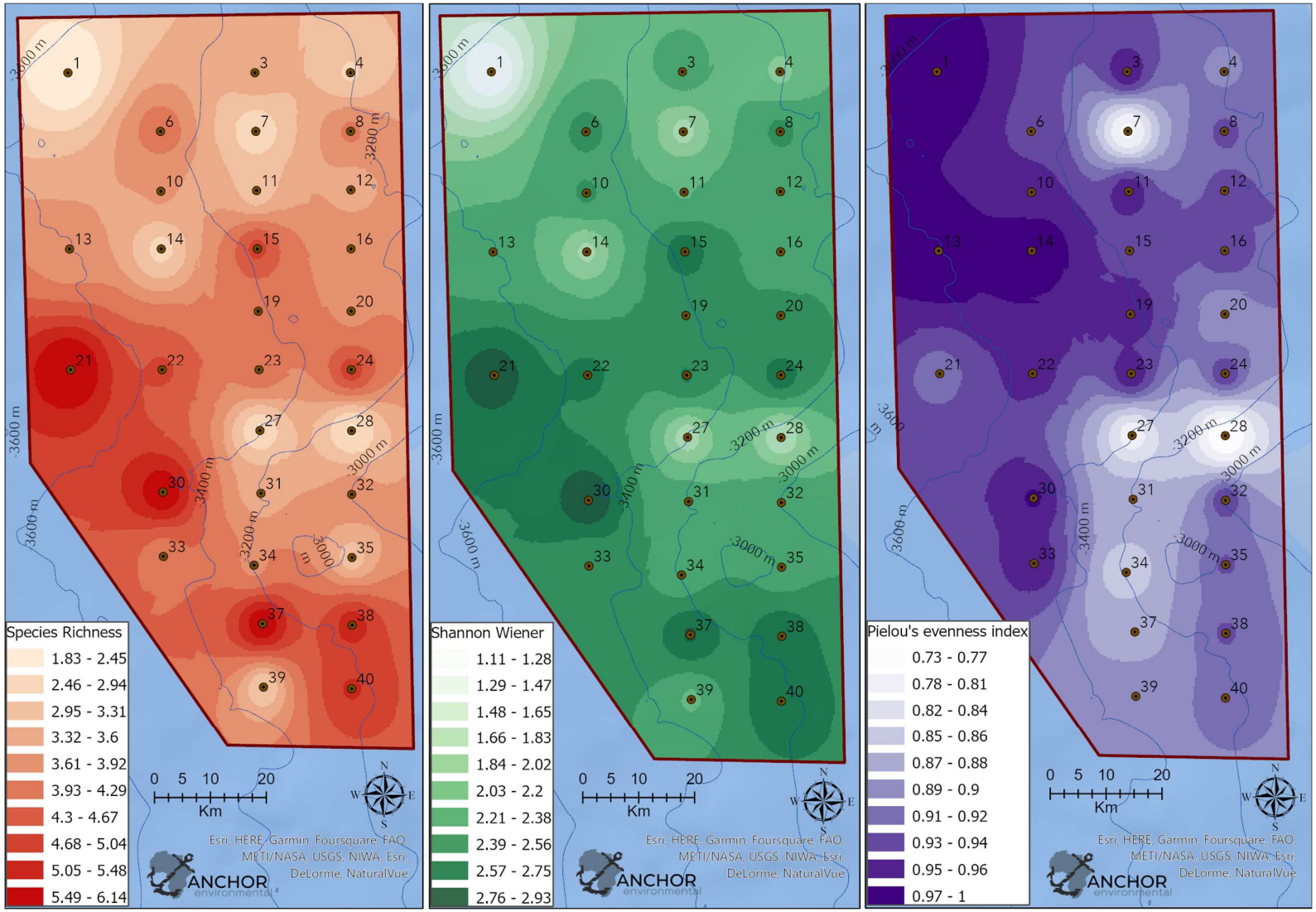


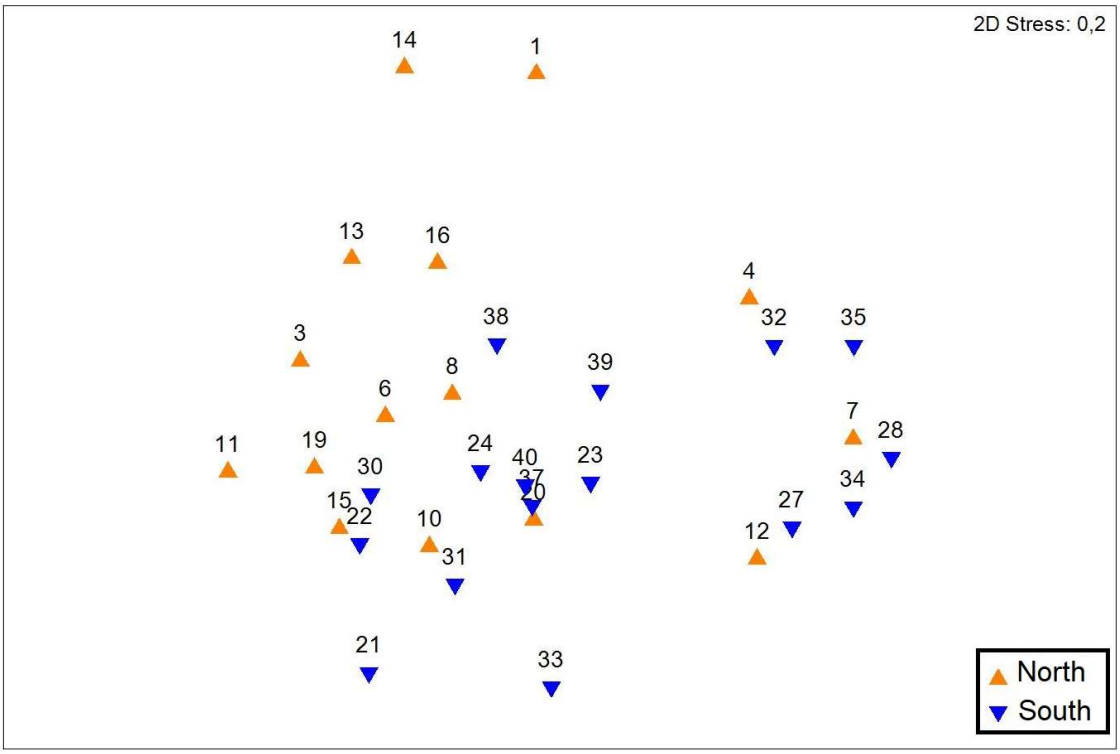
Figure 25. Spatial variation in benthic macrofaunal community descriptors (species richness (Margalef), Shannon–Wiener diversity index, and Pielou's evenness index)

3.2.3.2.2. Spatial variations

Univariate indices including the number of taxa, abundance, biomass, species richness (Margalef). Shannon–Wiener diversity index, and Pielou's evenness index for all Block 2912 stations sampled ($0.1m^2$) are presented in the following Table 31 and visualized in the following Figure 26 and Figure 27.

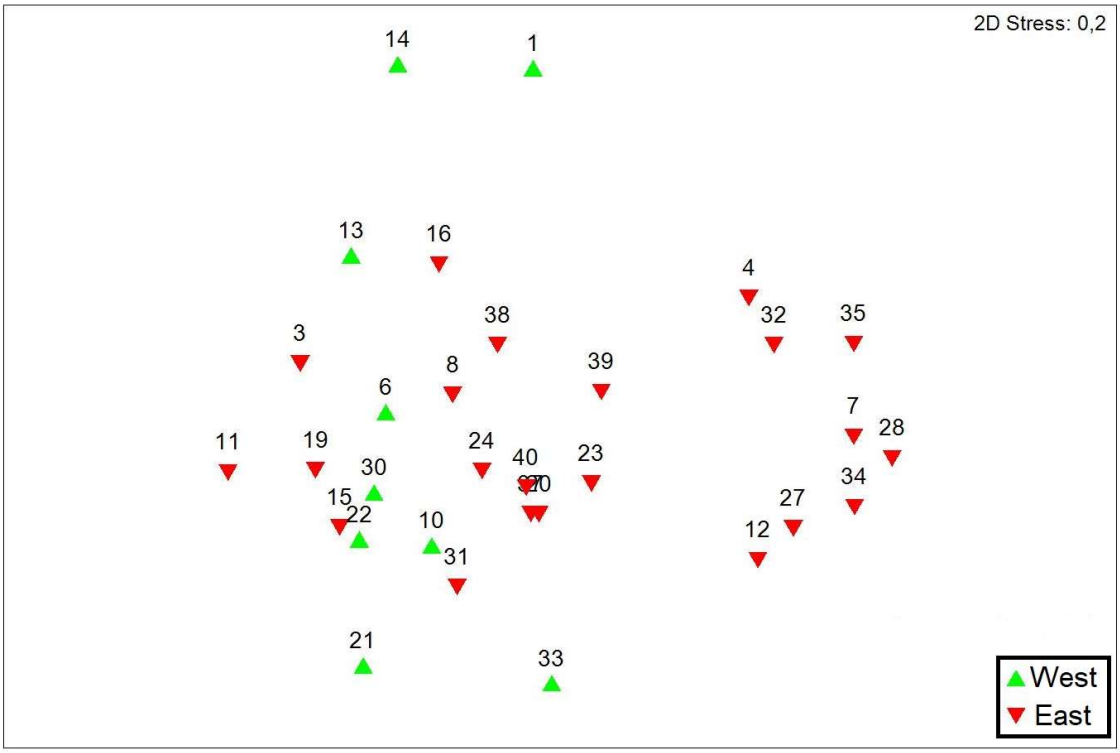
Once again, due to the general low diversity and abundance in the studied area, no high variation was observed between station. However, stations S01 and S14 can be characterized as close to azoic sites. Despite this low inter-station variability, we can observe that the values of all community descriptors, except evenness, increased with general latitudinal position, from North to South, in Block 2912 (see following figures). However, the macrofaunal community was not significantly structured by this factor (ANOSIM, R = 00.61, p = 0.08. Figure 26).

Community differences also differed according to general longitudinal position within Block 2912, with the number of taxa, species richness, Shannon–Wiener diversity, and evenness greater in the western portion of the block, while abundance and biomass were greater in the eastern portion of the block. This factor was found to significantly structure the macrofauna (ANOSIM, R = 0.189, p = 0.026, Figure 27), with the western and eastern community having an average similarity of 18% and 22% respectively, largely driven by the taxa *Spiophanes* spp. and *Microgloma mirmidina* (Table 31). These species also drive the 82% dissimilarity between these communities (Table 32). *Microgloma mirmidina* being largely dominant in the western portion of the block and *Spiophanes* sp B being more abundant in the eastern side. In spite of quite this high degree of dissimilarity, it is not possible to link this east-west gradient with depth since inter-variations of depth between stations are low and the substrate in the block is characterized by a homogeneous flat muddy seabed.



Symbols indicate latitudinal position in the block divided across the midpoint.

Figure 26. Non-metric multidimensional scaling (nMDS) ordination depicting the geographical (North – South) similarity between Block 2912 stations, according to benthic macrofauna composition



Symbols indicate longitudinal position in the block divided along the block midpoint.

Figure 27. Non-metric multidimensional scaling (nMDS) ordination depicting the geographical (West - East) similarity between Block 2912 stations, according to benthic macrofauna composition

Table 31. Results of SIMPER analysis indicating the percentage contribution of each taxon that overall contributed at least 90% to the similarity within the general western and eastern region of Block 2912

West	
Average similarity = 17.79%	
Taxon	**Contribution (%)**
Microgloma mirmidina	44.04
Spiophanes sp. A	14.78
Pristigloma nitens	7.56
Spiophanes sp. B	5.62
Ophiura (Ophiura) trimeni (?)	3.93
Lysippe cf. *labiata*	3.34
Paranarthrura sp.	2.31
Cirratulidae sp.	2.28
Maldanidae sp.	2.26
Paraonides sp. (?)	2.09
Ampharetidae sp.	1.94

East	
Average similarity = 22.35%	
Taxon	**Contribution (%)**
Spiophanes sp. B	31.77
Microgloma mirmidina	19.47
Spiophanes sp. A	13.3
Cirratulidae sp.	4.33
Bivalvia sp. A	2.89
Prionospio sp. (?)	2.6
Capitellidae sp. A	2.31
Pristigloma nitens	2.25
Ampharetidae sp.	2.14
Leanira quatrefagesi	1.9
Onuphidae sp. (juv)	1.24
Maldanidae sp.	1.19
Paraonides sp. (?)	1.17
Paranarthrura sp.	1.05
Goniada sp.	1.04
Nematoda sp.	0.96
Leviapseudes sp. A	0.7

Table 32. Results of SIMPER analysis indicating the percentage contribution of each taxon that overall contributed at least 70% to the difference between the general western and eastern region of Block 2912

West & East	
Average dissimilarity = 82.24%	
Taxon	**Contribution (%)**
Spiophanes sp. B	10.5
Microgloma mirmidina	7.68
Spiophanes sp. A	5.84
Bivalvia sp. A	5.02
Pristigloma nitens	3.28
Prionospio sp. (?)	2.79
Ampharetidae sp.	2.31
Capitellidae sp. A	2.1
Paraonides sp. (?)	2.1
Cirratulidae sp.	1.99
Lysippe cf. *labiata*	1.98
Microspio sp.	1.61
Paranarthrura sp.	1.55
Goniada sp.	1.51
Maldanidae sp.	1.48
Nematoda sp.	1.42
Ophiura (Ophiura) trimeni (?)	1.42
Haploniscus sp.	1.4
Kinbergonuphis sp.	1.21
Leanira quatrefagesi	1.18
Nemertea sp.	1.11
Ostracoda sp. A	1.08
Antennuloniscus dimeroceras	1.06
Jasmineira sp.	1.05
Paradiopatra sp.	1.04
Onuphidae sp. (juv)	1.04
Capitellidae sp. B	1.01
Bivalvia sp. B	0.98
Desmosoma sp.	0.97
Abyssoninoe sp.	0.93
Chaetozone sp. A	0.91

The Michaelis-Menton species accumulation curve suggests that the sampling effort was sufficient to accurately document the benthic macrofauna diversity in Block 2912 surveyed area (Figure 28) since the curve tends to a plateau level which means that any additional samples would not permit to capture many new species.

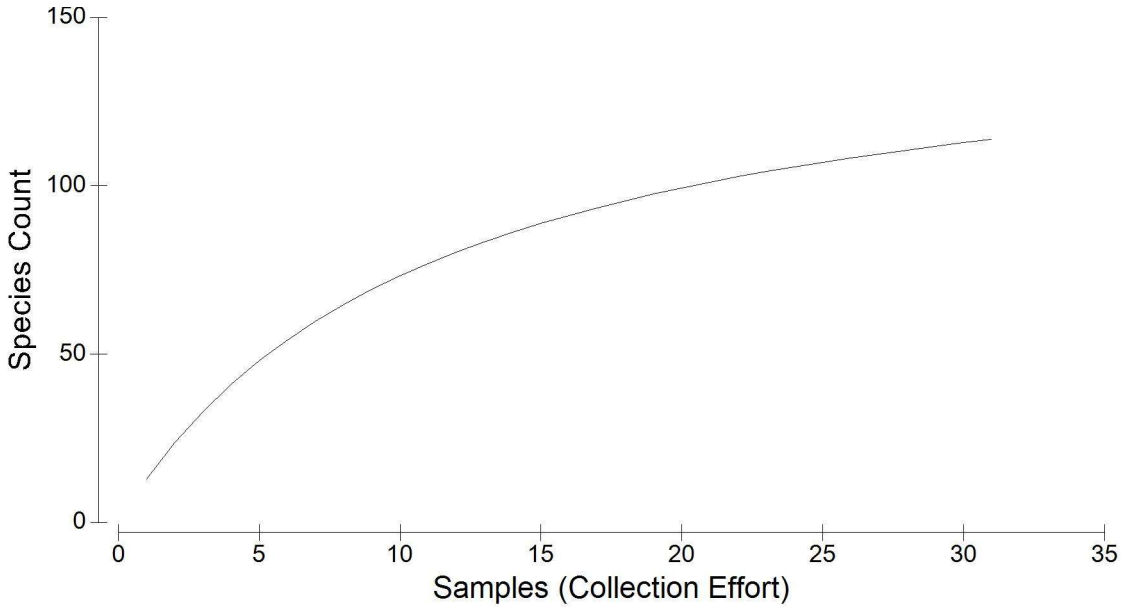


Figure 28. Michaelis-Menton species accumulation curve for Block 2912

3.3. Water compartment

3.3.1. Water Quality

3.3.1.1. Hydrographic profiles

Water column physicochemical parameters were recorded at four different locations using a multiparameter CTD (Midas Valeport) during downcast profils record.

Parameters included:

- conductivity (salinity),
- temperature,
- pressure (depth),
- recorded oxygen saturation,
- pH,
- turbidity,
- redox.

Results reflect water column hydrographic conditions at the time of the campaign which was between the 30/09 and the 14/10 of 2022 (beginning of the spring in this part of the southern hemisphere).

Charts illustrating values of all these parameters throughout the water column are presented below.

The charts show that:

- Data have a relatively **consistent water column profile between stations throughout the survey area.**

- **The temperature and salinity** profiles showed the upper ~100m of the water column to be relatively well mixed with temperatures ranging around 16°C and salinity around 35.5 PSU. The difference between surface and 100m depth was less than 1°C and 0.5 PSU in all profiles. A slow but consistent zone of transition then developed a weak thermocline / halocline down to a depth of ~700 meters with approximate temperatures and salinities reaching 4°C and 34 PSU, respectively. A second weak inversed halocline can be observed between 700m and 1700m. Near the seafloor (between 3170m and 3527m), the temperatures ranged between 2.1°C and 2.4°C, and salinity was 35 PSU.

- The observed dissolved **oxygen (DO) saturation** profiles at the four locations were also very characteristic of this type of oceanic environment with high values near the surface or subsurface (around 100% in the first 100m below sea surface), decreasing rapidly to about 42.5% at a depth of approximately 1200m, a little increase between 1500m and 2000m depth before decreasing trends again to a minimum of around 36% oxygen saturation at the lower depths. This indicates that waters are more productive near the surface due to good oxygenation and the presence of light which initiates photosynthesis and then gradually decreases with depth.

- **pH values** were consistent between the different water column profiles, with a slight decrease from 8.2 to 7.8 at approximately 350m and remaining constant down to the seafloor.

- **Turbidity** values were always low (between 0.17 FTU for S04 and 1.36 FTU for S23) indicating clear oceanic waters. While the turbidity values remained stable throughout the water column for most of the profiles. there was an increase to 0.8 FTU at 800 m for the S23 profile. The values of this profile and for this parameter remained higher until the depth of 2000 m. Higher values observed at station S23 were probably due to a faulty sensor.

- **Redox** values were always positive except on station S40 at the sub-surface level (low negative value). These results reflect the absence of dysfunction of the bacteriological activity and biological processes that originate from the degradation of organic matter, even in deep waters where the oxygenation was lower.

Table 33. Values ranges measured by the multiparameter CTD on the four sampled stations

Station	Value	Depth (m)	Tempe-rature (°C)	Salinity (PSU)	Oxygen Saturation (%)	PH	Turbidity (FTU)	Redox (mv)
S01	**Minimum**	2.0	2.1	34.4	34.6	7.8	0.11	153.8
	Maximum	3,534.7	16.2	35.5	102.3	8.2	0.96	216.3
S04	**Minimum**	1.5	2.4	34.4	37.4	7.8	0.10	102.9
	Maximum	3,171.2	16.2	35.6	101.1	8.2	0.61	164.8
S23	**Minimum**	1.0	2.3	34.3	36.1	7.8	0.11	14.6
	Maximum	3,415.8	16.7	35.6	101.9	8.2	1.36	221.5
S40	**Minimum**	2.2	2.4	34.4	37.6	7.8	0.18	-57.6
	Maximum	3,233.6	16.7	35.7	102.7	8.2	1.25	204.8

The water column showed evidence of four separate water masses, which were consistent with the expected surface, central, intermediate and deep-water masses of offshore Namibia (Hanz et al.. 2019):

- Within the first 100m, a well oxygenated layer of water was observed with temperature and salinity values indicative of South Atlantic and Subtropical Surface Waters (SASSW). This water mass is a mixture of sun-warmed upwelled water, and water stemming from the Agulhas Current (Hutchings *et al.,* 2009).
- From 100m to 700m, temperature and salinity properties within the water column correspond to those characteristic of Eastern South Atlantic Central Water (ESACW) (Stramma and England, 1999). ESACW is characterized by a slightly lower core salinity range of 34.5 to 35.5 PSU and temperature range of 6°C to 14°C (Liu and Tanhua, 2019).
- The influence of Antarctic Intermediate Water (AAIW) can be seen at around 700m depth where water becomes slightly fresher and continues to decline in temperature.
- At the base of the AAIW. beyond approximately 1000m, the water column is influenced by the cool mass of the North Atlantic Deep Waters (NADW); characteristics of this water mass include a deep salinity maximum as seen by the slightly increased salinity in the survey area, and a relatively high dissolved oxygen content given its depth (Valentine et al., 1993).

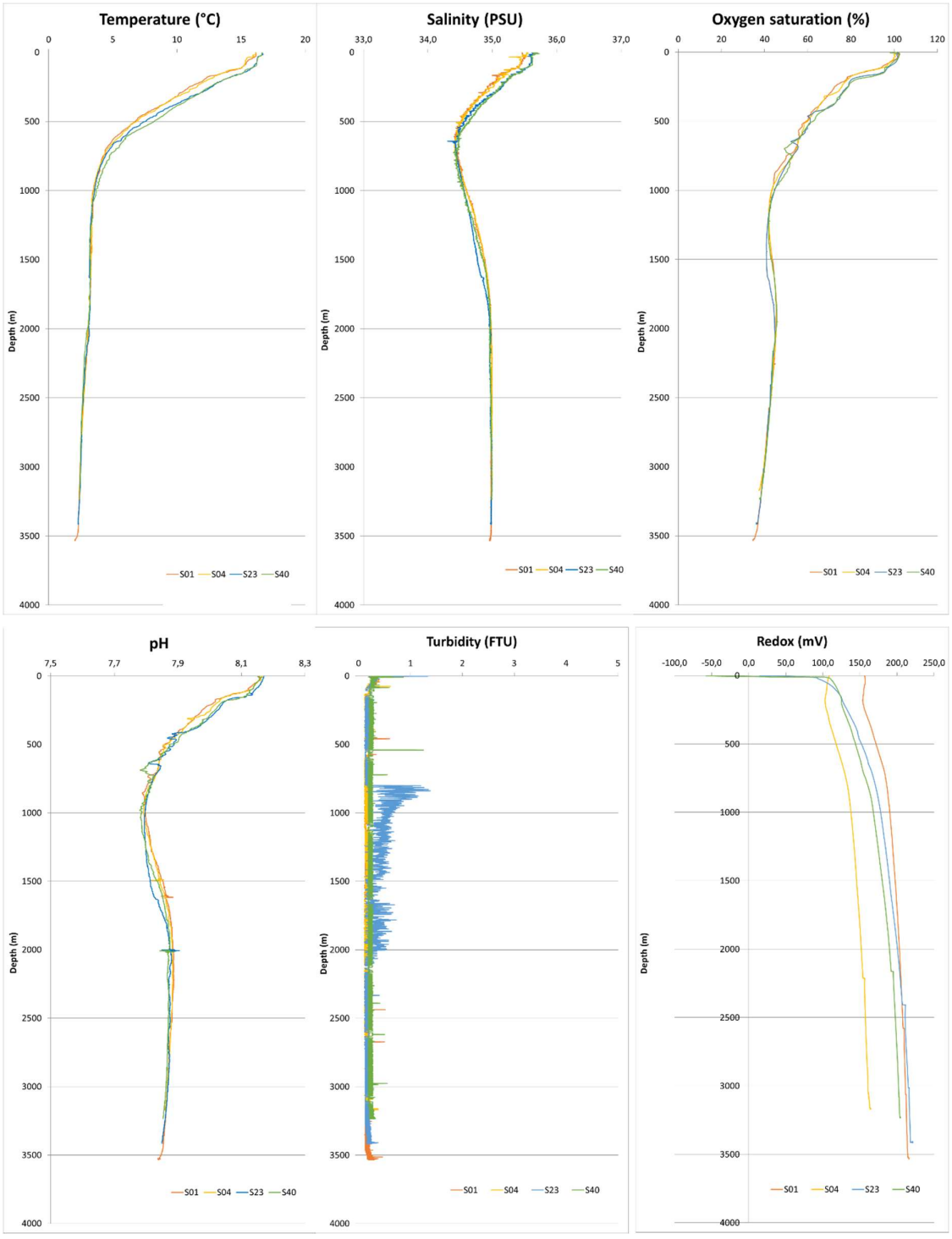


Figure 29. CTD water column profiles at four different locations of Block 2912

3.3.1.2. NORM values

All measurements were taken differed by <3 CPS from their respective sample background levels indicating no contamination (Table 34), except at one sample (S23_S) indicating a slight NORM presence in this water sample, but at a level which **not class as radioactive.**

Table 34. NORM values measured in the water column

Station	Water Depth (m)	NORM (counts per second)	
		αβ Background	αβ
S01	5	0.34	0.23
	1,000	0.34	0.53
	3,519	0.34	0.33
S04	5	0.26	0.48
	1,000	0.26	0.66
	3,160	0.26	0.43
S23	5	0.43	4.06
	1,000	0.46	0.33
	3,406	0.33	0.36
S40	5	0.49	0.33
	1,000	0.23	0.43
	3,204	0.23	0.39

3.3.1.3. Total Suspended Solids and Total Organic Carbon

> *In addition to dissolved matter (particles passing through a 0.5um filter), seawater contains suspended matter (Total Suspended Solids, TSS) of all sizes and shapes, mineral or organic, living or detrital. This suspended matter is biogenic (bacteria, Phytoplankton, Zooplankton, fish), terrigenous (river runoff, products of coastal erosion, anthropogenic detritus), wind-borne (particles transported by atmospheric currents and falling into the sea), or meteoric (Ivanoff, 1972 in Aminot & Kérouel, 2004). Put together, the organic (carbon-containing) substances in natural waters are called Total Organic Carbon TOC. There are many natural and human-made substances that all contribute to TOC. TOC is partly broken down by micro-organisms which causes oxygen consumption.*
>
> *Total Suspended Solids (TSS) and Total Organic Content (TOC) in seawater vary according to local contexts: influence of terrestrial and river runoff, water circulation, oligotrophic/eutrophic conditions, hydrodynamics or sediment nature. Concentrations of suspended solids are usually very low in the oceanic environment, especially in deep waters. These concentrations are subject to seasonal variations: plankton, terrigenous inputs, and storms. TSS values in the order of 0.5 to 5 mg/l can be observed in coastal waters and several hundred milligrams per liter in estuaries (up to several grams per liter)* (Aminot and Kérouel, 2004).

Raw data are given in appendix (6.15 Appendix XV – Organic and Nutrient Content. Trace Metal Concentrations and Microbiology Content in Water).

Total Suspended Solid (TSS) and Total Organic Carbon (TOC) were analyzed at three different depths (below surface, mid-depth, and near sea bottom) from water samples collected with a Niskin bottle.

TSS concentrations were below 10 mg/L except at station S04, where TSS appeared high compared to coastal water concentrations reported by Aminot and Kérouel (2004). TSS was lower near the surface than in deeper waters. If we compare these values to the turbidity recordings. TSS does not seem to be related to turbid waters. One hypothesis is that there are some large particles in suspension in the water column, increasing the concentration without altering the transparency of the water.

The TOC values were relatively consistent among the different samples: the values ranged from 26.1 to 31.3 mg/L. These concentrations can be considered as relatively high in spite of that they cannot be compared to a reference value: the only existing reference value on water organic content concerns dissolved organic carbon (DOC) and not total organic carbon (TOC) (see Table 10).

Table 35. Total Suspended Solids (TSS) and Total Organic Carbon (TOC) in the water column

Station	Depth (m)	TSS (mg/L)	TOC (mg/L)
S01	5	6.5	31.1
	1,000	8.9	31.3
	3,519	8.3	30.5
S04	5	8.6	26.1
	1,000	31.0	26.6
	3,160	19.0	26.4
S23	5	4.0	31.3
	1,000	8.8	30.0
	3,406	10.0	29.3
S40	5	3.0	29.0
	1,000	8.8	30.0
	3,204	8.0	26.1

3.3.1.4. Nutrients

> *The main nutrients that limit primary productivity are nitrogen, phosphorus, and silicon (Lalli & Parsons 1997; Levinton 2001). All three elements are necessary for phytoplankton to grow. Nitrogen requirements are met in the ocean by several forms of fixed inorganic nitrogen, such as nitrate, nitrite and ammonia, as well as by dissolved organic nitrogen species, such as urea and amino acids. Nitrate transported through the thermocline into the upper mixed layer supports most of the primary production in the ocean, while organic nitrogen recycled into the mixed layer supports regenerated production (Parsons et al., 1984). Nutrient requirements for phosphorus are met by the phosphate ion.*

Raw data are given in appendix (6.15 Appendix XV – Organic and Nutrient Content. Trace Metal Concentrations and Microbiology Content in Water).

Water samples collected at three reference depths at each of four locations were analyzed for the following nutrients:

- Nitrogen Kjedhal,
- Nitrites,
- Nitrates,
- Orthophosphates.

These data were compared with the threshold values from European regulations under the Water Framework Directive (order of 27 July 2015 and circular of 07 May 2007). The color code used ranges from light blue for low values (satisfactory quality) to red for high values (degraded quality) (Table 10).

Table 36. Nutrient concentrations in water samples

Station	Depth (m)	NTK mg/L	NO_2 mg/L	NO_3 mg/L	PO_4 mg/L
S01	5	< 0.5	<0.01	< 0.1	0.023
	1,000	< 0.5	<0.01	0.94	0.102
	3,519	< 0.5	<0.01	1.67	0.151
S04	5	< 0.5	<0.01	< 0.1	0.025
	1,000	< 0.5	<0.01	4.2	0.217
	3,160	< 0.5	<0.01	1.53	0.144

S3	5	< 0.5	<0.01	1.92	0.022
	1,000	< 0.5	<0.01	1.79	0.205
	3,406	< 0.5	<0.01	2.14	0.144
S40	5	< 0.5	<0.01	1.01	0.02
	1,000	< 0.5	<0.01	1.82	0.22
	3,200	< 0.5	<0.01	1.57	0.152

NTK: Nitrogen Kjeldhal; NO3: Nitrates; NO2: Nitrites; PO4: Orthophosphates

All the measurements of the nitrogen Kjeldahl and the nitrite parameters were below the detection limit of the laboratory.

Concentrations of nitrates and orthophosphates showed detectable values ranging from below 0.1 mg/L to 4.2 mg/L for nitrates, and from 0.020 mg/L to 0.217 mg/L for orthophosphates. Regarding the orthophosphate parameter, all stations at 1000m or near the seafloor showed poor or medium quality as compared with European reference values for nutrients in seawater.

Water below the mixed layer generally contains higher concentrations of dissolved nitrates, phosphates, and silicates than surface water (Mann and Lazier, 1966). Organic matter, primarily zooplankton fecal pellets, sink below the thermocline into deeper water exporting nutrient material from the surface.

This pattern of a richer deep layer was observed at the four sampled stations with nutrients close to zero at the surface layer and higher values at mid-depth and near bottom. It is consistent with previous results showing stratification of the water column. and the fact that the survey area is in one of the world's areas with the highest primary production.

Water mass appear to be impoverished in N et P elements at the four sampled stations, except intermediate and deep waters which present high concentration of PO_4.

3.3.1.5. Heavy and Trace Metal Concentrations

> *Trace metals play a critical role in the functioning of the ocean. Some trace elements (e.g., Fe, Co, Mo) are components of biological systems and are considered essential for marine biota (e.g., Fe is essential for primary production), while others, like Pb or Hg, appear to have no biological function and can be toxic when present in high concentrations (Da Silva and Williams, 2001). Although the concentration, distribution and bioavailability of trace metals have changed along the formation and evolution of the oceans, at present, they are found in the ocean at concentrations lower than 0.1 µM (Morel and Price, 2003). Their concentrations and distributions are controlled by the combination of several processes that include external sources (i.e. aerosol deposition, river runoff, hydrothermal inputs) and removal processes (i.e. biological uptake, scavenging onto either organic or inorganic particles, burial in marine sediments) (Bruland and Lohan, 2006), (Aparicio-González et al.,. 2012).*

Raw data are given in appendix (6.15 Appendix XV – Organic and Nutrient Content. Trace Metal Concentrations and Microbiology Content in Water).

A total of 21 heavy metals were analyzed in seawater at four locations for all three reference depths: subsurface, mid-depth, and near sea bottom. The results were compared with the reference values defined by UK marine SACs Project of 1999. and the NOAA reports of 2008 (Table 12).

Analyses for trace metal concentrations in water samples are summarized below shown in the following table:

- Silver, beryllium, cobalt, mercury, manganese, nickel., antimony, selenium, tin, and thallium were below the laboratory limit of detection.
- Aluminum showed detectable values at most of the stations, ranging between 12.1 µg/L (station S40 at 5m) and 30.5 µg/L (same station at 1000 m).
- Arsenic, barium, copper, iron, and lead concentrations were all below different threshold values.

- **Cadmium and chromium** both showed **one value above the environmental quality standard** for coastal and transitional waters (S04 at mid depth for cadmium and S01 at surface for Chromium). There were also above the background levels.

- Vanadium was above but very close to the background level (acute) at stations S01 (mid depth sample) and S04 (surface and bottom samples), not exhibiting significant contamination.

- Molybdenum showed values ranging from 6.92 µg/L to 10.6 µg/L, they remain below the thresholds of UK marine SACs Project and NOAA CCC (chronic) for this parameter. Values were also slightly below the background levels.

- **Zinc** measured concentrations were **relatively high in half of samples** (S01 subsurface, S04 subsurface, S04 near bottom, S23 subsurface and mid depth and S40 subsurface samples), with values higher than background levels). Nevertheless, they remained below NOAA's different thresholds established for this parameter.

Overall, water quality is quite good for all stations and metals, with few exceptions for cadmium, chromium and zinc.

Table 37. Metal concentrations in water samples

Station	Depth (m)	Ag µg/L	Al µg/L	As µg/L	Ba µg/L	Be µg/L	Cd µg/L	Co µg/L	Cr µg/L	Cu µg/L	Fe µg/L	Hg µg/L	Mn µg/L	Mo µg/L	Ni µg/L	Pb µg/L	Sb µg/L	Se µg/L	Sn µg/L	Th g/L	V µg/L	Zn µg/L
S01	5	<1	<10	1.79	5.06	<0.08	<0.05	<1	**3.72**	<1	<10	<0.015	<2	9.07	<2	<0.5	<1	<10	<2	<0.4	<2	**21.1**
	1,000	<1	13.3	1.87	5.38	<0.08	0.085	<1	<1	<1	<10	<0.015	<2	9.72	<2	<0.5	<1	<10	<2	<0.4	2.16	6.67
	3,519	<1	12.9	1.8	8.54	<0.08	0.108	<1	1.04	<1	<10	<0.015	<2	9.37	<2	<0.5	<1	<10	<2	<0.4	<2	5.39
S04	5	<1	29.5	2.16	4.89	<0.08	0.074	<1	1.11	<1	12.8	<0.015	<2	9.9	<2	1.18	<1	<10	<2	<0.4	2.08	**11.5**
	1,000	<1	26.8	1.68	8.4	<0.08	**0.359**	<1	1.87	<1	<10	<0.015	<2	9.65	<2	<0.5	<1	<10	<2	<0.4	<2	7.3
	3,160	<1	24.4	1.6	9.94	<0.08	0.196	<1	1.96	<1	<10	<0.015	<2	9.46	<2	<0.5	<1	<10	<2	<0.4	2.02	**9.11**
S23	5	<1	12.5	2.24	5.33	<0.08	<0.05	<1	1.22	<1	<10	<0.015	<2	10.6	<2	<0.5	<1	<10	<2	<0.4	<2	**18.0**
	1,000	<1	<10	1.33	6.17	<0.08	0.099	<1	1.38	<1	<10	<0.015	<2	6.92	<2	<0.5	<1	<10	<2	<0.4	<2	**11.2**
	3,406	<1	<10	2.2	9.29	<0.08	0.137	<1	<1	<1	<10	<0.015	<2	8.62	<2	<0.5	<1	<10	<2	<0.4	<2	4.43
S40	5	<1	12.1	1.49	4.31	<0.08	0.174	<1	1.48	1.04	<10	<0.015	<2	8.14	<2	0.795	<1	<10	<2	<0.4	<2	**52.6**
	1,000	<1	30.5	1.56	7.56	<0.08	0.16	<1	1.1	<1	<10	<0.015	<2	7.97	<2	0.535	<1	<10	<2	<0.4	<2	7.48
	3,200	<1	24.3	1.61	9.81	<0.08	0.101	<1	1.21	<1	<10	<0.015	<2	9.65	<2	<0.5	<1	<10	<2	<0.4	<2	7.67

Ag: Silver
Al: Aluminum
As: Arsenic
Ba: Barium
Be: Beryllium
Cd: Cadmium
Co: Cobalt
Cr: Chrome
Cu: Copper
Fe: Iron
Hg: Mercury
Mn: Manganese
Mo: Molybdenum
Ni: Nickel
Pb: Lead
Sb: Antimony
Se: Selenium
Sn: Tin
Th: Thallium
V: Vanadium
Zn: Zinc

Values in bold are overpassing one or several quality thresholds.

3.3.1.6. Hydrocarbon content

Results for hydrocarbons, alkanes and PAHs are summarized in the following table.

Table 38. Concentrations of detected PAH and Total Hydrocarbon in water samples

Station	Depth (m)	Total Hydrocarbon µg/L	Total PAHs ng/L	Total Naphtalène ng/L	Total Alkanes µg/L
S01	5	<27.4	26.75	0.0	160.0
	1,000	<27.4	27.78	0.0	74.9
	3,519	<27.4	1.44	0.0	77.4
S04	5	<27.4	77.31	0.0	93.9
	1,000	<27.4	25.43	0.0	276.6
	3,160	<27.4	65.77	0.0	238.9
S23	5	<27.4	6.54	0.0	133.2
	1,000	<27.4	7.35	0.0	210.3
	3,406	<27.4	18.85	0.0	115.1
S40	5	<27.4	25.71	0.0	247.0
	1,000	<27.4	59.40	25.4	158.2
	3,200	<27.4	213.43	88.0	168.3

3.3.1.6.1. Total Hydrocarbons and PAHs

Concentrations of total hydrocarbon were low among the 12 samples: below the LoD of 27.4 µm. Concentrations of Polycyclic Aromatic Hydrocarbons (PAHs) were also low, ranging between 1.44 ng/L and 213.43 ng/L for all samples and for the sum of the quantified molecules or groups of molecules, with an average of less than 50 ng/L (see below Figure 30). The PAH values represented no more than 0.03% of the total hydrocarbons.

Raw data are given in appendix 6.16 Appendix XVI – Polycyclic Aromatic Hydrocarbon Concentrations in Water

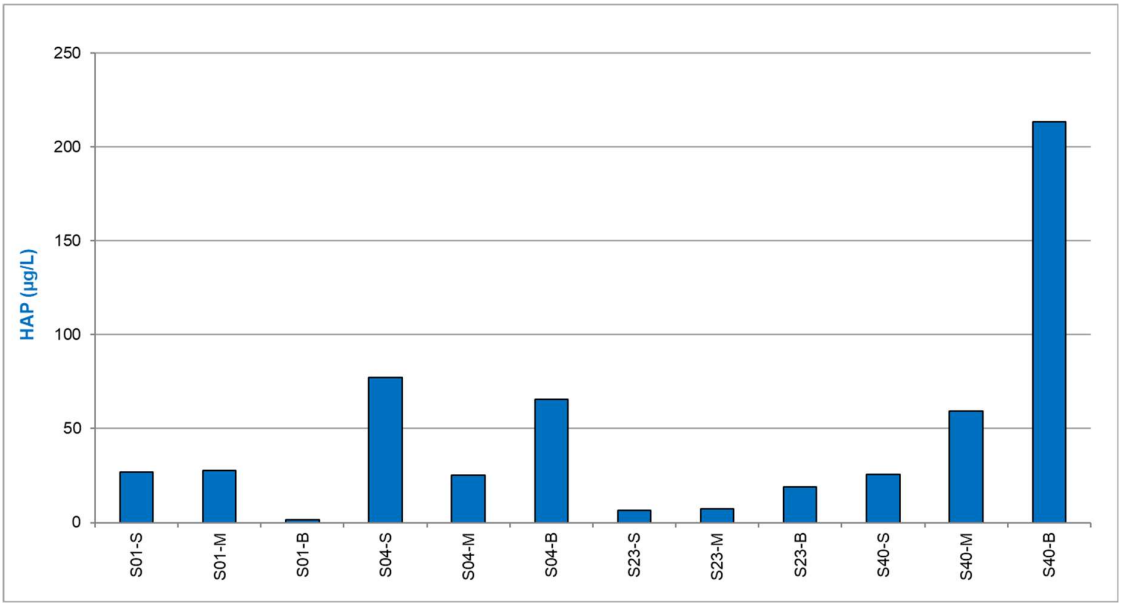


Figure 30. Sum of total PAHs (ng/L)

3.3.1.6.2. Alkanes

Due to an error of manipulation by the laboratory during the analysis, the samples were contaminated, and result were then lost for this parameter.

For block 2913B, sampled few days before, no water contamination by alkanes was observed since total alkanes were either below LoD or could not be determined but are assumed to be low.

3.3.1.6.3. BTEX

All the BTEX analyses were below the LoD threshold (3.0 µg/L for Toluene and 1.5 µg/L for the three other BTEX) (see raw data in: 6.17 Appendix XVII – BTEX Monocyclic Aromatic Hydrocarbons in Water).

3.3.1.7. Microbiology

Raw data are given in appendix (6.15 Appendix XV – Organic and Nutrient Content. Trace Metal Concentrations and Microbiology Content in Water).

The number of Aerobic Flora Adapted to Hydrocarbons (AFAH) remained generally low (<10 units/ml), except for station S04 at mid depth where the value reach 43 units /ml.

The Total Aerobic Flora (TAF) was higher, ranging from 82 to 1600 CFU/ml (CFU: Colony Forming Unit).

Low ratios between aerobic flora adapted to hydrocarbons and total aerobic flora do not suggest any contamination of the water by hydrocarbons.

One exception is observed at station S04 at 100m depth, where the ratio is high (52%). However, this result is both due to a particularly low value of TAF and a maximum value of AFAH. Then it is difficult to conclude between a hydrocarbon contamination of water and a natural water impoverished in bacterial community.

Table 39. Concentrations of aerobic flora adapted to hydrocarbons and total aerobic flora in water

Station	Depth	Aerobic flora adapted to hydrocarbons (AFAH) unit/ml [1]	Total aerobic flora (TAF) CFU/ml [2]	Ratio AFAH/TAF (%)
S01	5	9.3	1,000	0.9
	1,000	2.3	280	0.8
	3,519	2.3	260	0.9
S04	5	4.3	320	1.3
	1,000	43.0	82	52.4
	3,160	2.3	190	1.2
S23	5	2.3	1,000	0.2
	1,000	9.3	250	3.7
	3,406	0.36	430	0.1
S40	5	9.3	880	1.1
	1,000	9.3	170	5.5
	3,200	0.36	1,600	0.0

*[1] **AFAH** is calculated using the NPP (most probable number) method with reading of disorders in tubes, results are reported in units/ml.*

*[2] **TAF** is calculated using the mass enumeration method with colony counting on plates, results are reported in CFU/ml (colony-forming units/ml).*

3.3.2. Water Biology

3.3.2.1. Chlorophyll

Results show very low pigment concentrations, ranging from 0 µg/L Chl a (S04, S23 and S40 Middle, Bottom) to 0.349 µg/L Chl a (S23-Surface), associated with extremely low concentrations of Chl b (Green Algae) and Chl c (Diatoms and / or Dinoflagellates) and Phaeopigments. Concentrations in Chl b and Chl c were much lower than in Chl a, explaining the low ratio of b/a and c/a. Conversely, the percentages of pheophytin a (degradation product of Chlorophyll a) were higher in the "mid-water" or “bottom” water samples with particularly high values (up to 100%).

The main results obtained are:

- Indication of very low phytoplankton biomasses (less than 0.35 µg/L Chl a), corresponding to a low productive area in coherence with the low concentrations of nitrogen components in the water column.
- Chl a was concentrated in the surface waters when compared to deeper layers.

Table 40. Pigment concentrations in water samples

Station	Depth	Chl *a* µg/L	Chl *b* µg/L	Chl *c* µg/L	Pheo *a* µg/L	Pheo *a* %	b/a	c/a
S01	5	0.250	0.033	0.041	0.010	3.8	0.13	0.17
	1,000	0.003	0.000	0.000	0.005	62.5	0.15	0.15
	3,519	0.000	0.000	0.000	0.001	100	n.d.	0.31
S04	5	0.292	0.047	0.056	0.010	3.3	0.16	0.19
	1,000	0.001	0.000	0.000	0.002	66.7	0.42	0.32
	3,160	0.001	0.000	0.000	0.001	50	0.34	0.41
S23	5	0.349	0.029	0.06	0.003	0.9	0.08	0.17
	1,000	0.001	0.000	0.000	0.003	75	0.25	0.27
	3,406	0.001	0.000	0.000	0.002	66.7	0.32	0.39
S40	5	0.299	0.026	0.062	0.009	2.9	0.09	0.21
	1,000	0.001	0.000	0.000	0.003	75	0.23	0.36
	3,200	0.001	0.000	0.000	0.001	50	0.22	0.42

Chl a: chlorophyll a; Chl b: chlorophyll b; Chl c: chlorophyll c; Pheo a: Pheophytin a

3.3.2.2. Plankton

3.3.2.2.1. Important note

Plankton was collected during the 2022 Block 2912 campaign as planned in the scope of the study, but unfortunately the samples were lost during their transport to the laboratory at the marine station of Villefranche-sur-Mer (France). Due to the loss of the plankton and in replacement of the missing data, we used the following sources to provide an understanding of the planktonic community that could have been expected in Block 2912:

- Data from the contiguous Block 2913B in August 2022,
- Underwater video profiler (UVP) profiles conducted in 2015 within the same general area.

We present here a summary of this bibliography on plankton. A more detailed document is given in appendix (6.18 Appendix XVIII - Detailed bibliography on plankton).

Phytoplankton and zooplankton in Block 2913B were collected using nets with an aperture of 50 cm in diameter and a mesh size of 50 µm and 200 µm respectively. Nets were deployed at two locations: at the 250m South-East of the Venus2 proposed well location (PWL) and at 10000 m North-East from Venus2 PWL, hereafter referred to as the 250m_SE and the 10,000m_NE water stations. For

phytoplankton sampling, horizontal trawls of 350 m and 270 m were performed at the 250m_SE and the 10 000m_NE stations respectively. The trawl at station 250m_SE was 350m long, whilst the trawl at station 10000m_NE was 270m long. For zooplankton sampling, trawls of 100 m were conducted at each station. Phytoplankton and zooplankton samples from neighboring Block 2913B were therefore collected and fixed for preservation before the organisms were identified and counted by taxonomic expert. Phytoplankton and zooplankton were identified to the highest taxonomic level when possible. However, for the analysis, abundances of organisms were rather gathered into ecologically key taxa.

Underwater video profiler (UVP) profiles were performed in December 2015 in the same latitude and area as Block 2912 (Figure 31;

Table 41). Data were provided by the data owner Rainer Kiko from GEOMAR (Drago et al., 2022 In prep).

The UVP is an underwater video profiler that consists of a camera with its lens facing downward to take pictures of any particle, living or dead, passing in front of the lens and between two LEDs that illuminate a body of water of approximatively 1 L. A UVP profile is usually done during the descent of the camera, from the surface to the bottom of the water column. A UVP profile records the distribution of organisms ranging from 64 to 55 µm in size range (Kiko et al., 2022) within the water column and yields an estimate of the biovolume of plankton based on image analysis. Note that abundances estimated from UVP images are derived from a smaller water volume compared to those caught in a net.

UVP profiles were performed in 2015 between the 20th and 22nd of December 2015 at six stations. The difference in water depth among the different profiles may limit the offshore-coast gradient comparison. However, station S_1310, is of particular interest given its deep profile (2825m) and proximity to Block 2912. No phytoplankton or protists were observed at station S_1317 in 2015 and were therefore not represented in the figures below.

The UVP profiles gathered multiple pictures of organisms that were uploaded on Ecotaxa and identified by taxonomists. Depending on the size and quality of the image, and when possible, organisms were identified to the highest taxonomical level. For the analysis, all pictures representing non-living particles were removed and organisms were then gathered into ecologically key taxa. Abundances were estimated based on the volume imaged by the camera and the biovolumes of the organisms were estimated from the image analysis (Picheral et al., 2010; Kiko et al., 2022).

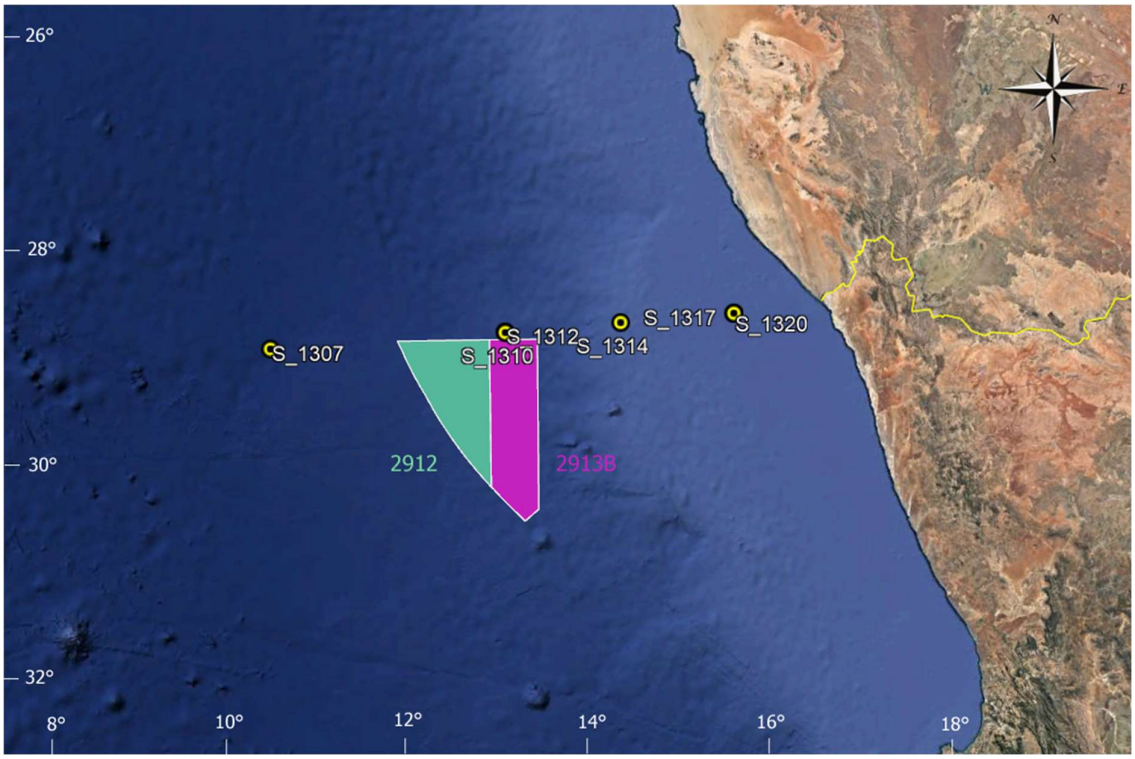


Figure 31. Location of the UVP water stations conducted in 2015 near Blocks 2912 and 2913B

Table 41. Date and location of the UVP water stations from 2015

Station number	Date and hour	Maximum depth of the UVP profile *	Latitude (m)	Longitude (m)
S_1307	2015-12-20 - 05:34:51	1,125 m	-29.0317	10.7047
S_1310	2015-12-21 - 01:11:35	2,625 m	-28.9255	13.1777
S_1312	2015-12-21 - 06:16:13	175 m	-28.9192	13.1762
S_1314	2015-12-21 - 14:39:19	475 m	-28.8392	14.3800
S_1317	2015-12-22 - 00:41:29	175 m	-28.7493	15.5582
S_1320	2015-12-22 - 02:07:15	175 m	-28.7493	15.5583

** Maximum water depth reported in the table corresponds to the maximum depth of the UVP profile, and not the seafloor depth at the UVP location*

3.3.2.2.2. Phytoplankton in Block 2913B, near Venus2

The two samples (250m_SE and 10000m_NE) were **dominated by diatoms (>55% contribution).** Other groups encountered contributed significantly less in comparison; **silicoflagellates contributed 6.28% at 250m_SE and 7.05% at 10000m_N, while dinoflagellates contributed 4.3% and 16% at 250_SE and 10000m_NE respectively. Both phytoplankton samples had high abundances of the diatom genus Thalassionema spp., as well as Pseudo-nitzschia spp**. Some Pseudo-nitzschia species, under certain conditions, can produce a harmful algal bloom neurotoxin called domoic acid; this can cause amnesic shellfish poisoning which can not only affect humans but other marine life too. Similarly, both phytoplankton samples had high abundances of the dinoflagellate Gonyaulax spp., particularly at station 10000m_NE where 160,445 individuals were found. Gonyaulax are red dinoflagellates and secrete a poisonous toxin known as 'saxitoxin' which causes paralysis in humans, as well as causes red tides. Dinoflagellates Pyrocystis fusiformis and Pyrocystis lunula were found at station 10000m_NE, both of which are known to produce bioluminescence.

The primary variables and derived univariate diversity indices for the phytoplankton species assemblage are displayed in Table. Images of phytoplankton found within the survey area are provided in 6.18 Appendix XVIII - Detailed bibliography on plankton).

Table 42. Percentage Contribution of Phytoplankton Groups

Station	Phytoplankton Group (%)				
	Diatoms	Dinoflagellates	Silicoflagellate	Cyanobacteria	Prasinophyte
250m_SE	88.3	4.30	6.28	1.11	0.00
10.000m_NE	56.3	16.0	7.05	20.5	0.19
Mean	72.3	10.1	6.67	10.8	0.10
SD	22.7	8.25	0.54	13.7	0.13
Variance (%)	31.4	81.4	8.1	127.0	141.4

Table 43. Primary and Univariate Diversities for Phytoplankton per 31.8m3 Filtered Sample

Station	Number of Species (S)	Number of Cells (N)	Richness (Margalef)	Evenness (Pielou's Evenness)	Shannon-Wiener Diversity	Simpson's Diversity (1-Lambda')
250m_SE	21	3,529,350	1.33	0.706	3.10	0.838
10000m_NE	26	1,531,001	1.76	0.668	3.14	0.827
Mean	24	2,530,176	1.54	0.687	3.12	0.832
SD	4	1,413,046	0.30	0.027	0.03	0.007
Variance (%)	15	55.8	19.7	3.9	0.9	0.9

A total of 28 species from 16 taxonomic families were recorded in the two water stations analysed in Block 2913B water samples, with Bacillariales representing on average 34.07% of the phytoplankton captured, followed by Thalassionematales (21.99%), Oscillatoriales (10.88%), and Gonyaulacales (8.25%).

Diatoms and dinoflagellates were the most dominant major taxonomic groups in both water samples. Diatoms comprised 88.3% and 56.3% of all taxa identified at 250m_SE and 10000m_NE respectively, the majority of which was driven by the presence of Fragilariopsis doliolus. Pseudo-nitzschia and Rhizosolenia bergonii at 250m_SE and by the presence of Thalassionema at 10000m_NE. **Dinoflagellates comprised 4.3% and 16% of all taxa identified** at 250m_SE and 10000m_NE respectively, of which 250m_SE was dominated by Dictyocha, while 10000m_NE was characterised by Trichodesmium and Gonyaulax.

3.3.2.2.3. Zootoplankton in Block 2913B, near Venus2

The primary and derived diversity indices for the zooplankton community from the two water samples collected on block 2913B are included in Table 44. This revealed a diverse community with 6,343 individuals recorded across the two samples within Block 2913B. **Zooplankton species were relatively consistent across the stations, with an average of 52 species per trawl recorded (±4SD**). Number of cells was more variable, ranging from 2,208 at station 10000m_NE to 4,135 at station 250m_SE, with no obvious pattern of distribution.

A total of 67 species from nine phyla were recorded in the two Block 2913B water samples, with Arthropoda representing on average 93.4% of the zooplankton captured, followed by Chaetognatha (3.45%) and Mollusca (1.2%).

Table 44. Univariate Parameters for Block 2913B Zooplankton Trawls

Station	Number of Species (S)	Number of Cells (N)	Richness (Margalef)	Evenness (Pielou's Evenness)	Shannon-Wiener Diversity	Simpson's Diversity (1-Lambda')
250m_SE	55	4,135	6.48	0.555	3.21	0.772
10000m_NE	49	2,208	6.23	0.748	4.20	0.919
Mean	52	3,172	6.36	0.651	3.70	0.846
SD	4	1,363	0.18	0.136	0.70	0.103
Variance (%)	8.2	43.0	2.8	20.9	18.9	12.2

Copepods were overwhelmingly dominant amongst the Arthropoda, comprising 95.7% at 250m_SE and 93.6% at 10000m_NE of this phylum at both stations. Copepoda were comprised of 36 species of which 84.9% of the species were Calanoida. The Calanoida is an order of copepods, dominant in the plankton in many parts of the world's oceans, making up 55% to 95% of plankton samples. They are therefore important in many food webs, taking in energy from phytoplankton and algae and 'repackaging' it for consumption by higher trophic level predators. Many commercial fish are dependent on calanoid copepods for diet in either their larval or adult forms. Baleen whales such as bowhead whales, sei whales, right whales and fin whales eat calanoid copepods as an important food source.

3.3.2.2.4. Underwater Video Profiler

Phytoplankton and Protists Community

The phytoplankton community determined from the 2015 UVP data was characterised by filamentous cyanobacteria of the genus Trichodesmium, which also characterised the phytoplankton community at station 10000m_NE in the current study.

Protists of the Rhizaria infrakingdom, which can be microalgal symbionts, were also very abundant. In particular, Phaeodaria, Acantharea, Foraminifera, and Polycystinea were observed at the different stations.

Trichodesmium were observed in nearly all stations with an abundance of 3.38 cells m^{-3} at station S_1310. At this station, the protist community was characterized by high abundances of Phaedoria that represented 41% of the protist abundance at this station. Phaeodaria were distributed throughout the water column down to 2125 m, though the highest abundances were found around 400-500 m depth. Foraminifera represented 20% of the abundance of protists at S_1310 and were found higher in the water column reaching down to a 425 m water depth. Finally, the Polycystinea represented only a small fraction of the protist abundance at S_1310 station (3%), but the specimen was observed in deep water at 1,375 m.

Trichodesmium biovolumes were low compared to their abundances, with biovolumes varying from 1.50 to 2.82 mm^3 m^{-3}. At station S_1310, Foraminifera represented 85% of the protists biovolume, however, further analyses of the data showed that this very large biovolume was mainly due to one specimen observed at 425m depth that bore particularly larges spicules.

Overall, the phytoplankton community in both surveys were primarily composed of diatoms.

Zooplankton Community

The zooplankton community identified using the UVP profiles was composed of multiple groups belonging to the crustacean subphylum including mostly copepods, Eumalacostraca, amphipods and ostracods, similar to the results for stations 250m_SE and 10000m_NE. A wide variety of gelatinous zooplankton also characterized the different stations investigated, such as Hydrozoa, Siphonophorae, Trachymedusae, Chaetognatha and Appendicularia.

Total zooplankton abundance was much lower at the offshore UVP stations (S_1307, S_1310, S_1312, S_1314) with around 20 individuals m^{-3} compared with stations near the coast (S_1317 and S_1320) that had approximatively 100 individuals m^{-3} in total. Despite this difference, all stations were dominated in term of abundance by copepods that represented 23% to 36 % of the zooplankton abundance at the offshore stations, and 54% to 56% of the zooplankton abundance at the coastal stations. Copepods were in much higher abundances in the current study (250m_SE and 10000m_NE), where copepods contributed to on average 83.3% of the zooplankton community. The analysis of the S_1310 station revealed that copepods represented most of the zooplankton abundance (36%), followed by Amphipoda (13%), and Eumalacostraca (11%). As described above for offshore stations in general, Chaetognatha also represented a large part of the zooplankton community abundance (11%). At S_1310, crustaceans appeared to be evenly distributed throughout the water column and down to 2625m depth. In comparison, gelatinous plankton such as Chaetognatha, Hydrozoa and Trachymedusae were observed higher in the water column and down to a 1,625m water depth.

Zooplankton biovolumes were not proportional to the abundances described above as the difference between offshore and coast stations was less evident. S_1317 located near the coast had particularly large biovolumes of 886.79 mm^3 m^{-3} while the other stations had total zooplankton biovolumes ranging from 192.68 to 386.61 mm^3 m^{-3}. In general, Amphipoda and Eumalacostraca had the highest biovolumes representing 22% to 46 % and 5% to 49 % of the total zooplankton biovolume, respectively. Despite high abundances, gelatinous zooplankton represented a smaller fraction of the zooplankton biovolume, from 1% to 10 % for Chaetognatha for instance. The only exception to this trend was recoded at station S_1310 as it was characterised by large biovolumes of Eumalacostracan, Amphipoda, Siphonophorae and Chaetognatha, representing respectively 28%, 22%, 20%, and 10 % of the zooplankton biovolume. The distribution pattern of zooplankton biovolumes followed the distribution of abundances in general although the largest specimens of Chaetognatha were observed at relatively the same depth, ranging from 800 to 1,000m.

Overall, zooplankton communities were fairly similar between the 2015 UVP study and the current survey but copepods were much more abundant in the current survey, which may relate to seasonal recruitment phase for the taxa.

3.4. Environmental habitats

Observations of the seafloor and epibenthic fauna were obtained from videos from the camera fixed to the box corer (one video for each of the 31 sediment samples) and by video transects (8 transects).

3.4.1. Epifauna observation from the camera fixed to the box corer

The following Table 45 presents lists traces of bioturbation and conspicuous epibenthic species observed on the 31 stations using the pressure activated camera system attached to the box corer. Bioturbation is described following Przeslawski *et al.* (2012) and Althaus *et al.* (2015). Example are shown in the following figure.

Table 45. Seabed features and/or visible fauna per station in Block 2912

Station	Biological Observation
S1	White ophiuroid (brittle star), Sea star impressions, Trails, Burrow clusters, *Ipnops* sp. (grideye fish)
S3	Mounds, Crater cone, Burrows
S4	Crater ring, Burrowing anemone (Actiniaria), Rosette
S6	Crater cone, Crater ring, Acorn worm spiral, Thin trails
S7	Mound, Crater cone, Thin trail
S8	Crater ring, Crater cone, Mound, Rosette
S10	Trails, Sea star impressions
S11	Mounds, Crater cones, Rosette, Burrowing anemone (Actiniaria)
S12	Mounds (various sizes), Rosettes, Burrowing anemone (Actiniaria), Thin trails
S13	White ophiuroid (brittle star), Sea star impressions, Depression
S14	Crater cone, Thin trails, Sea star impression
S15	Thin trails, Rosettes, Crater ring, Burrow clusters
S16	Crater ring, Thin trail
S19	Sea star impressions, Burrows
S20	Rosettes, Small mound
S21	Trails, Sea star impressions, Burrow clusters
S22	Rosettes, Trails, Burrows
S23	Crater cone, Rosettes, Polychaete tubes, Mound
S24	Rosettes, Small mound
S27	Crater cone, Mounds, Burrow, Polychaete tubes
S28	Rosettes, Mounds, Thin trail
S30	Mounds, Small depression, White ophiuroid (brittle star), Sea star impressions, Trails
S31	Small mounds, Thin trail, Burrowing anemone (Actiniaria)
S32	Xenophyophores, Acorn worm spirals
S33	Crater cone, Sea star impression, Thin trail, Rosette
S34	Crater ring, Polychaete tubes
S35	Mound, Curly casts (Holothurian), Burrow
S37	Small mounds, Hermit crabs (Parapaguridae) with zoanthid (*Epizoanthus* spp.), Polychaete tubes
S38	Rosettes, Thin trail
S39	White ophiuroid (brittle star), Crater ring, Sea star impressions
S40	Small mounds

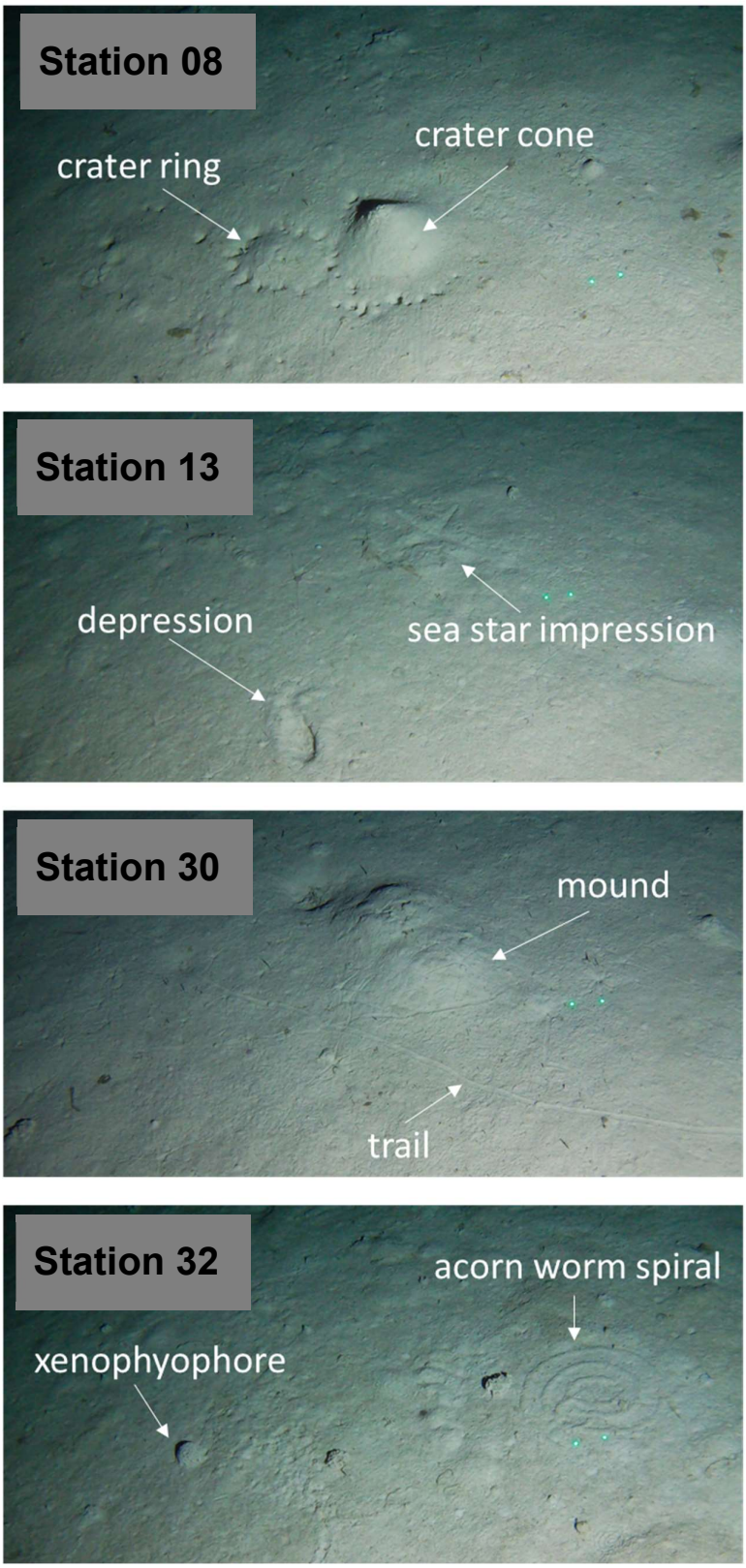


Figure 32. Examples of Seabed features and/or visible fauna per selected stations in Block 2912

3.4.2. Epifauna observations across video transects

8 Video transects from 332m to 574m length and 2,894m to 3,503m water depth are summarized by station in the Figure 34 to Figure 41 below. Details on video transect observations are given in appendix (6.20 Appendix XX – Camera Transect Log Sheets).

Environmental sampling revealed a relatively homogeneous seabed across Block 2912, with a pale soft silty mud overlaying a layer of cohesive clay observed at all stations and during all camera transects. The seabed comprised generally low relief sediment with occasional large depressions (>50cm) and extensive bioturbation. This was expected considering the depth profile of the block survey area, ranging from 2,900 to 3,700m. Bioturbation observed throughout the videos include a large size range of irregular to cone-shaped mounds, trails, crater rings, crater cones, star impressions (asteroid or ophiuroid), acorn worm (Enteropneusta) spirals, disturbed or pinnate traces, rosettes (echiuran or polychaete), burrows and casts (Figure 33). The habitat across all transects was homogenous with no special features observed. Bioturbation of this nature is indicative of a rich infaunal community.

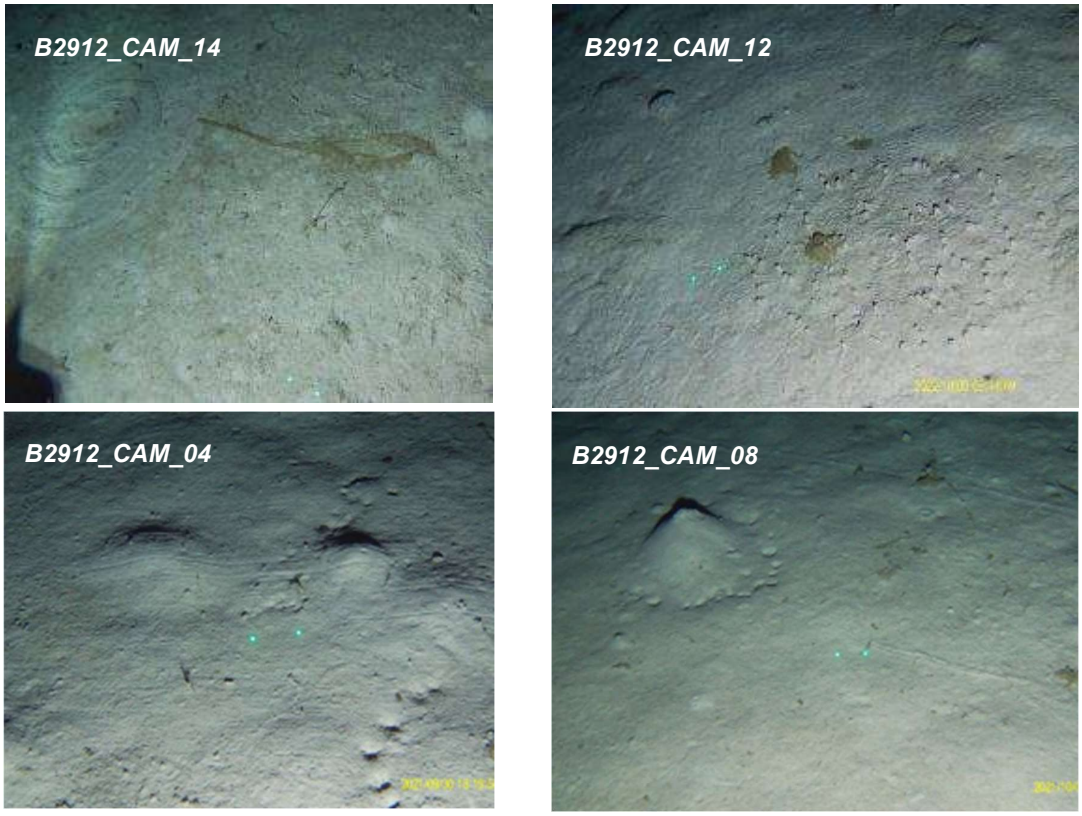


Figure 33. Example images of the seabed across the survey area

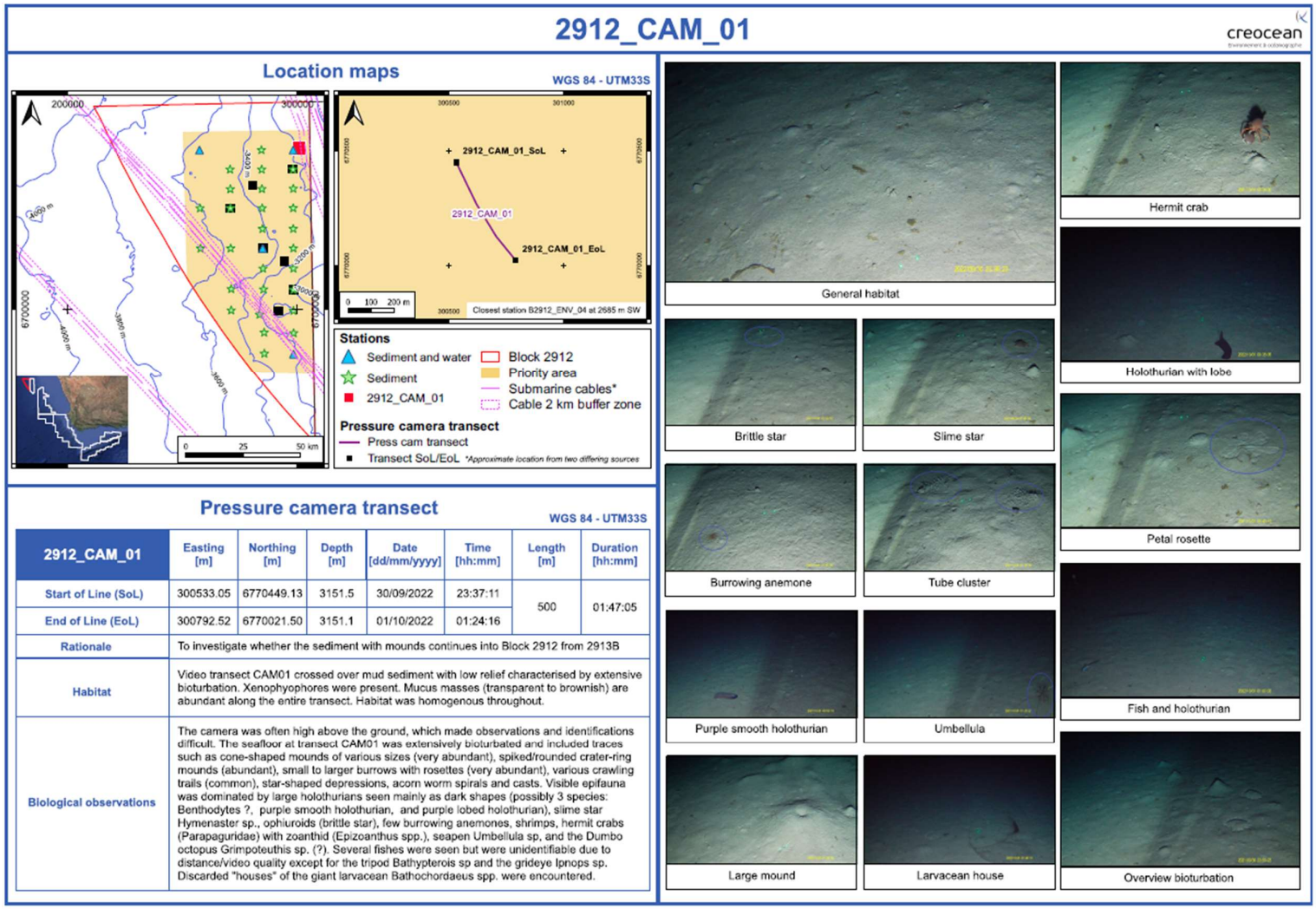


Figure 34. Synthetic file for CAM_01 transect

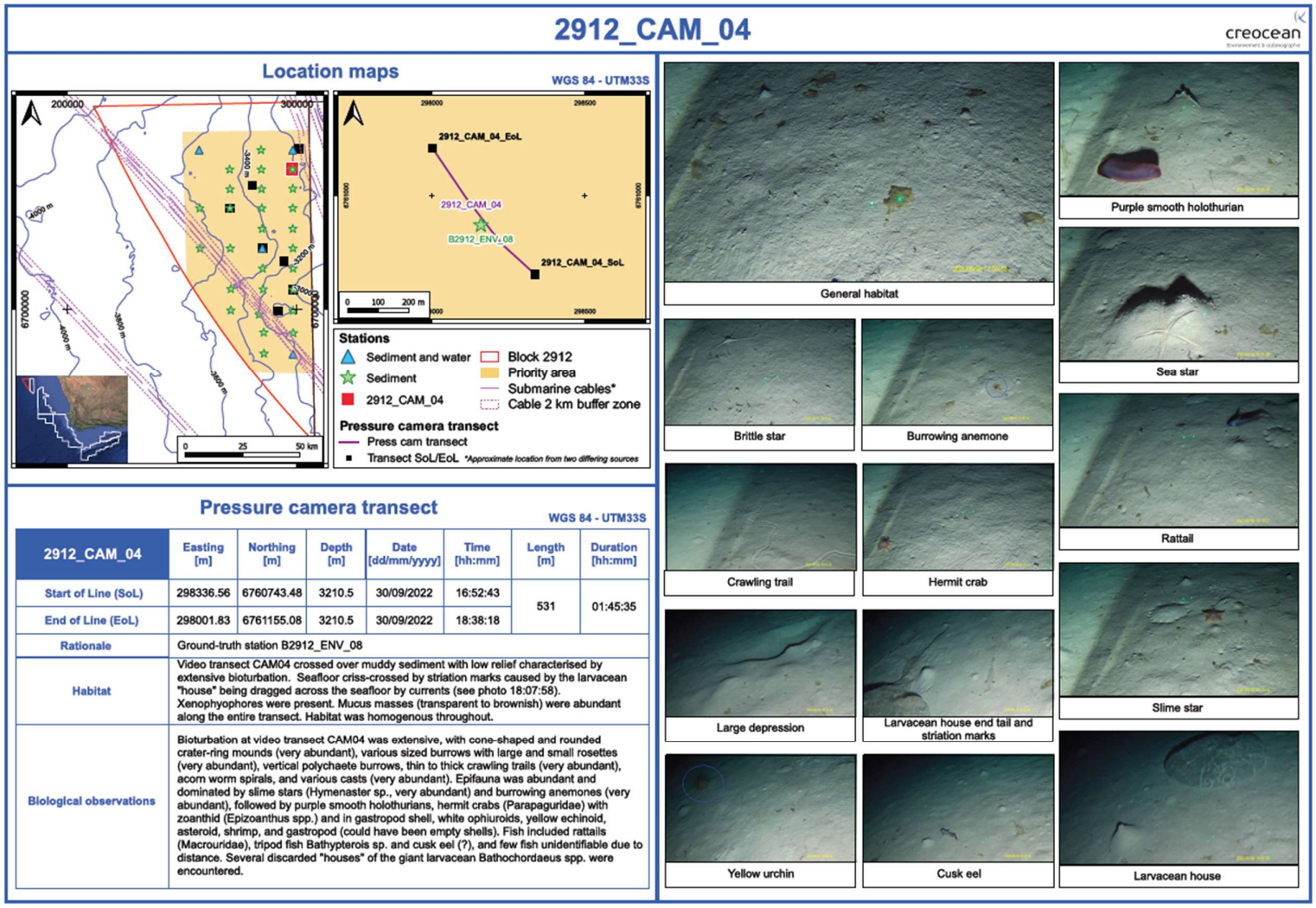


Figure 35. Synthetic file for CAM_04 transect

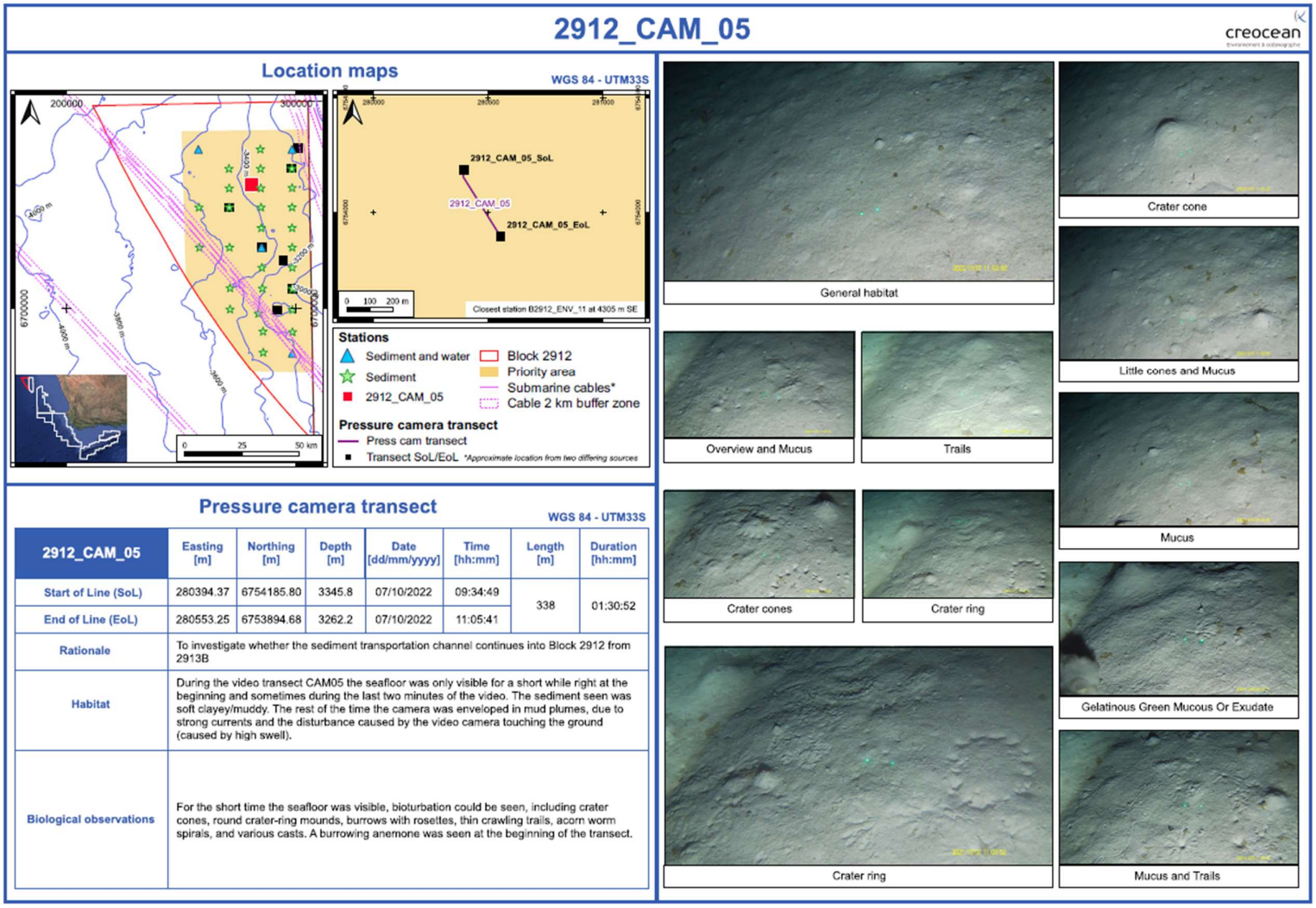
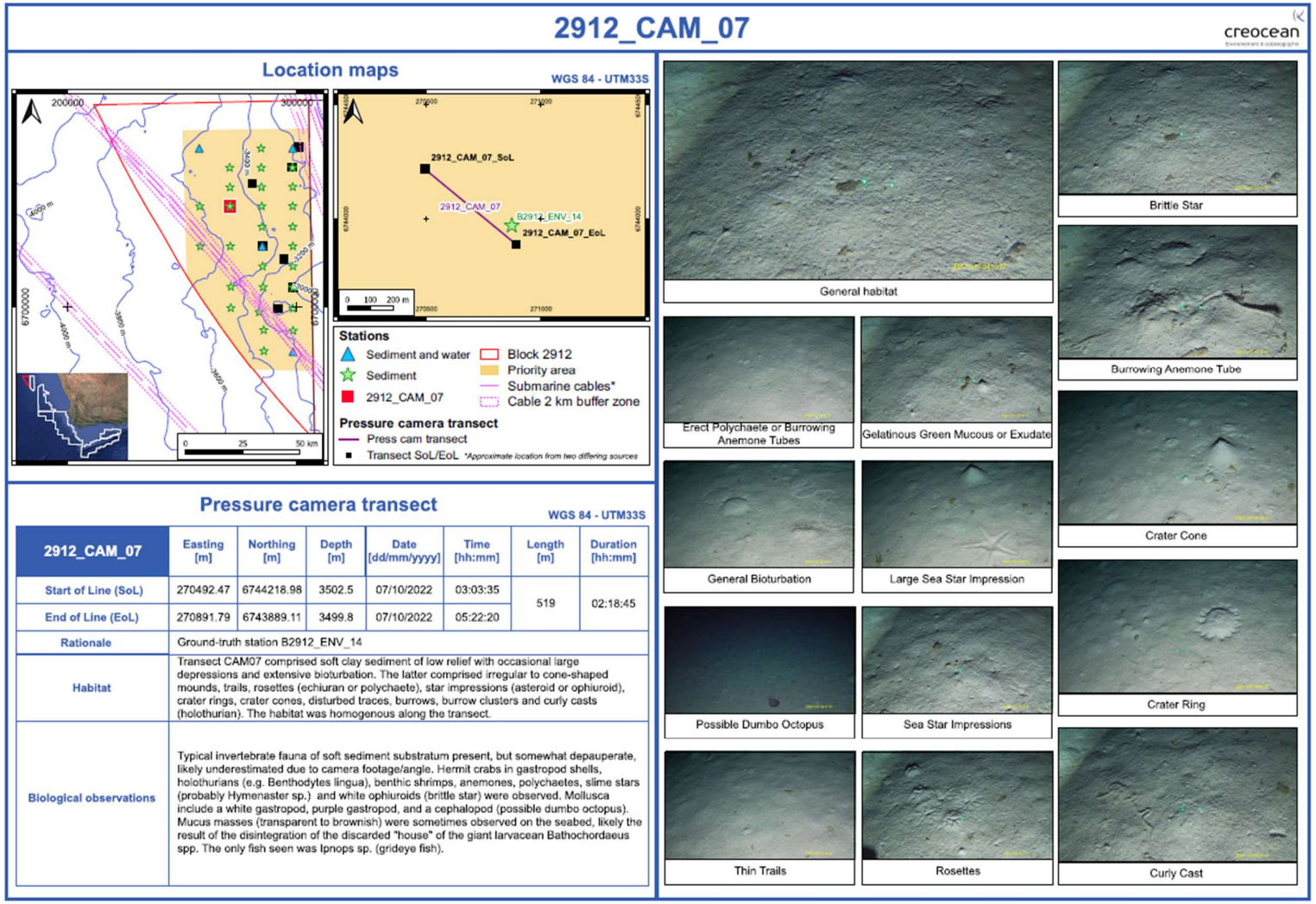
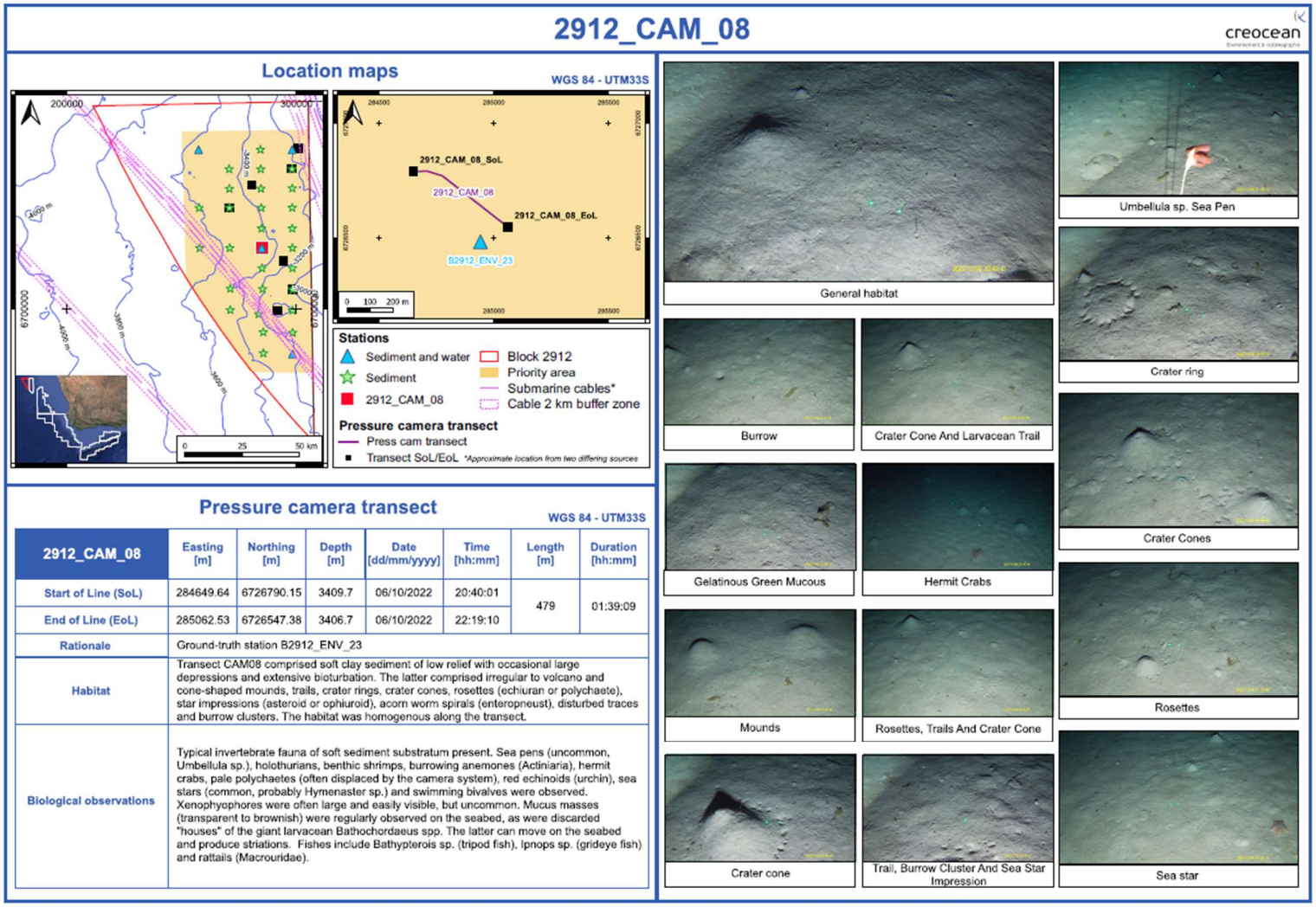


Figure 36. Synthetic file for CAM_05 transect



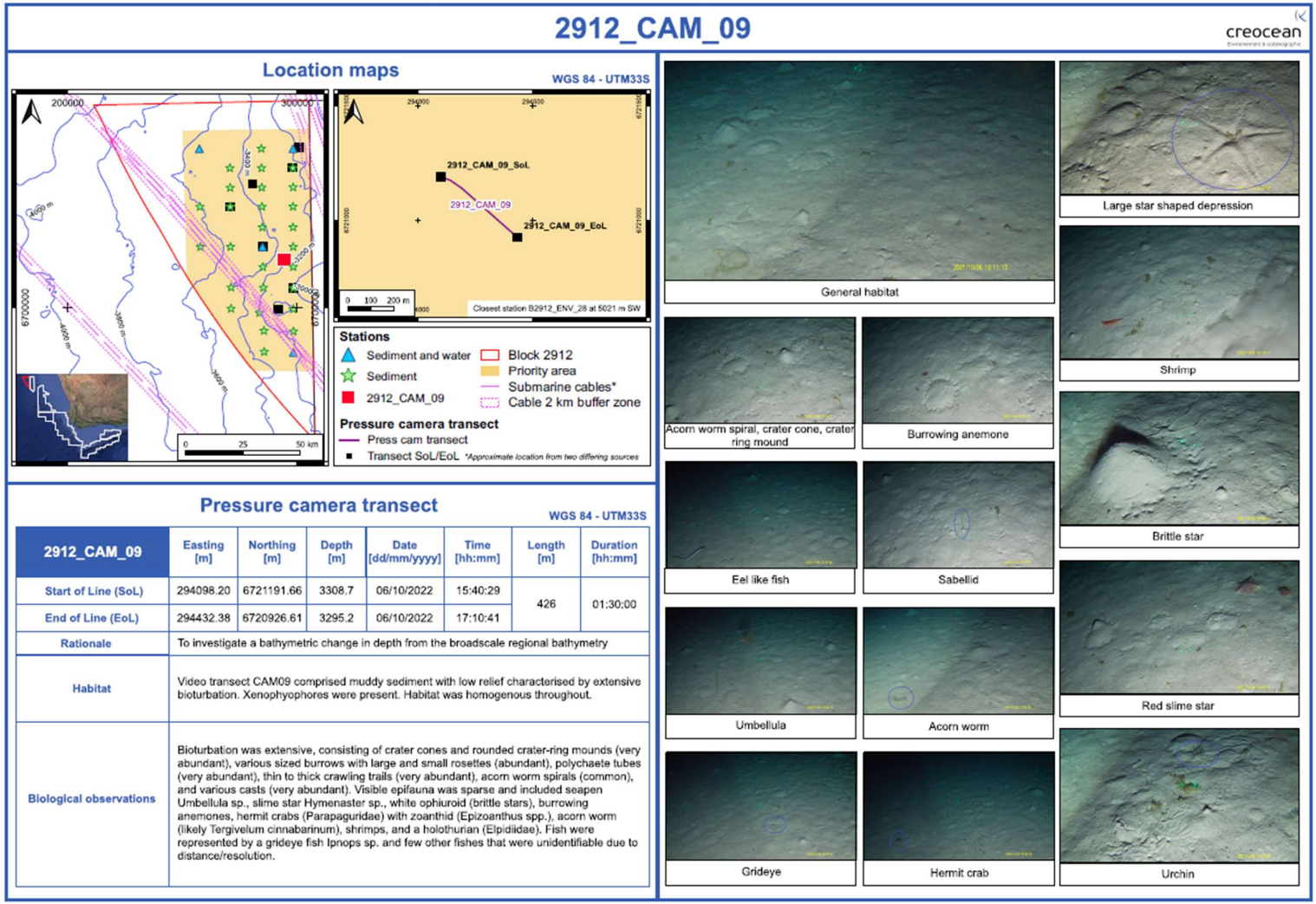
2912_CAM_07	Easting [m]	Northing [m]	Depth [m]	Date [dd/mm/yyyy]	Time [hh:mm]	Length [m]	Duration [hh:mm]
Start of Line (SoL)	270492.47	6744218.98	3502.5	07/10/2022	03:03:35	519	02:18:45
End of Line (EoL)	270891.79	6743889.11	3499.8	07/10/2022	05:22:20		
Rationale	Ground-truth station B2912_ENV_14						
Habitat	Transect CAM07 comprised soft clay sediment of low relief with occasional large depressions and extensive bioturbation. The latter comprised irregular to cone-shaped mounds, trails, rosettes (echiuran or polychaete), star impressions (asteroid or ophiuroid), crater rings, crater cones, disturbed traces, burrows, burrow clusters and curly casts (holothurian). The habitat was homogenous along the transect.						
Biological observations	Typical invertebrate fauna of soft sediment substratum present, but somewhat depauperate, likely underestimated due to camera footage/angle. Hermit crabs in gastropod shells, holothurians (e.g. Benthodytes lingua), benthic shrimps, anemones, polychaetes, slime stars (probably Hymenaster sp.) and white ophiuroids (brittle star) were observed. Mollusca include a white gastropod, purple gastropod, and a cephalopod (possible dumbo octopus). Mucus masses (transparent to brownish) were sometimes observed on the seabed, likely the result of the disintegration of the discarded "house" of the giant larvacean Bathochordaeus spp. The only fish seen was Ipnops sp. (grideye fish).						

Figure 37. Synthetic file for CAM_07 transect



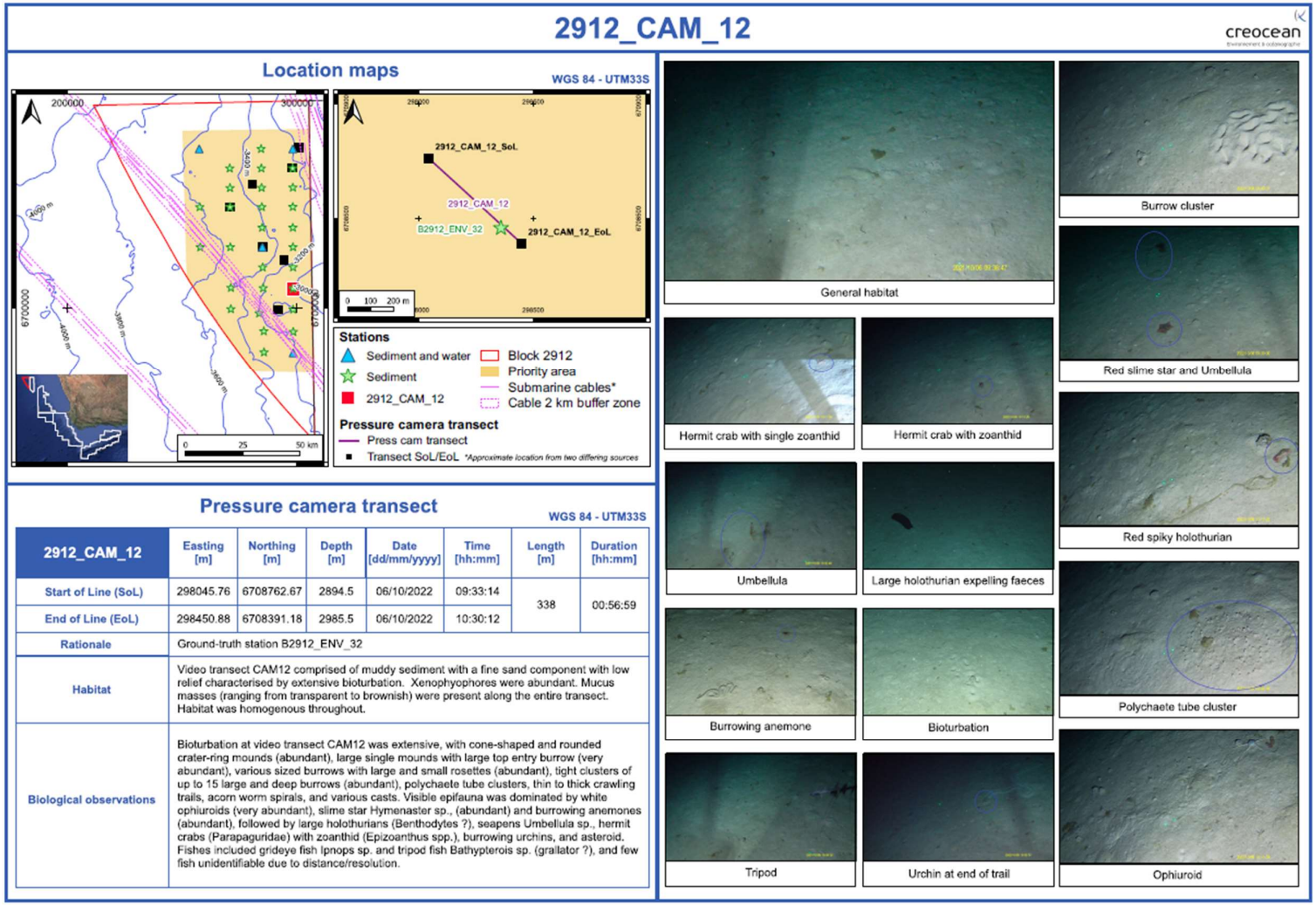
2912_CAM_08	Easting [m]	Northing [m]	Depth [m]	Date [dd/mm/yyyy]	Time [hh:mm]	Length [m]	Duration [hh:mm]
Start of Line (SoL)	284649.64	6726790.15	3409.7	06/10/2022	20:40:01	479	01:39:09
End of Line (EoL)	285062.53	6726547.38	3406.7	06/10/2022	22:19:10		
Rationale	Ground-truth station B2912_ENV_23						
Habitat	Transect CAM08 comprised soft clay sediment of low relief with occasional large depressions and extensive bioturbation. The latter comprised irregular to volcano and cone-shaped mounds, trails, crater rings, crater cones, rosettes (echiuran or polychaete), star impressions (asteroid or ophiuroid), acorn worm spirals (enteropneust), disturbed traces and burrow clusters. The habitat was homogenous along the transect.						
Biological observations	Typical invertebrate fauna of soft sediment substratum present. Sea pens (uncommon, Umbellula sp.), holothurians, benthic shrimps, burrowing anemones (Actiniaria), hermit crabs, pale polychaetes (often displaced by the camera system), red echinoids (urchin), sea stars (common, probably Hymenaster sp.) and swimming bivalves were observed. Xenophyophores were often large and easily visible, but uncommon. Mucus masses (transparent to brownish) were regularly observed on the seabed, as were discarded "houses" of the giant larvacean Bathochordaeus spp. The latter can move on the seabed and produce striations. Fishes include Bathypterois sp. (tripod fish), Ipnops sp. (grideye fish) and rattails (Macrouridae).						

Figure 38. Synthetic file for CAM_08 transect



2912_CAM_09	Easting [m]	Northing [m]	Depth [m]	Date [dd/mm/yyyy]	Time [hh:mm]	Length [m]	Duration [hh:mm]
Start of Line (SoL)	294098.20	6721191.66	3308.7	06/10/2022	15:40:29	426	01:30:00
End of Line (EoL)	294432.38	6720926.61	3295.2	06/10/2022	17:10:41		
Rationale	To investigate a bathymetric change in depth from the broadscale regional bathymetry						
Habitat	Video transect CAM09 comprised muddy sediment with low relief characterised by extensive bioturbation. Xenophyophores were present. Habitat was homogenous throughout.						
Biological observations	Bioturbation was extensive, consisting of crater cones and rounded crater-ring mounds (very abundant), various sized burrows with large and small rosettes (abundant), polychaete tubes (very abundant), thin to thick crawling trails (very abundant), acorn worm spirals (common), and various casts (very abundant). Visible epifauna was sparse and included seapen Umbellula sp., slime star Hymenaster sp., white ophiuroid (brittle stars), burrowing anemones, hermit crabs (Parapaguridae) with zoanthid (Epizoanthus spp.), acorn worm (likely Tergivelum cinnabarinum), shrimps, and a holothurian (Elpidiidae). Fish were represented by a grideye fish Ipnops sp. and few other fishes that were unidentifiable due to distance/resolution.						

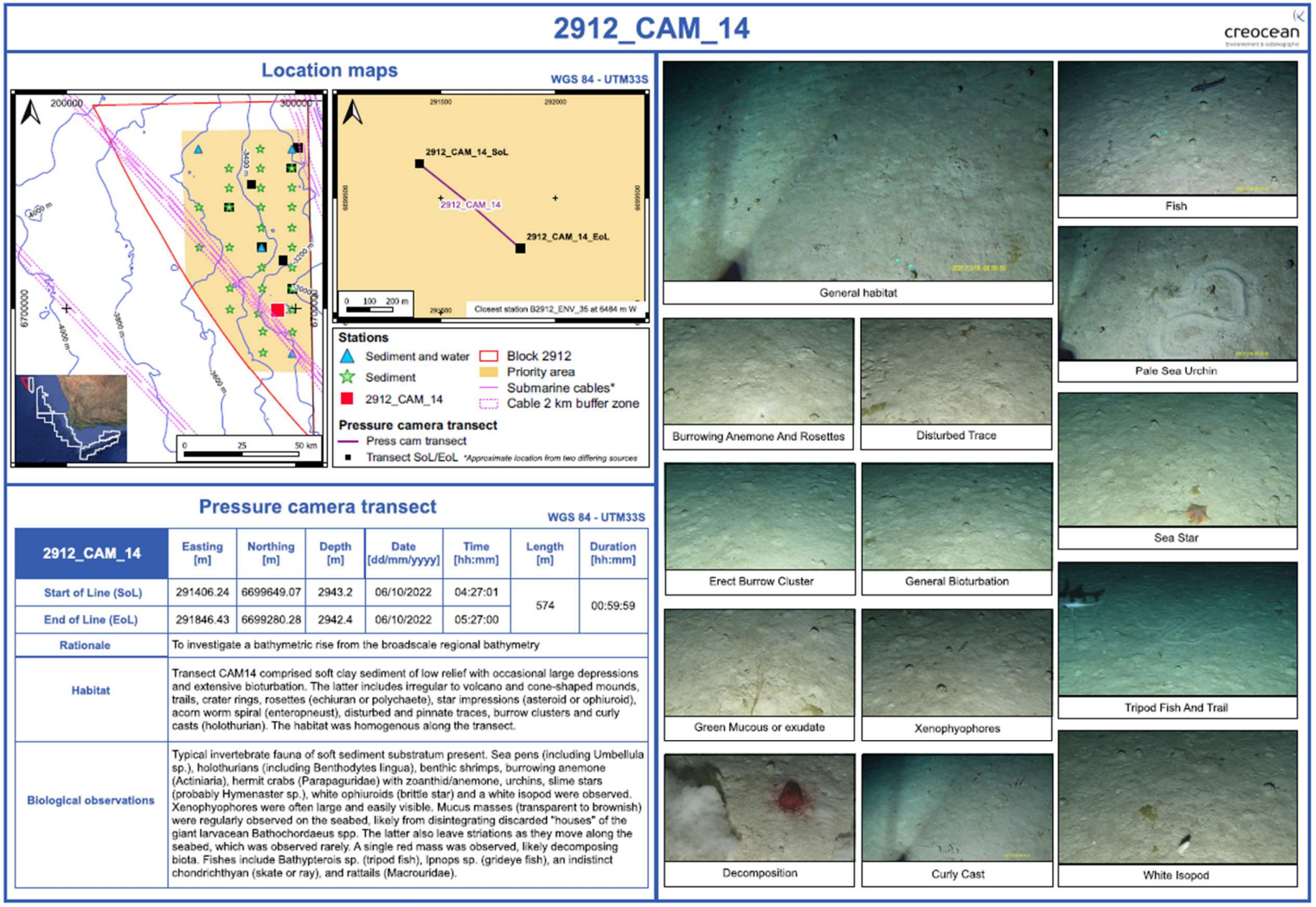
Figure 39. Synthetic file for CAM_09 transect



2912_CAM_12	Easting [m]	Northing [m]	Depth [m]	Date [dd/mm/yyyy]	Time [hh:mm]	Length [m]	Duration [hh:mm]
Start of Line (SoL)	298045.76	6708762.67	2894.5	06/10/2022	09:33:14	338	00:56:59
End of Line (EoL)	298450.88	6708391.18	2985.5	06/10/2022	10:30:12		
Rationale	Ground-truth station B2912_ENV_32						
Habitat	Video transect CAM12 comprised of muddy sediment with a fine sand component with low relief characterised by extensive bioturbation. Xenophyophores were abundant. Mucus masses (ranging from transparent to brownish) were present along the entire transect. Habitat was homogenous throughout.						
Biological observations	Bioturbation at video transect CAM12 was extensive, with cone-shaped and rounded crater-ring mounds (abundant), large single mounds with large top entry burrow (very abundant), various sized burrows with large and small rosettes (abundant), tight clusters of up to 15 large and deep burrows (abundant), polychaete tube clusters, thin to thick crawling trails, acorn worm spirals, and various casts. Visible epifauna was dominated by white ophiuroids (very abundant), slime star Hymenaster sp., (abundant) and burrowing anemones (abundant), followed by large holothurians (Benthodytes ?), seapens Umbellula sp., hermit crabs (Parapaguridae) with zoanthid (Epizoanthus spp.), burrowing urchins, and asteroid. Fishes included grideye fish Ipnops sp. and tripod fish Bathypterois sp. (grallator ?), and few fish unidentifiable due to distance/resolution.						

Author: CREOCEAN | Photo credit: TotalEnergies & BOURBON SUBSEA SERVICES | Date : 30/01/2023 | Project: 220834 | Environmental Baseline Survey: Block 2912, Namibia

Figure 40. Synthetic file for CAM_12 transect



2912_CAM_14	Easting [m]	Northing [m]	Depth [m]	Date [dd/mm/yyyy]	Time [hh:mm]	Length [m]	Duration [hh:mm]
Start of Line (SoL)	291406.24	6699649.07	2943.2	06/10/2022	04:27:01	574	00:59:59
End of Line (EoL)	291846.43	6699280.28	2942.4	06/10/2022	05:27:00		
Rationale	To investigate a bathymetric rise from the broadscale regional bathymetry						
Habitat	Transect CAM14 comprised soft clay sediment of low relief with occasional large depressions and extensive bioturbation. The latter includes irregular to volcano and cone-shaped mounds, trails, crater rings, rosettes (echiuran or polychaete), star impressions (asteroid or ophiuroid), acorn worm spiral (enteropneust), disturbed and pinnate traces, burrow clusters and curly casts (holothurian). The habitat was homogenous along the transect.						
Biological observations	Typical invertebrate fauna of soft sediment substratum present. Sea pens (including Umbellula sp.), holothurians (including Benthodytes lingua), benthic shrimps, burrowing anemone (Actiniaria), hermit crabs (Parapaguridae) with zoanthid/anemone, urchins, slime stars (probably Hymenaster sp.), white ophiuroids (brittle star) and a white isopod were observed. Xenophyophores were often large and easily visible. Mucus masses (transparent to brownish) were regularly observed on the seabed, likely from disintegrating discarded "houses" of the giant larvacean Bathochordaeus spp. The latter also leave striations as they move along the seabed, which was observed rarely. A single red mass was observed, likely decomposing biota. Fishes include Bathypterois sp. (tripod fish), Ipnops sp. (grideye fish), an indistinct chondrichthyan (skate or ray), and rattails (Macrouridae).						

Figure 41. Synthetic file for CAM_14 transect

3.4.3. Benthic epifaunal communities

Faunal communities observed on videos at all stations included the slime star (probably *Hymenaster* sp.) and burrowing anemone (Actiniaria). Records of the sea pen *Umbellula* sp., and hermit crabs (Paraguridae), which occupy white gastropods or are covered in zoanthids (*Epizoanthus* spp.) or anemones were observed throughout the Block. The latter represents a symbiotic relationship, with the zoanthid or anemone replacing the original shell, and providing protection from predators (Ates, 2003).

Echinoderms were abundant, comprising Holothurians (including *Benthodytes lingua* and the sea pig, family Elpidiidae), urchins, and white ophiuroids (brittle stars).

Other observations include benthopelagic shrimps, acorn worms (Enteropneusta, likely *Tergivelum cinnabarinum*), Polychaeta, a white isopod and Mollusca. The latter comprised gastropods, a swimming bivalve, and a cephalopod (possible dumbo octopus, *Grimpoteuthis* sp).

Xenophyophores (foraminifera) were often large and quite conspicuous. These were regularly collected in box core samples.

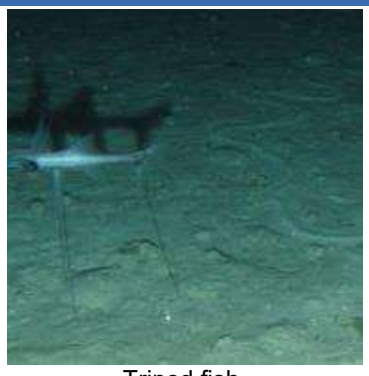
Chordata included *Bathypterois* sp. (tripod fish), *Ipnops* sp. (grideye fish), a single unidentified Chondrichthyan (skate or ray) and rattails (Macrouridae).

Besides the taxa listed above, discarded "houses" of the giant larvacean *Bathochordaeus* spp, were regularly observed. These animals live in the water column and secrete and build complex two-net mucus structures, which are collectively called a “house” as the larvacean lives inside it (Katija *et al.,* 2020). To feed, the larvacean beats its tail, pumping seawater through its house. The sticky filter structure has two parts: the outer filter, which can reach diameters of more than 1m, traps coarse particles; the inner traps fine ones. When the house becomes clogged, the animal discards it and it sinks to the bottom, carrying large amounts of detritus, as well as tiny animals that colonize the mucus, to the seafloor (Robison *et al*., 2002). These structures are thought to be an important carbon sink, as well as provide an important food source for deep-sea animals.

Discarded larvacean houses were frequently observed in Block 2912 and are most likely the source of the abundant mucus masses, ranging from fresh transparent to older brownish coloration, seen in all transects. The larvacean houses also play a role in habitat modification, as evidenced by the striation marks found at transect Block 2912_CAM_04. As the houses are dragged along the seafloor by near bottom currents, they create criss-crossing striations that can flatten and remodel bioturbation traces, and likely compact the muddy substrate.

Conspicuous Fauna Observed in Underwater Video Footage

Sea star
(Asteroidea)



Tripod fish
(*Bathypterois grallator*)

Burrowing Urchin
(Echinoidea)

Conspicuous Fauna Observed in Underwater Video Footage

Sea cucumber (Holothurian) | Brittle star (Ophiuroidea) | Acorn Worm (Xenophyophore)

Figure 42. Examples of conspicuous fauna recorded during the survey

3.4.4. Habitat Classification and sensitivity

3.4.4.1. Habitat classification

Habitats were identified based upon a combination of visual evidence (qualitative), quantitative laboratory analyses (i.e., particle size) and the relevant JNCC/EUNIS classifications as a basis. EUNIS and JNCC habitat classifications are often too general or too specific (e.g., species present), therefore actual field observations and results were used to build upon these designations to ensure project specificity.

According to the depth and the sediment characteristics and nature (pure mud), only one habitat corresponding to the **EUNIS habitat classification** (2019) was identified: “ME62 Atlantic upper bathyal mud” (corresponding to the 2012 EUNIS type “A6.5 deep sea mud”) applicable for 2500 to 3200m water depth. This designated habitat is described as: “Deep-sea mud sediments having a diverse infaunal community dominated by polychaetes. Epifauna tend to be sparse, mobile species, but aggregations of erect fauna such as glass sponges, sea pens and soft corals can occur. This biocoenosis is characterized by constant homothermy and an almost total absence of light.”

According to the **JNCC UK classification**, the habitat belongs to the “Atlantic upper or abyssal mud” respectively corresponding to 2100 – 3100 m or 3100 – 4100 m depth and can be described as “deep-sea mud sediments with a diverse infaunal community dominated by polychaetes. Epifauna tend to be sparse, mobile species, but aggregations of erect fauna such as glass sponges, seapens and soft corals can occur”.

3.4.4.2. Habitats and species sensitivity

The area was quite homogeneous with soft, muddy bottom. No particular hard bottom or relief was identified.

Overall, the benthic habitat supported low biological population levels which was consistent with the low organic and nutrient content of the sediments.

No species with a particular heritage or protection status was detected.

Thus, no potentially environmentally sensitive habitats were documented during this survey.

4. Conclusion

4.1.1. Sediment physico-chemistry

All sediment samples were from the abyssal plain and comprised soft pale mud over consolidated clay. Sediments were all characterized as fine to very fine silts, the fine fraction (> 63 µm) varying between 74% (S27) and 97% (S08, S39), which makes them quite homogeneous throughout the whole survey area.

Despite the muddy nature of the substrate, sediments show low levels of Total Organic Matter. Total Organic Carbon, as well as total Nitrogen and Phosphorous. Indeed, the summary Alzieu index resulted in a low organic enrichment close to oligotrophic conditions. This low enrichment of sediments may explain in part the unusually high normalized values of redox potential measured for this abyssal seafloor. Yet, redox measurements rather correspond to a very oxygenated sandy shallow substrate. In deep reduced seabed, microbial-mediated redox processes have been known to decrease the redox potential to a level as low as −300mV (Søndergaard, 2009). Then, these results can also be due to a consistent malfunction of the probe or relate to the high clay content of the sediment causing higher readings.

All stations had Alpha and Beta NORM measurements which differed by <3 CPS from their respective sample background levels indicating no contamination.

Sediments were characterized by the absence or a low contamination level of trace metals and hydrocarbons:

- Trace metals were recorded below existing reference values or laboratory detection limits.
- Concentrations of Total Hydrocarbon Content (THC) ranged from 827 µg/kg (station S35) to 1,861 µg/kg (S32), which is far below target values defined by OSPAR 2009 and EGASPIN 2002.
- Polycyclic Aromatic Hydrocarbons (PAH) analyses were below the detection limits in all sediment samples (< 1µg/kg of dry weight).
- Total n-alkanes ranged from 111 µg/kg (S33) up to 188 µg/kg (S11) and contributed on average around 10% to the total hydrocarbons. The Carbon Preference Index (close or greater than 2) and chromatograms (with a quasi-absence of molecules having less than 20 carbon atoms) suggest a substantial biogenic origin of hydrocarbons.
- BTEX analytes were below detection limits in all samples.

In spite of the low concentrations of organic and nutrient contents as well as metals, hydrocarbons, and BTEX contaminants, spatial distribution of the results shows higher values in the eastern part of Block 2912 surveyed area (for TOM, P, THC and alkanes) with suggest a slight decrease in sediment quality toward the east. As the study area is a very homogeneous muddy bathyal plain with no significant slope (around 1%), no correlation was found between studied parameters and the station depths.

4.1.2. Benthic fauna

In total, 836 specimens from 117 different taxa were recorded from the 31 stations sampled, comprising six phyla, 11 classes, 22 orders, and 58 families. The infaunal community was dominated by the phylum Annelida (segmented worms). Arthropoda (crustaceans) and Mollusca. The most abundant taxa recorded were two polychaetes (*Spiophanes* sp. A and *Spiophanes* sp. B) and the bivalve *Microgloma mirmidina*. These species also played a role in the significant structuring of the macrofauna communities: *Microgloma mirmidina* was dominating the western portion of the block whereas *Spiophanes* sp B was dominating in the eastern portion of the block.

Only 16 taxa could be identified to species level, likely attributed to the taxonomic impediment since the biodiversity in such deep marine environment still actually remains largely understudied and little known. At present, none of these are considered endemic or invasive.

The benthic community was characterized by low population levels:

- The number of taxa was low in all the stations (never exceeding 24 species).
- Abundance was quite low in all the stations (never exceeding 50 individuals).

- Biomass was low, never exceeding 1g/station except at stations 34 and 35 which was caused by the capture in the box core of one large Polychaete (*Abarenicola affinis Africana*) and an ophiurid (*Ophiomyxidae* sp.).
- Stations 1 and 14 were particularly impoverished and close to azoic conditions since only 3 and 6 individuals were sampled.
- Since abundance was never high, no great unbalance was observed between the different species density, even though Shannon-Wiener diversity index remained globally low (below 3).

The low population levels are consistent with the low organic and nutrient contents in the sediments.

Despite a low inter-station variability, values of all community descriptors differed according to general longitudinal position within Block 2912, with the number of taxa, species composition and richness, Shannon–Wiener diversity, and evenness being greater in the western portion of the block, while abundance and biomass were greater in the eastern portion of the block. This gradient is consistent with the one observed for sediment characteristics and the slight better quality of the seabed in the western part of the block. In spite of the degree of dissimilarity between the eastern and western portion of the block, it is not possible to clearly link the east-west gradient with bathymetry since inter-variations of depth between stations are low and the substrate in the study area is characterized by a homogeneous flat muddy seabed.

4.1.3. Water physico-chemistry

Water column profiles were quite similar between the four sampled stations. The Block 2912 located well beyond the shelf-break was characterized by typical physico-chemical profiles of the region with warm surface waters (16.5°C) and cold bottom waters (2°C) that matched the salinity and oxygen profiles with high salinity and oxygen saturation near the surface and lower values in deep waters.

Water was characterized by low content of TSS (except at station S04) and relatively high content of TOC, as well as low concentrations in nitrogenous elements. Orthophosphates were low near the surface and richer in deeper layers which is consistent with previous results showing stratification of the water column.

Water quality in terms of contaminants was globally good with low concentrations of metals, PAH, and BTEX. However, few exceptions were found:

- **Cadmium and chromium** both showed one value above the environmental quality standard for coastal and transitional waters (S04 at mid depth for cadmium and S01 at surface for Chromium). These were also above background levels.
- **Zinc** was relatively high in half of samples (S01 subsurface, S04 subsurface, S04 near bottom, S23 subsurface and mid depth and S40 subsurface samples), with values higher than background levels. Nevertheless, they remained below NOAA's different thresholds for this parameter.
- **Vanadium was above** but very close to **the background level** (acute) at stations S01 (mid depth sample) and S04 (surface and bottom samples), not exhibiting significant contamination.
- Concentrations of total hydrocarbon were low among the 12 samples: below the LoD of 27.4 µm/L.
- Due to an error of manipulation by the laboratory during the analysis, the samples were contaminated, and result of **Alkanes** were then lost for this parameter.
- **BTEX** analytes were below detection limits in all samples.
- The number of **Aerobic Flora Adapted to Hydrocarbons (AFAH)** remained low (<10 units/ml), except for station S04 at mid depth where the value reach 43 units /ml and a ratio of 52% when compared to the Total Aerobic Flora (TAF). This result is both due to a particularly low value of TAF and a maximum value of AFAH. Then it is difficult to conclude between a hydrocarbon contamination of water and a natural water impoverished in bacterial community.

Results on **pigment concentrations** showed indication of very low phytoplankton biomasses (less than 0.35 µg/L Chl a) and contrast between the mid-depth and sub-surface sampling points. Conversely, the percentages of pheophytin a (degradation product of Chlorophyll a) were higher in the "mid-water" or "bottom" water samples with particularly high values (up to 100%). The low values of pigment concentrations were consistent with low concentrations in sources of nitrogen.

4.1.4. Plankton

From the analysis of the different phytoplankton communities collected with nets or observed using a UVP, we can assess that the phytoplankton in the area of Blocks 2912 and 2913B were quite similar, and are characterized by high abundances of diatoms along with dinoflagellates and silicoflagellates as usually observed in Namibian waters (Barlow et al. 2006; Nagel et al. 2013; Wasmund et al. 2015).

These relative high abundances of diatoms, dinoflagellates and silicoflagellates may explain the relatively high values of TOC in the water column, as well as the low nutrient content which may have been depleted by the phytoplankton growth. However, they are inconsistent with low values of pigment concentrations**.** Note that the water samples for chlorophyl analysis were acquired near the sea surface (few meters depth) whereas plankton sampling was performed with a bongo net deployed from a 100m water depth and to the surface. This difference may explain in part the disconnect between the pigment concentrations and phytoplankton abundances.

Block 2912 was also characterized by the presence of filamentous cyanobacteria Trichodesmium that can occasionally bloom at the sea surface (Wasmund et al. 2015) and by protists including Foraminifera and Rhizaria that were distributed throughout the water column and down to 2125 m depth.

The zooplankton community of Block 2912 was dominated by crustaceans and mainly copepods. Further, gelatinous zooplankton such as Chaetognatha. Siphonophorae, and Hydrozoa were significant components of the zooplankton as seen at UVP profile station S_1310 located closest to Block 2912.

4.1.5. Epibenthic fauna

Faunal communities observed at all stations included the slime star (probably *Hymenaster* sp.) and burrowing anemone (Actiniaria). Records of the sea pen *Umbellula* sp., and hermit crabs (Paraguridae), which occupy white gastropods or are covered in zoanthids (*Epizoanthus* spp.) or anemones were observed throughout the Block. The latter represents a symbiotic relationship with the zoanthid or anemone replacing the original shell, and providing protection from predators (Ates, 2003).

Echinoderms were abundant, comprising Holothurians (including *Benthodytes lingua* and the sea pig, family Elpidiidae), urchins, and white ophiuroids (brittle stars).

Other observations include benthopelagic shrimps, acorn worms (*Enteropneusta*, likely *Tergivelum cinnabarinum*), Polychaeta, a white isopod, and Mollusca. The latter comprised gastropods, a swimming bivalve, and a cephalopod (possible dumbo octopus, *Grimpoteuthis* sp.).

Xenophyophores (foraminifera) were often large and easily visible. These were regularly collected in box core samples.

Chordata included *Bathypterois* sp. (tripod fish), *Ipnops* sp. (grideye fish), a single unidentified Chondrichthyan (skate or ray) and rattails (Macrouridae).

Besides the taxa listed above, discarded "houses" of the giant larvacean *Bathochordaeus* spp. were regularly observed. These are the most likely the source of the abundant mucus masses seen in all transects, ranging from fresh transparent to older brownish coloration.

4.1.6. Habitat classification and sensibility

The area was quite homogeneous with soft, muddy bottom. No particular hard bottom or relief was identified. Overall, the benthic habitat supported low biological population levels which was consistent with the low organic and nutrient content of the sediments. No species with a particular heritage or protection status was detected.

Thus, no potentially environmentally sensitive habitats were documented during this survey.

5. References

Althaus F, Hill N, Ferrari R, Edwards L, Przeslawski R, Schönberg CHL et al, (2015) A Standardised Vocabulary for Identifying Benthic Biota and Substrata from Underwater Imagery: The CATAMI Classification Scheme, PLoS ONE 1: e0141039.

Alzieu C (2003) Bioévaluation de la qualité environnementale des sédiments portuaires et des zones d'immersion [en ligne]. Quae, S.l. : s.n. ISBN 2844331246. Disponible à l'adresse : https://books.google.com/books?hl=fr&lr=&id=lHsnHa2CMFwC&pgis=1.

Aminot A et Kérouel R (2004) Hydrologie des écosystèmes marins : paramètres et analyses [en ligne]. S.l.: s.n. ISBN 9782844331335. Available at http://books.google.fr/books?id=dd7qZIWQGb8C.

Aparicio-González A, Duarte CM, Tovar-Sánchez A, (2012) Trace metals in deep ocean waters: A review. Journal of Marine Systems. Vol. 100-101. p. 26-33. DOI 10.1016/j.jmarsys.2012.03.008.

Ates RML (2003) A preliminary review of zoanthid-hermit crab symbioses (Cnidaria; Zoantharia/Crustacea. Paguridea). Zoologische Verhandelingen 345. 41-48.

Barlow R, Louw D, Balarin M, Alheit J (2006) Pigment signatures of phytoplankton composition in the northern Benguela ecosystem during spring. African J Mar Sci 28:479–491. https://doi.org/10.2989/18142320609504200

Bruland KW, Donat J, Hutchins DA (1991) Interactive Influences of Bioactive Trace Metals on Biological Production in Oceanic Waters. Limnology and Oceanography.

Bruland KW, Lohan MC (2003) Controls of Trace Metals in Seawater. Treatise on Geochemistry.

BSL (2018) Environmental Baseline Survey: West Africa – Namibia Block 2913B.

BSL (2022a) Environmental Baseline Survey: Block 2912. Field Report. Unpublished produced for Unpublished produced for Total E&P.

BSL (2022b) Environmental Baseline Survey: Block 2912: Regional. Marine Mammal Observation Monitoring Report.

BSL (2023) Environmental Baseline Survey: Block 2913B: Final Environmental Baseline and Habitat Assessment Survey (this report).

Buchman MF (2008) NOAA Quick Screening Reference Tables. NOAA OR&R Report 08-1 Seattle WA. Office of Response and Restoration Division. National Atmospheric and Oceanic Administration (2008): 34 pp.

Charriau A, Bodineau L, Ouddane B and Fischer JC (2009) Polycyclic aromatic hydrocarbons and n-alkanes in sediments of the Upper Scheldt River Basin: Contamination levels and source apportionment. In : Journal of Environmental Monitoring, Vol. 11, n° 5, p. 1086-1093. DOI 10.1039/b819928k.

Chow TJ and Snyder CG (1980) Barium in the Marine Environment: A Potential Indicator of Drilling Contamination. In Symposium Proceedings: Research on environmental fate and effects of drilling fluids and cuttings. Lake Buena Vista. Florida, 2. pp.23-736**.**

Clark MR, Rowden AA, Schlacher TA, Guinotte J, Dunstan PK, Williams A, Tsuchida S (2014) Identifying Ecologically or Biologically Significant Areas (EBSA): a systematic method and its application to seamounts in the South Pacific Ocean. Ocean & coastal management. 91, 65-79.

Clarke KR & Gorley GN (2006) PRIMER v6: User Manual/Tutorial. PRIMER-E Ltd. Plymouth: United Kingdom, 190 pp.

Costello MJ, Coll M, Danovaro R, Halpin P, Ojaveer H & Miloslavich P (2010) A census of marine biodiversity knowledge, resources, and future challenges. PLoS ONE 5: e12110.

Department of Petroleum Resources (DPR) (2002) EGASPIN soil/sediment target and intervention values for Mineral oil (or TPH). Environmental guidelines and standards for The Petroleum Industry in Nigeria, 2: 1-415.

Dutertre M, Hamon D, Chevalier C, and Ehrhold A (2013) The use of the relationships between

Emeis KC, Brüchert V, Currie B, Endler R, Ferdelman T, Kiessling A, Vogt T (2004) Shallow gas in shelf sediments of the Namibian coastal upwelling ecosystem, *Continental Shelf Research*. *24*(6). 627-642.

EU European References for Nutrients in Seawater Decrees of 25 January 2010 and 27 July 2015.

Fernández-Urruzola I, Osma N, Packard TT, et al (2014) Distribution of zooplankton biomass and potential metabolic activities across the northern Benguela upwelling system. J Mar Syst 140:138–149. https://doi.org/10.1016/j.jmarsys.2014.05.009

Finke G, Gee K, Gxaba T, Sorgenfrei R, Russo V, Pinto D, Nsingi KK (2020) Marine spatial planning in the Benguela Current Large Marine Ecosystem. Environmental Development. 36. 100569.

Gettleson DA and Laird CE (1980) Benthic Barium Levels in the Vicinity of Six Drill Sites on the Gulf of Mexico. In Symposium Proceedings: Research on Environmental Fate and Effects of Drilling Fluids and Cuttings. Lake Buena Vista, Florida. 1:739-785.

Hansen F, Cloete R, Verheye H (2005) Seasonal and spatial variability of dominant copepods along a transect off Walvis Bay (23°S). Namibia. African J Mar Sci 27:55–63. https://doi.org/10.2989/18142320509504068

Hargrave BT, Holmer M and Newcombe CP (2008) Towards a classification of organic enrichment in marine sediments based on biogeochemical indicators.

Hunt JM (1995) Petroleum Geochemistry and Geology. 2ND Ed. WH Freeman and Company. New York. pp. 743. ISBN 0 7167 2441 3.

Hutchings L, Van der Lingen C, Shannon L, Crawford R, Verheye H, Bartholomae C, Van der Plas A, Louw D, Kreiner A, and Ostrowski M (2009) The Benguela Current: An ecosystem of four components. Progress in Oceanography, 83: 15–32.

Katija K, Troni, G, Daniels J et al, (2020) Revealing enigmatic mucus structures in the deep sea using DeepPIV. Nature 583, 78–82.

Kennish MJ (1997) (Ed.) Practical Handbook of Estuarine and Marine Pollution. CRC Press. Boca Raton. FL. 524 pp.

Kiko R, Picheral M, Antoine D, et al (2022) A global marine particle size distribution dataset obtained with the Underwater Vision Profiler 5. Earth Syst Sci Data 14:4315–4337. https://doi.org/10.5194/essd-14-4315-2022

LaFlamme RE and Hites RA (1978) The global distribution of polycyclic aromatic hydrocarbons in recent sediments. Geochim. Cosmochim. Acta 42: 289–303.

Llopis Monferrer N, Leynaert A, Tréguer P, et al (2021) Role of small Rhizaria and diatoms in the pelagic silica production of the Southern Ocean. Limnol Oceanogr 66:2187–2202. https://doi.org/10.1002/lno.11743

Liu. M and Tanhua T (2019) Characteristics of Water Masses in the Atlantic Ocean based on GLODAPv2 data. Ocean Science Discussions.

Mann KH and Lazier JRN (1996) Dynamics of Marine Ecosystems: Biological-Physical Interactions in the Oceans. 2d ed.

RPS (2020) Metocean Design Criteria Study – Namibia – 2913B. Prepared for Total and P Namibia B.V. Doc Ref: MMC03586.000 100-CN-REP-1900. 658 pp.

Nagel B, Emeis K-C, Flohr A, et al (2013) N-cycling and balancing of the N-deficit generated in the oxygen minimum zone over the Namibian shelf-An isotope-based approach. J Geophys Res Biogeosciences 118:361–371. https://doi.org/10.1002/jgrg.20040

OSPAR (2009) Implementation report on Recommendation 2006/5 on a management regime for offshore cutting piles. pp. 24.

OSPAR (2014) Levels and Trends in Marine Contaminants and their Biological Effects. CEMP Assessment Report 2013. Publication number: 631/2014. OSPAR Commission 2014.1Buchman MF 2008 NOAA Quick Screening Reference Tables. NOAA OR&R Report 08-1 Seattle WA. Office of Response and Restoration Division. National Atmospheric and Oceanic Administration (2008): 34 pp.

Paez-Osuna F and Ruiz-Fernandez C (1995) Comparative Bioaccumulation of Trace Metals in Penaeus stylirostris in Estuarine and Coastal Environments. Estuarine. Coastal and Shelf Science. 40(1):35-44.

Pearson TH and Rosenberg R (1978) Macrobenthos succession in relation to organic enrichment and pollution of the marine environment. Oceanogr. Mar. Biol. A. Rev. 16: 229-311.

Picheral M, Guidi L, Stemmann L, et al (2010) The Underwater Vision Profiler 5: An advanced

Pichevin L (2004) Sédimentation organique profonde sur la marge continentale namibienne (Lüderitz. Atlantique Sud-Est): impacts des variations climatiques sur la paléoproductivité [en ligne]. S.l. : Université Sciences et Technologies - Bordeaux I. Disponible à l'adresse : http://grenet.drimm.u-bordeaux1.fr/pdf/2004/PICHEVIN_LAETITIA_2004.pdf.

Postel L, da Silva AJ, Mohrholz V, Lass H-U (2007) Zooplankton biomass variability off Angola and Namibia investigated by a lowered ADCP and net sampling. J Mar Syst 68:143–166. https://doi.org/10.1016/j.jmarsys.2006.11.005

Przeslawski R, Dundas K, Radke L & Anderson TJ (2012) Deep-sea Lebensspuren of the Australian continental margins. Deep Sea Research Part I: Oceanographic Research Papers 65: 26-35.

Robison BH, Reisenbichler KR & Sherlock RE (2005) Giant larvacean houses: rapid carbon transport to the deep-sea floor. Science 308(5728). 1609-11.

Schaule BK and Patterson CC (1983) Perturbations of the Natural Lead Depth Profile in the Sargasso Sea by Industrial Lead. In: Trace Metals in Seawater. Plenum Press. New York. pp.487-503.

Simpson SL, Batley GB and Chariton AA (2013) Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines. CSIRO Land and Water Science Report 08/07. CSIRO Land and Water.

SLR Environmental Consulting (2020) Proposed 3D Seismic Survey in Licence Blocks 2912 and 2913B. Orange Basin. Namibia. Final Environmental Impact Assessment Report and Environmental & Social Management Plan. Prepared for Total and P Namibia B.V. Doc Ref: 733.20071.00002. 882 pp.

Søndergaard M (2009) Redox Potential. 10.1016/B978-012370626-3.00115-0.

Steffani N (2012) Assessment of mining impacts on **macrofaunal** benthic communities in the northern inshore area of the De Beers Mining Licence Area 3 - 2011. Prepared for De Beers Marine Namibia (Pty) Ltd. pp. 54.

Stramma L and England M (1999) On the water masses and mean circulation of the South Atlantic Ocean. Journal of Geophysical Research: Oceans. 104. 20863-20883.

Trocine RP and Trefry JH (1983) Particulate Metal Tracers of Petroleum Drilling Mud Dispersion in the Marine Environment. Environmental Science & Technology. 17(9):507-512.

Valentine HR, Lutjeharms JRE and Brundrit GB (1993) The Water Masses and Volumetry of the Southern Agulhas Current Region. Deep Sea Research **Part I: Oceanographic Research Papers. 40(6):1285-1305.**

Warwick RM (1993) Environmental impact studies on marine communities: Pragmatical considerations. Australian Journal of Ecology 18: 63-80.

Wasmund N, Struck U, Hansen A, et al (2015) Missing nitrogen fixation in the Benguela region. Deep Sea Res Part I Oceanogr Res Pap 106:30–41. https://doi.org/10.1016/j.dsr.2015.10.007

WFD 2000/60/EC (2015) European references for nutrients in seawater (Decrees of 25 January 2010 and 27 July 2015).

6. Appendix

6.1. Appendix I - Field Operations and Survey Methods

6.1.1. Survey operation

Environmental sampling operations were carried out in Block 2912 by BSL and Creocean from 30th September to the 7th October (date of first deployment to date of final camera transect completed and recovered) on a 24-hour operational basis. The summarised timings for the different operational components of the survey are provided in the following table.

Table 46. Summary of operations

Date	Activity	Details of Activity
30/09 /2022	Transit; Environmental Operations;	Transit to Block 2912 after completion of Block 2913B survey operations; Completion of camera transect B2912_CAM_04; One PAM deployment between stations.
01/10 /2022	Environmental Operations;	Completion of camera transect B2912_CAM_01; Full suite water samples acquired from S04 including CTD, bottom, mid, surface and plankton samples; Crane lift to switch to box core operations; Successful box cores sample recoveries from stations S04, S08, S12, S16; 2 PAM deployments during transits between stations.
02/10 /2022	Environmental Operations;	Successful box cores sample recoveries from stations S20, S24, S28, S32, S35, S38, S40, S39; Full suite water samples acquired from S40 including CTD, bottom, mid, surface and plankton samples; 4 PAM deployments during transits between stations.
03/10 /2022	Environmental Operations;	Successful box cores sample recoveries from stations S37, S34, S31, S27, S23, S19, S15; Full suite water samples acquired from S23 including CTD, bottom, mid, surface and plankton samples; 3 PAM deployments during transits between stations.
04/10 /2022	Environmental Operations;	Successful box cores sample recoveries from stations S11, S07, S03, S01, S06, S10; Full suite water samples acquired from S01 including CTD, bottom, mid, surface and plankton samples; 1 PAM deployment during transit between stations.
05/10 /2022	Environmental Operations;	Successful box cores sample recoveries from stations S14, S13, S21, S22, S30, S33; Crane lift to swap to camera operations; Transit to B2912_CAM_14 with PAM hydrophone deployed.
06/10 /2022	Environmental Operations;	Live-feed camera transects B2912_CAM_14 and B2912_CAM_12 completed. Crane lift to swap to pressure camera operations; Pressure camera transects B2912_CAM_09 and B2912_CAM_08.
07/10 /2022	Environmental Operations;	Pressure camera transects B2912_CAM_07 and B2912_CAM_05 completed; Sea-fastening equipment to deck prior to transit to Lüderitz; Transit to Lüderitz.
08/10 /2022	Environmental Operations; Transit	Vessel transit to Lüderitz; Standby in Lüderitz for immigration officials.
09/10 /2022	Transit	Collection of passports by immigration officials to clear personnel and vessel for transit to Cape Town; Transit towards Cape Town.
10/10 /2022	Transit	Transit towards Cape town.
11/10 /2022	Transit	Transit towards Cape town.
14/10 /2022	Demobilisation	Samples demobilised from vessel to controlled room facility in Cape Town for flight back to UK.

6.1.1.1. Mobilisation

The vessel (PSV Bourbon Evolution 807) was provided and operated by Bourbon and was under contract to TEEPNA for this survey. BSL began personnel and equipment mobilization onboard the vessel alongside Walvis Bay port on the 6th of September, with a large proportion of survey equipment, previously kept in storage, arriving on the quayside on the 7th of September. This package included three sampling winches and hydraulic power units, along with the launch and recovery system (LARS) and a 20-foot operational container. The installation of the LARS commenced with the removal of a section of railings on the mid starboard side of the vessel and the placement and installation of all field units onto steel supports across the deck. The lifting of a container with soft strops required emptying it of its contents to be lifted separately in an HH container. A rotating USBL pole assembly, designed by BSL, was supplied, and installed on the port side approximately mid-ship and deployment tested in port. The remaining survey equipment (airfreighted) arrived onboard on the 9th September. Welding operations were completed and certified on the morning of the 10th September as well as sea-fastening of all loose items on deck and in the container prior to the vessel leaving the quayside in the early hours of the 11th September. Block 2912 survey was undertaken after completion of the adjacent Block 29123B program.

6.1.1.2. Deployment

The USBL pole was mounted on the port-side approximately mid-ship following the removal of a barrier, using simple deck welding and BSL's support frame design (following Figure). The pole was installed to lift forward via a small davit and electric winch supplied by BSL and welded and bolted to the deck above. The pole was deployed and recovered using this winch with additional safety and securing lines added forward and aft, respectively. The only limitation of this installation was that of slightly reduced survey speed of 4-5 knots when deployed. The calibration of the BSL system was carried out on the 14th September, with a 1.5m difference between the mounted USBL pole and the vessel USBL system.

The deployment and recovery of all sediment sampling equipment was carried out using the LARS systems and the deep-water sampling winch only. The smaller ORE electric winch was utilized for water-sampling through the LARS involving a multiprobe system (CTD), beacon and Niskin samplers secured to the Dyneema with messengers used to trigger the Niskin bottles. All operations were completed safely without major incident. Water ingress was noted on one of the pressure camera systems, which will be replaced for the next campaign. Survey operations were ceased when safe operational control could not be maintained on the LARS and deck during deteriorating sea conditions resulting in the equipment (and the camera) swaying and striking the side of the vessel or LARS on recovery. Vessel roll was the main concern when holding position on station in marginal weather conditions. The ORE winch operated without fault throughout the duration of the survey.

The MARE winch was used for all box coring operations and pressure camera transects. Due to wave ingression onto the deck, seawater washed up and into the electrical box of the MARE winch HPU during the prior survey of Block 2913B. This caused the spooling motor to cease working on a deployment before the issue was observed. Subsequently the internal box was dried, and wire entrances were sealed using silicon sealant. As a temporary solution the of the electrical box was partially protected with wooden boards were strapped to the HPU to deflect water rushing across the deck. The HPU cooling fan failing to engage when Hot Oil light illuminates can be the result of the tripped switch in the HPU electrical box. The continued use of the winch while cooling fan is off can lead to other switches tripping potentially disabling the winch. Following the issues from waves during the survey in Block 2913B and subsequent repairs and measures taken, the MARE winch operated without fault throughout the duration of the Block 2912 survey. However, it has been recommended that more substantial interventions are needed for subsequent surveys onboard to protect the MARE winch HPU (and other equipment) from the weather especially waves washing over deck.

The RAPP winch is fitted with coaxial cable was used for the live-feed camera transects. The RAPP winch did not encounter any issues throughout the duration of the survey in Block 2912 or cause any downtime.

Figure 43. BSL USBL pole installation

6.1.1.3. Demobilisation

The *Bourbon Evolution 807* left Block 2912 at 12:46 on 7th October 2022 to begin to transit to Cape Town for the crew change planned for 15th October 2022. The vessel first sailed to Lüderitz to obtain clearance to leave Namibian waters, with the immigration formalities completed on 9th October 2022.

The vessel then sailed to Cape Town, arriving alongside on at 06:20 on 13th October 2022. The crew change was completed by the 14th October, with deck modifications completed beforehand. These modifications used wood to create protection on the deck from the waves, as well as utilising a spare vessel 20ft open top container to house the LARS and MARE winch HPUs and provide protection for the associated electrical boxes from the waves coming onto the deck.

Samples were demobilized from the vessel to a control room facility in Cape Town on the 14th October 2022 prior to transportation to the respective laboratories.

6.1.1.4. Survey Duration and Performance

Following the proposed sampling strategy outlined in the PEP (and amended offshore) and the available acquisition window, sampling was conducted in order of priority with the aim to complete the scope before a crew change date of the 14th of October in Cape Town.

The operations completed 75% of the initial scope with the targeted accuracy of 2% of the water depth achieved at 87% of the 31 sampled locations, the remaining 4 locations being within 4%.

The total field operations consisted of 105:02h of environmental survey operations with an additional 61:13h of transit between sites accounting for a total approaching 7 days (around 60% of the overall survey). Furthermore, 93:26h were necessary for transit to site and from site to Lüderitz and towards Cape Town. The remainder of total time was spent on standby for immigration procedure in Lüderitz, accounting for 13:48h (5% of the overall survey). There was no operational or weather downtime

throughout the survey of Block 2912. A summary of the total field operations is presented in following Table and Figure.

Table 47. Field operational breakdown

Operation	Duration (hours)	
	Hours	%
Transit to/from site	93:26	34.16
Survey Operations	105:02	38.41
Survey Transit between sites	61:13	22.38
Standby (Lüderitz immigration)	13:48	5.05
Total Operations	**273:29**	**100.0**

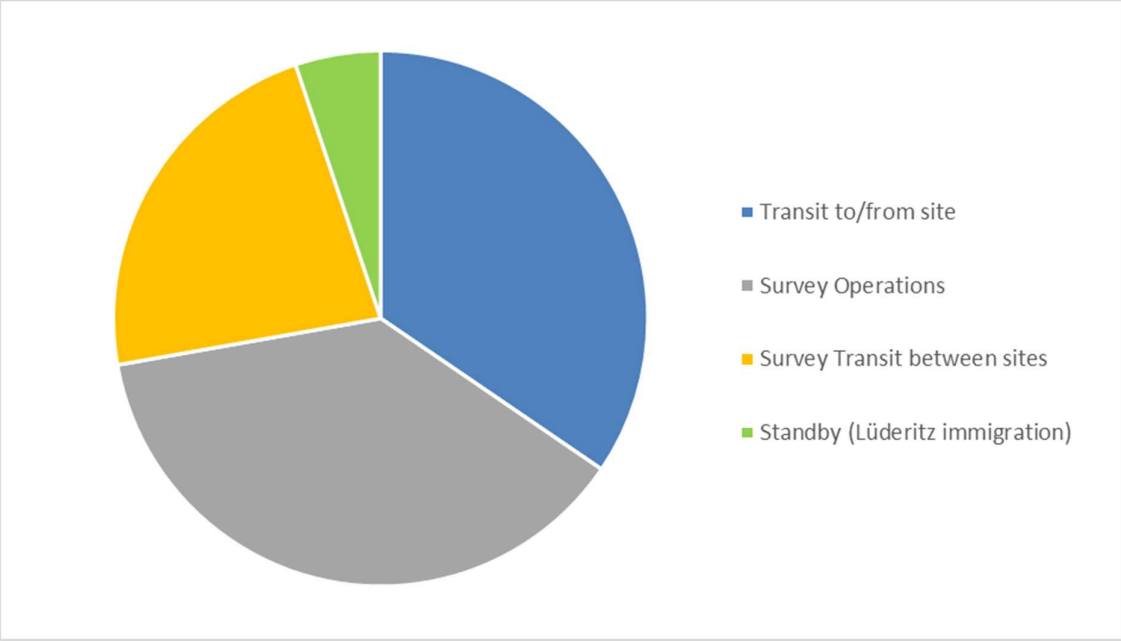


Figure 44. Operational breakdown for the environmental baseline survey Block 2912

6.1.2. Vessel characteristics

The BE807 is a 100m long French vessel built in 2014. It had an OVID inspection on 16-18th August and completing remedial actions in Durban (South-Africa) and Walvis Bay (Namibia).

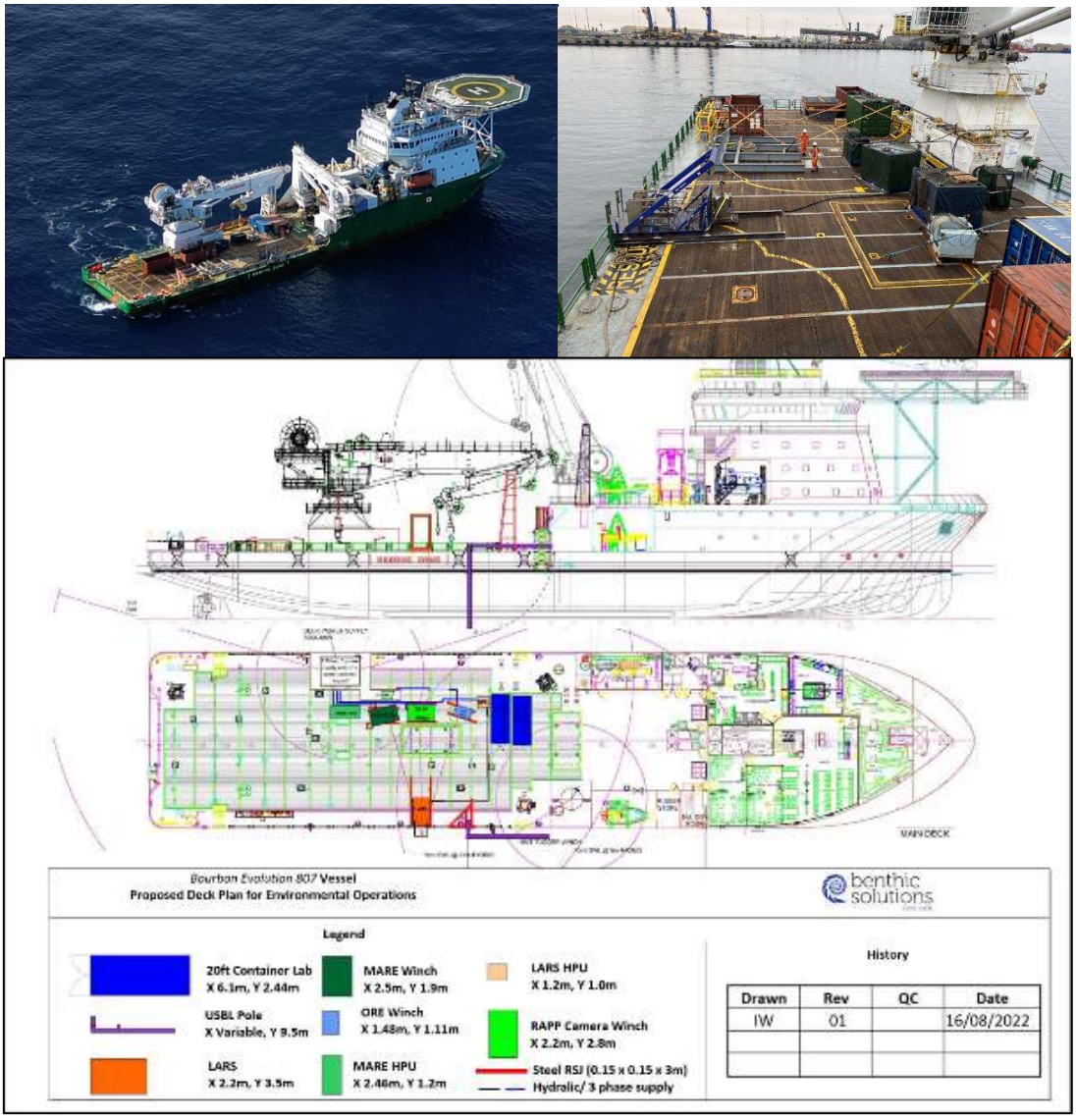


Figure 45. Photo of Bourbon Evolution 807

6.1.3. Sampling operations

Operations were completed using a deep-water sampling winch and a BSL LARS to deploy various sampling equipment to the seabed and through the water column.

Water sampling involved the use of:

- 10L Niskin bottles,
- a CTD for water profiling,
- a bongo plankton system for the acquisition of phytoplankton and zooplankton samples.

Equipment used for seabed sediment sampling included:

- a 0.25m^2 box core with a mounted BSL Pressure Camera system.

Redox and Alpha and Beta NORM measurements were taken on all sediment samples, with Redox collected at 1cm and 10cm penetration. Alpha and Beta NORM measurements were recorded throughout. No Gamma NORM readings were acquired due to a malfunction with the probe.

Camera transects were carried out using two specialist systems including the towed live-feed Seabug system or the BSL Pressure Camera system both mounted on a BSL camera sled frame. Additional wide-angle footage was obtained through securing a secondary BSL Pressure Camera system to the side of the sled frame with the set ups of both camera systems.

All sampling locations were approved with the Client prior to the start of the survey, with subsequent changes made in the field approved and discussed by the Client and BSL.

6.1.3.1. Seawater

Seawater profiles were acquired during the survey using a multiparameter Valeport MIDAS fitted with sensors to measure conductivity (salinity), temperature, pressure (depth), dissolved oxygen (DO), pH, redox and turbidity. The multi-profiler was deployed mounted on the deployment cable as a singular deployment or in conjunction with the water sampling process. The unit was submerged at the surface and allowed to acclimate to ambient sea conditions for approximately two minutes before deploying and recovering at a rate of 0.1-0.2 to 1m/second.

Seawater samples were collected at a total of four stations, from three key layers within the water column: the surface layer (5-10m), the middle layer (below the thermocline at approximately 1,000m) and the bottom layer approximately 10-30m above the seabed. Three separate 10L Niskin bottles were mounted on the dedicated winch with fine Dyneema rope at these predetermined depths, each Niskin bottle was triggered by a messenger release. Discrete water samples were extracted from the 10L Niskin bottles using a specialist tap fitting, taking care to prevent contact between the tap and the sample containers to avoid the potential for contamination.

Recovered water samples were processed onboard the survey vessel by trained environmental personnel. These water samples were collected directly from the Niskin bottles into appropriate containers provided by the laboratory and were stored at 4°C except for the hydrocarbon analyses which were frozen (-18°C).

In addition, 2 litres of seawater from each Niskin were filtered (Whatmann GFF filter - 0.45 µm) to analyse for chlorophyll-*a* and phaeopigment content. These filters are immediately frozen at -18°C in and stored at this temperature until extraction in the laboratory.

Water samples were stored as following:

- Total Organic Carbon: stored in 125ml bottles with 0.5ml of H2SO4 59% – refrigerated.
- Hydrocarbons: polycyclic aromatic hydrocarbons, alkanes; stored in 1L amber glass – frozen.
- Suspended matter and Kjeldhal nitrogen: stored in 500ml bottles – refrigerated.
- Nutrients: nitrate, nitrite, orthophosphates; stored in 100ml bottles – refrigerated.
- Trace metals: stored in 125ml bottles with 1ml of HNO3 65% - refrigerated.
- Mercury: stored in 100ml glass bottles with 1ml of HCl – refrigerated.
- Bacteria: total aerobic flora for 7 days and aerobic flora adapted to hydrocarbons over 7 days; stored in 250ml bottle – refrigerated.
- Chlorophyll-α: 2L of filtered seawater on 47mm filter – frozen.

Redox potential was also measured aboard the vessel on water subsampled from the Niskin bottles.

For each water sample, the station, date and depth of sampling are entered into the field database.

Figure 46. Water sampling

6.1.3.2. Plankton

Plankton samples were collected using two WP2 type nets with an opening of 0.25m² (diameter of 57cm) mounted on a bongo frame equipped with:

- an electronic depth gauge that records the maximum depth reached,
- a flow meter that allows the volume of water filtered to be evaluated,
- a collector at the end of the nets that collects the plankton.

Zooplankton samples were collected using a 200µm mesh size and phytoplankton organisms through a 50µm mesh. Samples were collected by lowering the bongo net to approximately 100m, collecting the plankton samples by raising it back to the surface at a rate of approximately 0.5m per second.

The plankton nets were processed on the back deck by rinsing with seawater to bring all the organisms down into the collectors. A valve at the lower end of the collector allows the planktonic organisms to be transferred to a sieve and then to plastic bottles. The zooplankton samples collected in this way were preserved by adding a solution of formol (5%) buffered with borax. The phytoplankton samples were preserved by adding lugol.

Plankton samples were stored as following:

- Phytoplankton (sieved over 50µm mesh; stored with 2ml of Lugol's iodine; stored in 250ml plastic bottles).
- Zooplankton (sieve over 200 µm mesh; stored in 5 % Formalin; stored in 250ml plastic bottles).

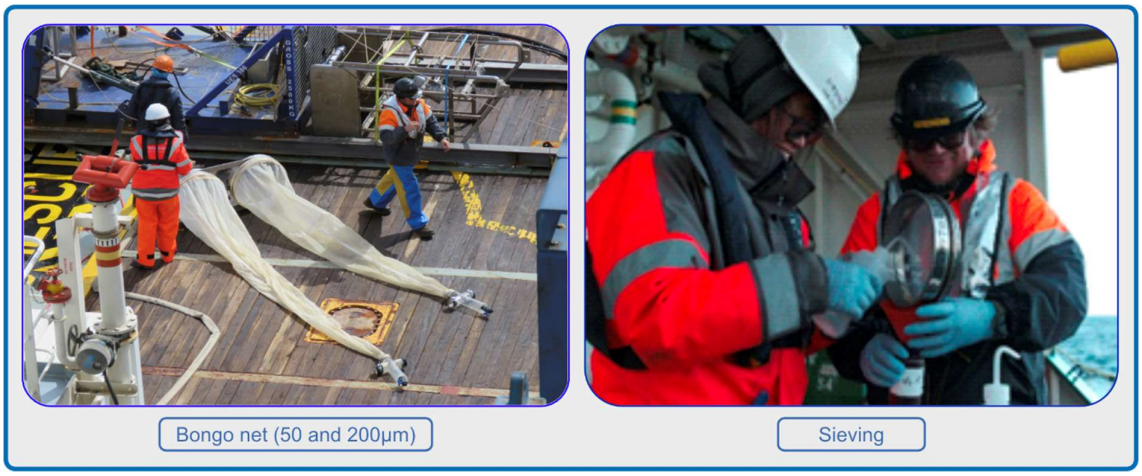


Figure 47. Plankton sampling

6.1.3.3. Sediment

All seabed samples were acquired using the Gray O'Hara box corer (0.25m2 box core) collecting 31 samples from 31 deployments. A total of 31 out of the 40 stations were successfully sampled with nine stations removed from the scope due to time constraints. One box core sample was taken at each station, which was subsequently subsampled for physio-chemical parameters, eDNA and macrofauna.

Recovered sediment samples were processed onboard the survey vessel by trained environmental personnel. Sediment samples were photographed and in-situ measurements such as redox, NORM and sediment observations (i.e. Munsell color and sediment type) were logged. Each station was sampled to provide sediment sub-samples for both organic and inorganic determination. Each core sample was divided with physico-chemical sediment sub-samples

Figure 48. Sediment sampling

Except for sediment biology (macrofaunal and microbiology) and BTEX all samples were immediately frozen and stored (-18°C) for later transportation to the laboratory upon demobilization. BTEX and microbiology sediment samples were refrigerated (<4°C), while macrofaunal samples were sieved in the field using a *Wilson* Auto-siever (WAS) over a 500µm sieve, and subsequently fixed in a 5-10% solution of buffered formalin and stained with Rose Bengal and subsequently stored at ambient room temperature. Photographs of the box core surface sediments were taken to document the macrofaunal residues retained after sieving.

A full suite of physico-chemical and biological samples was collected at stations across the Block 2912 survey area, for analysis of the following parameters:

- Particle size distribution (stored in doubled lined ziplock plastic bag - frozen);
- Heavy & trace Metals (HM) (stored in doubled lined ziplock plastic bag - frozen);
- Hydrocarbons (total petroleum hydrocarbons, saturate hydrocarbons, polycyclic aromatic hydrocarbons; stored in a pre-washed foil capped glass jar - frozen);
- BTEX (stored in a pre-washed foil capped glass jar - refrigerated);
- Microbiology (stored in a pre-washed foil capped glass jar – refrigerated);

6.1.3.4. Macrobenthic benthic Infauna

All samples were collected by Benthic Solutions Limited with technical support from Creocean and Anchor Environmental consultants. As recommended by Clark (2014), qualified and experienced scientists observed and supervised all aspects of the sample collection process. This included many of the authors on the present report.

At each sampling site, a sample was taken using a 50 x 50 x 50-centimetre (cm) steel Box Corer with a modified “impact trigger mechanism”. The grab samples an area of 0.25 m^2 and penetrates the sediment to a maximum depth of ~30 cm. A smaller rectangular corer was inserted into the sediment for the benthic macrofauna sample. A singular macrofaunal sample of 0.1 m2 was taken at each station and then transferred to a *Wilson* Autosiever (WAS). The sample was washed through a 500 µm sieve to remove all fines, before being rinsed into a labelled sample jar and fixed with formalin, diluted to 10% with seawater.

A: Grey O'Hara box corer
B: largely consisted of soft pale mud over consolidated clay
C: Wilson Autosiever (WAS)
D: 500 µm sieve

Figure 49. Sediment sampling methodology in Block 2912

6.1.3.5. Epibenthic infauna

A total of eight camera transects were carried out across Block 2912 with seven originally proposed transects removed from the work scope due to time constraints.

Camera transects were completed using one of two specialist camera systems provided by BSL.

The primary camera system was the towed Seabug camera providing live-feed SD footage via the sonar cable on the winch. The live video footage was overlaid with time, position and site details and viewed in real-time with videos recorded directly onto a storage device. This subsea camera also provides HD video and allows stills capture in real time. Photographs were uploaded instantly to the surface control unit for continuous review. Photographs were of high quality (6 megapixels, reduced from 24mp for faster upload speed) and can be used for detailed analysis.

The secondary system (classed as the primary system for transects deeper than 3,000m) utilised a BSL HD Pressure Camera coupled with an LED light and lasers mounted onto a BSL camera sled and deployed using the sampling winch. The pressure camera set up is a self-contained system that does not provide live-feed video to the survey team on the vessel as a coax cable would have been required which was deemed inappropriate for use in conjunction with a box corer, with different cable connection. Therefore, contact with the seabed is deduced using beacon depth and whether there is slack in the Dyneema rope. To aid in this, a secondary beacon was secured 500m above the camera frame on the sampling Dyneema rope. This allowed a differential in depths and location of both beacons to be used to determine contact with the seabed. Areas of the transects covered by this secondary system varied in usability but still provided valuable evidence and data of the habitat situated within the survey area.

An additional BSL Pressure Camera system was secured to the side of the camera sled of both systems to provide an additional angle of the seabed.

Proposed transects were 1km in length, it was agreed on board prior to commencing operations in this block to reduce the pressure camera transect length to between 300m and 500m to optimise data retrieval across the block.

Additional high-definition footage was acquired during the sediment box core sampling as a pressure camera system was fixed onto the frame of the box corer with custom deep-water housing, external light source and laser pointers. A total of 31 sediment sampling stations successfully captured seabed imagery.

Figure 50. Benthic sled with video equipment

6.2. Appendix II - Data Presentation. Laboratory and Statistical Analyses

6.2.1. List of laboratories

LPL (Laboratoire des Pyrénées et des Landes) (http://www.labopl.com/) (Lagor, France) analysed **water samples for nutrients, total heterotrophic microorganisms, and hydrocarbon adapted microorganisms**. Creocean has successfully used the LPL for analyses of samples in previous EBS projects conducted for TotalEnergies. The LPL is a group of labs accredited by the COmité FRançais d'ACcréditation (COFRAC) and the French government Ministère de l'Agriculture et de l'Alimentation.

CEDRE (https://wwz.cedre.fr/en/About-Cedre/Cedre-in-short) (Brest, France) analyzed **water samples for hydrocarbons, BTEX, and PAHs**. With its expertise in accidental water pollution, CEDRE has been operating in France and abroad for nearly 40 years. Its multidisciplinary team is composed of 50 technicians, engineers and scientists. CEDRE is certified ISO 9001:2015 (SGS-ICS), "Quality management systems", and ISO 14001:2015 (SGS-ICS), "Environmental management systems" for its full range of activities. CEDRE also hold various accreditations and authorizations on national and international levels. Creocean has successfully used the CEDRE lab for sample analyses in previous EBS projects conducted for TotalEnergies.

UMR MARBEC (Marine Biodiversity Exploitation and Conservation) (https://umr-marbec.fr/) (Montpellier, France) analyzes **water samples for Chlorophyll and phaeopigments**. Creocean has successfully used the MARBEC lab for sample analyses in previous EBS projects conducted for TotalEnergies.

PIQv is the only worldwide platform dedicated to the quantitative imaging **analysis of plankto**n and aquatic detritus. PIQv was created by researchers and engineers from the oceanology laboratory of Villefranche-sur-Mer (France) using original imaging instruments and purchased or developed software. The instruments, the associated expertise and the analysis of plankton and plastic samples are offered to the scientific community and to private companies. It offers then services for on-site and remote access requests from scientists.

The **SOCOTEC** marine team have established a longstanding reputation for technical expertise in UKAS-accredited marine sediment testing and marine environmental monitoring support, offering streamlined, robust extraction and analysis processes and fast turnaround times. The company's robust extraction and analytical procedures have been developed specifically for complex marine samples. In addition to UKAS accreditation, SOCOTEC has over a decade of proven performance in the Quality Assurance for Marine Environmental Monitoring (QUASIMEME) scheme. These qualifications provide assurance of the technical competence of SOCOTEC's testing laboratory to undertake a comprehensive array of **sediment chemistry analyses**.

Eurofins: is providing market-leading laboratory testing, monitoring and consultancy services to a wide range of industrial companies, environmental consultants, contractors, retailers and government authorities. Eurofins performs testing on routine parameters like heavy metals, TPH, PAH, EOX, aromatics, VOCs and pesticides, as well as non-standard parameters like glycols and phthalates using a wide range of modern techniques including ICP-AES, ICP-MS, (LVI)-GC/MS, HPLC and LC-MS. The pre-treatment and analytical methods that we currently use fully comply with national and international legislation and standards. **Sediment microbiology analysis** were provided for this project.

Anchor Environmental Consultants is a consulting firm based in Cape Town, South Africa that offers ecological and socio-economic assessment, research and monitoring to inform environmental management and policy. Their work encompasses ecology, livelihoods, economics, ecosystem services and natural capital accounting; it straddles marine, estuarine, freshwater and terrestrial realms; and it addresses decision-making, planning, policy and strategy regarding conservation, rural and urban development, resource allocation and management and climate change. Anchor Environmental has considerable experience in identification of benthic macrofauna to species level from both offshore and estuarine marine habitats in Africa. Anchor Environmental was in charge of the Epifauna identification during the survey and benthos analysis for this block. Anchor Environmental has undertaken offshore benthic macrofauna monitoring work in the following areas: Congo, Somaliland, South African, Southern Namibia.

The certificates of laboratories (Socotec / LPL/Cedre) are provided in the following links.

Certificate_LPL.pdf Certificate_Cedre.pdf Certificate_Socotec.pdf

6.2.2. Laboratory method for water analysis

Water samples analysis are listed in the following table:

Table 48. Method and limit of quantification (LoQ) of water parameter analysis

Water Parameter	Method	LoD / LoQ
Total Suspended Solids (TSS)	Gravimetry NF EN 872	2 mg/l
Total Organic Carbon (TOC)	Combustion /IR	0.2 mg/l
Nitrates (NO3-)	Continuous flow	0.1 mgl/l
Nitrites (NO2)	Continuous flow	0.01 mg/l
Orthophosphates (PO43-)	Continuous flow	0.02 mg/l
Total Nitrogen as N / Nitrogen Kjedhal	Spectrophotometry	0.5 mg N/l
Silver (Ag)	EPA 6020B	5 µg/l
Aluminum (Al)	EPA 6020B	10 µg/l
Arsenic (As)	EPA 6020B	5 µg/l)
Barium (Ba)	EPA 6020B	10 µg/l
Beryllium (Be)	EPA 6020B	5.0 µg/l
Cadmium (Cd)	EPA 6020B	0.2 µg/l
Cobalt (Co)	EPA 6020B	1 µg/l
Chromium (Cr)	EPA 6020B	1 µg/l
Copper (Cu)	EPA 6020B	1 µg/l
Iron (Fe)	EPA 6020B	0.1 mg/l
Mercury (Hg)	EPA 6020B	0.015 µg/l
Manganese (Mn)	EPA 6020B	1 µg/l
Molybdenum (Mo)	EPA 6020B	1 µg/l
Nickel (Ni)	EPA 6020B	1 µg/l
Lead (Pb)	EPA 6020B	1 µg/l
Antimony (Sb)	EPA 6020B	5 µg/l
Selenium (Se)	EPA 6020B	5 µg/l
Tin (Sn)	EPA 6020B	1 µg/l
Thallium (Tl)	EPA 6020B	1.0 µg/l
Zinc (Zn)	EPA 6020B	10 µg/l
Vanadium (V)	EPA 6020B	1 µg/l
Aliphatic hydrocarbons >C5 – 35	GC/MS Internal method	10 µg/l
Total aliphatic hydrocarbons	GC/MS Internal method	230 µg/l
Total aromatic hydrocarbons	GC/MS Internal method	170 µg/l
Total aliphatic and aromatic hydrocarbons	GC/MS Internal method	400 µg/l
Benzene	GC/MS	1.5 µg/l
Ethylbenzene	GC/MS	1.5 µg/l
o-Xylene	GC/MS	1.5 µg/l
Toluene	GC/MS	3.0 µg/l
Xylene (meta-. para-)	GC/MS	1.5 µg/l
PAH (x16 PAHs)	GC/MS	0.005 µg/l
Total heterotrophic microorganisms (yeast. fungi and bacteria) - TAF	Interna method	0.300 UFC/ml
Hydrocarbon adapted microorganisms (yeast. fungi and bacteria) - AFAH	Internal method	10 000 UFC/ml
Chlorophyll a.b.c pigments and phaeopigments	UV-VIS Spectrophotometer	NA

6.2.3. Plankton analysis

The plankton samples collected in the horizontal tows were sent for analysis to the Observatoire Océanologique (PIQv) of Villefranche-Sur-Mer (France).

Prior to the data analysing, several categories of images were removed from the data-set, notably, the non-living, non-identified and duplicate categories were removed. Eggs were also removed as a net is not the most suitable way to efficiently sample them. For abundances calculation any “part” of organisms identified were removed but were kept for the estimation of the biovolume.

For a general appreciation of the plankton communities collected at the different sampling stations, correspondence analysis was performed on the abundances of the two communities collected with the nets 200 µm and 50 µm respectively. To do so, only abundances of organisms sampled at all stations were kept for the analysis.

The plankton samples were analysed by imaging, i.e., photos of the organisms were taken and then sorted taxonomically using the web application ECOTAXA developed by the laboratory (http://ecotaxa.obs-vlfr.fr), which allows images of organisms to be classified efficiently using a reference taxonomy (http://unieuk.org/). The organisms were therefore not sorted under the microscope. This limits to some extent the taxonomic identification time while making the analysis reproducible and allowing automatic measurement of organisms, thus producing biomass estimates of the different taxa identified.

Zooplankton samples were collected in vertical tows using a 200 µm plankton net equipped with a volume counter. Samples were fixed in seawater formalin solutions buffered with borax.

The samples were examined in two subsets:

- 50µm which was examined using a FlowCAM,
- >200 µm which was subject to ZooScan imagery. Samples and resulting images can be stored for future analyses.

The protocol used was as follows:

- sample reception and feedback;
- project preparation and maintenance;
- sample analysis with the instrument (FlowCAM; analysis + process + extraction of images + sample reconditioning. ZooScan: analysis + process + separation of objects on the image + extraction of images + sample reconditioning);
- image storage on ECOTAXA database;
- validation of images for taxonomic groups with ECOTAXA;
- samples and resulting images can be stored for further analysis.

FlowCAM (Fluid imaging Inc.) is an *in situ* imaging instrument to measure/count and classify particles and organisms between 20 µm and 200 µm in the liquid environment. This instrument is well adapted for the study of departing or fixed nano- and micro-phytoplankton.

The **ZooScan** (HYDROPTIC Inc., CNRS patent) is an *in situ* imaging instrument to measure/count and classify particles and organisms between 150 µm and 5 cm in the liquid environment. This equipment is well adapted for the study of fixed or non-motile meso- and macro-plankton.

The ZooScan system uses scanner technology with custom illumination and a sealed scanning chamber into which samples of liquid zooplankton can be placed. The scanner retrieves a high-resolution digital image, and the sample can be recovered undamaged. These digital images can then be examined by computer processing. Although the resolution of the digitised zooplankton images is lower than that obtained with a binocular microscope, this technique has proven to be more than sufficient for large sample sets. Species identification is performed by automatically comparing the scanned images (thumbnail) of each animal with an existing library of images of marine plankton species. The latest machine learning algorithm allows high levels of species recognition estimated at 75%.

Figure 51. FlowCAM technology used to measure/count and classify organisms between 20 µm and 200 µm

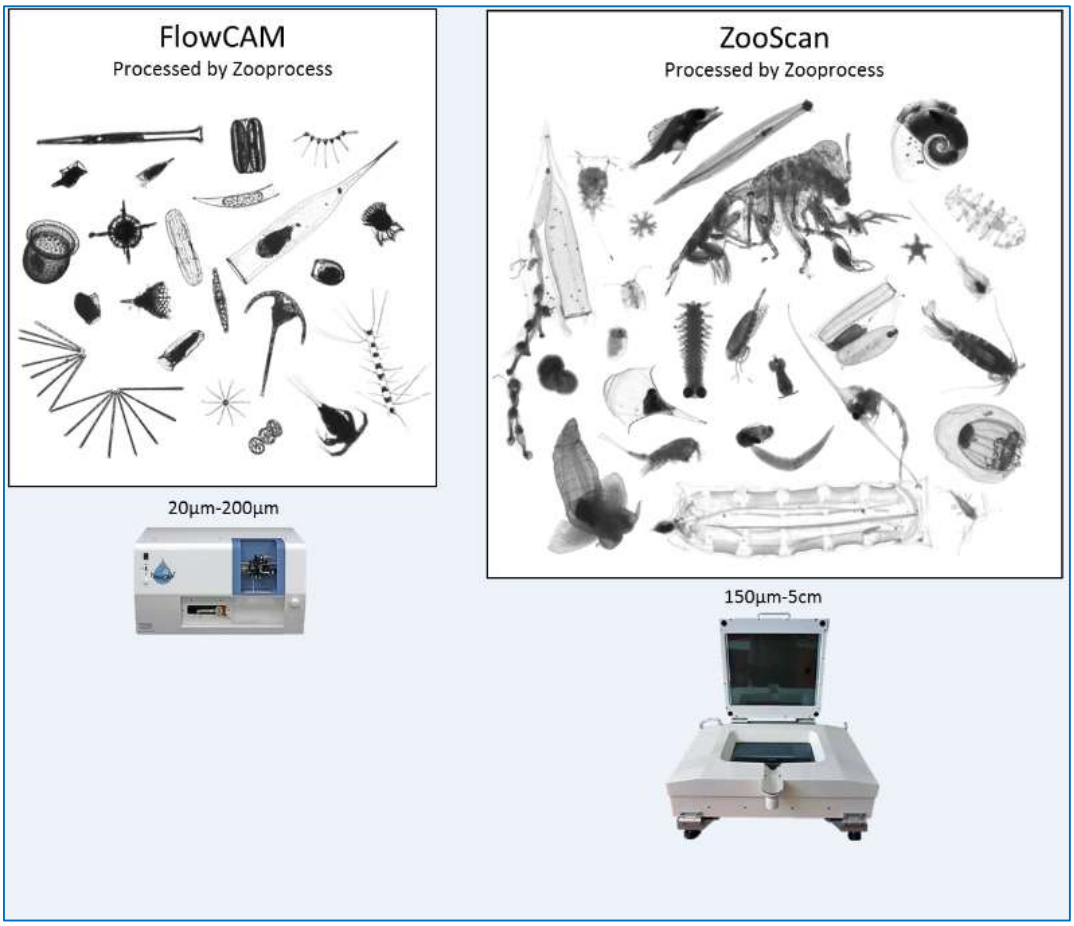


Figure 52. Illustrations of the successive use of FlowCAM and ZooScan for analysis of plankton.

ECOTAXA is a web-based application used to efficiently classify images of organisms using a reference taxonomy (http://unieuk.org/). Images, associated metadata and descriptive variables are loaded for each organism and used to predict identification (automatic classification). The user can then validate (check and make a finer sorting) on the web by visualizing the classified images using an efficient interface. All operations are recorded to allow close control of the tasks. ECOTAXA currently supports more than 5,000,000 images acquired by different instruments and about 30% have been validated by experts, which makes it the largest database of sorted images of plankton.

The data treatment and interpretation issued from ZooScan and FlooCam was performed by Cplankton company, specialised in the study of the functioning of planktonic food webs in their environment or in the face of environmental disturbances of anthropic origin or linked to climate change.

6.2.4. Laboratory method for sediment analysis

Sediment samples analysis are listed in the following table:

Table 49. Limit of detection (LoD) of sediment parameter analysis

Sediment Parameter	Methods	LoD
Full Particle Size Analysis (sieve and laser diffraction)	Diffraction laser and physical sieve	0.02 µm to 2000 µm
Moisture Content	Documented in-house method, oven drying @ 105°C, TMSS	0.20%
Total Organic Matter by LOI	Determination of loss on ignition at 450°C by gravimetry	0.2% m/m
Total Organic Carbon	Documented in-house method with carbonate removal and sulphurous acid digestion and high temperature combustion at 1600°C/NDIR, WSLM5	0.02% m/m
Total Nitrogen as N	Documented in-house method using Konelab discrete analyser, No AMMAR	0.05%
Total Phosphorous	Documented in-house method using aqua regia extraction and ICP-OES, ICP-SOIL	4 mg/kg
Metals Analysis by Aqua Regia Digest. Al, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Ti, Zn and V	method using aqua regia extraction and ICP-MS, ICP-MSS and ICP-OES, ICP-SOIL	0.01 - 36 mg/kg
Ba by Fusion	Fusion	100 mg/kg
Total Petroleum Hydrocarbons (TPH)	method using marine specification by GC-FID, TPHFIDUS	0.001 ppm = 1 µg/kg
Aliphatic hydrocarbons	method using marine specification by GC-FID, TPH-SED	0.001 ppm = 1 µg/kg
PAHs (16 USEPA) + NPD	method using DTI specification by GC-MS, PAH-SED	0.001 ppm = 1 µg/kg
BTEX (Benzene. Ethyl Benzene. Toluene. O.M.P-Xylenes)	method using headspace GC-MS, VOCHSAS	0.001-0.005 ppm = 1 - 5 µg/kg
Total heterotrophic microorganisms (yeast. fungi and bacteria) - TAF	Numeration - NPP	500 NPP/g
Hydrocarbon adapted microorganisms (yeast. fungi and bacteria) - AFAH	Numeration - NPP	5 NPP/ml

6.2.5. Methods for Benthic macrofauna analysis

6.2.5.1. Laboratory analyses

Samples were analysed by Anchor Environmental Consultants in South Africa. In the laboratory, samples were rinsed in a 500 µm sieve to remove formalin and stained with Rose Bengal to facilitate the separation of biological and non-biological matter. All fauna was removed and preserved in 1% phenoxytol (Ethyleneglycolmonophenyl ether) solution.

The macrofauna were examined under a dissecting and/or compound microscope and then identified to species level where possible, but at least to family level in all instances. The validity of each species was then checked on The World Register of Marine Species (WoRMS, www.marinespecies.org).

The biomass (blotted wet mass to four decimal places) and abundance of each species was recorded for each sample. Molluscs were weighed in their shells.

In order to remain consistent with benthic infaunal sampling methods (Steffani 2015), classic planktonic species such as Euphausiacea or hyperiid amphipods and Foraminifera that were present in the samples were excluded from all subsequent analyses as it is likely that these species were picked up while the corer was descending though the water column and were not bona fide members of the benthic infaunal community. Voucher/reference specimens of all species identified were preserved with a label both inside and outside the vial.

Photographs were taken of preserved reference specimens using a photomicroscope to create a photographic reference collection.

6.2.5.2. Data treatment

Biological index calculations

The analysis is focusing on benthic species. Then, a first examination is done on the samples to exclude non benthic organisms. However, on Block 2912, all taxa were included in the below analyses as none were exclusively pelagic species.

Six macrofaunal community descriptors, including the number of taxa, abundance, biomass, species richness (Margalef), Shannon–Wiener diversity index and Pielou's evenness index were calculated using the DIVERSE function in PRIMER v.6.1.11 (Plymouth Routines in Multivariate Ecological Research; Clarke & Gorley 2006), and visualised using RStudio, as well as ArcMap 10.8.2 and ArcGIS Pro 3.0.0.

Laboratory data are used to describe the main components of the benthic population:

- The total **number of species** present at each station.
- **Density / Abundance**, i.e., the number of individuals per species and per m².
- **Biomass**, i.e., the weight of dry matter sampled and per m^2.
- **Shannon-Weiner diversity** index (H') which express the specific diversity of a community and is calculated for each sampling location using PRIMER

$$H' = - \Sigma_i p_i (\log p_i)$$

Where p_i is the proportion of the total sample contributed by the i(th) species.

H' is maximum (H'max) when all species are equally abundant and close to 0 when one species predominates in the population to the detriment of others. It is a mean of characterizing the structural equilibrium of a population: H' will be highest in populations with high species richness and even distribution of species. The lowest values occur for population dominated by single species or with a small number of species

- **Pielou's evenness index** which is a measure of evenness of individual abundance between the different species, with variations between 0 (corresponding to the presence of a single species in the sample) and 1 (when all the species have the same abundance):

$$J' = -\Sigma\, p_i \ln(p_i)/\ln(S)$$

Where pi is the proportion of the total sample contributed by the i(th) species and S is the number of species recorded in the sample.

J'=1 represents a community with perfect evenness, and J' decreases to zero as the relative abundances of the species diverge from evenness.

- **Margalef richness index** which use another formula to calculate the specific diversity of a community:

  D = (S-1)/ln(N)

  Where S is the number of species, and N is the total number of individuals in the sample.

  D=0 when all individuals are of the same species and D is maximum when each individual belongs to a different species (S=N). Values below 2.0 are considered to be related to areas of low biodiversity and values above 6.0 are considered indicators of high biodiversity.

Statistical analysis

For multivariate analyses, the unstandardised and untransformed abundance data were converted to a similarity matrix using the Bray-Curtis similarity coefficient. Subsequently, **one-way analysis of similarity** (ANOSIM) and **non-metric multidimensional scaling (SIMPER)** ordination routines were performed to assess and visualise the macrofaunal (dis)similarities between sites, by the chosen factors:

- **ANOSIM** is an approximate equivalent of ANOVA, enabling a non-parametric test for statistically significant differences in the assemblage composition between sample groups specified by an *a priori* factor (Clarke & Gorley 2006), with the significance of this statistical test assigned here at the 5% level.

- **SIMPER** (similarity percentage analysis) is an exploratory analysis which indicates the species principally responsible for differences within/between sets of samples (Clarke & Gorley 2006) and was thus used to assess the extent of similarity within groups defined by significant factor(s), while also identifying the species contributing to the observed (dis)similarity.

PRIMER software was also used to generate a Michaelis-Menton species accumulation curve to determine whether the sampling effort had been sufficient to accurately document the benthic macrofauna diversity in Block 2912.

Species composition

Community composition was also analyzed: dominant species in terms of abundance or biomass, as well as relative contribution of the different taxa groups to the total abundance.

6.2.5.3. Macrobenthic mapping

In order to interpret spatial variations in macrobenthic characteristics, some maps were drawn by geographical interpolation of data using a method of crawling on Global Mapper. We underline that these spatial representations which illustrate distribution of biological parameters throughout the block B2912 should not be considered as a through geostatistical approach but rather a graphical view to potentially illustrate particularities or large-scale gradients.

6.3. Appendix III - Service Warranty

This report, with its associated works and services, has been designed solely to meet the requirements of the contract agreed with you, our client. If used in other circumstances, some or all of the results may not be valid, and we can accept no liability for such use. Such circumstances include different or changed objectives, use by third parties, or changes to, for example, site conditions or legislation occurring after completion of the work. In case of doubt, please consult Creocean.

6.4. Appendix IV – Particle Size Distribution

Aperture	S01	S03	S04	S06	S07	S08	S10	S11	S12	S13	S14	S15	S16	S19	S20	S21	S22	S23	S24	S27	S28	S30	S31	S32	S33	S34	S35	S37	S38	S39	S40
(mm)	(%)																														
8	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
4	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
2	0,0340	0,0001	0,0524	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0404	0,0819	0,0001	0,1309	0,0001	0,0001	0,0001	0,0001	0,0506	0,0403	0,0369	0,0001	0,0837	0,0364	0,0858	0,0001	0,0001	0,0001	0,0001	0,0001
1	0,0680	0,0833	0,1048	0,0624	0,0773	0,0405	0,0659	0,0846	0,0726	0,0417	0,0958	0,0809	0,0411	0,0672	0,0874	0,0761	0,0289	0,0634	0,0995	0,1012	0,0806	0,0738	0,0841	0,0838	0,0728	0,0859	0,0864	0,0854	0,0336	0,0671	0,0804
0,71	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0238	0,0001	0,0001	0,0012	0,0001	0,0001	0,0160	0,0001	0,0012	0,0001	0,0001	0,0001	0,0001	0,2893	0,0001	0,0001	0,0001	0,0007	0,0005	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
0,5	0,0924	0,0001	0,0001	0,0001	0,0001	0,0001	0,2310	0,0001	0,0529	0,4075	0,2148	0,0001	0,3125	0,0996	0,3628	0,0001	0,0518	0,0001	0,0001	1,2609	0,0001	0,0001	0,0001	0,2684	0,2409	0,0698	0,0063	0,0132	0,1454	0,0001	0,0195
0,355	2,0271	0,0001	0,0001	0,0001	0,0001	0,0001	0,2665	0,0001	0,4788	1,2831	1,1894	0,0001	0,5423	0,2706	1,0055	0,0005	0,6273	0,0001	0,0001	2,6524	0,0001	0,0001	0,0001	1,0054	0,9134	0,9124	0,1117	0,4115	0,7028	0,0001	0,4898
0,25	4,2629	0,0001	0,0001	0,0001	0,0001	0,0001	0,2428	0,0299	0,9826	1,9796	2,1567	0,0001	0,5617	0,3226	1,4811	0,2641	1,3142	0,0006	0,0010	3,8223	0,0001	0,1425	0,0238	1,7055	1,5726	2,1340	0,1528	1,1189	1,1788	0,0001	1,3098
0,18	4,0640	0,0219	0,0343	0,1381	0,0008	0,0002	0,3935	0,3811	1,4525	2,2148	2,4158	0,1624	0,6730	0,5694	1,6137	0,9118	1,5440	0,3326	0,2559	3,8635	0,0001	1,0022	0,6555	2,0078	1,9001	2,8218	0,3362	1,5663	1,4479	0,0002	1,8850
0,125	3,8752	0,5115	1,2132	0,7759	0,4796	0,1582	1,0602	1,2567	2,5058	3,1457	3,0887	1,1144	1,4036	1,4051	2,1485	1,9353	2,2739	1,8406	0,9555	4,4163	0,1928	2,3550	2,1268	2,8727	2,6802	4,1025	0,9683	2,4724	2,4045	0,1835	2,8727
0,09	3,7223	1,2830	3,2334	1,5346	1,5502	0,6987	1,8804	2,2546	3,2007	3,7862	3,4665	1,9241	2,2106	2,2556	2,4696	2,6736	2,9895	3,0448	1,7358	4,3593	1,6878	3,0816	3,1129	3,4362	3,0908	4,6781	1,7290	3,1493	3,3173	0,7857	3,3970
0,063	4,7485	2,5711	4,9977	2,7798	2,6732	1,7275	3,0974	3,6083	4,2531	4,9288	4,5412	2,8936	3,4491	3,4508	3,3165	3,8944	4,2474	4,1990	2,9133	5,1035	3,7293	4,0715	4,1956	4,4925	4,0142	5,6572	2,9019	4,2764	4,6584	1,6492	4,3846
0,044	5,0326	3,8616	5,3511	3,9322	3,3799	3,0508	3,9733	4,4819	4,7479	5,1741	4,9389	3,7284	4,3863	4,2426	3,8618	4,6938	4,8184	4,6963	3,8899	5,0328	4,5899	4,5465	4,6155	4,8490	4,4189	5,5058	3,9088	4,6720	5,0923	2,6350	4,7324
0,0315	4,3365	4,3634	4,7186	4,2753	3,6184	3,9253	4,0556	4,4739	4,6587	4,4696	4,4230	4,0961	4,6621	4,3799	3,9071	4,6368	4,4799	4,4735	4,1437	4,2124	4,3027	4,3874	4,3864	4,5475	4,1368	4,5695	4,2779	4,2361	4,5921	3,3648	4,3390
0,022	4,1009	5,0399	4,7642	4,7152	4,3822	5,1155	4,4466	4,7801	5,4092	4,2457	4,3433	4,9380	5,6136	5,1714	4,6466	4,9611	4,6993	4,7628	4,6706	4,0807	4,7118	4,9115	4,8959	5,1638	4,4093	4,5810	5,1162	4,4254	4,8801	4,5626	4,5425
0,0156	3,7972	5,3317	4,6909	4,7260	4,9918	5,9369	4,6764	4,7888	6,0522	3,9182	4,0973	5,4907	6,3340	5,8070	5,3717	4,9672	4,8584	4,8388	4,8508	4,0331	5,2198	5,4227	5,3834	5,7806	4,6488	4,8130	5,6952	4,7041	5,2891	5,5237	4,7123
0,011	4,8047	7,0171	5,9846	6,2145	6,9532	8,0511	6,3918	6,2099	7,8117	4,9567	5,1858	7,3346	8,1471	7,6611	7,3205	6,3273	6,3847	6,2782	6,4034	5,2210	7,1485	7,2982	7,1769	7,4821	6,2440	6,3264	7,5323	6,4116	6,9862	7,7401	6,2209
0,0078	6,9113	9,6916	8,4065	9,0383	9,8914	10,8430	9,2540	8,8182	9,8162	7,2366	7,5084	10,0229	10,2170	10,0682	9,8287	8,8058	8,8534	8,8344	9,2031	7,1768	9,8455	9,8098	9,6169	9,4230	8,7526	8,3900	10,0822	9,0114	9,2026	10,7906	8,6089
0,0055	9,5254	12,6208	11,3872	12,3952	13,0161	13,5156	12,4323	11,9381	11,5254	10,1669	10,5037	12,8573	12,0748	12,4272	12,2227	11,7850	11,6037	11,8864	12,5956	9,3028	12,5282	12,1746	12,0100	11,0955	11,4686	10,3945	12,7151	11,7523	11,3445	13,9334	11,2252
0,0039	10,5015	13,3396	12,4146	13,5736	13,7965	13,7297	13,3346	12,9904	11,2248	11,3353	11,6467	13,3309	11,8503	12,5413	12,3014	12,6490	12,1910	12,7974	13,7045	9,7959	12,9622	12,2738	12,2309	10,8239	12,0439	10,4890	13,0578	12,2626	11,4459	14,4481	11,7884
0,0028	9,2911	11,5001	10,8513	11,9610	11,8968	11,4783	11,5345	11,3768	9,1110	10,0498	10,1984	11,1801	9,6331	10,3292	10,0388	10,8263	10,2380	10,9782	11,8258	8,4378	11,0455	10,1390	10,2244	8,7861	10,1744	8,6384	10,9136	10,2850	9,4667	12,0722	9,9899
0,002	7,0234	8,5944	8,1076	9,0085	8,8592	8,3844	8,5796	8,5107	6,5291	7,5865	7,5411	8,0859	6,8772	7,3887	7,0944	7,8941	7,3536	8,0134	8,6629	6,3092	8,2457	7,2866	7,4618	6,2929	7,4003	6,1858	7,9138	7,4199	6,8378	8,6913	7,3063
0,0014	4,2271	5,1695	4,8560	5,3724	5,2699	4,9413	5,1001	5,0428	3,8053	4,5813	4,4273	4,7065	3,9959	4,2835	4,0719	4,6150	4,2642	4,6699	5,0726	3,7763	4,9813	4,2046	4,4036	3,6610	4,3453	3,5871	4,6478	4,3179	4,0125	5,0514	4,3056
0,001	2,4514	2,9893	2,8540	3,0839	3,0271	2,8369	2,9238	2,8909	2,1643	2,6608	2,5588	2,6855	2,3116	2,4583	2,3149	2,6591	2,4361	2,6912	2,9236	2,1589	2,8440	2,3407	2,5028	2,0827	2,4652	2,0300	2,6519	2,4770	2,2994	2,8602	2,4705
<0.001	5,1049	6,0120	5,9797	6,4150	6,1385	5,5678	6,0384	6,0845	4,1474	5,8324	5,4606	5,3292	4,6077	4,8029	4,4046	5,4257	4,7446	5,6005	6,0944	4,5452	5,8460	4,4429	4,8947	4,0575	4,9721	3,9445	5,1970	4,9336	4,6643	5,6426	5,3217
Mean (mm)	0,013	0,007	0,008	0,007	0,006	0,007	0,007	0,008	0,010	0,011	0,011	0,007	0,009	0,008	0,010	0,009	0,010	0,008	0,007	0,015	0,007	0,009	0,009	0,012	0,010	0,013	0,008	0,010	0,010	0,006	0,010
mean (mm) stdev	0,103	0,021	0,032	0,023	0,021	0,016	0,028	0,029	0,047	0,072	0,072	0,025	0,035	0,031	0,057	0,035	0,050	0,033	0,025	0,121	0,024	0,038	0,035	0,064	0,060	0,073	0,026	0,048	0,050	0,016	0,054
mean (phi)	6,229	7,183	6,891	7,204	7,270	7,256	7,097	7,037	6,577	6,545	6,551	7,074	6,790	6,888	6,705	6,875	6,679	6,902	7,153	6,022	7,085	6,764	6,812	6,431	6,641	6,242	7,039	6,696	6,593	7,333	6,641
Median (mm)	0,009	0,006	0,006	0,006	0,006	0,006	0,006	0,006	0,008	0,007	0,007	0,006	0,008	0,007	0,007	0,007	0,007	0,007	0,006	0,010	0,006	0,007	0,007	0,009	0,007	0,010	0,007	0,007	0,008	0,006	0,007
median (phi)	6,850	7,396	7,266	7,478	7,460	7,376	7,390	7,357	6,915	7,098	7,100	7,302	7,051	7,155	7,090	7,231	7,110	7,262	7,426	6,597	7,322	7,106	7,141	6,814	7,113	6,702	7,262	7,133	7,005	7,454	7,096
Sorting Coefficient	2,609	1,822	2,071	1,883	1,792	1,669	1,952	1,988	2,100	2,446	2,409	1,850	1,966	1,926	2,144	2,050	2,171	2,036	1,892	2,654	1,880	2,017	2,018	2,229	2,259	2,350	1,854	2,172	2,180	1,635	2,255
Sorting Classification	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted
Skewness	-0,286	-0,131	-0,193	-0,167	-0,136	-0,078	-0,188	-0,188	-0,208	-0,277	-0,287	-0,159	-0,174	-0,176	-0,263	-0,210	-0,256	-0,205	-0,175	-0,261	-0,142	-0,216	-0,200	-0,229	-0,274	-0,238	-0,154	-0,254	-0,235	-0,088	-0,250
Skewness Interpretation	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Symmetrical	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Negative (Fine)	Symmetrical	Negative (Fine)
Kurtosis	0,847	1,126	0,995	1,152	1,195	1,135	1,170	1,093	1,000	0,916	0,940	1,150	1,068	1,074	1,138	1,038	1,001	1,043	1,164	0,821	1,125	1,043	1,041	0,980	1,018	0,851	1,126	1,015	0,977	1,191	0,990
Kurtosis Interp	Platykurtic	Leptokurtic	Mesokurtic	Leptokurtic	Leptokurtic	Leptokurtic	Leptokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Leptokurtic	Mesokurtic	Mesokurtic	Leptokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Leptokurtic	Platykurtic	Platykurtic	Leptokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Platykurtic	Leptokurtic	Mesokurtic	Mesokurtic	Leptokurtic	Mesokurtic
Fines (%)	77,11%	95,53%	90,37%	94,71%	95,22%	97,38%	92,74%	92,39%	87,00%	82,21%	82,83%	93,79%	90,71%	91,56%	87,39%	90,25%	86,93%	90,52%	94,04%	74,08%	94,27%	89,24%	89,80%	84,05%	85,48%	79,45%	93,71%	86,91%	86,11%	97,32%	85,56%
Sands (%)	22,86%	4,47%	9,58%	5,29%	4,78%	2,63%	7,26%	7,62%	13,00%	17,79%	17,17%	6,18%	9,21%	8,44%	12,49%	9,76%	13,08%	9,48%	5,96%	25,87%	5,69%	10,73%	10,20%	15,87%	14,49%	20,46%	6,29%	13,09%	13,89%	2,69%	14,44%
Gravel (%)	0,03%	0,00%	0,05%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,04%	0,08%	0,00%	0,13%	0,00%	0,00%	0,00%	0,00%	0,05%	0,04%	0,04%	0,00%	0,08%	0,04%	0,09%	0,00%	0,00%	0,00%	0,00%	0,00%
Wentworth Classification	Fine Silt	V. Fine Silt	Fine Silt	V. Fine Silt	V. Fine Silt	V. Fine Silt	V. Fine Silt	V. Fine Silt	Fine Silt	Fine Silt	Fine Silt	V. Fine Silt	Fine Silt	Fine Silt	Fine Silt	Fine Silt	Fine Silt	Fine Silt	V. Fine Silt	Fine Silt	V. Fine Silt	Fine Silt	Fine Silt	Fine Silt	Fine Silt	Fine Silt	V. Fine Silt	Fine Silt	Fine Silt	V. Fine Silt	Fine Silt

6.5. Appendix V – Redox, pH and NORM in Sediment

Station	Water Depth (m)	Time (UTC+2)	Date	NORM		Observed Redox		pH	
				αβ Background*	αβ	1cm	10cm	1cm	10cm
S01	3,532	13:50	04/09/2022	0.28	0.49	152mV @ 9.0 °C	121mV @ 6.0 °C	8.0 @ 7.0 °C	7.9 @ 5.0 °C
S03	3,324	05:39	04/09/2022	0.28	0.83	204mV @ 7.7 °C	180mV @ 5.1 °C	7.5 @ 8.1 °C	7.1 @ 4.6 °C
S04	3,182	11:03	01/10/2022	0.29	0.66	258mV @ 12.4 °C	253mV @ 8.7 °C	7.2 @ 12.9 °C	7.0 @ 8.0 °C
S06	3,435	18:47	04/09/2022	0.36	0.56	201mV @ 7.0 °C	176mV @ 5.0 °C	7.9 @ 9.0 °C	7.9 @ 5.0 °C
S07	3,308	03:00	04/09/2022	0.26	0.36	236mV @ 7.8 °C	232mV @ 6.4 °C	7.5 @ 8.5 °C	7.5 @ 6.5 °C
S08	3,208	14:47	01/10/2022	0.43	0.46	176mV @ 8.0 °C	140mV @ 5.0 °C	7.2 @ 9.9 °C	6.8 @ 4.2 °C
S10	3,423	22:53	04/09/2022	0.56	0.43	238mV @ 8.0 °C	208mV @ 6.0 °C	7.0 @ 9.0 °C	7.7 @ 5.0 °C
S11	3,326	00:20	04/09/2022	0.24	0.39	270mV @ 8.0 °C	276mV @ 5.3 °C	7.9 @ 8.4 °C	7.8 @ 4.2 °C
S12	3,23	18:00	01/10/2022	0.01	0.29	295mV @ 6.0 °C	242mV @ 5.0 °C	7.0 @ 7.0 °C	6.3 @ 4.7 °C
S13	3,585	06:06	05/09/2022	0.33	0.66	159mV @ 7.7 °C	138mV @ 6.6 °C	7.9 @ 8.7 °C	7.7 @ 6.3 °C
S14	3,495	02:24	05/09/2022	0.39	0.53	230mV @ 8.2 °C	222mV @ 5.0 °C	7.5 @ 8.7 °C	6.7 @ 4.7 °C
S15	3,37	21:25	03/09/2022	0.36	0.43	264mV @ 8.0 °C	270mV @ 6.0 °C	7.0 @ 9.0 °C	7.0 @ 5.0 °C
S16	3,268	21:04	01/10/2022	0.43	0.59	203mV @ 8.5 °C	180mV @ 5.8 °C	7.5 @ 10.0 °C	7.3 @ 5.2 °C
S19	3,394	18:27	03/09/2022	0.16	0.33	190mV @ 5.0 °C	146mV @ 5.0 °C	8.0 @ 5.0 °C	8.0 @ 4.4 °C
S20	3,301	00:25	02/09/2022	0.36	0.56	165mV @ 8.1 °C	150mV @ 6.7 °C	7.3 @ 8.9 °C	7.5 @ 5.9 °C
S21	3,626	10:47	05/09/2022	0.19	0.63	325mV @ 7.7 °C	284mV @ 6.0 °C	6.7 @ 8.1 °C	6.9 @ 5.4 °C
S22	3,528	14:32	05/09/2022	0.26	0.53	137mV @ 9.5 °C	100mV @ 6.0 °C	7.5 @ 11.0 °C	7.0 @ 6.0 °C
S23	3,411	15:42	03/09/2022	0.36	0.19	245mV @ 10.0 °C	197mV @ 5.0 °C	7.0 @ 12.0 °C	7.2 @ 5.1 °C
S24	3,3	03:40	02/09/2022	0.26	0.63	230mV @ 7.1 °C	197mV @ 5.6 °C	5.6 @ 7.6 °C	6.0 @ 4.3 °C
S27	3,339	09:45	03/09/2022	0.28	0.69	148mV @ 9.1 °C	148mV @ 5.5 °C	8.8 @ 0.7 °C	8.7 @ 6.1 °C
S28	3,06	06:14	02/09/2022	0.36	0.46	302mV @ 7.2 °C	258mV @ 6.3 °C	7.1 @ 7.5 °C	7.1 @ 5.1 °C
S30	3,387	18:07	05/09/2022	0.39	0.29	222mV @ 8.0 °C	195mV @ 6.0 °C	7.0 @ 9.0 °C	7.6 @ 5.0 °C
S31	3,175	07:10	03/09/2022	0.28	0.23	226mV @ 7.6 °C	194mV @ 4.7 °C	8.1 @ 8.3 °C	8.2 @ 5.1 °C
S32	2,993	08:43	02/09/2022	0.36	0.26	403mV @ 7.6 °C	309mV @ 4.5 °C	6.6 @ 7.9 °C	7.9 @ 4.2 °C
S33	3,438	21:15	05/09/2022	0.53	0.33	254mV @ 8.0 °C	246mV @ 5.0 °C	6.0 @ 9.0 °C	5.2 @ 5.0 °C
S34	3,232	04:00	03/09/2022	0.31	0.56	341mV @ 8.5 °C	352mV @ 5.5 °C	6.9 @ 9.2 °C	7.0 @ 5 °C
S35	3,01	11:08	02/09/2022	0.31	0.63	238mV @ 7.6 °C	226mV @ 6.7 °C	8.8 @ 8.3 °C	7.8 @ 5.5 °C
S37	3,276	01:05	03/09/2022	0.24	0.53	320mV @ 6.9 °C	324mV @ 5.9 °C	7.2 @ 7.2 °C	8.1 @ 4.8 °C
S38	3,145	13:33	02/09/2022	0.33	0.59	179mV @ 8.0 °C	114mV @ 4.8 °C	8.0 @ 7.0 °C	8.0 @ 5.5 °C
S39	3,306	22:24	02/09/2022	1.36	1.46	323mV @ 7.0 °C	294mV @ 5.0 °C	7.2 @ 8.0 °C	7.3 @ 5.0 °C
S40	3,227	19:29	02/09/2022	0.29	0.73	217mV @ 8.0 °C	178mV @ 5.0 °C	8.0 @ 9.0 °C	8.0 @ 5.0 °C

Notes: **Background reading taken prior to reading of each sediment sample. NORM calibration performed by manufacturer prior to deployment.*

6.6. Appendix VI – Organic and Nutrient Content in Sediment

Station	Depth (m)	Total Organic Matter (% m/m)	Total Organic Carbon (% m/m)	Moisture Content (%)	Phosphorus as P (mg/kg)	Total Nitrogen as N (%)	Score Alzieu
S01	3,532	3.4	0.60	56.2	220	0.05	1
S03	3,324	3.4	0.71	58.3	269	0.05	1
S04	3,182	3.6	0.65	54.4	182	0.05	1
S06	3,435	3.6	0.64	55.2	260	0.05	1
S07	3,308	3.6	0.60	57.3	275	0.06	2
S08	3,208	3.7	0.67	57.0	283	0.06	2
S10	3,423	3.6	0.64	55.0	271	0.05	1
S11	3,326	3.9	0.72	56.5	245	0.06	2
S12	3,230	3.7	0.67	58.0	261	0.07	2
S13	3,585	3.4	0.63	54.0	220	0.05	1
S14	3,495	3.4	0.63	56.1	266	0.05	1
S15	3,370	3.7	0.75	55.2	273	0.06	2
S16	3,268	3.6	0.65	55.6	283	0.06	2
S19	3,394	3.3	0.68	58.6	257	0.05	1
S20	3,301	3.5	0.74	57.4	284	0.06	2
S21	3,626	3.4	0.60	55.0	253	<0.05	1
S22	3,528	3.2	0.62	54.1	224	0.05	1
S23	3,411	3.5	0.63	56.6	266	0.05	1
S24	3,300	3.9	0.71	56.6	184	0.06	2
S27	3,339	3.3	0.56	55.0	236	0.05	0
S28	3,060	3.3	0.54	53.8	280	0.05	0
S30	3,387	3.5	0.59	54.3	274	0.05	0
S31	3,175	3.2	0.63	56.8	265	0.05	1
S32	2,993	3.6	0.65	59.1	287	0.06	2
S33	3,438	3.2	0.61	53.2	255	0.05	1
S34	3,232	3.8	0.37	52.9	250	0.05	0
S35	3,010	4.0	0.36	55.3	271	<0.05	0
S37	3,276	3.6	0.34	54.6	207	0.05	0
S38	3,145	3.9	0.40	53.8	249	0.05	0
S39	3,306	4.1	0.38	55.9	266	0.06	1
S40	3,227	3.6	0.43	57.8	241	0.05	0
Mean		**3.6**	**0.59**	**55.8**	**253.5**	**0.05**	**1.0**
SD		**0.2**	**0.12**	**1.6**	**27.8**	**0.01**	**0.8**
Min		**3.2**	**0.3**	**52.9**	**182.0**	**0.1**	**0**
Max		**4.1**	**0.8**	**59.1**	**287.0**	**0.1**	**2**

6.7. Appendix VII – Total Hydrocarbon and Total Alkane Concentrations in Sediment

Station	THC (µg/kg)	Total n-alkanes (µg/kg)	Carbon Preference Index	Pristane (µg/kg)	Phytane (µg/kg)	Pristane/ Phytane Ratio	P/b ratio	Proportion of Alkanes (%)	Total PAHs (µg/kg)	NPD (µg/kg)	NPD (%)
S01	854	119	3.91	<1	<1	-	0.00	13.88	0.00	0.00	-
S03	1,423	131	2.93	<1	<1	-	0.06	9.23	0.00	0.00	-
S04	1,210	148	3.32	<1	<1	-	0.00	12.26	0.00	0.00	-
S06	1,328	119	3.87	<1	<1	-	0.00	8.96	0.00	0.00	-
S07	1,069	119	3.47	<1	<1	-	0.00	11.13	0.00	0.00	-
S08	1,097	148	1.95	<1	<1	-	0.00	13.51	0.00	0.00	-
S10	917	117	2.96	<1	<1	-	0.00	12.72	0.00	0.00	-
S11	1,510	188	3.17	6.1	<1	-	0.04	12.43	0.00	0.00	-
S12	1,748	126	3.02	<1	<1	-	0.02	7.22	0.00	0.00	-
S13	1,010	145	2.82	<1	<1	-	0.00	14.36	0.00	0.00	-
S14	1,124	117	3.39	<1	<1	-	0.00	10.39	0.00	0.00	-
S15	1,010	127	3.16	<1	<1	-	0.00	12.55	0.00	0.00	-
S16	1,010	152	2.40	<1	<1	-	0.00	15.06	0.00	0.00	-
S19	1,655	145	3.05	<1	<1	-	0.00	8.79	0.00	0.00	-
S20	1,518	175	3.41	<1	<1	-	0.02	11.52	0.00	0.00	-
S21	1,006	104	4.53	<1	<1	-	0.00	10.32	0.00	0.00	-
S22	1,307	143	3.12	<1	<1	-	0.02	10.93	0.00	0.00	-
S23	850	125	2.63	<1	<1	-	0.00	14.67	0.00	0.00	-
S24	1,176	131	3.41	<1	<1	-	0.00	11.18	0.00	0.00	-
S27	1,204	157	2.66	<1	<1	-	0.00	13.05	0.00	0.00	-
S28	1,390	130	3.36	<1	<1	-	0.01	9.37	0.00	0.00	-
S30	1,073	115	2.56	<1	<1	-	0.00	10.70	0.00	0.00	-
S31	1,819	134	2.71	<1	<1	-	0.08	7.38	0.00	0.00	-
S32	1,861	145	2.78	<1	<1	-	0.00	7.80	0.00	0.00	-
S33	883	111	2.75	<1	<1	-	0.00	12.52	0.00	0.00	-
S34	1,276	175	1.96	<1	<1	-	0.00	13.70	0.00	0.00	-
S35	827	131	2.77	<1	<1	-	0.00	15.87	0.00	0.00	-
S37	1,407	125	2.62	<1	<1	-	0.00	8.87	0.00	0.00	-
S38	1,464	120	3.06	<1	<1	-	0.00	8.22	0.00	0.00	-

S39	1,366	127	2.41	<1	<1	-	0.00	9.33	0.00	0.00	-
S40	1,646	131	2.91	<1	<1	-	0.00	7.94	0.00	0.00	-
SD	**292**	**20**	**0.55**	**-**	**-**	**-**	**0.02**	**2.41**	**-**	**-**	**-**
Min	**827**	**104**	**1.95**	**-**	**-**	**-**	**0.00**	**7.22**	**-**	**-**	**-**
Max	**1 861**	**188**	**4.53**	**-**	**-**	**-**	**0.08**	**15.87**	**-**	**-**	**-**

6.8. Appendix VIII – PAH Concentrations in Sediment

Units: (µg/kg)

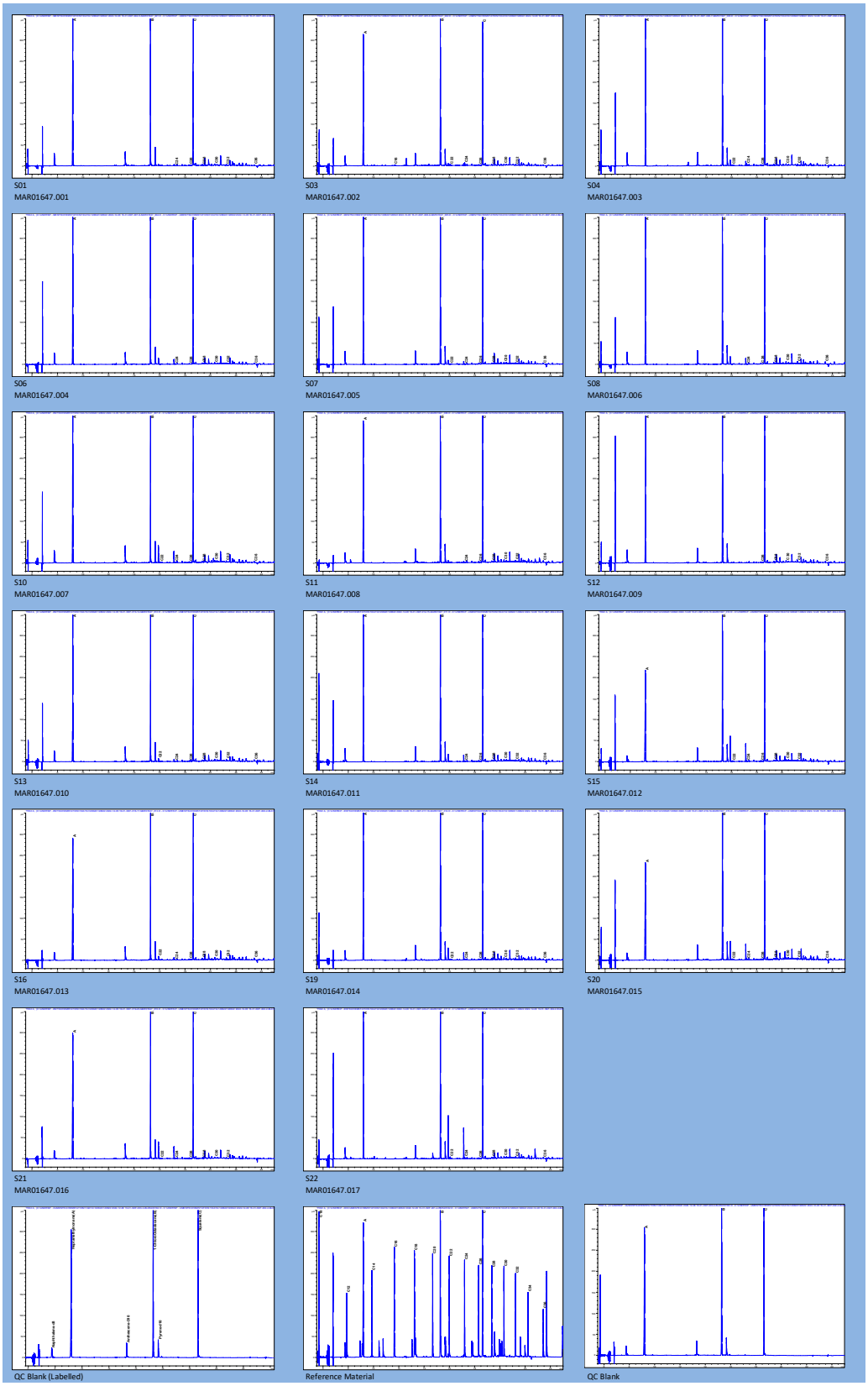
Station	S01	S03	S04	S06	S07	S08	S10	S11	S12	S13	S14	S15	S16	S19	S20	S21	S22	S23	S24	S27	S28	S30	S31	S32	S33	S34	S35	S37	S38	S39	S40
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C4 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Naphthalenes	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Phenanthrene / Anthracene	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C1 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 178	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Dibenzthiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Dibenzthiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Dibenzothiophenes	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Fluoranthene / Pyrene	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C1 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 202	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Benzanthracene / Chrysene	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C1 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 228	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Benzfluoranthenes / Benzopyrenes	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C1 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 252	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Aranthanthrenes / Indenopyrene / Benzperylene	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C1 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 276	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Sum of all PAHs	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
Sum of NPD fraction	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
NPD/4-6 Ring PAH Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

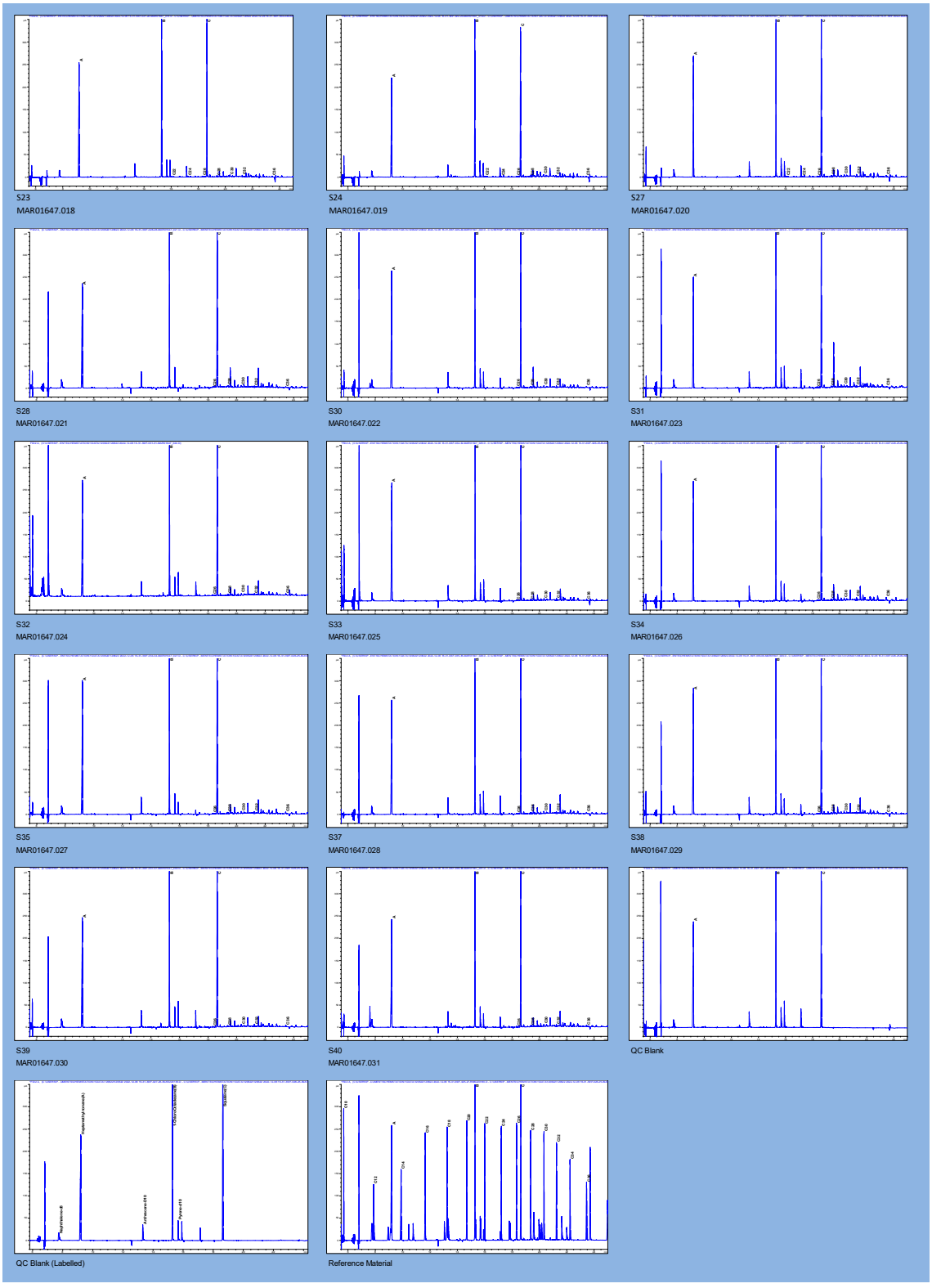
6.9. Appendix IX – Alkane Concentrations in Sediment

Units: (µg/kg)

Station	S01	S03	S04	S06	S07	S08	S10	S11	S12	S13	S14	S15	S16	S19	S20	S21	S22	S23	S24	S27	S28	S30	S31	S32	S33	S34	S35	S37	S38	S39	S40
nC10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC11	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC12	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC14	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2,41	<1	<1	<1	<1	<1	<1	<1	<1
nC15	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC16	<1	2,76	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC17	<1	1,76	<1	<1	<1	<1	<1	6,74	2,08	<1	<1	<1	<1	<1	<1	<1	2,87	<1	<1	<1	1,24	<1	3,20	<1	<1	<1	<1	<1	<1	<1	<1
Pristane	<1	<1	<1	<1	<1	<1	<1	6,06	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC18	<1	1,53	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1,19	<1	<1	<1	<1	<1	<1	<1	<1
Phytane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC19	<1	1,66	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2,77	<1	<1	<1	<1	<1	<1	<1	2,23	<1	<1	<1	<1	<1	<1	<1	<1
nC20	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1,23	<1	<1	<1	<1	<1	<1	<1	<1
nC21	1,50	1,89	2,41	<1	1,91	2,07	1,56	2,09	1,92	1,96	1,09	1,79	1,66	2,55	4,37	1,27	3,87	<1	2,72	3,28	2,33	1,86	1,13	2,62	1,42	<1	2,18	2,41	1,83	1,78	<1
nC22	<1	<1	1,26	<1	<1	<1	1,21	1,32	<1	<1	<1	<1	1,31	<1	<1	<1	<1	<1	<1	1,15	1,11	<1	1,26	<1	<1	<1	<1	<1	1,26	<1	<1
nC23	1,62	1,39	1,62	2,77	2,29	1,63	2,11	2,64	2,80	1,85	2,73	2,75	2,63	2,46	2,72	2,91	2,71	1,49	2,35	2,96	2,18	3,03	3,38	2,97	1,37	2,78	3,43	2,93	2,29	2,63	3,05
nC24	1,57	5,46	7,46	1,75	2,20	2,05	2,41	1,49	1,20	1,53	2,01	2,82	1,90	2,93	5,16	2,51	5,55	3,62	2,16	2,41	3,77	5,43	4,47	3,90	2,71	3,94	2,81	6,46	2,63	3,15	3,01
nC25	4,29	5,18	4,53	4,24	4,25	4,38	4,25	4,90	4,14	4,15	4,13	4,22	4,44	4,58	3,94	3,78	3,82	4,06	4,26	4,46	4,11	3,75	3,21	4,91	3,77	4,15	4,08	3,06	3,90	3,64	4,13
nC26	2,57	3,10	2,67	2,57	2,51	3,08	2,62	3,50	2,96	2,52	2,54	2,70	2,97	3,15	3,36	2,32	3,31	2,85	2,89	2,53	2,30	2,41	2,73	4,74	3,05	3,14	3,16	2,92	2,64	2,82	3,04
nC27	7,88	7,85	7,90	7,50	7,70	8,36	7,76	9,87	7,36	7,93	7,46	7,66	7,95	8,57	8,99	7,04	8,13	8,30	8,03	8,35	7,20	6,96	8,03	9,24	7,45	7,36	8,14	7,61	8,00	7,10	7,75
nC28	3,72	3,59	3,85	3,52	3,91	5,59	3,51	5,02	4,16	4,16	4,38	4,67	4,80	4,43	4,25	2,97	4,33	4,60	3,86	4,61	3,50	4,07	4,64	5,20	4,73	5,14	4,78	4,44	4,72	4,98	4,63
nC29	20,5	19,9	19,3	19,3	21,6	22,9	21,4	25,3	19,1	22,2	26,0	19,6	20,5	23,0	25,7	18,9	21,9	20,3	24,3	25,0	25,0	18,3	25,1	23,3	18,3	19,7	20,4	21,5	21,2	18,7	23,6
nC30	5,01	4,78	5,06	5,27	5,83	8,11	6,68	8,71	6,24	6,63	4,72	5,55	7,54	6,64	8,38	4,57	6,97	7,20	7,62	7,48	6,88	4,11	4,55	7,14	6,68	7,63	6,49	7,45	6,86	6,62	7,45
nC31	37,2	34,5	37,2	34,1	33,4	37,6	33,3	37,1	31,7	35,1	34,0	31,5	35,3	36,7	37,0	30,7	37,4	35,0	35,5	41,4	35,2	30,5	35,5	37,2	28,4	31,3	32,8	31,1	31,0	30,5	32,1
nC32	3,46	3,16	4,08	3,94	3,94	8,52	4,21	6,86	5,20	6,68	4,36	4,48	7,60	6,15	5,29	2,81	5,35	5,62	5,01	7,72	5,03	5,51	6,55	5,50	5,07	9,03	5,47	5,24	4,18	5,73	5,69
nC33	15,2	15,2	16,7	13,7	12,1	18,7	13,9	17,3	13,5	17,1	11,4	11,2	16,3	14,6	14,1	11,6	22,0	14,9	15,4	17,9	15,2	11,9	12,4	17,4	11,5	21,9	15,0	13,2	14,1	16,4	16,7
nC34	3,55	4,60	6,00	3,63	3,50	10,3	4,55	8,54	6,13	7,42	4,11	7,11	7,61	5,91	5,60	2,41	5,43	5,58	4,78	9,98	3,64	5,74	4,99	6,55	3,88	14,1	6,42	5,29	5,17	6,31	5,21
nC35	2,74	3,23	14,4	3,04	3,52	2,23	2,85	22,1	3,69	3,38	3,37	10,8	2,43	4,21	22,0	3,84	1,81	2,71	3,10	3,48	5,22	3,47	2,34	4,51	4,07	9,98	4,64	3,81	4,70	4,61	4,21
nC36	4,26	4,45	3,93	3,76	4,72	12,6	4,29	9,61	5,53	9,01	4,50	3,14	11,0	6,66	7,60	1,19	3,74	4,87	3,47	7,05	3,60	4,95	2,19	5,40	3,41	16,1	5,70	2,66	2,17	7,69	4,46
nC37	3,52	5,34	10,0	9,99	5,53	<1	<1	14,5	8,51	13,5	<1	6,91	16,2	12,9	13,7	4,99	3,58	3,62	5,92	7,26	2,70	2,81	1,62	4,47	4,69	18,6	5,67	4,80	3,68	4,74	5,66
Total Oil (µg/kg)	**854**	**1423**	**1210**	**1328**	**1069**	**1097**	**917**	**1510**	**1748**	**1010**	**1124**	**1010**	**1010**	**1655**	**1518**	**1006**	**1307**	**850**	**1176**	**1204**	**1390**	**1073**	**1819**	**1861**	**883**	**1276**	**827**	**1407**	**1464**	**1366**	**1646**
Total n-alkanes (µg/kg)	**119**	**131**	**148**	**119**	**119**	**148**	**117**	**188**	**126**	**145**	**117**	**127**	**152**	**145**	**175**	**104**	**143**	**125**	**131**	**157**	**130**	**115**	**134**	**145**	**111**	**175**	**131**	**125**	**120**	**127**	**131**

6.10. Appendix X – Chromatograms for sediment





S23
MAR01647.018

S24
MAR01647.019

S27
MAR01647.020

S28
MAR01647.021

S30
MAR01647.022

S31
MAR01647.023

S32
MAR01647.024

S33
MAR01647.025

S34
MAR01647.026

S35
MAR01647.027

S37
MAR01647.028

S38
MAR01647.029

S39
MAR01647.030

S40
MAR01647.031

QC Blank

QC Blank (Labelled)

Reference Material

6.11. Appendix XI – BTEX Concentrations in Sediment

Station	Benzene (µg/Kg)	Ethylbenzene µg/Kg)	m/p-Xylene (µg/Kg)	o-Xylene (µg/Kg)	Toluene (µg/Kg)
S01	<1.5	<1.5	<4	<1.5	<3.0
S03	<1.5	<1.5	<4	<1.5	<3.0
S04	<1.5	<1.5	<4	<1.5	<3.0
S06	<1.5	<1.5	<4	<1.5	<3.0
S07	<1.5	<1.5	<4	<1.5	<3.0
S08	<1.5	<1.5	<4	<1.5	<3.0
S10	<1.5	<1.5	<4	<1.5	<3.0
S11	<1.5	<1.5	<4	<1.5	<3.0
S12	<1.5	<1.5	<4	<1.5	<3.0
S13	<1.5	<1.5	<4	<1.5	<3.0
S14	<1.5	<1.5	<4	<1.5	<3.0
S15	<1.5	<1.5	<4	<1.5	<3.0
S16	<1.5	<1.5	<4	<1.5	<3.0
S19	<1.5	<1.5	<4	<1.5	<3.0
S20	<1.5	<1.5	<4	<1.5	<3.0
S21	<1.5	<1.5	<4	<1.5	<3.0
S22	<1.5	<1.5	<4	<1.5	<3.0
S23	<1.5	<1.5	<4	<1.5	<3.0
S24	<1.5	<1.5	<4	<1.5	<3.0
S27	<1.5	<1.5	<4	<1.5	<3.0
S28	<1.5	<1.5	<4	<1.5	<3.0
S30	<1.5	<1.5	<4	<1.5	<3.0
S31	<1.5	<1.5	<4	<1.5	<3.0
S32	<1.5	<1.5	<4	<1.5	<3.0
S33	<1.5	<1.5	<4	<1.5	<3.0
S34	<1.5	<1.5	<4	<1.5	<3.0
S35	<1.5	<1.5	<4	<1.5	<3.0
S37	<1.5	<1.5	<4	<1.5	<3.0
S38	<1.5	<1.5	<4	<1.5	<3.0
S39	<1.5	<1.5	<4	<1.5	<3.0
S40	<1.5	<1.5	<4	<1.5	<3.0

6.12. Appendix XII – Microflora Concentrations in Sediment

Station	Hydrocarbon bacteria (NPP/g)	Heterotrophic bacteria (NPP/g)	Ratio (%)
S01	600	7,000,000	1.00
S03	250	7,000,000	0.01
S04	2,500	>11,000,000	0.00
S06	2,500	>11,000,000	0.02
S07	2,500	2,500,000	0.02
S08	2,500	7,000,000	0.10
S10	2,500	600,000	0.04
S11	2,500	>11,000,000	0.42
S12	>11,000	>11,000,000	0.02
S13	>11,000	>11,000,000	0.10
S14	>11,000	>11,000,000	0.10
S15	250	1,300,000	0.10
S16	250	2,500,000	0.02
S19	250	>11,000,000	0.01
S20	250	>11,000,000	0.00
S21	250	2,500,000	0.00
S22	250	>11,000,000	0.01
S23	600	>11,000,000	0.00
S24	2,500	2,500,000	0.01
S27	250	>11,000,000	0.10
S28	250	600,000	0.00
S30	250	1,300,000	0.04
S31	250	7,000,000	0.02
S32	7,000	>11,000,000	0.00
S33	60	7,000,000	0.06
S34	250	2,500,000	0.00
S35	250	>11,000,000	0.01
S37	250	>11,000,000	0.00
S38	60	7,000,000	0.00
S39	2,500	>11,000,000	0.00
S40	2,500	2,500,000	0.02

The ratios were calculated without approximation sign '>'

6.13. Appendix XIII – Benthic Macrofauna Abundance Matrix

Units: nb. individuals per station

Taxa	S01	S03	S04	S06	S07	S08	S10	S11	S12	S13	S14	S15	S16	S19	S20	S21	S22	S23	S24	S27	S28	S30	S31	S32	S33	S34	S35	S37	S38	S39	S40	Mean	SD	Min	Max
Abarenicola affinis africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0,03	0,18	0,00	1
Abyssoninoe sp.	0	0	0	0	0	2	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0,23	0,56	0,00	2
Ampharetidae sp.	0	0	0	0	3	1	0	0	2	0	0	0	0	0	0	0	1	1	2	2	0	1	5	0	2	0	0	0	0	0	0	0,65	1,17	0,00	5
Amphipoda sp.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Antennuloniscus dimeroceras	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0,23	0,76	0,00	3
Arcturidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Aricidea (Acmira) simplex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0,13	0,34	0,00	1
Armandia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,06	0,36	0,00	2
Asellota sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0,03	0,18	0,00	1
Bathygnathia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0,06	0,36	0,00	2
Bivalvia sp. A	0	0	0	1	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	2	0	4	9	0	0	0	0	1,58	4,36	0,00	17
Bivalvia sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6	2	0	0	0	0	0,29	1,13	0,00	6
Bodotriidae sp. A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0,06	0,25	0,00	1
Bodotriidae sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0,03	0,18	0,00	1
Bodotriidae sp. C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,03	0,18	0,00	1
Bonelliidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Capitellidae sp. A	0	0	3	0	0	2	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	1	2	0	0	3	0	0	0	0	0,48	1,00	0,00	3
Capitellidae sp. B	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0,19	0,60	0,00	3
Caudofoveata sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,10	0,54	0,00	3
Chaetozone sp. A	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	0	1	0	0	0	0	0	0	2	0,26	0,58	0,00	2
Chaetozone sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Chauliodoniscus cf. *princeps*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0,10	0,30	0,00	1
Cirratulidae sp.	0	1	0	0	1	0	2	0	3	1	0	1	0	0	1	0	1	1	1	1	0	0	1	1	0	2	0	2	0	0	0	0,65	0,80	0,00	3
Copepoda sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Cuspidariidae sp.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,06	0,25	0,00	1
Dendrobranchiata sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,03	0,18	0,00	1
Desmosoma sp.	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	3	0	0,23	0,62	0,00	3
Diplocirrus sp.	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,06	0,36	0,00	2
Eurycopinae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0,06	0,25	0,00	1
Gastropoda sp.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0,06	0,25	0,00	1
Gnathiidae sp.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Goniada sp.	0	0	1	0	0	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	1	0	0,35	0,80	0,00	4
Haplomesus sp.	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0,13	0,43	0,00	2
Haploniscus sp.	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0,35	0,95	0,00	4
Hesionidae sp.	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Hippomedon sp.?	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,06	0,25	0,00	1
Holothuroidea sp.?	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Jasmineira sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	2	0	0	0	0	0	0	1	1	0	0	0	0	0	0,29	0,97	0,00	5

Taxa	S01	S03	S04	S06	S07	S08	S10	S11	S12	S13	S14	S15	S16	S19	S20	S21	S22	S23	S24	S27	S28	S30	S31	S32	S33	S34	S35	S37	S38	S39	S40	Mean	SD	Min	Max
Kinbergonuphis sp.	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	1	0	2	0	0	1	0	0	1	0	0	1	0	0	0	0,32	0,60	0,00	2
Leanira quatrefagesi	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	2	1	0	0	0	0	1	0	0	2	0	1	0	0	0,32	0,60	0,00	2
Ledellina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	3	0,16	0,58	0,00	3
Leucon sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Leviapseudes sp. A	0	0	1	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0,19	0,40	0,00	1
Leviapseudes sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Levinsenia sp.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Limatula sp.	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0,16	0,37	0,00	1
Limopsis sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0,06	0,25	0,00	1
Lumbrineris sp. A	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0,16	0,52	0,00	2
Lumbrineris sp. B	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0,06	0,25	0,00	1
Lumbrineris sp. C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Lysianassidae sp. A	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0,10	0,30	0,00	1
Lysianassidae sp. C	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Lysianassidae? sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0,06	0,25	0,00	1
Lysippe cf. *labiata*	0	0	1	2	0	0	2	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4	1	0,42	0,92	0,00	4
Macrostylis sp. A	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0,16	0,52	0,00	2
Macrostylis sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,06	0,36	0,00	2
Magelona bizkaiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	1	0	0	0	0,13	0,34	0,00	1
Makrokylindrus cf. *aculeatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	2	0	0	1	0	0,16	0,45	0,00	2
Maldanidae sp.	0	0	0	1	0	0	0	0	2	1	0	0	0	1	0	0	0	2	1	0	0	1	0	0	0	0	0	1	0	2	0	0,39	0,67	0,00	2
Melinnopsis sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Mendicula sp.?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,06	0,36	0,00	2
Microgloma mirmidina	1	3	0	5	0	6	4	3	0	2	1	6	2	2	8	8	4	3	7	0	0	2	9	0	0	0	0	6	1	6	5	3,03	2,86	0,00	9
Microspio sp.	0	0	0	0	0	1	0	1	0	0	0	4	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	4	0,42	1,12	0,00	4
Mysis sp. (larva)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Neastacilla sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0,06	0,36	0,00	2
Nematoda sp.	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	1	0	0	3	0	0	0	0	0	1	1	0	1	0,32	0,70	0,00	3
Nemertea sp.	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0,19	0,54	0,00	2
Neotanais sp.	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0,10	0,40	0,00	2
Nereididae sp. A	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0,13	0,34	0,00	1
Nereididae sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Notomastus sp. A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,10	0,30	0,00	1
Notomastus sp. B	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,06	0,36	0,00	2
Nucula atacellana	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	1	0,19	0,48	0,00	2
Oedicerotidae sp.	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,10	0,30	0,00	1
Oligobregma sp.	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,10	0,40	0,00	2
Oligobregma tani	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0,10	0,30	0,00	1
Oligochaeta sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0,06	0,25	0,00	1
Onuphidae sp. juv	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0	1	0	0	1	1	1	0,29	0,53	0,00	2

Taxa	S01	S03	S04	S06	S07	S08	S10	S11	S12	S13	S14	S15	S16	S19	S20	S21	S22	S23	S24	S27	S28	S30	S31	S32	S33	S34	S35	S37	S38	S39	S40	Mean	SD	Min	Max
Ophelina cf. *abranchiata*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Ophelina nematoides?	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0,16	0,37	0,00	1
Ophelina sp.	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0,16	0,52	0,00	2
Ophiomyxidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0,03	0,18	0,00	1
Ophiura (Ophiura) trimeni?	0	0	0	1	0	0	0	0	0	2	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0,19	0,48	0,00	2
Orbinia sp.	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0,10	0,30	0,00	1
Ostracoda sp. A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0,26	0,86	0,00	4
Ostracoda sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Oweniidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Paradiopatra sp.	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	1	0	2	0	0	1	0	0	0	0	0	1	0	0	0	0,29	0,59	0,00	2
Paranarthrura sp.	0	0	0	0	0	1	0	0	0	0	1	2	0	2	0	1	1	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0,39	0,72	0,00	2
Paraonidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	4	0	0	0	0	0	0,23	0,88	0,00	4
Paraonides sp.?	0	0	0	0	0	4	3	0	0	1	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	2	0	0,52	1,00	0,00	4
Pectinariidae sp.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0,10	0,40	0,00	2
Phascolosoma sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0,06	0,25	0,00	1
Pherusa sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Phyllodocidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0,03	0,18	0,00	1
Podocopida sp.	0	0	0	0	0	1	1	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0,19	0,60	0,00	3
Polychaeta sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0,06	0,25	0,00	1
Prionospio sp.?	0	0	0	0	2	0	5	0	1	0	0	0	0	0	0	1	0	1	0	2	3	0	4	0	0	2	2	0	0	0	0	0,74	1,32	0,00	5
Pristigloma nitens	0	0	0	0	0	0	2	0	0	0	0	0	1	3	2	0	2	3	0	0	0	2	3	0	4	0	0	1	0	0	3	0,84	1,27	0,00	4
Pseudotanaidae sp.?	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Scalibregmatidae sp.	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,13	0,34	0,00	1
Scalisetosus sp.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Sipuncula sp. A	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,10	0,30	0,00	1
Sipuncula sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0,10	0,30	0,00	1
Sipuncula sp. C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0,10	0,30	0,00	1
Sipuncula sp. D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0,06	0,25	0,00	1
Sipuncula sp. E	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Sipuncula sp. F	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Solenogastres sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0,03	0,18	0,00	1
Spionidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Spiophanes sp. A	0	2	0	3	0	2	2	3	0	0	0	4	1	4	5	0	4	2	3	0	0	3	4	0	2	0	0	10	7	0	6	2,16	2,49	0,00	10
Spiophanes sp. B	1	0	5	1	4	2	0	0	6	0	0	0	0	0	5	0	0	5	3	11	14	1	0	5	1	12	4	8	3	5	6	3,29	3,85	0,00	14
Synaptidae sp.	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,06	0,25	0,00	1
Tanaidacea sp.	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0,26	0,73	0,00	3
Terebellidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0,13	0,50	0,00	2
Travisia cf. *glandulosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,03	0,18	0,00	1
Urothoidae sp.	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0,19	0,60	0,00	3

6.14. Appendix XIV – Benthic Macrofauna Biomass Matrix

Units: g per station

Taxa	S01	S03	S04	S06	S07	S08	S10	S11	S12	S13	S14	S15	S16	S19	S20	S21	S22	S23	S24	S27	S28	S30	S31	S32	S33	S34	S35	S37	S38	S39	S40	Mean	SD	Min	Max
Abarenicola affinis africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,4652	0	0	0	0	0	0,05	0,26	0,00	1,4652
Abyssoninoe sp.	0	0	0	0	0	0,0063	0	0	0	0,0036	0	0	0,0145	0,0028	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0355	0	0	0	0,00	0,01	0,00	0,0355
Ampharetidae sp.	0	0	0	0	0,0031	0,0011	0	0	0,0015	0	0	0	0	0	0	0	0,0029	0,0023	0,0012	0,0043	0	0,0013	0,0036	0	0,0034	0	0	0	0	0	0	0,00	0,00	0,00	0,0043
Amphipoda sp.	0	0	0	0	0	0	0	0	0	0	0	0,0004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0004
Antennuloniscus dimeroceras	0	0	0	0	0	0	0	0,0012	0,0041	0	0	0	0	0	0	0	0	0	0	0	0	0,0005	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0041
Arcturidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0002	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0002
Aricidea (Acmira) simplex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0022	0	0	0	0	0	0	0	0,0001	0	0	0,0008	0	0	0,0131	0,00	0,00	0,00	0,0131
Armandia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0021
Asellota sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0004	0	0	0	0,00	0,00	0,00	0,0004
Bathygnathia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0066	0	0	0,00	0,00	0,00	0,0066
Bivalvia sp. A	0	0	0	0,0172	0,0355	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0089	0	0	0,0002	0	0,0002	0,0119	0	0	0	0	0,00	0,01	0,00	0,0355
Bivalvia sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0074	0	0	0	0	0	0	0	0	0	0,0006	0,0272	0	0	0	0	0,00	0,01	0,00	0,0272
Bodotriidae sp. A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0001	0	0	0,0001	0	0	0	0,00	0,00	0,00	0,0001
Bodotriidae sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0006	0	0	0	0	0	0,00	0,00	0,00	0,0006
Bodotriidae sp. C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0001	0	0,00	0,00	0,00	0,0001
Bonelliidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0003
Capitellidae sp. A	0	0	0,0007	0	0	0,0028	0	0	0	0	0,0003	0	0,0141	0	0	0	0	0	0	0	0	0	0,0015	0,0015	0	0	0,0018	0	0	0	0	0,00	0,00	0,00	0,0141
Capitellidae sp. B	0,0051	0,0026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0007	0,0008	0	0	0,00	0,00	0,00	0,0051
Caudofoveata sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,001
Chaetozone sp. A	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0005	0,0006	0,006	0	0,0021	0	0	0	0	0	0,0005	0	0	0	0	0	0	0,0054	0,00	0,00	0,00	0,006
Chaetozone sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0307	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,01	0,00	0,0307
Chauliodoniscus cf. *princeps*	0	0	0	0	0	0	0	0	0	0	0	0	0,0001	0	0	0,0005	0	0	0	0	0	0	0	0	0	0	0	0	0,0005	0	0	0,00	0,00	0,00	0,0005
Cirratulidae sp.	0	0,0013	0	0	0,0001	0	0,0033	0	0,0072	0,0015	0	0,0009	0	0	0,0005	0	0,0013	0,0038	0,0232	0,0001	0	0	0,0021	0,0015	0	0,0034	0	0,0012	0	0	0	0,00	0,00	0,00	0,0232
Copepoda sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0002	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0002
Cuspidariidae sp.	0	0,0054	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0054
Dendrobranchiata sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0454	0,00	0,01	0,00	0,0454
Desmosoma sp.	0	0	0	0	0	0	0,0005	0	0	0	0	0	0	0	0	0	0	0,0007	0	0,0002	0	0,0002	0	0	0	0	0	0	0	0,0032	0	0,00	0,00	0,00	0,0032
Diplocirrus sp.	0	0	0	0	0	0	0	0,0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0045
Eurycopinae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0201	0,0002	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0201
Gastropoda sp.	0	0	0	0,0007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0001	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0007
Gnathiidae sp.	0	0	0	0	0	0	0	0,0001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0001
Goniada sp.	0	0	0,0008	0	0	0	0	0	0	0,0005	0	0	0,0053	0	0	0	0	0	0	0	0,0001	0	0	0	0,0008	0,0018	0,0013	0	0	0,0001	0	0,00	0,00	0,00	0,0053
Haplomesus sp.	0	0	0	0,0005	0	0	0	0	0	0	0	0	0	0,0007	0	0	0	0	0	0	0	0	0	0,0002	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0007
Haploniscus sp.	0	0,0001	0	0	0,0011	0	0	0	0	0	0	0	0	0	0	0,0002	0	0	0	0	0,0002	0	0	0	0	0	0,0014	0	0	0	0	0,00	0,00	0,00	0,0014
Hesionidae sp.	0	0	0	0	0	0	0,0005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0005
Hippomedon sp.?	0	0	0	0	0	0,0002	0	0	0	0	0	0	0,0001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0002
Holothuroidea sp.?	0	0	0	0	0	0	0	0	0	0	0	0,0155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0155
Jasmineira sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0083	0	0	0,0132	0	0	0	0	0	0	0,0001	0,0019	0	0	0	0	0	0,00	0,00	0,00	0,0132
Kinbergonuphis sp.	0	0	0	0	0	0	0	0	0	0	0	0,0165	0	0,0005	0,002	0	0,001	0	0,0057	0	0	0,0015	0	0	0,0097	0	0	0,0093	0	0	0	0,00	0,00	0,00	0,0165
Leanira quatrefagesi	0	0	0	0	0,0041	0	0	0	0	0	0	0	0,0001	0	0,001	0	0	0,0057	0,0009	0	0	0	0,0242	0	0	0,0023	0	0,0031	0	0	0	0,00	0,00	0,00	0,0242
Ledellina sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0005	0	0	0	0	0	0,0138	0	0,0215	0,00	0,00	0,00	0,0215
Leucon sp.	0	0	0	0	0	0	0	0	0,0001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0001
Leviapseudes sp. A	0	0	0,0007	0	0	0	0,0001	0	0	0	0	0,0013	0,0015	0	0	0	0	0	0	0	0	0	0,0015	0	0	0	0	0	0	0	0,0033	0,00	0,00	0,00	0,0033
Leviapseudes sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0021
Levinsenia sp.	0	0	0	0	0	0	0	0,0014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0014
Limatula sp.	0	0	0	0,0107	0	0	0	0	0	0	0	0,0004	0	0	0	0,0017	0	0	0	0	0	0	0	0	0,0549	0	0	0,0007	0	0	0	0,00	0,01	0,00	0,0549
Limopsis sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,023	0	0,0003	0,00	0,00	0,00	0,023
Lumbrineris sp. A	0	0	0	0	0	0	0,0024	0	0	0	0	0	0	0	0	0	0	0,0036	0	0	0	0	0	0,0068	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0068
Lumbrineris sp. B	0	0	0	0	0	0,0051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0002	0	0,00	0,00	0,00	0,0051
Lumbrineris sp. C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0001	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0001
Lysianassidae sp. A	0	0	0,0002	0	0	0	0	0	0	0	0	0	0	0	0	0,0057	0	0	0,0004	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0057
Lysianassidae sp. C	0	0	0	0	0	0,0004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0004
Lysianassidae? sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0004	0,0002	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0004
Lysippe cf. *labiata*	0	0	0,0015	0,0012	0	0	0,0014	0	0	0	0,0013	0	0	0	0	0	0	0	0	0,003	0	0	0	0	0	0	0	0	0	0	0,0074	0,002	0,00	0,00	0,00	0,0074
Macrostylis sp. A	0	0	0	0,0003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,001	0,0005	0	0	0,00	0,00	0,00	0,001
Macrostylis sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0024
Magelona bizkaiensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0034	0,0041	0	0,0018	0	0	0	0	0,0011	0	0	0	0,00	0,00	0,00	0,0041
Makrokylindrus cf. *aculeatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0001	0	0	0	0	0	0	0,0006	0	0	0	0	0,0038	0	0	0,0001	0	0,00	0,00	0,00	0,0038

Taxa	S01	S03	S04	S06	S07	S08	S10	S11	S12	S13	S14	S15	S16	S19	S20	S21	S22	S23	S24	S27	S28	S30	S31	S32	S33	S34	S35	S37	S38	S39	S40	Mean	SD	Min	Max
Maldanidae sp.	0	0	0	0,0004	0	0	0	0	0,0021	0,0066	0	0	0	0,0011	0	0	0	0,0078	0,0025	0	0	0,0131	0	0	0	0	0	0,0001	0	0,0028	0	0,00	0,00	0,00	0,0131
Melinnopsis sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0008
Mendicula sp.?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,001
Microgloma mirmidina	0,0022	0,0106	0	0,0069	0	0,0076	0,0025	0,0031	0	0,002	0,001	0,007	0,0021	0,004	0,0082	0,009	0,0048	0,0042	0,009	0	0	0,0027	0,006	0	0	0	0	0,0045	0,0017	0,005	0,0049	0,00	0,00	0,00	0,0106
Microspio sp.	0	0	0	0	0	0,0025	0	0,0002	0	0	0	0,0113	0	0	0	0	0	0	0	0	0	0,0069	0	0	0	0	0	0	0	0	0,0105	0,00	0,00	0,00	0,0113
Mysis sp. (larva)	0	0	0	0,0005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0005
Neastacilla sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0012	0	0	0	0	0	0,00	0,00	0,00	0,0012
Nematoda sp.	0	0	0	0	0	0	0	0,0011	0	0	0	0	0,0012	0	0	0	0	0	0,0005	0	0	0,0002	0	0	0	0	0	0,0001	0,0007	0	0,0004	0,00	0,00	0,00	0,0012
Nemertea sp.	0	0	0,0012	0	0	0	0	0	0	0	0	0	0	0	0	0,0019	0	0	0	0	0	0	0	0,0001	0,0181	0	0	0	0	0	0	0,00	0,00	0,00	0,0181
Neotanais sp.	0	0	0	0	0	0	0	0,0021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0004	0	0	0,00	0,00	0,00	0,0021
Nereididae sp. A	0	0	0,0001	0	0	0	0	0	0	0	0	0	0	0	0,0016	0	0	0	0	0	0	0	0	0	0	0,0003	0	0	0	0	0,0132	0,00	0,00	0,00	0,0132
Nereididae sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0004	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0004
Notomastus sp. A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,006	0,0018	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0005	0,00	0,00	0,00	0,006
Notomastus sp. B	0	0	0	0	0	0	0	0	0,0019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0019
Nucula atacellana	0	0	0	0,0042	0	0	0	0	0	0	0	0	0	0	0,0002	0	0	0	0	0	0	0	0	0	0	0	0	0,003	0,0109	0	0,0002	0,00	0,00	0,00	0,0109
Oedicerotidae sp.	0	0	0	0	0	0	0	0,0004	0,0019	0	0	0	0	0	0	0,0009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0019
Oligobregma sp.	0	0	0	0,0246	0	0	0	0	0	0	0	0,001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0246
Oligobregma tani	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0008	0	0	0	0	0	0,0005	0	0	0	0	0	0	0,0007	0	0	0,00	0,00	0,00	0,0008
Oligochaeta sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0007	0	0	0	0	0	0,0002	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0007
Onuphidae sp. juv	0	0	0	0	0	0	0	0	0	0,0007	0	0	0	0	0	0	0	0,0071	0	0,0001	0,0002	0	0	0	0	0,0004	0	0	0,0004	0,0012	0,0004	0,00	0,00	0,00	0,0071
Ophelina cf. *abranchiata*	0	0	0	0	0	0	0	0	0	0,0023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0023
Ophelina nematoides ?	0	0	0	0	0	0	0	0	0	0,0208	0	0,0015	0	0	0	0,017	0	0	0	0	0	0	0	0	0	0	0	0	0,0045	0	0,0017	0,00	0,00	0,00	0,0208
Ophelina sp.	0	0	0	0	0	0	0	0	0	0	0	0,005	0	0	0	0	0	0	0	0	0	0,0046	0,0195	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0195
Ophiomyxidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,1042	0	0	0	0	0	0,07	0,38	0,00	2,1042
Ophiura (Ophiura) trimeni ?	0	0	0	0,0093	0	0	0	0	0	0,5163	0	0	0	0,2606	0	0,372	0	0	0	0	0	0,422	0	0	0	0	0	0	0	0	0	0,05	0,14	0,00	0,5163
Orbinia sp.	0	0,0013	0,0057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0029	0	0	0	0	0	0	0,00	0,00	0,00	0,0057
Ostracoda sp. A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0007	0,0004	0	0	0	0	0	0	0	0,0002	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0007
Ostracoda sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0003
Oweniidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0621	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,01	0,00	0,0621
Paradiopatra sp.	0	0	0	0	0	0	0	0	0	0	0	0,0165	0	0,0005	0,002	0	0,001	0	0,0057	0	0	0,0015	0	0	0	0	0	0,0093	0	0	0	0,00	0,00	0,00	0,0165
Paranarthrura sp.	0	0	0	0	0	0,0005	0	0	0	0	0,0003	0,0007	0	0,0004	0	0,0003	0,0004	0	0,0017	0	0	0	0	0	0	0	0	0	0,0004	0	0	0,00	0,00	0,00	0,0017
Paraonidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0018	0	0	0	0	0	0,0019	0	0	0	0	0	0,00	0,00	0,00	0,0019
Paraonides sp.?	0	0	0	0	0	0,0007	0,0012	0	0	0,0106	0	0,001	0,0003	0	0	0	0	0	0	0	0	0,0039	0	0	0	0	0	0,0003	0,0005	0,0008	0	0,00	0,00	0,00	0,0106
Pectinariidae sp.	0	0	0	0	0	0,0008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0047	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0047
Phascolosoma sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,8562	0	0	0	0	0	0	0	0	0	0	0	0,0056	0,03	0,15	0,00	0,8562
Pherusa sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0018	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0018
Phyllodocidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0008	0	0	0	0,00	0,00	0,00	0,0008
Podocopida sp.	0	0	0	0	0	0,0024	0,0002	0	0	0	0	0	0	0	0,0093	0	0	0	0,0016	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0093
Polychaeta sp.	0	0	0	0	0	0	0	0	0,0027	0	0	0	0	0	0	0	0	0	0,0025	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0027
Prionospio sp.?	0	0	0	0	0,0042	0	0,0106	0	0,0032	0	0	0	0	0	0	0,0011	0	0,0043	0	0,0065	0,0075	0	0,0107	0	0	0,0015	0,0025	0	0	0	0	0,00	0,00	0,00	0,0107
Pristigloma nitens	0	0	0	0	0	0	0,0057	0	0	0	0	0	0,0118	0,0097	0,0012	0	0,0015	0,0002	0	0	0	0,0131	0,0021	0	0,0067	0	0	0,0039	0	0	0,014	0,00	0,00	0,00	0,014
Pseudotanaidae sp.?	0	0	0	0	0	0	0	0	0	0	0	0,0001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0001
Scalibregmatidae sp.	0	0,0011	0	0	0,0002	0	0	0	0,29	0	0,0014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,01	0,05	0,00	0,29
Scalisetosus sp.	0	0,0196	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0196
Sipuncula sp. A	0	0,0012	0	0	0	0	0	0	0	0	0	0	0	0,5719	0	0	0,0054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,02	0,10	0,00	0,5719
Sipuncula sp. B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0015	0,0015	0	0	0	0	0	0	0	0,0021	0	0	0	0	0	0,00	0,00	0,00	0,0021
Sipuncula sp. C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0001	0	0	0,0004	0,0002	0	0	0,00	0,00	0,00	0,0004
Sipuncula sp. D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0141	0	0,0006	0	0	0	0,00	0,00	0,00	0,0141
Sipuncula sp. E	0	0	0	0	0	0	0	0	0,1829	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,01	0,03	0,00	0,1829
Sipuncula sp. F	0	0	0	0	0	0	0,0015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0015
Solenogastres sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0259	0	0	0	0,00	0,00	0,00	0,0259
Spionidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0031	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,00	0,00	0,0031
Spiophanes sp. A	0	0,0033	0	0,0123	0	0,0015	0,0008	0,0196	0	0	0	0,0023	0,0056	0,0114	0,0157	0	0,0162	0,0044	0,0127	0	0	0,0067	0,0039	0	0,0026	0	0	0,012	0,0053	0	0,0148	0,00	0,01	0,00	0,0196
Spiophanes sp. B	0,0005	0	0,0248	0,0065	0,0092	0,0046	0	0	0,0316	0	0	0	0	0	0,0085	0	0	0,0105	0,0079	0,0413	0,0341	0,0015	0	0,0133	0,0001	0,0307	0,0092	0,0166	0,0118	0,0152	0,0178	0,01	0,01	0,00	0,0413
Synaptidae sp.	0	0	0	0	0,2899	0	0	0	0	0	0,2822	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,02	0,07	0,00	0,2899
Tanaidacea sp.	0	0,0018	0	0	0	0	0	0	0	0	0	0,0003	0	0	0	0	0	0	0	0	0,0002	0	0	0	0	0,0001	0	0	0	0	0	0,00	0,00	0,00	0,0018
Terebellidae sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0032	0	0	0	0	0	0,0018	0	0	0	0,00	0,00	0,00	0,0032
Travisia cf. *glandulosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,1019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,00	0,02	0,00	0,1019
Urothoidae sp.	0	0	0	0	0,0022	0	0	0	0	0	0	0,0007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0031	0	0	0,0015	0	0,00	0,00	0,00	0,0031

6.15. Appendix XV – Organic and Nutrient Content. Trace Metal Concentrations and Microbiology Content in Water

Parameter	S01-S	S01-M	S01-B	S04-S	S04-M	S04-B	S23-S	S23-M	S23-B	S40-S	S40-M	S40-B	S35-S	S35-M	S35-B
TSS (mg/l)	6.5	8.9	8.3	8.6	31	19	4	8.8	10	3	8.8	8	9.1	21	26
TOC (mg/l)	31.1	31.3	30.5	26.1	26.6	26.4	31.3	30	29.3	29	30	26.1	32.3	31.3	32.5
NO_2 (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
NO_3 (mg/l)	< 0.1	0.94	1.67	< 0.1	4.2	1.53	1.92	1.79	2.14	1.01	1.82	1.57	0.295	2.17	1.27
NTK (mg/l)	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
PO_4 (mg/l)	0.023	0.102	0.151	0.025	0.217	0.144	0.022	0.205	0.144	0.02	0.22	0.152	0.025	0.222	0.134
Al (µg/l)	<10	13.3	12.9	29.5	26.8	24.4	12.5	<10	<10	12.1	30.5	24.3	<10	<10	<10
Ag (µg/l)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
As (µg/l)	1.79	1.87	1.8	2.16	1.68	1.6	2.24	1.33	2.2	1.49	1.56	1.61	1.86	1.8	1.34
Ba (µg/l)	5.06	5.38	8.54	4.89	8.4	9.94	5.33	6.17	9.29	4.31	7.56	9.81	5.38	8.95	9.22
Be (µg/l)	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Cd (µg/l)	<0.05	0.085	0.108	0.074	0.359	0.196	<0.05	0.099	0.137	0.174	0.16	0.101	0.096	0.154	0.1
Co (µg/l)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cr (µg/l)	3.72	<1	1.04	1.11	1.87	1.96	1.22	1.38	<1	1.48	1.1	1.21	1.18	1.17	1.74
Cu (µg/l)	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.04	<1	<1	<1	<1	5.42
Fe (µg/l)	<10	<10	<10	12.8	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Hg (µg/l)	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Mn (µg/l)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Mo (µg/l)	9.07	9.72	9.37	9.9	9.65	9.46	10.6	6.92	8.62	8.14	7.97	9.65	9.71	10.1	9.83
Ni (µg/l)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Pb(µg/l)	<0.5	<0.5	<0.5	1.18	<0.5	<0.5	<0.5	<0.5	<0.5	0.795	0.535	<0.5	<0.5	<0.5	0.763
Sb (µg/l)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Se(µg/l)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Sn (µg/l)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Va (µg/l)	<2	2.16	<2	2.08	<2	2.02	<2	<2	<2	<2	<2	<2	<2	<2	<2
Zn (µg/l)	21.1	6.67	5.39	11.5	7.3	9.11	18	11.2	4.43	52.6	7.48	7.67	11.6	6.82	4.15
Tl (µg/l)	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
FAAH (/ml)	9.3	2.3	2.3	4.3	43	2.3	2.3	9.3	0.36	9.3	9.3	0.36	430	150	<0.31
FTA (UFC/ml)	1000	280	260	320	82	190	1000	250	430	880	170	1600	5800	190	2200

TSS: Total Suspended Solids *TOC: Total Organic Carbon* *NTK: Total Nitrogen Kjeldahl (TKN)*
AFAH: Aerobic Flora Adapted to Hydrocarbons *TAF: Total Aerobic Flora*

6.16. Appendix XVI – Polycyclic Aromatic Hydrocarbon Concentrations in Water

HAP	LOD (ng/L)	LOQ (ng/L)	S01-S	S01-M	S01-B	S04-S	S04-M	S04-B	S23-S	S23-M	S23-B	S40-S	S40-M	S40-B
Decalin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
C1-Decalin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
C2-Decalin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
C3-Decalin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Naphtalène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LQ	13,3	<LD
C1-Naphtalène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	5,8	21,8
C2-Naphtalène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	6,3	34,5
C3-Naphtalène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	31,8
Benzothiophène	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
C1-Benzothiophène	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
C2-Benzothiophène	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
C3-Benzothiophène	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
Biphényl	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LQ	<LQ
Acénaphtylène	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
Acénaphtène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
Dibenzofuran	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
Fluorène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
C1-Fluorène	1,5	5,0	<LD	<LD	<LD	<LQ	<LD	<LD	<LD	<LQ	<LQ	<LQ	<LQ	<LQ
C2-Fluorène	1,5	5,0	6,8	7,6	<LD	12,0	11,4	24,6	6,5	6,3	17,6	7,5	10,0	12,6
C3-Fluorène	1,5	5,0	18,5	18,5	<LD	27,6	14,0	36,9	<LD	<LD	<LD	<LD	<LD	10,2
Carbazole	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
Phenanthrene	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
Anthracene	0,3	1,0	<LD	<LD	<LD	<LD	<LQ	<LQ	<LD	<LD	<LD	<LD	<LD	<LD
C1-Phenan/anthra	1,5	5,0	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	8,1	<LQ
C2-Phenan/anthra	1,5	5,0	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	<LD	<LQ	<LQ	<LQ	<LQ
C3-Phenan/anthra	1,5	5,0	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	<LQ	7,4	8,4	<LQ
Dibenzothiophène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
C1-Dibenzothiophène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
C2-Dibenzothiophène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
C3-Dibenzothiophène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
Fluoranthène	1,5	5,0	<LD	<LD	<LQ	36,4	<LD	<LD	<LD	<LD	<LQ	7,0	5,4	<LD
Pyrène	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LQ	<LD	<LD
C1-Fluoranthènes/Pyrènes	0,3	1,0	1,4	1,7	1,4	1,4	<LD	1,5	<LD	1,1	1,3	2,0	1,0	1,6
C2-Fluoranthènes/Pyrènes	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LQ	<LD	<LD	<LD	<LQ	<LD	<LD
C3-Fluoranthènes/Pyrènes	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LQ	<LD	<LD	<LD	<LD	<LD	<LD
Naphtobenzothiophene	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
C1-Naphtobenzothiophene	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
C2-Naphtobenzothiophene	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
C3-Naphtobenzothiophene	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
Benzo[a]anthracène	0,2	0,5	<LD	<LQ	<LQ	<LD	<LD	1,4	<LD	<LD	<LQ	0,5	<LQ	<LQ
Chrysène	0,3	1,0	<LD	<LD	<LD	<LD	<LD	1,3	<LD	<LD	<LD	1,3	1,2	<LD
C1-Chrysènes	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LQ	<LD	<LD	<LD	<LD	<LD	<LD
C2-Chrysènes	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LQ	<LD	<LD	<LD	<LD	<LD	<LD
C3-Chrysènes	0,3	1,0	<LD	<LD	<LD	<LD	<LD	<LQ	<LD	<LD	<LD	<LD	<LD	<LD
Benzo[b+k]fluoranthène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LQ
Benzo[e]pyrène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LQ
Benzo[a]pyrène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LQ
Pérylène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LQ
Indéno(1,2,3-cd)pyrène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	20,3
Dibenzo(a,h)anthracène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	40,2
Benzo(g,h,i)pérylène	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	40,6
	Somme HAPs (ng/L)		**26,8**	**27,8**	**1,4**	**77,3**	**25,4**	**65,8**	**6,5**	**7,4**	**18,9**	**25,7**	**59,4**	**213,4**
	∑ Naphtalènes (ng/L)		**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**25,4**	**88,0**

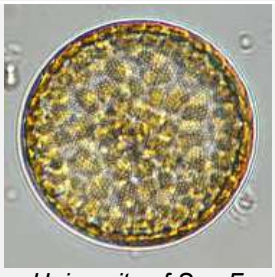
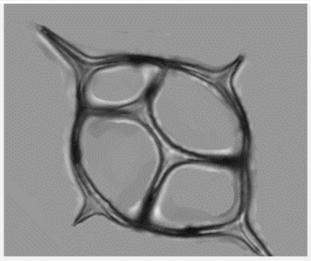
6.17. Appendix XVII – BTEX Monocyclic Aromatic Hydrocarbons in Water

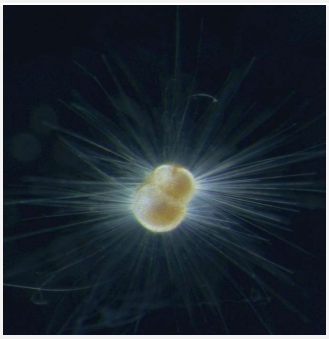
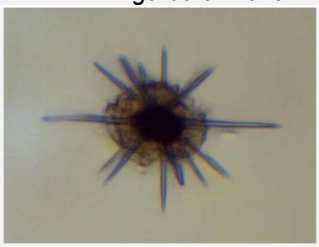
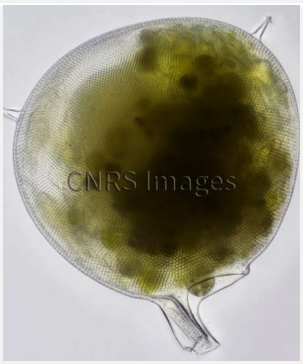
BTEX	LOD (µg/L)	LOQ (µg/L)	S01-S	S01-M	S01-B	S04-S	S04-M	S04-B	S23-S	S23-M	S23-B	S40-S	S40-M	S40-B
Benzene	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
Toluene	3,0	10,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
Ethylbenzene	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
m,p-xylene	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD
o-xylene	1,5	5,0	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD	<LD

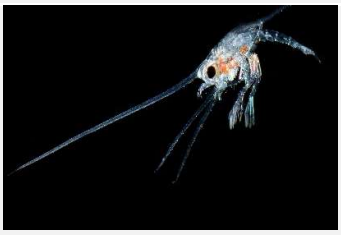
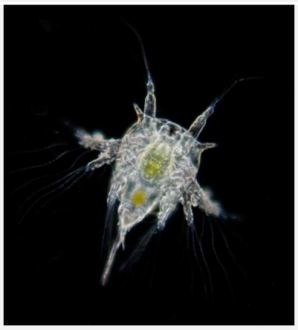
6.18. Appendix XVIII - Detailed bibliography on plankton

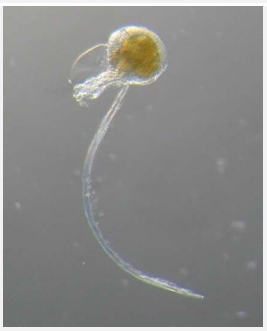
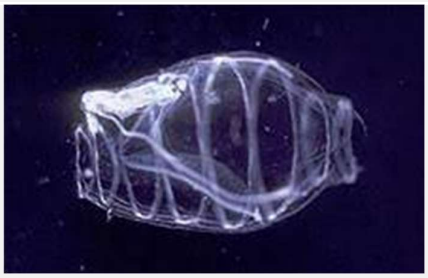
Plankton in Block 2913B, near Venus2 PWL

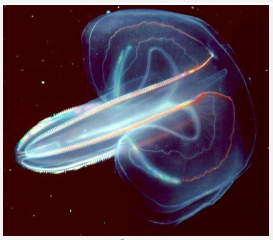
This section gives a taxonomical index of the main phytoplankton, protist, and zooplankton groups.

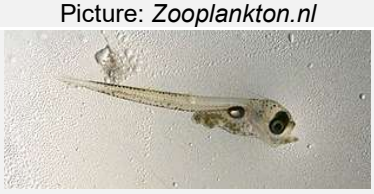
Taxonomic classification	Picture
Phytoplankton	
Cyanobacteria (phylum) > Cyanophyceae (class) > Oscillatoriophycideae (Subclass) > Oscillatoriales (order) > Phormidiaceae (family) > Phormidioideae (subfamily) > **Trichodesmium (Genus)** Trichodesmium is a genus of cyanobacteria living in colonies.	 Picture: *Woods Hole Oceanographic Institution*
Ochrophyta (phylum) > **Bacillariophyceae (Class)= Diatoms** Diatoms is considered as the major group of phytoplankton in the oceans. as they play a prominent role in the carbon and silica biogeochemical cycles.	 Picture: *University of San Francisco*
Mioza (phylum) > Myzozoa (Class) > Dinozoa (Subclass) > **Dinoflagellata (Superclass)** Dinoflagellates is a very diversified group comprising photosynthetic and heterotrophic organisms	 Picture: *M. Himemiya*
Chlorophyta (phylum) > **Prasinophyceae (Class)**	 Picture: *Protist Information Server*
Chrysophyta (phylum) > Dictyochophyceae (Class) > Dictyochales (Order) > **Dictyochaceae (Family) = Silicoflagellates**	 Picture: *D. Magyar et al. 2021*

Protists	
Rhizaria (infrakingdom) Rhizaria are unicellular eukaryotes with a silica exosqueleton that can conduct symbiosis with microalgae	
Rhizaria > **Foraminifera (phylum)**	 Picture: *Igaratza Fraile*
Rhizaria > Radiozoa (phylum) > **Acantharea (class)**	 Picture: *Arn – Ecole de la mer*
Rhizaria > Radiozoa (phylum) > **Polycystina (class)**	 Picture: *D. Munaretts*
Rhizaria > Cercozoa (phylum) > Filosa (subphylum) > Ventrifilosa (superclass) > Thecofilosea (class) > **Phaeodaria (subclass)**	 Picture: *CNRS Images*

Zooplankton	
Arthropoda (Phylum) > Crustacea (Subphylum) > Multicrustacea (Superclass) > **Copepoda (Class)** Copepods are small crustaceans. very abundant in the oceans and are often key actors in planktonic food webs	 Picture: *Minh Vu*
Arthropoda (Phylum) > Crustacea (Subphylum) > Malacostraca (Class) > Eumalacostraca (Subclass) > Peracarida (Superorder) > **Amphipoda (Order)**	 Picture: *Michal Manas*
Arthropoda (Phylum) > Crustacea (Subphylum) > Malacostraca (Class) > Eucarida (Superorder) > **Decapoda (Order)**	 Picture: *Natural History of Orange County. California*
Arthropoda (Phylum) > Crustacea (Subphylum) > Malacostraca (Class) > Eucarida (Superorder) > **Euphausiacea (Order)**	 Picture: *Oystein Paulsen MAR-ECO*
Arthropoda (Phylum) > Crustacea (Subphylum) > Multicrustacea (Superclass) > **Thecostraca (Class)**	 Picture: *Zooplankton.nl*

Arthropoda (Phylum) > Crustacea (Subphylum) > Oligostraca (Superclass) > **Ostracoda (Class)**	 Picture: *Anna Syme*
Chaetognatha (Phylum)	 Picture: *Zatelmar*
Chordata (Phylum) > Tunicata (Subhylum) > **Apendicularia (Class)**	 Picture: *WORMS*
Chordata (Phylum) > Tunicata (Subphylum) > Thaliacea (Class) > **Doliolida (Order)**	 Picture: *Marine Education Society of Australasia*
Chordata (Phylum) > Tunicata (Subphylum) > Thaliacea (Class) > **Salpida (Order)**	 Picture: *NIWA*

Cnidaria (Phylum) > Hydrozoa (Class) > Hydroidolina (Subclass) > **Siphonophorae (Order)**	 Picture: *Christian Sardet*
Cnidaria (Phylum) > Medusozoa (Subphylum) > **Hydrozoa (Class)**	 Picture: *Magnus Lundgren – Wild Wonders of China*
Ctenophora (Phylum)	 Picture: *UCMP Berkeley*
Mollusca (Phylum) > **Bivalvia (Class)**	 Picture: *M. Himemiya*
Mollusca (Phylum) > **Gastropoda (Class)**	 Picture: *R. Giesecke et al. 2010*

Mollusca (Phylum) > Gastropoda (Class) > Heterobranchia (Subclass) > **Pteropoda (Order)**	 Picture: *Christian Sardet*
Echinodermata (Phylum)	 Picture: *Zooplankton.nl*
Chordata (Phylum) > Olfactores (Clade) > **Ichthyoplankton (Fish) (Subphylum)**	 Picture: *NOAA FishWatch*
Annelida (Phylum) > **Polychaeta (Class)**	 Picture: *University of Washington*

Phytoplankton community and abundances at Block 2913B near the Venus2 PWL

The phytoplankton community sampled at the 250m_SE and 10000m_NE stations was composed of Cyanobacteria (*Trichodesmium*), diatoms, dinoflagellates, prasinophytes and silicoflagellates (Table 50 and following Figure 53).

Table 50. Plankton abundance at Block 2913B 250m_SE and 100000m_NE stations

Taxa	Abundance (ind./m³)		Abundance (%)	
Phytoplankton	**250m_SE**	**10000m_NE**	**250m_SE**	**10000m_NE**
Cyanobacteria	568	5929	1.1	20.5
Diatoms	45356	16248	88.3	56.3
Dinoflagellates	2207	4610	4.3	16.0
Prasinophyte	0	55	0.0	0.2
Silicoflagellate	3226	2036	6.3	7.1
Zooplankton and protists	**250m_SE**	**10000m_NE**	**250m_SE**	**10000m_NE**
Amphipoda	1.38	0.46	0.7	0.4
Appendicularia	0.41	0.10	0.2	0.1
Bivalvia	0.15	0.00	0.1	0.0
Chaetognatha	7.03	3.62	3.3	3.2
Copepoda	190.53	97.58	90.5	86.8
Ctenophora	0.05	0.00	0.0	0.0
Decapoda	0.05	0.05	0.0	0.0
Doliolida	0.20	0.51	0.1	0.5
Echinodermata	0.05	0.00	0.0	0.0
Euphausiacea	4.38	1.94	2.1	1.7
Foraminifera	0.76	0.00	0.4	0.0
Gastropoda	0.15	0.10	0.1	0.1
Hydrozoa	0.00	0.10	0.0	0.1
Ichthyoplankton	0.05	0.05	0.0	0.0
Ostracoda	2.29	3.92	1.1	3.5
Polychaeta	0.25	0.61	0.1	0.5
Pteropoda	1.73	1.38	0.8	1.2
Salpida	0.31	0.00	0.1	0.0
Siphonophorae	0.81	1.88	0.4	1.7
Thecostraca	0.00	0.15	0.0	01

Among these major phytoplankton taxa, diatoms were the most abundant (up to 16248 or 45356 cells m^{-3}) and represented 88% and 56% of the total phytoplankton abundance sampled at 250m_SE and 10000m_NE stations, respectively.

Dinoflagellates (2207 to 4610 cells m^{-3}) and silicoflagellates (2036 to 3226 cells m^{-3}) were also relatively abundant and represented respectively 4% and 6% at 250m_SE and 16 % and 7 % at 10000m_NE of the total phytoplankton abundances.

Cyanobacteria, which were essentially composed of the *Trichodesmium* genus, were abundant, especially at the 10000m_NE (5929 cells m^{-3}) and represented 21% of the abundance of phytoplankton at this station. Their abundances were much lower at the 250m_SE station (568 cells m^{-3}), representing only 1% of the total phytoplankton abundance at this location. Prasinophytes were only observed at the 10000m_NE station, but their abundances were so low (55 cells m^{-3}) that they represented less than 0.2% of the phytoplankton abundance at this station.

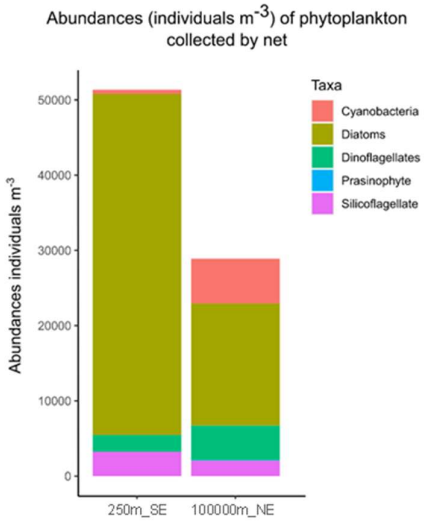


Figure 53. Abundances of major taxa of phytoplankton sampled at Block 2913B 250m_SE and 100000m_NE stations

Zooplankton community and abundances at Block 2913B near the Venus2 PWL

The zooplankton community at the 250m_SE and 10000m_NE stations was rather diversified (Table 50) but was clearly dominated by copepods (190 and 97 individuals m^{-3}). These represented 90% and 87% of the total zooplankton abundances at the stations, respectively (following Figure 54).

Chaetognatha was the second most abundant taxon (7.03 to 3.62 individuals m^{-3}) and represented around 3.5% of the zooplankton abundance at each station.

Other crustacean such as Amphipoda (0.46 to 1.38 individuals m^{-3}), Ostracoda (2.29 to 3.92 individuals m^{-3}), Euphausiacea (1.94 to 4.38 individuals m^{-3}), but also Siphonophorae (0.81 to 1.88 individuals m^{-3}), Pteropoda (1.38 to 1.73 individuals m^{-3}) and Polychaeta (0.25 to 0.61 individuals m^{-3}) each represented between 1% to 3% of the zooplankton abundance at the different stations.

As for the other zooplankton taxa, their abundance was very low and each represented less than 1% of the zooplankton abundance.

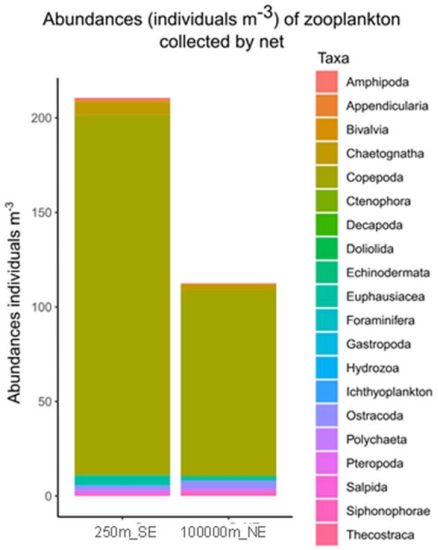


Figure 54. Abundances of major taxa of zooplankton sampled at Block 2913B 250m_SE and 10000m_NE stations

Phytoplankton and protists community from UVP profiles

The phytoplankton community determined from the 2015 UVP data was characterized by filamentous cyanobacteria of the genus *Trichodesmium*.

Protists of the Rhizaria infrakingdom, which can be microalgal symbionts, were also very abundant. In particular, Phaeodaria, Acantharea, Foraminifera, and Polycystinea were observed at the different stations.

Table 51. Plankton abundances and biovolumes from UVP profiles (2015)

Taxa	Abundance (ind./m3)					
Phytoplankton	**S_1307**	**S_1310**	**S_1312**	**S_1314**	**S_1317**	**S_1320**
Trichodesmium	3.50	3.38		2.47		5.68
Protists	**S_1307**	**S_1310**	**S_1312**	**S_1314**	**S_1317**	**S_1320**
rhizaria_foraminifera	2.49	2.73				
rhizaria_nonid	5.24	1.57				
rhizaria_phaeodaria	3.13	5.72				
rhizaria_polycycstinea	0.46					
rhizaria_acantharea			2.02			
Zooplankton	**S_1307**	**S_1310**	**S_13212**	**S_1314**	**S_1317**	**S_1320**
Amphipoda	2.49	2.71		4.72	5.29	
Annelida		1.46				12.91
Appendicularia				2.55	9.75	5.01
Chaetognatha	4.06	2.25		2.47	8.30	3.42
Copepoda	4.93	7.30	4.48	4.42	56.16	59.91
Crustacea	2.39	0.48			7.45	5.40
Eumalacostraca	2.38	2.13		4.99	1..68	17.08
Hydrozoa	3.11	1.81	2.40			3.04
Ostracoda	1.45					
Siphonophorae		1.00				
Trachymedusae		0.93				

Taxa	Biovolume (mm^3/m^3)					
Phytoplankton	**S_1307**	**S_1310**	**S_1312**	**S_1314**	**S_1317**	**S_1320**
Trichodesmium	2.38	2.83		1.50		3.20
Protists	**S_1307**	**S_1310**	**S_1312**	**S_1314**	**S_1317**	**S_1320**
rhizaria_foraminifera	7.84	112.27				
rhizaria_nonid	5.53	7.30				
rhizaria_phaeodaria	28.80	1.87				
rhizaria_polycycstinea	1.36					
rhizaria_acantharea			1.96			
Zooplankton	**S_1307**	**S_1310**	**S_1312**	**S_1314**	**S_1317**	**S_1320**
Amphipoda	52.49	76.43		177.24	395.15	
Annelida		25.48				15.53
Appendicularia				4.91	10.80	6.48
Chaetognatha	4.76	33.53		8.62	27.69	1.91
Copepoda	12.74	12.17	14.48	6.84	53.57	71.34
Crustacea	85.27	3.73			84.26	26.54
Eumalacostraca	10.27	95.22		189.00	315.32	242.17
Hydrozoa	16.55	8.20	11.27			2.14
Ostracoda	10.59					
Siphonophorae		67.72				
Trachymedusae		20.21				

Abundance of phytoplankton and protists

Trichodesmium (2.47 to 5.68 cells m^{-3}) were observed in nearly all stations, except the S_1312, and were mostly distributed from near the sea surface to 137 m water depth, though one specimen was found at 375 m depth. At station S_1310 *Trichodesmium* abundances reached 3.38 cells m^{-3}.

Among the different stations, protists were only found at the offshore stations (S_1307 and S_1310, S_1312). Phaeodaria was the most abundant taxon (3.12 to 5.72 cells m^{-3}), representing 29% and 41% of the protists abundances at stations S_1307 and S_1310, respectively (Figure 55). Foraminifera were also relatively abundant (2.49 to 2.73 cells m^{-3}) and represented around 20 % of the abundance of protists at stations S_1307 and S_1310. Acantharea (2.02 cells m^{-3}) and Polycystinea (0.46 cells m^{-3}) were rare and were only observed at stations S_1312 and S_1310, respectively. Protists were generally found in the first 1000 m but could also be found in deep water (around 2125 m).

At station S_1310, the protist community was characterized by high abundances of Phaedoria that represented 41% of the protist abundance at this station. Phaeodaria were distributed throughout the water column down to 2125 m, though the highest abundances were found around 400-500 m depth. Foraminifera represented 20% of the abundance of protists at S_1310 and were found higher in the water column reaching down to a 425 m water depth. Finally, the Polycystinea represented only a small fraction of the protists abundance at S_1310 station (3%), but the specimen was observed in deep water at 1375 m.

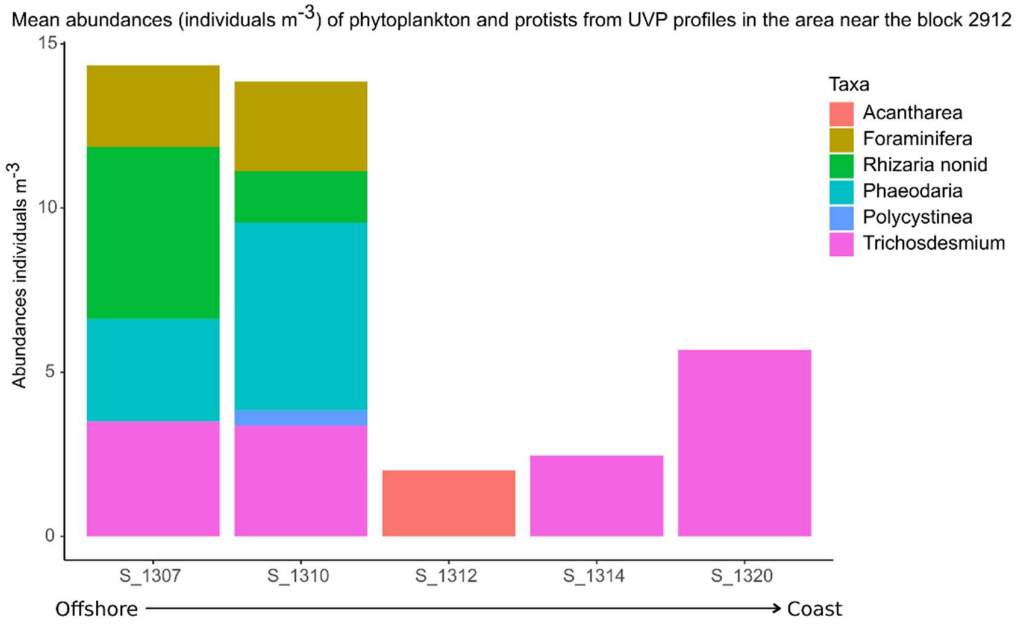


Figure 55. Abundances of phytoplankton and protists taxa by station from UVP profiles of 2015

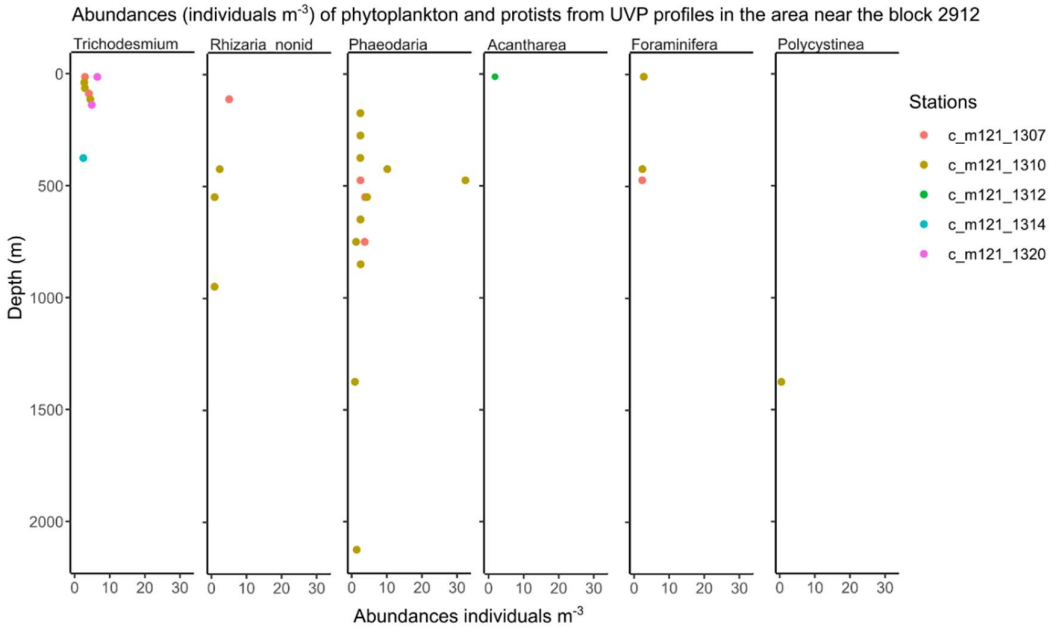


Figure 56. Distribution of phytoplankton and protists taxa abundance along the water column from UVP profiles of 2015

Phytoplankton and protists biovolumes

Trichodesmium biovolumes were low compared to their abundances, with biovolumes varying from 1.50 to 2.82 mm^3 m^{-3} (Figure 57). Among the protists, Foraminifera had the highest biovolumes ranging from 7.84 to 112.27 mm^3 m^{-3}. Biovolumes of Phaeodaria and unidentified Rhizaria (Rhizaria nonid) ranged from 10.87 to 28.80 mm^3 m^{-3} and 5.53 to 7.30 mm^3 m^{-3}, respectively. At station S_1310, Foraminifera represented 85% of the protists biovolume, however, further analyses of the data showed that this very large biovolume was mainly due to one specimen observed at 425 m depth that bore particularly larges spicules (Figure 58).

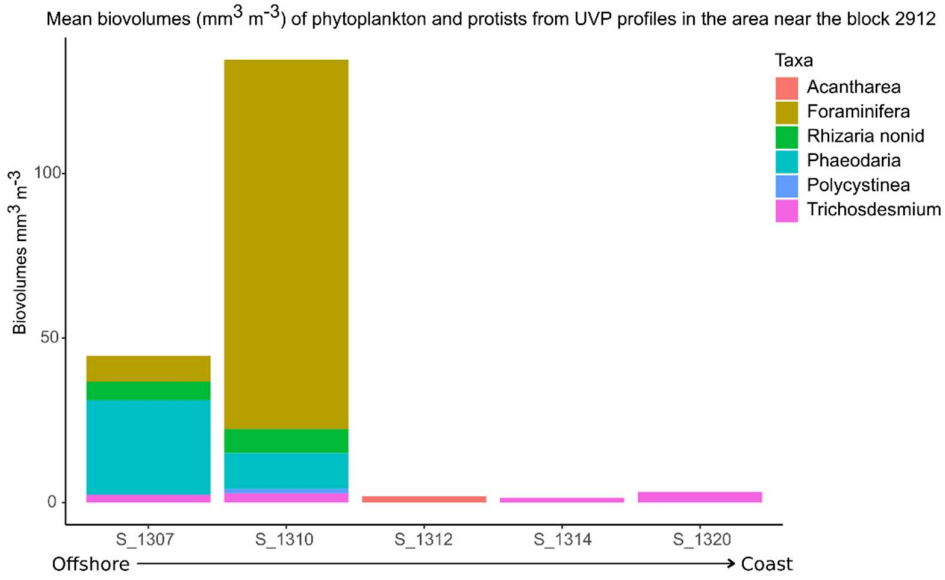


Figure 57. Biovolumes of phytoplankton and protists taxa by station from UVP profiles of 2015

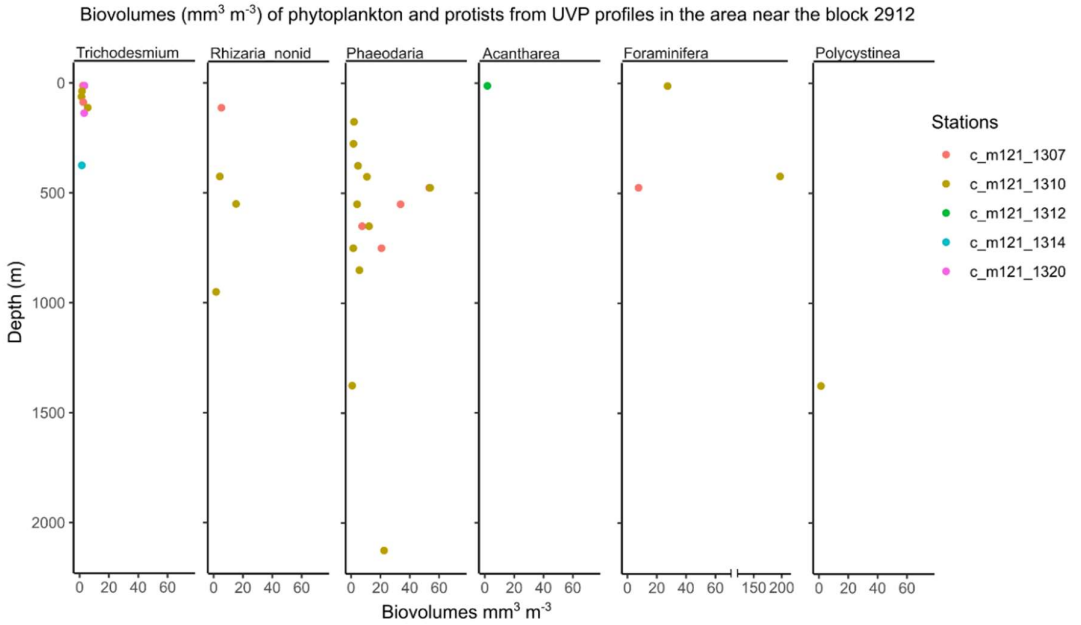


Figure 58. Distribution of phytoplankton and protists taxa biovolumes along the water column from the UVP profiles of 2015

Zooplankton community from UVP profiles

The zooplankton community identified using the UVP profiles was composed of multiple groups belonging to the crustacean subphylum including mostly copepods. Eumalacostraca. amphipods and ostracods (Figure 59). A wide variety of gelatinous zooplankton also characterized the different stations investigated. such as Hydrozoa. Siphonophorae. Trachymedusae. Chaetognatha and Appendicularia. Finally. few Annelida were also observed.

Zooplankton abundances from UVP profiles

Total zooplankton abundance was much lower at the offshore UVP stations (S_1307, S_1310, S_1312, S_1314) with around 20 individuals m^{-3} compared with stations near the coast (S_1317 and S_1320) that had approximatively 100 individuals m^{-3} in total (Figure 59). Despite this difference, all stations were dominated in term of abundance by copepods (2.38 to 59.91 individuals m^{-3}) that represented 23% to 36 % of the zooplankton abundance at the offshore stations, and 54% to 56% of the zooplankton abundance at the coastal stations. At the offshore stations (S_1307, S_1310, S_1312, S_1314), other crustacean taxa and gelatinous zooplankton were also relatively abundant. Indeed, Eumalacostraca (2.13 to 4.99 individuals m^{-3}) and Amphipoda (2.48 to 4.71 individuals m^{-3}) represented 11% to 26% and 12% to 25 % of the zooplankton abundances at these stations, respectively. Similarly, Chaetognatha (2.25 to 4.06 individuals m^{-3}), and Hydrozoa (1.81 to 3.11 individuals m^{-3}) also represented 11% to 19 % and 9% to 15 % of the zooplankton abundances, respectively. Near the coast (S_1317 and S_1320), other crustacean taxa were also abundant, notably Eumalacostraca (16.68 to 17.07 individuals m^{-3}) and Amphipoda (5.28 individuals m^{-3}) that respectively represented 5% and 16% of the zooplankton abundances, while gelatinous zooplankton represented less than 10% of the abundance at each of these stations.

The analysis of the S_1310 station revealed that copepods represented most of the zooplankton abundance (36%), followed by Amphipoda (13 %), and Eumalacostraca (11 %). As described above for offshore stations in general, Chaetognatha also represented a large part of the zooplankton community abundance (11 %). At S_1310, crustaceans appeared to be evenly distributed throughout the water column and down to 2625 m depth (Figure 60). In comparison, gelatinous plankton such as Chaetognatha, Hydrozoa and Trachymedusae were observed higher in the water column and down to a 1625 m water depth (Figure 60).

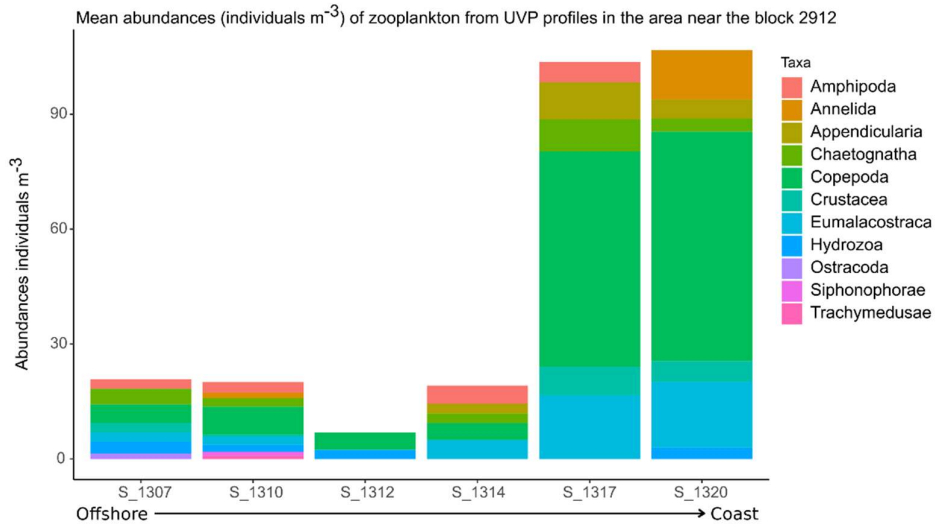


Figure 59. Abundances of zooplankton taxa by station from UVP profiles of 2015

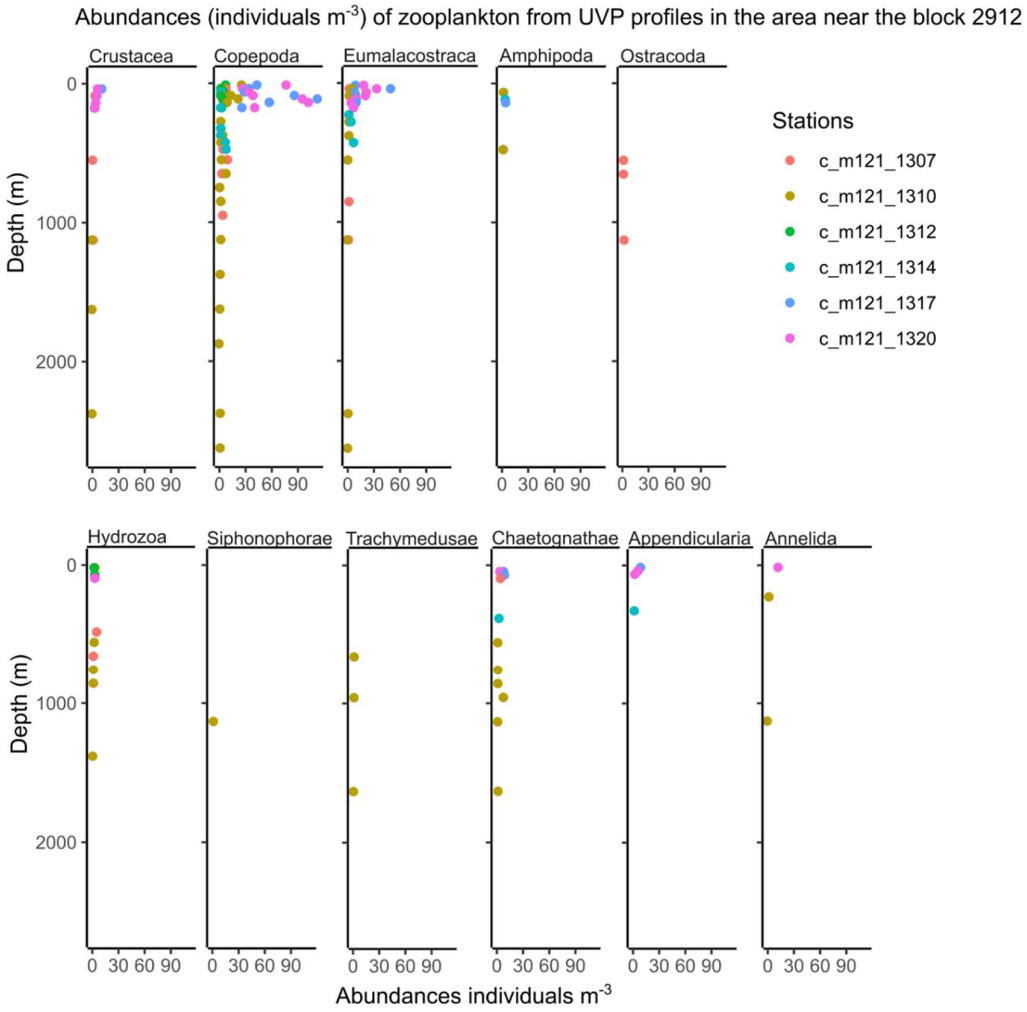


Figure 60. Distribution of zooplankton taxa abundances along the water column from the UVP profiles of 2015

Zooplankton biovolumes from UVP profiles

Zooplankton biovolumes were not proportional to the abundances described above as the difference between offshore and coast stations was less evident. S_1317 located near the coast had particularly large biovolumes of 886.79 mm^3 m^{-3} while the other stations had total zooplankton biovolumes ranging from 192.68 to 386.61 mm3 m-3 (excepting S_1312) (Figure 61). In general, Amphipoda (52.49 to 395.15 mm^3 m^{-3}) and Eumalacostraca (10.27 to 188.99 mm^3 m^{-3}) had the highest biovolumes representing 22% to 46 % and 5% to 49 % of the total zooplankton biovolume, respectively (Figure 61). Despite high abundances, gelatinous zooplankton represented a smaller fraction of the zooplankton biovolume, from 1% to 10 % for Chaetognatha (1.91 to 33.53 mm^3 m^{-3}) for instance. The only exception to this trend was recoded at station S_1310 as it was characterized by large biovolumes of Eumalacostracan, Amphipoda, Siphonophorae and Chaetognatha, representing respectively 28%, 22%, 20%, and 10 % of the zooplankton biovolume. The distribution pattern of zooplankton biovolumes followed the distribution of abundances in general although the largest specimens of Chaetognatha were observed at relatively the same depth, ranging from 800 to 1000 m (Figure 62).

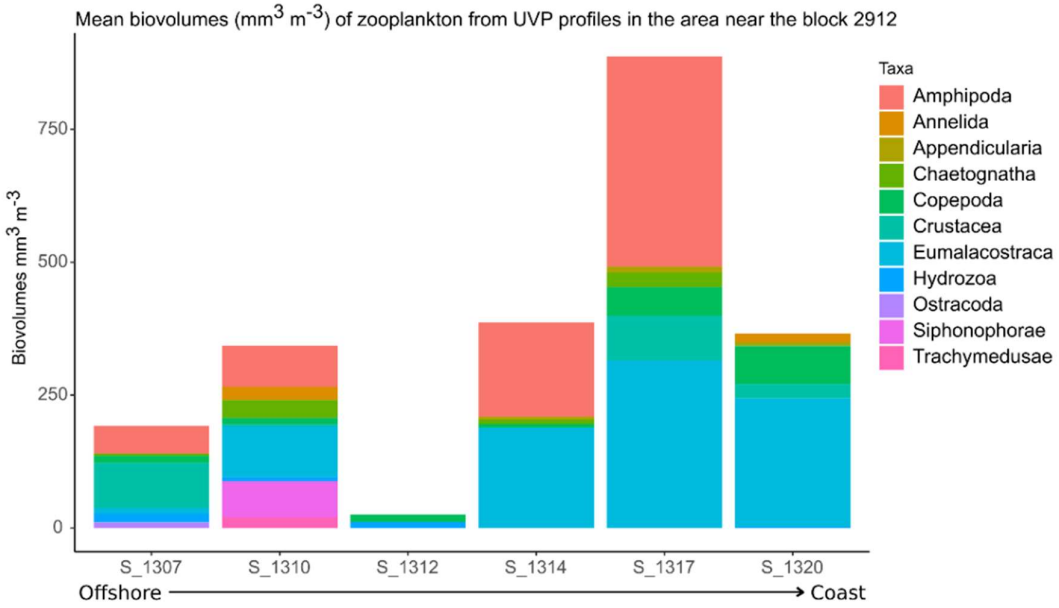


Figure 61. Biovolumes of zooplankton taxa by station from UVP profiles of 2015

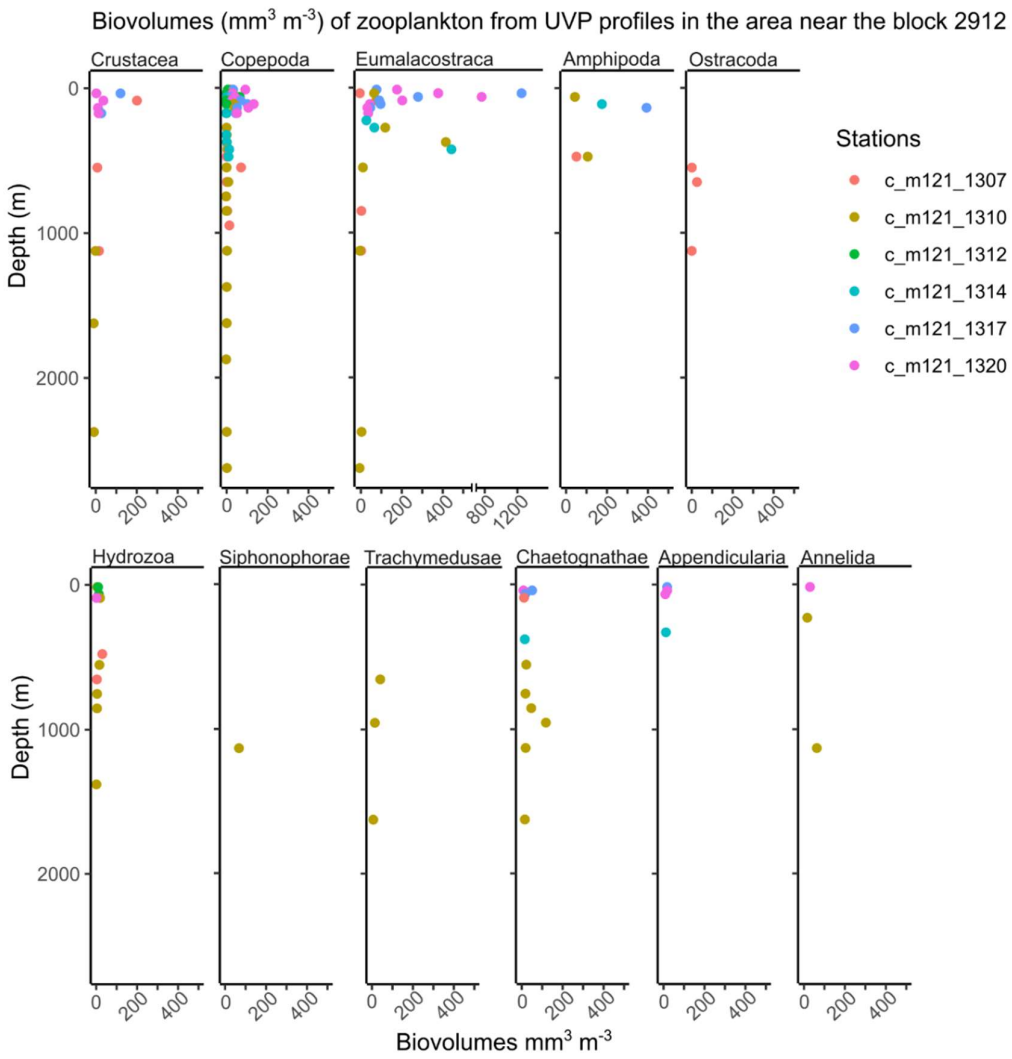
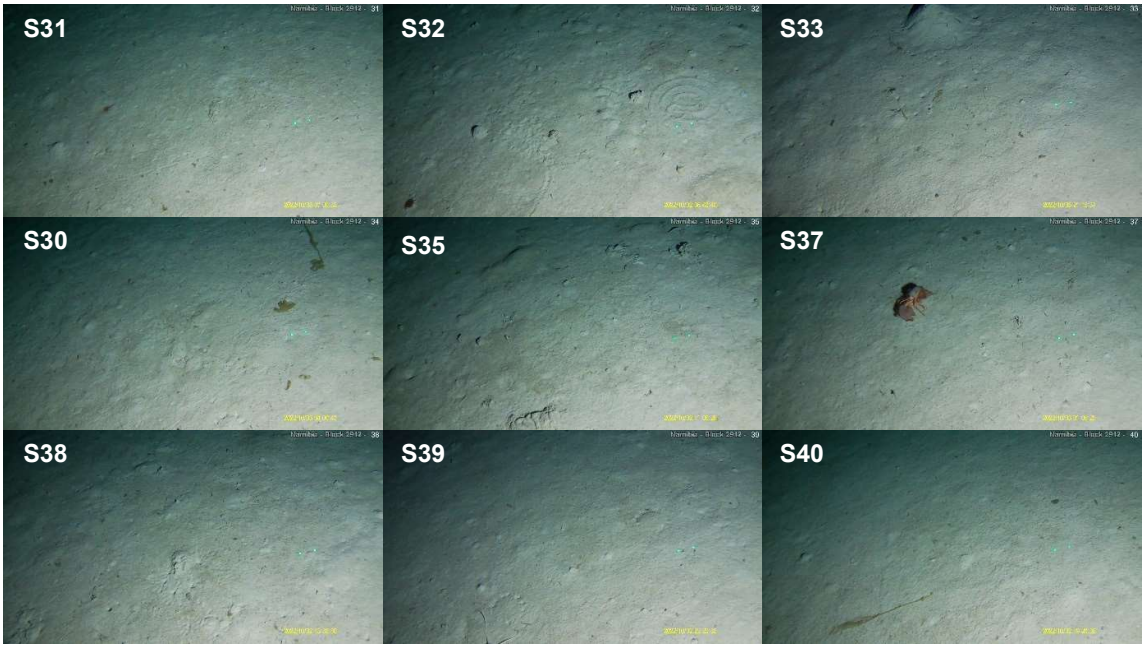


Figure 62. Distribution of zooplankton taxa biovolumes along the water column from the UVP profiles of 2015

6.19. Appendix XIX - Seabed Photograph


S31
S32
S33
S30
S35
S37
S38
S39
S40

6.20. Appendix XX – Camera Transect Log Sheets

Transect	Date	Time	WGS84 UTM 33S Easting (m)	WGS84 UTM 33S Northing (m)	Water Depth (m)	Minutes of Video	Camera Transect Length (m)	Camera System (Front view)	Camera System (Side view)
CAM_01	30/09/2022	23:37:11	300 533	6 770 449	3.152	01:47	500	Pressure Camera	Pressure Camera
	01/10/2022	01:24:16	300 793	6 770 022	3.151				
CAM_04	30/09/2022	16:52:43	298 337	6 760 743	3.211	01:45	531	Pressure Camera	Pressure Camera
	30/09/2022	18:38:18	298 002	6 761 155	3.211				
CAM_05	07/10/2022	09:34:49	280 394	6 754 186	3.346	01:30	332	Pressure Camera	Pressure Camera
	07/10/2022	11:05:41	280 553	6 753 895	3.262				
CAM_07	07/10/2022	03:03:35	270 492	6 744 219	3.503	02:18	519	Pressure Camera	Pressure Camera
	07/10/2022	05:22:20	270 892	6 743 889	3.500				
CAM_08	06/12/2022	20:40:01	284 650	6 726 790	3.410	01:39	479	Pressure Camera	Pressure Camera
	06/12/2022	22:19:10	285 063	6 726 547	3.407				
CAM_09	06/10/2022	15:40:29	294 098	6 721 192	3.309	01:30	426	Pressure Camera	Pressure Camera
	06/10/2022	17:10:41	294 432	6 720 927	3.295				
CAM_12	06/10/2022	09:33:14	298 046	6 708 763	2.894	00:56	550	Seabug (Live Feed)	Pressure Camera
	06/10/2022	10:30:12	298 451	6 708 391	2.985				
CAM_14	06/10/2022	04:27:01	291 406	6 699 649	2.943	00:59	574	Seabug (Live Feed)	Pressure Camera
	06/10/2022	05:27:00	291 846	6 699 280	2.942				