Environmental Survey Beneath Finfish pens at Deenish, Kenmare Bay

August 2014

Produced by

AQUAFACT International Services Ltd

On behalf of

Marine Harvest Ireland

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1. Introduction

This report documents the environmental conditions of the seabed at a Marine Harvest Ireland finfish (*Salmo salar*) aquaculture site in Kenmare Bay, Co. Kerry / Cork on 7th August, 2014 (see Figure 1.1). The aquaculture site is situated close to Deenish Island, County Kerry on the northern shore of Kenmare River.

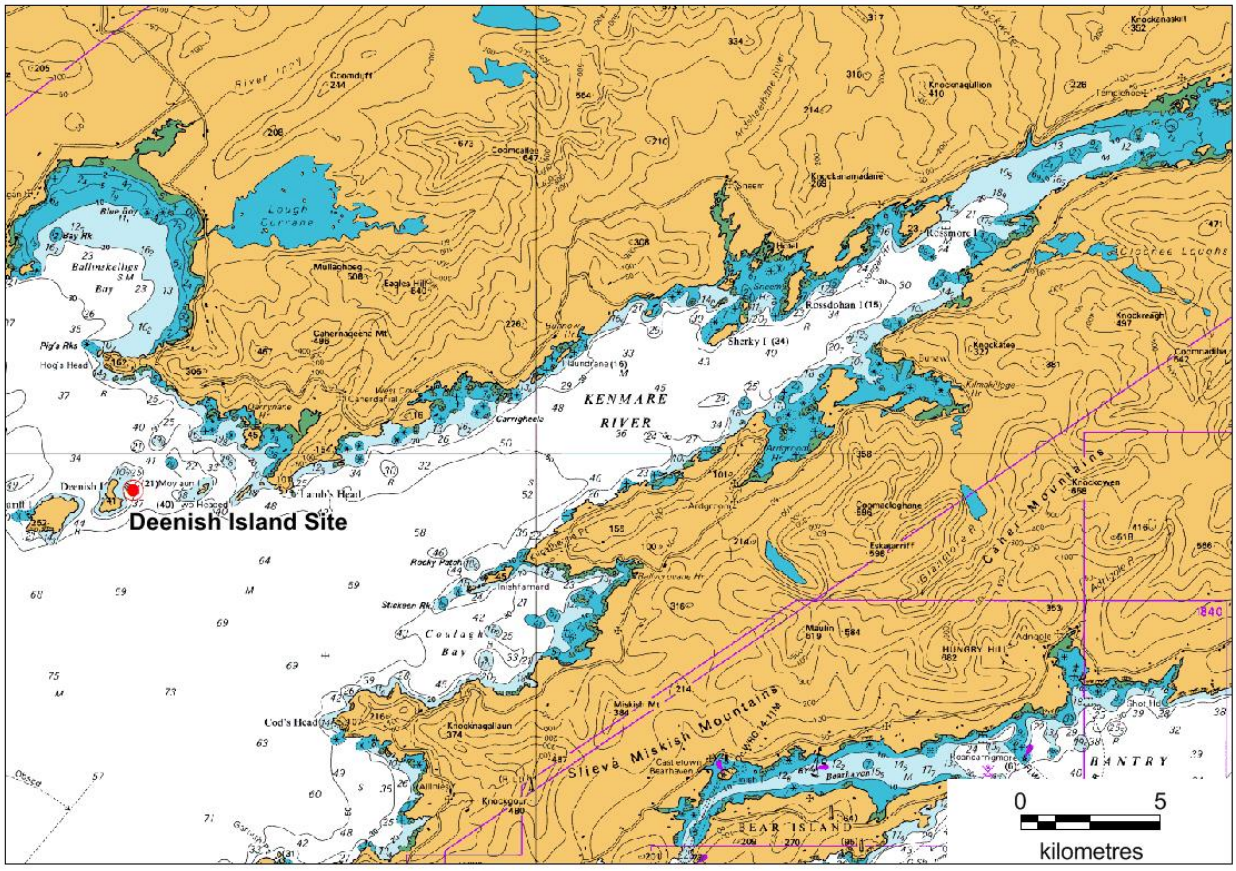


Figure 1.1. Map showing the location of the Deenish site surveyed in Kenmare Bay

Kenmare Bay, Co. Kerry, is a long and narrow, south-west facing bay. It is a deep, drowned glacial valley and the bedrock is mainly Old Red Sandstone which forms reefs along the middle of the bay throughout its length. Exposure to prevailing winds and swells at the mouth diminishes towards the head of the bay. Numerous islands and inlets along the length of the bay provide further areas of additional shelter in which a variety of habitats and unusual communities occur.

Two Natura 2000 sites are of relevance for the Deenish site (see Figure 1.2). Deenish Island is located in the outer reaches of the Kenmare River cSAC (Site code: 002158) and the island forms part of the Deenish Island and Scariff Island SPA (Site code: 004175).

Kenmare River cSAC has a very wide range of marine communities from exposed coast to ultra-sheltered areas. The site contains three marine habitats listed on Annex I of the EU Habitats Directive, namely reefs, large shallow bay and caves. There is also an extremely high number of rare and notable marine species present (24) and some uncommon communities. Kenmare River is the only known site in Ireland for the northern sea-fan, *Swiftia pallida* and is the only known area where this species and the southern sea-fan *Eunicella verrucosa* co-occur. Midway along the south coast of Kenmare River, a series of sea caves stretch back into the cliff. They typically support encrusting sponges, ascidians and bryozoans.

Deenish Island and Scariff Island are small- to medium-sized islands situated between 5 and 7 km west of Lamb's Head off the Co. Kerry coast; they are thus very exposed to the force of the Atlantic Ocean. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Fulmar, Manx Shearwater, Storm Petrel, Lesser Black-backed Gull and Arctic Tern. Scariff is the larger of the two. It is steep-sided all the way around and rises to a peak of 252m. The highest cliffs are on the south side. The island vegetation is a mix of maritime grassland, areas dominated by Bracken and heathy areas with Ling Heather. There are the ruins of a monastic settlement and a cottage in the north-east sector of the island. Deenish is less rugged than Scariff, and rises to 144m in its southern half; the northern half is lower and flatter. The vegetation is mostly grassland, with some heath occurring on the higher ground. Old fields are now overgrown with Bracken and brambles. The sea areas to 500m around the islands are included inside the SPA boundary to provide a 'rafting' area for shearwaters.

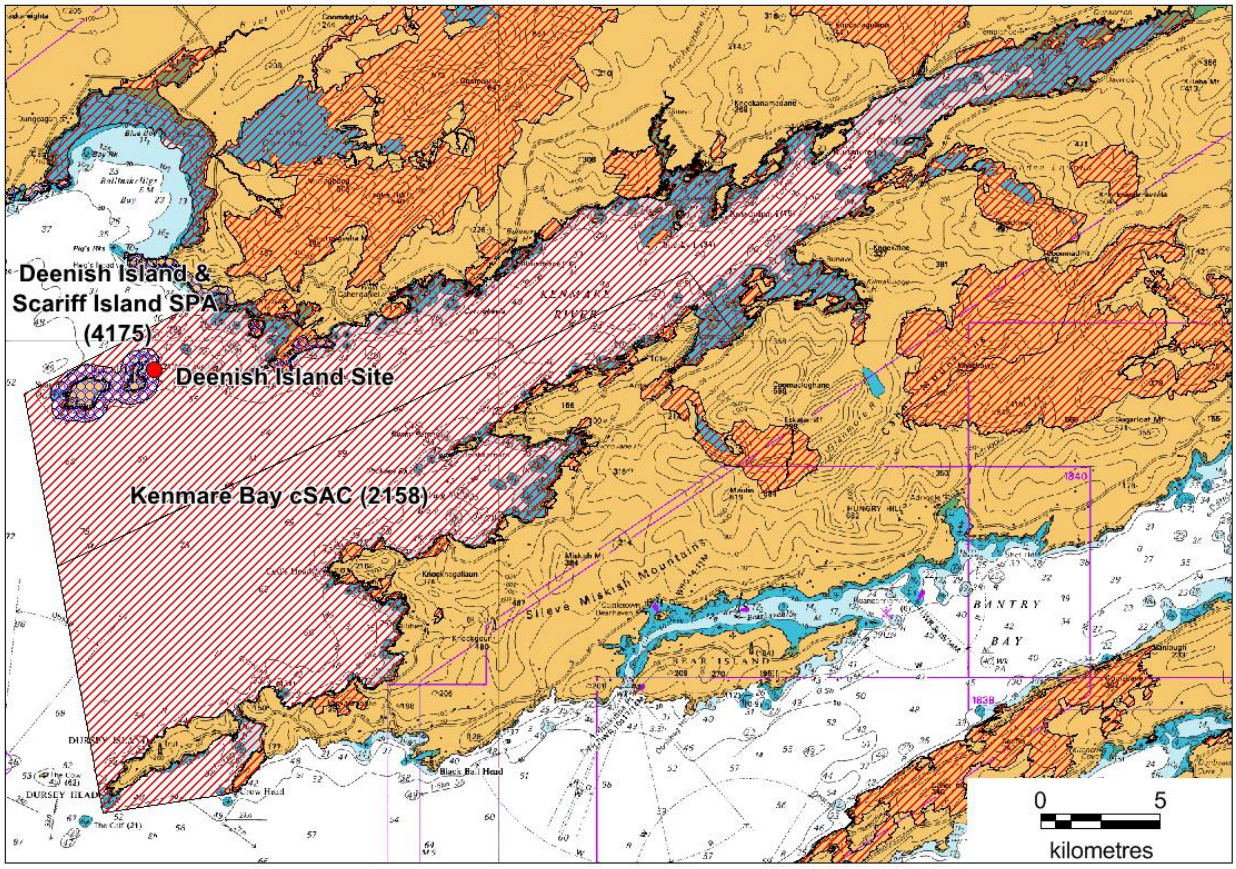


Figure 1.2. Map showing the locations of the relevant cSAC and SPA.

1.1. Offshore finfish farms – benthic monitoring

The main objective of the survey was to assess the overall state of the environment in relation to the salmon production process. The sites were surveyed according to the revised Benthic Monitoring Guidelines laid down by the Department of Agriculture, Fisheries and Food (December 2008). The benthic monitoring requirements at a fish farm are dependent on the level of biomass held at the site and the local hydrography. Table 1.1 below sets out the level of benthic monitoring required based on tonnage produced and mean current speeds at a fish farm:

Table 1.1. Matrix of production tonnage versus current speed to determine level of benthic monitoring required.

	MEAN CURRENT SPEED (CMS^{-1})		
TONNAGE	**<5**	**5-10**	**>10**
0-499	Level I	Level I	Level I
500-999	Level II	Level I	Level I
>1000	Level II	Level II	Level I

The current speed is a mean value calculated from maximum current measurements over spring and neap tidal cycles at the surface and near the bottom. The tonnage refers to the maximum biomass predicted for each site. An annual survey must be carried out at each site (production and smolt) operated by a company. A level I or level II survey may be carried out as follows:

Level I: Video/photographic and visual observations and recordings shall be made at the following stations:

- At a minimum of 2 sites directly beneath the pens
- At the edges of the pens
- Two transects at right angles to each other. Along each transect sampling stations at +/- 10m, +/- 20m, +/- 50m and + 100m from the pens
- At a control site

In addition to the above, the following samples/measurements shall be taken at the same stations as above. These will be used to calculate sediment quality parameters.

- A minimum of one Redox potential reading shall be made at each sampling station.
- A single sediment sample for Organic Carbon measurement.

Level II: In addition to the above, two replicate grab samples shall be captured at each of the sample stations for faunal analysis. The exact locations of sampling points should be agreed in advance with the Department of Agriculture Fisheries and Food (DAFF). The identification and abundance of macro-faunal invertebrates shall be estimated and tabulated. Identification of fauna to the level of species will be

required.

The current survey at the Deenish site was carried out at Level II.

It is important to take note that the exact position of the individual pen structures are not permanently fixed to a single position and there is a relatively large lateral movement due to depth, wind, currents and tides. For this reason bottom stations particularly at the under, edge and 10m zones are taken at the time of sampling but may vary relative to the overlying pen position under various environmental conditions.

2. Sampling Procedure & Processing

All survey work took place on the 7th August 2014. The dive at the Deenish site was conducted at a maximum depth of 23.8m and underwater visibility on the day was good at approximately 5 m. Pen layouts at the time of survey, dive entry points and benthic transects followed by the divers are shown in Figures 3.2 and 3.9 (Section 3).

Disinfection

Prior to each dive survey for each location all diving equipment, suits and boats are thoroughly disinfected utilizing both a dipping and spraying protocol.

2.1. Dive survey

Two dive transects (one parallel with the direction of the prevailing current and one perpendicular to the prevailing current) were laid out from the sea surface at each site using a boat equipped with a GPS mapper. Pen locations were noted as DGPS positions using a Trimble GeoXT, which is capable of sub-meter horizontal accuracy using real time corrections from the integrated EGNOS (European Geostationary Navigation Overlay System) receiver. Acoustic beacons were deployed to assist the divers in locating transect marks while underwater. The underwater survey itself involved the direct observation, sampling and recording (photographic and written) of benthic conditions by qualified biologists at a number of sites along the transects:

- directly under the pen (T1 Under)

- under the edge of the pen (T1 Edge)
- at 10m (T1 10m, T1 10m), 20m (T1 20m, T2 20m), 50m (T1 50m, T2 50m) and 100m (T1 100m) from the pens.

A reference station (Ref) was also assessed to give a representation of ambient benthic conditions in the area immediately surrounding the pen installations and served for comparison purposes. As such, it represents the 'undisturbed' condition of the seafloor surrounding the sites – it was taken at a distance greater than 150m from the pen installations.

All dives were carried out by highly experienced, qualified biologists who made notes of features and species encountered during the dives – these were transcribed to logs upon surfacing. In addition to standard SCUBA gear the divers were equipped with:

- A high end dSLR camera for photographing epibenthos. Photographs were taken at the prescribed stations along each transect and observations on benthic conditions at the site were noted down. The camera used was a Nikon D200 in a Subal ND20 underwater housing fitted with a 12-24mm lens and two INON strobes.
- A hand-held dSPI camera for photographing sediment profiles, i.e. images were taken of the sediment in cross profile at depths of to 23cm (Mean redox measurements were made using digital sediment profile imagery (SPI). This unit uses a Canon EOS 450D camera with Nikkor optics).
- A SONAR receiver & compass for underwater navigation.
- Two × 5cm diameter corers for taking faunal and sediment samples (for the Under station only, grabs were used for all other stations).
- Pre-labelled bags to store sediment samples for organic carbon analysis.
- Dive slates and waterproof pencils for making notes.
- Torches.

The divers photographed representative areas of the sediment and fauna and recorded observations in situ at the various stations investigated. Notes were completed during discussion immediately on surfacing and a map of the dive track was drawn up. Observations recorded during the dive may include:

- Presence of bacterial mats and uneaten food

- Presence of farm-derived litter
- Presence of gas bubbles or anoxic areas
- Animals visible or evidence of their presence
- Macroalgae visible
- Sediment colour and texture – among other things.

By noting the species of animals present and their densities, any tracks of animals or the presence of species that are known to be connected with certain states of benthic enrichment, the health of the benthos (including the highlighting of some potential problems) may be gauged.

An acoustic beacon was dropped on a buoyed line at the end of the 100m transect to allow the divers (equipped with an acoustic receiver unit) to determine their distance from this mark. This also allowed simplified underwater navigation – the unit gives the divers both range and direction of the beacon.

2.2. Sediment Profile Imagery (SPI)

A Sediment Profile Image (SPI) was also acquired at each of the stations mentioned above. These images were acquired using a diver-deployed sediment profile imaging camera system. This system is comprised of a digital SLR camera in a water-tight pressure vessel that is mounted above a prism that penetrates the upper 25cm of sediment (see Figure 2.1 for image). The sediment profile is viewed through a plexiglass window. Its image is reflected to the camera lens via a plane mirror. Illumination is provided by an internally-mounted strobe.

The diver depresses the unit into the seafloor and manually triggers the camera. This process is repeated at each station investigated. The prism unit is filled with distilled water – thus ambient water clarity is never a limiting factor in image quality.

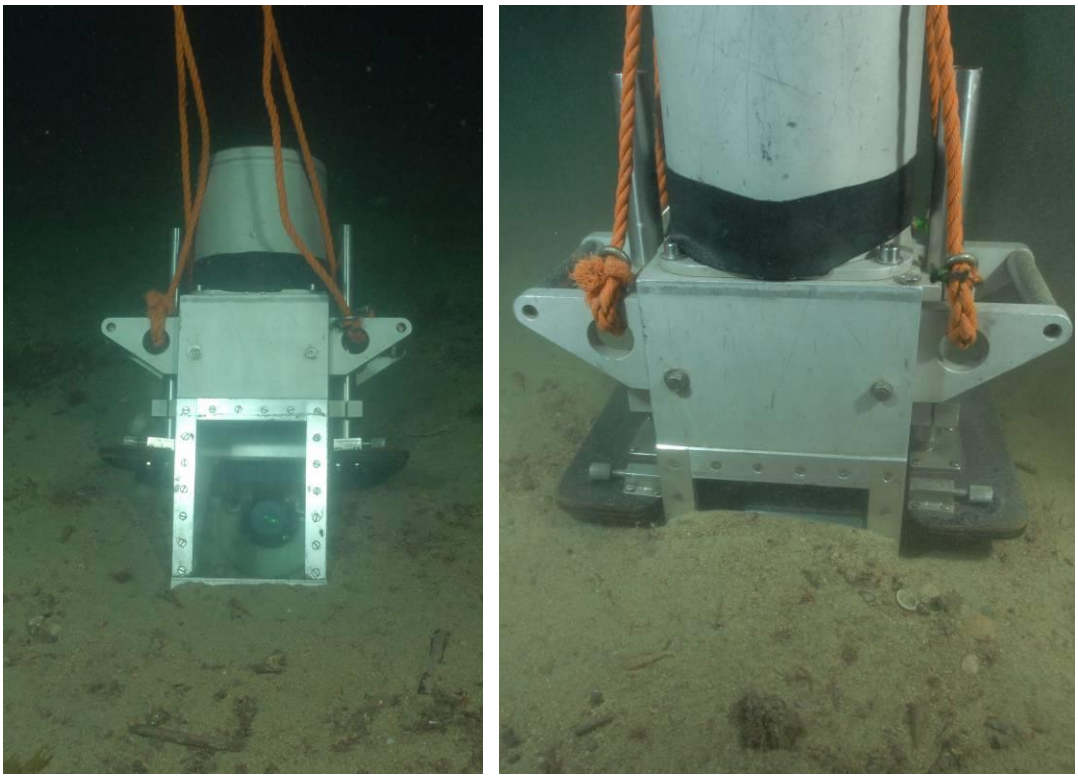


Figure 2.1. Diver operated Sediment Profile Imaging camera. The left-hand image gives a view of the camera at the sediment surface. The right-hand image shows the SPI camera when inserted into the sediment.

A great deal of information about benthic processes is available from sediment profile images. Measurable parameters, many of which are calculated directly by image analysis, include physical/chemical parameters (i.e. sediment type measured as grain size major mode, prism penetration depth providing a relative indication of sediment shear strength, sediment surface relief, condition of mud clasts, redox potential discontinuity depth and degree of contrast, sediment gas voids) and biological parameters (i.e. infaunal successional stage of a well documented successional paradigm for soft marine sediments (see Pearson and Rosenberg, 1978), degree of sediment reworking, dominant faunal type, epifauna and infauna, depth of faunal activity, presence of microbial aggregations).

For the purposes of the current survey the primary feature of interest is the depth of oxygen penetration into the sediments in the vicinity of the finfish pens (this information is required to satisfy the requirements of the Benthic Monitoring Protocol (DAFF, 2008). In this case the apparent redox potential discontinuity or ARPD depth is measured. Features of particular interest that may be gleaned from SPI images taken in sediments in the vicinity of finfish pens include the presence of:

- uneaten feed pellets (and depth of this material)
- faecal casts
- and depth of shell gravel deposits
- of gas voids in the sediment (refer to Figure 2.2)

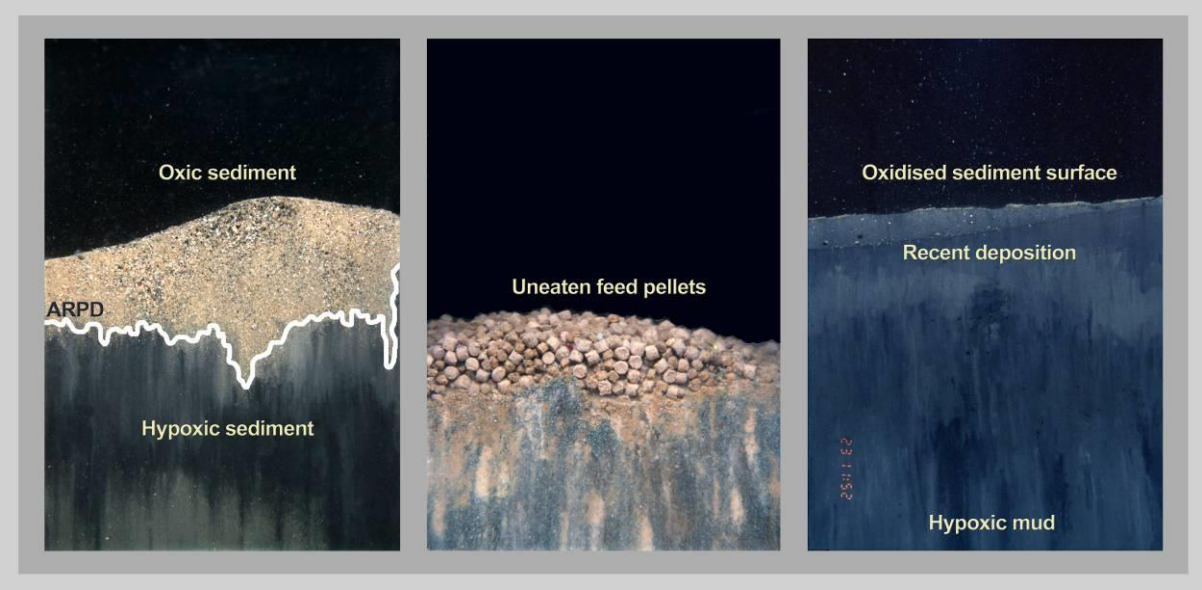


Figure 2.2. Typical sediment profile images with examples of features.

2.3. Sampling for faunal analysis

Sediment samples for faunal analysis were collected in one of two ways:

- Using handheld (15cm diameter) corers at the under pen station.
- Using a small (0.025m^2) van Veen grab at all other stations.

At each station, two replicate grab/core samples were collected. The faunal returns were sieved on a 1 mm mesh sieve, stained with Rhodamine dye, fixed with 10% buffered formalin and preserved in 70% alcohol. Samples were then sorted under a microscope (x 10 magnification) back in the laboratory, into four main groups: polychaeta, mollusca, crustacea and others. The 'others' group consisted of echinoderms, nematodes, nemerteans, cnidarians and other lesser phyla. The taxa were then identified to species level where possible.

2.3.1. Data Processing

The faunal replicates for each station were combined to give a total abundance for each station prior to analyses. A data matrix of all the combined faunal abundance data was compiled and used for statistical analyses. The faunal analysis was carried out using PRIMER ® (Plymouth Routines in Multivariate Ecological Research).

Univariate statistics in the form of diversity indices were calculated on the combined replicate data. The following diversity indices were calculated:

1) Margalef's species richness index (D), (Margalef, 1958).

$$D = \frac{S - 1}{\log_2 N}$$

where: N is the number of individuals

S is the number of species

2) Pielou's Evenness index (J), (Pielou, 1977).

$$J = \frac{H'(observed)}{H'_{max}}$$

where: H'_{max} is the maximum possible diversity, which could be achieved if all species were equally abundant (= $\log_2 S$)

3) Shannon-Wiener diversity index (H'), (Pielou, 1977).

$$H' = -\sum_{i=1}^{S} p_i (\log_2 p_i)$$

where: p_l is the proportion of the total count accounted for by the i^{th} taxa

Species richness is a measure of the total number of species present for a given number of individuals. Evenness is a measure of how evenly the individuals are distributed among different species. The diversity index incorporates both of these parameters.

The PRIMER ® manual (Clarke & Warwick, 2001) was used to carry out multivariate analyses on the

station-by-station faunal data. All species/abundance data were fourth root transformed and used to prepare a Bray-Curtis similarity matrix in PRIMER®. The fourth root transformation was used in order to down-weigh the importance of the highly abundant species and allow the mid-range and rarer species to play a part in the similarity calculation. The similarity matrix was then used in classification/cluster analysis. The aim of this analysis was to find "natural groupings' of samples, i.e. samples within a group that are more similar to each other, than they are similar to samples in different groups (Clarke & Warwick, *loc. cit.*). The PRIMER ® programme CLUSTER carried out this analysis by successively fusing the samples into groups and the groups into larger clusters, beginning with the highest mutual similarities then gradually reducing the similarity level at which groups are formed. The result is represented graphically in a dendrogram, the x-axis representing the full set of samples and the y-axis representing similarity levels at which two samples/groups are said to have fused. The CLUSTER programme was set to include a series of 'similarity profile' (SIMPROF) permutation tests, which look for statistical evidence of genuine clusters in samples which are *a priori* unstructured. SIMPROF performs tests at every node of a completed dendrogram, that the group being sub-divided has 'significant' internal structure. The test results are displayed in a colour convention on the dendrogram plot (samples connected by red lines cannot be significantly differentiated).

The Bray-Curtis similarity matrix was also subjected to a non-metric multi-dimensional scaling (MDS) algorithm (Kruskall & Wish, 1978), using the PRIMER ® program MDS. This programme produces an ordination, which is a map of the samples in two- or three-dimensions, whereby the placement of samples reflects the similarity of their biological communities rather than their simple geographical location (Clarke & Warwick, 2001). With regard to stress values, they give an indication of how well the multi-dimensional similarity matrix is represented by the two-dimensional plot. They are calculated by comparing the interpoint distances in the similarity matrix with the corresponding interpoint distances on the 2-d plot. Perfect or near perfect matches are rare in field data, especially in the absence of a single overriding forcing factor such as an organic enrichment gradient. Stress values increase not only with the reducing dimensionality (lack of clear forcing structure), but also with increasing quantity of data (it is a sum of the squares type regression coefficient). Clarke and Warwick (*loc. cit.*) have provided a classification of the reliability of MDS plots based on stress values, having compiled simulation studies of stress value behaviour and archived empirical data. This classification generally holds well for 2-d ordinations of the type used in this study. Their classification is given below:

- Stress value < 0.05: Excellent representation of the data with no prospect of misinterpretation.
- Stress value < 0.10: Good representation, no real prospect of misinterpretation of overall structure, but very fine detail may be misleading in compact subgroups.
- Stress value < 0.20: This provides a useful 2-d picture, but detail may be misinterpreted particularly nearing 0.20.
- Stress value 0.20 to 0.30: This should be viewed with scepticism, particularly in the upper part of the range, and discarded for a small to moderate number of points such as < 50.
- Stress values > 0.30: The data points are close to being randomly distributed in the 2-d ordination and not representative of the underlying similarity matrix.

Each stress value must be interpreted both in terms of its absolute value and the number of data points. In the case of this study, the moderate number of data points indicates that the stress value can be interpreted more or less directly. While the above classification is arbitrary, it does provide a framework that has proved effective in this type of analysis.

2.4. Sampling for organic carbon analysis

A grab/core sample was taken at each of the stations and used for organic carbon analyses. All samples were stored in pre-labelled plastic bags, kept in cold freezer boxes onboard the vessel and frozen at -20°C on return to the lab.

Organic carbon analysis was carried out by ALS Laboratories using the Loss on Ignition (LOI) technique. This method involves oven drying the sediment sample in a muffle furnace (450°C for a period of 6 hours) after which time the organic content of the sample is determined by expressing as a percentage the weight of the sediment after ignition over the initial weight of the sediment.

3. Results

3.1.1. Recent Stocking History

The site was fallow for a period of 3.5 weeks from the 14th March 2013 to 8th April 2013 before the current stocking cycle began. Between the 8th and 22nd April 2013, 49.44 tonnes were input to the site. At the time of the audit, 2116.5 tonnes were on site. There were 274,300 mortalities since input. Overall, there was a production biomass of 2067.1 tonnes. No harvesting has occurred since input.

Figure 3.1. View of pens at Deenish Island site, viewed at sea 7th August 2014.

3.1.2. Seabed Physical Characteristics

The seabed was composed of a mix of sediment types with areas of finne to medium sand the predominant bottom type of shelly sand of various coarsness

3.1.3. Photographic Record; Transect 1

This transect began beneath the north western most pen moored on site (see Figure 3.2). A total of six stations were investigated.

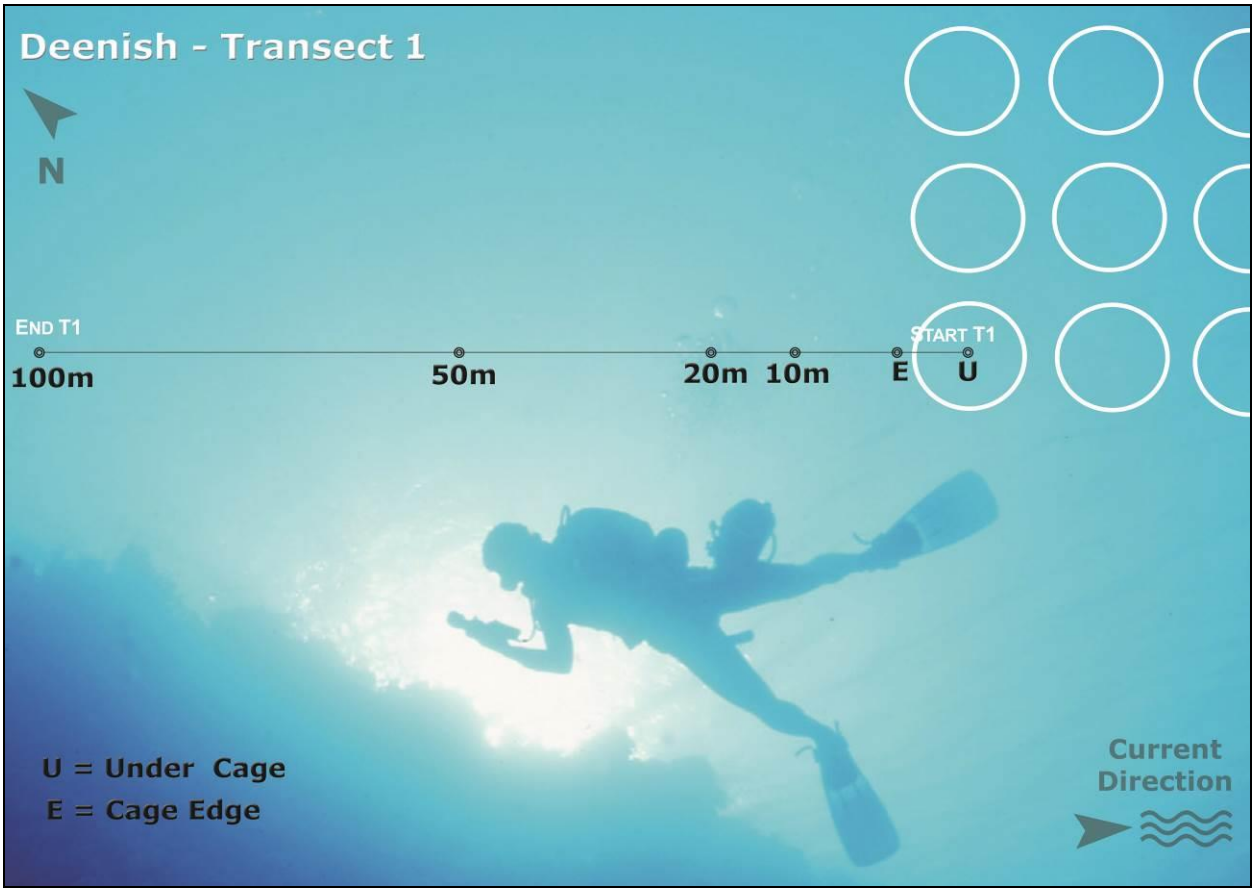


Figure 3.2. Transect 1 seafloor station layout, Deenish Island site, 7th August 2014.

3.1.3.1. Under Pen Location

The pens on site were stocked at the time of the study. The seafloor consisted of medium sand. There were some signs on the seafloor that finfish pens were overlying the site:

- scattering of uneaten food;
- scattering of faecal casts and faeces ;
- Shallow ARPD depths at this station;
- Light cover of *Beggiatoa* sp.

The mean ARPD at this station was 0.0 cm but there was no sign of outgassing was noted at this station.

Figure 3.3: T1 – Under pen, Deenish Island site, 7th August 2014.

3.1.3.2. Edge of Pen Location

The edge station was dominated by a fine to medium sand with some mussel shell debris through the sediments. There were signs on the seafloor that finfish pens were overlying the site:

- A scattering of uneaten feed pellets;
- A small number of faecal casts;
- A light layer of *Beggiatoa* spp.; and
- Relatively shallow ARPD depth.

Drifting algal material (kelp frond fragments) was imaged and the ARPD ranged from 0.0 to 0.5cm.
No signs of outgassing was noted at this station.

Figure 3.4. T1 – Pen edge, Deenish Island, 7th August 2014.

3.1.3.3. 10m from Pen

The seafloor at the 10m station was composed of shelly sand with mussel shell and small stones. There was no obvious signs of impact from the farm operations. A small flat fish (*Microstomus kitt*) is imaged in the center of the photograph amongst the red algae that is attached to structures buried in the sand. The mean ARPD at this station was 2.1cm.

Figure 3.5. T1 – 10m, Deenish Island, 7th August 2014.

3.1.3.4. 20m from Pen

The seafloor at the 20m station was composed of shelly sand and pebbles. There was an abundance of red algae protruding from the sand. There was no obvious impact from the farming operations. The average ARPD at this station measured 2.2cm.

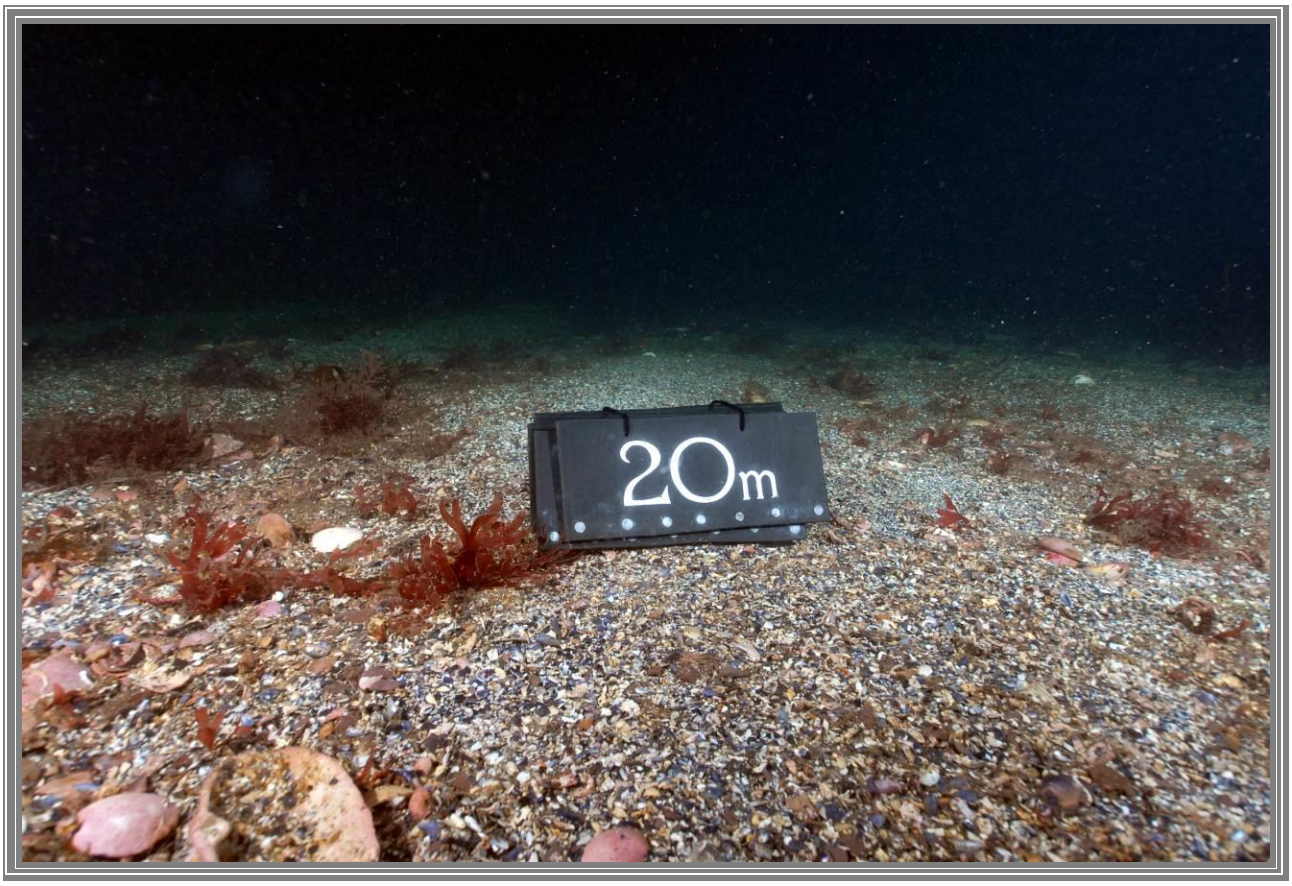


Figure 3.6. T1 – 20m, Deenish Island, 7th August 2014.

3.1.3.5. 50m from Pen

The seafloor at the 50m station was composed predominantly of sand with a high proportion of shell debris. Small plants of a common epilithic and epiphytic red seaweed (*Cryptopleura ramosa*) were noted attached to some of the larger shell fragments. There were no obvious signs of impact from the farming operations. The mean ARPD was greater than 3.7cm.

Figure 3.7. T1 – 50m, Deenish Island, 7th August 2014.

3.1.3.6. 100m from Pen

A sand, shell and pebble gravel seafloor was observed at this station formed into small crests and troughs by tidal currents and deep swell. There were no apparent signs of impact from the nearby finfish rearing operation. Scallops were common in this region. Numerous small monk fish were common at this site.

Mean APPD was greater than 4.3cm, the depth of the redox not being determined as it was greater than the penetration depth of the SPI camera in the coarse substrate.

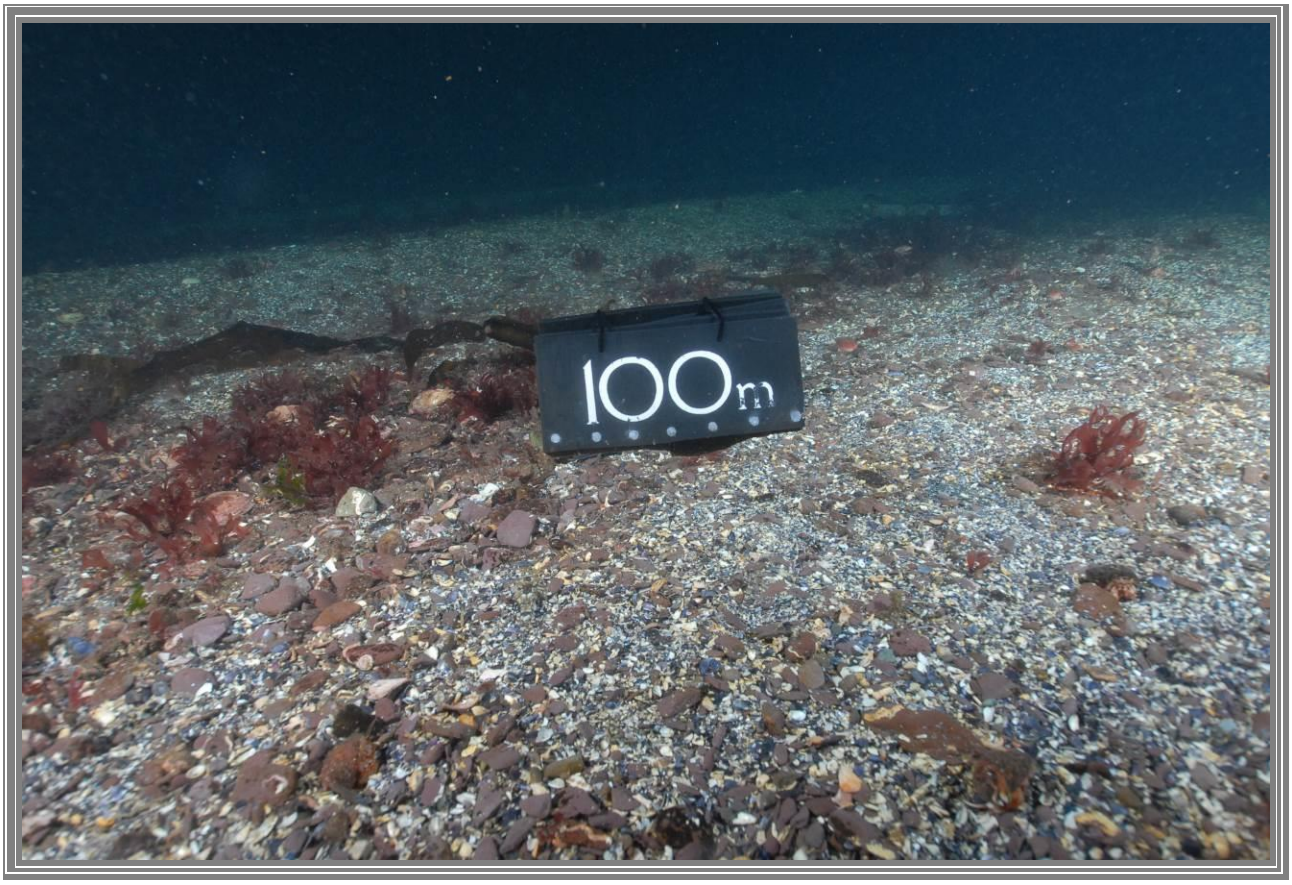
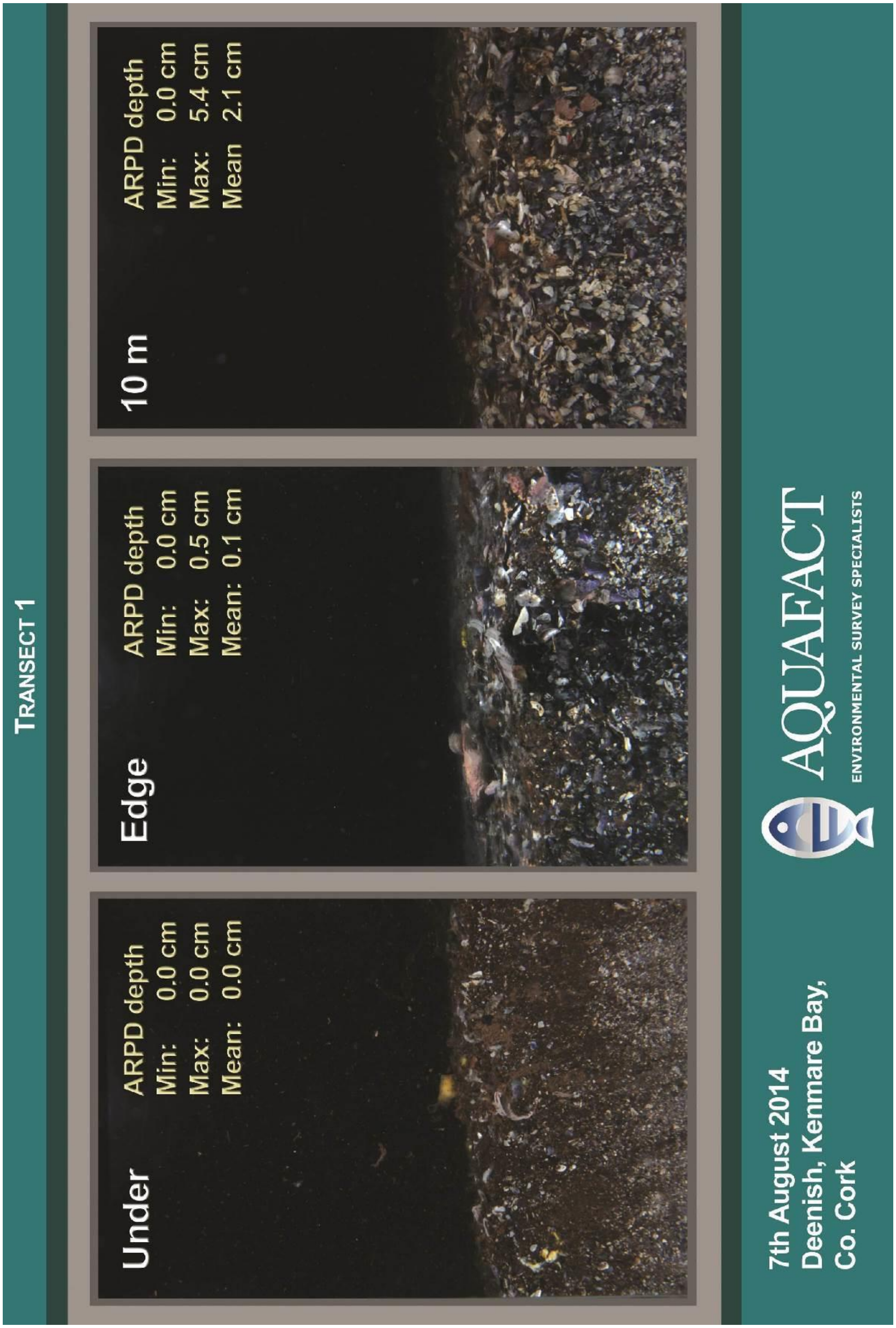


Figure 3.8. T1 – 100m, Deenish Island, 7th August 2014.

3.1.4. Sediment Profile Imagery – Transect 1

The following two plates present sediment profile images taken at the six stations visited on Transect 1 of the Deenish site. They display a single image and the maximum and minimum apparent redox potential discontinuity (ARPD) depths measured at each station. Each image is 15.5cm × 25cm. ARPD depths ranged from a minimum of 0.0cm (T1 Under, T1 Edge and T1 10m) to a maximum of >6.1cm (T1 50m). The composition of sediments at each station can be seen – fine sand at the under pen station to a coarser shelly gravelly sand at the outer end of the transect. Small amounts of uneaten feed and faecal material can be seen at the under pen station. The seafloor at this site is probably relatively mobile and experiences winter surges churning the benthic sands on a regular basis.


TRANSECT 1
Under
ARPD depth
Min: 0.0 cm
Max: 0.0 cm
Mean: 0.0 cm
Edge
ARPD depth
Min: 0.0 cm
Max: 0.5 cm
Mean: 0.1 cm
10 m
ARPD depth
Min: 0.0 cm
Max: 5.4 cm
Mean 2.1 cm
7th August 2014
Deenish, Kenmare Bay,
Co. Cork
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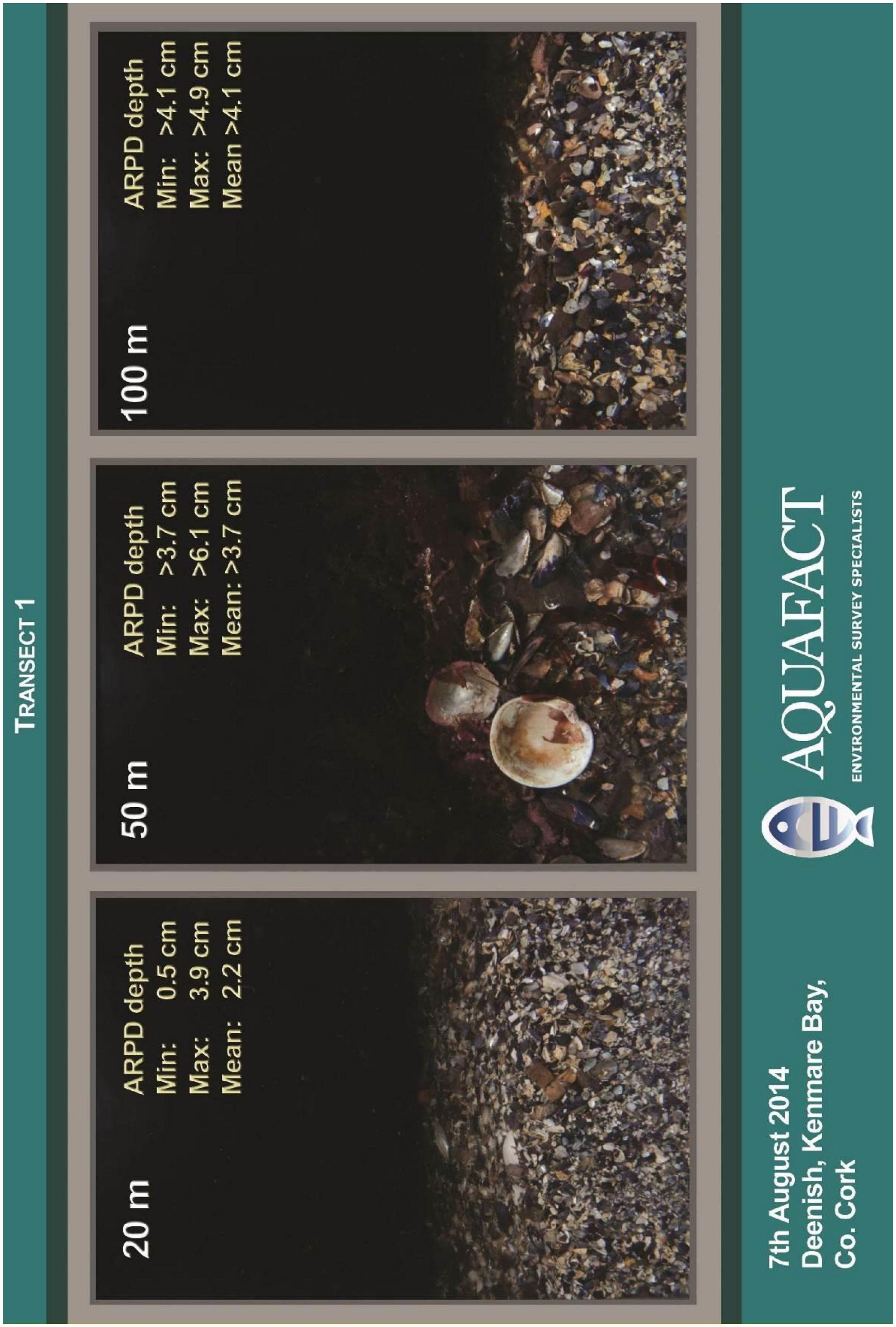
Transect 1
20 m
ARPD depth
Min: 0.5 cm
Max: 3.9 cm
Mean: 2.2 cm
50 m
ARPD depth
Min: >3.7 cm
Max: >6.1 cm
Mean: >3.7 cm
100 m
ARPD depth
Min: >4.1 cm
Max: >4.9 cm
Mean >4.1 cm
7th August 2014
Deenish, Kenmare Bay,
Co. Cork
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ENVIRONMENTAL SURVEY SPECIALISTS

3.1.5. Photographic Record; Transect 2

This transect began beneath the same pen as Transect 1. A total of five stations were investigated on Transect 2 (See Figure 3.9) with an additional (Reference) station investigated just *c.* 180m north of the pen edge.

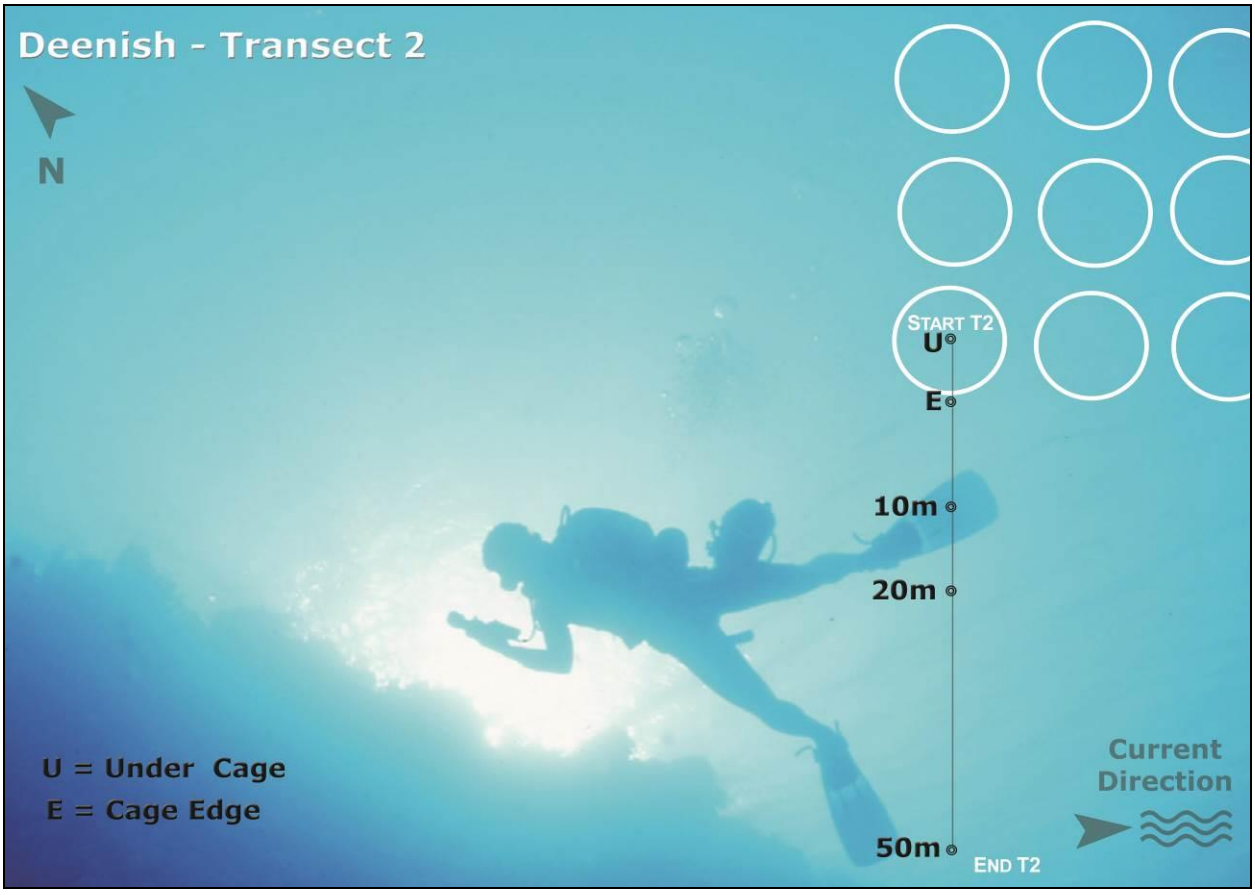

Figure 3.9. Transect 2 seafloor station layout, Deenish Island site, 7th August 2014.

3.1.5.1. Under Pen Location

This station was located beneath the same pen as the under pen station on Transect 1. Seafloor conditions are therefore similar. There were signs on the seafloor that finfish pens were overlying the site:

- A scattering of uneaten feed pellets;
- A small number of faecal casts;
- A light layer of Beggiatoa spp.; and
- Relatively shallow ARPD depth.

The ARPD at this station was at the sediment water interface and there was no signs of outgassing.

Figure 3.10. T2 – Under pen, Deenish Island, 7th August 2014.

3.1.5.2. Edge of Pen Location

The seafloor was composed of fine-medium sands with a small amount of shell gravel. There were some obvious signs on the seafloor that finfish pens were overlying the site:

- Feed pellets and faecal casts on the seabed;
- Light cover of the sulphur reducing bacteria *Beggiatoa* spp.; and
- Shallow ARPD depths.

The mean ARPD was 0.5cm. There were no signs of outgassing at this location

Figure 3.11. T2 – Pen edge, Deenish Island, 7th August 2014.

3.1.5.3. 10m from Pen

The seafloor consisted of a shell sand, the shell predominantly made up of mussel shell. Common starfish (*Asterias rubens*), seven-armed starfish (*Luidia ciliaris*) and numerous anemones (*Cerianthus lloydii*) were recorded. A discarded rope covered in red algae (*Cryptopleura ramose)* is imaged in the photograph beside the station tag. The algae is also prominent over the bottom attached to small stones and rocks buried in nthe shell. Mean ARPD was recorded at 4.8cm.

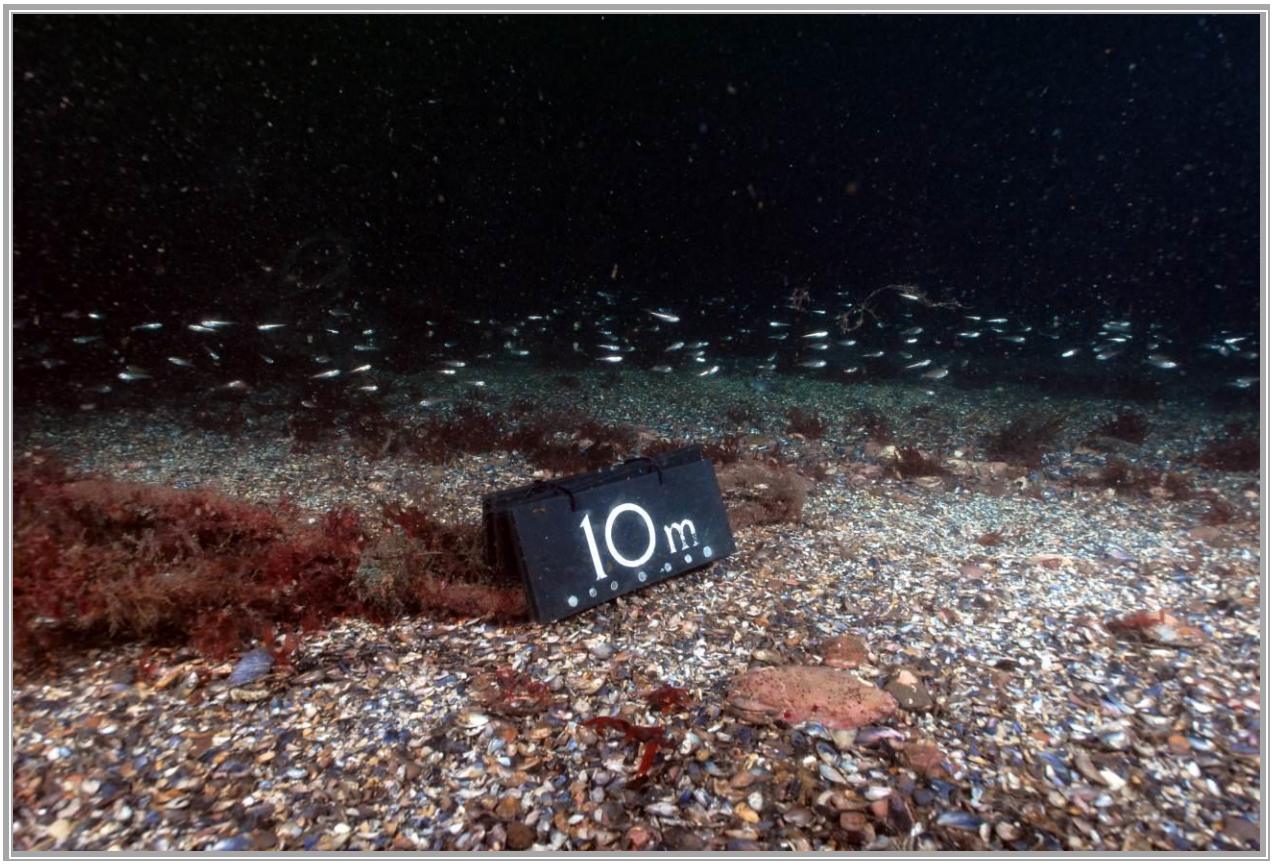

Figure 3.12. T2 - 10m, Deenish Island, 7th August 2014.

3.1.5.4. 20m from Pen

The seafloor at the 20 m station consisted of a relatively flat medium sand shell bottom with red algae, *C. ramose,* prominent. There were no obvious signs that a finfish farm was nearby. Biological features encountered included relatively high densities of the anemones, *Cerianthus lloydii* (one individual is seen located located beside the red algae clump on the frontof the photograph) and various encounters with the starfish *Asterias rubens*, *Marthasterias glacialis* and *Luidea ciliaris*. The Mean ARPD at this station was 3.6cm.

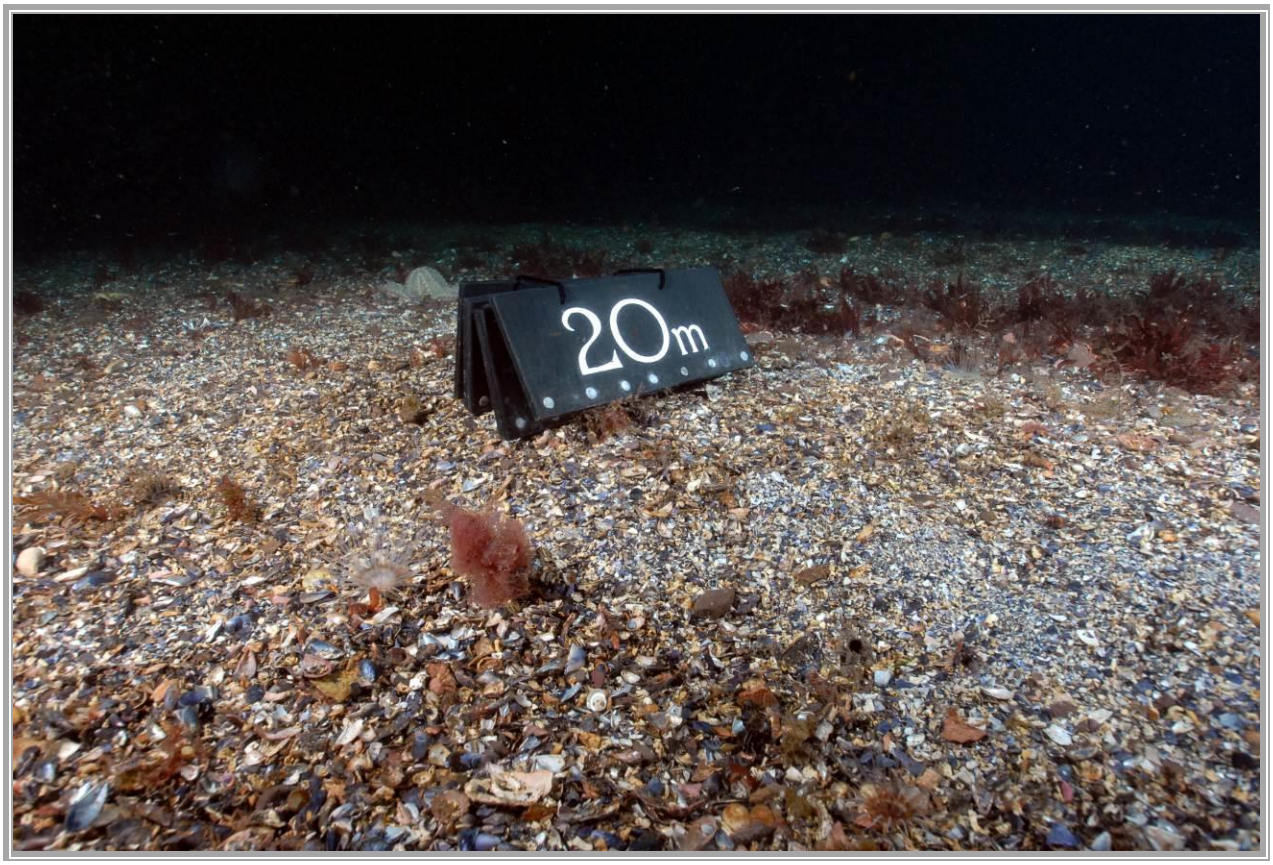

Figure 3.13. T2 – 20m, Deenish Island, 7th August 2014.

3.1.5.5. 50m from Pen

The seafloor at this station consisted of a medium sand with some shell debris. A small shoal of poor cod (*Trisopterus minutus*) are seen in the background of the photograph. There was no obvious impact from the farming operations. Mean ARPD was 2.7cm.

Figure 3.14. T2 – 50m, Deenish Island, 7th August 2014.

3.1.6. Reference Station

This photograph was taken at a distance of approximately 200m from the pen edge. Sediments at the reference station were composed of sand, stones and shell gravel forming broad shallow sand waves. There were no apparent signs of impact from the nearby finfish rearing operation:

- Seafloor 'clean' and free of feed/faecal material, *Beggiatoa* spp. cover;
- No items of farm debris; and
- Presence of 'normal' flora and fauna for this area.

Numerous red weed were attached to the stones in the troughs of small sand waves at this location. Mean ARPD was 2.5cm.

Figure 3.15. Reference Station, Deenish Island, 7th August 2014.

3.1.7. Sediment Profile Imagery – Transect 2 & Reference

The following two plates present sediment profile images taken at the five stations visited on Transect 2 of the Deenish site. A sediment profile image was also taken at the Reference station. They display a single image and the maximum and minimum apparent redox potential discontinuity (ARPD) depths measured at each station. Each image is 15.5cm × 25cm. Along Transect 2, ARPD depths ranged from a minimum of 0.0cm (T2 Under, T2 Edge, T2 10m and T2 20m) to a maximum of >7cm (T2 10m). ARPD depths at the Reference station ranged from >3.7cm to >6.7cm. The composition of sediments at each station can be seen. Sediment type varied from fine/medium sands under and close to the pen compared with higher proportions of gravel and shell with increasing distance from the pen.


TRANSECT 2
Under
ARPD depth
Min: 0.0 cm
Max: 0.0 cm
Mean: 0.0 cm
Edge
ARPD depth
Min: 0.0 cm
Max: 0.5 cm
Mean: 0.2 cm
10 m
ARPD depth
Min: 0.0 cm
Max: >7.0 cm
Mean 4.8 cm
7th August 2014
Deenish, Kenmare Bay,
Co. Cork
AQUAFACT
ENVIRONMENTAL SURVEY SPECIALISTS


TRANSECT 2
20 m
ARPD depth
Min: 0.0 cm
Max: 5.6 cm
Mean: 3.6 cm
50 m
ARPD depth
Min: 0.1 cm
Max: 5.5 cm
Mean: 2.7 cm
Ref.
ARPD depth
Min: >3.7 cm
Max: >6.7 cm
Mean >3.7 cm
7th August 2014
Deenish, Kenmare Bay,
Co. Cork
AQUAFACT
ENVIRONMENTAL SURVEY SPECIALISTS

3.1.8. Transect Species List

Table 3.1 shows a list of species observed during the dives at the Deenish fish farm site on this and previous occasions.

Table 3.1. Species noted during dives on the seabed beneath the Deenish pens.

Group	Species	Common Name
(Cnidaria) Hexacorallia	*Cerianthus lloydii*	Tube anemone
(Annelida) Polychaeta	*Pomatoceros* sp. *Lanice conchilega* *Chaetopterus variopedatus*	Tube worm The sand mason Parchment tube worm
(Mollusca) Bivalvia	*Pecten maximus* Faceliniidae Aeolidiida Nudibranch	King scallop Sea slugs Sea slugs Sea slugs
(Arthropoda) Decapoda	Paguridae	Hermit crab
Echinodermata	*Luidia ciliaris* *Asterias rubens* *Marthasterias sp* *Ophiura* sp. Amphiuridae sp.	Seven armed starfish Common starfish Starfish Brittlestar Brittlestar
(Chordata) Osteiichthyes	*Pomatoschistus* sp. Trisopterus minutus	Gobies Poor Cod
Rhodophyta	*Delesseria* sp. *Phycodrys rubens* *Cryptopleura ramosa*	Sea beech Sea oak
Ochrophyta	*Alaria esculenta*	Edible kelp

3.1.9. Benthic Macrofaunal Analysis

The taxonomic identification of the benthic infauna across all 11 stations sampled at the Deenish fish farm site yielded a total count of 294 taxa accounting for 21,256 individuals, ascribed to 14 phyla. Of the 294 taxa present, four were colonial and could not be enumerated (sponges and bryozoans). A complete listing of the taxa abundance is provided in Appendix 1. Of the 294 taxa present, 193 were identified to species level, the remaining 101 could not be identified to species level as they were juvenile, partial/damaged or indeterminate.

Of the 294 taxa enumerated, 120 were annelids (segmented worms including sipunculids), 75 were crustaceans (crabs, shrimps, prawns), 63 were molluscs (mussels, cockles, snails etc.), 20 were echinoderms (starfish, brittlestars, sea cucumbers), 4 were cnidarians (sea anemones, corals, jellyfish etc), 3 were bryozoans (moss animals), 2 were chelicerata (sea spiders), 1 was a nemertean (ribbon worms), 1 was a nematoda (round worms), 1 was a platyhelminthean (flat worm), 1 was a poriferan (sponge), 1 was a chaetognath (arrow worm), 1 was a brachiopod (lamp shell) and 1 was a piscean (fish).

3.1.9.1. Univariate Analysis

Univariate statistical analyses were carried out on the combined replicate station-by-station faunal data. The following parameters were calculated and can be seen in Table 3.5; taxon numbers, number of individuals, richness, evenness and diversity. Taxon numbers ranged from 46 (T2 50m) to 133 (T1 10m). Numbers of individuals ranged from 174 (T2 50m) to 4,437 (T1 10m). Richness ranged from 8.56 (T1 Under) to 16.9 (T1 50m). Evenness ranged from 0.45 (T2 20m) to 0.83 (T2 50m). Shannon Weiner diversity ranged from 2.7 (T2 20m) to 5.37 (T1 50m).

Table 3.2: Diversity indices.

Station	No. Taxa	No. Individuals	Richness	Evenness	Shannon Weiner Diversity
T1 Under	71	3570	8.56	0.46	2.84
T1 Edge	68	2427	8.60	0.47	2.87
T1 10m	133	4437	15.72	0.64	4.49
T1 20m	69	807	10.16	0.65	3.98
T1 50m	111	670	16.90	0.79	5.37

Station	No. Taxa	No. Individuals	Richness	Evenness	Shannon Weiner Diversity
T1 100m	122	1914	16.01	0.72	5.00
T2 Edge	84	2050	10.88	0.53	3.41
T2 10m	99	1664	13.21	0.56	3.72
T2 20m	63	1130	8.82	0.45	2.70
T2 50m	46	174	8.72	0.83	4.60
REF	116	2413	14.77	0.72	4.93

3.1.9.2. Multivariate analysis

The dendrogram and the MDS plot can be seen in Figures 3.16 and 3.17 respectively. The stress value of the MDS is 0.01 which indicates an excellent representation of the data with no prospect for misinterpretation. SIMPROF analysis revealed 5 statistically significant groupings between the 11 stations (the stations joined by red lines could not be statistically differentiated from each other).

Station T2 50m (**Group a**) separated away from all other stations at a 18.61% similarity level. This station contained 46 species (30 of which were present twice or less) comprising 174 individuals. Six species accounted for just over 54% of the faunal abundance: Nematoda (27 individuals, 15.52% abundance) and the polychaetes *Spio* sp. (21 individuals, 12.07% abundance), *Spiophanes bombyx* (13 individuals, 7.47% abundance), *Capitella* sp. complex (13 individuals, 7.47% abundance), *Mediomastus fragilis* (11 individuals, 6.32% abundance) and the oligochaete *Tubificoides pseudogaster* agg. (10 individuals, 5.75% abundance). Nematoda, *Spio* sp. and *Spiophanes bombyx* are tolerant to excess organic matter enrichment. They occur under normal conditions but their populations are stimulated by organic enrichment. *Mediomastus fragilis* is a second order opportunist and *Capitella* sp. complex is a first order opportunistic species which proliferates in reduced sediments.

All of the remaining species joined at a 44.79% similarity level. Amongst these stations 4 groups emerged. **Group b** (Stations T1 Under and T1 Edge) had a 66.35% within group similarity. This group contained 95 species (45 of which were present twice or less) comprising 5,997 individuals. Four species accounted for just over 82% of the faunal abundance: the polychaetes *Capitella* sp. complex (2,220 individuals, 37.02% abundance) and *Mediomastus fragilis* (1,820 individuals, 30.35% abundance), Nematoda (580 individuals, 9.67% abundance) and the gastropod mollusc *Nassarius pygmaeus* (321

individuals, 5.35% abundance). Nematoda are tolerant to excess organic matter enrichment. They occur under normal conditions but their populations are stimulated by organic enrichment. *Nassarius pygmaeus* is a species indifferent to enrichment always present in low densities with non-significant variations over time. *Mediomastus fragilis* is a second order opportunist and *Capitella* sp. complex is a first order opportunistic species which proliferate in reduced sediments. These stations had the highest numbers of individuals and the lowest richness, evenness and diversity. Both of these stations were in very close proximity to the cage and were expected to be similar.

Group b separated from **Group c** at at 53.03% similarity level. **Group c** (Stations T1 20m, T2 Edge, T2 10m and T2 20m) had a within group similarity level of 57.11). Stations T2 10m and T2 20m had a similarity of 63.54% and stations T1 20m and T2 Edge had a similarity of 60.09%. This group contained 146 species (57 of which were present twice or less) comprising 5,651 individuals. Five species accounted for *c.* 75% of the faunal abundance: the polychaete *Mediomastus fragilis* (1,678 individuals, 29.69% abundance), Nematoda (1,580 individuals, 27.96% abundance), the polychaete *Capitella* sp. complex (584 individuals, 10.33% abundance), the bivalve mollusc Mytilidae (221 individuals, 3.91% abundance) and the brittlestar *Amphipholis squamata* (168 individuals, 2.97% abundance). *Amphipholis squamata* is a species very sensitive to organic enrichment and present under unpolluted conditions. Nematoda and Mytildae are tolerant to excess organic matter enrichment. They occur under normal conditions but their populations are stimulated by organic enrichment. *Mediomastus fragilis* is a second order opportunist and *Capitella* sp. complex is a first order opportunistic species which proliferate in reduced sediments. Richness, evenness and diversity were average at these stations.

Groups b and **c** separated from **Groups d** and **e** at a 44.79% similarity level and **Groups d** and **e** separated from each other at a 52.98% similarity level. The stations in **Group d** (T1 100m and REF) had a 58.13% similarity level and the station in **Group e** (T1 10m and T1 50m) had a 57.35% similarity level.

Group d (T1 100m and REF) contained 165 species (65 of which were present twice or less) comprising 4,327 individuals. Six species accounted for *c.* 45% of the faunal abundance: Nematoda (444 individuals, 10.26% abundance), the amphipod *Leptocheirus hirsutimanus* (357 individuals, 8.25% abundance), the brittlestar *Amphipholis squamata* (341 individuals, 7.88% abundance), the gastropod mollusc *Caecum glabrum* (338 individuals, 7.81% abundance) and the polychaetes *Socarnes erythrophthalmus* (283

individuals, 6.54% abundance) and *Sphaerosyllis bulbosa* (216 individuals, 4.99% abundance). *Amphipholis squamata* and *Caecum glabrum* are species very sensitive to organic enrichment and present under unpolluted conditions. *Socarnes erythrophthalmus* and *Sphaerosyllis bulbosa* are species indifferent to enrichment always present in low densities with non-significant variations over time. Nematoda and *Leptocheirus hirsutimanus* are tolerant to excess organic matter enrichment. They occur under normal conditions but their populations are stimulated by organic enrichment. Richness and diversity were high at these stations. Both of these stations were furthest from the cage and were expected to be similar.

Group e (T1 10m and T1 50m) contained 168 species (79 of which were present twice or less) comprising 5,107 individuals. Five species accounted for *c.* 55% of the faunal abundance: Nematoda (789 individuals, 15.45% abundance), the polychaetes *Protodrilus purpureus* (723 individuals, 14.16% abundance), *Capitella* sp. complex (477 individuals, 9.34% abundance) and *Mediomastus fragilis* (464 individuals, 9.09% abundance) and the brittlestar *Amphipholis squamata* (335 individuals, 6.56% abundance). *Amphipholis squamata* and *Protodrilus purpureus* are species very sensitive to organic enrichment and present under unpolluted conditions. Nematoda are tolerant to excess organic matter enrichment. They occur under normal conditions but their populations are stimulated by organic enrichment. *Mediomastus fragilis* is a second order opportunist and *Capitella* sp. complex is a first order opportunistic species which proliferate in reduced sediments. Richness and diversity were high at these stations.

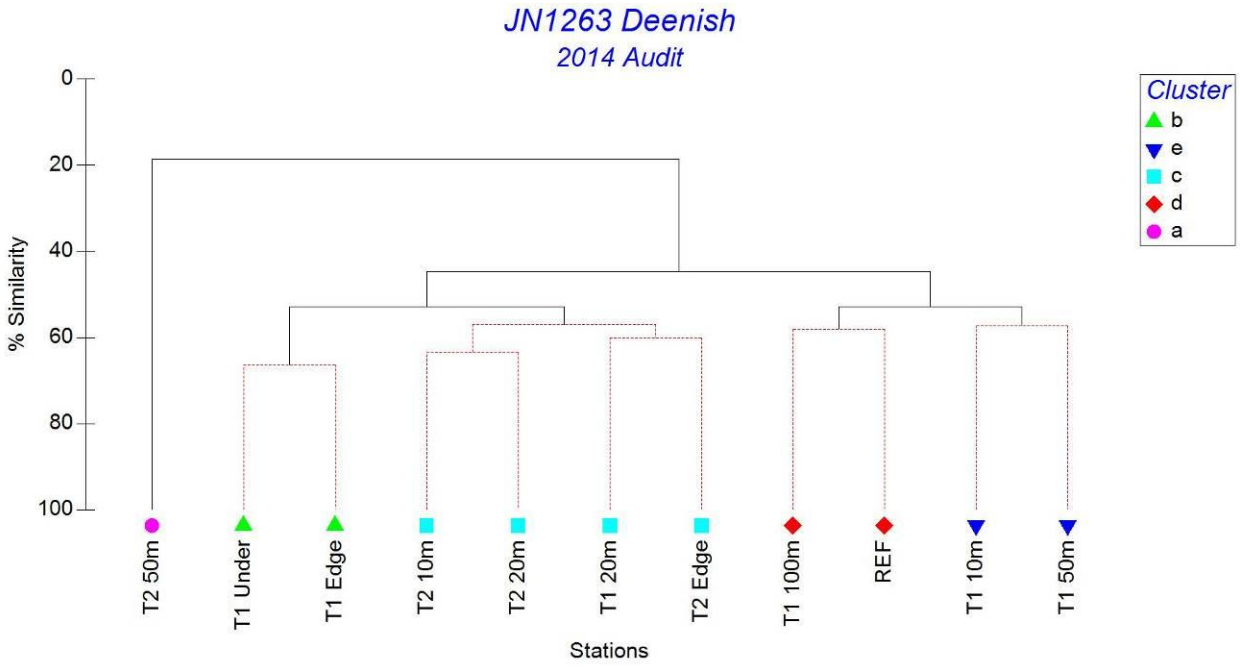

Figure 3.16: Dendrogram produced from Cluster analysis.

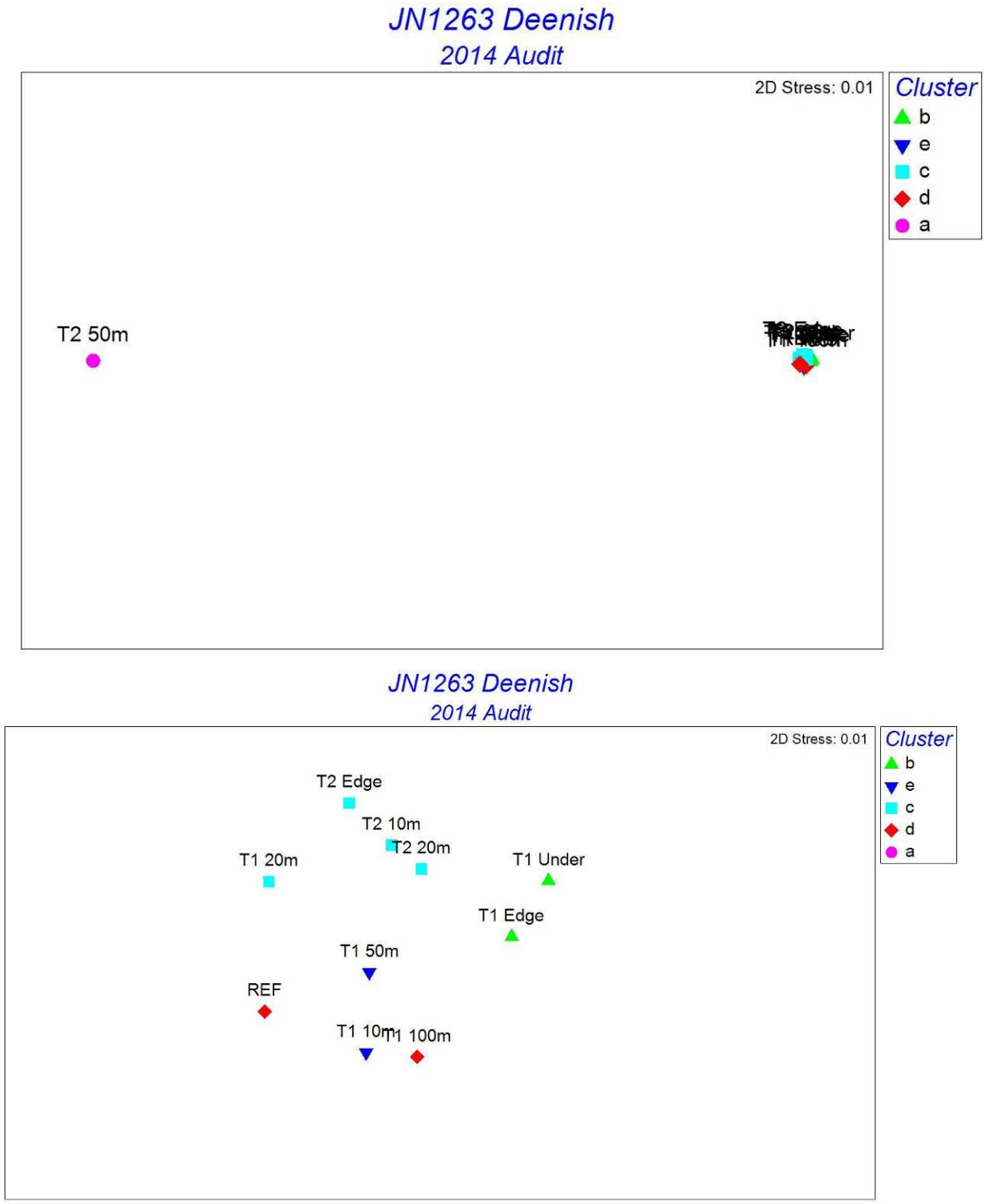

Figure 3.17: MDS plot.

3.1.10. Organic Carbon Analysis & ARPD Depths

Table 3.6 shows the organic carbon results from the Deenish stations. Organic carbon levels ranged from 1.41% (T2 50m) to 19.5% (T1 Under). Insufficient sediment was returned from the REF station for organic carbon analysis. Table 3.7 shows in tabular form the ARPD depths from the SPI images from Deenish (see Sections 3.1.4 and 3.1.7).

Table 3.3: Organic carbon results for Deenish (% values, Loss on Ignition at 450°C).

T1	**Under**	**Edge**	**10m**	**20m**	**50m**	**100m**
LOI %	19.5	19	14.95	9.4	5.31	8
T2	**Under**	**Edge**	**10m**	**20m**	**50m**	**REF**
LOI %	-	13.9	6.54	2.53	1.41	NSS

Table 3.4: ARPD Depths for Deenish, Kenmare Bay, 7th August 2014

Station		**Transect 1**	**Transect 2**
Under	Range (cm)	0 - 0	0 - 0
	Mean (cm)	0	0
Edge	Range (cm)	0 - 0.5	0 – 0.5
	Mean (cm)	0.1	0.2
10m	Range (cm)	0 - 5.4	0.0 - >7.0
	Mean (cm)	2.1	4.8
20m	Range (cm)	0.5 - 3.9	0 – 5.6
	Mean (cm)	2.2	3.6
50m	Range (cm)	>3.7 - >6.1	0.1 – 5.5
	Mean (cm)	>3.7	2.7
100m	Range (cm)	>4.1 - >4.9	-
	Mean (cm)	>4.1	-
Reference	Range (cm)	-	>3.7 - >6.7
	Mean (cm)	-	>3.7

4. Discussion

The extent to which an overlying fish farm impacts the seafloor is largely dependent on:

- the feeding regime at that farm, i.e. the amount of food that eventually ends up on the seafloor;
- the degree of current movement at the site in question; and
- the depth of water at that site.

These factors combine to form either erosional or depositional locations where organic material is either dispersed or accumulates, and subsequently affects the receiving environment, in this case the seafloor. The type of animal community living at a particular site will also play a role in determining bottom conditions there. The influence of feeding activities of populations of starfish, polychaete worms, anemones, crabs and finfish at the Deenish and Inishfarnard sites largely determine the level of impact of overlying farm operations on the benthos there.

Faunal feeding activity can remove large amounts of waste organic material from the seabed beneath a farm facility – with groups of mobile fauna capable of consuming large quantities of material. The fallowing schedule at a site also has a large bearing on benthic impact – most notably the length of time pens have been on site since the last fallow period. The presence of opportunistic deposit feeders such as *Capitella* sp., most notably at the under pen and pen edge stations will tend to help keep the benthic organics in a state of equilibrium at the fish farm sites. Sedimentary organic carbon levels in general are relatively higher at the under and edge of pen conditions and ranging 1.41 to 19.5% at the Dinish site .

Mobile epibenthic scavengers such as starfish, fish and crabs also help in reducing the amount of waste material on the seafloor. This potential speed of the removal of waste was demonstrated in a previous study where photographic evidence was collected showing that epibenthic macrofauna were capable of removing, in less than 7 days, fish feed pellets spread at a density of 3.4kg dry weight per m^2 on the sediment under a marine fish farm (Smith *et al.*, 1997).

Based on the benthic photographic records taken during the current survey, little habitat degradation is

obvious beyond the edge station on both transects at the Deenish site. Results from previous years surveys of the seafloor beneath the Deenish Island pen blocks indicated little change year on year on and showed few obvious signs of impact. In general the surface appearance of the seafloor was devoid of any indication of the overlying pens beyond the immediate footprint of the pens.

Detailed faunal analysis of grab and core samples at Deenish showed a clear statistical divide of 5 groups between the stations surveyed. In general, the stations under and close to the pen are dominated by pollution indicator species such as the polychaetes C*apitella* sp. complex and *Mediomastus fragilis.* Most stations along Transect 2 were also dominated by pollution indicator species but some pollution sensitive species were also dominating. Some of the stations along Transect 1 had a more balanced mix of pollution indicators and sensitive species and the Reference station and T1 100m were dominated by pollution sensitive species and species indifferent to enrichment with very low numbers of pollution indicator species.

5. Conclusion

Benthic audit surveys were carried out at the Deenish fish farm site operated by Marine Harvest Ireland. on 7th August 2014. The Deenish survey followed the DCMNR Level II monitoring protocols. In the present surveys beneath the pen blocks there were some obvious signs of impact from the farming operation on the benthos:

- Some waste feed/faecal material (and bacterial mat) was present at the under and edge stations;
- Organic carbon levels were elevated at the under and edge stations; and
- Species composition in the under pen locations were reflective of organic enrichment.

Diver observations at the Deenish site showed a clear divide between the stations closest to the pen and those furthest away. The images indicate that any significant impacts of the fish farm extend to less than 10m from the pen installations.

6. References

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Appendix 1

Faunal Grab Species List – Deenish

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
PORIFERA	C	1	0	0	0	0	0	0	0	0	0	0	0
CALCAREA	C	2	0	0	0	0	0	0	0	0	0	0	0
LEUCOSOLENIDA	C	49	0	0	0	0	0	0	0	0	0	0	0
Sycettidae	C	126	0	0	0	0	0	0	0	0	0	0	0
Sycon ciliatum	C	133	0	0	0	0	0	0	0	0	0	0	+
CNIDARIA	D	1	0	0	0	0	0	0	0	0	0	0	0
HYDROZOA	D	58	0	0	0	0	0	0	0	0	0	0	0
LEPTOLIDA	D	138	0	0	0	0	0	0	0	0	0	0	0
Myriothelidae	D	203	0	0	0	0	0	0	0	0	0	0	0
Candelabrum cf cocksii	D	205	0	0	0	0	0	0	0	0	0	0	4
ANTHOZOA	D	583	0	0	0	0	0	0	0	0	0	0	0
HEXACORALLIA	D	627	0	0	0	0	0	0	0	0	0	0	0
CERIANTHARIA	D	628	0	0	0	0	0	0	0	0	0	0	0
Cerianthidae	D	630	0	0	0	0	0	0	0	0	0	0	0
Cerianthus lloydii	D	632	0	0	1	0	0	0	0	0	0	1	0
ACTINIARIA	D	662	0	0	0	0	0	0	0	0	0	0	0
Actiniaria	D	662	0	0	1	0	1	0	0	0	0	0	1
Edwardsiidae	D	759	0	0	0	0	0	0	0	0	0	0	0
Edwardsiidae	D	759	0	0	0	0	0	0	0	0	0	1	0
Edwardsia claparedii	D	766	0	2	2	0	0	0	1	0	1	0	0
PLATYHELMINTHES	F	1	0	0	0	0	0	0	0	0	0	0	0
TURBELLARIA	F	2	0	0	0	0	0	0	0	0	0	0	0
Turbellaria	F	2	0	0	0	0	0	1	0	0	0	0	0
NEMATODA	HD	1	0	0	0	0	0	0	0	0	0	0	0
Nematoda	HD	1	510	70	755	62	34	214	506	469	543	27	230
NEMERTEA	G	1	0	0	0	0	0	0	0	0	0	0	0
Nemertea	G	1	2	1	29	3	9	16	11	9	7	3	34
CHAETOGNATHIA	L	1	0	0	0	0	0	0	0	0	0	0	0
Chaetognathia	L	1	0	0	0	0	0	7	0	0	0	0	0
SIPUNCULA	N	1	0	0	0	0	0	0	0	0	0	0	0
Sipuncula	N	1	0	0	3	0	0	0	0	0	0	0	0
SIPUNCULIDEA	N	2	0	0	0	0	0	0	0	0	0	0	0
GOLFINGIIFORMES	N	10	0	0	0	0	0	0	0	0	0	0	0
Golfingiidae	N	11	0	0	0	0	0	0	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Golfingiidae	N	11	0	0	4	0	1	0	0	0	0	0	0
Phascolionidae	N	29	0	0	0	0	0	0	0	0	0	0	0
Aspidosiphon (Aspidosiphon) muelleri muelleri	N	47	1	0	0	0	0	0	0	0	0	0	0
ANNELIDA	P	1	0	0	0	0	0	0	0	0	0	0	0
POLYCHAETA	P	2	0	0	0	0	0	0	0	0	0	0	0
PHYLLODOCIDA	P	3	0	0	0	0	0	0	0	0	0	0	0
Chrysopetalidae	P	5	0	0	0	0	0	0	0	0	0	0	0
Pisionidae	P	13	0	0	0	0	0	0	0	0	0	0	0
Pisione remota	P	15	0	0	0	0	4	64	0	0	0	0	24
Polynoidae	P	25	0	0	0	0	0	0	0	0	0	0	0
Polynoidae	P	25	1	4	27	6	18	41	4	23	5	0	49
Alentia gelatinosa	P	34	0	0	5	0	0	2	0	0	0	0	0
Harmothoe sp.	P	50	0	0	6	0	3	7	0	5	0	0	1
Malmgreniella arenicolae	P		0	0	0	0	0	0	1	0	0	0	0
Malmgreniella darbouxi	P		0	0	0	0	1	0	0	0	0	0	0
Harmothoe fraglis	P	59	0	0	0	0	1	0	0	0	0	0	0
Malmgreniella ljungmani	P	66	0	0	1	0	1	5	0	0	0	0	6
Lepidonotus squamatus	P	83	0	0	0	0	0	0	0	0	0	0	2
Pholoidae	P	90	0	0	0	0	0	0	0	0	0	0	0
Pholoe inornata	P	92	0	0	17	1	4	3	0	0	0	0	17
Pholoe baltica	P	95	2	0	7	0	0	0	0	1	0	0	0
Phyllodocidae	P	114	0	0	0	0	0	0	0	0	0	0	0
Phyllodocidae	P	114	0	1	2	3	1	3	0	1	1	0	2
Eteone sp.	P	115	0	1	0	0	0	0	0	0	0	0	0
Eteone longa agg.	P	118	9	10	3	5	5	1	2	6	7	0	0
Pseudomystides limbata	P	136	0	0	0	0	0	2	0	0	0	0	0
Phyllodoce mucosa	P	145	1	9	3	2	0	0	1	0	0	0	1
Phyllodoce rosea	P	148	0	2	0	0	0	0	0	0	1	0	0
Eumida sp.	P	163	0	0	0	0	0	1	0	1	0	1	0
Eumida bahusiensis	P	164	0	0	0	0	0	2	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Nereiphylla rubiginosa	P	171	0	0	0	0	0	0	0	0	0	0	11
Paranaitis kosteriensis	P	176	0	0	1	0	1	0	0	0	0	0	0
Phyllodoce sp.	P	178	10	3	0	0	0	0	0	0	0	0	0
Glyceridae	P	254	0	0	0	0	0	0	0	0	0	0	0
Glycera sp.	P	255	9	7	2	3	6	11	10	20	8	0	5
Glycera alba	P	256	0	0	0	0	0	0	0	0	0	1	0
Glycera lapidum agg.	P	260	0	1	6	9	21	16	7	16	16	0	3
Goniadidae	P	266	0	0	0	0	0	0	0	0	0	0	0
Goniadidae	P	266	0	0	0	1	0	0	0	0	0	0	0
Sphaerodoridae	P	277	0	0	0	0	0	0	0	0	0	0	0
Ephesiella peripatus	P		0	0	4	0	0	4	0	1	0	0	6
Sphaerodorum gracilis	P	291	0	0	3	0	0	0	0	0	0	0	0
Hesionidae	P	293	0	0	0	0	0	0	0	0	0	0	0
Hesionidae	P	293	1	0	27	3	6	10	2	6	0	1	4
Gyptis propinqua	P	300	0	0	0	0	0	0	0	0	0	0	1
Hesiospina aurantiaca	P		0	0	10	0	1	0	0	2	1	0	0
Psamthe fusca	P	305	3	3	1	0	2	17	1	7	0	0	0
Nereimyra punctata	P	311	0	0	1	0	1	0	0	0	0	0	0
Podarkeopsis helgolandica	P		0	0	0	0	0	2	0	0	0	0	0
Syllidia armata	P	321	0	1	39	0	10	17	1	8	1	1	0
Microphthalmus fragilis	P	330	3	0	2	1	0	0	2	2	4	0	0
Pilargidae	P	336	0	0	0	0	0	0	0	0	0	0	0
Pilargidae	P	336	0	0	0	0	0	1	0	0	0	0	0
Pilargis verrucosa	P	344	0	0	0	0	0	1	0	0	0	0	1
Syllidae	P	346	0	0	0	0	0	0	0	0	0	0	0
Syllis cornuta	P	349	0	0	0	1	0	0	0	0	0	0	7
Syllis sp.	P	358	1	0	0	0	0	0	0	0	0	0	0
Syllis pontxioi	P		1	1	0	0	0	1	0	1	1	0	3
Syllis garciai	P		1	1	0	0	0	3	0	0	0	0	2
Trypanosyllis coeliaca	P	362	7	1	12	0	1	21	3	1	2	0	46
Syllis armillaris	P	365	0	0	0	0	0	0	0	0	0	0	1
Odontosyllis sp.	P	385	0	0	0	0	0	0	0	0	0	0	1
Odontosyllis ctenostoma	P	386	0	0	0	2	0	0	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Odontosyllis fulgurans	P	387	0	0	1	0	0	0	0	0	0	0	0
Exogoninae	P	410	0	0	0	0	0	0	0	0	0	0	0
Exogone (Parexogone) hebes	P	421	0	0	1	0	0	0	0	0	0	0	0
Exogone (Exogone) naidina	P	422	0	0	2	0	0	0	0	0	0	0	0
Sphaerosyllis bulbosa	P	425	6	9	15	0	2	103	6	30	4	0	113
Sphaerosyllis hystrix	P	427	0	0	25	3	21	43	4	10	0	0	34
Myrianida sp.	P	434	0	0	0	0	1	1	1	0	0	0	0
Nereididae	P	458	0	0	0	0	0	0	0	0	0	0	0
Nereididae	P	458	0	0	4	0	3	9	0	1	0	0	3
Platynereis dumerilii	P	482	0	0	0	0	3	1	0	0	0	0	2
Nephtyidae	P	490	0	0	0	0	0	0	0	0	0	0	0
Nephtys sp.	P	494	0	0	0	0	0	0	0	0	0	2	0
AMPHIMOMIDA	P	511	0	0	0	0	0	0	0	0	0	0	0
Amphinomidae	P	512	0	0	0	0	0	0	0	0	0	0	0
Paramphinone jeffreysii	P	518	0	0	0	0	0	1	0	0	0	0	0
Pareurythoe borealis	P	520	0	0	0	0	0	0	0	0	0	0	34
EUNICIDA	P	536	0	0	0	0	0	0	0	0	0	0	0
Onuphidae	P	537	0	0	0	0	0	0	0	0	0	0	0
Onuphidae	P	537	0	0	0	0	0	0	0	0	1	0	0
Paradiopatra quadricuspis	P	550	0	1	3	0	1	16	1	1	2	0	70
Eunicidae	P	553	0	0	0	0	0	0	0	0	0	0	0
Lysidice unicornis	P	568	1	0	2	0	0	1	0	0	0	0	0
Lumbrineridae	P	569	0	0	0	0	0	0	0	0	0	0	0
Lumbrineridae	P	569	1	0	0	0	0	0	0	0	0	0	0
Lumbrineris cf cingulata	P		0	0	0	0	0	0	1	1	0	0	0
Dorvilleidae	P	598	0	0	0	0	0	0	0	0	0	0	0
Ophryotrocha sp.	P	613	4	1	9	0	3	26	7	1	0	0	1
Protodorvillea kefersteini	P	638	55	18	75	9	2	3	7	6	8	0	1
Schistomeringos sp.	P	641	0	0	0	0	0	0	3	0	0	0	0
Schistomeringos	P	642	0	0	1	0	0	2	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
neglecta													
Schistomeringos rudolphi	P	643	0	3	0	0	0	0	0	1	0	1	0
ORBINIIDA	P	654	0	0	0	0	0	0	0	0	0	0	0
Orbiniidae	P	655	0	0	0	0	0	0	0	0	0	0	0
Scoloplos armiger	P	672	0	0	0	0	0	0	0	0	0	1	0
Paraonidae	P	674	0	0	0	0	0	0	0	0	0	0	0
Aricidea (Arcidea) minuta	P	677	0	0	0	0	0	0	0	0	0	4	1
Aricidea (Acmira) cerrutii	P	685	1	0	0	0	0	0	0	0	0	1	0
Paradoneis lyra	P	699	0	0	1	0	0	0	0	2	0	0	0
SPIONIDA	P	707	0	0	0	0	0	0	0	0	0	0	0
Spionidae	P	720	0	0	0	0	0	0	0	0	0	0	0
Spionidae	P	720	8	0	0	6	1	0	4	0	0	0	0
Aonides sp.	P	721	0	0	0	0	1	0	0	1	3	0	0
Aonides oxycephala	P	722	71	26	19	14	9	3	4	21	2	0	0
Aonides paucibranchiata	P	723	0	0	0	0	0	0	0	0	0	1	0
Laonice bahusiensis	P	733	0	0	0	0	1	0	0	1	1	0	0
Malacoceros sp.	P	736	25	43	1	0	2	1	0	0	1	0	0
Malacoceros fuliginosus	P	737	59	82	0	18	0	0	0	0	0	1	0
Malacoceros tetracerus	P	738	1	0	1	0	0	0	0	2	2	0	0
Dipolydora sp.	P	748	0	0	1	0	0	0	0	0	0	0	0
Prionospio sp.	P	763	0	0	0	1	3	4	2	2	0	1	1
Prionospio fallax	P	765	0	0	0	0	0	0	0	0	0	2	0
Prionospio multibranchiata	P		0	0	0	0	0	4	0	0	0	0	0
Spio sp.	P	787	0	0	0	0	0	1	0	0	0	21	0
Spiophanes bombyx	P	794	0	0	0	0	0	0	0	0	0	13	0
Magelonidae	P	802	0	0	0	0	0	0	0	0	0	0	0
Magelona filiformis	P	805	0	0	0	0	0	0	0	0	0	3	0
Magelona minuta	P	806	0	0	0	0	0	0	0	0	0	1	0
Cirratulidae	P	822	0	0	0	0	0	0	0	0	0	0	0
Cirratulidae	P	822	4	0	0	0	0	0	4	3	0	3	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Caulleriella alata	P	829	28	6	0	5	0	0	12	21	10	1	0
Cirratulus sp.	P		0	0	0	0	1	0	0	0	0	0	0
Acrocirridae	P	886	0	0	0	0	0	0	0	0	0	0	0
Macrochaeta clavicornis	P	891	0	0	8	0	2	4	0	1	0	0	0
CAPITELLIDA	P	902	0	0	0	0	0	0	0	0	0	0	0
Capitellidae	P	903	0	0	0	0	0	0	0	0	0	0	0
Capitella sp. complex	P	906	1350	870	474	156	3	4	347	38	43	13	1
Mediomastus fragilis	P	919	1014	806	376	246	88	24	569	544	319	11	2
OPHELIIDA	P	992	0	0	0	0	0	0	0	0	0	0	0
Opheliidae	P	993	0	0	0	0	0	0	0	0	0	0	0
Opheliidae	P	993	0	0	0	0	1	0	0	0	0	0	0
Polyophthalmus pictus	P	1019	0	0	0	0	1	1	0	0	0	0	0
POLYGORDIIDA	P	1060	0	0	0	0	0	0	0	0	0	0	0
Polygordiidae	P	1061	0	0	0	0	0	0	0	0	0	0	0
Polygordius sp.	P	1062	4	2	46	0	37	8	0	10	1	0	41
Polygordius appendiculatus	P	1063	0	0	0	1	4	0	0	0	0	0	0
Polygordius lacteus	P	1065	0	0	46	0	18	2	0	0	0	0	7
PROTODRILIDA	P	1067	0	0	0	0	0	0	0	0	0	0	0
Protodrilidae	P	1068	0	0	0	0	0	0	0	0	0	0	0
Protodrilus sp.	P	1069	0	2	12	26	20	2	0	10	12	0	1
Protodrilus purpureus	P	1079	25	0	723	0	0	1	21	7	24	0	1
OWENIIDA	P	1089	0	0	0	0	0	0	0	0	0	0	0
Oweniidae	P	1090	0	0	0	0	0	0	0	0	0	0	0
Owenia fusiformis	P	1098	0	1	0	2	0	0	1	1	1	5	0
TEREBELLIDA	P	1099	0	0	0	0	0	0	0	0	0	0	0
Pectinariidae	P	1100	0	0	0	0	0	0	0	0	0	0	0
Pectinariidae	P	1100	0	0	0	0	0	0	0	0	0	3	0
Trichobranchidae	P	1171	0	0	0	0	0	0	0	0	0	0	0
Trichobranchus sp.	P	1176	0	0	1	0	0	0	0	0	0	0	0
Terebellidae	P	1179	0	0	0	0	0	0	0	0	0	0	0
Terebellidae	P	1179	0	0	1	0	5	0	1	0	0	0	0
Pista sp.	P	1216	0	0	0	0	0	1	2	0	0	0	0
Polycirrus sp.	P	1235	2	0	162	3	27	18	5	21	9	7	12

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Polycirrus denticulatus	P	1239	0	0	0	0	0	2	0	0	0	0	0
Polycirrus norvegicus	P	1243	0	0	0	0	0	0	0	0	0	0	6
SABELLIDA	P	1256	0	0	0	0	0	0	0	0	0	0	0
Sabellidae	P	1257	0	0	0	0	0	0	0	0	0	0	0
Chone sp.	P	1264	0	0	0	0	0	0	0	1	0	0	0
Serpulidae	P	1324	0	0	0	0	0	0	0	0	0	0	0
Serpulidae	P	1324	0	0	29	1	10	11	1	1	1	0	5
Hydroides norvegica	P	1334	1	0	4	3	1	3	0	0	3	0	5
Spirobranchus sp.	P	1339	10	0	12	1	8	9	0	5	9	0	0
Spirobranchus lamarcki	P	1340	7	4	19	10	21	8	4	2	3	0	2
Spirobranchus triqueter	P	1341	0	0	0	0	1	0	0	0	0	0	1
OLIGOCHAETA	P	1402	0	0	0	0	0	0	0	0	0	0	0
TUBIFICIDA	P	1403	0	0	0	0	0	0	0	0	0	0	0
Naididae	P	1405	0	0	0	0	0	0	0	0	0	0	0
Tubificidae	P	1425	0	0	0	0	0	0	0	0	0	0	0
Tubificoides pseudogaster aggregate	P	1498	0	0	0	0	0	0	0	0	0	10	0
Tubificoides benedii	P	1490	13	2	33	3	1	0	0	6	5	0	0
Enchytraeidae	P	1501	0	0	0	0	0	0	0	0	0	0	0
Grania sp.	P	1524	11	17	5	3	1	4	2	5	3	0	0
CHELICERATA	Q	1	0	0	0	0	0	0	0	0	0	0	0
PYCNOGONIDA	Q	2	0	0	0	0	0	0	0	0	0	0	0
Ammotheidae	Q	13	0	0	0	0	0	0	0	0	0	0	0
Achelia echinata	Q	15	0	0	1	0	0	0	0	0	0	0	0
Callipallenidae	Q	31	0	0	0	0	0	0	0	0	0	0	0
Callipallene sp.	Q	32	0	0	1	0	0	0	0	0	0	0	0
CRUSTACEA	R	1	0	0	0	0	0	0	0	0	0	0	0
MAXILLOPODA	R	13	0	0	0	0	0	0	0	0	0	0	0
CIRRIPEDIA	R	14	0	0	0	0	0	0	0	0	0	0	0
THORACICA	R	15	0	0	0	0	0	0	0	0	0	0	0
Verrucidae	R	39	0	0	0	0	0	0	0	0	0	0	0
Verruca stroemia	R	41	0	0	0	0	0	0	0	0	0	0	1
COPEPODA	R	142	0	0	0	0	0	0	0	0	0	0	0
HARPACTICOIDA	R	785	0	0	0	0	0	0	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Longipediidae	R	787	0	0	0	0	0	0	0	0	0	0	0
Longipedia sp.	R	788	0	0	0	0	1	0	0	0	0	0	0
Tisbidae	R	974	0	0	0	0	0	0	0	0	0	0	0
Tisbidae	R	974	0	0	0	0	1	0	0	0	0	0	0
Tisbe sp.	R	983	0	0	0	0	1	0	0	0	0	0	0
Peltidiidae	R	1034	0	0	0	0	0	0	0	0	0	0	0
Alteutha interrupta	R	1035	0	0	0	0	1	0	0	0	0	0	0
Thalestridae	R	1061	0	0	0	0	0	0	0	0	0	0	0
Thalestridae	R	1061	0	0	0	1	0	1	0	5	0	0	1
Phyllothalestris mysis	R	1076	0	0	0	0	0	0	0	0	0	0	1
Thalestris longimana	R	1079	0	0	0	0	4	0	0	0	0	0	1
Ambunguipedidae	R	1132	0	0	0	0	0	0	0	0	0	0	0
Ambunguipes rufocincta	R	1134	0	0	28	0	9	18	4	7	1	0	0
Ambunguipes vanhoeffeni	R		0	0	0	0	0	13	0	0	0	0	0
Miraciidae	R	1144	0	0	0	0	0	0	0	0	0	0	0
Miraciidae	R	1144	46	11	29	7	37	39	72	43	0	0	0
Bulbamphiasus denticulatus	R	1178	0	0	0	5	0	0	0	0	0	0	0
Bulbamphiasus imus	R	1179	0	0	2	0	0	0	0	0	0	0	0
Tetragonicipitidae	R	1436	0	0	0	0	0	0	0	0	0	0	0
Tetragoniceps scotti	R	1452	0	0	0	0	0	2	0	0	0	0	0
Laophonitdae	R	1667	0	0	0	0	0	0	0	0	0	0	0
Laophonte cornuta	R	1702	0	0	0	0	2	3	2	0	0	0	1
Pseudolaophonte spinosa	R	1744	0	0	0	0	0	1	0	0	0	0	0
SIPHONOSTOMATOIDA	R	2061	0	0	0	0	0	0	0	0	0	0	0
Caligidae	R	2206	0	0	0	0	0	0	0	0	0	0	0
Caligus sp.	R	2207	1	0	0	0	0	0	0	0	0	0	0
OSTRACODA	R	2412	0	0	0	0	0	0	0	0	0	0	0
Ostracoda	R	2412	1	0	1	0	1	1	0	0	0	0	59
MALACOSTRACA	S	1	0	0	0	0	0	0	0	0	0	0	0
LEPTOSTRACA	S	3	0	0	0	0	0	0	0	0	0	0	0
Nebaliidae	S	4	0	0	0	0	0	0	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Nebalia sp.	S		17	8	5	0	0	0	3	0	0	0	0
Nebalia cf strausi	S	9	0	0	0	0	0	0	0	1	0	0	0
Nebalia kocatasi	S		18	11	2	0	0	0	0	2	2	0	0
EUMALACOSTRACA	S	23	0	0	0	0	0	0	0	0	0	0	0
AMPHIPODA	S	97	0	0	0	0	0	0	0	0	0	0	0
Oedicerotidae	S	118	0	0	0	0	0	0	0	0	0	0	0
Perioculodes longimanus	S	131	0	0	0	0	0	0	0	0	0	7	0
Amphilochidae	S	152	0	0	0	0	0	0	0	0	0	0	0
Gitana sarsi	S	164	0	0	0	0	1	3	0	0	0	0	0
Stenothoidae	S	187	0	0	0	0	0	0	0	0	0	0	0
Stenothoe monoculoides	S	214	0	0	0	0	1	28	0	1	0	0	7
Urothoidae	S	245	0	0	0	0	0	0	0	0	0	0	0
Urothoe elegans	S	248	0	0	0	0	0	0	0	0	0	4	0
Lysianassidae	S	271	0	0	0	0	0	0	0	0	0	0	0
Lysianassidae	S	271	0	0	2	0	1	5	0	0	0	0	0
Lysianassa plumosa	S	305	0	0	0	0	0	0	0	1	0	0	0
Socarnes sp.	S	329	0	0	0	0	0	4	0	0	0	0	0
Socarnes erythrophthalmus	S	330	1	0	230	28	72	270	7	4	1	1	13
Tryphosella sp.	S	341	0	0	0	0	0	0	1	0	0	0	2
Liljeborgiidae	S	394	0	0	0	0	0	0	0	0	0	0	0
Liljeborgiidae	S	394	0	0	0	0	0	0	0	0	0	0	4
Liljeborgia pallida	S	397	0	0	3	0	0	4	0	0	0	0	1
Ampeliscidae	S	422	0	0	0	0	0	0	0	0	0	0	0
Ampelisca brevicornis	S	427	0	0	0	0	0	0	0	0	0	2	0
Ampelisca typica	S	442	0	0	0	0	0	0	0	0	0	1	0
Melitidae	S	495	0	0	0	0	0	0	0	0	0	0	0
Melitidae	S	495	0	0	2	0	1	3	0	2	0	0	1
Animoceradocus semiserratus	S	502	0	0	45	1	3	4	0	1	0	0	36
Isaeidae	S	537	0	0	0	0	0	0	0	0	0	0	0
Gammaropsis lobata	S	540	0	0	1	0	1	69	0	3	0	0	17

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Photidae	S		0	0	0	0	0	0	0	0	0	0	0
Photis longicaudata	S	552	0	0	0	0	1	0	0	0	0	0	0
Ischyroceridae	S	558	0	0	0	0	0	0	0	0	0	0	0
Jassa sp.	S	568	3	0	0	0	0	2	0	0	0	0	0
Jassa herdmani	S		4	0	0	0	0	0	0	0	0	0	0
Aoridae	S	577	0	0	0	0	0	0	0	0	0	0	0
Aoridae	S	577	0	0	1	0	4	67	0	3	0	0	3
Leptocheirus hirsutimanus	S	588	0	0	0	0	0	272	0	1	1	0	85
Microdeutopus versiculatus	S	598	0	0	0	0	0	5	0	0	0	0	0
Corophiidae	S	604	0	0	0	0	0	0	0	0	0	0	0
Caprellidae	S	639	0	0	0	0	0	0	0	0	0	0	0
Caprella acanthifera	S	641	0	0	0	0	0	0	0	0	0	0	3
Pariambus typicus	S	651	0	0	0	0	0	0	0	0	0	1	0
Phtisicidae	S	655	0	0	0	0	0	0	0	0	0	0	0
Phtisica marina	S	657	0	0	0	0	1	0	0	0	0	0	2
ISOPODA	S	790	0	0	0	0	0	0	0	0	0	0	0
Gnathiidae	S	792	0	0	0	0	0	0	0	0	0	0	0
Gnathia sp. (pranzia)	S	793	0	0	0	1	0	3	0	0	0	0	2
Gnathia oxyuraea	S	796	0	0	0	0	0	0	0	0	0	0	1
Anthuridae	S	801	0	0	0	0	0	0	0	0	0	0	0
Anthura gracilis	S	803	0	0	0	0	1	0	0	0	0	0	0
Sphaeromatidae	S	857	0	0	0	0	0	0	0	0	0	0	0
Cymodoce truncata	S	863	0	0	0	0	0	1	0	0	0	0	0
Janiridae	S	883	0	0	0	0	0	0	0	0	0	0	0
Janira maculosa	S	892	0	0	0	0	1	0	0	0	0	0	0
Microcharon harrisi	S	896	0	0	0	0	0	11	0	0	0	0	1
Paramunnidae	S	909	0	0	0	0	0	0	0	0	0	0	0
Paramunna bilobata	S	911	0	0	0	0	1	17	0	0	0	0	13
Idoteidae	S	933	0	0	0	0	0	0	0	0	0	0	0
Idotea pelagica	S	942	1	0	0	0	0	0	0	0	0	0	0
TANAIDACEA	S	1099	0	0	0	0	0	0	0	0	0	0	0
Tanaidae	S	1102	0	0	0	0	0	0	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Tanaidae	S	1102	0	0	0	0	0	4	0	0	0	0	2
Leptognathidae	S	1130	0	0	0	0	0	0	0	0	0	0	0
Leptognathidae	S	1130	0	1	0	0	0	0	0	0	0	0	0
CUMACEA	S	1183	0	0	0	0	0	0	0	0	0	0	0
Bodotriidae	S	1184	0	0	0	0	0	0	0	0	0	0	0
Vaunthompsonia cristata	S	1191	0	0	0	0	1	0	0	0	0	0	0
Iphinoe trispinosa	S	1203	0	0	0	0	0	0	0	0	0	2	0
Nannastacidae	S	1214	0	0	0	0	0	0	0	0	0	0	0
Nannastacus unguiculatus	S	1228	0	0	0	0	0	0	0	0	0	0	7
Pseudocumatidae	S	1231	0	0	0	0	0	0	0	0	0	0	0
Pseudocuma sp.	S	1234	0	0	0	0	1	0	0	0	0	0	0
DECAPODA	S	1276	0	0	0	0	0	0	0	0	0	0	0
Decapoda larvae	S	1276	0	1	0	0	0	0	0	0	0	0	0
PAGUROIDEA	S	1436	0	0	0	0	0	0	0	0	0	0	0
Paguridae	S	1445	0	0	0	0	0	0	0	0	0	0	0
Paguridae	S	1445	0	5	7	6	6	0	0	6	2	0	0
Anapagurus hyndmanni	S	1448	0	0	0	0	1	0	0	0	1	0	0
Porcellanidae	S	1480	0	0	0	0	0	0	0	0	0	0	0
Pisidia longicornis	S	1482	0	0	1	0	0	0	0	0	0	2	0
BRACHYURA	S	1485	0	0	0	0	0	0	0	0	0	0	0
Brachyura	S	1485	0	0	0	0	0	0	0	1	0	0	0
Leucosiidae	S	1502	0	0	0	0	0	0	0	0	0	0	0
Ebalia tuberosa	S	1508	0	0	1	1	0	0	0	2	0	0	0
Ebalia tumefacta	S	1509	0	0	1	0	0	0	0	0	0	0	0
Majidae	S	1512	0	0	0	0	0	0	0	0	0	0	0
Inachus sp.	S	1525	0	0	0	0	0	0	0	0	0	0	1
Atelecyclidae	S	1553	0	0	0	0	0	0	0	0	0	0	0
Atelecyclus rotundatus	S	1555	1	4	2	0	0	0	5	0	0	0	1
BRACHYRHYNCHA	S	1567	0	0	0	0	0	0	0	0	0	0	0
Portunidae	S	1569	0	0	0	0	0	0	0	0	0	0	0
Liocarcinus sp.	S	1577	0	0	1	1	1	0	2	2	0	1	0
Liocarcinus depurator	S	1580	0	0	0	1	0	0	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Liocarcinus marmoreus	S	1582	0	0	0	0	0	1	0	0	0	0	0
Liocarcinus pusillus	S	1584	0	0	0	0	0	1	0	0	0	0	0
Necora puber	S	1589	0	0	0	0	0	0	1	0	0	0	0
Goneplacidae	S	1603	0	0	0	0	0	0	0	0	0	0	0
Monodaeus couchi	S	1609	0	0	1	0	0	1	0	0	0	0	0
MOLLUSCA	W	1	0	0	0	0	0	0	0	0	0	0	0
CHAETODERMATIDA	W	3	0	0	0	0	0	0	0	0	0	0	0
Chaetodermatidae	W	7	0	0	0	0	0	0	0	0	0	0	0
Chaetoderma nitidulum	W	9	0	0	0	0	1	3	0	0	0	0	0
POLYPLACOPHORA	W	46	0	0	0	0	0	0	0	0	0	0	0
NEOLORICATA	W	47	0	0	0	0	0	0	0	0	0	0	0
Leptochitonidae	W	48	0	0	0	0	0	0	0	0	0	0	0
Leptochiton sp.	W	51	0	0	1	0	0	1	1	0	0	0	11
Leptochiton asellus	W	53	1	0	5	0	1	0	0	1	0	0	2
Leptochiton cancellatus	W	54	5	1	55	5	5	22	1	5	1	0	88
GASTROPODA	W	88	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	W	88	0	1	19	0	1	6	0	4	0	0	40
ARCHAEOGASTROPODA	W	90	0	0	0	0	0	0	0	0	0	0	0
Trochidae	W	140	0	0	0	0	0	0	0	0	0	0	0
Gibbula sp.	W	157	0	0	5	0	1	1	1	0	0	0	0
Gibbula tumida	W	161	1	1	8	0	0	0	2	0	0	0	0
Gibbula cineraria	W	163	1	2	0	0	0	0	0	0	0	0	0
Gibbula pennanti	W	164	0	0	4	0	0	0	0	0	0	0	0
Jujubinus montagui	W	174	0	0	0	0	0	0	2	0	0	0	0
Osilinus lineatus	W	177	0	0	0	0	0	0	0	0	0	0	1
Skeneidae	W	194	0	0	0	0	0	0	0	0	0	0	0
Skenea serpuloides	W	198	0	0	0	0	0	0	0	0	0	0	24
PATELLOGASTROPODA	W	219	0	0	0	0	0	0	0	0	0	0	0
Lottiidae	W	221	0	0	0	0	0	0	0	0	0	0	0
Tectura sp.	W	222	0	0	1	0	0	0	0	0	0	0	0
MESOGASTROPODA	W	256	0	0	0	0	0	0	0	0	0	0	0
Turritellinae	W	267	0	0	0	0	0	0	0	0	0	0	0
Turritella communis	W	270	0	0	0	1	0	0	0	0	0	0	0
Littorinidae	W	283	0	0	0	0	0	0	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Lacuna vincta	W	292	0	0	0	0	0	0	0	0	0	0	1
Rissoidae	W	324	0	0	0	0	0	0	0	0	0	0	0
Rissoa parva	W	334	0	1	3	0	2	0	5	0	0	0	6
Alvania beanii	W	338	0	0	3	1	0	0	8	0	0	0	0
Onoba semicostata	W	371	1	0	18	1	1	0	11	1	0	0	0
Caecidae	W	411	0	0	0	0	0	0	0	0	0	0	0
Caecum trachea	W	414	6	3	3	0	2	2	2	5	4	0	0
Caecum glabrum	W	418	11	7	89	0	3	34	25	11	1	0	304
Naticidae	W	482	0	0	0	0	0	0	0	0	0	0	0
Euspira sp.	W	492	0	0	0	0	0	0	0	0	0	1	0
Euspira nitida	W		2	4	1	1	4	7	4	3	4	2	0
Eulimidae	W	599	0	0	0	0	0	0	0	0	0	0	0
Melanella alba	W	634	0	0	0	0	0	0	0	1	0	0	0
NEOGASTROPODA	W	670	0	0	0	0	0	0	0	0	0	0	0
Muricidae	W	672	0	0	0	0	0	0	0	0	0	0	0
Trophonopsis muricatus	W	679	0	0	1	0	0	0	0	0	0	0	0
Buccinidae	W	702	0	0	0	0	0	0	0	0	0	0	0
Nassarius sp.	W	743	17	17	52	6	4	1	1	0	0	0	5
Nassarius incrassatus	W	747	3	15	2	2	0	1	2	0	1	0	0
Nassarius pygmaeus	W	748	93	228	43	24	2	0	37	0	0	0	2
Nassarius nitidus	W		0	12	0	0	0	0	0	0	0	0	0
Mangeliidae	W	771	0	0	0	0	0	0	0	0	0	0	0
Mangeliidae	W	771	0	0	1	0	0	0	0	0	0	0	0
OPISTHOBRANCHIA	W		0	0	0	0	0	0	0	0	0	0	0
CEPHALASPIDEA	W	1002	0	0	0	0	0	0	0	0	0	0	0
Diaphanidae	W	1053	0	0	0	0	0	0	0	0	0	0	0
Diaphana minuta	W	1059	0	0	1	0	0	0	0	0	1	0	0
Retusidae	W	1073	0	0	0	0	0	0	0	0	0	0	0
Retusa truncatula	W	1080	0	0	0	1	0	0	0	2	0	0	0
NUDIBRANCHIA	W	1243	0	0	0	0	0	0	0	0	0	0	0
Nudibranch	W	1243	0	1	11	0	8	1	0	2	1	0	0
PELECYPODA	W	1560	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	W	1560	1	0	1	0	0	0	4	0	1	0	2
MYTILOIDA	W	1689	0	0	0	0	0	0	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Mytilidae	W	1691	0	0	0	0	0	0	0	0	0	0	0
Mytilidae	W	1691	40	36	34	8	3	10	162	43	8	0	130
Mytilus edulis	W	1695	1	23	5	5	1	0	6	0	0	0	0
Modiolus modiolus	W	1702	13	1	0	0	0	0	4	0	0	0	0
OSTREOIDA	W	1752	0	0	0	0	0	0	0	0	0	0	0
Anomiidae	W	1805	0	0	0	0	0	0	0	0	0	0	0
Anomiidae	W	1805	0	0	0	0	0	1	0	0	0	0	6
Anomia ephippium	W	1807	0	0	0	0	0	0	0	0	0	0	1
VENEROIDA	W	1815	0	0	0	0	0	0	0	0	0	0	0
Lucinidae	W	1817	0	0	0	0	0	0	0	0	0	0	0
Lucinoma borealis	W	1829	0	0	1	0	0	0	0	0	0	0	0
Montacutidae	W	1888	0	0	0	0	0	0	0	0	0	0	0
Kurtiella bidentata	W	1906	8	5	42	2	0	3	19	8	4	0	14
Astartidae	W	1921	0	0	0	0	0	0	0	0	0	0	0
Goodallia triangularis	W	1929	1	3	0	2	2	24	1	6	1	0	55
Cardiidae	W	1938	0	0	0	0	0	0	0	0	0	0	0
Cardiidae	W	1938	0	0	0	0	0	3	0	0	1	0	0
Parvicardium sp.	W	1947	0	0	0	0	1	0	0	0	0	0	5
Parvicardium pinnulatum	W	1951	1	1	2	0	1	1	1	1	0	0	2
Mactridae	W	1967	0	0	0	0	0	0	0	0	0	0	0
Mactridae	W	1967	0	0	0	0	0	0	0	0	1	0	0
Spisula subtruncata	W	1978	0	0	0	0	0	0	0	0	0	1	0
Tellinidae	W	2008	0	0	0	0	0	0	0	0	0	0	0
Tellinidae	W	2008	0	0	1	0	0	0	0	1	0	0	0
Arcopagia crassa	W	2015	1	0	0	0	0	0	0	0	0	0	0
Angulus pygmaeus	W	2023	1	0	0	0	0	0	0	3	0	0	0
Psammobiidae	W	2042	0	0	0	0	0	0	0	0	0	0	0
Gari sp.	W	2044	0	0	11	4	0	4	6	5	0	1	20
Gari tellinella	W	2049	0	2	47	13	3	4	1	6	4	0	14
Semelidae	W	2057	0	0	0	0	0	0	0	0	0	0	0
Abra sp.	W	2058	0	0	0	0	0	0	0	0	0	1	0
Veneridae	W	2086	0	0	0	0	0	0	0	0	0	0	0
Veneridae	W	2086	0	0	1	1	0	3	0	2	0	0	5

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Gouldia minima	W	2095	1	0	1	2	0	0	1	0	0	0	2
Clausinella fasciata	W	2100	5	5	8	1	2	2	8	2	2	0	5
Timoclea ovata	W	2104	0	0	11	2	1	2	2	6	0	1	4
Polititapes rhomboides	W	2113	0	1	0	0	0	0	0	0	0	0	1
Dosinia sp.	W	2126	0	0	2	0	0	1	0	0	0	0	2
Dosinia lupinus	W	2128	0	0	0	0	1	0	0	0	0	0	0
MYOIDA	W	2140	0	0	0	0	0	0	0	0	0	0	0
Hiatellidae	W	2164	0	0	0	0	0	0	0	0	0	0	0
Hiatella arctica	W	2166	0	1	0	1	0	0	1	0	0	0	1
PHOLADOMYOIDA	W	2220	0	0	0	0	0	0	0	0	0	0	0
Thraciidae	W	2226	0	0	0	0	0	0	0	0	0	0	0
Thracia sp.	W	2228	0	0	6	1	2	6	3	2	1	0	1
Thracia phaseolina	W	2231	0	0	0	0	0	0	0	1	0	0	1
Thracia villosiuscula	W	2233	0	1	0	0	0	0	0	0	0	0	0
BRACHIOPODA	X	1	0	0	0	0	0	0	0	0	0	0	0
ARTICULATA	X	9	0	0	0	0	0	0	0	0	0	0	0
Megathiriididae	X	33	0	0	0	0	0	0	0	0	0	0	0
Gwynia capsula	X	38	0	0	0	0	0	1	0	0	0	0	5
BRYOZOA	Y	1	0	0	0	0	0	0	0	0	0	0	0
STENOLAEMATA	Y	2	0	0	0	0	0	0	0	0	0	0	0
CYCLOSTOMATIDA	y	3	0	0	0	0	0	0	0	0	0	0	0
Crisiidae	Y	4	0	0	0	0	0	0	0	0	0	0	0
Crisia denticulata	Y	16	0	0	0	0	0	0	0	0	0	+	0
Crisia eburnea	Y	17	0	0	0	0	0	0	0	0	0	0	+
GYMNOLAEMATA		69	0	0	0	0	0	0	0	0	0	0	0
CHEILOSTOMATIDA	Y	149	0	0	0	0	0	0	0	0	0	0	0
Electridae	Y	174	0	0	0	0	0	0	0	0	0	0	0
Electra pilosa	Y	178	0	0	+	0	0	0	0	0	0	0	0
ECHINODERMATA	ZB	1	0	0	0	0	0	0	0	0	0	0	0
CRINOIDEA	ZB	2	0	0	0	0	0	0	0	0	0	0	0
COMATULIDA	ZB	7	0	0	0	0	0	0	0	0	0	0	0
Antedonidae	ZB	8	0	0	0	0	0	0	0	0	0	0	0
Antedonidae	ZB	8	0	0	0	0	0	1	0	0	0	0	0
Antedon bifida	ZB	10	0	0	1	0	0	0	1	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
ASTEROIDEA	ZB	18	0	0	0	0	0	0	0	0	0	0	0
Asteroidea	ZB	18	0	0	1	0	1	0	0	1	0	0	1
Astropectinidae	ZB	24	0	0	0	0	0	0	0	0	0	0	0
Astropecten irregularis	ZB	26	0	0	0	0	0	1	0	0	0	0	0
FORCIPULATIDA	ZB	95	0	0	0	0	0	0	0	0	0	0	0
Asteriidae	ZB	96	0	0	0	0	0	0	0	0	0	0	0
Asterias rubens	ZB	100	0	0	1	0	0	0	0	0	0	0	0
OPHIUROIDEA	ZB	105	0	0	0	0	0	0	0	0	0	0	0
Ophiuroidea	ZB	105	0	0	0	0	1	0	8	1	1	0	68
OPHIURIDA	ZB	121	0	0	0	0	0	0	0	0	0	0	0
Ophiocomidae	ZB	126	0	0	0	0	0	0	0	0	0	0	0
Ophiocomina nigra	ZB	128	0	0	11	0	2	0	0	2	0	0	168
Amphiuridae	ZB	148	0	0	0	0	0	0	0	0	0	0	0
Amphiuridae	ZB	148	0	1	126	3	0	52	7	13	3	0	52
Amphipholis squamata	ZB	161	0	0	322	37	13	62	36	79	16	0	279
Ophiuridae	ZB	165	0	0	0	0	0	0	0	0	0	0	0
Ophiura sp.	ZB	166	0	0	1	0	0	0	1	0	0	0	0
Ophiura albida	ZB	168	0	0	0	0	0	0	0	1	0	0	0
ECHINOIDEA	ZB	181	0	0	0	0	0	0	0	0	0	0	0
Echinoidea	ZB	181	0	0	1	0	0	0	0	0	0	0	1
ECHINOIDA	ZB	190	0	0	0	0	0	0	0	0	0	0	0
Parechinidae	ZB	191	0	0	0	0	0	0	0	0	0	0	0
Psammechinus miliaris	ZB	193	0	0	1	0	0	1	0	0	0	0	1
Echinidae	ZB	194	0	0	0	0	0	0	0	0	0	0	0
Echinocyamus pusillus	ZB	212	0	0	2	2	0	1	1	3	0	1	0
SPATANGOIDA	ZB	213	0	0	0	0	0	0	0	0	0	0	0
Loveniidae	ZB	221	0	0	0	0	0	0	0	0	0	0	0
Echinocardium sp.	ZB	222	0	1	0	0	0	1	1	3	0	4	1
HOLOTHURIOIDEA	ZB	229	0	0	0	0	0	0	0	0	0	0	0
DENDROCHIROTIDA	ZB	249	0	0	0	0	0	0	0	0	0	0	0
Phyllophoridae	ZB	258	0	0	0	0	0	0	0	0	0	0	0
Thyone sp.	ZB	261	0	0	10	1	5	2	4	9	1	0	4
Thyone fusus	ZB	262	0	1	2	15	5	2	11	10	0	0	1
Cucumariidae	ZB	266	0	0	0	0	0	0	0	0	0	0	0

Station			T1 Under	T1 Edge	T1 10m	T1 20m	T1 50m	T1 100m	T2 Edge	T2 10m	T2 20m	T2 50m	REF
Oncus brunneus	ZB	274	0	0	1	0	0	0	1	1	0	0	0
APODIDA	ZB	289	0	0	0	0	0	0	0	0	0	0	0
Synaptidae	ZB	290	0	0	0	0	0	0	0	0	0	0	0
Leptosynapta sp.	ZB	291	0	0	4	0	0	0	0	0	0	0	1
Leptosynapta minuta	ZB	297	0	0	0	0	0	0	0	0	0	0	4
PISCES			0	0	0	0	0	0	0	0	0	0	0
OSTEICHTHYES	ZG	1	0	0	0	0	0	0	0	0	0	0	0
PERCIFORMES	ZG	302	0	0	0	0	0	0	0	0	0	0	0
Callionymidae	ZG	450	0	0	0	0	0	0	0	0	0	0	0
Callionymus lyra	ZG	452	0	0	1	0	0	0	0	0	0	0	0