Lochside Environmental Seabed Survey, UK 2007.

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Report C015/08

Institute for Marine Resources and Ecosystem Studies

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Summary

In July 2007 Geolab Nor AS carried out an environmental survey for Chevron Upstream Europe at the Lochside prospect at UKCS block 213/22 and 23 in the Faroe Shetland Channel. The objective of the survey was to describe the physico-chemical and biological characteristics in the Lochside prospect area. This environmental characterisation is needed for as part of a Corporately required Environmental, Social and Health Impact Assessment (ESHI) and a regulatory required Environmental Statement prior to potential exploration drilling operations in 2008.

A total of 10 sample locations were selected over an area of approximately 5.5 km^2. Samples of the seabed were taken using a 0.25 m^2 Haja box corer. Sub samples were collected for different geochemical analyses and biological analysis on macrofauna.

The top seabed sediment of the Lochside area can be characterised as fine to very fine sands with gravel of different sizes scattered over area. The average medium grain size is d(0.5) of 225.4 µm. The sediment of the deeper layer consisted of tough and compacted clay.

The macrofauna community in the study area is relative homogeneous with an overall similarity between the sampling stations of more than 50%. The macrofauna community at the Lochside prospect is almost completely living in the top 10 cm's of the seabed. In the samples of this surface layer of the sediment 78 taxa were found with an average of 32 species per station and an average density of 1080 individuals per m^2. Only 8 species were found in the deeper than 10 cm layer with an average of 1 species per station and 2 individuals per station. Although some species reached higher abundances than others, no indications were found for macrofauna communities dominated by a few species.

The macrofauna assemblage at the Lochside prospect area corresponds to the deep and 'cold' temperature assemblage described found in the Faroe Shetland Channel during the AFEN investigations between 1996 and 2000 and is comparable to the community at the Aberlour prospect SSE of the Lochside area.

Contents

1 Introduction

Chevron North Sea Limited / Chevron Upstream Europe has contracted Geolab Nor AS to conduct several environmental surveys to describe the seabed at a number of areas and locations in the UK sector of the North Sea. One of these locations comprises the Lochside prospect at UKCS block 213/22 and 23 in the West of Shetland area (Figure 1).

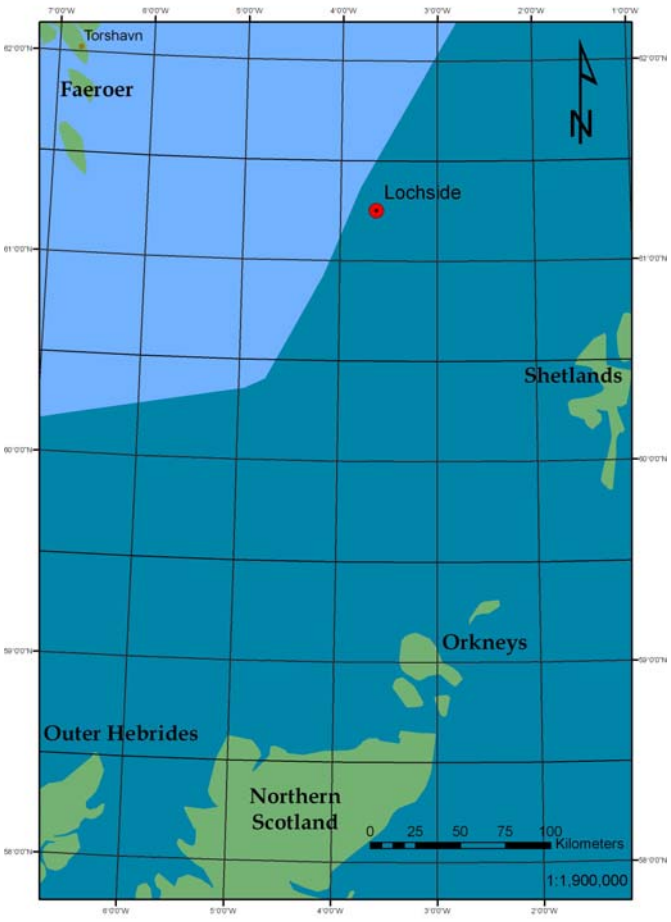

Figure 1: Location of the Lochside prospect.

The Lochside prospect is located approximately 160 km northwest of the Shetland Islands. An environmental characterisation is part of the requirements for the Environmental, Social and Health Impact Assessment (ESHIA) and the regulatory required Environmental Statement prior to exploration drilling operations which are foreseen in 2008. Next to remote sensing operations to describe the seabed, Geolab Nor AS has undertaken geochemical sampling as well as environmental sampling to groundtruth the seabed and sub-seabed. TNO IMARES assisted in the environmental description of the seabed.

The objective of the survey was to describe the physico-chemical and biological characteristics at the Lochside prospect area. In this report the macrofaunal community is characterised.

2 Sampling and techniques

2.1 Field survey

The centre of the Lochside environmental description area is approximately located at station LO-5 at 466405 X and 6791132 Y (ED50). In the area of UKCS block 213/22 and 23 a total of 10 sample stations were selected. The sampling stations are located scattered around Station LO-5 within a circle with a diameter of 11 Km. The coordinates of the sampling stations were provided by Geolab Nor. The positions of the actual sampling stations are given in Table 1 and Figure 2. Positioning and administration of positions were taken care of by Geolab Nor.

Table 1: Position of the stations sampled at Lochside prospect, coordinates in UTM 30N, ED50

Station	Easting	Northing	Depth
LO-01	467792.33	6793850.7	-1118.78
LO-02	465505.98	6788670.4	-1137.05
LO-03	465051.57	6793895.5	-1099.81
LO-04	470338.31	6796482.8	-1126.35
LO-05	466421.5	6791171.9	-1127.40
LO-06	463122.57	6788711.4	-1123.72
LO-07	464720.9	6786067.1	-1149.55
LO-08	469360.25	6788405.0	-1177.20
LO-09	470958.41	6793690.4	-1158.26
LO-10	461650.48	6793949.6	-1071.54

For the survey, the vessel MV Elisabeth was chartered by Geolab Nor The MV Elisabeth is fully capable of undertaking safe seabed sampling and was adjusted for sampling in great water depths. It is equipped with the necessary navigation equipment (DGPS and USBL) for the positioning. General information on water depth, time of sampling and allocation of samples was recorded at the bridge for each sample. Water depth was measured by using CTD probes.

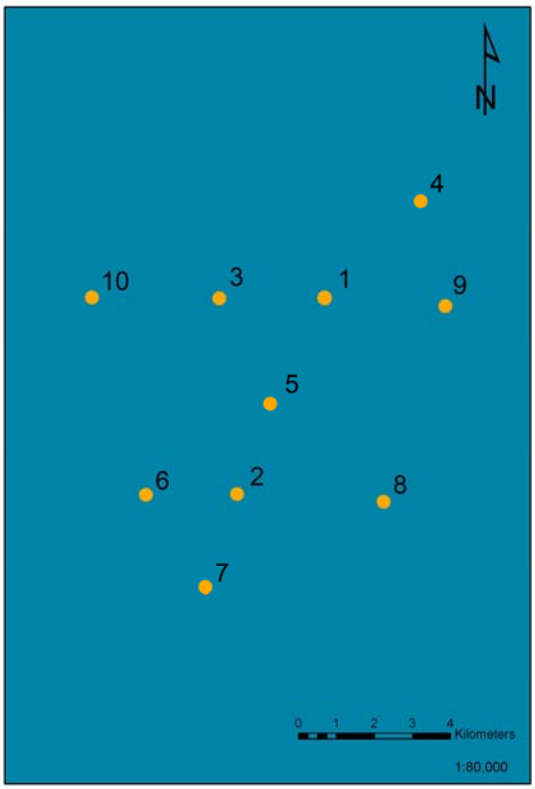

Figure 2: Sampling grid with station numbers at the Lochside prospect, 2007

2.2 Seabed sampling

Sampling of the seabed was conducted using a Haja box corer with a sampling surface of 0.25m². This type of box corer has been designed for undisturbed sampling of the sea bed top soil and is suitable for each sediment type. This equipment has two movable arms. One serves for closing the box with a connected spade, tThe other ensures the resistance in the sediment is equal at both sides preventing distortions and minimizes disruption of the sediment. The corer is operated by a self releasing trigger system, which is released when the frame touches the sea bed (Figure 3).

Figure 3: Haja box corer used at the Lochside prospect

When the box corer was brought on board samples were collected for different geochemical analyses (sediment particle size analysis, heavy and trace metal analyses) and biological analysis on macrofauna.

For the biological analyses, two subsamples were taken from each core: a rectangle sub sample of 0.1 m² and a sub core with an surface area of 50 cm² for the macrofauna analysis. Both samples were split into two layers, i.e. the 0-10 cm surface layer and a rest deeper than 10 cm. This resulted in a total of four samples per core sample. The 0.1 m² samples were sieved over a sieve with 1 mm diameter mesh size and the 50 cm² samples were sieved over a sieve with 500 µm diameter mesh size. From each sample the material left behind on the sieve was collected separately into polyethylene containers and preserved in a 6% borax buffered formaldehyde seawater solution. Each sample was clearly marked for easy identification.

Photographs were taken of both the intact box core surface and the residues of sieving. If applicable notes were made on specific fauna elements present in the sample.

2.3 Geophysical characterisation

The sediment samples were analyzed for particle size distribution and heavy and trace metals by TNO Built Environment and Geosciences, the Netherlands. The particle size distribution was performed on dried sediment

and determined using a Malvern Master Particle Sizer. The results are integrated in this report as back ground information in order to describe the macrofauna in wider environmental setting.

2.4 Macrofauna analyses

In the laboratory of TNO IMARES, the macrobenthos samples were washed over a 0.5 mm mesh sieve to remove the formaldehyde solution and then sorted. Collected macrofauna was examined and identified under a stereomicroscope. Standard taxonomic keys and reference were used to identify the individual organisms. Most taxa were identified at species level, but some at a higher taxonomic level.

In each of the samples, the number of species and species abundance was determined at species level, or, if not possible, at a higher taxonomic level. Juveniles of polychaetes and crustaceans, whose species-specific features weren't present at the time of sampling, were listed as genus followed by "spec. juv.". Data are presented as species-abundance data. Control and further taxonomical analysis was conducted by Mr. B. Wasson of Benthic Studies, UK. Problematic specimens were kept aside for further examination and were double checked by specialists.

The benthic community of the samples is described by species richness and diversity. The diversity is expressed by the number of species and by the Shannon-Wiener index (H'). The Shannon-Wiener index is the most commonly used index in marine ecology and takes both the number of species and their abundance into account. To express how evenly the individuals are distributed among the different species, Pielou's evenness index (J') is also given. The index J' ranges between 0 and 1, with low values indicating that one or a few species dominate the benthic community, whereas higher values indicate a more even distribution of the number of individuals over the species. Furthermore, Margalef's index (d) is calculated as a measure for species richness.

3 Results

3.1 Sampling

All samples were taken at July 18 - 19th, 2007. All 10 samples were taken using the 0.25 m^2 Haja box corer. The box corer deployments resulted in good quality cores with virtually undisturbed sediment surfaces.

In all samples the sediment consisted of fine mud with scattered stones ranging in size from approximately 1mm to several cm's. Sediment of the deeper layers of the cores consisted of extremely tough and compacted clay which was difficult to wash over the sieve, without risking to damage organisms possibly present in the sample. In all cases the sediment surface gave a undisturbed appearance. Due to the handling on board the overlying water was turbid by resuspension of the very finest sediment fraction. Visible macrofauna elements were mainly tube building polychaetes, some amphipods and a few molluscs. A short description of the samples and a photographical description is given in Annex 2.

3.2 Sediment parameters

The surface sediment characteristics of the 10 samples were similar and can be described as ranging from very fine to medium sands (average fine sands) with scattered stones ranging in size from approximately 1 mm to several cm's. The results of the particle size distribution are summarised in Table 2. The sediment at the 10 stations showed some differences in silt content (<63µm) and sorting coefficient (d(0.6)/d(0.1)). Silt content at the surface varied between 16.89 and 51.44 %. The average medium grain size d(0.5) is 225.4 µm. At Station LO 06 a finer sediment was found which resulted in low D(50) value of 57.5 µm and a relative high silt content. At this station some of the heavy and trace metals values were higher when compared to the other stations possible as a result of the higher silt content (Table 3). The values for Lead and Zink were found extremely high at Station LO 02. In the calculation of average values these outliers were not included.

Table 2: Sediment parameters (TNO Built Environment and Geosciences)

Station	< 63µ	d (0.1)	d (0.5)	d (0.6)	d (0.9)	d(0.6)/d(0.1)
LO 01	30.93	6.44	217.31	264.38	524.64	41.04
LO 02	35.23	6.06	193.78	240.85	446.72	39.72
LO 03*	26.52	9.84	234.26	285.24	851.36	29.43
LO 04	25.47	7.75	250.73	304.04	671.58	39.21
LO 05	21.87	9.39	301.46	367.28	1045.61	39.14
LO 06	51.44	8.61	57.54	149.20	488.45	17.32
LO 07	16.89	13.69	297.86	348.88	862.48	25.49
LO 08	22.30	9.77	252.04	294.55	634.03	30.16
LO 09	29.46	8.51	227.52	287.92	840.26	33.83
LO 10*	32.79	7.49	221.41	282.68	725.42	38.33
avg	29.29	8.76	225.39	282.50	709.06	33.37

* average of 2 samples

Table 3: Metal concentrations as mg/kg dry sediment. (TNO Built Environment and Geosciences). For Pb and Zn the values for station LO 02 were not included in the calculation of the average value

Element	As	Ba	Cr	Cd	Hg	Pb	Mn	Ni	Sr	V	Zn
Detection limit	0.01	0.03	0.09	0.00	0.00	0.01	0.10	0.03	0.01	0.01	0.09
Station	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
LO 01	4.69	153	37	1.53	0.04	8.63	582	23	250	92	64
LO 02	4.81	152	38	1.68	0.04	44.44	544	26	241	90	747
LO 03	4.38	140	32	1.42	0.04	8.33	472	21	254	83	57
LO 04	4.49	130	33	1.68	0.04	8.33	504	29	197	83	63
LO 05	4.71	162	39	1.82	0.04	7.51	566	24	235	90	66
LO 06	5.01	194	58	1.67	0.04	9.70	659	39	232	123	82
LO 07	4.68	170	32	1.62	0.03	7.31	511	19	230	82	58
LO 08	4.27	144	32	1.68	0.03	7.85	495	19	213	79	60
LO 09	4.43	133	33	1.38	0.04	9.79	516	20	225	79	64
LO 10	4.09	116	44	1.64	0.04	8.26	551	28	212	101	70
avg	4.55	149	38	1.61	0.04	8.41*	540	25	229	90	65*

* values of Station LO 02 not included

3.3 Macrofaunal analysis

3.3.1 Abundance

In the samples of the top 10 cm of the sediment an average density of 1080 individuals per m^2 were found. A full station by species matrix is given in Annex 3. In this top 10 cm sediment layer the most dominant species were the polychaetes *Paramphinome jeffreysii*, *Notomastus sp., Notoproctus oculatus*, *Chaetozone setosa* and *Proclea grafii* and individuals belonging to the family of sipunculan worms *Golfingiidae.*

In the deeper sediment layer (10 cm) the abundance of macrofauna organisms is very low (average 22 ind/m^2). At 4 stations no organisms were found at all in the deeper layer The organisms present were polychaetes and each species was only present at one or two stations.

3.3.2 Diversity

De results of the macrofauna analysis are given in Annex 3. A total number of 92 macrofauna taxa was identified. As juveniles specimens are very difficult to determine to species level, juveniles were not counted as separate species when adults of the same Genus were present in the sample. Three gastropod species at station LO 03 and LO 04 could not be identified with certainty, but were thought to be *Cylichnina umbilicata*.

In the top 10 cm of the sediment all 92 taxa were found with an average of 32 taxa per station. Only 8 taxa were found in the layer below 10 cm, with an average of 1 species per station.

Numerically the most important taxonomic groups in the upper layer were the polychaete worms, represented with 34 taxa (42%) and the crustaceans represented with 31 taxa (34%). Mollusc species are present with 9 taxa (10%) and Echinoderms with two taxa (2%).The other taxa belong to various taxonomic groups.

Nine taxa were present at all stations of the top 10 cm of sediment. These taxa included the *Porifera* (sponges), *Nematoda*, sipunculan worms of the family *Golfingiidae,* the polychaete species *Paramphinome jeffreysii*,

Chaetozone setosa, Notomastus sp., Notoproctus oculatus, *Myriochele fragilis, Proclea grafii* and *Chone duneri* . These nine taxa represent approximately 68 % of the total number of individuals found in the top sediment layer. Next to these nine species also the *Porifera* family *Scettidae*, the polychaete species *Glycera minima*, *Prionospio cirrifera*, *Aphelochaeta sp*. and *Samythella neglecta* and the Gammarid species *Harpinia mucronata* and *Harpinia abyssi* were present in at least 70% of the stations.

The diversity indices (Shannon-Wiener H', Pielou's eveness J' and Margalef's d) for the 0-10 cm seabed layer are given in Table 4. Values for the Shannon Wiener index in the top layer of the 10 stations range from 2.33 at station LO 09 to 3.15 at station LO 04, reflecting a moderate species richness in the survey area. The values for Pielou evenness index J' varied from 0.72 at station LO 09 to 0.87 at station LO 06, respectively. Although just nine taxa make up 68 % of the total number of individuals found in the top sediment layer, the relative high value for Pielou's J' indicate that the macrofauna community at the different stations is not dominated by one or a few species.

In the deeper layer the diversity is low as a result of the low abundance of organisms and species. Diversity indexes could only be calculated for stations LO 08 and station LO 09 (Table 5).

Table 4: Summary of macrofauna analysis of the top 10 cm sediment samples; number of species, density, species richness (Margalef's d), Eveness (Pielou J') and Shannon Wiener Diversity index H'.

	no. of species	**no. ind/m²**	**Species richness (Margalef's d)**	**Eveness Pielou's (J')**	**Shannon Wiener Diversity (H')**
Station	S*	N **	d	J'	H'(loge)
LO 01	31	980	6.73	0.82	2.85
LO 02	27	1270	5.56	0.81	2.70
LO 03	28	930	6.16	0.82	2.77
LO 04	41	1260	8.66	0.84	3.15
LO 05	30	870	6.91	0.83	2.86
LO 06	31	1020	6.69	0.87	3.00
LO 07	33	990	7.14	0.80	2.84
LO 08	37	1030	7.95	0.85	3.11
LO 09	25	1160	5.04	0.72	2.33
LO 10	32	1120	6.97	0.81	2.85
avg	31.5	1081	6.78	0.82	2.85

* Nr of species corrected for juveniles or *indet* (*sp*)

** Porifera, Sycettidae and Anthozoa were not included in the density calculations

Table 5: Summary of macrofauna analysis of the deeper (10 cm) sediment layer samples; number of species, density, species richness (Margalef's d), Eveness (Pielou J') and Shannon Wiener Diversity index H'.

	no. of species	no. ind/m²	Species richness (Margalef's d)	Eveness Pielou's (J')	Shannon Wiener Diversity (H')
Station	S **	N *	d	J'	H'(loge)
LO 01	0	0	-	-	-
LO 02	1	20	-	-	-
LO 03	0	0	-	-	-
LO 04	0	0	-	-	-
LO 05	1	40	-	-	-
LO 06	0	0	-	-	-
LO 07	1	40	-	-	-
LO 08	3	60	1.820478	1	1.098612
LO 09	2	20	1.442695	1	0.693147
LO 10	1	20	-	-	-
avg	0.90	22.00	1.63	1.00	0.90

3.3.3 Benthic community structure

The benthic community structure from the top 10 cm was analysed using a hierarchical cluster analysis on the abundance data. The abundance data were square root transformed. With an overall similarity of more than 50% among the 10 stations the distribution of the macrofauna in at the Lochside area is relative homogeneous (Figure 4). Stations LO 03 is somewhat separated, while the other stations are combined in groups of two or three stations all with similarities of approximately 60%. At the Lochside area the differences between the groups of stations are related to differences in abundance of the dominant species as *Paramphinome jeffreysii*, *Proclea grafii*, *Chaetozone setosa*, *Golfingiidae* and *Notoproctus oculatus*. The lower abundance of *Paramphinome jeffreysii Chaetozone setosa* and *Proclea grafii* is responsible for the differentiation between station LO 03 and the other stations.

Due to the almost absence of macrofauna organisms it is not sensible to make a community analysis of the deeper layer. It is clear that the benthic community in the Lochside area has to be characterised by the organisms in the upper 10 cm of the seabed.

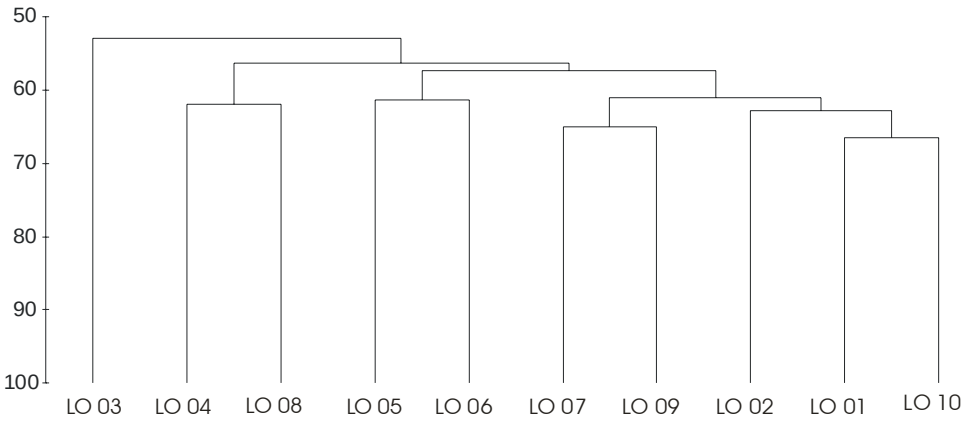

Figure 4 Dendrogram of Bray-Curtis Similarity (%) for all stations, abundance data square root transformed. Surface samples 0-10 cm.

4 Discussion

The Lochside prospect at UKCS block 213/22 and 23 in the Faroe Shetland Channel area was described by taking samples of the seabed at 10 stations. The top seabed sediment of the Lochside area can be characterised as fine to very fine sands with gravel of different sizes scattered over area. The average medium grain size is d(0.5) of 225.4 µm. The deeper layer consists of very compact clay. The sediment characteristics of the stations at the Lochside prospect are within the range found at stations at comparable depth in the Faroe Shetland Channel during the environmental SEA 4 survey's between 1996 and 2000 (Bett, 2000, Hughes*et al.*, 2000) and a environmental survey at UKCS block 213/28 in 2007 (Van Dalfsen & Witbaard, 2008).

The metal concentrations at the Lochside prospect are low, except for Lead and Zink, which reached very high values at station LO 02. An explanation for these outliers is obvious. The nearest stations LO 05 to LO 08 do not show levels that are elevated. Only at station LO 06 some of the heavy and trace metal values were a little higher compared to the other stations, but these can be related to the higher silt content of the sediment at this station. At all 10 stations the concentration of Barium as a trace metal of drilling activities was lower than the 250 – 300 mg/kg described in the AFEN investigations.

The macrofauna community at the Lochside prospect is almost completely living in the top 10 cm's of the seabed. In the deeper compact clay layer below 10 cm only a few organisms were found and appears not to be a suitable habitat for benthic organisms. The macrofauna assemblage in the area can be described as homogeneous with an overall similarity over 50 % between the stations.

The range in average density of 870 - 1260 individuals per m^2 corresponds well to the 1000 – 1500 ind/m^2 described for stations in the same depth zone sampled in the AFEN investigations (Bett, 2000, Hughes*et al.*, 2000) and the 760 – 1290 individuals per m^2 at the Aberlour prospect SSE of the Lochside area (Van Dalfsen & Witbaard, 2008). The species richness in the top 10 cm of the seabed, as assessed by the Shannon-Wiener index and Pielou's index for Eveness, is relatively high. The values of the Shannon-Wiener diversity index and Pielou's Index of Eveness found for the different stations are also comparable to those found in the region during the AFEN study, respectively H' 2.72 – 3.25; J' 0.8 – 0.95. Species richness as presented by Margalef's d, however is at the Lochside prospect two times higher compared to the AFEN investigations for the stations at a 1000 m depth (d 6.8 vs. 3.5).
The macrofauna assemblage at the Lochside prospect area corresponds with the deep and 'cold' temperature assemblage described found in the SEA4 area of the AFEN study and resembles that of the Aberlour prospect (Van Dalfsen & Witbaard, 2008). In the Lochside survey polychaetes and crustaceans were the dominant taxonomical groups which clearly correspond to the pattern in the deep and cold water assemblages.

The numerical dominant polychaete species *Notoproctus oculatus*, *Paramphinome jeffreysii* and *Chaetozone setosa* as well as the family *Golfingidae* found in this study were also found to be the dominant species at the Aberlour prospect. The polychaetes *Paramphinome jeffreysii* and *Chaetozone* were also amongst the dominant species during the cruises between 1996 and 2000. In the AFEN study the polychaete *Spiophanes kroyeri* dominated as well, but it was only present at one station in this study. S*piophanes kroyeri* , however, showed a rapid decrease below 900 m in the AFEN studies (Hughes*et al.*, 2000)
The results of the environmental survey at the Lochside prospect are in agreement with the biological characteristics of the deep-water fauna described for a larger area with water depths in excess of 1000 m in the Faroe Shetland Channel.

5 References

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Van Dalfsen J.A. & R. Witbaard (2008): Aberlour Environmental seabed survey, UK 2007. Wageningen IMARES report C016/08.

6 Referees and Authors

Rapport	C015/08
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This report has been professionally prepared by Wageningen IMARES. The scientific validity of this report has been internally tested and verified by another researcher at Wageningen IMARES.

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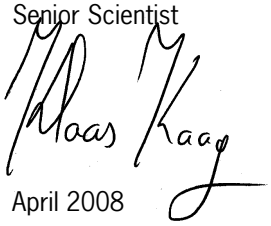
Signature:	
Date:	April 2008

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Signature:	
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7 Quality assurance

IMARES utilises an ISO 9001:2000 certified quality management system (certificate number: 08602-2004-AQ-ROT-RvA). This certificate is valid until 15 December 2009. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. The last certification inspection was held the 16-22 of May 2007. Furthermore, the chemical laboratory of the Environmental Division has NEN-AND-ISO/IEC 17025:2000 accreditation for test laboratories with number L097. This accreditation is valid until 27 March 2009 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation, with the last inspection being held on the 12th of June 2007.

Annex 1 Cruise summary

Participants; Rob Witbaard, Arnold Bakker
Subject: Environmental survey, macrofauna sampling
Ship: Elisabeth
Periode July 15th-21th 2007
Location; Faroe-Shetland Channel, Lochside Prospect.

Mobilisation at Grabster July 16th. Departure in the evening of July 16th, heading towards the Aberlour research area in the Faroe-Shetland Channel, arrival Tuesday 17th around noon. The bottom at the research areas is so soft that the core does not contain overlying water. Three layers of lead were removed and the stopper bar was moved on the central shaft of the boxcorer so that penetration of the corer is limited. Penetration depth was limited resulting in approximately 20 cm of overlying water. The rest of the boxcores taken during this sampling campaign were accordingly good and in terms of penetration depth and core quality approved. All cores came on board with overlying water but due to the handling on board the overlying water was turbid by resuspension of the very finest sediment fraction. Apart from this minor disturbance, all cores appeared to have undisturbed surfaces. The sediment consisted of fine mud with scattered stones ranging in size from approximately 1 mm to several cm. Sediment at deep layers of the cores was extremely tough and compacted clay. This was very hard to handle. When noticeable, obvious fauna elements were photographed. Out off the boxcorer a subsample with a size of 28X36 cm was sieved over a 500µ screen.

Work at the Aberlour prospect was continued until July 18th at approximately 13:30. Transit was made to the Lochside area (LO) where coring was started at approximately 20:00 hr. Unfortunately the first trial at this station was unsuccessful. Floats attached to the steel cable above the corer, to keep the cable "afloat" above the seabed, had imploded. The steel cable was hooked under the flag of the corer and came untripped to the surface. Due to handling it tripped at the sea surface. The tripping mechanism became a bit distorted but was still functioning. Coring was continued and went rapidly afterwards and without further trouble, except for station LO-07. At July 19th 12:30 coring operations were ended. Late in the afternoon the ship set sail heading east towards Norway.

Table: List of station locations as supplied by Geolab Nor.

Environmental Survey 2007 Lochside
Sample locations and preliminary as-sampled positions.

	Intended X	Intended Y	Average Sampled X	Average Sampled Y	Average Depth	Average Delta X	Average Delta Y	Average Distance from Intended	Accepted?
LO-01A	467802	6793884	467798.95	6793808.06	-1107.46		75.94	76.00	NO - Grab Empty
LO-01B	467802	6793884	467792.33	6793850.72	-1118.78	9.67	33.28	34.65	YES
LO-02	465498	6788707	465505.98	6788670.39	-1137.05	-7.98	36.61	37.47	YES
LO-03	465047	6793861	465051.57	6793895.46	-1099.81	-4.57	-34.46	34.76	YES
LO-04	470317	6796467	470338.31	6796482.83	-1126.35	-21.31	-15.83	26.55	YES
LO-05	466405	6791132	466421.50	6791171.91	-1127.40	-16.50	-39.91	43.18	YES
LO-06	463120	6788711	463122.57	6788711.39	-1123.72	-2.57	-0.39	2.60	YES
LO-07A	464695	6786120	464707.26	6786083.93	-1147.99	-12.26	36.07	38.09	NO - Grab Empty
LO-07B	464695	6786120	464720.90	6786067.13	-1149.55	-25.90	52.87	58.87	YES
LO-08	469369	6788440	469360.25	6788405.02	-1177.20	8.75	34.98	36.06	YES
LO-09	470944	6793673	470958.41	6793690.44	-1158.26	-14.41	-17.44	22.63	YES
LO-10	461689	6793892	461650.48	6793949.63	-1071.54	38.52	-57.63	69.32	YES

All "as sampled" positions are preliminary calculations, and are taken as average of X/Y positions when Grab at maximum depth +/- 10m.

Geodetic information
Survey datum ED50
Ellipsoid: international 1924
Semi-major axis 6,378,388
1/Flattening; 297.00
Projection : UTM 30N
Central Meridian 3 deg West

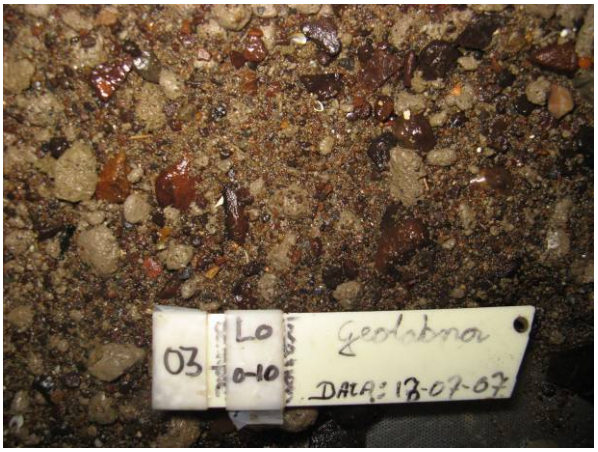
Annex 2 Photo documentation

In the photo documentation below for each station the following photographs have been given:
on the first row: habitus of the drained core surface;
on the second row: sieving residue of the top layer and of the deeper layer;
on the third row: details an or fauna components observed in the sample.

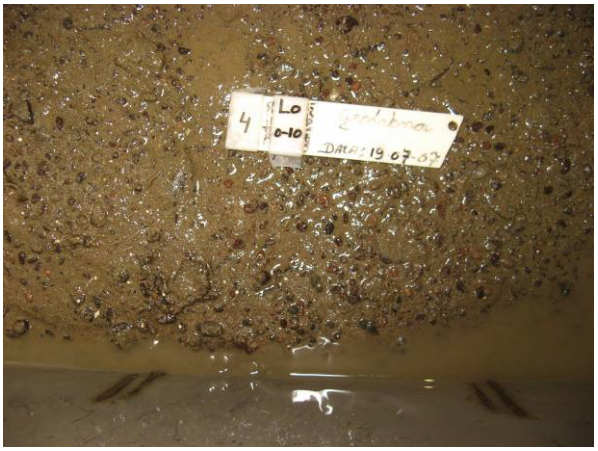
Station LO 01
Date 18/07/2007
Start time 19:50
End time 20:30
Penetration depth 35cm

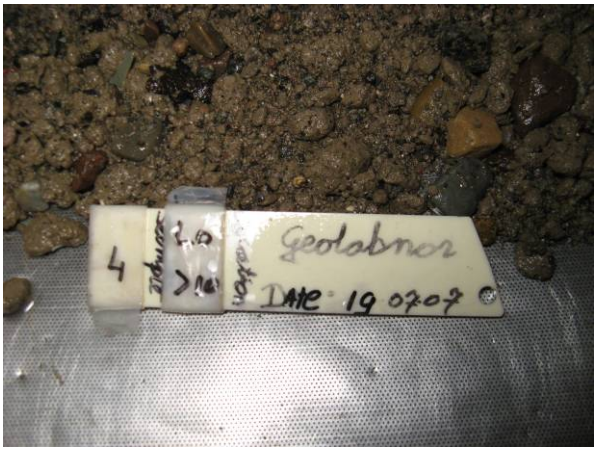
Station LO 02
Date 18/07/2007
Start time 21:30
End time 22:15
Penetration depth 36cm

Station LO 03
Date 18/07/2007
Start time 23:00
End time 23:40
Penetration depth 31cm



Station LO 04
Date 19/07/2007
Start time 12:40 (18/07)
End time 01:30 (19/07)
Penetration depth 32 cm





Station LO 05
Date 19/07/2007
Start time 02:55
End time 03:40
Penetration depth 32cm

Station LO 06
Date 19/07/2007
Start time 04:40
End time 05:20
Penetration depth 36cm

Station LO 07
Date 19/07/2007
Start time 06:55
End time 07:40
Penetration depth 33cm

Station LO 08
Date 19/07/2007
Start time 08:40
End time 09.20
Penetration depth 29cm

Station LO 09
Date 19/07/2007
Start time
End time
Penetration depth

Station LO 10
Date 19/07/2007
Start time 12:00
End time 12:30
Penetration depth 33cm

Annex 3 Species List

(0 -10 CM SEDIMENT LAYER)

Species	Authority	LO 01	LO 02	LO 03	LO 04	LO 05	LO 06	LO 07	LO 08	LO 09	LO 10
Porifera		p	p	p	p	p	p	p	p	p	p
Sycettidae		p	p		p	p		p	p		p
Anthozoa								p			
Cerianthidae				1							
Actiniaria		p	1					1		1	1
Nemertina						1	1		1	1	
Nematoda		1	6	3	2	1	2	3	2	2	1
Golfingiidae		10	23	11	18	4	5	3	8	12	8
Phascolion sp	Théel, 1875				3			1			
Eunoe nodosa	(M Sars, 1861)			1			1	1	1		
Mystides sp	Theel, 1879				2						
Eumida sp	Malmgren, 1865				1						
Eumida bahusiensis	Bergstrom, 1914				1						
Glycera [juv]	Savigny, 1818			2							
Glycera mimica	Hartman, 1965	2	1		4	1	1	3	1		2
Eunereis longissima	(Johnston, 1840)			1							
Paramphinome jeffreysii	(McIntosh, 1868)	10	16	5	4	19	9	14	5	16	17
Euphrosinidae							2				
Nothria conchylega	(G O Sars, 1835)	1	1	4	2			1			2
Schistomeringos rudolphi	(Delle Chiaje, 1828)		1								
Paraonidae			2								
Aricidea catherinae	(Laubier, 1967)		1								
Paradoneis lyra	(Southern, 1914)										1
Prionospio cirrifera	Wirén, 1883	1	3		1	1	4	1	1		1
Spiophanes kroyeri	Grube, 1860							1			
Spiochaetopterus sp	Sars, 1853				1						
Chaetozone setosa	Malmgren, 1867	8	9	4	15	14	13	4	13	2	13
Cirratulus [juv]	Lamarck, 1801	1	1								1
Cirratulus cirratus	(O F Müller, 1776)		1		2	1	2		2		
Aphelochaeta sp	Blake, 1991	6	2	4	6	3	7		5	3	3
Brada villosa	(Rathke, 1843)	1			1						
Notomastus sp	Sars, 1851	5	6	4	7	5	9	7	13	8	8
Maldanidae								1			
Maldane sp	Grube, 1860				1						
Praxillella affinis	(M Sars, 1872)		1				1				

Species	Authority	LO 01	LO 02	LO 03	LO 04	LO 05	LO 06	LO 07	LO 08	LO 09	LO 10
Notoproctus oculatus	Arwidsson, 1907	21	18	26	20	10	13	23	15	41	23
Myriochele fragilis	Nilson & Holthe, 1985	3	3	1	4	3	3	2	1	2	3
Myriochele oculata	(Zachs, 1923)			1	4		2	1	2	1	
Ophelina cylindricaudata	(Hansen, 1878)			1							
Asclerocheilus intermedius	(Saint-Joseph, 1894)			1	1	1				2	
Amage auricula	Malmgren, 1866		1	1	2		2	2			
Ampharete [juv]	Malmgren, 1866					1					
Ampharete lindstroemi	Hessle, 1917					1					
Melythasides laubieri	Desbruyères, 1978						1		1		
Glyphanostomum pallescens	(Theel, 1878)		1								
Samythella neglecta	(Wollebaek, 1912)	1			1	2	1	1	1	1	
Terebellides atlantis	Williams, 1984							2			
Terebellides stroemi	M Sars, 1835			1					3		
Amphitritinae						1	1		1		
Proclea sp	Saint-Joseph, 1894					2					
Proclea grafii	(Langerhans, 1884)	10	16	7	3	2	9	14	3	12	5
Thelepus cincinnatus	(Fabricius, 1780)			2	1			1	4		1
Sabellidae [juv]		1				1					1
Chone duneri	Malmgren, 1867	1	1	3	1			3	1	3	4
Potamilla neglecta	(M Sars, 1851)	1									
Copepoda		1				3	1				
Monoculodes sp	Stimpson, 1853						1				
Amphilochidae									1		
Amphilochus manudens	Bate, 1862	1					1				
Amphilochus tenuimanus	Boeck, 1871					1			1		
Harpinia sp	Boeck, 1876	2									1
Harpinia mucronata	Sars, 1879		2		1	1		1	2	1	1
Harpinia crenulata	(Boeck, 1871)										1
Harpinia abyssi	Sars, 1879			1	2	1	1	1		1	2
Lysianassidae					3				1		
Anonyx sp	Kröyer, 1838			1						1	1
Hippomedon sp	Boeck, 1871	1			1				2		
Orchomene pectinatus	Sars, 1882					1					
Tmetonyx cicada	(O Fabricius, 1780)	1			1			1	1		
Onesimus sp	Boeck, 1871	1							1	1	
Pardalisca tenuipes	Sars, 1893		2								
Halice sp	Boeck, 1871								1		
Byblis minuticornis	Sars, 1879			1							
Haploops sp	Liljeborg, 1855	1					2				1
Melphidippa borealis	Boeck, 1871				1						

Species	Authority	LO 01	LO 02	LO 03	LO 04	LO 05	LO 06	LO 07	LO 08	LO 09	LO 10
Neohela monstrosa	(Boeck, 1861)	1									
Unciola sp	Say, 1818	1				1		1	3	1	
Gnathiidae [female]					1		1				1
Gnathia sp	Leach, 1814				1		1				1
Nannoniscoides sp	Hansen, 1916										1
Macrostylidae			2						1		1
Desmosomatidae											3
Eurycope sp	Sars, 1864							1			
Heteromesus frigidus	Hansen, 1916				1						
Paratanaoidea		2				1	1	1		1	
Pseudosphyrapus anomalus	(G.O. Sars, 1869)		6			1		1	1		
Akanthophoreinae					1					1	
Leptognathia voeringi	(G.O. Sars, 1877)					1					
Akanthophoreus longiremis	(Lilljeborg), 1864								1		
Mollusca											1
Buccinidae [juv]	Rafinesque, 1813			1				1			
Colus jeffreysianus	(P Fischer, 1868)				1						
Philine sp	Ascanius, 1772				1				1		
Cylichnina ?umbilicata	(Montagu, 1803)			2	1						
Yoldiella lucida	(Lovén, 1846)									1	
Limidae								1			
Cuspidaria sp	Nardo, 1840			2	1				1		
Policordia sp	Dall Bartsch & Rehder, 1938	1			1					1	
Crossaster [juv]	(Linnaeus, 1767)						3		1		1
Amphiuridae [juv]							1				
Myriotrochidae						2					1
Ascidiacea [juv]				1							
	nr individuals*	100	129	94	128	89	103	102	105	117	114
	nr species**	31	27	28	41	30	31	33	37	25	32

* presence p counted as 1

** corrected for juveniles or indet (sp)

Species List

(>10 CM SEDIMENT LAYER)

Species	Authority	LO 01	LO 02	LO 03	LO 04	LO 05	LO 06	LO 07	LO 08	LO 09	LO 10
Nematoda									2		
Golfingiidae			2								
Paramphinome jeffreysii	(McIntosh, 1868)					4					
Chaetozone setosa	Malmgren, 1867								2		
Aphelochaeta sp	Blake, 1991									2	
Notoproctus oculatus	Arwidsson, 1907							4		2	
Myriochele fragilis	Nilson & Holthe, 1985										2
Chone duneri	Malmgren, 1867								2		
	nr individuals	0	2	0	0	4	0	4	6	4	2
	nr species**	0	1	0	0	1	0	1	3	2	1

** corrected for juveniles or indet (sp)