# Meil Bay 2023 – Baseline Survey Report

Survey Notes

To be read in conjunction with:
Survey report **MPFF-SiteSuitabilitySurveyResultsv2-Meil Bay 2023**
and **IQI Workbook UKTAG v02 (EG v01) Meil Bay Baseline 2023**

1. Sampling

Baseline sampling was carried out at Meil Bay fish farm (CAR/L/1003888), Orkney on 24th May 2023.

Map and Chart plots of the sampled stations (1-10) are shown below. No samples could be collected from Station 5 due to the rocky nature of the seabed.

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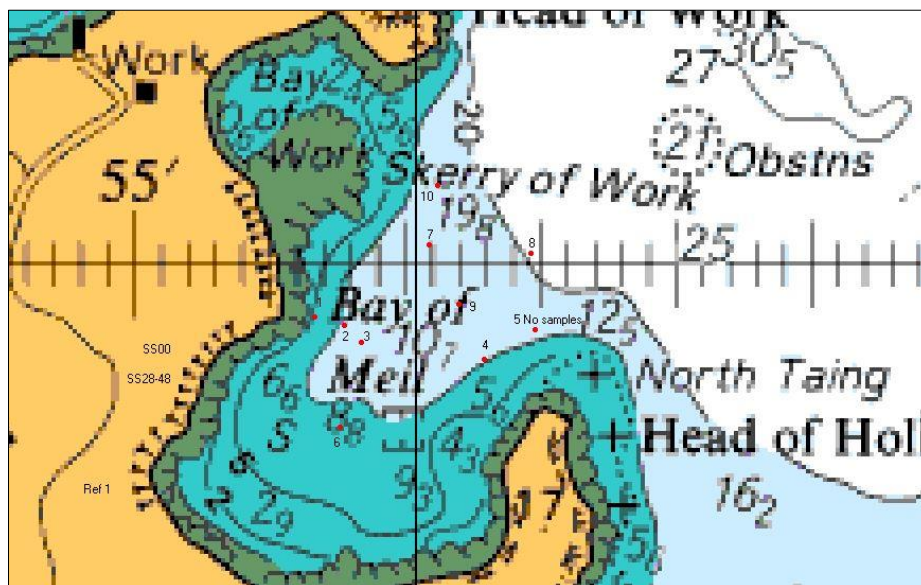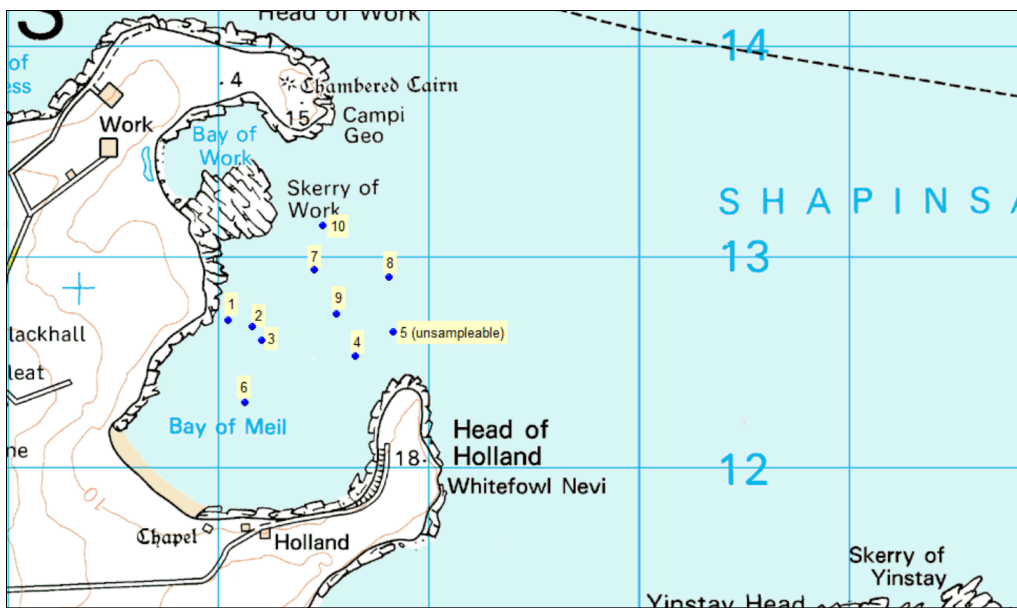
2. Data Analysis

The faunal data set was analysed through PRIMER, UKTAG IQI Workbook v02 and was assessed for enrichment polychaete (EP) numbers. Results are provided in Section 2.1.

Where appropriate, various faunal data rows (e.g. juveniles with adults of the same species) reported in the SEPA MPFF report template were combined prior to data analysis to avoid over representation of species number.

UKTAG IQI Workbook v02 was used to determine IQI values. To reduce high proportions of fauna showing as 'non assigned', row entries were ascribed (where available) their EG classification taken from UKTAG IQI Workbook v01. These changes are highlighted in the IQI Workbook Metrics sheet.

PSA results were entered into the UKTAG IQI Workbook v02. Where station results lie at the outer limits of the Workbook design centiles, the IQI results have been reported but should be considered with caution.

2.1 Sediment description, Particle Size Analysis (PSA) and Total Organic Carbon (TOC)

Sediment at stations 1, 2 and 4 is described as small shell fragments; grey or grey/white in colour and firm in texture. Stations 3, 6, 7 and 9 were soft, light brown/red fine sand with worm casings, and Stations 8 and 10 were soft, light brown fine sand (with shell fragments at Station 8). No smell or fungus was noted at any station.

A graph of Particle Size Analysis (PSA) results for each sampled station is provided below.
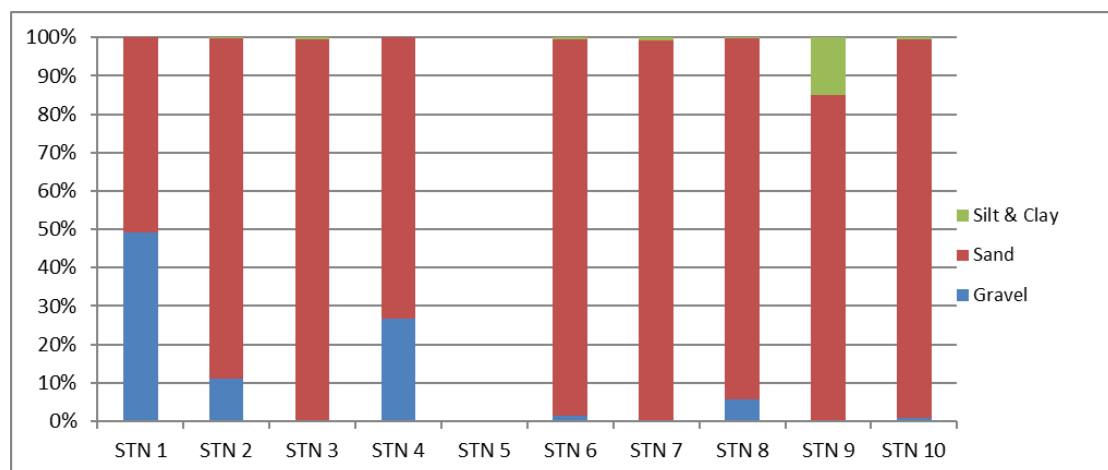
PSA results show sediment from the nine sampled stations is patchy in composition. Stations 1, 2, 4 and 8 comprise the greatest proportions of gravel sized particles (6-49%), 51-94% sand and <1% silt clay. The simplified classification of the Folk triangle for UKSeaMap classes the sediment from these stations as 'coarse sediments'.

Sediment from Stations 3, 6, 7 and 10 is sandiest (98-100%), with <2% silt clay and <1% gravel, and Station 9 is finest with 85% sand and the greatest proportion of silt clay (15%). These stations are classed as 'sand and muddy sand'.

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Carbon TOC results are provided in the table below. Values range from 0.16% at Stations 3 and 6, to 0.56% at Station 2, and are highest in the coarser sediment from the stations located closest to the shore on either side of Meil Bay.

Station	Total Organic Carbon (%)
Station 1	0.45
Station 2	0.56
Station 3	0.16
Station 4	0.47
Station 5	-
Station 6	0.16
Station 7	0.22
Station 8	0.20
Station 9	0.18
Station 10	0.19

2.2 PRIMER, IQI and Enrichment Polychaetes

The table below summarises PRIMER, enrichment polychaete (EP), ITI and IQI results for each station.

ITI (>60) values indicating 'Normal' community status are highlighted in green.
IQI (>0.64) values indicating Good or High Ecological (Eco) Status are shown in red.

	Number of taxa (S)	Abundance (N)	Margalef's Richness (d)	Pielou's Evenness (J)	S-Wiener Diversity (H'(log 2))	Number of Enrichment Polychaete (EP) Species	EP Density (/m²)	ITI	IQI WB v02 (with WBv01 EG where available)	Ecological (Eco)Status
Stn 1	34	419	5.47	0.54	2.76	1	11	23.53	0.442	MODERATE
Stn 2	53	297	9.13	0.78	4.47	1	67	45.77	0.712	GOOD
Stn 3	57	231	10.29	0.87	5.06	2	22	70.02	0.803	HIGH
Stn 4	46	552	7.13	0.66	3.66	1	278	26.98	0.547	MODERATE
Stn 6	34	243	6.01	0.84	4.25	1	22	61.99	0.647	GOOD
Stn 7	46	151	8.97	0.90	4.96	0	0	60.55	0.758	HIGH
Stn 8	49	238	8.77	0.79	4.43	0	0	74.68	0.787	HIGH
Stn 9	51	189	9.54	0.88	4.98	0	0	65.59	0.740	GOOD
Stn 10	58	146	11.44	0.87	5.13	0	0	69.23	0.814	HIGH

The top-ranking species (by abundance) for each station (taken from the UKTAG IQI Workbook) are shown in the table below.

	Most abundant taxa (% of sample)	2nd Most abundant taxa (% of sample)	3rd Most abundant taxa (% of sample)	4th Most abundant taxa (% of sample)	5th Most abundant taxa (% of sample)
Stn 1	Tubificoides benedii (48.8%)	Aonides oxycephala (18.7%)	Psamathe fusca (7.4%)	Mediomastus fragilis (3.8%)	Nematoda (3.8%)
Stn 2	Mediomastus fragilis (18.2%)	Protodorvillea kefersteini (13.9%)	Caulleriella alata (10.5%)	Urothoe marina (6.4%)	Tryphosa nana (5.4%)
Stn 3	Urothoe elegans (10.4%)	Euclymene oerstedii (7.8%)	Spio symphyta (6.5%)	Odostomia unidentata (5.7%)	Owenia (5.7%)
Stn 4	Mediomastus fragilis (30.5%)	Tubificoides benedii (18.9%)	Tubificoides pseudogaster (10.3%)	Capitella (4.5%)	Caulleriella alata (4.2%)
Stn 6	Pygospio elegans (16%)	Dipolydora quadrilobata (13.6%)	Euclymene (7.8%)	Spio symphyta (7.4%)	Euclymene oerstedii (6.2%)
Stn 7	Odostomia unidentata (9.3%)	Leiochone (8.7%)	Euclymene (7.3%)	Lucinoma borealis (6%)	Nephtys assimilis (5.3%)
Stn 8	Urothoe elegans (30.1%)	Prionospio fallax (4.2%)	Euclymene (4.2%)	Harpinia antennaria (4.2%)	Ampelisca tenuicornis (4.2%)
Stn 9	Euclymene oerstedii (12.3%)	Spio symphyta (11.2%)	Lumbrineris cingulata (6.4%)	Kurtiella bidentata (5.9%)	Phoronis (3.7%)
Stn 10	Urothoe elegans (16.6%)	Harpinia antennaria (9%)	Eumida bahusiensis (5.5%)	Lumbrineris cingulata (4.1%)	Lucinoma borealis (3.4%)

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The following table provides enrichment polychaete (EP) results for each station.

|	Enrichment polychaete (EP) species		Number of EP species	Overall EP density (/m²)
	Capitella	Ophryotrocha		
Stn 1	1	0	1	11
Stn 2	6	0	1	67
Stn 3	1	1	2	22
Stn 4	25	0	1	278
Stn 6	2	0	1	22
Stn 7	0	0	0	0
Stn 8	0	0	0	0
Stn 9	0	0	0	0
Stn 10	0	0	0	0

Station Results

IQI>0.64 (Good or High Eco Status) is achieved at seven of the nine sampled stations. Stations 1 and 4, approaching the shore on either side of the bay, located in shallower water and where sediment is coarsest, show some evidence of disturbance with oligochaetes and ITI group 3 polychaete *Mediomastus fragilis* high ranking.

No Priority Marine Feature species or communities were recorded.

Results from the nine sampled stations show a range of species numbers (34-58) and abundance (146-552). Richness index values range from 5.47 (at Station 1) to 11.44 (at Station 10), Evenness ranges from 0.54 at Station 1 (where oligochaete *Tubificoides benedii* makes up 49% of total abundance) to 0.90 at Station 7 where the top-ranking species, mollusc *Odostomia unidentata,* contributes only 9%. Shannon Wiener values range from 2.76 at Station 1 to 5.13 at the most diverse Station 10. Enrichment polychaetes (EPs) are generally absent or recorded in low densities (22-67/m²) with a slightly higher density recorded at Station 4 (278/m²).

ITI scores range from 23.53-74.68 and class Stations 1 and 4 as 'degraded', Station 2 as 'changed' and the remaining station communities as 'normal'. IQI values of 0.442 and 0.547 class Stations 1 and 4 as Moderate Eco status, Stations 2, 6 and 9 as Good, and Stations 3, 7, 8 and 10 as High Eco status.

PRIMER Multivariate Bray Curtis and Ordination plots are shown below.
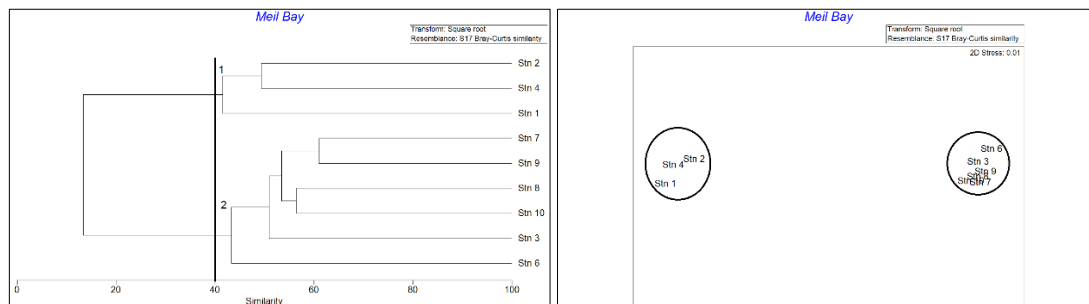
At 40% similarity the stations form two distinct groups which share only 13% similarity in composition.

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Group 1 comprises Stations 1, 2 and 4, located on either side of Meil Bay and where sediment is coarsest. These communities show some evidence of sediment disturbance with ITI Group 3 and 4 species dominating. Within the Station 1 community, Group 4 oligochaete *Tubificoides* and Group 3 polychaete *Mediomastus fragilis* are high ranking, at Station 2, *M. fragilis* and Group 4 EP *Protodorvillea kefersteini* are top ranking and at Station 4, *M. fragilis*, *Tubificoides* spp., and Group 4 EP *Capitella* are most numerous. Stations 2 and 4 share 49% similarity in composition, with Station 1 splitting at 42%.

Group 2 comprises the remaining stations, grouped at >43% similarity, where there is no evidence of disturbance. At these stations, EPs are either absent or present in low densities (22/m^2), ITI scores class the communities as 'normal' and IQI scores indicate Good or High Eco status. Group 3 polychaetes *Euclymene* spp., are generally high ranking, and Group 1 crustacean *Urothoe elegans* is top ranking at Stations 3, 8 and 10.

	Most abundant taxa (% of sample)	2nd Most abundant taxa (% of sample)	3rd Most abundant taxa (% of sample)	4th Most abundant taxa (% of sample)	5th Most abundant taxa (% of sample)
Stn 1	Tubificoides benedii (48.8%)	Aonides oxycephala (18.7%)	Psamathe fusca (7.4%)	Mediomastus fragilis (3.8%)	Nematoda (3.8%)
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Stn 10	Urothoe elegans (16.6%)	Harpinia antennaria (9%)	Eumida bahusiensis (5.5%)	Lumbrineris cingulata (4.1%)	Lucinoma borealis (3.4%)

3. Summary

Baseline Stations 1, 2 and 4, located closest to the shore on either side of Meil Bay and where sediment is coarsest, show some evidence of sediment disturbance as ITI scores are depressed by high proportions of ITI Group 4 polychaetes and/or oligochaetes, and Group 3 polychaete *Mediomastus fragilis*.

The remaining sampled stations: Station 3 and Stations 6-10, located more centrally in the bay where sediment is finer, show good sediment conditions. Enrichment polychaetes are generally absent, ITI 'normal' (>60) is achieved at each station and IQI values exceed 0.64, indicating Good or High Eco status.

No Priority Marine species or features were recorded at any station.

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