Marine Benthic Faunal Ecology Report,

Marine Dredging Monitoring for the Killybegs Smoothpoint Pier Extension

2021

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1. Introduction

This report documents the benthic faunal communities of the seabed at the disposal site used by ABCO Marine Ltd. during the work carried out for the extension of the Smoothpoint pier in Killybegs harbour, and additional locations in Donegal Bay (see location map in Figure 2.1). To carry out the preliminary subtidal benthic assessment of the area in question, AQUAFACT sampled a total of 9 stations (Table 2.1). Sampling took place on the 30th of October and 25th of November 2019, and on the 18th of October 2020 once dredging and sediment disposal operations had been completed. In accordance with the Permit No. S0028-01, the disposal site was sampled 6 months after operations had ceased on the 19th of March 2021 when all fauna and sediment chemistry grabs were taken at the 5 disposal site stations and the 4 monitoring stations. However, Sediment Profile Imagery, that was planned to be taken at the disposal site, was not completed on this date due to hydraulic issues with the crane on the boat. This element was completed on 28th May when weather conditions were suitable and a boat with suitable lifting capabilities was available.

2. Materials and Methods

2.1. Sampling

2.1.1. Sampling Procedure

Pre-disposal sampling began on the 30th October 2019 on-board M/T "SMS Cian" (Sinbad Marine Services Ltd.). However, due to unfavourable conditions at sea (Force 4 Westerly) sampling was restricted to the more sheltered sampling locations C7 (McSwyne's Bay) and C6 (Killybegs Harbour). 3 grab samples for faunal analysis and an additional grab for sediment analysis were taken at each of the stations.

Sampling resumed on the 25th November 2019 on-board the MV "Sinbad" (Sinbad Marine Services Ltd.). A Force 2 sea state provided better conditions to carry out sampling at the remaining sampling locations. The offshore Control site was first sampled on-route to the disposal site. Sample locations C1 to C5 were sampled at the disposal site. Lastly, the

remaining sampling location C8 (Inver Bay) was sampled. 3 grab samples for faunal analysis and an additional grab for sediment analysis were taken at each of the stations. One station, C2 presented difficulties during sampling. Multiple attempts, at this location, as well as repositioned locations in the vicinity, returned grabs that were empty due to grab jaws closing on large stones. The decision was taken to abandon this station rather than expend further survey time.

Benthic sample replicas were required **within 10 days** of the completion of the dredging work and use of the disposal site by ABCO Marine Ltd.

Post dredge and disposal benthic monitoring sampling was carried out on the 18th October 2020 on-board the MV "Ocean Supporter" (Atlantic Towage & Marine Ltd.). A calm sea state and a light Force 2 Easterly wind provided settled conditions for sampling. Each sampling location (C1 – C5) at the disposal site was first sampled using the drop down SPI camera system (see separate SPI report), before sediment grabs were obtained for faunal analysis and sediment analysis. Sediment grabs for faunal and sediment analysis were then taken at C8 (Inver Bay), Control site, C7 (McSwyne's Bay) and finally C6 (Killybegs Harbour).

Benthic sample replicas were required 6 months after the completion of the dredging work and use of the disposal site by ABCO Marine Ltd.

6 months post dredge and disposal benthic monitoring sampling was carried out on the 19th March 2021 on-board the MV "Madelen" (Rossaveal Port Services Ltd.). A slight sea state (Douglas Sea State level 3) and a light Force 3 Easterly wind provided suitable conditions for sampling. Each sampling location (C1 – C5) at the disposal site was sampled for sediment grabs for faunal analysis and sediment analysis. Sediment grabs for faunal and sediment analysis were then taken at C8 (Inver Bay), Control site, C7 (McSwyne's Bay) and finally C6 (Killybegs Harbour). No SPI imagery was obtained on the sampling date due to technical issues.

Sampling continued on the 28th May 2021 on-board the MV "Madelen". A Force 2 south-westerly and minor swell were suitable conditions for SPI imagery. 3 replica SPI images at the stations located at the disposal site (C1 – C5) were taken.

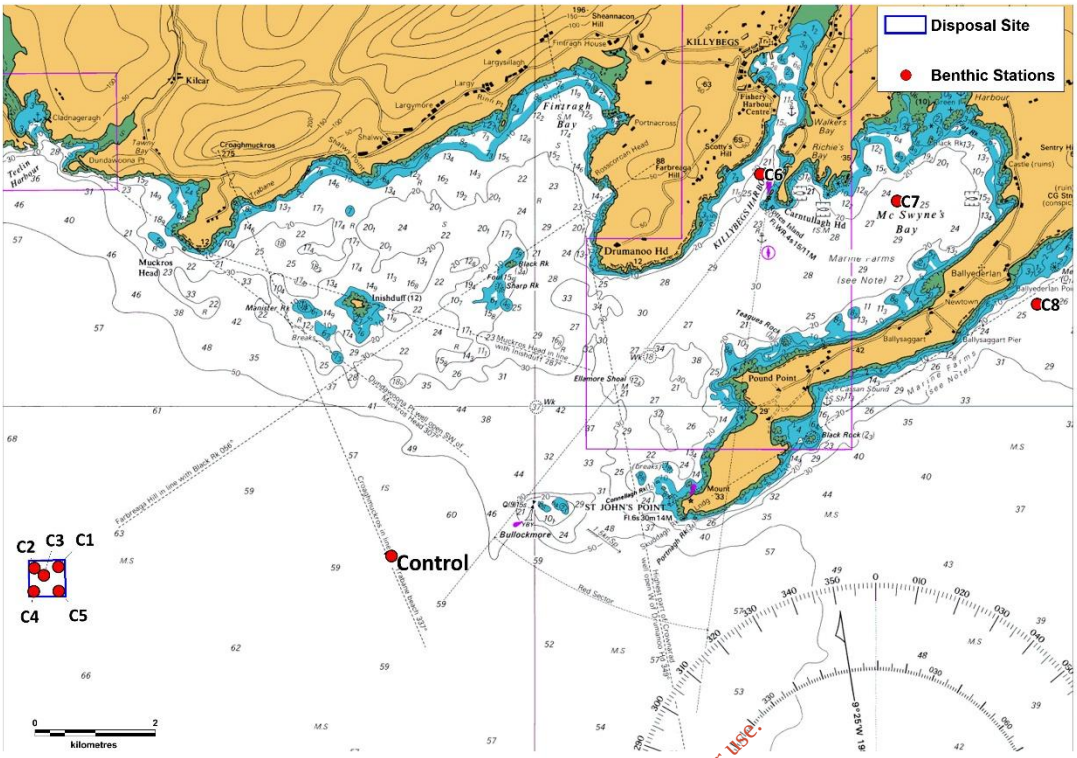

Figure 2.1: Location of all 9 stations sampled on 30th Oct and 25th Nov 2019, 18th Oct 2020 and 19th March 2021.

Table 2.1: Station coordinates of all 9 stations sampled on 30th Oct and 25th Nov 2019, 18th October 2020, and 19th March 2021.

Station	Latitude	Longitude	Depth (m)
Control	54.55672	-8.53748	56.5
C1	54.55608	-8.62112	55
C2	54.55696	-8.62525	65
C3	54.55475	-8.62361	65
C4	54.55361	-8.62475	66
C5	54.55359	-8.6206	66
C6	54.61738	-8.43964	17
C7	54.60755	-8.41963	29
C8	54.57894	-8.39681	37

AQUAFACT has in-house standard operational procedures for benthic sampling and these were followed for this project. Additionally, the recently published MESH report on "Recommended Standard methods and procedures" was adhered to.

A 0.1m^2 Day grab was used to sample each station and 3 replicate grab samples were

collected at each site. On arrival at each sampling station, the vessel location was recorded using DGPS (Lat/Long). The grab deployment and recovery rates did not exceed 1 metre/sec and were <0.5 m/sec for the last 5 metres for water depths up to 30m and for the last 10m for depths greater than 30m.

A digital image of each sample (including sample label) was taken, and its reference number entered in the sample data sheet. The grab sampler was cleaned between stations to prevent cross contamination.

Each grab sample was carefully and gently sieved on a 1mm mesh sieve as a sediment water suspension for the retention of fauna. Great care was taken during the sieving process in order to minimise damage to taxa such as spionids, scale worms, phyllodocids and amphipods. The sample residue was carefully flushed into a pre-labelled (internally and externally) container from below. Each label contained the sample code and date. The samples were stained immediately with Eosin-briebrich scarlet and fixed immediately in with 4% w/v buffered formaldehyde solution (10% w/v buffered formaldehyde solution for very organic mud).

An addition grab sample was collected at each station for sediment analysis (organic carbon and granulometry). Each sediment sample was placed in plastic sampling bags and labelled internally and externally. These samples were frozen (<-18ºC) as soon as possible after acquisition.

2.1.2. Sample Processing

All faunal samples were placed in an illuminated shallow white tray and sorted first by eye to remove large specimens and then sorted under a stereo microscope (x 10 magnification). Following the removal of larger specimens, the samples were placed into Petri dishes, approximately one-half teaspoon at a time and sorted using a binocular microscope at x25 magnification.

The fauna was sorted into four main groups: Polychaeta, Mollusca, Crustacea and others. The 'others' group consisted of echinoderms, nematodes, nemerteans, cnidarians and other lesser phyla. The fauna were maintained in stabilised 70% industrial methylated spirit (IMS) following retrieval and identified to species level where practical using a binocular

microscope, a compound microscope and all relevant taxonomic keys. After identification and enumeration, specimens were separated and stored to species level.

The sediment granulometric analysis was carried out by AQUAFACT using the traditional granulometric approach. Traditional analysis involved the dry sieving of approximately 100g of sediment using a series of Wentworth graded sieves. The process involved the separation of the sediment fractions by passing them through a series of sieves. Each sieve retained a fraction of the sediment, which were later weighed, and a percentage of the total was calculated. Table 2.2 shows the classification of sediment particle size ranges into size classes. Sieves, which corresponded to the range of particle sizes (Table 2.2), were used in the analysis.

Sediment samples for organic carbon analysis were taken at each of the stations surveyed during the third round of sampling (19/03/2021), 6 months after dredging and disposal operations had ceased. All samples were stored in pre-labelled plastic bags, kept in cold 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.

Table 2.2: The classification of sediment particle size ranges into size classes (adapted from Buchanan, 1984).

Range of Particle Size	Classification	Phi Unit
<63µm	Silt/Clay	>4 Ø
63-125 µm	Very Fine Sand	4 Ø, 3.5 Ø
125-250 µm	Fine Sand	3 Ø, 2.5 Ø
250-500 µm	Medium Sand	2 Ø, 1.5 Ø
500-1000 µm	Coarse Sand	1 Ø, 1.5 Ø
1000-2000 µm (1 – 2mm)	Very Coarse Sand	0 Ø, -0.5 Ø
>2000 µm (> 2mm)	Gravel	< -1 Ø

2.2. Data analysis

2.2.1. Sediment Data

For the granulometric analysis of sediment samples, the <63 µm (Silt-Clay) fraction was determined by weight loss following wet sieving. Coarser fractions comprising the sediment samples were determined by mechanical dry sieving through a series of Wentworth sieves; >4mm (Fine Gravel), 2-4mm (Very Fine Gravel), 1-2mm (Very Coarse Sand), 0.5-1mm (Coarse Sand), 0.25-0.5mm (Medium Sand), 125-250mm (Fine Sand), 62.5-125mm (Very Fine Sand). For each station, the weight of each fraction of the sediment retained on the sieve was expressed as a percentage of the total sample. The relative proportion of sediments in each fraction was used to classify sediments at the station *sensu* Folk (1954).

2.2.2. Faunal Data

Uni- and multi-variate statistical analysis of the faunal data was undertaken using PRIMER v.6 (Plymouth Routines in Ecological Research).

2.2.2.1. *Univariate Indices*

Using PRIMER the faunal data was used to produce a range of univariate indices. Univariate indices are designed to condense species data in a sample into a single coefficient that provides quantitative estimates of biological variability (Heip *et al.,* 1998; Clarke and Warwick, 2001). Univariate indices can be categorised as primary or derived indices.

Primary biological indices used in the current study include:

1. number of taxa (S) in the samples and
2. number of individuals (N) in the samples.

Derived biological indices, which are calculated based on the relative abundance of species in samples, used in the study include:

3. Margalef's species richness index (d) (Margalef, 1958),

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

where: N is the number of individuals and S is the number of species

Margalef's species richness is a measure of the total number of species present for a given number of individuals.

4. 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 (= $\log_2 S$)

Pielou's evenness is a measure of how evenly the individuals are distributed among different species.

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

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

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

Shannon-Wiener diversity index takes both species abundance and species richness into account quantify diversity (Shannon & Weaver, 1949).

6. The Shannon-Wiener based Effective Number of Species (ENS) (Hill, 1973; Jost, 2006)

$$H = \exp(H')$$

where H' is the Shannon-Wiener diversity index.

The Shannon-Wiener index diversity index is converted to ENS to reflect 'true diversities' (Hill, 1973, Jost, 2006) that can then be compared across communities (MacArthur, 1965; Jost, 2006). The ENS is equivalent to the number of equally abundant species that would be needed in each sample to give the same value of a diversity index, *i.e.* Shannon-Wiener Diversity index. The ENS behaves as one would intuitively expect when diversity is doubled or halved, while other standard indices of diversity do not (Jost, 2006). If the ENS of one community is twice that of another then it can be said that that community is twice as diverse as the other.

2.2.2.2. *Multivariate Analysis*

The PRIMER programme (Clarke & Warwick, 2001) was used to carry out multivariate analyses on the station-by-station faunal data. All species abundance data from the grab surveys was square root transformed and used to prepare a Bray-Curtis similarity matrix in PRIMER. The square root transformation allows the intermediate abundant species to play a part in the similarity calculation. Various ordination and clustering techniques can then be applied to the similarity matrix to determine the relationship between the samples.

Multidimensional scaling (MDS) is a technique that ordinates samples as points in 2D or 3D space based on similarity in species distribution data. MDS performed on the Bray-Curtis

similarity matrix produce ordination maps whereby the placement of samples reflects the similarity of their biological communities, rather than their simple geographical location (Clarke & Warwick, 2001).

An indication of how well the similarity matrix is represented by the ordination is given by stress values calculated by comparing the interpoint distances in the similarity matrix with the corresponding interpoint distances on the ordinations. 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 & Warwick (2001) 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 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 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 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.

Hierarchical Agglomerative Clustering (HAC) is used to cluster samples based on between-

sample similarities into groups in dendrograms. Similarity Profiling (SIMPROF) is used to test if differences between HAC derived similarity-based clusters are significant. Similarity Percentages (SIMPER) analysis can be used to determine the characterising species of each cluster of stations identified either arbitrarily (by eye) from HAC dendrograms or statistically using SIMPROF testing (Clarke and Warwick, 2001; Clarke and Gorley, 2006; Anderson *et al*., 2008).

The species, which are responsible for the grouping of samples in CLUSTER analyses, were identified using the PRIMER programme SIMPER (Clarke & Warwick, 1994). This programme determined the percentage contribution of each species to the dissimilarity/similarity within and between each sample group.

2.2.2.3. *AZTI Marine Biotic Index*

To assess the benthic ecological quality of the community, the AZTI Marine Biotic Index (AMBI) was calculated. AMBI offers a 'pollution or disturbance classification' which represents the benthic community health (*sensu* Grall & Glémarec, 1997).

In the AMBI tool, species are allocated to one of five ecological groups depending on their sensitivity to pollution:

- Group I - very sensitive to disturbance/pollution;
- Group II - indifferent to disturbance/pollution;
- Group III - tolerant to disturbance/pollution;
- Group IV - second-order opportunists and
- Group V - first order opportunists)

The AMBI score is calculated as a weighted average of the sensitivity scores of each replicate sample. Assemblages with high proportions of sensitive taxa are indicative of areas with low levels of disturbance and stations dominated by opportunistic taxa reflect impacted areas.

3. Results

3.1.1. Pre-disposal Faunal results (Nov 2019)

The taxonomic identification of the benthic infauna across all 8 stations sampled in the survey area (station C2 was abandoned due to the rocky nature of the substrate) yielded a total count of 211 taxa ascribed to 11 phyla. The 211 taxa consisted of 3,809 individuals. Of the 211 taxa identified, 146 were identified to species level. The remaining 65 could not be identified to species level as they were juveniles, damaged or indeterminate. The full faunal abundance species list can be seen in Appendix 1.

Of the 211 taxa recorded, 3 were cnidarians (anemones, hydrozoan *etc.*), 1 was a platyhelminth (flatworm), 1 was a nematode (round worm), 3 were nemerteans (ribbon worms), 1 was a kinorhynch (mud dragons), 4 were sipunculans (peanut worms), 88 were annelids (segmented worms), 47 were arthropods (crabs, shrimps, sea spiders), 45 were molluscs (mussels, cockles, snails *etc*.), 1 was a phoronid (horseshoe worm) and 17 were echinoderms (brittlestars, sea stars, sea cucumbers).

3.1.1.1. *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 3.1; species numbers, number of individuals, richness, evenness, Shannon-Wiener diversity, and Effective Number of Species (ENS). Species numbers ranged from 28 (C1) to 135 (C6). Number of individuals ranged from 79 (C3) to 2,518 (C6). Richness ranged from 6.08 (C1) to 17.11 (C6). Evenness ranged from 0.69 (C6) to 0.93 (C3). Shannon-Wiener diversity ranged from 2.87 (C1) to 3.74 (C6). ENS ranged from 17.72 (C1) to 42.19 (C7) indicating that station C7 is over 2.3 times more diverse than station C1. All stations exhibit high levels of diversity. Figure 3.1 shows these community indices in graphical form.

Table 3.1: Univariate measures of community structure (November 2019).

Station	No. Taxa	No. Individuals	Richness	Evenness	Shannon-Wiener Diversity	Effective Number of Species
	S	N	d	J'	H'(loge)	EXP(H')
Control	35	111	7.22	0.88	3.14	23.15
C1	28	85	6.08	0.86	2.87	17.72
C3	35	79	7.78	0.93	3.31	27.38
C4	41	102	8.65	0.92	3.41	30.33
C5	51	175	9.68	0.89	3.49	32.67
C6	135	2518	17.11	0.69	3.37	29.04
C7	85	599	13.13	0.84	3.74	42.19
C8	44	140	8.70	0.86	3.26	25.99

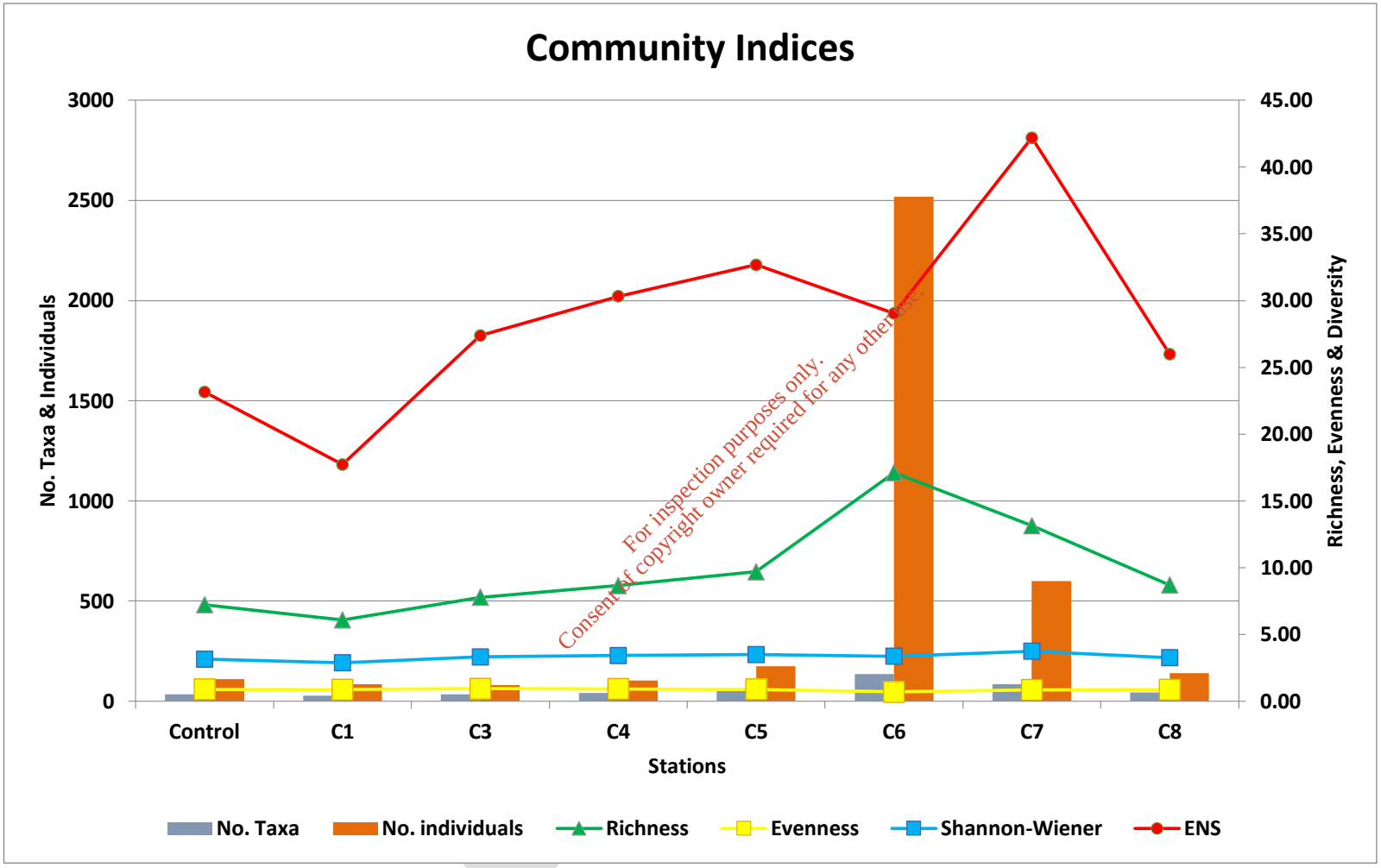

Figure 3.1: Community diversity indices. Diversity is expressed in Shannon-Wiener Diversity and Effective Number of Species (ENS) (November 2019).

3.1.1.2. *Multivariate Analysis*

The same data set used above for the univariate analyses was also used for the multivariate analyses. The dendrogram and the MDS plot can be seen in Figures 3.2 and 3.3 respectively. SIMPROF analysis revealed 4 statistically significant groupings between the 8 stations (the samples connected by red lines cannot be significantly differentiated). The stress level on the MDS plot indicates an excellent representation of the data with no prospect of misinterpretation of overall structure.

A clear divide (21.21% similarity) can be seen between **Group a** and **Groups b** and **c**.

Group a consisted of stations C6 and C7. This group separated from all other groups at a 78.79% dissimilarity level and had a within-group similarity of 44.62%. Group a contained 165 taxa comprising 3,117 individuals. Of the 165 taxa, 100 were present twice or less. Six taxa accounted for over 55% of the abundance. The polychaetes *Paradoneis lyra* (16.78% abundance, 523 individuals), *Magelona minuta* (9.34% abundance, 291 individuals) and *Pholoe baltica* (*sensu* Petersen) (2.6% abundance, 81 individuals), the ostracod *Euphilomedes sinister* (10.68% abundance, 333 individuals), the bivalve molluscs *Kurtiella bidentata* (4.78% abundance, 149 individuals) and *Nucula nitidosa* (3.02% abundance, 94 individuals) and Nematoda (4.65% abundance, 145 individuals). SIMPER analysis could not be carried out to find the characterising species as there were only two stations in this group. *Magelona minuta* and *Nucula nitidosa* are very sensitive to organic enrichment and present under unpolluted conditions. *Paradoneis lyra, Euphilomedes sinister, Kurtiella bidentata* and Nematoda are tolerant to excess organic matter enrichment, occurring under normal conditions but their populations are stimulated by organic enrichment. *Pholoe baltica* is a second order opportunistic species that is present in slight to pronounced unbalanced conditions. This group contained the highest numbers of taxa and individuals and had the highest richness and diversity.

Group b consisted of Station C8. Group b separated from Group c at a 67.98% dissimilarity level. This group contained 44 taxa comprising 140 individuals. Of the 44 taxa, 30 were present twice or less. Six species accounted for over 49% of the faunal abundance: the polychaetes *Magelona minuta* (18.57% abundance, 26 individuals), *Paradoneis lyra* (8.57% abundance, 12 individuals) and *Leitoscoloplos mammosus* (4.29% abundance, 6 individuals),

Nematoda (7.86 abundance, 11 individuals), the bivalve *Thyasira flexuosa* (5.71% abundance, 8 individuals), and the gastropod *Cylichna cylindracea* (4.29% abundance, 6 individuals). SIMPER analysis could not be carried out to find the characterising species as there was only one station in this group. *Magelona minuta* is very sensitive to organic enrichment and present under unpolluted conditions. *Cylichna cylindracea* is indifferent to disturbance, typically present in low densities with non-significant variations over time. *Paradoneis lyra,* Nematoda and *Thyasira flexuosa* are tolerant to excess organic matter enrichment, occurring under normal conditions but their populations are stimulated by organic enrichment. *Leitoscoloplos mammosus* is a second order opportunistic species that is present in slight to pronounced unbalanced conditions.

Group c consisted of Stations C1, C3, C4, C5 and Control. Group c separated from Group b at a 67.98% dissimilarity level. This group had a within-group similarity 51.02%. This group contained 89 taxa comprising 552 individuals. Of the 89 taxa, 63 were present twice or less. Seven species accounted for over 44% of the faunal abundance: the amphipod *Harpinia antennaria* (11.47% abundance, 63 individuals, the polychaetes *Nepthys* sp. (juv) (7.43% abundance, 41 individuals) and *Sthenelais* sp. (damaged) (4.35% abundance, 24 individuals) and the bivalves *Nucula nitidosa* (6.34% abundance, 35 individuals), *Abra nitida* (4.35% abundance, 24 individuals) and *Thyasira flexuosa* (4.17% abundance, 23 individuals). SIMPER analysis further revealed the bivalve *Myrtea spinifera,* the amphipod *Urothoe elegans* and the polychaete *Nephtys hombergii* as characterising species within this group. *Harpinia antennaria, Nucula nitidosa* and *Urothoe elegans* are very sensitive to organic enrichment and present under unpolluted conditions. *Nephtys* sp. (juv), *Nephtys hombergii, Myrtea spinifera* and *Sthenelais* sp. are indifferent to disturbance, typically present in low densities with non-significant variations over time. *Abra nitida* and *Thyasira flexuosa* are tolerant to excess organic matter enrichment, occurring under normal conditions but their populations are stimulated by organic enrichment.

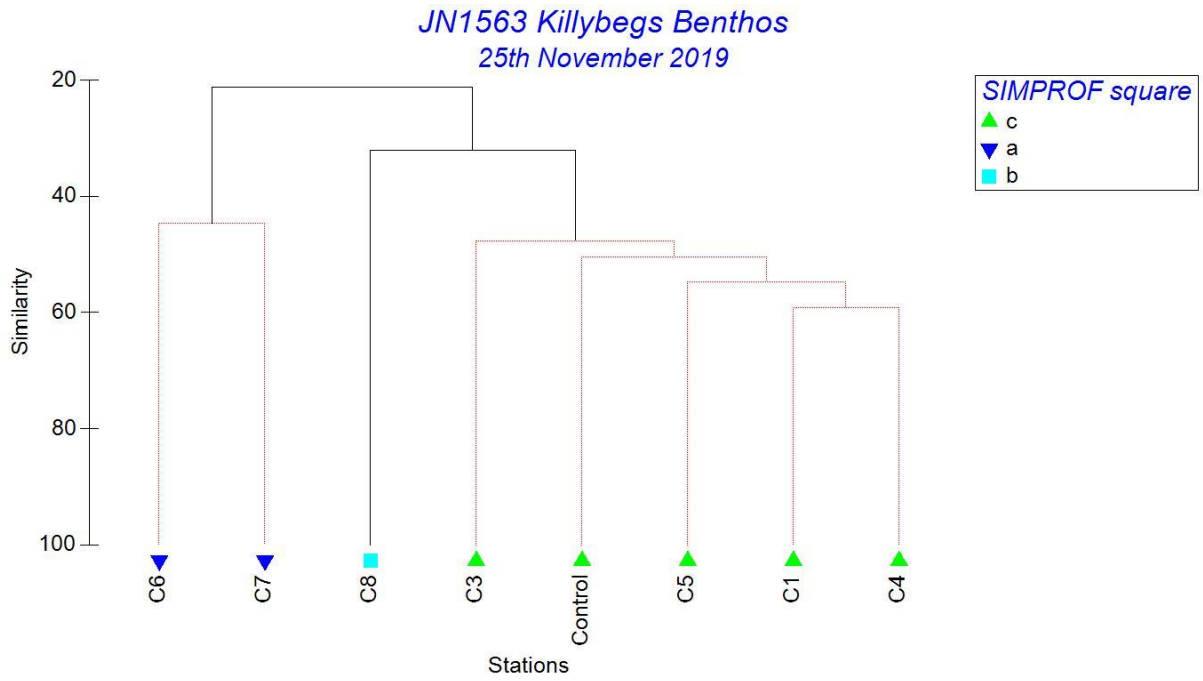

Figure 3.2: Dendrogram produced from Cluster analysis (November 2019).

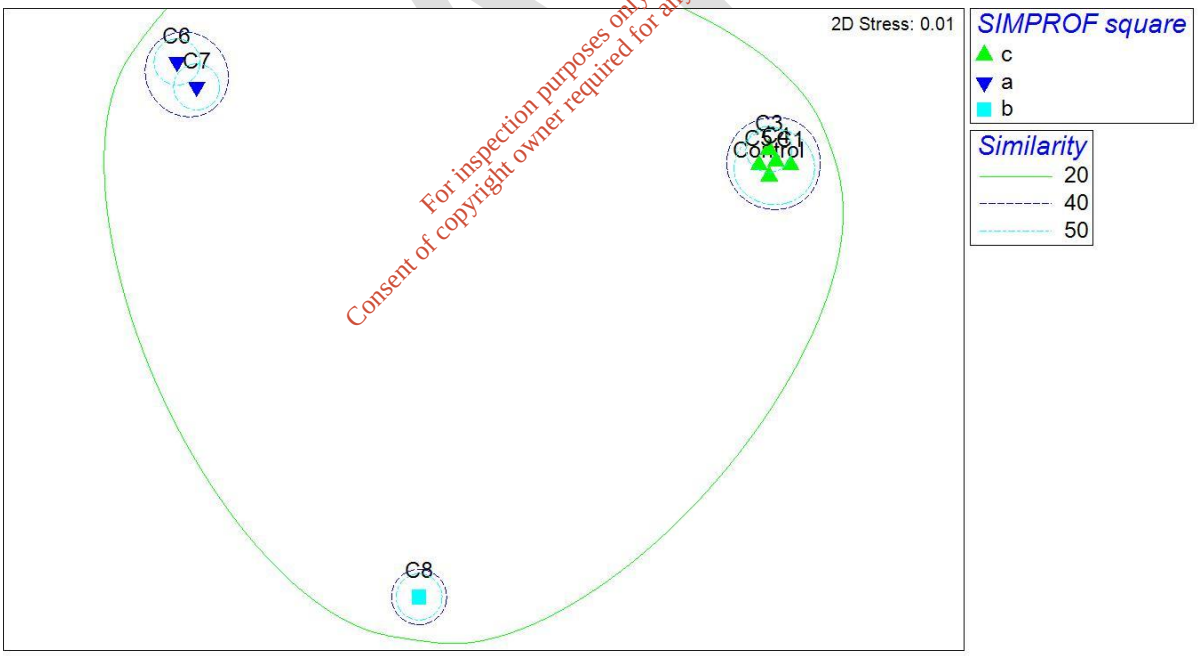

Figure 3.3: MDS plot (November 2019).

3.1.1.3. *AMBI Results (November 2019)*

Table 3.2 shows the mean AMBI results from the analysis of the replicate samples and these results are presented in a histogram in Figure 3.4. All stations were described as slightly disturbed. These slightly disturbed stations had a high abundance of sensitive species that cannot survive in polluted/disturbed sediments and those indifferent to disturbance/pollution. There were very few first and second order opportunist species that thrive in polluted or organically enriched sediments.

Table 3.2: AMBI results (November 2019).

Stations	I(%)	II(%)	III(%)	IV(%)	V(%)	Not assigned (%)	Mean AMBI	BI from Mean AMBI	Disturbance Classification
Control	45.0	34.2	15.3	5.4	0.0	0.0	1.216	2	Slightly disturbed
C1	34.9	41.0	18.1	6.0	0.0	2.4	1.428	2	Slightly disturbed
C3	17.7	49.4	24.1	8.9	0.0	0.0	1.861	2	Slightly disturbed
C4	31.3	44.4	20.2	3.0	1.0	1.0	1.470	2	Slightly disturbed
C5	28.8	40.0	26.5	4.7	0.0	1.7	1.606	2	Slightly disturbed
C6	24.6	12.0	53.4	6.7	3.3	0.7	2.284	2	Slightly disturbed
C7	27.4	30.3	30.4	11.1	0.8	0.7	1.916	2	Slightly disturbed
C8	31.9	24.6	31.2	12.3	0.0	0.0	1.859	2	Slightly disturbed

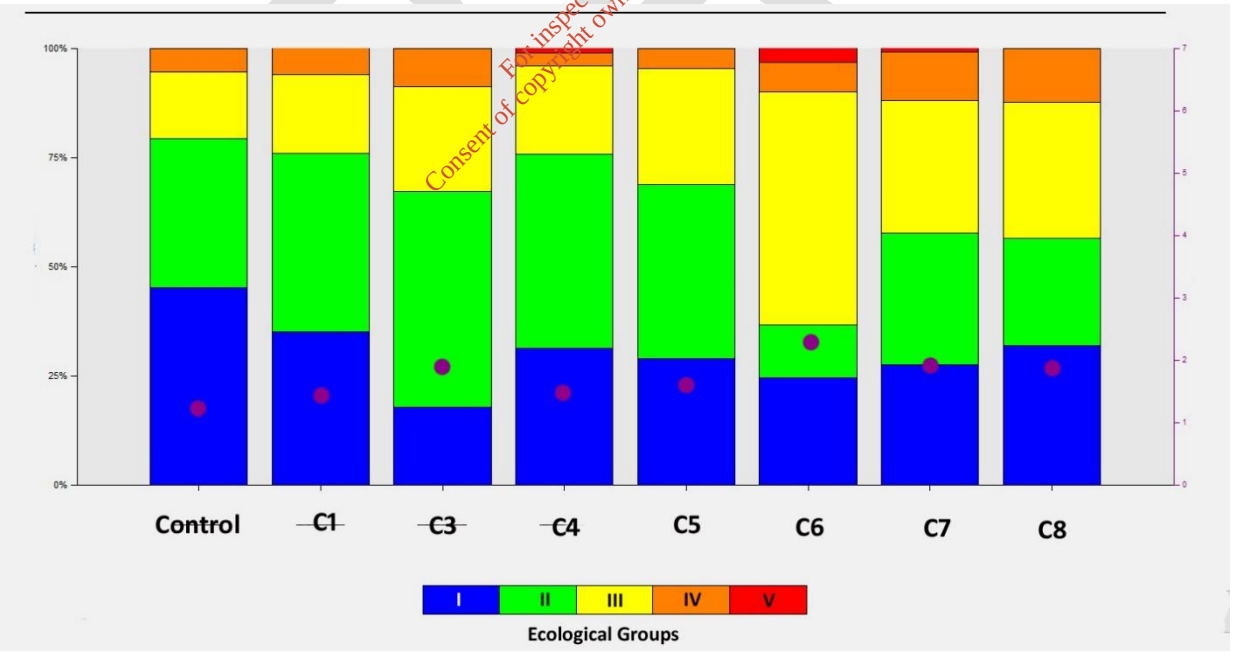

Figure 3.4: Histogram of AMBI results (November 2019).

3.1.2. Post-Disposal Faunal Results (Oct. 2020).

The taxonomic identification of the benthic infauna across all 9 stations sampled in the survey area yielded a total count of 165 taxa ascribed to 9 phyla. The 165 taxa consisted of 2,967 individuals. Of the 165 taxa identified, 146 were identified to species level. The remaining 53 could not be identified to species level as they were juveniles, damaged or indeterminate. The full faunal abundance species list can be seen in Appendix 1.

Of the 165 taxa recorded, 3 were cnidarians (anemones, hydrozoan *etc.*), 1 was a nematode (round worm), 3 were nemerteans (ribbon worms), 3 were sipunculans (peanut worms), 65 were annelids (segmented worms), 43 were arthropods (crabs, shrimps, sea spiders), 34 were molluscs (mussels, cockles, snails *etc*.), 1 was a phoronid (horseshoe worm) and 13 were echinoderms (brittlestars, sea stars, sea cucumbers).

3.1.2.1. *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 3.3; species numbers, number of individuals, richness, evenness, Shannon-Wiener diversity, and Effective Number of Species (ENS). Species numbers ranged from 27 (C8) to 90 (Control). Number of individuals ranged from 80 (C5) to 905 (Control). Richness ranged from 4.67 (C8) to 13.07 (Control). Evenness ranged from 0.5 (Control) to 0.87 (C5). Shannon-Wiener diversity ranged from 2.04 (C8) to 3.08 (C5). ENS ranged from 7.66 (C8) to 21.86 (C5) indicating that station C5 is over 2.8 times more diverse than station C8. All stations exhibit high levels of diversity. Figure 3.5 shows these community indices in graphical form.

Table 3.3: Univariate measures of community structure (October 2020).

Station	No. Taxa	No. Individuals	Richness	Evenness	Shannon-Wiener Diversity	Effective Number of Species
	S	N	d	J'	H'(loge)	EXP(H')
Control	90	905	13.07	0.50	2.23	9.30
C1	43	199	7.93	0.61	2.31	10.03
C2	42	144	8.25	0.78	2.92	18.47
C3	39	99	8.27	0.81	2.98	19.75
C4	52	243	9.28	0.66	2.62	13.75
C5	35	80	7.76	0.87	3.08	21.86
C6	46	556	7.12	0.76	2.89	18.02
C7	49	479	7.78	0.73	2.86	17.40
C8	27	262	4.67	0.62	2.04	7.66

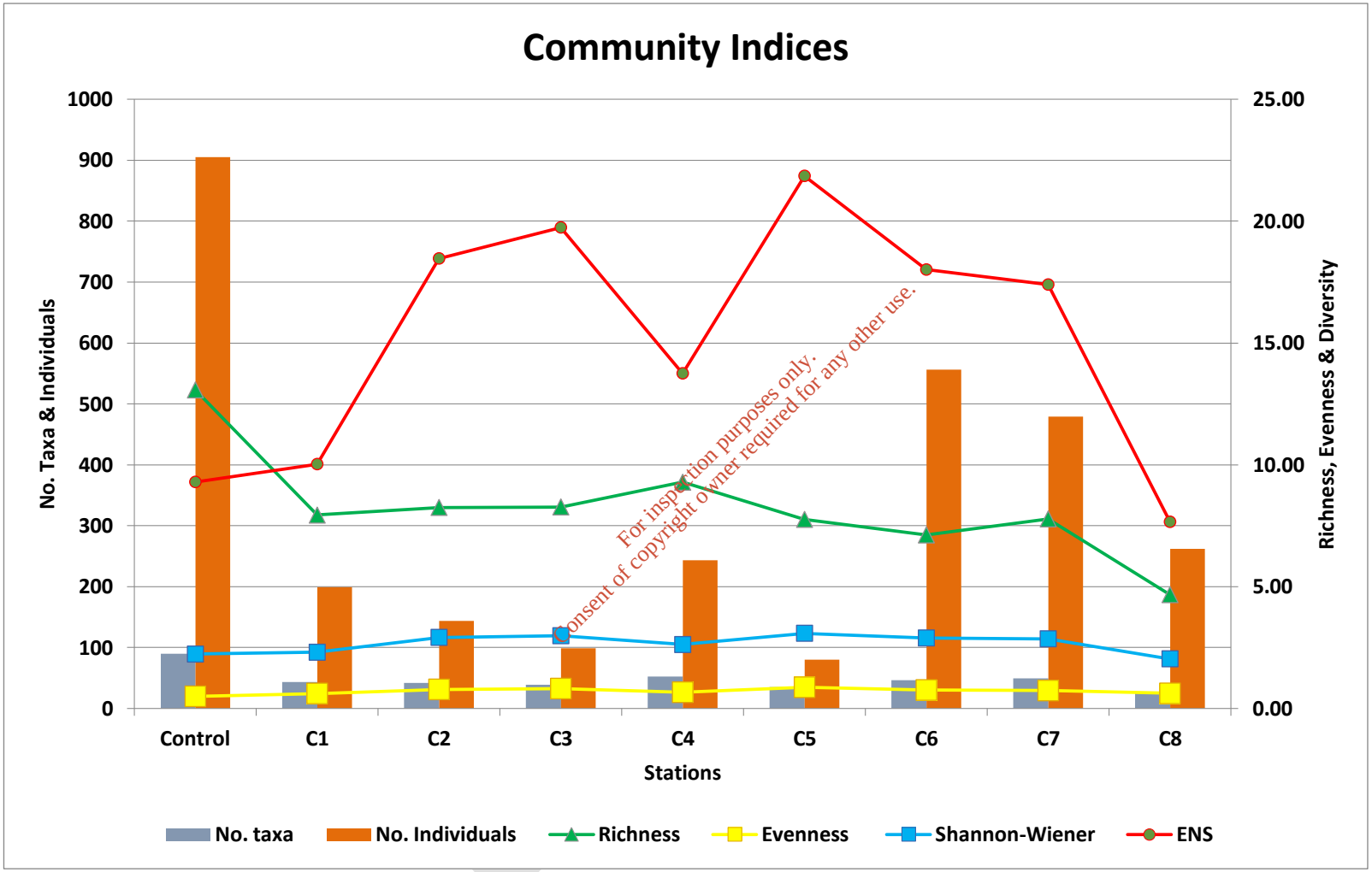

Figure 3.5: Community diversity indices. Diversity is expressed in Shannon-Wiener Diversity and Effective Number of Species (ENS). (October 2020).

3.1.2.2. *Multivariate Analysis*

The same data set used above for the univariate analyses was also used for the multivariate analyses. The dendrogram and the MDS plot can be seen in Figures 3.6and 3.7 respectively. SIMPROF analysis revealed 4 statistically significant groupings between the 9 stations (the samples connected by red lines cannot be significantly differentiated). The stress level on the MDS plot indicates an excellent representation of the data with no prospect of misinterpretation of overall structure.

A clear divide (23.31% similarity) can be seen between **Group c** & **d (control and disposal site)** and **Group a** & **b.**

Group a consisted of stations C8. This group separated from group b at a 58.46% dissimilarity level. Group a contained 27 taxa comprising 262 individuals. Of the 27 taxa, 17 were present twice or less. Four taxa accounted for over 76% of the abundance. The gastropods *Turritellinella tricarinata (*formerly *Turritella communis*) (44.27% abundance, 116 individuals) and *Hyala vitrea* (13.36% abundance, 35 individuals) and the polychaetes *Levinsenia gracilis* (11.07% abundance, 29 individuals), and *Magelona minuta* (8.02% abundance, 21 individuals). SIMPER analysis could not be carried out to find the characterising species as there were only one station in this group. *Magelona minuta* and *Hyala vitrea* are very sensitive to organic enrichment and present under unpolluted conditions. *T. tricarinata* are indifferent to disturbance, typically present in low densities with non-significant variations over time. *Levinsenia gracilis* are tolerant to excess organic matter enrichment, occurring under normal conditions but their populations are stimulated by organic enrichment.

Group b consisted of Station C6 and C7. Group b separated from Group a at a 58.46% dissimilarity level. This group had a within-group similarity 58.27%. This group contained 66 taxa comprising 1,035 individuals. Of the 66 taxa, 32 were present twice or less. Five species accounted for over 52% of the faunal abundance: the bivalve *Kurtiella bidentata* (15.94% abundance, 165 individuals), the gastropod *Turritellinella tricarinata* (10.43% abundance, 108 individuals), the polychaetes *Paradoneis lyra* (11.4% abundance, 118 individuals), *Magelona minuta* (8.31% abundance, 86 individuals), and *Scalibregma inflatum* (6.18% abundance, 64 individuals), SIMPER analysis could not be carried out to find the

characterising species as there were only two stations in this group. *M. minuta* is very sensitive to organic enrichment and present under unpolluted conditions. *T. tricarinata* is indifferent to disturbance, typically present in low densities with non-significant variations over time. *K. bidentata, P. lyra,* and *S. inflatum* are tolerant to excess organic matter enrichment, occurring under normal conditions but their populations are stimulated by organic enrichment.

Group c consisted of the Control station. Group c separated from Group d at a 71.47% dissimilarity level. This group contained 90 taxa comprising 905 individuals. Of the 90 taxa, 50 were present twice or less. Four taxa accounted for over 70% of the faunal abundance: Nematoda (59.45% abundance, 538 individuals), and the polychaetes *Lumbrineris cingulata* aggregate (6.08% abundance, 55 individuals), *Pisione remota* (2.76% abundance, 25 individuals) and *Galathowenia oculata* (1.99% abundance, 18 individuals). SIMPER analysis could not be carried out to find the characterising species as there were only one station in this group. *P. remota* are very sensitive to organic enrichment and present under unpolluted conditions. *L. cingulata* aggregate are indifferent to disturbance, typically present in low densities with non-significant variations over time. Nematoda and *G. oculata* are tolerant to excess organic matter enrichment, occurring under normal conditions but their populations are stimulated by organic enrichment.

Group d consisted of the disposal site stations C1, C2, C3, C4, and C5. Group c separated from Group d a 71.47% dissimilarity level. This group had a within-group similarity 43.45%. This group contained 105 taxa comprising 765 individuals. Of the 105 taxa, 74 were present twice or less. Four species accounted for over 53% of the faunal abundance: the polychaetes *Galathowenia oculata* (36.99% abundance, 283 individuals), *Lumbrineris cingulata* aggregate (9.54% abundance, 73 individuals) and *Ampharete lindstroemi* (4.31% abundance, 33 individuals) and the bivalve *Nucula nitidosa* (2.61% abundance, 20 individuals). SIMPER analysis further revealed the polychaetes *Spiochaetopterus costarum, Lagis koreni* and *Goniada maculata* as additional characterising species within this group. *L. cingulata* aggregate*, A. lindstroemi, S. costarum* and *N. nitidosa* are very sensitive to organic enrichment and present under unpolluted conditions. *G. maculata* are indifferent to disturbance, typically present in low densities with non-significant variations over time. *G. oculata* are tolerant to excess organic matter enrichment, occurring under normal conditions but their populations are stimulated by organic enrichment. *L. koreni* is a second

order opportunistic species that is present in slight to pronounced unbalanced conditions.

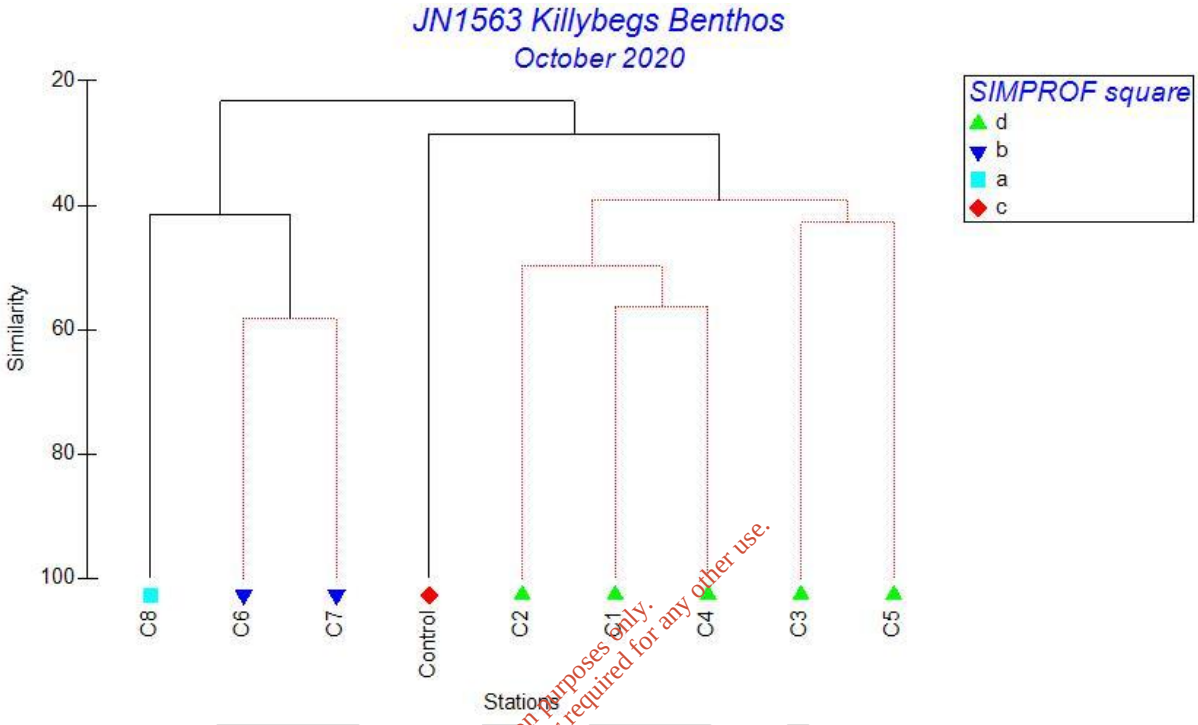

Figure 3.6: Dendrogram produced from Cluster analysis (October 2020).

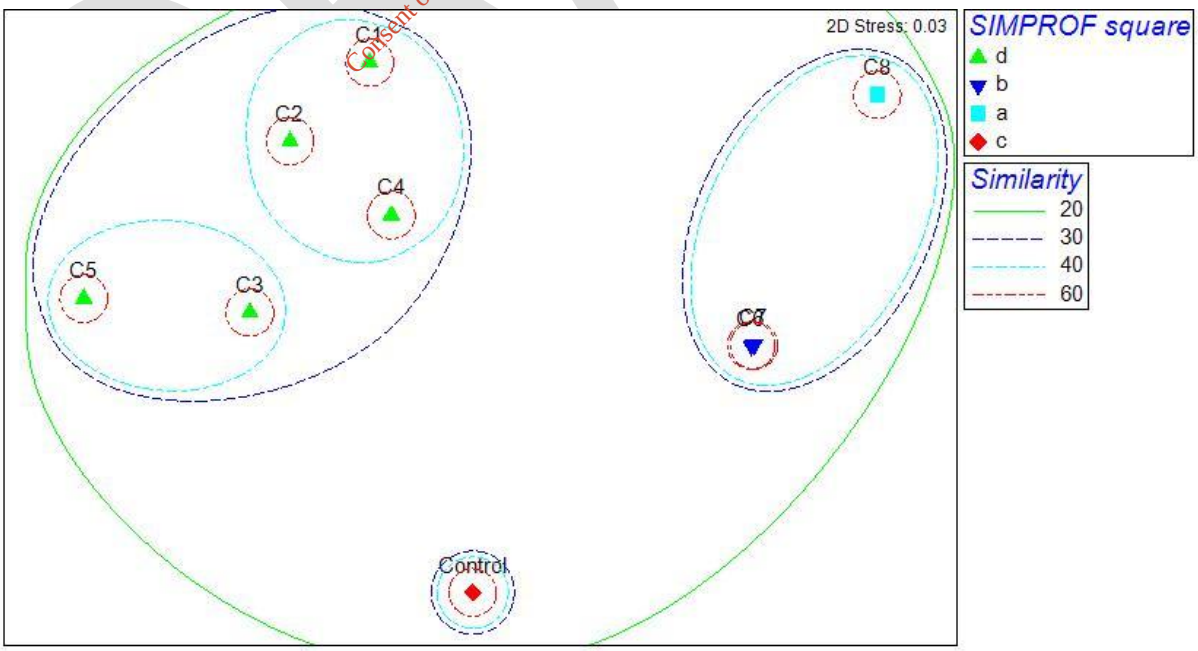

Figure 3.7: MDS plot (October 2020).

3.1.2.3. *AMBI Results (October 2020)*

Table 3.4 shows the mean AMBI results from the analysis of the October 2020 replicate samples and these results are presented in a histogram in Figure 3.8. All stations were described as slightly disturbed. These slightly disturbed stations had a high abundance of sensitive species that cannot survive in polluted/disturbed sediments and those indifferent to disturbance/pollution. There were very few first and second order opportunist species that thrive in polluted or organically enriched sediments.

Table 3.4: AMBI results (October 2020).

Stations	I(%)	II(%)	III(%)	IV(%)	V(%)	Not assigned (%)	Mean AMBI	BI from Mean AMBI	Disturbance Classification
Control	12.6	15.9	68.6	2.9	0	0.7	2.428	2	Slightly disturbed
C1	16.2	20.8	58.4	4..6	0	1	2.269	2	Slightly disturbed
C2	35.9	22.5	40.1	1.4	0	1.4	1.606	2	Slightly disturbed
C3	27.9	42.6	23.4	5.3	1.1	5.1	1.644	2	Slightly disturbed
C4	19	23.6	54	3.4	0	2.5	2.127	2	Slightly disturbed
C5	19.5	54.5	16.9	18.2	0	3.8	2.006	2	Slightly disturbed
C6	25.2	28.3	41.6	4.9	0	0.9	1.892	2	Slightly disturbed
C7	17.6	23	55.4	4	0	0.2	2.187	2	Slightly disturbed
C8	25.8	56.5	16.5	1.2	0	0.8	1.396	2	Slightly disturbed

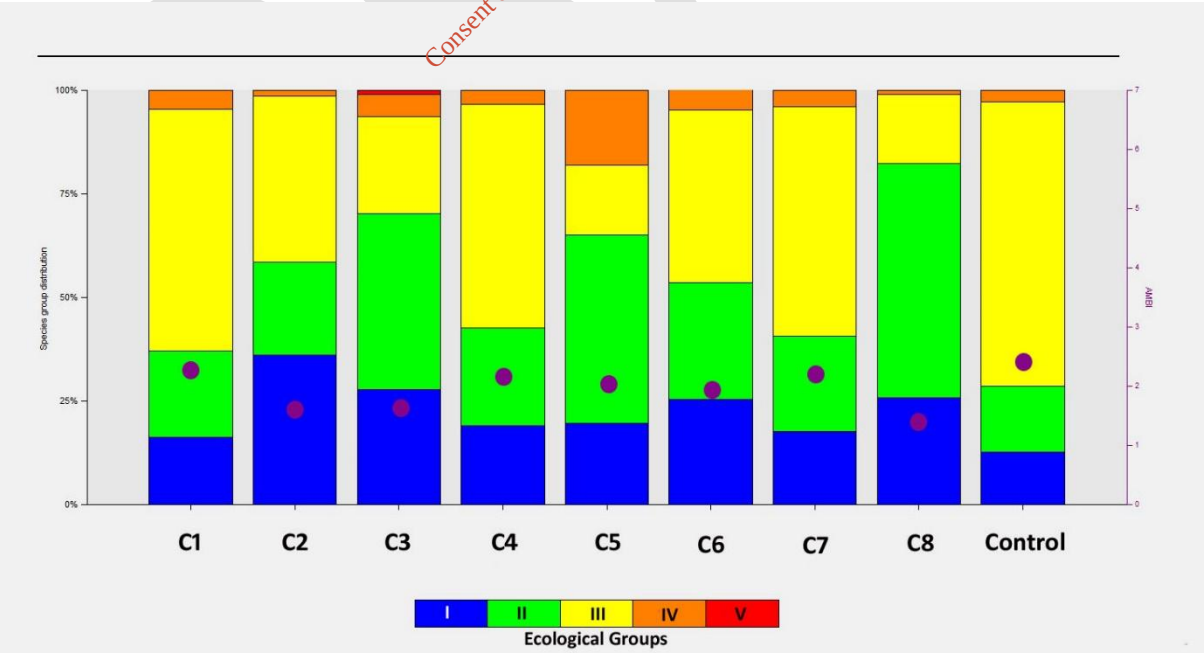

Figure 3.8: Histogram of AMBI results, October 2020.

3.1.3. Post-Disposal Faunal Results (March 2021).

The taxonomic identification of the benthic infauna across all 9 stations sampled in the survey area in March 2021 yielded a total count of 160 taxa ascribed to 11 phyla. The 160 taxa consisted of 3,033 individuals. Of the 160 taxa identified, 116 were identified to species level. The remaining 44 could not be identified to species level as they were juveniles, damaged or indeterminate. The full faunal abundance species list can be seen in Appendix 1.

Of the 160 taxa recorded, 2 were cnidarians (anemones, hydrozoan *etc.*), 1 was a platyhelminth, (flat worm), 1 was a nematode (round worm), 2 were nemerteans (ribbon worms), 3 were sipunculans (peanut worms), 74 were annelids (segmented worms), 30 were arthropods (crabs, shrimps, sea spiders), 33 were molluscs (mussels, cockles, snails *etc.*), 1 was a phoronid (horseshoe worm), 12 were echinoderms (brittlestars, sea stars, sea cucumbers) and 1 was a hemichordate (acorn worm).

3.1.3.1. *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; species numbers, number of individuals, richness, evenness, Shannon-Wiener diversity, and Effective Number of Species (ENS). Species numbers ranged from 29 (C8) to 72 (C6 and C7). Number of individuals ranged from 93 (C3) to 1,408 (C6). Richness ranged from 5.0 (C8) to 12.17 (C7). Evenness ranged from 0.58 (C2 and C6) to 0.9 (C4). Shannon-Wiener diversity ranged from 2.16 (C2) to 3.57 (C4). ENS ranged from 8.65 (C2) to 35.66 (C4) indicating that station C4 is over 4 times more diverse than station C2. All stations exhibit high levels of diversity. Figure 3.9 shows these community indices in graphical form.

Table 3.5: Univariate measures of community structure (March 2021).

Station	No. Taxa	No. Individuals	Richness	Evenness	Shannon-Wiener Diversity	Effective Number of Species
	S	N	d	J'	H'(loge)	EXP(H')
Control	52	168	9.95	0.87	3.42	30.62
C1	38	196	7.01	0.74	2.69	14.75
C2	40	192	7.42	0.58	2.16	8.65
C3	37	93	7.94	0.86	3.11	22.34
C4	54	147	10.62	0.90	3.57	35.66
C5	48	217	8.74	0.71	2.76	15.81
C6	72	1408	9.79	0.58	2.48	11.89
C7	72	341	12.17	0.82	3.50	33.14
C8	29	271	5.00	0.68	2.29	9.87

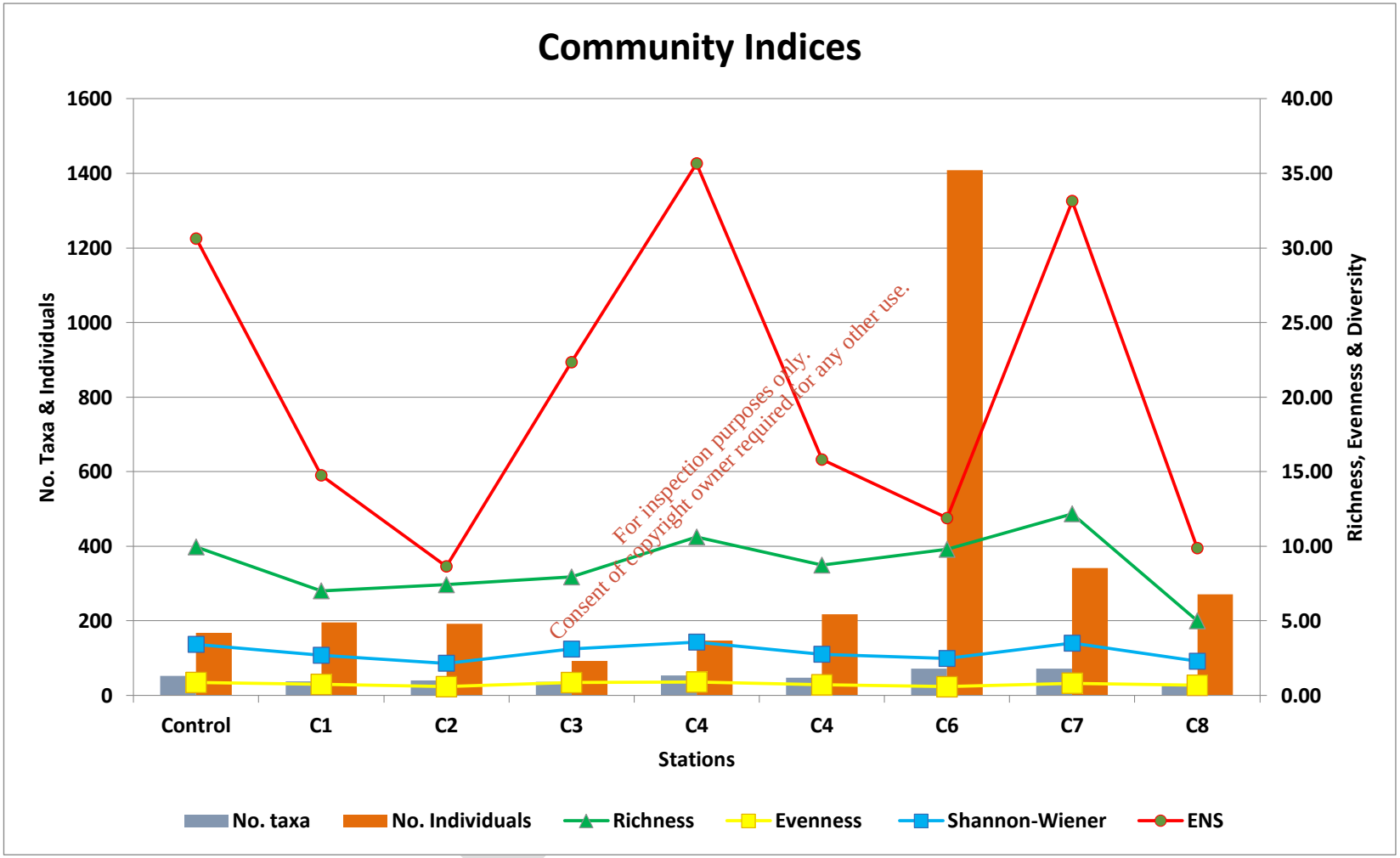

Figure 3.9: Community diversity indices. Diversity is expressed in Shannon-Wiener Diversity and Effective Number of Species (ENS). (March 2021).

3.1.3.2. *Multivariate Analysis*

The same data set used above for the univariate analyses was also used for the multivariate analyses. The dendrogram and the MDS plot can be seen in Figures 3.10 and 3.11 respectively. SIMPROF analysis revealed 2 statistically significant groupings between the 9 stations (the samples connected by red lines cannot be significantly differentiated). The stress level on the MDS plot indicates an excellent representation of the data with no prospect of misinterpretation of overall structure.

A clear divide (25.86 % similarity) can be seen between **Group a (control and disposal site)** and **Group b.**

Group a consisted of stations C1, C2, C3, C4, C5 and Control. This group separated from group b at a 74.14% dissimilarity level. This group had a within-group similarity 53.5%. Group a contained 112 taxa comprising 1,013 individuals. Of the 112 taxa, 55 were present twice or less. Six taxa accounted for over 53% of the abundance. The polychaetes *Galathowenia oculata* (30.5% abundance, 309 individuals), *Lumbrineris cingulata* aggregate (7.21% abundance, 73 individuals), and *Spiochaetopterus costarum* (2.86% abundance, 29 individuals), the bivalve *Thyasira flexuosa* (6.61% abundance, 67 individuals), the gastropod *Cylichna cylindracea* (4.15% abundance, 42 individuals) and the amphipod *Harpinia antennaria* (2.17% abundance, 22 individuals). SIMPER analysis further revealed the polychaete *Nephtys hombergii,* the bivalve *Nucula nitidosa,* the cumacean *Diastylis laevis,* the gastropod *Eulima glabra* and Nemertea (indet) as additional characterising species of this group. *S. costarum*, *H. antennaria, N. nitidosa* and *E. glabra* are very sensitive to organic enrichment and present under unpolluted conditions. *L. cingulata* agg., *C. cylindracea* and *D. laevis* are indifferent to disturbance, typically present in low densities with non-significant variations over time. *G. oculata, T. flexuosa* and Nemertea (indet.) are tolerant to excess organic matter enrichment, occurring under normal conditions but their populations are stimulated by organic enrichment.

Group b consisted of Station C6, C7 and C8. Group b separated from Group a at a 74.14% dissimilarity level. This group had a within-group similarity 44.23%. This group contained 104 taxa comprising 2,020 individuals. Of the 104 taxa, 55 were present twice or less. Six species accounted for over 64% of the faunal abundance: the polychaetes *Paradoneis lyra* (24.06% abundance, 486 individuals), *Magelona minuta* (18.76% abundance, 379 individuals), *Galathowenia oculata* (6.68% abundance, 135 individuals), and *Melinna palmata* (4.36% abundance, 88 individuals), the gastropod

*Turritellinella tricarinata (*formerly *Turritella communis*) (7.03% abundance, 142 individuals), and the bivalve *Kurtiella bidentata* (3.86% abundance, 78 individuals). SIMPER analysis further revealed the bivalve *Nucula nitidosa,* the nemertean *Tubulanus polymorphus*, Nemertea (indet.) and the polychaete *Oxydromus flexuosus* as additional characterising taxa for this group. *M. minuta* and *N. nitidosa* are very sensitive to organic enrichment and present under unpolluted conditions. *T. tricarinata, T. polymorphus* and *O. flexuosus* are indifferent to disturbance, typically present in low densities with non-significant variations over time. *P. lyra, K. bidentata, G. oculata,* and *M. palmata* are tolerant to excess organic matter enrichment, occurring under normal conditions but their populations are stimulated by organic enrichment.

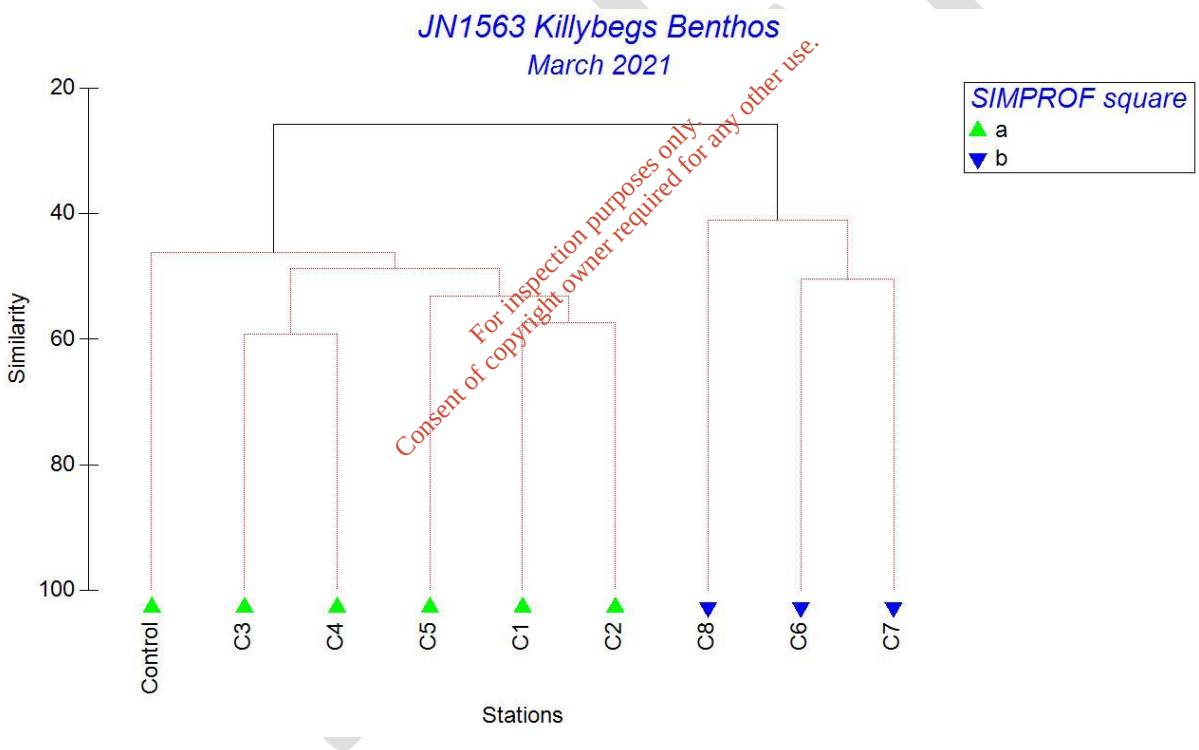

Figure 3.10: Dendrogram produced from Cluster analysis (March 2021).

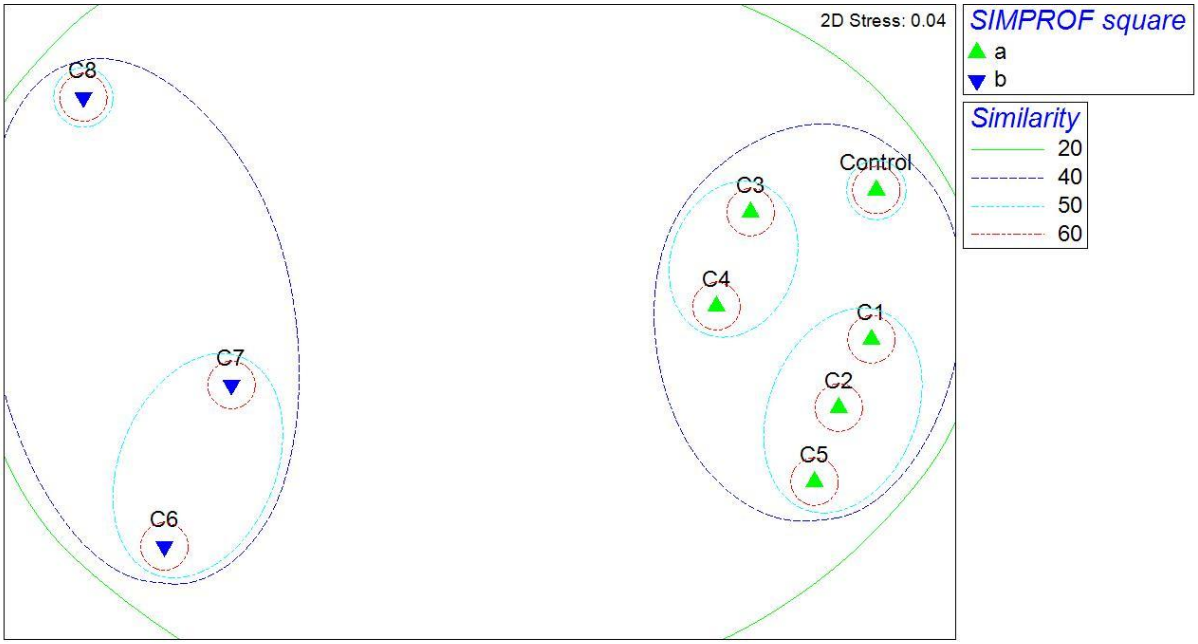

Figure 3.11: MDS plot (March 2021).

3.1.3.3. *AMBI Results (March 2021)*

Table 3.6 shows the mean AMBI results from the analysis of the March 2021 replicate samples and these results are presented in a histogram in Figure 3.12. All stations were described as slightly disturbed. These slightly disturbed stations had a high abundance of sensitive species that cannot survive in polluted/disturbed sediments and those indifferent to disturbance/pollution. There were very few first and second order opportunist species that thrive in polluted or organically enriched sediments.

Table 3.6: AMBI results (March 2021.)

Stations	I(%)	II(%)	III(%)	IV(%)	V(%)	Not assigned (%)	Mean AMBI	BI from Mean AMBI	Disturbance Classification
Control	27.9	37	26.1	9.1	0	1.8	1.745	2	Slightly disturbed
C1	17.3	29.1	50	3.6	0	0	2.097	2	Slightly disturbed
C2	13.2	16.9	67.7	2.1	0	1.6	2.381	2	Slightly disturbed
C3	19.8	36.3	38.5	4.4	1.1	2.2	1.962	2	Slightly disturbed
C4	18.6	40	34.3	7.1	0	4.8	1.95	2	Slightly disturbed
C5	23.3	27	47	2.8	0	0.9	1.94	2	Slightly disturbed
C6	29.5	7.5	58.3	4.5	0.1	1.1	2.074	2	Slightly disturbed
C7	20.3	33.4	38.8	6.9	0.6	1.8	2.01	2	Slightly disturbed
C8	29.4	47.6	13	8.6	1.5	0.3	1.578	2	Slightly disturbed

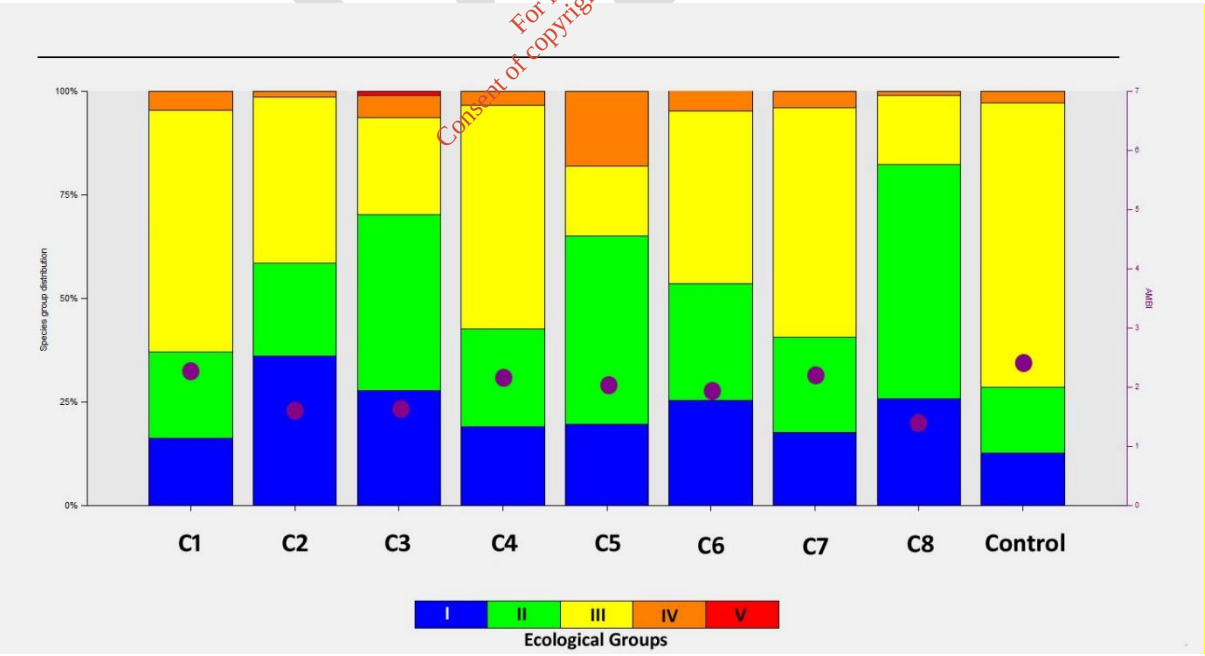

Figure 3.12: Histogram of AMBI results (March 2021).

3.1.4. Sediment Results

3.1.4.1. *Organic Carbon Analysis*

Table 3.7 presents the organic carbon results from samples taken from Donegal Bay.

Table 3.7: Organic Carbon Results (% values, LOI at 450°C) taken on the 19th March 2021 in Donegal Bay.

Station Number	% Values Loss on Ignition at 450°C
C1	0.57
C2	0.54
C3	0.56
C4	0.56
C5	0.37
C6	1.90
C7	2.77
C8	1.76
CONTROL	0.36

4. Discussion

Post-disposal (October 2020)

Analysis of the benthos at the disposal site after cessation of dredge disposal (Oct. 2020) indicated that the benthic ecological quality of the community remained slightly disturbed with a high abundance of sensitive species that cannot survive in polluted/disturbed sediments and those indifferent to disturbance/pollution. There were very few first and second order opportunist species that thrive in polluted or organically enriched sediments.

Multivariate analysis revealed that pre-disposal, stations C1, C3, C4, and C5 (disposal site) grouped with the Control station (with a within-group similarity of 51%). Post-disposal (Oct. 2020) the disposal site stations grouped together (with a within-group similarity of 43.45%) and separated from the Control station at a dissimilarity of 71.47%.

One-way ANOVA showed a significant difference between the Evenness, Shannon-Wiener Diversity and the Effective Number of Species between the 2019 and 2020 results (see Appendix 2).

Post-disposal (March 2020)

Analysis of the benthos at the disposal site six months post-disposal (March 2021) indicated that the benthic ecological quality of the community was still slightly disturbed with a high abundance of sensitive species that cannot survive in polluted/disturbed sediments and those indifferent to disturbance/pollution. Again, there were very few first and second order opportunist species that thrive in polluted or organically enriched sediments.

Multivariate analysis revealed that the disposal site stations, and the Control station were once again grouped together (with a within-group similarity of 53.5%).

One-way ANOVA showed a no significant differences between univariate indices between the 2019 and 2021 results (see Appendix 2) indicating that the means of community indices in the 2 populations are basically equal.

5. Conclusion

Based on these results, the disposal of dredge material at the disposal site had no significant impact

on the ecological quality of benthic communities (as measured by AMBI), with high proportions of sensitive taxa present before disposal (2019), immediately after disposal ceased (2020), and six months post disposal (2021).

Significant reductions in the diversity (particularly as measured by Effective Number of Species) were detected when comparing the 2019 and 2020 benthic communities. However, six months following cessation of disposal, comparing the 2019 and 2020 benthic community indices detected no significant differences.

Examination of the taxa present across all stations survey revealed that prior to disposal the stations within the disposal site grouped closely with the control station. However, immediately following cessation of disposal, this was no longer the case with a dissimilarity of 71% detected between community structure of the control and disposal sites. Six months after the disposal ended, the community structure of the disposal site and control station were again grouped together as being most similar to one another.

6. References

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APPENDIX 1 Species Lists

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
CNIDARIA	1267								
ANTHOZOA	1292								
ACTINIARIA	1360								
Actiniaria (indet)	1360							2	
Edwardsiidae	100665								
Edwardsiidae (damaged)	100665	1					1		
Edwardsia claparedii	100880		1		1		1	13	
PLATYHELMINTHES	793								
Platyhelminthes (indet)	793	1	1				2		
NEMATODA	799								
Nematoda	799	5	5	6	6	11	143	2	11
NEMERTEA	152391								
Nemertea (indet)	152391	1				1	48	1	2
PALAEONEMERTEA	122307								
Tubulanidae	122321								
Tubulanus polymorphus	122637						36	15	
HETERONEMERTEA	122305								
Lineidae	122314								
Cerebratulus sp. (damaged)	122348						1		
Cerebratulus fuscus	122471							1	
KINORHYNCHA	101060								
Kinorhyncha (indet)	101060						2		
SIPUNCULA	1268								
SIPUNCULIDEA	1296								
GOLFINGIIDA	1385								
Golfingiidae	2032								
Golfingiidae (juv)	2032							2	
Golfingia sp.	1648						1		
Golfingia (Golfingia) vulgaris vulgaris	410724	1							

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Thysanocardia procera	136063						1		
Phascolionidae	1647								
Phascolion (Phascolion) strombus strombus	410749						2		
ANNELIDA	882								
POLYCHAETA	883								
PHYLLODOCIDA	892								
Polynoidae	939								
Malmgrenia sp. (damaged)	147006							1	3
Malmgrenia andreapolis	147008							1	
Pholoidae	941								
Pholoe inornata	130601						28		
Pholoe baltica (sensu Petersen)	130599						60	21	
Sigalionidae	943								
Sigalion sp. (juv)	129594								1
Sigalion mathildae	131072			1	1	5			
Sthenelais sp. (damaged)	129595	6	5	3	5	5		1	
Sthenelais boa	131074						1		
Sthenelais limicola	131077						1		
Phyllodocidae	931								
Phyllodocidae (juv)	931						1		
Phyllodocidae (damaged)	931						1		
Eteone longa aggregate	130616						1	1	
Eumida bahusiensis	130641						10	2	
Phyllodoce groenlandica	334506			1			1		
Glyceridae	952								
Glycera sp. (juv)	129296						1		
Glycera alba	130116							2	
Glycera unicornis	130131								3
Goniadidae	953								
Glycinde nordmanni	130136	1				1	11	7	2

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Goniada maculata	130140								3
Hesionidae	946								
Hesionidae (damaged)	946		1						
Oxydromus flexuosus	710680						1	2	
Podarkeopsis helgolandicus	130197						3	6	
Pilargidae	15009								
Ancistrosyllis groenlandica	130695								2
Syllidae	948								
Odontosyllis gibba	131328						3		
Exogone naidina	327985						1		
Parexogone hebes	757970						37	1	2
Prosphaerosyllis	195974								
Prosphaerosyllis chauseyensis	597722						1		
Sphaerosyllis bulbosa	131379						2		
Sphaerosyllis hystrix	131388						6		
Nephtyidae	956								
Nephtys sp. (juv)	129370	5	11	5	6	14	2	5	5
Nephtys hombergii	130359	3	1	1	2	2	6	16	1
Nephtys incisa	130362						1	5	
AMPHINOMIDA	893								
EUNICIDA	895								
Onuphidae	965								
Aponuphis bilineata	130452						2		
Lumbrineridae	967								
Lumbrineris sp. (juv)	129337					1	1		
Lumbrineris cingulata aggregate	130240	2		6	4	10	4	6	1
Lumbrineris latreilli	130248						1		
Abyssoninoe hibernica	146469								1
Dorvilleidae	971								
Ophryotrocha sp. (damaged)	129266						2		
Protodorvillea kefersteini	130041						1		

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
ORBINIIDA	884								
Orbiniidae	902								
Leitoscoloplos mammosus	130514			2					6
Orbinia sp. (damaged)	129420					1			
Scoloplos armiger	130537			1					
Paraonidae	903								
Paraonidae (damaged)	903					3	8		
Aricidea sp. (damaged)	129430				1				
Aricidea (Acmira) cerrutii	525497						6		
Cirrophorus branchiatus	130576						1		
Levinsenia gracilis	130578						1		5
Paradoneis lyra	130585						491	32	12
SPIONIDA	889								
Poecilochaetidae	916								
Poecilochaetus serpens	130711						3		
Spionidae	913								
Spionidae (damaged)	913						1	2	
Aonides oxycephala	131106							1	
Polydora sp. (juv)	129619						1		
Dipolydora sp. (damaged)	129611							1	
Dipolydora flava	131118						2		
Prionospio sp. (damaged)	129620				2	3	8	21	4
Prionospio fallax	131157						40	5	1
Pseudopolydora sp. (juv)	129621							1	
Spiophanes bombyx	131187							6	
Magelonidae	914								
Magelona sp. (damaged)	129341						2	1	
Magelona alleni	130266						18	13	1
Magelona filiformis	130268					1	1		
Magelona minuta	130270			1		1	230	61	26

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Chaetopteridae	918								
Spiochaetopterus costarum	129922		1				19	15	5
CAPITELLIDA	890								
Capitellidae	921								
Mediomastus fragilis	129892			1			9	4	
Notomastus latericeus	129898						1	2	
Maldanidae	923								
Maldanidae (damaged)	923						1		
Euclymene oerstedii	157376						78		
OPHELIIDA	891								
Opheliidae	924								
Ophelina acuminata	130500	1			1	1			1
TEREBELLIDA	900								
Cirratulidae	919								
Cirratulidae (partial/damaged)	919		1	3	1		14	4	2
Chaetozone setosa	129955	1	4			5	3	1	1
Chaetozone christiei	152217	4							
Cirriformia tentaculata	129964						2		
Tharyx killariensis	152269						10	4	
Flabelligeridae	976								
Diplocirrus glaucus	130100						17	7	1
Diplocirrus sp.	129290							1	
Pectinariidae	980								
Amphictene auricoma	152448	3					4		
Lagis koreni	152367	1		1				2	1
Ampharetidae	981								
Ampharetidae (partial/damaged)	981						4	1	
Melinna palmata	129808						82	21	
Ampharete lindstroemi aggregate	129781							4	
Amphicteis sp. (damaged)	129156							1	
Trichobranchidae	983								

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Terebellides stroemii	131573	1							1
Terebellidae	982								
Polycirrus sp. (damaged)	129710							1	
SABELLIDA	901								
Oweniidae	975								
Galathowenia oculata	146950	1			4	3	3	1	
Owenia borealis	329882	4				2	11	5	
Sabellidae	985								
Jasmineira caudata	130920						2		
OLIGOCHAETA	2036								
HAPLOTAXIDA	2118								
Naididae	2039								
Tubificoides sp. (damaged)	137393						2		
Tubificoides amplivasatus	137570						76	4	
Tubificoides diazi	137574						3		
Tubificoides benedii	137571				1			1	
ARTHROPODA	1065								
CRUSTACEA	1066								
COPEPODA	1080								
HARPACTICOIDA	1102								
Longipediidae	115160								
Longipedia minor	116371						2		
Longipedia scotti	116375						16		
Normanellidae	115165								
Normanella sp.	115413					1	4		
Thalestridae	115181								
Thalestridae (damaged)	115181						1		
Miraciidae	115163								
Miraciidae	115163						1		
Bulbamphiascus imus	115930						2		

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Cletodidae	115143								
Cletodidae (indet)	115143						3		
Laophontidae	115155								
Laophonte sp. (damaged)	115374						1		
OSTRACODA	1078								
Ostracoda (indet)	1078						10		
Ostracoda sp. A	1078				2	1	3		
MYODOCOPIDA	2104								
Philomedidae	127483								
Euphilomedes sinister	127866		2	1	3	9	306	27	1
Cylindroleberididae	196139								
Cylindroleberis mariae	238708						3		
MALACOSTRACA	1071								
LEPTOSTRACA	146996								
Nebaliidae	147029								
Nebalia kocatasi	459304						1		
Sarsinebalia urgorrii	388224						1		
AMPHIPODA	1135								
Oedicerotidae	101400								
Perioculodes longimanus	102915				1				
Synchelidium maculatum	102928						12		
Amphilochidae	101365								
Paramphilochoides odontonyx	101982				1				
Leucothoidae	101393								
Leucothoe lilljeborgi	102462					2			
Urothoidae	101412								
Urothoe elegans	103228	1	3	1	2	4	11		
Phoxocephalidae	101403								
Harpinia sp. (damaged)	101716	1		1			1		2
Harpinia antennaria	102960	15	17	6	13	12	26		2
Lysianassidae	101395								

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Hippomedon denticulatus	102570					1			
Lepidepecreum longicornis	102599						1		
Tryphosites longipes	102779				1				
Ampeliscidae	101364								
Ampelisca sp. (damaged)	101445						4		
Ampelisca brevicornis	101891	7	1			1		2	1
Ampelisca diadema	101896						4		
Ampelisca typica	101933						5		
Pontoporeiidae	101406								
Bathyporeia sp. (damaged)	101742				1				
Bathyporeia elegans	103058		1						
Melitidae	101397								
Melitidae (damaged)	101397					1		1	
Photidae	148558								
Photis longicaudata	102383							1	
Caprellidae	101361								
Pariambus typicus	101857							1	
ISOPODA	1131								
Gnathiidae	118278								
Gnathia sp. (Praniza)	118437						1		
Munnidae	118263								
Munna minuta	118759						1		
Arcturidae	118280								
Astacilla dilatata	295579			2					
Bopyridae	1195								
Bopyridae (indet)	1195								2
TANAIDACEA	1133								
Tanaellidae	244585								
Araphura brevimanus	136344		1			1	34	1	
Leptognathiidae	237596								
Akanthophoreus gracilis	136340							1	

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Pseudoparatanais batei	136457		1						
Tanaopsis graciloides	136458						58	7	
CUMACEA	1137								
Leuconidae	110382								
Eudorella truncatula	110535	1			1	2	3	1	
Diastylidae	110380								
Diastylis sp. (juv)	110398						1		
Diastylis bradyi	110472		1	1	3	1	1	2	
Diastylis cornuta	110474						1		
Diastylis laevis	110481	2	2		3	1	1	3	
DECAPODA	1130								
Alpheidae	106776								
Alpheus glaber	107477								1
Processidae	106791								
Processa sp. (damaged)	107054								1
MOLLUSCA	51								
CAUDOFOVEATA	151365								
CHAETODERMATIDA	2088								
Chaetodermatidae	2089								
Chaetoderma nitidulum	139106		1	2	1				
GASTROPODA	101								
Turritellidae	127								
Turritellinella tricarinata	1381415						39	1	
LITTORINIMORPHA	382213								
Iravadiidae	122								
Ceratia proxima	140128							2	
Caecidae	126								
Caecum trachea	138957						1		
Naticidae	145								
Euspira nitida	151894			1			3		
Epitonium trevelyanum	139736					1			

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Eulimidae	135								
Eulima glabra	139805			1			1	1	
Melanella alba	139832				1				
Pyramidellidae	162								
Odostomia sp. (juv)	138413							1	
Acteonidae	155								
Acteon tornatilis	138691				1	2	1		
CEPHALASPIDEA	154								
Cylichnidae	159								
Cylichna cylindracea	139476			1	1	1	7	8	6
Scaphandridae	158								
Roxania utriculus	139486				1				
Philinidae	161								
Philine sp. (damaged)	138339			2					
Philine quadripartita	574582							15	
Philine catena	140747		3	3	1	1			
Hermania scabra	867492	3			5	2			
SCAPHOPODA	104								
DENTALIIDA	200								
Dentallidae	202								
Antalis entalis	150534					3	1		
NUCULIDA	382247								
Nuculidae	204								
Nucula sp. (juv)	138262						24	5	
Nucula nitidosa	140589	15	3	4	5	8	73	21	1
MYTILIDA	210								
Mytilidae	211								
Mytilidae (juv)	211						1		
LUCINIDA	489106								
Lucinidae	218								
Myrtea spinifera	140287	4	1	3	3	7	18	14	2

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Lucinoma borealis	140283	2	2		2	4	3		
Thyasiridae	219								
Thyasira sp. (juv)	138552		5		4	12			
Thyasira sp. (damaged)	138552			1					
Thyasira flexuosa	141662	7		5	2	9	42	26	8
IMPARIDENTIA	869600								
Lasaeidae	222								
Tellimya ferruginosa	146952			1				7	3
Kurtiella bidentata	345281	1				1	115	34	
Mactridae	230								
Spisula subtruncata	140302								1
CARDIIDA	869602								
Cardiidae	229								
Acanthocardia echinata	138992				1				
Tellinidae	235								
Macomangulus tenuis	878470						1		
Asbjornsenia pygmaea	879714						5		
Semelidae	1781								
Abra sp. (juv)	138474			1					
Abra alba	141433					1	5		
Abra nitida	141435	1	7	4	3	9	1	1	1
Abra prismatica	141436		1		1	2			
ADAPEDONTA	869601								
Pharidae	23091								
Ensis sp. (damaged)	138333	1				1			
Phaxas pellucidus	140737						2	1	
VENERIDA	217								
Veneridae	243								
Veneridae (juv)	243					1		2	
Chamelea striatula	141908	3							
Dosinia sp. (juv)	138636						6		

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Dosinia lupinus	141912						1		
Mysia undata	140728							1	
MYIDA	245								
Myidae	247								
Corbulidae	248								
Varicorbula gibba	378492						22	3	2
ANOMALODESMATA	254								
Thraciidae	256								
Thracia sp. (juv)	138549						4		
Thracia phaseolina	152378						22		
Periplomatidae	1786								
Cochlodesma praetenue	181373						1		
PHORONIDA	1789								
Phoronidae	148378								
Phoronis sp.	128545							8	
ECHINODERMATA	1806								
ASTEROIDEA	123080								
Asteroidea (juv)	123080					1			
OPHIUROIDEA	123084								
Ophiuroidea (juv)	123084	2				1			
OPHIURIDA	123117								
Amphiuridae	123206								
Amphiuridae (juv)	123206	3	1	4	3		3	4	
Amphiuridae (damaged)	123206						1		
Amphiura sp. (damaged)	123613							1	
Acrocnida brachiata	236130							2	
Amphiura filiformis	125080			1		1	21	40	
Amphipholis squamata	125064						2		
Ophiuridae	123200								
Ophiuridae sp.	123200						4		
Ophiura sp. (juv)	123574		2			1	16	3	

JN1563 Killybegs benthos Nov. 2019	AphiaID	Control	C1	C3	C4	C5	C6	C7	C8
Ophiura albida	124913			1					
ECHINOIDEA	123082								
Echinoidea (juv)	123082						3		
CLYPEASTEROIDA	123100								
Echinocyamidae	510679								
Echinocyamus pusillus	124273						1		
SPATANGOIDA	123106								
Loveniidae	123175								
Echinocardium sp. (juv)	123426						1		
Echinocardium cordatum	124392							7	
DENDROCHIROTIDA	123111								
Phyllophoridae	123188								
Leptopentacta elongata	124635				1				
APODIDA	123108								
Synaptidae	123182								
Leptosynapta sp. (damaged)	123449								1
Leptosynapta bergensis	124462							8	1
Oestergrenia digitata	152547							1	

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
CNIDARIA	1267	0	0	0	0	0	0	0	0	0
ANTHOZOA	1292	0	0	0	0	0	0	0	0	0
SPIRULARIA	151646	0	0	0	0	0	0	0	0	0
Cerianthidae	100684	0	0	0	0	0	0	0	0	0
Cerianthus lloydii	283798	3	0	0	0	0	0	0	0	0
ACTINIARIA	1360	0	0	0	0	0	0	0	0	0
Actiniaria (indet)	1360	1	0	0	0	0	0	0	0	0
Edwardsiidae	100665	0	0	0	0	0	0	0	0	0
Edwardsia claparedii	100880	16	0	1	2	1	0	0	0	0
NEMATODA	799	0	0	0	0	0	0	0	0	0
Nematoda	799	538	0	2	0	3	2	1	1	0
NEMERTEA	152391	0	0	0	0	0	0	0	0	0
Nemertea (indet)	152391	12	0	0	1	0	2	3	2	0
PALAEONEMERTEA	122307	0	0	0	0	0	0	0	0	0
Tubulanidae	122321	0	0	0	0	0	0	0	0	0
Tubulanus polymorphus	122637	0	0	0	0	0	0	2	0	0
SIPUNCULA	1268	0	0	0	0	0	0	0	0	0
GOLFINGIIDA	1385	0	0	0	0	0	0	0	0	0
Golfingiidae	2032	0	0	0	0	0	0	0	0	0
Golfingiidae (juv)	2032	0	0	0	0	0	1	2	0	0
Thysanocardia procera	136063	0	0	0	0	0	0	3	8	0
Phascolionidae	1647	0	0	0	0	0	0	0	0	0
Phascolion (Phascolion) strombus strombus	410749	0	1	0	0	4	0	6	2	1
ANNELIDA	882	0	0	0	0	0	0	0	0	0
POLYCHAETA	883	0	0	0	0	0	0	0	0	0
PHYLLODOCIDA	892	0	0	0	0	0	0	0	0	0
Aphroditidae	938	0	0	0	0	0	0	0	0	0

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
Aphrodita aculeata	129840	0	0	0	0	1	0	0	0	0
Polynoidae	939	0	0	0	0	0	0	0	0	0
Polynoidae (damaged)	939	0	0	0	0	0	0	0	1	0
Harmothoe sp. (damaged)	129491	1	0	0	0	0	0	0	1	0
Malmgrenia sp. (damaged)	147006	1	0	0	0	0	1	0	0	0
Pholoidae	941	0	0	0	0	0	0	0	0	0
Pholoe baltica (sensu Petersen)	130599	3	0	0	0	0	0	8	16	1
Sigalionidae	943	0	0	0	0	0	0	0	0	0
Sigalion mathildae	131072	0	2	0	0	2	1	0	0	0
Sthenelais sp. (damaged)	129595	0	0	3	0	2	3	0	0	0
Pisione remota	130707	25	0	0	0	0	0	0	0	0
Phyllodocidae	931	0	0	0	0	0	0	0	0	0
Eteone longa agg.	130616	2	0	0	0	0	0	0	0	0
Phyllodoce mucosa	334512	1	0	0	0	1	0	0	1	0
Glyceridae	952	0	0	0	0	0	0	0	0	0
Glycera sp. (damaged)	129296	0	0	0	1	0	0	0	0	1
Glycera alba	130116	0	0	0	2	0	2	0	0	0
Glycera lapidum agg.	130123	1	0	0	0	0	0	0	0	0
Glycera tridactyla	130130	1	0	0	0	0	0	0	0	0
Goniadidae	953	0	0	0	0	0	0	0	0	0
Goniadidae	953	0	0	0	0	0	1	0	0	0
Glycinde nordmanni	130136	2	0	0	0	0	0	0	0	0
Goniada maculata	130140	4	1	1	2	1	3	0	0	0
Hesionidae	946	0	0	0	0	0	0	0	0	0
Hesionidae (damaged)	946	0	0	0	1	0	0	1	0	0
Pilargidae	15009	0	0	0	0	0	0	0	0	0
Ancistrosyllis groenlandica	130695	0	0	0	0	0	0	0	2	10

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
Syllidae	948	0	0	0	0	0	0	0	0	0
Syllidae (damaged)	948	0	1	0	0	0	0	0	0	0
Syllis pontxioi	196003	1	0	0	0	0	0	0	0	0
Sphaerosyllis bulbosa	131379	3	0	0	0	0	0	0	0	0
Nereididae	22496	0	0	0	0	0	0	0	0	0
Nereididae (damaged)	22496	0	0	0	0	0	0	0	0	1
Nephtyidae	956	0	0	0	0	0	0	0	0	0
Aglaophamus agilis	130343	2	0	0	0	0	0	0	0	0
Nephtys sp. (juv)	129370	0	1	1	0	2	0	1	0	0
Nephtys sp. (damaged)	129370	2	2	1	1	4	0	10	8	4
Nephtys hombergii	130359	1	0	3	1	2	1	3	2	12
EUNICIDA	895	0	0	0	0	0	0	0	0	0
Onuphidae	965	0	0	0	0	0	0	0	0	0
Aponuphis bilineata	130452	12	0	0	0	0	0	0	0	0
Lumbrineridae	967	0	0	0	0	0	0	0	0	0
Lumbrineris cingulate aggregate	130240	55	3	13	27	11	19	2	0	0
Dorvilleidae	971	0	0	0	0	0	0	0	0	0
Protodorvillea kefersteini	130041	8	0	0	0	0	0	0	0	0
ORBINIIDA	884	0	0	0	0	0	0	0	0	0
Orbiniidae	902	0	0	0	0	0	0	0	0	0
Leitoscoloplos mammosus	130514	0	0	0	1	0	0	0	0	1
Scoloplos armiger	130537	0	1	0	0	0	0	0	0	0
Paraonidae	903	0	0	0	0	0	0	0	0	0
Paraonidae (damaged)	903	0	0	1	1	3	1	0	0	0
Aricidea (Arcidea) minuta	730747	0	0	0	0	0	1	0	0	0
Cirrophorus branchiatus	130576	4	1	0	0	1	2	0	0	1
Levinsenia gracilis	130578	1	0	0	0	0	1	0	40	29

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
Paradoneis lyra	130585	1	0	0	3	1	2	89	29	1
SPIONIDA	889	0	0	0	0	0	0	0	0	0
Poecilochaetidae	916	0	0	0	0	0	0	0	0	0
Poecilochaetus serpens	130711	2	0	0	0	0	0	0	0	0
Spionidae	913	0	0	0	0	0	0	0	0	0
Spionidae (damaged)	913	0	0	0	3	0	0	0	0	0
Aonides oxycephala	131106	8	0	0	0	0	0	0	0	0
Prionospio sp. (damaged)	129620	6	1	0	1	1	4	4	0	1
Prionospio fallax	131157	3	0	0	0	0	0	0	0	0
Scolelepis sp. (damaged)	129623	1	0	0	0	0	0	0	0	0
Magelonidae	914	0	0	0	0	0	0	0	0	0
Magelona alleni	130266	5	1	0	0	0	0	2	4	0
Magelona filiformis	130268	0	0	2	2	0	0	0	0	0
Magelona minuta	130270	2	1	0	0	0	0	74	12	21
Chaetopteridae	918	0	0	0	0	0	0	0	0	0
Spiochaetopterus costarum	129922	1	1	6	1	5	3	9	6	0
CAPITELLIDA	890	0	0	0	0	0	0	0	0	0
Capitellidae	921	0	0	0	0	0	0	0	0	0
Capitella sp. complex	129211	0	0	0	1	0	0	0	0	0
Mediomastus fragilis	129892	3	0	0	0	0	0	0	0	1
Notomastus latericeus	129898	0	0	0	0	0	0	2	0	0
OPHELIIDA	891	0	0	0	0	0	0	0	0	0
Scalibregmatidae	925	0	0	0	0	0	0	0	0	0
Scalibregma inflatum	130980	4	0	0	0	1	0	4	60	0
POLYCHAETA INCERTAE SEDIS	155086	0	0	0	0	0	0	0	0	0
Polygordiidae	993	0	0	0	0	0	0	0	0	0
Polygordius sp. (damaged)	129472	1	0	0	0	0	0	0	0	0

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
TEREBELLIDA	900	0	0	0	0	0	0	0	0	0
Cirratulidae	919	0	0	0	0	0	0	0	0	0
Cirratulidae (partial/damaged)	919	3	0	0	0	0	0	0	0	0
Flabelligeridae	976	0	0	0	0	0	0	0	0	0
Flabelligeridae (damaged)	976	0	0	0	0	0	0	1	0	0
Diplocirrus glaucus	130100	1	0	0	0	0	0	0	0	0
Pectinariidae	980	0	0	0	0	0	0	0	0	0
Amphictene auricoma	152448	1	0	1	0	0	0	0	1	0
Lagis koreni	152367	1	3	1	1	2	8	2	0	0
Ampharetidae	981	0	0	0	0	0	0	0	0	0
Ampharetidae (partial/damaged)	981	1	0	1	0	0	1	0	0	0
Melinna palmata	129808	5	0	0	0	0	0	42	2	0
Ampharete lindstroemi	129781	9	6	6	6	13	2	0	1	0
Trichobranchidae	983	0	0	0	0	0	0	0	0	0
Terebellides stroemii	131573	2	0	0	0	1	0	0	0	0
Terebellidae	982	0	0	0	0	0	0	0	0	0
Pista bansei	152254	1	0	0	0	0	0	0	0	0
Polycirrus sp. (damaged)	129710	0	2	0	0	0	0	0	0	0
SABELLIDA	901	0	0	0	0	0	0	0	0	0
Oweniidae	975	0	0	0	0	0	0	0	0	0
Galathowenia oculata	146950	18	107	48	13	112	3	35	1	0
Owenia borealis	329882	14	0	0	0	0	0	0	0	0
Serpulidae	988	0	0	0	0	0	0	0	0	0
Hydroides norvegica	131009	0	2	0	0	0	0	0	0	0
ARTHROPODA	1065	0	0	0	0	0	0	0	0	0
CRUSTACEA	1066	0	0	0	0	0	0	0	0	0
COPEPODA	1080	0	0	0	0	0	0	0	0	0

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
Longipedia minor	116371	2	0	0	0	0	0	0	0	0
OSTRACODA	1078	0	0	0	0	0	0	0	0	0
Ostracoda	1078	0	1	0	0	0	0	0	0	0
MYODOCOPIDA	2104	0	0	0	0	0	0	0	0	0
Philomedidae	127483	0	0	0	0	0	0	0	0	0
Euphilomedes sinister	127866	0	2	0	2	1	0	0	1	0
Cylindroleberididae	196139	0	0	0	0	0	0	0	0	0
Cylindroleberis mariae	238708	1	0	0	0	0	0	0	0	0
MALACOSTRACA	1071	0	0	0	0	0	0	0	0	0
AMPHIPODA	1135	0	0	0	0	0	0	0	0	0
Oedicerotidae	101400	0	0	0	0	0	0	0	0	0
Monoculoides sp. (damaged)	101694	3	0	0	0	0	0	0	0	0
Perioculodes longimanus	102915	0	0	2	1	3	0	0	0	0
Synchelidium maculatum	102928	0	1	0	0	0	0	0	0	0
Leucothoidae	101393	0	0	0	0	0	0	0	0	0
Leucothoe lilljeborgi	102462	0	0	0	1	1	0	0	3	0
Urothoidae	101412	0	0	0	0	0	0	0	0	0
Urothoe elegans	103228	0	3	0	0	3	0	0	0	0
Phoxocephalidae	101403	0	0	0	0	0	0	0	0	0
Harpinia antennaria	102960	0	6	4	1	3	0	0	0	0
Metaphoxus fultoni	102985	1	0	0	0	0	0	0	0	0
Lysianassidae	101395	0	0	0	0	0	0	0	0	0
Hippomedon denticulatus	102570	1	1	0	0	0	1	0	0	0
Tryphosa crenata	761800	0	0	0	0	1	0	0	0	0
Atylidae	146525	0	0	0	0	0	0	0	0	0
Nototropis vedlomensis	488968	1	0	0	0	0	0	0	0	0
Ampeliscidae	101364	0	0	0	0	0	0	0	0	0

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
Ampelisca sp. (damaged)	101445	3	0	0	0	1	0	0	3	0
Ampelisca brevicornis	101891	0	1	3	1	2	0	2	2	1
Ampelisca spinipes	101928	1	0	0	1	0	0	0	1	0
Ampelisca typica	101933	2	0	1	0	0	0	0	0	0
Pontoporeiidae	101406	0	0	0	0	0	0	0	0	0
Bathyporeia sp. (damaged)	101742	0	0	0	1	0	0	0	0	0
Melphidippidae	101398	0	0	0	0	0	0	0	0	0
Megaluropus agilis	102783	0	0	0	0	1	0	0	0	0
Melitidae	101397	0	0	0	0	0	0	0	0	0
Cheirocratus sp. (female)(damaged)	101669	0	0	0	0	2	0	0	0	0
Photidae	148558	0	0	0	0	0	0	0	0	0
Photis longicaudata	102383	0	0	0	1	0	0	0	0	0
Aoridae	101368	0	0	0	0	0	0	0	0	0
Aoridae (female)(damaged)	101368	3	0	0	0	0	1	0	0	0
Corophiidae	101376	0	0	0	0	0	0	0	0	0
Corophiidae (juv)	101376	0	0	1	0	0	0	0	0	0
Siphonoecetes kroyeranus	102111	1	0	0	0	0	0	0	0	0
Caprellidae	101361	0	0	0	0	0	0	0	0	0
Phtisica marina	101864	0	0	1	0	0	1	0	0	0
ISOPODA	1131	0	0	0	0	0	0	0	0	0
Gnathiidae	118278	0	0	0	0	0	0	0	0	0
Gnathia sp. (female)	118437	0	2	0	0	0	0	0	0	0
Gnathia oxyuraea	118995	0	2	0	0	0	1	0	0	0
TANAIDACEA	1133	0	0	0	0	0	0	0	0	0
Leptognathiidae	237596	0	0	0	0	0	0	0	0	0
Tanaopsis graciloides	136458	1	0	0	0	0	0	0	1	0
CUMACEA	1137	0	0	0	0	0	0	0	0	0

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
Bodotriidae	110378	0	0	0	0	0	0	0	0	0
Vaunthompsonia cristata	110467	0	0	3	0	1	0	0	0	0
Leuconidae	110382	0	0	0	0	0	0	0	0	0
Eudorella truncatula	110535	1	0	0	0	0	0	0	1	0
Diastylidae	110380	0	0	0	0	0	0	0	0	0
Diastylis sp. (damaged)	110398	1	0	0	2	2	1	0	0	0
Diastylis bradyi	110472	6	4	2	0	4	2	0	0	0
Diastylis laevis	110481	3	9	1	0	4	2	1	0	1
DECAPODA	1130	0	0	0	0	0	0	0	0	0
Decapoda larvae (damaged)	1130	0	0	0	0	1	0	0	0	0
Caridea	106674	0	0	0	0	0	0	0	0	0
Alpheidae	106776	0	0	0	0	0	0	0	0	0
Alpheus glaber	107477	0	0	0	0	0	0	0	1	0
Processidae	106791	0	0	0	0	0	0	0	0	0
Processa sp. (damaged)	107054	0	0	0	0	1	0	0	0	0
Processa nouveli holthuisi	108344	0	0	2	0	0	0	0	0	5
Crangonidae	106782	0	0	0	0	0	0	0	0	0
Crangon sp. (damaged)	107007	0	0	1	0	0	0	0	0	0
PAGUROIDEA	106687	0	0	0	0	0	0	0	0	0
Paguridae	106738	0	0	0	0	0	0	0	0	0
Paguridae (juv)(damaged)	106738	0	2	1	0	0	1	0	0	0
Galatheidae	106733	0	0	0	0	0	0	0	0	0
Galathea sp. (damaged)	106834	0	0	1	0	0	0	0	0	0
BRACHYURA	106673	0	0	0	0	0	0	0	0	0
Corystidae	106750	0	0	0	0	0	0	0	0	0
Corystes cassivelaunus	107277	0	0	0	0	1	0	0	0	0
Goneplacidae	106757	0	0	0	0	0	0	0	0	0

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
Goneplax rhomboides	107292	1	1	0	0	0	0	0	0	0
MOLLUSCA	51	0	0	0	0	0	0	0	0	0
CAUDOFOVEATA	151365	0	0	0	0	0	0	0	0	0
CHAETODERMATIDA	2088	0	0	0	0	0	0	0	0	0
Chaetodermatidae	2089	0	0	0	0	0	0	0	0	0
Chaetoderma nitidulum	139106	0	3	0	0	1	0	0	0	0
GASTROPODA	101	0	0	0	0	0	0	0	0	0
Trochidae	443	0	0	0	0	0	0	0	0	0
Steromphala umbilicalis	1039840	0	0	0	0	0	0	1	0	0
Cerithiidae	128	0	0	0	0	0	0	0	0	0
Bittium reticulatum	139054	0	0	0	0	0	0	1	0	0
Turritellidae	127	0	0	0	0	0	0	0	0	0
Turritellinella tricarinata	1381415	0	0	0	0	1	0	66	42	116
LITTORINIMORPHA	382213	0	0	0	0	0	0	0	0	0
Rissoidae	123	0	0	0	0	0	0	0	0	0
Rissoa parva	141365	0	0	0	0	0	0	1	0	0
Iravadiidae	122	0	0	0	0	0	0	0	0	0
Hyala vitrea	140129	5	0	2	0	2	0	26	9	35
Naticidae	145	0	0	0	0	0	0	0	0	0
Epitonium trevelyanum	139736	0	0	1	0	0	0	0	0	0
Eulimidae	135	0	0	0	0	0	0	0	0	0
Eulima glabra	139805	2	0	2	1	0	0	0	3	0
Nassariidae	151	0	0	0	0	0	0	0	0	0
Tritia sp. (juv)	246140	0	0	0	0	0	0	2	0	1
Tritia pygmaea	876854	0	0	0	0	0	0	18	8	0
Mangeliidae	153853	0	0	0	0	0	0	0	0	0
Mangelia attenuata	139265	1	0	0	0	0	0	0	1	1

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
Pyramidellidae	162	0	0	0	0	0	0	0	0	0
Odostomia sp. (damaged)	138413	0	0	0	0	0	0	3	2	2
Acteonidae	155	0	0	0	0	0	0	0	0	0
Acteon tornatilis	138691	0	1	2	0	0	0	0	0	0
CEPHALASPIDEA	154	0	0	0	0	0	0	0	0	0
Cylichnidae	159	0	0	0	0	0	0	0	0	0
Cylichna cylindracea	139476	5	5	2	1	8	0	4	2	2
Philinidae	161	0	0	0	0	0	0	0	0	0
Philine sp. (damaged)	138339	0	0	0	0	0	0	0	1	0
Philine catena	140747	0	0	2	0	2	0	0	0	0
Retusa truncatula	141138	1	0	0	0	0	0	0	0	0
BIVALVIA	105	0	0	0	0	0	0	0	0	0
Bivalvia sp.	105	2	0	0	0	0	0	3	0	1
NUCULIDA	382247	0	0	0	0	0	0	0	0	0
Nuculidae	204	0	0	0	0	0	0	0	0	0
Nucula nitidosa	140589	5	4	7	4	4	1	12	23	5
LUCINIDA	489106	0	0	0	0	0	0	0	0	0
Lucinidae	218	0	0	0	0	0	0	0	0	0
Myrtea spinifera	140287	8	0	0	1	0	0	1	7	0
Lucinoma borealis	140283	1	1	3	2	0	0	0	1	0
Thyasiridae	219	0	0	0	0	0	0	0	0	0
Thyasira sp. (damaged)	138552	0	2	0	3	0	1	0	1	0
Thyasira flexuosa	141662	0	0	0	1	0	0	1	0	0
IMPARIDENTIA	869600	0	0	0	0	0	0	0	0	0
Lasaeidae	222	0	0	0	0	0	0	0	0	0
Tellimya ferruginosa	146952	0	0	0	0	1	0	0	0	0
Kurtiella bidentata	345281	2	0	1	0	0	1	47	118	0

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
CARDIIDA	869602	0	0	0	0	0	0	0	0	0
Tellinidae	235	0	0	0	0	0	0	0	0	0
Cuspidaria cuspidata	139442	0	0	1	0	0	0	0	0	0
Psammobiidae	237	0	0	0	0	0	0	0	0	0
Gari fervensis	140870	1	0	0	0	0	0	0	0	0
Semelidae	1781	0	0	0	0	0	0	0	0	0
Abra sp. (damaged)	138474	0	1	2	0	0	0	0	0	0
Abra nitida	141435	0	1	2	0	7	0	5	7	1
ADAPEDONTA	869601	0	0	0	0	0	0	0	0	0
Pharidae	23091	0	0	0	0	0	0	0	0	0
Phaxas pellucidus	140737	1	0	0	0	0	0	0	0	0
VENERIDA	217	0	0	0	0	0	0	0	0	0
Veneridae	243	0	0	0	0	0	0	0	0	0
Chamelea striatula	141908	0	0	0	0	0	0	1	1	0
Dosinia sp. (juv)	138636	3	0	0	0	0	0	1	0	0
MYIDA	245	0	0	0	0	0	0	0	0	0
Corbulidae	248	0	0	0	0	0	0	0	0	0
Varicorbula gibba	378492	10	3	1	0	5	0	13	3	0
Hiatellidae	251	0	0	0	0	0	0	0	0	0
Hiatella arctica	140103	0	0	0	0	0	0	3	0	0
PHORONIDA	1789	0	0	0	0	0	0	0	0	0
Phoronidae	148378	0	0	0	0	0	0	0	0	0
Phoronis sp.	128545	1	1	0	0	1	0	33	18	6
ECHINODERMATA	1806	0	0	0	0	0	0	0	0	0
ASTEROIDEA	123080	0	0	0	0	0	0	0	0	0
Asteroidea (juv)	123080	1	0	0	0	0	0	0	0	0
OPHIUROIDEA	123084	0	0	0	0	0	0	0	0	0

JN1563 Killybegs benthos October 2020	AphiaID	Control	C1	C2	C3	C4	C5	C6	C7	C8
OPHIURIDA	123117	0	0	0	0	0	0	0	0	0
Amphiuridae	123206	0	0	0	0	0	0	0	0	0
Amphiuridae (juv)	123206	3	0	0	0	1	0	0	0	0
Amphiuridae (damaged)	123206	0	3	0	1	0	0	0	0	0
Amphiura filiformis	125080	4	1	0	0	0	0	4	13	0
Amphipholis squamata	125064	0	0	0	0	0	2	0	0	0
Ophiuridae	123200	0	0	0	0	0	0	0	0	0
Ophiura sp. (juv)	123574	4	0	0	1	1	1	0	1	0
Ophiura albida	124913	1	1	0	0	0	0	0	0	0
Ophiura ophiura	124929	1	0	0	0	0	0	0	0	0
ECHINOIDEA	123082	0	0	0	0	0	0	0	0	0
CLYPEASTEROIDA	123100	0	0	0	0	0	0	0	0	0
Echinocyamidae	510679	0	0	0	0	0	0	0	0	0
Echinocyamus pusillus	124273	5	0	0	0	0	0	0	0	0
SPATANGOIDA	123106	0	0	0	0	0	0	0	0	0
Loveniidae	123175	0	0	0	0	0	0	0	0	0
Echinocardium sp. (damaged)		0	0	0	0	1	0	0	0	0
Echinocardium sp. (juv)	123426	0	0	0	0	1	0	0	0	0
Echinocardium cordatum	124392	0	0	0	0	1	0	0	0	0
HOLOTHUROIDEA	123083	0	0	0	0	0	0	0	0	0
Holothuroidea	123083	0	0	2	0	0	0	0	0	0
DENDROCHIROTIDA	123111	0	0	0	0	0	0	0	0	0
Cucumariidae	123187	0	0	0	0	0	0	0	0	0
Leptopentacta elongata	124635	2	0	0	2	0	0	0	0	0
APODIDA	123108	0	0	0	0	0	0	0	0	0
Synaptidae	123182	0	0	0	0	0	0	0	0	0
Leptosynapta sp. (damaged)	123449	5	0	0	0	0	0	1	5	0

JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
CNIDARIA	1267									
ANTHOZOA	1292									
ACTINIARIA	1360									
Actiniaria (indet)	1360							1		
Edwardsiidae	100665									
Edwardsia claparedii	100880	2	1	2	4			1		2
PLATYHELMINTHES	793									
Platyhelminthes (indet)	793	1								
NEMATODA	799									
Nematoda	799			1	1		23	3		
NEMERTEA	152391									
Nemertea (indet)	152391	2	2	2	2	1	27	11	5	3
PALAEONEMERTEA	122307									
Tubulanidae	122321									
Tubulanus polymorphus	122637			1	1		14	2	1	
SIPUNCULA	1268									
SIPUNCULIDEA	1296									
GOLFINGIIDA	1385									
Golfingiidae	2032									
Golfingiidae (juv)	2032						4			
Golfingia (Golfingia) elongata	175026						1	2		
Thysanocardia procera	136063							6		
Phascolionidae	1647									
Phascolion (Phascolion) strombus strombus	410749				1	1	8	6	8	
ANNELIDA	882									

JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
POLYCHAETA	883									
PHYLLODOCIDA	892									
Polynoidae	939									
Malmgrenia sp. (damaged)	147006							1		
Malmgrenia andreapolis	147008							1		
Pholoidae	941									
Pholoe sp. (juv)	129439									2
Pholoe inornata	130601						1			
Pholoe baltica (sensu Petersen)	130599				1		13	8		
Sigalionidae	943									
Sigalion mathildae	131072	1								1
Sthenelais sp. (damaged)	129595				2	1				
Sthenelais limicola	131077	1		1						1
Phyllodocidae	931									
Phyllodoce rosea	334514						1			
Paranaitis kosteriensis	130662									1
Glyceridae	952									
Glycera sp. (juv)	129296	1								
Glycera alba	130116		1							2
Glycera tridactyla	130130	1			1					5
Goniadidae	953									
Glycinde nordmanni	130136			1	1		1	1		
Goniada maculata	130140			3	2	3	2		2	6
Hesionidae	946									
Hesionidae (damaged)	946						1			
Oxydromus flexuosus	710680			3	1	1	2	2	1	
Podarkeopsis helgolandicus	130197				2		2	2		

JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
Pilargidae	15009									
Ancistrosyllis groenlandica	130695							1		
Syllidae	948									
Odontosyllis gibba	131328									1
Parexogone hebes	757970						1			
Nereididae	22496									
Eunereis longissima	130375					1		1		
Nephtyidae	956									
Nephtys sp. (damaged)	129370			1			2	3		
Nephtys sp. (juv)	129370		3	2			1	2	1	1
Nephtys hombergii	130359	4	3	3	4	3	1	1		3
Nephtys incisa	130362						12	13	11	
Nephtys kersivalensis	130363					1				
EUNICIDA	895									
Lumbrineridae	967									
Lumbrineris sp. (juv)	129337	1			3					
Lumbrineris cingulata aggregate	130240	21	2	9	15	7	2			19
ORBINIIDA	884									
Orbiniidae	902									
Leitoscoloplos mammosus	130514						5	4	9	
Orbinia sp. (damaged)	129420				1					
Scoloplos armiger	130537			1	1					
Paraonidae	903									
Paraonidae (damaged)	903				4		12	3		1
Aricidea sp. (damaged)	129430				3					
Aricidea (Acmira) laubieri	326587			6	8	3				
Cirrophorus branchiatus	130576	1		1	1					2

JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
Levinsenia gracilis	130578							21	26	
Paradoneis lyra	130585						483	3		
SPIONIDA	889									
Spionidae	913									
Spionidae (damaged)	913						2		2	
Aonides oxycephala	131106			1						
Polydora cornuta	131143						1	1		
Prionospio sp. (damaged)	129620		1	1	2	2	24	2	4	1
Prionospio fallax	131157							2	4	
Spiophanes bombyx	131187	1			1	1				4
Magelonidae	914									
Magelona sp. (damaged)	129341						1			
Magelona alleni	130266						4	7		1
Magelona filiformis	130268				1	2				1
Magelona minuta	130270	1		1	1		306	20	53	1
Chaetopteridae	918									
Spiochaetopterus sp. (damaged)	129233									1
Spiochaetopterus costarum	129922	8	2	3	2	6	22	4	1	8
CAPITELLIDA	890									
Capitellidae	921									
Capitella sp. complex	129211						1	1	4	
Mediomastus fragilis	129892		1	1	6	1	2	1		1
Notomastus latericeus	129898						9	1		
Arenicolidae	922									
Arenicola marina	129868						1			
Maldanidae	923									
Euclymene oerstedii	157376							1		

JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
OPHELIIDA	891									
Scalibregmatidae	925									
Scalibregma inflatum	130980				1					
TEREBELLIDA	900									
Cirratulidae	919									
Cirratulidae (partial/damaged)	919				3		7	1	5	
Caulleriella alata	129943						1			
Chaetozone setosa	129955	3				2				
Chaetozone christiei	152217		2	3	3		1			10
Tharyx killariensis	152269					2				1
Flabelligeridae	976									
Diplocirrus glaucus	130100	1	2	2			2			2
Pectinariidae	980									
Amphictene auricoma	152448		1		1					3
Lagis koreni	152367				1					
Ampharetidae	981									
Ampharetidae (damaged)	981			1				1		
Ampharetidae (juv)	981		1	1						
Melinna palmata	129808						86	2		
Ampharete lindstroemi	129781	5	3		1	1	1	1		2
Trichobranchidae	983									
Terebellides stroemii	131573	2					1	1		
Terebellidae	982									
Lanice conchilega	131495	1								
SABELLIDA	901									
Oweniidae	975									
Galathowenia oculata	146950	56	108	20	18	84	122	10	3	23

JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
Owenia borealis	329882					1	1	1		
OLIGOCHAETA	2036									
HAPLOTAXIDA	2118									
Tubificinae	137344									
Tubificoides amplivasatus	137570			1				1		
Tubificoides galiciensis	137576						1			
ARTHROPODA	1065									
CHELICERATA	1274									
PYCNOGONIDA	1302									
PANTOPODA	1358									
Phoxichilidiidae	14469									
Anoplodactylus petiolatus	134723							1		
CRUSTACEA	1066									
COPEPODA	1080									
HARPACTICOIDA	1102									
Longipediidae	115160									
Longipedia minor	116371									1
Canuellidae	115141									
Canuella perplexa	115723					1		1		
OSTRACODA	1078									
Ostracoda	1078						1			
MYODOCOPIDA	2104									
Philomedidae	127483									
Euphilomedes sinister	127866	1	1		2	5				
Cylindroleberididae	196139									
Cylindroleberis mariae	238708						1			
PODOCOPA	155944									

JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
Trachyleberididae	127509									
Pterygocythereis jonesii	128389		2							
MALACOSTRACA	1071									
AMPHIPODA	1135									
Oedicerotidae	101400									
Perioculodes longimanus	102915	1	1		2	3				
Synchelidium maculatum	102928									2
Leucothoidae	101393									
Leucothoe lilljeborgi	102462		1				3		2	1
Urothoidae	101412									
Urothoe elegans	103228	1	3			1			1	
Phoxocephalidae	101403									
Harpinia sp. (damaged)	101716			1						
Harpinia antennaria	102960	3	3			16		1		
Lysianassidae	101395									
Lysianassa plumosa	102611	1								
Ampeliscidae	101364									
Ampelisca sp. (juv)	101445				1					
Ampelisca sp. (damaged)	101445		1							
Ampelisca brevicornis	101891						1			
Ampelisca diadema	101896		1		1	3		2		
Ampelisca spinipes	101928					2				
Ampelisca typica	101933					1				
Corophiidae	101376									
Corophium volutator	102101							1		
ISOPODA	1131									
Anthuridae	118244									

JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
Anthura gracilis	118467							1		
Paramunnidae	118266									
Paramunna bilobata	118793						5			
Arcturidae	118280									
Astacilla dilatata	295579		1							
TANAIDACEA	1133									
Tanaellidae	244585									
Araphura brevimanus	136344						1			
Leptognathiidae	237596									
Tanaopsis graciloides	136458			1	1		10	3	1	6
CUMACEA	1137									
Leuconidae	110382									
Eudorella truncatula	110535						1			
Diastylidae	110380									
Diastylis sp. (juv)/(damaged)	110398					3	4			
Diastylis laevis	110481	1	2	1	3	1	1			3
DECAPODA	1130									
Processidae	106791									
Processa sp. (damaged)	107054								3	
MOLLUSCA	51									
CAUDOFOVEATA	151365									
CHAETODERMATIDA	2088									
Chaetodermatidae	2089									
Chaetoderma nitidulum	139106		1		3	1				
GASTROPODA	101									
Gastropoda (damaged)	101							1		
Turritellidae	127									

JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
Turritellinella tricarinata	1381415	1					18	26	98	
LITTORINIMORPHA	382213									
Rissoidae	123									
Onoba semicostata	141320						1			
Iravadiidae	122									
Hyala vitrea	140129				1	1	34	3	13	
Naticidae	145									
Euspira nitida	151894			1					1	1
Epitonium trevelyanum	139736		1							
Eulimidae	135									
Eulima glabra	139805	4	1	1	1	1		3		2
Nassariidae	151									
Tritia sp. (juv)	246140						1			
Mangeliidae	153853									
Sorgenfreispira brachystoma	847930		1							
Pyramidellidae	162									
Odostomia unidentata	141025									2
Acteonidae	155									
Acteon tornatilis	138691									1
CEPHALASPIDEA	154									
Cylichnidae	159									
Cylichna cylindracea	139476	8	7	6	6	7	1	2	1	8
Philinidae	161									
Philine quadripartita	574582							1		
Philine catena	140747		1			2				
BIVALVIA	105									
NUCULIDA	382247									

JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
Nuculidae	204									
Nucula sp. (juv)	138262					1		2		2
Nucula nitidosa	140589	3	2	1	3	2	19	13	6	7
LUCINIDA	489106									
Lucinidae	218									
Myrtea spinifera	140287	5	2	1	4	8	1	6	2	
Lucinoma borealis	140283	4		1	2	2				2
Thyasiridae	219									
Thyasira sp. (juv)	138552		2			14				3
Thyasira flexuosa	141662	34	13	5	7	8	17	14		
IMPARIDENTIA	869600									
Lasaeidae	222									
Kurtiella bidentata	345281				3		22	56		
CARDIIDA	869602									
Psammobiidae	237									
Gari sp. (juv)	138388									1
Semelidae	1781									
Abra sp. (juv)	138474						4			
Abra nitida	141435	1	2				6	1		1
ADAPEDONTA	869601									
Pharidae	23091									
Phaxas pellucidus	140737			1		1				
VENERIDA	217									
Veneridae	243									
Veneridae (juv)	243	3	2	1	1	2				
Chamelea striatula	141908						2			
Dosinia lupinus	141912				1					

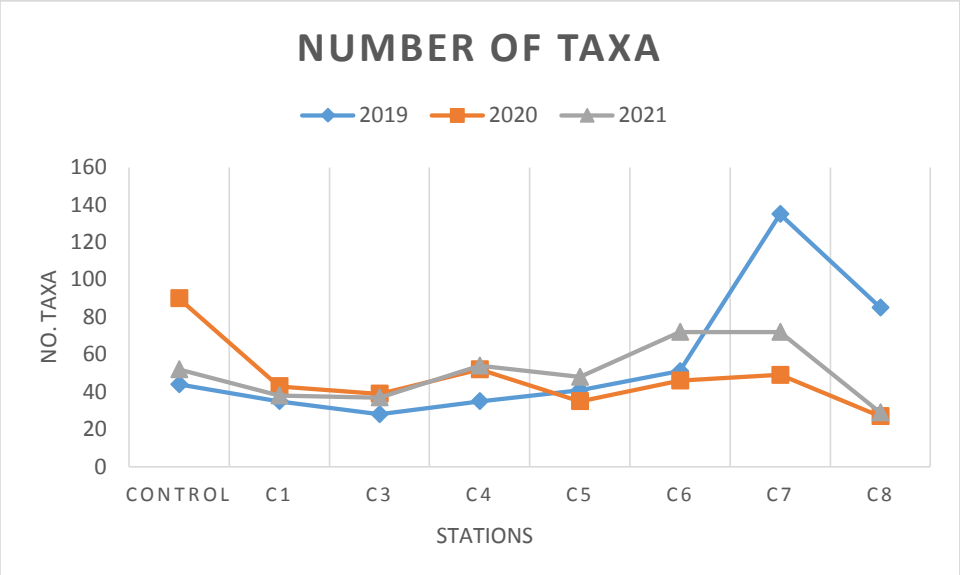
JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
Mysia undata	140728							1		
MYIDA	245									
Corbulidae	248									
Varicorbula gibba	378492	4					11	5	1	1
ANOMALODESMATA	254									
Thraciidae	256									
Thracia sp. (juv)	138549		2				1			
Thracia phaseolina	152378							1		
PHORONIDA	1789									
Phoronidae	148378									
Phoronis sp.	128545						23	17	2	
ECHINODERMATA	1806									
ASTEROIDEA	123080									
Asteroidea (juv)	123080									1
PAXILLOSIDA	123088									
Astropectinidae	123127									
Astropecten irregularis	123867							1		
OPHIUROIDEA	123084									
OPHIURIDA	123117									
Amphiuridae	123206									
Amphiuridae (juv)	123206	3	5		2	1		2		2
Amphiura filiformis	125080	4	1		2		1	14		1
Amphipholis squamata	125064					3	1			
Ophiuridae	123200									
Ophiura sp. (juv)	123574							1		1
Ophiura albida	124913							1		
ECHINOIDEA	123082									

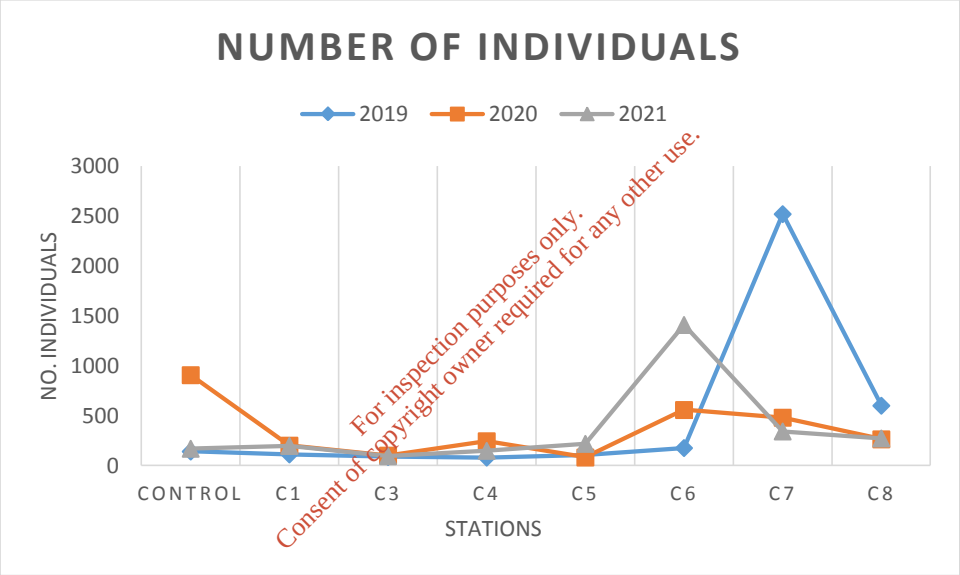
JN 1563 Killybegs March 2021	AphiaID	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9
CLYPEASTEROIDA	123100									
Echinocyamidae	510679									
Echinocyamus pusillus	124273									9
SPATANGOIDA	123106									
Loveniidae	123175									
Echinocardium sp. (damaged)	123426					1				
Echinocardium cordatum	124392					1		1		
HOLOTHUROIDEA	123083									
DENDROCHIROTIDA	123111									
Cucumariidae	123187									
Leptopentacta elongata	124635				1	1				
APODIDA	123108									
Synaptidae	123182									
Leptosynapta sp. (damaged)	123449						2	2		
HEMICHORDATA	1818									
Hemichordata (indet)	1818									1

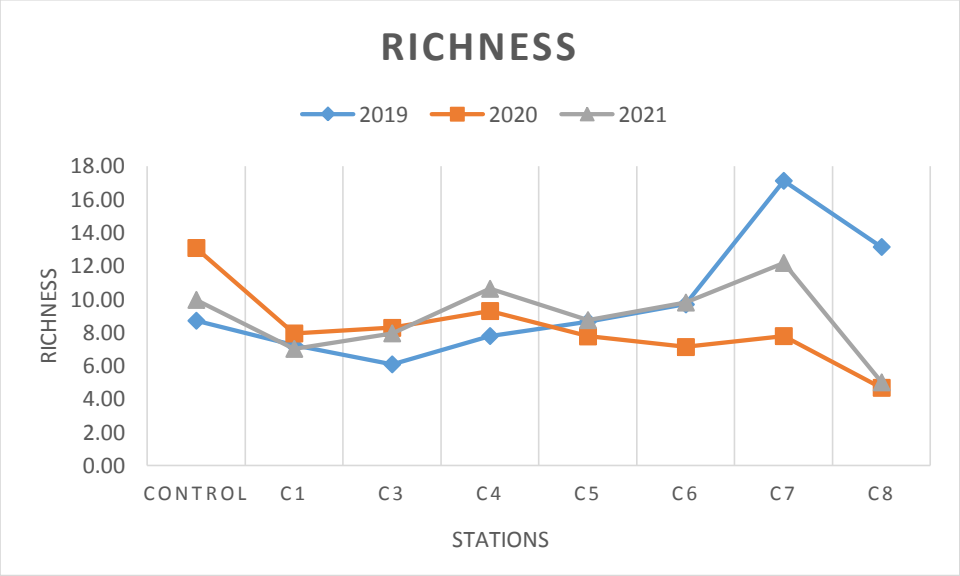
Appendix 2 Survey Comparisons

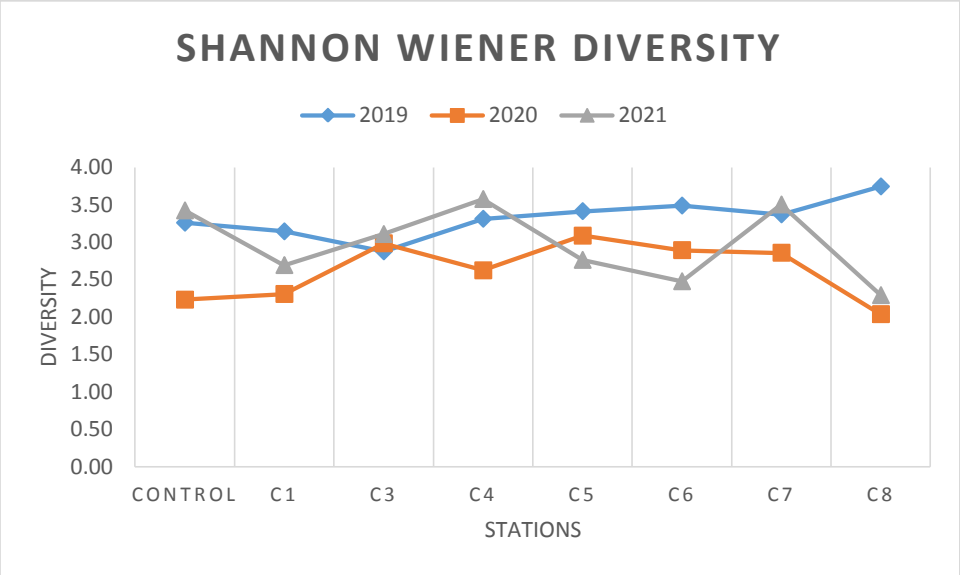
2019 v 2020

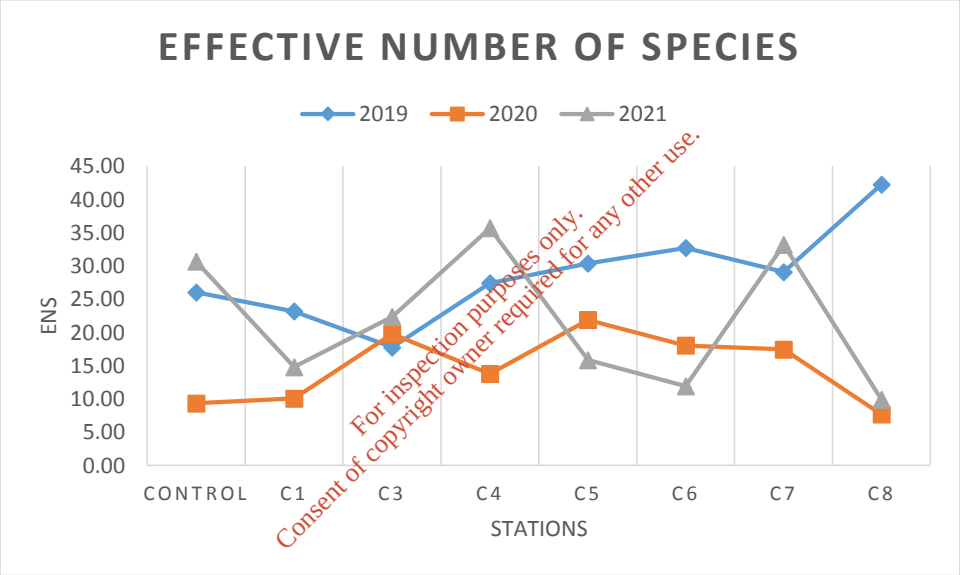
2019 v 2021











Comparison 2019 v 2020 (ANOVA)

No. taxa						
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	454	56.75	1305.357		
2020	8	381	47.625	357.125		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	333.0625	1	333.0625	0.400681	0.536941	4.60011
Within Groups	11637.38	14	831.2411			
Total	11970.44	15				
Conclusion: if F > F crit, we reject the null hypothesis. This is not the case, 0.4<4.6 Therefore, we can't reject the null hypothesis. The means of the 2 populations are basically equal.						
No. Individuals						
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	3809	476.125	710283		
2020	8	2823	352.875	77847.27		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	60762.25	1	60762.25	0.154193	0.700473	4.60011
Within Groups	5516912	14	394065.1			
Total	5577674	15				
Richness						
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	78.35509	9.794386	13.10129		
2020	8	65.88666	8.235832	5.570567		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	9.716359	1	9.716359	1.040749	0.324954	4.60011
Within Groups	130.703	14	9.33593			
Total	140.4194	15				
Evenness						

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	6.872844	0.859106	0.005729		
2020	8	5.56068	0.695085	0.014662		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.107611	1	0.107611	10.55459	0.005827	4.60011
Within Groups	0.142739	14	0.010196			
Total	0.25035	15				

Conclusion: if F > F crit, we reject the null hypothesis. This is the case, 10.55>4.6. Therefore, we reject the null hypothesis. The means of the 2 populations are not all equal. At least one of the means is different. However, the ANOVA does not tell you where the difference lies. You need a t-Test to test each pair of means.

Shannon-Wiener Diversity

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	26.59352	3.32419	0.064387		
2020	8	21.0081	2.626013	0.152724		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.949804	1	1.949804	17.96136	0.000827	4.60011
Within Groups	1.519776	14	0.108555			
Total	3.46958	15				

Effective Number of Species

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	228.4669	28.55837	51.55004		
2020	8	117.7651	14.72064	28.06821		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	765.9306	1	765.9306	19.24008	0.000621	4.60011
Within Groups	557.3278	14	39.80913			
Total	1323.258	15				

AMBI

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	15.949	1.993625	0.115653		
2020	8	13.64	1.705	0.115527		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.333218	1	0.333218	2.882754	0.111639	4.60011
Within Groups	1.61826	14	0.11559			
Total	1.951477	15				

Comparison 2019 v 2020

(t-Test: Two-sample assuming unequal variances)

Evenness		
t-Test: Two-Sample Assuming Unequal Variances		
	2019	*2020*
Mean	0.859106	0.695085
Variance	0.005729	0.014662
Observations	8	8
Hypothesized Mean Difference	0	
df	12	
t Stat	3.248783	
P(T<=t) one-tail	0.003486	
t Critical one-tail	1.782288	
P(T<=t) two-tail	0.006972	
t Critical two-tail	2.178813	
Conclusion: We do a two-tail test (inequality). If t Stat < -t Critical two-tail or t Stat > t Critical two-tail, we reject the null hypothesis. This is the case,3.24 > 2.17. Therefore, we do reject the null hypothesis.		

Shannon-Wiener Diversity		
t-Test: Two-Sample Assuming Unequal Variances		
	2019	*2020*
Mean	3.32419	2.626013
Variance	0.064387	0.152724
Observations	8	8
Hypothesized Mean Difference	0	
df	12	
t Stat	4.238085	
P(T<=t) one-tail	0.000576	
t Critical one-tail	1.782288	
P(T<=t) two-tail	0.001151	
t Critical two-tail	2.178813	
Conclusion: We do a two-tail test (inequality). If t Stat < -t Critical two-tail or t Stat > t Critical two-tail, we reject the null hypothesis. This is the case,4.23 > 2.17. Therefore, we do reject the null hypothesis.		

Effective Number of Species		
t-Test: Two-Sample Assuming Unequal Variances		
	2019	*2020*
Mean	28.55837	14.72064
Variance	51.55004	28.06821
Observations	8	8
Hypothesized Mean Difference	0	
df	13	
t Stat	4.386351	
P(T<=t) one-tail	0.000368	
t Critical one-tail	1.770933	
P(T<=t) two-tail	0.000736	
t Critical two-tail	2.160369	

Conclusion: We do a two-tail test (inequality). If t Stat < -t Critical two-tail or t Stat > t Critical two-tail, we reject the null hypothesis. This is the case,3.24 > 2.17. Therefore, we do reject the null hypothesis. The observed difference between the sample means (28.55 - 14.72) is convincing enough to say that the diversity measured in Effective Number of Species present in 2020 differs significantly to those in 2019

Comparison 2019 v 2021 (ANOVA)

No. Taxa						
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	454	56.75	1305.357		
2021	8	402	50.25	249.3571		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	169	1	169	0.217403	0.648198	4.60011
Within Groups	10883	14	777.3571			
Total	11052	15				
Conclusion: if F > F crit, we reject the null hypothesis. This is not the case, 0.217<4.6 Therefore, we can't reject the null hypothesis. The means of the 2 populations are basically equal.						
No. Individuals						
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	3809	476.125	710283		
2021	8	2841	355.125	186751.8		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	58564	1	58564	0.130572	0.723234	4.60011
Within Groups	6279244	14	448517.4			
Total	6337808	15				
Richness						
Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	78.35509	9.794386	13.10129		
2021	8	71.22809	8.903511	5.046977		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3.174629	1	3.174629	0.349855	0.563625	4.60011
Within Groups	127.0379	14	9.074135			
Total	130.2125	15				
Evenness						

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	6.872844	0.859106	0.005729		
2021	8	6.152761	0.769095	0.012054		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.032407	1	0.032407	3.644842	0.076955	4.60011
Within Groups	0.124479	14	0.008891			
Total	0.156886	15				

Shannon-Wiener Diversity

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	26.59352	3.32419	0.064387		
2021	8	23.82058	2.977573	0.242504		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.480575	1	0.480575	3.131892	0.098541	4.60011
Within Groups	2.148236	14	0.153445			
Total	2.628811	15				

Effective Number of Species

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	228.4669	28.55837	51.55004		
2021	8	174.0949	21.76186	103.5781		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	184.7701	1	184.7701	2.382162	0.145026	4.60011
Within Groups	1085.897	14	77.56405			
Total	1270.667	15				

AMBI

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2019	8	15.949	1.993625	0.115653		
2021	8	15.356	1.9195	0.030542		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.021978	1	0.021978	0.300668	0.592101	4.60011
Within Groups	1.023366	14	0.073098			
Total	1.045344	15				